STATE OF IDAHO
TRANSPORTATION DEPARTMENT
BOISE

CONTRACT NO. 8938

PROJECT A021(981), A022(879), A023(746), A024(280)

KEY 21981, 22879, 23746, 24280

WORK AUTH T203540

LOCATION SIMCO RD. REHABILITATION & SAFETY IMPROVEMENTS, MTN. HOME HD

HIGHWAY OFF SYS

COUNTY ELMORE

CONTRACTOR STAKER & PARSON COMPANIES DBA IDAHO MATERIALS & CONSTRUCTION
PO BOX 1310
NAMPA, ID 83653-1310

NOTICE OF LETTING

Idaho Federal Aid Project No. A021(981), A022(879), A023(746), A024(280), in Elmore County, Key No. 21981, 22879, 23746, 24280; for the work of pavement rehabilitation on Simco Rd by performing Cement Recycled Asphalt Base Stabilization (CRABS).

Sealed proposals will be received only at the office of the IDAHO TRANSPORTATION DEPARTMENT, 11331 WEST CHINDEN BLVD. BLDG #8, BOISE, IDAHO 83714 or PO Box 40, BOISE, IDAHO 83707-0040, ATTN: ADVERTISEMENT AND AWARD. Bids may also be submitted electronically through Bid Express (www.bidx.com). All bids must be received by two o'clock p.m., on December 10, 2024.

ADDITIONAL INFORMATION CONTACT: RESIDENT ENGINEER MEGAN KAUTZ (LHTAC) at (208) 344-0565 for any design related questions.

Digital copies of the Plans, Proposals, and Specifications must be downloaded for a fee of $22.00. **Bidders must appear on the plan holders list for their proposal to be accepted by the Department.** Please contact QuestCDN.com at 952-233-1632 or info@questcdninfo.com for assistance in downloading and working with this digital project information.

General Bidding information and Specifications may be obtained from the Idaho Transportation Department website at http://itd.idaho.gov/business/

In an effort to achieve ITD's DBE Annual Participation Goal (APG) of 10.11% utilization, ITD requires responder to utilize certified subcontractors and suppliers listed on its DBE Directory located at: https://itd.dbesystem.com/. For this project, it has been determined that there is a DBE availability of 10.0% or more. For more information regarding ITD's DBE Program please go to https://itd.idaho.gov/civilrights/

This contract requires full compliance with Title VI of the Civil Rights Act of 1964, which protects persons from being denied the benefits of or excluded from participation in programs or activities; or subjected to discrimination based on race, color, national origin, sex, age, disability, Limited English Proficiency or economic status. The Contractor is encouraged to utilize the goods and services of disadvantaged firms in accomplishing the tasks or providing the services of this agreement, and to provide equal opportunity to all sub-bidders and suppliers.

CONTRACT AGREEMENT

THIS AGREEMENT, made and entered into, in duplicate, this 16 day of December, 20 24, by and between the State of Idaho, hereinafter called the State, by the Idaho Transportation Board of said State, party of the first part,

ITD TO DATE UPON AWARD

and STAKER & PARSON COMPANIES DBA IDAHO MATERIALS & CONSTRUCTION, hereinafter called the Contractor, party of the second part.

WITNESSETH: That the contractor, in consideration of the sum to be paid to him by said State, in the matter and at the time hereinafter provided, and of other covenants and agreements herein contained, hereby agrees for themself, their heirs, administrators, successors and assigns to furnish the material and perform the work of: pavement rehabilitation on Simco Rd by performing Cement Recycled Asphalt Base Stabilization (CRABS); in Elmore County, designated as Idaho Federal Aid Project No. A021(981), A022(879), A023(746), A024(280).

To furnish all necessary machinery, tools, apparatus, materials and labor to complete the work in the most substantial and workmanlike manner according to the plans and specifications therefore on file in the office of the Idaho Transportation Department of said State, and such modifications of the same and other directions that may be made by the State Highway Administrator as provided herein: Provided, however, that the proposed work covered by this contract does not include that portion or portions of the work to be done in right of way to which title is being contested in any court having jurisdiction, until a specific award has been made by the court in each instance and in good and sufficient title to such portion of right of way in dispute has been assured.

CONTRACT DOCUMENTS:

It is further agreed that the said plans and specifications and the schedule of rates and prices set forth in the proposal and the general and special provisions appended to this contract agreement are hereby specifically referred to and made a part of this contract, and shall have the same force and effect as though all of same were fully inserted herein.

PAYMENTS:

For the faithful performance of the work herein embraced, as set forth in the contract agreement, general and special provisions, notice to contractors, instructions to bidders, proposals, general and detailed specifications and plans, which are a part hereof, in accordance with the directions of the State Highway Administrator and to his satisfaction, the State agrees to pay said Contractor the amount earned, computed from the actual quantities of the work performed as shown by the estimates of the Administrator and unit prices named in such proposal, and to make such payments in the manner and at the time provided in such proposal, and to make such payments in the manner and at the time provided in the general provisions thereto appended. Payments shall be made by the State Treasurer of said State, upon warrants of the State Auditor of said State, issued upon vouchers of said State Highway Administrator, which have been approved by the Idaho Transportation Board out of monies legally available for that purpose.

IN WITNESS WHEREOF, The said State of Idaho, by the Idaho Transportation Board, executes this contract and the said STAKER & PARSON COMPANIES DBA IDAHO MATERIALS & CONSTRUCTION, does sign and seal the same, the day and year in this contract first above written.

Attest (The State):

I hereby attest that all contract documentation has been checked and included in this final contract, as appropriate.

Karen Hamm

Name & Title

Contracts Manager

STATE OF IDAHO
Idaho Transportation Board

By: David B Kuisti

District Engineer/ HQ Division Administrator
Party of the First Part

TRANSPORTATION BOARD
STATE OF IDAHO

CONTRACTOR

Pursuant to Idaho Code Section 9-1406 "I certify (or declare) under penalty of perjury pursuant to the law of the State of Idaho that the foregoing is true and correct." The undersigned is duly authorized to sign this document on behalf of the above referenced company.

Pete Wilson
Pete Wilson (Dec 13, 2024 15:03 MST)

Signature

Pete Wilson

Print Name

Authorized Agent

Title
Party of the Second Part

Dec 13, 2024

Date

Seal

STAKER & PARSON COMPANIES
CORPORATE SEAL
UTAH

SURETY

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, That we STAKER & PARSON COMPANIES DBA IDAHO MATERIALS & CONSTRUCTION, as Principal, and

Fidelity and Deposit Company of Maryland

as Surety are held and firmly bound unto the State of Idaho in the penal sum of

EIGHT MILLION NINETY SIX THOUSAND EIGHT HUNDRED FORTY NINE DOLLARS

($8,096,849.00) lawful money of the United States, which sum is agreed to be the maximum liability hereunder, well and truly to be paid, and for the payment of which we and each one of us bind ourselves, our heir, executors, administrators and assigns, jointly and severally, firmly by these presents.

The condition of the instrument is such, that whereas the Principal has entered into a certain agreement, hereto attached, with the State of Idaho, dated December 16, 2024, for the work of pavement rehabilitation on Simco Rd by
ITD TO DATE UPON AWARD
performing Cement Recycled Asphalt Base Stabilization (CRABS); SIMCO RD. REHABILITATION & SAFETY IMPROVEMENTS, MTN. HOME HD; known as IDAHO FEDERAL AID Key No. 21981, 22879, 23746, 24280 Contract No. 8938, in Elmore County.

NOW, THEREFORE, If the said Principal shall pay all claimants supplying labor or materials to him or his subcontractors in the prosecution of the work provided for in said contract, and any and all authorized modifications of said contract that may hereafter be made, notice of which modifications to the Surety being hereby waived and shall pay all taxes when due, as required by Title 63, Chapter 15, Idaho Code, then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, However, that this bond is executed pursuant to the provisions of the Public Contracts Bond Act, and all liabilities on this bond shall be determined in accordance with said provisions to the same extent as if set forth in full herein.

IN WITNESS WHEREOF, the Principal and Surety have executed this instrument to become effective on the date of the contract agreement as set forth above.

CONTRACTOR:

By:

Pete Wilson

Pete Wilson (Dec 13, 2024 15:03 MST)

Signature

Pete Wilson

Print Name

Authorized Agent

Title

CORPORATE SURETY:

Fidelity and Deposit Company of Maryland

Surety Company Name

By:

Misty Witt

Misty Witt (Dec 13, 2024 18:15 CST)

Signature

Misty Witt

Print Name

Attorney-in-Fact

Title

713-276-8000

Phone Number

oldcastle.surety@marsh.com

Email Address

SURETY

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, That we STAKER & PARSON COMPANIES DBA IDAHO MATERIALS & CONSTRUCTION, as Principal, and

Fidelity and Deposit Company of Maryland

as Surety are held and firmly bound unto the State of Idaho in the penal sum of

EIGHT MILLION NINETY SIX THOUSAND EIGHT HUNDRED FORTY NINE DOLLARS

($8,096,849.00) lawful money of the United States, which sum is agreed to be the maximum liability hereunder, well and truly to be paid, and for the payment of which we and each one of us bind ourselves, our heir, executors, administrators and assigns, jointly and severally, firmly by these presents.

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ITD TO DATE UPON AWARD
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NOW, THEREFORE, If the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract and any extensions thereof that may be granted by the State, with or without notice to the Surety and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, then this obligation to be null and void, otherwise to remain in full force and effect.

PROVIDED, However, that this bond is executed pursuant to the provisions of the Public Contracts Bond Act, and all liabilities on this bond shall be determined in accordance with said provisions to the same extent as if set forth in full herein.

IN WITNESS WHEREOF, the Principal and Surety have executed this instrument to become effective on the date of the contract agreement as set forth above.

CONTRACTOR:

By:

Pete Wilson
Pete Wilson (Dec 13, 2024 15:03 MST)

Signature

Pete Wilson

Print Name

Authorized Agent

Title

CORPORATE SURETY:

Fidelity and Deposit Company of Maryland

Surety Company Name

By:

Misty Witt
Misty Witt (Dec 13, 2024 18:15 CST)

Signature

Misty Witt

Print Name

Attorney-in-Fact

Title

7132768000

Phone Number

oldcastle.surety@marsh.com

Email Address

ATTACH POWER OF ATTORNEY
CB-2-B

Power Of Attorney ☑

STATE OF IDAHO

TRANSPORTATION DEPARTMENT

BOISE, IDAHO

DATE: December 03, 2024

ADDENDUM NO. 1

Idaho Federal Aid Project No. A021(981), A022(879), A023(746), A024(280)
SIMCO RD. REHABILITATION & SAFETY IMPROVEMENTS, MTN. HOME HD
Elmore County, Key No. 21981, 22879, 23746, 24280

NOTICE TO PLANHOLDERS:

Enclosed are Revised Pages 1 through 4 of 4 of the revised Bid Schedule.

The above revised sheets that are underlined must be used instead of the corresponding sheets in the Contractor's Bid Proposal used for bidding purposes. This letter must be signed/initialed and dated and included with your hard copy bid. If submitting bid electronically, bidder must acknowledge this addenda, by inclusion of the amendment, in the electronic bid

FAILURE TO ACKNOWLEDGE INCLUSION OF THIS ADDENDUM SHALL RENDER THE BID PROPOSAL IRREGULAR AND THE BID WILL BE REJECTED.

Sincerely,

Karen Hanna

Karen Hanna
Contracts Manager

Proposal

In compliance with your bid package to be received for this letting, the undersigned certifies to have examined the location of work and/or materials sites, and is satisfied as to the condition to be encountered, and that the plans, specifications, contract and method of payment for such work is understood. The undersigned hereby proposes to furnish the material and perform the work as described in the Notice of Letting in accordance with the Proposal/Plans purchased through QuestCDN for this project.

On the acceptance of this proposal for said work, the undersigned will execute Contract Forms CA in accordance with the bid as accepted, and furnish the Contract Performance and Payment Bonds on Forms CB with approved and sufficient surety within 15 days after the prescribed forms are presented for signature.

The bidder further agrees that, if awarded, the contract work will be completed as stated in the Special Provisions, after authority to proceed has been given in conformity with and subject to such extensions as may be authorized by the terms of Extension of Contract Time of the Standard Specifications.

Accompanying this proposal is a Certified Check or a Cashier's Check drawn on an Idaho bank in the amount of five percent of the total amount bid, made payable to the Idaho Transportation Department, or a Bidder's Bond in the amount of five percent of the total amount bid.

The undersigned being duly sworn upon oath deposes and says that it complies with the provisions of Section 72-1717 Idaho Code (Drug Free Workplace program).

The contractor/consultant warrants and takes the steps to verify that it does not knowingly hire or engage persons not authorized to work in the United States; and that any misrepresentation in this regard or any employment of person not authorized to work in the United States constitutes a material breach and shall be cause for the imposition of monetary penalties up to five percent (5%) of the contract price, per violation, and/or termination of its contract.

By signature on this proposal, the bidder declares under penalty of perjury under the laws of the United States, that the firm, association, or corporation has not by or through any of its officers, partners, owners, or any other person associated therewith, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with this highway project, and is not financially interested in or otherwise affiliated in a business way with any other bidder on this project.

Legal Company Name: Staker & Parson Companies DBA Idaho Materials & Construction

Company Business Address: 924 N Sugar Street, Nampa Idaho 83687

Mailing (Shipping) Address, if different or N/A: PO Box 1310, Nampa Idaho 83653

Company organized under the state of: Idaho

Legal Name of Highest Officer in Company: Scott Parson

Title of Highest Officer in Company: President

Contact Name: Pete Wilson

Title of Contact: Construction Manager/Authorized Agent

Contact Phone No.: 208-941-4088 Email: peter.wilson@idahomaterials.com

Idaho Public Works License No.: 11916-U-1-2 Exp. Date: 06-30-2025

Unique Entity Identifier (UEI): TVQ6LPR967V7

Submittal, signature, acceptance, authorization and certifications are hereby made by signing this internet bid with a Digital ID. ***

State of Idaho
Idaho Transportation Department
Schedule of Items

LINE NUMBER	ITEM NUMBER	QUANTITY	UNIT	UNIT PRICE	EXTENSION PRICE
SECTION 001 Simco Rd Rehabilitation and Safety Improvements					
0005	201-010A CLEARING & GRUBBING	1	LS	$16,450.00000	$16,450.00
0010	203-006A REMOVAL OF SIGN	24.000	EACH	$262.50000	$6,300.00
0015	203-125A REMOVAL OF MISCELLANEOUS ITEMS	1	LS	$9,500.00000	$9,500.00
0020	205-005A EXCAVATION	10969.000	CY	$16.00000	$175,504.00
0030	205-005B EXCAVATION ROCK	100.000	CY	$156.00000	$15,600.00
0035	205-045A GRANULAR BORROW	32468.000	TON	$16.25000	$527,605.00
0040	205-060A WATER FOR DUST ABATEMENT	785.000	MG	$1.00000	$785.00
0045	205-071A EXCAVATION AND REPAIR OF SOFT SPOTS	120.000	CY	$54.00000	$6,480.00
0050	205-090A SHOULDER GRADING	23.640	MILE	$1,250.00000	$29,550.00
0055	212-011A FIBER WATTLE	1360.000	FT	$7.50000	$10,200.00
0060	212-105A WATER AND POLLUTION	3370.000	CA	$1.00000	$3,370.00
0065	303-022A 3/4" AGGREGATE TYPE B FOR BASE	70205.000	TON	$19.50000	$1,368,997.50
0070	308-005A CEMENT RECYCLED ASPHALT BASE STABILIZATION	184302.000	SY	$1.85000	$340,958.70
0075	308-010A PORTLAND CEMENT	1658.760	TON	$288.00000	$477,722.88
0080	308-015A PULVERIZE EXISTING SURFACE	164908.000	SY	$1.45000	$239,116.60
0085	402-020A EMULSIFIED ASPHALT FOR PRIME COAT	156.710	TON	$580.00000	$90,891.80
0095	405-245A APPROACH PAVED	6.000	EACH	$2,854.00000	$17,124.00
0105	405-245B APPROACH GRAVEL	23.000	EACH	$1,345.00000	$30,935.00
0110	405-435A SUPERPAVE HMA PAVEMENT INCLUDING ASPHALT & ADDITIVES CLASS SP-3	39690.000	TON	$97.00000	$3,849,930.00
0115	602-025A 12" PIPE CULVERT	96.000	FT	$165.00000	$15,840.00
0120	602-030A	197.750	FT	$186.00000	$36,781.50

	15" PIPE CULVERT				
0125	602-035A 18" PIPE CULVERT	50.000	FT	$175.00000	$8,750.00
0130	611-001A CATTLE GUARD (PAVEMENT MARKINGS)	1.000	EACH	$10,122.00000	$10,122.00
0135	611-010A CATTLE GUARD TYPE A	1.000	EACH	$62,701.00000	$62,701.00
0140	616-010A SIGN TYPE B-1	145.000	SF	$39.27000	$5,694.15
0145	616-040G STEEL SIGN POST TYPE B-2	158.000	FT	$408.36000	$64,520.88
0155	616-040J STEEL SIGN POST TYPE E-1	39.000	FT	$37.36000	$1,457.04
0160	616-040k STEEL SIGN POST TYPE E-2	24.000	FT	$39.99000	$959.76
0170	617-005A DELINEATOR TYPE 1	493.000	EACH	$73.45000	$36,210.85
0175	617-060A MILEPOST TYPE 3	4.000	EACH	$540.60000	$2,162.40
0180	621-005A SEED BED PREPARATION	0.349	ACRE	$3,000.00000	$1,047.00
0185	621-010A SEEDING	0.349	ACRE	$2,700.00000	$942.30
0190	621-015A MULCHING	0.698	ACRE	$2,500.00000	$1,745.00
0195	621-035A FERTILIZING	0.349	ACRE	$1,800.00000	$628.20
0200	626-100A MISCELLANEOUS TEMPORARY TRAFFIC CONTROL ITEMS	3000.000	CA	$1.00000	$3,000.00
0205	630-005A TRANSVERSE, WORD, SYMBOL, AND ARROW PAVEMENT MARKINGS - WATERBORNE	282.000	SF	$3.00000	$846.00
0210	630-025A LONGITUDINAL PAVEMENT MARKING - WATERBORNE	542307.000	FT	$0.12000	$65,076.84
0220	640-015A SUBGRADE SEPARATION GEOTEXTILE TYPE III	25588.000	SY	$1.50000	$38,382.00
0225	675-005A SURVEY	1	LS	$47,334.00000	$47,334.00
0230	675-010A DIRECTED SURVEYING	5000.000	CA	$1.00000	$5,000.00
0235	677-005A RECORD DRAWINGS	1	LS	$1,050.00000	$1,050.00
0245	S900-50A CONTINGENCY AMOUNT WEED CONTROL	5000.000	CA	$1.00000	$5,000.00
0255	S900-50B CONTINGENCY AMOUNT MISCELLANEOUS WORK	5000.000	CA	$1.00000	$5,000.00
0265	S904-05A SP TEMPORARY TRAFFIC CONTROL	1	LS	$259,000.00000	$259,000.00
0270	Z629-05A	1.000	LS	$200,577.60000	$200,577.60

MOBILIZATION

Section 001 Total	$8,096,849.00

Item Total	$8,096,849.00

Your Safety • Your Mobility
Your Economic Opportunity

ITD 2396 (Rev.06-15-2022)
itd.idaho.gov

DISADVANTAGED BUSINESS ENTERPRISE (DBE) COMMITMENTS

This form must be submitted by all primes (Non-DBE and DBE Primes). This form is part of the DBE Submittal Package and must be accompanied by a quote or ITD-2399, along with any documentation relating to good faith efforts. Award of the contract is contingent on good faith efforts to provide opportunity for DBE participation in this project. Failure to complete items will result in an irregular bid. All documentation must either be emailed to DBESubmittal@itd.idaho.gov or delivered to ITD Headquarters at 11331 W. Chinden Blvd, Bldg #8, Boise, ID 83714 by 5:00 pm MT on bid opening day.

Bid Date: 12/10/2024 Bid Amount: $ 8,096,849.00

Key Number	Project Number	Project Name		
21981, 22879, 23746, 24280	A021(981), A022(879), A023(746), A024(280)	SIMCO RD. REHABILITATION & SAFETY IMPROVEMENTS, MTN. HOME HD		
Prime Contractor		Prime Contractor EEO Officer	EEO Officer Phone #	Prime Contractor EEO Office Email
Staker & Parson Companies dba Idaho Materials & Construction		Ashleigh Rocha	208-465-4011	ashleigh.rocha@na.crh.com
Prime Contractor's Signature (must be handwritten or digitally certified)			Date	Prime Contractor Phone Number
			12/10/2024	208-466-5001

Assigned goal for DBE subcontractors and suppliers for this project: 10 %

Section 1 - Summary of DBE Goal Commitment (Items below must match commitment amount in Section 3.)

	Amount Quoted by Supplier		Commitment
1. One hundred percent (100%) of total amount to be performed by DBE firms, other than those listed in Item 2 through 5.		1) $	$ 570,410.31
2. One hundred percent (100%) of total amount to be paid DBE Equipment leasers		2) $	
3. One hundred percent (100%) of total amount to be paid to DBE Manufacturers (e.g., asphalt emulsions, cutback asphalts, fabricated signs, or delivery companies)		3) $	
4. Sixty percent (60%) of total amount to be paid to DBE regular dealers/ suppliers	4) $ 447,865.20	x60% = $	$ 268,719.12
5. Net fee of DBE brokers or bonding agents		5) $	

Total lines 1 through 5

10.36% % $ 839,129.43

(Enter the overall total and DBE% above. The approved percentage of commitment is contractual.)

☒ Approved 10.36 % ☐ Not Approved	By: Ronnie Winks Digitally signed by Ronnie Winks Date: 2024.12.12 16:06:09 -07'00'	
	Idaho Transportation Department	Date

Section 2 -DBE Submittal Package Instructions

All documentation must be emailed DBESubmittal@itd.idaho.gov or delivered to ITD Headquarters at 11331 W. Chinden Blvd, Bldg #8, Boise, ID by 5:00 pm MT on bid opening day.

DBE Submittal Package includes the ITD-2396, and the DBE quote **or** ITD-2399 with all of the following information:

1) Commitment Statement: a written statement that the DBE is committed to performing the work quoted, if selected.
2) Date
3) Prime Contractor (Can be shown as "To Prime Contractor" or "To All Prime Contractors"; Cannot be shown as "To All Bidders")
4) Project identifier (project name and/or key number)
5) DBE work items
6) DBE firm total (Must match the ITD-2396 form)
7) DBE Signature which can be in one of the following forms:
   a) Handwritten signature or initials;
   b) An electronic signature that is not typed using software (e.g., Adobe® Reader, Adobe Professional, Adobe E-Signature, DocuSign®);
   c) Other acceptable forms of confirming the commitment include:
      1) Email with the DBE email return address, project name and key number in the subject line and place the committed dollar amount in body of the email with typed first and last name and title of sender.
      2) DBE Firm Letterhead with the project name, key number and the committed dollar amount in body of the letter with typed or signed first and last name and title.

Any changes to the original DBE Commitment must be accompanied by written acknowledgement from the DBE subcontractor, as noted above.

Section 3 - Explanation of DBE Commitments

Note: Use 'Alt'+'Enter' to start a new line within a row if completing electronically.

	Name of DBE Firm Being Committed to the Prime for this Project (include person who submitted the quote and contact information, to include phone number and address)	Items Quoted for DBE Credit (List by Contract Item Numbers (not Line Item Number) and Brief Work or Material Description)	For Materials Only: Supplied (S) Leased (L) Manufactured (M)	Total Amount Quoted by DBE for DBE Credit
1)	NXB Geo, PO Box 3388, Nampa, ID 83653 Marcus Beagley 208-899-3953	675-005A SURVEY 675-010A DIRECTED SURVEYING 677-005A RECORD DRAWINGS		$ 51,080.00
2)	Curtis Clean Sweep, PO Box 44112, Boise, ID 83711 Cory Zubizareta, 208-284-1475	203-006A REMOVAL OF SIGN 203-006A REMOVAL OF MISCELLANEOUS ITEMS-DELINEATORS ONLY		$ 200,934.31
3)		611-001A CATTLE GUARD (PAVEMENT MARKINGS) paint 616-010A SIGN TYPE B-1		
4)		616-040G BRKAWY STL SIGN POST TY B-2 61-040J BRKAWY STL SIGN POST TY E-1 616-040K BRKAWY STL SIGN POST TY E-2		
5)		617-005A DELINEATOR TY 1 617-055A MILEPOST TY 3 630-005A TRANSVERSE, WORD, SYMBOL, AND ARROW PAEMENT MARKINGS-WATERBORNE		
6)		630-025A LONGITUDINAL PAV MARKING - WATERBORNE Z629-05A MOBILIZATION (PORTION)		
7)	Coldwater Group LLC, 1452 Wj. Stone Field Way, B3, Pleasant View, UT 84404 801-823-9493	308-010A PORTLAND CEMENT 308-005A CEMENT RECYCLED ASPHALT BASE STABILIZATION	$ 447,865.20	$ 318,396.00
8)		205-005A EXCAVATION (PORTION) 308-015A PULVERIZE EXISTING SURFACE Z629-05A MOBILIZATION (PORTION)		
9)				

Use additional sheets if necessary.

Section 4 - Summary of DBE Good Faith Effort

If the DBE participation goal for this project has not been met you MUST complete Section 4 and Section 5. In addition, submit the following: copies of correspondence, email, telephone logs, or other documentationn supporting good faith efforts made. Email all documentation to DBESubmittal@itd.idaho.gov or deliver to ITD Headquarters at 11331 W. Chinden Blvd, Bldg #8, Boise, ID 83714 on bid opening day by 5:00pm MT.

Name of DBE Firm (Include person who submitted a quote and contact information with phone number and address)	Date of Contact	Items Quoted (List by Contract Item Numbers and briefly describe proposed work item or materials.)	Amount Quoted by DBE	Describe why DBE Firm was not selected	Non-DBE Firm chosen for this work item	Amount Quoted by Non-DBE

Use additional sheets if necessary.

Section 5 - Explanation of DBE Good Faith Efforts

If the DBE participation goal for this project has not been met, the Contractor is required to answer the following questions in order to describe efforts to obtain DBE participation. Each following effort will require a detailed explanation.

1) What efforts has the Contractor made to conduct outreach/advertise to ITD-certified DBEs? Describe efforts, and attach copies of screenshots, published advertisements or proofs of publication if applicable.

2) Has the Contractor provided written notice to a reasonable number of specific DBEs that their interest in the contract was being solicited in sufficient time to allow the DBEs to participate effectively? Describe efforts. Submit a copy of all correspondence (including emails) soliciting bids from DBEs.

3) Has the Contractor followed up initial solicitation of interest by contacting DBEs to determine with certainty whether the DBEs were interested? Submit telephone logs, letters, emails, etc., to document follow-up activity.

4) Has the Contractor selected portions of the work to be performed by DBEs in order to increase the likelihood of meeting the DBE goal, including, where appropriate, breaking down contracts into economically feasible units to facilitate DBE participation? Describe efforts.

5) Has the Contractor provided interested DBEs with adequate information about the plans, specifications, and requirements of the contract? Describe what action was taken.

6) Has the Contractor negotiated in good faith with interested DBEs, not rejecting DBEs as unqualified without sound reasons based on a thorough investigation of their capabilities? Describe efforts.

7) Describe any other efforts not covered by Numbers 1 through 6 above that may demonstrate the Contractor's good faith efforts to obtain DBE participation on this project.

DBE Submittal Package Checklist

This form is provided for the convenience of the Prime and/or DBE firm. It is not contractual, therefore, it is not required to be submitted with your DBE Submittal Package. You may use multiple sheets for multiple DBE firms.

- [ ] Completed ITD-2396

- [ ] DBE Quote <u>or</u> ITD-2399

DBE Quote must contain:

- [ ] Commitment Statement: a written statement that the DBE is committed to performing the work, if selected.
- [ ] Date
- [ ] Prime Contractor (Can be shown as "To Prime Contractor" or "To All Prime Contractors"; Cannot be shown as "To All Bidders")
- [ ] Project identifier (project name and/ or key number)
- [ ] DBE work items
- [ ] DBE firm total (Must match the ITD-2396 form)
- [ ] DBE Signature, as identified in Section 2

- [ ] Any changes to the original quote provided by the DBE are acknowledged via signature by the DBE firm, as noted in Section 2.

Coldwater Group LLC
1452 W Stone Field Way, B3
Pleasant View, UT 84404
O: (801) 823-9493

Quote

Bid Date:	12/10/2024
Quote Date:	12/8/2024
Project:	Simco Rd Rehab
Valid Until:	10 Days after Quote Date
Quote #:	11252024-01

Item No.	Description	QTY	Unit	Unit Price	Total Price
MOBILIZATION					
Z629-05A	Mobilization Cement Recycled Asphalt	1	EA	$ 5,500.00	$ 5,500.00
Z629-05A	Mobilization Pulverizer	9	EA	$ 2,500.00	$ 22,500.00
CRABS/PULVERIZING					
308-005A	Cement Recycled Asphalt Base .75'	184200	SY	$ 0.86	$ 158,412.00
308-010A	Portland Cement	1658.76	Tons	$ 270.00	$ 447,865.20
308-015A	Pulverize Existing Material	164980	SY	$ 0.80	$ 131,984.00

Total: $ 766,261.20

Notes:

Add 1.5% if bond is needed. Bond must be paid within 15 days of bond receipt.
Quote includes labor and equipment to pulverize existing material and mix cement into pulverized material.
water to equipment, grading, and compaction by others

Prosecution:

Any costs arising from damage to Coldwater's leased or owned equipment caused by marked, or unmarked obstructions not lowered by contractor will be billed to Contractor. Intersections to be milled in conjunction with mainline work. If schedule requires intersections to be milled separately from the mainline work, an additional mobilization of $500.00 per location may be charged. Work is to be completed in one continuous operation. Coldwater will not be held responsible for damage to property where the work is being performed. An additional .20 per SYI will be added for depths cut deeper than quoted depth. Standby - any work stoppage outside of the control of Coldwater, billed at $650.00 per hour. Staging area within the limits of each day's work provided by contractor. Damage done to staging areas appointed by Contractor will not be Coldwater's responsibility. All obstructions to the milling operation to be lowered to at least 1" below milled surface requirements. If staging on job is not feasible, or provided, Coldwater will mobilize and demobilize daily for the quoted mobilization price. Quote does not include Sunday operations. If mill machine is tracked/walked a distance that exceeds 1 mile then a site to site mobilization will be charged at $650 LS. **Minimum charge per day for Pulverizer $5,500.00 Water Truck $1200.00 Broom $plus mob. If work is not continuous, please assume 1 mobilization for each production break that is 1 day or greater.**

Exclusions:

Utilities	**Site Access**
Sanitary Facilities	**All SWPPP BMPS**
Areas not accessible to rotomill	**Lowering of any obstructions**
Water truck and Sweeping (unless included above)	**Surveying**
Water Source	**All Traffic Control**
	QA/QC Testing

Thank you for giving Coldwater the opportunity to quote this project. Please feel free to contact Trent Webb at **208-815-0946** or Andy Bell at **435-225-4069.**

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ITD-2399 (Rev.10/15/2020)
itd.idaho.gov

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Date:	12.10.2024
Project Name and/or Key Number:	Simco Rd Rehabilitation and Safety Improvements
Prime Contractor Name:	All Prime Contractors
DBE Firm Name:	Coldwater Group, Inc.
DBE Address:	1452 W Stone Field Way B3, Pleasant View, UT 84404
DBE Contact Name/ Phone Number:	Trent Webb - 208-815-0946
DBE Firm Total:	$766,261.20

DBE WORK ITEMS

Item Number	Item Name	Item Quote
Z629-05A	Mobiliztion Cement Recycled Asphalt Base	$5,500.00
Z629-05A	Mobilization Pulverizer	$22,500.00
308-005A	Cement Recycled Asphalt Base	$158,412.00
308-010A	Portland Cement	$447,865.20
308-015A	Pulverize Existing Material	$131,984.00

DBE Commitment Statement
As the authorized representative of the DBE, I confirm that my firm has been contacted by the Prime Contractor/Bidder with regard to the above referenced project and work items. If the Prime Contractor is awarded the contract, we will enter into an agreement with them to perform the above referenced bid items.

DBE Authorized Representative Matt Montoro

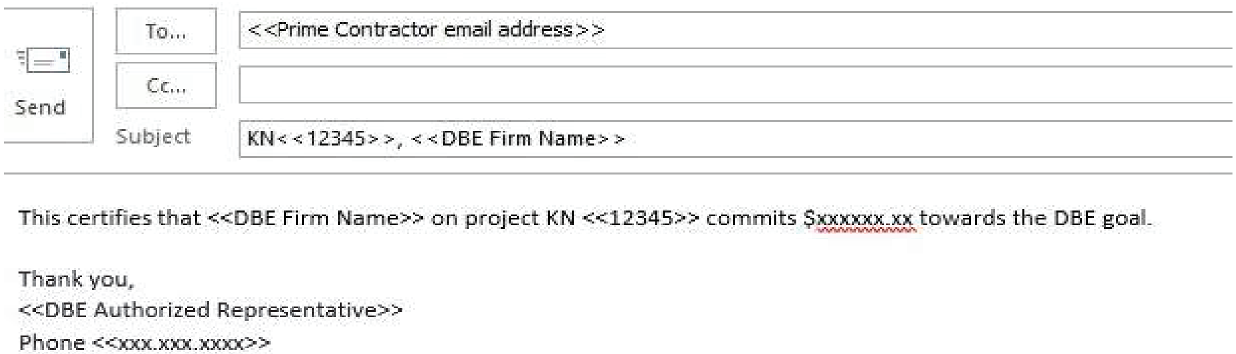
DBE Signature which can be in one of the following forms:

a) Handwritten signature or initials
b) An electronic signature that is not typed using software (e.g., Adobe® Reader, Adobe Professional, Adobe E-Signature, DocuSign®);
c) Other acceptable forms of confirming the commitment include:

1) Email with the DBE email return address, project name and key number in the subject line and place the committed dollar amount in body of the email with typed first and last name and title of sender.

2) DBE Firm Letterhead with the project name, key number and the committed dollar amount in body of the letter with typed or signed first and last name and title.

Example Email



Send

To... <<Prime Contractor email address>>

Cc...

Subject KN<<12345>>, <<DBE Firm Name>>

This certifies that <<DBE Firm Name>> on project KN <<12345>> commits $xxxxxx.xx towards the DBE goal.

Thank you,
<<DBE Authorized Representative>>
Phone <<xxx.xxx.xxxx>>

PROPOSAL

CURTIS CLEAN SWEEP

P.O. Box 44112 Boise, ID 83711
PHONE: (208)343-7600
FAX: (208)343-2159

Idaho Public Works - 13294-A- 4 (09950, 02761, 02785, 01570, 18800, 02890)
Oregon Construction License - 129615
DBE Authority - 49 CFR 26
RCE - 1922

PROPOSAL SUBMITTED TO	PHONE	DATE
To All Prime Contractors		12/9/2024
STREET	JOB NAME	
	Simco Rd Rehabilitation & Safety Improvements	
CITY, STATE, ZIP CODE	JOB LOCATION	
	Elmore County	
CONTACT	PROJECT NO.	
	A021(981), A022(879), A023(746), A024(280)	

BASE BID

ITEM #	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	BID AMOUNT
0010	203-006A - REMOVAL OF SIGN	24.0	EA	$250.00	$6,000.00
0015	203-006A - REMOVAL OF MISCELLANEOUS ITEMS - DELINEATORS ONLY	493.0	EA	$19.00	$9,367.00
0130	611-001A - CATTLE GUARD (PAVEMENT MARKINGS) - paint	1.0	EA	$615.00	$615.00
0140	616-010A - SIGN TYPE B-1	145.0	SQFT	$38.50	$5,582.50
0145	616-040G - BRKAWY STL SIGN POST TY B-2	158.0	FT	$400.35	$63,255.30
0155	616-040J - BRKAWY STL SIGN POST TY E-1	39.0	FT	$36.63	$1,428.57
0160	616-040K - BRKAWY STL SIGN POST TY E-2	24.0	FT	$39.21	$941.04
0170	617-005A - DELINEATOR TY 1	493.0	EA	$72.01	$35,500.93
0175	617-055A - MILEPOST TY 3	4.0	EA	$530.00	$2,120.00
0205	630-005A - TRANSVERSE, WORD, SYMBOL, AND ARROW PAVEMENT MARKINGS - WATERBORNE	282.0	SQFT	$2.93	$826.26
0210	630-025A - LONGITUDINAL PAV MARKING - WATERBORNE	542,307.0	LNFT	$0.1134	$61,497.61
0270	Z629-05A - MOBILIZATION	1.0	LS	$13,800.00	$13,800.00

SPECIAL NOTES

1. This bid may expire if notice of intent is not given within ***10*** days of the bid opening.
2. This bid excludes business signs, sign & delineator survey, delineator removal, testing, and any & all traffic control.
3. **These prices reflect all line items as a total package and cannot be broken up individually.**
4. Obliteration of pavement markings excludes fog seal and any damage caused to joint sealant.
5. Bid Bond not included in price. If required add 3% to overall quote total.
6. General contractor responsible for layout of all lines, crosswalks, stop bars, and symbols. Layout of lines must consist of a control point every 50 ft on a tangent, and every 25 ft on a curve. All layout must be approved before we can proceed with any striping. Please plan accordingly.
7. Striping prices do not include obliteration, preparation, cleaning or brooming of surfaces, or layout for control points of lines.
8. If accepted, this proposal to become an exhibit to the subcontract agreement.
9. Delays or layout of control points shall be charged an hourly rate of $500.00 / hr per crew.
10. This is a unit price proposal. This contract is based on estimated quantities. Actual payment will be based on final quantities completed.
11. Work cannot be guaranteed unless performed at specified minimum temperatures.
12. Due to the instability of the traffic paint industry with the associated price increases and material shortages, Curtis Clean Sweep Inc reserves the right to adjust the pricing for the pavement marking products quoted above as we receive these increases. In the event that traffic paint becomes unavailable, Curtis Clean Sweep Inc will be held harmless.

We propose hereby to furnish material and labor - complete in accordance with the above specification's for the sum of: $200,934.21

Payment is to be made as follows: UPON INVOICE

All material is guaranteed to be as specified. All work to be completed in a workmanlike manner according to standard practices. Any alteration or deviation from above specifications involving extra costs will be executed only upon written orders, and will become and extra charge over and above the estimate. All agreements contingent upon strikes, accidents, or delays beyond our control.. Owner to carry fire, tornado and other necessary insurance. Our workers are fully covered by Workman's Compensation Insurance.

Authorized Signature:
CORY ZUBIZARETA

Note: This proposal will be withdrawn by us if not accepted within 10 days.

Acceptance of Proposal *- The prices, specifications and conditions are satisfactory and are here by accepted. You are authorized to do the work as specified. Payment will be made as specified above*

SIGNATURE: ______________________ DATE: ______________

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Date:	**December 9, 2024**
Project Name and/or Key Number:	**Simco Rd Rehabilitation & Safety Improvements**
Prime Contractor Name:	**To All Prime Contractors**
DBE Firm Name:	**Curtis Clean Sweep Inc**
DBE Address:	**117 E 37th** **Garden City, Idaho 83714**
DBE Contact Name/ Phone Number:	**Cory Zubizareta - 208-343-7600**
DBE Firm Total:	**$ 200,934.21**

DBE WORK ITEMS

Item Number	Item Name	Item Quote
0010	203-006A - REMOVAL OF SIGN	$ 6,000.00
0015	203-006A - REMOVAL OF MISCELLANEOUS ITEMS - DELIN	$ 9,367.00
0130	611-001A - CATTLE GUARD (PAVEMENT MARKINGS) - pain	$ 615.00
0140	616-010A - SIGN TYPE B-1	$ 5,582.50
0145	616-040G - BRKAWY STL SIGN POST TY B-2	$ 63,255.30
0155	616-040J - BRKAWY STL SIGN POST TY E-1	$ 1,428.57
0160	616-040K - BRKAWY STL SIGN POST TY E-2	$ 941.04
0170	617-005A - DELINEATOR TY 1	$ 35,500.93
0175	617-055A - MILEPOST TY 3	$ 2,120.00
0205	630-005A - TRANSVERSE, WORD, SYMBOL, AND ARROW	$ 826.26
0210	630-025A - LONGITUDINAL PAV MARKING - WATERBORNE	$ 61,497.61
0270	Z629-05A - MOBILIZATION	$ 13,800.00

DBE Commitment Statement

As the authorized representative of the DBE, I confirm that my firm has been contacted by the Prime Contractor/Bidder with regard to the above referenced project and work items. If the Prime Contractor is awarded the contract, we will enter into an agreement with them to perform the above referenced bid items.

DBE Authorized Representative ______________________

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Date:	December 10, 2024
Project Name and/or Key Number:	KN21981/22879/23746/24280 Simco Road Rehabilitation
Prime Contractor Name:	All Prime Contractors
DBE Firm Name:	NXB Geo
DBE Address:	PO Box 3388 Nampa, ID 83653
DBE Contact Name/ Phone Number:	Marcus Beagley/208-899-3953
DBE Firm Total:	$ 51,080.00

DBE WORK ITEMS

Item Number	Item Name	Item Quote
675-005A	Survey	$ 45,080.00
675-010A	Directed Surveying	$ 5,000.00
677-005A	Record Drawings	$ 1,000.00

DBE Commitment Statement
As the authorized representative of the DBE, I confirm that my firm has been contacted by the Prime Contractor/Bidder with regard to the above referenced project and work items. If the Prime Contractor is awarded the contract, we will enter into an agreement with them to perform the above referenced bid items.

DBE Authorized Representative Marcus Beagley

P.O. Box 3388, Nampa, ID 83653 ~ (208) 899-3953 marcus@nxbgeo.com

B-13024 December 9, 2024

Project: KN 21981, 22879, 23746, 24280 Simco Rd Rehabilitation

Project Location: Elmore Co., ID

NXB Geo has reviewed the above referenced project plans and specifications. Our proposed scope includes staking/supplying each item listed below:

675-005A Survey: <u>$45,080.00 LUMP SUM</u>

- Site control and benchmark verification
- Topographic survey for model creation and volumetric quantities
- **FG model for motorized grading** (grading for approaches without profiles is not included, linework only)
- BMP's
- Project stationing
- Signs
- Striping
- Delineators
- **Quantity Calculation:** All pay items that require volumetric calculations

675-010A Directed Surveying: <u>$5,000.00 CA</u>

677-005A Record Drawings: <u>$1,000.00 LUMP SUM</u>

<u>Exclusions:</u>

- Topographic survey for excavation – contractor is expected to capture and send data

NXB Geo acknowledges Addendum #1

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Date:	**December 10, 2024**	
Project Name and/or Key Number:	**KN21981/22879/23746/24280 Simco Road Rehabilitation**	
Prime Contractor Name:	**All Prime Contractors**	
DBE Firm Name:	**NXB Geo**	
DBE Address:	**PO Box 3388** **Nampa, ID 83653**	
DBE Contact Name/ Phone Number:	**Marcus Beagley/208-899-3953**	
	DBE Firm Total:	**$ 51,080.00**

DBE WORK ITEMS

Item Number	Item Name	Item Quote
675-005A	Survey	$ 45,080.00
675-010A	Directed Surveying	$ 5,000.00
677-005A	Record Drawings	$ 1,000.00

DBE Commitment Statement

As the authorized representative of the DBE, I confirm that my firm has been contacted by the Prime Contractor/Bidder with regard to the above referenced project and work items. If the Prime Contractor is awarded the contract, we will enter into an agreement with them to perform the above referenced bid items.

DBE Authorized Representative Marcus Beagley

DAVIS-BACON WAGE

GENERAL WAGE DECISION ID240079

PUBLICATION DATE 02/16/2024 ID79

The above referenced wage rates can be obtained

at

http://www.sam.gov

DAVIS-BACON WAGE RATES

Idaho Federal Aid Project No. A021(981), A022(879), A023(746), A024(280)
SIMCO RD. REHABILITATION & SAFETY IMPROVEMENTS, MTN. HOME HD
Elmore County, Key No. 21981, 22879, 23746, 24280

The following Davis Bacon Wage Rates shall be posted by the Contractor using Poster WH-1321 and shall be placed prominently in a location where it will be noticeable and accessible to all workers at the site of the work on each Federal Aid Project.

Should these papers tear or become illegible, they shall be replaced as long as work continues. Posters and additional copies of this form are available from the Engineer.

"General Decision Number: ID20240079 02/16/2024

Superseded General Decision Number: ID20230079

State: Idaho

Construction Type: Highway

County: Elmore County in Idaho.

HIGHWAY CONSTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/05/2024
1	01/19/2024
2	02/16/2024

```
 PLAS0072-001 06/01/2023

ZONE 1:

                                  Rates          Fringes

CEMENT MASON/CONCRETE FINISHER...$ 38.05            16.89

Zone Differential (Add to Zone 1 rate):  Zone 2 - $3.00

BASE POINTS:  Spokane, Pasco, Lewiston, Wenatchee

Zone 1:  0-45 radius miles from the main post office

Zone 2:  Over 45 radius miles from the main post office

----------------------------------------------------------------
  SUID2013-007 06/17/2013

                                  Rates          Fringes

CARPENTER (Form Work Only).......$ 26.57             8.10

ELECTRICIAN......................$ 26.83            11.94

HIGHWAY/PARKING LOT STRIPING:
 Painter.........................$ 23.80             6.67

LABORER:  Asphalt, Includes
Raker, Shoveler, Spreader and
Distributor......................$ 23.09            10.44

LABORER:  Common or General......$ 23.88            11.05

LABORER:  Concrete Saw (Hand
Held/Walk Behind)................$ 23.98            11.05

LABORER:  Grade Checker..........$ 23.41            10.78

LABORER:  Mason Tender -
Cement/Concrete..................$ 23.88            11.05

OPERATOR:
Backhoe/Excavator/Trackhoe.......$ 26.20             9.97

OPERATOR:  Bobcat/Skid
Steer/Skid Loader................$ 25.35            11.55

OPERATOR:  Broom/Sweeper.........$ 23.93             9.09

OPERATOR:  Bulldozer.............$ 25.94            10.36

OPERATOR:  Crane.................$ 26.04            10.28

OPERATOR:  Crusher...............$ 25.06             9.23

OPERATOR:  Grader/Blade..........$ 26.00            10.30

OPERATOR:  Hydroseeder...........$ 24.76            11.51

OPERATOR:  Loader................$ 26.11            10.00

OPERATOR:  Mechanic..............$ 25.40             8.63
```

OPERATOR: Oiler	$ 25.66	9.23
OPERATOR: Paver (Asphalt, Aggregate, and Concrete)	$ 25.63	10.33
OPERATOR: Roller (Subgrade)	$ 22.24	8.57
OPERATOR: Roller	$ 25.24	10.42
OPERATOR: Rotomill	$ 27.06	12.65
OPERATOR: Screed	$ 24.07	9.63
TRAFFIC CONTROL: Laborer-Cones/ Barricades/Barrels - Setter/Mover/Sweeper	$ 22.66	10.90
TRUCK DRIVER: Dump Truck	$ 21.80	13.95
TRUCK DRIVER: Lowboy Truck	$ 22.12	13.20
TRUCK DRIVER: Oil Distributor Truck	$ 22.54	12.35
TRUCK DRIVER: Water Truck	$ 21.80	10.86

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

SPECIAL PROVISIONS
IDAHO FEDERAL AID PROJECT NO. A021(981), A022(879), A023(746), A024(280)

Simco Rd. Rehabilitation & Safety Improvements, Mtn. Home HD Elmore County

For the work of pavement rehabilitation on Simco Rd by performing Cement Recycled Asphalt Base Stabilization (CRABS).

The following special provisions and all addenda issued supplement or modify the 2023 Idaho Transportation Department Standard Specifications for Highway Construction: 2024 Supplemental for the Idaho Transportation Department 2023 Standard Specifications for Highway Construction, 2020 Quality Assurance (QA) Manual (10/19), 2024 QA Manual Supplementals to the 2020 QA Manual (7/29/24), 2024 Buy America Insert (4/9/2024), 2023 Quality Assurance Special Provision for State Acceptance (12/07/2023), 2024 Special Provision for 405 Superpave Hot Mix Asphalt (11/29/2023), April 2023 Standard Drawings, Title VI Special Provisions, FHWA-1273 Federal-Aid Required Contract Provisions, General Wage Decision ID240079.

SOURCE IDENTIFICATION

Designated source(s): Designated source(s) are not identified for this contract/project.

Contractor provided sources. Provide an approved source(s) for all materials. ITD sources will not be available for this project.

Cost. Assume all costs incurred in obtaining approvals for use of source(s).

CONTRACT TIME

Work will not start earlier than June 30, 2025 or later than August 25, 2025 and must be completed within 70 working days.

See Environmental Concerns section for constraints on starting window.

Once started, work must continuously progress until completion. Return traffic through the work zone to normal operations during any planned or unplanned work stoppage lasting longer than 3 working days.

LIQUIDATED DAMAGES

The amount of liquidated damages for failure to complete the work on time will be $9,000 per day.

Liquidated damages provision does not waive the Department's right to seek other remedies for a breach of contract by the awarded Contractor.

CONTRACTOR NOTES

DBE PROGRAM REQUIREMENTS

10/21

For bidding purposes, the Contractor must comply with the DBE program requirement of **10.0**%. Upon award, the approved percentage % on the ITD-2396 DBE Commitments form becomes contractual and failure to comply is a breach of contract. Any change to this contractual commitment during the administration of the contract must be coordinated through the Office of Civil Rights.

Whenever the Engineer determines, after investigating and obtaining evidence the Contractor has not complied with the DBE program requirement, the Engineer will take corrective action. Refer to the Department's Standard Specifications for Highway Construction, Section 110, Civil Rights.

The Contractor, sub recipient, or subcontractor will not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor will carry out applicable requirements of 49 CFR Part 26 in the award and administration of USDOT-assisted contracts. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate (e.g., withholding monthly progress payments, assessing sanctions, liquidated damages, disqualifying the Contractor from future bidding as non-responsible).

For additional DBE Program information see the Department's DBE program requirements located at: *https://itd.idaho.gov/civilrights/*

AGGREGATE BASE

For aggregate base material added to the roadway ballast to be used in CRABS process, In-Place Density acceptance for the aggregate base will be in accordance with density requirements of the CRABS process.

COMMUNICATION PROTOCOL DURING CONSTRUCTION BIDDING 11/23

During the advertisement period, prospective Contractors/Bidders will address all questions to the Design Construction (Resident) Engineer shown on the Notice of Letting. After Bid Opening and through Contract Award, all communications between the Department and the Contractor/Bidder, and any unsuccessful bidders, will be through the State Design Engineer at 208.334.8502. The Department will be unable to share any information related to bid submittals or pending Department decisions during this time. After Contract Award, all communications between the Department and the Contractor will be through the Design Construction (Resident) Engineer.

CONSTRUCTION STAGING

This staging sequencing was used to determine the project working day time. The Contractor may request to add, delete, or modify work activities, work areas, methods, sequencing, or work windows. See section 107.17.B. Contract Revisions – Contractor Requested. There must be no additional charge to the project for any change to the staging. Submit any and all changes to the Engineer two weeks before the preconstruction meeting.

Mobilize and setup traffic control
Reconstruct curves 1 & 2
Reconstruct curves 4 & 5
Reconstruct curves 8 & 9
Reconstruct curve 15, start placing ¾" Aggregate Base over existing asphalt, start class I CRABS
Start microcracking 24 hours after crabbing, remove cattle guard
Start paving within 48 hours after crabbing
Shoulder grading & approaches
Pavement markings & signing
Seeding
Remove traffic control

CONSULTANT CONFLICT OF INTEREST 01/21

The Consultant and sub-consultants, as the designers of this project, agree that no one in their firms shall perform any services for the contractor on the construction of this project.

The following Consultants worked on the design of this project:

HMH Engineering
Terracon Consultants, Inc.
Water, Civil, Environmental, Inc.
Bionomics, Inc.

COORDINATION WITH PROPERTY OWNERS

Maintain access to all properties adjacent to the project to the maximum extent feasible. Make arrangements with individual property owners to provide acceptable alternative access, or other arrangements, in the event a temporary closure is necessary. A minimum of one week prior to starting construction on affected approaches, contact each property owner in person to discuss the impacts, time frame, and methods of access. Give each property owner the name and phone number of the Traffic Control Supervisor (TCS) and/or the Superintendent for contact during construction. Submit written documentation to the Engineer outlining the conversation following each property owner contact.

Contact the Idaho Air National Guard one week prior to commencement of work and notify them of work adjacent to their tank crossing on Simco Road.

Idaho Air National Guard -Comm Squad

SMSgt Ruel Gadbury
124FW/CES Facility Manager
Comm: (208) 422-6112
Cell: (208) 860-1152
ruel.a.gadbury.mil@mail.mil

CRABS LAYER CONSTRUCTION AND PROTECTION

Based on field data, the existing asphalt surfacing thickness varies between about 2.5 to 4 inches but is typically 3 to 3.4 inches in thickness over most of the project. Contractor is required to review the material report prior to the preconstruction meeting. The full thickness of the existing asphalt pavement will be pulverized. No additional payment will be made for any area thicker than called out above.

The CRABS layer thickness to be constructed is 9 inches. Multiple pulverization and mixing of cement passes, and additional compaction effort and equipment may be necessary during CRABS layer construction.

The Contractor is solely responsible for protection and repair of the new CRABS layer, and all existing underground utilities, structures, monuments, culverts, irrigation, and drainage features.

Verify the depth of the culverts and monuments prior to pulverizing over their location.
There will be no pulverization over the new constructed areas.

DELINEATOR ASSEMBLIES

Provide Shur-Flex Driveable Delineators manufactured by Shur-Tite Products or an approved equivalent.

DEPARTMENT STANDARD DRAWINGS 06/18

The applicable Department standard drawings supplement the contract plans and are incorporated into the contract by reference. The Department Standard Drawings identified for this project are available on the Department Website, http://apps.itd.idaho.gov/apps/StandardDrawings/StandardDrawings.htm. The Department will not provide printed or electronic file copies of the Standard Drawings to bidders prior to contract award or to the Contractor after contract award. Each bidder has sole responsibility to obtain the applicable Department Standard Drawings, and to provide a bid in accordance with the Standard Drawing revision specified on the first page of this contract.

EMERGENCY SERVICES NOTIFICATION

No less than 48 hours before implementing any traffic restricting measures, provide in writing the following entities with specific traffic control methods and dates all such controls will be in use, along with one phone number with which they will be able to contact the on-site project supervisor at any time during construction:

1. Emergency response agencies: Idaho State Patrol, Elmore County Sheriff, and Fire Departments, ambulance services, etc.

Provide the Engineer with copies of communications with the above entities.

EMPLOYMENT AGENCY 01/23

To find the nearest employment office, visit https://www.labor.idaho.gov/dnn/Local-Office-Directory.

ENVIRONMENTAL CONCERNS

All planned work must adhere to ITD Standard Specifications Section 251 requirements that the Contractor must avoid and minimize impacts and harassment to listed migratory birds during construction.

According to IFWIS data, golden eagles have been seen within 1 mile of the project area, but eagle nests are not present in the project area. BLM property adjacent to the project area is part of the Morley Nelson Snake River Birds of Prey NCA, which is actively managed for the conservation of birds of prey. Burrowing owls and Ferruginous hawks (BLM Sensitive Species) have been observed in the close vicinity of the project area. Burrowing owls could nest in any of the many abandoned badger holes along the roadside.

To avoid harming burrowing owl nests, the contractor may conduct ground-disturbing activities between August 8 and March 6. If the contractor must conduct ground-disturbing activities between March 7 and August 7, the contractor must provide a qualified biologist (at no cost to the project) to locate any active burrowing owl nests or other migratory birds' nests in the project area. Per BLM's recommendation, ground-disturbing work must not occur within 1,320 feet (1/4 mile) of an active burrowing owl nest.

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention at this project location. This is not a list of every bird found in this location, nor a guarantee that every bird on this list will be found at this project area.

NAME	BREEDING SEASON
Brewer's Sparrow Spizella breweri https://ecos.fws.gov/ecp/species/9291	Breeds May 15 to Aug 10
Lewis's Woodpecker Melanerpes lewis https://ecos.fws.gov/ecp/species/9408	Breeds Apr 20 to Sep 30
Long-billed Curlew Numenius americanus https://ecos.fws.gov/ecp/species/5511	Breeds Apr 1 to Jul 31
Sage Thrasher Oreoscoptes montanus https://ecos.fws.gov/ecp/species/9433	Breeds Apr 15 to Aug 10

Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php

Contractor Commitments
Implement the following Best Management Practices to support pollinators and pollinator habitat along roadside corridors:

- Protect Existing Habitat: Protect existing stands of native vegetation. Ground disturbing activities will be limited only to those areas deemed necessary for the construction of the project. Disturbing existing areas of native vegetation purely for the convenience of the contractor is prohibited.
- Herbicide Use: Reduce the risk of herbicide exposure to pollinators by:
  (1) Eliminating or reducing herbicide exposure to pollinators by first utilizing non-chemical (manual)

methods to eliminate noxious and undesirable weeds.
(2) If herbicide use is necessary, spot treat specific weeds with selective herbicides that do not leave residuals in the soil.
(3) Treat weeds before they flower, to avoid spraying when pollinators are present.
(4) Avoid spray application if winds are above 10 mph.

ESTIMATING BASIS

The unit weights in the estimating basis were determined from area history and past project experience. This information is provided for use by the designer in developing reasonable project quantities. The actual quantities will vary and are dependent on the Contractor provided materials source, crushing operation, and mix designs. The Contractor is responsible for determining actual unit weights based on the material produced and providing adequate materials for the project plus any losses due to stockpile operation, out of specification (rejected) materials, or other wastes.

GENERAL WAGE DECISION 01/18

Upon written request 10 calendar days before the bid opening date, the Department will provide a missing job classification, wage rate, and fringe benefit rate as outlined on FHWA-1273 IV.1.b to all plan holders as addenda.

HAZARDOUS MATERIALS SPILL PREVENTION/CONTINGENCY PLAN

Prepare a Hazardous Materials Spill Prevention/Contingency Plan prior to mobilization and submit it to the Engineer for approval. State the following in the plan:

- Contractor response to any unexpected finding of a hazardous material or release of a hazardous material to the environment.
- Contractor response time to any hazardous materials finding or release.
- Names and phone numbers of all government or private agencies to be contacted.
- Construction and use of a designated fuel storage and equipment refueling area, in accordance with the Idaho Transportation Department Standard Drawing 212-15, Petroleum Storage Area. Any fueling must take place a minimum of 150 feet from live water or fuel over absorbent pads to assure protection from chemical spills.
- All Best Management Practices designed to prevent or contain hazardous materials spills.

No separate payment will be made for containment devices or plan generation.

HMA PAVEMENT

Equip the paver with a shoe to provide a 30° safety edge on the outside shoulder.

Tack coat is incidental and included in the contract unit price for the Superpave HMA contract pay item.

IDAHO IMPLEMENTATION OF AASHTO MANUAL FOR ASSESSING SAFETY HARDWARE, 2ND EDITION (2016) 01/21

The following safety hardware must meet AASHTO 2016 MASH criteria, ITD's Standard Drawings, and if the hardware is a proprietary product, it must be approved on ITD's Qualified Product List (QPL) for new permanent installations and full replacements:

- W-beam
- Cast-in-place concrete barriers
- W-beam tangent terminals and buried-in-backslope terminals
- W-beam flared terminals and terminals installed on a flare
- Crash cushions
- Transitions

- Permanently installed portable barriers
- Bridge rails
- Cable barriers
- Cable barrier terminals

The following safety hardware may be MASH 2009/2016 or NCHRP 350 compliant for new permanent installations and full replacements:

- Double-sided or median terminals
- Sign supports
- All other breakaway hardware

Temporary work zone devices (including portable barriers, truck- and trailer-mounted attenuators, portable changeable message signs (PCMS), temporary traffic signals, and camera trailers) manufactured after December 31, 2019, must have been successfully tested to the 2016 edition of MASH. Such devices manufactured on or before this date, and successfully tested to NCHRP Report 350 or the 2009 edition of MASH, may continue to be used throughout their normal service lives.

MATERIALS PHASE REPORTS

The following materials reports prepared for this project are available from the Resident Engineer:

- Phase I(R) Pavement Rehabilitation Report dated December 6, 2023
- Phase III Pavement Estimating Report dated December 6, 2023

PARKING AND ACCESS RESTRICTIONS

Set up a designated parking area in an approved location. Contractor's personnel are required to park their private vehicles in this designated area.

PLANT CONTROL CHARTS LHTAC 01/21

As noted in ITD Standard Specifications Section 405.03, plant control charts will be a required submittal. These submittals must include mix design inputs, and actual aggregate and additive weights as recorded by automated or staff recorded log.

POLLUTION PREVENTION PLAN

The estimated project area of impact is approximately 2.65 acres. A pollution prevention plan (PPP) may be used if the project qualifies for a Low Erosivity Waiver (LEW), including an erosivity factor of less than 5.0. If the Contractor's operations, including but not limited to, staging, waste, or material source disturbances result in a disturbed area 5 acre or more and there is a potential connection to discharge to Waters of the US, an active IPDES permit and associated SWPPP will be required as specified in 107.17. All monetary and time impacts required to establish a SWPPP will be borne by the Contractor. A draft SWPPP must be submitted to the Engineer for approval before filing the Notice of Intent.

PROJECT MAINTENANCE DURING CONSTRUCTION

Maintain project throughout the life of the contract. This responsibility includes, but is not limited to, blading, proper and adequate drainage, dust control, access for emergency equipment, and appropriate access to adjacent properties.

Maintain both on-site and off-site roadway facilities that are adversely affected by construction activities, including hauling. This maintenance may include, but is not limited to, street sweeping to eliminate tracking (within the project limits, adjacent streets, private driveways, and parking lots), and roadway repairs due to truck and equipment traffic. Required roadway facility maintenance shall be at the discretion of the Engineer.

The cost of all maintenance is incidental to other project work and no separate payment will be made therefore. Failure to adequately provide dust control shall be grounds for stopping work. The cost of providing dust control by other than the Contractor if required, shall be deducted from progress estimates.

REFERENCES TO THE STATE, DEPARTMENT, AND ITD

Mountain Home Highway District are the owners of this project and the project is being administered by the Local Highway Technical Assistance Council (LHTAC). References to the "State", "Department", or "ITD" as being the owner or the Engineer should be understood to be referencing Mountain Home Highway District or LHTAC where appropriate.

REQUIREMENTS OF THE CONTRACTOR WHEN ON RAILROAD PROPERTY 12/23

Union Pacific Railroad (Railroad Company), at its determination, may provide inspection, security, flagging, or other protective services as necessary for the protection of the Railroad Company property or operations whenever there are Contractor operations on Railroad Company property. Costs charged to the Contractor for services provided by the Railroad Company will be reimbursed by the Department at invoice cost.

Notify the Railroad Company representative, Leo Craig (817-907-9560) at least **30 calendar days** before the start of work on Railroad Company property. This is to provide the Railroad Company time to furnish railroad flagging or other protective services as might be necessary to ensure the safety of Railroad Company operations.

Consider recommendations made by the Railroad Company regarding activities or operations on Railroad Company property. The Department will not relieve the Contractor of liability by accepting recommendations made by the Railroad Company.

The Contractor must apply, obtain, and coordinate with the Railroad Company to obtain necessary approvals and/or documentation as appropriate to work within the Railroad Company property. Fees associated with this are incidental to mobilization.

All employees needing access to Railroad Company property must hold a current certification of safety training as required by the Railroad Company. The Contractor must contact the Railroad Company to identify the required training and to identify how to obtain the training. Training fees are incidental to mobilization.

The Railroad Company reserves the right to stop and/or require modifications to any Contractor operations on Railroad Company property that, at the Railroad Company determination, could create or is creating an eminent hazard to Railroad Company property or operations.

Perform work on Railroad Company property in a manner satisfactory to the Railroad Company. Perform work at a time and in a manner that will not damage the track or interfere unnecessarily with the movement of trains or other authorized users of the track(s) of the Railroad Company.

Dress suitably to perform work safely and in a manner that will not interfere with vision, hearing, or free use of hands or feet when on Railroad Company property. Wear the following clothing and personal protective equipment:

a) Waist length shirts with sleeves.

b) Trousers covering the entire leg, with any flare-legged style tied to prevent catching.

c) Sturdy footwear such as work boots. No open-toed (e.g., sandals), thin soled (e.g., tennis or walking shoes), or high-heeled shoes are allowed.

d) ANSI Class II or III highly visible outer wear.

e) Protective headgear per ANSI/ISEA Z89.1, latest revision. The Department recommends that all hard-hats be affixed with the entity's name or logo.

f) Eye protection per ANSI/ISEA Z87.1, latest revision. Provide additional eye protection to meet specific job situations (e.g., welding, grinding).

g) Hearing protection per 29 CFR 1910.95.

Contact the Railroad Company before commencing work on Railroad Company property for determination if any telecommunication or other facilities are located within the area. Locate and protect any known facilities at no expense to the Railroad Company.

Do not discharge explosives on Railroad Company property without the prior consent of the Railroad Company. The Railroad Company reserves the right to impose additional conditions and restrictions on the Contractor when explosives are used, stored, or transported on Railroad Company property in addition to the following:

a) Provide a minimum of 48 hours' notice to the Department and the Railroad Company, excluding weekends and holidays, before discharging any explosives unless the Railroad Company has agreed otherwise.

b) Discharge explosives loaded in holes or otherwise readied for discharge that same day during daylight hours at a time acceptable to the Railroad Company.

c) Take precautionary measures and construct temporary shelters necessary to guard against danger of damage, destruction, or interference arising out of or connected with any blasting, transportation, handling, storage, security, or use of explosives, at no expense to the Railroad Company.

d) Use, store, and transport explosives in a manner acceptable to the Railroad Company and in accordance with local, state, and federal laws and regulations, including, without limitation, United States Department of Labor, Bureau of Labor Standards, Safety and Health Regulations for Construction, 29 CFR Part 1518, Subpart U--"Blasting and the Use of Explosives;" and Occupational Safety and Health Administration Occupational Safety and Health Standards, 29 CFR Part 1910, Subpart H--"Hazardous Materials".

Do not foul the drainage ditches or railroad ballast with debris. Remove all debris at the completion of the work at no expense to the Railroad Company.

Do not place combustible material, erect any structure, or obstruct the view along the tracks on Railroad Company property without prior approval from the Railroad Company.

ON PAGE 19, SUBSECTION 101.04 - DEFINITIONS

Delete the following under Working Day.:

4. Days during December, January, and February.

ON PAGE 28, SUBSECTION 104.01.B. – CONSTRUCTION PARTNERING

Delete the entire section.

ON PAGE 36, SUBSECTION 105.04 – COORDINATION OF CONTRACT DOCUMENTS 4/24

Delete items 7 through 12 and add the following:

7. Buy America Insert
8. Quality Assurance (QA) Manual Supplementals
9. Standard Supplementals
10. Standard Specifications
11. Standard Drawings
12. QA Manual
13. Electronic Files (if specified as part of the contract)

ON PAGE 39, SUBSECTION 105.07 – UTILITY FACILITIES 01/18

Add the following:

Lumen

Tenille Sorenson
Network Implementation Engineer II
216 S. Park Ave W.
Twin Falls, ID 83301
Office: (208) 646-3600
Cell: (208) 921-1317
tenille.sorenson@lumen.com

Idaho Power

R. Brack Judy
1221 W. Idaho St
Boise, ID 83702
Office: (208) 388-6047
Cell: (208) 861-4715
BJudy2@idahopower.com

Rural Telephone Co

Michael Martell
892 W. Madison Ave
Glenns Ferry, ID 83623
Office: (208) 943-1455
michael@rtci.net

AT&T

Donna Franks
(678) 917-3174

Williams Northwest Pipeline

1301 S Locust Grove Rd
Meridian, ID 83642
Office (208) 884-4300
SLCNWPpipelinecontrol@Williams.com

A Williams representative must be onsite for any excavation or heavy equipment movement in the vicinity of the Williams pipeline. Contact Alex at (208) 806-6185 or Daly at (208) 488-2888 no less than 48 hours prior to any excavation or heavy equipment work in the vicinity of the Williams Pipeline.

Request locates of buried utility facilities by contacting the Utility One-Call Center by calling 1-800-342-1585, e-mailing digline@digline.com or faxing 1-800-342-1586.

Request locates of utilities buried within Union Pacific Right of Way at www.up.com/CBUD

ON PAGE 79, SUBSECTION 107.17 – ENVIRONMENTAL AND CULTURAL RESOURCE PROTECTION

Add the following at then end of Section J. Stormwater Pollution Prevention:

Low Erosivity Waiver
With the approval of the engineer a PPP may also be used if total project has a potential to discharge to a WOTUS and disturbance exceeds 1.0 acres but is less than 5.0 acres and the Rainfall Erosivity R factor is less than 5.0. If approved, obtain a Low Erosivity Waiver (LEW). Include all LEW documentation in the PPP and retain on site.

For R value calculations see: https://lew.epa.gov/

ON PAGE 87, SUBSECTION 108.01 - SUBLETTING OF CONTRACT 05/23

Delete the second sentence and substitute the following:

If the Engineer consents to subletting a portion of the work, the Contractor will use its own organization to perform work amounting to at least 30 percent of the original contract amount.

ON PAGE 91, SUBSECTION 108.03 – PROJECT SCHEDULE

Add the following after the second paragraph of Subsection C:

Each week, submit a simplified look-ahead schedule showing dates, shifts, and items of work planned for the upcoming three-week period. Submit either a hard copy or a PDF.

ON PAGE 91, SUBSECTION 108.05 – LIMITATION OF OPERATIONS

Add the following to the end of the second paragraph:

unless approved by the Engineer.

ON PAGE 112, SUBSECTION 109.05 – PARTIAL PAYMENT MOD LHTAC

Delete the first sentence of the second paragraph and replace with the following:

The Engineer may withhold progress estimates until the Contractor complies with the contract, including:

ON PAGE 159, SUBSECTION 205.05 – BASIS OF PAYMENT

Add the following after the last paragraph:

In areas of reconstruction, the removal of bituminous surface is included in the quantity for excavation.

ON PAGE 192, SUBSECTION 308.01 – DESCRIPTION

In the last sentence of the first paragraph delete '4 steps:' and replace with '6 steps:'

ON PAGE 192, SUBSECTION 308.01 – DESCRIPTION

Add the following after step 4.

5. Microcracking.
6. Application of a Prime Coat.

ON PAGE 194, SUBSECTION 308.03 – CONSTRUCTION REQUIREMENTS

Delete the last sentence of the last paragraph under Part 308.03.B.5: Compacting and Finishing and replace with the following.

Do not use vibratory rollers on the CRABS surface beyond the 1½ hours after the addition of water and cement, except for Micro-cracking as described in 6.1.

ON PAGE 194, SUBSECTION 308.03 – CONSTRUCTION REQUIREMENTS

Add the following after Part 308.03.B.6: Protection.

6.1 Micro-cracking. Micro-crack the CRABS layer with three (3) complete coverages of a vibratory roller prior to placing the Prime Coat and paving. Do not micro-crack the CRABS layer until at least 24 hours after introduction of the cement and water.

ON PAGE 194, SUBSECTION 308.03 – CONSTRUCTION REQUIREMENTS

Delete the first sentence under Part 308.03.B.7 Paving, and replace it with the following:

Pave over the CRABS as soon as possible following micro-cracking and within 48 hours after introduction of cement and water to the CRABS.

ON PAGE 199, SUBSECTION 402.04 – METHOD OF MEASUREMENT

Delete #2.

ON PAGE 199, SUBSECTION 402.05 – BASIS OF PAYMENT

Delete "Blotter.. Ton or CY"

Add the following at the end of the section:

The Department will not make separate payment for blotter and is considered incidental and included in the Prime Coat unit price.

ON PAGE 112, SUBSECTION 109.05 – PARTIAL PAYMENTS

Delete the 3rd sentence.

ON PAGE 476, SUBSECTION 602.03 – CONSTRUCTION REQUIREMENTS

Add the following after the first paragraph:

When installing a new pipe in an existing pipe location, remove the existing pipe prior to installation.

ON PAGE 476, SUBSECTION 602.05 – BASIS OF PAYMENT

Add the following to the end of the section:

Removal of the existing pipe is included in the culvert contract unit price.

ON PAGE 491, SUBSECTION 611.02 – MATERIALS

Delete “Culverts ....602”

Add the following:

Aggregates..703

Painting. Provide materials as specified in 627 for paint systems C.

ON PAGE 491, SUBSECTION 611.03 – CONSTRUCTION REQUIREMENTS

Delete the first sentence and replace with the following:

Complete roadway grading at the location of the cattle guard before excavating out the existing cattle guard.

Add the following to the end of the section:

Place Coarse Aggregate Size No. 5, inside the cattle guard from the bottom of the structure to 6" from the bottom of the steel beam.

Paint cattle guard as stated on standard drawing following 627.

ON PAGE 491, SUBSECTION 611.05 – BASIS OF PAYMENT

Delete the last paragraph and replace with the following:

Structural excavation, removal of existing cattle guard, placement of Coarse Aggregate, compacting backfill and painting are incidental and the cost included in the cattle guard contract unit price.

ON PAGE 518, SUBSECTION 621.03 – CONSTRUCTION REQUIREMENTS

Add the following to the end of 621.03.A:

Seeding of areas shown on the plans will include:

Seedbed Preparation 0.349 acres
Seeding 0.349 acres
Fertilizing 0.349 acres
Mulching 0.698 acres
Mulch Anchoring 0.698 acres

Seed between October 1st and November 15th or as directed.

ON PAGE 519, SUBSECTION 621.03 – CONSTRUCTION REQUIREMENTS

Add the following to 621.03.C:

Apply Sustane concentrated compost (fertilizer), Biosol Forte, or other approved soil amendment product listed on the QPL at the manufacturer’s recommended rate for the site and soil conditions of the seeded area on the project site.

Add the following to 621.03.D:

Use the following seed mix on locations shown in the plans:

Grasses	Pounds Seed per Acre
Bluebunch Wheatgrass	8.0 PLS LB/AC
Sandburg Bluegrass	1.0 PLS LB/AC
Bottlebrush Squirreltail	2.8 PLS LB/AC

Forb	Pounds Seed per Acre
Western Yarrow	0.2 PLS LB/AC
TOTAL	12.0 PLS LB/AC

ON PAGE 523, SUBSECTION 621.03 – CONSTRUCTION REQUIREMENTS

Remove the following from 621.03.H Performance Standards and Acceptance:

"1 year following seeding completion. The contractor will request the inspection at least 10 calendar days in advance."

Add the following to 621.03.H Performance Standards and Acceptance:

"Seed all disturbed areas on the project site as shown on the plans."

ON PAGE 612, SUBSECTION 675.04 – METHOD OF MEASUREMENT **03/19**

Delete the first paragraph and substitute the following:

Survey will be measured on a lump sum basis, based on a percent complete as determined in consultation with the Engineer and the Contractor, up to 70 percent of the total lump sum payment. Full payment will not be made on the survey contract pay item until all survey submittals are received and accepted.

S900-50A CONTINGENCY AMOUNT – WEED CONTROL

Description. This work will consist of chemical and physical control of undesirable weed species including noxious weeds. Mechanical or hand weeding or pulling will be first utilized wherever possible and especially around wetlands, when plants are blooming/flowering, and where chemical spray can adversely affect new plantings or seeding. Chemical control methods are allowed in areas such as ditches (with no standing water), and areas within the project limits where it will not affect pollinator or native habitat or new plantings and seeding. No chemicals must be applied below the mean high-water mark or within 100 feet of a wetland, river, and water source or where there is standing or running water. Chemicals for treating weeds may be applied multiple times through the growing season as long as plants are not in bloom and treatments are not applied later than six weeks prior to seeding applications.

In seasonal wetlands, sensitive areas, native vegetation, or when pollinators are present and after new plantings and seeding, use mechanical or hand-weeding methods where herbicides may adversely affect new plantings or seeding. Complete hand-weeding before beginning seeding applications.

Materials. In areas outside wetlands, sensitive areas, and native vegetation, the Contractor is responsible for the delivery, handling, storage, and use of the herbicide. A broad-spectrum post-emergent herbicide containing a minimum of 50% of the active ingredient Glyphosate, N phosphonomethyl glycine or an approved equal in composition and application must be used for chemical control of weeds. For seeding applications including duration or timing, follow the product label and manufacturer's recommendations.

Construction Requirements. The Contractor will hand pull weeds within wetlands, riparian areas and where feasible. No herbicides will be applied to areas within 100 feet of a river, water source, or where there is standing or running water. Hand weeding will be accomplished during the planting and seeding operation. Prior to the planting and seeding operation, mechanical or chemical methods may be used to control weeds in areas where directed. Spraying herbicide on open water areas and wetlands are prohibited. After planting and seeding operations are completed, only hand weeding and/or direct blotter application of chemical weed control will be used on target species.

The application rate for herbicide will follow the manufacturer's recommendations. The Contractor will be responsible for disposal of all containers and other herbicide contaminated materials properly. If materials are stored on-site they will be in sealed containers with appropriate containment and cleanup materials in case of a spill. If a spill occurs the Contractor will be responsible for notifying the appropriate emergency response agencies and notifying the Engineer immediately.

Method of Measurement. The Engineer will measure acceptably completed work as specified in ITD Standard Specification Subsection 109.03.

Basis of Payment. The Department will pay for the accepted quantities as follows:

Pay Item	Pay Unit
S900-05A Contingency Amount – Weed Control	CA

S900-50B CONTINGENCY AMOUNT - MISCELLANEOUS WORK

Description. This item will compensate the Contractor for minor work or material not specified in the project documents that is necessary to the work as directed by the Engineer.

Materials. Provide material as directed by the Engineer and in accordance with the ITD Standard Specifications.

Construction Requirements. Complete construction as directed by the Engineer and in accordance with the ITD Standard Specifications.

Method of Measurement. The Engineer will measure acceptably completed work by the Contingency Amount (CA).

Basis of Payment. The Department will pay for the accepted quantities at the contract unit price as follows:

Pay Item	Pay Unit
S900-05B Contingency Amount - Miscellaneous Work	CA

S904-05A SP - TEMPORARY TRAFFIC CONTROL

Description. Provide temporary traffic control (TTC) as specified in 626.

Materials. Provide TTC devices as specified in 626.02.

Construction Requirements. Submit TTC plans, items, and estimated quantities as specified in 105.14.D. The Engineer's approval of the TTC plan is not an approval of the items and quantities; it only confirms that the plan appears to meet 626 and the MUTCD. Items and quantities shown on the plans are for estimating purposes only and do not necessarily represent what will be required to fit the Contractor's staging plan.

Correct traffic control deficiencies within 1 hour of receiving notification from the Engineer of requested corrective action.

Place PCMS 7 calendar days before the construction start date. Submit a proposed message prior to placing the

PCMS. Remove PCMS after the first coat of permanent pavement markings is installed and traffic is restored to normal operations.

Furnish, install, and maintain all TTC devices as shown on the accepted traffic control plan and as specified in 626.03.

If items in the approved TTC plan were underestimated and determined to be inadequate to suit the needs of the Contractor's operation while meeting 626 and the MUTCD, provide additional devices and services as necessary at no additional cost to the Department.

If all applicable requirements are being met but unforeseen conditions necessitate additional TTC, the Engineer will direct the Contractor to provide additional devices and services to be paid by force account.

Areas requiring reconstruction may be reduced to one lane of traffic controlled by either flaggers or a temporary signal during daylight or nighttime hours.

Areas outside of reconstruction may be reduced to one lane of traffic controlled by flaggers during construction hours of operation, otherwise two lanes of traffic must be maintained.

Place temporary flexible raised pavement markers to separate traffic before opening the lanes to free-flowing traffic.

Method of Measurement. The Engineer will measure acceptably completed work by the lump sum.

Basis of Payment. The Department will pay for accepted quantities at the contract unit prices as follows:

Pay Item	Pay Unit
S904-05A SP - Temporary Traffic Control	LS

The Department will pay 40 percent of the contract price on the first monthly progress payment estimate. The Engineer will use the Contractor's CPM schedule to determine a prorated payment percentage for TTC for each monthly progress payment thereafter, retaining 10 percent of the contract unit price of this item until the work is complete. On completion of work, the Department will pay the remaining TTC bid amount.

In the event that a temporary traffic control deficiency occurs, including maintenance of temporary traffic control devices, and is not corrected within 1 hour after notification, the Engineer will assess $250 in penalties for each hour or partial hour thereafter the temporary traffic control remains deficient.

2024 SUPPLEMENTALS
FOR THE
2023 STANDARD SPECIFICATIONS
FOR
HIGHWAY CONSTRUCTION

Table of Contents

ON PAGE 12, 101.04 - DEFINITIONS

Delete the definition for “Contingency Item” in its entirety and replace with the following in alphabetical order:

Contingency Amount. A dollar amount for items of work that are difficult to accurately estimate or quantify. The Department will pay for authorized work performed under a contingency item as required by the contract. Payment for accepted work will be made using the force account method (109.03.C.5) or as approved by the Engineer.

ON PAGE 23, 102.10 - PROPOSAL ACCEPTANCE AND IRREGULAR PROPOSAL

Add the following to the numbered list:

8. Not having a UEI (Unique Entity Identifier) at the time of bid on a federal-aid contract.

ON PAGE 40, 105.11 - INSPECTION OF WORK

Delete the last two paragraphs of the section.

ON PAGE 41, 105.14.C - MAINTENANCE OF PUBLIC HAUL ROADS

Delete the first full paragraph under this section starting with “The Contractor is responsible for...”

ON PAGE 61, 106.06 - STORAGE AND HANDLING OF MATERIALS

In the third sentence of the first paragraph, delete “re inspect” and replace with “re-inspect”.

ON PAGE 66, 107.01.B - NON-FEDERAL AID CONTRACTS

Delete the three paragraphs and replace with the following:

Non-federal-aid contracts must comply with 44-1001 through 44-1005, Idaho Code. Certify compliance monthly during the life of the contract using form ITD-2434, Idaho 95% Resident Monthly Workforce Certification for State-Funded Contracts, except for projects with fifty (50) or fewer employees. If a Contractor is not in compliance, they are required to take corrective action to restore compliance. Failure to supply the form ITD-2434 certifying monthly compliance may be considered a breach of the construction contract.

ON PAGE 66, 107.02 - PERMITS AND LICENSES

Change the section name to “Permits, Licenses, and Taxes”.

ON PAGE 69, 107.10 - RESPONSIBILITY FOR INJURY DAMAGE

Delete the fourth paragraph and replace with:

Submit a certificate of insurance to the email address provided on the Award letter and do not start work before obtaining approval of the insurance coverage by the Department.

ON PAGE 87, 108.01 - SUBLETTING OF CONTRACT

Delete the second sentence fourth paragraph and replace with the following:

> For federal-aid contracts, the subcontractor must have a Unique Entity Identifier (UEI) prior to Engineer approval of subcontract agreement.

ON PAGE 114, 109.08.3 - ACCEPTANCE AND FINAL PAYMENT

Delete the word “retainage” in Item 3 under 109.08 and replace with “withholding”.

ON PAGE 147, 205.03.H.3.a - QUALIFICATIONS

Delete the last sentence in the first paragraph starting with “Provide the following...” and replace with the following:

> “The Blaster in Charge must meet the following minimum experience and qualifications or be pre-approved as a Blasting Consultant on ITD’s Consultant Term Agreement List.”

ON PAGE 147, 205.03.H.3.a - QUALIFICATIONS

Delete item (7).

ON PAGE 183, 301.03.A - GENERAL

Delete the word “enough” from the last sentence of the last paragraph.

ON PAGE 187, 303.03.A - GENERAL

Delete the word “enough” from the last sentence of the last paragraph.

ON PAGE 188, 303.03.C - AGGREGATE BASE MATERIAL

Revise the section name to: “C. Aggregate Base Material - Load, Haul, and Place”

Delete “Load, Haul, and Place.” from the first paragraph.

ON PAGE 242, TABLE 409.01.A - CLASSIFICATION

Delete the last sentence of Note (f) under Table 409.01-1 starting with “The alkali content...”

ON PAGE 247, 409.03.A - PROPORTIONING

Delete “CRD-C 662CRD-C 662” from the first sentence of the last paragraph on the page.

ON PAGE 251, 409.03.D - MIXING AND DELIVERING

Under Item 10, delete “85°F” and replace with “90°F”.

ON PAGE 252, 409.03.F.3 - TEMPERATURE LIMITATIONS

Delete the text in Item 3 and 4 and replace with the following:

3. Do not place concrete if the concrete temperature is greater than 90°F. Do not place concrete when the evaporation rate is greater than 0.15 pounds per square foot per hour when tested in accordance with Idaho IT 133. Submit for acceptance an evaporation and curing plan as described in 409.03.M. If the evaporation rate approaches 0.15 pounds per square foot, implement the accepted evaporation and curing plan. Admixtures can be used to extend delivery times and revolutions if noted in the mix design with the approval of the Engineer. Night or early morning placement may be necessary to avoid excess evaporation. Ice used as part of the mixing water must be completely melted by the time the mixing is completed.
4. Do not place concrete against any surface with a temperature less than 32°F or greater than 90°F.

ON PAGE 259, 409.03.M - COLD WEATHER CONCRETING WORK PLAN

Replace section name with:

M. Cold and Hot Weather Concreting Work Plans

ON PAGE 260, 409.03.M - COLD WEATHER CONCRETING WORK PLAN

Add the following hot weather information to the end of the section.

Submit for approval a hot weather concreting work plan, also known as an evaporation and curing plan, when ambient temperatures are likely to be above 85°F during placement or when the evaporation rate could potentially approach 0.15 pounds per square foot due to wind and other factors. At no time can the concrete temperature or evaporation rate exceed the limitations specified. The plan may include development of a concrete mixture and a detailed plan for mixing, transporting, placing, protecting, curing and testing of concrete. Precautions must be made to avoid thermal cracking or deleterious effects to the concrete due to high temperatures. Retempering is not allowed.

Use of established mathematical and empirical models will be required.

Evaporation retardant must be on hand and available for use as an emergency protection when the curing operation is delayed. Do not use evaporation retardant as a finishing aid. Evaporation retardant material and use must be addressed in the Contractor's evaporation and curing plan.

ON PAGE 301, 502.01.A - CLASSIFICATION

Delete the last sentence of Note (c) under Table 502.01-1 starting with "The alkali..."

ON PAGE 302, 502.01.A - CLASSIFICATION

In the first sentence of the last paragraph, delete “303” and replace with “380”.

ON PAGE 306, 502.02 - MATERIALS

Add the following to the list of test methods:

Standard Test Method for Determination of Length of Change of Concrete Due to Alkali-Silica Reaction .... ASTM C 1293

ON PAGE 311, 502.03.D.10 - MIXING AND DELIVERY

Delete Item 10 and replace with the following:

10. Do not place concrete when the concrete temperature is below 50°F. Do not place concrete if the concrete temperature is greater than 80°F for bridge decks or when placing concrete where the least dimension is greater than 3.0 feet; otherwise, the concrete temperature must not exceed 85°F. The concrete temperature must not exceed 85°F at the time of placement for precast members. Refer to 502.03.F.4 for temperature limitations with massive placements. When placing flatwork, do not place concrete when the evaporation rate is greater than 0.15 pounds per square foot per hour when tested in accordance with Idaho IT 133. Submit for acceptance an evaporation and curing plan as described in 409.03.M if the concrete temperatures are anticipated to approach the temperature limitations specified or if the evaporation rate is anticipated to approach 0.15 pound per square foot for flatwork. Implement the accepted evaporation and curing plan when appropriate based on the actual concrete temperature and evaporation rates. Admixtures can be used to extend delivery times and revolutions if noted in the mix design with the approval of the Engineer. Night or early morning placement may be necessary to avoid excess evaporation. Ice used as part of the mixing water must be completely melted by the time the mixing is completed.
11. Do not place concrete against any surface with a temperature less than 32°F or greater than 90°F.

ON PAGE 312 AND 313, 502.03.E.3.a(6) - FALSEWORK AND FORMS

Delete item (6), including the “Note”, and replace with the following:

(6) For applying the lateral pressure formulas, columns are defined as elements with no plan dimension exceeding 6.5 feet. Walls are defined as vertical elements with at least 1 plan dimension greater than 6.5 feet.

ON PAGE 317 AND 318, 502.03.E.5 - REMOVAL OF FALSEWORK AND FORMS

Correct formatting for Table 502.03-5.

Table 502.03-5 – Form and Falsework Removal and Loading of Concrete

Part 1: **Removal of Forms and Falsework** **Structural Element**	**Minimum Days [a] [b] [f]**	**Percent of Design Strength [e]**
Side forms for: footings, abutment caps, pier caps, traffic and pedestrian barriers, end diaphragms, intermediate diaphragms, sleeper beams, moment slabs, and other side forms not supporting the concrete mass	1	—
Columns, abutment backwalls, and retaining walls	3	50
Cantilever bridge deck sidewalks	7	—
Bridge decks, top slabs of concrete box culverts or stifflegs [c]	10	80
Crossbeams, caps, box girders, T-beam Girders, and flat slab superstructures [c]	7	80
Signal, Luminaire, and Sign Support Foundations	7	80
Part 2: **Subsequent Loading [d] of Structural Element**	**Minimum Days [a] [f]**	**Percent of Design Strength [e]**
Footings and abutments	3	80
Approach slabs, sleeper beams, moment slabs, and bottom slabs of box girders with falsework in place	5	80
Columns and walls	5	100
Bridge decks, top slabs of concrete box culverts or stifflegs and other members	10	100
Signal, Luminaire, and Sign Support Foundations	7	100
Erecting girders on pier caps	7	100

(a) From the time of the last placement in the forms or falsework supports and excluding the days when the surrounding temperature is below 40°F for a total of 4 hours or more. Requirements in 502.03.G still apply. The Contractor will monitor the temperature during curing time by continuous recording thermometers.

(b) Do not remove forms until the concrete has sufficient strength to prevent damage to the surface or cause over stressing of the concrete.

(c) Where continuous spans are involved, the time for spans will be determined by the last concrete placed.

(d) Except loads from formwork and reinforcing steel of further concrete placements.

(e) Standard concrete mix designs may not achieve strength in the minimum days shown.

(f) 1 day is 24 hours.

ON PAGE 322, 502.03.G.1 - COLD WEATHER CONCRETING

Delete items b and c, and renumber the remaining items in alphabetical order.

ON PAGE 323, 502.03.H - HOT WEATHER CONCRETING

Delete the first sentence of the first paragraph and replace with:

> Submit for acceptance an evaporation and curing plan as described in 409.03.M.2 if the concrete temperatures are anticipated to approach the temperature limitations specified or if the evaporation rate is anticipated to approach 0.15 pounds per square foot per hour for flatwork.

ON PAGE 329, 502.05.6 - SURFACE RESISTIVITY PRICE ADJUSTMENT

Delete the first full sentence and replace with the following:

> The Department will pay the price adjustment to the contract unit price for each lot of Schedule No. 2 concrete meeting the surface resistivity requirements in Table 502.05-2 when measured using AASHTO T 358 at 28 calendar days.

Change the number of the table to: “502.05-2”

ON PAGE 330, 503.03.B - PROTECTION OF MATERIAL

Remove the 4th sentence and replace with the following:

> Do not flame cut reinforcing steel.
>
> Prevent condensation from forming on the bars. Store and cover epoxy-coated metal reinforcement off the ground to protect them from sunlight, salt spray, and weather exposure. Do not drag or drop epoxy-coated reinforcing steel. Repair coating cracks, abrasions, chips, and bond loss before oxidation appears on the bar surface.

ON PAGE 331, 503.03.D - PLACING AND FASTENING

Add the following after the fifth sentence of the 1st paragraph:

> Locate supports at least 1.5 times the maximum aggregate size or 2 inches, whichever is greater, from formed corners to allow for concrete consolidation around the supports.

ON PAGE 333, 503.03.E - SPLICES

Replace the first sentence of the first full paragraph with the following:

> Make one tension test specimen splice to represent each lot of bars spliced at the project site and submit to a qualified lab for testing. Submit test results to the Engineer before installation.

ON PAGE 346, 504.03.M.2 - PREHEATING

Delete ", Section 4" from the sentence.

ON PAGE 347, 504.03.M.3 – WELDING PROCEDURES

Delete ", Sections 5.7 and 5.12" from the last sentence of the first paragraph.

ON PAGE 347, 504.03.M.4 - FILLERS

Delete " Table 4.2" from the sentence.

ON PAGE 348, 504.03.M.6.b - RADIOGRAPHIC INSPECTION

Add the following to the end of the paragraph:

> Provide an inspection report in digital format that includes a full set of radiographic digital images per AWS D1.5 Ch 8.12.3.

ON PAGE 352, 505.03.B - HELMET ASSEMBLY

Delete the 3rd sentence and replace with the following:

> Provide a pile hammer helmet assembly (strike plate, hammer cushion, drive cap base, and pile insert or pile adapter) that is approved by the pile hammer manufacturer and sized for the pile hammer. Field fabricated pile hammer components are not acceptable.

ON PAGE 357, 505.05 - BASIS OF PAYMENT

Delete the second paragraph of Section 505.05 and replace it with the following:

> Splice steel pile before driving: the Department will pay for up to 1 splice per pile if the estimated pile lengths are 60 feet or longer. Splice steel pile during driving: the Department will pay for up to 1 splice per pile for estimated pile lengths from 60 up to 100 feet and up to 2 splices per pile for estimated pile lengths that are greater than 100 feet.

ON PAGE 373 AND 374, TABLE 510.02-2 - LATEX-MODIFIED CONCRETE PROPERTIES

Modify the formatting of Table 510.02-2 as follows:

Table 510.02-2 – Latex-Modified Concrete Properties

Mix Design Item	Requirement
Cement content	660 lb/yd^3
Latex emulsion admixture	25 gal/yd^3
Approx. added water [(a)], including free moisture in the FA & CA	150 lb/yd^3
Air content, percent of plastic mix	0 - 6.5
Slump[(b)]	4 - 6 in
Percent fine aggregate as percent of total aggregate by weight (rounded CA)	55 ± 5
Percent fine aggregate as percent of total aggregate by weight (crushed CA)	60 ± 5
Weight ratio of cement-FA-CA- (rounded CA)[(c)]	1:2.5:2.0 dry basis
Weight ratio of cement-FA-CA- (crushed CA)[(c)]	1:2.7:1.8 dry basis
28-day compressive strength (Minimum)	4,000 psi

(a) This is in addition to the latex. Adjust the water added to control the slump and to produce net water-cement ratios of 0.35 to 0.40 by weight.

(b) Measure the slump 4 to 5 minutes after discharge from the mixer or immediately ahead of the finisher.

(c) The Contractor may adjust the dry-weight ratios within limits as approved. The Contractor may increase the FA ratio by as much as 0.2 if the CA is reduced by an equivalent amount.

ON PAGE 373, TABLE 510.02-2 - LATEX-MODIFIED CONCRETE PROPERTIES

Delete “Cement Content” and replace with “Cementitious Content (Cement + SCM)”.

ON PAGE 374, TABLE 510.02-3 - SILICA FUME CONCRETE PROPERTIES

Delete “Cement Content” and replace with “Cementitious Content (Cement + SCM)”.

Delete “Course” from “Course Aggregates” and replace with “Coarse”.

ON PAGE 377, 510.03.E - PLACING AND FINISHING

Add the following to the end of the first paragraph:

> Remove any plastic sheeting prior to placement of bonding coat.

Delete “visqueen” from the first paragraph and replace with “plastic sheeting”.

ON PAGE 381, 511.01.B.3 - SUBMITTALS

Add the following after item "f":

g. Submit a quality control plan for acceptance.

ON PAGE 384, 511.03.A - SURFACE PREPARATION

Delete the second paragraph and replace with:

For structure rehabilitation, remove foreign materials from the concrete surface before applying waterproofing system. Repairs and patches must be fully cured before applying waterproofing. Prepare the surface according to an accepted quality control plan.

ON PAGE 384, 511.03.B.1 - TYPE C APPLICATION OF PENETRATING WATER REPELLENT SYSTEM

Delete the word "sandblasted" from the third sentence of the first paragraph and replace with "prepared".

ON PAGE 389, 511.04 - METHOD OF MEASUREMENT

Replace the first sentence with the following:

The Engineer will measure acceptably completed work by the square yard based on plan quantity.

ON PAGE 400, TABLE 522.02-1 - CDF MIXTURE PROPERTIES

Delete Table 522.02-1 and replace with the following:

Table 522.02-1 – CDF Mixture Properties[1]

	Min. Cement Content (LB/CY)	Fly Ash (Class F) or Slag Content (LB/CY)	Max Water to Cementitious Ratio	Fine Aggregate (SSD) (LB/CY)	Coarse Aggregate (SSD) (LB/CY)	Slump[4] (inch)	Air[4] Content (%)
Flowable Fill	50	0-260	2.0	1300-3000	0-2500[2]	6-8	0-15
Low Flowability Fill	100	- -	4.0	1300-2000	1300-1900[3]	0-2	0-5

Notes:

1. Refer to ACI 229R for guidance.
2. 3/8 inch to No. 4 according to ASTM C33, or pea gravel.
3. ¾ inch according to ASTM C33.
4. Provided for guidance.

ON PAGE 426 AND 427, TABLE 565.02-1 - EXPANSION JOINT BINDER MATERIAL

Modify the formatting of Table 565.02-1 as follows:

Table 565.02-1 – Expansion Joint Binder Material

Parameter	Test Method	Requirements
Softening Point	ASTM D36	179.6°F (82°C) minimum
Tensile Adhesion	ASTM D5329	700 % minimum
Ductility @ 77°F (25°C)	ASTM D113	40 cm minimum
Penetration: @ 77°F (25 °C), 150g, 5 sec @ -4°F (-18 °C), 200g, 60 sec	 ASTM D5329 ASTM D5329	 90 dmm maximum 10 dmm minimum
Flow 5 h @ 140°F (60°C), 150g, 5 sec	ASTM D5329	3.0 mm maximum
Resiliency 77°F (25°C)	ASTM D5329	40% minimum
Asphalt Compatibility	ASTM D5329	Pass
Recommended Pouring Temperature	—	370°F – 390.2°F (188 – 199°C)
Specific Gravity	—	1.10 plus or minus 0.05

ON PAGE 439, 576.02.A - SUBMITTALS

Delete the following sentence:

Provide certifications bearing the notarized signature of a manufacturer’s representative having quality control responsibility.

ON PAGE 446, 578.03 - CONSTRUCTION REQUIREMENTS

Delete the last sentence of the second paragraph and replace with:

Provide box culvert dimensional tolerances in accordance with ASTM C1577, Section 12. Provide three-sided frame dimensional tolerances in accordance with ASTM C1504, Section 11.

ON PAGE 455, 582.03 - CONSTRUCTION REQUIREMENTS

Replace A through D with the following:

A. Preparation of Concrete Surfaces.

Mark out and score removal areas to a depth of ½-inch with a dry concrete saw to form faces perpendicular to the surface. Angle the sawcut or adjust the sawcut depth as needed to avoid penetrating other bridge elements or damaging existing metal reinforcement.

Remove unsound concrete using jackhammers with a nominal rating of 15 pounds or less and held at an angle of 45° or less from the concrete surface. Do not remove concrete within ½-inch of girder bearing systems, including neoprene pads or lead plates, between the bearing seat and 4 inches above the bottom of abutment and pier caps. Notify the Engineer if unsound concrete is found within ½-inch of the girder bearing system. If any reinforcement is or becomes exposed during the removal and the bond between concrete and reinforcement is destroyed, remove deteriorated, loose, or unsound concrete to a minimum depth of ¾-inch behind the bar or to the depth of sound concrete, whichever is greater. Exercise care to prevent additional damage or debonding of metal reinforcement in adjacent concrete areas.

After concrete removal, sandblast the cavity and the surrounding concrete area to remove dirt, oil, grease, paint, corrosion deposits, dust, laitance, and bond inhibiting materials. Prepare the cavity using mechanical scarification or additional sandblasting to provide a minimum surface profile of ± ⅛-inch.

Protect property and traffic from damage and flying debris during concrete removal and sandblasting operations.

B. Existing Reinforcing Steel.

Repair or replace damaged (cracked, broken, gouged, or deteriorated) metal reinforcement where the effective bar area is less than 75 percent of the original bar diameter. Properly embed or splice replacement of supplemental bars as directed.

Clean exposed reinforcing steel to remove dirt, oil, grease, paint, corrosion deposits, dust, laitance, and bond-inhibiting materials immediately prior to patch material placement. Protect cleaned metal reinforcement from the elements and from contamination.

C. Inspection.

Prior to mortar placement, allow the Engineer to inspect concrete areas after final surface preparation has been completed for approval. After allowing the mortar to set in accordance with the manufacturer's recommendations, sound the repaired areas with a sounding bar or hammer. The Engineer must be present during the sounding inspection. Remove and replace any unsound patches at no additional cost to the Department.

D. Finish.

Place mortar for each repair area in a single continuous pour or as directed. Match the texture of the existing surface and ensure the finished surface is flush with the existing surface. Immediately after removing forms, remove any excess mortar that has accumulated over an intended joint.

ON PAGE 473, 601.02 - MATERIALS

Add the following after “Ribbed Polyvinyl Chloride (PVC) Pipe”:

Corrugated PE Pipe 706.16

Ribbed PE Pipe................................... 706.17

Add the abbreviation “(PP)” after “Polypropylene Pipe”.

ON PAGE 475, 601.03.D - PLASTIC PIPE

Delete the fourth paragraph and replace with the following;

Test PE lines for leakage in accordance with ASTM F2164. No leakage rate is allowed.
Test PP lines for leakage in accordance with ASTM F2487. No leakage rate is allowed.

ON PAGE 509, 619.02 - MATERIALS

Delete the following section references and replace with those listed below:

LED Luminaires.. 713.04
Rigid Steel Conduit.. 713.11
Plastic Conduit... 713.11
Concrete Junction Boxes.. 713.11
Composite Junction Boxes 713.11
Electrical Conductors.. 713.11

ON PAGE 529, 626.02.A - TEMPORARY TRAFFIC CONTROL SIGNS

Add the following to the end of the section:

Do not use double-sided signs.

ON PAGE 540, 627.03.C.1 - SURFACE PREPARATION

Delete “3.2.9” from the first paragraph and replace with “5.2.9”.

ON PAGE 549, 630.05 - BASIS OF PAYMENT

Add the following to the end of the section:

Preparation of pavement surface before pavement marking application is incidental.

ON PAGE 553, 632.05 - BASIS OF PAYMENT

Add the following to the end of the section:

Debris containment, water treatment, disposal, cleanup, submittals, and other related work are incidental.

ON PAGE 619, 702.03 - EMULSIFIED ASPHALTS

Delete Items 1 and 2 and replace with:

1. Standard Specification for Emulsified Asphalt .... AASHTO M 140

   For SS-1 and SS-1h, provide Rotational Paddle Viscosity measurements @ 25 °C for information only. Report the test results on or with the Bill of Lading in addition to Saybolt Viscosity results.

2. Standard Specification for Cationic Emulsified Asphalt .... AASHTO M 208

   For CSS-1 and CSS-1h, provide Rotational Paddle Viscosity measurements @ 25 °C for information only. Report the test results on or with the Bill of Lading in addition to Saybolt Viscosity results.

ON PAGE 628, 703.02.D - COMBINED AGGREGATE GRADATION FOR CONCRETE

In the last sentence of the first paragraph, delete “Method B.:” and replace with “Method A or B.”

ON PAGE 632, 703.05 - AGGREGATE FOR SUPERPAVE HMA PAVEMENT

In Table 703.05-1, Superpave Mixture Requirements, delete the row with “R-Value”.

ON PAGE 636, 703.08 - AGGREGATE FOR OPEN GRADED BASE

Delete the first sentence of the first paragraph and replace with the following:

Meet aggregate gradation requirements specified in Table 703.08-1 in accordance with AASHTO T 27 for Class I and II, T 27/ T 11 for Class III.

ON PAGE 637, 703.08 -AGGREGATE FOR OPEN GRADED BASE

Delete the following from the last line of Table 703.08-2 under Fracture Face:

90% retained on #4 with 2 fractured faces for Class II

ON PAGE 643, 704.05 - SILICONE SEALANT

In the 2nd full paragraph, delete the 3rd sentence starting with “Do not place...”

ON PAGES 644 AND 645, TABLE 704.06-1 - ELASTOMERIC REQUIREMENTS

Delete Table 704.06-1 and replace with the following:

Table 704.06-1 – Elastomeric Requirements

Physical Property	Test Method	Performance Requirements
Hardness, Durometer A	ASTM D2240	60 ± 10 points
Tensile strength	ASTM D412	2,000 psi, minimum
Elongation at break	ASTM D412	300%, minimum
Brittleness temperature	ASTM D746	- 40°F (- 40°C)
Tear resistance	ASTM D624 (Die C)	150 lb/in minimum
Flame resistance	ASTM C542	must not propagate flame
Resistance to heat aging change in original properties after 70 hr at 212°F (100°C)		
Hardness	ASTM D573	+ 10 points, maximum
Elongation	ASTM D573	- 40%, maximum
Tensile strength	ASTM D573	- 15%, maximum
Resistance to oil aging change in volume after 70 hr immersion in ASTM oil No. 3 at 212°F (100°C)	ASTM D471	+ 80%, maximum
Resistance to ozone condition after exposure to 100 pphm ozone in air for 100 hr at 100°F (38°C) (sample under 20 percent strain)	ASTM D1149	No cracks
Resistance to permanent set compression set after 22 hours at 158°F (70°C)	ASTM D395 (Method B)	30%, maximum
Resistance to water change in weight after 7 days immersion at 158°F (70°C)	ASTM D471	+ 5%, maximum

ON PAGE 650, 706.18 - STEEL REINFORCED RIBBED PE PIPE

Replace the paragraph with the following:

Meet AASHTO M 335 for SRRPE Pipe nominal size of 12 to 60 inches in diameter. Meet AASHTO MP 40 for SRRPE Pipe nominal size of 66 to 120 inches in diameter. Limit size of SRRPE to 120 inches maximum diameter.

ON PAGE 657, 708.06.1 - 9.2.2

Delete “3.2.3” from the first paragraph and replace with “5.2.3”.

ON PAGE 671, 709.04 - SET RETARDING ADMIXTURE

Delete Section 709.04 and replace with the following:

709.04 Chemical Admixtures – Types A-G, and Type S

A. Types A through G.

Meet ASTM C494.

B. Type S

Type S admixtures must be approved by the Engineer prior to use. Provide data sheets and describe intended use and dosage. Provide a letter from manufacturer stating that it will not adversely impact the concrete and describe any limitations.

Delete Section 709.05 and renumber 709.06 to 709.05.

ON PAGE 688, 713.01.A.3 - PEDESTRIAN SIGNAL POLE REQUIREMENTS

Delete item “a” and replace with the following:

a. A 4-inch schedule 40 or 80 aluminum pole.

ON PAGE 689, 713.04.A - ILLUMINATION POLES

Delete “Error! References source not found” in the first full paragraph and replace with the “708.19”.

ON PAGES 213 OF 844 OF THE 2020 QA MANUAL (DATED 10/19), SECTION 500.00 – STANDARD METHODS & PRACTICES

Delete "IDAHO STANDARD PRACTICE (IR), IDAHO STANDARD METHOD OF TEST (IT)" from the second and third lines and replace with the following:

The QA Manual Supplemental has been updated with some important changes to how test methods are named and organized in Sections 570.00 and 580.00. Here is a quick guide to the changes:

1. **New Naming System**:
    - New names have been introduced to clearly show whether a test method has been modified by the Idaho Transportation Department (ITD), WAQTC, or if it remains an original standard.
2. **Examples of How to Read the New Names**:
    - **WFOP** (WAQTC Field Operating Procedure) AASHTO T 209: This means WAQTC has modified the original AASHTO T 209 standard.
    - **IWFOP** AASHTO T 209: This means ITD has modified the WAQTC version of AASHTO T 209.
    - **IFOP** ASTM D4791: This means ITD has modified the original ASTM D4791 standard.
3. **Reorganized Sections**:
    - All ITD modifications to WAQTC methods (IWFOP) are now listed right before the WAQTC method they modify.

These changes are designed to make it easier for everyone to understand which standards have been modified and by whom.

Consensus Standards Organizations and Abbreviations

In this QA Manual Supplemental, various standards and procedures are referenced using specific abbreviations. These abbreviations are used throughout Sections 570.00 and 580.00 to clearly indicate the source and type of each test method and modification. Below are tables explaining the consensus standards organizations and abbreviations used.

Consensus Standards Organizations

This table lists the organizations and their abbreviations that create the standards we use:

Abbreviation	Full Name
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ASTM	American Society for Testing of Materials
Idaho	Idaho Transportation Department
WAQTC	WAQTC Modification of an ACI, ASTM, or AASHTO Method

List of Abbreviations

This table explains the abbreviations used to describe different test methods and procedures:

Abbreviation	Meaning
FOP	Field Operating Procedures
IFOP	Idaho FOP for the test method indicated
IWFOP	Idaho Modification to the WAQTC FOP for the test method indicated
IR	Idaho Standard Practice
IT	Idaho Standard Method of Test
PEC	Performance Exam Checklist
TM	Test Method
WFOP	WAQTC FOP for the test method indicated

How These Abbreviations Are Used

The new naming conventions use these abbreviations to provide a clear and structured way to identify the source and type of each test method and modification. For example:

- **WFOP AASHTO T 209**: This means WAQTC has modified the original AASHTO T 209 standard.
- **IWFOP AASHTO T 209**: This means Idaho has modified the WAQTC version of AASHTO T 209.
- **IFOP ASTM D4791**: This means Idaho has modified the original ASTM D4791 standard.

By using these abbreviations, the new naming conventions make it easier for users to quickly identify and understand the modifications and source(s) of each test method.

These tables and explanations help navigate the updated QA Manual Supplemental, ensuring clarity and consistency in the identification of standards and procedures.

ON PAGES 215 THRU 217 OF 844 OF THE 2020 QA MANUAL (DATED 10/19), SECTION 570.00 – WAQTC/ IDAHO FIELD OPERATING PROCEDURES (INDEX), AND 580.00 – IDAHO FIELD OPERATING PROCEDURES (INDEX)

DELETE INDEX SECTIONS 570.00 THROUGH 580.00 AND REPLACE WITH THE FOLLOWING:

SECTION – 570.00 WAQTC FOP (WFOP)/ Idaho Modified WAQTC FOP (IWFOP)

570.01 – WFOP/ IWFOP AGGREGATE

570.02 - WAQTC FOP (WFOP)/ IDAHO MODIFIED WFOP (IWFOP) ASPHALT I & II

570.03 - CONCRETE

570.04 – EMBANKMENT AND BASE

570.05 – IN-PLACE DENSITY

570.06 – SELF-CONSOLIDATING CONCRETE

SECTION – 580.00 IDAHO FOP (IFOP)

ON PAGES 431 THRU 786 OF 844, 2020 QA MANUAL – SECTIONS 570.00 THRU 570.05 – WAQTC/ IDAHO FIELD OPERATING PROCEDURES

Delete Sections 570.00 through 570.05 and replace with the following.

SECTION – 570.00
WAQTC FOP (WFOP) / Idaho Modified WAQTC FOP (IWFOP)

570.01 - WFOP/ IWFOP AGGREGATE

SECTION – 570.00 WAQTC FOP (WFOP)/ Idaho Modified WAQTC FOP (IWFOP)

570.01 – WFOP/ IWFOP AGGREGATE

SAMPLING AGGREGATE PRODUCTS
WFOP AASHTO R 90

Scope

This procedure covers sampling of coarse, fine, or a combination of coarse and fine aggregates (CA and FA) in accordance with AASHTO R 90-18. Sampling from conveyor belts, transport units, roadways, and stockpiles is covered.

Apparatus

- Shovels or scoops, or both
- Brooms, brushes, and scraping tools
- Sampling tubes of acceptable dimensions
- Mechanical sampling systems: normally a permanently attached device that allows a sample container to pass perpendicularly through the entire stream of material or diverts the entire stream of material into the container by manual, hydraulic, or pneumatic operation
- Belt template
- Sampling containers

Procedure – General

Sampling is as important as testing. The technician shall use every precaution to obtain samples that are representative of the material. Determine the time or location for sampling in a random manner.

1. Wherever samples are taken, obtain multiple increments of approximately equal size.

2. Mix the increments thoroughly to form a field sample that meets or exceeds the minimum mass recommended in Table 1.

TABLE 1
Recommended Sample Sizes

Nominal Maximum Size* mm (in.)		Minimum Mass g (lb)	
90	(3 1/2)	175,000	(385)
75	(3)	150,000	(330)
63	(2 1/2)	125,000	(275)
50	(2)	100,000	(220)
37.5	(1 1/2)	75,000	(165)
25.0	(1)	50,000	(110)
19.0	(3/4)	25,000	(55)
12.5	(1/2)	15,000	(35)
9.5	(3/8)	10,000	(25)
4.75	(No. 4)	10,000	(25)
2.36	(No. 8)	10,000	(25)

* One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps in specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum size. Maximum size is one size larger than nominal maximum size.

Note 1: Sample size is based upon the test(s) required. As a general rule, the field sample size should be such that, when split twice will provide a testing sample of proper size. For example, the sample size may be four times that shown in Table 1 of the FOP for AASHTO T 27/T 11, if that mass is more appropriate.

Procedure – Specific Situations

Conveyor Belts

Avoid sampling at the beginning or end of the aggregate run due to the potential for segregation. Be careful when sampling in the rain. Make sure to capture fines that may stick to the belt or that the rain tends to wash away.

Method A (From the Belt)

1. Stop the belt.
2. Set the sampling template in place on the belt, avoiding intrusion by adjacent material.
3. Remove the material from inside the template, including all fines.
4. Obtain at least three approximately equal increments.
5. Combine the increments and mix thoroughly to form a single sample.

Method B (From the Belt Discharge)

1. Pass a sampling device through the full stream of the material as it runs off the end of the conveyor belt. The sampling device may be manually, semi-automatic or automatically powered.
2. The sampling device shall pass through the stream at least twice, once in each direction, without overfilling while maintaining a constant speed during the sampling process.
3. When emptying the sampling device into the container, include all fines.
4. Combine the increments and mix thoroughly to form a single sample.

Transport Units

1. Visually divide the unit into four quadrants.
2. Identify one sampling location in each quadrant.
3. Dig down and remove approximately 0.3 m (1 ft.) of material to avoid surface segregation. Obtain each increment from below this level.
4. Combine the increments and mix thoroughly to form a single sample.

Roadways

Method A (Berm or Windrow)

1. Obtain sample before spreading.
2. Take the increments from at least three random locations along the fully formed windrow or berm. Do not take the increments from the beginning or the end of the windrow or berm.
3. Obtain full cross-section samples of approximately equal size at each location. Take care to exclude the underlying material.
4. Combine the increments and mix thoroughly to form a single sample.

Note 2: Obtaining samples from berms or windrows may yield extra-large samples and may not be the preferred sampling location.

Method B (In-Place)

1. Obtain sample after spreading and before compaction.
2. Take the increments from at least three random locations.
3. Obtain full-depth increments of approximately equal size from each location. Take care to exclude the underlying material.
4. Combine the increments and mix thoroughly to form a single sample.

Stockpiles

Method A – Loader Sampling

1. Direct the loader operator to enter the stockpile with the bucket at least 150 mm (6 in.) above ground level without contaminating the stockpile.
2. Discard the first bucketful.
3. Have the loader re-enter the stockpile and obtain a full loader bucket of the material, tilt the bucket back and up.
4. Form a small sampling pile at the base of the stockpile by gently rolling the material out of the bucket with the bucket just high enough to permit free flow of the material. (Repeat as necessary.)
5. Create a flat surface by having the loader back drag the small pile.
6. Visually divide the flat surface into four quadrants.
7. Collect an increment from each quadrant by fully inserting the shovel into the flat pile as vertically as possible, take care to exclude the underlying material, roll back the shovel and lift the material slowly out of the pile to avoid material rolling off the shovel.
8. Combine the increments and mix thoroughly to form a single sample.

Method B – Stockpile Face Sampling

1. Create horizontal surfaces with vertical faces in the top, middle, and bottom third of the stockpile with a shovel or loader.
2. Prevent continued sloughing by shoving a flat board against the vertical face. Sloughed material will be discarded to create the horizontal surface.
3. Obtain sample from the horizontal surface as close to the intersection as possible of the horizontal and vertical faces.
4. Obtain at least one increment of equal size from each of the top, middle, and bottom thirds of the pile.
5. Combine the increments to and mix thoroughly form a single sample.

Method C – Alternate Tube Method (Fine Aggregate)

1. Remove the outer layer that may have become segregated.
2. Using a sampling tube, obtain one increment of equal size from a minimum of five random locations on the pile.
3. Combine the increments to and mix thoroughly form a single sample.

Identification and Shipping

- Identify samples according to agency standards.
- Include sample report (below).
- Ship samples in containers that will prevent loss, contamination, or damage of material.

Report

- On forms approved by the agency
- Date
- Time
- Sample ID
- Sampling method
- Location
- Quantity represented
- Material type
- Supplier

PERFORMANCE EXAM CHECKLIST

SAMPLING AGGREGATE PRODUCTS
WFOP AASHTO R 90

Participant Name ______________________________Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
Conveyor Belts – Method A (From the Belt)		
1. Belt stopped?	_____	_____
2. Sampling template set on belt, avoiding intrusion of adjacent material?	_____	_____
3. Sample, including all fines, scooped off?	_____	_____
4. Samples taken in at least three approximately equal increments?	_____	_____
5. Increments combined and mixed to form a single sample?	_____	_____
Conveyor Belts – Method B (From the Belt Discharge)		
6. Sampling device passed through full stream of material twice (once in each direction) as it runs off end of belt?	_____	_____
7. Increments combined and mixed to form a single sample?	_____	_____
Transport Units		
8. Unit divided into four quadrants?	_____	_____
9. Increment obtained from each quadrant, 0.3 m (1ft.) below surface?	_____	_____
10. Increments combined and mixed to form a single sample?	_____	_____
Roadways Method A (Berm or Windrow)		
11. Sample taken before spreading?	_____	_____
12. Full depth of material taken?	_____	_____
13. Underlying material excluded?	_____	_____
14. Samples taken in at least three approximately equal increments?	_____	_____
15. Increments combined and mixed to form a single sample?	_____	_____

OVER

Roadways Method B (In-place)

16. Sample taken after spreading? _____ _____
17. Full depth of material taken? _____ _____
18. Underlying material excluded? _____ _____
19. Samples taken in at least three approximately equal increments? _____ _____
20. Increments combined and mixed to form a single sample? _____ _____

Stockpile Method A– (Loader sampling)

21. Loader operator directed to enter the stockpile with the bucket at least 150 mm (6 in.) above ground level without contaminating the stockpile? _____ _____
22. First bucketful discarded? _____ _____
23. The loader re-entered the stockpile and obtained a full loader bucket of the material with the bucket tilted back and up? _____ _____
24. A small sampling pile formed at the base of the stockpile by gently rolling the material out of the bucket with the bucket just high enough to permit free-flow of the material? _____ _____
25. A flat surface created by the loader back dragging the small pile? _____ _____
26. Increment sampled from each quadrant by fully inserting the shovel into the flat pile as vertically as possible, care taken to exclude the underlying material? _____ _____
27. Increments combined and mixed to form a single sample? _____ _____

Stockpile Method B (Stockpile Face)

28. Created horizontal surfaces with vertical faces? _____ _____
29. At least one increment taken from each of the top, middle, and bottom thirds of the stockpile. _____ _____
30. Increments combined and mixed to form a single sample? _____ _____

Stockpile Method C – Alternate Tube Method (Fine Aggregate)

31. Outer layer removed? _____ _____
32. Increments taken from at least five locations with a sampling tube? _____ _____
33. Increments combined and mixed to form a single sample? _____ _____

Comments: First attempt: Pass____ Fail____ Second attempt: Pass____ Fail ____

____

____

____

Examiner Signature ______________________WAQTC #:____________________

REDUCING SAMPLES OF AGGREGATE TO TESTING SIZE
WFOP AASHTO R 76
Scope

This procedure covers the reduction of samples to the appropriate size for testing in accordance with AASHTO R 76-23. Techniques are used that minimize variations in characteristics between test samples and field samples. Method A (Mechanical Splitter) and Method B (Quartering) are covered.

This FOP applies to fine aggregate (FA), coarse aggregate (CA), and combinations of the two (FA / CA) and may also be used on soils.

Terminology

Saturated Surface-Dry (SSD) – condition of an aggregate particle when the permeable voids are filled with water, but no water is present on exposed surfaces.

Note 1: As a quick approximation, if the fine aggregate will retain its shape when molded in the hand, it may be considered wetter than saturated surface-dry.

Apparatus

Method A – Mechanical Splitter

Splitter chutes:

- Even number of equal width chutes.
- Discharge alternately to each side.
- Minimum of 8 chutes total for CA and FA / CA, 12 chutes total for FA
- Width:
  - Minimum 50 percent larger than largest particle
  - Maximum chute width of 19 mm (3/4 in.) for fine aggregate passing the 9.5 mm (3/8 in.) sieve.
- Feed Control:
  - Hopper or straightedge pan with a width equal to or slightly less than the overall width of the assembly of chutes.
  - Capable of feeding the splitter at a controlled rate.
- Splitter receptacles / pans:
  - Capable of holding two halves of the sample following splitting.

The splitter and accessory equipment shall be so designed that the sample will flow smoothly without restriction or loss of material.

Method B – Quartering and Sectoring

- Straightedge scoop, shovel, or trowel
- Broom or brush
- Stick or pipe
- Tarp: A tear resistant rectangular tarp, appropriate for the amount and size of the material being reduced.
- Quartering Template: Formed in the shape of a 90-degree cross with equal length sides that exceed the diameter of the flattened cone of material sufficient to allow complete separation of the quartered sample. The height of the sides must be sufficient to extend above the thickness of the flattened cone of the sample to be quartered.

Method Selection

Selecting the method of sample reduction depends on

- The type of material: fine aggregate (FA), coarse aggregate (CA), and combinations of the two (FA / CA)
- The moisture content: drier than saturated surface-dry (SSD), SSD, or wetter than SSD.

Note 2: To use Method A on samples of FA and CA/FA that are at SSD or wetter, the entire sample may be dried – using temperatures that do not exceed those specified for any of the tests contemplated – and then reduced.

Select from the following methods based on the material type and moisture condition.

Method A Mechanical

- CA
- FA/CA drier than SSD
- FA drier than SSD

Method B Quartering

- CA
- FA/CA
- FA at SSD or wetter

Method B Sectoring

- FA at SSD or wetter

Table 1

	Drier than SSD	SSD or Wetter
Fine Aggregate (FA)	Method A Mechanical	Method B Quartering Method B Sectoring
Mixture of FA/CA	Method A Mechanical Method B Quartering	Method B Quartering
Coarse Aggregate (CA)	Method A Mechanical Method B Quartering	Method A Mechanical Method B Quartering

Procedure

Method A – Mechanical Splitter

1. Place two clean empty receptacles under the splitter.
2. Empty the sample into the hopper or pan without loss of material.
3. Uniformly distribute the material in the hopper or pan from edge to edge so that approximately equal amounts flow through each chute.
4. Discharge the material at a uniform rate, allowing it to flow freely through the chutes.
5. Remove any material retained on the surface of the splitter and place into the appropriate receptacle.
6. Using one of the two receptacles containing material, repeat Steps 1 through 6 until the material in one of the two receptacles is the appropriate sample size for the required test.
7. Retain and properly identify the remaining unused sample for further testing if required.

Mechanical Splitter Check

- Determine the mass of each reduced portion. If the percent difference of the two masses is greater than 5 percent, corrective action must be taken.

Calculation

$$\frac{Smaller\ Mass}{Larger\ Mass} = Ratio \qquad (1 - ratio) \times 100 = \%\ Difference$$

Splitter check: 5127 g total sample mass

Splitter pan #1: 2583 g

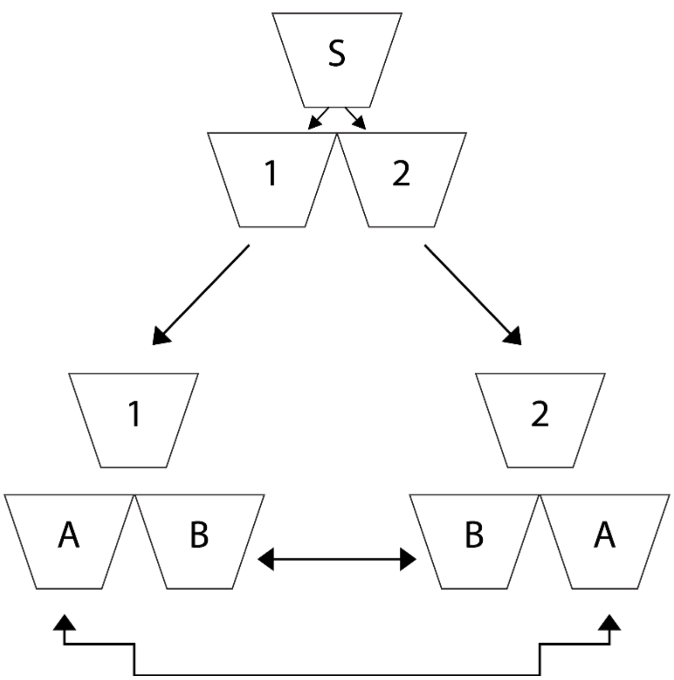
Splitter pan #2: 2544 g

$$\frac{2544\ \text{g}}{2583\ \text{g}} = 0.985 \qquad (1 - 0.985) \times 100 = 1.5\%$$

Alternative to Mechanical Splitter Check

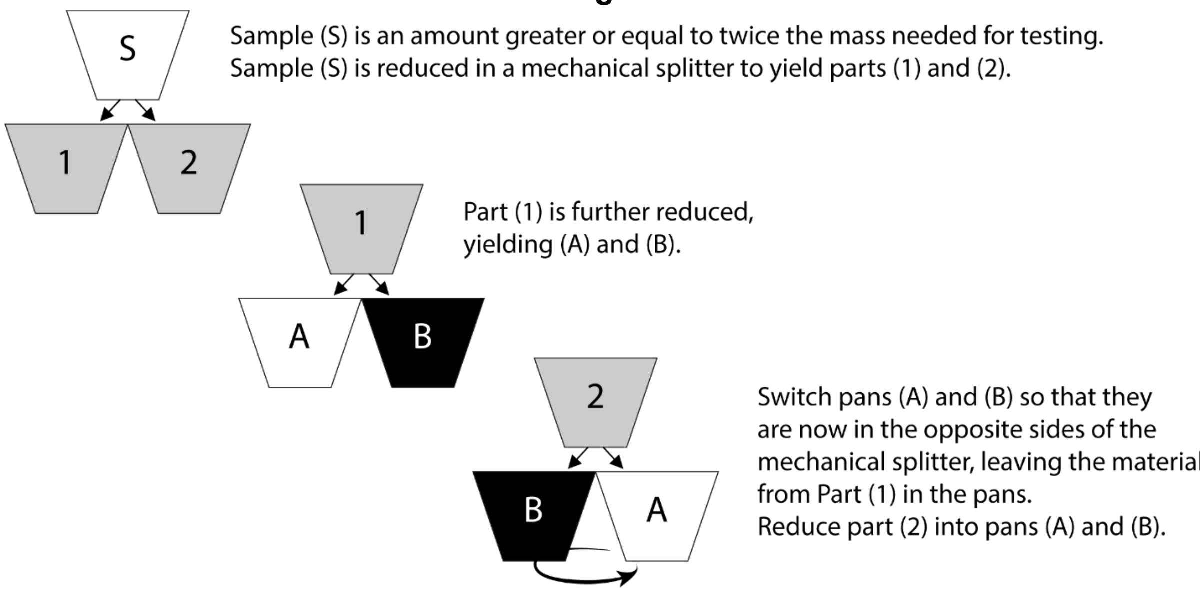
- In lieu of determining the mass of each reduced portion, use the method illustrated in Figure 1 or 2 during reduction.

Figure 1



- Sample (S) is an amount greater than or equal to twice the mass needed for testing. Sample (S) is reduced in a mechanical splitter to yield parts (1) and (2).
- Part (1) is further reduced yielding (A) and (B) while part (2) is reduced to yield (B) and (A).
- Final testing sample is produced by combining alternate pans, i.e. A/A or B/B only.

Figure 2



Method B

Method B Quartering

Use either of the following two procedures or a combination of both.

Surface

1. Place the sample on a hard, clean, level surface where there will be neither loss of material nor the accidental addition of foreign material.

2. Mix the material thoroughly by turning the entire sample over a minimum of four times. With the last turning, shovel the entire sample into a conical pile by depositing each shovelful on top of the preceding one.

3. Flatten the conical pile to a uniform thickness and diameter by pressing down with a shovel. The diameter should be four to eight times the thickness.

4. Divide the flattened pile into four approximately equal quarters with a shovel or trowel.

5. Remove two diagonally opposite quarters, including all fine material, and brush the cleared spaces clean.

6. Successively mix and quarter the remaining material until the sample is reduced to the desired size.

7. The final test sample consists of <u>two diagonally opposite</u> quarters.

Tarp

1. Place the sample on the tarp.

2. Mix the material thoroughly a minimum of four times by pulling each corner of the tarp horizontally over the sample toward the opposite corner. After the last turn, form a conical pile.

3. Flatten the conical pile to a uniform thickness and diameter by pressing down with a shovel. The diameter should be four to eight times the thickness.

4. Divide the flattened pile into four approximately equal quarters with a shovel or trowel or insert a stick or pipe beneath the tarp and under the center of the pile, then lift both ends of the stick, dividing the sample into two roughly equal parts. Remove the stick leaving a fold of the tarp between the divided portions. Insert the stick under the center of the pile at right angles to the first division and again lift both ends of the stick, dividing the sample into four roughly equal quarters.

5. Remove two diagonally opposite quarters, being careful to clean the fines from the tarp.

6. Successively mix and quarter the remaining material until the sample size is reduced to the desired size.

7. The final test sample consists of two diagonally opposite quarters.

Method B Sectoring

1. Place the sample on a hard, clean, level surface where there will be neither loss of material nor the accidental addition of foreign material.

2. Mix the material thoroughly by turning the entire sample over a minimum of four times. With the last turning, shovel the entire sample into a conical pile by depositing each shovelful on top of the preceding one.

3. Flatten the conical pile to a uniform thickness and diameter by pressing down with a shovel. The diameter should be four to eight times the thickness.

4. Divide the flattened cone into four approximately equal quarters using a quartering template, straightedge, shovel, or trowel, assuring complete separation.

5. Using a straightedge, obtain a sector by slicing through a quarter of the material from the center point to the outer edge of the quarter.

6. Pull or drag the sector from the quarter with two straight edges or hold one edge of the straightedge in contact with quartering device.

7. Remove an equal sector from the diagonally opposite quarter and combine to create the appropriate sample mass.

8. Continue obtaining sectors from diagonally opposite quarters until the required sample size has been obtained for all required tests.

PERFORMANCE EXAM CHECKLIST

REDUCING SAMPLES OF AGGREGATE TO TESTING SIZE
WFOP AASHTO R 76

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

	Trial 1	Trial 2
Method A - Splitting		
1. Chutes appropriate size and number?	_____	_____
2. Material spread uniformly on feeder.	_____	_____
3. Rate of feed slow enough so that sample flows freely through chutes?	_____	_____
4. Material in one pan re-split until desired mass is obtained?	_____	_____
5. Mechanical splitter checked or alternative used?	_____	_____
Method B - Quartering		
1. Sample placed on a tarp or clean, hard, and level surface?	_____	_____
2. Mixed by turning over 4 times with shovel or by pulling the tarp horizontally over pile?	_____	_____
3. Conical pile formed without loss of material?	_____	_____
4. Pile flattened to uniform thickness and diameter?	_____	_____
5. Diameter equal to about 4 to 8 times thickness?	_____	_____
6. Divided into 4 equal portions without loss of material?		
a. Using a shovel or trowel?	_____	_____
b. Placing stick or pipe under the tarp?	_____	_____
c. Using quartering template?	_____	_____
7. Quartering		
a. Two diagonally opposite quarters, including all fine material, remove	_____	_____
b. Process continued until desired sample size is obtained when two opposite quarters combined?	_____	_____
8. Sectoring		
a. Using two straightedges or a quartering device and one straightedge, sector obtained from one of the quarters from the center point to the outer edge of the quarter?	_____	_____
b. Equal sector obtained taken from the diagonally opposite quarter.	_____	_____

9. Increments combined to produce appropriate sample mass? _____ _____

Comments: First attempt: Pass_____Fail_____ Second attempt: Pass_____Fail______

____

____

____

____

____

____

Examiner Signature _____________________________ WAQTC #:_______________

TOTAL EVAPORABLE MOISTURE CONTENT OF AGGREGATE BY DRYING WFOP AASHTO T 255

Scope

This procedure covers the determination of moisture content of aggregate in accordance with AASHTO T 255-22. It may also be used for other construction materials.

Overview

Moisture content is determined by comparing the wet mass of a sample and the mass of the sample after drying to constant mass. The term constant mass is used to define when a sample is dry.

Constant mass – the state at which a mass does not change more than a given percent, after additional drying for a defined time interval, at a required temperature.

Apparatus

- Balance or scale: Capacity sufficient for the principal sample mass, accurate to 0.1 percent of sample mass or readable to 0.1 g, meeting the requirements of AASHTO M 231.
- Containers: clean, dry, and capable of being sealed
- Suitable drying containers
- Microwave safe container with ventilated lids
- Heat source: thermostatically controlled, capable of maintaining 110 ± 5°C (230 ± 9°F).
  - Forced draft oven (preferred)
  - Ventilated oven
  - Convection oven
- Heat source, uncontrolled, for use when allowed by the agency, will not alter the material being dried, and close control of the temperature is not required.
  - Infrared heater, hot plate, fry pan, or any other device/method allowed by the agency
  - Microwave oven (900 watts minimum)
- Hot pads or gloves
- Utensils such as spoons

Sample Preparation

Obtain a representative sample according to the FOP for AASHTO R 90 in its existing condition. If necessary, reduce to moisture content sample size according to the FOP for AASHTO R 76.

The moisture content sample size is based on Table 1 or other information that may be specified by the agency.

TABLE 1
Sample Sizes for Moisture Content of Aggregate

Nominal Maximum Size* mm (in.)	Minimum Sample Mass g (lb)
150 (6)	50,000 (110)
100 (4)	25,000 (55)
90 (3 1/2)	16,000 (35)
75 (3)	13,000 (29)
63 (2 1/2)	10,000 (22)
50 (2)	8000 (18)
37.5 (1 1/2)	6000 (13)
25.0 (1)	4000 (9)
19.0 (3/4)	3000 (7)
12.5 (1/2)	2000 (4)
9.5 (3/8)	1500 (3.3)
4.75 (No. 4)	500 (1.1)

* One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps in specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum size.

Immediately seal or cover moisture content samples to prevent any change in moisture content or follow the steps in “Procedure.”

Procedure

Determine all sample masses to the nearest 0.1 percent of the sample mass or to the nearest 0.1 g.

When determining the mass of hot samples or containers or both, place and tare a buffer between the sample container and the balance. This will eliminate damage to or interference with the operation of the balance or scale.

1. Determine and record the mass of the container (and lid for microwave drying).

2. Place the wet sample in the container.
3. Determine and record the total mass of the container and wet sample.
   a. For oven(s), hot plates, infrared heaters, etc.: Spread the sample in the container.
   b. For microwave oven: Heap sample in the container; cover with ventilated lid.
4. Determine and record the wet mass of the sample (M_W) by subtracting the container mass determined in Step 1 from the mass of the container and sample determined in Step 3.
5. Place the sample in one of the following drying apparatuses:
   a. Controlled heat source (oven): at 110 ±5°C (230 ±9°F).
   b. Uncontrolled heat source (Hot plate, infrared heater, or other heat sources as allowed by the agency): Stir frequently to avoid localized overheating.
6. Dry until sample appears moisture free.
7. Determine mass of sample and container.
8. Determine and record the mass of the sample by subtracting the container mass determined in Step 1 from the mass of the container and sample determined in Step 7.
9. Return sample and container to the heat source for the additional time interval.
   a. Controlled (oven): 30 minutes
   b. Uncontrolled (Hot plate, infrared heater, or other heat sources as allowed by the agency): 10 minutes
   c. Uncontrolled (Microwave oven): 2 minutes

Caution: Some minerals in the sample may cause the aggregate to overheat, crack and explode, altering the aggregate gradation.

10. Determine mass of sample and container.
11. Determine and record the mass of the sample by subtracting the container mass determined in Step 1 from the mass of the container and sample determined in Step 10.
12. Determine percent change by subtracting the new mass determination (M_n) from the previous mass determination (M_p), dividing by the previous mass determination (M_p), and multiplying by 100.
13. Continue drying, performing Steps 9 through 12, until there is less than a 0.10 percent change after additional drying time.
14. Constant mass has been achieved; sample is defined as dry.
15. Allow the sample to cool. Determine and record the total mass of the container and dry sample.
16. Determine and record the dry mass of the sample (M_D) by subtracting the mass of the container determined in Step 1 from the mass of the container and sample determined in Step 15.
17. Determine and record percent moisture (w) by subtracting the final dry mass determination (M_D) from the initial wet mass determination (M_W), dividing by the final dry mass determination (M_D), and multiplying` by 100.

TABLE 2
Methods of Drying

Heat Source	Specific Instructions	Drying intervals to achieve constant mass (minutes)
Controlled: Forced Draft Oven (preferred), Ventilated Oven, or Convection Oven	110 ±5°C (230 ±9°F)	30
Uncontrolled:		
Hot plate, Infrared heater, or any other device/method allowed by the agency	Stir frequently	10
Microwave	Heap sample and cover with ventilated lid	2

Calculation

Constant Mass:

Calculate constant mass using the following formula:

$$\%\,Change = \frac{M_p - M_n}{M_p} \times 100$$

where:

M_p = previous mass measurement

M_n = new mass measurement

Example:

Mass of container:		1232.1 g
Mass of container after first drying cycle:		2637.2 g
Mass, M_p, of possibly dry sample:	2637.2 g - 1232.1 g =	1405.1 g
Mass of container and sample after second drying cycle:		2634.1 g
Mass, M_n, of sample:	2634.1 g - 1232.1 g =	1402.0 g

$$\%\,Change = \frac{1405.1\text{ g} - 1402.0\text{ g}}{1405.1\text{ g}} \times 100 = 0.22\%$$

0.22 percent is not less than 0.10 percent, so continue drying

Mass of container and sample after third drying cycle: 2633.0 g

Mass, M_n, of sample: 2633.0 g - 1232.1 g = 1400.9 g

$$\% \, Change = \frac{1402.0 \text{ g} - 1400.9 \text{ g}}{1402.0 \text{ g}} \times 100 = 0.08\%$$

0.08 percent is less than 0.10 percent, so constant mass has been reached.

Moisture Content:

Calculate the moisture content, w, as a percent, using the following formula:

$$w = \frac{M_W - M_D}{M_D} \times 100$$

where:

w	=	moisture content, percent
M_W	=	wet mass
M_D	=	dry mass

Example:

Mass of container:		1232.1 g
Mass of container and wet sample:		2764.7 g
Mass, M_W, of wet sample:	2764.7 g - 1232.1 g =	1532.6 g
Mass of container and dry sample (COOLED):		2633.5 g
Mass, M_D, of dry sample:	2633.5 g - 1232.1 g =	1401.4 g

$$w = \frac{1532.6 \text{ g} - 1401.4 \text{ g}}{1401.4 \text{ g}} \times 100 = \frac{131.7 \text{ g}}{1401.4 \text{ g}} = 9.40\% \text{ report } 9.4\%$$

Report

- On forms approved by the agency
- Sample ID
- M_W, wet mass
- M_D, dry mass
- Moisture content to the nearest 0.1 percent

PERFORMANCE EXAM CHECKLIST

TOTAL MOISTURE CONTENT OF AGGREGATE BY DRYING
WFOP AASHTO T 255

Participant Name ______________________________Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Representative sample of appropriate mass obtained?	______	______
2. Mass of container determined to 0.1 percent or 0.1 g?	______	______
3. Sample placed in container and wet mass determined to 0.1 percent or 0.1 g?	______	______
4. Test sample mass conforms to the required mass?	______	______
5. Loss of moisture avoided prior to mass determination?	______	______
6. Sample dried by a suitable heat source?	______	______
7. If aggregate heated by means other than a temperature controlled oven, is sample stirred to avoid localized overheating?	______	______
8. If heated in a microwave, heaped and covered with a ventilated lid?	______	______
9. Is aggregate heated for the additional, specified time?	______	______
a. Forced draft, ventilated, convection ovens – 30 minutes		
b. Microwave – 2 minutes		
c. Other – 10 minutes		
10. Mass determined and compared to previous mass – showing less than 0.10 percent loss?	_____	_____
11. Sample cooled before dry mass determination to 0.1 percent or 0.1 g?	_____	_____
12. Calculations performed properly, and results reported to the nearest 0.1 percent?	_____	_____

Comments: First attempt: Pass____Fail________Second attempt: Pass_____Fail___

____

____

____

____

____

Examiner Signature _________________________ WAQTC #:_______________

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES
WFOP AASHTO T 27
MATERIALS FINER THAN 75 µm (No. 200) SIEVE IN MINERAL AGGREGATE BY WASHING
WFOP AASHTO T 11

Scope

A sieve analysis, or 'gradation,' measures distribution of aggregate particle sizes within a given sample.

Accurate determination of the amount of material smaller than 75 µm (No. 200) cannot be made using just AASHTO T 27. If quantifying this material is required, use AASHTO T 11 in conjunction with AASHTO T 27.

This FOP covers sieve analysis in accordance with AASHTO T 27-23 and materials finer than 75 µm (No. 200) in accordance with AASHTO T 11-22 performed in conjunction with AASHTO T 27. The procedure includes three methods: A, B, and C.

Apparatus

- Balance or scale: Capacity sufficient for the masses shown in Table 1, accurate to 0.1 percent of the sample mass or readable to 0.1 g, and meeting the requirements of AASHTO M 231
- Sieves: Meeting the requirements of ASTM E11
- Mechanical sieve shaker: Meeting the requirements of AASHTO T 27
- Suitable drying equipment (refer to FOP for AASHTO T 255)
- Containers and utensils: A pan or vessel of sufficient size to contain the sample covered with water and permit vigorous agitation without loss of material or water
- Optional
    - Mechanical washing device
    - Mallet: With a rubber or rawhide head having a mass of 0.57 ±0.23 kg (1.25 ±0.5 lb)

Sample Sieving

- In all procedures, the sample is shaken in nested sieves. Sieves are selected to furnish information required by specification. Intermediate sieves are added for additional information or to avoid overloading sieves, or both.
- The sieves are nested in order of increasing size from the bottom to the top, and the sample, or a portion of the sample, is placed on the top sieve.
- The loaded sieves are shaken in a mechanical shaker for approximately 10 minutes, refer to Annex A, *Time Evaluation*.

- Care must be taken so that sieves are not overloaded, refer to Annex B, *Overload Determination*. The sample may be sieved in increments and the mass retained for each sieve added together from each sample increment to avoid overloading sieves.

Sample Preparation

Obtain samples according to the FOP for AASHTO R 90 and reduce to sample size, shown in Table 1, according to the FOP for AASHTO R 76.

TABLE 1
Sample Sizes for Aggregate Gradation Test

Nominal Maximum Size* mm (in.)	Minimum Dry Mass g (lb)
125 (5)	300,000 (660)
100 (4)	150,000 (330)
90 (3 1/2)	100,000 (220)
75 (3)	60,000 (130)
63 (2 1/2)	35,000 (77)
50 (2)	20,000 (44)
37.5 (1 1/2)	15,000 (33)
25.0 (1)	10,000 (22)
19.0 (3/4)	5000 (11)
12.5 (1/2)	2000 (4)
9.5 (3/8)	1000 (2)
6.3 (1/4)	1000 (2)
4.75 (No. 4)	500 (1)

*Nominal maximum size: One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps between specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum size.

Sample sizes in Table 1 are standard for aggregate sieve analysis, due to equipment restraints samples may need to be divided into several "subsamples." For example, a gradation that requires 100 kg (220 lbs.) of material would not fit into a large tray shaker all at once.

Some agencies permit reduced sample sizes if it is proven that doing so is not detrimental to the test results. Some agencies require larger sample sizes. Check agency guidelines for required or permitted sample sizes.

Selection of Procedure

Agencies may specify which method to perform. If a method is not specified, perform Method A.

Overview

Method A

- Determine original dry mass of the sample
- Wash over a 75µm (No. 200) sieve
- Determine dry mass of washed sample
- Sieve washed sample
- Calculate and report percent retained and passing each sieve

Method B

- Determine original dry mass of the sample
- Wash over a 75 µm (No. 200) sieve
- Determine dry mass of washed sample
- Sieve sample through coarse sieves, 4.75 mm (No. 4) sieves and larger
- Determine mass of fine material, minus 4.75 mm (No. 4)
- Reduce fine material
- Determine mass of reduced portion
- Sieve reduced portion
- Calculate and report percent retained and passing each sieve

Method C

- Determine original dry mass of the sample
- Sieve sample through coarse sieves, 4.75 mm (No. 4) sieves and larger
- Determine mass of fine material, minus 4.75 mm (No. 4)
- Reduce fine material
- Determine mass of reduced portion
- Wash reduced portion over a 75µm (No. 200) sieve
- Determine dry mass of washed reduced portion
- Sieve washed reduced portion
- Calculate and report percent retained and passing each sieve

Procedure Method A

1. Dry the sample to constant mass 110 ± 5°C (230 ± 9°F) according to the FOP for AASHTO T 255. Cool to room temperature.
2. Determine and record the original dry mass of the sample to the nearest 0.1 percent or 0.1 g. Designate this mass as *M*.

   When the specification does not require the amount of material finer than 75 µm (No. 200) be determined by washing, skip to Step 11.
3. Nest a sieve, such as a 2.0 mm (No. 10), above the 75 µm (No. 200) sieve.
4. Place the sample in a container and cover with water.

Note 1: When required by the agency, add a detergent, dispersing solution, or other wetting agent to the water to assure a thorough separation of the material finer than the 75 µm (No. 200) sieve from the coarser particles. There should be enough wetting agent to produce a small amount of suds when the sample is agitated. Excessive suds may overflow the sieves and carry material away with them.

5. Agitate vigorously to ensure complete separation of the material finer than 75 µm (No. 200) from coarser particles and bring the fine material into suspension above the coarser material. Avoid degradation of the sample when using a mechanical washing device limit agitation to 10 min.
6. Immediately pour the wash water containing the suspended material over the nested sieves; be careful not to pour out the coarser particles or over fill the 75 µm (No. 200) sieve.
7. Add water to cover material remaining in the container, agitate, and repeat Step 5. Continue until the wash water is reasonably clear.
8. Remove the upper sieve and return material retained to the washed sample.
9. Rinse the material retained on the 75 µm (No. 200) sieve until water passing through the sieve is reasonably clear and detergent or dispersing agent is removed, if used.
10. Return all material retained on the 75 µm (No. 200) sieve to the container by rinsing into the washed sample.

Note 2: Excess water may be carefully removed with a bulb syringe; the removed water must be discharged back over the 75 µm (No. 200) sieve to prevent loss of fines.

11. Dry the washed sample to constant mass at 110 ± 5°C (230 ± 9°F) according to the FOP for AASHTO T 255. Cool to room temperature.
12. Determine and record the dry mass of the sample.
13. Select sieves required by the specification and those necessary to avoid overloading as described in Annex B. With a pan on bottom, nest the sieves increasing in size starting with the 75 µm (No. 200).
14. Place the sample, or a portion of the sample, on the top sieve. Sieves may already be in the mechanical shaker, if not place sieves in mechanical shaker and shake for the minimum time determined to provide complete separation for the sieve shaker being used (approximately 10 minutes, the time determined by Annex A).

Note 3: Excessive shaking (more than 10 minutes) may result in degradation of the sample.

15. Determine and record the individual or cumulative mass retained for each sieve and in the pan. Ensure that all material trapped in full openings of the sieve are removed and included in the mass retained.

Note 4: *For sieves 4.75 mm (No. 4) and larger, check material trapped in less than a full opening by sieving over a full opening. Use coarse wire brushes to clean the 600 µm (No. 30) and larger sieves, and soft bristle brushes for smaller sieves.*

Note 5: *In the case of coarse / fine aggregate mixtures, distribute the minus 4.75 mm (No. 4) among two or more sets of sieves to prevent overloading of individual sieves.*

16. Perform the *Check Sum* calculation – Verify the *total mass after sieving* compared to the *dry mass before sieving* is not more than 0.3 percent. The *dry mass before sieving* is the dry mass after wash or the original dry mass (*M*) if performing the sieve analysis without washing. Do not use test results for acceptance if the *Check Sum* result is more than 0.3 percent.

17. Calculate the total percentages passing, and the individual or cumulative percentages retained to the nearest 0.1 percent by dividing the individual sieve masses or cumulative sieve masses by the original dry mass (*M*) of the sample.

18. Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Method A Calculations

Check Sum

$$Check\ Sum = \frac{dry\ mass\ before\ seiving - total\ mass\ after\ sieving}{dry\ mass\ before\ sieving} \times 100$$

Percent Retained

$$IPR = \frac{IMR}{M} \times 100 \qquad or \qquad CPR = \frac{CMR}{M} \times 100$$

Where:

IPR	=	Individual Percent Retained
CPR	=	Cumulative Percent Retained
M	=	Original dry mass of the sample
IMR	=	Individual Mass Retained
CMR	=	Cumulative Mass Retained

Percent Passing (PP)

$$PP = PPP - IPR \qquad or \qquad PP = 100 - CPR$$

Where:

PP = Percent Passing

PPP = Previous Percent Passing

Method A Example Individual Mass Retained

Original dry mass of the sample (*M*):	5168.7 g
Dry mass of the sample after washing:	4911.3 g
Total mass after sieving equals	
Sum of Individual Masses Retained (IMR), including minus 75 µm (No. 200) in the pan:	4905.9 g
Amount of 75µm (No. 200) minus washed out (5168.7 g – 4911.3 g):	257.4 g

Check Sum

$$Check\ Sum = \frac{4911.3\ g - 4905.9\ g}{4911.3\ g} \times 100 = 0.1\%$$

The result is not more than 0.3 percent therefore the results can be used for acceptance purposes.

Individual Percent Retained (IPR) for 9.5 mm (3/8 in.) sieve:

$$IPR = \frac{619.2\ g}{5168.7\ g} \times 100 = 12.0\%$$

Percent Passing (PP) 9.5 mm (3/8 in.) sieve:

$$PP = 86.0\% - 12.0\% = 74.0\%$$

Reported Percent Passing = 74%

Method A Individual Gradation on All Sieves

Sieve Size mm (in.)	Individual Mass Retained g (IMR)	Determine IPR by dividing IMR by *M* and multiplying by 100	Individual Percent Retained (IPR)	Determine PP by subtracting IPR from previous PP	Percent Passing (PP)	Reported Percent Passing*
19.0 (3/4)	0		0		100.0	100
12.5 (1/2)	724.7	$\frac{724.7}{5168.7} \times 100 =$	14.0	$100.0 - 14.0 =$	86.0	86
9.5 (3/8)	619.2	$\frac{619.2}{5168.7} \times 100 =$	12.0	$86.0 - 12.0 =$	74.0	74
4.75 (No. 4)	1189.8	$\frac{1189.8}{5168.7} \times 100 =$	23.0	$74.0 - 23.0 =$	51.0	51
2.36 (No. 8)	877.6	$\frac{877.6}{5168.7} \times 100 =$	17.0	$51.0 - 17.0 =$	34.0	34
1.18 (No. 16)	574.8	$\frac{574.8}{5168.7} \times 100 =$	11.1	$34.0 - 11.1 =$	22.9	23
0.600 (No. 30)	329.8	$\frac{329.8}{5168.7} \times 100 =$	6.4	$22.9 - 6.4 =$	16.5	17
0.300 (No. 50)	228.5	$\frac{228.5}{5168.7} \times 100 =$	4.4	$16.5 - 4.4 =$	12.1	12
0.150 (No. 100)	205.7	$\frac{205.7}{5168.7} \times 100 =$	4.0	$12.1 - 4.0 =$	8.1	8
0.075 (No. 200)	135.4	$\frac{135.7}{5168.7} \times 100 =$	2.6	$8.1 - 2.6 =$	5.5	5.5
minus 0.075 (No. 200) in the pan	20.4					
Total mass after sieving = sum of sieves + mass in the pan = 4905.9 g						
Original dry mass of the sample *(M)*: 5168.7g						

* Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Method A Example Cumulative Mass Retained

Original dry mass of the sample (*M*):	5168.7 g
Dry mass of the sample after washing:	4911.3 g
Total mass after sieving equals Final Cumulative Mass Retained (FCMR) (includes minus 75 µm (No. 200) from the pan):	4905.9 g
Amount of 75µm (No. 200) minus washed out (5168.7 g – 4911.3 g):	257.4 g

Check Sum

$$Check\ Sum = \frac{4911.3\ g - 4905.9\ g}{4911.3\ g} \times 100 = 0.1\%$$

The result is not more than 0.3 percent therefore the results can be used for acceptance purposes.

Cumulative Percent Retained (CPR) for 9.5 mm (3/8 in.) sieve:

$$CPR = \frac{1343.9\ g}{5168.7\ g} \times 100 = 26.0\%$$

Percent Passing (PP) 9.5 mm (3/8 in.) sieve:

$$PP = 100.0\% - 26.0\% = 74.0\%$$

Reported Percent Passing = 74%

Method A Cumulative Gradation on All Sieves

Sieve Size mm (in.)	Cumulative Mass Retained g (CMR)	Determine CPR by dividing CMR by M and multiplying by 100	Cumulative Percent Retained (CPR)	Determine PP by subtracting CPR from 100.0	Percent Passing (PP)	Reported Percent Passing*
19.0 (3/4)	0		0.0		100.0	100
12.5 (1/2)	724.7	$\frac{724.7}{5168.7} \times 100 =$	14.0	$100.0 - 14.0 =$	86.0	86
9.5 (3/8)	1343.9	$\frac{1343.9}{5168.7} \times 100 =$	26.0	$100.0 - 26.0 =$	74.0	74
4.75 (No. 4)	2533.7	$\frac{2533.7}{5168.7} \times 100 =$	49.0	$100.0 - 49.0 =$	51.0	51
2.36 (No. 8)	3411.3	$\frac{3411.3}{5168.7} \times 100 =$	66.0	$100.0 - 66.0 =$	34.0	34
1.18 (No. 16)	3986.1	$\frac{3986.1}{5168.7} \times 100 =$	77.1	$100.0 - 77.1 =$	22.9	23
0.600 (No. 30)	4315.9	$\frac{4315.9}{5168.7} \times 100 =$	83.5	$100.0 - 83.5 =$	16.5	17
0.300 (No. 50)	4544.4	$\frac{4544.4}{5168.7} \times 100 =$	87.9	$100.0 - 87.9 =$	12.1	12
0.150 (No. 100)	4750.1	$\frac{4750.1}{5168.7} \times 100 =$	91.9	$100.0 - 91.9 =$	8.1	8
0.075 (No. 200)	4885.5	$\frac{4885.5}{5168.7} \times 100 =$	94.5	$100.0 - 94.5 =$	5.5	5.5
FCMR	4905.9					
Total mass after sieving: 4905.9 g						
Original dry mass of the sample *(M)*: 5168.7 g						

* Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Procedure Method B

1. Dry the sample to constant mass at 110 ± 5°C (230 ± 9°F) according to the FOP for AASHTO T 255. Cool to room temperature.
2. Determine and record the original dry mass of the sample to the nearest 0.1 percent or 0.1 g. Designate this mass as *M*.

   When the specification does not require the amount of material finer than 75 µm (No. 200) be determined by washing, skip to Step 11.
3. Nest a protective sieve, such as a 2.0 mm (No. 10), above the 75 µm (No. 200) sieve.
4. Place the sample in a container and cover with water.

Note 1: *If required by the agency, add a detergent, dispersing solution, or other wetting agent to the water to assure a thorough separation of the material finer than the 75 µm (No. 200) sieve from the coarser particles. There should be enough wetting agent to produce a small amount of suds when the sample is agitated. Excessive suds may overflow the sieves and carry material away with them.*

5. Agitate vigorously to ensure complete separation of the material finer than 75 µm (No. 200) from coarser particles and bring the fine material into suspension above the coarser material. Avoid degradation of the sample when using a mechanical washing device limit agitation to 10 min.
6. Immediately pour the wash water containing the suspended material over the nested sieves; be careful not to pour out the coarser particles or over fill the 75 µm (No. 200) sieve.
7. Add water to cover material remaining in the container, agitate, and repeat Step 5. Continue until the wash water is reasonably clear.
8. Remove the upper sieve and return material retained to the washed sample.
9. Rinse the material retained on the 75 µm (No. 200) sieve until water passing through the sieve is reasonably clear and detergent or dispersing agent is removed, if used.
10. Return all material retained on the 75 µm (No. 200) sieve to the container by rinsing into the washed sample.

Note 2: *Excess water may be carefully removed with a bulb syringe; the removed water must be discharged back over the 75 µm (No. 200) sieve to prevent loss of fines.*

11. Dry the washed sample to constant mass at 110 ± 5°C (230 ± 9°F) according to the FOP for AASHTO T 255. Cool to room temperature.
12. Determine and record the dry mass after wash.
13. Select sieves required by the specification and those necessary to avoid overloading as described in Annex B. With a pan on bottom, nest the sieves increasing in size starting with the 4.75 mm (No. 4).
14. Place the sample, or a portion of the sample, on the top sieve. Sieves may already be in the mechanical shaker, if not place the sieves in the mechanical shaker and shake for the minimum time determined to provide complete separation for the sieve shaker being used (approximately 10 minutes, the time determined by Annex A).

*Note 3**:** Excessive shaking (more than 10 minutes) may result in degradation of the sample.*

15. Determine and record the individual or cumulative mass retained for each sieve. Ensure that all particles trapped in full openings of the sieve are removed and included in the mass retained.

Note 4: *For sieves 4.75 mm (No. 4) and larger, check material trapped in less than a full opening by sieving over a full opening. Use coarse wire brushes to clean the 600 µm (No. 30) and larger sieves, and soft hair bristle for smaller sieves.*

16. Determine and record the mass of the minus 4.75 mm (No. 4) material in the pan. Designate this mass as M_1.
17. Perform the *Coarse Check Sum* calculation – Verify the *total mass after coarse sieving* compared to the *dry mass before sieving* to not more than 0.3 percent. The *dry mass before sieving* is the dry mass after wash or the original dry mass (M) if performing the sieve analysis without washing. Do not use test results for acceptance if the *Check Sum* result is more than 0.3 percent.
18. Reduce the minus 4.75 mm (No. 4) according to the FOP for AASHTO R 76 to produce a sample with a minimum mass of 500 g. Determine and record the mass of the minus 4.75 mm (No. 4) split, designate this mass as M_2.
19. Select sieves required by the specification and those necessary to avoid overloading as described in Annex B. With a pan on bottom, nest the sieves increasing in size starting with the 75 µm (No. 200) up to, but not including, the 4.75 mm (No. 4) sieve.
20. Place the sample portion on the top sieve and place the sieves in the mechanical shaker. Shake for the minimum time determined to provide complete separation for the sieve shaker being used (approximately 10 minutes, the time determined by Annex A).
21. Determine and record the individual or cumulative mass retained for each sieve and in the pan. Ensure that all particles trapped in full openings of the sieve are removed and included in the mass retained. (See Note 4.)
22. Perform the *Fine Check Sum* calculation – Verify the *total mass after sieving* compared to the *dry mass before sieving* (M_2) is not more than 0.3 percent. Do not use test results for acceptance if the *Check Sum* result is more than 0.3 percent.
23. Calculate to the nearest 0.1 percent, the Individual Mass Retained (IMR) or Cumulative Mass Retained (CMR) of the size increment of the reduced sample and the original sample.
24. Calculate the total percent passing.
25. Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Method B Calculations

Check Sum

$$Coarse\ Check\ Sum = \frac{dry\ mass\ before\ sieveing - total\ mass\ after\ coarse\ sieving}{dry\ mass\ before\ sieving} \times 100$$

$$Fine\ Check\ Sum = \frac{M_2 - total\ mass\ after\ fine\ sieving}{M_2} \times 100$$

Percent Retained for 4.75 mm (No. 4) and larger

$$IPR = \frac{IMR}{M} \times 100 \qquad or \qquad CPR = \frac{CMR}{M} \times 100$$

Where:

IPR	=	Individual Percent Retained
CPR	=	Cumulative Percent Retained
M	=	Original dry mass of the sample
IMR	=	Individual Mass Retained
CMR	=	Cumulative Mass Retained

Percent Passing (PP) for 4.75 mm (No. 4) and larger

$$PP = PPP - IPR \qquad or \qquad PP = 100 - CPR$$

Where:

PP	=	Percent Passing
PPP	=	Previous Percent Passing

Minus 4.75mm (No. 4) adjustment factor (R)

The mass of material retained for each sieve is multiplied by the adjustment factor, the total mass of the minus 4.75 mm (No. 4) from the pan, M_1, divided by the mass of the reduced split of minus 4.75 mm (No. 4), M_2. For consistency, this adjustment factor is carried to three decimal places.

$$R = \frac{M_1}{M_2}$$

where:

R = minus 4.75 mm (No. 4) adjustment factor

M_1 = total mass of minus 4.75 mm (No. 4) before reducing

M_2 = mass of the reduced split of minus 4.75 mm (No. 4)

Total Individual Mass Retained (TIMR):

$$TIMR = R \times B$$

where:

TIMR = Total Individual Mass Retained

R = minus 4.75 mm (No. 4) adjustment factor

B = individual mass of the size increment in the reduced portion sieved

Total Cumulative Mass Retained (TCMR)

$$TCMR = (R \times B) + D$$

where:

TCMR = Total Cumulative Mass Retained

R = minus 4.75 mm (No. 4) adjustment factor

B = cumulative mass of the size increment in the reduced portion sieved

D = cumulative mass of plus 4.75mm (No. 4) portion of sample

Method B Example Individual Mass Retained

Dry mass of total sample, before washing: 3214.0 g

Dry mass of sample after washing: 3085.1 g

Total mass after sieving

Sum of Individual Masses Retained (IMR) plus the minus 4.75 mm (No. 4) from the pan: 3085.0 g

Amount of 75 µm (No. 200) minus washed out (3214.0 g – 3085.1 g): 128.9 g

Coarse Check Sum

$$Coarse\ Check\ Sum = \frac{3085.1\ g - 3085.0\ g}{3085.1\ g} \times 100 = 0.0\%$$

The result is not more than 0.3 percent therefore the results can be used for acceptance purposes.

Individual Percent Retained (IPR) for 9.5 mm (3/8 in.) sieve

$$IPR = \frac{481.4\ g}{3214.0\ g} \times 100 = 15.0\%$$

Percent Passing (PP) for 9.5 mm (3/8 in.) sieve:

$$PP = 95.0\% - 15.0\% = 80.0\%$$

Reported Percent Passing = 80%

Method B Individual
Gradation on Coarse Sieves

Sieve Size mm (in.)	Individual Mass Retained g (IMR)	Determine IPR by dividing IMR by M and multiplying by 100	Individual Percent Retained (IPR)	Determine PP by subtracting IPR from previous PP	Percent Passing (PP)
16.0 (5/8)	0		0		100
12.5 (1/2)	161.1	$\frac{161.1}{3214.0} \times 100 =$	5.0	$100.0 - 5.0 =$	95.0
9.50 (3/8)	481.4	$\frac{481.4}{3214.0} \times 100 =$	15.0	$95.0 - 15.0 =$	80.0
4.75 (No. 4)	475.8	$\frac{475.8}{3214.0} \times 100 =$	14.8	$80.0 - 14.8 =$	65.2
Minus 4.75 (No. 4) in the pan	1966.7 (**M_1**)				
Total mass after sieving: sum of sieves + mass in the pan = 3085.0 g					
Original dry mass of the sample *(M)*: 3214.0 g					

Fine Sample

The minus 4.75 mm (No. 4) from the pan, M_1 (1966.7 g), was reduced according to the FOP for AASHTO R 76, to at least 500 g. In this case, the reduced mass was determined to be **512.8 g**. This is M_2.

The reduced mass was sieved.

Total mass after sieving equals

Sum of Individual Masses Retained (IMR) including minus 75 µm (No. 200) in the pan 511.8 g

Fine Check Sum

$$Fine\ Check\ Sum = \frac{512.8\ g - 511.8\ g}{512.8\ g} \times 100 = 0.2\%$$

The result is not more than an 0.3 percent therefore the results can be used for acceptance purposes.

Adjustment Factor (R) for Total Individual Mass Retained (TIMR) on minus 4.75 (No. 4) sieves

The mass of material retained for each sieve is multiplied by the adjustment factor (*R*) carried to three decimal places.

$$R = \frac{M_1}{M_2} = \frac{1{,}966.7\ g}{512.8\ g} = 3.835$$

where:

R = minus 4.75 mm (No. 4) adjustment factor

M_1 = total mass of minus 4.75 mm (No. 4) from the pan

M_2 = mass of the reduced split of minus 4.75 mm (No. 4)

Each "individual mass retained" on the fine sieves must be multiplied by *R* to obtain the *Total Individual Mass Retained (TIMR)*.

Total Individual Mass Retained (TIMR) for 2.00 mm (No. 10) sieve

$$TIMR = 3.835 \times 207.1\ g = 794.2\ g$$

Individual Percent Retained (IPR) for 2.00 mm (No. 10) sieve:

$$IPR = \frac{794.2\ g}{3214.0\ g} \times 100 = 24.7\%$$

Percent Passing (PP) 2 mm (No. 10) sieve:

$$PP = 65.2\% - 24.7\% = 40.5\%$$

Reported Percent Passing = 41%

Method B Individual Gradation on Fine Sieves

Sieve Size mm (in.)	Individual Mass Retained g (IMR)	Determine TIMR by multiplying IMR by R $\left(\frac{M_1}{M_2}\right)$	Total Individual Mass Retained (TIMR)
2.00 (No. 10)	207.1	$207.1 \times 3.835 =$	794.2
0.425 (No. 40)	187.9	$187.9 \times 3.835 =$	720.6
0.210 (No. 80)	59.9	$59.9 \times 3.835 =$	229.7
0.075 (No. 200)	49.1	$49.1 \times 3.835 =$	188.3
minus 0.075 (No. 200) in the pan	7.8		
Total mass after sieving: sum of fine sieves + the mass in the pan = 511.8 g			

Method B Individual
Final Gradation on All Sieves

Sieve Size mm (in.)	Total Individual Mass Retained g (TIMR)	Determine IPR by dividing TIMR by M and multiplying by 100	Individual Percent Retained (IPR)	Determine PP by subtracting IPR from previous PP	Percent Passing (PP)	Reported Percent Passing*
16.0 (5/8)	0		0		100	100
12.5 (1/2)	161.1	$\frac{161.1}{3214.0} \times 100 =$	5.0	$100.0 - 5.0 =$	95.0	95
9.50 (3/8)	481.4	$\frac{481.4}{3214.0} \times 100 =$	15.0	$95.0 - 15.0 =$	80.0	80
4.75 (No. 4)	475.8	$\frac{475.8}{3214.0} \times 100 =$	14.8	$80.0 - 14.8 =$	65.2	65
2.00 (No. 10)	794.2	$\frac{794.2}{3214.0} \times 100 =$	24.7	$65.2 - 24.7 =$	40.5	41
0.425 (No. 40)	720.6	$\frac{720.6}{3214.0} \times 100 =$	22.4	$40.5 - 22.4 =$	18.1	18
0.210 (No. 80)	229.7	$\frac{229.7}{3214.0} \times 100 =$	7.1	$18.1 - 7.1 =$	11.0	11
0.075 (No. 200)	188.3	$\frac{188.3}{3214.0} \times 100 =$	5.9	$11.0 - 5.9 =$	5.1	5.1
minus 0.075 (No. 200) in the pan	29.9					
Original dry mass of the sample *(M)*: 3214.0 g						

* Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Method B Example Cumulative Mass Retained

Original dry mass of the sample *(M)*:	3214.0 g
Dry mass of sample after washing:	3085.1 g
Total mass after sieving equals	
Cumulative Mass Retained (CMR) on the 4.75 (No. 4) plus the minus 4.75 mm (No. 4) in the pan:	3085.0 g
Amount of 75 µm (No. 200) minus washed out (3214.0 g – 3085.1 g):	128.9 g

Coarse Check Sum

$$Coarse\ Check\ Sum = \frac{3085.1\ g - 3085.0\ g}{3085.1\ g} \times 100 = 0.0\%$$

The result is not more than 0.3 percent therefore the results can be used for acceptance purposes.

Cumulative Percent Retained (CPR) for 9.5 mm (3/8 in.) sieve

$$CPR = \frac{642.5\ g}{3214.0\ g} \times 100 = 20.0\%$$

Percent Passing (PP) for 9.5 mm (3/8 in.) sieve

$$PP = 100.0\% - 20.0\% = 80.0\%$$

Reported Percent Passing = 80%

Method B Cumulative
Gradation on Coarse Sieves

Sieve Size mm (in.)	Cumulative Mass Retained g (CMR)	Determine CPR by dividing CMR by M and multiplying by 100	Cumulative Percent Retained (CPR)	Determine PP by subtracting CPR from 100.0	Percent Passing (PP)
16.0 (5/8)	0		0		100
12.5 (1/2)	161.1	$\frac{161.1}{3214.0} \times 100 =$	5.0	$100.0 - 5.0 =$	95.0
9.50 (3/8)	642.5	$\frac{642.5}{3214.0} \times 100 =$	20.0	$100.0 - 20.0 =$	80.0
4.75 (No. 4)	1118.3 (D)	$\frac{1118.3}{3214.0} \times 100 =$	34.8	$100.0 - 34.8 =$	65.2
Minus 4.75 (No. 4) in the pan	1966.7 (M_1)				
CMR: 1118.3 + 1966.7 = 3085.0					
Original dry mass of the sample *(M)*: 3214.0 g					

Fine Sample

The mass of minus 4.75 mm (No. 4) material in the pan, M_1 (1966.7 g), was reduced according to the FOP for AASHTO R 76, to at least 500 g. In this case, the reduced mass was determined to be **512.8 g**. This is M_2.

The reduced mass was sieved.

Total mass after fine sieving equals

Final Cumulative Mass Retained (FCMR) (includes minus 75 µm (No. 200) from the pan): 511.8 g

Fine Check Sum

$$Fine\ Check\ Sum = \frac{512.8\ g - 511.8\ g}{512.8\ g} \times 100 = 0.2\%$$

The result is not more than 0.3 percent therefore the results can be used for acceptance purposes.

The cumulative mass of material retained for each sieve is multiplied by the adjustment factor (*R*) carried to three decimal places to obtain the *Adjusted Cumulative Mass Retained (ACMR)* and added to the cumulative mass retained on the 4.75 mm (No. 4) sieve, *D,* to obtain the *Total Cumulative Mass Retained (TCMR)*.

Adjustment factor (R) for Adjusted Cumulative Mass Retained (ACMR) in minus 4.75 (No. 4) sieves.

$$R = \frac{M_1}{M_2} = \frac{1{,}966.7\ g}{512.8\ g} = 3.835$$

where:

R = minus 4.75 mm (No. 4) adjustment factor

M_1 = total mass of minus 4.75 mm (No. 4) from the pan

M_2 = mass of the reduced split of minus 4.75 mm (No. 4)

Adjusted Cumulative Mass Retained (ACMR) for the 2.00 mm (No. 10) sieve

$$ACMR = 3.835 \times 207.1\ g = 794.2\ g$$

Total Cumulative Mass Retained (TCMR) for the 2.00 mm (No. 10) sieve

$$TCMR = 794.2\ g + 1118.3\ g = 1912.5\ g$$

Cumulative Percent Retained (CPR) for 2.00 mm (No. 10) sieve:

$$CPR = \frac{1912.5\ g}{3214.0\ g} \times 100 = 59.5\%$$

Percent Passing (PP) 2.00 mm (No. 10) sieve:

$$PP = 100.0\% - 59.5\% = 40.5\%$$

Reported Percent Passing = 41%

Method B Cumulative
Gradation on Fine Sieves

Sieve Size mm (in.)	Cumulative Mass Retained, g (CMR)	Determine TCMR by multiplying CMR by R $\left(\frac{M_1}{M_2}\right)$ and adding D	Total Cumulative Mass Retained (TCMR)
2.00 (No. 10)	207.1	$207.1 \times 3.835 + 1118.3 =$	1912.5
0.425 (No. 40)	395.0	$395.0 \times 3.835 + 1118.3 =$	2633.1
0.210 (No. 80)	454.9	$454.9 \times 3.835 + 1118.3 =$	2862.8
0.075 (No. 200)	504.0	$504.0 \times 3.835 + 1118.3 =$	3051.1
FCMR	511.8		
Total: sum of masses on fine sieves + minus 75 µm (No. 200) in the pan = 511.8			

Method B Cumulative
Final Gradation on All Sieves

Sieve Size mm (in.)	Total Cumulative Mass Retained g (TCMR)	Determine CPR by dividing CMR by M and multiplying by 100	Cumulative Percent Retained (CPR)	Determine PP by subtracting CPR from 100.0	Percent Passing (PP)	Reported Percent Passing*
16.0 (5/8)	0		0		100.0	100
12.5 (1/2)	161.1	$\frac{161.1}{3214.0} \times 100 =$	5.0	$100.0 - 5.0 =$	95.0	95
9.5 (3/8)	642.5	$\frac{642.5}{3214.0} \times 100 =$	20.0	$100.0 - 20.0 =$	80.0	80
4.75 (No. 4)	1118.3 (*D*)	$\frac{1118.3}{3214.0} \times 100 =$	34.8	$100.0 - 34.8 =$	65.2	65
2.00 (No. 10)	1912.5	$\frac{1912.5}{3214.0} \times 100 =$	59.5	$100.0 - 59.5 =$	40.5	41
0.425 (No. 40)	2633.1	$\frac{2633.1}{3214.0} \times 100 =$	81.9	$100.0 - 81.9 =$	18.1	18
0.210 (No. 80)	2862.8	$\frac{2862.8}{3214.0} \times 100 =$	89.1	$100.0 - 89.1 =$	10.9	11
0.075 (No. 200)	3051.1	$\frac{3051.1}{3214.0} \times 100 =$	94.9	$100.0 - 94.9 =$	5.1	5.1
FCMR	3081.1					
Original dry mass of the sample *(M)*: 3214.0 g						

* Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Procedure Method C

1. Dry the sample to constant mass at 110 ± 5°C (230 ± 9°F) according to the FOP for AASHTO T 255. Cool to room temperature.
2. Determine and record the original dry mass of the sample to the nearest 0.1 percent or 0.1 g. Designate this mass as *M***.**
3. Break up any aggregations or lumps of clay, silt, or adhering fines to pass the 4.75 mm (No. 4) sieve.
4. Select sieves required by the specification and those necessary to avoid overloading as described in Annex B. With a pan on bottom, nest the sieves increasing in size starting with the 4.75 mm (No. 4) sieve.
5. Place the sample, or a portion of the sample, on the top sieve. Sieves may already be in the mechanical shaker, if not place the sieves in the mechanical shaker and shake for the minimum time determined to provide complete separation for the sieve shaker being used (approximately 10 minutes, the time determined by Annex A).

Note 1: *Excessive shaking (more than 10 minutes) may result in degradation of the sample.*

6. Determine and record the cumulative mass retained for each sieve. Ensure that all material trapped in full openings of the sieve are removed and included in the mass retained.

Note 2: *For sieves 4.75 mm (No. 4) and larger, check material trapped in less than a full opening sieving over a full opening. Use coarse wire brushes to clean the 600 µm (No. 30) and larger sieves, and soft bristle brush for smaller sieves.*

7. Determine and record the mass of the minus 4.75 mm (No. 4) material in the pan. Designate this mass as M_1.
8. Perform the *Coarse Check Sum* calculation –Verify the *total mass after coarse sieving* compared to the *original dry mass (M*) is not more than 0.3 percent.
9. Reduce the minus 4.75 mm (No. 4) according to the FOP for AASHTO R 76, to produce a sample with a minimum mass of 500 g.
10. Determine and record the mass of the minus 4.75 mm (No. 4) split, designate this mass as M_3.
11. Nest a protective sieve, such as a 2.0 mm (No. 10), above the 75 µm (No. 200) sieve.
12. Place the sample in a container and cover with water.

Note 3: *If required by the agency, adda detergent, dispersing solution, or other wetting agent to the water to assure a thorough separation of the material finer than the 75 µm (No. 200) sieve from the coarser particles. There should be enough wetting agent to produce a small amount of suds when the sample is agitated. Excessive suds may overflow the sieves and carry material away with them.*

13. Agitate vigorously to ensure complete separation of the material finer than 75 µm (No. 200) from coarser particles and bring the fine material into suspension above the coarser material. Avoid degradation of the sample when using a mechanical washing device limit agitation to 10 min.

14. Immediately pour the wash water containing the suspended material over the nested sieves; be careful not to pour out the coarser particles or over fill the 75 µm (No. 200) sieve.
15. Add water to cover material remaining in the container, agitate, and repeat Step 12. Repeat until the wash water is reasonably clear.
16. Remove the upper sieve and return material retained to the washed sample.
17. Rinse the material retained on the 75 µm (No. 200) sieve until water passing through the sieve is reasonably clear and detergent or dispersing agent is removed, if used.
18. Return all material retained on the 75 µm (No. 200) sieve to the container by flushing into the washed sample.

Note 4: Excess water may be carefully removed with a bulb syringe; the removed water must be discharged back over the 75 µm (No. 200) sieve to prevent loss of fines.

19. Dry the washed sample portion to constant mass at 110 ± 5°C (230 ± 9°F) according to the FOP for AASHTO T 255. Cool to room temperature. Determine and record the dry mass, designate this mass as *dry mass before sieving*.
20. Select sieves required by the specification and those necessary to avoid overloading as described in Annex B. With a pan on bottom, nest the sieves increasing in size starting with the 75 µm (No. 200) sieve up to, but not including the 4.75 mm (No. 4) sieve.
21. Place the sample portion on the top sieve. Place the sieves in the mechanical shaker and shake for the minimum time determined to provide complete separation for the sieve shaker being used (approximately 10 minutes, the time determined by Annex A).

Note 5: Excessive shaking (more than 10 minutes) may result in degradation of the sample.

22. Determine and record the cumulative mass retained for each sieve. Ensure that all material trapped in full openings of the sieve are removed and included in the mass retained.

Note 6: For sieves 4.75 mm (No. 4) and larger, check material trapped in less than a full opening by sieving over a full opening. Use coarse wire brushes to clean the 600 µm (No. 30) and larger sieves, and soft bristle brushes for smaller sieves.

23. Perform the *Fine Check Sum* calculation – Verify the *total mass after fine sieving* compared to the *dry mass before sieving* is not more than 0.3 percent. Do not use test results for acceptance if the *Check Sum* is more than 0.3 percent.
24. Calculate the Cumulative Percent Retained (CPR) and Percent Passing (PP) for the 4.75 mm (No. 4) and larger.
25. Calculate the Cumulative Percent Retained ($CPR_{-\#4}$) and the Percent Passing ($PP_{-\#4}$) for minus 4.75 mm (No. 4) split and Percent Passing (PP) for the minus 4.75 mm (No. 4).
26. Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Method C Calculations

Check Sum

$$Coarse\ check\ sum = \frac{M - total\ mass\ after\ coarse\ sieving}{M} \times 100$$

$$Fine\ check\ sum = \frac{dry\ mass\ before\ sieving - total\ mass\ after\ fine\ sieving}{dry\ mass\ before\ sieving} \times 100$$

where:

M = Original dry mass of the sample

Cumulative Percent Retained (CPR) for 4.75 mm (No. 4) sieve and larger

$$CPR = \frac{CMR}{M} \times 100$$

where:

CPR = Cumulative Percent Retained of the size increment for the total sample

CMR = Cumulative Mass Retained of the size increment for the total sample

M = Total dry sample mass before washing

Percent Passing (PP) 4.75 mm (No. 4) sieve and larger

$$PP = 100 - CPR$$

where:

PP = Percent Passing of the size increment for the total sample

CPR = Cumulative Percent Retained of the size increment for the total sample

Or calculate PP for sieves larger than 4.75 mm (No. 4) sieve without calculating CPR

$$\frac{M - CMR}{M} \times 100$$

Cumulative Percent Retained ($CPR_{-\#4}$) for minus 4.75 mm (No. 4) split

$$CPR_{-\#4} = \frac{CMR_{-\#4}}{M_3} \times 100$$

where:

$CPR_{-\#4}$	=	Cumulative Percent Retained for the sieve sizes of M_3
$CMR_{-\#4}$	=	Cumulative Mass Retained for the sieve sizes of M_3
M_3 =		Total mass of the minus 4.75 mm (No. 4) split before washing

Percent Passing ($PP_{-\#4}$) for minus 4.75 mm (No. 4) split

$$PP_{-\#4} = 100 - CPR_{-\#4}$$

where:

$PP_{-\#4}$	=	Percent Passing for the sieve sizes of M_3
$CPR_{-\#4}$	=	Cumulative Percent Retained for the sieve sizes of M_3

Percent Passing (PP) for sieves smaller than 4.75 mm (No. 4) sieve

$$PP = \frac{(PP_{-\#4} \times \#4\ PP)}{100}$$

where:

PP	=	Total Percent Passing
$PP_{-\#4}$	=	Percent Passing for the sieve sizes of M_3
#4 PP	=	Total Percent Passing the 4.75 mm (No. 4) sieve

Or calculate PP for sieves smaller than 4.75 mm (No. 4) sieve without calculating
$CPR_{-\#4}$ and $PP_{-\#4}$

$$PP = \frac{\#4\ PP}{M_3} \times (M_3 - CMR_{-\#4})$$

where:

PP	=	Total Percent Passing
#4 PP	=	Total Percent Passing the 4.75 mm (No. 4) sieve
M_3	=	Total mass of the minus 4.75 mm (No. 4) split before washing
$CMR_{-\#4}$	=	Cumulative Mass Retained for the sieve sizes of M_3

Method C Example

Original dry mass of the sample (*M*): 3304.5 g

Total mass after sieving equals

Cumulative Mass Retained (CMR) on the 4.75 (No. 4) plus the minus 4.75 mm (No. 4) from the pan: 3085.0 g

Coarse Check Sum

$$Coarse\ Check\ Sum = \frac{3304.5\ g - 3304.5\ g}{3304.5\ g} \times 100 = 0.0\%$$

The result is not more than 0.3 percent therefore the results can be used for acceptance purposes.

Cumulative Percent Retained (CPR) for the 9.5 mm (3/8 in.) sieve:

$$CPR = \frac{604.1\ g}{3304.5\ g} \times 100 = 18.3\%$$

Percent Passing (PP) for the 9.5 mm (3/8 in.) sieve:

$$PP = 100.0\% - 18.3\% = 81.7\%$$

Reported Percent Passing = 82%

Example for Alternate Percent Passing (PP) formula for the 9.5 mm (3/8 in.) sieve:

$$PP = \frac{3304.5 \; - 604.1}{3304.5} \times 100 = 81.7\%$$

Reported Percent Passing = 82%

Method C Cumulative
Gradation on Coarse Sieves

Sieve Size mm (in.)	Cumulative Mass Retained, g (CMR)	Determine CPR by dividing CMR by M and multiplying by 100	Cumulative Percent Retained (CPR)	Determine PP by subtracting CPR from 100.0	Percent Passing (PP)	Reported Percent Passing*
16.0 (5/8)	0		0.0		100.0	100
12.5 (1/2)	125.9	$\frac{125.9}{3304.5} \times 100 =$	3.8	$100.0 - 3.8 =$	96.2	96
9.50 (3/8)	604.1	$\frac{604.1}{3304.5} \times 100 =$	18.3	$100.0 - 18.3 =$	81.7	82
4.75 (No. 4)	1295.6	$\frac{1295.6}{3304.5} \times 100 =$	39.2	$100.0 - 39.2 =$	**60.8 (#4 PP)**	61
Mass in pan	2008.9					
CMR: 1295.6 + 2008.9 = 3304.5						
Original dry mass of the sample *(M)*: 3304.5						

Fine Sample

The pan (2008.9 g) was reduced according to the FOP for AASHTO R 76, to at least 500 g. In this case, the reduced mass was determined to be **527.6 g**. This is M_3.

Dry mass of minus 4.75mm (No. 4) reduced portion before wash (M_3):	527.6 g
Dry mass of minus 4.75mm (No. 4) reduced portion after wash:	495.3 g
Total mass after fine sieving equals Final Cumulative Mass Retained (FCMR) (includes minus 75 µm (No. 200) from the pan):	495.1 g

Fine Check Sum

$$Fine\ Check\ Sum = \frac{495.3\ g - 495.1\ g}{495.3\ g} \times 100 = 0.0\%$$

The result is not more than 0.3 percent therefore the results can be used for acceptance purposes.

Cumulative Percent Retained ($CPR_{-\#4}$) for minus 4.75 mm (No. 4) for the 2.0 mm (No. 10) sieve:

$$CPR_{-\#4} = \frac{194.3\ g}{527.6\ g} \times 100 = 36.8\%$$

Percent Passing ($PP_{-\#4}$) for minus 4.75 mm (No. 4) for the 2.0 mm (No. 10) sieve:

$$PP_{-\#4} = 100.0\% - 36.8\% = 63.2\%$$

Method C Cumulative
Gradation on Fine Sieves

Sieve Size mm (in.)	Cumulative Mass Retained g ($CMR_{-\#4}$)	Determine $CPR_{-\#4}$ by dividing CMR by M_3 and multiplying by 100	Cumulative Percent Retained$_{-\#4}$ ($CPR_{-\#4}$)	Determine $PP_{-\#4}$ by subtracting $CPR_{-\#4}$ from 100.0	Percent Passing$_{-\#4}$ ($PP_{-\#4}$)
2.0 (No. 10)	194.3	$\frac{194.3}{527.6} \times 100 =$	36.8	$100.0 - 36.8 =$	63.2
0.425 (No. 40)	365.6	$\frac{365.6}{527.6} \times 100 =$	69.3	$100.0 - 69.3 =$	30.7
0.210 (No. 80)	430.8	$\frac{430.8}{527.6} \times 100 =$	81.7	$100.0 - 81.7 =$	18.3
0.075 (No. 200)	484.4	$\frac{484.4}{527.6} \times 100 =$	91.8	$100.0 - 91.8 =$	8.2
FCMR	495.1				
Dry mass of minus 4.75mm (No. 4) reduced portion before wash *(M_3)*: 527.6 g					
Dry mass after washing: 495.3 g					

Percent Passing (PP) for the 2.0 mm (No. 10) sieve for the entire sample:

#4 PP (Total Percent Passing the 4.75 mm (No. 4) sieve) = 60.8%

$$PP = \frac{63.2\% \times 60.8\%}{100} = 38.4\%$$

Reported Percent Passing = 38%

Method C Cumulative
Final Gradation on All Sieves

Sieve Size mm (in.)	Cumulative Mass Retained g (CMR)	Cumulative Percent Retained (CPR)	Percent Passing (PP -#4)	Determine PP by multiplying $PP_{-\#4}$ by #4 PP and dividing by 100	Percent Passing (PP)	Reported Percent Passing*
16.0 (5/8)	0	0.0			100.0	100
12.5 (1/2)	125.9	3.8			96.2	96
9.5 (3/8)	604.1	18.3			81.7	82
4.75 (No. 4)	1295.6	39.2			**60.8 (#4 PP)**	61
2.0 (No. 10)	194.3	36.8	63.2	$\frac{63.2 \times 60.8}{100} =$	38.4	38
0.425 (No. 40)	365.6	69.3	30.7	$\frac{30.7 \times 60.8}{100} =$	18.7	19
0.210 (No. 80)	430.8	81.7	18.3	$\frac{18.3 \times 60.8}{100} =$	11.1	11
0.075 (No. 200)	484.4	91.8	8.2	$\frac{8.2 \times 60.8}{100} =$	5.0	5.0
FCMR	495.1					

* Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Example for Alternate Percent Passing (PP) for the 4.75 mm (No. 4) sieve for the entire sample:

#4 PP (Total Percent Passing the 4.75 mm (No. 4) sieve) = 60.8%

$$PP = \frac{60.8\%}{527.6} \times (527.6 - 194.3) = 38.4\%$$

Reported Percent Passing = 38%

Alternate Method C Cumulative Gradation on Coarse Sieves

Sieve Size mm (in.)	Cumulative Mass Retained, g (CMR)	Determine PP by subtracting CMR from M, and dividing the result by M then multiplying by 100	Percent Passing (PP)	Reported Percent Passing*
16.0 (5/8)	0.0		100.0	100
12.5 (1/2)	125.9	$\frac{3304.5 - 125.9}{3304.5} \times 100 =$	96.2	96
9.5 (3/8)	604.1	$\frac{3304.5 - 604.1}{3304.5} \times 100 =$	81.7	82
4.75 (No. 4)	1295.6	$\frac{3304.5 - 1295.6}{3304.5} \times 100 =$	**60.8 (#4 PP)**	61
Mass in Pan	2008.9			
Cumulative sieved mass: 1295.6 + 2008.9 = 3304.5				
Original dry mass of the sample *(M)*: 3304.5				

Alternate Method C Cumulative Gradation on Fine Sieves

Sieve Size mm (in.)	Cumulative Mass Retained g ($CMR_{-\#4}$)	Determine $PP_{-\#4}$ by subtracting $CMR_{-\#4}$ from M_3, dividing result by M_3 and multiplying by 100	Percent Passing$_{-\#4}$ ($PP_{-\#4}$)
2.0 (No. 10)	194.3	$\frac{527.6 - 194.3}{527.6} \times 100 =$	63.2
0.425 (No. 40)	365.6	$\frac{527.6 - 365.6}{527.6} \times 100 =$	30.7
0.210 (No. 80)	430.8	$\frac{527.6 - 430.8}{527.6} \times 100 =$	18.3
0.075 (No. 200)	484.4	$\frac{527.6 - 484.4}{527.6} \times 100 =$	8.2
FCMR	495.1		
Dry mass of minus 4.75mm (No. 4) reduced portion before wash (**M_3**): 527.6 g			
Dry mass after washing: 495.3 g			

Alternate Method C Cumulative Final Gradation on All Sieves

Sieve Size mm (in.)	Percent Passing$_{-\#4}$ (PP$_{-\#4}$)	Determine PP by multiplying PP$_{-\#4}$ by #4 PP and dividing by 100	Determined Percent Passing (PP)	Reported Percent Passing*
16.0 (5/8)			100.0	100
12.5 (1/2)			96.2	96
9.5 (3/8)			81.7	82
4.75 (No. 4)			**60.8 (#4 PP)**	61
2.0 (No. 10)	63.2	$\frac{63.2 \times 60.8}{100} =$	38.4	38
0.425 (No. 40)	30.7	$\frac{30.7 \times 60.8}{100} =$	18.7	19
0.210 (No. 80)	18.3	$\frac{18.3 \times 60.8}{100} =$	11.1	11
0.075 (No. 200)	8.2	$\frac{8.2 \times 60.8}{100} =$	5.0	5.0

* Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Fineness Modulus

Fineness Modulus (FM) is used in determining the degree of uniformity of the aggregate gradation in PCC mix designs. It is an empirical number relating to the fineness of the aggregate. The higher the FM the coarser the aggregate. Values of 2.40 to 3.00 are common for fine aggregate in PCC.

The sum of the cumulative percentages retained on specified sieves in the following table divided by 100 gives the FM.

Sample Calculation

	Example A				Example B		
	Percent				Percent		
		Retained				Retained	
Sieve Size mm (in)	**Passing**		**On Spec'd Sieves***		**Passing**		**On Spec'd Sieves***
75*(3)	100	0	0		100	0	0
37.5*(11/2)	100	0	0		100	0	0
19*(3/4)	15	85	85		100	0	0
9.5*(3/8)	0	100	100		100	0	0
4.75*(No.4)	0	100	100		100	0	0
2.36*(No.8)	0	100	100		87	13	13
1.18*(No.16)	0	100	100		69	31	31
0.60*(No.30	0	100	100		44	56	56
0.30*(No.50)	0	100	100		18	82	82
0.15*(100)	0	100	100		4	96	96
			$\sum = 785$				$\sum = 278$
			FM = 7.85				FM = 2.78

In decreasing size order, each * sieve is one-half the size of the preceding * sieve.

Report

- On forms approved by the agency
- Sample ID
- Percent passing for each sieve
- Individual mass retained for each sieve
- Individual percent retained for each sieve

  or

- Cumulative mass retained for each sieve
- Cumulative percent retained for each sieve
- FM to the nearest 0.01

Report percentages to the nearest 1 percent except for the percent passing the 75 µm (No. 200) sieve, which shall be reported to the nearest 0.1 percent.

ANNEX A

Time Evaluation

(Mandatory information)

The sieving time for each mechanical sieve shaker shall be checked at least annually to determine the time required for complete separation of the sample by the following method:

1. Shake the sample over nested sieves for approximately 10 minutes.
2. Provide a snug-fitting pan and cover for each sieve and hold in a slightly inclined position in one hand.
3. Hand shake each sieve by striking the side of the sieve sharply and with an upward motion against the heel of the other hand at the rate of about 150 times per minute, turning the sieve about one sixth of a revolution at intervals of about 25 strokes.

Note A1: A mallet may be used instead of the heel of the hand if comparable force is used.

If more than 0.5 percent by mass of the total sample before sieving passes any sieve after one minute of continuous hand shaking adjust shaker time and re-check.

In determining sieving time for sieve sizes larger than 4.75 mm (No. 4), limit the material on the sieve to a single layer of particles.

ANNEX B

Overload Determination

(Mandatory information)

The amount of material retained on a sieve may be regulated by:

- adding a sieve with larger openings immediately above the given sieve
- testing the sample in multiple increments
- testing the sample over a nest of sieves with a larger sieve-frame dimension.

Additional sieves may be necessary to provide other information, such as fineness modulus. For sieves with openings smaller than 4.75 mm (No. 4), the mass retained on any sieve shall not exceed 7 kg/m^2 (4 g/in^2) of sieving surface.

- For sieves with openings 4.75 mm (No. 4) and larger, the mass, in grams shall not exceed the product of 2.5 × (sieve opening in mm) × (effective sieving area). See Table B1.

TABLE B1
Maximum Allowable Mass of Material Retained on a Sieve, g
Nominal Sieve Size, mm (in.)
Exact size is smaller (see AASHTO T 27)

Sieve Size mm (in.)		203 dia (8)	305 dia (12)	305 by 305 (12 × 12)	350 by 350 (14 × 14)	372 by 580 (16 × 24)
		Sieving Area m^2				
		0.0285	**0.0670**	**0.0929**	**0.1225**	**0.2158**
90	(3 1/2)	*	15,100	20,900	27,600	48,500
75	(3)	*	12,600	17,400	23,000	40,500
63	(2 1/2)	*	10,600	14,600	19,300	34,000
50	(2)	3600	8400	11,600	15,300	27,000
37.5	(1 1/2)	2700	6300	8700	11,500	20.200
25.0	(1)	1800	4200	5800	7700	13,500
19.0	(3/4)	1400	3200	4400	5800	10,200
16.0	(5/8)	1100	2700	3700	4900	8600
12.5	(1/2)	890	2100	2900	3800	6700
9.5	(3/8)	670	1600	2200	2900	5100
6.3	(1/4)	440	1100	1500	1900	3400
4.75	(No. 4)	330	800	1100	1500	2600
-4.75	(-No. 4)	200	470	650	860	1510

PERFORMANCE EXAM CHECKLIST

METHOD B
SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES
WFOP FOR AASHTO T 27
MATERIALS FINER THAN 75 µm (No. 200) SIEVE IN MINERAL AGGREGATE BY WASHING
WFOP AASHTO T 11

Participant Name ______________________________Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Minimum sample mass meets requirement of Table 1?	_____	_____
2. Sample dried to a constant mass by FOP for AASHTO T 255 at 110 ± 5°C (230 ± 9°F)?	_____	_____
3. Sample cooled, and original dry mass of the sample recorded to the nearest 0.1 percent or 0.1 g?	_____	_____
4. Sample placed in container and covered with water?	_____	_____
5. Contents of the container vigorously agitated?	_____	_____
6. Suspension of minus 75 µm (No. 200) achieved?	_____	_____
7. Wash water poured through nested sieves such as 2 mm (No. 10) and 75 µm (No. 200)?	_____	_____
8. Operation continued until wash water is reasonably clear?	_____	_____
9. Material retained on sieves returned to washed sample?	_____	_____
10. Washed sample dried to a constant mass by FOP for AASHTO T 255 at 110 ± 5°C (230 ± 9°F)?	_____	_____
11. Washed sample cooled, and dry mass recorded to nearest 0.1 percent or 0.1 g?	_____	_____
12. Sample placed in nest of sieves specified? (Additional sieves may be used to prevent overloading as allowed in FOP.)	_____	_____
13. Material sieved in verified mechanical shaker for proper time?	_____	_____
14. Mass of material on each sieve and pan determined to the nearest 0.1 percent or 0.1 g?	_____	_____
15. Total mass of material after sieving compared to the mass before sieving is not more than 0.3 percent (coarse check sum)?	_____	_____

OVER

Procedure Element	**Trial 1**	**Trial 2**
16. Material in pan reduced in accordance with FOP for AASHTO R 76 to at least 500 g?	_____	_____
17. Mass of minus 4.75 mm (No. 4) split recorded to the nearest 0.1 g?	_____	_____
18. Sample placed in nest of sieves specified? (Additional sieves may be used to prevent overloading as allowed in FOP.)	_____	_____
19. Material sieved in verified mechanical shaker for proper time?	_____	_____
20. Mass of material on each sieve and pan recorded to the nearest percent or 0.1 g?	_____	_____
21. Total mass of material after sieving compared to the mass before sieving is not more than 0.3 percent (fine check sum)?	_____	_____
22. Percentages calculated to the nearest 0.1 percent and reported to the nearest whole number, except 75 µm (No. 200) which is reported to the nearest 0.1 percent?	_____	_____
23. Percentage calculations based on original dry mass of the sample?	_____	_____
24. Calculations performed properly?	_____	_____

Comments: First attempt: Pass_____Fail_____ Second attempt: Pass_____Fail_____

Examiner Signature ______________________________ WAQTC#:________________

DETERMINING THE PERCENTAGE OF FRACTURE IN COARSE AGGREGATE WFOP AASHTO T 335

Scope

This procedure covers the determination of the percentage, by mass, of a coarse aggregate (CA) sample that consists of fractured particles meeting specified requirements in accordance with AASHTO T 335-09.

In this FOP, a sample of aggregate is screened on the sieve separating CA and fine aggregate (FA). This sieve will be identified in the agency's specifications but might be the 4.75 mm (No. 4) sieve. CA particles are visually evaluated to determine conformance to the specified fractured criteria. The percentage of conforming particles, by mass, is calculated for comparison to the specifications.

Apparatus

- Balance or scale: Capacity sufficient for the principal sample mass, accurate to 0.1 percent of the sample mass or readable to 0.1 g and meeting the requirements of AASHTO M 231.
- Sieves: Meeting requirements of the FOP for AASHTO T 27/T 11.
- Splitter: Meeting the requirements of FOP for AASHTO R 76.

Terminology

1. Fractured criteria: The specified requirement for fractured particles determined by each agency.
2. Fractured face: An angular, rough, or broken surface of an aggregate particle created by crushing or by other means. A face is considered a "fractured face" whenever one-half or more of the projected area, when viewed normal to that face, is fractured with sharp and well-defined edges. This excludes small nicks.
3. Fractured particle: A particle of aggregate having at least the minimum number of fractured faces specified. (This is usually one or two.)

Sampling and Sample Preparation

1. Sample and reduce the aggregate in accordance with the FOPs for AASHTO R 90 and R 76.
2. When the specifications list only a total fracture percentage, the sample shall be prepared in accordance with Method 1. When the specifications require that the fracture be counted and reported on each sieve, the sample shall be prepared in accordance with Method 2.
3. Method 1 - Combined Fracture Determination
    a. Dry and cool the sample, if necessary, to sufficiently obtain a clean separation of FA and CA material in the sieving operation.

b. Sieve the sample in accordance with the FOP for AASHTO T 27/ T 11 over the 4.75 mm (No. 4) sieve, or the appropriate sieve listed in the agency's specifications for this material.

Note 1: *Where necessary, wash the sample over the sieve designated for the determination of fractured particles to remove any remaining fine material, and dry to a constant mass in accordance with the FOP for AASHTO T 255.*

c. Reduce the sample using Method A – Mechanical Splitter, in accordance with the FOP for AASHTO R 76, to the appropriate test size. This test size should be slightly larger than shown in Table 1, to account for loss of fines through washing if necessary.

TABLE 1
Sample Size
Method 1 (Combined Sieve Fracture)

Nominal Maximum Size* mm (in.)	Minimum Cumulative Sample Mass Retained on 4.75 mm (No. 4) Sieve g (lb)
37.5 (1 1/2)	2500 (6)
25.0 (1)	1500 (3.5
19.0 (3/4)	1000 (2.5)
12.5 (1/2)	700 (1.5)
9.5 (3/8)	400 (0.9)
4.75 (No. 4)	200 (0.4)

* One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps in specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum size.

4. Method 2 – Individual Sieve Fracture Determination

a. Dry and cool the sample, if necessary, to sufficiently to obtain a clean separation of FA and CA material in the sieving operation. A washed sample from the gradation determination (the FOP for AASHTO T 27/T 11) may be used.

b. If not, sieve the sample in accordance with the FOP for AASHTO T 27 over the sieves listed in the specifications for this material.

Note 2: *If overload (buffer) sieves are used the material from that sieve must be added to the next specification sieve.*

c. The size of test sample for each sieve shall meet the minimum size shown in Table 2. Utilize the total retained sieve mass or select a representative portion from each sieve mass by splitting or quartering in accordance with the FOP for AASHTO R 76.

Note 3: *Where necessary, wash the sample over the sieves designated for the determination of fractured particles to remove any remaining fine material, and dry to a constant mass in accordance with the FOP for AASHTO T 255.*

TABLE 2
Sample Size
Method 2 (Individual Sieve Fracture)

Sieve Size mm (in.)	Minimum Sample Mass g (lb)
31.5 (1 1/4)	1500 (3.5)
25.0 (1)	1000 (2.2)
19.0 (3/4)	700 (1.5)
16.0 (5/8)	500 (1.0)
12.5 (1/2)	300 (0.7)
9.5 (3/8)	200 (0.5)
6.3 (1/4)	100 (0.2)
4.75 (No. 4)	100 (0.2)
2.36 (No. 8)	25 (0.1)
2.00 (No. 10)	25 (0.1)

Note 4: *If fracture is determined on a sample obtained for gradation, use the mass retained on the individual sieves, even if it is less than the minimum listed in Table 2. If less than 5 percent of the total mass is retained on a single specification sieve, include that material on the next smaller specification sieve. If a smaller specification sieve does not exist, this material shall not be included in the fracture determination.*

Procedure

1. After cooling, spread the dried sample on a clean, flat surface.
2. Examine each particle face and determine if the particle meets the fractured criteria.
3. Separate the sample into three categories:
    - Fractured particles meeting the criteria
    - Particles not meeting the criteria
    - Questionable or borderline particles
4. Determine the dry mass of particles in each category to the nearest 0.1 g.
5. Calculate the percent questionable particles to the nearest 1 percent.
6. Re-sort the questionable particles when more than 15 percent is present. Continue sorting until there is no more than 15 percent in the questionable category.
7. Calculate the percent fractured particles meeting criteria to nearest 0.1 percent. Report to 1 percent.

Calculation

Calculate the percent questionable particles to the nearest 1 percent using the following formula:

$$\%Q = \frac{Q}{F + Q + N} \times 100$$

Where:

%Q	=	Percent of questionable particles
F	=	Mass of fractured particles
Q	=	Mass of questionable or borderline particles
N	=	Mass of unfractured particles

Example:

$$\%Q = \frac{97.6\ g}{632.6\ g + 97.6\ g + 352.6\ g} \times 100 = 9\%$$

Given:

F	=	632.6 g
Q	=	97.6 g
N	=	352.6 g

Calculate the percent fractured particles to the nearest 0.1 percent using the following formula:

$$\mathrm{P} = \frac{\frac{Q}{2} + F}{F + Q + N} \times 100$$

Where:

P	=	Percent of fractured particles
F	=	Mass of fractured particles
Q	=	Mass of questionable particles
N	=	Mass of unfractured particles

Example:

$$P = \frac{\frac{97.6\ g}{2} + 632.6\ \text{g}}{632.6\ g + 97.6\ g + 352.6\ g} \times 100 = 62.9\% \qquad \text{Report } 63\%$$

Given:

F = 632.6 g

Q = 97.6 g

N = 352.6 g

Report

- On forms approved by the agency
- Sample ID
- Fractured particles to the nearest 1 percent.

PERFORMANCE EXAM CHECKLIST

DETERMINING THE PERCENTAGE OF FRACTURE IN COARSE AGGREGATE WFOP AASHTO T 335

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Sample dried and cooled, if necessary?	_____	_____
2. Sample properly sieved through specified sieve(s)?	_____	_____
3. Sample reduced to correct size?	_____	_____
4. Each particle examined to determine if the particle meets the fractured criteria?	_____	_____
5. Particles separated into fractured, unfractured, and questionable categories?	_____	_____
6. Dry mass of each category determined to nearest 0.1 g?	_____	_____
7. Questionable category resorted if more than 15 percent of total mass falls in that category?	_____	_____
8. Fractured calculation performed correctly?	_____	_____

Comments: First attempt: Pass_____Fail_____Second attempt: Pass_____Fail_____

Examiner Signature ____________________________ WAQTC #:_______________

PLASTIC FINES IN GRADED AGGREGATES AND SOILS BY THE USE OF THE SAND EQUIVALENT TEST
IWFOP AASHTO T 176

This method modifies the Western Alliance for Quality Transportation (WAQTC) Field Operations Procedure (FOP) for AASHTO T 176. The Idaho Transportation Department has implemented specific changes detailed in the following procedure. Adherence to this modified procedure is mandatory for all Idaho projects, superseding the original WAQTC FOP.

Sample Preparation

Add the following to Step 1:

The samples must be maintained at field moist condition until testing. Do not allow the sample to dry out. If testing will not be performed immediately, the sample must be kept in a sealed container.

Procedure

Add the following to Step 6a:

Only the Mechanical Method will be used.

Delete Step 6b and 6c.

PLASTIC FINES IN GRADED AGGREGATES AND SOILS BY THE USE OF THE SAND EQUIVALENT TEST
WFOP AASHTO T 176

Scope

This procedure covers the determination of plastic fines in accordance with AASHTO T 176-22. It serves as a rapid test to show the relative proportion of fine dust or clay-like materials in fine aggregates (FA) and soils.

Apparatus

See AASHTO T 176 for a detailed listing of sand equivalent apparatus. Note that the siphon tube and blow tube may be glass or stainless steel as well as copper.

- Graduated plastic cylinder.
- Rubber stopper.
- Irrigator tube.
- Weighted foot assembly: Having a mass of 1000 ±5g. There are two models of the weighted foot assembly. The older model has a guide cap that fits over the upper end of the graduated cylinder and centers the rod in the cylinder. It is read using a slot in the centering screws. The newer model has a sand-reading indicator 254 mm (10 in.) above this point and is preferred for testing clay-like materials.
- Bottle: clean, glass or plastic, of sufficient size to hold working solution
- Siphon assembly: The siphon assembly will be fitted to a 4 L (1 gal.) bottle of working calcium chloride solution placed on a shelf 915 ±25 mm (36 ±1 in.) above the work surface.
- Measuring can: With a capacity of 85 ±5 mL (3 oz.).
- Balance or scale: Capacity sufficient for sample mass, accurate to 0.1 percent of the sample mass or readable to 0.1 g and meeting the requirements of AASHTO M 231.
- Funnel: With a wide mouth for transferring sample into the graduated cylinder.
- Quartering cloth: 600 mm (2 ft.) square nonabsorbent cloth, such as plastic or oilcloth.
- Mechanical splitter: See the FOP for AASHTO R 76.
- Strike-off bar: A straightedge or spatula.
- Clock or watch reading in minutes and seconds.
- Manual shaker: A manually operated sand equivalent shaker capable of producing an oscillating motion at a rate of 100 complete cycles in 45 ±5 seconds, with a hand assisted half stroke length of 127 ±5 mm (5 ±0.2 in.). It may be held stable by hand during the shaking operation. It is recommended that this shaker be fastened securely to a firm and level mount, by bolts or clamps, if many determinations are to be made.

- Mechanical shaker: See AASHTO T 176 for equipment and procedure.
- Oven: Capable of maintaining a temperature of 110 ±5°C (230 ±9°F).
- Thermometer: Calibrated liquid-in-glass or electronic digital type designed for total immersion and accurate to 0.1°C (0.2°F).
- Sieve: 4.75-mm (No. 4) sieve meeting the requirements of the FOP for AASHTO T 27/T 11

Materials

- Stock calcium chloride solution: Obtain commercially prepared calcium chloride stock solution meeting AASHTO requirements.
- Working calcium chloride solution: Make 3.8 L (1 gal) of working solution. Fill the bottle with 2 L (1/2 gal) of distilled or demineralized water, add one 3 oz. measuring can (85 ±5 mL) of stock calcium chloride solution. Agitate vigorously for 1 to 2 minutes. Add the remainder of the water, approximately 2 L (1/2 gal.) for a total of 3.8 L (1 gal) of working solution. Repeat the agitation process. Tap water may be used if it is proven to be non-detrimental to the test and if it is allowed by the agency. The shelf life of the working solution is approximately 30 days. Label working solution with the date mixed. Discard working solutions more than 30 days old.

Note 1: The graduated cylinder filled to 4.4 in. contains 88 mL and may be used to measure the stock solution.

Control

The temperature of the working solution should be maintained at 22 ±3°C (72 ±5°F) during the performance of the test. If field conditions preclude the maintenance of the temperature range, reference samples should be submitted to the Central/Regional Laboratory, as required by the agency, where proper temperature control is possible. Samples that meet the minimum sand equivalent requirement at a working solution temperature outside of the temperature range need not be subject to reference testing.

Sample Preparation

1. Obtain the sample in accordance with the FOP for AASHTO R 90 and reduce in accordance with the FOP for AASHTO R 76.
2. Sieve the sample over the 4.75 mm (No. 4) sieve. If the material is in clods, break it up and re-screen it over a 4.75 mm (No. 4) sieve. Clean all fines from particles retained on the 4.75 mm (No. 4) sieve and include with the material passing that sieve.
3. Split or quarter 1000 to 1500 g of material from the portion passing the 4.75 mm (No. 4) sieve. Use extreme care to obtain a truly representative portion of the original sample.

Note 2: Experiments show that, as the amount of material being reduced by splitting or quartering is decreased, the accuracy of providing representative portions is reduced. It is imperative that the sample be split or quartered carefully. When it appears necessary, dampen the material before splitting or quartering to avoid segregation or loss of fines.

Note 3: All tests, including reference tests, will be performed using Alternative Method No. 2 as described in AASHTO T 176, unless otherwise specified.

4. The sample must have the proper moisture content to achieve reliable results. This condition is determined by tightly squeezing a small portion of the thoroughly mixed sample in the palm of the hand. If the cast that is formed permits careful handling without breaking, the correct moisture content has been obtained.

Note 4: Clean sands having little 75 µm (No. 200), such as sand for Portland Cement Concrete (PCC), may not form a cast.

If the material is too dry, the cast will crumble, and it will be necessary to add water and remix and retest until the material forms a cast. When the moisture content is altered to provide the required cast, the altered sample should be placed in a pan, covered with a lid or with a damp cloth that does not touch the material, and allowed to stand for a minimum of 15 minutes. Samples that have been sieved without being air-dried and still retain enough natural moisture are exempted from this requirement.

If the material shows any free water, it is too wet to test and must be drained and air dried. Mix frequently to ensure uniformity. This drying process should continue until squeezing provides the required cast.

5. Place the sample on the quartering cloth and mix by alternately lifting each corner of the cloth and pulling it over the sample toward the diagonally opposite corner, being careful to keep the top of the cloth parallel to the bottom, thus causing the material to be rolled. When the material appears homogeneous, finish the mixing with the sample in a pile near the center of the cloth.
6. Fill the measuring can by pushing it through the base of the pile while exerting pressure with the hand against the pile on the side opposite the measuring can. As the can is moved through the pile, hold enough pressure with the hand to cause the material to fill the tin to overflowing. Press firmly with the palm of the hand, compacting the material and placing the maximum amount in the can. Strike off the can level with the straightedge or spatula.
7. When required, repeat steps 5 and 6 to obtain additional samples.

Procedure

1. Start the siphon by forcing air into the top of the solution bottle through the tube while the pinch clamp is open. Siphon 101.6 ±2.5 mm (4 ±0.1 in.) of working calcium chloride solution into the plastic cylinder.
2. Pour the prepared test sample from the measuring can into the plastic cylinder, using the funnel to avoid spilling.
3. Tap the bottom of the cylinder sharply on the heel of the hand several times to release air bubbles and to promote thorough wetting of the sample.
4. Allow the wetted sample to stand undisturbed for 10 ±1 minutes.
5. At the end of the 10-minute period, stopper the cylinder and loosen the material from the bottom by simultaneously partially inverting and shaking the cylinder.

6. After loosening the material from the bottom of the cylinder, shake the cylinder and contents by any one of the following methods:

   a. Mechanical Method – Place the stoppered cylinder in the mechanical shaker, set the timer, and allow the machine to shake the cylinder and contents for 45 ±1 seconds.

Caution: Agencies may require additional operator qualifications for the next two methods.

   b. Manual Method – Secure the stoppered cylinder in the three spring clamps on the carriage of the manually-operated sand equivalent shaker and set the stroke counter to zero. Stand directly in front of the shaker and force the pointer to the stroke limit marker painted on the backboard by applying an abrupt horizontal thrust to the upper portion of the right hand spring strap.

      Remove the hand from the strap and allow the spring action of the straps to move the carriage and cylinder in the opposite direction without assistance or hindrance. Apply enough force to the right-hand spring steel strap during the thrust portion of each stroke to move the pointer to the stroke limit marker by pushing against the strap with the ends of the fingers to maintain a smooth oscillating motion. The center of the stroke limit marker is positioned to provide the proper stroke length and its width provides the maximum allowable limits of variation.

      Proper shaking action is accomplished when the tip of the pointer reverses direction within the marker limits. Proper shaking action can best be maintained by using only the forearm and wrist action to propel the shaker. Continue shaking for 100 strokes.

   c. Hand Method – Hold the cylinder in a horizontal position and shake it vigorously in a horizontal linear motion from end to end. Shake the cylinder 90 cycles in approximately 30 seconds using a throw of 229 mm ±25 mm (9 ±1 in.). A cycle is defined as a complete back and forth motion. To properly shake the cylinder at this speed, it will be necessary for the operator to shake with the forearms only, relaxing the body and shoulders.

7. Set the cylinder upright on the worktable and remove the stopper.

8. Insert the irrigator tube in the cylinder and rinse material from the cylinder walls as the irrigator is lowered. Force the irrigator through the material to the bottom of the cylinder by applying a gentle stabbing and twisting action while the working solution flows from the irrigator tip. Work the irrigator tube to the bottom of the cylinder as quickly as possible as it becomes more difficult to do this as the washing proceeds. This flushes the fine material into suspension above the coarser sand particles.

   Continue to apply a stabbing and twisting action while flushing the fines upward until the cylinder is filled to the 381 mm (15 in.) mark. Then raise the irrigator slowly without shutting off the flow so that the liquid level is maintained at about 381 mm (15 in.) while the irrigator is being withdrawn. Regulate the flow just before the irrigator is entirely withdrawn and adjust the final level to 381 mm (15 in.).

Note 5: Occasionally the holes in the tip of the irrigator tube may become clogged by a particle of sand. If the obstruction cannot be freed by any other method, use a pin or other sharp object to force it out, using extreme care not to enlarge the size of the opening. Also, keep the tip sharp as an aid to penetrating the sample.

9. Allow the cylinder and contents to stand undisturbed for 20 minutes ±15 seconds. Start timing immediately after withdrawing the irrigator tube.

Note 6: Any vibration or movement of the cylinder during this time will interfere with the normal settling rate of the suspended clay and will cause an erroneous result.

10. Clay and sand readings:

    a. At the end of the 20-minute sedimentation period, read and record the level of the top of the clay suspension. This is referred to as the clay reading.

    b. If no clear line of demarcation has formed at the end of the 20-minute sedimentation period, allow the sample to stand undisturbed until a clay reading can be obtained, then immediately read and record the level of the top of the clay suspension and the total sedimentation time. If the total sedimentation time exceeds 30 minutes, rerun the test using three individual samples of the same material. Read and record the clay column height of the sample requiring the shortest sedimentation period only. Once a sedimentation time has been established, subsequent tests will be run using that time. The time will be recorded along with the test results on all reports.

    c. After the clay reading has been taken, place the weighted foot assembly over the cylinder and gently lower the assembly until it comes to rest on the sand. Do not allow the indicator to hit the mouth of the cylinder as the assembly is being lowered. Subtract 254 mm (10 in.) from the level indicated by the extreme top edge of the indicator and record this value as the sand reading.

    d. If clay or sand readings fall between 2.5 mm (0.1 in.) graduations, record the level of the higher graduation as the reading. For example, a clay reading that appears to be 7.95 would be recorded as 8.0; a sand reading that appears to be 3.22 would be recorded as 3.3.

    e. If two Sand Equivalent (SE) samples are run on the same material and the second varies by more than ±4, based on the first cylinder result, additional tests shall be run.

    f. If three or more Sand Equivalent (SE) samples are run on the same material, average the results. If an individual result varies by more than ±4, based on the average result, additional tests shall be run.

Calculations

Calculate the SE to the nearest 0.1 using the following formula:

$$SE = \frac{Sand\ Reading}{Clay\ Reading} \times 100$$

Example

$$SE = \frac{3.3}{8.0} \times 100 = 41.25 \ or \ 41.3 \qquad \text{Report 42}$$

Given:

Sand Reading	=	3.3
Clay Reading	=	8.0

Note 7: This example reflects the use of equipment made with English units. At this time, equipment made with metric units is not available.

Report the SE as the next higher whole number. In the example above, the 41.3 would be reported as 42. An SE of 41.0 would be reported as 41.

When averaging two or more samples, raise each calculated SE value to the next higher whole number (reported value) before averaging.

Example:

calculated value 1 = 41.3

calculated value 2 = 42.8

These values are reported as 42 and 43, respectively.

Average the two reported values:

$$Average\ SE = \frac{42 + 43}{2} = 42.5 \qquad \text{Report 43}$$

If the average value is not a whole number, raise it to the next higher whole number.

Report

- On forms approved by the agency
- Sample ID
- Results to the next higher whole number
- Sedimentation time if over 20 minutes

PERFORMANCE EXAM CHECKLIST

PLASTIC FINES IN GRADED AGGREGATES AND SOILS BY THE USE OF THE SAND EQUIVALENT TEST
WFOP AASHTO T 176

Participant Name ______________________________Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
Sample Preparation		
1. Sample passed through 4.75 mm (No. 4) sieve?	_____	_____
2. Material in clods broken up and re-screened?	_____	_____
3. Split or quarter 1,000 to 1,500 g of material passing the 4.75 mm (No. 4) sieve? NOTE: If necessary, the material may be dampened before splitting to avoid segregation or loss of fines.	_____	_____
4. No fines lost?	_____	_____
5. Working solution dated?	_____	_____
6. Temperature of working solution 22 ±3°C (72 ±5°F)?	_____	_____
7. Working calcium chloride solution 915 ±25 mm (36 ±1in) above the work surface?	_____	_____
8. 101.6 ±2.5 mm (4 ±0.1in) working calcium chloride solution siphoned into cylinder?	_____	_____
9. Material checked for moisture condition by tightly squeezing small portion in palm of hand and forming a cast?	_____	_____
10. Sample at proper water content?		
a. If too dry (cast crumbles easily) water added, re-mixed, covered, and allowed to stand for at least 15 minutes?	_____	_____
b. If too wet (shows free water) sample drained, air dried and mixed frequently?	_____	_____
11. Sample placed on splitting cloth and mixed by alternately lifting each corner of the cloth and pulling it over the sample toward diagonally opposite corner, causing material to be rolled?	_____	_____
12. Is material thoroughly mixed?	_____	_____
13. When material appears to be homogeneous, mixing finished with sample in a pile near center of cloth?	_____	_____
14. Fill the 85 mL (3 oz) tin by pushing through base of pile with other hand on opposite side of pile?	_____	_____
15. Material fills tin to overflowing?	_____	_____
16. Material compacted into tin with palm of hand?	_____	_____

OVER

Procedure Element	**Trial 1**	**Trial 2**
17. Tin struck off level using spatula or straightedge?	_____	_____
18. Prepared sample funneled into cylinder with no loss of fines?	_____	_____
19. Bottom of cylinder tapped sharply on heel of hand several times to release air bubbles?	_____	_____
20. Wetted sample allowed to stand undisturbed for 10 min. ±1 min.?	_____	_____
21. Cylinder stoppered and material loosened from bottom by shaking?	_____	_____
22. Stoppered cylinder shaken:		
a. Mechanical: for 45 ±1 seconds?	_____	_____
b. Manual: for 100 strokes?	_____	_____
c. Hand: 90 cycles in approximately 30 seconds?	_____	_____
23. Following shaking, cylinder set vertical on work surface and stopper removed?	_____	_____
24. Irrigator tube inserted in cylinder and material rinsed from cylinder walls as irrigator is lowered?	_____	_____
25. Irrigator tube forced through material to bottom of cylinder by gentle stabbing and twisting action?	_____	_____
26. Stabbing and twisting motion applied until cylinder filled to 381 mm (15 in.) mark?	_____	_____
27. Liquid raised and maintained at 381 mm (15 in.) mark while irrigator is being withdrawn?	_____	_____
28. Liquid at the 381 mm (15 in.) mark?	_____	_____
29. Contents let stand 20 minutes ±15 seconds?	_____	_____
30. Timing started immediately after withdrawal of irrigator?	_____	_____
31. No vibration or disturbance of the sample?	_____	_____
32. Readings taken at 20 minutes or up to 30 minutes, when a definite line appears?	_____	_____
33. Clay level correctly read, rounded, and recorded?	_____	_____
34. Weighted foot assembly lowered into cylinder without hitting mouth of cylinder?	_____	_____
35. Sand level correctly read, rounded, and recorded?	_____	_____
36. Calculations performed correctly?	_____	_____

Comments: First attempt: Pass_____ Fail_____ Second attempt: Pass_____ Fail_______

Examiner Signature ______________________________ **WAQTC #:**_________

570.02 – WAQTC FOP (WFOP)/ IDAHO MODIFIED WFOP (IWFOP) ASPHALT I & II

SAMPLING OF BITUMINOUS PAVING MIXTURES
IWFOP AASHTO R 97

None needed. The previous Idaho FOP's were either incorporated into the method or addressed in other methods.

SAMPLING ASPHALT MIXTURES
WFOP AASHTO R 97

Scope

This procedure covers sampling asphalt mixtures from plants, haul units, and roadways in accordance with AASHTO R 97-19. Sampling is as important as testing. Use care to obtain a representative sample. Avoid segregation and contamination of the material during sampling.

This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

Apparatus

- Shovel or Metal Scoops, or Other Equipment: square-head metal shovels at least 125 mm (5.5 in.) wide.
- Sample containers: such as cardboard boxes, metal cans, stainless steel bowls, or other agency-approved containers
- Sampling plate: thick metal plate, minimum 8 gauge, sized to accommodate sample requirements, with a wire attached to one corner long enough to reach from the center of the paver to the outside of the farthest auger extension. A minimum of one hole 6 mm (0.25 in.) in diameter must be provided in a corner of the plate.
- Cookie cutter sampling device: formed steel angle with two 100 mm by 150 mm by 9 mm (4 in. by 6 in. by 3/8 in.) handles, sized to accommodate sample requirements. Minimum 50 mm (2 in.) smaller than the sampling plate when used together.

  Example: Sampling plate 380 mm (15 in.) square and a cookie cutter sampling device 330 mm (13 in.) square.
- Mechanical sampling device: a permanently attached device that allows a sample receptacle to pass perpendicularly through the entire stream of material or diverts the entire stream of material into the container by manual, hydraulic, or pneumatic operation.
- Agency approved release agent: a non-stick product that prevents the asphalt mixture from sticking to the apparatus and does not contain solvents or petroleum-based products that could affect asphalt binder properties.

Sample Size

Sample size depends on the test methods specified by the agency for acceptance. Check agency requirement for the size required.

Procedure

General

- Select sample locations using a random or stratified random sampling procedure, as specified by the agency. The material shall be tested to determine variations. The supplier/contractor shall provide equipment for safe and appropriate sampling, including sampling devices on plants when required.
- Ensure the container(s) and sampling equipment are clean and dry before sampling.
- For dense graded mixture samples use cardboard boxes, stainless steel bowls or other agency-approved containers.
- For hot open graded mixture samples use stainless steel bowls. Cardboard boxes can used if the sample has cooled to the point that asphalt binder will not migrate from the aggregate.

Attached Sampling Devices

These are normally permanently attached devices that allow a sample container to pass perpendicularly through the entire stream of material. Operation may be manual, pneumatic, or hydraulic and allow the sample container to pass through the stream twice without overfilling. A sampling device may also divert the entire stream into container.

1. Lightly coat the container attached to the sampling device with an agency-approved release agent or preheat it, or both, to approximately the same discharge temperature of the mix.
2. Pass the container twice, once in each direction, through the material perpendicularly without overfilling the container.
3. Transfer the asphalt mixture to an agency-approved container without loss of material.
4. Repeat until proper sample size has been obtained.
5. Combine the increments to form a single sample.

Conveyor Belts

1. Avoid sampling at the beginning or end of an asphalt mixture production run due to the potential for segregation.
2. Stop the belt containing asphalt mixture.
3. Set the sampling template into the asphalt mixture on the belt, avoiding intrusion by adjacent material.
4. Remove the asphalt mixture from inside the template, including all fines, and place in a sample container.
5. Repeat, obtaining equal size increments, until proper sample size has been obtained.
6. Combine the increments to form a single sample.

Haul Units

1. Visually divide the haul unit into approximately four equal quadrants.
2. Identify one sampling location in each quadrant.
3. Dig down and remove approximately 0.3 m (1 ft.) of material to avoid surface segregation. Obtain each increment from below this level.
4. Combine the increments to form a sample of the required size.

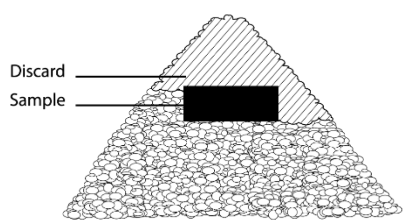
Paver Auger

1. Obtain samples from the end of the auger using a square head shovel.
2. Place the shovel in front of the auger extension, with the shovel blade flat upon the surface to be paved over.
3. Allow the front face of the auger stream to cover the shovel with asphalt mixture, remove the shovel before the auger reaches it by lifting as vertically as possible.
4. Place asphalt mixture in a sample container.
5. Repeat until proper sample size has been obtained.
6. Combine the increments to form a sample of the required size.

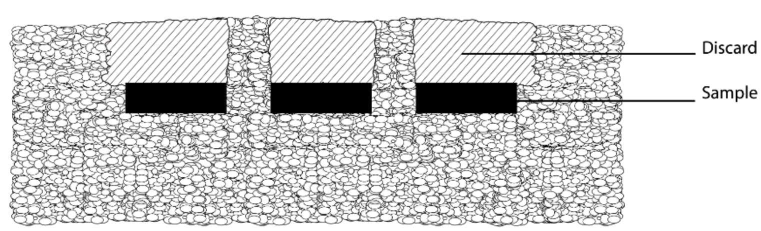
Note 1: First full shovel of material may be discarded to preheat and 'butter' the shovel.

Windrow

1. Obtain samples from the windrow of a transport unit. Avoid the beginning or the end of the windrow section.
2. Visually divide the windrow into approximately three equal sections.
3. Remove approximately 0.3 m (1 ft) from the top of each section.
4. Fully insert the shovel into the flat surface as vertically as possible, exclude the underlying material, roll back the shovel and lift the material slowly out of the windrow to avoid material rolling off the shovel.
5. Place in a sample container.
6. Repeat, obtaining equal size increments, in each of the remaining thirds.
7. Combine the increments to form a sample of the required size.



Windrow cross section



Windrow side view

Roadway before Compaction

There are two conditions that will be encountered when sampling asphalt mixtures from the roadway before compaction. The two conditions are:

- Laying asphalt mixture on grade or untreated base material requiring Method 1.
- Laying asphalt mixture on existing asphalt or laying a second lift of asphalt mixture allowing Method 2.

SAFETY:

Sampling is performed behind the paving machine, in front of the breakdown roller. For safety, the breakdown roller must remain at least 3 m (10 ft.) behind the sampling operation until the sample has been obtained and the hole filled with loose asphalt mixture.

Method 1 requires a plate to be placed in the roadway in front of the paving operation. There is always concern with moving, operating equipment. It is safest to stop the paving train while a plate is installed in front of the paver. When this is not possible the following safety rules must be followed.

1. The plate placing operation must be at least 3 m (10 ft.) in front of the paver or pickup device. The technician placing the plate must have eye contact and communication with the paving machine operator. If eye contact cannot be maintained at all times, a third person must be present to provide communication between the operator and the technician.
2. No technician is to be between the asphalt supply trucks and the paving machine. The exception to this rule is if the supply truck is moving forward creating a windrow, in which case the technician must be at least 3 m (10 ft.) behind the truck.

If at any time the Engineer feels that the sampling technique is creating an unsafe condition, the operation is to be halted until it is made safe, or the paving operation will be stopped while the plate is being placed.

Method 1 - Obtaining a Sample on Grade or Untreated Base (Plate Method)

1. Following the safety rules detailed above, the technician is to:
   a. Smooth out a location in front of the paver at least 0.5 m (2 ft.) inside the edge of the mat.
   b. Lay the plate down diagonally with the direction of travel, keeping it flat and tight to the base with the lead corner facing the paving machine.

   Note 2: The plate may be secured by driving a nail through the hole in the lead corner of the plate.
2. Pull the wire, attached to the outside corner of the plate, taut past the edge of the asphalt mixture mat and secure it. Let the paving operation pass over the plate and wire.
3. Using the exposed end of the wire, pull the wire up through the fresh asphalt mixture to locate the corner of the plate.

a. Plate only:
   i. Using a small square head shovel, scoop, or both, remove the full depth of the asphalt mixture from the plate. Take care to prevent sloughing of adjacent material.
   ii. Place asphalt mixture, including any material adhering to the plate and scoop or shovel in a sample container.
   iii. Remove the sample cutter from the roadway. The hole made from the sampling must be filled by the contractor with loose asphalt mixture.

b. "Cookie Cutter":
   i. Place the "cookie cutter" sample device, just inside the end of the wire; align the cutter over the plate. Press "cookie cutter" device down through the asphalt mixture to the plate.
   ii. Using a small square tipped shovel or scoop, or both, carefully remove all the asphalt mixture from inside of the cutter and place in a sample container.
   iii. Remove the sample cutter and the plate from the roadway. The hole made from the sampling must be filled by the contractor with loose asphalt mixture.

Method 2 - Obtaining a Sample on Asphalt Surface (Non-plate Method)

1. After the paving machine has passed the sampling point, immediately place the "cookie cutter" sampling device on the location to be sampled.
2. Push the cutter down through the asphalt mixture until it is flat against the underlying asphalt mat.
3. Using a small square tipped shovel, scoop, or both, carefully remove all the asphalt mixture from inside of the cutter and place in a sample container.
4. Remove the cutter from the roadway. The hole made from the sampling must be filled by the contractor with loose asphalt mixture.

Stockpiles

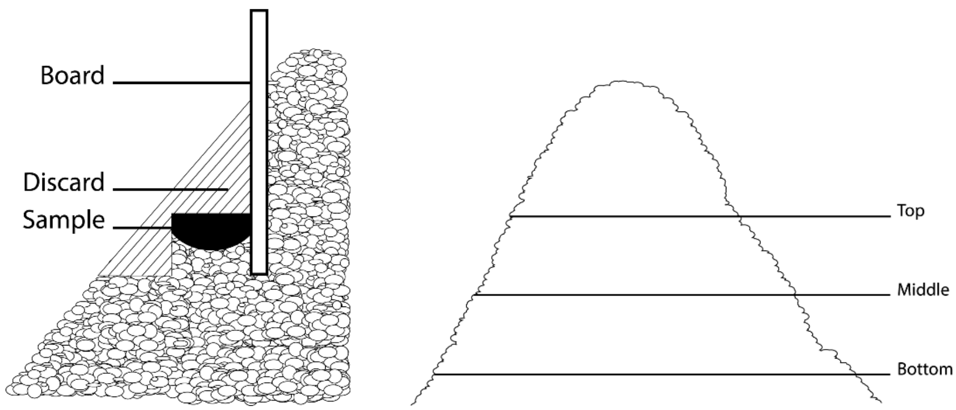
Remove at least 0.1 m (4 in.) from the surface before sampling; mixtures in a stockpile may develop an oxidized crust.

***Method 1* – Loader**

1. Direct the loader operator to enter the stockpile with the bucket at least 0.3 m (1 ft) above ground level without contaminating the stockpile.
2. Obtain a full loader bucket of the asphalt mixture; tilt the bucket back and up.
3. Form a small sampling pile at the base of the stockpile by gently rolling the asphalt mixture out of the bucket with the bucket just high enough to permit free flow of the mixture. Repeat as necessary.
4. Create a flat surface by having the loader "back-drag" the small pile.
5. Obtain approximately equal increments from at least three randomly selected locations on the flat surface at least 0.3 m (1 ft) from the edge.
6. Fully insert the shovel, exclude the underlying material, roll back the shovel and lift the asphalt mixture slowly out of the pile to avoid mixture rolling off the shovel.
7. Combine the increments to form a sample.

Method 2 – Stockpile *Face*

1. Create horizontal surfaces with vertical faces in the top, middle, and bottom third of the stockpile with a shovel or a loader if one is available.
2. Shove a flat board against the vertical face behind the sampling location to prevent sloughing of asphalt mixture. Discard the sloughed mixture to create the horizontal surface.
3. Obtain the sample from the horizontal surface as close as possible to the intersection of the horizontal and vertical faces.
4. Obtain at least one sample increment of equal size from each of the top, middle, and bottom thirds of the pile.
5. Combine the increments to form a single sample.



Identification and Shipping

1. Identify sample containers as required by the agency.
2. Ship samples in containers that will prevent loss, contamination, or damage.

Report

- On forms approved by the agency
- Sample ID
- Date
- Time
- Location
- Quantity represented

PERFORMANCE EXAM CHECKLIST (ORAL)

SAMPLING Asphalt MIXTURES
FOP FOR AASHTO R 97

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. At the hot plant, how must a sample be obtained using an attached sampling device?		
a. Coat or preheat sample container.	____	_____
b. Sampling device passed through stream twice, once in each direction, perpendicular to material.	____	_____
c. The sampling device cannot be overfilled.	____	_____
2. How is a sample obtained from a conveyor belt?		
a. Stop the belt.	_____	_____
b. Set the sampling template on belt, avoiding intrusion of adjacent material.	_____	_____
c. All the material is removed from belt including all fines.	_____	_____
3. What must be done to sample from transport units?		
a. Divide the unit into four quadrants.	_____	_____
b. Obtain increments from each quadrant, 0.3 m (1 ft) below surface.	_____	_____
4. How is a sample obtained from the paver auger?		
a. Shovel blade is placed flat on the surface to be paved in front of the auger extension.	_____	_____
b. Shovel is filled and removed by lifting as vertically as possible.	_____	_____
5. Describe the procedure for sampling from a windrow.		
a. Do not sample from the beginning or end of the windrow.	_____	_____
b. Approximately 0.3 m (1 ft) removed from the top.	_____	_____
c. Underlying material is excluded	_____	_____
d. Equal increments obtained from 3 locations along the windrow.	_____	_____

OVER

Procedure Element	Trial 1	Trial 2
6. Describe how to take samples from the roadway using Method 1 (plate).		
a. Place the plate well in front of the paver.	_____	_____
b. Pull the wire to locate the corner of the plate.	_____	_____
c. Place the cutter (if used) on the asphalt material above the plate and push it down to the plate.	_____	_____
d. Collect all the material inside the cutter.	_____	_____
7. Describe how to take samples from the roadway using Method 2.		
a. Place the cutter on the asphalt material and push it down to the underlying material.	_____	_____
b. Collect all the material inside the cutter.	_____	_____
8. Describe the procedure for sampling a stockpile Method 1 (Loader Sampling).		
a. Loader removes surface and creates sampling pile.	_____	_____
b. Loader back drags pile to create a flat surface.	_____	_____
c. Take three approximately equal increments from at least 0.3 m (1 ft) from the edge, excluding the underlying material.	_____	_____
9. Describe the procedure for sampling a stockpile Method 2 (Stockpile Face Sampling).		
a. Create horizontal surfaces with vertical faces with a shovel.	_____	_____
b. At least one increment taken from each of the top, middle, and bottom thirds of the stockpile.	_____	_____
10. Increments combined to form a sample of required size?	_____	_____
11. What types of containers can be used?		
a. Cardboard boxes, stainless steel bowls, or other agency approved containers.	_____	_____
12. What dictates size of sample?		
a. Agency requirements.	_____	_____
b. Specified by test method.	_____	_____

Comments: First attempt: Pass____Fail_____ Second attempt: Pass______Fail______

____
____
____
____
____

Examiner Signature ______________________________ WAQTC #:_______________

PERFORMANCE EXAM CHECKLIST

SAMPLING Asphalt MIXTURES
FOP FOR AASHTO R 97

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
Attached Sampling Device		
1. Container coated or preheated or both?	_____	_____
2. Sampling device passed through stream twice perpendicular to material?	_____	_____
3. Sampling device not over filled?	_____	_____
Conveyor Belt		
4. Belt stopped?	_____	_____
5. Sampling template set on belt, avoiding intrusion of adjacent material?	_____	_____
6. Sample, including all fines, scooped off?	_____	_____
Haul Units		
7. Unit divided into four quadrants?	_____	_____
8. Increment obtained from each quadrant, 0.3 m (1ft.) below surface?	_____	_____
9. Increments combined to make up the sample?	_____	_____
Paver Auger		
10. Shovel blade flat on the surface to be paved?	_____	_____
11. Shovel lifted vertically after it is filled?	_____	_____
Windrow		
12. Beginning and end avoided?	_____	_____
13. Equal increments obtained from three sections?		
14. Approximately 0.3 m (1 ft) removed from top of each section?	_____	_____
15. Underlying material excluded?	_____	_____
Roadway Before Compaction (Method 1)		
16. Plate placed well in front of paver?	_____	_____
17. Wire pulled to locate plate corner?	_____	_____

OVER

Procedure Element	Trial 1	Trial 2
18. Cookie cutter (if used) placed on asphalt and pushed through to plate?	_____	_____
19. All material removed from inside the cutter?	_____	_____
Roadway Before Compaction (Method 2)		
20. Cookie cutter placed on asphalt and pushed through to underlying material?	_____	_____
21. All material removed from inside the cutter?	_____	_____
Stockpile Method 1– (Loader sampling)		
22. Loader operator directed to enter the stockpile with the bucket at least 0.3 m (1 ft) above ground level without contaminating the stockpile?	_____	_____
23. The loader obtained a full loader bucket of the material with the bucket tilted back and up?	_____	_____
24. A small sampling pile formed at the base of the stockpile by gently rolling the material out of the bucket with the bucket just high enough to permit free-flow of the material?	_____	_____
25. A flat surface created by the loader back dragging the small pile?	_____	_____
26. Increment sampled from three locations at least 0.3 m (1 ft) from the edge by fully inserting the shovel into the flat pile as vertically as possible, care taken to exclude the underlying material?	_____	_____
Stockpile Method 2 (Stockpile Face)		
27. Created horizontal surfaces with vertical faces?	_____	_____
28. Sample obtained from the horizontal face as close as possible to the vertical face?	_____	_____
29. At least one increment taken from each of the top, middle, and bottom thirds of the stockpile?	_____	_____
General		
30. Sample placed in appropriate container?	_____	_____
31. Sample size meets agency requirements?	_____	_____
32. Sample identified as required?	_____	_____

Comments: First attempt: Pass____Fail_____ Second attempt: Pass______Fail______

____

____

____

____

Examiner Signature ______________________________ WAQTC #:_______________

REDUCING SAMPLES OF ASPHALT MIXTURES TO TESTING SIZE
IWFOP AASHTO R 47

This method modifies the Western Alliance for Quality Transportation (WAQTC) Field Operations Procedure (FOP) for AASHTO R 47. The Idaho Transportation Department has implemented specific changes detailed in the following procedure. Adherence to this modified procedure is mandatory for all Idaho projects, superseding the original WAQTC FOP.

Selection of Procedure (Method)

Add the following:

Only the Quartering, Sectoring, and Incremental Methods will be used.

REDUCING SAMPLES OF ASPHALT MIXTURES TO TESTING SIZE
WFOP AASHTO R 47

Scope

This procedure covers sample reduction of asphalt mixtures to testing size in accordance with AASHTO R 47-23. The reduced portion is to be representative of the original sample.

Apparatus

- Thermostatically controlled oven capable of maintaining a temperature of at least 110°C (230°F) or high enough to heat the material to a pliable condition for splitting.
- Non-contact temperature measuring device.
- Metal spatulas, trowels, metal straightedges, drywall taping knives, or a combination thereof; for removing asphalt mixture samples from the quartering device, cleaning surfaces used for splitting, etc.
- Square-tipped, flat-bottom scoop, shovel, or trowel for mixing asphalt mixture before quartering.
- Miscellaneous equipment including hot plate, non-asbestos heat-resistant gloves or mittens, pans, buckets, and cans.
- Sheeting: Non-stick heavy paper or other material as approved by the agency.
- Agency-approved release agent, free of solvent or petroleum-based material that could affect asphalt binder.
- Mechanical Splitter Type B (Riffle): having a minimum of eight equal-width chutes discharging alternately to each side with a minimum chute width of at least 50 percent larger than the largest particle size. A hopper or straight-edged pan with a width equal to or slightly smaller than the assembly of chutes in the riffle splitter to permit uniform discharge of the asphalt mixture through the chutes without segregation or loss of material. Sample receptacles of sufficient width and capacity to receive the reduced portions of asphalt mixture from the splitter without loss of material.
- Quartering Template: formed in the shape of a 90- degree cross with equal sides that exceed the diameter of the flattened cone of material sufficient to allow complete separation of the quartered sample. The height of the sides must be sufficient to extend above the thickness of the flattened cone of the sample to be quartered. Manufactured of metal that will withstand heat and use without deforming.
- Non-stick mixing surface that is hard, heat-resistant, clean, level, and large enough to permit asphalt mixture samples to be mixed without contamination or loss of material.

Sampling

Obtain samples according to the FOP for AASHTO R 97.

Sample Preparation

The sample must be warm enough to separate. If not, warm in an oven until it is sufficiently soft to mix and separate easily. Do not exceed either the temperature or time limits specified in the test method(s) to be performed.

Selection of Procedure (Method)

Refer to agency requirements when determining the appropriate method(s) of sample reduction. In general, the selection of a particular method to reduce a sample depends on the initial size of the sample vs. the size of the sample needed for the specific test to be performed. It is recommended that, for large amounts of material, the initial reduction be performed using a mechanical splitter. This decreases the time needed for reduction and minimizes temperature loss. Further reduction of the remaining asphalt mixture may be performed by a combination of the following methods, as approved by the agency.

The methods for reduction are:

- Mechanical Splitter Type B (Riffle) Method
- Quartering and Sectoring Methods
  - Quartering
  - Sectoring
- Incremental Method

Procedure

When heating of the equipment is desired, it shall be heated to a temperature not to exceed the maximum mixing temperature of the job mix formula (JMF).

Mechanical Splitter Type B (Riffle) Method

1. Clean the splitter and apply a light coating of agency-approved release agent to the surfaces that will come in contact with asphalt mixture (hopper or straight-edged pan, chutes, receptacles).
2. Place two empty receptacles under the splitter.
3. Carefully empty the asphalt mixture from the agency-approved container(s) into the hopper or straight-edged pan without loss of material. Uniformly distribute from side to side of the hopper or pan.
4. Discharge the asphalt mixture at a uniform rate, allowing it to flow freely through the chutes.
5. Any asphalt mixture that is retained on the surface of the splitter shall be removed and placed into the appropriate receptacle.
6. Reduce the remaining asphalt mixture as needed by this method or a combination of the following methods as approved by the agency.
7. Using one of the two receptacles containing asphalt mixture, repeat the reduction process until the asphalt mixture contained in one of the two receptacles is the appropriate size for the required test.
8. After each split, remember to clean the splitter hopper and chute surfaces if needed.
9. Retain and properly identify the remaining unused asphalt mixture sample for further testing if required by the agency.

Quartering and Sectoring Methods

1. If needed, apply a light coating of agency-approved release agent to quartering template.
2. Place the sample from the agency approved container(s) into a conical pile on a hard, “non-stick,” clean, level surface where there will be neither a loss of material nor the accidental addition of foreign material. The surface can be made non-stick by the application of an agency-approved release agent, or sheeting.
3. Mix the material thoroughly by turning the entire sample over a minimum of four times with a flat-bottom scoop; or by alternately lifting each corner of the sheeting and pulling it over the sample diagonally toward the opposite corner, causing the material to be rolled. Create a conical pile by either depositing each scoop or shovelful of the last turning on top of the preceding one or lifting both opposite corners.
4. Flatten the conical pile to a uniform diameter and thickness where the diameter is four to eight times the thickness. Make a visual observation to ensure that the material is homogeneous.
5. Divide the flattened cone into four equal quarters using the quartering template or straightedges assuring complete separation.
6. Reduce to appropriate sample mass by quartering or sectoring.

Quartering

a. Remove diagonally opposite quarters, including all the fine material, and place in a container to be retained.
b. Remove the quartering template, if used.
c. Combine the remaining quarters.
d. If further reduction is necessary, repeat Quartering Method Steps 3 through 6.
e. Repeat until appropriate sample mass is obtained. The final sample must consist of the two remaining diagonally opposite quarters.
f. Retain and properly identify the remaining unused portion of the asphalt mixture sample for further testing if required by the agency.

Sectoring

a. Using a straightedge, obtain a sector by slicing through a quarter of the asphalt mixture from the center point to the outer edge of the quarter.

b. Pull or drag the sector from the quarter with two straight edges or hold one edge of the straightedge in contact with quartering device.

c. Remove an approximately equal sector from the diagonally opposite quarter and combine.

d. If necessary, repeat until the appropriate sample mass has been obtained.

e. Continue sectoring with the unused portion of the asphalt mixture until samples have been obtained for all required tests.

f. Retain and properly identify the remaining unused portion of the asphalt mixture sample for further testing if required by the agency.

Incremental Method

1. Cover a hard, clean, level surface with sheeting. This surface shall be large enough that there will be neither a loss of material nor the accidental addition of foreign material.
2. Place the sample from the agency approved container(s) into a conical pile on that surface.
3. Mix the material thoroughly by turning the entire sample over a minimum of four times:
   a. Use a flat-bottom scoop; or
   b. Alternately lift each corner of the sheeting and pull it over the sample diagonally toward the opposite corner, causing the material to be rolled.
4. Create a conical pile by either depositing each scoop or shovelful of the last turning on top of the preceding one or lifting both opposite corners.
5. Grasp the sheeting and roll the conical pile into a cylinder (loaf), then flatten the top. Make a visual observation to determine that the material is homogenous.
6. Remove one quarter of the length of the loaf and place in a container to be saved by either:
   a. Pull sheeting over edge of counter and drop material into container.
   b. Use a straightedge at least as wide as the full loaf to slice off material and place into container.
7. Obtain an appropriate sample mass for the test to be performed; by either:
   a. Pull sheeting over edge of counter and drop cross sections of the material into container until proper sample mass has been obtained.
   b. Use a straightedge at least as wide as the full loaf to slice off cross sections of the material until proper sample mass has been obtained and place into container.

Note 1: When reducing the sample to test size it is advisable to take several small increments, determining the mass each time until the proper minimum size is achieved. Unless the sample size is grossly in excess of the minimum or exceeds the maximum test size, use the sample as reduced for the test.

8. Repeat Step 7 until all the samples for testing have been obtained or until the final quarter of the original loaf is reached.

9. Retain and properly identify the remaining unused portion of the asphalt mixture sample for further testing if required by the agency.

PERFORMANCE EXAM CHECKLIST

REDUCING SAMPLES OF Asphalt Mixtures TO TESTING SIZE
WFOP AASHTO R 47

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Sample made soft enough to separate easily without exceeding temperature limits?	_____	_____
2. Splitting apparatus and tools, if preheated, not exceeding maximum mixing temperature from the JMF?	_____	_____
Mechanical Splitter Type B (Riffle) Method		
1. Splitter cleaned, and surfaces coated with release agent?	_____	_____
2. Two empty receptacles placed under splitter?	_____	_____
3. Sample placed in hopper or straight edged pan without loss of material and uniformly distributed from side to side?	_____	_____
4. Material discharged across chute assembly at controlled rate allowing free flow of asphalt mixture through chutes?	_____	_____
5. Splitter surfaces cleaned of all retained asphalt mixture allowing it to fall into appropriate receptacles?	_____	_____
6. Further reduction with the riffle splitter:		
a. Material from one receptacle discharged across chute assembly at controlled rate, allowing free flow of asphalt mixture through chutes?	_____	_____
b. Splitting process continued until appropriate sample mass obtained, with splitter surfaces cleaned of all retained asphalt mixture after every split?	_____	_____
7. Remaining unused asphalt mixture stored in suitable container, properly labeled?	_____	_____

OVER

Procedure Element	Trial 1	Trial 2
Quartering Method		
1. Sample placed in a conical pile on a hard, non-stick, heat-resistant splitting surface such as metal or sheeting?	_____	_____
2. Sample mixed by turning the entire sample over a minimum of 4 times?	_____	_____
3. Conical pile formed and then flattened uniformly to diameter equal to about 4 to 8 times thickness?	_____	_____
4. Sample divided into 4 equal quarters either with a metal quartering template or straightedges such as drywall taping knives?	_____	_____
5. Quartering:		
a. Two diagonally opposite quarters removed and placed in a container to be retained?	_____	_____
b. Two other diagonally opposite quarters combined?	_____	_____
c. Process continued, if necessary, until appropriate sample mass has been achieved?	_____	_____
6. Sectoring:		
a. Using two straightedges or a quartering device and one straightedge, sector obtained from one of the quarters from the center point to the outer edge of the quarter?	_____	_____
b. Equal sector obtained taken from the diagonally opposite quarter?	_____	_____
7. Increments combined to produce appropriate sample mass?	_____	_____
8. Remaining unused asphalt mixture stored in suitable container, properly labeled?	_____	_____

OVER

Procedure Element	Trial 1	Trial 2
Incremental Method		
1. Sample placed on hard, non-stick, heat-resistant splitting surface covered with sheeting?	______	______
2. Sample mixed by turning the entire sample over a minimum of 4 times?	______	______
3. Conical pile formed?	______	______
4. Asphalt mixture rolled into loaf and then flattened?	______	______
5. The first quarter of the loaf removed by slicing off or dropping off edge of counter and set aside?	______	______
6. Proper sample mass sliced off or dropped off edge of counter into sample container?	______	______
7. Process continued until all samples are obtained or final quarter is remaining?	______	______
8. All remaining unused asphalt mixture stored in suitable container, properly labeled?	______	______

Comments: First attempt: Pass____Fail_____ Second attempt: Pass_____Fail_____

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Examiner Signature ________________________ **WAQTC #:**_______________

MOISTURE CONTENT OF ASPHALT MIXTURES BY OVEN METHOD
WFOP AASHTO T 329

Scope

This procedure covers the determination of moisture content of asphalt mixtures in accordance with AASHTO T 329-22.

Overview

Moisture content is determined by comparing the wet mass of a sample and the mass of the sample after drying to constant mass. The term constant mass is used to define when a sample is dry.

Constant mass – the state at which a mass does not change more than a given percent, after additional drying for a defined time interval, at a required temperature.

Apparatus

- Balance or scale: 2 kg capacity, readable to 0.1 g and conforming to AASHTO M 231.
- Forced draft, ventilated, or convection oven: Capable of maintaining the temperature surrounding the sample at 163 ±14°C (325 ±25°F).
- Container: Clean, dry, not affected by heat and of sufficient size to contain a test sample without danger of spilling.
- Thermometer or other suitable device with a temperature range of 50 to 200°C (122 to 392°F) and readable to the nearest 2°C (4°F).

Sample

The test sample shall be obtained in accordance with the FOP for AASHTO R 97 and reduced in accordance with the FOP for AASHTO R 47. The size of the test sample shall be a minimum of 1000 g.

Procedure

1. Preheat the oven to the Job Mix Formula (JMF) mixing temperature range. If the mixing temperature is not supplied, a temperature of 163 ±14ºC (325 ±25ºF) is to be used.
2. Determine and record the mass of the container, including release media, to the nearest 0.1 g.

   Note 1: When using paper or other absorptive material to line the container ensure it is dry before determining initial mass of container.
3. Place the wet sample in the container.
4. Determine and record the temperature of the sample to the nearest 2°C (4°F).
5. Determine and record the mass of the sample and container to the nearest 0.1 g.
6. Determine and record the wet mass (M_i) of the sample by subtracting the container mass determined in Step 2 from the mass of the sample and container determined in Step 5.
7. Place the sample and container in the oven and dry for 90 ±5 min.
8. Determine the mass of sample and container.

9. Determine and record the mass of the sample by subtracting the container mass determined in Step 2 from the mass of the sample and container determined in Step 8.
10. Return sample and container to the oven and dry for 30 ±5 min.
11. Determine the mass of sample and container.
12. Determine and record the mass of the sample by subtracting the container mass determined in Step 2 from the mass of the sample and container determined in Step 11.
13. Determine percent change by subtracting the new mass determination (M_n) from the previous mass determination (M_p), dividing by the previous mass determination (M_p), and multiplying by 100.
14. Continue drying, performing Steps 10 through 13, until there is less than 0.05 percent change after additional drying time.
15. Cool the sample and container to ±9°C (±15°F) of the temperature determined in Step 4.
16. Determine and record the dry mass of the sample and container to the nearest 0.1 g.
17. Determine and record the mass of dry sample (M_f) by subtracting the mass of the container determined in Step 2 from the dry mass of the sample and container determined in Step 16.

    Note 2: Moisture content and the number of samples in the oven will affect the rate of drying at any given time. Placing wet samples in the oven with nearly dry samples could affect the drying process.

Calculations

Constant Mass:

Calculate constant mass using the following formula:

$$\% \, Change = \frac{M_p - M_n}{M_p} \times 100$$

Where:

M_p	=	previous mass measurement
M_n	=	new mass measurement

Example:

Mass of container and release media:		232.6 g
Initial mass of sample and container:		1367.5 g
Initial mass of sample (M_i):	1367.5 g – 232.6 g =	1134.9 g
Mass of sample and container after first drying cycle:		1361.8 g
Mass, M_p, of sample:	1361.8 g – 232.6 g = 1129.2 g	
Mass of sample and container after second drying cycle:		1360.4 g

Mass, M_n, of sample: 1360.4 g – 232.6 g = 1127.8 g

$$\% \, Change = \frac{1129.2\ g - 1127.8\ g}{1129.2\ g} \times 100 = 0.12\%$$

0.12 percent is not less than 0.05 percent, so continue drying the sample.

Mass of sample and container after third drying cycle: 1359.9 g

Mass, M_n, of sample: 1359.9 g – 232.6 g = 1127.3 g

$$\% \, Change = \frac{1127.8\ g - 1127.3\ g}{1127.8\ g} \times 100 = 0.04\%$$

0.04 percent is less than 0.05 percent, so constant mass has been reached.

Moisture Content:

Calculate the moisture content, as a percent, using the following formula.

$$Moisture\ Content = \frac{M_i - M_f}{M_f} \times 100$$

Where:

M_i = initial, wet mass

M_f = final, dry mass

Example:

M_i = 1134.9 g

M_f = 1127.3 g

$$Moisture\ Content = \frac{1134.9\ g - 1127.3\ g}{1127.3\ g} \times 100 = 0.674, \text{report } 0.67\%$$

Report

- On forms approved by the agency
- Sample ID
- Moisture content to the nearest 0.01 percent

PERFORMANCE EXAM CHECKLIST

MOISTURE CONTENT OF ASPHALT MIXTURES BY OVEN METHOD
WFOP AASHTO T 329

Participant Name ________________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Mass of clean dry container including release media determined to 0.1 g?	_____	_____
2. Representative sample obtained; 1000 g minimum?	_____	_____
3. Initial temperature taken and recorded?	_____	_____
4. Mass of sample determined to the nearest 0.1 g?	_____	_____
5. Sample placed in drying oven for 90 ±5 minutes?	_____	_____
6. Sample dried at a temperature not to exceed the JMF (if known) mixing temp or 163 ±14ºC (325 ±25ºF)?	_____	_____
7. Constant mass checked at 30 ±5 minute intervals and reached?	_____	_____
8. Sample and container cooled to ±9°C (15°F) of the initial temperature before final dry mass determined to 0.1 g?	_____	_____
9. Calculation of moisture content performed correctly to 0.01 percent?	_____	_____

$$Moisture\ Content = \frac{M_i - M_f}{M_f} \times 100$$

Comments: First attempt: Pass____Fail_____ Second attempt: Pass______Fail______

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Examiner Signature __________________________WAQTC #:_______________

DETERMINING THE ASPHALT BINDER CONTENT OF ASPHALT MIXTURES BY THE IGNITION METHOD
IWFOP AASHTO T 308

This method modifies the Western Alliance for Quality Transportation (WAQTC) Field Operations Procedure (FOP) for AASHTO T 308. The Idaho Transportation Department has implemented specific changes detailed in the following procedure. Adherence to this modified procedure is mandatory for all Idaho projects, superseding the original WAQTC FOP.

Overview

Add the following after the first paragraph:

This procedure outlines the Idaho-specific modifications to the WAQTC Field Operating Procedure (FOP) for AASHTO T 308, "Standard Method of Test for Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Oven." A key modification addresses the change in ignition furnace temperature introduced in the 2024 ITD 405 Special Provisions for asphalt pavement. This IWFOP provides guidance for projects under both the 2024 and earlier versions of the ITD 405 specification.

Apparatus

Replace the following:

Ignition Furnace: A forced-air ignition furnace that heats the specimens by either the convection or direct IR irradiation method. The convection-type furnace must be capable of maintaining the temperature between at least 530 and 545°C (986 and 1013°F) and have a temperature control accurate within ±5°C (±9°F).

With:

Ignition Furnace: A forced-air ignition furnace that heats the specimens by either the convection or direct IR irradiation method. The convection-type furnace must meet the following requirements:

- Temperature Range: Capable of maintaining the temperature within ±7°C (±12.6°F) of the furnace set point temperature, as specified in Table 1.
- Temperature Control Accuracy: ±5°C (±9°F).

Refer to Table 1 for the appropriate furnace set point temperature based on the project specifications.

Add the following Table 1 after the revised paragraph:

Table 1. Ignition Furnace Set Point Temperature Requirements

ITD 405 Special Provision[1]	Furnace Set Point Temperature (°C)
2024 and later	426
2021 and earlier	538 or 482[1]

1 For projects using the 2021 and earlier ITD 405 Special Provisions, the furnace set point temperature is 538°C unless the aggregate is determined to be high loss. High loss aggregates require a lower furnace set point temperature of 482°C to prevent aggregate degradation during testing. See Annex – Correction Factors Procedure Section to determine the appropriate furnace set point temperature.

General

Delete the following:

1. For the convection-type furnace, preheat the ignition furnace to 538 ± 5°C (1000 ± 9°F) or to the temperature determined in the Correction Factors Annex of this method. Manually record the furnace temperature (set point) before the initiation of the test if the furnace does not record automatically. For the direct IR irradiation-type furnace, use the same burn profile as used during the correction factor determination.

Add the following to Step 1:

1. Determine the required ignition furnace set point temperature based on contract requirements. (Note B)
2. For the convection-type furnace, preheat the ignition furnace to the set point temperature determined in Step 1. Manually record the furnace temperature (set point) before the initiation of the test if the furnace does not record automatically. For the direct IR irradiation-type furnace, use the same burn profile as used during the correction factor determination.

Note B – The Idaho Transportation Department's 2024 Special Provisions for 405 Superpave Hot Mix Asphalt Specification lowered the ignition furnace temperature set point to 426°C (800°F). If this version is in the contract, the set point temperature is 426°C (800°F). For all other versions the set point temperature is 538 ± 5°C (1000 ± 9°F) or to the temperature determined in the Correction Factors Annex of this method.

Procedure – Method A (Internal Balance)

Delete the following from Step 15:

Asphalt binder content percentage can also be calculated using the formula from "Method B" Step 16.

Add the following Steps 16 & 17

16. Using Mi and Mf from above and formula in the "Calculation" portion of Method B calculate the asphalt binder content percent. Compare the results from the "Calculation" portion of Method A with the result from the "Calculation" portion from Method B. If the asphalt binder content from Method B is within 0.15% of the binder content from Method A use the results from Method A (Internal Balance) / printed ticket. If the difference is greater than 0.15% use the asphalt binder content percent as calculated from Method B's formula.

17. Discrepancy Investigation and Corrective Action: If a discrepancy exceeding 0.15% between Method A and Method B is observed, immediately investigate the source of the variation. Document the investigation findings and any corrective actions taken. If the source of variation cannot be identified and corrected, take the ignition furnace out of service until it has been inspected, repaired, or recalibrated by a qualified technician. Document the furnace's out-of-service status.

ANNEX – CORRECTION FACTORS

Add the following paragraphs after "(Mandatory Information)":

For projects using the 2024 ITD 405 Special Provision and later: Follow the batching procedures outlined in Section 405.03.B.3. of the applicable project 405 Special Provisions. The furnace temperature for these projects is 426 ± 9 °C.

For projects using the 2021 ITD 405 Special Provision and earlier: Correction factors are based on a furnace temperature of 538 ± 9 °C. Refer to the applicable project Special Provision for specific guidance and Idaho IR-157.

Add the following to Procedure, Step 4:

Combining Aggregates for Producing Calibration Factor Samples. All samples shall be the same gradation and shall be combined sieve by sieve down to and including the material passing the No. 200 sieve.

DETERMINING THE ASPHALT BINDER CONTENT OF ASPHALT MIXTURES BY THE IGNITION METHOD

WFOP AASHTO T 308

Scope

This procedure covers the determination of asphalt binder content of asphalt mixtures by ignition of the binder in accordance with AASHTO T 308-22.

Overview

The sample is heated in a furnace at 538°C (1000°F) or less; samples may be heated by convection or direct infrared irradiation (IR). The aggregate remaining after burning can be used for sieve analysis using the FOP for AASHTO T 30.

Some agencies allow the use of recycled asphalt mixtures. When using recycled asphalt mixtures, check with the agency for specific correction procedures.

Asphalt binder in the asphalt mixture is ignited in a furnace. Asphalt binder content is calculated as the percentage difference between the initial mass of the asphalt mixture and the mass of the residual aggregate, with the asphalt binder correction factor, and moisture content subtracted. The asphalt binder content is expressed as a percent of moisture-free mix mass.

Two methods, A and B, are presented.

Apparatus

Note 1: The apparatus must be calibrated for the specific mix design. See "Correction Factors" at the end of this FOP.

The apparatus for Methods A and B is the same except that the furnace for Method A requires an internal balance.

- Ignition Furnace: A forced-air ignition furnace that heats the specimens by either the convection or direct IR irradiation method. The convection-type furnace must be capable of maintaining the temperature between at least 530 and 545°C (986 and 1013°F) and have a temperature control accurate within ±5°C (±9°F).

  For Method A, the furnace will be equipped with an internal scale thermally isolated from the furnace chamber and accurate to 0.1 g. The scale shall be capable of determining the mass of a 3500 g sample in addition to the sample baskets. A data collection system will be included so that mass can be automatically determined and displayed during the test. The furnace shall have a built-in computer program to calculate the change in mass of the sample and provide for the input of a correction factor for aggregate loss. The furnace shall provide a printed ticket with the initial specimen mass, specimen mass loss, temperature compensation, correction factor, corrected asphalt binder content, test time, and test temperature. The furnace shall provide an audible alarm and indicator light when the sample mass loss does not exceed 0.01 percent of the total sample mass for three consecutive minutes. Perform lift test according to manufacturer's instructions weekly during use, if applicable. The furnace shall be designed to permit the operator to change the ending mass loss percentage from both 0.01 percent to 0.02 percent.

For both Method A and Method B, the furnace chamber dimensions shall be adequate to accommodate a 3500 g sample. The furnace door shall be equipped so that it cannot be opened during the ignition test. A method for reducing furnace emissions shall be provided and the furnace shall be vented so that no emissions escape into the laboratory. The furnace shall have a fan to pull air through the furnace to expedite the test and to eliminate the escape of smoke into the laboratory.

- Sample Basket Assembly: consisting of sample basket(s), catch pan, and basket guards. Sample basket(s) will be of appropriate size allowing samples to be thinly spread and allowing air to flow through and around the sample particles. Sets of two or more baskets shall be nested. A catch pan: of sufficient size to hold the sample basket(s) so that aggregate particles and melting asphalt binder falling through the screen mesh are caught. Basket guards will completely enclose the basket and be made of screen mesh, perforated stainless steel plate, or other suitable material.
- Thermometer, or other temperature measuring device, with a temperature range of 10 -260°C (50-500°F).
- Oven capable of maintaining 110 ±5°C (230 ±9°F).
- Balance or scale: Capacity sufficient for the sample mass and conforming to the requirements of M 231, Class G2.
- **Safety equipment**: Safety glasses or face shield, high temperature gloves, long sleeved jacket, a heat resistant surface capable of withstanding 650°C (1202°F), a protective cage capable of surrounding the sample baskets during the cooling period, and a particle mask for use during removal of the sample from the basket assembly.
- Miscellaneous equipment: A container larger than the sample basket(s) for transferring sample after ignition, large flat pan, spatulas, bowls, and wire brushes.

Sampling

1. Obtain samples of asphalt mixture in accordance with the FOP for AASHTO R 97.
2. If the mixture is not sufficiently soft to separate with a spatula or trowel, place it in a large flat pan in an oven at 110 ±5°C (230 ±9°F) until workable.
3. Reduce asphalt mixture samples in accordance with the FOP for AASHTO R 47.
4. Test sample size shall conform to the mass requirement shown in Table 1.

Note 2: When the mass of the test specimen exceeds the capacity of the equipment used or for large samples of fine mixes, the test specimen may be divided into suitable increments, tested, and the results appropriately combined through a weighted average for calculation of the asphalt binder content.

Table 1

Nominal Maximum Aggregate Size* mm (in.)	Minimum Mass Specimen g	Maximum Mass Specimen g
37.5 (1 ½)	4000	4500
25.0 (1)	3000	3500
19.0 (3/4)	2000	2500
12.5 (1/2)	1500	2000
9.5 (3/8)	1200	1700
4.75 (No. 4)	1200	1700

* One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps in specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum size.

General

1. For the convection-type furnace, preheat the ignition furnace to 538 ± 5°C (1000 ± 9°F) or to the temperature determined in the Correction Factors Annex of this method. Manually record the furnace temperature (set point) before the initiation of the test if the furnace does not record automatically. For the direct IR irradiation-type furnace, use the same burn profile as used during the correction factor determination.

Procedure – Method A (Internal Balance)

1. Dry the sample to constant mass, according to the FOP for AASHTO T 329; or determine the moisture content of a companion sample in accordance with the FOP for AASHTO T 329.
2. Determine and record the mass of the sample basket assembly to the nearest 0.1 g.
3. Evenly distribute the sample in the sample basket assembly, taking care to keep the material away from the edges of the basket. Use a spatula or trowel to level the sample.
4. Determine and record the total mass of the sample and sample basket assembly at room temperature to the nearest 0.1 g.
5. Calculate the initial mass of the sample by subtracting the mass of the sample basket from the mass of the sample and sample basket assembly and record to the nearest 0.1 g. Designate this mass as (M_i).
6. Record the correction factor or input into the furnace controller for the specific asphalt mixture.
7. Input the initial mass of the sample (M_i) into the ignition furnace controller. Verify that the correct mass has been entered.
8. Verify the furnace scale is reading zero, if not, reset to zero.

CAUTION: Operator should wear safety equipment – high temperature gloves, face shield, fire-retardant shop coat – when opening the door to load or unload the sample.

9. Open the chamber door and gently set the sample basket assembly in the furnace. Carefully position the sample basket assembly so it is not in contact with the furnace wall. Close the chamber door and verify that the sample mass displayed on the furnace scale equals the total mass of the sample and sample basket assembly recorded in Step 5 within ±5 g.

   Note 3: Differences greater than 5 g or failure of the furnace scale to stabilize may indicate that the specimen basket assembly is contacting the furnace wall.

   Note 4: Furnace temperature will drop below the set point when the door is opened but will recover when the door is closed, and ignition begins. Sample ignition typically increases the temperature well above the set point – relative to sample size and asphalt binder content.

10. Initiate the test by pressing the start button. This will lock the sample chamber and start the combustion blower.

Safety note: Do not attempt to open the furnace door until the asphalt binder has been completely burned off.

11. Allow the test to continue until the stable light and audible stable indicator indicate that the change in mass does not exceed 0.01 percent for three consecutive minutes. Press the stop button. This will unlock the sample chamber and cause the printer to print out the test results.

    Note 5: An ending mass loss percentage of 0.02 may be used, if allowed by the agency, when aggregate that exhibits an excessive amount of loss during ignition testing is used.

12. Open the chamber door, remove the sample basket assembly, and place on the cooling plate or block. Place the protective cage over the sample basket assembly and allow it to cool to room temperature (approximately 30 minutes).
13. Determine and record the mass of the sample and sample basket assembly after ignition to the nearest 0.1 g.
14. Calculate the mass of the sample by subtracting the mass of the sample basket assembly from the mass of the sample and sample basket assembly and record to the nearest 0.1 g. Designate this mass as M_f.
15. Use the asphalt binder content percentage from the printed ticket. Subtract the moisture content and the correction factor if not entered into the furnace controller from the printed ticket asphalt binder content and report the difference as the corrected asphalt binder content.

    Asphalt binder content percentage can also be calculated using the formula from "Method B" Step 16.

Calculation

Corrected asphalt binder content:

$$P_b = BC - MC - C_f{}^*$$

*If correction factor is not entered into the furnace controller

where:

P_b = the corrected asphalt binder content as a percent by mass of the asphalt mixture

BC = asphalt binder content shown on printed ticket

MC = moisture content of the companion asphalt mixture sample, percent, as determined by the FOP for AASHTO T 329 (if the specimen was oven-dried before initiating the procedure, MC=0)

C_f = correction factor as a percent by mass of the asphalt mixture sample

Procedure – Method B (External Balance)

1. Dry the sample to constant mass, according to the FOP for AASHTO T 329; or determine the moisture content of a companion sample in accordance with the FOP for AASHTO T 329.
2. Determine and record the mass of the sample basket assembly to the nearest 0.1 g.
3. Place the sample basket(s) in the catch pan. Evenly distribute the sample in the sample basket(s), taking care to keep the material away from the edges of the basket. Use a spatula or trowel to level the sample.
4. Determine and record the mass of the sample and sample basket assembly at room temperature to the nearest 0.1 g.
5. Calculate the initial mass of the sample by subtracting the mass of the sample basket from the mass of the sample and sample basket assembly and record to the nearest 0.1 g. Designate this mass as (M_i).
6. Record the correction factor for the specific asphalt mixture.
7. Open the chamber door and gently set the sample basket assembly in the furnace. Carefully position the sample basket assembly so it is not in contact with the furnace wall. Burn the asphalt mixture sample in the furnace for 45 minutes or the length of time determined in the "Correction Factors" section.
8. Open the chamber door, remove the sample basket assembly, and place on the cooling plate or block. Place the protective cage over the sample and allow it to cool to room temperature (approximately 30 min).
9. Determine and record the mass of the sample and sample basket assembly to the nearest 0.1 g.
10. Calculate the sample mass by subtracting the mass of the sample basket assembly from the mass of the sample and sample basket assembly and record to the nearest 0.1 g.
11. Place the sample basket assembly back into the furnace.

12. Burn the sample for at least 15 minutes after the furnace reaches the set temperature.
13. Open the chamber door, remove the sample basket assembly, and place on the cooling plate or block. Place the protective cage over the sample basket assembly and allow it to cool to room temperature (approximately 30 min.).
14. Determine and record the mass of the sample and sample basket assembly to the nearest 0.1 g.
15. Calculate the mass of the sample by subtracting the mass of the sample basket assembly from the mass of the sample and sample basket assembly and record to the nearest 0.1 g.
16. Determine percent change by subtracting the new mass determination (M_n) from the previous mass determination (M_p), dividing by the previous mass determination (M_p), and multiplying by 100.
17. If the percent change exceeds 0.01 percent of the previous sample mass, repeat Steps 11 through 16 until the percent change does not exceed 0.01 percent.

    Note 6: An ending mass loss percentage of 0.02 may be used, if allowed by the agency, when aggregate that exhibits an excessive amount of loss during ignition testing is used.

18. Determine and record the mass of the sample and sample basket assembly to the nearest 0.1 g.
19. Calculate the final sample mass by subtracting the mass of the sample basket assembly and sample and sample basket assembly and record to the nearest 0.1 g. Designate this mass as M_f.
20. Calculate the asphalt binder content of the sample.

Calculations

Constant Mass

Calculate %change:

$$\% \, Change = \frac{M_p - M_n}{M_p} \times 100$$

where:

M_p = sample mass after ignition

M_n = sample mass after 15 min. additional ignition

Example

	Initial mass of sample and basket	= 5292.7 g
	Mass of basket assembly = 2931.5 g	
M_i	= 2361.2 g	
Sample mass and basket after first ignition		= 5154.4 g
	Sample mass after first ignition	= 2222.9 g
	Sample mass and basket after additional 15 min ignition =	5154.2 g

Constant mass

Sample mass after additional 15 min ignition = 2222.7 g

$$\%change = \frac{2222.9 \, g - 2222.7 \, g}{2222.9 \, g} \times 100 = 0.009\%$$

%change is not greater than 0.01 percent, so **M_f =** 2222.7 g

Percent asphalt binder (P_b)

Calculate the asphalt binder content of the sample as follows:

$$P_b = \frac{M_i - M_f}{M_i} \times 100 - MC - C_f$$

where:

P_b = the corrected asphalt binder content as a percent by mass of the asphalt mixture sample

M_f = the final sample mass after ignition, g

M_i = the initial mass of the asphalt mixture sample before ignition, g

MC= moisture content of the companion asphalt mixture sample, percent, as determined by the FOP for AASHTO T 329 (if the specimen was oven-dried before initiating the procedure, MC = 0).

C_f =correction factor as a percent by mass of the asphalt mixture sample

Example

Correction factor	= 0.42%
Moisture content	= 0.04%
Initial mass of sample and basket	=5292.7 g
Mass of basket assembly	=2931.5 g
M_i	=2361.2 g
M_f	=2222.7 g

$$P_b = \frac{2361.2\ g - 2222.7\ g}{2361.2\ g} \times 100 - 0.04\% - 0.42\% = 5.41\%$$

P_b= 5.41%

Gradation

1. Empty contents of the basket(s) into a container, being careful to capture all material. Use a small wire brush to ensure all residual fines are removed from the baskets.

   Note 7: Particle masks are a recommended safety precaution.

2. Perform the gradation analysis in accordance with the FOP for AASHTO T 30.

Report

- On forms approved by the agency
- Sample ID
- Method of test (A or B)
- Corrected asphalt binder content, P_b, to the nearest 0.01 percent or per agency standard
- Correction factor, C_f , to the nearest 0.01 percent
- Temperature compensation factor (Method A only)
- Total percent loss
- Sample mass
- Moisture content to the nearest 0.01%
- Test temperature

Attach the original printed ticket with all intermediate values (continuous tape) to the report for furnaces with internal balances.

ANNEX – CORRECTION FACTORS

ASPHALT BINDER AND AGGREGATE

(Mandatory Information)

Asphalt binder content results may be affected by the type of aggregate in the mixture and by the ignition furnace. Asphalt binder and aggregate correction factors must, therefore, be established by testing a set of correction specimens for each Job Mix Formula (JMF) mix design. Each ignition furnace will have its own unique correction factor determined in the location where testing will be performed.

This procedure must be performed before any acceptance testing is completed, and repeated each time there is a change in the mix ingredients or design. Any changes greater than 5 percent in stockpiled aggregate proportions should require a new correction factor.

All correction samples will be prepared by a central / regional laboratory unless otherwise directed.

Asphalt binder correction factor: A correction factor must be established by testing a set of correction specimens for each Job Mix Formula (JMF). Certain aggregate types may result in unusually high correction factors (> 1.00 percent). Such mixes should be corrected and tested at a lower temperature as described below.

Aggregate correction factor: Due to potential aggregate breakdown during the ignition process, a correction factor will need to be determined for the following conditions:

a. Aggregates that have a proven history of excessive breakdown

b. Aggregate from an unknown source.

This correction factor will be used to adjust the acceptance gradation test results obtained according to the FOP for AASHTO T 30.

Procedure

1. Obtain samples of aggregate in accordance with the FOP for AASHTO R 90.
2. Obtain samples of asphalt binder in accordance with the FOP for AASHTO R 66.

Note 8: Include other additives that may be required by the JMF.

3. Prepare an initial, or "butter," mix at the design asphalt binder content. Mix and discard the butter mix before mixing any of the correction specimens to ensure accurate asphalt content.
4. Prepare two correction specimens at the JMF design asphalt binder content. Aggregate used for correction specimens shall be sampled from material designated for use on the project. An agency approved method will be used to combine aggregate. An additional "blank" specimen shall be batched and tested for aggregate gradation in accordance with the FOP for AASHTO T 30. The gradation from the "blank" shall fall within the agency specified mix design tolerances.
5. Place the freshly mixed specimens directly into the sample basket assembly. If mixed specimens are allowed to cool before placement in the sample basket assembly, the specimens must be dried to constant mass according to the FOP for AASHTO T 329. Do not preheat the sample basket assembly.
6. Test the specimens in accordance with Method A or Method B of the procedure.
7. Once both correction specimens have been burned, determine the asphalt binder content for each specimen by calculation or from the printed ignition furnace tickets, if available.

8. Calculate the difference between asphalt binder contents of the two specimens:
   a. If the difference between the asphalt binder contents of the two specimens does not exceed 0.15 percent, use these two results to determine the correction factor.
   b. If the difference between the asphalt binder contents of the two specimens exceeds 0.15 percent, repeat with two more specimens and, from the four results, discard the high and low results. Determine the correction factor from the two remaining results.
9. Calculate the difference between the actual and measured asphalt binder contents to 0.01 percent. The asphalt binder correction factor, C_f, is the average of the differences expressed as a percent by mass of asphalt mixture.
10. If the asphalt binder correction factor exceeds 1.00 percent, the test temperature must be lowered to 482 ± 5°C (900 ± 9°F) and new samples must be burned. If the correction factor is the same or higher at the lower temperature, it is permissible to use the higher temperature. The temperature for determining the asphalt binder content of asphalt mixture samples by this procedure shall be the same temperature determined for the correction samples.
11. For the direct IR irradiation-type burn furnaces, the **default** burn profile should be used for most materials. The operator may select burn-profile Option 1 or Option 2 to optimize the burn cycle. The burn profile for testing asphalt mixture samples shall be the same burn profile selected for correction samples.

    Option 1 is designed for aggregate that requires a large asphalt binder correction factor (greater than 1.00 percent) – typically very soft aggregate (such as dolomite).

    Option 2 is designed for samples that may not burn completely using the **default** burn profile.
12. Perform a gradation analysis on the residual aggregate in accordance with the FOP for AASHTO T 30, if required. The results will be utilized in developing an "Aggregate Correction Factor" and should be calculated and reported to 0.1 percent.
13. From the gradation results subtract the percent passing for each sieve, for each sample, from the percent passing each sieve of the "Blank" specimen gradation results from Step 4.
14. Determine the average difference of the two values. If the difference for any single sieve exceeds the allowable difference of that sieve as listed in Table 2, then aggregate gradation correction factors (equal to the resultant average differences) for all sieves shall be applied to all acceptance gradation test results determined by the FOP for AASHTO T 30. If the 75 µm (No. 200) is the only sieve outside the limits in Table 2, apply the aggregate correction factor to only the 75 µm (No. 200) sieve.

Table 2
Permitted Sieving Difference

Sieve	Allowable Difference
Sizes larger than or equal to 2.36 mm (No.8)	± 5.0%
Sizes larger than to 75 µm (No.200) and smaller than 2.36 mm (No.8)	± 3.0%
Sizes 75 µm (No.200) and smaller	± 0.5%

Examples:

Sieve Size mm (in.)	Correction Factor Blank Sample % Passing	Correction Factor Sample #1 % Passing	Correction Factor Sample #2 % Passing	Difference 1 / 2	Avg. Diff.	Sieves to adjust
19.0 (3/4)	100	100	100	0/0	0.0	
12.5 (1/2)	86.3	87.4	86.4	-1.1/-0.1	-0.6	
9.5 (3/8)	77.4	76.5	78.8	+0.9/-1.4	-0.3	
4.75 (No. 4)	51.5	53.6	55.9	-2.1/-4.4	-3.3	
2.36 (No. 8)	34.7	36.1	37.2	-1.4/-2.5	-2.0	
01.18 (No. 16)	23.3	25.0	23.9	-1.7/-0.6	-1.2	
0.600 (No. 30)	16.4	19.2	18.1	-2.8/-1.7	-2.3	
0.300 (No. 50)	12.0	11.1	12.7	+0.9/-0.7	+0.1	
0.150 (No. 100)	8.1	9.9	6.3	-1.8/+1.8	0.0	
75 µm (No. 200)	5.5	5.9	6.2	-0.4/-0.7	-0.6	**- 0.6**

In this example, all gradation test results performed on the residual aggregate (FOP for AASHTO T 30) would have an aggregate correction factor applied to the percent passing the 75 µm (No. 200) sieve. The correction factor must be applied because the average difference on the 75 µm (No. 200) sieve is outside the tolerance from Table 2.

In the following example, aggregate correction factors would be applied to each sieve because the average difference on the 4.75 mm (No. 4) is outside the tolerance from Table 2.

Sieve Size mm (in.)	Correction Factor Blank Sample % Passing	Correction Factor Sample #1 % Passing	Correction Factor Sample #2 % Passing	Difference 1 / 2	Avg. Diff.	Sieves to adjust
19.0 (3/4)	100	100	100	0/0	0.0	0.0
12.5 (1/2)	86.3	87.4	86.4	-1.1/-0.1	-0.6	**-0.6**
9.5 (3/8)	77.4	76.5	78.8	+0.9/-1.4	-0.3	**-0.3**
4.75 (No. 4)	51.5	55.6	57.9	-4.1/-6.4	-5.3	**-5.3**
2.36 (No. 8)	34.7	36.1	37.2	-1.4/-2.5	-2.0	**-2.0**
01.18 (No. 16)	23.3	25.0	23.9	-1.7/-0.6	-1.2	**-1.2**
0.600 (No. 30)	16.4	19.2	18.1	-2.8/-1.7	-2.3	**-2.3**
0.300 (No. 50)	12.0	11.1	12.7	+0.9/-0.7	+0.1	**+0.1**
0.150 (No. 100)	8.1	9.9	6.3	-1.8/+1.8	0.0	0.0
75 µm (No. 200)	5.5	5.9	6.2	-0.4/-0.7	-0.6	**-0.6**

PERFORMANCE EXAM CHECKLIST

DETERMINING THE ASPHALT BINDER CONTENT OF ASPHALT MIXTURES BY THE IGNITION METHOD
WFOP AASHTO T 308

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Oven at correct temperature 538 ± 5°C (1000 ± 9°F) or correction factor temperature?	_____	_____
Or: for IR ovens, correct burn profile applied?	_____	_____
2. Sample reduced to correct size?	_____	_____
3. Asphalt mixture sample or companion moisture sample taken and dried per FOP for AASHTO T 329?	_____	_____
4. Mass of sample basket assembly recorded to 0.1 g?	_____	_____
5. With pan below basket assembly, sample evenly distributed in basket assembly keeping material away from the edges?	_____	_____
6. Mass of sample basket and sample recorded to 0.1 g?	_____	_____
7. Sample mass conforms to the required mass?	_____	_____
8. Method A		
a. Initial mass entered into furnace controller?	_____	_____
b. Internal scale reading zero?	_____	_____
c. Sample correctly placed into furnace?	_____	_____
d. Test continued until stable indicator signals?	_____	_____
e. Uncorrected asphalt binder content obtained on printed ticket?	_____	_____
f. Sample cooled to room temperature?	_____	_____
g. Sample mass determined to nearest 0.1 g.?	_____	_____

OVER

Procedure Element	**Trial 1**	**Trial 2**
9. Method B		
a. Sample correctly placed into furnace?	_____	_____
b. Sample burned for 45 min or time determined by correction process?	_____	_____
c. Sample cooled to room temperature?	_____	_____
d. Sample burned to constant mass?	_____	_____
e. Sample cooled to room temperature?		
f. Sample mass determined to nearest 0.1 g?	_____	_____
g. Uncorrected asphalt binder content calculated correctly and recorded?	_____	_____
10. Asphalt binder content corrected for Correction Factor if needed?	_____	_____
11. Asphalt binder content corrected for moisture per the FOP for AASHTO T 329 if needed?	_____	_____
12. Corrected asphalt binder content recorded?	_____	_____
13. Contents of the basket(s) carefully emptied into a pan?	_____	_____

Comments: First attempt: Pass____Fail______ Second attempt: Pass______Fail______

____

____

____

Examiner Signature _________________________WAQTC #:______________

MECHANICAL ANALYSIS OF EXTRACTED AGGREGATE
WFOP AASHTO T 30

Scope

This procedure covers mechanical analysis of aggregate recovered from asphalt mix samples in accordance with AASHTO T 30-21. This FOP uses the aggregate recovered from the ignition furnace used in AASHTO T 308. AASHTO T 30 was developed for analysis of extracted aggregate and thus includes references to extracted bitumen and filter element, which do not apply in this FOP.

Sieve analyses determine the gradation or distribution of aggregate particles within a given sample to determine compliance with design and production standards.

Apparatus

- Balance or scale: Capacity sufficient for the sample mass, accurate to 0.1 percent of the sample mass or readable to 0.1 g and conforming to AASHTO M 231.
- Sieves, meeting the requirements of FOP for AASHTO T 27/T 11.
- Mechanical sieve shaker, meeting the requirements of FOP for AASHTO T 27/T 11.
- Mechanical Washing Apparatus (optional).
- Suitable drying equipment, meeting the requirements of the FOP for AASHTO T 255.
- Containers and utensils: A pan or vessel of a size sufficient to contain the sample covered with water and to permit vigorous agitation without loss of any part of the sample or water.
- Wetting Agent: Any dispersing agent, such as dishwashing detergent, that will promote separation of the fine materials.

Sample Sieving

- In this procedure, it is required to shake the sample over nested sieves. Sieves are selected to furnish information required by specification. Intermediate sieves are added for additional information or to avoid overloading sieves, or both.
- The sieves are nested in order of increasing size from the bottom to the top, and the test sample, or a portion of the test sample, is placed on the top sieve.
- The loaded sieves are shaken in a mechanical shaker for approximately 10 minutes, refer to Annex A; *Time Evaluation*.

Mass Verification

The aggregate sample mass, $M_{(T30)}$, determined in this method, shall agree with the mass of the aggregate remaining after ignition, M_f from the FOP for AASTHO T 308, within 0.1 percent. If the variation exceeds 0.1 percent, the results cannot be used for acceptance.

Procedure

1. Determine and record the mass of the sample that was removed from the basket in the FOP for AASHTO T 308 to 0.1 g. Designate this mass as $M_{(T30)}$.
2. Verify the mass of the sample is within 0.1 percent by subtracting $M_{(T30)}$ from $M_{f(T308)}$ dividing by $M_{f(T308)}$ and multiplying by 100 (see *Mass Verification Calculation* and example).

   If the variation exceeds 0.1 percent, the sieve analysis results cannot be used for acceptance.
3. Nest a sieve, such as a 2.0 mm (No. 10) or 1.18 mm (No. 16), above the 75µm (No. 200) sieve.
4. Place the test sample in a container and cover with water. Add a wetting agent to the water to assure a thorough separation of the material finer than the 75µm (No. 200) sieve from the coarser particles. There should be enough wetting agent to produce a small amount of suds when the sample is agitated. Excessive suds may overflow the sieves and carry material away with them.
5. Agitate vigorously to ensure complete separation of the material finer than 75µm (No. 200) from coarser particles and bring the fine material into suspension above the coarser material. Avoid degradation of the sample when using a mechanical washing device. Maximum agitation is 10 min.

   Note 1: When mechanical washing equipment is used, the introduction of water, agitating, and decanting may be a continuous operation. Use care not to overflow or overload the 75µm (No. 200) sieve.
6. Immediately pour the wash water containing the suspended material over the nested sieves; be careful not to pour out the coarser particles or over fill the 75 µm (No. 200) sieve.
7. Add water to cover material remaining in the container, agitate, and repeat Step 6. Continue until the wash water is reasonably clear.
8. Remove the upper sieve, return material retained to the washed sample.
9. Rinse the material retained on the 75 µm (No. 200) sieve until water passing through the sieve is reasonably clear and wetting agent is removed.
10. Return all material retained on the 75 µm (No. 200) sieve to the washed sample by rinsing into the washed sample.
11. Dry the washed test sample to constant mass according to the FOP for AASHTO T 255. Cool to room temperature. Determine and record the "dry mass after washing."
12. Select sieves required by the specification and those necessary to avoid overloading. (See Annex B.) With a pan on bottom, nest the sieves increasing in size starting with the 75 µm (No. 200).
13. Place the test sample, or a portion of the test sample, on the top sieve.
14. Place sieves in mechanical shaker and shake for the minimum time determined to provide complete separation for the sieve shaker being used (approximately 10 minutes, the time determined by Annex A).

    Note 2: Excessive shaking (more than 10 minutes) may result in degradation of the sample.

15. Determine and record the individual or cumulative mass retained for each sieve including the pan. Ensure that all material trapped in full openings of the sieves are removed and included in the mass retained.

    Note 3: For sieves 4.75 mm (No. 4) and larger, check material trapped in less than a full opening by sieving over a full opening. Use coarse wire brushes to clean the 600 µm (No. 30) and larger sieves, and soft bristle brushes for smaller sieves.

16. Perform the *Check Sum* calculation – Verify the *total mass after sieving* of material compared to the *dry mass after washing* is not more than 0.2 percent. Do not use test results for acceptance if the *Check Sum* result is more than 0.2 percent.
17. Calculate the total percentages passing, and the individual or cumulative percentages retained, to the nearest 0.1 percent by dividing the individual sieve masses or cumulative sieve masses by the total mass of the initial dry sample.
18. Apply the Aggregate Correction Factor (ACF) to the calculated percent passing, as required in the FOP for AASHTO T 308 "Correction Factor," to obtain the reported percent passing.
19. Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Calculations

Mass verification

$$Mass\ verification = \frac{M_{f\,(T308)} - M_{(T30)}}{M_{f\,(T308)}} \times 100$$

Where:

$M_{f(T308)}$ = Mass of aggregate remaining in the basket assembly after ignition from the FOP for AASHTO T 308

$M_{(T30)}$ = Mass of aggregate sample obtained from the FOP for AASHTO T 308

Check Sum

$$check\ sum = \frac{dry\ mass\ after\ washing - total\ mass\ after\ sieving}{dry\ mass\ after\ washing} \times 100$$

Percent Retained

Individual

$$\mathrm{IPR} = \frac{IMR}{M_{T30}} \times 100$$

CUMULATIVE

$$\mathrm{CPR} = \frac{CMR}{M_{T30}} \times 100$$

WHERE:

IPR	=	INDIVIDUAL PERCENT RETAINED
CPR	=	CUMULATIVE PERCENT RETAINED
M_{T30}	=	TOTAL DRY SAMPLE MASS BEFORE WASHING
IMR	=	INDIVIDUAL MASS RETAINED
CMR	=	CUMULATIVE MASS RETAINED

Percent Passing

Individual

$$PP = PCP - IPR$$

Cumulative

$$PP = 100 - CPR$$

WHERE:

PP	=	CALCULATED PERCENT PASSING
PCP	=	PREVIOUS CALCULATED PERCENT PASSING

Reported Percent Passing

$$RPP = PP + ACF$$

WHERE:

RPP	=	REPORTED PERCENT PASSING
ACF	=	AGGREGATE CORRECTION FACTOR (IF APPLICABLE)

Example

Mass verification

$$Mass\ verification = \frac{2422.5\ g\ -\ 2422.3\ g}{2422.5\ g} \times\ 100\ = 0.01\%$$

Given:

$M_{f(T308)}$	=	2422.5 g
$M_{(T30)}$	=	2422.3 g

Dry mass of total sample, before washing (M_{T30}): 2422.3 g

Dry mass of sample, after washing out the 75 µm (No. 200) minus: 2296.2 g

Amount of 75 µm (No. 200) minus washed out (2422.3 g – 2296.2g): 126.1 g

Check sum

$$check\ sum = \frac{2296.2\ g - 2295.3\ g}{2296.2\ g} \times 100 = 0.0\%$$

This is not more than 0.2 percent therefore the results can be used for acceptance purposes.

Percent Retained for the 75 µm (No. 200) sieve

$$IPR = \frac{63.5\ g}{2422.3\ g} \times 100 = 2.6\%$$

$$or$$

$$CPR = \frac{2289.6\ g}{2422.3\ g} \times 100 = 94.5\%$$

Percent Passing using IPR and PCP for the 75 µm (No. 200) sieve

$$PP = 8.1\% - 2.6\% = 5.5\%$$

Percent Passing using CPR for the 75 µm (No. 200) sieve

$$PP = 100.0\% - 94.5\% = 5.5\%$$

Reported Percent Passing

$$RPP = 5.5\% + (-0.6\%) = 4.9\%$$

Individual
Gradation on All Sieves

Sieve Size mm (in.)	Individual Mass Retained g (IMR)	Determine IPR by dividing IMR by *M* and multiplying by 100	Individual Percent Retained (IPR)	Determine PP by subtractin IPR from Previous PP	Percent Passing (PP)	Agg. Corr. Factor from T 308 (ACF)	Reported Percent Passing*
19.0 (3/4)	0		0		100.0		100
12.5 (1/2)	346.9	$\frac{346.9}{2422.3} \times 100 =$	14.3	$100.0 - 14.3 =$	85.7		86
9.5 (3/8)	207.8	$\frac{207.8}{2422.3} \times 100 =$	8.6	$85.7 - 8.6 =$	77.1		77
4.75 (No. 4)	625.4	$\frac{625.4}{2422.3} \times 100 =$	25.8	$77.1 - 25.8 =$	51.3		51
2.36 (No. 8)	416.2	$\frac{416.2}{2422.3} \times 100 =$	17.2	$51.3 - 17.2 =$	34.1		34
1.18 (No. 16)	274.2	$\frac{274.2}{2422.3} \times 100 =$	11.3	$34.1 - 11.3 =$	22.8		23
0.600 (No. 30)	152.1	$\frac{152.1}{2422.3} \times 100 =$	6.3	$22.8 - 6.3 =$	16.5		17
0.300 (No. 50)	107.1	$\frac{107.1}{2422.3} \times 100 =$	4.4	$16.5 - 4.4 =$	12.1		12
0.150 (No. 100)	96.4	$\frac{96.4}{2422.3} \times 100 =$	4.0	$12.1 - 4.0 =$	8.1		8
0.075 (No. 200)	63.5	$\frac{63.5}{2422.3} \times 100 =$	2.6	$8.1 - 2.6 =$	5.5	-0.6 $(5.5 - 0.6 =)$	4.9
minus 75 µm (No. 200) in the pan	5.7						
Total mass after sieving = sum of sieves + mass in the pan = 2295.3 g							
Dry mass of total sample, before washing (M_{T30}): 2422.3g							

Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Cumulative
Gradation on All Sieves

Sieve Size mm (in.)	Cumulative Mass Retained g (CMR)	Determine CPR by dividing CMR by M and multiplying by 100	Cumulative Percent Retained (CPR)	Determine PP by subtracting CPR from 100.0	Percent Passing (PP)	Agg. Corr. Factor from T 308 (ACF)	Reported Percent Passing*
19.0 (3/4)	0		0.0		100.0		100
12.5 (1/2)	346.9	$\frac{346.9}{2422.3} \times 100 =$	14.3	$100.0 - 14.3 =$	85.7		86
9.5 (3/8)	554.7	$\frac{554.7}{2422.3} \times 100 =$	22.9	$100.0 - 22.9 =$	77.1		77
4.75 (No. 4)	1180.1	$\frac{1180.1}{2422.3} \times 100 =$	48.7	$100.0 - 48.7 =$	51.3		51
2.36 (No. 8)	1596.3	$\frac{1596.3}{2422.3} \times 100 =$	65.9	$100.0 - 65.9 =$	34.1		34
1.18 (No. 16)	1870.5	$\frac{1870.5}{2422.3} \times 100 =$	77.2	$100.0 - 77.2 =$	22.8		23
0.600 (No. 30)	2022.6	$\frac{2022.6}{2422.3} \times 100 =$	83.5	$100.0 - 83.5 =$	16.5		17
0.300 (No. 50)	2129.7	$\frac{2129.7}{2422.3} \times 100 =$	87.9	$100.0 - 87.9 =$	12.1		12
0.150 (No. 100)	2226.1	$\frac{2226.1}{2422.3} \times 100 =$	91.9	$100.0 - 91.9 =$	8.1		8
0.075 (No. 200)	2289.6	$\frac{2289.6}{2422.3} \times 100 =$	94.5	$100.0 - 94.5 =$	5.5	-0.6 $(5.5 - 0.6 =)$	4.9
minus 75 µm (No. 200) in the pan	2295.3						
Total mass after sieving = 2295.3 g							
Dry mass of total sample, before washing (M_{T30}): 2422.3g							

Report total percent passing to 1 percent except report the 75 µm (No. 200) sieve to 0.1 percent.

Report

- On forms approved by the agency
- Sample ID
- Depending on the agency, this may include:
  - Individual mass retained on each sieve
  - Individual percent retained on each sieve
  - Cumulative mass retained on each sieve
  - Cumulative percent retained on each sieve
  - Aggregate Correction Factor for each sieve from AASHTO T 308
  - Calculated percent passing each sieve to 0.1 percent
- Percent passing to the nearest 1 percent, except 75 µm (No. 200) sieve to the nearest 0.1 percent.

ANNEX A TIME EVALUATION

(Mandatory Information)

The minimum time requirement should be evaluated for each shaker at least annually by the following method:

1. Shake the sample over nested sieves for approximately 10 minutes.
2. Provide a snug-fitting pan and cover for each sieve and hold in a slightly inclined position in one hand.
3. Hand-shake each sieve by striking the side of the sieve sharply and with an upward motion against the heel of the other hand at the rate of about 150 times per minute, turning the sieve about one sixth of a revolution at intervals of about 25 strokes.

If more than 0.5 percent by mass of the total sample before sieving passes any sieve after one minute of continuous hand sieving adjust shaker time and re-check.

In determining sieving time for sieve sizes larger than 4.75 mm (No. 4), limit the material on the sieve to a single layer of particles.

ANNEX B OVERLOAD DETERMINATION

(Mandatory Information)

- For sieves with openings smaller than 4.75 mm (No. 4), the mass retained on any sieve shall not exceed 7 kg/m^2 (4 g/in^2) of sieving surface.
- For sieves with openings 4.75 mm (No. 4) and larger, the mass (in kg) shall not exceed the product of 2.5 x (sieve opening in mm) x (effective sieving area). See Table B1.

Additional sieves may be necessary to keep from overloading the specified sieves. The sample may also be sieved in increments or sieves with a larger surface area.

TABLE B1
Maximum Allowable Mass of Material Retained on a Sieve, g
Nominal Sieve Size, mm (in.)
Exact size is smaller (see AASHTO T 27)

Sieve Size mm (in.)		203 mm (8 in.) dia.	254 mm (10 in.) dia.	305 mm (12 in.) dia.
		Sieving Area m^2 (in^2)		
		0.0285 (44.2)	**0.0457 (70.8)**	**0.0670 (103.5)**
50	(2)	3600	5700	8400
37.5	(1 1/2)	2700	4300	6300
25.0	(1)	1800	2900	4200
19.0	(3/4)	1400	2200	3200
16.0	(5/8)	1100	1800	2700
12.5	(1/2)	890	1400	2100
9.5	(3/8)	670	1100	1600
6.3	(1/4)	440	720	1100
4.75	(No. 4)	330	540	800
-4.75	(-No. 4)	200	320	470

PERFORMANCE EXAM CHECKLIST

MECHANICAL ANALYSIS OF EXTRACTED AGGREGATE
WFOP AASHTO T 30

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Total dry mass determined to 0.1 g?	_____	_____
2. Dry mass agrees with sample mass after ignition (M_f) from AASHTO T 308 within 0.1 percent?	_____	_____
3. Sample placed in container and covered with water?	_____	_____
4. Wetting agent added?	_____	_____
5. Contents of container agitated vigorously?	_____	_____
6. Wash water poured through proper nest of two sieves?	_____	_____
7. Washing continued until wash water is reasonably clear and no wetting agent remaining?	_____	_____
8. Retained material returned to washed sample?	_____	_____
9. Washed material coarser than 75 µm (No. 200) dried to constant mass at 110 ±5°C (230 ±9°F)?	_____	_____
10. Sample cooled to room temperature?	_____	_____
11. Dry mass after washing determined to 0.1 g?	_____	_____
12. Material sieved on specified sieves?	_____	_____
13. Mass of each fraction of aggregate, including minus 75 µm (No. 200), determined and recorded to 0.1 g?	_____	_____
14. Total mass of material after sieving agrees with mass before sieving to within 0.2 percent?	_____	_____
15. Percent passing each sieve determined correctly to the nearest 0.1 percent?	_____	_____
16. Aggregate correction factor applied, if applicable?	_____	_____
17. Percent passing on each sieve reported correctly to the nearest 1 percent and nearest 0.1 percent on the 75 µm (No. 200)?	_____	_____

Comments: First attempt: Pass___Fail________ Second attempt: Pass_____Fail_____

____

____

____

Examiner Signature ______________________________WAQTC #:_____________

THEORETICAL MAXIMUM SPECIFIC GRAVITY (G_{mm}) AND DENSITY OF ASPHALT MIXTURES IWFOP AASHTO T 209

This method modifies the Western Alliance for Quality Transportation (WAQTC) Field Operations Procedure (FOP) for AASHTO T 209. The Idaho Transportation Department has implemented specific changes detailed in the following procedure. Adherence to this modified procedure is mandatory for all Idaho projects, superseding the original WAQTC FOP.

Test Sample Preparation

Add the following to the end of Step 1:

Condition all laboratory-developed mix samples per AASHTO R 30 (Mixture Conditioning of Hot Mix Asphalt) for 2 hours ± 5 minutes at the asphalt binder manufacturer's recommended compaction temperature.

Add the following to the end of Step 3:

3.1 Cure all loose mix samples for 3 hours ± 60 minutes at the laboratory target compaction temperature specified in the approved mix design job mix formula (JMF).

Curing time begins immediately after the truck is loaded.

If the specified curing time cannot be met due to unforeseen circumstances, document the reason and the actual curing time in the "Remarks" section of the test report and notify the contractor and IA immediately.

Add Step 4:

4. Determine the final test result from the average of two specimens.

4.1. The initial dry mass of the two specimens shall not vary by more than 50.0 grams.

4.2. The allowable Gmm variance between the two specimens is 0.014. If the variance exceeds 0.014:

- Review testing procedures and verify calibration of equipment used.
- Document and implement necessary adjustments before testing the next random sample. This documentation shall include the specific actions taken, the date, and the technician's initials.
- Document the reason for the variance and the corrective actions taken in the "Remarks" section.

4.3. If the Gmm variance exceeds 0.014 for two consecutive samples, halt further testing. The Independent Assurance (IA) Inspector must evaluate the tester, equipment, and testing procedure to determine the cause of the variance. The IA will document the findings and any corrective actions taken. Resume testing only after the IA approves.

Procedure – General

Add the following:

The volumetric flask method, as described in AASHTO T 209, shall be used exclusively for determining the theoretical maximum specific gravity (Gmm) of asphalt mixtures. Alternative methods outlined in AASHTO T 209 are not permitted.

Report

Add the following:

Report the average Gmm result of the two gyratory specimens to three decimal places.

THEORETICAL MAXIMUM SPECIFIC GRAVITY (G_{mm}) AND DENSITY OF ASPHALT MIXTURES WFOP AASHTO T 209

Scope

This procedure covers the determination of the maximum specific gravity (G_{mm}) of uncompacted asphalt mixtures in accordance with AASHTO T 209-23. Two methods using different containers – bowl and pycnometer / volumetric flask– are covered.

Specimens prepared in the laboratory shall be cured according to agency standards.

Apparatus

- Balance or scale: 10,000 g capacity, readable to 0.1 g, meeting AASHTO M 231, Class G2
- Container: A glass, metal, or plastic bowl, pycnometer or volumetric flask between 2000 and 10,000 mL as required by the minimum sample size requirements in Table 1 sample and capable of withstanding full vacuum applied
- Pycnometer / volumetric flask cover: A glass plate or a metal or plastic cover with a vented opening
- Vacuum lid: A transparent lid with a suitable vacuum connection, with a vacuum opening to be covered with a fine wire mesh
- Vacuum pump or water aspirator: Capable of evacuating air from the container to a residual pressure of 3.4 kPa (25 mm Hg)
- Vacuum measurement device: Residual pressure manometer or vacuum gauge, capable of measuring residual pressure down to 3.4 kPa (25 mmHg) or less and readable to at least 0.2 kPa (2 mmHg)
- Suspension apparatus: Suitable apparatus and holder to permit determining the mass of the sample while suspended below the balance. The wire suspending the holder shall be the smallest practical size to minimize any possible effects of a variable immersed length for Bowl Method.
- Water bath: A constant-temperature water bath (optional for Pycnometer or Volumetric Flask Method)
- Thermometers: Thermometric devices accurate to 0.25°C (0.5°F) and with a temperature range of at least 20 to 45°C (68 to 113°F).
- Bleeder valve to adjust vacuum
- Automatic vacuum control unit (optional)
- Timer
- Towel

Standardization

Use a container that has been standardized according to the Annex. The container shall be standardized periodically in conformance with procedures established by the agency.

Test Sample Preparation

1. Obtain samples in accordance with the FOP for AASHTO R 97 and reduce according to the FOP for AASHTO R 47.
2. Test sample size shall conform to the requirements of Table 1. Samples larger than the capacity of the container may be tested in two or more increments. Results will be combined by calculating the weighted average ($G_{mm\ (avg)}$.). If the increments have a specific gravity difference greater than 0.013, the test must be re-run.
3. Plant-produced samples may be short-term conditioned according to AASHTO R 30 as specified by the agency.

Note 1: Short-term conditioning at the specified temperature is especially important when absorptive aggregates are used. This short-term conditioning will ensure the computation of realistic values for the amount of asphalt absorbed by the aggregate and void properties of the mix. Plant-produced asphalt mixtures should be evaluated to make sure short-term conditioning has taken place during production and delivery.

Table 1
Test Sample Size for G_{mm}

Nominal MaximumAggregate Size mm (in.)	Minimum Mass g
37.5 or greater (1½)	4000
19 to 25 (3/4 to 1)	2500
12.5 or smaller (1/2)	1500

*Nominal maximum size: One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained.

Procedure – General

Two procedures – bowl and pycnometer / volumetric flask – are covered. The first 11 steps are the same for both.

1. Separate the particles of the sample, taking care not to fracture the mineral particles, so that the particles of the fine aggregate portion are not larger than 6.3 mm (1/4 in.). If the mixture is not sufficiently soft to be separated manually, place it in a large flat pan and warm in an oven only until it is pliable enough for separation.
2. Cool the sample to room temperature.
3. Determine and record the mass of the dry container to the nearest 0.1 g.
4. Place the sample in the container.
5. Determine and record the mass of the dry container and sample to the nearest 0.1 g.

6. Determine and record the mass of the sample by subtracting the mass determined in Step 3 from the mass determined in Step 5. Designate this mass as "A."
7. Add sufficient water at approximately 25° C (77° F) to cover the sample by about 25 mm (1 in.).

Note 1: The release of entrapped air may be facilitated by the addition of a wetting agent. Check with the agency to see if this is permitted and, if it is, for a recommended agent.

8. Place the lid on the container and attach the vacuum line. To ensure a proper seal between the container and the lid, wet the O-ring or use a petroleum gel.
9. Remove entrapped air by subjecting the sample to a partial vacuum of 4.0 ±0.6 kPa (30 ±5 mmHg) residual pressure for 15 ±1 minutes.
10. Agitate the container and sample, either continuously by mechanical device or manually by vigorous shaking at 2-minute intervals. This agitation facilitates the removal of air.
11. Release the vacuum. Increase the pressure to atmospheric pressure in 10 to 15 seconds if the vacuum release is not automated. Turn off the vacuum pump and remove the lid. When performing the pycnometer / volumetric flask method, complete steps 12B through 16B within 10 ±1 minute.

Procedure – Bowl

12A. Fill the water bath to overflow level with water at 25 ±1°C (77 ±2°F) and allow the water to stabilize.

13A. Zero or tare the balance with the immersion apparatus attached, ensuring that the device is not touching the sides or the bottom of the water bath. Immerse the suspension apparatus sufficiently to cover both it and the bowl.

14A. Suspend and immerse the bowl and sample in water at 25 ±1°C (77 ±2°F) for 10 ±1 minute.

15A. Determine and record the submerged weight of the bowl and sample to the nearest 0.1 g. Designate as "C."

Procedure – Pycnometer or Volumetric Flask

12B. Immediately fill the pycnometer / volumetric flask with water without reintroducing air.

13B. Stabilize the temperature of the pycnometer / volumetric flask and sample so that the final temperature is within 25 ±1°C (77 ±2°F).

14B. Finish filling the pycnometer / volumetric flask with water that is 25 ±1°C (77 ±2°F), place the cover or a glass plate on the pycnometer / volumetric flask, and eliminate all air.

Note 2: When using a metal pycnometer and cover, place the cover on the pycnometer and push down slowly, forcing excess water out of the hole in the center of the cover. Use care when filling the pycnometer to avoid reintroducing air into the water.

15B. Towel dry the outside of the pycnometer / volumetric flask and cover.

16B. Determine and record the mass of the pycnometer / volumetric flask, cover, de-aired water, and sample to the nearest 0.1 g. within 10 ±1 minute of completion of Step 11. Designate this mass as "E."

Procedure – Mixtures Containing Uncoated Porous Aggregate

If the pores of the aggregates are not thoroughly sealed by an asphalt binder film, they may become saturated with water during the vacuuming procedure, resulting in an error in G_{mm} and theoretical maximum density. To determine if this has occurred, complete the general procedure and then:

1. Carefully drain water from sample through a towel held over the top of the container to prevent loss of material.
2. Spread sample in a flat shallow pan and place before an electric fan to remove surface moisture.
3. Determine the mass of the sample when the surface moisture appears to be gone.
4. Continue drying and determine the mass of the sample at 15-minute intervals until less than a 0.5 g loss is found between determinations.
5. Record the mass as the saturated surface dry mass to the nearest 0.1 g. Designate this mass as "A_{SSD}."
6. Calculate, as indicated below, G_{mm} using "A" and "A_{SSD}," and compare the two values.

Calculation

Calculate the G_{mm} to three decimal places as follows:

Bowl Procedure

$$G_{mm} = \frac{A}{A + B - C} \qquad or \qquad G_{mm} = \frac{A}{A_{SSD} + B - C}$$

(for mixes containing uncoated aggregate materials)

Where:

A = mass of dry sample in air, g

A_{SSD} = mass of saturated surface dry sample in air, g

B = standardized submerged weight of the bowl, g (see Annex)

C = submerged weight of sample and bowl, g

Example:

$$G_{mm} = \frac{1432.7\ g}{1432.7\ g + 286.3\ g - 1134.9\ g} = 2.453 \quad or$$

$$G_{mm} = \frac{1432.7\ g}{1434.2\ g + 286.3\ g - 1134.9\ g} = 2.447$$

Given:

A	= 1432.7 g
A_{SSD}	= 1434.2 g
B	= 286.3 g
C	= 1134.9 g

Pycnometer / Volumetric Flask Procedure

$$G_{mm} = \frac{A}{A + D - E} \qquad or \qquad G_{mm} = \frac{A}{A_{SSD} + D - E}$$

(for mixtures containing uncoated materials)

Where:

A	=	mass of dry sample in air, g
A_{SSD}	=	mass of saturated surface-dry sample in air, g
D	=	standardized mass of pycnometer / volumetric flask filled with water at 25°C (77°F), g, (See Annex)
E	=	mass of pycnometer / volumetric flask filled with water and the test sample at test temperature, g

Example (two increments of a large sample):

$$G_{mm_1} = \frac{2200.3\ g}{2200.3\ g + 7502.5\ g - 8812.0\ g} = 2.470$$

$$G_{mm_2} = \frac{1960.2\ g}{1960.2\ g + 7525.5\ g - 8690.8\ g} = 2.466$$

Given:

Increment 1	Increment 2
A_1 = 2200.3 g	A_2 = 1960.2 g
D_1 = 7502.5 g	D_2 = 7525.5 g
E_1 = 8812.0 g	E_2 = 8690.8 g

Variation = 2.470 - 2.466 = 0.004, which is < 0.013

Allowable variation is: 0.013. The values may be used.

Weighted average

For large samples tested a portion at a time, calculate the $G_{mm\ (avg)}$ by multiplying the dry mass of each increment by its G_{mm}, add the results together (Σ) and divide by the sum (Σ) of the dry masses.

$$G_{mm(avg)} = \frac{\sum(A_x \times G_{mm_x})}{\sum A_x}$$

or

$$G_{mm(avg)} = \frac{(A_1 \times G_{mm_1}) + (A_2 \times G_{mm_2})}{A_1 + A_2}\ etc.$$

Where:

A_x	=	mass of dry sample increment in air, g
G_{mmx}	=	theoretical maximum specific gravity of the increment

Example:

$$G_{mm(avg)} = \frac{(2200.3\ g \times 2.470) + (1960.2\ g \times 2.466)}{2200.3\ g + 1960.2\ g} = \frac{10,268.6}{4160.5\ g} = 2.468$$

Theoretical Maximum Density

To calculate the theoretical maximum density at 25°C (77°F) use one of the following formulas. The density of water at 25°C (77°F) is 997.1 kg/ m^3 in Metric units or 62.245 lb/ft^3 in English units.

Theoretical maximum density kg/m^3 = G_{mm} × 997.1 kg/ m^3

2.468 × 997.1 kg/ m^3 = 2461 kg/ m^3

or

Theoretical maximum density lb/ft^3 = G_{mm} × 62.245 lb/ft^3

2.468 × 62.245 lb/ft^3 = 153.6 lb/ft^3

Report

- On forms approved by the agency
- Sample ID
- G_{mm} to the nearest 0.001
- Theoretical maximum density to the nearest 1 kg/m^3 (0.1 lb/ft^3)

ANNEX – STANDARDIZATION OF BOWL AND PYCNOMETER OR VOLUMETRIC FLASK

(Mandatory Information)

Bowl – Standardization

1. Fill the water bath to overflow level with 25 ±1°C (77 ±2°F) water and allow the water to stabilize.
2. Zero or tare the balance with the immersion apparatus attached, ensuring that the device is not touching the sides or the bottom of the water bath. Immerse the suspension apparatus sufficiently to cover both it and the bowl.
3. Suspend and completely immerse the bowl for 10 ±1 minute.
4. Determine and record the submerged weight of the bowl to the nearest 0.1 g.
5. Refill the water bath to overflow level.
6. Perform Steps 2 through 5 two more times for a total of three determinations.
7. If the range of the three determinations is less than or equal to 0.3 g., average the determinations. Designate as “B.”
8. If the range of the three determinations is greater than 0.3 g., take corrective action and perform the standardization procedure again.

Bowl – Check

1. Fill the water bath to overflow level 25 ±1°C (77 ±2°F) water and allow the water to stabilize.
2. Zero or tare the balance with the immersion apparatus attached, ensuring that the device is not touching the sides or the bottom of the water bath. Immerse the suspension apparatus sufficiently to cover both it and the bowl.
3. Suspend and completely immerse the bowl for 10 ±1 minute.
4. Determine and record the submerged weight of the bowl to the nearest 0.1 g.
5. If this determination is within 0.3 g of the standardized value, use the standardized value for “B.”
6. If it is not within 0.3 g, take corrective action and perform the standardization procedure again.
7. For labs that check the bowl standardization frequently (such as daily), calculate the moving average and range of the last three mass determinations. Designate the average of the last three masses as “B.”
8. If the moving range exceeds 0.3 g at any time, take corrective action and perform the standardization procedure again.

Pycnometer or Volumetric Flask – Standardization

1. Fill the pycnometer / volumetric flask with water at approximately 25°C (77°F).
2. Place the metal or plastic cover, or a glass plate on the pycnometer / volumetric flask and eliminate all air. (See Note 2.)
3. Stabilize the pycnometer / volumetric flask at 25 ± 1ºC (77 ± 2ºF) for 10 ± 1 min.
4. Towel dry the outside of the pycnometer / volumetric flask and cover.
5. Determine and record the mass of the pycnometer / volumetric flask, water, and cover or plate to the nearest 0.1 g.
6. Perform Steps 2 through 5 two more times for a total of three determinations.
7. If the range of the three determinations is less than or equal to 0.3 g, average the three determinations. Designate as “D.”
8. If the range of the determinations is greater than 0.3 g., take corrective action and perform the “Pycnometer or Volumetric Flask – Standardization” again.

Pycnometer or Volumetric Flask – Check

1. Fill the pycnometer / volumetric flask with water at approximately 25°C (77°F).
2. Place the metal or plastic cover or a glass plate on the pycnometer / volumetric flask and eliminate all air. (See Note 2.)
3. Stabilize the pycnometer / volumetric flask at 25 ± 1ºC (77 ± 2ºF) for 10 ± 1 min.
4. Towel dry the outside of the pycnometer / volumetric flask and cover.
5. Determine and record the mass of the pycnometer / volumetric flask, water, and cover or plate.
6. If this determination is within 0.3 g of the standardized value, use the standardized value for “D.”
7. If it is not within 0.3 g, perform the standardization procedure again.

PERFORMANCE EXAM CHECKLIST

THEORETICAL MAXIMUM SPECIFIC GRAVITY (G_{mm}) AND DENSITY OF ASPHALT MIXTURES WFOP AASHTO T 209

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Sample reduced to correct size?	_____	_____
2. Particles carefully separated insuring that aggregate is not fractured?	_____	_____
3. After separation, fine aggregate particles not larger than 6.3 mm (1/4 in.)?	_____	_____
4. Sample at room temperature?	_____	_____
5. Standardized container (bowl or pycnometer / volumetric flask)?	_____	_____
6. Mass of container determined to 0.1 g?	_____	_____
7. Mass of sample and container determined to 0.1 g?	_____	_____
8. Mass of sample calculated and conforms to required size?	_____	_____
9. Water at approximately 25°C (77°F) added to cover sample?	_____	_____
10. O-ring wet or petroleum gel used?	_____	_____
11. Entrapped air removed using partial vacuum of 4.0 ±0.6 kPa (30 ±5 mm Hg) residual pressure for 15 ±1 min?	_____	_____
12. Container and sample agitated continuously by mechanical device or manually by vigorous shaking at intervals of about 2 minutes?	_____	_____
13. Vacuum released to atmospheric pressure in 10 to 15 seconds if not auto controlled?	_____	_____
14. Vacuum pump turned off?	_____	_____
15. Bowl determination:		
a. Water bath filled to the overflow level?	_____	_____
b. Balance tared?	_____	_____
c. Bowl and sample suspended in water at 25 ±1°C (77 ±2°F) for 10 ±1 minute?	_____	_____
d. Suspension apparatus submerged?	_____	_____
e. Submerged weight of bowl and sample determined to 0.1 g?	_____	_____

OVER

Procedure Element	Trial 1	Trial 2
16. Pycnometer / Volumetric Flask determination:		
a. Pycnometer / volumetric flask filled with water without reintroducing air into the sample?	_____	_____
b. Contents stabilized at 25 ±1°C (77 ±2°F)	_____	_____
c. Pycnometer / volumetric flask completely filled with water that is 25 ±1°C (77 ±2°F)?	_____	_____
d. Mass of filled pycnometer / volumetric flask and cover determined to 0.1 g, 10 ±1 min. after removal of entrapped air completed?	_____	_____
17. G_{mm} calculated correctly and reported to 0.001?	_____	_____
18. Density calculated correctly and reported to 1 kg/m^3 (0.1 lb/ft^3)?	_____	_____

Comments: First attempt: Pass____Fail_____ Second attempt: Pass______Fail______

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Examiner Signature ________________________________WAQTC #:_______________

BULK SPECIFIC GRAVITY (G_{mb}) OF COMPACTED ASPHALT MIXTURES USING SATURATED SURFACE-DRY SPECIMENS
IWFOP AASHTO T 166

This method modifies the Western Alliance for Quality Transportation (WAQTC) Field Operations Procedure (FOP) for AASHTO T 166. The Idaho Transportation Department has implemented specific changes detailed in the following procedure. Adherence to this modified procedure is mandatory for all Idaho projects, superseding the original WAQTC FOP.

Scope

Delete from the last sentence:

“AASHTO T 275 or”

Overview

Add the following:

Method A: Suspension shall be used exclusively for determining the bulk specific gravity (Gmb) of compacted asphalt mixtures using this procedure. Method B and Method C are not permitted.

Test Specimens

Add the following:

Gyratory Specimens.

1.1 Two specimens are required for testing when produced using the FOP for AASHTO T 312. These gyratory-produced specimens shall have a surface temperature between 68°F and 80°F, documented on the test forms. The use of a fan is recommended to aid in the cooling process.

1.2 Determine the final test result from the average of the two specimens. The allowable Gmb variance between these specimens is 0.012.

1.3 If the variance exceeds 0.012:

- Review testing procedures and verify the calibration of the equipment used.
- Document the reason for the variance and the corrective actions taken in the "Remarks" section.
- Make necessary adjustments before performing the next random sample testing.

1.4 If the Gmb variance exceeds 0.012 for two consecutive samples, halt further testing. The Independent Assurance (IA) Inspector must evaluate the tester, equipment, and test procedure to determine the cause of the variance. The IA will document the findings of the investigation. Make adjustments to correct deficiencies before performing the next random sample testing.

Report

Add the following:

- Report the average Gmb result of the two gyratory specimens to the nearest thousandth (0.001)

BULK SPECIFIC GRAVITY (G_{mb}) OF COMPACTED ASPHALT MIXTURES USING SATURATED SURFACE-DRY SPECIMENS
WFOP AASHTO T 166

Scope

This procedure covers the determination of bulk specific gravity (G_{mb}) of compacted asphalt mixtures using three methods – A, B, and C – in accordance with AASHTO T 166-22. This FOP is for use on specimens not having open or interconnecting voids or absorbing more than 2.00 percent water by volume, or both. When specimens have open or interconnecting voids or absorbing more than 2.00 percent water by volume, or both, AASHTO T 275 or AASHTO T 331 should be performed.

Overview

- Method A: Suspension
- Method B: Volumeter
- Method C: Rapid test for A or B

Test Specimens

Test specimens may be either laboratory-molded or sampled from asphalt mixture pavement. For specimens it is recommended that the diameter be equal to four times the maximum size of the aggregate and the thickness be at least one- and one-half times the maximum size.

Terminology

Constant Mass: The state at which a mass does not change more than a given percent, after additional drying for a defined time interval, at a required temperature.

Apparatus – Method A (Suspension)

- Balance or scale: 5 kg capacity, readable to 0.1 g, and fitted with a suitable suspension apparatus and holder to permit weighing the specimen while suspended in water, conforming to AASHTO M 231.
- Suspension apparatus: Wire of the smallest practical size and constructed to permit the container to be fully immersed.
- Water bath: For immersing the specimen in water while suspended under the balance or scale and equipped with an overflow outlet for maintaining a constant water level.
- Towel: Damp cloth towel used for surface drying specimens.
- Oven: Capable of maintaining a temperature of 52 ± 3°C (126 ±5°F) for drying the specimens to a constant mass.
- Pan: Pan or other suitable container of known mass, large enough to hold a sample for drying in oven.

- Thermometer: Having a range of 15 to 45°C (59 to 113°F) and, graduated in 0.1°C (0.2°F) subdivisions.
- Vacuum device: refer to the FOP for AASHTO R 79 (optional)

Procedure – Method A (Suspension)

Recently molded laboratory samples that have not been exposed to moisture do not need drying.

1. Dry the specimen to constant mass, if required.
   a. Oven method
      i. Initially dry overnight at 52 ±3°C (125 ±5°F).
      ii. Determine and record the mass of the specimen. Designate this mass as M_p.
      iii. Return the specimen to the oven for at least 2 hours.
      iv. Determine and record the mass of the specimen. Designate this mass as M_n.
      v. Determine percent change by subtracting the new mass determination, M_n, from the previous mass determination, M_p, dividing by the previous mass determination M_p, and multiplying by 100.
      vi. Continue drying until there is no more than 0.05 percent change in specimen mass after 2-hour drying intervals (constant mass).
      vii. Constant mass has been achieved; sample is defined as dry.

   Note 1: To expedite the procedure, steps 1 and 2 may be performed last. To further expedite the process, see Method C.

   b. Vacuum dry method according to the FOP for AASHTO R 79.

2. Cool the specimen in air to 25 ±5°C (77 ±9°F), and determine and record the dry mass to the nearest 0.1 g. Designate this mass as A.
3. Fill the water bath to the overflow level with water at 25 ±1°C (77 ±2°F) and allow the water to stabilize.
4. Zero or tare the balance with the suspension apparatus attached, ensuring that the suspension apparatus is completely submerged and not touching the sides or the bottom of the water bath.
5. Immerse the specimen shaking to remove the air bubbles. Place the specimen on its side in the suspension apparatus. Leave it immersed for 4 ±1 minutes.
6. Determine and record the submerged weight to the nearest 0.1 g. Designate this submerged weight as C.
7. Remove the sample from the water and quickly surface dry with a damp cloth towel within 5 sec.
8. Zero or tare the balance.
9. Immediately determine and record the mass of the saturated surface-dry (SSD) specimen to nearest 0.1 g. Designate this mass as B. Any water that seeps from the specimen during the mass determination is considered part of the saturated specimen. Do not exceed 15 sec. performing Steps 7 through 9.

Calculations – Method A (Suspension)

Constant Mass:

Calculate constant mass using the following formula:

$$\%Change = \frac{M_p - M_n}{M_p} \times 100$$

Where:

M_p = previous mass measurement, g

M_n = new mass measurement, g

Bulk specific gravity (G_{mb}) and percent water absorbed:

$$G_{mb} = \frac{A}{B - C}$$

$$Percent\ Water\ Absorbed\ (by\ volume) = \frac{B - A}{B - C} \times 100$$

Where:

G_{mb} = Bulk specific gravity

A = Mass of dry specimen in air, g

B = Mass of SSD specimen in air, g

C = Weight of specimen in water at 25 ±1°C (77 ±2°F), g

Example:

$$G_{mb} = \frac{4833.6\ g}{4842.4\ g - 2881.3\ g} = 2.465$$

$$\%\ Water\ Absorbed\ (by\ volume) = \frac{4842.4\ g - 4833.6\ g}{4842.4\ g - 2881.3\ g} \times 100 = 0.45\%$$

Given:

A	=	4833.6 g
B	=	4842.4 g
C	=	2881.3 g

Apparatus – Method B (Volumeter)

- Balance or scale: 5 kg capacity, readable to 0.1 g and conforming to AASHTO M 231.
- Water bath: For immersing the specimen in water, capable of maintaining a uniform temperature at 25 ± 1°C (77 ± 2°F).
- Thermometer: Range of 15 to 45°C (59 to 113°F) and graduated in 0.1°C (0.2°F) subdivisions.
- Volumeter: Calibrated to 1200 mL or appropriate capacity for test sample and having a tapered lid with a capillary bore.
- Oven: Capable of maintaining a temperature of 52 ± 3°C (126 ± 5°F). for drying the specimens to a constant mass.
- Pan: Pan or other suitable container of known mass, large enough to hold a sample for drying in oven.
- Towel: Damp cloth towel used for surface drying specimens.
- Vacuum device: refer to the FOP for AASHTO R 79 (optional)

Procedure – Method B (Volumeter)

Method B is not acceptable for use with specimens that have more than 6 percent air voids.

Recently molded laboratory samples that have not been exposed to moisture do not need drying.

1. Dry the specimen to constant mass, if required.
    a. Oven method:
        i. Initially dry overnight at 52 ±3°C (125 ±5°F).
        ii. Determine and record the mass of the specimen. Designate this mass as M_p.
        iii. Return the specimen to the oven for at least 2 hours.
        iv. Determine and record the mass of the specimen. Designate this mass as M_n.
        v. Determine percent change by subtracting the new mass determination, M_n, from the previous mass determination, M_p, dividing by the previous mass determination, M_p, and multiplying by 100.
        vi. Continue drying until there is no more than 0.05 percent change in specimen mass after 2-hour drying intervals (constant mass).
        vii. Constant mass has been achieved; sample is defined as dry.

    Note 1: To expedite the procedure, steps 1 and 2 may be performed last. To further expedite the process, see Method C.

    b. Vacuum dry method according to the FOP for AASHTO R 79.
2. Cool the specimen in air to 25 ±5°C (77 ±9°F), and determine and record the dry mass to the nearest 0.1 g. Designate this mass as A.
3. Immerse the specimen in the temperature-controlled water bath at 25 ±1°C (77 ±2°F) for at least 10 minutes.
4. At the end of the ten-minute period, fill the volumeter with distilled water at 25 ±1°C (77 ±2°F) making sure some water escapes through the capillary bore of the tapered lid.
5. Wipe the volumeter dry. Determine the mass of the volumeter and water to the nearest 0.1 g. Designate this mass as D.
6. Remove the specimen from the water bath and quickly surface dry with a damp cloth towel within 5 sec.
7. Immediately determine and record the mass of the SSD specimen to the nearest 0.1 g. Designate this mass as B. Any water that seeps from the specimen during the mass determination is considered part of the saturated specimen.
8. Place the specimen in the volumeter and let stand 60 sec.
9. Bring the temperature of the water to 25 ±1°C (77 ±2°F) and cover the volumeter, making sure some water escapes through the capillary bore of the tapered lid.
10. Wipe the volumeter dry.
11. Determine and record the mass of the volumeter, water, and specimen to the nearest 0.1 g. Designate this mass as E.

Calculations – Method B (Volumeter)

Constant Mass:

Calculate constant mass using the following formula:

$$\%Change = \frac{M_p - M_n}{M_p} \times 100$$

Where:

M_p = previous mass measurement, g

M_n = new mass measurement, g

Bulk specific gravity (G_{mb}) and percent water absorbed:

$$G_{mb} = \frac{A}{B + D - E}$$

$$Percent\ Water\ Absorbed\ (by\ volume) = \frac{B - A}{B + D - E} \times 100$$

Where:

G_{mb} = Bulk specific gravity

A = Mass of dry specimen in air, g

B = Mass of SSD specimen in air, g

D = Mass of volumeter filled with water at 25 ±1°C (77 ±2°F), g

E = Mass of volumeter filled with specimen and water, g

Example:

$$G_{mb} = \frac{4833.6\ g}{4842.4\ g + 2924.4\ g - 5806.0\ g} = 2.465$$

$$\%\ Water\ Absorbed\ (by\ volume) = \frac{4842.4\ g - 4833.6\ g}{4842.4\ g + 2924.4\ g - 5806.0\ g} \times 100 = 0.45\%$$

Given:

A	=	4833.6 g
B	=	4842.4 g
D	=	2924.4 g
E	=	5806.0 g

Apparatus – Method C (Rapid Test for Method A or B)

- Oven: Capable of maintaining a temperature of 110 ±5°C (230 ±9°F) for drying the specimens to a constant mass.

See Methods A or B.

Note 2: This procedure can be used for specimens that are not required to be saved and contain substantial amounts of moisture. Cores can be tested the same day as obtained by this method.

Procedure – Method C (Rapid Test for Method A or B)

1. Start on Step 3 of Method A or B, and complete that procedure, then determine dry mass, A, as follows.
2. Determine and record mass of a large, flat-bottom container.
3. Place the specimen in the container.
4. Place in an oven at 110 ± 5 C (230 ± 9 F).
5. Dry until the specimen can be easily separated into fine aggregate particles that are not larger than 6.3 mm (¼ in.).
6. Determine and record the mass of the specimen. Designate this mass as M_p.
7. Return the specimen to the oven for at least 2 hours.
8. Determine and record the mass of the specimen. Designate this mass as M_n.
9. Determine percent change by subtracting the new mass determination, M_n, from the previous mass determination, M_p, dividing by the previous mass determination, M_p, and multiplying by 100.

10. Continue drying until there is no more than 0.05 percent change in specimen mass after 2-hour drying intervals (constant mass).
11. Constant mass has been achieved; sample is defined as dry.
12. Cool in air to 25 ±5°C (77 ±9°F).
13. Determine and record the mass of the container and dry specimen to the nearest 0.1 g.
14. Determine and record the mass of the dry specimen to the nearest 0.1 g by subtracting the mass of the container from the mass determined in Step 13. Designate this mass as A.

Calculations – Method C (Rapid Test for Method A or B)

Complete the calculations as outlined in Methods A or B, as appropriate.

Report

- On forms approved by the agency
- Sample ID
- G_{mb} to the nearest 0.001
- Absorption to the nearest 0.01 percent
- Method performed.

PERFORMANCE EXAM CHECKLIST

BULK SPECIFIC GRAVITY OF COMPACTED ASPHALT MIXTURES USING SATURATED SURFACE-DRY SPECIMENS
FOP FOR AASHTO T 166

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	**Trial 1**	**Trial 2**
Method A:		
1. Mass of dry sample determined.		
a. Sample dried to constant mass if required?	_____	_____
b. Cooled in air to 25 ±5°C (77 ±9°F)?	_____	_____
c. Dry mass determined to 0.1g?	_____	_____
2. Water at the overflow?	_____	_____
3. Balance zeroed?	_____	_____
4. Immersed weight determined.		
a. Water at 25 ±1°C (77 ±2°F)?	_____	_____
b. Immersed, shaken, on side, for 4 ±1 min.?	_____	_____
c. Immersed weight determined to 0.1g?	_____	_____
5. Sample rapidly surface dried (within 5 sec.) with a damp towel and saturated surface dry (SSD) mass determined to 0.1 g (entire operation performed within 15 sec.)?	_____	_____
6. G_{mb} calculated to the nearest 0.001?	_____	_____
7. Absorption calculated to the nearest 0.01 percent	_____	_____

OVER

Procedure Element	Trial 1	Trial 2

Method B:

1. Specimen dried, cooled, and mass determined as in Method A? _____ _____
2. Saturated surface-dry (SSD) mass determined to 0.1g.
   a. Immersed at least 10 minutes at 25 ±1°C (77 ±2°F)? _____ _____
   b. Sample rapidly dried (within 5 sec.) with damp towel ? _____ _____
   c. Specimen mass determined to 0.1 g? _____ _____
   d. Any water that seeps from specimen included in mass? _____ _____
3. Mass of volumeter filled with distilled water at 25 ±1°C (77 ±2°F) determined? _____ _____
4. SSD specimen placed into volumeter and let stand for 1 minute? _____ _____
5. Temperature of water brought to 25 ±1°C (77 ±2°F) and volumeter covered, allowing some water to escape through the capillary bore of the tapered lid? _____ _____
6. Volumeter wiped dry, and mass of volumeter and contents determined? _____ _____
7. G_{mb} calculated to the nearest 0.001? _____ _____
8. Absorption calculated to the nearest 0.01 percent? _____ _____

Method C/A:

1. Immersed weight determined.
   a. Water at 25 ±1°C (77 ±2°F)? _____ _____
   b. Immersed, shaken, on side, for 4 ±1 minutes? _____ _____
   c. Immersed weight determined to 0.1 g? _____ _____
2. Sample rapidly surface dried with damp cloth (within 5 sec.)? _____ _____
3. Saturated surface dry mass determined to 0.1 g? _____ _____
4. Dry mass determined by:
   a. Heating in oven at 110 ± 5 C (230 ± 9 F)? _____ _____
   b. Breaking down to 6.3 mm (¼ in.) particles? _____ _____
   c. Drying in oven to constant mass (change less than 0.05 percent in 2 hours of additional drying)? _____ _____
   d. Cooled in air to 25 ±5°C (77 ±9°F) and mass determined to 0.1 g? _____ _____
5. G_{mb} calculated to the nearest 0.001? _____ _____
6. Absorption calculated to the nearest 0.01? _____ _____

OVER

Procedure Element	Trial 1	Trial 2

Method C/B:

1. Saturated surface-dry (SSD) mass determined to 0.1g.
   a. Immersed at least 10 minutes at 25 ±1°C (77 ±2°F)? _____ _____
   b. Sample rapidly dried with damp towel (within 5 sec.)? _____ _____
   c. Specimen mass determined to 0.1g? _____ _____
   d. Any water that seeps from specimen included in mass? _____ _____
2. Mass of volumeter filled with distilled water at 25 ±1°C (77 ±2°F) determined to 0.1 g? _____ _____
3. SSD specimen placed into volumeter and let stand for 1 minute? _____ _____
4. Temperature of water brought to 25 ±1°C (77 ±2°F) and volumeter covered, allowing some water to escape through the capillary pore of the tapered lid? _____ _____
5. Volumeter wiped dry, and mass of volumeter and contents determined to 0.1 g? _____ _____
6. Dry mass determined by:
   a. Heating in oven at 110 ± 5 C (230 ± 9 F)? _____ _____
   b. Breaking down to 6.3 mm (¼ in.) particles? _____ _____
   c. Drying in oven to constant mass (change less than 0.05 percent in 2 hours of additional drying)? _____ _____
   d. Cooled in air to 25 ±5°C (77 ±9°F) and mass determined to 0.1 g? _____ _____
7. G_{mb} calculated to the nearest 0.001? _____ _____
8. Absorption calculated to the nearest 0.01 percent? _____ _____

Comments: First attempt: Pass____Fail_________ Second attempt: Pass______Fail______

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Examiner Signature ________________________________WAQTC #:_______________

SAMPLING ASPHALT MATERIALS
WFOP AASHTO R 66

Scope

This procedure covers obtaining samples of liquid asphalt materials in accordance with AASHTO R 66-16. Sampling of solid and semi-solid asphalt materials – included in AASHTO R 66 – is not covered here.

Agencies may be more specific on exactly who samples, where to sample, and what type of sampling device to use.

Warning: Always use appropriate safety equipment and precautions for hot liquids.

Terminology

- Asphalt binder: Asphalt cement or modified asphalt cement that binds the aggregate particles into a dense mass.
- Asphalt emulsion: A mixture of asphalt binder and water.
- Cutback asphalt: Asphalt binder that has been modified by blending with a chemical solvent.

Containers

Sample containers must be new, and the inside may not be washed or rinsed. The outside may be wiped with a clean, dry cloth.

All samples shall be put in 1 L (1 qt) containers and properly identified on the outside of the container with contract number, date sampled, data sheet number, brand and grade of material, and sample number. Include lot and sublot numbers when appropriate.

- Emulsified asphalt: Use wide-mouth plastic jars with screw caps. Protect the samples from freezing since water is a part of the emulsion. The sample container should be completely filled to minimize a skin formation on the sample.
- Asphalt binder and cutbacks: Use metal cans

Note: The sample container shall not be submerged in solvent, nor shall it be wiped with a solvent saturated cloth. If cleaning is necessary, use a clean dry cloth.

Procedure

1. Coordinate sampling with contractor or supplier.
2. Allow a minimum of 4 L (1 gal) to flow before obtaining samples.
3. Obtain samples of:
   - Asphalt binder from the line between the storage tank and the mixing plant while the plant is in operation, or from the delivery truck.
   - Cutback and emulsified asphalt from distributor spray bar or application device; or from the delivery truck before it is pumped into the distributor. Sample emulsified asphalt at delivery or before dilution.

Report

- On standard agency forms
- Sample ID
- Date
- Time
- Location
- Quantity represented

PREPARING AND DETERMINING THE DENSITY OF ASPHALT MIXTURE SPECIMENS BY MEANS OF THE SUPERPAVE GYRATORY COMPACTOR
IWFOP AASHTO T 312

This method modifies the Western Alliance for Quality Transportation (WAQTC) Field Operations Procedure (FOP) for AASHTO T 312. The Idaho Transportation Department has implemented specific changes detailed in the following procedure. Adherence to this modified procedure is mandatory for all Idaho projects, superseding the original WAQTC FOP.

Sample Preparation - Laboratory Prepared Asphalt Mixtures

Add the following:

Determine the average mass necessary to produce a trial specimen that achieves the required height. Report this mass in the Mix Design submittal.

When compacting laboratory-produced asphalt mixtures, the initial dry mass of each specimen shall not vary more than 30.0 grams from the mass determined in the Mix Design to achieve the height requirement.

PLANT PRODUCED ASPHALT MIXTURES

Delete the 2nd bullet and substitute the following:

- Obtain the sample in accordance with IWFOP AASHTO R 97.

Delete the 3nd bullet and substitute the following:

- Reduce the sample in accordance with IWFOP AASHTO R 47.

Delete the 4th bullet and substitute the following:

- The final test result will be determined from an average of two replicate specimens.
- The initial dry mass of each specimen shall not vary more than 30.0 grams from the mass determined in the Mix Design to achieve the height requirement.

Delete Step 3 and substitute the following:

3. Heat the material in a covered container until it reaches a temperature within the compaction range specified in the mix design.

PREPARING AND DETERMINING THE DENSITY OF ASPHALT MIXTURE SPECIMENS BY MEANS OF THE SUPERPAVE GYRATORY COMPACTOR
WFOP AASHTO T 312

Scope

This procedure covers preparing specimens, using samples of plant produced asphalt mixtures, for determining the mechanical and volumetric properties of asphalt mixtures in accordance with AASHTO T 312-22.

Apparatus

- Superpave Gyratory Compactor (SGC) meeting the requirements of AASHTO T 312
- Molds meeting the requirements of AASHTO T 312
- Chute, mold funnel or both (Optional)
- Scale meeting the requirements of AASHTO M 231 Class G 5
- Oven, thermostatically controlled, capable of maintaining set temperature within ±3ºC (±5ºF)
- Thermometers with a temperature range of at least 10 to 230°C (50 - 450°F) and accurate to ±1ºC (±2°F)

Note 1: Non-Contact thermometers are not acceptable.

- Miscellaneous pans, spoons, spatulas, hot pads, gloves, paper discs, markers, etc.

Equipment Requirements

The calibration shall be performed on the SGC per the Manufacturer's instructions. See agency requirements for the calibration frequency.

The mold and base plate dimensions shall be checked every twelve months or 80 hours of operation to determine that they are within the tolerances listed in AASHTO T 312.

Equipment Preparation

Prepare the equipment in accordance with manufacturer's recommendations. At a minimum preparation includes:

- Warm-up gyratory compactor
- Verify machine settings
  - Internal Angle: 1.16 ±0.02°
  - Ram Pressure: 600 ±18 kPa

- Number of gyrations

Note 2: The number of gyrations (N_{des}) is obtained from the Job Mix Formula (JMF).

- Lubricate bearing surfaces
- Prepare recording device as required
- Pre-heat molds and plates at the compaction temperature range (minimum of 30 min.) or before reuse reheat (minimum of 5 min.)

Note 3: The use of multiple molds will speed up the compaction process.

- Pre-heat chute, mold funnel, spatulas, and other apparatus (not to exceed the maximum compaction temperature)

Sample Preparation

Laboratory Prepared Asphalt Mixtures

This is a sample produced during the Mix Design process using aggregate and binder that is combined in the laboratory. When designing asphalt mixtures using the gyratory compactor, refer to AASHTO T 312 and AASHTO R 35.

Plant Produced Asphalt Mixtures

- Determine initial sample size, number of gyrations (N_{des}), and compaction temperature range from the Job Mix Formula (JMF).
- Obtain the sample in accordance with the FOP for AASHTO R 97.
- Reduce the sample in accordance with the FOP for AASHTO R 47.
- The sample size should be such that it results in a compacted specimen that is 115 ±5 mm at the desired number of gyrations.

Note 4: Replicate specimens are generally prepared. Refer to agency requirements.

If the material is not in the compaction temperature range:

1. Place the appropriate sample mass into a container.
2. Spread to a depth of 1 to 2 in. for even heating of mixture.
3. Place in the oven until the material is within the compaction temperature range.

Note 5: The material properties may be altered when the times of delivery of the test sample and the placement of the material on the roadway are different.

Compaction Procedure

Follow the manufacturer's recommended loading procedure. This may require the steps below to be performed in a different order. Steps 1 through 8 must be performed before the sample and mold cools below minimum compaction temperature.

1. Remove pre-heated mold and plate(s) from the oven (verify mold and plate(s) has been cleaned if previously used).
2. Place the base plate and paper disc in bottom of mold.
3. Place the mix into the mold in a single lift (care should be taken to avoid segregation or loss of material).
4. Level the mix in the mold.
5. Place a paper disc and the heated upper plate (if required) on top of the leveled sample.
6. Load the mold into the compactor, check settings.
7. Start the compaction process.
    a. Check the pressure (600 ±18 kPa).
    b. Check the angle (1.16 ±0.02°).
8. Extrude the specimen from the mold; a brief cooling period may be necessary before fully extruding some specimens to ensure the specimens are not damaged.

Note 6: Clean molds after each use.

9. Upon completion of the compaction process, record the number of gyrations and specimen height.

Note 7: If the specimen is not 115 ±5 mm, follow agency requirements.

10. Carefully remove the paper discs.
11. Cool the compacted specimen to room temperature.
12. Identify the specimen with chalk or other marker.

Report

- On forms approved by the agency
- Sample ID
- Number of gyrations
- Specimen height to the nearest 0.1 mm

PERFORMANCE EXAM CHECKLIST

PREPARING AND DETERMINING THE DENSITY OF ASPHALT MIXTURE SPECIMENS BY MEANS OF THE SUPERPAVE GYRATORY COMPACTOR
FOP FOR AASHTO T 312

Participant Name ___________________________________ Exam Date _______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Gyratory warmed up?	_____	_____
2. Angle, pressure and number of gyrations set?	_____	_____
3. Bearing surfaces lubricated?	_____	_____
4. Representative sample obtained according to the FOP for AASHTO R 97?	_____	_____
5. Sample reduced according to FOP AASHTO R 47?	_____	_____
6. Sample placed in a container and spread to 1 or 2 inches thick for even heating?	_____	_____
7. Asphalt mixture heated to within compaction temperature range?	_____	_____
8. Mold, base plate, and upper plate heated to compaction temperature range?	_____	_____
9. Mold, base plate, and upper plate (if required) removed from oven and paper disk placed on bottom of mold?	_____	_____
10. Mix placed into mold in one lift without segregation?	_____	_____
11. Paper disk placed on top of the asphalt mixture?	_____	_____
12. Mold placed into compactor and upper plate clamped into place?	_____	_____
13. Pressure applied at 600 kPa ±18 kPa?	_____	_____
14. Specified number of gyrations applied?	_____	_____
15. Proper angle confirmed from display?	_____	_____
16. Compacted specimen removed from mold, paper disc(s) removed, and allowed to cool to room temperature?	_____	_____
17. Specimen height and number of gyrations recorded?	_____	_____

Comments: First attempt: Pass____Fail_____ Second attempt: Pass______Fail______

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Examiner Signature _________________________________WAQTC #:_______________

VOLUMETRIC PROPERTIES OF ASPHALT MIXTURES
IWFOP WAQTC TM 13

This method modifies the Western Alliance for Quality Transportation (WAQTC) Field Operations Procedure (FOP) for WAQTC TM 13. The Idaho Transportation Department has implemented specific changes detailed in the following procedure. Adherence to this modified procedure is mandatory for all Idaho projects, superseding the original WAQTC FOP.

Definition of Terms

Delete the following:

Va = air Voids (Voids air)

Add the following:

Pa = Air Voids: The Asphalt Institute MS-2, 7th Edition introduces Pa to represent air voids. ITD has adopted this standard, and Pa will be used throughout this procedure. Historically, Va was used for this purpose, and it may be encountered in other publications.

Table 1

Modify Table 1 as follows:

In Table 1, under the 'Data' column, locate the row for 'Gsb.' Replace the existing entry in the 'Test Method' column for 'Gsb' with 'WAQTC FOP for AASHTO T 85, Idaho IT-144, Idaho IT-146'.

Air Voids (Va)

Replace:

Air Voids (Va)

with:

Air Voids (Pa)

Add the following:

Asphalt Institute MS-2, 7th Edition now uses the following equation to calculate Air Voids. They are mathematically equivalent and the use of either is acceptable.

$$P_a = 100 - \left(\frac{100 - G_{mb}}{G_{mm}}\right)$$

VOLUMETRIC PROPERTIES OF ASPHALT MIXTURES
WFOP WAQTC TM 13

Scope

This procedure covers the determination of volumetric properties of plant produced asphalt mixtures, i.e., air voids (V_a), voids in mineral aggregate (VMA), voids filled with asphalt binder (VFA), effective asphalt binder content (P_{be}) and Dust to Binder Ratio ($P_{\#200}/P_{be}$). The in-production volumetric properties are then compared to agency specifications.

Definition of Terms

- G_{mm} = theoretical maximum specific gravity (Gravity $_{mix\ max}$)
- G_{mb} = measured bulk specific gravity (Gravity $_{mix\ bulk}$)
- G_{sb} = oven-dry bulk specific gravity of aggregate (Gravity $_{stone\ bulk}$)
- G_{sa} = apparent specific gravity of aggregate (Gravity $_{stone\ apparent}$)
- G_{se} = effective specific gravity of aggregate (Gravity $_{stone\ effective}$)
- G_b = specific gravity of the binder (Gravity $_{binder}$)
- V_a = air Voids (Voids $_{air}$)
- VMA = Voids in Mineral Aggregate
- VFA = Voids Filled with Asphalt (binder)
- V_{ba} = absorbed binder volume (Voids $_{binder\ absorbed}$)
- V_{be} = effective binder volume (Voids $_{binder\ effective}$)
- P_b = percent binder content (Percent $_{binder}$)
- P_{ba} = percent absorbed binder (Percent $_{binder\ absorbed}$)
- P_{be} = percent effective binder content (Percent $_{binder\ effective}$)
- P_s = percent of aggregate (Percent $_{stone}$)
- DP = Dust proportion to effective binder ratio ($P_{\#200}/P_{be}$)

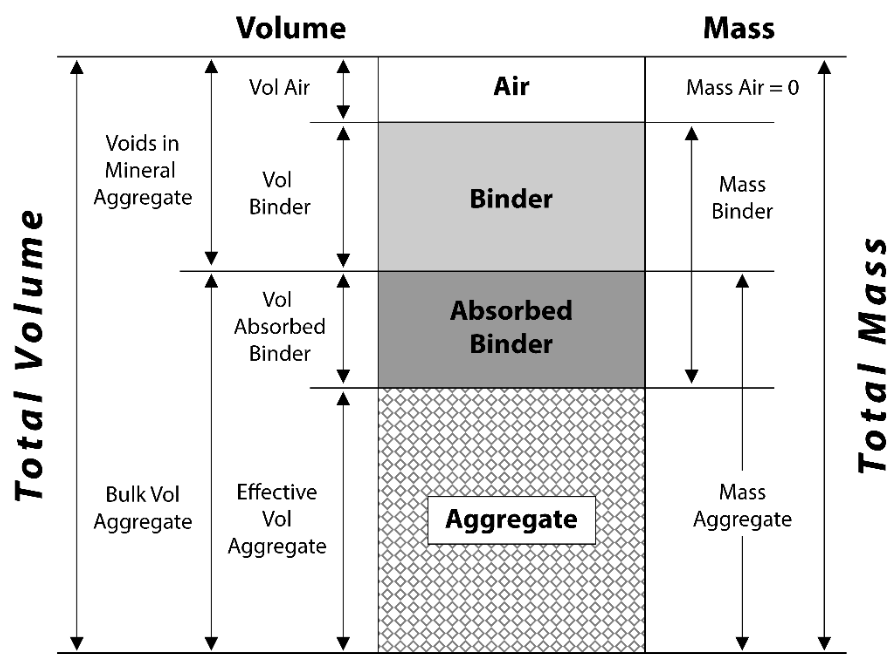
Background

Whether a mix design is developed through a Marshall, Hveem, or Superpave mix design process there are basic volumetric requirements of all. Volumetric properties are the properties of a defined material contained in a known volume. Asphalt mixture volumetric properties can include bulk specific gravity, theoretical maximum specific gravity, air voids, and voids in mineral aggregate.

Many agencies specify values of the volumetric properties to ensure optimum performance of the pavement. The asphalt mixture must be designed to meet these criteria. In production the asphalt mixture is evaluated to determine if the mix still meets the specifications and is consistent with the original mix design (JMF). The production asphalt mixture may vary from the mix design and may need to be modified to meet the specified volumetric criteria.

To compare the in-production volumetric properties to agency specifications and the JMF a sample of loose asphalt mixture mix is obtained in accordance with FOP for AASHTO R 97. The sample is then compacted in a gyratory compactor to simulate the in-place asphalt mixture pavement after it has been placed, compacted, and endured several years of traffic. The volumetric properties of the compacted specimen are determined.

Asphalt mixture phase diagram

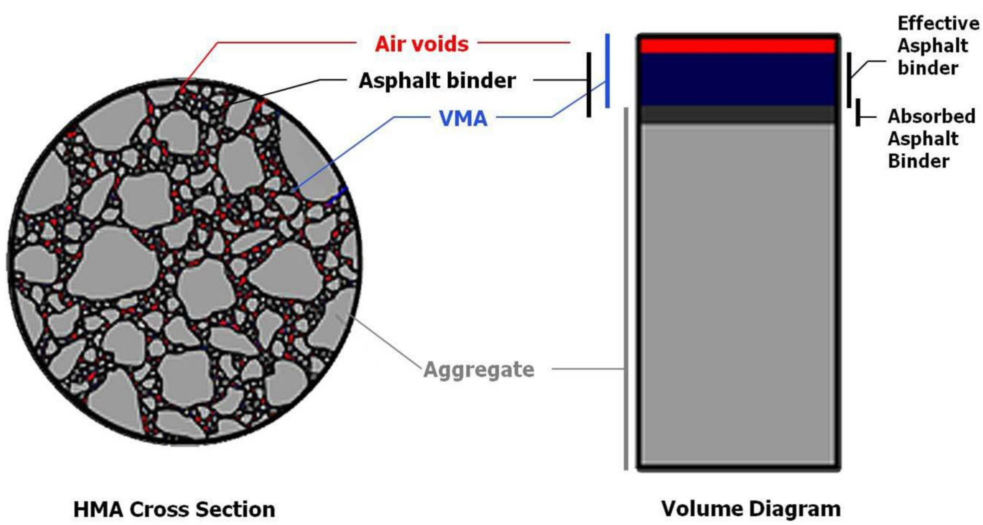


Each of the properties in the asphalt mixture phase diagram can be measured or calculated. For example: The mass of the aggregate is measured; the voids in mineral aggregate (VMA) is calculated; total asphalt binder can be measured but the amount available to act as an effective binder in the mix must be calculated because it is the quantity left after the aggregate has absorbed some of the asphalt binder.

The volumetric proportions of the asphalt binder and aggregate components of an asphalt mixture and their relationship to the other components are considered. The mass of the components and their specific gravities are used to determine the volumes of each of the components in the mix. The volumetric properties of a compacted asphalt mixture: air voids (V_a), voids in mineral aggregate (VMA), voids filled with asphalt binder (VFA), and effective asphalt binder content (P_{be}) provide some indication of the mixture's probable performance.

Volumetric Properties

Volumetric Relationship of Asphalt Mixture Constituents



Required Values

The specific gravities listed in Table 1 and the percent by mass of each of the components in the asphalt mixture are needed to determine the volumetric properties. Other values required are also listed. Some of these values are obtained from the JMF and some are measured from a plant produced asphalt mixture sample.

Table 1

Data	Test Method	Obtained
G_{sb} - combined aggregate bulk specific gravity	AASHTO T 84 / T 85 or agency approved test method	JMF or performed at the beginning of placement
G_b – measured specific gravity of the asphalt binder	AASHTO T 228	JMF or from the supplier
G_{mm} – measured maximum specific gravity of the loose mix	FOP for AASHTO T 209	Performed on the field test sample
G_{mb} – measured bulk specific gravity of the compacted paving mix	FOP for AASHTO T 166	Performed on the field compacted specimen
P_b – percent asphalt binder	FOP for AASHTO T 308	Performed on the field test sample
$P_{-\#200}$ – aggregate passing the #200 (75 µm) sieve	FOP for AASHTO T 30	Performed on the field test sample

Air Voids (V_a)

Air voids are the total volume of the small pockets of air between the coated aggregate particles throughout a compacted paving mixture. Appropriate air voids contribute to the stability of the asphalt mixture and help the pavement withstand the combined action of environment and traffic loads. The designated percent air voids allows for thermal expansion of the asphalt binder and contributes a cushion for future compaction. Air voids are expressed as a percent of the bulk volume of the compacted mixture (G_{mb}) when compared to the maximum specific gravity (G_{mm}).

$$V_a = 100\left[\frac{(G_{mm} - G_{mb})}{G_{mm}}\right]$$

Where:

V_a = air voids in compacted mixture, percent of total volume (report to 0.1)

G_{mm} = maximum specific gravity of paving mixture (AASHTO T 209)

G_{mb} = bulk specific gravity of compacted mixture (AASHTO T 166)

Percent Aggregate (Stone) (P_s)

P_s is the percent aggregate (stone) content, expressed as a percentage of the total mass of the sample.

$$P_s = 100 - P_b$$

Where:

P_s = percent aggregate (stone) percent by total weight

P_b = asphalt binder content (AASHTO T 308)

Voids in the Mineral Aggregate (VMA)

VMA is the volume of intergranular void space between the aggregate particles of the compacted paving mixture that includes the air voids and the effective binder content, expressed as a percent of the total volume of the sample.

$$VMA = 100 - \left[\frac{(G_{mb} \times P_s)}{G_{sb}}\right]$$

Where:

VMA = voids in mineral aggregate, percent of bulk volume (report to 0.1)

G_{sb} = bulk specific gravity of combined aggregate (AASHTO T 85 / T 84 or agency approved method from Job Mix Formula)

G_{mb} = bulk specific gravity of compacted mixture (AASHTO T 166)

P_s = aggregate content, percent by total weight = 100 – P_b

P_b = asphalt binder content (AASHTO T 308) percent by total weight

Voids Filled with Asphalt (binder) (VFA)

VFA is the volume of space between the aggregate particles of the compacted paving mixture filled with asphalt binder, expressed as a percent of the total volume of the sample. The VFA increases as the asphalt binder content increases as it is the percent of voids that are filled with asphalt which doesn't include the absorbed asphalt.

$$VFA = 100\left[\frac{(VMA - V_a)}{VMA}\right]$$

Where:

VFA = voids filled with asphalt, percent of VMA (report to 1)

VMA = voids in mineral aggregate, percent of bulk volume

V_a = air voids in compacted mixture, percent of total volume.

Effective Specific Gravity of the Aggregate (Stone) (G_{se})

The G_{se} is used to quantify the asphalt binder absorbed into the aggregate particle. This is a calculated value based on the specific gravity of the mixture, G_{mm}, and the specific gravity of the asphalt binder, G_b This measurement includes the volume of the aggregate particle plus the void volume that becomes filled with water during the test soak period minus the volume of the voids that absorb asphalt binder. Effective specific gravity lies between apparent and bulk specific gravity.

G_{se} is formally defined as the ratio of the mass in air of a unit volume of a permeable material (excluding voids permeable to asphalt binder) at a stated temperature to the mass in air (of equal density) of an equal volume of gas-free distilled water at a stated temperature.

$$G_{se} = \frac{P_s}{\left[\left(\frac{100}{G_{mm}}\right) - \left(\frac{P_b}{G_b}\right)\right]}$$

Where:

G_{se} = effective specific gravity of combined aggregate (report to 0.001)

P_s = aggregate content, percent by total weight = 100 – P_b

G_{mm} = maximum specific gravity of mix (AASHTO T 209)

P_b = asphalt binder content (AASHTO T 308) percent by total weight

G_b = specific gravity of asphalt binder (JMF or asphalt binder supplier)

Percent of Absorbed (asphalt) Binder (P_{ba})

P_{ba} is the total percent of the asphalt binder that is absorbed into the aggregate, expressed as a percentage of the mass of aggregate rather than as a percentage of the total mass of the mixture. This portion of the asphalt binder content does not contribute to the performance of the mix.

$$P_{ba} = 100\left[\frac{(G_{se} - G_{sb})}{(G_{sb} \times G_{se})}\right] G_b$$

Where:

P_{ba} = absorbed asphalt binder (report to 0.01) percent of aggregate

G_{se} = effective specific gravity of combined aggregate

G_{sb} = bulk specific gravity of combined aggregate (AASHTO T 85 / T 84 or agency approved method from Job Mix Formula)

G_b = specific gravity of asphalt binder (JMF or asphalt binder supplier)

Percent of Effective (asphalt) Binder (P_{be})

P_{be} is the total asphalt binder content of a paving mixture minus the portion of asphalt binder that is lost by absorption into the aggregate particles, expressed as a percentage of the mass of aggregate. It is the portion of the asphalt binder content that remains as a coating on the outside of the aggregate particles. This is the asphalt content that controls the performance of the mix.

$$P_{be} = P_b - \left[\frac{P_{ba}}{100} \times P_s\right]$$

Where:

P_{be} = effective asphalt binder content (report to 0.01), percent by total weight

P_s = aggregate content, percent by total weight = 100 – P_b

P_b = asphalt binder content (AASHTO T 308) percent by total weight

P_{ba} = absorbed asphalt binder

Dust Proportion – DP (Dust to Effective (asphalt) Binder Ratio)

The DP is the percent passing the No. 200 sieve of the gradation divided by the percent of effective asphalt binder. Excessive dust reduces asphalt binder film thickness on the aggregate which reduces the durability. Insufficient dust may allow excessive asphalt binder film thickness, which may result in a tender, unstable mix.

$$DP = \frac{P_{-\#200}}{P_{be}}$$

Where:

DP = Dust Proportion, (dust-to-binder ratio) (report to 0.01)

$P_{-\#200}$ = aggregate passing the -#200 (75 µm) sieve, percent by mass of aggregate (AASHTO T 30)

P_{be} = effective asphalt binder content, percent by total weight

Mix Design and Production Values

Job Mix Formula

Table 2 includes example data required from the JMF. Some of these values are used in the example calculations.

Note: Some of the targets may change after the asphalt mixture is in production based on field test data.

Table 2

JMF Data	
Asphalt binder grade	PG 64-28
N_{values}	N_{ini} = 7 **N_{des} = 75** N_{max} = 115
G_{sb} (combined specific gravity of the aggregate)	2.678
Target P_b	4.75%
Initial sample mass for gyratory specimens	4840 grams
Mixing temperature range	306 – 312 °F
Laboratory compaction temperature range	286 – 294 °F
G_b (specific gravity of the asphalt binder)	1.020
Target gradation	
Sieve Size mm (in.)	**Percent Passing**
19.0 (3/4)	100
12.5 (1/2)	85
9.5 (3/8)	80
4.75 (No. 4)	50
2.36 (No. 8)	30
01.18 (No. 16)	25
0.600 (No. 30)	15
0.300 (No. 50)	10
0.150 (No. 100)	7
75 µm (No. 200)	5.0

Sample Test Result

Tables 3 and 4 include data from test results performed on a field sample of asphalt mixture used in the example calculations.

Table 3

Field Data		
	Test method	**Example values**
P_b	FOP for AASHTO T 308	4.60%
G_{mb}	FOP for AASHTO T 166	2.415
G_{mm}	FOP for AASHTO T 209	2.516

Table 4

Sieve Analysis FOP for AASHTO T 30	
Sieve Size mm (in.)	**Percent Passing**
19.0 (3/4)	100
12.5 (1/2)	86
9.5 (3/8)	77
4.75 (No. 4)	51
2.36 (No. 8)	34
01.18 (No. 16)	23
0.600 (No. 30)	16
0.300 (No. 50)	12
0.150 (No. 100)	8
75 µm (No. 200)	4.9

Sample Calculations

Air Voids (V_a)

$$V_a = 100\left[\frac{(G_{mm} - G_{mb})}{G_{mm}}\right]$$

$$V_a = 100\left[\frac{(2.516 - 2.415)}{2.516}\right] = 4.01431\ report\ 4.0$$

Given:

G_{mm} = 2.516

G_{mb} = 2.415

Percent Aggregate (Stone) (P_s)

$$P_s = 100 - P_b$$

$$P_s = 100.0 - 4.60 = 95.40$$

Given:

P_b = 4.60

Voids in the Mineral Aggregate (VMA)

$$VMA = 100 - \left[\frac{(G_{mb} \times P_s)}{G_{sb}}\right]$$

$$VMA = 100.0 - \left[\frac{2.415 \times 95.40)}{2.678}\right] = 13.96\, report\ 14.0$$

Given:

G_{sb} =2.678

Voids Filled with Asphalt (binder) (VFA)

$$VFA = 100\left[\frac{(VMA - V_a)}{VMA}\right]$$

$$VFA = 100\left[\frac{(14.0 - 4.0)}{14.0}\right] = 71.4\, report\ 71$$

Effective Specific Gravity of the Aggregate (Stone) (G_{se})

$$G_{se} = \frac{P_s}{\left[\left(\frac{100}{G_{mm}}\right) - \left(\frac{P_b}{G_b}\right)\right]}$$

$$G_{se} = \frac{(100 - 4.60)}{\left[\left(\frac{100}{2.516}\right) - \left(\frac{4.60}{1.020}\right)\right]} =$$

$$G_{se} = \frac{95.40}{39.74563 - 4.50980} = 2.70747\ report\ 2.707$$

Given:

G_b = 1.020

Percent of Absorbed (asphalt) Binder (P_{ba})

$$P_{ba} = 100\left[\frac{(G_{se} - G_{sb})}{(G_{sb} \times G_{se})}\right] G_b$$

$$P_{ba} = 100\left[\frac{(2.707 - 2.678)}{(2.678 \times 2.707)}\right] 1.020 =$$

$$P_{ba} = 100\left[\frac{0.0290}{7.24935}\right] 1.020 = 0.40804\ report\ 0.41$$

Percent of Effective (asphalt) Binder (P_{be})

$$P_{be} = P_b - \left[\frac{P_{ba}}{100} \times P_s\right]$$

$$P_{be} = 4.60 - \left[\frac{0.41}{100} \times (100 - 4.60)\right] = 4.20886\ report\ 4.21$$

Dust Proportion – DP (Dust to Effective (asphalt) Binder Ratio)

$$DP = \frac{P_{-\#200}}{P_{be}}$$

$$DP = \frac{4.9}{4.21} = 1.16390\ report\ 1.16$$

Given:

$P_{-\#200}$ = 4.9

Report

- On forms approved by the agency
- Sample ID
- Air Voids, V_a to the nearest 0.1 percent
- Voids in the Mineral Aggregate, VMA to the nearest 0.1 percent
- Voids Filled with Asphalt, VFA to the nearest whole value
- Effective Specific Gravity of Aggregate (stone), G_{se} to the nearest 0.001
- Percent of Absorbed (asphalt) Binder, P_{ba} to the nearest 0.01
- Percent Effective (asphalt) Binder, P_{be} to the nearest 0.01
- Dust Proportion, DP to the nearest 0.01

Appendix - Formulas

Air Voids (V_a)

$$V_a = 100\left[\frac{(G_{mm} - G_{mb})}{G_{mm}}\right]$$

Where:

V_a = air voids in compacted mixture, percent of total volume (report to 0.1)

G_{mm} = maximum specific gravity of paving mixture (AASHTO T 209)

G_{mb} = bulk specific gravity of compacted mixture (AASHTO T 166)

Percent Aggregate (Stone) (P_s)

$$P_s = 100 - P_b$$

Where:

P_s = percent aggregate (stone) percent by total weight

P_b = asphalt binder content (AASHTO T 308)

Voids in the Mineral Aggregate (VMA)

$$VMA = 100 - \left[\frac{(G_{mb} \times P_s)}{G_{sb}}\right]$$

Where:

VMA = voids in mineral aggregate, percent of bulk volume (report to 0.1)

G_{sb} = bulk specific gravity of combined aggregate (AASHTO T 85 / T 84 or agency approved method from Job Mix Formula)

G_{mb} = bulk specific gravity of compacted mixture (AASHTO T 166)

P_s = aggregate content, percent by total weight = 100 – P_b

P_b =asphalt binder content (AASHTO T 308) percent by total weight

Voids Filled with Asphalt (binder) (VFA)

$$VFA = 100\left[\frac{(VMA - V_a)}{VMA}\right]$$

Where:

VFA = voids filled with asphalt, percent of VMA (report to 1)

VMA = voids in mineral aggregate, percent of bulk volume

V_a = air voids in compacted mixture, percent of total volume.

Effective Specific Gravity of the Aggregate (Stone) (G_{se})

$$G_{se} = \frac{P_s}{\left[\left(\frac{100}{G_{mm}}\right) - \left(\frac{P_b}{G_b}\right)\right]}$$

Where:

G_{se} = effective specific gravity of combined aggregate (report to 0.001)

P_s = aggregate content, percent by total weight = 100 – P_b

G_{mm} = maximum specific gravity of mix (AASHTO T 209)

P_b = asphalt binder content (AASHTO T 308) percent by total weight

G_b = specific gravity of asphalt binder (JMF or asphalt binder supplier)

Percent of Absorbed (asphalt) Binder (P_{ba})

$$P_{ba} = 100\left[\frac{(G_{se} - G_{sb})}{(G_{sb} \times G_{se})}\right]G_b$$

Where:

P_{ba} = absorbed asphalt binder (report to 0.01) percent of aggregate

G_{se} = effective specific gravity of combined aggregate

G_{sb} = bulk specific gravity of combined aggregate (AASHTO T 85 from Job Mix Formula)

G_b = specific gravity of asphalt binder (JMF or asphalt binder supplier)

Percent of Effective (asphalt) Binder (P_{be})

$$P_{be} = P_b - \left[\frac{P_{ba}}{100} \times P_s\right]$$

Where:

P_{be} = effective asphalt binder content (report to 0.01), percent by total weight

P_s = aggregate content, percent by total weight = 100 – P_b

P_b = asphalt binder content (AASHTO T 308) percent by total weight

P_{ba} = absorbed asphalt binder

Dust Proportion – DP (Dust to Effective (asphalt) Binder Ratio)

$$DP = \frac{P_{-\#200}}{P_{be}}$$

Where:

DP = Dust Proportion, (dust-to-binder ratio) (report to 0.01)

$P_{-\#200}$ = aggregate passing the -#200 (75 µm) sieve, percent by mass of aggregate (AASHTO T 30)

P_{be} = effective asphalt binder content, percent by total weight

570.03 - CONCRETE

570.03 - CONCRETE

SAMPLING FRESHLY MIXED CONCRETE
WAQTC TM 2

Scope

This practice covers procedures for obtaining representative samples of fresh concrete delivered to the project site. The practice includes sampling from stationary, paving and truck mixers, and from agitating and non-agitating equipment used to transport central mixed concrete.

This practice also covers the removal of large aggregate particles by wet sieving.

Sampling concrete may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices.

Warning—Fresh Hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

Apparatus

- Receptacle: wheelbarrow, bucket or other suitable container that does not alter the properties of the material being sampled
- Sample cover (plastic, canvas, or burlap)
- Shovel
- Cleaning equipment, including scrub brush, rubber gloves, water
- Apparatus for wet sieving, including: a sieve(s), meeting the requirements of WFOP AASHTO T 27/T 11, minimum of 2 ft^2 (0.19 m^2) of sieving area, conveniently arranged and supported so that the sieve can be shaken rapidly by hand.

Procedure

1. Use every precaution in order to obtain samples representative of the true nature and condition of the concrete being placed being careful not to obtain samples from the very first or very last portions of the batch. The size of the sample will be 1.5 times the volume of concrete required for the specified testing, but not less than 0.03 m^3 (1 ft^3).
2. Dampen the surface of the receptacle just before sampling, empty any excess water.

Note 1: Sampling should normally be performed as the concrete is delivered from the mixer to the conveying vehicle used to transport the concrete to the forms; however, specifications may require other points of sampling, such as at the discharge of a concrete pump.

3. Use one of the following methods to obtain the sample:

- **Sampling from stationary mixers**

  Obtain the sample after a minimum of 1/2 m^3 (1/2 yd^3) of concrete has been discharged. Perform sampling by passing a receptacle completely through the discharge stream, or by completely diverting the discharge into a receptacle. Take care not to restrict the flow of concrete from the mixer, container, or transportation unit so as to cause segregation. These requirements apply to both tilting and non-tilting mixers.

- **Sampling from paving mixers**

  Obtain the sample after the contents of the paving mixer have been discharged. Obtain increments from at least five different locations in the pile and combine into one test sample. Avoid contamination with subgrade material or prolonged contact with absorptive subgrade. To preclude contamination or absorption by the subgrade, the concrete may be sampled by placing a shallow container on the subgrade and discharging the concrete across the container.

- **Sampling from revolving drum truck mixers or agitators**

  Obtain the sample after a minimum of 1/2 m^3 (1/2 yd^3) of concrete has been discharged. Obtain sample after all of the water has been added to the mixer. Do not obtain sample from the very first or last portions of the batch discharge. Perform sampling by repeatedly passing a receptacle through the entire discharge stream or by completely diverting the discharge into a receptacle. Regulate the rate of discharge of the batch by the rate of revolution of the drum and not by the size of the gate opening.

- **Sampling from open-top truck mixers, agitators, non-agitating equipment, or other types of open-top containers**

  Obtain the sample by whichever of the procedures described above is most applicable under the given conditions.

- **Sampling from pump or conveyor placement systems**

  Obtain sample after a minimum of 1/2 m^3 (1/2 yd^3) of concrete has been discharged. Obtain sample after all of the pump slurry has been eliminated. Perform sampling by repeatedly passing a receptacle through the entire discharge system or by completely diverting the discharge into a receptacle. Do not lower the pump arm from the placement position to ground level for ease of sampling, as it may modify the air content of the concrete being sampled. Do not obtain samples from the very first or last portions of the batch discharge.

4. Transport sample to the testing location.
5. Remix with a shovel the minimum amount necessary to ensure uniformity. Protect the sample from direct sunlight, wind, rain, and sources of contamination.

6. Complete test for temperature and start tests for slump and air content within 5 minutes of obtaining the sample. Start molding specimens for strength tests within 15 minutes of obtaining the sample. Complete the test methods as expeditiously as possible.

Wet Sieving

When required due to oversize aggregate, the concrete sample shall be wet sieved, after transporting but prior to remixing, for slump testing, air content testing or molding test specimens, by the following:

1. Place the sieve designated by the test procedure over the dampened receptacle.
2. Pass the concrete over the designated sieve. Do not overload the sieve (one particle thick).
3. Shake or vibrate the sieve until no more material passes the sieve. A horizontal back and forth motion is preferred.
4. Discard oversize material including all adherent mortar.
5. Repeat until sample of sufficient size is obtained. Mortar adhering to the wet-sieving equipment shall be included with the sample.
6. Using a shovel, remix the sample the minimum amount necessary to ensure uniformity.

Note 2: Wet sieving is not allowed for samples being used for density determinations according to the WFOP AASHTO T 121.

Report

- On forms approved by the agency
- Sample ID
- Date
- Time
- Location
- Quantity represented

PERFORMANCE EXAM CHECKLIST (ORAL)

SAMPLING FRESHLY MIXED CONCRETE
WAQTC TM 2

Participant Name ______________________________Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. What is the minimum sample size?		
a. 0.03 m^3 or 1 ft^3	_____	_____
2. Describe the surface of the receptacle before the sample is introduced into it?		
a. It must be dampened.	_____	_____
3. Describe how to obtain a representative sample from a drum mixer.		
a. Sample the concrete after 1/2 m3 (1/2 yd3) has been discharged.	_____	_____
b. Pass receptacle through entire discharge stream or completely divert discharge stream into sampling container.	_____	_____
4. Describe how to obtain a representative sample from a paving mixer.		
a. Sample the concrete after all the concrete has been discharged.	_____	_____
b. Obtain the increments from at least 5 different locations in the pile.	_____	_____
c. Avoid contaminating the sample with sub-grade materials.	_____	_____
5. Describe how to obtain a representative sample from a pump:		
a. Sample the concrete after 1/2 m^3 (1/2 yd^3) has been discharged.	_____	_____
b. Make sure all the pump slurry is out of the lines.	_____	_____
c. Pass receptacle through entire discharge stream or completely divert discharge stream into sampling container.	_____	_____
d. Do not lower the pump arm from the placement position.	_____	_____
6. After obtaining the sample what must you do?		
a. Transport to place of testing.	_____	_____
7. What must be done with the sample once you have transported them to the place of testing?		
a. Combine and remix the sample.	_____	_____
b. Protect sample against rapid evaporation and contamination.	_____	_____

OVER

Procedure Element	Trial 1	Trial 2
8. What are the two time parameters associated with sampling?		
a. Complete temperature test and start tests for slump and air within 5 minutes of sample being obtained?	_____	_____
b. Start molding cylinders within 15 minutes of sample being obtained?	_____	_____
9. What test methods may require wet sieving?		
a. Slump, air content, and strength specimens?	_____	_____
10. The sieve size used for wet sieving is based on?		
a. The test method to be performed.	_____	_____
11. How long must you continue wet sieving?		
a. Until a sample of sufficient size for the test being performed is obtained.	_____	_____
12. What is done with the oversized aggregate?		
a. Discard it.	_____	_____
13. What must be done to the sieved sample before testing?		
a. Remix.	_____	_____

Comments: First attempt: Pass__Fail_____Second attempt: Pass__Fail_____

____

____

____

Examiner Signature ______________________________WAQTC #:_______________

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PERFORMANCE EXAM CHECKLIST

SAMPLING FRESHLY MIXED CONCRETE
WAQTC TM 2

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Receptacle dampened and excess water removed?	_____	_____
2. Obtain a representative sample from drum mixer:		
a. Concrete sampled after 1/2 m^3 (1/2 yd^3) discharged?	_____	_____
b. Receptacle passed through entire discharge stream or discharge stream completely diverted into sampling container?	_____	_____
3. Obtain a representative sample from a paving mixer:		
a. Concrete sampled after all the concrete has been discharged?	_____	_____
b. Material obtained from at least 5 different locations in the pile?	_____	_____
c. Avoid contaminating the sample with sub-grade materials.	_____	_____
4. Obtain a representative sample from a pump:		
a. Concrete sampled after 1/2 m^3 (1/2 yd^3) has been discharged?	_____	_____
b. All the pump slurry is out of the lines?	_____	_____
c. Receptacle passed through entire discharge stream or discharge stream completely diverted into sampling container?	_____	_____
d. Do not lower the pump arm from the placement position.	_____	_____
5. Sample transported to place of testing?	_____	_____
6. Sample combined, or remixed, or both?	_____	_____
7. Protect sample against rapid evaporation and contamination?	_____	_____
8. Minimum size of sample used for strength tests 0.03 m^3 (1ft^3)?	_____	_____
9. Completed temperature test within 5 minutes of obtaining sample?	_____	_____
10. Start tests for slump and air within 5 minutes of obtaining sample?	_____	_____
11. Start molding cylinders within 15 minutes of obtaining sample?	_____	_____

OVER

Procedure Element	**Trial 1**	**Trial 2**
12. Wet Sieving:		
a. Required sieve size determined for test method to be performed?	_____	_____
b. Concrete placed on sieve and doesn't overload the sieve?	_____	_____
c. Sieve shaken until no more material passes the sieve?	_____	_____
d. Sieving continued until required testing size obtained?	_____	_____
e. Oversized aggregate discarded?	_____	_____
f. Sample remixed?	_____	_____

Comments: First attempt: Pass__Fail_____Second attempt: Pass__Fail_____

____

____

____

Examiner Signature ______________________________WAQTC #:______________

TEMPERATURE OF FRESHLY MIXED PORTLAND CEMENT CONCRETE WFOP AASHTO T 309

Scope

This procedure covers the determination of the temperature of freshly mixed Portland Cement Concrete in accordance with AASHTO T 309-22.

Warning—Fresh Hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

Apparatus

- Container: Made of non-absorptive material and large enough to cover the sensor with concrete at least 75 mm (3 in.) in all directions; concrete cover must also be a least three times the nominal maximum size of the coarse aggregate.
- Thermometer: Capable of measuring the temperature of the concrete throughout the temperature range likely to be encountered, at least –18 to 50°C (0 to 120°F), and readable to ±0.5°C (±1°F) or smaller.

Note 1: Thermometer types suitable for use include ASTM E1 mercury thermometer or ASTM E2251 Low Hazard Precision Liquid-in-glass thermometer; ASTM E2877 digital metal stem thermometer; or thermocouple thermometer ASTM E230, Type T Special or IEC 60584 Type T, Class 1.

Standardization of Thermometer

Each thermometer shall be verified for accuracy annually and whenever there is a question of accuracy. Standardization shall be performed by comparing readings on the thermometer with another calibrated thermometer at two temperatures at least 15°C or 27°F apart.

Sample Locations and Times

The temperature of freshly mixed concrete may be measured in the transporting equipment, in forms, or in sample containers, provided the sensor of the thermometer has at least 75 mm (3 in.) of concrete cover in all direction around it.

Complete the temperature measurement of the freshly mixed concrete within 5 minutes of obtaining the sample.

Procedure

1. Dampen the sample container.
2. Obtain the sample in accordance with the WFOP WAQTC TM 2.
3. Place sensor of the thermometer in the freshly mixed concrete so that it has at least 75 mm (3 in.) of concrete cover in all directions around it.
4. Gently press the concrete in around the sensor of the thermometer at the surface of the concrete so that air cannot reach the sensor.
5. Leave the sensor of the thermometer in the freshly mixed concrete for a minimum of two minutes, or until the temperature reading stabilizes.
6. Complete the temperature measurement of the freshly mixed concrete within 5 minutes of obtaining the sample.
7. Read and record the temperature to the nearest 0.5°C (1°F).

Report

- Results on forms approved by the agency
- Sample ID
- Measured temperature of the freshly mixed concrete to the nearest 0.5°C (1°F)

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PERFORMANCE EXAM CHECKLIST

TEMPERATURE OF FRESHLY MIXED CONCRETE
WFOP AASHTO T 309

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Obtain sample of concrete large enough to provide a minimum of 75 mm (3 in.) of concrete cover around sensor in all directions?	_____	_____
2. Place thermometer in sample with a minimum of 75 mm (3 in.) cover around sensor?	_____	_____
3. Gently press concrete around thermometer?	_____	_____
4. Read temperature after a minimum of 2 minutes or when temperature reading stabilizes?	_____	_____
5. Complete temperature measurement within 5 minutes of obtaining sample?	_____	_____
6. Record temperature to nearest 0.5°C (1°F)?	_____	_____

Comments: First attempt: Pass___Fail_______ Second attempt: Pass_____Fail_____

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Examiner Signature ________________________________WAQTC #:_______________

SLUMP OF HYDRAULIC CEMENT CONCRETE
WFOP AASHTO T 119

Scope

This procedure provides instructions for determining the slump of hydraulic cement concrete in accordance with AASHTO T 119-23. It is not applicable to non-plastic and non-cohesive concrete.

Warning—Fresh Hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

Apparatus

Mold: conforming to AASHTO T 119

- Metal: a metal frustum of a cone provided with foot pieces and handles. The mold must be constructed without a seam. The interior of the mold shall be relatively smooth and free from projections such as protruding rivets. The mold shall be free from dents, deformations, and adhered mortar. A mold that clamps to a rigid nonabsorbent base plate is acceptable provided the clamping arrangement is such that it can be fully released without movement of the mold.
- Non-metal: see AASHTO T 119, Section 5.1.2.

Tamping rod: 16 mm (5/8 in.) diameter and 400 mm (16 in.) to 600 mm (24 in.) long, having a hemispherical tip the same diameter as the rod. (Hemispherical means "half a sphere"; the tip is rounded like half of a ball.)

Scoop: a receptacle of appropriate size so that each representative increment of the concrete sample can be placed in the container without spillage.

Tape measure or ruler with at least 5 mm or 1/8 in. graduations

Base: flat, rigid, non-absorbent moistened surface on which to set the slump mold

Procedure

1. Obtain the sample in accordance with the WFOP WAQTC TM 2. If the concrete mixture contains aggregate retained on the 37.5mm (1½ in.) sieve, the aggregate must be removed in accordance with the Wet Sieving portion of the WFOP WAQTC TM 2.

   Begin testing within five minutes of obtaining the sample.
2. Dampen the inside of the mold and place it on a dampened, rigid, nonabsorbent surface that is level and firm.
3. Stand on both foot pieces to hold the mold firmly in place.
4. Use the scoop to fill the mold 1/3 full by volume, to a depth of approximately 67 mm (2 5/8 in.).
5. Consolidate the layer with 25 strokes of the tamping rod, using the rounded end. Rod the bottom layer throughout its depth. Distribute the strokes evenly over the entire cross section of the concrete.

For the bottom layer, incline the rod slightly and make approximately half the strokes near the perimeter, and then progress with vertical strokes, spiraling toward the center.

6. Use the scoop to fill the mold 2/3 full by volume, to a depth of approximately 155 mm (6 1/8 in.).
7. Consolidate this layer with 25 strokes of the tamping rod, penetrate approximately 25 mm (1 in.) into the bottom layer. Distribute the strokes evenly.
8. Use the scoop to fill the mold to overflowing.
9. Consolidate this layer with 25 strokes of the tamping rod, penetrate approximately 25 mm (1 in.) into the second layer. Distribute the strokes evenly. If the concrete falls below the top of the mold, stop, add more concrete, and continue rodding for a total of 25 strokes. Always keep an excess of concrete above the top of the mold. Distribute strokes evenly.
10. Strike off the top surface of concrete with a screeding and rolling motion of the tamping rod.
11. Clean overflow concrete away from the base of the mold.
12. Remove the mold from the concrete by raising it carefully in a vertical direction. Raise the mold 300 mm (12 in.) in 5 ±2 seconds by a steady upward lift with no lateral or torsional (twisting) motion being imparted to the concrete.

    Complete the entire operation from the start of the filling through removal of the mold without interruption within an elapsed time of 2 1/2 minutes.

13. Immediately measure the slump:
    a. Invert the slump mold and set it next to the specimen.
    b. Lay the tamping rod across the mold so that it is over the test specimen.
    c. Measure the distance between the bottom of the rod and the displaced original center of the top of the specimen to the nearest 5 mm (1/4 in.).
    d. If a decided falling away or shearing off of concrete from one side or portion of the mass occurs, disregard the test and perform a new test on another portion of the sample.

Note 1: If two consecutive tests on a sample of concrete show a falling away or shearing off of a portion of the concrete from the mass of the specimen, the concrete probably lacks the plasticity and cohesiveness necessary for the slump test to be applicable.

14. Discard the tested sample.

Report

- Results on forms approved by the agency
- Sample ID
- Slump to the nearest 5 mm (1/4 in.).

PERFORMANCE EXAM CHECKLIST

SLUMP OF HYDRAULIC CEMENT CONCRETE
WFOP AASHTO T 119

Participant Name ______________________________Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
First layer		
1. Mold and floor or base plate dampened?	_____	_____
2. Mold held firmly against the base by standing on the two foot pieces? Mold not allowed to move in any way during filling?	_____	_____
3. Representative sample scooped into the mold?	_____	_____
4. Mold approximately one third (by volume), 67 mm (2 5/8 in.) deep?	_____	_____
5. Layer rodded throughout its depth 25 times with hemispherical end of rod, uniformly distributing strokes?	_____	_____
Second layer		
6. Representative samples scooped into the mold?	_____	_____
7. Mold filled approximately two thirds (by volume), 155 mm (6 1/8 in.), deep?	_____	_____
8. Layer rodded throughout its depth 25 times with hemispherical end of rod, uniformly distributing strokes, penetrate approximately 25 mm (1 in.) into the bottom layer?	_____	_____
Third layer		
9. Representative sample scooped into the mold?	_____	_____
10. Mold filled to just over the top of the mold?	_____	_____
11. Layer rodded throughout its depth 25 times with hemispherical end of rod, uniformly distributing strokes, penetrate approximately 25 mm (1 in.) into the second layer?	_____	_____
12. Excess concrete kept above the mold at all times while rodding?	_____	_____
13. Concrete struck off level with top of mold using tamping rod?	_____	_____

OVER

Procedure Element	Trial 1	Trial 2
14. Concrete removed from around the outside bottom of the mold?	_____	_____
15. Mold lifted upward 300 mm (12 in.) in one smooth motion, without a lateral or twisting motion of the mold, in 5 ±2 seconds?	_____	_____
16. Test performed from start of filling through removal of the mold within 2 1/2 minutes?	_____	_____
17. Slump immediately measured to the nearest 5 mm (1/4 in.) from the top of the mold to the displaced original center of the top surface of the specimen?	_____	_____

Comments: First attempt: Pass____Fail_______ Second attempt: Pass_____Fail_____

____

____

____

____

____

____

Examiner Signature _______________________________WAQTC #:_______________

This checklist is derived, in part, from copyrighted material printed in ACI CP-1, published by the American Concrete Institute.

DENSITY (UNIT WEIGHT), YIELD, AND AIR CONTENT (GRAVIMETRIC) OF CONCRETE
WFOP AASHTO T 121

Scope

This method covers the determination of density, or unit weight, of freshly mixed concrete in accordance with AASHTO T 121-23. It also provides formulas for calculating the volume of concrete produced from a mixture of known quantities of component materials and provides a method for calculating cement content and cementitious material content – the mass of cement or cementitious material per unit volume of concrete. A procedure for calculating water/cement ratio is also covered.

Warning—Fresh Hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

Apparatus

- Measure: May be the bowl portion of the air meter used for determining air content under the WFOP AASHTO T 152. Otherwise, it shall be a cylindrical metal container meeting the requirements of AASHTO T 121. The capacity and dimensions of the measure shall conform to those specified in Table 1.
- Balance or scale: Accurate to within 45 g (0.1 lb) or 0.3 percent of the test load, whichever is greater, at any point within the range of use.
- Tamping rod: 16 mm (5/8 in.) diameter and 400 mm (16 in.) to 600 mm (24 in.) long, having a hemispherical tip the same diameter as the rod. (Hemispherical means "half a sphere"; the tip is rounded like half of a ball.)
- Vibrator: frequency at least 9000 vibrations per minute (150 Hz), at least 19 to 38 mm (3/4 to 1 1/2 in.) in diameter but not greater than 38 mm (1 1/2 in.), and the length of the shaft shall be at least 75 mm (3 in.) longer than the depth of the section being vibrated.
- Scoop: a receptacle of appropriate size so that each representative increment of the concrete sample can be placed in the container without spillage.
- Strike-off plate: A flat rectangular metal plate at least 6 mm (1/4 in.) thick or a glass or acrylic plate at least 12 mm (1/2 in.) thick, with a length and width at least 50 mm (2 in.) greater than the diameter of the measure with which it is to be used. The edges of the plate shall be straight and smooth within tolerance of 1.5 mm (1/16 in.).
- Mallet: With a rubber or rawhide head having a mass of 0.57 ±0.23 kg (1.25 ±0.5 lb) for use with measures of 14 L (1/2 ft^3) or less or having a mass of 1.02 ±0.23 kg (2.25 ±0.5 lb) for use with measures larger than 14 L (0.5 ft^3).

Table 1
Dimensions of Measures*

Capacity m^3 (ft^3)	Inside Diameter mm (in.)	Inside Height mm (in.)	Minimum Thicknesses mm (in.)		Nominal Maximum Size of Coarse Aggregate*** mm (in.)
			Bottom	Wall	
0.0071	203 ±2.54	213 ±2.54	5.1	3.0	25
(1/4)**	(8.0 ±0.1)	(8.4 ±0.1)	(0.20)	(0.12)	(1)
0.0142	254 ±2.54	279 ±2.54	5.1	3.0	50
(1/2)	(10.0 ±0.1)	(11.0 ±0.1)	(0.20)	(0.12)	(2)

* ***Note 1:*** The indicated size of measure shall be for aggregates of nominal maximum size equal to or smaller than that listed.

** Measure may be the base of the air meter used in the WFOP AASHTO T 152.

*** Nominal maximum size: One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps in specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum size.

Consolidation Selection

There are two methods of consolidating the concrete – rodding and vibration. If the slump is greater than 75 mm (3 in.), consolidation is by rodding. When the slump is 25 to 75 mm (1 to 3 in.), internal vibration or rodding can be used to consolidate the sample, but the method used must be that required by the agency to obtain consistent, comparable results. For concrete with slump less than 25 mm (1 in.), consolidate the sample by internal vibration. Do not consolidate self-consolidating concrete (SCC).

When using measures greater than 0.0142 m^3 (1/2 ft^3), see AASHTO T 121.

Procedure

Sampling

1. Obtain the sample in accordance with the WFOP WAQTC TM 2. Testing may be performed in conjunction with the WFOP AASHTO T 152. When doing so, this WFOP should be performed before the WFOP AASHTO T 152.

Note 2: *If the two tests are being performed using the same sample, this test shall begin within five minutes of obtaining the sample.*

Rodding

1. Dampen the inside of the measure and empty excess water.
2. Determine and record the mass of the measure.
3. Use the scoop to fill the measure approximately 1/3 full with concrete. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.

4. Consolidate the layer with 25 strokes of the tamping rod, using the rounded end. Distribute the strokes evenly over the entire cross section of the concrete. Rod throughout its depth without hitting the bottom too hard.
5. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet to close voids and release trapped air.
6. Add the second layer, filling the measure about 2/3 full. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
7. Consolidate this layer with 25 strokes of the tamping rod, penetrating about 25 mm (1 in.) into the bottom layer.
8. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet.
9. Add the final layer, slightly overfilling the measure. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
10. Consolidate this layer with 25 strokes of the tamping rod, penetrating about 25 mm (1 in.) into the second layer.
11. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet.
12. Continue with 'Strike-off and Determining Mass.'

Internal Vibration

1. Dampen the inside of the measure and empty excess water.
2. Determine and record the mass of the measure.
3. Use the scoop to fill the measure approximately 1/2 full with concrete. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
4. Insert the vibrator at three different points in each layer. Do not let the vibrator touch the bottom or side of the measure. Continue vibration only long enough to achieve proper consolidation of the concrete. Over vibration may cause segregation and loss of appreciable quantities of intentionally entrained air.
5. Slightly overfill the measure. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
6. Insert the vibrator at three different points, penetrating the first layer approximately 25 mm (1 in.). Do not let the vibrator touch the side of the measure.
7. Continue with 'Strike-off and Determining Mass.'

Self-Consolidating Concrete

1. Dampen the inside of the measure and empty excess water.
2. Determine and record the mass of the measure.
3. Use the scoop to slightly overfill the measure. Do not exceed 125 mm (5 in.) drop height. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
5. Continue with 'Strike-off and Determining Mass.'

Strike-off and Determining Mass

1. After consolidation, the measure should be slightly over full, about 3 mm (1/8 in.) above the rim. If there is a great excess of concrete, remove a portion with the scoop. If the measure is under full, add a small quantity. This adjustment may be done only after consolidating the final layer and before striking off the surface of the concrete.
2. Press the strike-off plate flat against the top surface, covering approximately 2/3 of the measure.
3. Withdraw the strike-off plate with a sawing motion to finish the 2/3 originally covered.
4. Cover the original 2/3 again with the plate; finishing the remaining 1/3 with a sawing motion (do not lift the plate; continue the sawing motion until the plate has cleared the surface of the measure).
5. Finish the surface with the inclined edge of the strike-off plate. The surface should be smooth and free of voids.
6. Clean off all excess concrete from the exterior of the measure including the rim.
7. Determine and record the mass of the measure and the concrete.
8. If the air content of the concrete is to be determined, ensure the rim (flange) is clean and proceed to 'Strike-off and Air Content' Step 3 of the WFOP AASHTO T 152.

Calculations

Mass of concrete in the measure

$$concrete\ mass = M_c - M_m$$

Where:

Concrete mass	=	mass of concrete in measure
M_c	=	mass of measure and concrete
M_m	=	mass of measure

Density

$$\rho = \frac{concrete\ mass}{V_m}$$

Where:

ρ	=	density of the concrete mix
V_m	=	volume of measure (Annex)

Yield m^3

$$Y_{m^3} = \frac{W}{\rho}$$

Where:

$Y_m{}^3$	=	yield (m^3 of the batch of concrete)
W	=	total mass of the batch of concrete

Yield yd^3

$$Y_{ft^3} = \frac{W}{\rho} \qquad\qquad Y_{yd^3} = \frac{Y_{ft^3}}{27ft^3/yd^3}$$

Where:

Y_{ft^3}	=	yield (ft^3 of the batch of concrete)
Y_{yd^3}	=	yield (yd^3 of the batch of concrete)
W	=	total mass of the batch of concrete
ρ	=	density of the concrete mix

Note 5: The total mass, W, includes the masses of the cement, water, and aggregates in the concrete.

Cement Content

$$N = \frac{N_t}{Y}$$

Where:

N	=	actual cementitous material content per Y_m^3 or Y_{yd}^3
N_t	=	mass of cementitious material in the batch
Y	=	Y_m^3 or Y_{yd}^3

Note 6: Specifications may require Portland Cement content and supplementary cementitious materials content.

Water Content

The mass of water in a batch of concrete is the sum of:

– water added at batch plant
– water added in transit
– water added at jobsite
– free water on coarse aggregate*
– free water on fine aggregate*
– liquid admixtures (if required by the agency)

*M**ass of free water on aggregate**

This information is obtained from concrete batch tickets collected from the driver. Use the Table 2 to convert liquid measures.

Table 2
Liquid Conversion Factors

To Convert From	To	Multiply By
Liters, L	Kilograms, kg	1.0
Gallons, gal	Kilograms, kg	3.785
Gallons, gal	Pounds, lb	8.34
Milliliters, mL	Kilograms, kg	0.001
Ounces, oz	Milliliters, mL	28.4
Ounces, oz	Kilograms, kg	0.0284
Ounces, oz	Pounds, lb	0.0625
Pounds, lb	Kilograms, kg	0.4536

Mass of free water on aggregate

$$Free\ Water\ Mass = CA\ or\ FC\ Aggregate - \frac{CA\ or\ FC\ Aggregate}{1 + (Free\ Water\ Percentage/100)}$$

Where:

Free Water Mass = on coarse or fine aggregate

FC or CA Aggregate = mass of coarse or fine aggregate

Free Water Percentage = percent of moisture of coarse or fine aggregate

Water/Cement Ratio

$$\frac{Water\ Content}{C}$$

Where:

Water Content = total mass of water in the batch

C = total mass of cementitious materials

Example

Mass of concrete in measure (M_m) 16.290 kg (36.06 lb)

Volume of measure (V_m) 0.007079 m^3 (0.2494 ft^3)

<u>From batch ticket:</u>

Yards batched	4 yd^3
Cement	950 kg (2094 lb)
Fly ash	180 kg (397 lb)
Coarse aggregate	3313 kg (7305 lb)
Fine aggregate	2339 kg (5156 lb)
Water added at plant	295 L (78 gal)

<u>Other</u>

Water added in transit	0
Water added at jobsite	38 L (10 gal)
Total mass of the batch of concrete (W)	7115 kg (15,686 lb)
Moisture content of coarse aggregate	1.7%
Moisture content of coarse aggregate	5.9%

Density

$$\rho = \frac{concrete\ mass}{V_m}$$

$$\rho = \frac{16.920\ kg}{0.007079\ m^3} = 2390\ \ kg/m^3 \quad \rho = \frac{36.06\ lb}{0.2494\ ft^3} = 144.6\ \ lb/ft^3$$

Given:

concrete mass = 16.920 kg (36.06 lb)

V_m = 0.007079 m^3 (0.2494 ft^3) (Annex)

Yield m^3

$$Y_{m^3} = \frac{W}{\rho}$$

$$Y_{m^3} = \frac{7115\ kg}{2390\ kg/m^3} = 2.98\ m^3$$

Given:

Total mass of the batch of concrete (W), kg = 7115 kg

Yield yd^3

$$Y_{ft^3} = \frac{W}{\rho} \qquad\qquad Y_{yd^3} = \frac{Y_{ft^3}}{27 ft^3/yd^3}$$

$$Y_{ft^3} = \frac{15{,}686\ lb}{144.6\ lb/ft^3} = 108.48\ ft^3 \qquad Y_{yd^3} = \frac{108.48\ ft^3}{27\ ft^3/yd^3} = 4.02\ yd^3$$

Given:

Total mass of the batch of concrete (W), lb = 15,686 lb

Cement Content

$$N = \frac{N_t}{Y}$$

$$N = \frac{950\ kg + 180\ kg}{2.98\ m^3} = 379\ kg/m^3 \quad N = \frac{2094\ lb + 397\ lb}{4.02\ yd^3} = 620\ \ lb/yd^3$$

Given:

N_t (cement) = 950 kg (2094 lb)

N_t (flyash) = 180 kg (397 lb)

Y= Y_{m^3} or Y_{yd^3}

Note 6: Specifications may require Portland Cement content and supplementary cementitious materials content.

Free water

$$Free\ Water\ Mass = CA\ or\ FC\ Aggregate - \frac{CA\ or\ FC\ Aggregate}{1 + (Free\ Water\ Percentage/100)}$$

$$CA\ Free\ Water = 3313\ kg - \frac{3313\ kg}{1 + (1.7/100)} = 55\ kg$$

$$CA\ Free\ Water = 7305\ lb - \frac{7305\ lb}{1 + (1.7/100)} = 122\ lb$$

$$FA\ Free\ Water = 2339\ kg - \frac{2339\ kg}{1 + (5.9/100)} = 130\ kg$$

$$FA\ Free\ Water = 5156\ lb - \frac{5156\ lb}{1 + (5.9/100)} = 287\ lb$$

Given:

CA aggregate	=	3313 kg (7305 lb)
FC aggregate	=	2339 kg (5156 lb)
CA moisture content	=	1.7%
FC moisture content	=	5.9%

Water Content

Total of all water in the mix.

$$Water\ Content = [(78\ gal + 10\ gal) * 3.785\ kg/gal] + 55\ kg + 130\ kg = 518\ kg$$

$$Water\ Content = [(78\ gal + 10\ gal) * 8.34\ lb/gal] + 122\ lb + 287\ lb = 1143\ lb$$

Given:

Water added at plant	=	295 L (78 gal)
Water added at the jobsite	=	38 L (10 gal)

Water/ Cement Ratio

$$W/C = \frac{518\ kg}{950\ kg + 180\ kg} = 0.458 \quad W/C = \frac{1143\ lb}{2094\ lb + 397\ lb} = 0.459$$

Report 0.46

Report

- Results on forms approved by the agency
- Sample ID
- Density (unit weight) to the nearest 1 kg/m^3 (0.1 lb/ft^3)
- Yield to the nearest 0.01 m^3 (0.01 yd^3)
- Cement content to the nearest 1 kg/m^3 (1 lb/yd^3)
- Cementitious material content to the nearest 1 kg/m^3 (1 lb/yd^3)
- Water/Cement ratio to the nearest 0.01

ANNEX – Standardization of Measure

(Mandatory Information)

Standardization is a critical step to ensure accurate test results when using this apparatus. Failure to perform the standardization procedures as described herein will produce inaccurate or unreliable test results.

Apparatus

Listed in the WFOP AASHTO T 121

- Measure
- Balance or scale
- Strike-off plate

- Thermometer: Standardized liquid-in-glass, or electronic digital total immersion type, accurate to 0.5°C (1°F)

Procedure

1. Determine the mass of the dry measure and strike-off plate.
2. Fill the measure with water at a temperature between 16°C and 29°C (60°F and 85°F) and cover with the strike-off plate in such a way as to eliminate bubbles and excess water.
3. Wipe the outside of the measure and cover plate dry, being careful not to lose any water from the measure.
4. Determine the mass of the measure, strike-off plate, and water in the measure.
5. Determine the mass of the water in the measure by subtracting the mass in Step 1 from the mass in Step 4.
6. Measure the temperature of the water and determine its density from Table A1, interpolating as necessary.
7. Calculate the volume of the measure, V_m, by dividing the mass of the water in the measure by the density of the water at the measured temperature.

Calculations

$$V_m = \frac{M}{\rho_w}$$

Where:

V_m	=	volume of the mold
M	=	mass of water in the mold
ρ_w	=	density of water at the measured temperature

Example

Mass of water in Measure = 7.062 kg (15.53 lb)

Density of water at 23°C (73.4°F) (ρ_w) = 997.54 kg/m^3 (62.274 lb/ft^3)

$$V_m = \frac{7.062\ kg}{997.54\ kg/m^3} = 0.007079\ m^3 \qquad V_m = \frac{15.53\ lb}{62.274\ lb/ft^3} = 0.2494\ ft^3$$

Table A1
Unit Mass of Water
15°C to 30°C

°C	(°F)	kg/m^3	(lb/ft^3)	°C	(°F)	kg/m^3	(lb/ft^3)
15	(59.0)	999.10	(62.372)	23	(73.4)	997.54	(62.274)
15.6	(60.0)	999.01	(62.366)	23.9	(75.0)	997.32	(62.261)
16	(60.8)	998.94	(62.361)	24	(75.2)	997.29	(62.259)
17	(62.6)	998.77	(62.350)	25	(77.0)	997.03	(62.243)
18	(64.4)	998.60	(62.340)	26	(78.8)	996.77	(62.227)
18.3	(65.0)	998.54	(62.336)	26.7	(80.0)	996.59	(62.216)
19	(66.2)	998.40	(62.328)	27	(80.6)	996.50	(62.209)
20	(68.0)	998.20	(62.315)	28	(82.4)	996.23	(62.192)
21	(69.8)	997.99	(62.302)	29	(84.2)	995.95	(62.175)
21.1	(70.0)	997.97	(62.301)	29.4	(85.0)	995.83	(62.166)
22	(71.6)	997.77	(62.288)	30	(86.0)	995.65	(62.156)

Report

- Measure ID
- Date Standardized
- Temperature of the water
- Volume, V_m, of the measure

PERFORMANCE EXAM CHECKLIST

DENSITY (UNIT WEIGHT), YIELD, AND AIR CONTENT (GRAVIMETRIC) OF CONCRETE
WFOP AASHTO T 121

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Mass of dampened measure determined?	_____	_____
First Layer		
2. Measure filled approximately one third full, moving a scoop around the perimeter of the measure to evenly distribute the concrete as discharged?	_____	_____
3. Layer rodded throughout its depth 25 times, without forcibly striking the bottom of the measure, with hemispherical end of rod, uniformly distributing strokes?	_____	_____
4. Perimeter of the measure tapped 10 to 15 times with the mallet after rodding?	_____	_____
Second layer		
5. Measure filled approximately two thirds full, moving a scoop around the perimeter of the measure to evenly distribute the concrete as discharged?	_____	_____
6. Layer rodded throughout its depth, just penetrating the previous layer (approximately 25 mm (1 in.) 25 times with hemispherical end of rod, uniformly distributing strokes?	_____	_____
7. Perimeter of the measure tapped 10 to 15 times with the mallet after rodding?	_____	_____
Third layer		
8. Measure slightly overfilled, moving a scoop around the perimeter of the measure to evenly distribute the concrete as discharged?	_____	_____
9. Layer rodded throughout its depth, just penetrating the previous layer (approximately 25 mm (1 in.) 25 times with hemispherical end of rod, uniformly distributing strokes?	_____	_____
10. Perimeter of the measure tapped 10 to 15 times with the mallet after rodding each layer?		
11. Any excess concrete removed using a trowel or a scoop, or small quantity of concrete added to correct a deficiency, after consolidation of final layer?	_____	_____

OVER

Procedure Element	Trial 1	Trial 2
12. Strike-off plate placed flat on the measure covering approximately 2/3 of the surface, then sawing action used to withdraw the strike-off plate across the previously covered surface?	_____	_____
13. Strike-off plate placed flat on the measure covering approximately 2/3 of the surface, then sawing action used to advance the plate across the entire measure surface?	_____	_____
14. Strike off completed using the inclined edge of the plate creating a smooth surface?	_____	_____
15. All excess concrete cleaned off and mass of full measure determined?	_____	_____
16. Concrete mass calculated?	_____	_____
17. Density calculated correctly?	_____	_____

Comments: First attempt: Pass____Fail_______ Second attempt: Pass_____Fail____

____

____

____

____

Examiner Signature _______________________________WAQTC #:_______________

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AIR CONTENT OF FRESHLY MIXED CONCRETE BY THE PRESSURE METHOD WFOP AASHTO T 152

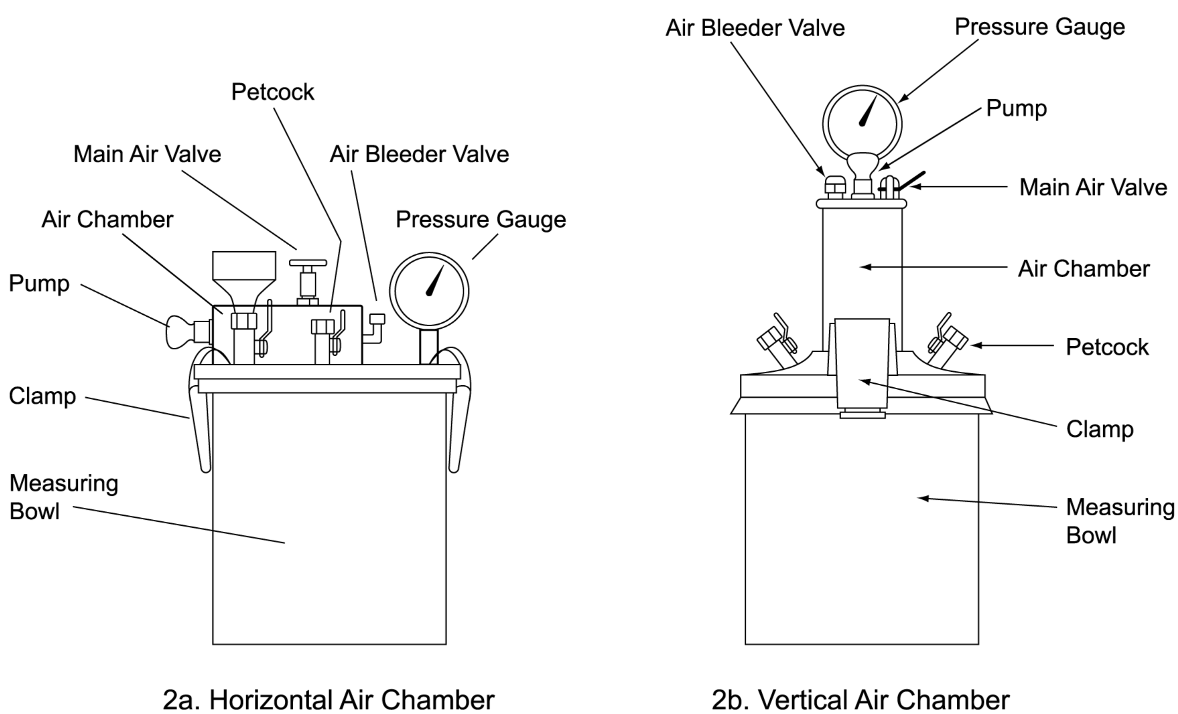
Scope

This procedure covers determination of the air content in freshly mixed Portland Cement Concrete containing dense aggregates in accordance with AASHTO T 152-23, Type B meter. It is not for use with lightweight or highly porous aggregates. This procedure includes standardization of the Type B air meter gauge, Annex.

Warning—Fresh Hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

Apparatus

Air meter: Type B, as described in AASHTO T 152



Type B Meter

- Balance or scale: Accurate to 0.3 percent of the test load at any point within the range of use (for Method 1 standardization only)
- Tamping rod: 16 mm (5/8 in.) diameter and 400 mm (16 in.) to 600 mm (24 in.) long, having a hemispherical tip the same diameter as the rod. (Hemispherical means “half a sphere”; the tip is rounded like half of a ball.)

- Vibrator: frequency at least 9000 vibrations per minute (150 Hz), at least 19 to 38 mm (3/4 to 1 1/2 in.) in diameter but not greater than 38 mm (1 1/2 in.), and the length of the shaft shall be at least 75 mm (3 in.) than the depth of the section being vibrated.
- Scoop: a receptacle of appropriate size so that each representative increment of the concrete sample can be placed in the container without spillage.
- Container for water: rubber syringe or plastic wash bottle
- Strike-off bar: Approximately 300 mm x 22 mm x 3 mm (12 in. x 3/4 in. x 1/8 in.)
- Strike-off plate: A flat rectangular metal plate at least 6 mm (1/4 in.) thick or a glass or acrylic plate at least 12 mm (1/2 in.) thick, with a length and width at least 50 mm (2 in.) greater than the diameter of the measure with which it is to be used. The edges of the plate shall be straight and smooth within tolerance of 1.5 mm (1/16 in.).

  Note 1: Use either the strike-off bar or strike-off plate; both are not required.
- Mallet: With a rubber or rawhide head having a mass of 0.57 ±0.23 kg (1.25 ±0.5 lb)

Consolidation Selection

There are two methods of consolidating the concrete – rodding and vibration. If the slump is greater than 75 mm (3 in.), consolidation is by rodding. When the slump is 25 to 75 mm (1 to 3 in.), internal vibration or rodding can be used to consolidate the sample, but the method used must be that required by the agency to obtain consistent, comparable results. For concrete with slumps less than 25 mm (1 in.), consolidate the sample by internal vibration. Do not consolidate self-consolidating concrete (SCC).

Procedure

Sampling

1. Obtain the sample in accordance with the WFOP WAQTC TM 2. If the concrete mixture contains aggregate retained on the 37.5mm (1½ in.) sieve, the aggregate must be removed in accordance with the Wet Sieving portion of the WFOP WAQTC TM 2.

   Testing shall begin within five minutes of obtaining the sample.

Rodding

1. Dampen the inside of the air meter measure and place on a firm level surface.
2. Use the scoop to fill the measure approximately 1/3 full with concrete. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
3. Consolidate the layer with 25 strokes of the tamping rod, using the rounded end. Distribute the strokes evenly over the entire cross section of the concrete. Rod throughout its depth without hitting the bottom too hard.
4. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet to close voids and release trapped air.
5. Add the second layer, filling the measure about 2/3 full. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.

6. Consolidate this layer with 25 strokes of the tamping rod, penetrating about 25 mm (1 in.) into the bottom layer.
7. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet.
8. Add the final layer, slightly overfilling the measure. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
9. Consolidate this layer with 25 strokes of the tamping rod, penetrating about 25 mm (1 in.) into the second layer.
10. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet.
11. Continue with 'Strike-off and Air Content.'

Internal Vibration

1. Dampen the inside of the air meter measure and place on a firm level surface.
2. Use the scoop to fill the measure approximately 1/2 full with concrete. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
3. Insert the vibrator at three different points. Do not let the vibrator touch the bottom or side of the measure. Remove the vibrator slowly, so that no air pockets are left in the material. Continue vibration only long enough to achieve proper consolidation of the concrete. Over vibration may cause segregation and loss of appreciable quantities of intentionally entrained air.
4. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet.
5. Use the scoop to fill the measure a bit over full. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
6. Insert the vibrator at three different points, penetrating the first layer approximately 25 mm (1 in.). Do not let the vibrator touch the side of the measure. Remove the vibrator slowly, so that no air pockets are left in the material. Continue vibration only long enough to achieve proper consolidation of the concrete. Over vibration may cause segregation and loss of appreciable quantities of intentionally entrained air.
7. Tap around the perimeter of the measure smartly 10 to 15 times with the mallet.
8. Continue with 'Strike-off and Air Content.'

Self-Consolidating Concrete

1. Dampen the inside of the air meter measure and place on a firm level surface.
2. Use the scoop to slightly overfill the measure. Evenly distribute the concrete in a circular motion around the inner perimeter of the measure.
3. Continue with 'Strike-off and Air Content.'

Strike-Off and Air Content

1. After consolidation, the measure should be slightly over full, about 3 mm (1/8 in.) above the rim. If there is a great excess of concrete, remove a portion with the trowel or scoop. If the measure is under full, add a small quantity. This adjustment may be done only after consolidating the final layer and before striking off the surface of the concrete.
2. Strike off the surface of the concrete and finish it smoothly with a sawing action of the strike-off bar or inclined plate, using great care to leave the measure just full. The surface should be smooth and free of voids.
3. Clean the top flange of the measure to ensure a proper seal.
4. Moisten the inside of the cover and check to see that both petcocks are open, and the main air valve is closed.
5. Clamp the cover on the measure.
6. Inject water through a petcock on the cover until water emerges from the petcock on the opposite side. Jar the meter gently until all air is expelled from this same petcock.
7. Verify that water is present in both petcocks.
8. Close the air bleeder valve and pump air into the air chamber until the needle goes past the initial pressure determined for the gauge. Allow a few seconds for the compressed air to cool.
9. Tap the gauge gently with one hand while slowly opening the air bleeder valve until the needle rests on the initial pressure. Close the air bleeder valve.
10. Close both petcocks.
11. Open the main air valve.
12. Tap the side of the measure smartly with the mallet.
13. With the main air valve open, lightly tap the gauge to settle the needle, and then read the air content to the nearest 0.1 percent.
14. Release or close the main air valve.
15. Open both petcocks to release pressure, remove the concrete, and thoroughly clean the cover and measure with clean water.
16. Open the main air valve to relieve the pressure in the air chamber.

Report

- On forms approved by the agency
- Sample ID
- Percent of air to the nearest 0.1 percent.
- Some agencies require an aggregate correction factor to determine total percent of entrained air.

  Total % entrained air = Gauge reading – aggregate correction factor from mix design

  (See AASHTO T 152 for more information.)

ANNEX
Standardization of Air Meter Gauge

(Mandatory Information)

Standardization is a critical step to ensure accurate test results when using this apparatus. Failure to perform the standardization procedures as described below will produce inaccurate or unreliable test results.

Standardization shall be performed at a minimum of once every three months. Record the date of the standardization, the standardization results, and the name of the technician performing the standardization in the logbook kept with each air meter.

There are two methods for standardizing the air meter, mass or volume, both are covered below.

1. Screw the short piece of straight tubing into the threaded petcock hole on the underside of the cover.
2. Determine and record the mass of the dry, empty air meter measure and cover assembly (mass method only).
3. Fill the measure nearly full with water.
4. Clamp the cover on the measure with the tube extending down into the water. Mark the petcock with the tube attached for future reference.
5. Add water through the petcock having the pipe extension below until all air is forced out the other petcock.
6. Wipe off the air meter measure and cover assembly; determine and record the mass of the filled unit (mass method only).
7. Pump up the air pressure to a little beyond the predetermined initial pressure indicated on the gauge. Wait a few seconds for the compressed air to cool, and then stabilize the gauge hand at the proper initial pressure by pumping up or relieving pressure, as needed.
8. Close both petcocks and immediately open the main air valve exhausting air into the measure. Wait a few seconds until the meter needle stabilizes. The gauge should now read 0 percent. If two or more tests show a consistent variation from 0 percent in the result, change the initial pressure line to compensate for the variation, and use the newly established initial pressure line for subsequent tests.
9. Determine which petcock has the straight tube attached to it. Attach the curved tube to external portion of the same petcock.
10. Pump air into the air chamber. Open the petcock with the curved tube attached to it. Open the main air valve for short periods of time until 5 percent of water by mass or volume has been removed from the air meter. Remember to open both petcocks to release the pressure in the measure and drain the water in the curved tube back into the measure. To determine the mass of the water to be removed, subtract the mass found in Step 2 from the mass found in Step 6. Multiply this value by 0.05. This is the mass of the water that must be removed. To remove 5 percent by volume, remove water until the external standardization vessel is level full.

Note A1: Many air meters are supplied with a standardization vessel(s) of known volume that are used for this purpose. Standardization vessel must be protected from crushing or denting. If an external standardization vessel is used, confirm what percentage volume it represents for the air meter being used. Vessels commonly represent 5 percent volume, but they are for specific size meters. This should be confirmed by mass.

11. Remove the curved tube. Pump up the air pressure to a little beyond the predetermined initial pressure indicated on the gauge. Wait a few seconds for the compressed air to cool, and then stabilize the gauge hand at the proper initial pressure by pumping up or relieving pressure, as needed.
12. Close both petcocks and immediately open the main air valve exhausting air into the measure. Wait a few seconds until the meter needle is stabilized. The gauge should now read 5.0 ±0.1 percent. If the gauge is outside that range, the meter needs adjustment. The adjustment could involve adjusting the starting point so that the gauge reads 5.0 ±0.1 percent when this standardization is run or could involve moving the gauge needle to read 5.0 percent. Any adjustment should comply with the manufacturer's recommendations.
13. When the gauge hand reads correctly at 5.0 percent, additional water may be withdrawn in the same manner to check the results at other values such as 10 percent or 15 percent.
14. If an internal standardization vessel is used, follow Steps 1 through 8 to set initial reading.
15. Release pressure from the measure and remove cover. Place the internal standardization vessel into the measure. This will displace 5 percent of the water in the measure. (See AASHTO T 152 for more information on internal standardization vessels.)
16. Place the cover back on the measure and add water through the petcock until all the air has been expelled.
17. Pump up the air pressure chamber to the initial pressure. Wait a few seconds for the compressed air to cool, and then stabilize the gauge hand at the proper initial pressure by pumping up or relieving pressure, as needed.
18. Close both petcocks and immediately open the main air valve exhausting air into the measure. Wait a few seconds until the meter needle stabilizes. The gauge should now read 5 percent.
19. Remove the extension tubing from threaded petcock hole in the underside of the cover before starting the test procedure.

Report

- Air meter ID
- Date standardized
- Initial pressure (IP)

PERFORMANCE EXAM CHECKLIST

AIR CONTENT OF FRESHLY MIXED CONCRETE BY THE PRESSURE METHOD WFOP AASHTO T 152

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Representative sample selected?	_____	_____
First Layer		
2. Dampened measure filled approximately one third full, moving a scoop around the perimeter of the measure to evenly distribute the concrete as discharged?	_____	_____
3. Layer rodded throughout its depth 25 times, without forcibly striking the bottom of the measure, with hemispherical end of rod, uniformly distributing strokes?	_____	_____
4. Perimeter of the measure tapped 10 to 15 times with the mallet after rodding?	_____	_____
Second layer		
5. Measure filled approximately two thirds full, moving a scoop around the perimeter of the measure to evenly distribute the concrete as discharged?	_____	_____
6. Layer rodded throughout its depth, just penetrating the previous layer (approximately 25 mm (1 in.)) 25 times with hemispherical end of rod, uniformly distributing strokes?	_____	_____
7. Perimeter of the measure tapped 10 to 15 times with the mallet after rodding?	_____	_____
Third layer		
8. Measure slightly overfilled, moving a scoop around the perimeter of the measure to evenly distribute the concrete as discharged?	_____	_____
9. Layer rodded throughout its depth, just penetrating the previous layer (approximately 25 mm (1 in.)) 25 times with hemispherical end of rod, uniformly distributing strokes?	_____	_____
10. Perimeter of the measure tapped 10 to 15 times with the mallet after rodding each layer?	_____	_____
11. Concrete struck off level with top of the measure using the bar or inclined strike-off plate?	_____	_____
12. Top flange of measure cleaned?	_____	_____

OVER

Procedure Element	**Trial 1**	**Trial 2**
Using a Type B Meter:		
13. Both petcocks open?	_____	_____
14. Air valve closed between air chamber and the measure?	_____	_____
15. Inside of cover cleaned and moistened before clamping to base?	_____	_____
16. Water injected through petcock until it flows out the other petcock?	_____	_____
17. Meter jarred gently until all air is expelled?	_____	_____
18. Water is present in both petcocks?	_____	_____
19. Air pumped up to just past initial pressure line?	_____	_____
20. A few seconds allowed for the compressed air to stabilize?	_____	_____
21. Gauge adjusted to the initial pressure?	_____	_____
22. Both petcocks closed?	_____	_____
23. Air valve opened between chamber and measure?	_____	_____
24. The outside of measure tapped smartly with the mallet?	_____	_____
25. With the main air valve open, gauge lightly tapped and air percentage read to the nearest 0.1 percent?	_____	_____
26. Air valve released or closed and then petcocks opened to release pressure before removing the cover?	_____	_____
27. Aggregate correction factor applied if required?	_____	_____
28. Air content recorded to 0.1 percent?	_____	_____

Comments: First attempt: Pass____Fail_______ Second attempt:Pass_______Fail_____

____
____
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Examiner Signature ________________________________WAQTC #:_____________

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METHOD OF MAKING AND CURING CONCRETE TEST SPECIMENS IN THE FIELD WFOP AASHTO R 100

Scope

This practice covers the method for making, initially curing, and transporting concrete test specimens in the field in accordance with AASHTO R 100-23.

Warning—Fresh Hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

Apparatus

- Concrete cylinder molds: Conforming to AASHTO M 205 with a length equal to twice the diameter. Standard specimens shall be 150 mm (6 in.) by 300 mm (12 in.) cylinders. Mold diameter must be at least three times the maximum aggregate size unless wet sieving is conducted according to the WFOP WAQTC TM 2. Agency specifications may allow cylinder molds of 100 mm (4 in.) by 200 mm (8 in.) when the nominal maximum aggregate size does not exceed 25 mm (1 in.).
- Beam molds: Rectangular in shape with ends and sides at right angles to each other. Must be sufficiently rigid to resist warpage. Surfaces must be smooth. Molds shall produce length no more than 1.6 mm (1/16 in.) shorter than that required (greater length is allowed). Maximum variation from nominal cross section shall not exceed 3.2 mm (1/8 in.). Ratio of width to depth may not exceed 1:5; the smaller dimension must be at least 3 times the maximum aggregate size. Standard beam molds shall result in specimens having width and depth of not less than 150 mm (6 in.). Agency specifications may allow beam molds of 100 mm (4 in.) by 100 mm (4 in.) when the nominal maximum aggregate size does not exceed 25 mm (1 in.). Specimens shall be cast and hardened with the long axes horizontal.
- Standard tamping rod: 16 mm (5/8 in.) in diameter and 400 mm (16 in.) to 600 mm (24 in.) long, having a hemispherical tip of the same diameter as the rod for preparing 150 mm (6 in.) x 300 mm (12 in.) cylinders.
- Small tamping rod: 10 mm (3/8 in.) diameter and 305 mm (12 in.) to 600 mm (24 in.) long, having a hemispherical tip of the same diameter as the rod for preparing 100 mm (4 in.) x 200 mm (8 in.) cylinders.
- Vibrator: At least 9000 vibrations per minute, with a diameter no more than ¼ the diameter or width of the mold and at least 75 mm (3 in.) longer than the section being vibrated.
- Scoop: a receptacle of appropriate size so that each representative increment of the concrete sample can be placed in the container without spillage.
- Trowel or float
- Mallet: With a rubber or rawhide head having a mass of 0.57 ±0.23 kg (1.25 ±0.5 lb.).

- Rigid base plates and cover plates: may be metal, glass, or plywood.
- Initial curing facilities: Temperature-controlled curing box or enclosure capable of maintaining the required range of 16 to 27°C (60 to 80°F) during the entire initial curing period (for concrete with compressive strength of 40 Mpa (6000 psi) or more, the temperature shall be 20 to 26°C (68 to 78°F). As an alternative, sand or earth for initial cylinder protection may be used provided that the required temperature range is maintained, and the specimens are not damaged.
- Thermometer: Capable of registering both maximum and minimum temperatures during the initial cure meeting the requirements for WFOP AASHTO T 309.

Consolidation Selection

There are two methods of consolidating the concrete – rodding and internal vibration. If the slump is greater than 25 mm (1 in.), consolidation may be by rodding or vibration. When the slump is 25 mm (1 in.) or less, consolidate the sample by internal vibration. Agency specifications may dictate when rodding or vibration will be used.

Procedure

Molding Specimens – General

1. Obtain the sample according to the WFOP WAQTC TM 2.
2. Wet Sieving per the WFOP WAQTC TM 2 is required for 150 mm (6 in.) diameter specimens containing aggregate with a nominal maximum size greater than 50 mm (2 in.); screen the sample over the 50 mm (2 in.) sieve.
3. Remix the sample after transporting to testing location.
4. Begin making specimens within 15 minutes of obtaining the sample.
5. Set molds upright on a level, rigid base in a location free from vibration and relatively close to where they will be stored.
6. Fill molds in the required number of layers, overfilling the mold on the final layer.

Casting Cylinders

Rodding

1. For the standard 150 mm (6 in.) by 300 mm (12 in.) specimen, fill each mold in three approximately equal layers, moving the scoop or trowel around the perimeter of the mold to evenly distribute the concrete. For the 100 mm (4 in.) by 200 mm (8 in.) specimen, fill the mold in two layers. When filling the final layer, slightly overfill the mold.
2. Consolidate each layer with 25 strokes of the appropriate tamping rod, using the rounded end. Distribute strokes evenly over the cross section of the concrete. Rod the first layer throughout its depth without forcibly hitting the bottom. For subsequent layers, rod the layer throughout its depth penetrating approximately 25 mm (1 in.) into the underlying layer.

3. After rodding each layer, tap the sides of each mold 10 to 15 times with the mallet (reusable steel molds) or lightly with the open hand (single-use light-gauge molds).
4. Strike off the surface of the molds with tamping rod, straightedge, float, or trowel.
5. Immediately begin initial curing.

Internal Vibration

1. Fill the mold in two layers.
2. Insert the vibrator at the required number of different points for each layer (two points for 150 mm (6 in.) diameter cylinders; one point for 100 mm (4 in.) diameter cylinders). When vibrating the bottom layer, do not let the vibrator touch the bottom or sides of the mold. When vibrating the top layer, penetrate into the underlying layer approximately 25 mm (1 in.)
3. Remove the vibrator slowly, so that no large air pockets are left in the material.

   Note 1: Continue vibration only long enough to achieve proper consolidation of the concrete. Over vibration may cause segregation and loss of appreciable quantities of intentionally entrained air.

4. After vibrating each layer, tap the sides of each mold 10 to 15 times with the mallet (reusable steel molds) or lightly with the open hand (single-use light-gauge molds).
5. Strike off the surface of the molds with tamping rod, straightedge, float, or trowel.
6. Immediately begin initial curing.

Self-Consolidating Concrete

1. Use the scoop to slightly overfill the mold. Evenly distribute the concrete in a circular motion around the inner perimeter of the mold.
2. Strike off the surface of the molds with tamping rod, straightedge, float, or trowel.
3. Immediately begin initial curing.

Casting Flexural Beams

Rodding

1. Fill the mold in two approximately equal layers with the second layer slightly overfilling the mold.
2. Consolidate each layer with the tamping rod once for every 1300 mm^2 (2 in^2) using the rounded end. Rod each layer throughout its depth, taking care to not forcibly strike the bottom of the mold when compacting the first layer. Rod the second layer throughout its depth, penetrating approximately 25 mm (1 in.) into the lower layer.
3. After rodding each layer, strike the mold 10 to 15 times with the mallet and spade along the sides and end using a trowel.
4. Strike off the surface of the molds with tamping rod, straightedge, float, or trowel.
5. Immediately begin initial curing.

Internal Vibration

1. Fill the mold to overflowing in one layer.
2. Consolidate the concrete by inserting the vibrator vertically along the centerline at intervals not exceeding 150 mm (6 in.). Take care to not over-vibrate and withdraw the vibrator slowly to avoid large voids. Do not contact the bottom or sides of the mold with the vibrator.
3. After vibrating, strike the mold 10 to 15 times with the mallet.
4. Strike off the surface of the molds with tamping rod, straightedge, float, or trowel.
5. Immediately begin initial curing.

Initial Curing

- When moving cylinder specimens made with single use molds support the bottom of the mold with trowel, hand, or other device.
- For initial curing of cylinders, there are two methods, use of which depends on the agency. In both methods, the curing place must be firm, within ¼ in. of a level surface, and free from vibrations or other disturbances.
- Maintain initial curing temperature:
- 16 to 27°C (60 to 80°F) for concrete with design strength up to 40 Mpa (6000 psi).
- 20 to 26°C (68 to 78°F) for concrete with design strength of 40 Mpa (6000 psi) or more.
- Prevent loss of moisture.

Method 1 – Initial cure in a temperature-controlled chest-type curing box

1. Finish the cylinder using the tamping rod, straightedge, float, or trowel. The finished surface shall be flat with no projections or depressions greater than 3.2 mm (1/8 in.).
2. Place the mold in the curing box. When lifting light-gauge molds be careful to avoid distortion (support the bottom, avoid squeezing the sides).
3. Place the lid on the mold to prevent moisture loss.
4. Mark the necessary identification data on the cylinder mold and lid.

Method 2 – Initial cure by burying in earth or by using a curing box over the cylinder

Note 2: This procedure may not be the preferred method of initial curing due to problems in maintaining the required range of temperature.

1. Move the cylinder with excess concrete to the initial curing location.
2. Mark the necessary identification data on the cylinder mold and lid.
3. Place the cylinder on level sand or earth, or on a board, and pile sand or earth around the cylinder to within 50 mm (2 in.) of the top.

4. Finish the cylinder using the tamping rod, straightedge, float, or trowel. Use a sawing motion across the top of the mold. The finished surface shall be flat with no projections or depressions greater than 3.2 mm (1/8 in.).
5. If required by the agency, place a cover plate on top of the cylinder and leave it in place for the duration of the curing period, or place the lid on the mold to prevent moisture loss.

Transporting Specimens

- Initially cure the specimens for 24 to 48 hours. Transport specimens to the laboratory for final cure. Specimen identity will be noted along with the date and time the specimen was made and the maximum and minimum temperatures registered during the initial cure.
- Protect specimens from jarring, extreme changes in temperature, freezing, or moisture loss during transport.
- Secure cylinders so that the axis is vertical.
- Do not exceed 4 hours transportation time.

Final Curing

- Upon receiving cylinders at the laboratory, remove the cylinder from the mold and apply the appropriate identification.
- For all specimens (cylinders or beams), final curing must be started within 30 minutes of mold removal. Temperature shall be maintained at 23° ±2°C (73 ±3°F). Free moisture must be present on the surfaces of the specimens during the entire curing period. Curing may be accomplished in a moist room or water tank conforming to AASHTO M 201.
- For cylinders, during the final 3 hours before testing the temperature requirement may be waived, but free moisture must be maintained on specimen surfaces at all times until tested and ambient temperature is between 20 to 30°C (68 to 80°F).
- Final curing of beams must include immersion in lime-saturated water for at least 20 hours before testing.

Report

- On forms approved by the agency
- Pertinent placement information for identification of project, element(s) represented, etc.
- Sample ID
- Date and time molded.
- Test ages.
- Slump, air content, and density.
- Temperature (concrete, initial cure max. and min., and ambient).
- Method of initial curing.
- Other information as required by agency, such as: concrete supplier, truck number, invoice number, water added, etc.

PERFORMANCE EXAM CHECKLIST

MAKING AND CURING CONCRETE TEST SPECIMENS IN THE FIELD
WFOP AASHTO R 100 (6 X 12)

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Molds placed on a level, rigid, horizontal surface free of vibration?	_____	_____
2. Representative sample selected?	_____	_____
3. Making of specimens begun within 15 minutes of sampling?	_____	_____
First layer		
4. Concrete placed in the mold, moving a scoop or trowel around the perimeter of the mold to evenly distribute the concrete as discharged?	_____	_____
5. Mold filled approximately one third full?	_____	_____
6. Layer rodded throughout its depth 25 times with hemispherical end of rod, uniformly distributing strokes?	_____	_____
7. Sides of the mold tapped 10-15 times after rodding each layer?		
a. With mallet for reusable steel molds	_____	_____
b. With the open hand for flexible light-gauge molds	_____	_____
Second layer		
8. Concrete placed in the mold, moving a scoop or trowel around the perimeter of the mold to evenly distribute the concrete as discharged?	_____	_____
9. Mold filled approximately two thirds full?	_____	_____
10. Layer rodded 25 times with hemispherical end of rod, uniformly distributing strokes and penetrating 25 mm (1 in.) into the underlying layer?	_____	_____
11. Sides of the mold tapped 10-15 times after rodding?		
a. With mallet for reusable steel molds	_____	_____
b. With the open hand for flexible light-gauge molds	_____	_____
Third layer		
12. Concrete placed in the mold, moving a scoop or trowel around the perimeter of the mold to evenly distribute the concrete as discharged?	_____	_____

OVER

Procedure Element	Trial 1	Trial 2
13. Mold slightly overfilled on the last layer?	_____	_____
14. Layer rodded 25 times with hemispherical end of rod, uniformly distributing strokes and penetrating 25 mm (1 in.) into the underlying layer?	_____	_____
15. Sides of the mold tapped 10-15 times after rodding?		
a. With mallet for reusable steel molds	_____	_____
b. With the open hand for flexible light-gauge molds	_____	_____
16. Concrete struck off with tamping rod, straightedge, float, or trowel?	_____	_____
17. Specimens covered with non-absorptive, non-reactive cap or plate?	_____	_____
18. Initial curing addressed?	_____	_____

Comments: First attempt: Pass____Fail_____ Second attempt: Pass______Fail______

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Examiner Signature _______________________________WAQTC #:_______________

PERFORMANCE EXAM CHECKLIST

MAKING AND CURING CONCRETE TEST SPECIMENS IN THE FIELD WFOP AASHTO R 100 (4 X 8)

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Molds placed on a level, rigid, horizontal surface free of vibration?	_____	_____
2. Representative sample selected?	_____	_____
3. Making of specimens begun within 15 minutes of sampling?	_____	_____
First layer		
4. Concrete placed in the mold, moving a scoop or trowel around the perimeter of the mold to evenly distribute the concrete as discharged?	_____	_____
5. Mold filled approximately half full?	_____	_____
6. Layer rodded throughout its depth 25 times with hemispherical end of rod, uniformly distributing strokes?	_____	_____
7. Sides of the mold tapped 10-15 times after rodding?		
a. With mallet for reusable steel molds	_____	_____
b. With the open hand for flexible light-gauge molds	_____	_____
Second layer		
8. Concrete placed in the mold, moving a scoop or trowel around the perimeter of the mold to evenly distribute the concrete as discharged?	_____	_____
9. Mold slightly overfilled on the last layer?	_____	_____
10. Layer rodded 25 times with hemispherical end of rod, uniformly distributing strokes and penetrating 25 mm (1 in.) into the underlying layer?	_____	_____
11. Sides of the mold tapped 10-15 times after rodding each layer?		
a. With mallet for reusable steel molds	_____	_____
b. With the open hand for flexible light-gauge molds	_____	_____
12. Concrete struck off with tamping rod, float or trowel?	_____	_____
13. Specimens covered with non-absorptive, non-reactive cap or plate?	_____	_____
14. Initial curing addressed?	_____	_____

OVER

Comments: First attempt: Pass____Fail_____ Second attempt: Pass______Fail_____

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Examiner Signature ________________________________WAQTC #_______________

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570.04 - EMBANKMENT AND BASE

TOTAL EVAPORABLE MOISTURE CONTENT OF AGGREGATE BY DRYING WFOP AASHTO T 255
LABORATORY DETERMINATION OF MOISTURE CONTENT OF SOILS WFOP AASHTO T 265

Scope

This procedure covers the determination of moisture content of aggregate and soil in accordance with AASHTO T 255-22 and AASHTO T 265-22. It may also be used for other construction materials.

Overview

Moisture content is determined by comparing the wet mass of a sample and the mass of the sample after drying to constant mass. The term constant mass is used to define when a sample is dry.

Constant mass – the state at which a mass does not change more than a given percent, after additional drying for a defined time interval, at a required temperature.

Apparatus

- Balance or scale: capacity sufficient for the principal sample mass, accurate to 0.1 percent of sample mass or readable to 0.1 g, and meeting the requirements of AASHTO M 231
- Containers: clean, dry, and capable of being sealed
- Suitable drying container
    - For soils: container requires close-fitting lid
    - For aggregate: container lid is optional
- Microwave safe container with ventilated lid (for drying aggregate only)
- Heat source, thermostatically controlled, capable of maintaining 110 ± 5°C (230 ± 9°F).
    - Forced draft oven (preferred)
    - Ventilated oven
    - Convection oven
- Heat source, uncontrolled, for use when allowed by the agency, will not alter the material being dried, and close control of the temperature is not required:
    - Infrared heater/heat lamp, hot plate, fry pan, or any other device/method allowed by the agency .
    - Microwave oven (900 watts minimum)
- Utensils such as spoons
- Hot pads or gloves

Sample Preparation

Obtain a representative sample according to the WFOP AASHTO R 90 in its existing condition. If necessary, reduce the sample to moisture content sample size according to the WFOP AASHTO R 76.

For aggregate, the moisture content sample size is based on Table 1 or other information that may be specified by the agency.

TABLE 1
Sample Sizes for Moisture Content of Aggregate

Nominal Maximum Size* mm (in.)	Minimum Sample Mass g (lb)
150 (6)	50,000 (110)
100 (4)	25,000 (55)
90 (3 1/2)	16,000 (35)
75 (3)	13,000 (29)
63 (2 1/2)	10,000 (22)
50 (2)	8000 (18)
37.5 (1 1/2)	6000 (13)
25.0 (1)	4000 (9)
19.0 (3/4)	3000 (7)
12.5 (1/2)	2000 (4)
9.5 (3/8)	1500 (3.3)
4.75 (No. 4)	500 (1.1)

* One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps in specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum.

For soils the moisture content sample size is based on Table 2 or other information that may be specified by the agency.

TABLE 2
Sample Sizes for Moisture Content of Soil

Maximum Particle Size mm (in.)	Minimum Sample Mass g
50 (2)	1000
25.0 (1)	500
12.5 (1/2)	300
4.75 (No. 4)	100
0.425 (No. 40)	10

Immediately seal or cover moisture content samples to prevent any change in moisture content or follow the steps in "Procedure."

Procedure

Determine and record the sample masses as follows:

- For aggregate, determine and record all masses to the nearest 0.1 percent of the sample mass or to the nearest 0.1 g.
- For soil, determine and record all masses to the nearest 0.1 g.

When determining the mass of hot samples or containers or both, place and tare a buffer between the sample container and the balance. This will eliminate damage to or interference with the operation of the balance or scale.

1. Determine and record the mass of the container .
   a. For soils: the container includes the mass of the close-fitting lid.
   b. For aggregate: the lid is optional unless drying with a microwave then a ventilated lid is required.
2. Place the wet sample in the container.
3. Determine and record the total mass of the container and wet sample.
   a. For oven(s), hot plates, infrared heaters, etc.: Spread the sample in the container.
   b. For microwave oven: Heap sample in the container; cover with ventilated lid.
4. Determine and record the wet mass of the sample (M_W) by subtracting the container mass determined in Step 1 from the mass of the container and sample determined in Step 3.
5. Place the sample in one of the following drying apparatuses:
   a. For aggregate –
      i. Controlled heat source (oven): at 110 ±5°C (230 ±9°F).

ii. Uncontrolled heat source (Hot plate, infrared heater, or other heat source as allowed by the agency): Stir frequently to avoid localized overheating.

b. For soil – controlled heat source (oven): at 110 ±5°C (230 ±9°F).

Note 1: Soils containing gypsum or significant amounts of organic material require special drying. For reliable moisture contents dry these soils at 60°C (140°F). For more information see AASHTO T 265, Note 2.

6. Dry until sample appears moisture free.
7. Determine mass of sample and container.
8. Determine and record the mass of the sample by subtracting the container mass determined in Step 1 from the mass of the container and sample determined in Step 7.
9. Return sample and container to the heat source for the additional time interval.
   a. Drying intervals for aggregate –
      i. Controlled heat source (oven): 30 minutes
      ii. Uncontrolled heat source (Hot plate, infrared heater, or other heat source as allowed by the agency): 10 minutes
      iii. Uncontrolled heat source (Microwave oven): 2 minutes

Caution: Some minerals in the sample may cause the aggregate to overheat, crack, and explode; altering the aggregate gradation.

   b. Drying interval for soil – controlled heat source (oven): 1 hour
10. Determine mass of sample and container.
11. Determine and record the mass of the sample by subtracting the container mass determined in Step 1 from the mass of the container and sample determined in Step 10.
12. Determine percent change by subtracting the new mass determination (M_n) from the previous mass determination (M_p), dividing by the previous mass determination (M_p), and multiplying by 100.
13. Continue drying, performing steps 9 through 12, until there is less than a 0.10 percent change after additional drying time.
14. Constant mass has been achieved; sample is defined as dry.
15. Allow the sample to cool. Immediately determine and record the total mass of the container and dry sample.
16. Determine and record the dry mass of the sample (M_D) by subtracting the mass of the container determined in Step 1 from the mass of the container and sample determined in Step 15.
17. Determine and record percent moisture (w) by subtracting the final dry mass determination (M_D) from the initial wet mass determination (M_W), dividing by the final dry mass determination (M_D), and multiplying by 100.

Table 3
Methods of Drying

Aggregate		
Heat Source	**Specific Instructions**	**Drying intervals to achieve constant mass (minutes)**
Controlled: Forced draft (preferred), ventilated, or convection oven	110 ±5°C (230 ±9°F)	30
Uncontrolled:		
Hot plate, infrared heater, or any other device/method allowed by the agency	Stir frequently	10
Microwave	Heap sample and cover with ventilated lid	2
Soil		
Heat Source	**Specific Instructions**	**Drying interval to achieve constant mass**
Controlled: Forced draft (preferred), ventilated, or convection oven	110 ±5°C (230 ±9°F)	1 hour

Calculation

Constant Mass

Calculate constant mass using the following formula:

$$\% \, Change = \frac{M_p - M_n}{M_p} \times 100$$

Where:

M_p = previous mass measurement

M_n = new mass measurement

Example:

Mass of container: 1232.1 g

Mass of container and sample after first drying cycle: 2637.2 g

Mass, M_p, of possibly dry sample: 2637.2 g - 1232.1 g = 1405.1 g

Mass of container and sample after second drying cycle: 2634.1 g

Mass, M_n, of sample: 2634.1 g - 1232.1 g = 1402.0 g

$$\% \, Change = \frac{1405.1\,g - 1402.0\,g}{1405.1\,g} \times 100 = 0.22\%$$

0.22 percent is not less than 0.10 percent, so continue drying.

Mass of container and sample after third drying cycle: 2633.0 g

Mass, M_n, of sample: 2633.0 g - 1232.1 g = 1400.9 g

$$\% \, Change = \frac{1402.0\,g - 1400.9\,g}{1402.0\,g} \times 100 = 0.08\%$$

0.08 percent is less than 0.10 percent, so constant mass has been reached.

Moisture Content:

Calculate the moisture content, as a percent, using the following formula:

$$w = \frac{M_W - M_D}{M_D} \times 100$$

where:

w	=	moisture content, percent
M_W	=	wet mass
M_D	=	dry mass

Example:

Mass of container:		1232.1 g
Mass of container and wet sample:		2764.7 g
Mass, M_W, of wet sample:	2764.7 g - 1232.1 g =	1532.6 g
Mass of container and dry sample (COOLED):		2633.5 g
Mass, M_D, of dry sample:	2633.5 g - 1232.1 g =	1401.4 g

$$w = \frac{1532.6\ g - 1401.4\ g}{1401.4\ g} \times 100 = \frac{131.2g}{1401.4\ g} \times 100 = 9.36\% \quad report\ 9.4\%$$

Report

- On forms approved by the agency
- Sample ID
- M_W, wet mass
- M_D, dry mass
- w, moisture content to the nearest 0.1 percent

PERFORMANCE EXAM CHECKLIST

TOTAL EVAPORABLE MOISTURE CONTENT OF AGGREGATE BY DRYING WFOP AASHTO T 255
LABORATORY DETERMINATION OF MOISTURE CONTENT OF SOILS
WFOP AASHTO T 265

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Representative sample of appropriate mass obtained?	_____	_____
2. Mass of container determined to 0.1 g?	_____	_____
3. Sample placed in container and mass determined to 0.1 g?	_____	_____
4. Test sample mass conforms to the required mass?	_____	_____
5. Wet sample mass determined to 0.1 g?	_____	_____
6. Loss of moisture avoided prior to mass determination?	_____	_____
7. Sample dried by a suitable heat source?	_____	_____
a. Describe suitable heat sources for aggregate?	_____	_____
b. Describe suitable heat sources for soils?	_____	_____
8. If aggregate heated by means other than a controlled oven, is sample stirred to avoid localized overheating?	_____	_____
9. For microwave, aggregate heaped and covered with a ventilated lid?	_____	_____
10. For aggregate, heated for the additional, specified time?	_____	_____
a. Forced draft, ventilated, convection ovens – 30 minutes		
b. Microwave – 2 minutes		
c. Other – 10 minutes		
11. For soil:		
a. Heated for at least 1hour additional drying time using a controlled heat source?	_____	_____
12. Mass determined and compared to previous mass - showing less than 0.10 percent loss?	_____	_____
13. Sample cooled, dry mass determined and recorded to the nearest 0.1 percent?	_____	_____
14. Moisture content calculated correctly and recorded to the nearest 0.1 percent?	_____	_____

OVER

Comments: First attempt: Pass____Fail_____ Second attempt: Pass______Fail_____

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Examiner Signature _______________________________WAQTC #:_______________

MOISTURE DENSITY RELATIONS OF SOILS
IWFOP AASHTO T 99 T 180

ANNEX A.

Insert the following after the second paragraph:

Coarse Particle Correction: If more than 10% of the material is retained on the 3/4 inch sieve, a correction for coarse particles must be performed as specified in Annex A of this procedure.

MOISTURE-DENSITY RELATIONS OF SOILS: USING A 2.5 kg (5.5 lb) RAMMER AND A 305 mm (12 in.) DROP
WFOP AASHTO T 99
USING A 4.54 kg (10 lb) RAMMER AND A 457 mm (18 in.) DROP
WFOP AASHTO T 180

Scope

This procedure covers the determination of the moisture-density relations of soils and soil-aggregate mixtures in accordance with two similar test methods:

- AASHTO T 99-22: Methods A, B, C, and D
- AASHTO T 180-22: Methods A, B, C, and D

This test method applies to soil mixtures having 40 percent or less retained on the 4.75 mm (No. 4) sieve for methods A or B, or 30 percent or less retained on the 19 mm (¾ in.) sieve with methods C or D. The retained material is defined as oversize (coarse) material. If no minimum percentage is specified, 5 percent will be used. Samples that contain oversize (coarse) material that meet percent retained criteria should be corrected by using *Annex A, Correction of Maximum Dry Density and Optimum Moisture for Oversized Particles*. Samples of soil or soil-aggregate mixture are prepared at several moisture contents and compacted into molds of specified size, using manual or mechanical rammers that deliver a specified quantity of compactive energy. The moist masses of the compacted samples are multiplied by the appropriate factor to determine wet density values. Moisture contents of the compacted samples are determined and used to obtain the dry density values of the same samples. Maximum dry density and optimum moisture content for the soil or soil-aggregate mixture is determined by plotting the relationship between dry density and moisture content.

Apparatus

- Mold – Cylindrical mold made of metal with the dimensions shown in Table 1 or Table 2. If permitted by the agency, the mold may be of the "split" type, consisting of two half-round sections, which can be securely locked in place to form a cylinder. Determine the mold volume according to *Annex B, Standardization of the Mold.*
- Mold assembly – Mold, base plate, and a detachable collar.
- Rammer – Manually or mechanically operated rammers as detailed in Table 1 or Table 2. A manually operated rammer shall be equipped with a guide sleeve to control the path and height of drop. The guide sleeve shall have at least four vent holes no smaller than 9.5 mm (3/8 in.) in diameter, spaced approximately 90 degrees apart and approximately 19 mm (3/4 in.) from each end. A mechanically operated rammer will uniformly distribute blows over the sample and will be calibrated with several soil types, and be adjusted, if necessary, to give the same moisture-density results as with the manually operated rammer. For additional information concerning calibration, see AASHTO T 99 and T 180.

- Sample extruder – A jack, lever frame, or other device for extruding compacted specimens from the mold quickly and with little disturbance.
- Balance(s) or scale(s) of the capacity and sensitivity required for the procedure used by the agency.

  A balance or scale with a capacity of 11.5 kg (25 lb) and a sensitivity of 1 g for obtaining the sample, meeting the requirements of AASHTO M 231, Class G 5.

  A balance or scale with a capacity of 2 kg and a sensitivity of 0.1 g is used for moisture content determinations done under both procedures, meeting the requirements of AASHTO M 231, Class G 2.
- Drying apparatus – A thermostatically controlled drying oven, capable of maintaining a temperature of 110 ±5°C (230 ±9°F) for drying moisture content samples in accordance with the WFOP AASHTO T 255/T 265.
- Straightedge – A steel straightedge at least 250 mm (10 in.) long, with one beveled edge and at least one surface plane within 0.1 percent of its length, used for final trimming.
- Sieve(s) – 4.75 mm (No. 4) and/or 19.0 mm (3/4 in.), meeting the requirements of WFOP AASHTO T 27/T 11.
- Mixing tools – Miscellaneous tools such as a mixing pan, spoon, trowel, spatula, etc., or a suitable mechanical device, for mixing the sample with water.
- Containers with close-fitting lids to prevent gain or loss of moisture in the sample.

Table 1
Comparison of Apparatus, Sample, and Procedure – Metric

	T 99	T 180
Mold Volume, m^3	Methods A, C: 0.000943 ±0.000014	Methods A, C: 0.000943 ±0.000014
	Methods B, D: 0.002124 ±0.000025	Methods B, D: 0.002124 ±0.000025
Mold Diameter, mm	Methods A, C: 101.60 ±0.40	Methods A, C: 101.60 ±0.4
	Methods B, D: 152.40 ±0.70	Methods B, D: 152.40 ±0.70
Mold Height, mm	116.40 ±0.50	116.40 ±0.50
Detachable Collar Height, mm	50.80 ±0.64	50.80 ±0.64
Rammer Diameter, mm	50.80 ±0.25	50.80 ±0.25
Rammer Mass, kg	2.495 ±0.009	4.536 ±0.009
Rammer Drop, mm	305 ±2	457 ±2
Layers	3	5
Blows per Layer	Methods A, C: 25	Methods A, C: 25
	Methods B, D: 56	Methods B, D: 56
Material Size, mm	Methods A, B: 4.75 minus	Methods A, B: 4.75 minus
	Methods C, D: 19.0 minus	Methods C, D: 19.0 minus
Test Sample Size, kg	Method A: 3 Method B: 7 Method C: 5 (1) Method D: 11(1)	
Energy, kN-m/m^3	592	2,693

(1) This may not be a large enough sample depending on your nominal maximum size for moisture content samples.

Table 2
Comparison of Apparatus, Sample, and Procedure – English

	T 99	T 180
Mold Volume, ft^3	Methods A, C: 0.0333 ±0.0005	Methods A, C: 0.0333 ±0.0005
	Methods B, D: 0.07500 ±0.0009	Methods B, D: 0.07500 ±0.0009
Mold Diameter, in.	Methods A, C: 4.000 ±0.016	Methods A, C: 4.000 ±0.016
	Methods B, D: 6.000 ±0.026	Methods B, D: 6.000 ±0.026
Mold Height, in.	4.584 ±0.018	4.584 ±0.018
Detachable Collar Height, in.	2.000 ±0.025	2.000 ±0.025
Rammer Diameter, in.	2.000 ±0.025	2.000 ±0.025
Rammer Mass, lb	5.5 ±0.02	10 ±0.02
Rammer Drop, in.	12 ±0.06	18 ±0.06
Layers	3	5
Blows per Layer	Methods A, C: 25	Methods A, C: 25
	Methods B, D: 56	Methods B, D: 56
Material Size, in.	Methods A, B: No. 4 minus	Methods A, B: No.4 minus
	Methods C, D: 3/4 minus	Methods C, D: 3/4 minus
Test Sample Size, lb	Method A: 7 Method B: 16 Method C: 12(1) Method D: 25(1)	
Energy, lb-ft/ft^3	12,375	56,250

(1) This may not be a large enough sample depending on your nominal maximum size for moisture content samples.

Sample

If the sample is damp, dry it until it becomes friable under a trowel. Drying may be in air or by use of a drying apparatus maintained at a temperature not exceeding 60°C (140°F). Thoroughly break up aggregations in a manner that avoids reducing the natural size of individual particles.

Obtain a representative test sample of the mass required by the agency by passing the material through the sieve required by the agency. See Table 1 or Table 2 for test sample mass and material size requirements.

In instances where the material is prone to degradation, i.e., granular material, a compaction sample with differing moisture contents should be prepared for each point.

If the sample is plastic (clay types), it should stand for a minimum of 12 hours after the addition of water to allow the moisture to be absorbed. In this case, several samples at different moisture contents should be prepared, put in sealed containers, and tested the next day.

Note 1: Both T 99 and T 180 have four methods (A, B, C, D) that require different masses and employ different sieves.

Procedure

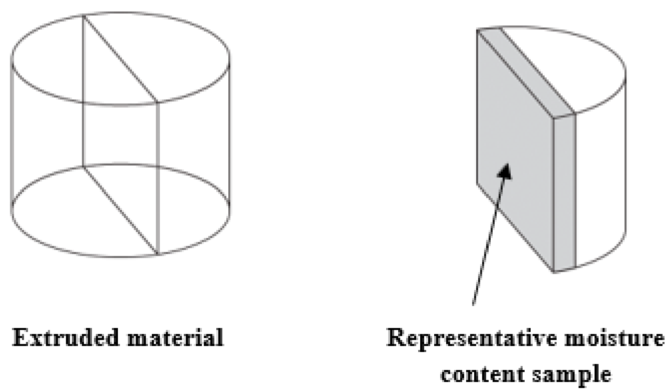
During compaction, rest the mold firmly on a dense, uniform, rigid, and stable foundation, or base. This base shall remain stationary during the compaction process.

1. Determine the mass of the clean, dry mold. Include the base plate but exclude the extension collar. Record the mass to the nearest 1 g (0.005 lb).
2. Thoroughly mix the selected representative sample with sufficient water to dampen it to approximately 4 to 8 percentage points below optimum moisture content. For many materials, this condition can be identified by forming a cast by hand.
    a. Prepare individual samples of plastic or degradable material, increasing moisture contents 1 to 2 percent for each point.
    b. Allow samples of plastic soil to stand for 12 hrs.
3. Form a specimen by compacting the prepared soil in the mold assembly in approximately equal layers. For each layer:
    a. Spread the loose material uniformly in the mold.

    Note 2: It is recommended to cover the remaining material with a non-absorbent sheet or damp cloth to minimize loss of moisture.

    b. Lightly tamp the loose material with the manual rammer or other similar device, this establishes a firm surface.
    c. Compact each layer with uniformly distributed blows from the rammer. See Table 1 for mold size, number of layers, number of blows, and rammer specification for the various test methods. Use the method specified by the agency.
    d. Trim down material that has not been compacted and remains adjacent to the walls of the mold and extends above the compacted surface.

4. Remove the extension collar. Avoid shearing off the sample below the top of the mold. The material compacted in the mold should not be over 6 mm (¼ in.) above the top of the mold once the collar has been removed.
5. Trim the compacted soil even with the top of the mold with the beveled side of the straightedge.
6. Clean soil from exterior of the mold and base plate.
7. Determine and record the mass of the mold, base plate, and wet soil to the nearest 1 g (0.005 lb).
8. Determine and record the wet mass (M_w) of the sample by subtracting the mass in Step 1 from the mass in Step 7.
9. Calculate the wet density (ρ_w), in kg/m^3 (lb/ft^3), by dividing the wet mass by the measured volume (V_m).
10. Extrude the material from the mold. For soils and soil-aggregate mixtures, slice vertically through the center and remove one of the cut faces for a representative moisture content sample. For granular materials, a vertical face will not exist. Take a representative sample ensuring that all layers are represented. This sample must meet the sample size requirements of the test method used to determine moisture content.



Note 3: When developing a curve for free-draining soils such as uniform sands and gravels, where seepage occurs at the bottom of the mold and base plate, taking a representative moisture content from the mixing bowl may be preferred in order to determine the amount of moisture available for compaction.

11. Determine and record the moisture content (w) of the sample in accordance with the WFOP AASHTO T 255 / T 265.
12. If the material is degradable or plastic, return to Step 3 using a prepared individual sample. If not, continue with Steps 13 through 15.
13. Thoroughly break up the remaining portion of the molded specimen until it will again pass through the sieve, as judged by eye, and add to the remaining portion of the sample being tested.
14. Add sufficient water to increase the moisture content of the remaining soil by 1 to 2 percentage points and repeat steps 3 through 11.
15. Continue determinations until there is either a decrease or no change in the wet mass. There will be a minimum of three points on the dry side of the curve and two points on the wet side. For non-cohesive, drainable soils, one point on the wet side is sufficient.

Calculations

Wet Density

$$\rho_w = \frac{M_w}{V_m}$$

Where:

ρ_w = wet density, kg/m^3 (lb/ft^3)

M_w = wet mass

V_m = volume of the mold, Annex B

Dry Density

$$\rho_d = \left(\frac{\rho_w}{w + 100}\right) \times 100 \quad or \quad \rho_d = \frac{\rho_w}{\left(\frac{w}{100}\right) + 1}$$

Where:

ρ_d = dry density, kg/m^3 (lb/ft^3)

w = moisture content, as a percentage

Example for 4-inch mold, Methods A or C

Wet mass, M_w = 1.928 kg (4.25 lb)

Moisture content, w = 11.3%

Measured volume of the mold, V_m = 0.000946 m^3 (0.0334 ft^3)

Wet Density

$$\rho_w = \frac{1.928\ kg}{0.000946\ m^3} = 2038\ kg/m^3 \quad \rho_w = \frac{4.25\ lb}{0.0334\ ft^3} = 127.2\ lb/ft^3$$

Dry Density

$$\rho_d = \left(\frac{2038\ kg/m^3}{11.3 + 100}\right) \times 100 = 1831\ kg/m^3 \quad \rho_d = \left(\frac{127.2\ lb/ft^3}{11.3 + 100}\right) \times 100 = 114.3\ lb/ft^3$$

Or

$$\rho_d = \left(\frac{2038\, kg/m^3}{\frac{11.3}{100}+1}\right) = 1831\, kg/m^3 \quad \rho_d = \left(\frac{127.2\ lb/ft^3}{\frac{11.3}{100}+1}\right) = 114.3\, lb/ft^3$$

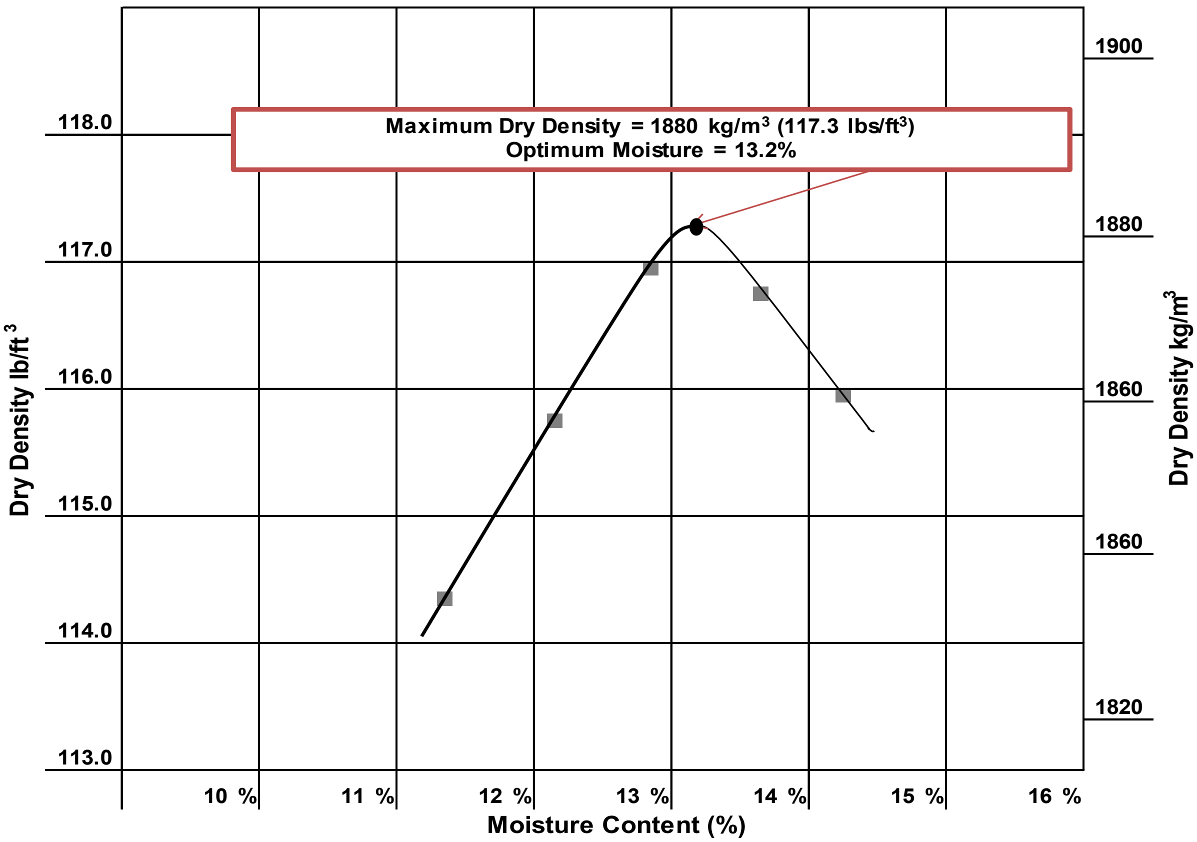
Moisture-Density Curve Development

When dry density is plotted on the vertical axis versus moisture content on the horizontal axis and the points are connected with a smooth line, a moisture-density curve is developed. The coordinates of the peak of the curve are the maximum dry density, or just “maximum density,” and the “optimum moisture content” of the soil.

Example

Given the following dry density and corresponding moisture content values develop a moisture-density relations curve and determine maximum dry density and optimum moisture content.

Dry Density		**Moisture Content, %**
kg/m³	**lb/ft³**	
1831	114.3	11.3
1846	115.7	12.1
1873	116.9	12.8
1869	116.7	13.6
1857	115.9	14.2



In this case, the curve has its peak at:

Maximum dry density = 1880 kg/m^3 (117.3 lb/ft^3)

Optimum moisture content = 13.2%

Note that both values are approximate since they are based on sketching the curve to fit the points.

Report

- Results on forms approved by the agency
- Sample ID
- Maximum dry density to the nearest 1 kg/m^3 (0.1 lb/ft^3)
- Optimum moisture content to the nearest 0.1 percent

ANNEX A
CORRECTION OF MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE FOR OVERSIZED PARTICLES

(Mandatory Information)

This section corrects the maximum dry density and moisture content of the material retained on the 4.75 mm (No. 4) sieve, Methods A and B; or the material retained on the 19 mm (¾ in.) sieve, Methods C and D. The maximum dry density, corrected for oversized particles and total moisture content, are compared with the field-dry density and field moisture content.

This correction can be applied to the sample on which the maximum dry density is performed. A correction may not be practical for soils with only a small percentage of oversize material. The agency shall specify a minimum percentage below which the method is not needed. If not specified, this method applies when more than 5 percent by weight of oversize particles is present.

Bulk specific gravity (G_{sb}) of the oversized particles is required to determine the corrected maximum dry density. Use the bulk specific gravity as determined using the WFOP AASHTO T 85 in the calculations. For construction activities, an agency established value or specific gravity of 2.600 may be used.

This correction can also be applied to the sample obtained from the field while performing in-place density.

Procedure

1. Use the sample from this procedure or a sample obtained according to the WFOP AASHTO T 310.
2. Sieve the sample on the 4.75 mm (No. 4) sieve for Methods A and B or the 19 mm (¾ in.) sieve, Methods C and D.
3. Determine the dry mass of the oversized and fine fractions (M_{DC} and M_{DF}) by one of the following:
   a. Dry the fractions, fine and oversized, in air or by use of a drying apparatus that is maintained at a temperature not exceeding 60ºC (140ºF).
   b. Calculate the dry masses using the moisture samples.

To determine the dry mass of the fractions using moisture samples.

1. Determine the moist mass of both fractions, fine (M_{Mf}) and oversized (M_{Mc}):
2. Obtain moisture samples from the fine and oversized material.
3. Determine the moisture content of the fine particles (MC_f) and oversized particles (MC_C) of the material by WFOP AASHTO T 255/T 265 or agency approved method.
4. Calculate the dry mass of the oversize and fine particles.

$$M_D = \frac{M_m}{1 + \mathrm{MC}}$$

Where:

M_D = mass of dry material (fine or oversize particles)

M_m = mass of moist material (fine or oversize particles)

MC = moisture content of respective fine or oversized, expressed as a decimal

5. Calculate the percentage of the fine (P_f) and oversized (P_c) particles by dry weight of the total sample as follows: See Note 2.

$$\mathrm{P_f} = \frac{100 \times M_{DF}}{M_{DF} + M_{DC}} \qquad \frac{100 \ \times 15.4\ lb}{15.4\ lbs + 5.7\ lb} = 73\% \qquad \frac{100 \ \times 6.985\ kg}{6.985\ kg + 2.585\ kg} = 73\%$$

And

$$\mathrm{P_c} = \frac{100 \times M_{DC}}{M_{DF} + M_{DC}} \qquad \frac{100 \ \times 5.7\ lb}{15.4\ lbs + 5.7\ lb} = 27\% \qquad \frac{100 \ \times 2.585 kg}{6.985\ kg + 2.585\ kg} = 27\%$$

Or for $\mathbf{P_c}$:

$$\mathrm{P_c} = 100 - \mathrm{P_f}$$

Where:

P_f = percent of fine particles, of sieve used, by weight

P_c = percent of oversize particles, of sieve used, by weight

M_{DF} = mass of dry fine particles

M_{DC} = mass of dry oversize particles

Optimum Moisture Correction Equation

1. Calculate the corrected moisture content as follows:

$$MC_T = \frac{(MC_F \times P_f) + (MC_c \times P_c)}{100} \qquad \frac{(13.2\% \times 73.0\%) + (2.1\% \times 27.0\%)}{100} = 10.2\%$$

MC_T = corrected moisture content of combined fines and oversized particles, expressed as a % moisture

MC_F = moisture content of fine particles, as a % moisture

MC_C = moisture content of oversized particles, as a % moisture

Note 1: Moisture content of oversize material can be assumed to be two (2) percent for most construction applications.

Note 2: In some field applications agencies will allow the percentages of oversize and fine materials to be determined with the materials in the wet state.

Density Correction Equation

2. Calculate the corrected dry density (ρ_d) of the total sample (combined fine and oversized particles) as follows:

$$\rho_d = \frac{100\%}{\left[\left(\frac{P_f}{\boldsymbol{\rho_f}}\right) + \left(\frac{P_c}{k}\right)\right]}$$

Where:

ρ_d = corrected total dry density (combined fine and oversized particles) kg/m^3 (lb/ft^3)

$\boldsymbol{\rho_f}$ = dry density of the fine particles kg/m^3 (lb/ft^3), determined in the lab

P_c = percent of dry oversize particles, of sieve used, by weight.

P_f = percent of dry fine particles, of sieve used, by weight.

k = Metric: 1,000 * Bulk Specific Gravity (G_{sb}) (oven dry basis) of coarse particles (kg/m^3).

k = English: 62.4 * Bulk Specific Gravity (G_{sb}) (oven dry basis) of coarse particles (lb/ft^3)

Note 3: If the specific gravity is known, then this value will be used in the calculation. For most construction activities the specific gravity for aggregate may be assumed to be 2.600.

Calculation

Example

- Metric:

Maximum laboratory dry density ($\boldsymbol{\rho_f}$):	1880 kg/m^3
Percent coarse particles (P_c):	27%
Percent fine particles (P_f):	73%
Mass per volume coarse particles (k):	(2.697) (1000) = 2697 kg/m^3

$$\rho_d = \frac{100\%}{\left[\left(\frac{P_f}{\boldsymbol{\rho_f}}\right) + \left(\frac{P_c}{k}\right)\right]}$$

$$\rho_d = \frac{100\%}{\left[\left(\frac{73\%}{1880\, kg/m^3}\right) + \left(\frac{27\%}{2697\, kg/m^3}\right)\right]}$$

$$\rho_d = \frac{100\%}{[0.03883\, kg/m^3 + 0.01001\, kg/m^3]}$$

$$\rho_d = 2047.5\, kg/m^3\ report\ \ 2048\, kg/m^3$$

English:

Maximum laboratory dry density ($\boldsymbol{\rho_f}$): 117.3 lb/ft^3

Percent coarse particles (P_c): 27%

Percent fine particles (P_f): 73%

Mass per volume of coarse particles (k): (2.697) (62.4) = 168.3 lb/ft^3

$$\rho_d = \frac{100\%}{\left[\left(\frac{P_f}{\boldsymbol{\rho_f}}\right) + \left(\frac{P_c}{k}\right)\right]}$$

$$\rho_d = \frac{100\%}{\left[\left(\frac{73\%}{117.3\, lb/ft^3}\right) + \left(\frac{27\%}{168.3\, lb/ft^3}\right)\right]}$$

$$\rho_d = \frac{100\%}{[0.6223\ lb/ft^3 + 0.1604\ lb/ft^3]}$$

$$\rho_d = \frac{100\%}{0.7827\ lb/ft^3}$$

$$\rho_d = 127.76\ lb/ft^3 \quad Report\ 127.8\ lb/ft^3$$

Report

- On forms approved by the agency
- Sample ID
- Corrected maximum dry density to the nearest 1 kg/m^3 (0.1 lb/ft^3)
- Corrected optimum moisture to the nearest 0.1 percent

ANNEX B
STANDARDIZATION OF THE MOLD

(Mandatory Information)

Standardization is a critical step to ensure accurate test results when using this apparatus. Failure to perform the standardization procedure as described herein will produce inaccurate or unreliable test results.

Apparatus

- Mold and base plate
- Balance or scale – Accurate to within 45 g (0.1 lb) or 0.3 percent of the test load, whichever is greater, at any point within the range of use.
- Cover plate – A piece of plate glass, at least 6 mm (1⁄4 in.) thick and at least 25 mm (1 in.) larger than the diameter of the mold.
- Thermometers – Standardized liquid-in-glass, or electronic digital total immersion type, accurate to 0.5°C (1°F)

Procedure

1. Create a watertight seal between the mold and base plate.
2. Determine and record the mass of the dry sealed mold, base plate, and cover plate.
3. Fill the mold with water at a temperature between 16°C and 29°C (60°F and 85°F) and cover with the cover plate in such a way as to eliminate bubbles and excess water.
4. Wipe the outside of the mold, base plate, and cover plate dry, being careful not to lose any water from the mold.
5. Determine and record the mass of the filled mold, base plate, cover plate, and water.
6. Determine and record the mass of the water in the mold by subtracting the mass in Step 2 from the mass in Step 5.
7. Measure the temperature of the water and determine its density from Table B1, interpolating, as necessary.
8. Calculate the volume of the mold, V_m, by dividing the mass of the water in the mold by the density of the water at the measured temperature.

Calculations

$$V_m = \frac{M}{\rho_{water}}$$

Where:

V_m = volume of the mold

M = mass of water in the mold

ρ_{water} = density of water at the measured temperature

Example

- Mass of water in mold = 0.94367 kg (2.0800 lb)

ρ_{water} at 23°C (73.4°F) = 997.54 kg/m^3 (62.274 lb/ft^3)

$$V_m = \frac{0.94367\ kg}{997.54\ kg/m^3} = 0.000946\ m^3 \qquad V_m = \frac{2.0800\ lb}{62.274\ lb/ft^3} = 0.0334\ ft^3$$

Table B1
Unit Mass of Water
15°C to 30°C

°C	(°F)	kg/m^3	(lb/ft^3)	°C	(°F)	kg/m^3	(lb/ft^3)
15	(59.0)	999.10	(62.372)	23	(73.4)	997.54	(62.274)
15.6	(60.0)	999.01	(62.366)	23.9	(75.0)	997.32	(62.261)
16	(60.8)	998.94	(62.361)	24	(75.2)	997.29	(62.259)
17	(62.6)	998.77	(62.350)	25	(77.0)	997.03	(62.243)
18	(64.4)	998.60	(62.340)	26	(78.8)	996.77	(62.227)
18.3	(65.0)	998.54	(62.336)	26.7	(80.0)	996.59	(62.216)
19	(66.2)	998.40	(62.328)	27	(80.6)	996.50	(62.209)
20	(68.0)	998.20	(62.315)	28	(82.4)	996.23	(62.192)
21	(69.8)	997.99	(62.302)	29	(84.2)	995.95	(62.175)
21.1	(70.0)	997.97	(62.301)	29.4	(85.0)	995.83	(62.166)
22	(71.6)	997.77	(62.288)	30	(86.0)	995.65	(62.156)

Report

- Mold ID
- Date Standardized
- Temperature of the water
- Volume, V_m, of the mold to the nearest 0.000001 m^3 (0.0001 ft^3)

PERFORMANCE EXAM CHECKLIST

MOISTURE-DENSITY RELATION OF SOILS
WFOP AASHTO T 99

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. If damp, sample dried in air or drying apparatus, not exceeding 60°C (140°F)?	_____	_____
2. Sample broken up and an adequate amount sieved over the appropriate sieve (4.75 mm / No. 4 or 19.0 mm / 3/4 in.) to determine oversize (coarse particle) percentage?	_____	_____
3. Sample passing the sieve has appropriate mass?	_____	_____
4. If material is degradable:		
a. Multiple samples mixed with water varying moisture content by 1 to 2 percent, bracketing the optimum moisture content?	_____	_____
5. If soil is plastic (clay types):		
a. Multiple samples mixed with water varying moisture content by 1 to 2 percent, bracketing the optimum moisture content?	_____	_____
b. Samples placed in covered containers and allowed to stand for at least 12 hours?	_____	_____
6. Sample determined to be 4 to 8 percent below expected optimum moisture content?	_____	_____
7. Determine mass of clean, dry mold without collar to nearest 1 g (0.005 lb.)?	_____	_____
8. Mold placed on rigid and stable foundation?	_____	_____
9. Layer of soil (approximately one third compacted depth) placed in mold with collar attached, loose material lightly tamped?	_____	_____
10. Soil compacted with appropriate number of blows (25 or 56)?	_____	_____
11. Material adhering to the inside of the mold trimmed?	_____	_____
12. Layer of soil (approximately two thirds compacted depth) placed in mold with collar attached, loose material lightly tamped?	_____	_____
13. Soil compacted with appropriate number of blows (25 or 56)?	_____	_____
14. Material adhering to the inside of the mold trimmed?	_____	_____
15. Mold filled with soil such that compacted soil will be above the mold, loose material lightly tamped?	_____	_____

OVER

Procedure Element	**Trial 1**	**Trial 2**
16. Soil compacted with appropriate number of blows (25 or 56)?	_____	_____
17. Collar removed without shearing off sample?	_____	_____
18. Approximately 6 mm (1/4 in.) of compacted material above the top of the mold (without the collar)?	_____	_____
19. Soil trimmed to top of mold with the beveled side of the straightedge?	_____	_____
20. Remove all soil from exterior surface of mold and base plate?	_____	_____
21. Mass of mold and contents determined to appropriate precision (1 g)?	_____	_____
22. Wet density calculated from the wet mass?	_____	_____
23. Soil removed from mold using a sample extruder if needed?	_____	_____
24. Soil sliced vertically through center (non-granular material)?	_____	_____
25. Moisture sample removed ensuring all layers are represented?	_____	_____
26. Moist mass determined immediately to 0.1 g?	_____	_____
27. Moisture sample mass of correct size?	_____	_____
28. Sample dried, and water content determined according to the WFOP T 255/T 265?	_____	_____
a. Remainder of material from mold broken up until it will pass through the sieve, as judged by eye, and added to remainder of original test sample?	_____	_____
b. Water added to increase moisture content of the remaining sample in approximately 1 to 2 percent increments?	_____	_____
c. Steps 7 through 29 repeated for each increment of water added?	_____	_____
29. Process continued until wet density either decreases or stabilizes?	_____	_____
30. Moisture content and dry density calculated for each sample?	_____	_____
31. Dry density plotted on vertical axis, moisture content plotted on horizontal axis, and points connected with a smooth curve?	_____	_____
32. Moisture content at peak of curve recorded as optimum water content and recorded to nearest 0.1 percent?	_____	_____
33. Dry density at optimum moisture content reported as maximum density to nearest 1 kg/m^3 (0.1 lb/ft^3)?	_____	_____
34. Corrected for coarse particles if applicable?	_____	_____

Comments: First attempt: Pass____Fail_____ Second attempt: Pass______Fail_____

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Examiner Signature ________________________________WAQTC #:_______________

DEVELOPING A FAMILY OF CURVES
WFOP AASHTO R 75

Scope

This procedure provides a method to develop a family of curves in accordance with AASHTO R 75-16 using multiple moisture-density relationships developed using the same method, A, B, C, or D, from the WFOP AASHTO T 99/T 180.

All curves used in a family must be developed using a single Method: A, B, C, or D of a procedure for AASHTO T 99 or T 180. See the WFOP AASHTO T 99/T 180.

Terminology

family of curves — a group of soil moisture-density relationships (curves) determined using AASHTO T 99 or T 180, which reveal certain similarities and trends characteristic of the soil type and source.

***spine* —** smooth line extending through the point of maximum density and optimum moisture content of a family of moisture-density curves.

Procedure

1. Sort the curves by Method (A, B, C, or D of the WFOP T 99/T 180). At least three curves are required to develop a family.
2. Select the highest and lowest maximum dry densities from those selected to assist in determining the desired scale of the subsequent graph.
3. Plot the maximum density and optimum moisture points of the selected curves on the graph.
4. Draw a smooth, "best fit," curved line through the points creating the spine of the family of curves.
5. Remove maximum density and optimum moisture points that were not used to establish the spine.
6. Add the moisture-density curves associated with the points that were used to establish the spine. It is not necessary to include the portion of the curves over optimum moisture.

Note 1—Intermediate curves using slopes similar to those of the original moisture-density curves may be included when maximum density points are more than 2.0 lb/ft^3 apart. Intermediate curves are indicated by a dashed line.

7. Plot the 80 percent of optimum moisture range when desired:
   a. Using the optimum moisture of an existing curve, calculate 80 percent of optimum moisture and plot this value on the curve. Repeat for each curve in the family.
   b. Draw a smooth, "best fit," curved line connecting the 80 percent of optimum moisture points plotted on the curves that parallel the spine.

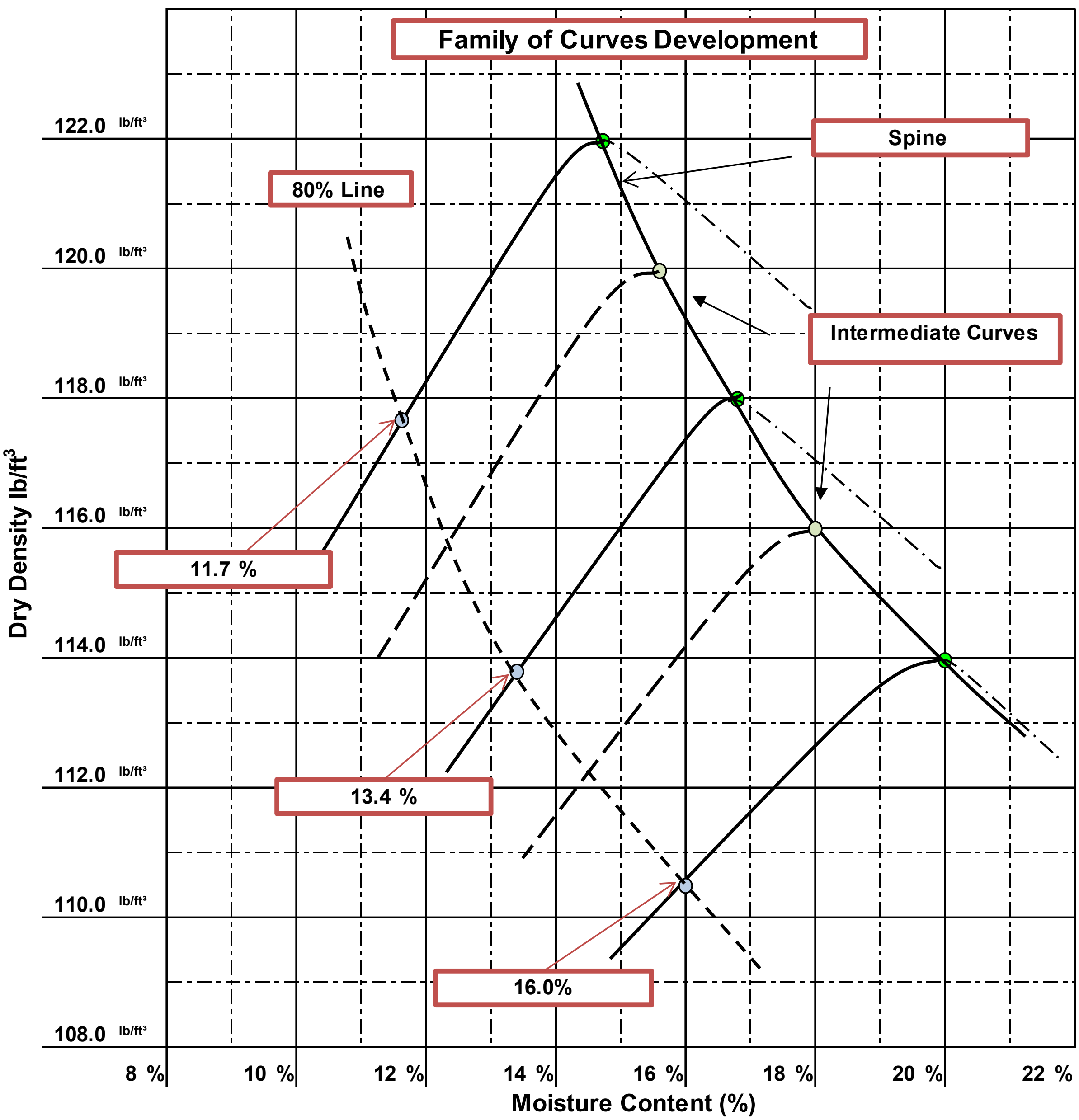
Calculations

Calculate 80 percent of optimum moisture of each curve:

Example:

Optimum moisture of the highest density curve = 14.6%

$$80\%\ point = \frac{80}{100} \times 14.6\% = 11.7\%$$



PERFORMANCE EXAM CHECKLIST

DEVELOPING A FAMILY OF CURVES
WFOP AASHTO R 75

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Curves sorted by method and procedure (A, B, C, or D of the WFOP T 99/T 180)?	_____	_____
a. At least three curves per family?	_____	_____
b. Curves within family are similar soil type and from same source?	_____	_____
2. Maximum density and optimum moisture points plotted on the graph?	_____	_____
3. Spine drawn correctly?	_____	_____
4. Maximum density and optimum moisture points removed that were not used for the spine?	_____	_____
5. Moisture-density curves added?	_____	_____
6. Optimum moisture range?	_____	_____
a. 80 percent of optimum moisture calculated for each curve?	_____	_____
b. Curved line through 80 percent of optimum moisture drawn correctly?	_____	_____

Comments: First attempt: Pass____Fail_____ Second attempt: Pass_____Fail_____

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Examiner Signature ______________________________WAQTC #:______________

SPECIFIC GRAVITY AND ABSORPTION OF COARSE AGGREGATE WFOP AASHTO T 85

Scope

This procedure covers the determination of specific gravity and absorption of coarse aggregate in accordance with AASHTO T 85-22. Specific gravity may be expressed as bulk specific gravity (G_{sb}), bulk specific gravity, saturated surface dry (G_{sb} SSD), or apparent specific gravity (G_{sa}). G_{sb} and absorption are based on aggregate after soaking in water. This procedure is not intended to be used with lightweight aggregates.

Terminology

Absorption – the increase in the mass of aggregate due to water being absorbed into the pores of the material, but not including water adhering to the outside surface of the particles, expressed as a percentage of the dry mass. The aggregate is considered "dry" when it has been maintained at a temperature of 110 ±5°C (230 ±9°F) for sufficient time to remove all uncombined water.

Saturated Surface Dry (SSD) – condition of an aggregate particle when the permeable voids are filled with water, but no water is present on exposed surfaces.

Specific Gravity – the ratio of the mass, in air, of a volume of a material to the mass of the same volume of gas-free distilled water at a stated temperature.

Apparent Specific Gravity (G_{sa})– the ratio of the mass, in air, of a volume of the impermeable portion of aggregate to the mass of an equal volume of gas-free distilled water at a stated temperature.

Bulk Specific Gravity (G_{sb})– the ratio of the mass, in air, of a volume of aggregate (including the permeable and impermeable voids in the particles, but not including the voids between particles) to the mass of an equal volume of gas-free distilled water at a stated temperature.

Bulk Specific Gravity (SSD) (G_{sb} SSD) – the ratio of the mass, in air, of a volume of aggregate, including the mass of water within the voids filled to the extent achieved by submerging in water for 15 to 19 hours (but not including the voids between particles), to the mass of an equal volume of gas-free distilled water at a stated temperature.

Apparatus

- Balance or scale: with a capacity of 5 kg, sensitive to 0.1 g. Meeting the requirements of AASHTO M 231.
- Sample container: a wire basket of 3.35 mm (No. 6) or smaller mesh, with a capacity of 4 to 7 L (1 to 2 gal) to contain aggregate with a nominal maximum size of 37.5 mm (1 1/2 in.) or smaller; or a larger basket for larger aggregates, or both.
- Water tank: watertight and large enough to completely immerse aggregate and basket, equipped with an overflow valve to keep water level constant.
- Suspension apparatus: wire used to suspend apparatus shall be of the smallest practical diameter.

- Sieves: 4.75 mm (No. 4) or other sizes as needed, meeting the requirements of WFOP AASHTO T 27/T 11.
- Large absorbent cloth

Sample Preparation

1. Obtain the sample in accordance with the WFOP AASHTO R 90 (see Note 1).
2. Mix the sample thoroughly and reduce it to the approximate sample size required by Table 1 in accordance with the WFOP AASHTO R 76.
3. Reject all material passing the appropriate sieve by dry sieving.
4. Thoroughly wash sample to remove dust or other coatings from the surface.
5. Dry the sample to constant mass according to the WFOP AASHTO T 255/T 265 at a temperature of 110 ±5°C (230 ±9°F) and cool in air at room temperature for 1 to 3 hours.

Note 1: Where the absorption and specific gravity values are to be used in proportioning concrete mixtures in which the aggregates will be in their naturally moist condition, the requirement for initial drying to constant mass may be eliminated, and, if the surfaces of the particles in the sample have been kept continuously wet until test, the 15-to-19-hour soaking may also be eliminated.

6. Re-screen the sample over the appropriate sieve. Reject all material passing that sieve.
7. The sample shall meet or exceed the minimum mass given in Table 1.

Note 2: If this procedure is used only to determine the G_{sb} of oversized material for the WFOP AASHTO T 99 / T 180, the material can be rejected over the appropriate sieve. For T 99 / T 180 Methods A and B, use the 4.75 mm (No. 4) sieve; T 99 / T 180 Methods C and D use the 19 mm (3/4 in).

Table 1

Nominal Maximum Size* mm (in.)	Minimum Mass of Sample, g (lb)
12.5 (1/2) or less	2000 (4.4)
19.0 (3/4)	3000 (6.6)
25.0 (1)	4000 (8.8)
37.5 (1 1/2)	5000 (11)
50 (2)	8000 (18)
63 (2 1/2)	12,000 (26)
75 (3)	18,000 (40)

* One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps in specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum size.

Procedure

1. Immerse the sample in water at room temperature for a period of 15 to 19 hours.

Note 3: When testing coarse aggregate of large nominal maximum size requiring large samples, it may be more convenient to perform the test on two or more subsamples, and then combine the values obtained.

2. Place the empty basket into the water bath and attach to the balance. Inspect the immersion tank to ensure the water level is at the overflow outlet height and basket is fully submerged. Tare the balance with the empty basket attached in the water bath.

3. Remove the sample from the water and roll it in a large absorbent cloth until all visible films of water are removed. Wipe the larger particles individually. If the sample dries past the SSD condition, immerse in water for 30 min, and then resume the process of surface-drying.

Note 4: A moving stream of air may be used to assist in the drying operation but take care to avoid evaporation of water from aggregate pores.

4. Determine the SSD mass of the sample, and record this and all subsequent masses to the nearest 0.1 g or 0.1 percent of the sample mass, whichever is greater. Designate this mass as “B.”

5. Immediately place the SSD sample in the sample container and weigh it in water maintained at 23.0 ±1.7°C (73.4 ±3°F). Shake the container to release entrapped air before recording the weight. Re-inspect the immersion tank to ensure the water level is at the overflow outlet height and basket is fully submerged. Designate this submerged weight as “C.”

Note 5: The container should be immersed to a depth sufficient to cover it and the sample during mass determination. Wire suspending the container should be of the smallest practical size to minimize any possible effects of a variable immersed length.

6. Remove the sample from the basket. Ensure all material has been removed. Place in a container of known mass.

7. Dry the sample to constant mass according to the WFOP AASHTO T 255 / T 265 at 110 ±5°C (230 ±9°F) and cool in air at room temperature for 1 to 3 hours.

8. Determine and record the dry mass. Designate this mass as “A.”

Calculations

Perform calculations and determine values using the appropriate formula below.

Bulk specific gravity (G_{sb})

$$G_{sb} = \frac{A}{B - C}$$

Bulk specific gravity, SSD (G_{sb} SSD)

$$G_{sb}SSD = \frac{B}{B - C}$$

Apparent specific gravity (G_{sa})

$$G_{sa} = \frac{A}{A - C}$$

Absorption

$$\text{Absorption} = \frac{B - A}{A} \times 100$$

Where:

A	= oven dry mass, g
B	= SSD mass, g
C	= weight in water, g

Sample Calculations

Sample	A	B	C	B - C	A - C	B - A
1	2030.9	2044.9	1304.3	740.6	726.6	14.0
2	1820.0	1832.5	1168.1	664.4	651.9	12.5
3	2035.2	2049.4	1303.9	745.5	731.3	14.2

Sample	G_{sb}	G_{sb} SSD	G_{sa}	Absorption
1	2.742	2.761	2.795	0.7
2	2.739	2.758	2.792	0.7
3	2.730	2.749	2.783	0.7

These calculations demonstrate the relationship between G_{sb}, G_{sb} SSD, and G_{sa}. G_{sb} is always lowest since the volume includes voids permeable to water. G_{sb} SSD is always intermediate. G_{sa} is always highest since the volume does not include voids permeable to water. When running this test, check to make sure the values calculated make sense in relation to one another.

Report

- On forms approved by the agency
- Sample ID
- Specific gravity values to the nearest 0.001
- Absorption to the nearest 0.1 percent

PERFORMANCE EXAM CHECKLIST

SPECIFIC GRAVITY AND ABSORPTION OF COARSE AGGREGATE
WFOP AASHTO T 85

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Sample obtained by WFOP AASHTO R 90 and reduced by WFOP AASHTO R 76 or from WFOP AASHTO T 99 / T 180?	_____	_____
2. Screened on the appropriate size sieve?	_____	_____
3. Sample mass appropriate?	_____	_____
4. Particle surfaces clean?	_____	_____
5. Dried to constant mass 110 ±5°C (230 ±9°F) and cooled to room temperature?	_____	_____
6. Re-screen over appropriate sieve?	_____	_____
7. Covered with water for 15 to 19 hours?	_____	_____
8. Wire basket completely submerged in immersion tank and attached to balance?	_____	_____
9. Immersion tank inspected for proper water height?	_____	_____
10. Balance tared with basket in tank and temperature checked 23.0 ±1.7°C (73.4 ±3°F)?	_____	_____
11. Sample removed from water and rolled in cloth to remove visible films of water?	_____	_____
12. Larger particles wiped individually?	_____	_____
13. Evaporation avoided?	_____	_____
14. Sample mass determined to 0.1 g?	_____	_____
15. Sample immediately placed in basket, in immersion tank?	_____	_____
16. Entrapped air removed before weighing by shaking basket while immersed?	_____	_____
17. Immersion tank inspected for proper water height?	_____	_____
18. Immersed sample weight determined to 0.1 g?	_____	_____
19. All the sample removed from basket?	_____	_____
20. Sample dried to constant mass and cooled to room temperature?	_____	_____

OVER

Procedure Element	Trial 1	Trial 2
21. Sample mass determined to 0.1 g?	_____	_____
22. Proper formulas used in calculations?	_____	_____

Comments: First attempt: Pass____Fail_____ Second attempt: Pass_____Fail_____

____
____
____
____
____
____

Examiner Signature ______________________________WAQTC #:_____________

570.05 - IN-PLACE DENSITY

570.05 – IN-PLACE DENSITY

IN-PLACE DENSITY OF ASPHALT MIXTURES BY NUCLEAR METHOD IWFOP AASHTO T 355

Scope

Add the following:

Asphalt mixtures when no acceptance test strip is required See Section 270.00, Minimum Testing Requirements for 405 SUPERPAVE Hot Mix Asphalt.

Apparatus

Add the following:

Informational Note:

1. Gauge Selection for Thin Lifts: Accurate density measurement is crucial for thin-lift asphalt pavements (generally less than 3 inches thick). While traditional nuclear density gauges (e.g., Troxler 3430/3440/3440+ or equivalent) are commonly used, their accuracy on thin lifts can be compromised due to influence from the underlying layer. Thin-lift specific nuclear density gauges (e.g., Troxler 4640-B or equivalent) are designed to overcome this limitation and provide more reliable readings on thin asphalt layers.
2. Factors to Consider: When selecting a gauge for density testing on thin-lift asphalt pavements, consider the following factors:

   Lift Thickness: Thin-lift gauges are strongly recommended for lifts less than 3 inches thick.

   Gauge Availability: Determine the availability of thin-lift gauges within a reasonable distance to minimize project delays and costs.
3. Documentation: Clearly document the type of gauge used (thin-lift or traditional), model and serial number, measurement mode, and lift thickness on the In-Place Density Reports (ITD-855).
4. ITD Evaluation: ITD is actively evaluating the use of thin-lift gauges and may provide further guidance or requirements in the future.

Procedure

Add the following:

5. Method A is specified for all lift thicknesses.

IN-PLACE DENSITY OF ASPHALT MIXTURES BY NUCLEAR METHODS WFOP AASHTO T 355

Scope

This test method describes a procedure for determining the density of asphalt mixtures by means of a nuclear gauge using the backscatter method in accordance with AASHTO T 355-22. Correlation with densities determined under the WFOP AASHTO T 166 is required by some agencies.

Apparatus

- Nuclear density gauge with the factory-matched standard reference block.
- Transport case for properly shipping and housing the gauge and tools.
- Instruction manual for the specific make and model of gauge.
- Radioactive materials information and calibration packet containing:
  - Daily standard count log
  - Factory and laboratory calibration data sheet
  - Leak test certificate
  - Shippers' declaration for dangerous goods
  - Procedure memo for storing, transporting, and handling nuclear testing equipment
  - Other radioactive materials documentation as required by local regulatory requirements

Material

- Filler material: Fine-graded sand from the source used to produce the asphalt pavement or other agency approved materials.

Radiation Safety

This method does not purport to address all of the safety problems associated with its use. This test method involves potentially hazardous materials. The gauge utilizes radioactive materials that may be hazardous to the health of the user unless proper precautions are taken. Users of this gauge must become familiar with the applicable safety procedures and governmental regulations. All operators will be trained in radiation safety before operating nuclear density gauges. Some agencies require the use of personal monitoring devices such as a thermoluminescent dosimeter or film badge. Effective instructions, together with routine safety procedures such as source leak tests, recording and evaluation of personal monitoring device data, etc., are a recommended part of the operation and storage of this gauge.

Calibration

Calibrate the nuclear gauge as required by the agency. This calibration may be performed by the agency using the manufacturer's recommended procedures or by other facilities approved by the agency. Verify or re-establish calibration curves, tables, or equivalent coefficients every 12 months.

Standardization

1. Turn the gauge on and allow it to stabilize (approximately 10 to 20 minutes) before standardization. Leave the power on during the day's testing.
2. Standardize the nuclear gauge at the construction site at the start of each day's work and as often as deemed necessary by the operator or agency. Daily variations in standard count shall not exceed the daily variations established by the manufacturer of the gauge. If the daily variations are exceeded after repeating the standardization procedure, the gauge should be repaired, recalibrated, or both.
3. Record the standard count for both density and moisture in the daily standard count log. The exact procedure for standard count is listed in the manufacturer's Operator's Manual.

Note 1: New standard counts may be necessary more than once a day. See agency requirements.

Test Site Location

1. Select a test location(s) randomly and in accordance with agency requirements. Test sites should be relatively smooth and flat and meet the following conditions:
   a. At least 10 m (30 ft.) away from other sources of radioactivity.
   b. At least 3 m (10 ft.) away from large objects.
   c. If the gauge will be closer than 600 mm (24 in.) to any vertical mass, or less than 300 mm (12 in.) from a vertical pavement edge, use the gauge manufacturer's correction procedure.

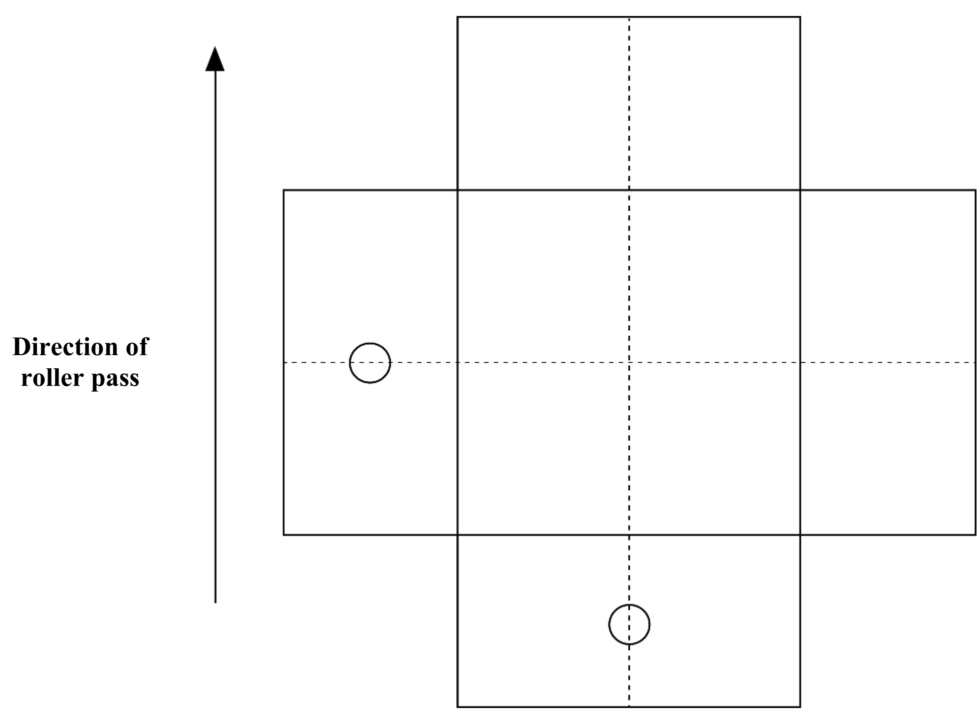
Procedure

1. Maintain maximum contact between the base of the gauge and the surface of the material under test.
2. Use filler material to fill surface voids.
3. Spread a small amount of filler material over the test site surface and distribute it evenly. Strike off the surface with a straightedge (such as a lathe or flat-bar steel) to remove excess material.
4. If using thin-layer mode, enter the anticipated overlay thickness into the gauge.

Note 2: If core correlation is required, entered thickness, anticipated thickness, and nominal core thickness may be required to match.

Method A – Average of two one-minute tests

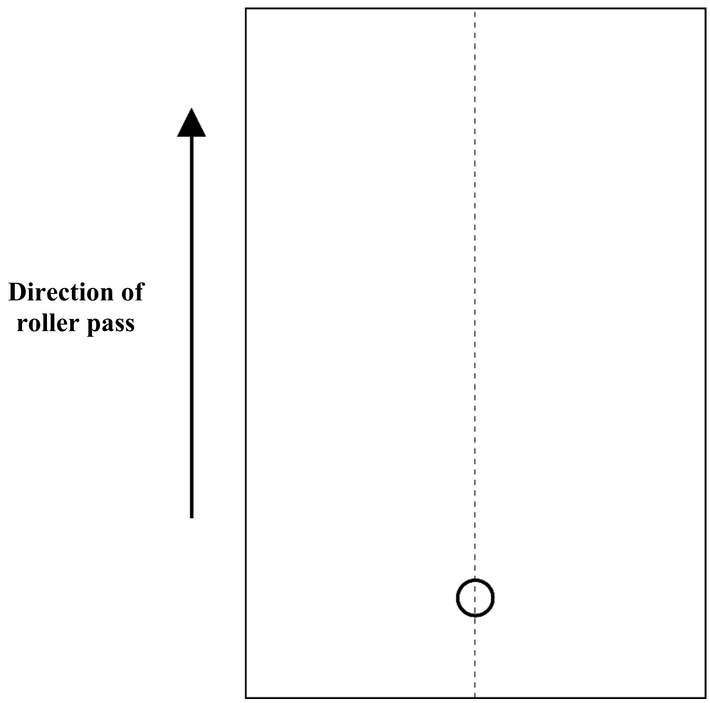
1. Place the gauge on the test site, perpendicular to the roller passes.
2. Using a crayon (not spray paint), mark the outline or footprint of the gauge.
3. Extend the source rod to the backscatter position.
4. Take a one-minute test and record the wet density reading.
5. Rotate the gauge 90 degrees centered over the original footprint. Mark the outline or footprint of the gauge.
6. Take another one-minute test and record the wet density reading.
7. If the difference between the two one-minute tests is greater than 40 kg/m^3 (2.5 lb/ft^3), retest in both directions. If the difference of the retests is still greater than 40 kg/m^3 (2.5 lb/ft^3) test at 180 and 270 degrees.
8. The density reported for each test site shall be the average of the two individual one-minute wet density readings.



Method A
Footprint of the gauge test site

Method B – One four-minute test

1. Place the gauge on the test site, parallel to the roller passes.
2. Using a crayon (not spray paint), mark the outline or footprint of the gauge.
3. Extend the source rod to the backscatter position.
4. Take one 4-minute test and record the wet density reading.



Method B

Footprint of the gauge test site

Calculation of Results

Percent (%) compaction is determined by comparing the in-place wet density as determined by this method to the appropriate agency density standard. See appropriate agency policy for use of density standards.

$$\% \, Compaction = \frac{Corrected\ Reading}{Maximum\ Density} \times 100$$

Method A Example:

Reading #1: 141.5 lb/ft^3

Reading #2: 140.1 lb/ft^3 Are the two readings within the tolerance? (YES)

Reading average: 140.8 lb/ft^3

Core correction: +2.1 lb/ft^3

Corrected reading: 142.9 lb/ft^3

Method B Example:

Reading: 140.8 lb/ft^3

Core correction: +2.1 lb/ft^3

Corrected reading 142.9 lb/ft^3

Example percent (%) compaction:

From the WFOP AASHTO T 209:

$\mathbf{G_{mm}} = 2.466$

$$Theoretical\ Maximum\ Density = 2.466 \times 62.245 lb/ft^3 = 153.5 lb/ft^3$$

$$\% \, Compaction = \frac{142.9\, lb/ft^3}{153.5\, lb/ft^3} \times 100 = 93.1\%$$

Report

- On forms approved by the agency
- Test ID
- Location of test and thickness of layer tested
- Mixture type
- Make, model and serial number of the nuclear moisture-density gauge
- Calculated wet density of each measurement and any adjustment data
- Density standard
- Compaction to the nearest 0.1 percent
- Name and signature of operator

APPENDIX – CORRELATION WITH CORES

(Nonmandatory Information)

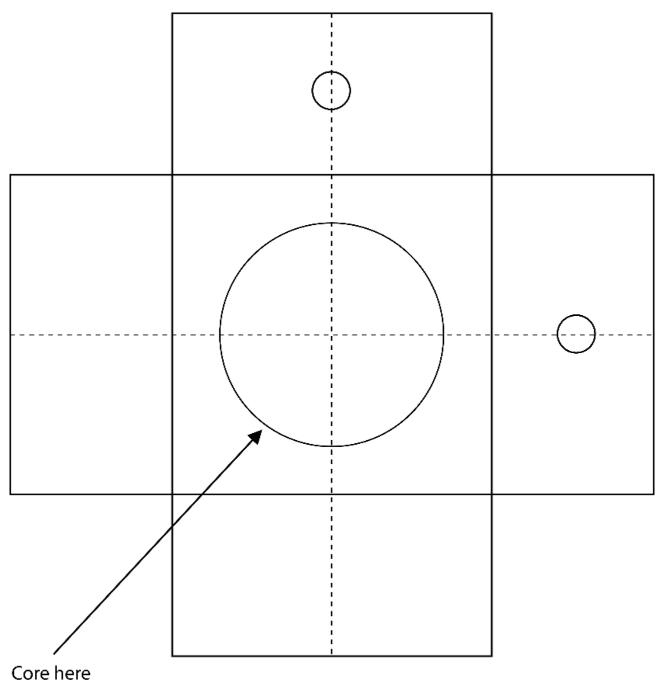
The bulk specific gravity (G_{mb}) of the core is a physical measurement of the in-place asphalt mixture and can be compared with the nuclear density gauge readings. Comparing the core value to the corresponding gauge values, a correlation can be established.

The correlation can then be used to adjust the gauge readings to the in-place density of the cores. The core correlation is gauge specific and must be determined without traffic allowed on the pavement between nuclear density gauge readings and obtaining the core. When using multiple nuclear density gauges each gauge should be correlated to the core locations before removal of the core.

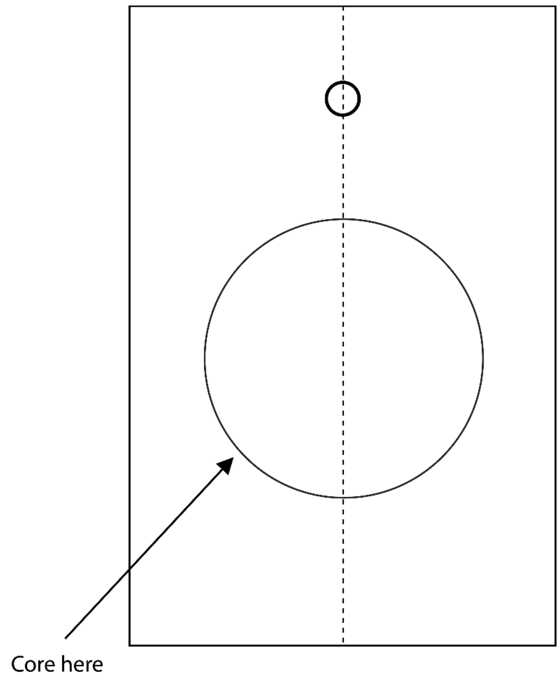
When density correlation with the WFOP AASHTO T 166 is required, correlation of the nuclear gauge with pavement cores shall be made on the first day's paving (within 24 hours) or from a test strip constructed before the start of paving. Cores must be taken before traffic is allowed on the pavement.

Correlation with Cores

1. Determine the number of cores required for correlation from the agency's specifications. Cores shall be located on the first day's paving or on the test strip. Locate the test sites in accordance with the agency's specifications. Follow the "Procedure" section above to establish test sites and obtain densities using the nuclear gauge.
2. Obtain a pavement core from each of the test sites according to AASHTO R 67. The core should be taken from the center of the nuclear gauge footprint.



Method A – Footprint of the gauge test site. Core location in the center of the footprint.



Method B - Footprint of the gauge test site.

3. Determine the density of the cores by the WFOP AASHTO T 166, Bulk Specific Gravity of Compacted Asphalt Mixtures Using Saturated Surface Dry Specimens.
4. Calculate a correlation factor for the nuclear gauge reading as follows:
    a. Calculate the difference between the core density and the average nuclear gauge density at each test site to the nearest 1 kg/m^3 (0.1 lb/ft^3). Calculate the average difference and standard deviation of the differences for the entire data set to the nearest 1 kg/m^3 (0.1 lb/ft^3).
    b. If the standard deviation of the differences is equal to or less than 40 kg/m^3 (2.5 lb/ft^3), the correlation factor applied to the average nuclear gauge density shall be the average difference calculated above in 4.a.
    c. If the standard deviation of the differences is greater than 40 kg/m^3 (2.5 lb/ft^3), the test site with the greatest variation from the average difference shall be eliminated from the data set and the data set properties and correlation factor recalculated following 4.a and 4.b.
    d. If the standard deviation of the modified data set still exceeds the maximum specified in 4.b, additional test sites will be eliminated from the data set and the data set properties and correlation factor recalculated following 4.a and 4.b. If the data set consists of less than five test sites, additional test sites shall be established.

Note A1: The exact method used in calculating the nuclear gauge correlation factor shall be defined by agency policy.

Note A2: The above correlation procedure must be repeated if there is a new job mix formula. Adjustments to the job mix formula beyond tolerances established in the contract documents will constitute a new job mix formula. A correlation factor established using this procedure is only valid for the particular gauge used in the correlation procedure. If another gauge is brought onto the project, it shall be correlated using the same procedure. Multiple gauges may be correlated from the same series of cores if done at the same time.

Note A3: For the purpose of this procedure, a job mix formula is defined as the percent and grade of paving asphalt used with a specified gradation of aggregate from a designated aggregate source. A new job mix formula may be required whenever compaction of the wearing surface exceeds the agency's specified maximum density or minimum air voids.

Calculations

Correlation Factor

$$\sqrt{\frac{\sum x^2}{n-1}}$$

Where:

$\sum$ = Sum

x = Difference from the average Difference

n-1 = number of data sets minus 1

Example

Core #	Core results from T 166:	Average Gauge reading	Difference:	x	x^2
1	144.9 lb/ft^3	142.1 lb/ft^3	2.8 lb/ft^3	-0.7	0.49
2	142.8 lb/ft^3	140.9 lb/ft^3	1.9 lb/ft^3	0.2	0.04
3	143.1 lb/ft^3	140.7 lb/ft^3	2.4 lb/ft^3	-0.3	0.09
4	140.7 lb/ft^3	138.9 lb/ft^3	1.8 lb/ft^3	0.3	0.09
5	145.1 lb/ft^3	143.6 lb/ft^3	1.5 lb/ft^3	0.6	0.36
6	144.2 lb/ft^3	142.4 lb/ft^3	1.8 lb/ft^3	0.3	0.09
7	143.8 lb/ft^3	141.3 lb/ft^3	2.5 lb/ft^3	-0.4	0.16
8	142.8 lb/ft^3	139.8lb/ft^3	3.0 lb/ft^3	0.9	0.81
9	144.8 lb/ft^3	143.3 lb/ft^3	1.5 lb/ft^3	-0.6	0.36
10	143.0 lb/ft^3	141.0 lb/ft^3	2.0 lb/ft^3	-0.1	0.01
	Average Difference:		+2.1 lb/ft^3	Σx^2	= 2.5

Number of data sets

$$n - 1 = 10 - 1 = 9$$

Standard deviation

$$standard\ deviation = \sqrt{\frac{2.5}{9}} = 0.53$$

Given:

Sum of x^2	=	2.5
Number of data sets	=	9

The standard deviation of 0.53 is less than 2.5 therefore no cores are eliminated. The average difference from all ten cores is used.

PERFORMANCE EXAM CHECKLIST

IN-PLACE DENSITY OF ASPHALT MIXTURES BY NUCLEAR METHODS WFOP AASHTO T 355

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Gauge turned on approximately 10 to 20 minutes before use?	_____	_____
2. Gauge calibrated, and standard count recorded?	_____	_____
3. Test location selected appropriately [600 mm (24 in.) from vertical projections or 10 m (30 ft.) from any other radioactive sources]?	_____	_____
4. Filler spread evenly over test site?	_____	_____
5. Excess filler material removed by striking off the surface?	_____	_____
6. Gauge placed on pavement surface and footprint of gauge marked?	_____	_____
7. Source rod extended to backscatter position?	_____	_____
8. Method A:		
a. One-minute count taken; gauge rotated 90°, reseated, and another one-minute count taken?	_____	_____
b. Densities averaged?	_____	_____
c. If difference of the wet densities is greater than 40 kg/m^3 (2.5 lb/ft^3), retest conducted in both directions?	_____	_____
9. Method B:		
a. One four-minute count taken?	_____	_____
10. Core correlation applied if required?	_____	_____
11. Percent compaction calculated correctly?	_____	_____

Comments: First attempt: Pass____Fail_____ Second attempt: Pass_____Fail_____

____

____

____

____

Examiner Signature ______________________________WAQTC #:______________

IN-PLACE DENSITY AND MOISTURE CONTENT OF SOIL AND SOIL-AGGREGATE BY NUCLEAR METHODS (SHALLOW DEPTH) IWFOP AASHTO T 310

Procedure

Add the following to Step 12:

For each soil or material type, the average moisture content of at least seven (7) consecutive tests is calculated to indicate the density gauge is reading the moisture content within a tolerance of 1% moisture content of the actual AASHTO T 255/265 test results. If the average moisture content exceeds the 1% tolerance, a moisture correction is applied. If less than seven density tests are required for a specific material type, then the percent moisture is determined by performing AASHTO T 255/265.

Percent Compaction

Delete the entire section and substitute the following:

- Percent compaction is determined by comparing the in-place dry density as determined by this procedure to the appropriate density standard. For soil or soil-aggregate mixes, these are moisture-density curves developed using the IWFOP AASHTO T 99 T 180. When using curves developed by the IWFOP AASHTO T 99 T 180, it may be necessary to use the Annex of IWFOP AASHTO T 99 T 180 and WAQTC WFOP AASHTO T 272 to determine maximum density and moisture determinations.
- When the maximum density standard is from IWFOP AASHTO T 99 T 180, a one-point determination per WAQTC WFOP AASHTO T 272 is performed for every IWFOP AASHTO T 310 compaction test to select the proper individual moisture-density curve or family of curves, including correction for coarse aggregate when necessary.
- A family of curves developed per WAQTC WFOP AASHTO R 75 may be used to determine the maximum density standard only if the moisture density curves were developed with material from the same geologic source area with concurrence from the District Materials Engineer.
- For coarse granular materials, the maximum density standard may be density-gradation curve developed using a vibratory method such as AKDOT&PF's ATM 212, Idaho IT-74, WSDOT's TM 606, or WFLHD's Humphres.

Granular Materials and Processed Aggregates above Subgrade

- For Idaho IT-74 curve, the standard density is the maximum dry density corresponding to the percent passing the No. 4 sieve. A laboratory density curve is used (produced) that represents the granular material or processed aggregate.
- Obtain a representative sample directly beneath the gauge. The sample size will be determined by the nominal maximum aggregate size from the table in AASHTO T255.
- Determine moisture content in accordance with AASHTO T255.
- Perform a field gradation test using the representative dry sample. Shake the sample over the No. 4 sieve. Hand shaking must continue until not more than 0.5 percent by mass of

the total sample passes the sieve during one minute of continuous shaking. No wash is required.

- When large aggregate is present, use a 1 inch buffer sieve.
- Do not overload the No. 4 sieve.
- Use the Idaho IT 74 laboratory curve to find the maximum dry density at the percent passing No. 4 sieve. Divide the in place dry density by the maximum dry density to determine the compaction percent.
- A new Idaho IT 74 curve must be provided annually for existing stockpiles or for new stockpiles of processed material.
- A field gradation test is not required for each density test if the nuclear density gauge has been calibrated for moisture correction and the gauge in place dry density reading is equal to or greater than 95% (94.6 rounded) at the peak point of the Idaho IT 74 curve.
- A compaction test result over 105% is not considered valid. The material and calculations must be evaluated to resolve the cause of this type of test result.

IN-PLACE DENSITY AND MOISTURE CONTENT OF SOIL AND SOIL-AGGREGATE BY NUCLEAR METHODS (SHALLOW DEPTH) WFOP AASHTO T 310

Scope

This procedure covers the determination of density, moisture content, and relative compaction of soil, aggregate, and soil-aggregate mixes in accordance with AASHTO T 310-22. This procedure provides a rapid, nondestructive technique for determining the in-place wet density and moisture content of soil, aggregate, and soil-aggregate mixes. This field operating procedure is derived from AASHTO T 310. The nuclear moisture-density gauge is used in the direct transmission mode.

Apparatus

- Nuclear density gauge with the factory matched standard reference block.
- Drive pin, guide/scraper plate, and hammer for testing in direct transmission mode.
- Transport case for properly shipping and housing the gauge and tools.
- Instruction manual for the specific make and model of gauge.
- Radioactive materials information and calibration packet containing:
  - Daily Standard Count Log.
  - Factory and Laboratory Calibration Data Sheet.
  - Leak Test Certificate.
  - Shippers Declaration for Dangerous Goods.
  - Procedure Memo for Storing, Transporting and Handling Nuclear Testing Equipment.
  - Other radioactive materials documentation as required by local regulatory requirements.
- Sealable containers and utensils for moisture content determinations.

Radiation Safety

This method does not purport to address all of the safety problems associated with its use. This test method involves potentially hazardous materials. The gauge utilizes radioactive materials that may be hazardous to the health of the user unless proper precautions are taken. Users of this gauge must become familiar with the applicable safety procedures and governmental regulations. All operators will be trained in radiation safety prior to operating nuclear density gauges. Some agencies require the use of personal monitoring devices such as a thermoluminescent dosimeter or film badge. Effective instructions together with routine safety procedures such as source leak tests, recording and evaluation of personal monitoring device data, etc., are a recommended part of the operation and storage of this gauge.

Calibration

Calibrate the nuclear gauge as required by the agency. This calibration may be performed by the agency using manufacturer's recommended procedures or by other facilities approved by the agency. Verify or re-establish calibration curves, tables, or equivalent coefficients every 12 months.

Standardization

1. Turn the gauge on and allow it to stabilize (approximately 10 to 20 minutes) prior to standardization. Leave the power on during the day's testing.
2. Standardize the nuclear gauge at the construction site at the start of each day's work and as often as deemed necessary by the operator or agency. Daily variations in standard count shall not exceed the daily variations established by the manufacturer of the gauge. If the daily variations are exceeded after repeating the standardization procedure, the gauge should be repaired and/or recalibrated.
3. Record the standard count for both density and moisture in the Daily Standard Count Log. The exact procedure for standard count is listed in the manufacturer's Operator's Manual.

Note 1: New standard counts may be necessary more than once a day. See agency requirements.

Overview

There are two methods for determining in-place density of soil / soil aggregate mixtures. See agency requirements for method selection.

- Method A Single Direction
- Method B Two Direction

Procedure

1. Select a test location(s) randomly and in accordance with agency requirements. Test sites should be relatively smooth and flat and meet the following conditions:
   a. At least 10 m (30 ft) away from other sources of radioactivity
   b. At least 3 m (10 ft) away from large objects
   c. The test site should be at least 150 mm (6 in.) away from any vertical projection.
   d. Correct for trench wall effect according to manufacturer's correction procedures if the test site is closer than 600 mm (24 in.) to vertical projection. See Note 2.

   Note 2: To perform moisture and density tests in a trench or against a large solid object, it is necessary to perform a trench offset correction to adjust the gauge, or it may read a falsely high moisture content. Moisture present in the walls can thermalize neutrons which return to the gauge and are read as moisture by the detector in the gauge.
2. Remove all loose and disturbed material and remove additional material as necessary to expose the top of the material to be tested.
3. Prepare a flat area sufficient in size to accommodate the gauge. Plane the area to a smooth condition so as to obtain maximum contact between the gauge and the material being tested. For Method B, the flat area must be sufficient to permit rotating the gauge 90 or 180 degrees about the source rod.

4. Fill in surface voids beneath the gauge with fines of the material being tested passing the 4.75 mm (No. 4) sieve or finer. Smooth the surface with the guide plate or other suitable tool. The depth of the filler should not exceed approximately 3 mm (1/8 in.).
5. Make a hole perpendicular to the prepared surface using the guide plate and drive pin. The hole shall be at least 50 mm (2 in.) deeper than the desired source rod depth and shall be aligned such that insertion of the source rod will not cause the gauge to tilt from the plane of the prepared area. Remove the drive pin by pulling straight up and twisting the extraction tool.
6. Place the gauge on the prepared surface so the source rod can enter the hole without disturbing loose material.
7. Lower the source rod into the hole to the desired test depth using the handle and trigger mechanism.
8. Seat the gauge firmly by partially rotating it back and forth about the source rod. Ensure the gauge is seated flush against the surface by pressing down on the gauge corners and making sure that the gauge does not rock.
9. Pull gently on the gauge to bring the side of the source rod nearest to the scaler / detector firmly against the side of the hole.
10. Perform one of the following methods, per agency requirements:
    a. Method A Single Direction: Take a test consisting of the average of two, one-minute readings, and record both density and moisture data. The two wet density readings should be within 32 kg/m^3 (2.0 lb/ft^3) of each other. The average of the two wet densities and moisture contents will be used to compute dry density.
    b. Method B Two Direction: Take a one-minute reading and record both density and moisture data. Rotate the gauge 90 or 180 degrees, pivoting it around the source rod. Reseat the gauge by pulling gently on the gauge to bring the side of the source rod nearest to the scaler/detector firmly against the side of the hole and take a one-minute reading. (In trench locations, rotate the gauge 180 degrees for the second test.) Some agencies require multiple one-minute readings in both directions. Analyze the density and moisture data. A valid test consists of wet density readings in both gauge positions that are within 50 kg/m^3 (3.0 lb/ft^3). If the tests do not agree within this limit, move to a new location. The average of the wet density and moisture contents will be used to compute dry density.
11. If required by the agency, obtain a representative sample of the material, 4 kg (9 lb) minimum, from directly beneath the gauge full depth of material tested. This sample will be used to verify moisture content and / or identify the correct density standard. Immediately seal the material to prevent loss of moisture.

    The material tested by direct transmission can be approximated by a cylinder of soil approximately 300 mm (12 in.) in diameter directly beneath the centerline of the radioactive source and detector. The height of the cylinder will be approximately the depth of measurement. When organic material or large aggregate is removed during this operation, disregard the test information, and move to a new test site.
12. To verify the moisture content from the nuclear gauge, determine the moisture content with a representative portion of the material using the WFOP AASHTO T 255/T 265 or other agency approved methods. If the moisture content from the nuclear

gauge is within ±1 percent, the nuclear gauge readings can be accepted. Moisture content verification is gauge and material specific. Retain the remainder of the sample at its original moisture content for a one-point compaction test under the WFOP AASHTO T 272, or for gradation, if required.

Note 2: Example: A gauge reading of 16.8 percent moisture and an oven dry of 17.7 percent are within the ±1 percent requirement. Moisture correlation curves will be developed according to agency guidelines. These curves should be reviewed and possibly redeveloped every 90 days.

13. Determine the dry density by one of the following.
    a. From nuclear gauge readings, compute by subtracting the mass (weight) of the water (kg/m^3 or lb/ft^3) from the wet density (kg/m^3 or lb/ft^3) or compute using the percent moisture by dividing wet density from the nuclear gauge by 1 plus the moisture content expressed as a decimal.
    b. When verification is required and the nuclear gauge readings cannot be accepted, the moisture content is determined by the WFOP AASHTO T 255/T 265 or other agency approved methods. Compute dry density by dividing wet density from the nuclear gauge by 1 plus the moisture content expressed as a decimal.

Percent Compaction

- Percent compaction is determined by comparing the in-place dry density as determined by this procedure to the appropriate agency density standard. For soil or soil-aggregate mixes, these are moisture-density curves developed using the WFOP AASHTO T 99/T 180. When using maximum dry densities from the WFOP AASHTO T 99/T 180 or WFOP AASHTO T 272, it may be necessary to use the Annex in the WFOP T 99/T 180 to determine corrected maximum dry density and optimum moisture content.

  For coarse granular materials, the density standard may be density-gradation curves developed using a vibratory method such as AKDOT&PF's ATM 212, ITD's T 74, WAQTC TM 15, or WFLHD's Humphres.

See appropriate agency policies for use of density standards.

Calculation

Calculate the dry density as follows:

$$\rho_d = \left(\frac{\rho_w}{w + 100}\right) \times 100 \quad or \quad \rho_d = \frac{\rho_w}{\frac{w}{100} + 1}$$

Where:

ρ_d = Dry density, kg/m^3 (lb/ft^3)

ρ_w = Wet density, kg/m^3 (lb/ft^3)

w = Moisture content from the WFOP's for AASHTO T 255 / T 265, as a percentage

Calculate percent compaction as follows:

$$\%\ Compaction = \frac{\rho_d}{Agency\ density\ standard} \times 100$$

Where:

ρ_d = Dry density, kg/m^3 (lb/ft^3)

Agency density standard = Corrected maximum dry density from the WFOP from T 99/T 180 Annex

Example:

Wet density readings from gauge: 1948 kg/m^3 (121.6 lb/ft^3)

1977 kg/m^3 (123.4 lb/ft^3)

Avg: 1963 kg/m^3 (122.5 lb/ft^3)

Moisture readings from gauge: 14.2% and 15.4% = Avg 14.8%

Moisture content from the WFOP's for AASHTO T 255/ T 265: 15.9%

Moisture content is greater than 1 percent different so the gauge moisture cannot be used.

Calculate the dry density as follows:

$$\rho_d = \left(\frac{1963\, kg/m^3 \ or \ 122.5 \ lb/ft^3}{15.9 + 100}\right) \times 100 \ or \ \rho_d = \frac{1963\, kg/m^3 \ or \ 122.5 \ lb/ft^3}{\frac{15.9}{100} + 1}$$

$$= 1694 \ kg/m^3 \ or \ 105.7 \ lb/ft^3$$

Given:

ρ_w = 1963 kg/m^3 or 122.5 lb/ft^3

w = 15.9%

Calculate percent compaction as follows:

$$\% \ Compaction = \frac{105.7 \ lb/ft^3}{111.3 \ lb/ft^3} \times 100 = 95\%$$

Given:

Agency density standard = 111.3 lb/ft^3

Report

- On forms approved by the agency
- Sample ID
- Location of test, elevation of surface, and thickness of layer tested
- Visual description of material tested
- Make, model and serial number of the nuclear moisture-density gauge
- Wet density to the nearest 0.1 lb/ft^3
- Moisture content as a percent, by mass, of dry soil mass to the nearest 0.1 percent
- Dry density to the nearest 0.1 lb/ft^3
- Density standard to the nearest 0.1 lb/ft^3
- Percent compaction the nearest 1 percent
- Name and signature of operator

PERFORMANCE EXAM CHECKLIST

IN-PLACE DENSITY AND MOISTURE CONTENT OF SOIL AND SOIL-AGGREGATE BY NUCLEAR METHODS (SHALLOW DEPTH) WFOP AASHTO T 310

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
Gauge turned on 10 to 20 minutes before use?	_____	_____
Calibration verified	_____	_____
Standard count taken and recorded in accordance with manufacturer's instructions?	_____	_____
Test location selected appropriately 10 m (30 ft.) from other radioactive sources, 3 m (10 ft.) from large objects, 150 mm (6 in.) away from vertical projections?	_____	_____
Loose, disturbed material removed?	_____	_____
Flat, smooth area prepared?	_____	_____
Surface voids filled with native fines (-No. 4) to 3 mm (1/8 in.) maximum thickness?	_____	_____
Hole driven 50 mm (2 in.) deeper than source rod depth?	_____	_____
Gauge placed and source rod lowered without disturbing loose material?	_____	_____
Method A:		
a. Gauge firmly seated, and gently pulled back so that the source rod is against the side of the hole toward the scaler / detectors?	_____	_____
b. Two, one-minute reading taken; wet density within 32 kg/m^3 (2.0 lb/ft^3)?	_____	_____
c. Density and moisture data averaged?	_____	_____
Method B:		
d. Gauge firmly seated, and gently pulled back so that the source rod is against the side of the hole toward the scaler / detectors?	_____	_____
e. A minimum of a one-minute reading taken; density and moisture data recorded?	_____	_____
f. Gauge turned 90° or 180° (180° in trench)?	_____	_____

OVER

Procedure Element	Trial 1	Trial 2
g. Gauge firmly seated, and gently pulled back so that the source rod is against the side of the hole toward the scaler / detectors?	_____	_____
h. A minimum of a one-minute reading taken; density and moisture data recorded?	_____	_____
i. Wet densities within 50 kg/m^3 (3.0 lb/ft^3)?	_____	_____
j. Density and moisture data averaged?	_____	_____
Representative sample (4 kg or 9 lb) obtained from test location?	_____	_____
Sample sealed immediately to prevent moisture loss?	_____	_____
Moisture content correctly determined using other means than the nuclear density gauge reading?	_____	_____
Dry Density calculated using proper moisture content?	_____	_____
Percent compaction calculated correctly?	_____	_____

Comments: First attempt: Pass____Fail_____ Second attempt: Pass______Fail_____

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Examiner Signature ________________________________WAQTC #:_______________

TOTAL EVAPORABLE MOISTURE CONTENT OF AGGREGATE BY DRYING WFOP AASHTO T 255 LABORATORY DETERMINATION OF MOISTURE CONTENT OF SOILS WFOP AASHTO T 265

Scope

This procedure covers the determination of moisture content of aggregate and soil in accordance with AASHTO T 255-22 and AASHTO T 265-22. It may also be used for other construction materials.

Overview

Moisture content is determined by comparing the wet mass of a sample and the mass of the sample after drying to constant mass. The term constant mass is used to define when a sample is dry.

Constant mass – the state at which a mass does not change more than a given percent, after additional drying for a defined time interval, at a required temperature.

Apparatus

- Balance or scale: capacity sufficient for the principal sample mass, accurate to 0.1 percent of sample mass or readable to 0.1 g, and meeting the requirements of AASHTO M 231
- Containers: clean, dry, and capable of being sealed
- Suitable drying container
  - For soils: container requires close-fitting lid
  - For aggregate: container lid is optional
- Microwave safe container with ventilated lid (for drying aggregate only)
- Heat source, thermostatically controlled, capable of maintaining 110 ± 5°C (230 ± 9°F).
  - Forced draft oven (preferred)
  - Ventilated oven
  - Convection oven
- Heat source, uncontrolled, for use when allowed by the agency, will not alter the material being dried, and close control of the temperature is not required:
  - Infrared heater/heat lamp, hot plate, fry pan, or any other device/method allowed by the agency .
  - Microwave oven (900 watts minimum)
- Utensils such as spoons
- Hot pads or gloves

Sample Preparation

Obtain a representative sample according to the WFOP AASHTO R 90 in its existing condition. If necessary, reduce the sample to moisture content sample size according to the WFOP AASHTO R 76.

For aggregate, the moisture content sample size is based on Table 1 or other information that may be specified by the agency.

TABLE 1
Sample Sizes for Moisture Content of Aggregate

Nominal Maximum Size* mm (in.)	Minimum Sample Mass g (lb)
150 (6)	50,000 (110)
100 (4)	25,000 (55)
90 (3 1/2)	16,000 (35)
75 (3)	13,000 (29)
63 (2 1/2)	10,000 (22)
50 (2)	8000 (18)
37.5 (1 1/2)	6000 (13)
25.0 (1)	4000 (9)
19.0 (3/4)	3000 (7)
12.5 (1/2)	2000 (4)
9.5 (3/8)	1500 (3.3)
4.75 (No. 4)	500 (1.1)

* One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps in specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum.

For soils the moisture content sample size is based on Table 2 or other information that may be specified by the agency.

TABLE 2
Sample Sizes for Moisture Content of Soil

Maximum Particle Size mm (in.)	Minimum Sample Mass g
50 (2)	1000
25.0 (1)	500
12.5 (1/2)	300
4.75 (No. 4)	100
0.425 (No. 40)	10

Immediately seal or cover moisture content samples to prevent any change in moisture content or follow the steps in "Procedure."

Procedure

Determine and record the sample masses as follows:

- For aggregate, determine and record all masses to the nearest 0.1 percent of the sample mass or to the nearest 0.1 g.
- For soil, determine and record all masses to the nearest 0.1 g.

When determining the mass of hot samples or containers or both, place and tare a buffer between the sample container and the balance. This will eliminate damage to or interference with the operation of the balance or scale.

1. Determine and record the mass of the container .
   a. For soils: the container includes the mass of the close-fitting lid.
   b. For aggregate: the lid is optional unless drying with a microwave then a ventilated lid is required.
2. Place the wet sample in the container.
3. Determine and record the total mass of the container and wet sample.
   a. For oven(s), hot plates, infrared heaters, etc.: Spread the sample in the container.
   b. For microwave oven: Heap sample in the container; cover with ventilated lid.
4. Determine and record the wet mass of the sample (M_W) by subtracting the container mass determined in Step 1 from the mass of the container and sample determined in Step 3.
5. Place the sample in one of the following drying apparatuses:
   a. For aggregate –
      i. Controlled heat source (oven): at 110 ±5°C (230 ±9°F).

ii. Uncontrolled heat source (Hot plate, infrared heater, or other heat source as allowed by the agency): Stir frequently to avoid localized overheating.

b. For soil – controlled heat source (oven): at 110 ±5°C (230 ±9°F).

Note 1: Soils containing gypsum or significant amounts of organic material require special drying. For reliable moisture contents dry these soils at 60°C (140°F). For more information see AASHTO T 265, Note 2.

6. Dry until sample appears moisture free.
7. Determine mass of sample and container.
8. Determine and record the mass of the sample by subtracting the container mass determined in Step 1 from the mass of the container and sample determined in Step 7.
9. Return sample and container to the heat source for the additional time interval.

   a. Drying intervals for aggregate –

      i. Controlled heat source (oven): 30 minutes

      ii. Uncontrolled heat source (Hot plate, infrared heater, or other heat source as allowed by the agency): 10 minutes

      iii. Uncontrolled heat source (Microwave oven): 2 minutes

Caution: Some minerals in the sample may cause the aggregate to overheat, crack, and explode; altering the aggregate gradation.

   b. Drying interval for soil – controlled heat source (oven): 1 hour

10. Determine mass of sample and container.
11. Determine and record the mass of the sample by subtracting the container mass determined in Step 1 from the mass of the container and sample determined in Step 10.
12. Determine percent change by subtracting the new mass determination (M_n) from the previous mass determination (M_p), dividing by the previous mass determination (M_p), and multiplying by 100.
13. Continue drying, performing steps 9 through 12, until there is less than a 0.10 percent change after additional drying time.
14. Constant mass has been achieved; sample is defined as dry.
15. Allow the sample to cool. Immediately determine and record the total mass of the container and dry sample.
16. Determine and record the dry mass of the sample (M_D) by subtracting the mass of the container determined in Step 1 from the mass of the container and sample determined in Step 15.
17. Determine and record percent moisture (w) by subtracting the final dry mass determination (M_D) from the initial wet mass determination (M_W), dividing by the final dry mass determination (M_D), and multiplying by 100.

Table 3
Methods of Drying

Aggregate		
Heat Source	**Specific Instructions**	**Drying intervals to achieve constant mass (minutes)**
Controlled: Forced draft (preferred), ventilated, or convection oven	110 ±5°C (230 ±9°F)	30
Uncontrolled:		
Hot plate, infrared heater, or any other device/method allowed by the agency	Stir frequently	10
Microwave	Heap sample and cover with ventilated lid	2
Soil		
Heat Source	**Specific Instructions**	**Drying interval to achieve constant mass**
Controlled: Forced draft (preferred), ventilated, or convection oven	110 ±5°C (230 ±9°F)	1 hour

Calculation

Constant Mass

Calculate constant mass using the following formula:

$$\% \, Change = \frac{M_p - M_n}{M_p} \times 100$$

Where:

M_p = previous mass measurement

M_n = new mass measurement

Example:

Mass of container: 1232.1 g

Mass of container and sample after first drying cycle: 2637.2 g

Mass, M_p, of possibly dry sample: 2637.2 g - 1232.1 g = 1405.1 g

Mass of container and sample after second drying cycle: 2634.1 g

Mass, M_n, of sample: 2634.1 g - 1232.1 g = 1402.0 g

$$\% \, Change = \frac{1405.1 \, g - 1402.0 \, g}{1405.1 \, g} \times 100 = 0.22\%$$

0.22 percent is not less than 0.10 percent, so continue drying.

Mass of container and sample after third drying cycle: 2633.0 g

Mass, M_n, of sample: 2633.0 g - 1232.1 g = 1400.9 g

$$\% \, Change = \frac{1402.0 \, g - 1400.9 \, g}{1402.0 \, g} \times 100 = 0.08\%$$

0.08 percent is less than 0.10 percent, so constant mass has been reached.

Moisture Content:

Calculate the moisture content, as a percent, using the following formula:

$$w = \frac{M_W - M_D}{M_D} \times 100$$

where:

w = moisture content, percent

M_W = wet mass

M_D = dry mass

Example:

Mass of container: 1232.1 g

Mass of container and wet sample: 2764.7 g

Mass, M_W, of wet sample: 2764.7 g - 1232.1 g = 1532.6 g

Mass of container and dry sample (COOLED): 2633.5 g

Mass, M_D, of dry sample: 2633.5 g - 1232.1 g = 1401.4 g

$$w = \frac{1532.6\ g - 1401.4\ g}{1401.4\ g} \times 100 = \frac{131.2g}{1401.4\ g} \times 100 = 9.36\% \quad report\ 9.4\%$$

Report

- On forms approved by the agency
- Sample ID
- M_W, wet mass
- M_D, dry mass
- w, moisture content to the nearest 0.1 percent

PERFORMANCE EXAM CHECKLIST

TOTAL EVAPORABLE MOISTURE CONTENT OF AGGREGATE BY DRYING WFOP AASHTO T 255
LABORATORY DETERMINATION OF MOISTURE CONTENT OF SOILS WFOP AASHTO T 265

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Representative sample of appropriate mass obtained?	_____	_____
2. Mass of container determined to 0.1 g?	_____	_____
3. Sample placed in container and mass determined to 0.1 g?	_____	_____
4. Test sample mass conforms to the required mass?	_____	_____
5. Wet sample mass determined to 0.1 g?	_____	_____
6. Loss of moisture avoided prior to mass determination?	_____	_____
7. Sample dried by a suitable heat source?	_____	_____
a. Describe suitable heat sources for aggregate?	_____	_____
b. Describe suitable heat sources for soils?	_____	_____
8. If aggregate heated by means other than a controlled oven, is sample stirred to avoid localized overheating?	_____	_____
9. For microwave, aggregate heaped and covered with a ventilated lid?	_____	_____
10. For aggregate, heated for the additional, specified time?	_____	_____
a. Forced draft, ventilated, convection ovens – 30 minutes		
b. Microwave – 2 minutes		
c. Other – 10 minutes		
11. For soil:		
a. Heated for at least 1hour additional drying time using a controlled heat source?	_____	_____
12. Mass determined and compared to previous mass - showing less than 0.10 percent loss?	_____	_____
13. Sample cooled, dry mass determined and recorded to the nearest 0.1 percent?	_____	_____
14. Moisture content calculated correctly and recorded to the nearest 0.1 percent?	_____	_____

OVER

Comments: First attempt: Pass____Fail_____ Second attempt: Pass______Fail_____

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Examiner Signature _______________________________WAQTC #:_______________

ONE-POINT METHOD FOR DETERMINING MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE
WFOP AASHTO T 272

Scope

This procedure provides for a rapid determination of the maximum dry density and optimum moisture content of a soil sample, using a one-point determination in accordance with AASHTO T 272-18. This procedure is related to the WFOPs for AASHTO T 99/T 180 and R 75.

One-point determinations are made by compacting the soil in a mold of a given size with a specified rammer dropped from a specified height and then compared to an individual moisture-density curve (WFOP AASHTO T 99 or T 180) or a family of curves (WFOP AASHTO R 75). Four alternate methods – A, B, C, and D – are used and correspond to the methods described in the WFOP AASHTO T 99/T 180. The method used in AASHTO T 272 must match the method used for the reference curve or to establish the family of curves. For example, when moisture-density relationships as determined by T 99 - Method C are used to form the family of curves or an individual moisture density curve, then T 99 - Method C must be used to for the one-point determination.

Apparatus

See the WFOP AASHTO T 99/T 180.

Sample

Sample size determined according to the WFOP AASHTO T 310. In cases where the existing individual curve or family cannot be used a completely new curve will need to be developed and the sample size will be determined by the WFOP AASHTO T 99/T 180.

1. If the sample is damp, dry it until it becomes friable under a trowel. Drying may be in air or by use of a drying apparatus maintained at a temperature not exceeding 60°C (140°F).
2. Thoroughly break up aggregations in a manner that avoids reducing the natural size of individual particles.
3. Pass the material through the appropriate sieve.

Procedure

Use the method matching the individual curve or Family of Curves. Refer to Table 1 of the WFOP AASHTO T 99 / T 180 for corresponding mold size, number of layers, number of blows, sieve size, and rammer specification for the various test methods.

1. Determine the mass of the clean, dry mold. Include the base plate but exclude the extension collar. Record the mass to the nearest 1 g (0.005 lb).
2. Thoroughly mix the sample with sufficient water to adjust moisture content to 80 to 100 percent of the anticipated optimum moisture.
3. Form a specimen by compacting the prepared soil in the mold (with collar attached) in approximately equal layers. For each layer:

a. Spread the loose material uniformly in the mold.

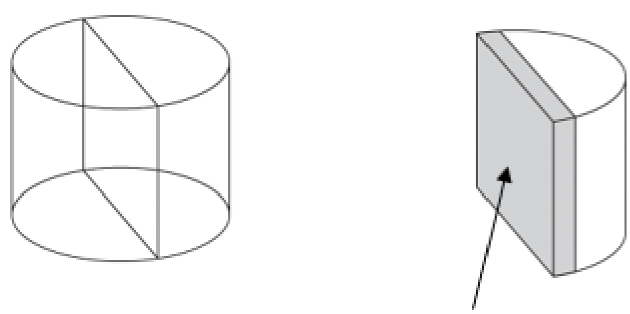
Note 1: It is recommended to cover the remaining material with a non-absorbent sheet or damp cloth to minimize loss of moisture.

b. Lightly tamp the loose material with the manual rammer or other similar device, this establishes a firm surface.

c. Compact each layer with uniformly distributed blows from the rammer.

d. Trim down material that has not been compacted and remains adjacent to the walls of the mold and extends above the compacted surface.

4. Remove the extension collar. Avoid shearing off the sample below the top of the mold. The material compacted in the mold should not be over 6 mm (¼ in.) above the top of the mold once the collar has been removed.
5. Trim the compacted soil even with the top of the mold with the beveled side of the straightedge.
6. Clean soil from exterior of the mold and base plate.
7. Determine the mass of the mold and wet soil to the nearest 1 g (0.005 lb).
8. Determine the wet mass of the sample by subtracting the mass in Step 1 from the mass in Step 7.
9. Calculate the wet density (ρ_w) as indicated below under "Calculations."
10. Extrude the material from the mold. For soils and soil-aggregate mixtures, slice vertically through the center and remove one of the cut faces for a representative moisture content sample. For granular materials, a vertical face will not exist. Take a representative sample ensuring that all layers are represented. This sample must meet the sample size requirements of the test method used to determine moisture content.



Extruded material **Representative moisture content sample**

11. Determine the moisture content (w) of the sample in accordance with the WFOP AASHTO T 255 / T 265.

Calculations

1. Calculate the wet density, in kg/m³ (lb/ft³), by dividing the wet mass by the measured volume of the mold (T 19).

   Example – Methods A or C mold:

   Wet mass = 2.0055 kg (4.42 lb)

   Measured volume of the mold = 0.0009469 m³ (0.0334 ft³)

$$\rho_w = \frac{2.0055\ kg}{0.0009469\ m^3} = 2118\ kg/m^3$$

$$\rho_w = \frac{4.42\ lb}{0.0334\ ft^3} = 132.2\ lb/ft^3$$

   Where:

   ρ_w = Wet density, kg/m³ (lb/ft³)

2. Calculate the dry density as follows.

$$\rho_d = \left(\frac{\rho_w}{w + 100}\right) \times 100 \quad or \quad \rho_d = \frac{\rho_w}{\left(\frac{w}{100}\right) + 1}$$

   Where:

   ρ_d = Dry density, kg/m³ (lb/ft³)

   w = Moisture content, as a percentage

   Example:

   ρ_w = 2118 kg/m³ (132.2 lb/ft³)

   w = 13.5%

$$\rho_d = \left(\frac{2118\ kg/m^3}{13.5 + 100}\right) \times 100 = 1866\ \ kg/m^3 \quad \rho_d = \left(\frac{132.2\ lb/ft^3}{13.5 + 100}\right) \times 100 = 116.5\ lb/ft^3$$

or

$$\rho_d = \left(\frac{2118\ kg/m^3}{\frac{13.5}{100} + 1}\right) = 1866\ \ kg/m^3 \quad \rho_d = \left(\frac{132.2\ lb/ft^3}{\frac{13.5}{100} + 1}\right) = 116.5\ lb/ft^3$$

Maximum Dry Density and Optimum Moisture Content Determination Using an Individual Moisture - Density Curve

1. The moisture content must be within 80 to 100 percent of optimum moisture of the reference curve. Compact another specimen, using the same material, at an adjusted moisture content if the one-point does not fall in the 80 to 100 percent of optimum moisture range.

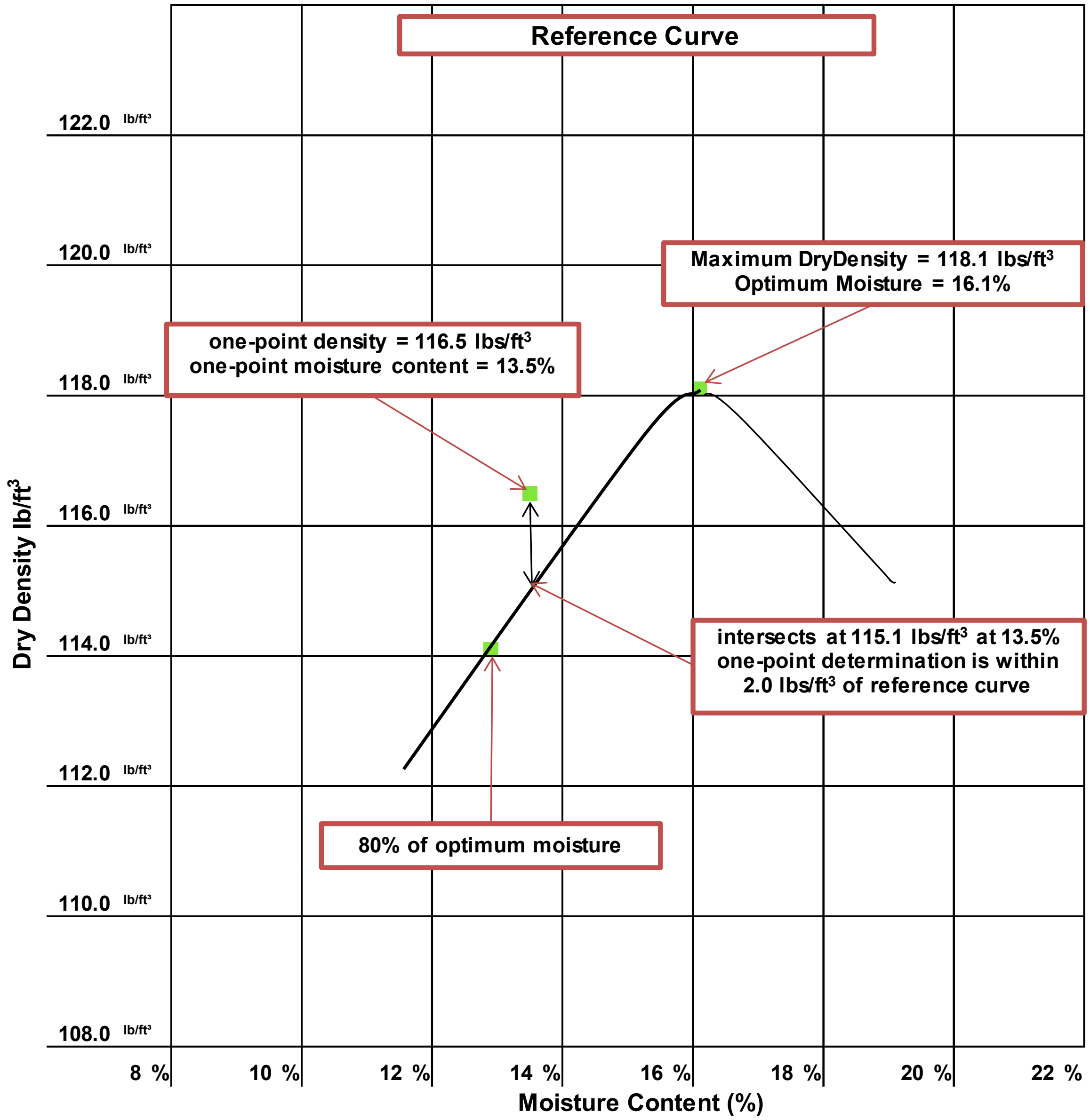
2. Plot the one-point, dry density on the vertical axis and moisture content on the horizontal axis, on the reference curve graph.

3. If the one-point falls on the reference curve or within ±2.0 lbs/ft^3, use the maximum dry density and optimum moisture content determined by the curve.

4. Use the WFOP AASHTO T 99/T 180 Annex A to determine corrected maximum dry density and optimum moisture content if oversize particles have been removed.

5. Perform a full moisture-density relationship if the one-point does not fall on or within ±2.0 lbs/ft^3 of the reference curve at 80 to 100 percent optimum moisture.

Example



The results of a one-point determination were 116.5 lb/ft^3 at 13.5 percent moisture. The point was plotted on the reference curve graph. The one-point determination is within 2.0 lb/ft^3 of the point on the curve that corresponds with the moisture content.

Maximum Dry Density and Optimum Moisture Content Determination Using a Family of Curves

1. Plot the one-point, dry density on the vertical axis and moisture content on the horizontal axis, on the reference family of curves graph.

2. If the moisture-density one-point falls on one of the curves in the family of curves, use the maximum dry density and optimum moisture content defined by that curve.

3. If the moisture-density one-point falls within the family of curves but not on an existing curve, draw a new curve through the plotted single point, parallel and in character with the nearest existing curve in the family of curves. Use the maximum dry density and optimum moisture content as defined by the new curve.

    a. The one-point must fall either between or on the highest or lowest curves in the family. If it does not, then a full curve must be developed.

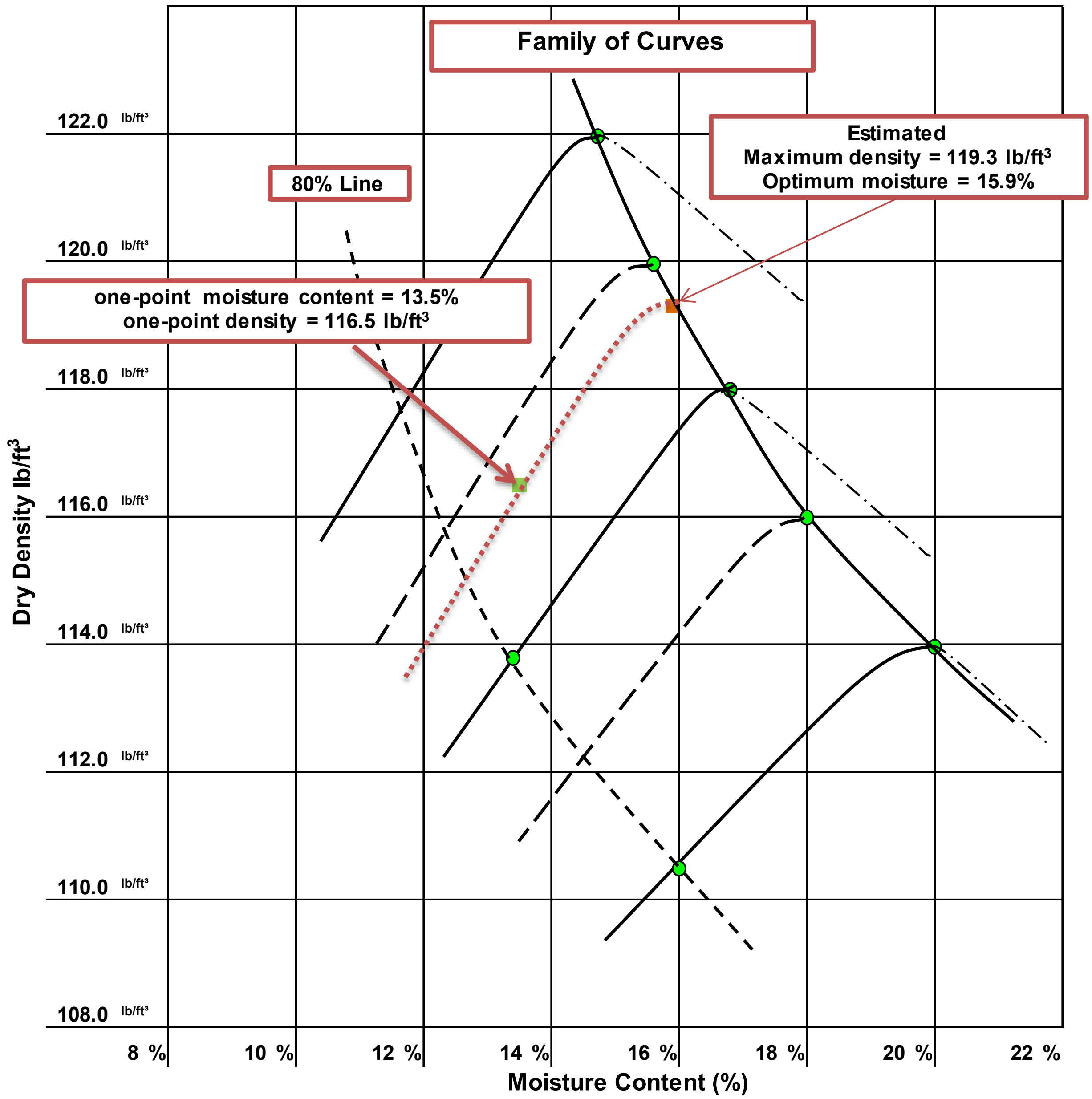
    b. If the one-point plotted within or on the family of curves does not fall in the 80 to 100 percent of optimum moisture content, compact another specimen, using the same material, at an adjusted moisture content that will place the one point within this range.

4. Use the WFOP AASHTO T 99/T 180 Annex A to determine corrected maximum dry density and optimum moisture content if oversize particles have been removed.

5. If the new curve through a one-point is not well defined or is in any way questionable, perform a full moisture-density relationship to correctly define the new curve and verify the applicability of the family of curves.

Note 2: New curves drawn through plotted single point determinations shall not become a permanent part of the family of curves until verified by a full moisture-density procedure following the WFOP AASHTO T 99/T 180.

Example



The results of a one-point determination were 116.5 lb/ft^3 at 13.5 percent moisture. The point was plotted on the reference curve graph. The point was plotted on the appropriate family between two previously developed curves near and intermediate curve.

The "dotted" curve through the moisture-density one-point was sketched between the existing curves. A maximum dry density of 119.3 lb/ft^3 and a corresponding optimum moisture content of 15.9 percent were estimated.

Report

- On forms approved by the agency
- Sample ID
- Maximum dry density to the nearest 1 kg/m^3 (0.1 lb/ft^3)
- Corrected maximum dry density (if applicable)
- Optimum moisture content to the nearest 0.1 percent
- Corrected optimum moisture content (if applicable)
- Reference curve or Family of Curves used

PERFORMANCE EXAM CHECKLIST

ONE-POINT METHOD
WFOP AASHTO T 272 (T 99)

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. One-point determination of dry density and corresponding moisture content made in accordance with the WFOP AASHTO T 99?	_____	_____
a. Correct size (4.75 mm / No. 4 or 19.0 mm / 3/4 in.) material used?	_____	_____
2. If necessary, sample dried until friable in air or drying apparatus, not exceeding 60°C (140°F)?	_____	_____
3. Sample broken up and an adequate amount sieved over the appropriate sieve (4.75 mm / No. 4 or 19.0 mm / 3/4 in.) to determine oversize (coarse particle) percentage?	_____	_____
4. Sample passing the sieve has appropriate mass?	_____	_____
5. Moisture content adjusted if needed?	_____	_____
6. Determine mass of clean, dry mold without collar to nearest 1 g (0.005 lb.)?	_____	_____
7. Mold placed on rigid and stable foundation?	_____	_____
8. Layer of soil (approximately one third compacted depth) placed in mold with collar attached, loose material lightly tamped?	_____	_____
9. Soil compacted with appropriate number of blows (25 or 56)?	_____	_____
10. Material adhering to the inside of the mold trimmed?	_____	_____
11. Layer of soil (approximately two thirds compacted depth) placed in mold with collar attached, loose material lightly tamped?	_____	_____
12. Soil compacted with appropriate number of blows (25 or 56)?	_____	_____
13. Material adhering to the inside of the mold trimmed?	_____	_____
14. Mold filled with soil such that compacted soil will be above the mold, loose material lightly tamped?	_____	_____
15. Soil compacted with appropriate number of blows (25 or 56)?	_____	_____
16. Collar removed without shearing off sample?	_____	_____
17. Approximately 6 mm (1/4 in.) of compacted material above the top of the mold (without the collar)?	_____	_____
18. Soil trimmed to top of mold with the beveled side of the straightedge?	_____	_____
19. Remove soil from exterior surface of mold and base plate?	_____	_____
20. Mass of mold and contents determined to appropriate precision?	_____	_____

OVER

Procedure Element	**Trial 1**	**Trial 2**
21. Wet density calculated from the wet mass?	_____	_____
22. Soil removed from mold using a sample extruder if needed?	_____	_____
23. Soil sliced vertically through center (non-granular material)?	_____	_____
24. Moisture sample removed ensuring all layers are represented?	_____	_____
25. Moist mass determined immediately to 0.1 g?	_____	_____
26. Moisture sample mass of correct size?	_____	_____
27. Sample dried and water content determined according to the WFOP T 255/T 265?	_____	_____
28. One-point plotted on family of curves supplied?	_____	_____
a. One-point falls within 80 to 100 percent of optimum moisture content in order to be valid?	_____	_____
b. If one-point does not fall within 80 to 100 percent of optimum moisture content, another one-point determination with an adjusted water content is made?	_____	_____
c. Maximum dry density and corresponding optimum moisture content correctly estimated?	_____	_____
29. One-point plotted on a single reference curve?	_____	_____
a. Does one-point plot within 2 lb/ft^3 in order to be valid?	_____	_____
b. Does one-point fall within 80 to 100 percent of optimum moisture content in order to be valid?	_____	_____
c. Maximum dry density and corresponding optimum moisture content determined from single reference curve?	_____	_____

Comments: First attempt: Pass____Fail_____ Second attempt: Pass______Fail_____

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Examiner Signature _______________________________WAQTC #:_______________

570.06 - SELF-CONSOLIDATING CONCRETE

PASSING ABILITY OF SELF-CONSOLIDATING CONCRETE (SCC) BY J-RING WFOP AASHTO T 345

Scope

This procedure provides instruction for determining the passing ability of self-consolidating concrete (SCC) by the J-Ring method, in accordance with AASHTO T 345-12, both in the laboratory and in the field. SCC is defined as a highly workable concrete that can flow through densely reinforced or complex structural elements under its own weight without vibration and adequately fill voids without segregation or excessive bleeding.

Passing ability and J-Ring test value are an indication of the ability of the SCC to flow around and between reinforcement without blocking.

To determine the passing ability of the mix the slump flow must be determined according to the WFOP AASHTO T 347/T 351. A difference between the J-Ring flow and the slump flow of less than 25 mm (1 in.) indicates good passing ability, and a difference greater than 50 mm (2 in.) indicates poor passing ability.

A J-Ring test value less than 15 mm (½ in.) indicates satisfactory passing ability without blockage.

Apparatus

- J-Ring Apparatus: a rigid ring made of steel or some other nonabsorbent material connecting 100 mm (4 in.) vertical smooth bars with the dimensions shown in Figure 1, with Table 1 tolerances. The 16 mm (5/8 in.) diameter vertical round bars are connected to the ring and spaced as shown in Figure 1. Do not use an apparatus with out-of-plumb bars or incorrect clear spacing.
- Mold: meeting the requirements of the WFOP AASHTO T 119.
- Base plate: made of stiff nonabsorbent material, at least 820 mm (32 in.) square, marked with a circle indicating the central location for the mold, and a concentric circle with a diameter of 500 mm (20 in.).
- Pouring vessel or scoop: a water-tight container large enough so each amount of concrete obtained from the sampling receptacle is representative and small enough, so it is not spilled during placement in the mold.
- Strike-off bar: a straight bar of steel or other suitable metal.
- Tape measure or ruler with 5 mm (¼ in.) increments

Figure 1 - J-Ring Dimensions

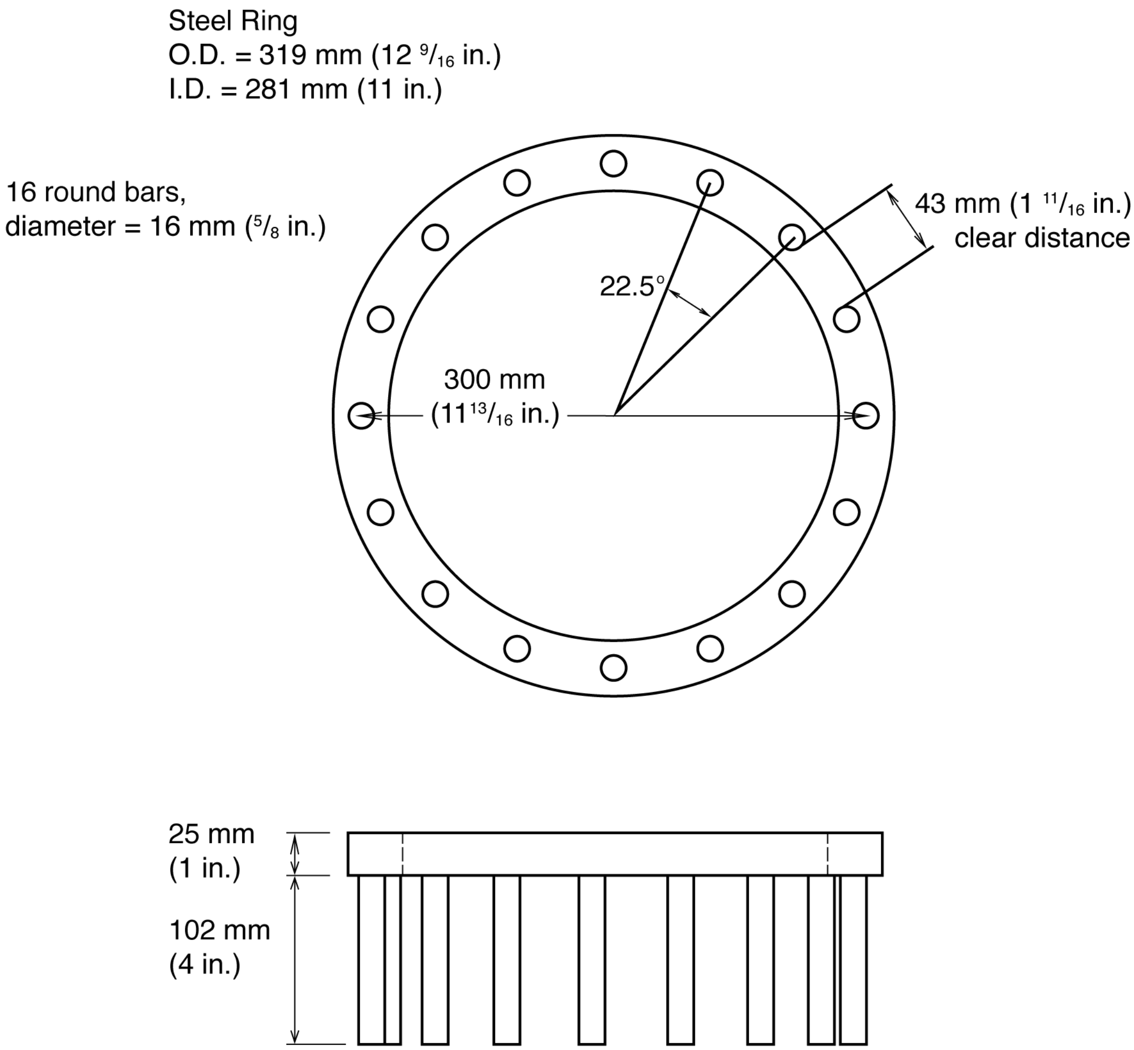


Table 1
J-Ring Dimensions and Tolerances

Dimension	mm	in.
Ring diameter (centerline)	30 ± 3.3	11 13/16 ± 1/8
Ring width	38 ± 1.5	1 9/16 ± 1/16
Bar diameter	16 ± 3.3	5/8 ± 1/32
Bar spacing (clear distance)	43 ± 1.0	1 11/16 ± 1/32
Ring thickness	25 ± 1.5	1 ± 1/16
Bar length	102 ± 6.0	4 ± 1/4

Procedure

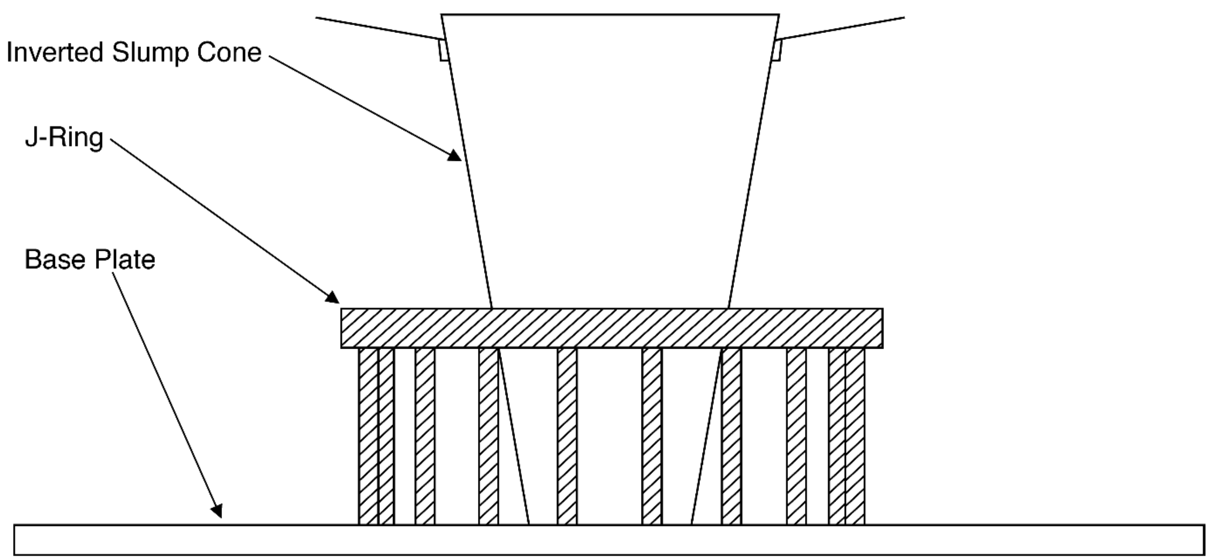
Using SCC from the same sample, determine the J-Ring flow and the slump flow (WFOP AASHTO T 347). The two results are used to indicate the passing ability.

1. Obtain the sample according to the WFOP WAQTC TM 2.

Note 1: Approximately 6 L (0.2 ft^3) of SCC is needed to perform the slump flow and VSI tests.

2. Dampen the inside of the mold and the base plate
3. Place the base plate on a level, stable surface.
4. Place the J-Ring in the center of the base plate, invert the mold and place inside the J-Ring. Hold down firmly.

Figure 2 – J-Ring, Mold (Inverted), and Base Plate



5. Use the pouring vessel or scoop to slightly overfill the mold. Do not rod or tamp the SCC. Do not tap or vibrate the mold.
6. Use the strike-off bar to strike off the SCC level with the top of the mold.
7. Clean off all SCC from around the base of the mold to prevent interference with the flowing SCC.
8. Raise the mold vertically 230 ± 75 mm (9 ± 3 in.) above the base plate with no lateral or torsional motion in 3 ± 1 second, allowing the SCC to flow out freely from within.

   Complete the entire operation within 2 ½ minutes from the start of the filling through removal of the mold without interruption.

9. After the concrete flow has stopped, measure the diameter of the SCC in two directions, the largest diameter (j_1) and the diameter perpendicular to the largest diameter (j_2), to the nearest 5 mm (¼ in.). Include any border without coarse aggregate or a bleed water 'halo' in the diameter measurements.

If the two measured diameters differ by more than 50 mm (2 in.), the test is invalid and must be repeated.

Note 2: A difference in the measured diameter more than 50 mm (2 in.) is likely due to the mold being raised with lateral motion.

10. Lay the strike-off bar across the J-Ring.
11. Measure from the bottom of the bar to the top of the SCC in the center of the J-Ring to the nearest 5 mm (¼ in.), designate as C.
12. Measure from the bottom of the bar to the top of the SCC in two locations just inside the J-Ring to the nearest 5 mm (¼ in.), designate the measured heights as I_1 and I_2.
13. Measure from the bottom of bar to the top of the SCC in two locations just outside the J-Ring to the nearest 5 mm (¼ in.), designate as E_1 and E_2.

Note 3: With the bar in place across the J-Ring, take measurements in the center, and outside and just inside the J-Ring at each end of the bar, rotate the bar around the J-Ring and repeat measurements outside and just inside the J-Ring.

14. Lay the strike-off bar across the J-Ring in a different location.
15. Measure from the bottom of the bar to the top of the SCC in two locations just inside the J-Ring to the nearest 5 mm (¼ in.), designate the measured heights as I_3 and I_4.
16. Measure from the bottom of bar to the top of the SCC in two locations just outside the J-Ring to the nearest 5 mm (¼ in.), designate as E_3 and E_4.
17. Calculate the J-Ring flow by averaging the two measured diameters.
18. Calculate the passing ability by subtracting the J-Ring flow from the slump flow determined according to the WFOP AASHTO T 347/T 351.
19. Calculate the height of the SCC in the center of the J-Ring, subtract C from 127 mm (5 in.), designate as h_c.
20. Calculate the average height of SCC just inside the J-Ring to the nearest 5 mm (¼ in.), average I_1 through I_4 and subtract from 125 mm (5 in.), designate as h_{am}.
21. Calculate the average height of SCC outside the J-Ring to the nearest 5 mm (¼ in.), average E_1 through E_4 and subtract from 125 mm (5 in.), designate as h_{bm}.
22. Calculate the difference in average heights inside the J-Ring and outside the J-Ring, subtract h_{bm} from h_{am}, designate as h_{ab}.
23. Calculate the difference between the height of the SCC at the center of the J-Ring, and the average height of the SCC inside the J-Ring, subtract h_{am} from h_c, designate as h_{ac}.
24. Calculate the J-Ring test value, subtract h_{ac} from 2 times h_{ab}, designate as J.

Calculations

J-ring Flow

$$J\_ring\ flow = \frac{(j_1 + j_2)}{2}$$

Where:

j_1 = the largest diameter of the circular spread of SCC

j_2 = the diameter perpendicular to the largest diameter (j_1)

Passing ability

$$passing\ ability = slump\ flow - J_{-ring} flow$$

Where:

passing ability = the difference between the J-Ring flow and the slump flow

slump flow = determined according to the WFOP AASHTO T 347/T 351

Average height inside the J-Ring

$$h_{am} = 125\ mm\ (5\ in.) - \left(\frac{I_1 + I_2 + I_3 + I_4}{4}\right)$$

Where:

h_{am} = average height of SCC inside the J-Ring to the nearest 5 mm (¼ in.)

I_1 through I_4 = measurements from the bottom of the strike-off bar to the top of the SCC inside the J-Ring

Average height outside the J-Ring

$$h_{bm} = 125\ mm\ (5\ in.) - \left(\frac{E_1 + E_2 + E_3 + E_4}{4}\right)$$

Where:

h_{bm} = average height of SCC outside the J-Ring to the nearest 5 mm (¼ in.)

E_1 through E_4 = measurements from the bottom of the strike-off bar to the top of the SCC outside the J-Ring

Difference of the average heights

$$h_{ab} = h_{am} - h_{bm}$$

Where:

h_{ab} = difference between the average height of SCC inside the J-Ring and outside the J-Ring

Difference between the center and the inside average heights

$$h_{ac} = h_c - h_{am}$$

Where:

h_{ac} = difference between the average height inside the J-Ring and the height at the center

J-Ring test value

$$J = (2 \times h_{ab}) - h_{ac}$$

Where:

J = J-Ring test value

Example

J-ring Flow

$$J_{ring}flow = \frac{615\ mm\ \left(24\frac{1}{4}\ in.\right) + 590\ mm\ (23\frac{1}{4}\ in.)}{2} = 605\ mm\ (23\frac{3}{4}\ in.)$$

Given:

j_1	=	615 mm (24 ¼ in)
j_2	=	590 mm (23 ¼ in.)

Passing ability

$$passing\ ability = 635\ mm\ (25\ in.) - 605\ mm\ \left(23\frac{3}{4}\ in.\right) = 30\ mm\ \left(1\frac{1}{4}\ in.\right)$$

Given:

slump flow = 635 mm (25 in.) (determined according to the WFOP AASHTO T 347/T 351)

Average height inside the J-Ring

$$h_{am} = 125\ mm - \left(\frac{100\ mm + 110\ mm + 110\ mm + 110\ mm}{4}\right) = 20\ mm$$

$$h_{am} = 5\ in. - \left(\frac{4\ in. + 4\frac{1}{4}\ in. + 4\frac{1}{4}\ in. + 4\frac{1}{4}\ in.}{4}\right) = \frac{3}{4}\ in.$$

Given:

I_1	=	100 mm (4 in.)
I_2	=	110 mm (4 ¼ in.)
I_3	=	110 mm (4 ¼ in.)
I_4	=	110 mm (4 ¼ in.)

Average height outside the J-Ring

$$h_{bm} = 125\ mm - \left(\frac{110\ mm + 115\ mm + 115\ mm + 115\ mm}{4}\right) = 10\ mm$$

$$h_{bm} = 5\ in. - \left(\frac{4\frac{1}{4}\ in. + 4\frac{1}{2}\ in. + 4\frac{1}{4}\ in. + 4\frac{1}{2}\ in.}{4}\right) = \frac{1}{2}\ in.$$

Given:

E_1 = 110 mm (4 ¼ in.)

E_2 = 115 mm (4 ½ in.)

E_3 = 115 mm (4 ½ in.)

E_4 = 115 mm (4 ½ in.)

Difference of the average heights

$$h_{ab} = 20\ mm\ \left(\frac{3}{4}\ in.\right) - 10\ mm\ \left(\frac{1}{2}\ in.\right) = 10\ mm\ \left(\frac{1}{4}\ in.\right)$$

Difference between the center and the inside average

$$h_{ac} = 25\ mm\ (1\ in.) - 20\ mm\ \left(\frac{3}{4}\ in.\right) = 5\ mm\ \left(\frac{1}{4}\ in.\right)$$

J-Ring test value

$$J = \left(2 \times 10\ mm\ \left(\frac{1}{4}\ in.\right)\right) - 5\ mm\ \left(\frac{1}{4}\ in.\right) = 15\ mm\ \left(\frac{1}{4}\ in.\right)$$

Report

1. On forms approved by the agency
2. Sample ID
3. J-Ring flow to the nearest 5 mm (¼ in.)
4. Slump flow from the WFOP AASHTO T 347
5. Passing ability to the nearest 5 mm (¼ in.)
6. The difference between the average heights inside and outside the J-Ring (h_{ab}) to the nearest 5 mm (¼ in.)
7. The difference between the height at the center of the SCC and the average height inside the J-Ring (h_{ac}) to the nearest 5 mm (¼ in.)
8. J-Ring test value to the nearest 5 mm (¼ in.)

PERFORMANCE EXAM CHECKLIST

PASSING ABILITY OF SELF-CONSOLIDATING CONCRETE (SCC) BY J-RING WFOP AASHTO T 345

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Mold and floor or base plate dampened?	_____	_____
2. Base plate, J-Ring, and inverted mold placed correctly on a level stable surface and mold held down firmly?	_____	_____
3. Mold slightly overfilled?	_____	_____
4. Concrete struck off level with top of mold using strike-off bar?	_____	_____
5. Concrete removed from around the outside of the mold?	_____	_____
6. Mold lifted upward 230 ± 75 mm (9 ±3 in.) in one smooth motion, without a lateral or twisting motion of the mold, in 3 ±1 seconds?	_____	_____
7. Test performed from start of filling through removal of the mold within 2 ½ minutes?	_____	_____
8. The J-Ring flow measured and averaged correctly?	_____	_____
9. Passing ability calculated correctly?	_____	_____
10. The heights of the SCC patty measured:		
a. At the center of the J-Ring?	_____	_____
b. Just inside the J-Ring in four locations?	_____	_____
c. Just outside the J-Ring in four locations?	_____	_____
11. J-ring test value calculated correctly?	_____	_____

Comments: First attempt: Pass___Fail_____Second attempt: Pass_____Fail_____

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Examiner Signature ______________________________ WAQTC #:_______________

SLUMP FLOW OF SELF-CONSOLIDATING CONCRETE (SCC)
WFOP AASHTO T 347
VISUAL STABILITY INDEX (VSI) OF SELF-CONSOLIDATING CONCRETE (SCC)
WFOP AASHTO T 351

Scope

This procedure provides instruction for determining the slump flow and the visual stability index (VSI) of self-consolidating concrete (SCC), in accordance with AASHTO T 347-13 and AASHTO T 351-14, both in the laboratory and in the field.

The slump flow assesses the horizontal free flow, filling ability of self-compacting concrete in the absence of obstructions and may give some indication of resistance to segregation. It does not indicate the ability of the SCC to pass between reinforcement without blocking.

The Visual Stability Index (VSI) is used to assess the stability of SCC. The stability (or segregation resistance) of an SCC mixture is the ability of the mixture to remain homogeneous during transport, during placement, and after placement. The VSI determination is useful for quality control and consistency testing.

Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

Apparatus

- Mold: meeting the requirements of the WFOP AASHTO T 119.
- Base plate: made of stiff nonabsorbent material, at least 820 mm (32 in.) square, marked with a circle indicating the central location for the mold, and a concentric circle with a diameter of 500 mm (20 in.).
- Pouring vessel or scoop: a water-tight container large enough so each amount of concrete obtained from the sampling receptacle is representative and small enough, so it is not spilled during placement in the mold.
- Strike-off bar: a flat straight steel bar or other suitable metal at least 3 mm (1/8 in.) thick and 20 mm (¾ in.) wide by 300 mm (12 in.) long.
- Tape measure or ruler with 5 mm (¼ in.) increments
- Stopwatch

Procedure

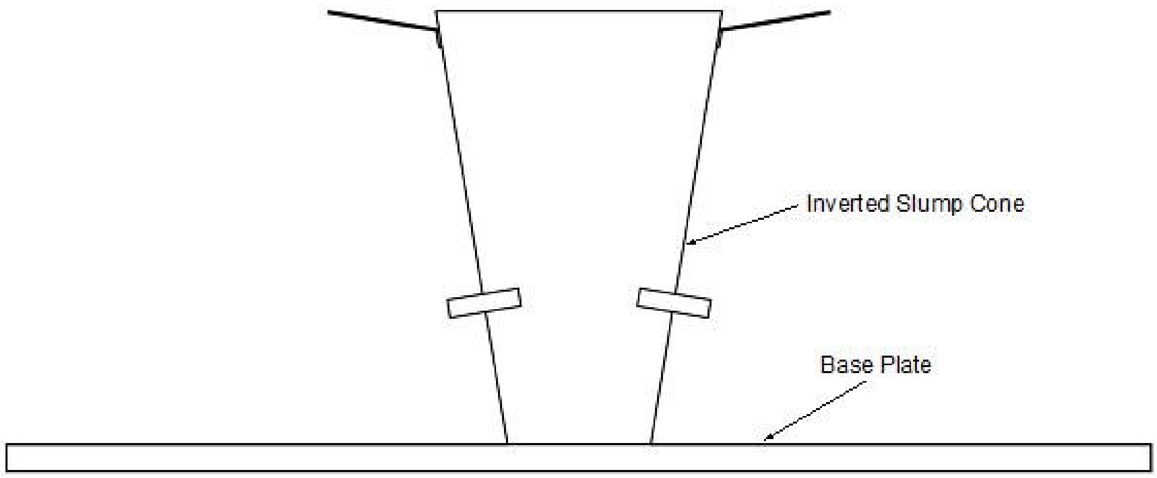
1. Obtain the sample according to the WFOP WAQTC TM 2.

   Begin testing within five minutes of obtaining the sample.

Note 1: Approximately 6 L (0.2 ft^3) of SCC is needed to perform the slump flow and VSI tests.

2. Dampen the inside of the mold and base plate.
3. Place the base plate on a level, stable surface,
4. Invert the mold and place in the center of the base plate. Hold down firmly.

Figure 1- Mold (Inverted) and Base Plate



5. Use the pouring vessel or scoop to slightly overfill the mold. Do not rod or tamp the SCC. Do not tap or vibrate the mold.
6. Use the strike-off bar to strike off the SCC level with the top of the mold.
7. Clean off all SCC from around the base of the mold to prevent interference with the flowing SCC.
8. Start the stopwatch.
9. Immediately raise the mold vertically 230 ± 75 mm (9 ± 3 in.) above the base plate with no lateral or torsional motion in 3 ± 1 second, allowing the SCC to flow out freely from within.

   Complete the entire operation within 2 1/2 minutes from the start of the filling through removal of the mold.
10. Determine and record the time required for the SCC slump flow patty to first contact the 500 mm (20 in.) ring on the base plate. Designate this as T-50.
11. After the concrete flow has stopped, measure the diameter of the SCC in two directions, the largest diameter (d_1) and the diameter perpendicular to the largest diameter (d_2), to the nearest 5 mm (1/4 in.). Include any border without coarse aggregate or a bleed water 'halo' in the diameter measurements.
12. The slump flow is the average of the two measured diameters. If the two measured diameters differ by more than 50 mm (2 in.), the test is invalid and must be repeated.

Note 3: A difference in the measured diameter more than 50 mm (2 in.) is likely due to the mold being raised with lateral motion.

13. Use the guidelines in Table 1 to rate the stability of the mixture in 1.0 increments by visual examination of the SCC on the base plate and in the wheelbarrow or mixer.

    See Figures 2 through 8 for reference in assignment of VSI.

Note 4: In the case of severe segregation, most of the coarse aggregate may remain in the center of the slump flow patty of SCC. A border of mortar without coarse aggregate or a bleed water "halo" may occur at the edge of the slump flow patty of SCC.

Table 1
Criteria of Visual Stability Index

Rating	Criteria
0	No evidence of segregation in slump flow patty or mixer drum or wheelbarrow
1	No border of mortar without coarse aggregate in the slump flow patty, but some slight bleed or air popping on the surface of the concrete in the mixer drum or wheelbarrow.
2	A slight border of mortar without coarse aggregate (<10 mm (3/8 in.)) or aggregate pile in the slump flow patty, or both, and highly noticeable bleeding in the mixer drum or wheelbarrow.
3	Clearly segregating by evidence of a large border of mortar without coarse aggregate (>10 mm (3/8 in.)) or large aggregate pile in the center, or both, of the slump flow patty and a thick layer of paste on the surface of the resting concrete in the mixer drum or wheelbarrow.

Figure 2
Visual Index = 0

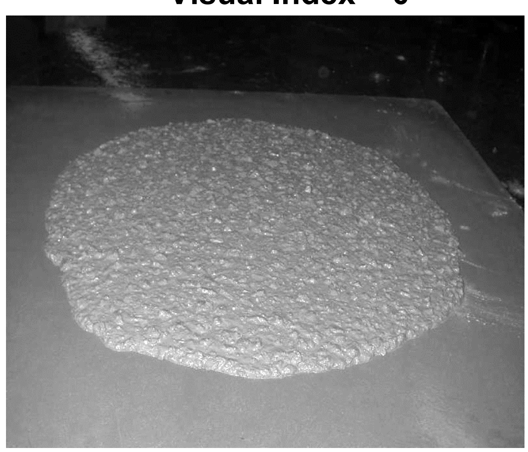
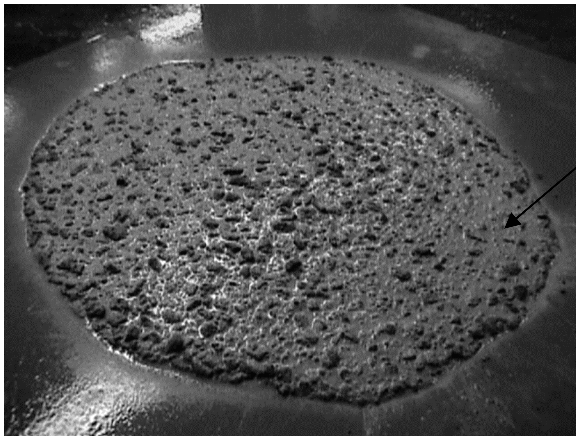


Figure 3
Visual Stability Index = 1

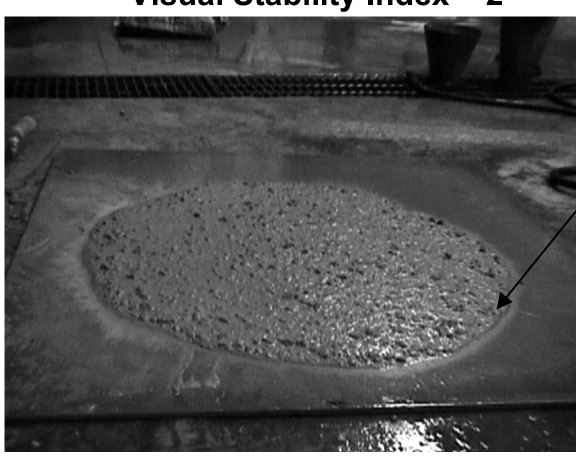


Some slight bleed or air popping on the surface

Figure 4
Visual Stability Index = 1

Some slight bleed or air popping on the surface

Figure 5
Visual Stability Index = 2



Border of mortar without coarse aggregate and bleeding

Figure 6
Visual Stability Index = 2

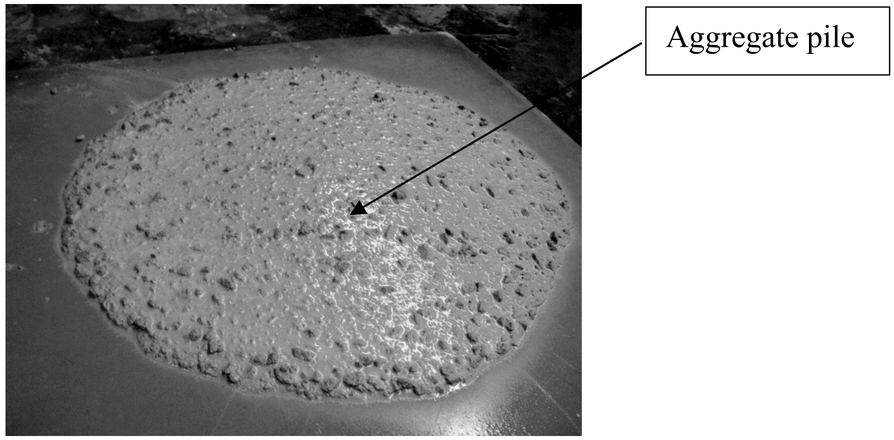


Figure 7
Visual Stability Index = 3

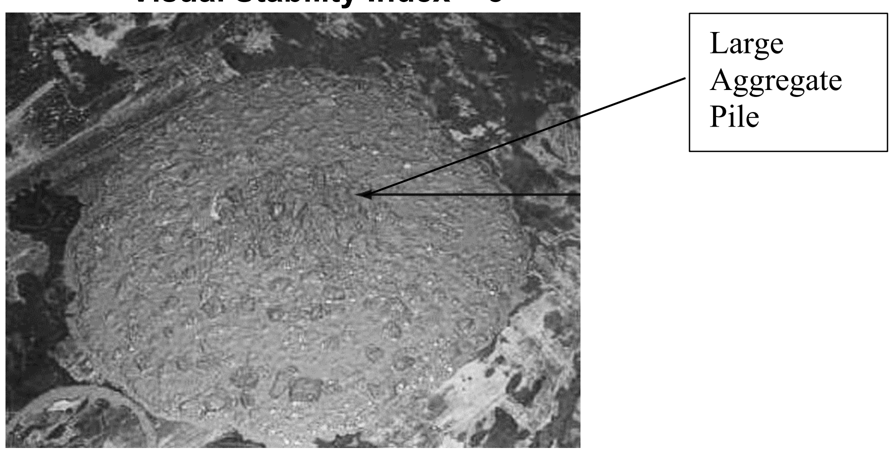
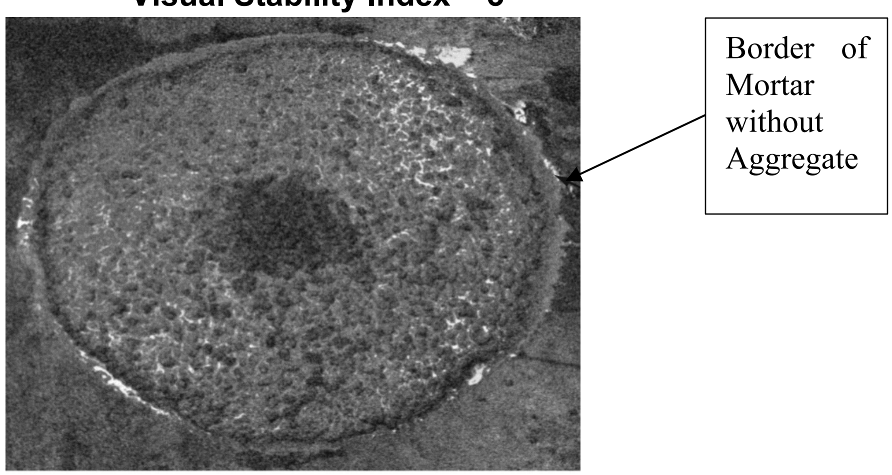


Figure 8
Visual Stability Index = 3



Calculations

$$slump\ flow = \frac{(d_1 + d_2)}{2}$$

Given:

d_1 = the largest diameter of the circular spread of SCC

d_2 = the diameter perpendicular to the largest diameter (d_1)

Example

$$slump\ flow = \frac{655\ mm\ \left(25\frac{3}{4}\ in.\right) + \ 615\ mm\ (24\frac{1}{4}\ in.)}{2} = 635\ mm\ (25\ in.)$$

Given:

d_1 = 655 mm (31 ¾ in.)

d_2 = 615 mm (30 ¼ in.)

Report

- On forms approved by the agency
- Sample ID
- Slump flow to the nearest 5 mm (¼ in.)
- T-50
- Visual Stability Index of mixture:
    - of the slump flow patty
    - in the wheelbarrow or mixer

PERFORMANCE EXAM CHECKLIST

SLUMP FLOW OF SELF-CONSOLIDATING CONCRETE (SCC)
WFOP AASHTO T 347
VISUAL STABILITY INDEX (VSI) OF SELF-CONSOLIDATING CONCRETE (SCC)
WFOP AASHTO T 351

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Mold and floor or base plate dampened?	_____	_____
2. Base plate and inverted mold placed correctly on a level stable surface and held down firmly?	_____	_____
3. Mold slightly overfilled?	_____	_____
4. Concrete struck off level with top of mold using strike-off bar?	_____	_____
5. Concrete removed from around the outside of the mold?	_____	_____
6. Stopwatch started?	_____	_____
7. Mold lifted upward 230 ± 75 mm (9 ±3 in.) in one smooth motion, without a lateral or twisting motion of the mold, in 3 ±1 seconds?	_____	_____
8. Test performed from start of filling through removal of the mold within 2 ½ minutes?	_____	_____
9. Time recorded for slump flow patty to contact the 500 mm (20 in.) ring?	_____	_____
10. Slump flow measured and averaged correctly?	_____	_____
11. VSI on the baseplate and wheelbarrow or mixer determined and recorded?	_____	_____

Comments: First attempt: Pass___Fail_____Second attempt: Pass_____Fail_____

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Examiner Signature ____________________________ WAQTC #:______________

PENETRATION TEST FOR STATIC SEGREGATION RESISTANCE OF SELF-CONSOLIDATING CONCRETE (SCC)
WAQTC TM 18

Scope

This procedure provides instruction for assessing the static segregation resistance of self-consolidating concrete (SCC) in accordance with ASTM C1712-20.

Segregation is the tendency for coarse aggregate to separate from the sand-cement mortar. Segregation resistance is a critical requirement in self-consolidating concrete.

Static segregation is affected by fluid (paste) rheology and by the size, density, volume fraction, shape, and gradation properties of suspended particles (aggregates).

Static segregation may occur after the SCC has been placed until it has hardened.

This method is a quick and easy assessment of the likelihood that static segregation of an SCC concrete will occur. A mass (penetration head) is placed on a sample of static (motionless) SCC in a mold for a specified time and the distance that the mass penetrates the SCC is measured.

Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

Apparatus

- Mold: meeting the requirements of the WFOP AASHTO T 119.
- Penetration apparatus, meeting the requirements of ASTM C1712, consisting of:
  - Support frame
  - Metal sleeve
  - Set screw
  - Penetration head comprised of a hollow cylinder with a metal rod bolted vertically to the top.
  - Reading scale with 1 mm increments mounted on the support frame next to the metal rod
- Base plate (optional): flat, rigid, non-absorbent moistened surface on which to set the mold
- Strike-off bar: a straight steel bar or other suitable metal.
- Pouring vessel or scoop: a water-tight container large enough so each amount of concrete obtained from the sampling receptacle is representative and small enough, so it is not spilled during placement in the mold.

Procedure

Testing may be performed in conjunction with the WFOP AASHTO T 347/T 351 providing the mold is filled and removed within 2 ½ minutes.

1. Prepare the penetration apparatus.
    a. Dampen the hollow cylinder.
    b. Hold the device horizontally and release the set screw.
    c. Spin the hollow cylinder to ensure free movement of the rod in the sleeve.
    d. Ensure the bottom of the hollow cylinder does not protrude past the bottom of the frame.
    e. Tighten the set screws to hold the rod in the sleeve.
2. Obtain the sample according to the WFOP WAQTC TM 2.
3. Dampen the inside of the mold.
4. Invert the mold and place on the dampened base plate or a dampened, rigid, nonabsorbent surface that is level and firm. Hold down firmly.
5. Use the pouring vessel or scoop to slightly overfill the mold. Do not rod or tamp the SCC. Do not tap or vibrate the mold.
6. Use the strike-off bar to strike off the SCC level with the top of the mold.

Note 2: When performing in conjunction with the WFOP AASHTO T 347/T 351, clean off all SCC from around the base of the mold to prevent interference with the flowing SCC.

7. Allow SCC to stabilize for 80 ±5 sec.
8. Position the penetration apparatus while the SCC is stabilizing.
    a. Place the device on the top of the inverted mold with the penetration head aligned with the center of the inverted mold.
    b. Hold the metal rod while releasing the set screw.
    c. Lower the penetration head carefully so that it just touches the surface of the SCC.
    d. Tighten the set screw to hold the metal rod in place.
    e. Read the mark on the scale that is in line with the top of the metal rod. Designate as d_i.
9. At the end of 80 ±5 sec., release the set screw so that the hollow cylinder penetrates the SCC.
10. After 30 ±2 sec, read the mark on the scale that is in line with the top of the metal rod. Designate as d_f.

Note 3: Continue with Step 8 of the WFOP AASHTO T 347/T 351 if performing them together.

11. Remove, clean, and dry the penetration apparatus.
12. Calculate the penetration depth (P_d), by subtracting d_i from d_f.

Calculation

Calculate the penetration depth.

$$P_d = d_f - d_i$$

Where:

P_d = penetration depth, mm

d_f = final reading, mm

d_i = initial reading, mm

Example:

$$P_d = 17\ mm - 5\ mm = 12\ mm$$

Given:

d_f = 17 mm

d_i = 5 mm

Report

- On forms approved by the agency
- Sample ID
- Penetration depth (P_d) to the nearest 1 mm

PERFORMANCE EXAM CHECKLIST

PENETRATION TEST FOR STATIC SEGREGATION RESISTANCE OF SELF-CONSOLIDATING CONCRETE (SCC)
WFOP WAQTC TM 18

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	**Trial 1**	**Trial 2**
1. Penetration Apparatus prepared:		
a. Cylinder dampened?	_____	_____
b. Hollow cylinder spins freely?	_____	_____
c. Hollow cylinder does not protrude past the bottom of the frame?	_____	_____
d. Set screw tightened?	_____	_____
2. Mold and floor or base plate dampened?	_____	_____
3. Inverted mold placed correctly on a level stable surface?	_____	_____
4. Mold slightly overfilled?	_____	_____
5. SCC struck off level with top of mold using strike-off bar?	_____	_____
6. SCC allowed to stabilize for 80 ±5 sec?	_____	_____
7. Penetration apparatus positioned correctly:		
a. Penetration head aligned with the center of the inverted mold?	_____	_____
b. Penetration head lowered to just touch the surface of the SCC?	_____	_____
c. Mark on the top of the scale that is in line with the top of the metal rod read correctly?	_____	_____
8. Set screw released after 80 ±5 sec?	_____	_____
9. Mark on the top of the scale that is in line with the top of the metal rod read correctly?	_____	_____
10. Penetration apparatus removed, cleaned, and dried?		
11. Penetration depth calculated correctly?	_____	_____

Comments: First attempt: Pass___Fail_____Second attempt: Pass_____Fail_____

____

____

____

Examiner Signature ______________________________ WAQTC #:_______________

STATIC SEGREGATION OF SELF-CONSOLIDATING CONCRETE (SCC) USING THE COLUMN METHOD
WFOP WAQTC TM 19

Scope

This procedure provides instruction for assessing the static segregation of self-consolidating concrete (SCC) in accordance with ASTM C1610-21.

Column segregation is a static test that measures aggregate segregation of SCC mixtures at rest. In this method, a column mold is filled with SCC and allowed to stabilize undisturbed for 15 ± 1 min., then the amount of coarse aggregate in the top quarter of the mold is compared to the amount of coarse aggregate in the bottom quarter of the mold. If there is significantly more coarse aggregate in the bottom quarter of the mold, static segregation has occurred.

Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

Apparatus

- Balance or scale: accurate to within 45 g (0.1 lb) or 0.3 percent of the test load, whichever is greater, at any point within the range of use.
- Column Mold: a 200 mm (8 in.) diameter PVC column separated into three sections, top, middle and bottom, fastened together to form a mortar-tight joint and secured to a base plate, meeting the requirements of ASTM C1610.
- Collector plate: non-absorbent, rigid, plate at least 510 mm (20 in.) square with a 220 mm (8.7 in.) cutout in the center and 50 mm 2 in. lip around three sides of the perimeter, meeting the requirements of ASTM C1610.
- Sieve: 4.75 mm (No. 4) rectangular sieve at least 330 mm (13 in.) by 630 mm (25 in.).
- Strike-off bar: a straight steel bar or other suitable metal.
- Pouring vessel or scoop: a water-tight container large enough so each amount of concrete obtained from the sampling receptacle is representative and small enough, so it is not spilled during placement in the mold.
- Plastic container: a bucket or other suitable container.

Procedure

1. Obtain the sample according to the WFOP WAQTC TM 2.
2. Dampen the inside of the mold and empty excess water.
3. Use the pouring vessel or scoop vessel to slightly overfill the mold within 2 min. Do not rod or tamp the SCC. Do not tap or vibrate the mold.
4. Use the strike-off bar to strike off the SCC level with the top of the mold.
5. Allow SCC to stabilize for 15 ±1 min.

Complete the following in 20 min. or less.

6. Hold the top section of the mold and remove fastening system.
7. Place the collector plate around the mold below the top joint.
8. Pull the SCC in the top section of the mold on to the collector plate with a rotating screeding motion.
9. Place SCC into a plastic container.
10. Hold the middle section of the mold and remove fastening system.
11. Place the collector plate around the mold below the middle joint.
12. Pull the SCC in the middle section of the mold on to the collector plate with a rotating screeding motion and discard.
13. Wash the SCC from the top portion of the mold on the 4.75 mm (No. 4) sieve so that only the coarse aggregate remains.
14. Place the coarse aggregate from the top portion of the mold in a clean plastic container.
15. Wash the SCC from the bottom portion of the mold on the 4.75 mm (No. 4) sieve so that only the coarse aggregate remains.
16. Dry the aggregate from top portion of the mold to a surface-dry surface dry condition by rolling in a large absorbent cloth until all visible films of water are removed.
17. Determine the mass of the surface-dry aggregate to the nearest 50 g. Designate as C_t.
18. Repeat Step 15 through 17 with the aggregate from the bottom portion of the mold. Designate as C_b.
19. Calculate the static segregation, S, to the nearest 0.1 percent.
20. If the mass of aggregate in the top portion of the mold exceeds the mass of aggregate in the bottom portion of the mold, S = 0.

Calculation

Calculate the percent of static segregation.

$$S = \left[2 \times \left(\frac{C_b - C_t}{C_b + C_t}\right)\right] \times 100$$

Where:

S = static segregation, percent

C_b = mass of coarse aggregate in the bottom portion of the mold, g

C_t = mass of coarse aggregate in the top portion of the mold, g

If $C_b < Ct$, $S = 0$.

Example:

$$S = \left[2 \times \left(\frac{5800\ g - 5650\ g}{5800\ g + 5650g}\right)\right] \times 100 = 2.6\%$$

Given:

C_b = 5800 g

C_t = 5650 g

Report

- On forms approved by the agency
- Sample ID
- Static segregation (S) to the nearest 0.1 percent

PERFORMANCE EXAM CHECKLIST

STATIC SEGREGATION OF SELF-CONSOLIDATING CONCRETE (SCC) USING THE COLUMN METHOD
WAQTC TM 19

Participant Name ______________________________ Exam Date ______________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Mold dampened with no excess water?	_____	_____
2. Mold slightly overfilled?	_____	_____
3. SCC struck off level with top of mold using strike-off bar?	_____	_____
4. SCC allowed to stabilize for 15 ±1 min?	_____	_____
5. SCC in top section pulled onto collector plate with a rotating and screeding motion and placed into a plastic container?	_____	_____
6. SCC in middle section pulled onto collector plate with a rotating and screeding motion and discarded?	_____	_____
7. SCC from top section washed on a 4.75 mm (No. 4) sieve so that only the coarse aggregate remains and placed in a clean plastic container?	_____	_____
8. SCC from the bottom portion of the mold washed on the 4.75 mm (No. 4) sieve so that only the coarse aggregate remains and placed into a clean plastic container?	_____	_____
9. Coarse aggregate from the top and bottom sections surface dried?	_____	_____
10. Mass of the surface dry aggregate determined and recorded to the nearest 50 g?	_____	_____
11. Steps 5 through 10 completed in 20 min. or less?	_____	_____
12. Static segregation calculated correctly?	_____	_____

Comments: First attempt: Pass___Fail_____Second attempt: Pass_____Fail_____

____

____

____

Examiner Signature ______________________________ WAQTC #:_______________

ON PAGES 787 THRU 810 OF 844, 2020 QA MANUAL – SECTION 580.00 – IDAHO FIELD OPERATING PROCEDURES (IFOP)

Delete Section 580.00 and replace with the following.

SECTION – 580.00 IDAHO FOP (IFOP)

Idaho Field Operating Procedure for

FLAT AND ELONGATED PARTICLES IN COARSE AGGREGATE IFOP ASTM D4791

1 SCOPE

1.1 This Idaho Field Operating Procedure (IFOP) covers the determination of the percentage, by mass, of flat and elongated particles in coarse aggregates for comparison with specification limits.

1.2 This IFOP can be performed in conjunction with AASHTO T 27/T 11.

2 SUMMARY AND SIGNIFICANCE OF METHOD

2.1 Flat and elongated particles of aggregates, for some construction applications, may interfere with consolidation and result in harsh, difficult to place materials and a potentially unstable mixture.

3 REFERENCE DOCUMENTS

3.1 AASHTO Standards

- M 231, Weighing Devices Used in the Testing of Materials
- R 76, Standard Practice for Reducing Samples of Aggregate to Testing Size
- R 90, Sampling Aggregate Products
- T 27, Sieve Analysis of Coarse and Fine Aggregates
- T 11, Materials Finer Than 75-µm (No. 200) Sieve in Material Aggregates by Washing

3.2 ASTM Standards

- D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
- E11, Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

3.3 OTHER Standards

- Standard Specifications for Highway Construction, Subsection 703.

4 APPARATUS

4.1 *Balance or Scale*: Meets the requirements of AASHTO M 231 Class G 2. Capacity sufficient for the principal sample mass, accurate to 0.1 percent of the sample mass or readable to 0.1 g.

4.2 *Sieves*: Meeting requirements of ASTM E11.

4.3 *Proportional Caliper Device*: Meeting the requirements of ASTM D4791.

4.3.1 The device typically consists of a base plate with two fixed posts and a swinging arm mounted between them so that the openings between the arm and the posts maintain a constant ratio.

4.3.2 The numbers on the arm represent the ratios for which the apparatus can be set. For example, the number 5 represents the 5:1 ratio.

5 TERMINOLOGY

5.1 Flat and elongated particles are defined as those coarse aggregate particles that have a ratio of length to thickness equal to or greater than a specified value such as 5:1.

6 SAMPLE AND SAMPLE PREPARATION

6.1 Sample the aggregate in accordance with the IFOP AASHTO R 90.

6.2 Mix the sample and reduce to sample size in accordance with the IFOP AASHTO R 76. See Table 1 for minimum required sample mass.

Table 1 Sample Size

Nominal Maximum Size	Sample Mass, min.	
	kg	lb
3/8”	1	2
1/2”	2	4
¾”	5	11
1”	10	22
1 ½”	15	33

6.3 Dry the sample to constant mass.

6.4 Sieve the aggregate according to the IFOP AASHTO T 27/11.

6.4.1 If an individual sieve size fraction is not represented by at least 10% of the +No. 4 aggregate material, combine that sieve size fraction with the next smaller fraction for all sieves except the 3/8” sieve.

6.4.2 If the 3/8” sieve is not represented by at least 10% of the +No. 4, combine the 3/8” sieve material with the next larger sieve size material.

6.5 Reduce each individual sieve size fraction through and including the 3/8” sieve to approximately 100 particles per R 76 (Reduction to an exact amount is not permitted).

7 PROCEDURE

7.1 From Step 6.5, perform the following for each sieve size fraction:

7.1.1 Determine the total dry mass of each fraction to the nearest 0.1 g. This mass is designated as T in the calculation.

7.1.2 Set the proportional caliper device to the ratio required in the contract specifications: (2:1, 3:1, or 5:1).

7.1.3 Expedite testing through preliminary visual separation of all material which obviously is not flat and elongated.

7.1.4 Test each questionable particle by setting the larger opening of the proportional caliper device equal to the maximum dimension of the particle’s length. Determine the dimension which represents the particle thickness (the smallest dimension). Pull the particle horizontally through the smaller opening without rotating, maintaining contact of the particle with the fixed post at all times. If the entire particle thickness can be pulled through the smaller opening, the particle is flat and elongated. Develop two categories of aggregate for each size fraction, flat and elongated and not flat and elongated.

7.1.5 Determine the dry mass of the flat and elongated particles in each size fraction to the nearest 0.1 g. This mass is designated as F in the calculation.

8 CALCULATIONS

8.1 Calculate the percentage of flat and elongated particles in each size fraction to the nearest 0.1% according to the equation shown below:

$$P_i = \frac{F}{T} \times 100$$

Where:

Pi = percent flat & elongated of individual size fraction

F = mass of flat and elongated particles in fraction

T = total mass of particles in fraction

Example –

Individual Percent Flat & Elongated for 3/4" Sieve Size Fraction:

$$P_i = \frac{196.4}{1178.0} \times 100 \ = 16.7, Report\ 17\%$$

9 REPORT

9.1 Sample Report

Sieve Size	Total Mass in Size Fraction (Mass)	Mass of Flat & Elongated Particles (Mass)	Flat & Elongated (Percent) *
1"	1640.9	589.2	36
3/4"	1178.0	196.4	17
1/2"	825.7	70.1	8
3/8"	277.0	23.3	8

* Report to the nearest 1 percent.

PERFORMANCE EXAM CHECKLIST

FLAT PARTICLES, ELONGATED PARTICLES, OR FLAT AND ELONGATED PARTICLES IN COARSE AGGREGATE FOP
IDAHO FOP ASTM D4791

Participant Name:________________________________Exam Date: ___________________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
Sample Preparation		
1. Sample obtained, mixed and reduced in accordance with AASHTO R 90 and AASHTO R 76 to approximately the amount required for testing? For combined samples fine portion (- # 4) removed?	_______	_______
2. Minimum dry sample mass meets requirements of Table 1?	_______	_______
Procedure		
1. If determination by mass, sample oven-dried to constant mass at 230 ±9° F? **Note:** If determination is by particle count drying is not necessary.	_______	_______
2. Sample sieved according to AASHTO T 27?		
3. Each coarse aggregate size fraction present in amount of 10% or more of original coarse sample reduced according to R 76 until approximately 100 particles obtained?	_______	_______
Flat and Elongated Particles		
1. Each particle in each size fraction tested and placed into one of two groups: (1) flat and elongated or (2) not flat and elongated?	_______	_______
2. Proportional caliper device positioned at proper ratio?	_______	_______
3. Larger opening set equal to particle <u>length</u>?	_______	_______
4. Particle is <u>flat and elongated</u> if the <u>thickness</u> can be placed in the smaller opening?	_______	_______
5. Proportion of sample in each group determined by count or by mass, as required?	_______	_______
Calculation		
1. Percentage of flat and elongated particles calculated to nearest 1% for each sieve size greater than No. 4?	_______	_______

2. When weighted average for sample is required, sieve sizes not tested (those representing less than 10% of sample) assumed to have same percentage of flat particles, elongated particles, or flat and elongated particles as the next smaller or the next larger size?
   Or if both are present, is average for next smaller and larger sizes used? ______ ______

First Attempt: Pass________Fail____ Second Attempt: Pass ______Fail___

Comments:

Testing Technician's Signature:________WAQTC #:____________________Date: ______

Examiner's Name:___________________Signature: __________________WAQTC #: ______

Idaho Field Operating Procedure for

SAMPLING AND FABRICATION OF 2-IN. (50-MM) CUBE SPECIMENS USING GROUT (NON-SHRINK) OR MORTAR IFOP AASHTO R 64

1 SCOPE

1.1 This method covers field sampling and fabrication and initial curing of 2-in. (50-mm) cube specimens of non-shrink grout and/or mortar materials.

1.2 The values stated in either SI or inch-pound units shall be regarded separately as standard. The SI units are shown in brackets. The values stated might not be exact equivalents; therefore, each system must be used independently of the other.

Note 1—Unit weight was the previous terminology used to describe the property determined by this test method, which is mass per unit volume.

1.3. The text of this test method references notes and footnotes that provide explanatory information. These notes and footnotes (excluding those in tables) shall not be considered as requirements of this test method.

1.4. This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

2 REFERENCE DOCUMENTS

2.1 *AASHTO Standards*

- T 106, Test method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens.)

2.2 *ASTM Standards*

- C 1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
- D 2240, Standard Test Method for Rubber Property—Durometer Hardness

2.3 *WAQTC Method*

- TM 2, Sampling Freshly Mixed Concrete

3 TERMINOLOGY

3.1 DefinitionsPlastic mix – material viscous enough that an indentation will be left in the surface of the grout after tamping.

3.1.2 Fluid mix – material fluid enough that little or no indentation will be left in the surface after puddling.

4 APPARATUS

4.1 Specimen Molds including cover plate (s): The 2 in. (50 mm) cube specimen molds shall be tight fitting and made of brass or other suitable material. This material shall not be susceptible to attack by the cement mortar. The molds shall have not more than three (3) cube compartments and shall be separable into not more than two (2) parts. The parts of the molds, when assembled, shall be positively held together. The cover plate(s) working surface shall be plane and shall be positively attached to the side walls of the mold. The interior faces of the molds shall conform to the tolerances of Table 1.

Table 1─Permissible Variations of Specimen Molds

	2-in. Cube Mold		50-mm Cube Molds	
Parameter	New	In Use	New	In Use
Planeness of Sides	<0.001 in.	<0.002 in.	<0.025 mm	<0.05 mm
Distance Between Opposite Sides	2 in. + 0.005 in.	2 in. + 0.02 in.	50 mm + 0.13 mm	50 mm + 0.50 mm
Height of Each Compartment	2 in. + 0.001 in. to -0.005 in.	2 in. + 0.01 in. to -0.015 in.	50 mm + 0.25 mm to -0.013 mm	50 mm + 0.25 mm to -0.38 mm
Angle Between Adjacent Faces [A]	90 + 0.5°	90 + 0.5°	90 + 0.5°	90 + 0.5°

[A] Measured at points slightly removed from the intersection. Measured separately for each compartment between all the interior faces and the adjacent face and between interior faces and top and bottom planes of the mold.

4.2 Tamper: A non-absorptive, nonabrasive, non-brittle material such as a hard rubber compound having a Shore A durometer hardness of 80 ± 10. The tamper shall have a cross section of about 1/2 in. x 1 in. (13 mm x 25 mm) and a length of 5 in. to 6 in. (125 mm to 150 mm). The tamping face shall be flat and at right angles to the length of the tamper

4.3 Trowel: Steel bladed, 4 in. to 6 in. (100 to 150 mm) in length, with straight edges.

4.4 Water tight container: a 6 in. x 12 in. (150 mm x 300 mm) concrete cylinder mold with lid

4.5 Other Equipment: Rubber gloves, scoop, clamps to secure the cover plate, light release oil for oiling the molds, small brush or lint-free cloth for applying and removing excess release oil, burlap or wrapping cloth capable of retaining moisture.

5 SAMPLING

5.1 Samples shall be obtained in accordance with WAQTC TM 2 when the batch equals or exceeds 1 cy (1 m3). When the batch is less than 1 cy (1 m3) sample from the batch after discharge. If remixing is required, sample after remixing. Begin molding the specimen within an elapsed time of not more than 2 1/2 minutes from completion of mixing

Note 2—This test is to be used only for grouts with 100 percent passing the 3/8- in. (9.5-mm) sieve.

5.2 Obtain a representative sample of the mix. Samples shall be a minimum size of 4 lb. (2000 g) for each set of three (3) cubes to be fabricated.

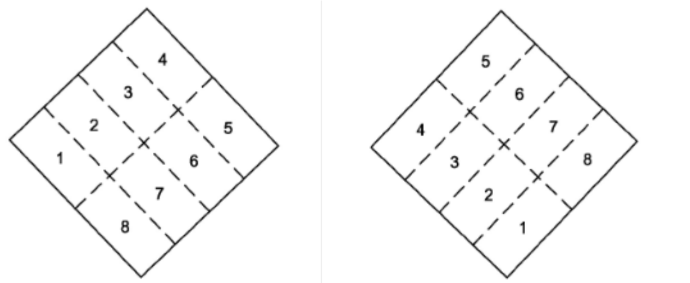
6 PROCEDURE

6.1 Assemble both portions of the mold and the bottom cover plate. All joints shall be water tight. If not water tight, seal the surfaces where the halves of the mold join by applying a coating of light cup grease (non water soluble). The amount should be sufficient to extrude slightly when the halves are tightened together. Repeat this process for attaching the mold to the bottom cover plate. Remove any excess grease. Apply a thin coating of release agent to the interior faces of the mold and the bottom cover plate. Wipe the mold faces and base plate as necessary to remove any excess release agent and to achieve a thin, even coating on the interior surfaces. Adequate coating is that which is just sufficient to allow a distinct fingerprint to remain following light finger pressure.

6.2 Place a layer of grout about 1 in. (25 mm) (approximately one-half of the depth of the mold) in all of the cube compartments. Consolidated according to the consistency (plastic or fluid) of the mix.

6.2.1 For plastic mixes, tamp the lift in four rounds of 8 tamps for a total of 32 tamps with the rubber tamper in 10 seconds. See Figure 1 for tamping sequence of each round. Rounds 1 and 3; and 2 and 4 shall be the same.

Figure #1

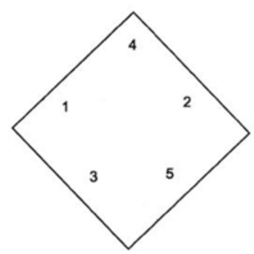


Rounds 1 and 3 Rounds 2 and 4

Tamping Sequence

6.2.2 For fluid mixes, puddle the lift 5 times with a gloved finger. See Figure 2 for tamping sequence.

Figure #2



Puddling Sequence

6.3 Place the second lift in each of the cube compartments, slightly over-filling each compartment Consolidate the material in the same fashion as the first lift with the additional requirement that during consolidation of the second lift any grout forced out onto the top of the mold after each round will be pushed back onto the compartment by means of the tamper and/or gloved fingers before the next consolidation round. When consolidation of the grout is completed, material should extend slightly above the top of the mold. Push any grout forced out onto the top of the mold after the last round back onto the compartment with the trowel.

6.4 Smooth off the cubes by drawing the flat side of the trowel (with the leading edge slightly raised) once across the top of each cube at right angles to the length of the mold. Then, for the purpose of leveling the mortar and making the mortar that protrudes above the top of the mold of more uniform thickness, draw the flat trailing edge of the trowel (with leading edge slightly raised) once lightly along the length of the mold. Cut off the mortar to a plane surface flush with the top of the mold by drawing the straight edge of the trowel (held nearly perpendicular to the mold) with a sawing motion over the length of the mold. The material shall be flush with the top of the mold.

6.5 Immediately secure the top cover plate to the cube mold.

6.6 Place the molds in a secure location away from vibration and as close as possible to the structure for initial curing. Cover with wet burlap, towels, or rags, seal it in a plastic sack in a level location out of direct sunlight, and record the time. These samples shall remain undisturbed and protected from freezing or overheating for a period of 24 ± 4 hours.

6.7 At the end of the initial curing period as required by the agency either.

6.7.1 Place the sealed plastic sack into a water tight container. Transport the cube samples immediately to the location of final curing. During transport, the cube samples shall be protected from jarring, freezing, and moisture loss.

6.7.2 Disassemble the mold and carefully remove the cube samples. Using a permanent marker, identify the cube samples. Handling the cube samples very carefully, wrap them in wet burlap or wet towels and place them into a water tight container. Transport the cube samples immediately to the location of final curing. During transport, the cube samples shall be protected from jarring, freezing, and moisture loss.

6.8 Final curing shall consist of immersing the cube samples in a lime-saturated water storage tank. They are to remain in the storage tank until time of test. (Curing cube samples of material other than hydraulic cement shall be in conformance with the manufacturer's recommendations.) The storage tank shall be made of non-corroding materials.

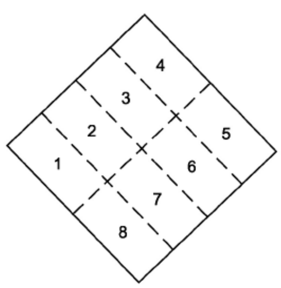
PERFORMANCE EXAM CHECKLIST

SAMPLING & FABRICATION OF 2" (50 – MM) CUBE SPECIMENS USING GROUT (NON-SHRINK) MORTAR
IFOP AASHTO R 64

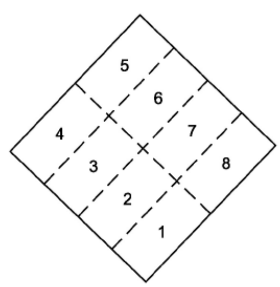
Participant Name: ______________________________ Exam Date: ________________________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Elements:	Trial 1	Trial 2
1. **Obtain Sample.** Use WAQTC TM 2 for 1 yd^3 or more or for less than 1 yd^3 sample from discharge after remixing takes place.	_____	_____
2. **Inspect and adjust test apparatus.** Apparatus includes mold assembly, tamper, trowel, watertight container.	_____	_____
3. **Mold portion attached to bottom plate and joints are water tight.** Use of a light coating of non water-soluble grease is allowed.	_____	_____
4. **Place a 1" (approximately 1/2 the depth of the mold) layer of Grout or non-shrink mortar into the mold.** Grout or mortar shall be placed in all compartments.	_____	_____
5. **Consolidate the mix.** The mix shall be consolidated depending on the consistency, either plastic or fluid.	_____	_____
6. **Plastic mixes:** tamp lift in 4 rounds, 8 tamps per round, for a total of 32 tamps in 10 seconds with rubber tamper. Rounds 1 and 3 and 2 and 4 shall be the same.	_____	_____

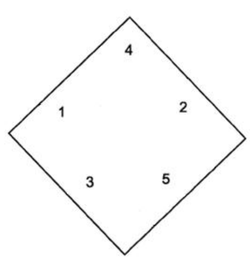


Rounds 1 and 3



Rounds 2 and 4

	Trial 1	Trial 2
7. **Fluid Mixes: puddle the lift 5 times with gloved finger.**	_____	_____



8. **Place the second lift into all of the mold compartments and consolidate:** Slightly overfill. Consolidate in same fashion as first lift. After consolidation material should extend slightly above the top of the mold. Push any grout forced out onto the top of the mold back onto the compartment with a trowel.

9. **Strike off the surface.** Using the trowel draw the flat side with the leading edge slightly raised once across the top of each cube at right angles to the length of the mold. Then draw the flat trailing edge of the trowel, with leading edge slightly raised,) once lightly along the length of the mold. Cut off the mortar to a plane surface flush with the top of the mold by drawing the straight edge of the trowel (held nearly perpendicular to the mold) with a sawing motion over the length of the mold. The material shall be flush with the top of the mold.

10. **Immediately secure the top plate to the molds.**

11. **Molds properly stored:** Cover with wet burlap, towels, or rags, seal it in a plastic sack in a level location out of direct sunlight, and record the time. These samples shall remain undisturbed and protected from freezing or overheating for a period of 24 ± 4 hours.

First Attempt: Pass ☐ Fail ☐ Second Attempt: Pass ☐ Fail ☐

Comments:

Testing Technician's Signature: WAQTC #: Date:

Examiner's Name: Signature: WAQTC #:

Idaho Field Operating Procedure for

UNCOMPACTED VOID CONTENT OF FINE AGGREGATE IFOP AASHTO T 304

1 SCOPE

1.1 This Idaho Field Operating Procedure (FOP) covers a method for determining the loose uncompacted void content of a sample of fine aggregate.

1.2 Three procedures are included for the measurement of void content:

1.2.1 Standard Graded Sample (Method A)

1.2.2 Individual Size Fractions (Method B)

1.2.3 As-Received Grading (Method C)

1.3 For Method A or C, the percent void content is determined directly and the average value of two test runs is reported.

1.4 For Method B, the mean percent void content is calculated using the results from each of the three individual size fractions.

2 REFERENCE DOCUMENTS

2.1 IDAHO Test Methods

- IT-144, Specific Gravity and Absorption of Fine Aggregate Using Automatic Vacuum Sealing (CoreLok) Method

2.2 AASHTO Standards

- M 231, Weighing Devices Used in the Testing of Materials
- R 76, Reducing Samples of Aggregate to Testing Size
- R 90, Sampling Aggregate Products
- T 11, Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregate
- T 27, Sieve Analysis of Fine and Coarse Aggregate
- T 304, Uncompacted Void Content of Fine Aggregate.
- T 308, Determining Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method

3 SUMMARY AND SIGNIFICANCE OF METHOD

3.1 Methods A and B provide percent void content determined under standardized conditions which depend on the particle shape and texture of a fine aggregate. An increase in void content by these procedures indicates greater angularity, less sphericity, rougher surface texture, or some combination of these three factors.

3.2 Method C measures the uncompacted void content of the minus No. 4 portion of the as-received material. This void content depends on grading as well as particle shape and texture.

3.3 The standard graded sample (Method A) is most useful as a quick test that indicates the particle shape properties of a graded fine aggregate. Typically, the material used to make up the standard graded sample can be obtained from the remaining size fractions after performing a single sieve analysis of the fine aggregate.

3.4 Obtaining and testing individual size fractions (Method B) is more time-consuming and requires a larger initial sample than using the graded sample. However, Method B provides additional information concerning the shape and texture characteristics of individual size fractions.

3.5 Testing samples in the as-received grading (Method C) may be useful in selecting proportions of the components used in a variety of mixtures. In general, high void content suggests that the material could be improved by providing additional fine aggregate or more binder may be needed to fill the voids between particles.

3.6 The bulk dry specific gravity of the fine aggregate (Gsb) is used to calculate the void content. The effectiveness of these methods of determining void content and its relationship to particle shape and texture depend on the bulk specific gravity of the various size fractions being equal (or nearly so).

3.7 Void content information from Methods A, B, and C may be a useful indicator of properties such as:

3.7.1 Mixing water demand of hydraulic cement concrete.

3.7.2 Flowability, pumpability, or workability of grouts and mortars.

3.7.3 The effect of fine aggregate on stability, strength and VMA in asphalt mixtures.

3.7.4 Stability and strength of base course material.

4 APPARATUS

4.1 *Cylindrical Measure:* A right cylinder of approximately 100 mL capacity having an inside diameter of approximately 1.5 inches and an inside height of approximately 3.4 inches made of drawn copper water tube. The bottom of the measure shall be at least 0.25 inches thick, shall be firmly sealed to the tubing, and shall be provided with the means for aligning the axis of the cylinder with that of the funnel. Determine the volume of the measure to the nearest 0.1 mL.

4.2 *Funnel*: A funnel such that the lateral surface of the right frustum of the cone is sloped 60°±4° from the horizontal with an opening 0.5±0.02 inches diameter. The funnel section shall be a piece of metal, smooth on the inside, and at least 1.5 inches high. It shall have a volume of at least 200 mL, or shall be provided with a supplemental container to provide the required volume.

4.3 *Funnel Stand:* A three or four-legged support capable of holding the funnel firmly in position with the axis of the funnel collinear (within 4o angle and a displacement of 0.07 inches) with the axis of the cylinder measure. The funnel opening shall be 4.5 inches above the top of the cylinder.

4.4 *Glass Plate:* A square glass plate approximately 2.3 by 2.3 inches with a minimum 0.15-inch thickness.

4.5 *Pan:* A metal or plastic pan of sufficient size to contain the funnel stand and prevent loss of material.

4.6 *Spatula:* A metal spatula with a blade approximately 4 inches long and at least 0.75 inches wide, with straight edges. The end shall be cut at a right angle to the edges.

4.7 *Balance:* Meets the requirements of AASHTO M 231 Class G 2. A balance with a capacity of 1000 g and sensitive to 0.1 g.

5 SAMPLE

5.1 The samples used for this test shall be obtained using AASHTO R 90 and AASHTO R 76, or from sieve analysis samples used for AASHTO T 27, or from an extracted asphalt mixture sample using AASHTO T 308

5.2 For Methods A and B, the sample is washed over a No. 100 or No. 200 sieve in accordance with AASHTO T 11 and then dried and sieved into separate size fractions according to AASHTO T 27. Maintain the necessary size fractions obtained from one or more sieve analyses in a dry condition in separate containers for each size.

5.3 For Method C, dry a split of the as-received sample in accordance with the drying provisions of AASHTO T 27.

6 SAMPLE PREPARATION

6.1 Method A – Standard Graded Sample

6.1.1 Weigh out and combine the following quantities of fine aggregate that has been dried and sieved in accordance with AASHTO T 27.

Individual Size Fraction	Mass, g
Passing No. 8 to Retained on No. 16	44 ±0.2
Passing No. 16 to Retained on No. 30	57 ±0.2
Passing No. 30 to Retained on No. 50	72 ±0.2
Passing No. 50 to Retained on No. 100	17 ±0.2
	190 ±0.2

6.2 Method B – Individual Size Fractions

6.2.1 Prepare a separate 190 g sample of fine aggregate, dried and sieved in accordance with AASHTO T 27 for each of the following size fractions:

Individual Size Fraction	Mass, g
Passing No. 8 to Retained on No. 16	190 ±1
Passing No. 16 to Retained on No. 30	190 ±1
Passing No. 30 to Retained on No. 50	190 ±1

Do not mix fractions together. Each size is tested separately.

6.3 Method C – As-received Grading

6.3.1 Pass the sample (dried in accordance with AASHTO T 27) through a No. 4 sieve. Obtain a 190 ±1 g sample of this material for the test.

6.4 Specific Gravity of Fine Aggregate

6.4.1 If the bulk specific gravity (Gsb) of the fine aggregate sample is unknown, determine it according to Idaho IT-144.

7 PROCEDURE

7.1 Record all masses to the nearest 0.1 g.

7.2 Record the mass of the empty measure.

7.3 Mix each test sample with the spatula until it appears to be homogeneous.

7.4 Position the jar and funnel section in the stand and center the cylindrical measure with the axis of the funnel. Use a finger to block the opening of the funnel.

7.5 Pour the test sample into the funnel. Level the material in the funnel with the spatula.

7.6 Remove the finger and allow the sample to freely flow into the cylindrical measure.

7.7 After the funnel empties, strike off excess from the top of the cylindrical measure by a single pass of the spatula with the width of the blade vertical, using the straight part of its edge in light contact with the top of the measure.

7.7.1 Until this operation is complete, avoid vibration or disturbance that could cause compaction of the fine aggregate in the measure (see note).

Note: After strike off, the cylindrical measure may be tapped lightly to compact the sample to make it easier to transfer the container to the scale or balance without spilling any of the sample.

7.8 Brush adhering grains from the outside of the cylindrical measure. Determine the mass of the measure and its contents to the nearest 0.1 g.

7.9 Recombine the sample from the retaining pan and cylindrical measure, repeat the procedure, and average the results of the two test runs.

8 CALCULATIONS

8.1 Calculate the uncompacted voids for each determination according to the following formula:

$$U = \frac{V - \left(\frac{F}{G}\right)}{V} \times 100$$

Where:

U = uncompacted voids, percent, in the material;

V = volume of cylindrical measure, mL;

F = net mass of fine aggregate in measure, g; and,

G = bulk specific gravity (Gsb) of aggregate

8.1.1 **For Methods A and C**: Calculate the average uncompacted voids for the two determinations.

8.2 **For Method B**: First determine the uncompacted void content for each of the individual size fractions; then calculate the mean uncompacted void content as follows:

$$U_m = \frac{U_1 + U_2 + U_3}{3}$$

Where:

U = Mean uncompacted void content, %

U1, U2, U3 = Uncompacted void content of individual size fractions

8.3 Calculation Examples

$$U = \frac{99.8 - \left(\frac{146.2}{2.636}\right)}{V} \times 100 = 44.3, \text{say } 44.4\%$$

Where:

U = Uncompacted void content, %;

V = 99.8 mL

F = 146.2 g.

G = 2.636

$$U_m = \frac{48.7 + 49.9 + 47.0}{3} = 48.53, \text{say } 48.5\%$$

Where:

Um = Mean uncompacted void content, %

U1 = 48.7%

U2 = 49.9%

U3 = 47.0%

9 REPORT

9.1 Results shall be reported on Form ITD-1046 to the nearest 0.1 percent.

PERFORMANCE EXAM CHECKLIST

UNCOMPACTED VOID CONTENT OF FINE AGGREGATE
FOP FOR AASHTO T 304

Participant Name: ______________________________________ Exam Date: ____________

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element: (all test methods are AASHTO unless otherwise shown)	**Trial 1**	**Trial 2**
Sampling		
1. **Sample obtained by one of the following:**		
(a) R 90 & R 76 (sampling, splitting and quartering)? or;	_____	_____
(b) From sieve analysis samples used for T 27? or;	_____	_____
(c) From aggregate extracted from a bituminous concrete specimen (T 308)?	_____	_____
2. ***Methods A***		
(a) Sample washed over No. 100 or No. 200 sieve in accordance with		
■ T 11?	_____	_____
(b) Sample dried and sieved into separate size fractions in accordance with		
■ T 27?	_____	_____
(c) Necessary size fractions obtained from sieve analysis maintained in a dry condition in separate containers for each size?	_____	_____
Sample Preparation		
Method A- Standard Graded Sample		
1. Following quantities of aggregate that has been dried and sieved in accordance with T 27 weighed out and combined?	_____	_____

Individual Size Fractions	Mass, g	OK?
No. 8 to No. 16	44 ± 0.2	
No. 16 to No. 30	57 ± 0.2	
No. 30 to No. 50	72 ± 0.2	
No. 50 to No. 100	17 ± 0.2	
Total:	190 ± 0.2	

Specific Gravity of Fine Aggregate

If bulk dry specific gravity of aggregate from the source is unknown, specific gravity determined on material passing No. 4 sieve in accordance with IT 144. ______ ______

PROCEDURE

1. Each test sample mixed with spatula until it appears to be homogeneous? ______ ______
2. Funnel stand apparatus with cylindrical measure, positioned in retaining pan? ______ ______
3. Finger used to block opening of funnel? ______ ______
4. Test sample poured into funnel? ______ ______
5. Material in funnel leveled with spatula? ______ ______
6. After funnel empties, excess heaped aggregate struck off from cylindrical measure by single pass of spatula, with blade width vertical and using straight part of its edge in light contact with top of measure? ______ ______
7. Care exercised to avoid vibration or any disturbance that could cause compaction of aggregate into cylindrical measure? ______ ______

Note: After strike-off, measure may be tapped lightly to compact sample to make it easier to transfer container to scale or balance without spilling any of the sample.

8. Adhering grains brushed from outside of container? ______ ______
9. Mass of cylindrical measure and contents determined to nearest 0.1 g? ______ ______
10. All aggregate particles retained for second test run? ______ ______
11. Sample from retaining pan and cylindrical measure recombined and procedure repeated? ______ ______
12. Mass of empty measure recorded? ______ ______
13. Calculations performed properly? ______ ______

Formula for Calculation of Uncompacted Voids, percent

$$U = \frac{V - \left(\frac{F}{G}\right)}{V} \times 100$$

Where:
U= uncompacted voids, percent;
V= volume of cylindrical measure to nearest 0.1 mL;
F= net mass, g, of fine aggregate in measure; and,
G= bulk dry specific gravity of fine aggregate (G_{sb})

First Attempt: Pass ☐ Fail ☐ Second Attempt: Pass ☐ Fail ☐

Comments ____

____

____

____

____

Testing Technician's Signature: ____________________ WAQTC # __________ Date: __________

Examiner's Name: ____________________ Signature: ____________________ WAQTC # __________

Idaho Field Operating Procedure for

PAVEMENT THICKNESS BY MAGNETIC PULSE INDUCTION IFOP AASHTO T 359

1 SCOPE

1.1 This procedure covers the determination of the pavement thickness by using magnetic pulse induction in accordance with AASHTO T 359. This field operating procedure is derived from AASHTO T 359.

1.1.1 This procedure is intended for use with plain jointed concrete pavements, asphalt pavements, bases with binders and unbound aggregate layers. It is not applicable for continuously reinforced, mesh reinforced or fiber reinforced pavement where the reinforcement would interfere with the magnetic field.

1.2 The values stated in SI units are to be regarded as the standard.

1.3 This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2 REFERENCE DOCUMENTS

2.1 AASHTO Standards

- T 359, Pavement Thickness by Magnetic Pulse Induction
- T 148, Measuring Length of Drilled Concrete Cores

2.2 ASTM Standards

- A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

3 SUMMARY OF TEST METHOD

3.1 The method uses magnetic pulse induction technology to measure the thickness of one or several layers above a metal reflector. While scanning, the device generates a variant magnetic field that creates an eddy current in the reflector. The eddy current will generate an induced magnetic field inside the reflector, the intensity of which is detected by sensors from the device. For a given type of reflector, the intensity of the induced magnetic field is determined primarily by the distance from the device to the target. A calibration file, recording the relationship between the induced magnetic field intensity and the distance, is developed for each unique type of reflector produced by the manufacturer. Reflectors are usually either round or square galvanized sheet steel about 0.6 mm thick. They usually range in size depending on the anticipated thickness of the pavement to be measured. For pavements up to 350 mm thick, round 300-mm diameter reflectors are adequate. Square 355-mm reflectors are adequate for pavements up to 500 mm thick.

4 INTERFERENCES

4.1 This test method can produce misleading results when metal is nearby. Steel-toe shoes can also affect the results if the operator steps too close to the gauge head during the measurement process.

5 APPARATUS

5.1 An electromagnetic pulse induction device that generates a variant magnetic field that creates an eddy current in a reflector capable of measuring pavement thickness.

5.2 A metal reflector that can be detected by the sensors of the pulse induction device. The type of metal and size of the reflector depends on the type and thickness of the pavement that is being measured.

5.2.1 For deeper sections larger reflectors are needed since they create larger magnetic fields. For pavements between 6 and 14 inches thick use 12 inch diameter reflectors.

5.2.2 For pavements less than 6 inches thick use 6 inch diameter reflector.

5.3 Use the manufacturer’s reflectors or 24 gauge sheet metal meeting ASTM A653, CS Type B, G90.

Note 1—The metal reflectors should conform to the manufacturer’s specifications.

6 PROCEDURE

6.1 Place targets at required locations prior to paving.

6.1.1 It is usually necessary to fasten the reflectors to the base or subbase to prevent movement during the paving operation.

6.1.2 Place the reflector at least 3 feet from any steel or dowel bars.

6.1.3 Record the approximate location reference for ease of locating after paving.

6.2 **Note** – Fasten reflectors with nails. Bright common, galvanized, and coated nails as well as masonry nails up to 3-1/2 inch have worked well. Use of more than three nails per the reflector could affect the accuracy of the readings and therefore is not recommended.

6.3 Thickness measurements are normally made within 2 feet of each edge and across the driving lane.

6.3.1 When adjacent lanes are placed simultaneously, plates across the width of the pavement will represent both lanes.

6.3.2 When pavements include shoulders, measurements may be made in the shoulder area within 3 feet of the lane line, unless special circumstances dictate otherwise.

6.4 At a minimum, place reflectors at twice the number of stations required for each 0.1 mile section.

6.4.1 Reflectors are to be placed at random locations within the section.

6.4.2 The minimum number of measurements per 0.1 mile is as follows in Table 1:

Table 1 Minimum Number of Reflectors per 0.1 Mile

Placement Type	Minimum No. of Measurements
1 lane no, no shoulders	3
1 lane, 1 shoulder	3
2 lanes, no shoulder	5
2 lanes, 2 shoulders	5

6.4.3 In cases where a tapered or an unusual pavement width is being placed, use engineering judgment to determine where thickness measurements are made.

6.5 Once the pavement is sufficiently cured to support foot traffic, use the gauge search mode to locate the reflector center.

6.5.1 This is done by holding the gauge head 2 to 3 inches above the pavement and moving it side to side and forward and backward.

6.5.2 When the gauge search function is showing the strongest signal, mark directly above the reflector on the pavement.

6.6 Remove all debris from the surface where the gauge wheels will pass.

6.7 With the gauge switched to the measurement mode, place the front wheel approximately 1-1/2 feet before the mark.

6.7.1 Press the measurement button and then slowly push the gauge over the reflector.

6.7.2 After the gauge has traveled approximately 6 feet, the gauge processor will calculate the thickness of the pavement above the reflector.

6.8 Repeat step 6.7 two more times and record the results.

6.8.1 No single result at a single location should be more than 0.125 inch different than the other 2 readings.

6.8.2 If an individual reading exceeds 0.125 inches, repeat the three readings.

6.8.3 If an individual reading is more than 0.125 different with the second set of readings, record the thickness at that location could not be determined and move to another reflector.

6.9 Repeat 6.5 to 6.8 to obtain the required number of measurements.

7 CALCULATION AND INTERPRETATION OF RESULTS

7.1 Average the 3 readings for a location and record the average to the nearest 0.05 inch.

7.2 Average the readings for a section and record the average to the nearest 0.1 inch.

8 REPORT

8.1 Report the metal target type used, date, test locations, all thickness measurements and averages.

REMS Project:	798481
Agency Project:	21981
Start Date:	8/9/2024
End Date:	8/9/2025

UNION PACIFIC **BUILDING AMERICA**®

Maintenance Consent Letter

Penny Meyers
Mountain Home Highway District
1208 NW Mashburn Road
Mountain Home, ID 83647

It is the intention of the MOUNTAIN HOME HIGHWAY DISTRICT (**Agency**) to perform the scope of work at the location(s) identified in Exhibit A (**Work**) of the Contractor Endorsement (**Endorsement**). This letter serves as acceptance by UNION PACIFIC RAILROAD COMPANY (**Railroad**) of the proposed Work to be performed.

If a contractor is to perform any Work on Railroad's property, the Agency shall require its contractor to execute and return the attached Endorsement. Under no circumstances will Agency's contractor be allowed on Railroad's property until the executed Endorsement is received with a $2,200 administrative fee to be paid by the Agency or the contractor.

This Consent Letter shall be valid for one (1) year or until the Work is completed or this Consent Letter is revoked by the Railroad.

Prior to performing the Work, the contractor agrees to provide forty-five (45) days advance notice to the Railroad Representative identified below.

Leo Craig (817) 901-9560 – lcraig@olsson.com

DocuSigned by:
Erik Lewis
B2EE06D9B27B4E0...

Erik S. Lewis 8/9/2024
Manager I
Engineering-Public Projects

REMS Project: 798481
Agency Project: 21981
Consent End Date: 8/9/2025

Contractor Endorsement

A. It is the intention of the MOUNTAIN HOME HIGHWAY DISTRICT (**Agency**) to perform the scope of work at the location(s) identified in Exhibit A (**Work**) of this Contractor Endorsement (**Endorsement)**. As a condition to entering upon UNION PACIFIC RAILROAD COMPANY (**Railroad**) property to perform the Work, contractor acknowledges and agrees to comply with the following conditions.

- Completion of Union Pacific Property Access Training (UP-PAT).
  www.up.com/up-pat
- Compliance with Contractor Endorsement-General Terms and Provisions.
  www.up.com/ce-terms
- Acknowledgement of Third-party Flagging Policy.
  www.up.com/flagging
- Acknowledgement that insurance documentation will be provided to Railroad upon request.

B. Fiber optics and telecommunication facilities can be present on Railroad property. Prior to performing work with the potential to impact Railroad facilities, the Agency or its contractor shall follow the procedures outlined on the Railroad webpage link below.

Fiber Optics & Telecommunications (Call Before You Dig) - www.up.com/CBUD

C. Prior to performing the Work, contractor agrees to provide forty-five (45) days advance notice to the Railroad Representative identified below.

Leo Craig (817) 901-9560 – lcraig@olsson.com

D. This Endorsement must be executed and sent to the Railroad before the **Consent End Date** above. The terms of this Endorsement shall commence on the date of execution and continue for one (1) year or until such time as contractor has completed the Work. The Work may be terminated within 24 hours' notice by either party. No work may proceed until the terms of this Endorsement have been met and the executed Endorsement is submitted with the $2,200 administrative fee payment.

Email a scanned copy of the executed Endorsement to **upmaintenance@olsson.com** Proceed to the next page for payment instructions.

Remainder of page intentionally left blank.

REMS Project: 798481
Agency Project: 21981
Consent End Date: 8/9/2025

The administrative fee must be submitted by one of the payment remittance methods indicated on the attached Bill. If mailing by check, send the Bill with the check. For ACH or Wire transfers, include the Bill Number in the transmittal notes.

Company Name			
Contact Name			
Address			
City, ST Zip			
Phone		**Email**	
Contact Signature		**Date**	
Payment Method	☐ **Check**	☐ **ACH**	☐ **Wire Transfer**

REMS Project: 798481
Agency Project: 21981
Consent End Date: 8/9/2025

Exhibit A to Contractor Endorsement
Project Scope and Location(s)

Scope of Work

Roadway pavement will be rehabilitated by performing Cement Recycled Asphalt Base Stabilization (CRABS), overlaying with asphalt pavement, install pavement markings, roadway signs, and perform traffic control. Vertical and horizontal curves will be flattened to meet current design standards and improve sight distance. The proposed work will match existing grade at the railroad crossing.

Location

Nampa Subdivision

DOT	Milepost	Street Name
819294E	419.05	Simco Road

Union Pacific Railroad Company

BUILDING AMERICA℠

MOUNTAIN HOME HIGHWAY DISTRICT
1208 NW MASHBURN RD
MOUNTAIN HOME,ID 83647

Bill Number	**334503945**
Project Number	0798481
Audit Number	314496
Customer Number	57535
Folder Number	
Bill Date	7/31/2024
Due Date	8/31/2024

Bill Description : Agency No: 21981 Simco Rd Rehab; DOT 819294E; Mntnc-Roadway. Effective date: 07/28/24
Location of Agreement: MOUNTAIN HOME, ID
Primary Purpose of Agreement:

If payment has already been submitted , please email REBilling@up.com

Description	Period		Amount
	From	To	
Roadway-Contractor's ROE Fee	7/31/2024	7/31/2024	$2,200.00
		Total Due:	**$2,200.00**

Please include Project 0798481 and/or Bill 334503945 when submitting payment.

To assure proper credit to your account, please remit payment using one of these methods:

ACH/Wire Information:
Union Pacific Acct nbr: 3752021457 (Checking)

Company Wire XFER ABA Routing nbr: 026009593
ACH PYMT ABA Routing nbr: 111000012

Remittance Email: MISCash@up.com
Project Number: 0798481
Bill Number: 334503945

Receiving Bank's Address
Bank of America
901 Main Street
Dallas, TX 75202

DUNS nbr: 00-699-1590
SWIFT Code: BOFAUS3N
Tax ID: 94-6001323
Network ID: 0136400825

SEND Checks to:
Union Pacific Railroad Company
12567 Collections Center Drive
Chicago, Il 60693

Please Include Remittance Information:

Bill Number	**334503945**
Project Number	0798481
Audit Number	314496
Customer Number	57535
Payable Upon Receipt:	**$2,200.00**

Your Safety • Your Mobility
Your Economic Opportunity

Pollution Prevention Plan
Idaho Transportation Department (ITD)

ITD 2788 (Rev. 04-18)
itd.idaho.gov

Instructions

The Pollution Prevention Plan (PPP) is a requirement for ITD projects which do not have coverage under the National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP).

Prior to ground disturbing activities, the Contractor designated support areas shall be identified and the disturbed area shall be recalculated to determine if the project is still exempt from NPDES permitting requirements.

To help you develop the PPP use the following template. This template is designed to guide you through the PPP development process and help ensure that your PPP addresses all the necessary elements. EPA's 2007 guidance document titled *Developing Your Stormwater Pollution Prevention Plan* can also be used to help you develop your PPP. This guide can be found at: https://www.epa.gov/npdes/developing-stormwater-pollution-prevention-plan-swppp. On the ITD's stormwater management website: http://itd.idaho.gov/env/ other useful information including the Best Management Practices Manual, Standard Drawings, and other stormwater forms and templates is available.

Using the PPP Template: This template was developed so that you can easily add text or tables. Some sections may require only a brief description while others may require more extensive explanation. Modify this template so that it meets the specific needs of your project.

Multiple operators may share the same PPP, but make sure that responsibilities are clearly described, and that all signatory requirements are met.

The Best Management Practices (BMPs) from ITD's BMP Manual are listed in tables throughout the template. Refer to the manual for further guidance on each BMP. The link is provided above.

Applicable Federal, Tribal, State, or Local Programs

The PPP shall meet the requirements of Sections 107.17 and 212 of the Standard Specifications for Highway Construction and be consistent with all applicable federal, state, tribal, and/or local requirements or ordinances, including MS4 requirements, for erosion control and stormwater management and compliance.

Table of Contents

Pollution Prevention Plan Narrative Site Information

Key Number	Project Name		
21981	Simco Rd Rehabilitation		
Location/Address	City	County	Zip Code
		Elmore	
Beginning Milepost (if applicable)	Ending Milepost (if applicable)		
102.3	120.0		

Operator(s)

Local Highway Technical Assistance Council 3

LHTAC Contact Name		Title	
Karissa Nelson		Environmental Engineer	
Office Address	City	County	Zip Code
3330 Grace Street	Boise	Ada	83703
Telephone Number	E-mail Address	Fax Number	
208-334-0565	knelson@lhtac.org		

Local Sponsor 3

Organization Name		Contact Name	
Mountain Home Highway District		Penny Meyers	
Organization Address	City	State	Zip Code
1208 NW Mashburn Road	Mountain Home	ID	83647
Telephone Number	E-mail Address	Fax Number	
208-587-3211	Pmeyers2@mindspring.com		

Contractor's PPP and 24 Hour Emergency Contact Information

Company/Organization Name		Site Manager's Printed Name	
Company/Organization Address	City	State	Zip Code
Telephone Number for 24/7/365 Availability	E-mail Address	Fax Number	

Estimated Project Start Date August 8th 2025

Estimated Project End Date December 3rd 2025

Section 1 - Project/Site Information

Location Information

Project/Site Name	Project Street/Location/Milepost/Route	
Simco Rd	Milepost 102.3 to Milepost 115.1	
City	County	ZIP Code
	Elmore	

Contact Information/Responsible Parties

Prime Contractor

Company/Organization Name				
Company/Organization Address		City	State	Zip Code
Telephone Number	E-mail Address		Fax Number	
Area of Control (if there is more than one operator at the site)				

Project Manager(s) or Site Supervisor(s)

Company/Organization Name		Manager/Supervisor's Name(s)		
Company/Organization Address		City	State	Zip Code
Cell Phone Number	E-mail Address		Fax Number	
Area of Control (if there is more than one operator at the site, insert area of control for each)				

PPP Preparer Information (Contractor)

Company/Organization Name		Preparer's Name		
Company/Organization Address		City	State	Zip Code
Cell Phone Number	E-mail Address			

LHTAC Resident Engineer Information

Engineer's Name
Megan Kautz/Matt Koster/Jayme Coonce

Address		City	Zip Code
3330 Grace Street		Boise	83703
Cell Phone Number	E-mail Address		Fax Number
208-369-0066	mkautz@lhtac.org; mkoster@lhtac.org; Jcoonce@lhtac.org		

General Scope of Work or Project Description

The Simco Rd Rehabilitation project consists of pavement rehabilitation of the segment of Simco Rd beginning at milepost (MP) 102.3 and terminating at I-84 at MP 120.0 in Elmore County, Idaho. This approximately 17.7-mile-long segment of Simco Rd is maintained by the Mountain Home Highway District (MHHD) and provides access to State Highway (SH) 67 (via ID-167) to the south and I-84 to the north. The asphalt paved roadway consists of a single travel lane in each direction (see attached vicinity map).

The proposed pavement design for this project consists of Cement Recycled Asphalt Base Stabilization (CRABS). The existing asphalt pavement will be pulverized in place and blended with the existing base, new aggregate, and cement. This mixture will be compacted, and new asphalt pavement will be placed. New aggregate will be placed on the shoulders and graded to match into the new edge of pavement. The approximate extent of shoulder grading will be 10 feet off the edge of pavement. A 10-inch increase in grade is anticipated as a result of this work. The existing pavement width of 26 feet will be maintained.

There are three groups of reverse curves and one other curve within the project limits that do not currently meet standards. These curves will be reconstructed to improve safety. The approximate limits of these curves are as follows:

- Curves 1 and 2: STA 182+91 to STA 194+59
- Curves 4 and 5: STA 307+11 to STA 317+79
- Curves 8 and 9: STA 344+43 to STA 357+64
- Curve 15: STA 838+53 to STA 845+82

The road within the above limits will be regraded to meet the improved horizontal and vertical alignment. The vertical curves will be flattened which will result in an excavation depth of five feet at most. The proposed pavement section consists of 1.08-feet of ¾" aggregate for base and 0.33-feet of Hot Mix Asphalt pavement. The base layer will be cement treated along with the CRABS portion of the project. Side slopes will be regraded and will tie in with the existing right of way. All work will be completed within the existing right of way.

The superelevation of 5 other curves within the project limits will be corrected to meet current standards by placing additional aggregate during the CRABS process. The existing horizontal alignment will be maintained. These curves are located at the following locations:

- Curve 3: STA 196+91 to STA 203+06
- Curve 7: STA 335+15 to STA 339+62
- Curve 10: STA 506+44 to STA 513+76
- Curve 14: STA 820+14 to STA 828+64

Other miscellaneous work is required for this project. There are several cross-culvert pipes ranging in size from 12-inches to 18-inches that will need to be replaced. Other pipes within the project limits ranging from 10 inches to 36 inches will be retained and protected. Two cattle guards will be repaved within the project limits. One cattle guard is at milepost 104.44, the other is at the end of the project limits (milepost 120.00). There is an existing concrete military crossing that will be retained and protected at milepost 103.92. There is no guardrail work proposed for this project. This project will cross an at grade railroad crossing. The railroad tracks, planking, signals, and gates will be retained and protected. All construction staging will take place within the existing highway right-of-way or easements.

Activity Description by Responsible Party

To add more rows, hit Tab in the last cell of the table.

Name and Contact Information for Subcontractor	Area of Subcontractor Controls/Work Performed

Soils, Slopes, Vegetation, Existing Drainage Patterns, Climate

Soil Type(s) Bahem, Minidoka, & Trevino Silt Loam
Slopes - Describe existing slopes and any changes due to construction activities Existing roadway slopes are relatively flat to 4:1. Proposed sloped will predominantly parallel (be similar) to the existing slopes.
Drainage Patterns - Describe existing drainage patterns and note any changes due to construction In general, runoff from the highway is collected in roadside ditches where it infiltrates into the soil. There are intermittent small stream crossings throughout the project where roadway runoff can drain.
Existing Vegetation The project is primarily surrounded by natural desert vegetation with some areas of agricultural pastureland. Proposed gravel shoulder grading will disturb vegetation on the roadway foreslopes.
Climate/Rainfall Patterns – Select amount that applies Semi-Arid (10"-20" annual rainfall)

Construction Site Estimates

The following are estimates of the project disturbance. Show acreage to the nearest 0.25 acre

Project site area to be disturbed – 2.75 acres

Off-site waste sites to be disturbed - acres

Off-site borrow/source sites to be disturbed - acres

Staging Area to be disturbed - acres

Total project disturbed area - acres

Receiving Waters

Describe receiving surface waters (if applicable) The CJ Strike Reservoir is an impoundment of the Snake River and Bruneau River and is approximately six miles south of the project area. Two intermittent creeks, Squaw Creek and Canyon Creek are located near the project area. At their closest point to the project area, Squaw Creek is located 0.35 miles east and Canyon Creek is located 1.1 miles east of the project area. An unnamed tributary to Squaw creek crosses Simco Rd in several locations.
Describe receiving storm sewer systems (if applicable) and note MS4 areas N/A

List immediate downstream water bodies (water bodies that are connected or would receive a direct discharge from the Project) that have been listed as impaired for sediment or waters subject to TMDLs by the Idaho Department of Environmental Quality (IDEQ) under Section 303(d) of the CWA N/A

Site Features and Sensitive Areas that Require Protection

Provide a description of any unique features (such as wetlands) that require protection (if applicable) N/A
If applicable, describe measures to protect these unique features

PPP Plans and Site Maps

The PPP will show the following locations:

- Temporary and permanent BMPS
- On-site staging areas, off-site material, waste, borrow or equipment storage or staging areas
- Locations of all ITD defined hazardous materials
- Any industrial stormwater discharges other than from project construction
- Waters of the United States including wetlands
- Storm sewer inlets

Insert a copy of all applicable Plan Sheets and/or Site Maps in **Appendix A**

Potential Sources of Pollution

Use the table below to identify all potential pollutants and sources, other than sediment, to stormwater runoff

Trade Name Material	Stormwater Pollutants	Location or N/A
Fuels and/or Lubricants	Petroleum Distillates	Where equipment is working. Equipment will move with the progress of the work or will be located in the Staging Area.
Hydraulic Oils	Mineral Oil	Where equipment is working
Asphalts	Petroleum Distillates	Where Prime or Tack Coat Material is being placed on the roadway and transferred to distribution trucks. At the Hot Plant.
Concrete/Curing Compounds	pH	Installation of signs.
Anti-freeze	Glycol, Heavy Metals	Where equipment is working.
Paints	Organic Chemicals, VOCs	Along the roadway during pavement marking operations.
Fertilizers	Nutrients-Nitrogen, Phosphorous	In seeding areas.
Sanitary Toilets	Bacteria, Viruses, Parasites	At staging areas, or portable toilets to follow work.

Add additional rows as needed by hitting Tab in the last cell of the table

Each of the pollutants listed in the table above must be addressed with a specific BMP.

Section 2 - Erosion and Sediment Control BMPs

In the tables provided below, check the boxes of the BMPs that will be used on your project. Delete the BMPs that will not be used, or leave unchecked. Add any BMPS that might be required to meet your project needs.

BMPs should be implemented as needed at all designated staging and storage areas, source and borrow sites, and disposal/excess material/waste sites prior to initiating any ground disturbance activities in these areas.

➡ **Note: In the following tables, ITD SD SPECS and Drawings, and BMP Numbers from ITD BMP Manual are referenced beside each BMP**

Minimize Disturbed Area and Protect Natural Features and Soil

BMPs	Specification(s)	Check if Used	Implementation Schedule
Preservation of Existing / Natural Vegetation	- SD SPECS (201 and 202) - EC-2	☒	Date Location (Stations or MP)

Preservation of natural existing vegetation shall be utilized throughout the project, where practical, to minimize erosion potential, minimize total ground disturbance, and minimize stormwater movement off site. Existing vegetated buffers (including preserving mature vegetation and trees) shall be utilized to minimize stormwater erosion potential and down slope movement to any watershed, water feature (including irrigation amenities or domestic water sources), or area susceptible to stormwater or surface water movement. The vegetated buffers shall consist of areas of undisturbed vegetation including grasses, shrubs, woody plants, and trees that are located between the traversed roadway section and the existing swales, ditches, canals, wetlands, and intermittent/perennial streams or rivers that are located within ITD right-of-way. The vegetated buffers shall be left undisturbed throughout the project life and act as permanent erosion and sediment control BMPs to ensure short and long-term slope stability.

Phase Construction Activity

BMP	Specification(s)	Check if Used	Implementation Schedule
Scheduling and Sequencing of Construction Activities	- SD SPECS (108, 205, and 212) - EC-1	☒	Date Location (Stations or MP)

The specific scheduling and sequencing of construction activities are required to be outlined by the Contractor and become a permanent part of the PPP. Records must be maintained as part of the PPP and shall include dates and durations when major activities occur (i.e. soil disturbing activities); dates when construction activities temporarily or permanently cease on a portion of the site; and dates when stabilization measures have been initiated and are obtained. Scheduling and sequencing of construction activities including the CMP Schedule shall be documented in this PPP by the Contractor. Describe major phases of construction in the spaces provided here:

Phase I – Mobilization and Site Prep

- Mobilization is expected to take place August.
- Temporary BMP installation will take place prior to any ground disturbing construction activities taking place and will remain in place until final stabilization has been achieved. BMP installation includes installation of fiber wattle, establishing construction limits, installation of staging area and stabilized construction entrances.

Phase II – Curve Reconstruction

- Remove existing Roadway
- Realign and reprofile roadway
- Prepare and compact subgrade

Phase III – Cement Recycled Asphalt Base Stabilization (CRABS)

- Place new ¾" aggregate base on top of existing asphalt surface.
- Pulverize existing surface
- Perform CRABS process
- Place Prime Coat

- Pave with HMA

Phase IV – Final Stabilization
- Seeding
- Remove all equipment and leftover materials from site. Clean up staging area.
- After final stabilization, remove all temporary BMP's.

Control Stormwater Flowing Onto and Through the Project

BMP	Specification(s)	Check if Used	Implementation Schedule
Coffer and Tarp Dams / Water Filled Bladders/ Aprons	- SD SPECS (210 and 501) - EC-3	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Interceptor Ditches / Diversion Channels/Ditches	- SD SPECS (208, 209, and 212) - SD Drawings (P-1-D, P-1-E, and P-2-E) - EC-4	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Slope Drains	- SD SPECS (212 and 706) - SD Drawings (P-1-A) - EC-5	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Dikes / Berms	- SD SPECS (205, 209, and 212) - SD Drawings P-1-F and P-1-E - SC-1	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Channel Protection:	- Check Dams / Flexible Liners / Rigid Liners - SD SPECS (209, 212, 512, 623, 624, 711, 715, and 718) - SD Drawings (P-1-D, P-2-A, P-2-B, P-2-C, and P-2-D) - SC-2, PC-3, PC-4	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Retention/Detention Sediment Basin(s)/Trap(s)	- SD SPECS (205 and 212) - SD Drawings (P-1-A, P-1-C, P-1-D, P-1-E, P- 4-A, and P-4-B) - SC-10	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Clear Water Diversion	- SD SPECS (N/A) - NS-5	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
		☐	Date to be Implemented Location (Stations or MP) Quantity of BMP

Stabilize Soils and Protect Slopes

BMP	Specification(s)	Check if Used	Implementation Schedule
Hydraulically Applied Erosion Control Products	- SD SPECS (212, 621, and 711) - EC-6	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Hydroseeding	- SD SPECS (621 and 711) - EC-7	☒	Date to be Implemented November 15th 2025 Location (Stations or MP) 184+50 – 192+80 LT 187+98 – 193+30 RT 309+93 – 316+50 LT 308+50 – 311-90 RT 336+80 – 352+70 LT 336+21 – 340+50 RT 348+25 – 356+60 RT 402+40 – 403+60 LT 402+30 – 403+80 RT

BMP	Specification(s)	Check if Used	Implementation Schedule
			Quantity of BMP 0.349 Acres
Soil Binders	- SD SPECS (212) - EC-8	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Straw Mulch	- SD SPECS (212, 621, and 711) - EC-9	☒	Date to be Implemented November 15th 2025 Location (Stations or MP) 184+50 – 192+80 LT 187+98 – 193+30 RT 309+93 – 316+50 LT 308+50 – 311-90 RT 336+80 – 352+70 LT 336+21 – 340+50 RT 348+25 – 356+60 RT 402+40 – 403+60 LT 402+30 – 403+80 RT Quantity of BMP 0.698 Acres
Wood Mulch	- SD SPECS (212, 621, and 711) - EC-10	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Geotextiles, Plastic Covers, and Erosion Control Blanket	- SD SPECS (212, 621, and 711) - EC-11	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Vegetation-Seeding	- SD SPECS (212 and 621) - EC-12	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Dust Control	- SD SPECS (104, 106, 107, 205, 212, 621, and 711) - EC-13	☒	Date to be Implemented Through project duration Location (Stations or MP) 182+91 - 194+59 307+11 - 317+79 344+43 - 357+64 838+53 - 845+82 Quantity of BMP 785 MG
Wind Erosion Control	- SD SPECS (205 and 212) - EC-14	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
		☐	Date to be Implemented Location (Stations or MP) Quantity of BMP

Protect Storm Drain Inlets

BMP	Specification(s)	Check if Used	Implementation Schedule
Inlet/Outlet Protection	- SD SPECS (212, 640, 711, and 718) - SC-6	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP

BMP	Specification(s)	Check if Used	Implementation Schedule
		☐	Date to be Implemented Location (Stations or MP) Quantity of BMP

Establish Perimeter Controls and Sediment Barriers

BMP	Specification(s)	Check if Used	Implementation Schedule
Gravel Bag Barrier	- SD SPECS (212) - SC-3	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Sandbag Barrier	- SD SPECS (212) - SC-5	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Silt Fence	- SD SPECS (212 and 718) - SC-7	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP

BMP	Specification(s)	Check if Used	Implementation Schedule
Sediment Retention Fiber Rolls	- SD SPECS (N/A) - SC-8	☒	Date to be Implemented August 25th 2025 Location (Stations or MP) 199+31.46 LT 199+32.52 RT 209+54.86 LT 209+49.04 RT 237+88.11 LT 237+84.74 RT 284+34.72 LT 284+37.63 RT 316+43.82 LT 316+43.82 RT 331+95.17 LT 331+92.87 RT 344+29.70 LT 344+28.06 RT 355+13.30 LT 355+13.41 RT 401+56.99 LT 401+59.31 RT 413+43.22 LT 413+43.22 RT 425+43.88 LT 425+42.78 RT 441+56.98 LT 441+55.40 RT 462+36.93 LT 462+09.85 RT 489+29.10 LT 489+25.80 RT 679+39.43 LT 679+40.06 RT 724+28.69 LT 724+29.26 RT 847+78.02 LT 847+80.65 RT Quantity of BMP 1360 Feet
		☐	Date to be Implemented Location (Stations or MP) Quantity of BMP

Retain Sediment On-Site

BMP	Specification(s)	Check if Used	Implementation Schedule
Sediment-Desilting Basin	- SD SPECS (212) - SD Drawings (P-1-C, P-1-D, P-4-A) - SC-9	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Retention / Detention Sediment Basin(s) / Trap(s)	- SD SPECS (205 and 212)	☐	Date to be Implemented Location (Stations or MP)

	- SD Drawings (P-1-A, P-1-C, P-1-D, P-1-E, P-4-A, and P-4-B) - SC-10		Quantity of BMP
		☐	Date to be Implemented Location (Stations or MP) Quantity of BMP

Establish Stabilized Construction Exits and Temporary Haul Roads

BMP	Specification(s)	Check if Used	Implementation Schedule
Street Sweeping and Vacuuming	- SD SPECS (N/A) - SC-4	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Temporary Construction Entrances	- SD SPECS (104, 205, and 212) - SD Drawings (P-1-F) - SC-11	☒	Date to be Implemented Location (Stations or MP) Quantity of BMP
Temporary Roads	- SD SPECS (104, 107, 205, and 212) - SC-12	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Entrance Outlet Tire Wash	- SD SPECS (621) - SD Drawings (P-3-E) -SC-13	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Temporary Stream Crossing	- SD SPECS (602) - NS-4	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
		☐	Date to be Implemented Location (Stations or MP) Quantity of BMP

Insert any required additional text or tables here

Section 3 - Good Housekeeping BMPs

All staging areas, material storage/stockpile sites, source sites, disposal/excess material/waste sites, haul roads, temporary roads, construction entrances and exits, and any other disturbed soil areas not defined within the contract documents must be approved by the Resident Engineer and have BMPs implemented prior to approved use. All sites require appropriate erosion, sediment, and pollution prevention control BMPs installed prior to initiation of construction and throughout the length of construction activities. The Contractor is responsible for attaching a record of Environmental Clearance/Approvals and for obtaining any permitting for any Contractor designated sites, including cultural resources, ESA, etc.

The following are material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to stormwater runoff. For the purposes of this plan and for any ITD projects, ***Hazardous Material*** is defined as “any material that poses harmful risks to human health and/or the environment. Includes any hazardous or toxic substance, waste, pollutant, or chemical regulated under the CAA, CWA, TSCA, and/or RCRA; a pollutant or contaminant as any substance likely to cause death, disease, abnormalities, etc. (CERCLA Sec. 101(33)); or those listed in 40 CFR 302. For ITD purposes, petroleum, lead paint, asbestos, and other substances will be considered hazardous materials, as identified in the scope of work”.

- An effort will be made to store only enough product required to complete the job
- All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers and, if possible under a roof or other enclosure that minimizes contact with stormwater
- Products will be kept in their original containers with the original manufacturer’s label
- Substances will not be mixed with one another unless recommended by the manufacturer
- Whenever possible, all of the product will be used up before disposing of the container
- Manufacturer’s recommendations for proper use and disposal will be followed
- The site superintendent will inspect daily to ensure proper use and disposal of materials
- Tanks containing fuel will have secondary containment installed to contain any spilled material

Material Handling and Waste Management in Staging Areas

BMP	Specification(s)	Check if Used	Implementation Schedule
Staging and Materials Site Management	- SD SPECS (107) - SD Drawings (P-1-D, P-3-E, and P-5-A) - WM-1	☒	Date to be Implemented Location (Stations or MP)
Solid Waste Management	- SD SPECS (N/A) - WM-6	☒	Date to be Implemented Location (Stations or MP)
Concrete Curing	- SD SPECS (N/A) - NS-12	☐	Date to be Implemented Location (Stations or MP)
Material and Equipment Use Over Water	- SD SPECS (N/A) - NS-13	☐	Date to be Implemented Location (Stations or MP)
Concrete Finishing	- SD SPECS (N/A) - NS-14	☐	Date to be Implemented Location (Stations or MP)
Structure Demolition-Removal Over or Adjacent to Water	- SD SPECS (N/A) - NS-15	☐	Date to be Implemented Location (Stations or MP)
Material Delivery and Storage	- SD SPECS (N/A) - WM-2	☒	Date to be Implemented Location (Stations or MP)
Material Use	- SD SPECS (N/A) - WM-3	☒	Date to be Implemented Location (Stations or MP)

BMP	Specification(s)	Check if Used	Implementation Schedule
Stockpile Management	- SD SPECS (N/A) - WM-4	☒	Date to be Implemented Location (Stations or MP)
		☐	Date to be Implemented Location (Stations or MP)

Solid and source site materials, excess materials, hazardous materials, vehicle equipment and maintenance, sanitary waste management, and waste in general shall be managed at designated staging and waste areas. Staging and waste areas should be located a minimum of 150-ft away from any water feature (including irrigation amenities or domestic water sources) or areas susceptible to stormwater or surface water movement.

Solid and source site materials, include but are not limited to, dedicated asphalt or concrete plants (where the manufacturing of asphalt or concrete will occur on-site), gravel pits, stockpiles, source sites, general construction materials, and excess materials. The Contractor shall use an approved licensed solid waste management company. The Contractor shall reuse and recycle trash, source materials, construction materials, and construction debris unless it is not usable. If it is not usable or cannot be recycled it will be considered solid waste. All solid waste materials, with the exception of source materials, will be collected and disposed of in a securely lidded dumpster and shall be covered and secured at night and during all precipitation events. Any leaky solid waste dumpster must be exchanged or replaced within 24-hours of confirmation. Collection and proper disposal of all leaking materials shall be the responsibility of the Contractor.

The Contractor shall arrange an adequate solid waste disposal schedule to ensure that there is adequate solid waste disposal capacity on-site at all times and that dumpsters do not overflow and are emptied on a regular basis. All solid waste materials shall be removed from the project site throughout the duration and after the project is completed. Solid waste materials shall not be buried, burned, or discharged from the site.

Designate Washout Areas

BMP	Specification(s)	Check if Used	Implementation Schedule
Liquid Waste Management	- SD SPECS (N/A) - WM-11	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Concrete Waste Management	- SD SPECS (N/A) - SD Drawings (P-5-B) - WM-9	☒	Date to be Implemented Location (Stations or MP) Quantity of BMP
Entrance/Outlet Tire Wash	- SD SPECS (621) - SD Drawings (P-3-E) - SC-13	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
		☐	Date to be Implemented Location (Stations or MP) Quantity of BMP

Concrete waste procedures and practices are designed to minimize or eliminate the discharge of concrete waste materials to the storm drain systems or to watercourses. A wash station may also be required to prevent transporting noxious weeds and contaminated soils from a contaminated site to an uncontaminated site or road surface.

Covering or containing hazardous materials or washing contaminated equipment may be required. All vehicle and equipment cleaning and maintenance shall occur in a designated staging site/area and include a water pollution control equipment wash down area that shall have secondary containment and protection through the use of berms or other erosion and sediment controls or BMPs to reduce or eliminate discharges of pollutants.

The Contractor shall avoid mixing excess amounts of fresh concrete or cement mortar on-site. Storage of dry and wet materials associated with concrete should be located a minimum of 150-ft upslope of any water feature (including irrigation amenities or domestic water sources) or area susceptible to stormwater or surface water movement. The Contractor shall **Never** dispose of concrete, grout, or cement mortar washout into a watershed, water feature, or area susceptible to stormwater or surface water movement. Wash out concrete transit mixers only in designated washout areas. The Contractor shall design a temporary concrete washout station (s) as per ITD Standard Drawing P-5-B. All hardened concrete, grout, or cement mortar waste, including waste generated during equipment cleaning and QA/QC testing, shall be collected and transported to an approved licensed solid waste disposal/processing or recycling site by the Contractor.

Establish Proper Equipment/Vehicle Fueling and Maintenance Practices

BMP	Specification(s)	Check if Used	Implementation Schedule
Vehicle and Equipment Fueling	- SD SPECS (N/A) - SD Drawings (P-5-E) - NS-9	☒	Date to be Implemented Location (Stations or MP) Quantity of BMP
Vehicle and Equipment Maintenance	- SD SPECS (N/A) - NS-10	☒	Date to be Implemented Location (Stations or MP) Quantity of BMP
Pile Driving Operations	- SD SPECS (N/A) - NS-11	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
		☐	Date to be Implemented Location (Stations or MP) Quantity of BMP

Drip pans and drip cloths shall be used to drain and replace fluids. Spill prevention kits shall be located on site at all times and readily available in case of a leak, spill, or discharge and used when needed to contain and minimize unwanted and unnecessary leak, spill, or discharge impacts.

Fueling activities should be located at least 150’ away from surface water features. If site features do not allow this minimum setback, additional controls may be necessary. Additionally, if more stringent standards are required by permitting agencies or local entities, those standards shall be met.

Vehicles and construction equipment shall be monitored for leaks and receive regular preventative maintenance, and fueled on site using a portable service truck with a portable fuel tank or temporary storage tanks. Fueling shall occur within a hazardous materials containment staging area as approved by the Resident Engineer.

Fueling and/or Maintenance Activity	Practices to be Implemented to Control Spills and/or Exposure to Stormwater

Add additional rows as needed by hitting Tab in the last cell of the table

Sanitary Waste BMPs

BMP	Specification(s)	Check if Used	Implementation Schedule
Sanitary-Septic Waste Management	- SD SPECS (N/A) - WM-10	☒	Date to be Implemented Location (Stations or MP) Quantity of BMP

Sanitary and Septic Waste procedures and practices are used to minimize or eliminate the discharge of construction site sanitary/septic waste materials to the storm drain system or to watercourses. Sanitary/septic waste management practices are implemented on all construction sites that use temporary or portable sanitary/septic waste systems. Temporary portable toilets from an approved licensed sanitary waste company shall be used during the duration of the project and maintained and cleaned as needed. Portable toilets shall be located at designated staging areas and have secondary containment in case of a leak, spill, or discharge. All sanitary waste will be collected from the portable units a minimum once per week. Placement and removal of all portable toilets shall be the responsibility of the Contractor.

Contaminated Soil BMPs

BMP	Specification(s)	Check if Used	Implementation Schedule
Contaminated Soil Management	- SD SPECS (N/A) - WM-8	☐	Date to be Implemented Location (Stations or MP)

Prior to construction or soil disturbance, ITD shall inspect the site for physical contamination. During the construction phase, if the Contractor detects evidence of contamination, or encounters leaks, spills, or discharges are detected, contaminated soils and water should be contained and held for testing whenever contamination is suspected. Any specific contaminant known to exist or that is discovered on site and which has contaminated soil or has the potential to contaminant soil and/or drainages or water features (including irrigation amenities or domestic water sources) shall be reported to the Resident Engineer immediately. The Resident Engineer will coordinate clean-up of contaminated soils with the Idaho Communications Center (Statecom) at 1-800-632-8000.

Allowable Non-Stormwater Discharge Management and Equipment/Vehicle Washing

Non-stormwater (dust control water, water used in road grading, irrigation drainage, springs or ground water dewatering, etc) may combine with stormwater and be present in the discharge at this site. All water shall be treated in the same manner as stormwater runoff. The same BMPs used in this PPP for stormwater runoff shall be implemented to reduce non-stormwater impacts and limit non-stormwater discharges. The use of soap, solvents, and degreasers is specifically prohibited for cleaning use. Uncontaminated water discharge from dust control, dust abatement activities, and water used in road grading or excavation activities and compaction shall not reach waters of the United States.

The following incidental non-stormwater from the sources marked below may combine with stormwater and be present in the discharge at this site.

- ☐ Hydrant or Water Line Flushing
- ☐ Vehicle Wash-Down Water
- ☒ Dust Control Water
- ☐ Irrigation Drainage (including landscape)
- ☐ Spring or Groundwater

☒ Air Conditioner Condensate
☐ Uncontaminated Foundation or Footing Drains
☐ Pavement or Building Wash Water
☐ Uncontaminated Excavation Dewatering (without detergents)
☐ Potable Water
☐ No Known Non-Stormwater Sources Apparent

List allowable non-stormwater discharges marked above and the measures used to eliminate or reduce them and to prevent them from becoming contaminated:

Allowable Non-Stormwater Discharges	**Measures to be Implemented to Eliminate or Reduce Contamination**
Dust Control Water	Limit runoff by controlling watering rate and by using temporary sediment control barriers in accordance with ITD BMPs.
Air Conditioner Condensate	Air conditioners will be used sparingly and condensate will be monitored.

Add additional rows as needed by hitting Tab in the last cell of the table

Non-Stormwater BMPs

BMP	Specification(s)	Check if Used	Implementation Schedule
Water Conservation Practices	- SD SPECS (106 and 205) - NS-1	☐	Date to be Implemented Location (Stations or MP)
Dewatering Operations	- SD SPECS (N/A) - NS-2	☐	Date to be Implemented Location (Stations or MP)
Paving and Grinding Operations	- SD SPECS (203) - NS-3	☒	Date to be Implemented Location (Stations or MP)
Potable Water-Irrigation Management	- SD SPECS (N/A) - NS-7	☐	Date to be Implemented Location (Stations or MP)
Vehicle and Equipment Cleaning	- SD SPECS (N/A) - SD Drawings () - NS-8	☐	Date to be Implemented Location (Stations or MP)
Freeze Reduction	- SD SPECS (N/A) - NS-16	☐	Date to be Implemented Location (Stations or MP)
Snow Management	- SD SPECS (N/A) - EC-15	☐	Date to be Implemented Location (Stations or MP)
Snow Accumulation Management	- SD SPECS (N/A) - EC-16	☐	Date to be Implemented Location (Stations or MP)
		☐	Date to be Implemented Location (Stations or MP)

Spill Prevention and Control BMPs

All ITD projects shall follow the Idaho Hazardous Materials/WMD Incident Command and Response Support Plan and ITD Incident Management Plan. In addition, a project Spill Plan shall be provided by the Contractor, and should be included in **Appendix B.** The ITD BMPs listed below also contain guidance on waste management, spill prevention and control, and cleanup.

BMP	Specification(s)	Check if Used	Implementation Schedule
Spill Prevention and Control	- SD SPECS (N/A) - WM-5	☒	Date to be Implemented Location (Stations or MP)
Hazardous Waste Management	- SD SPECS (N/A) - WM-7	☐	Date to be Implemented Location (Stations or MP)
Illicit Connection-Illegal Discharge Detection and Reporting	- SD SPECS (N/A) - NS-6	☐	Date to be Implemented Location (Stations or MP)
		☐	Date to be Implemented Location (Stations or MP)

Per 40 CFR 112, if petroleum products stored at the construction site aggregate 1,320 gallons or more, a Spill Prevention, Control, and Countermeasure Plan (SPCC) plan will be required.

Section 4 - Permanent Erosion or Sediment Control BMPs

Permanent erosion and sediment control BMPs shall be designated and referenced on the project bid plans in association to their placement locations and amounts, lengths, and types used and as specified by the Engineer. The following permanent erosion and sediment control BMPS or combination of control BMPs will be installed and used to collect, retain, and treat stormwater runoff and pollutant discharges and to provide permanent stabilization of disturbed soils per ITD PPP requirements. In the table provided below, check the boxes of the BMPs that will be used on your project and insert implementation/installation times. Delete the BMPs that will not be used, or leave unchecked.

BMP	Specification(s)	Check if Used	Implementation Schedule
Channel Protection - Check Dams	- SD SPECS (212) - SD Drawings (P-2-B) - PC-1	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Sheet Flow to Buffers	- SD SPECS (N/A) - PC-2	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Channel Protection-Flexible Liners	- SD SPECS (212 and 624) - SD Drawings (P-2-A and P-2-C) - PC-3	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Channel Protection-Rigid Channel Liners	- SD SPECS (209 and 623) - SD Drawings (P-2-D) - PC-4	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Dikes and Berms	- SD SPECS (205, 209, and 212) - SD Drawings (P-1-E and P-1-F) - PC-5	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Dry Swale	- SD SPECS (N/A) - PC-6	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP

BMP	Specification(s)	Check if Used	Implementation Schedule
Wet Swale	- SD SPECS (N/A) - PC-7	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Geosynthetics	- SD SPECS (640 and 718) - PC-8	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Surface Sand Filter	- SD SPECS (N/A) - PC-9	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Subsurface Sand Filter	- SD SPECS (N/A) - PC-10	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Perimeter Sand Filter	- SD SPECS (N/A) - PC-11	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Organic Filter	- SD SPECS (N/A) - PC-12	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Pocket Sand Filter	- SD SPECS (N/A) - PC-13	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Bioretention	- SD SPECS (N/A) - PC-14	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Inlet-Outlet Protection	- SD SPECS (212, 608, 609, 640, 711, 718) - SD Drawings (D-1-A, D-1-B, P-1-A, P-1-H, and P-2-F) - PC-15	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Interceptor Ditches	- SD SPECS (208 and 209) - PC-16	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Retaining Walls	- SD SPECS (210 and 512) - PC-17	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Stormwater Basins	- SD SPECS (205 and 212) - SD Drawings (P-1-C and P-4-A) - PC-18	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Extended Detention Basin with Micropool	- SD SPECS (N/A) - PC-19	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Wet Basin	- SD SPECS (N/A) - PC-20	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP

BMP	Specification(s)	Check if Used	Implementation Schedule
Wet Extended Detention Basin	- SD SPECS (N/A) - PC-21	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Shallow Wetland	- SD SPECS (N/A) - PC-22	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Extended Detention Shallow Wetland	- SD SPECS (N/A) - PC-23	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Pond Wetland System	- SD SPECS (N/A) - PC-24	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Pocket Wetland	- SD SPECS (N/A) - PC-25	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Sediment Control Box	- SD SPECS (605 and 609) - SD Drawings (E-6-A-F, P-1-H, P-3-A, P-3-B, and P-3-D) - PC-26	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Infiltration Trench	- SD SPECS (N/A) - PC-27	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Infiltration Basin	- SD SPECS (N/A) - PC-28	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Slope Drains - Chutes - Flumes	- SD SPECS (208, 212, 409, 606, 607, and 609) - SD Drawings (D-1-A, D-1-B, and P-2-D) - PC-29	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Rock Armor / Mulch – Turf Reinforced Mat	- SD SPECS (N/A) - PC-30	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Serrations / Roughening	- SD SPECS (205) - ITD Design Manual Sec. 5.6 - PC-31	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Terraces / Benching	- SD SPECS (205) - ITD Design Manual Sec. 5.6 - PC-32	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Topsoil Management	- SD SPECS (213 and 711.09) - PC-33	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP

BMP	Specification(s)	Check if Used	Implementation Schedule
Vegetation-Seeding	- SD SPECS (621, 711.05, 711.12, 711.06) - PC-34	☒	Date to be Implemented November 15th 2025 Location (Stations or MP) 184+50 – 192+80 LT 187+98 – 193+30 RT 309+93 – 316+50 LT 308+50 – 311-90 RT 336+80 – 352+70 LT 336+21 – 340+50 RT 348+25 – 356+60 RT 402+40 – 403+60 LT 402+30 – 403+80 RT Quantity of BMP 0.349 Acres
Vegetation-Planting	- SD SPECS (620 and 711.06) - PC-35	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Water Quality Inlet / Oil Grit Separator	- SD SPECS (N/A) - PC-36	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Street Sweeping	- SD SPECS (N/A) - PC-37	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Deep Sump Catch Basin	- SD SPECS (N/A) - PC-38	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
On-line Storage in Storm Drain Network (Vaults)	- SD SPECS (N/A) - PC-39	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Porous Pavements	- SD SPECS (N/A) - PC-40	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
Proprietary Manufactured Systems	- SD SPECS (N/A) - PC-41	☐	Date to be Implemented Location (Stations or MP) Quantity of BMP
		☐	Date to be Implemented Location (Stations or MP) Quantity of BMP

Section 5 - Inspection and Maintenance Requirements

Inspections

- Contractor shall inspect and maintain all structural and non-structural control measures for functionality as required by the contract
- Conduct inspections using the inspection and corrective action log form in the Appendix

- Completed, certified, and executed Inspection Forms serve as a Corrective Action Log for ITD projects. These forms should be retained along with this PPP in **Appendix C**

All BMP deficiencies identified during the inspection, or any inadequacies related to the PPP, must be corrected as soon as possible but never later than 7 days after the inspection.

Maintaining an Updated PPP Plan

Changes to the PPP must be documented and may include any one of the following:

Construction methods
Operation methods
Design of the project (including civil plan sheets)
In the field change orders
Maintenance or inspection procedures
Staging sites
Material source sites/stockpile sites
Disposal/excess material/waste sites
Haul roads, temporary roads, and locations where vehicles travel and enter or exit staging areas and construction sites
Implementation and maintenance of BMPs
Stormwater discharge locations
Sequencing/scheduling changes
Impacts to wetlands or sensitive areas
Changes in personnel

All of these can result in the need for additional BMPs, and therefore a PPP update.

The sole objective of all modifications is to keep the PPP concurrent to existing on-the-ground conditions and to eliminate erosion and sediment impacts, as well as other pollutant impacts that could potentially result from the project. All modifications to the PPP shall be documented in **Appendix C** through the completion of inspections reports that shall serve as the corrective action log on this project.

Section 6 - Recordkeeping

Low Erosivity Waiver

If this PPP is being prepared in lieu of a Stormwater Pollution Prevention Plan based on the applicability of obtaining a Low Erosivity Waiver for the project, a copy of ITD, the Contractor, and any applicable local entity filing for a Low Erosivity Waiver (LEW) should be included in **Appendix D**. Guidance on the applicability of the LEW on your project can be found at the following website: http://water.epa.gov/polwaste/npdes/stormwater/Welcome-to-the-Rainfall-Erosivity-Factor-Calculator.cfm

Attention should be given to the expirations date on the LEW.

Inspections

Completed, certified, and executed Inspection Forms serve as a Corrective Action Log for ITD projects. These forms should be retained along with this PPP in **Appendix C**.

Section 7 - Certification and Notification

LHTAC Representative's Printed Name	Title	Signature	Approval Date
Karissa Nelson	LHTAC Environmental Engineer		

Contractor Certification Statement
As an operator, I certify that this Pollution Prevention Plan (PPP) narrative and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. As an operator, I certify that I understand requirements of the Clean Water Act as it relates to my activities and will, to the maximum extent practicable, implement BMPs to minimize release of pollutants into the environment.

Contractor's Printed Name	Title	Signature	Date

Place all signed copies of the Subcontractor Certification/Agreement form in **Appendix E**.

Appendices

Appendix A – PPP Plan Sheets and Site Maps

Appendix B – Basic Spill Prevention and Control Plan Language

In addition to all the erosion and sediment control BMPs, non-stormwater BMPs, and good housekeeping BMPs discussed in this PPP plan, the minimum following information will be provided by the Contractor for Spill Prevention and Cleanup:

1) Contact information for Contractor's designated Spill Coordinator for the project. This person must have authority to mobilize equipment, personnel, and materials in the event of a spill or discharge.
2) Documentation of training and/or education on spill response and cleanup.
3) Description of the location and content of spill kits on the project site.

Appendix C – Executed Inspection Reports/Corrective Action Log

Appendix D – Low Erosivity Waivers (if applicable)

Appendix E – Subcontractor Certifications/Agreements

Subcontractor Certification for Pollution Prevention Plan

Project Number	Project Name	Operator(s)

As a subcontractor, you are required to comply with the Pollution Prevention Plan (PPP) for any work that you perform on-site. Any person or group who violates any condition of the PPP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the PPP. A copy of the PPP is available for your review at the office trailer.

Each subcontractor engaged in activities at the construction site that could impact stormwater must be identified and sign the following certification statement:

I certify under the penalty of law that I have read and understand the terms and conditions of the PPP for the above designated project and agree to follow the BMPs and practices described in the PPP.

This certification is hereby signed in reference to the above named project.

Company Name	Address	City	State	Zip Code
Telephone Number	Construction Service to be Provided			
Printed Name	Title	Signature	Date	

2024 BUY AMERICA INSERT

This document is intended as a Build America Buy America (BABA or BA) contract insert that includes changes to the 2023 Standard Specifications for Highway Construction (SSHC), and the 2020 Quality Assurance Manual (Dated 10/19).

REVISIONS TO THE 2023 SSHC

ON PAGE 11, SUBSECTION 101.04 – DEFINITIONS 02/24

Replace the definition of "Construction Material" with the following:

Construction Material. A Construction Material is an article, material, or supply that consists of only one of the items listed, except for minor additions: non-ferrous metals; plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cable); glass (including optic glass); lumber (including treated wood, and untreated wood); Fiber optic cable; Optical fiber; Engineered wood or drywall. To the extent one of the items listed above contains as inputs other items listed above, it is nonetheless a Construction Material. For example, fiber optic cable contains as inputs other items listed, such as glass and/or plastics, but fiber optic cable is nonetheless a Construction Material. Items specifically excluded from Construction Materials are products that are primarily iron or steel (defined under Iron and Steel Products); cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives. Coatings do not change the categorization of a Construction Material. Minor additions of articles, materials, supplies, or binding agents to a Construction Material do not change the categorization of Construction Material. For example, wax added to engineered wood should not disqualify the engineered wood from categorization as a Construction Material. However, if before the engineered wood is brought to the work site, it is combined with glass or other items or materials to produce a new product, which is not listed above, the new product would be classified as a Manufactured Product, not a Construction Material.

ON PAGE 14, SUBSECTION 101.04 – DEFINITIONS 02/24

Add the following in alphabetical order:

Manufactured Product. Any product that is classified as an iron or steel product, or a Construction Material is not a Manufactured Product. Cement and cementitious materials, aggregates such as stone, sand, or gravel, or aggregate binding agents or additives, also cannot be classified as a Manufactured Product. Otherwise, the following definition of Manufactured Product applies: Articles, materials, or supplies that have been: a) Processed into a specific form and shape; or b) Combined with other articles, materials, or supplies to create a product with different properties than the individual articles, materials, or supplies.

ON PAGE 59, 106.01.A.1 – IRON AND STEEL PRODUCTS **02/2024**

Add the following after the first paragraph.

> Iron or steel products means articles, materials, or supplies that consist wholly or predominantly of iron or steel or a combination of both. "Predominantly of iron or steel" means that the cost of the iron and steel content exceeds 50 percent of the total cost of all its components. The cost of iron and steel is the cost of the iron or steel mill products (such as bar, billet, slab, wire, plate, or sheet), castings, or forgings utilized in the manufacture of the product and a good faith estimate of the cost of iron or steel components.

ON PAGE 60, 106.01.A.1 – IRON AND STEEL PRODUCTS **02/2024**

Delete the second sentence of the fifth paragraph and replace with the following:

> Cost determination is based on supplier invoice costs.

ON PAGE 60, 106.01.A.2 – CONSTRUCTION MATERIALS **02/2024**

Delete the first paragraph and replace with:

> All Construction Materials must be produced in the United States. Produced in the United States is defined below for each Construction Material.
>
> (1) Non-ferrous metals. All manufacturing processes, from initial smelting or melting through final shaping, coating, and assembly, occurred in the United States.
> (2) Plastic and polymer-based products. All manufacturing processes, from initial combination of constituent plastic or polymer-based inputs, or, where applicable, constituent composite materials, until the item is in its final form, occurred in the United States.
> (3) Glass. All manufacturing processes, from initial batching and melting of raw materials through annealing, cooling, and cutting, occurred in the United States.
> (4) Fiber optic cable (including drop cable). All manufacturing processes, from the initial ribboning (if applicable), through buffering, fiber stranding and jacketing, occurred in the United States. All manufacturing processes also include the standards for glass and optical fiber, but not for non-ferrous metals, plastic and polymer-based products, or any others.
> (5) Optical fiber. All manufacturing processes, from the initial preform fabrication stage through the completion of the draw, occurred in the United States.
> (6) Lumber. All manufacturing processes, from initial debarking through treatment and planing, occurred in the United States.
> (7) Drywall. All manufacturing processes, from initial blending of mined or synthetic gypsum plaster and additives through cutting and drying of sandwiched panels, occurred in the United States.
> (8) Engineered wood. All manufacturing processes from the initial combination of constituent materials until the wood product is in its final form, occurred in the United States.

ON PAGE 60, 106.01.A.2 – CONSTRUCTION MATERIALS **04/2024**

Add the following after the second paragraph:

> The Engineer may allow small quantities of foreign or non-compliant Construction Materials, so long as the total value of the foreign or non-compliant Construction Materials does not exceed the lesser of $1,000,000 or 5 percent of the Total Applicable Project Costs for the project or where the Total Amount of Federal Financial Assistance is below $500,000. "Total Applicable Project Costs" are defined as the cost of iron/ steel, Construction Materials and Manufactured Products used in the project that are subject

to a domestic preference requirement, including materials that are within the scope of an existing waiver. "Total Amount of Federal Financial Assistance" includes federal funding provided for preliminary engineering, right of way, and all construction contracts. For projects under a NEPA decision, include all federal funding provided for all projects under that NEPA decision.

The Contractor must maintain and provide in .csv format for each estimate to the Engineer a running total, listed by bid item and manufacturer, of the cost of Construction Materials not meeting the Buy America criteria and a running total of the Total Applicable Project Costs (as defined in the paragraph above). Invoices must be available for audit at any time and must be retained for a period of five years from the date of substantial completion for the project. If the Contractor does not provide these costs for each estimate, the estimate payment will not be made until the costs are supplied, or the Contractor provides a written statement(*) that they are not going to supply these costs. The written statement will include a statement from the Contractor acknowledging that they will not be able to incorporate any non-compliant Construction Materials into the project. The Engineer needs to make sure the running total of the Total Applicable Project Costs and the running total of foreign or non-compliant Construction Materials are received prior to issuing each pay estimate and that the Contractor does not exceed the Buy America threshold for non-compliant Construction Materials or have received the written statement from the Contractor indicating they will not be providing the running total.

* The written statement must include the following sentence:

"As the authorized representative of the Contractor, by providing this written statement that I will not be providing the running total for each estimate of the Total Applicable Project Costs, the Contractor is acknowledging that non-compliant Construction Materials cannot be incorporated into the project."

REVISIONS TO THE 2020 QUALITY ASSURANCE MANUAL (DATED 10/19)

Section 100.00.01 – Quality Control (QC) Producer

Delete the second sentence of the first paragraph and replace with:

Quality control of materials used in construction is the Contractor's responsibility and is performed during the production of the material and/or at the point of delivery.

Section 200 "Outline"

Revise Section 230.01 as follows:

230.01	General Provisions and Buy America.
230.01.01	General Provisions.
230.01.02	Buy America.
230.01.02.01	Iron and Steel Products
230.01.02.02	Construction Materials

Section 230.01 General Provisions

Delete Section 230.01 and replace with the following:

230.01 General Provisions and Buy America

230.01.01 General Provisions

Standard Department certification forms will be used. The standard forms are:

- ITD-849 Geotextile and Geogrid
- ITD-851 Miscellaneous Items
- ITD-875 Non-Structural Concrete
- ITD-914 Steel and Iron, and Buy America
- ITD-915 Construction Materials for Buy America
- ITD-966 PG Asphalt Binder
- ITD-968 Cement / Fly Ash

The standard forms must be completed in their entirety and be signed by the manufacturer's representative who has quality control responsibility for the manufacture or fabrication of the material.

When required by the contract, QC test results must be attached to the specified standard form. Certification does not preclude inspection, sampling, testing, or verification of certified test results of the material received on the project. Project inspectors will review all certification results for specification compliance before accepting the material. If the certified material is found to be outside acceptable specification limits, the material is subject to rejection.

Each shipment of certified material must be visually inspected for obvious defects and shipping/handling damage. Repair, reject, or replace damaged or defective material to the satisfaction of the Engineer. Where feasible, simple measurements of specified properties should be spot-checked at least once per project and recorded to verify certification. Examples would be length, mass per unit length, or thickness of steel items.

Withdraw acceptance of material by certification when sample test or inspection results show the material consistently fails to meet specifications requirements. Reestablishment of the certification acceptance may be achieved through Department pre-testing, pre-inspection, and review of historical certification records and test results of the material before its incorporation into a project. Additionally, the manufacturer's QA program may require revision and reevaluation by the Department.

230.01.02 Buy America

Buy America applies to any contract eligible for Federal Aid Highway funding within the scope of an applicable NEPA finding, determination, or decision regardless of the funding source of such contracts if at least one contract or phase of the project is funded with Federal-Aid highway funds. All permanently incorporated steel and iron materials along with Construction Materials as established in Standard Specification 106.A must be certified that they were manufactured in the United States of America including application of a coating. Certification must be provided before incorporation of the materials into the project. Materials that are only used or rented during the project construction, but not incorporated into the work (temporarily installed), do not require certification.

230.01.02.01 Iron and Steel Products

The ITD-914 form will serve as Buy America Certification and be signed by a person having quality control responsibility for the company that manufactures or fabricates the material. The ITD-914 will be sent with mill tests reports attached, except as noted in the MTRs.

Small quantities of steel and iron may be accepted without Buy American Certification, so long as its total cost for the project does not exceed 0.1% of the contract amount or $2,500, whichever is greater. The total cost of steel and iron includes the cost of the material plus the cost of transportation to the project site, as evidenced by delivery receipt, but does not include labor cost involved in final assembly performed on the project site.

If Department project staff or consultant inspectors discover that foreign iron and/or steel products are incorporated into a federal-aid project that exceed the Buy America minimal use amount for iron or steel (the greater of $2,500 or 0.1% of the contract value), the FHWA Idaho Division must be contacted to resolve this after-the-fact discovery. All information on foreign iron and steel permanently incorporated into a project that exceeds the minimal use amount must be presented to FHWA to determine the appropriate resolution. The Department will not complete a project's Material's Certification without FHWA's resolution when the project is not compliant with Buy America. The Department has no authority to complete such a resolution and cannot resolve Buy America compliance issues by use of non-Federal funds.

230.01.02.02 Construction Materials

A Construction Material is an article, material, or supply that consists of only one of the items listed, except for minor additions: non-ferrous metals; plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cable); glass (including optic glass); lumber (including treated wood, and untreated wood); Fiber optic cable; Optical fiber; Engineered wood or drywall.

To the extent one of the items listed above contains as inputs other items listed above, it is nonetheless a Construction Material. For example, fiber optic cable contains as inputs other items listed, such as glass and/or plastics, but fiber optic cable is nonetheless a Construction Material.

Items specifically excluded from Construction Materials are products that are primarily iron or steel (defined under Iron and Steel Products); cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives.

Coatings do not change the categorization of a Construction Material. Minor additions of articles, materials, supplies, or binding agents to a Construction Material do not change the categorization of Construction Material. For example, wax added to engineered wood should not disqualify the engineered wood from categorization as a Construction Material. However, if before the engineered wood is brought to the work site, it is combined with glass or other items or materials to produce a new product, which is not listed above, the new product would be classified as a Manufactured Product, not a Construction Material.

Any product that is classified as an iron or steel product, or a Construction Material is not a Manufactured Product. Cement and cementitious materials, aggregates such as stone, sand, or gravel, or aggregate binding agents or additives, also cannot be classified as a Manufactured Product. Otherwise, the following definition of Manufactured Product applies: Articles, materials, or supplies that have been: a) Processed into a specific form and shape; or b) Combined with other articles, materials, or supplies to create a product with different properties than the individual articles, materials, or supplies.

For awards obligated on or after August 16, 2023, the Engineer may allow small quantities of foreign Manufactured Products and Construction Materials, so long as the total value of the non-compliant products does not exceed the lesser of $1,000,000 or 5 percent of the total applicable costs for the project or where the total amount of federal financial assistance is below $500,000. “Total applicable project costs” are defined as the cost of Construction Materials and Manufactured Products used in the project that are subject to a domestic preference requirement, including materials that are within the scope of an existing waiver. “Total Amount of Federal Financial Assistance” includes federal funding provided for preliminary engineering, right of way, and all construction contracts. For projects under a NEPA decision, include all federal funding provided for all projects under that NEPA decision.

The Contractor must maintain and provide in .csv format for each estimate to the Engineer a running total, listed by bid item and manufacturer, of the cost of Construction Materials not meeting the Buy America criteria and a running total of the Total Applicable Project Costs (as defined in the paragraph above).). Invoices must be available for audit at any time and must be retained for a period of five years from the date of substantial completion for the project. If the Contractor does not provide these costs for each estimate, the estimate payment will not be made until the costs are supplied, or the Contractor provides a written statement(*) that they are not going to supply these costs. The written statement will include a statement from the Contractor acknowledging that they will not be able to incorporate any non-compliant Construction Materials into the project. The Engineer needs to make sure the running total of the Total Applicable Project Costs and the running total of foreign or non-compliant Construction Materials are received prior to issuing each pay estimate and that the Contractor does not exceed the Buy America threshold for non-compliant Construction Materials or have received the written statement from the Contractor indicating they will not be providing the running total.

* The written statement must include the following sentence:

“As the authorized representative of the Contractor, by providing this written statement that I will not be providing the running total for each estimate of the Total Applicable Project Costs, the Contractor is acknowledging that non-compliant Construction Materials cannot be incorporated into the project.”

The ITD-915 form serves as Buy America Certification for Construction Materials and must be signed by a person having quality control responsibility for the company that manufactures the Construction Material.

If Department project staff or consultant inspectors discover that foreign Construction Materials are incorporated into a federal-aid project, the FHWA Idaho Division must be contacted to resolve this after-the-fact discovery. All information on foreign Construction Materials permanently incorporated into a project must be presented to FHWA to determine the appropriate resolution. The Department will not complete a project’s Material’s Certification without FHWA’s resolution when the project is not compliant with Buy America requirements. The Department has no authority to complete such a resolution and cannot resolve Buy America compliance issues by use of non-Federal funds.

Section 230.03 Steel.

Delete the last sentence of the first paragraph and replace with:

Steel will comply with 230.01.02 Buy America.

Section 230.07 Corrugated Metal Pipe and Corrugated Plate Pipe.

Add the following to the end of the second paragraph of the section:

Additionally, a form ITD-915 will be submitted attesting that the aluminum pipe meets applicable Buy America requirements for Construction Material (non-ferrous metals).

Section 230.08 Plastic Pipe.

Add the following to the end of the first paragraph of the section:

Additionally, a form ITD-915 will be submitted attesting that the plastic pipe meets applicable Buy America requirements for Construction Material (plastic and polymer-based products).

Section 230.09 Geosynthetics.

Add the following to the end of the first paragraph of the section:

Additionally, a form ITD-915 will be submitted attesting that the geosynthetic meets applicable Buy America requirements for Construction Material (plastic and polymer-based products).

Section 270.00 Minimum Testing Requirements (Table)

Use the Buy America Summary Table below for BA requirements and BA certifications of materials. Iron or steel products are listed as “Fe”. Construction Materials as listed as “CM”. If the material is listed as a possible Construction Material (CM), it is up to the manufacturer to either certify the product with the ITD-0915, or submit the product through the Buy America Exemption Application for review by HQ Construction and Materials for a possible exemption. Only products that are not by definition a Construction Material can receive an exemption.

Buy America Summary Table (Section 270)

Section	Item Desc.	Code[1,4,6,7]	Form(s)[2,3,5,9]	Comments
212	Slope Drain	Fe, CM	ITD-914, ITD-915	
405	Pavement Reinforcement Fabric	CM	ITD-915	
503	GFRP	BA N/A		GFRP is a combination of glass and polymers combined in a manufacturing process. See notes 10 and 11.
503	GFRP	BA N/A		
504	Bolts, Nuts, Hardened Washers, DTI	Fe, CM	ITD-914, ITD-915	
504	Two Tube Curb-Mount Railing	Fe, CM	ITD-914, ITD-915	
504	Pedestrian Bicycle Railing	Fe, CM	ITD-914, ITD-915	
504	Combination Pedestrian Bicycle, and Traffic Railing	Fe, CM	ITD-914, ITD-915	
505	Timber Piles	CM	ITD-915	
507	Neoprene Bearing Pads	CM	ITD-915	
507	TFE/PTFE Bridge Bearing Pads	CM	ITD-915	
508	Corrugated Plate Pipe - Entire Section	Fe, CM	ITD-914, ITD-915	
511	Concrete Waterproofing Systems - Types A, B	CM	ITD-915	
511	Concrete Waterproofing Systems - Types C, D	BA N/A		Note, Type C Silanes and siloxane chemicals are not polymers and are not Construction Materials. Type D is an asphalt filled fabric laminate combined in a manufacturing process and is not a Construction Material.
511	Concrete Waterproofing Systems - Types E	CM	ITD-915	
565	Backer Rod	CM	ITD-915	
565	Location Spike	Fe, CM	ITD-914, ITD-915	
566	Neoprene Seals - Compression Seal Expansion Joint	CM	ITD-915	

Buy America Summary Table (Section 270)

Section	Item Desc.	Code[1,4,6,7]	Form(s)[2,3,5,9]	Comments
567	Neoprene Seals - Strip Seal Expansion Joint	CM	ITD-915	
578	Gaskets for Concrete Pipe	CM	ITD-915	
586	Utility Conduit	Fe, CM	ITD-914, ITD-915	
586	Deck Inserts	Fe, CM	ITD-914, ITD-915	
602-608	Corrugated Metal pipe and Pipe arches	Fe, CM	ITD-914[2], ITD-915	
602-608	Structural Plate Pipe, Pipe Arches and Arches	Fe, CM	ITD-914, ITD-915	
602-608	Pipe Underdrains (Metallic Coated corrugated steel, aluminum pipe, corrugated PE drainage tubing PVC Pipe.	Fe, CM	ITD-914, ITD-915	
602-608	Abs or PVC or PE Pipe	CM	ITD-915	
602-608	Metal Aprons	Fe, CM	ITD-914, ITD-915	
602-608	Gaskets for Concrete Pipe	CM	ITD-915	
602-608	Rubber Gaskets for CMP	CM	ITD-915	
602-608	Corrugated Metal Embankment Protectors	Fe, CM	ITD-914, ITD-915	
609	Timber - Minor Structures	CM	ITD-915	
610	Wood Posts	CM	ITD-915	
610	Gates	Fe, CM	ITD-914, ITD-915	
610	Hardware for Barbed or Woven Wire Fence	Fe, CM	ITD-914, ITD-915	
612	Wood Post and Blocks - Guardrail	CM	ITD-915	
612	Non - Wood Post and Block - Guardrail	CM	ITD-915	
612	Aluminum Rail and Fittings - Guardrail	CM	ITD-915	
612	Metal Terminal Section - Guardrail	Fe, CM	ITD-914, ITD-915	

Buy America Summary Table (Section 270)

Section	Item Desc.	Code[1,4,6,7]	Form(s)[2,3,5,9]	Comments
612	Impact Attenuator - Permanent - Guardrail	Fe, CM	ITD-914, ITD-915	
613	Crash Cushions	CM	ITD-915	
616	Signs and Sign Support Extruded Aluminum	CM	ITD-915	
616	Signs and Sign Support Sheet Aluminum	CM	ITD-915	
616	Signs and Sign Support - Steel and Aluminum	Fe, CM	ITD-914, ITD-915	
616	Signs and Sign Support - Hardware for Signs	Fe, CM	ITD-914, ITD-915	
616	Plywood for Type E Signs	CM	ITD-915	
616	Signs and Sign Support - Breakaway Wood Posts	CM	ITD-915	
617	Aluminum Posts Delineators and Mileposts	CM	ITD-915	
617	Aluminum Posts Delineators and Mileposts Plates	CM	ITD-915	
617	Aluminum Posts Delineators and Mileposts Reflector Unit	CM	ITD-915	
617	Aluminum Posts Delineators and Mileposts Reflective Sheeting	BA N/A		Finished product undergoes manufacturing process to combine the sheeting and aluminum into one product so it is not a Construction Material. See notes 10 and 11.
618	Right of Way Marker	Fe, CM	ITD-914, ITD-915	
618	Brass Caps	CM	ITD-915	
618	Reference Marker	Fe, CM	ITD-914, ITD-915	
618	Project Markers	Fe, CM	ITD-914, ITD-915	BA N/A if temporary
618	Reference Marker	Fe, CM	ITD-914, ITD-915	BA N/A if fiberglass is used. See notes 8, 10 and 11.
618	Witness Posts - Wood	CM	ITD-915	

Buy America Summary Table (Section 270)

Section	Item Desc.	Code[1,4,6,7]	Form(s)[2,3,5,9]	Comments
618	Witness Posts - Fiberglass	BA N/A		Fiberglass is a combined material and is a Manufactured Product.
619	Illumination Poles and Bases	Fe, CM	ITD-914, ITD-915	
619	Illumination Components	Fe, CM	ITD-914, ITD-915	
623	Pre-formed expansion Joint Filler Concrete Slope Paving	CM	ITD-915	
625	Pre-formed expansion Joint Filler Joints	CM	ITD-915	
625	Neoprene Compression Seal	CM	ITD-915	
630	Glass Beads	CM	ITD-915	
630	Preformed Thermoplastic	CM	ITD-915	
634	Support Mailbox	Fe, CM	ITD-914, ITD-915	
634	Mailbox	Fe, CM	ITD-914, ITD-915	
640	Geosynthetics all materials	CM	ITD-915	
641	Biaxial Geogrid	CM	ITD-915	
652	Underground Sprinkler System - All Items	CM	ITD-915	
656	Signal Poles and Mast Arms Traffic Signal Installation	Fe, CM	ITD-914, ITD-915	
656	Signal Components Traffic Signal Installation	Fe, CM	ITD-914, ITD-915	
656	Signal Cabinet Electrical Components Traffic Signal Installation	BA N/A		Electrical Components are a combination of materials that are combined thru a manufacturing process so they are not a Construction Material. See note 10 and 11.

Notes:

1. Code Key: Fe = iron & steel, CN = Construction Material, BA N/A = Item determined not to apply to BA.
2. The ITD-914 applies to Iron and steel products only. There is no change to the Buy America certification process for Iron and Steel.
3. This table makes additional requirements to the existing table only; the existing ITD-914 requirements for Iron and Steel are not restated.

Buy America Summary Table (Section 270)

Section	Item Desc.	Code[1,4,6,7]	Form(s)[2,3,5,9]	Comments

4. Buy America requirements apply to all iron and steel items no matter what form of manufacturing or material combinations are used.
5. The ITD-915 applies to Construction Materials only (eight listed items).
6. Besides Fe and CM, no other products/items are considered by the Department to be applicable to these Buy America requirements.
7. Field assembly does not constitute a manufactured process and does not necessarily preclude applicability to Buy America requirements.
8. Wood products, even when treated, are considered Construction Materials.
9. Any justification denying applicability to the Buy America requirements is to be submitted on/with the ITD-915 form.
10. Items consisting of a combination of two or more Construction Materials combined in a manufacturing process are not Construction Materials.
11. Items consisting of one construction material with something else in a manufactured process are not Construction Materials.

Section 470.01 Exceptions.

In the sixth full paragraph, replace the sentence with:

> Exceptions to the Buy America specification must be presented to FHWA for determination of a resolution, see Section 230.01.02 Buy America.

ON PAGE13, 15 AND 16, SUBSECTION 101.04 – DEFINITIONS

HMA Paving Quality Control Plan. A quality control plan specific to hot mix asphalt paving.

Quality Assurance. All planned and systematic operations to ensure that the operation, material, and/or end product meets specifications. Quality assurance includes:

1. Approval and oversight of the Contractor's quality control plan.
2. Review of inspector, sampler, tester, and laboratory qualifications.
3. Inspection for conformity with contract requirements.
4. Contractor quality control.
5. Acceptance.
6. Independent assurance.
7. Challenge resolution.

Quality Control Plan. The documentation, approved by the Department, of the program used by the Contractor which specifies the actions, inspection, sampling, and testing necessary to keep production and placement operations within specifications, including provisions to quickly determine when an operation becomes out of control and those actions that the Contractor will take to restore compliance.

ON PAGE 36, SUBSECTION 105.03 – CONFORMITY WITH PLANS AND SPECIFICATIONS

Add after the first sentence:

> For the quality characteristics of the items included in QASP SA Table 106.03-1, and subject to quality level analysis, acceptance will be based on the requirements of the 2023 Quality Assurance Special Provision for State Acceptance (2023 QASP SA).

ON PAGE 61, SUBSECTION 106.03 – SAMPLES, TESTS, AND CITED SPECIFICATIONS

Delete this subsection and replace with the following:

106.03 Samples, Tests, and Cited Specifications.

The Engineer will accept material, based on inspection and test results, before the Contractor incorporates material into the work. The Contractor may, with approval, incorporate material the Engineer cannot routinely sample before delivery, at the Contractor's risk. The Department will pay the Contractor for material incorporated into the work if the material meets the sampling, testing, and certification requirements.

Ensure the sampling and testing required by the contract, including references to WAQTC, ASTM, AASHTO, and Idaho standard test methods are from the current edition at time of bid opening, except as modified by the contract.

For testing performed on the Contractor's behalf for plant mix designs, alkali-silica reactivity expansion, and claim or dispute resolution, a professional engineer, licensed in the state where the testing will be performed, will supervise testing reporting.

Ensure a safe means of sampling and testing. If safe means of sampling and testing is not provided, work will be halted, at no additional cost to the Department. No material will be accepted after unsafe conditions have been identified and the Contractor has been notified of the unsafe conditions, until corrective action has been taken and the resumption of work is approved by the Engineer.

Ensure the individuals sampling and testing material and the testing facilities are qualified for the tests performed.

Provide crushing, screening, and mixing plants with approved sampling equipment capable of operating from the ground or a platform. Ensure the sampling equipment is capable of the following:

1. Moving at a constant rate across the width of the material falling from the discharge belt or chute.
2. Taking a representative sample of the material.
3. Conveying (e.g., slide, chute) the sample to the ground level where the sample can be safely and conveniently collected.

The Contractor is responsible for the quality of construction and materials incorporated into the work. The Contractor will perform all necessary quality control inspection, sampling, and testing and the Department is responsible for acceptance testing and independent assurance (IA) testing. Sampling and testing costs are included in the respective contract pay items. The Contractor is allowed to take the acceptance or IA samples as long as the sample collection is witnessed by the Department. The Contractor may employ an independent laboratory. The laboratory must follow the Contractor's approved quality control plan. Make all project records, including test results and all original source documentation for specified contract quality requirements available for review and allow Department representatives immediate access to the testing facilities during delivery and production hours.

The Contractor may observe the Department's sampling and testing activities. If the Contractor observes a deviation from the specified sampling or testing procedures, then the Contractor must describe the deviation to the Department immediately and document the deviation in writing within 24 hours to preserve their ability to challenge the sample.

A. Material Subject to Statistical-Based Acceptance.

When specified in the contract, the Department will use the quality level analysis as specified in 106.03.B to determine quality-based pay adjustments.

The Contractor and the Department will work cooperatively within their respective quality assurance (QA) responsibilities to produce and document a high quality project, meeting or exceeding the quality requirements of the contract.

1. The Department's Quality Assurance Responsibilities.

   The Department is responsible for determining the acceptability of the work, approving and monitoring of the Contractor's quality control plan (QCP). The Department will perform acceptance sampling, testing, and inspection for any element of the work to ensure Contractor compliance with the QCP and contract requirements. The Department may also perform IA and verification sampling and testing at any time.

   Acceptance sampling and testing is the Department's responsibility, unless alternate procedures are specified. The Department is responsible for performing acceptance testing and for evaluating the quality characteristics as specified in the QASP SA Table 106.03-1.

   The Department will obtain all samples by utilizing stratified random sampling in accordance with Idaho IR 148.

   Rounding will not be permitted at any level of calculating acceptance test results. The final reported value will be rounded to the nearest significant figure as specified in the QASP SA Table 106.03-1. ASTM E 29 does not apply.

   The Department will provide official acceptance test results within 24 hours of receipt of the final sample for the lot. The Department will not provide official acceptance test results before the completion of the lot. Acceptance results and all original source documents/datasheets used during material acceptance testing will be made available for review upon request.

   Unofficial results before final review can be shared with the Contractor, if available. These results must not be used for process quality control.

   The Department will complete acceptance sampling, splitting, and testing as specified in the QASP SA Table 106.03-1 using independent, stratified random samples. Approximately ½ of the sample will be used for acceptance testing and the other ½ retained for challenge testing. The challenge samples must be secured with Department provided serialized security tape. All chain of custody information must be documented on Department provided forms and samples must be stored in a location only accessible by Department representatives.

   a. Lot Description.

      A lot is a specific quantity of material from a single source which is produced or placed by the same controlled process. Acceptance tests will be grouped into lots by the Engineer. Lot size will be determined by the Engineer using the following criteria:

      i. The minimum lot size is 3 tests for each quality characteristic. The minimum testing frequency is specified in the QASP SA Table 106.03-1.

      ii. A lot is based on a work shift's production when the minimum lot size is achieved.

         1. If the work shift is represented by less than 3 tests for any quality

characteristic, the work shift will be combined with the following work shift to form a lot.

2. If the final work shift is represented by less than 3 tests for any quality characteristic, the final work shift will be combined with the previous work shift to form a lot. A Superpave HMA acceptance test strip is considered a lot.

2. The Contractor's Quality Control Responsibilities.

The Contractor is responsible for quality control for all work. The Contractor will not rely on the Department's acceptance testing results for their process quality control.

a. Quality Control Plan (QCP). The Contractor will develop, submit, and implement a QCP that meets the requirements of Idaho IR 158, as approved by the Department, for each of the materials included in QASP SA Table 106.03-1. A QCP for each of the materials, will be submitted to the Department at or before the preconstruction conference. The Department will provide the Contractor with approval or rejection of each QCP within 5 business days after receiving the QCP. Rejection of the QCP will require an additional 5 business days for re-evaluation. The QCP must be approved before that material is incorporated into the work/project. The QCP, as approved by the Department in accordance with Idaho IR 159, is binding upon the Contractor as a contract requirement.

   i. QCP Amendments. Amend the QCP as necessary to conform to the current operations and submit the amended QCP for the Engineer's approval in accordance with IR 158. The Engineer will review and provide approval or rejection of the QCP amendment in accordance with Idaho IR 159 before the amendment is implemented.

At a minimum, the QCP will consist of plans, procedures, responsibilities, authority, and an organizational structure that demonstrates that an effective level of quality control will exist resulting in the end product complying with the contract requirements. The Contractor will provide all necessary quality control inspection, sampling, and testing to implement the QCP. The QCP will include an organizational structure and reporting requirements that demonstrate that QC personnel have sufficient independence to allow them to be primarily concerned with quality, as opposed to schedule and budget.

The Department will not sample or test for process control or assist in controlling the Contractor's production operations. The Contractor will provide QC personnel and testing equipment capable of providing a quality product that meets or exceeds the contract requirements. Continued production of non-conforming work for a reduced price as determined by the Department, instead of making adjustments to bring the work into conformance, is not allowed. The QCP will specifically include:

i. Construction items covered by the QCP as specified in the contract.

ii. Sampling location and techniques.

iii. Sampling plan.

iv. Tests and test methods.

v. Testing frequencies.

vi. Testing forms.

vii. Inspection frequencies.

viii. Detailed description of production and placement equipment and methods.

ix. Detailed calibration processes and procedures for hot plants or mixing plants.

x. Documentation procedures, including:

(1) Inspection and test records.

(2) Temperature measurements.

(3) Accuracy, calibration, or recalibration checks performed on production or testing equipment.

The QCP will identify the Contractor's QC personnel, including the company official ultimately responsible for the quality of the work. The Department's QCP approval process may include inspection of testing equipment and a sampling and testing demonstration by the Contractor's QC personnel to assure an acceptable level of performance.

The Contractor will comply with the approved QCP and will take all other steps necessary to assure a high quality project.

Failure by the Contractor to comply with the approved QCP will result in mandatory work suspension until compliance.

The Contractor will maintain and make available, quality control charts (at a minimum, a run chart as the material is being produced) for each quality characteristic to be used in the statistical analysis. Where applicable, the run chart will be plotted with the material's specification upper and lower limits for statistical analysis.

B. Quality Level Analysis.

Quality level analysis will not be performed if the total quantity of material, except the test strip(s), based on planned quantity, is less than the quantity computed for 3 tests at the frequencies specified in QASP SA Table 106.03-1.

1. Statistical Analysis. Unless otherwise specified, quality levels and pay factors will be computed as specified below:

a. Determine the unrounded arithmetic mean $(\bar{X})$.

$$\bar{X} = \frac{\sum x_i}{n}$$

Where:

Σ = Summation.

x_i = Individual test value.

n = Total number test values.

b. Compute the unrounded sample standard deviation (S).

$$S = \sqrt{\frac{\sum (x_i - \bar{X})^2}{n-1}}$$

c. Compute the unrounded upper quality index (Q_u).

$$Q_u = \frac{USL - \bar{X}}{S}$$

Where:

USL = Upper specification limit.

S = Standard deviation.

d. Compute the unrounded lower quality index (Q_L).

$$Q_L = \frac{\bar{X} - LSL}{S}$$

Where:

LSL = Lower specification limit.

S = Standard deviation.

e. Determine P_U (percent within the upper specification limit, which corresponds to a given Q_U).

$$P_U = 100 - \left(100 \times \int_0^A \text{beta}\left(X; \frac{n}{2} - 1\right) dX\right)$$

Where:

P_U = Unrounded percent within upper limits.

A = Maximum $\left[0, 0.5 - Q_U \times \frac{n^{0.5}}{2(n-1)}\right]$

X = Maximum $\left[0, 0.5 - Q_U \times \frac{n^{0.5}}{2(n-1)}\right]$

beta($X; \frac{n}{2} - 1$) = Beta distribution density with $\alpha = \beta = \frac{n}{2} - 1$ where α and β are parameters of the beta distribution.

If a USL is not specified, P_U will be 100.

f. Determine P_L (percent within lower specification limit, which corresponds to a given Q_L).

$$P_L = 100 - \left(100 \times \int_0^A \text{beta}\left(X; \frac{n}{2} - 1\right) dX\right)$$

Where:

P_L = Unrounded percent within lower limits.

A = Maximum $\left[0, 0.5 - Q_L \times \frac{n^{0.5}}{2(n-1)}\right]$

X = Maximum $\left[0, 0.5 - Q_L \times \frac{n^{0.5}}{2(n-1)}\right]$

beta($X; \frac{n}{z} - 1$) = Beta distribution density with $\alpha = \beta = \frac{n}{z} - 1$ where α and β are parameters of the beta distribution.

If a LSL is not specified or the specification is zero, P_L will be 100.

g. Determine the unrounded percent within limits (PWL) (i.e., the total percent within the specification limits).

$$PWL = (P_U + P_L) - 100$$

h. Repeat steps 106.03.B.1.c through 106.03.B.1.g to calculate the PWL for each quality characteristic.

2. Acceptance Criteria. The Engineer will accept a lot containing material that does not meet specifications if the PWL is at least 40 for each of the quality characteristics. The Engineer must reject a lot containing non-specification material, which does not obtain at least a PWL of 40 for each quality characteristic. Remove rejected material, including those portions of the work in which that material was incorporated, at no additional cost to the Department. The Contractor may reuse the removed material if adjustments are made so the material meets the specifications.

   If the PWL of a lot falls below 60 for any quality characteristic, stop production and/or delivery. A corrective action plan must be submitted to the Engineer and approved. Production and/or delivery may resume after the Contractor takes effective and acceptable actions to improve the production quality as outlined in the approved corrective action plan. If resuming production involves a significant change to the production process, as determined by the Engineer, stop the current lot and begin a new lot.

   The Contractor may elect to remove defective material and replace it with new material on an entire lot basis, at no additional cost to the Department. The Department and the Contractor must re-sample, retest, and re-evaluate the new lot for acceptance.

   The Engineer may isolate and reject obviously defective material without regard to testing procedures. The Contractor may isolate and reject obviously defective material during delivery and production before acceptance testing.

3. Materials.

   a. 301, 303, and 635 Materials. The upper and lower specification limits (USL and LSL) for gradations will be set based on the applicable requirements of 703 except as specified below:

      (1) Test results will not be included in the quality level analysis for fracture, sand equivalent, cleanness value, 100 percent passing, or for any sieves where the upper specification limit is 100 percent passing and the lower specification limit is 95 percent passing or greater.

      The Engineer will use the lowest PWL computed for any 1 sieve as the basis of acceptance for that lot. The average PWL will be used for payment.

   b. 404 Material. When the lower specification limit is 0 percent and the upper specification limit is less than 3 percent, the upper specification limit will be 3 percent for statistical analysis. A 2 percent tolerance will be given for the percentage retained on the maximum sized sieve provided that 100 percent of the material passes the next larger sieve size. Only #4 and #8 sieves will be used for quality level analysis.

   c. 405 Superpave Material. The upper and lower specification limits for Superpave quality characteristics will be set by the limits established in 405.

(1) For SP 2 aggregates, the lowest PWL for any 1 sieve will be used for acceptance and pay factor calculations.

ON PAGE 62, SUBSECTION 106.07 – TEST RESULT CHALLENGE RESOLUTION

Delete this subsection and replace with the following:

106.07 Test Result Challenge Resolution.

The Contractor and the Department may enter into a challenge resolution when the quality of a lot is believed to be misrepresented.

The test result challenge process as specified in 106.07 will be exhausted in its entirety before other dispute or claims processes are initiated as specified in 105.16, 105.17, 105.18, and 105.19. The intent of challenge resolution is to resolve testing issues early, efficiently, and as close to the project level as possible. The Contractor will waive their right to challenge test results if they fail to comply with the requirements set forth in this subsection.

A. Initiation of a Challenge.

To request a challenge of acceptance test results, provide written notice, including all quality characteristics and copies of original quality control source documentation, within 3 business days after receipt of the acceptance test results. Failure to comply with these requirements in this subsection will bar either party from any further administrative, equitable, or legal remedy.

1. The Contractor will waive their right to challenge if either of the following conditions occur:
   i. The Engineer does not receive a written notice as specified within the time requirements (i.e., 3 business days).
   ii. The Contractor does not obtain the required number of the Contractor's quality control tests reported on forms established in the QCP at the frequency specified in QASP SA Table 106.3-1.
2. The Department will review the written notice and quality control documentation.

B. Challenge Resolution Process.

1. The Department and the Contractor will identify differences in procedures and equipment.
2. The Department and the Contractor will agree to a work plan for initiating resolution by a challenge laboratory as specified in 106.07.C. or 106.07.D.
3. The Contractor can witness challenge testing.

C. Challenge of Material Not Subject to Statistical-Based Acceptance.

The challenge lab is the Department Central Materials Laboratory or a Department District Materials Laboratory not associated with the District in which the acceptance testing is being performed. Splits of the Department's acceptance samples for the entire lot will be used for challenge testing. The challenge samples will be tested for all quality characteristics used in the quality level analysis by the challenge laboratory. The challenge laboratory results are final and the Engineer will use the challenge laboratory's test results for all quality characteristics for acceptance.

1. If the Department's acceptance test results indicate reject level material, and:

i. The challenge laboratory test results indicate acceptable material, then the Department will bear the cost of challenge laboratory testing.

ii. The challenge laboratory test results indicate reject level material, then the costs of challenge laboratory testing will be deducted from any monies due or that may come due the Contractor under the contract at the rate of $500.00 per sample.

For challenging of density properties, the Department's acceptance cores will be retained for retesting. The Contractor may request to observe challenge testing.

D. Challenge Laboratory Resolution of Material Subject to Statistical-Based Acceptance.

The challenge laboratory is the Department Central Materials Laboratory. The Central Materials Laboratory may elect to choose another challenge laboratory as needed to accommodate testing timelines. Upon challenge notification, the Department will arrange for testing of all challenged acceptance samples of the lot in question. Splits of the Department's acceptance samples will be used for challenge testing. The challenge samples for the entire lot will be tested for all quality characteristics used in the quality level analysis by the challenge laboratory. The challenge laboratory test results are final and the Engineer will use the challenge laboratory test results of all quality characteristics for acceptance for the entire lot.

The Contractor may use challenge resolution for density when the density pay factor is less than 1.00. The entire lot will be retested for density and used in the quality level analysis. A challenge resolution test will be performed by obtaining cores in new, stratified random sample locations equal to the same number of original acceptance tests. Sample locations will be identified by the Department using Idaho IR 148. Sampling of cores will be performed by the Contractor and must be witnessed by the Engineer. Traffic control and sampling will be performed by the Contractor. Challenge resolution may be performed regardless of the sampling location being exposed to traffic. The challenge test results are final and the Engineer will use the challenge test results for acceptance of the entire lot.

1. If the new composite pay factor results in a lower or equal composite pay factor for the lot in question, then the costs of challenge testing, in addition to the cost of any work related to traffic control performed for retesting at unit bid prices for the costs incurred, will be deducted from any monies due or that may come due the Contractor under the Contract at the rate shown in Table 106.07-1 per sample in the challenged lot.
2. If the new composite pay factor results in a higher composite pay factor for the lot in question, then the Department will bear the costs associated with the challenge testing, and the cost of any work related to traffic control performed for retesting at unit bid prices for the costs incurred.

Table 106.07-1 – Challenge Laboratory Testing Rates

Material	Rate Per Sample
301 Granular Subbase	$200
303 Aggregate Base	$250
404 Cover Coat Material	$300
635 Anti-Skid Material in Stockpile	$300
405 SP 2 Mix Quality Characteristics	$600
405 SP 2 Roadway Quality Characteristics	$400
405 SP 3 Mix Quality Characteristics	$600

Material	Rate Per Sample
405 SP 3 Roadway Quality Characteristics	$400
405 SP 5 Mix Quality Characteristics	$600
405 SP 5 Roadway Quality Characteristics	$400

ON PAGE 91, SUBSECTION 108.04 – PRECONSTRUCTION AND PREOPERATIONAL CONFERENCES

Delete #4 and replace with the following: :

4. A quality control plan as specified in 106.03.A.2.

ON PAGE 115, NEW SUBSECTION 109.09 – PAY FACTOR EQUATIONS

Insert with the following new subsection:

109.09 Pay Factor Equations.

The Engineer will determine a pay factor for each quality characteristic in an individual lot not rejected and replaced, except as otherwise specified, for use in the basis of payment calculations.

With the exception of 405 pay items or reject quality level material, if any quality characteristic used in calculating the pay factor for the lot falls below 60 PWL, all quality characteristics will be paid corresponding to the lowest, unrounded PWL.

For 405 pay items, with the exception of reject quality level material, if any two quality characteristic used in calculating the pay factor for the lot fall below 60 PWL, all quality characteristics will be paid corresponding to the average two lowest, unrounded PWL.

A. 405 Mainline Density.

For mainline density, calculate the pay factor for each lot using the following formula:

$$\mathrm{PF}_{MLD} = \frac{55 + 0.5\times \left(PWL_{92} - \frac{(\mathrm{PWL}_{92} - 90) + |PWL_{92} - 90|}{2}\right)}{100} + \frac{((PWL_{92} - 90)) + |(PWL_{92} - 90)|}{1000} + \frac{(PWL_{93} - 90) + |PWL_{93} - 90|}{1000} + \frac{(PWL_{94} - 90) + |PWL_{94} - 90|}{2000}$$

Where:

PWL_{92} is the percent of material between 92.0 to 100.0% compaction.

PWL_{93} is the percent of material between 93.0 to 100.0% compaction.

PWL_{94} is the percent of material between 94.0 to 100.0% compaction.

B. All Other Quality Characteristics.

For all other quality characteristics calculate the unrounded pay factors for each lot using the following equation:

$$PF = \frac{55+0.5\times(PWL)}{100}$$

ON PAGE 184, SUBSECTION 301.05 – BASIS OF PAYMENT

Add the following:

A. Granular Subbase Pay Factor. All acceptable material will be paid at contract unit price.

When RAP material is included in acceptable subbase, the natural material will be tested as specified in 301 and the blended material will be paid at contract unit price.

ON PAGE 188, SUBSECTION 303.05 – BASIS OF PAYMENT

Delete this subsection and replace with the following:

Calculation of Incentive/Disincentive. The incentive/disincentive dollar amount to be paid or deducted for all ____aggregate type _____for base accepted by the Department will be computed using the following formula:

$$\mathrm{PA}_{303} = (\mathrm{PF}_{303} - 1) \times \mathrm{Q_i} \times \mathrm{P}$$

Where:

PA_{303} = Pay adjustment for all ____aggregate type ____for base in dollars.

PF_{303} = Per 106.B.3 and 109.09.

Q_i = Quantity represented by individual lot (n).

P = Contract unit price.

The incentive/disincentive dollar amount to be paid or deducted for all ____aggregate type ____for base in stockpile accepted by the Department will be computed using the following formula:

$$\mathrm{PA}_{\mathrm{STKPL}\ 303} = (\mathrm{PF}_{\mathrm{STKPL}\ 303} - 1) \times \mathrm{Q_i} \times \mathrm{P}$$

Where:

$PA_{STKPL303}$ = Pay adjustment for all ____aggregate type ____for base in stockpile in dollars.

$PF_{STKPL303}$ = Per 106.B.3 and 109.09.

Q_i = Quantity represented by individual lot (n).

P = Contract unit price.

Note: The incentive may be a negative amount (i.e., a deduction from the total amount bid for the item).

ON PAGE 208, SUBSECTION 404.05 – BASIS OF PAYMENT

Add the following:

If the aggregate pay factor is less than 0.75, the material may be allowed to be left in place with a price adjustment if the finished product is found to be capable of performing its intended purpose. The price adjustment will be 50 percent of the contract unit bid price multiplied by the total quantity of material with a pay factor less than 0.75.

For surface treatment aggregate, the Engineer will use the lowest pay factor computed for any 1 sieve as the pay factor for that lot.

Calculation of Incentive/Disincentive. The incentive/disincentive dollar amount to be paid or deducted for all cover coat material class _____accepted by the Department, excluding material in stockpile and material with a pay factor less than 0.75 allowed to remain in place with a price adjustment, will be computed using the following formula:

$PA_{404} = (PF_{404} - 1) \times Q_i \times P$

Where:

PA_{404} = Pay adjustment for all cover coat material class _____in dollars.

PF_{404} = Per 106.B.3 and 109.09.

Q_i = Quantity represented by individual lot (n).

P = Contract unit price.

The incentive/disincentive dollar amount to be paid or deducted for all cover coat material class _____in stockpile accepted by the Department will be computed using the following formula:

$PA_{STKPL404} = (PF_{STKPL404} - 1) \times Q_i \times P$

Where:

$PA_{STKPL404}$ = Pay adjustment for all cover coat material class _____in stockpile in dollars.

$PF_{STKPL404}$ = Per 106.B.3 and 109.09.

Q_i = Quantity represented by individual lot (n).

P = Contract unit price.

Note: The incentive may be a negative amount (i.e., a deduction from the total amount bid for the item).

ON PAGE 556, SUBSECTION 635.05 – BASIS OF PAYMENT

Add the following:

For anti-skid material, the Engineer will use the lowest pay factor computed for any 1 sieve as the pay factor for that lot.

Calculation of Incentive/Disincentive. The incentive/disincentive dollar amount to be paid or deducted for all anti-skid material accepted by the Department, excluding anti-skid defined as small quantity, will be computed for each lot using the following formula:

$$PA_{635} = (PF_{635} - 1) \times Q_i \times P$$

Where:

PA_{635} = Pay adjustment in dollars.

PF_{635} = Per 106.B.3 and 109.09.

Q_i = Quantity represented by individual lot (n).

P = Contract unit price.

Note: The incentive may be a negative amount (i.e., a deduction from the total amount bid for the item).

QASP SA Table 106.03-1 – Material Subject to Statistical Based Acceptance

Material	Quality Characteristic	Test Method	Quality Characteristic Reported to	Quality Control Plan by the Contractor	Acceptance by the Department	
				Minimum Testing Frequency [a]	Minimum Testing Frequency [a]	Point of Sampling
301 Granular Subbase [f]	Gradation – 703.11	FOP for AASHTO T 27	0.01%	1 test per 5,000 Tons 1 test per 5,000 Tons	1 test per 5,000 Tons	From windrow or roadway
	Sand Equivalent	FOP for AASHTO T 176 (Alt. Method #2), Mechanical	See Note 2.	1 test per 5,000 Tons 1 test per 5,000 Tons	1 test per 5,000 Tons (pass/fail, no statistical analysis)	From windrow or roadway
303 Aggregate Base [f]	Gradation – 703.04	FOP for AASHTO T 27 with FOP for AASHTO T 11 (use wash method for all gradation measurements)	0.01%	1 test per 1,000 Tons 1 test per 1,000 Tons	1 test per 1,000 Tons	From windrow or roadway
	Sand Equivalent	FOP for AASHTO T 176 (Alt. Method #2), Mechanical	See Note 2.	1 test per 1,000 Tons	1 test per 1,000 Tons (pass/fail, no statistical analysis)	From windrow or roadway
	Fracture Count	FOP for AASHTO T 335, Method 1	See Note 2.	1 test per 1,000 Tons	1 test per 1,000 Tons (pass/fail, no statistical analysis)	From windrow or roadway
404 Cover Coat Material [f]	Gradation – 703.06	FOP for AASHTO T 27 with FOP for AASHTO T 11 (use wash method for all gradation measurements)	0.01%	1 test per 400 Tons 1 test per 400 Tons	1 test per 400 Tons	At point of loading to the roadway
	Cleanness Value	Idaho IT 72	See Note 2.	1 test per 400 Tons 1 test per 400 Tons	1 test per 400 Tons (pass/fail, no statistical analysis)	At point of loading to the roadway
	Fracture Count	FOP for AASHTO T 335, Method 1	See Note 2.	1 test per 400 Tons 1 test per 400 Tons	1 test per 400 Tons (pass/fail, no statistical analysis)	At point of loading to the roadway

Continued –QASP SA Table 106.03-1 – Material Subject to Statistical Based Acceptance						
Material	Quality Characteristic	Test Method	Quality Characteristic Reported to	Quality Control Plan by the Contractor	Acceptance by the Department	
				Minimum Testing Frequency [(a)]	Minimum Testing Frequency [(a)]	Point of Sampling
405 Superpave Class SP2 [(f)] [(g)]	Asphalt Content, P_b [(e)]	FOP for AASHTO T 168[(c)] and FOP for AASHTO R 47 and FOP for AASHTO T 308 and FOP for AASHTO T 329	0.01%	1 test minimum per 750 Tons	1 test per 750 Tons	FOP for AASHTO R 97 [(c)]
	Gradation[(e]	FOP for AASHTO T 168[(c)] and FOP for AASHTO R 47 and FOP for AASHTO T 30 (use wash method for all gradation measurements)	0.01%	1 test minimum per 750 Tons	1 test per 750 Tons	FOP for AASHTO R 97 [(c)]
	Fracture Count	FOP for AASHTO T 335, Method 1	See Note 2.	By the Contractor as needed to control the operation. 1 test minimum per 1,500 Ton	N/A	N/A
	Sand Equivalent	FOP for AASHTO T 176 (Alt. Method #2), Mechanical	See Note 2.	By the Contractor as needed to control the operation. 1 test minimum per 1,500 Tons	N/A	N/A
	Mainline Density, MLD [(d)]	FOP for AASHTO T 355 [(b)] or FOP for AASHTO T 343	0.01%	1 test minimum per 375 Tons	1 test per 375 Tons [(b)]	FOP for AASHTO R 97 [(c)]
	Recycled Asphalt Pavement	FOP for AASHTO T 308 and FOP for AASHTO T 30	See Note 2.	1 test minimum per 1,500 Tons	N/A	N/A

Continued –QASP SA Table 106.03-1 – Material Subject to Statistical Based Acceptance						
Material	Quality Characteristic	Test Method	Quality Characteristic Reported to	Quality Control Plan by the Contractor	Acceptance by the Department	
				Minimum Testing Frequency [a]	Minimum Testing Frequency [a]	Point of Sampling
405 Superpave HMA Class SP 3, and SP 5 [f] [g]	Asphalt Content, P_b [e]	FOP for AASHTO T 168[c] and FOP for AASHTO R 47 and FOP for AASHTO T 308 and FOP for AASHTO T 329	0.01%	1 test minimum per 750 Tons	1 test minimum per 750 Tons	FOP for AASHTO R 97 [c]
	Gradation [e]	FOP for AASHTO T 30 (use wash method for all gradation measurements)	0.01%	1 test minimum per 750 Tons	1 test minimum per 750 Ton	FOP for AASHTO R 97 [c]
	Maximum Specific Gravity, G_{mm} [e]	FOP for AASHTO T 168[c] and FOP for AASHTO R 47 and FOP for AASHTO T 209 (Bowl Method)	0.001	1 test minimum per 750 Tons	1 test minimum per 750 Ton	FOP for AASHTO R 97 [c]
	Bulk Specific Gravity of Compacted Mix, G_{mb} [e]	FOP for AASHTO T 168[c] and FOP for AASHTO R 47 and FOP for AASHTO T 312 and FOP for AASHTO T 166 (Method A)	0.001	1 test minimum per 750 Tons	1 test minimum per 750 Tons	FOP for AASHTO R 97 [c]
	Effective Specific Gravity of Combined Aggregate, G_{se} [e]	WAQTC TM 13	0.001	1 test minimum per 750 Tons	1 test minimum per 750 Tons	FOP for AASHTO R 97 [c]
	Air Voids @ N_{design}, P_a [e]	WAQTC TM 13	0.01%	1 test minimum per 750 Tons	1 test minimum per 750 Tons	FOP for AASHTO R 97 [c]
	VMA @ N_{design} [e]	WAQTC TM 13	0.01%	1 test minimum per 750 Tons	1 test minimum per 750 Tons	FOP for AASHTO R 97 [c]
	Dust Proportion, DP [e]	WAQTC TM 13	0.001	1 test minimum per 750 Tons	1 test minimum per 750 Tons	FOP for AASHTO R 97 [c]
	Mainline Density [d] [e]	FOP for AASHTO T 355 [b] or FOP for AASHTO T 343 For cores: FOP for AASHTO R 67; FOP for AASHTO T 166 Method A or FOP for AASHTO T 331	0.01%	1 test minimum per 375 Tons	1 test per 375 Tons [b]	Roadway [c]
	Recycled Asphalt Pavement	FOP for AASHTO T 308 and FOP for AASHTO T 30	See Note 2.	1 test minimum per 1,500 Tons	N/A	N/A
635 Anti-Skid Material in Stockpile [f]	Gradation – 703.10	FOP for AASHTO T 27 with FOP for AASHTO T 11 (use wash method for all gradation measurements)	0.01%	1 test per 1,000 Tons By the Contractor as needed to control the operation	1 test per 1,000 Tons	From crusher or if previously crushed, final stockpile location.

Note: 1. Refer to the QA Manual minimum test requirements for minimum testing not included in QASP SA Table 106.03-1.

[a] If the total quantity of material is less than the minimum testing frequency for 1 test from QASP SA Table 106.03-1, acceptance will be as specified in the QA Manual Section 270.04.

[b] When a test strip is not required, density acceptance is based on cores as specified in 405.L.

[c] Sampling from the plant is not permitted unless the planned quantity is less than 750 tons or during the acceptance test strip.

[d] The Department will use nuclear gauges. The Contractor may use nuclear or non-nuclear (i.e., electronic) gauges.

[e] Calculated value based on unrounded results.

[f] This material requires an approved quality control plan.

[g] If the total quantity of material is between 750 and 2,250 tons, the entire quantity of material will be considered a single lot and will be accepted as specified in 405.03.I.

2. This quality characteristic is not subject to statistical based acceptance. Refer to the QA Manual Table 275.01.1 for calculating and reporting requirements.

2024 Special Provision for 405 Superpave Hot Mix Asphalt (for use with 2023 Spec Book) 11/29/2023

ON PAGES 209-234, SECTION 405 – SUPERPAVE® HOT MIX ASPHALT

Delete this section, in its entirety, and replace with the following:

405.01 Description. Construct 1 or more courses of Superpave hot mix asphalt (HMA) plant mix, including leveling courses if applicable, on a prepared surface. References in this section also apply to warm mix asphalt (WMA).

405.02 Materials. Provide materials as specified in:

Aggregate 703

Asphalt 702

Anti-Stripping Additive 702

Hydrated Lime 720.06

Recycled Asphalt Pavement (RAP) 720.07

Test materials in accordance with the following applicable standard methods:

Particle Size Distribution of Aggregate .... FOP for AASHTO T 27

With Materials Finer than 75um (No. 200) Sieve
in Mineral Aggregate by Washing .... FOP for AASHTO T 11 Method A or B

Mechanical Analysis of Extracted Aggregate .... FOP for AASHTO T 30

Preparing and Determining the Density of Hot Mix Asphalt (HMA)
Specimens by Means of the Superpave Gyratory Compactor .... FOP for AASHTO T 312

Superpave Volumetric Design for Hot Mix Asphalt (HMA) .... AASHTO R 35

Determining the Percentage of Fracture in
Coarse Aggregate .... FOP for AASHTO T 335 Method 1

Percent Air Voids in Compacted Dense
and Open Bituminous Paving Mixtures .... AASHTO T 269

Theoretical Maximum Specific Gravity and
Density of Bituminous Paving Mixtures .... FOP for AASHTO T 209 Bowl Method

Bulk Specific Gravity of Compacted Bituminous
Mixtures Using Saturated Surface Dry Specimens .... FOP for AASHTO T 166 Method A

Pavement Straightedge Procedures .... Idaho IR 87

In-Place Density of Asphalt Mixtures by Nuclear Methods .... FOP for AASHTO T 355
Backscatter mode

Sampling Asphalt Mixtures after Compaction (Obtaining Cores) .... FOP for AASHTO R 67

Determining Volume of Liquids in Horizontal or Vertical Storage Tanks .... Idaho IT 120

Acceptance Test Strip for Hot Mix Asphalt (HMA) Pavement .... Idaho IR 125

Sampling of Aggregate……………………… ……………………… …………….FOP for AASHTO R 90

Standard Practice for Operating Inertial Profilers and
Evaluating Pavement Profiles ....AASHTO R 57

Determining the Asphalt Binder Content
of Hot Mix Asphalt (HMA) by the Ignition Method .... FOP for AASHTO T 308

Sampling Asphalt Mixtures...AASHTO R 97
(See QA Manual Section 270 for sampling method)

Reducing Samples of Hot Mix Asphalt to Testing Size .... FOP for AASHTO R 47

Moisture Content of Hot Mix Asphalt (HMA) by Oven Method..................... FOP for AASHTO T 329

Plastic Fines in Graded Aggregate and Soils By Use of the
Sand Equivalent Test .... FOP for AASHTO T 176
Alternate Method #2, Mechanical, Pre-wet

Standard Method of Test for Compressive Strength of Hot Mix Asphalt....................AASHTO T 167

Standard Test Method for Effect of Water on Compressive Strength
of Compacted Bituminous Mixtures (Immersion-Compression) .... ASTM D1075
(Replace ASTM D1074 and ASTM D2726 with AASHTO T 167 and AASHTO T 166)

Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage ....AASHTO T 283

Uncompacted Void Content of Fine Aggregate, Method A ....AASHTO T 304

Mixture Conditioning of Hot-Mix Asphalt (HMA) ....AASHTO R 30

Sampling Asphalt Materials... FOP for AASHTO R 66

Determining Rutting Susceptibility of Asphalt Pavement
Mixture Using the Asphalt Pavement Analyzer (APA)..AASHTO T 340

Superpave Volumetric Mix Design .... AASHTO M 323

Evaluation of the Superpave Gyratory Compactor (SGC)

Internal angle of Gyration Using Simulated Loading ....AASHTO T 344

Standard Test Method for Flat Particles, Elongated Particles,
or Flat and Elongated Particles in Coarse Aggregate ....Idaho FOP for ASTM D4791
(ratio of length to thickness equal to or greater than 5:1)

Bulk Specific Gravity and Density of Compacted Asphalt Mixtures
Using Automatic Vacuum Sealing Method...AASHTO T 331

Standard Practice for Rapid Drying of Compacted
Asphalt Specimens Using Vacuum Drying Apparatus ....AASHTO R 79

Standard Test Method for Maximum Specific Gravity and Density of
Bituminous Paving Mixtures Using Automatic Vacuum Sealing Method .... ASTM D6857

Specific Gravity and Absorption of Aggregate
Using Automatic Vacuum Sealing Method..Idaho IT 144

Quantitative Extraction of Bitumen from Bituminous Paving Mixtures ....AASHTO T 164

Quantitative Extraction and Recovery of Asphalt Binder from
Asphalt Mixtures ....AASHTO T 319

Lime for Asphalt Mixtures........AASHTO T 303

Determination of Recycled Asphalt Pavement (RAP)
Aggregate Dry Bulk Specific Gravity (G_{sb}) ....Idaho IT 146

Standard Test Method for Automated Extraction of Asphalt Binder
From Asphalt Mixtures (Asphalt Analyzer™) .... ASTM D8159

Standard Method of Test for Determination of Cracking
Tolerance Index of Asphalt Mixture Using the Indirect
Tensile Cracking Test at Intermediate Temperature .... ASTM D8225

Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA) ....AASHTO T 324

Stratified Random Sampling........ Idaho IR 148

Superpave Mix Design .... Idaho IR 150

Superpave Mix Design Evaluation........ Idaho IR 151

HMA Quality Control Plan Development and Implementation .... Idaho IR 152

Split Sample Comparison........ Idaho IR 153

Nuclear Density Gauge Correlation........ Idaho IR 154

Procedures for Checking Asphalt Drum Mix Plant Calibrations .... Idaho IR 155

Method for Determining Rolling
Gmm........Idaho IR 156

NCAT Correction Factor........ Idaho IR 157

Evaluation and Approval of HMA Plants........ Idaho IR 160

Provide Superpave HMA composed of a combination of aggregate, approved additives, mineral filler (if required), RAP (if used), WMA additives or process (if used), and performance graded (PG) asphalt binder material. Provide a job mix formula (JMF) reported on ITD-0774 and a Superpave HMA pavement as specified and meeting the requirements in this section, 703, and 720.

Table 405.02-1 – Superpave Mixture Requirements

Mixture Type	**SP 2 (50 gyrations)**	**SP 3 (75 gyrations)**	**SP 5 (100 gyrations)**
Design ESALs [(a)] (millions)	< 1	1 < 10	≥ 10
Gyratory Compaction Gyrations for N_{ini} Gyrations for N_{des} Gyrations for N_{max}	 6 50 75	 7 75 115	 8 100 160
Relative Density, % G_{mm} @ N_{ini}	≤ 90.5	≤ 89.0	≤ 89.0
Relative Density, % G_{mm} @ N_{des}	96.0	96.0	96.0
Relative Density, % G_{mm} @ N_{max}	≤ 98.0	≤ 98.0	≤ 98.0

Air Voids, % P_a	4.0	4.0	4.0
Dust Proportion Range [b]	0.6 – 1.4	0.6 – 1.4	0.6 – 1.4
Voids Filled with Asphalt (VFA) Range, % 1½" 1" ¾" ½" ³/₈" #4	 64 – 80 65 – 78 65 – 78 65 – 78 65 – 78 67 – 79	 64 – 75 65 – 75 65 – 75 65 – 75 73 – 76 67 – 77	 64 – 75 65 – 75 65 – 75 65 – 75 73 – 76 67 – 77
Rut Depth, mm [c]	≤ 10.0 mm	≤ 10.0 mm	≤ 10.0 mm
Stripping, passes [d]	12,500	15,000	15,000
Cracking Test, IDEAL-CT_{Index} [e]	80 (index value)	80 (index value)	80 (index value)

[a] The anticipated project traffic level expected on the design lane over a 20 year period. Regardless of the actual design life of the roadway, determine the design ESALs for 20 years.

[b] For No. 4 nominal maximum size mixtures, the dust proportion is 1.0 to 2.0 for SP 2 mixes and 1.5 to 2.0 for SP 3 and SP 5 mixes. For coarse graded ³/₈, ½, and ¾ inch nominal maximum size mixtures, the dust proportion is 0.6 – 1.5. (Fine and coarse graded mixtures are defined in 703.05).

[c] Maximum depth after specified number of stripping passes. The Hamburg must have passing test results in the mix design.

[d] Minimum number of passes with no stripping inflection point. The Hamburg must have passing test results in the mix design.

[e] The Ideal-CT value and the associated data generated will be included in the mix design submittal; the data will only be used for information.

Approved SP 3 mixes may be substituted for SP 2 mixes. Use the binder content corresponding to 3.5 percent air voids. Adjust the SP 3 mix binder content by selecting the binder content that achieves 3.5 percent air voids at 75 gyrations from the binder content versus air voids graph of the approved mix design and target this binder content in the C-JMF. The SP 3 mix will be tested during production and accepted as an SP 2 mix (i.e., measuring binder content and gradation) when a substitution is made and the SP 2 VFA value will be used.

Use a QPL anti-stripping additive, if needed. Determine the amount of liquid anti-stripping additive or lime required by performing AASHTO T 324 during the mix design development.

1) Warm Mix Asphalt (WMA). WMA is defined as HMA that is produced at a target discharge temperature of 275 °F or less using QPL WMA additives or processes. WMA is allowed for use. QPL WMA additives or processes may be used to facilitate mixing and compaction of HMA produced at target discharge temperatures above 275 °F; however, such mixtures will not be defined as WMA.

   Use additives or processes from the QPL. Follow the supplier's or the manufacturer's written instructions for additives and processes when producing WMA mixtures.

   Use equipment and WMA technologies capable of producing an asphalt mixture that meet specifications and is workable at the minimum placement and compaction temperature desired, regardless of storage or haul distance considerations.

Produce Superpave WMA by 1 or a combination of several QPL-approved technologies including chemical, foaming, and organic processes.

The Department and the Contractor will prepare Superpave WMA field samples, as recommended by the manufacturer's representative, for WMA mixture testing.

2) Recycled Asphalt Pavement (RAP). The Department will allow RAP in the Superpave HMA. Provide RAP as specified in 720.07. Produce the mixture as specified in 405. Select the mass of RAP, the type of RAP, and the extent of RAP processing necessary to meet specifications. The Department will not change specifications or the contract unit price if RAP is used in the mixture.

If RAP material is to be used from the project, obtain a representative sample of material for the mix design.

The mass of RAP used in Superpave HMA is the mass of asphalt binder, in percent that the RAP contributes to the total mass of binder in the mixture.

Use the following equation to determine the percent of RAP

by weight of mix: X% = c (a/b)

Where:

a = optimum asphalt content, percent in mixture to produce 4.0% air voids.

b = percent asphalt content in the RAP (from chemical extraction and/or FOP for AASHTO T 308 burn with asphalt binder correction factor).

c = percent of RAP binder by weight of the total binder

desired in the mix. X = desired RAP percent by total weight

of mix.

The following is an example of the calculation:

Total RAP binder desired equals 17% of total binder in the mixture. If RAP will contribute 5.1% asphalt content and the optimum asphalt content is 5.8%, then:

X% = 17% * (5.8/5.1) = 19.3% RAP percent by total weight of mix.

3. Recycled Asphalt Shingles (RAS). RAS is not allowed in any Superpave HMA.

4. Re-refined Engine Oil Bottoms (REOB). REOB is not allowed in any Superpave HMA.

5. Crumb Rubber Modifier (CRM). CRM is not allowed in any Superpave HMA.

405.03 Construction Requirements.

A. Specific Gravity of Aggregates and RAP. The Department will determine the bulk dry specific gravity of aggregate, G_{sb}, apparent specific gravity of aggregate, G_{sa}, and water absorption (by percent weight of dry aggregate) of the coarse and fine aggregate for each stockpile used in the mixture using AASHTO T 85 and Idaho IT 144. The Department will evaluate the RAP G_{sb}, if used, by determining the RAP G_{se} in accordance with Idaho IT-146. The Department will determine the specific gravity of aggregates and RAP at a minimum of once a calendar year for each stockpile.

1. Sampling Requirements. The date, time, and location of sampling will be agreed to by the Engineer and the Contractor. The Contractor will sample the aggregate stockpiles and RAP stockpiles to be used in the mix design in accordance with FOP for AASHTO R 90 and reduce in accordance with FOP for AASHTO 76. Obtain samples from at least 6 distinct locations within each stockpile. When project millings are used, obtain samples of the project millings to be used in the mix design from the sampling location specified in the approved HMA quality control plan. Sample, combine, and reduce the material for each stockpile to the Department's required material submittal size in the Engineer's presence. Immediately give possession of the samples to the Engineer.
2. Submittal Requirements. Provide blend sheets for the mixture proportions and submit the following:
   a. Aggregate Stockpile. For each aggregate stockpile, submit:
      i. 100 pound minimum sample in clean 5-gallon plastic buckets with airtight lids.
         (1) Each bucket must weigh no more than 50 pounds.
      ii. A summary of all QC test data used to develop average stockpile gradation.
      iii. A summary of all QC test data of G_{sb}, G_{sa}, and water absorption (by percent weight of dry aggregate) of the coarse and fine aggregate produced during stockpile production.
      iv. Source number.
   b. RAP Stockpile. For each RAP stockpile, submit:
      i. 100 pound minimum sample in clean 5-gallon plastic buckets with airtight lids.
         (1) Each bucket must weigh no more than 50 pounds.
      ii. All QC test data used to develop average stockpile gradation.
      iii. Report the asphalt binder/aggregate correction factor for asphalt binder and gradation for each RAP stockpile as specified in 720.
3. Testing Timeframe. The Department will not begin testing until the complete submittal has been received. The Engineer will provide the Contractor with an aggregate test report (i.e., ITD-802 form) within 7 business days after receiving the complete submittal package. G_{sb} testing will be performed by either the Headquarters Lab or a District Lab. A Contractor's representative may be present during the G_{sb} testing, if requested. Retesting, at the Contractor's request, will require an additional 15 business days for re-evaluation. Additional materials and additional information may be required from the Contractor. The Contractor may request a retest only if the QC data submitted supports retesting.

The Contractor will use the established G_{sb} in the mix design calculation, the mix design report, and for production paving testing.

The Engineer will use the established G_{sb} and G_{sa} during the mix design submittal evaluation, acceptance test strip testing, production acceptance testing, and challenge testing.

If the G_{sb} changes during production more than 0.030, as determined by the Engineer, the Engineer will notify the Contractor. The Engineer will establish a new G_{sb} and re-evaluate the mix design as specified in 405.03.B. All subsequent mix produced after the Contractor has been notified of the new G_{sb} will use the newly established G_{sb}. If at any time testing indicates that G_{sa} is greater than or equal to G_{se} and/or G_{se} is greater than or equal to G_{sb} (i.e., $G_{sa} \geq G_{se}$ and/or $G_{se} \geq G_{sb}$) is not true, production will be halted and a new G_{sb} will be established in accordance with this section.

Following bid award, and before HMA mix design submittal, small areas within the project site may be milled to collect RAP for pre-mix design testing. Perform this work according to a 405.03.C. HMA quality control plan, approved by the Engineer, including the plan and methods to sample and process RAP. At a minimum, for pre-milling the HMA quality control plan will include:

1. An approved traffic control plan that will minimize disturbance to traveling public.
2. Identification of no more than 6 RAP sampling locations within the project site. Each location must be less than 100 feet long with a maximum of 1 lane wide, unless otherwise approved.
3. The milling depth of each location must not be deeper than that shown in the plans for each location.
4. Patching plan.
5. Patch maintenance plan.
6. Detailed narrative of processing of milling and sampling locations to ensure representative samples are obtained.

After processing, sample for G_{sb} and asphalt content testing in accordance with the FOP for AASHTO R 90 and
405.03.A.

B. Mix Design. Develop a Superpave mix design in accordance with Idaho IR 150 to determine the appropriate combination of aggregate, approved additives, mineral filler (if required), RAP (if used), WMA additives or process (if used), and performance graded (PG) asphalt binder material meeting the requirements in 405, 703, and 720. The grade of asphalt is specified on the plans. Mix designs will be designed with a minimum of three virgin stockpiles. The Contractor may also "bump" this PG binder with the following restrictions: the selected PG binder may be one grade lower than the low PG grade temperature. A binder may be selected one grade higher than the upper PG grade temperature if it meets the intermediate testing (G*(sin δ)) of the specified binder grade. Binder adjustments/"bumps" must meet the contract requirements at no additional cost to the Department. (Examples: A specified PG 58-28 may be bumped to PG 58-34. A specified PG 58-28 binder may be bumped to PG 64-28 if it meets the G*(sin δ) requirements of the specified binder. A specified PG 58-28 binder may be bumped to PG 64-34 if it meets the requirements of the specified binder.)

1. Approved Mix Design. A mix design must be approved before use using the following process:
   a. Mix Design Submittal. Submit the mix design and all supporting documentation in accordance with Idaho IR 150 a minimum of 5 business days before paving is scheduled to begin. Email to mixdesigns@ITD.idaho.gov and submit to the Engineer. Only 1 mix design per email notification will be accepted.
   b. Mix Design Submittal Evaluation. The Engineer in conjunction with the District Materials Engineer, the Construction and Materials section, and the Central Materials Laboratory will evaluate the mix design in accordance with Idaho IR 151. The

Engineer will provide the Contractor with written approval or rejection of the mix design within 5 business days after receiving the full submittal package.

i. Mix Design Submittal Approval. Once the mix design submittal is approved by the Department, and the FOP AASHTO T-308 correction factor samples have been submitted as per 405.03.B.3 the Contractor may proceed with acceptance test strip using the JMF from the approved mix design submittal. The mix design will be approved for use for up to 2 calendar years from the date of test strip acceptance.

ii. Mix Design Submittal Rejection. Rejection of the mix design will require:

(1) The mix designer will amend the mix design to address the items noted in the notification of rejection. The Contractor will resubmit the mix design as specified in 405.B.2. The Department will re-evaluate the mix design for approval or rejection as specified in 405.B.3.

(2) Develop and submit a new mix design as specified in 405.B.

2. Approved Mix Design Expiration. An approved mix design, associated JMF, and any associated C-JMF will be considered expired when one of the following situations occur (but not limited to):

a. More than 2 calendar year has elapsed from the time of test strip acceptance for the mix design.

b. Changes in stockpile gradation.

c. Changes in aggregate specific gravity or absorption.

d. Changes in RAP specific gravity.

e. Changes in aggregate, RAP, or binder sources.

f. Aggregate does not meet physical requirements specified in 703.

g. Changes in additives, including a change in the dosage rates.

h. Repeated non-conformance as defined in 405.03.M.1.

3. The Contractor will use FOP AASHTO T-308 to prepare Minimum of 18 hand mixed JMF correction factor samples and four "blank" samples for a Plant Mix design that will be used for one year. The contractor must allow the Engineer to witness samples being prepared and mixed. Each sample will be a virgin aggregate and virgin oil sample constructed to the same NCAT blank proportion. A prebatch meeting will be held 48 hours before starting to mix the samples. In addition to FOP AASHTO T-308 the Engineer will require the following:

a. Virgin aggregate will be graded per each individual sieve through the minus #200 or 95% retained or greater whichever comes first,

b. Batch two individual virgin aggregate sample specimens. Perform FOP AASHTO T11 and FOP AASHTO T27 on the samples and determine the difference between target and actual values. Determine what masses need to be adjusted to get back to the target on each sieve size. Batch two more individual sample specimens using the adjusted masses, repeat until washed gradation matches JMF.

c. RAP will not be added to the sample.

d. T-308 samples will target JMF blended gradation values and oil values.

e. Establish a correction Factor for each JMF. This procedure must be performed for every ignition furnace on a project and for each JMF before any acceptance or verification testing is started.

A new correction factor is required if the source or grade of the asphalt cement changes, if a different ignition furnace is used, or for a new JMF. A new correction factor shall be determined for each JMF and each oven prior to its first use every calendar year.

Prepare 23 correction factor samples at the JMF without asphalt cement and with the appropriate proportions of mineral filler, fibers or other additive included in the JMF. (For JMFs with RAP, batch the virgin aggregate to the JMF targets. The Recycled Asphalt Materials will not be used for batching correction Factor samples.)

- Batch each sample separately and according to the JMF target values with the following tolerances

Batching Tolerances "Virgin Aggregate and Add Asphalt Cement"

Sieve Size	**Allowable Difference**
Larger than (No. 8)	±3.0%
Size (No. 8)	±2.0%
Larger than (No. 200) and smaller than (No. 8)	±1.0%
Size (No. 200) and smaller	±0.5%
Asphalt Cement	±0.10%

- The "blank" sample shall have the same gradation, but no asphalt cement shall be added. This "blank" samples will be used to establish correction factors for the aggregate gradations. The "blank" samples is not burned. The engineer will select the four samples after all samples have been built to the same gradation and before any asphalt has been added. Provide sample sizes meeting the requirements of AASHTO T 308.
- Mix and discard one of the remaining 19 samples. The purpose of this sample is to "butter" the mixing bowl.
- For the remaining 18 (or more) samples, tare the mixing bowl and weigh the mixing bowl again after the mixture is removed from the bowl. The empty bowl must be within ±1 gram of the previous tare weight. The weights of the bowl before and after will be done within 10°F of each other. The Engineer will randomly select four samples for test strip lab, four samples for production testing lab, four samples for contractor, four samples for dispute testing, and two sample for HQ lab for info only testing.
- Individually identify each calibration sample and supply documentation showing the actual weights of aggregate, asphalt cement, mineral filler, fibers or any other additive for each sample and resultant actual calculated asphalt cement content for each sample. Also provide documentation for each sample verifying that the empty bowl weight after mixing is within ±1 gram of the empty bowl weight prior to mixing.

The gradation correction factor for each sieve size is the difference between the result from the “blank” sample and the average of the two incinerated correction samples to the nearest 0.1%.

If the correction factor for any single sieve size exceeds the allowable difference for that sieve established in the following table, contact the Engineer. The Engineer will apply the gradation correction factors for all sieves.

Gradation Difference Tolerances

Sieve	**Allowable Difference**
Sizes larger than (No. 8)	±5.0%
Size (No. 8)	±4.0%
Sizes larger than (No. 200) and smaller than (No. 8)	±2.0%
Size (No. 200) and smaller	±1.0%

Ignition oven specimen verification. The Department will perform FOP AASHTO T11 and FOP AASHTO T27 on the “blank” samples and compare the results to the JMF. If the gradation varies by more than the allowable difference in table Batching Tolerances “Virgin Aggregate and Add Asphalt Cement” the AASHTO T308 correction factor samples will be discarded and new AASHTO T308 correction factor samples will be made.

- The Department may sample aggregate being used to make the AASHTO T308 during the specimen batching process. The sample will be delivered to either the Headquarters Lab or a District Lab for verification Gsa testing. The verification Gsa test results will be compared to the Gsa test results determined prior to Mix Design approval. For coarse materials tested using AASHTO T 85, the difference in values must not vary by more than 0.035 and the fine Gsa aggregate tested using IT 144 must not vary by more than 0.015. If the differences in Gsa values for both course and fine aggregates are not within tolerance, FOP AASHTO T 308 correction factor samples will be discarded and new AASHTO T308 samples will be made using aggregates that can be proven to have come from the aggregate source described in the mix design documents. The Gsa differences will be recorded on Source Verification Form, ITD 4666.

Conduct all NCAT AASHTO T 308 ignition furnace correction factor determination and AASHTO T 308 asphalt content ignition furnace testing at 426 ± 5°C (800 ± 9°F). Manually record the furnace temperature (set point) before the initiation of the test if the furnace does not record automatically.

The JMF correction factor samples will be collected by the Engineer a minimum of 5 business days before test strip.

C. HMA Quality Control Plan. Develop and submit for approval a HMA quality control plan that complies with the requirements of Idaho IR 152, Idaho IR 155, Idaho IR 160, and 106.03.A.2. The Contractor HMA quality control plan must be approved by the Engineer in accordance with 106.03.A.2, Idaho IR 152, Idaho IR 159, Idaho IR 160, and Idaho IR 155 before the material is incorporated into the work/project.

D. Weather Limitations for Permanent Paving. Do not place Superpave HMA on a wet or frozen surface or when weather or surface conditions will otherwise prevent the proper handling or finishing of the Superpave HMA material. Place Superpave HMA as specified in the temperature limitations in Table 405.03-2.

Table 405.03-2 – Air and Surface Temperature Limitations

Compacted Thickness of Individual Courses	Top Course	Leveling and Courses Below the Top Course
Less than 0.10 foot	60 °F	50 °F
0.10 to 0.18 foot	50 °F	40 °F
Greater than 0.18 foot	40 °F	40 °F

Provide a paved surface for travel if the work extends into the winter. Do not start construction on the pavement surface, unless the progress schedule realistically shows the pavement can be replaced or completed within the temperature limitations listed above.

E. Mixing Plants. Use an approved mixing plant that complies with Idaho IR 160 and in accordance with the approved HMA Quality Control Plan. Meet the requirements of Idaho IR 155, with the exception that the Contractor may calibrate the asphalt plant according to current National Asphalt Pavement Association (NAPA) manuals and documented best practices or in accordance to the manufacturer's recommendations. The Contractor will provide the calibration documentation (e.g., manufacturer's recommendation) to the Engineer.

F. Hauling Equipment. Provide hauling equipment in accordance with the approved HMA Quality Control Plan.

G. Paver. Provide a paver that complies with the approved HMA Quality Control Plan.

H. Pre-Paving Meeting. Immediately before paving, the Contractor, the asphalt supplier, the Engineer, and the Department personnel involved in the paving operation will hold a pre-operational paving meeting to discuss how to achieve the highest quality surface. The Engineer will prepare minutes of the pre-operational paving meeting and distribute them to the attendees. Any requests to revise the minutes must be made to the Engineer within 7 business days of receipt. These minutes will constitute the final record of the pre-operational paving meeting.

I. Acceptance Test Strip (Lot 1). Note: If a C-JMF has been accepted, this section does not apply because a test strip has already been accepted. Construct an acceptance test strip of 200 to 750 tons in accordance with Idaho IR 125 using the approved JMF (including offsite test strips). The Department does not require acceptance test strips on small quantity pavement less than 750 tons, nonstructural pavement, or temporary pavement.

The Engineer will base acceptance on the requirements in Table 405.03-4. Do not continue production paving until properties of the acceptance test strip are accepted and a C-JMF has been established as specified in 405.03.K.

1. Test Strip Location. The first day of production paving will be considered the acceptance test strip. The Contractor may elect to perform an offsite mix verification of the JMF. Do not use Department-owned or controlled sources for offsite testing.
2. Testing Timeframe. The Department will require 5 full business days from the time of receipt of Superpave HMA mix samples, core samples, and cold feed samples to perform acceptance testing. Time will begin when all the required samples and associated paperwork needed to perform the specified testing are in the Engineer's possession.

3. Acceptance Testing Lab. Acceptance testing for the acceptance test strip will be performed by either the Headquarters Lab or a District Lab. The Contractor will give 48 hour notice to the Engineer prior to test strip.
4. Test Strip Tolerance. The Engineer will apply the tolerances to the acceptance test strip test properties as specified in Table 405.03-4 to establish the upper specification limit (USL) and lower specification limit (LSL) for quality level analysis.

Table 405.03-4 – Acceptance Test Strip Tolerance

Quality Characteristic	Test Strip Mix Tolerance
VMA, %	703.05 minimum value-0.20
Laboratory Air Voids, %	4.0 ± 1.5
Asphalt Binder Content, %	JMF ± 0.40
Dust Proportion (DP)	Table 405.02-1 range ± 0.10
VFA, %	Table 405.02-1 range ± 5
No. 4 and larger sieves, %	JMF value ± 6.0 [a]
No. 8 to No. 30 sieves, %	JMF value ± 5.0 [a]
No. 50 to No. 100 sieves, %	JMF value ± 4.0 [a]
No. 200 and smaller sieves, %	JMF value ± 2.0 [a]
G_{mm}	JMF value at P_b ± 0.012 [d]
G_{se}	JMF value ± 0.012 [d]
Mainline Density, % Compaction	92.0 – 100.0
Rut Depth, mm [b]	10.0 mm maximum [d]
Stripping, passes [c]	12,500/15,000 [d]
Cracking Test, IDEAL-CT_{Index}	80 (index value) [d]

[a] The upper and lower specification limits are never allowed to be outside the control points specified in 703.05.
[b] Maximum depth after 12,500/15,000 passes. For information only.
[c] Minimum number of passes with no stripping inflection point.
[d] For information only.

If the acceptance test strip is considered acceptable, the Contractor may proceed to production paving once a C-JMF is established as specified in 405.03.K.

The Engineer will reject an unacceptable test section for SP 3 and SP 5 mixtures and require removal. The Department will not pay for the removal or the applicable contract pay item quantities. An unacceptable test section for an SP 2 mixture will be subject to rejection. If the Engineer determines the failed SP 2 test section may remain in place, the Contractor may leave the test section in place with a 50 percent reduction in price or remove the failed material and replace it with acceptable material and receive full payment. Remove the failed SP 2 test section if rejected. The Department will not pay for removal or for the applicable contract pay item quantities.

If the Contractor is unable to meet the requirements after 3 test strips, the Engineer will require a new mix design to meet specifications. Place a new acceptance test strip at no additional cost to the Department.

If the Contractor’s testing determines the test strip fails and the Contractor chooses to proceed with another test strip before receiving the Engineer’s results, the Engineer will not complete testing of the test strip in question and the failed test strip will count as a failed test strip.

Statistical Acceptance and payment for the Test Strip. Use the statistical method outlined in 106.03.B. for evaluating acceptance and payment for the test strip. For material with a percent within limits (PWL) 40 and greater, use a 1.0 pay factor. If any quality characteristic, except Gmm or Gse, has a PWL less than 40, the asphalt mix will be rejected.

J. Production Laboratory Comparison Process. The Contractor, the lab performing test strip testing, and the lab performing acceptance testing will perform a split sample comparison testing during test strip, or before, split sample can either be one of the test strip samples or a separate sample. Previously used designs will perform split sample comparison on, or before the first day of production paving. The split sample comparison will be performed using Idaho IR 153.

1. The Contractor or the Engineer may request split sample comparison testing at any time during the project

K. C-JMF. Once a JMF is confirmed at acceptance test strip, the Contractor will establish an initial C-JMF.

1. Adjusting the C-JMF. C-JMF adjustments are allowed that will result in improved mix quality characteristics. If a lot is currently in progress, the adjustment will go into effect at the beginning of the next lot.
    a. Adjustments within Table 405.03-5. Adjustments listed in Table 405.03-5 can be made to the JMF. Provide a detailed description of how these adjustments will be made and what quality characteristics will be affected. The Engineer will be notified within 24 hours of adjustments and descriptions.

Table 405.03-5 – C-JMF Adjustment Limit Table

Parameter	Adjustment
No. 4 (4.75 mm) and greater	± 3% from JMF
No. 8 (2.36 mm)	± 2% from JMF
No. 100 to No. 30 (0.600 mm)	± 2% from JMF
No. 200 (0.075 mm)	± 0.3% from JMF
Asphalt Content	± 0.2% from JMF
G_{mm}	± 0.010 from C-JMF (c)
G_{se}	± 0.010 from C-JMF (c)
Individual Cold Feed Percentage for Aggregate	± 10.0% from JMF (a) (d)

Cold Feed Percentage for RAP	- 10.0% from JMF [b] [d]

[a] The cold feed percentage of any aggregate may be adjusted up to 10 percentage points from the amount listed on the JMF, however no aggregate listed on the JMF will be eliminated.

[b] The cold feed percentage for RAP may be reduced up to 10 percentage points from the amount listed on the JMF and must not exceed the percentage of RAP approved in the JMF or for the specific application under any circumstances.

[c] Based on the initial C-JMF.

[d] Individual cold feed percentages for aggregate and RAP greater than 5.0% for a single stock pile of the same product must have a new correction factor established in accordance with IR 157.

b. Adjustments outside of Table 405.03-5. Adjustments outside the limits listed in Table 405.03-5 can be requested, but these adjustments are considered significant adjustments and will require the Contractor to document any differences in the asphalt plant settings necessary to achieve the designed asphalt plant output as documented by acceptance test results. Thus, additional supporting documentation and justification must be submitted and how these adjustments will affect on the quality characteristics of the asphalt mix. Adjustments and descriptions must be submitted for the Engineer's prior approval and the Engineer will have 1 business day after the date the request was submitted.

Use the C-JMF to establish target values and control limits when producing control charts during production paving.

L. Tack Coat. Apply an asphalt tack coat as specified in 401 to the following surfaces:

1. Existing plant mix surfaces and to the surface of each course constructed, except the final course.
2. Surfaces of curbing, gutters, manholes, portland cement pavement, and other structures. Paint or spray a thin, uniform tack coat of asphalt before placing pavement against the surfaces.
3. Contact surfaces of transverse joints and cold longitudinal joints just before additional mixture is placed against previously laid material.

M. Production Paving. Before production milling, obtain approval for Superpave HMA mix design(s). Milling, coring, or sampling for preliminary sample collection will be allowed for mix design development in accordance with the QCP.

The Contractor may request to continue production paving in accordance with the C-JMF after the acceptance test strip (Lot 1) is approved. Superpave HMA paving acceptance during production is based on the requirements in Table 405.03-6. The production paving lot (Lot 2) following the accepted test strip will be based on Table 405.03-4 except the gradation requirements. The Contractor will produce and place mix in accordance with the approved QCP.

If aggregate or asphalt binder sources change from the approved mix design, develop a new mix design as specified in 405.03.B. at no additional cost to the Department. If the G_{sb} changes during production more than 0.030, the Engineer may establish a new G_{sb} and re-evaluate the mix design.

1. Conformance to the C-JMF. The Contractor will produce mix that meets the requirements of Table 405.03-6. The Contractor may elect to remove defective material and replace it with new

material on a lot basis, at no additional cost to the Department to ensure conformance to the C-JMF.

a. Isolated Non-Conformance. If the Contractor is unable to meet the requirements on a single lot, the Engineer will require the Contractor to stop production and/or delivery until a corrective action plan can be developed and implemented to remedy the non-conformance. Submit the corrective action plan to the Engineer before resuming work.

b. Repeated Non-Conformance. If the Contractor is unable to meet the requirements on 2 consecutive lots, the C-JMF, mix design, and associated JMF will be considered expired as defined in 405.03.B.2. The Engineer will require a new mix design to meet the specifications in 405.03.B. at no additional cost to the Department.

If aggregate or asphalt binder sources change from the approved mix design, develop a new mix design to meet the specifications in 405.03.B. at no additional cost to the Department.

2. Production Limits**.** The properties listed in Table 405.03-6 will be used for purpose of quality analysis calculations, acceptance, and payment. The Engineer will apply the tolerances to the properties as specified in Table 405.03-6 to establish the upper specification limit (USL) and lower specification limit (LSL) for quality level analysis.

3. Production Acceptance Criteria. The Engineer will perform quality level analysis and determine acceptance as specified in 106.03.B using the quality characteristics specified in Table 405.03-6. ITD will submit test results to contractors as soon as possible.

Table 405.03-6 – Production Paving Quality Limits

Mix Quality Characteristic	**Limits**
SP 2 Mixture	
No. 4 sieve and larger sieves, %	C-JMF value ± 5.0 [(a)]
No. 8 to No. 30 sieves, %	C-JMF value ± 4.0 [(a)]
No. 50 to No. 100 sieves, %	C-JMF value ± 3.0 [(a)]
No. 200 sieve and smaller sieves, %	C-JMF value ± 1.5 [(a)]
Asphalt Binder Content, %	C-JMF value ± 0.3
SP 3 and SP 5 Mixtures	
Laboratory Air Voids, % N_{design}	SP 3: 2.5 – 5.0% SP 5: 2.8 – 5.0%
VMA, % N_{design}	703.05 minimum value
Dust Proportion	Table 405.02-1Range
G_{se} [(f)]	C-JMF value ± 0.012 [(g)]
G_{mm} [(e, f)]	C-JMFvalue@ P_b± 0.012 [(g)]
Rut Depth, mm	10.0 maximum [(b, c)]
Stripping, passes	12,500/15,000 [(b, d)]
Cracking Test, IDEAL-CT_{Index}	80 (index value)[(b)]
Roadway Quality Characteristic	**Limits**
Mainline Density, % Compaction	92.0 –100.0

[a] The upper and lower specification limits are never allowed to be outside the control points specified in 703.05.
[b] Hamburg and Ideal-CT are for information only at this time.
[c] Maximum depth after 15,000 passes.
[d] Minimum number of passes with no stripping inflection point.
[e] G_{mm} tests must be performed only after a 2-hour oven cure time in accordance to the mix design requirements to limit test result variability.
[f] G_{mm} and G_{se} values are indicators of consistency of the asphalt mix and are tracked using PWL. G_{mm} and G_{se} will be monitored for information only and, if the PWL is less than 40, the Engineer and the Contractor will review the data and take appropriate action (e.g., review plant settings, review test results). There will be no deduction for a low PWL based on G_{mm} or G_{se}.
[g] Based on the initial C-JMF.

N. Spreading and Finishing. Place the mixture on an approved surface. Use pavers to distribute the mixture over the entire width or over a partial width as practical. Do not extend partial width paving beyond one day's production. Minimum lift thickness will be no less than 3.5 times nominal maximum aggregate size (NMAS) of the mix design.

Use pavement marking tape to temporarily mark roadway centerline on pavements being used by traffic as specified in 626.03.

Unless otherwise specified, equip the paver with a shoe on the outside to provide slopes as follows:

> The Engineer will allow an 18-inch-wide shoe for depths 0.2 foot or less on initial pavement placement. The shoe must be 24 inches wide for depths greater than 0.2 foot. The shoe must be 24 inches wide on pavement overlays.

Meet-lines must be within 1 foot of lane lines or within 1 foot of center of lanes. Meet-lines are not allowed within a wheel path. Ensure transverse and longitudinal joints are smooth and match the adjacent surfaces.

O. Compaction. Compact the pavement to a density between 92.0 percent and 100.0 percent of maximum theoretical density for SP 2, SP 3, and SP 5 asphalt mixes. Determine G_{mm} using Idaho IR156.

Following acceptance test strip approval or C-JMF approval, pavement density testing for acceptance will be performed by the Department using a nuclear density gauge with the readings corrected by cores in accordance with AASHTO T 355. The G_{mm} for determining the percent compaction will be determined using a rolling, consecutive 2-lot average (i.e., the most recent 2 completed lots) of the Department's acceptance test results. For the first lot of production paving, the test strip's G_{mm} corresponding to the C-JMF is used for determining the percent compaction. The Contractor is responsible for quality control testing.

Density Gauge Correlation. When nuclear density gauges are used for acceptance, the Engineer will correlate the gauges in accordance with Idaho IR 154. A new gauge correlation will be established for each mix design, each paving lift, each paving lift thickness, and each underlying material (e.g., ¾" base, CRABs, 0.25' underlying lift of HMA).

Repair holes left in the pavement by the coring operation with non-shrink grout at no additional cost to the Department. Do not begin coring until repair methods and materials have been approved.

P. Joints. Do not roll over the unprotected end of freshly laid mixture. Form transverse joints by cutting back on the previous run to expose a vertical edge the full depth of the course.

Slope the cold transverse construction joints open to public traffic at 20H:1V. Remove the sloped surface (ramp) without damage to the base just before paving is resumed. Test the new joint for smoothness as specified in 405.03.S.

Construct end transitions between overlays and the adjoining pavement by milling a wedge out of the adjoining pavement, starting at the surface and continuing into the adjoining pavement on a 200H:1V slope or flatter until a vertical edge equal to 0.15 foot or the depth of overlay is reached. Transitions to ramps and crossroads are transverse joints. The milled wedge is a transverse joint when the adjoining pavement is concrete. Mill the wedge from the pavement to be overlaid, with the vertical edge against the concrete, when the adjoining pavement is concrete. Taper transitions between overlays and approaches to form a smooth transition while maintaining drainage.

Provide a positive bond, density, and a finish surface to the new mixture at longitudinal joints that is equal to the mixture against which it is placed. The Engineer may take density tests at longitudinal joints to ensure the integrity of material in the joint area.

Locate the longitudinal joint in the top course at the centerline of the traveled way if the roadway is two lanes wide or at the lane lines if the roadway is more than 2 lanes wide. On the lower courses, stagger the longitudinal joint and offset it 6 inches to 1 foot from the centerline of the traveled way if the roadway is 2 lanes wide or from the lane lines if the roadway is more than 2 lanes wide. Match the pavement surface across a longitudinal joint with the transverse slope shown on typical sections.

Test joints, except crowns, for smoothness in accordance with Idaho IR 87. Use an approved 10-foot straightedge. Complete the test and necessary corrections before the material temperature drops below 175 °F.

Place longitudinal joints straight and true. Use approved methods to bring back to straight and true unacceptable deviations. Make adjustments as needed to achieve the specified results.

Obtain approval for Superpave HMA mix design(s) before the start of milling operations.

Q. Miscellaneous Pavement. Place miscellaneous Superpave HMA pavement in irregular areas (e.g., raised or depressed medians, gores, tapers, radii (excluding approach radii), tapered paving for guardrail terminal widening). Include areas that taper from 0 to 8 feet maximum width and gore areas from roadway shoulders to termini in this work. Do not include pavement widening for installation of guardrail in this work.

R. Small Quantities. Small quantities will be accepted in accordance with the QA Manual. When an acceptance test strip is not required as per 405.03.I, the Department will base acceptance for pavement density on the density of cores taken from the finished pavement. Obtain 5 randomly located core samples in accordance with the FOP for AASHTO R 67 from the compacted Superpave HMA in the Engineer's presence. The Engineer will determine the random core locations. Immediately submit the cores for testing. The Department will determine the density of the cores the FOP for AASHTO T 166 Method A or AASHTO T 331. In addition, obtain 3 randomly located mix samples during HMA placement, in the Engineer's presence, and immediately submit samples for testing. Obtain the samples in accordance with the AASHTO R 97 (see the QASP Table 106.03-1 Note 1.c.). The Engineer will randomly locate the mix samples and the Department will test the mix samples to determine the G_{mm} value in accordance with the FOP for AASHTO T 209 or ASTM D6857. The Department will use the average of the 3 G_{mm} values to compute in-place density of the cores taken for density acceptance. If paving will be performed in different construction seasons (e.g., bridge approaches), obtain 5 additional cores from the compacted Superpave HMA and 3 additional mix samples for density acceptance when paving resumes. The Contractor is responsible for quality control testing.

S. Leveling Course. Construct the leveling course of Superpave HMA, with a compacted thickness greater than 0.2 foot, in multiple courses.

Place the leveling course on the existing surface in quantities as approved. Use pavers and/or motor graders and a sufficient number of pneumatic tire rollers to adequately place and compact the leveling course to the required cross-section and grade. Use a steel-wheel roller for final rolling if the leveling course is to be used as a wearing course or if a seal coat is to be applied.

When blade laid leveling course is specified, place Superpave HMA in wheel ruts and other surface irregularities. Blade Superpave HMA into the low areas using a motor grader. Normally, 2 passes are required to fill depressions. Follow each pass of the motor grader with a pneumatic tired roller to provide compaction. Position the blade of the motor grader so light contact with the existing pavement surface is maintained. The Contractor may dispose of excess coarse aggregate resulting from placing the blade laid leveling course along the edge of the roadway.

When machine laid leveling course is specified, place Superpave HMA on the roadway with a paver to restore crown, super elevation, or rideability. Operate the screed close to the existing pavement surface. The Engineer will accept minor surface tears from this operation. Use pneumatic and vibratory rolling for compaction.

T. Surface Smoothness. Place pavement complying with Schedule II unless otherwise specified.

For Schedule III only, perform pre-paving, quality control, and acceptance surface smoothness testing, analyze the results of this testing, and submit the results. Submit pre-paving results. Before paving, submit a plan showing how Schedule III smoothness will be achieved.

Perform acceptance testing on the final lift and submit the results before corrective action. Complete acceptance testing within 1 week of paving completion.

Perform quality control testing in international roughness index (IRI). Request to use quality control testing for acceptance before the start of paving.

Submit quality control results by the next business day following placement.

If the quality control testing results show surface smoothness is not within the acceptable specification limits, suspend paving operations until it can be shown the steps taken to modify operations will result in acceptable smoothness.

Acceptance surface smoothness testing must be verified by the Engineer. The profile run must be witnessed by the Engineer and a preliminary copy of the report submitted immediately after the end of the run. The Engineer will not accept the testing, unless witnessed. Submit the profile data in a format suitable for evaluation using ProVAL or other industry standard software. In addition, each week or as requested by the Engineer, submit to the Engineer an electronic, editable Microsoft Excel spread sheet containing the data produced from the acceptance smoothness testing. Do not perform corrective action until approved.

The Engineer may elect to perform additional testing for verification. If the results vary from the Contractor's IRI results by more than 10 percent, the Engineer will use the Department's IRI results for acceptance.

Measure the finished pavement as follows:

1. Test the surface with a 10-foot straightedge at locations determined by the Engineer. Identify the locations that vary more than ¼ inch from the lower edge when the straightedge is laid on finished pavement in a direction parallel with centerline or perpendicular to centerline. Remove the high points that cause the surface to exceed the ¼ inch tolerance by grinding with equipment specified in Corrective Action below.
2. Profile the surface 3 feet from and parallel to each edge of each traffic lane. The Engineer will use the average of the results for each 0.1 mile section to calculate incentive payments and determine sections requiring corrective action.

   Use Class 1 or Class 2 profilers as defined in ASTM E950. Operate profilers in accordance with the manufacturer's instructions and AASHTO R 57. Set the profiler as follows:

   1. High pass or pre-filter: off or at least 200 feet.
   2. Bump detection: on
   3. Dip detection: on
   4. Resolution: 0.01 inch
   5. Low pass filter: off
   6. Other filters: off

   Operate the profiler according to the manufacturer's recommended speed. Calibrate the profiler at the beginning of the work and as needed thereafter.

   The Department requires the pavement to comply with the following surface smoothness schedule requirements:

   a. Where longitudinal grade is 6.5 percent or less, pavement on tangent alignment and pavement on horizontal curves having centerline radius of curve 1,000 feet or more must meet the surface smoothness requirements for the smoothness schedule specified. The Engineer will add consecutive 0.1 mile sections of roadway tested together to obtain the mile section. There will be no overlapping of the 0.1 mile or 1 mile sections to change cumulative test results.
      (1) Smoothness Schedule using IRI:
         (a) Schedule I Projects: Target IRI values range from 60.0 to 70.0 inches per mile per0.1 mile. Corrective action required above 95.0 inches per mile per 0.1 mile.
         (b) Schedule II Projects: Target IRI values range from 71.0 to 80.0 inches per mile per
      0.1 mile. Corrective action required above 95.0 inches per mile per 0.1 mile.
   (c) Schedule III Projects: Target IRI value range defined as one of the following:
            i. For sections with a pre-paving IRI less than 160.0 inches per mile per 0.1mile the final index must not exceed 80.0 inches per mile per 0.1 mile.

ii. For sections with a pre-paving IRI of 160.0 inches per mile per 0.1 mile or greater, use the smoother of either:

1. A 50 percent improvement of the pre-paving index.

2. A maximum final index of 100.0 inches per mile per 0.1 mile. Corrective action is required above the target IRI.

b. The Engineer will exclude acceptance test strips, pavement on horizontal curves having a centerline radius of curve of less than 1,000 feet and pavement within the super elevation transition of such curves, or pavement with a longitudinal grade greater than 6.5 percent from incentive/disincentive payments. Meet the corrective action requirements for the smoothness schedule specified.

c. Profile the pavement to provide continuous, uninterrupted profile data. The Department will not apply profile smoothness tolerances and incentive/disincentive payments to the following:

(1) Pavement within 50 feet of a transverse joint that separates the pavement from a structure deck, an approach slab, or an existing pavement not constructed under the contract.

(2) Pavement for approaches and structure decks.

(3) Roadways with a speed limit less than 40 mph.

(4) Interstate ramps.

Smoothness acceptance for these areas will be as specified with straightedge requirements.

Surface Smoothness Corrective Action:

Use power-driven grinding equipment that is specifically designed to smooth portland cement concrete pavement with diamond blades. Use a machine with an effective wheelbase at least 12 feet and a cutting width of at least 3 feet. Restrict the machine forward speed to 5 feet per minute while milling. Provide grinding equipment of a shape and dimension that does not encroach on traffic movement.

Grind parallel to centerline. Extend adjacent grinder passes, within ground area, to produce a neat rectangular area having a uniform surface appearance. Make smoothly feathered transitions at transverse boundaries between ground and unground areas. Apply a fog coat to the ground pavement surface as specified in 408 after grinding has been completed.

Grind individual high points in excess of 0.3 inch within 25 feet or less, as determined by the California Profilograph simulation, until such high points do not exceed 0.3 inch.

After individual high point grinding has been completed, perform additional grinding in sections requiring corrective action to reduce the IRI to a maximum of 80.0 inches per mile per 0.1 mile section along lines parallel with the pavement edge.

Individual low points are areas in excess of 0.3 inch within 25 feet or less, as determined by the California Profilograph simulation. Low points will be subject to rejection and replacement at no cost to the Department. Under these circumstances, the Engineer’s decision whether to accept the completed pavement or to require corrections is final.

Check the pavement for smoothness after grinding as specified in this subsection and make additional corrections necessary to achieve smoothness. Submit a report and graph showing compliance of the final surface to the smoothness requirements. The Department will not pay for the cost of grinding, milling or related work (e.g., fog coat), disposal of milled material, traffic control, flagging, profiling, surface repair of ground or milled areas, or temporary striping.

Surface Smoothness Deductions, Incentives, and Disincentives:

1. Straight-Edge Evaluation.

   If correction of the roadway as specified will not produce satisfactory smoothness results or it reduces pavement thicknesses and serviceability, the Engineer may accept the completed pavement and will deduct from monies due or may become due to the Contractor the sum of $500.00 for each individual high point exceeding ¼ inch tolerance or $3,000.00 for each 0.1 mile section. $500.00 per individual low point exceeding ¼ inch tolerance will be deducted from monies due or may become due to the Contractor. Low points exceeding ½ inch will be subject to rejection and replacement at no cost to the Department. Under these circumstances, the Engineer's decision whether to accept the completed pavement or to require corrections is final.

2. Profilograph Evaluation.

   For each evaluation section, the Contractor is entitled to a payment adjustment excluding acceptance test strips and Schedule III surface smoothness work. An evaluation section is defined as a 0.1 mile per traffic lane or fraction as applicable. The Department will not pay an incentive for pavement on the roadway shoulders, center turn lanes, turn bays, crossovers, tapers, or other miscellaneous pavement. The Department will pay incentive as specified in Table 405.03-7.

   The Department will base incentive payments on initial profiles before corrective work on the top course of paving.

Table 405.05-1 – IRI
Initial Index inches per mile per 0.1 mile section

Payment $ per 0.1 mi	Schedule I	Schedule II
$500.00	40.4 or less	45.4 or less
$300.00	40.5 to 50.4	45.5 to 60.4
$100.00	50.5 to 60.4	60.5 to 70.4
$0.00	60.5 to 70.4	70.5 to 80.4
-$100.00	70.5 to 75.4	80.5 to 85.4
-$300.00	75.5 to 85.4	85.5 to 95.4
-$500.00	85.5 to 95.4	—
-$500.00 and corrective action	95.5 or greater	95.5 or greater
-$500.00 and corrective action	Individual high points [a]	Individual high points [a]
-$500.00 and corrective action	Individual low points [a]	Individual low points [a]

(a) In addition to the incentive/disincentive payment applied to the 0.1 mile section, the Engineer will deduct from monies due or may become due to the Contractor the sum of $500.00 for each individual high point or low point up to a maximum of $3,000.00 for each 0.1 mile section.

The Department will make only 1 incentive payment per evaluation section. An evaluation section runs consecutively from the point paving begins to the point paving is interrupted (e.g., at bridges, the end of lane paving areas specifically excluded by the specifications). The Department will prorate partial sections based on their percentage of a full section.

The Department will base incentive payments on initial profiles before corrective work on the top course of paving.

405.04 Method of Measurement. The Engineer will measure acceptably completed work as follows:

1. Pavements, leveling courses, and asphalts by the ton. The Engineer will not permit batch weights as a method of measurement. The Superpave HMA quantity will be the weight used in the accepted pavement and will include the weight of the aggregate, asphalt, and additives in the mixture.
2. Anti-stripping additive by the percentage of additive per ton of asphalt.
3. Miscellaneous pavement by the square yard. Final measurement will be based on plan quantities, unless changed by the Engineer. Miscellaneous pavement measurement is in addition to the measurement of asphalt and Superpave HMA material.
4. Approaches per each regardless of width or length. Separate mailbox turnouts will be measured as an approach. Mailbox turnouts adjacent to an approach will be considered as part of the approach and no separate measurement will be made. Approach measurements are in addition to the measurement of asphalt and Superpave HMA material.
5. Wedge milling for the transition section by the square yard.
6. Tack coat will be paid for as specified in 401.

405.05 Basis of Payment.

1. Superpave SP3 and SP5.

Composite mix pay factor will be computed for each lot using the following equation:

$$CPF_{405Mix} = (0.4 \times PF_{AIRVOIDS}) + (0.4 \times PF_{VMA}) + (0.2 \times PF_{DP})$$

Where:

CPF_{405Mix} = Composite pay factor for mix quality characteristics.

$PF_{AIRVOIDS}$ = Pay factor for air voids.

PF_{VMA} = Pay factor for VMA.

PF_{DP} = Pay factor for dust proportion.

Calculation of Composite Incentive/Disincentive. The composite incentive/disincentive dollar amount to be paid or deducted for Superpave plant mix pavement accepted by the

Department, excluding plant mix pavement for test strips, small quantity, approaches, and miscellaneous paving not placed with mainline paving, will be computed for each lot using the formula:

$PA_{405} = (CPF_{405Mix} + PF_{MLD} - 2) \times Q_i \times P$

Where:

PA_{405} = Pay adjustment for material and main line density in dollars for the lot.

CPF_{405Mix} = Composite pay factor for material characteristics for the lot.

PF_{MLD} = Pay factor for main line density for the lot.

Q_i = Quantity represented by individual lot.

P = Contract unit price.

Note: The incentive may be a negative amount (i.e., a deduction from the total amount bid for the item).

A pay factor of 1.00 will be used for all acceptable Superpave plant mix pavement incorporated into the onsite acceptance test strip for volumetrics.

Density pay factor for the Superpave plant mix leveling course will be 1.00.

2. Pay factors for approaches and miscellaneous paving not placed with mainline paving will be 1.00.Superpave SP2.

Composite pay factors will be computed for each lot using the following equations:

$CPF_{405} = (0.3 \times PF_{AC}) + (0.3 \times PF_{AGG}) + (0.4 \times PF_{MLD})$

Where:

CPF_{405} = Composite pay factor for mix quality

characteristics. PF_{AC} = Pay factor for asphalt

content.

PF_{AGG} = Pay factor for plant

mix aggregate. PF_{MLD} = Pay

factor for main line density.

Calculation of Composite Incentive/Disincentive. The composite incentive/disincentive dollar amount to be paid or deducted for Superpave plant mix pavement accepted by the Department, excluding plant mix pavement for test strips, small quantity, approaches, and miscellaneous paving not placed with mainline paving, will be computed for each lot using the formula:

$PA_{405} = (CPF_{405} - 1) \times Q_i \times P$

Where:

PA_{405} = Pay adjustment for material and main line density in

dollars for the lot. CPF_{405} = Composite pay factor for material characteristics for the lot.

Q_i = Quantity represented by individual lot. P = Contract unit price.

Note: The incentive may be a negative amount (i.e., a deduction from the total amount bid for the item).

Density pay factor for the Superpave plant mix leveling course will be 1.00.

Pay factors for approaches and miscellaneous paving not placed with mainline paving will be 1.00.

A pay factor of 1.00 will be used for calculating a pay factor for all acceptable Superpave plant mix pavement incorporated into an onsite acceptance test strip for volumetrics.

The Department will pay for accepted quantities as follows:

Pay Item	**Pay Unit**
Superpave HMA Pavement Class SP	Ton
Superpave HMA Pavement, including asphalt and additives Class SP	Ton
Leveling Course Class SP	Ton
Leveling Course, including asphalt and additives, Class SP	Ton
__Asphalt Binder for Superpave HMA Pavement	Ton
__Percent Anti-stripping Additive for Superpave HMA Pavement	TOA
Miscellaneous Pavement	SY
Approaches	Each
Wedge Milling	SY

The cost to produce the required aggregate in each stockpile to accommodate blends is incidental and included in the contract unit price for the Superpave HMA contract pay item.

When Superpave HMA includes RAP, in any proportion, the Department will not include the asphalt binder contributed by the RAP in the quantity for asphalt and additives when asphalt and additives are paid for separately.

3. Pre-milling, Coring, or Sampling for RAP.

All work and maintenance associated with the pre-mix design RAP sampling is incidental.

ON PAGES 631-634, SECTION 703.05 – AGGREGATE FOR SUPERPAVE HMA PAVEMENT
Delete this section, in its entirety, and replace with the following:

703.05 Aggregate for Superpave HMA Pavement. Provide aggregate for mixes, except SP 2, in at least 3 separate stockpiles. Use aggregate consisting of crushed stone or crushed gravel. Combine with other required aggregate fractions and fillers in the proper proportion so the resulting mixture meets the gradation required.

Screen the aggregate used for Superpave HMA so 10 percent or less of the naturally occurring minus ½ inch material remains in the material used to produce the stockpile(s). Crush the plus ½ inch material to produce the required gradation. This requirement does not apply to SP 2 mixes or mixtures designated as nonstructural or temporary mixtures.

Size, grade, and combine the fractions for the mixture in proportions so the resulting blend conforms to the grading requirements as defined in Table 703.05-2a and Table 703.05-2b.

Use aggregate that meets the requirements in Table 703.05-1.

Table 703.05-1 – Superpave Mixture Requirements

Mix Type	**SP 2**	**SP 3**	**SP 5**
Design ESALs [(a)] (millions)	< 1	1 < 10	≥ 10
Idaho Degradation, maximum loss, %	5.0	5.0	5.0
Ethylene Glycol, minimum retained, %	90	90	90
R-Value	80 or more minimum	80 or more minimum	80 or more minimum
LA Wear, Maximum % loss	35	30	30
Sodium Sulfate Soundness [(b)] Maximum loss after 5 cycles, %	12	12	12
Fractured Face, Coarse Aggregate [(c)] % Minimum	65/-	75/60	98/98
Uncompacted Void Content of Fine Aggregate, % Minimum	40	40	45
Sand Equivalent, Minimum	35	40	45
Flat and Elongated [(d)], % Maximum	10	10	10

[(a)] The anticipated project traffic level expected on the design lane over a 20 year period. Regardless of the actual design life of the roadway, determine the design ESALs for 20 years.
[(b)] Perform sodium sulfate soundness testing when directed.

[c] 75/60 denotes that 75 percent of the coarse aggregate has 1 fractured face and 60 percent has 2 or more fractured faces.
[d] This criterion does not apply to No. 4 nominal maximum size mixtures.

Table 703.05-2a – Nominal Maximum Aggregate Size-Control Points (Percent Passing) and VMA Requirements PCS Control Points for Mixture Nominal Maximum Aggregate Size (b)

Sieve Size	$1^1/_2$ in		1 in		$^3/_4$ in	
	Restricted Zone	Control Points	Restricted Zone	Control Points	Restricted Zone	Control Points
2 in	—	—	—	—	—	—
$1^1/_2$ in	—	90 to 100	—	100	—	—
1 in	—	90 max	—	90 to 100[a]	—	100
$^3/_4$ in	—	—	—	90 max	—	90 to 100[a]
$^1/_2$ in	—	40 to 70[a]	—	—	—	90 max
$^3/_8$ in	—	—	—	42 to 70[a]	—	52 to 80[a]
No. 4	34.7	—	39.5	—	—	—
No. 8	23.3	15 to 41[a]	26.8	19 to 45[a]	34.6	23 to 49[a]
No. 16	15.5	—	18.1	—	23.1	—
No. 30	11.7	—	13.6	—	16.7	—
No. 50	10	—	11.4	—	13.7	—
No. 100	—	—	—	—	—	—
No. 200	—	0.0 to 6.0[a]	—	1.0 to 7.0[a]	—	2.0 to 8.0[a]
VMA	11.5		12.5		13.5	
Primary Control Sieve	$^3/_8$ in		No. 4		No. 4	
PCS Control Point (% passing)	47		40		47	

Table 703.05-2b – Nominal Maximum Aggregate Size-Control Points (Percent Passing) and VMA Requirements PCS Control Points for Mixture Nominal Maximum Aggregate Size [(b)]

Sieve Size	$^1/_2$ in		$^3/_8$ in		#4	
	Restricted Zone	Control Points	Restricted Zone	Control Points	Restricted Zone	Control Points
2 in	—	—	—	—	—	—
$1^1/_2$ in	—	—	—	—	—	—
1 in	—	—	—	—	—	—
$^3/_4$ in	—	100	—	—	—	—
$^1/_2$ in	—	90 to 100[(a)]	—	100	—	100
$^3/_8$ in	—	90 max	—	90 to 100[(a)]	—	95 to 100[(a)]
No. 4	—	—	—	90 max	—	90 to 100
No. 8	39.1	28 to 58[(a)]	47.2	32 to 67[(a)]	—	—
No. 16	25.6	—	31.6	—	—	30 to 55[(a)]
No. 30	19.1	—	23.5	—	—	—
No. 50	15.5	—	18.7	—	—	—
No. 100	—	—	—	—	—	—
No. 200	—	2.0 to 10.0[(a)]	—	2.0 to 10.0[(a)]	—	6.0 to 13.0[(a)]
VMA	14.5		15.5		16.5	
Primary Control Sieve	No. 8		No. 8		No. 16	
PCS Control Point (% passing)	39		47		42	

(a) Denotes the sieves that will be used for mix design control points and quality analysis sieves for a Class SP 2 mix.

(b) The combined aggregate gradation will be classified as coarse-graded when it passes below the primary control sieve (PCS) control point as defined in Table 703.05-2a and Table 703.05-2b. Other gradations will be classified as fine graded. This classification is based on the Contractor's job mix formula and not individual gradation tests. Coarse graded mixtures will not pass through the restricted zone.

ON PAGES 711-713, SECTION 720.07 – RECYCLED ASPHALT PAVEMENT (RAP)

Delete this section, in its entirety, and replace with the following:

720.07 Recycled Asphalt Pavement (RAP). Prepare and maintain a RAP processing and stockpiling quality control plan and make these records available to the Department.

1. RAP Categories. Provide RAP that complies with one of the following categories:
   A. Category 1. The Department defines this material as being from a Department project or is traceable to another public agency sponsored project. The Engineer will accept Category 1 RAP for use provided the Contractor submits a letter stating the RAP is from a specific pavement, including the route and mile post. Do not add material from other sources during stockpiling and submit certification of this from the producer on a stockpile-by-stockpile basis.

      Category 1 RAP may consist of asphalt material removed from interstates, United States Highways, or State Highways.

   B. Category 2. The Department defines this material as not being from Department projects or is not traceable to a Department project. Produce uniform RAP stockpiles when Category 2 material originates from different sources. The Engineer will accept Category 2 RAP for use as Category 1 RAP if the Contractor performs tests as specified in 720.07.3 and submits test results and materials that show the RAP meets the specifications and is verifiable by the Department.

      Do not use Category 2 RAP that does not meet these requirements as Category 1 RAP.

Category 2 RAP is:

1) Production Returns. Asphalt material generated from plant waste (e.g., start-up/shut down material).

2) Random RAP. Crushed and screened asphalt material removed from private paving projects, plant overruns, rejected loads, or combination.

2 RAP Processing. The Contractor may use processed RAP as follows:

a) Processed RAP. RAP that is processed by crushing and screening to produce a uniform gradation from coarse to a fine and a uniform binder content in the RAP before use in a recycled mix. Provide processed RAP with 100 percent passing the ⅝ inch sieve on entry into the mixing plant.

The Contractor may recycle processed RAP in Superpave HMA at the percentages shown below:

1) Category 1 RAP is limited to 17 percent by binder replacement.

2) Category 2 RAP is allowed up to 10 percent by binder replacement when used in the top lift and is limited to 17 percent maximum by binder replacement when used in a lower lift.

Processed RAP stockpiles may contain RAP from sources as indicated by the category and may be replenished with RAP from sources of that same category.

3 RAP Testing and Test Frequency. Perform the following tests at the specified testing frequencies for each category and provide the data to the Department as soon as test results are available:

a. Category 1. Establish an extraction correlation. Determine the asphalt binder content and aggregate gradation in accordance with the FOP for AASHTO T 308 and AASHTO T 30 at the minimum frequency of 1 test per 500 tons for the first 2,000 tons and 1 test per 1,000 tons thereafter. Then perform at least 6 tests for stockpiles less than 4,000 tons.

   Perform chemical binder extractions in accordance with AASHTO T 319 to reclaim the binder from the RAP when blending charts are used. Determine the PG binder grading of the recycled binder as specified in 702 at the frequency of 1 test per 5,000 tons with at least 1 test per stockpile.

b. Category 2. Asphalt binder content, aggregate gradation, and binder grade testing requirements are the same as Category 1. In addition, test the aggregate recovered from the RAP by the extraction process AASHTO T 308 or AASHTO T 164 or AASHTO T 319 to determine the aggregate quality. Test RAP aggregate quality as follows:

   1) AASHTO T 96 and Idaho IT 15 tested on extracted aggregate as specified at a frequency of 1 test per stockpile.

   2) AASHTO T 335, AASHTO T 304, and ASTM D4791 at the minimum frequency of 1 test per 500 tons for the first 2,000 tons and 1 test per 1,000 tons thereafter. Perform at least 6 tests for stockpiles less than 4,000 tons.

Meet the applicable aggregate quality requirements in Table 703.05-1 and 703 for the combination of virgin and RAP aggregate.

Use the RAP as Category 2 RAP, unprocessed, if it was not tested.

Asphalt Binder/Aggregate Correction Factor. Perform at least 6 AASHTO T 164 or AASHTO T 319 chemical extraction tests and AASHTO T 30 gradation tests and 6 AASHTO T 308 burn tests and AASHTO T 30 gradation tests to establish a correction factor for asphalt binder and aggregate gradation. Prepare 6 identical pairs of samples and test 1 sample of each pair in accordance with AASHTO T 164 or AASHTO T 319 and test the other sample in accordance with AASHTO T 308.

Bulk Specific Gravity of the RAP Aggregate. Test RAP material for G_{sb} according to Idaho IT 146 at the rate of 1 test per 500 tons for the first 2,000 tons and 1 test per 1,000 tons thereafter. Perform a minimum of 10 tests per stockpile. Provide the test results on a spreadsheet with the specific gravity of aggregates and RAP submittal as specified in 405.03.A.

For testing after stockpiling, submit a sample plan and test the RAP pile, either in-situ or by re-stockpiling, for approval. Meet the minimum frequency required and detail the procedure used to obtain representative samples throughout the stockpile for testing.

4 RAP Stockpiles and Record Keeping. Place RAP stockpiles on a base with adequate drainage and construct in layers to minimize RAP segregation and ensure a workable face. Construct separate stockpiles for each source of RAP based on the category of RAP, the quality of aggregate, type and quantity of asphalt binder, and size of processed material. Identify RAP stockpiles on a map of the stockpile areas and place signs in or near each stockpile.

Maintain a record system at the plant site for RAP stockpiles that includes, at a minimum, the following:

a. Stockpile identification and a sketch of stockpile areas at the plant site.

b. RAP category (project, state route, plant waste, rejected loads).

c. Origin or dates milled and approximate number of tons in the stockpile.

d. Chemical extraction and AASHTO T 308 burn test results.

Make the RAP stockpile records available at the plant site. The Engineer will reject, by visual inspection, stockpiles that are not kept clean and free of foreign materials. The Engineer will reject RAP containing contaminants (e.g., earth, brick, sand, concrete, pavement fabric, joint sealants). The Contractor may reprocess the rejected RAP stockpile to meet requirements or remove the stockpile from use.

To the end of sub-section 270.04 of the QA Manual (2019 and later versions) insert the following:

270.04.01 Acceptance of Small Quantities – Asphalt Mix
General. Contractor will sample loose mix and cores in the presence of the State. The State will complete acceptance testing.

1. **Plan Quantity Less than 750 tons**
   For bridge approaches see 270.05.01 *Non-standard Acceptance of Materials - Asphalt Mix*. For other applications use this subsection. Contractor may use a commercial (non-Superpave) mix design. Aggregate shall come from an ITD-approved source. The mix design will be submitted for information only.

   Establish paving location compared to travel path:
   i. Within travel path - cores and Gmm are required. Numbers of samples will be established in ITD 862 Sample Schedule. Compaction must be 92.0% or greater. Failing work will be removed and replaced.

  ii. Outside travel path accept by RE Letter of Inspection. The inspector will use ITD form 891 for density observation and will include equipment used and compaction temperatures. Gauge readings are not required.

2. **Plan Quantities between 750 - 2,250 tons and a *continuous operation*, use MTR Table 270 (405-6)**

3. **Plan Quantities between 750-2,250 tons per year and specific applications use 270.05.01 Non-standard Acceptance of Materials - Miscellaneous Asphalt Mix**

To the end of sub-section 270.05 of the QA Manual (2019 and later versions) insert the following:

270.05.01 Non-standard Acceptance of Materials – Asphalt Mix.

These acceptance criteria are established for plan quantities between 750 – 2,250 tons per year or locations such as bridge approaches, cross-overs, patching within travel lanes, gore areas and shoulders. These criteria may apply to projects with intermittent paving schedules spanning multiple months or seasons.

Acceptance Criteria:

- A Department-approved Superpave mix design is required before paving begins. A test strip will not be required.
- Tack Coat must be applied. Target guidelines for a 1:1 dilution are listed below, with the understanding this work may not be conducive to quantifying application rates:
  - 0.18 gallon per square yard on milled surfaces
  - 0.12 gallon per square yard on existing plant mix surfaces and
  - 0.08 gallon per square yard on newly paved surfaces.
- Acceptance requires 1 random core and 1 loose mix sample (Gmm only) per:
  - Bridge lane-approach (minimum of 1 per bridge quadrant per lift). Contractor has the option for state to use composite cores for acceptance (minimum of 1 per bridge quadrant). A composite core is a single core with multiple lifts included in the core. Gmm is determined using the weighted average (based on thickness) of the Gmm for each lift represented by the core. Composite cores will not be split into component lifts for evaluation.
  - Patch with any dimension exceeding 12.0 ft.
  - Day of paving (not applicable for bridge approaches)
  - One (1) random sample per 750 tons placed when the daily total exceeds 750 tons.

Compaction must be 92.0% or greater. Failing work will be removed and replaced.

Idaho Standard Practice for

Acceptance Test Strip for Asphalt Mixtures

IDAHO Designation: IR-125-23

1. SCOPE

1.1. This Standard Practice is used to evaluate hot mix asphalt (HMA) and warm mix asphalt (WMA) produced through a hot plant for conformance to the mix design and JMF and for acceptance. This IR includes responsibilities of the Engineer, the Central Materials Laboratory, and the Contractor.

1.2. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the user's responsibility of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations before use.*

2. REFERENCE DOCUMENTS

2.1 *AASHTO Standards*

- FOP for T 27, Particle Size Distribution of Aggregate
- FOP for T 11 Method A or B, Materials Finer than 75um (No. 200) Sieve in Mineral Aggregate by Washing
- FOP for T 30, Mechanical Analysis of Extracted Aggregate
- FOP for T 312, Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor
- R 35, Superpave Volumetric Design for Hot Mix Asphalt (HMA)
- FOP for T 335, Method 1, Determining the Percentage of Fracture in Coarse Aggregate
- T 269, Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
- FOP for AASHTO T 209, Bowl Method, Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
- FOP for AASHTO R 67, Sampling Asphalt Mixtures after Compaction (Obtaining Cores)
- R 57, Standard Practice for Operating Inertial Profilers and Evaluating Pavement Profiles
- FOP for T 308, Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method
- R 97, Sampling Asphalt Mixtures
- FOP for R 47, Reducing Samples of Hot Mix Asphalt to Testing Size
- FOP for T 329, Moisture Content of Hot Mix Asphalt (HMA) by Oven Method
- FOP for T 176, Alternate Method #2 Mechanical Pre-Wet, Plastic Fines in Graded Aggregate and Soils By Use of the Sand Equivalent Test
- T 304, Method A, Uncompacted Void Content of Fine Aggregate

- FOP for R 66, Sampling Asphalt Materials
- M 323, Superpave Volumetric Mix Design
- T 344, Evaluation of the Superpave Gyratory Compactor (SGC) Internal angle of Gyration Using Simulated Loading
- T 331, Bulk Specific Gravity and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method
- R 79, Standard Practice for Rapid Drying of Compacted Asphalt Specimens Using Vacuum Drying Apparatus
- T 164, Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
- T 319, Quantitative Extraction and Recovery of Asphalt Binder from Asphalt Mixtures
- FOP for T 166, Method A, Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface Dry Specimens
- FOP for T 355, In-Place Density of Asphalt Mixtures by Nuclear Methods
- T 324, Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)

2.2 *ASTM Standards*

- D 1075, Standard Test Method for Effect of Water on Compressive Strength of Compacted Bituminous Mixtures (Immersion-Compression)
- D 4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
- D 6857, Standard Test Method for Maximum Specific Gravity and Density of Bituminous Paving Mixtures Using Automatic Vacuum Sealing Method
- 8159, Standard Test Method for Automated Extraction of Asphalt Binder From Asphalt Mixtures (Asphalt Analyzer™)
- 8225, Standard Method of Test for Determination of Cracking Tolerance Index of Asphalt Mixture Using the Indirect Tensile Cracking Test at Intermediate Temperature

2.3 *Idaho Standards*

- Idaho IR 87, Pavement Straightedge Procedures
- IT 120, Determining Volume of Liquids in Horizontal or Vertical Storage Tanks
- IR 125, Acceptance Test Strip for Hot Mix Asphalt (HMA) Pavement
- IT 144, Specific Gravity and Absorption of Aggregate Using Automatic Vacuum Sealing Method
- IT 146, Determination of Recycled Asphalt Pavement (RAP) Aggregate Dry Bulk Specific Gravity (G_{sb})
- IR 148, Stratified Random Sampling
- IR 150, Superpave Mix Design
- IR 151, Superpave Mix Design Evaluation
- IR 152, HMA Quality Control Plan Development and Implementation
- IR 153, Split Sample Comparison
- IR 154, Nuclear Density Gauge Correlation
- IR 155, Procedures for Checking Asphalt Drum Mix Plant Calibrations

- IR 156, Method for Determining Rolling G_{mm}
- IR 157, Determining Ignition Furnace Correction Factor
- IR 158, Quality Control Plan (QCP) Development and Implementation
- IR 159, Quality Control Plan (QCP) Review Process
- IR 160, Development, Evaluation, and Approval of HMA Plant Quality Control Plans

2.4 Standard Specifications, Subsection 106.03

2.5 Standard Specifications, Section 405

2.6 Quality Assurance Manual, Section 220

3. GENERAL TEST STRIP REQUIREMENTS

3.1. The Contractor will notify the Engineer of the date, time, and location of the acceptance test strip before or during the pre-pave meeting. The Engineer will immediately notify the Central Materials Laboratory.

3.2. The Engineer must witness all sampling of material to be used for acceptance. Any acceptance sample obtained that is not witnessed by the Engineer will be rejected.

3.3. The Contractor is responsible for material sampling. The Contractor will have a qualified technician available for the duration of the test strip. The Contractor will immediately give the samples to the Engineer.

4. IDENTIFYING THE TYPE OF ACCEPTANCE TEST STRIP

4.1. There are 2 types of test strips, an onsite test strip and an off-site test strip (i.e., off-site mix verification). The onsite test strip is performed at the start of production paving operations and encompasses the first lot of production paving. The off-site test strip is performed before beginning production paving.

Note: For the density correlation, reference IR-154. Density correlation is not a test strip.

4.2. Determine if the Contractor will perform an onsite test strip or off-site test strip to verify the JMF.

4.3. For an onsite test strip, the test strip will be the first day of production with the following exception:

4.3.1. If the total estimated quantity of material for the bid item is between 750 and 2,250 tons, the entire quantity of material will be considered the test strip, use the modified sampling schedule found in Annex 1 – On-Site Test Strip Procedure for Smaller Production Runs.

4.4. For an off-site test strip (i.e., offsite mix verification), the test strip sampling will be performed while the Contractor is targeting the JMF.

5. DETERMINING THE TEST STRIP SAMPLING SCHEDULE

5.1. Before the test strip, determine, in conjunction with the Contractor, the anticipated quantity of material that will be produced for the test strip.

Note: It is recommended to do this via email or other written communication to ensure adequate documentation for the project records.

5.2. Calculate the testing frequency by dividing the anticipated quantity of material that will be produced for the test strip by the required number of samples needed.

5.3. Using the value calculated in 5.2, perform Idaho IR 148 to determine the sampling schedule to obtain the required number of stratified, random samples.

5.4. Repeat step 5.2 and step 5.3 for each material to be sampled. See Example of Determining the Test Strip Sampling Schedule.

6. MATERIAL SAMPLING REQUIREMENTS

6.1. Before obtaining the first sample, confirm at the hot plant that the approved JMF is being targeted in the hot plant control system and that the most current hot plant calibrations have been verified in accordance with Idaho IR 155.

6.2. The Contractor will sample the required materials as shown in Table 6.1 at the intervals given in the test strip sampling schedule.

6.2.1. Each sample must be clearly labeled and secured in the Engineer's possession immediately after the sample is taken. If a sample consists of multiple containers, label each container in such a way that the samples and the increments are readily distinguishable (i.e., if there are 2 boxes of material for Sample 1: label one box "Box 1 of 2", and the other box "Box 2 of 2").

6.2.2. Each sample must be accompanied by the appropriate sample tracking form with all sampling information included and signed by the WAQTC sampling technician.

6.3. Continue to monitor that the proper mix is being produced throughout the test strip.

6.4. Immediately after completion of the test strip, obtain the hot plant printouts showing production totals for each mix constituent and the most current calibration records (e.g., take a snap shot or provide a written note on the plant printout of where the test strip begins/ends and the next lot begins).

6.5. The testing timeframe begins once the Engineer has received all test strip samples, sample tracking forms, and hot plant printouts and calibration records. The Engineer will submit samples, and original sample tracking forms to the acceptance lab for testing.

Table 6.1-Sampling Requirements

Material	**Sampling Procedure**	**Number of Samples**	**Minimum Sample Size**	**Sample Container**
Mix	AASHTO R 97	6	200 lbs	Cardboard box [(a)]
Aggregate	AASHTO R 90	2	50 lbs	5-gallon bucket [(b)]
RAP	AASHTO R 97	2	50 lbs	5-gallon bucket [(b)]
Binder	FOP for AASHTO R 66	1	Three 1-quart containers	Screw top can [(a)]
Field Compacted Mix	FOP for AASHTO R 67	10 [(d)]	One 6-inch diameter core	Suitable protective container [(c)]

[(a)] See Quality Assurance Manual Table 220.01.1.
[(b)] Clean 5-gallon bucket with a snap-on lid.
[(c)] See FOP for AASHTO R 67 for guidance on packaging and transporting samples.

[d] No cores required for offsite test strips.
[e] The 200 lbs sample needs to be thoroughly blended in the presence of the engineer and reduced per AASHTO R 47. 100 lbs of each sample will be sent to the lab performing acceptance testing of the test strip. 50 lbs of each sample is sent to the production acceptance lab and 50 lbs of each sample is sent to the Contractor QC lab. The production acceptance and QC portion of the sample does not need to be shipped to the test strip acceptance lab prior to distribution to the labs performing split sample testing.

7. SAMPLING AND TESTING FIELD COMPACTED MIX

7.1. For on-site test strips, field compacted mix acceptance will be based on the results of cores sampled in accordance with AASHTO R 67. Sample locations cannot be closer than 1.0 foot from a cold joint.

7.1.1. When nuclear density gauge results are to be used for acceptance for lots after the completion of the acceptance test strip, correlate the nuclear density gauge(s) in accordance with Idaho IR 154.

7.2. For off-site test strips, there is no field compacted mix acceptance performed during test strip.

7.2.1. When nuclear density gauge results are to be used for acceptance for lots after the completion of the acceptance test strip, correlate the nuclear density gauge(s) in accordance with IR 154.

8. TEST STRIP DOCUMENTATION

8.1. Maintain in ProjectWise the following records, *at a minimum,* for the test strip sampling:

8.1.1. Sampling schedule.

8.1.2. The carbon copy of the appropriate sample tracking form for each sample obtained.

8.1.3. A daily work report (DWR) or daily diary documenting the day’s events.

8.1.4. A copy of the hot plant calibration records and a hot plant printout showing recorded data every 15 minutes.

8.2. Ensure the documentation listed under 8.1 is available in ProjectWise within 2 business days after the completion of the test strip.

9. ACCEPTANCE LAB RECEIVING PROCEDURE

9.1. Upon receiving the samples and associated sample tracking forms, ensure that all required documentation is included.

9.2. Document condition of samples, and date and time received.

9.3. Notify the Engineer of receipt and provide a time of estimated completion and review of all testing.

9.4. *With the mix samples:*

9.4.1. Select 1 sample for Idaho IT 157.

9.4.2. Select 3 samples for volumetric testing shown in Table 10.1.

9.4.3. Select 2 samples for performance testing shown in Table 10.2.

9.4.4. Test the mix samples in accordance with Section 10.

9.5. *With the aggregate samples:*

9.5.1. Test the aggregate samples in accordance with Section 11.

9.6. *With the RAP samples:*

9.6.1. Test the RAP samples in accordance with Section 12.

9.7. *With the binder sample:*

9.7.1. Test the binder sample in accordance with Section 13.

9.8. *With the field compacted mix samples:*

9.8.1. Test the field compacted mix samples in accordance with Section 14.

10. ACCEPTANCE LAB MIX TESTING REQUIREMENTS

10.1. With the 1 sample selected in Section 9.4.1, perform Idaho IT 157.

10.2. With each of the 3 samples selected in Section 9.4.2 retain 1 box of each sample for dispute resolution testing. With the remaining box from each sample, reduce in accordance with FOP for AASHTO R 47 and perform the volumetric testing shown in Table 10.1.

10.2.1. Report results on the most current ITD-773 form and include copies of all original source documents.

Table 10.1 – Test Strip Mix Volumetric Testing Requirements.

Test Method	**Increments Per Sample**
FOP for AASHTO T 308	1
FOP for AASHTO T 30	1
FOP for AASHTO T 312	2
FOP for AASHTO T 166 Method A	2
FOP for AASHTO T 209	2
FOP for AASHTO T 329	1

10.3. With the 2 samples selected in Section 9.4.3 retain 1 sample for dispute resolution testing.

10.3.1. With the remaining sample, blend and reduce in accordance with FOP for AASHTO R 47 to within (plus or minus) 15.0 grams of the desired sample size. Fine tune by hand to the desired sample size and perform the performance testing shown in Table 10.2.

10.3.2. Report results on the most current ITD-773 form and include copies of all original source documents.

Table 10.2 – Test Strip Mix Performance Testing Requirements.

Test Method	**Increments [(a)] Per Sample**
AASHTO T 324	4
ASTM D 8225	3

[(a)] An increment is considered a single SGC puck.

11. ACCEPTANCE LAB AGGREGATE TESTING REQUIREMENTS

11.1. With one of the 2 samples selected in Section 9.5.1, reduce in accordance with FOP for AASHTO R 76 and perform the testing shown in Table 11.1.

11.1.1. Retain remaining 1 sample for testing, test remaining 1 sample if the first sample fails.

11.1.2. Report results on the most current Department forms, include copies of all original source documents.

Table 11.1 – Test Strip Aggregate Testing Requirements.

Test Method	Increments Per Sample
FOP for AASHTO T 335	1
FOP for AASHTO T 255	1
AASHTO T 304 Method A	1
FOP for ASTM D 4791	2
FOP for AASHTO T 176 (Alternate Method 2, Mechanical)	2
AASHTO T 85[(a)]	3
Idaho IT 144[(a)]	3

[(a)] Department may elect to perform to confirm G_{sb}.

12. ACCEPTANCE LAB RAP TESTING REQUIREMENTS

12.1. With 1 of the samples selected in Section 9.6.1, reduce in accordance with FOP for AASHTO R 76 and perform the testing shown in Table 12.1.

12.1.1. Report results on the most current Department forms include copies of all original source documents.

Table 12.1 – Test Strip RAP Testing Requirements.

Test Method	Increments Per Sample
FOP for AASHTO T 255 (Controlled Heat Source)	1
Idaho IT 146 [(a)]	1
ASTM D8159 [(a)]	1
AASHTO T 30 [(a)]	1
AASHTO T 308 [(a)]	1

[(a)] The Department may confirm the RAP G_{sb}.

13. ACCEPTANCE LAB BINDER TESTING REQUIREMENTS

13.1. With the one sample selected in Section 9.7.1, select 2 quarts for Department acceptance testing and 1 quart for challenge resolution. Perform the testing shown in Table 13.1.

13.1.1. Report results on the most current Department forms, include copies of all original source documents.

Table 13.1 – Test Strip Binder Testing Requirements.

Test Method	Increments Per Sample
Idaho IT 99	1
AASHTO M 320[a]	1
ASTM D 8159[a]	1

[a] See QA Manual Sections 230.10. Meet the requirements of Standard Specifications Sections 702.01 and 702.06.

14. ACCEPTANCE LAB FIELD COMPACTED MIX TESTING REQUIREMENTS

14.1. With the each of the 10 samples selected in Section 9.8.1, separate two or more pavement courses, lifts, or layers per FOP for AASHTO R 67. Perform the testing shown in Table 14.1.

14.1.1. Report results on the most current Department forms, include copies of all original source documents.

Table 14.1 – Field Compacted Mix Testing Requirements.

Test Method	Increments Per Sample
FOP for AASHTO T 166 Method A or AASHTO T 331[a]	1

[a] Use the average G_{mm} from testing performed in Section 10 to compute the in-place density of the cores.

15. ACCEPTANCE LAB TEST STRIP RESULTS REPORTING PROCEDURE

15.1. Report the results of each test performed on the most current Department forms, include copies of all original source documents and sample tracking forms in the report.

15.1.1. Each original source document will be signed by the testing technician.

15.2. The lab manager or the lab manager’s qualified designated agent will fully review the report and all supporting documents for completeness.

15.3. Submit a complete electronic copy of the report to the Engineer for distribution with ample time to allow the Engineer time to review and determination of test strip acceptance.

16. EVALUATING ACCEPTANCE TEST STRIP RESULTS

16.1. The Engineer, upon receipt of the results from 15.3, will determine acceptance of the test strip as follows:

16.1.1. Use the Department approved method (e.g., Department provided spreadsheet or web portal) to perform the quality level analysis and determine acceptance as specified in 106.03.B and 405.03.I.

16.2. *Review of hot plant calibration records:*

16.2.1. Verify that the calibration records meet Idaho IR 155. If they do not match the most recent plant calibration record that was witnessed, perform a calibration verification in accordance with Idaho IR 155.

16.3. *Review of hot plant printout:*

16.3.1. Use the ITD-774 form to verify that the hot plant printout indicates the individual cold feed percentage for aggregate, cold feed percentage for RAP, asphalt content for the RAP, and virgin binder meet the requirements of 405.03.I.

17. ACCEPTANCE OF THE TEST STRIP

17.1. The test strip is considered acceptable when it meets Section 16.

18. EXAMPLE OF DETERMINING THE TEST STRIP SAMPLING SCHEDULE

Example: During the pre-paving meeting, the Contractor informs the Engineer that they will be performing an onsite test strip on April 19th. They anticipate paving 2,130 tons.

The Engineer will use this information to develop a test strip sampling schedule as follows:

For plant mix:

- The plant mix sampling frequency is calculated by dividing 2,130 by 6.
- Sampling frequency for plant mix is 1 sample per 355 tons.
- Use a 355 ton sample frequency and 6 samples, perform Idaho IR 148 to determine the sampling schedule to obtain 6 stratified random, samples of plant mix.
- Obtain plant mix samples in accordance with AASHTO R 97 per the sampling schedule.

For cold feed aggregate:

- Before sampling asphalt mix, obtain 1 cold feed aggregate sample by Conveyor Belt Method A or Method B of FOP for AASHTO R 90. Conveyor Belt Method B is the preferred method if automatic sampling devices are available.
- After sampling asphalt mix, obtain 1 cold feed aggregate sample by Conveyor Belt Method A or Method B of FOP for AASHTO R 90. Conveyor Belt Method B is the preferred method if automatic sampling devices are available.

For RAP (if used):

- Before sampling asphalt mix, obtain 1 RAP sample by FOP for AASHTO R 90. Conveyor Belt Method B is the preferred method if automatic sampling devices are available.
- After sampling asphalt mix, obtain 1 RAP sample by FOP for AASHTO R 90. Conveyor Belt Method B is the preferred method if automatic sampling devices are available.

For binder:

- Use a 2,130 ton sample frequency and 1 sample, perform Idaho IR 148 to determine the sampling schedule to 1 stratified, random samples of binder.
- Obtain 1 binder sample (consisting of 3, 1-quart cans) in accordance with FOP for AASHTO R 66 per the sampling schedule.

For field compacted mix:

- The field compacted mix sampling frequency is calculated by dividing 2,130 by 10.
- Sampling frequency for plant mix is 1 sample per 213 tons.
- Use a 213 ton sample frequency and 10 samples, perform Idaho IR 148 to determine the sampling schedule to obtain 10 stratified random, samples of field compacted mix.
- Obtain field compacted mix samples in accordance with AASHTO R 67 per the sampling

Idaho Standard Practice for

Superpave Volumetric Mix Design

IDAHO Designation: IR-150-21

1. SCOPE

1.1. This practice describes the requirements for developing a Superpave mix design.

1.2. *This standard practice may involve hazardous materials, operations, and equipment. This standard practice does not purport to address all of the safety concerns, if any, associated with its use. It is the user's responsibility of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations before use.*

2. BACKGROUND

2.1. Developing a mix design is a function of quality control (QC). A mix design is developed to find a combination of aggregates, recycled materials, asphalt, and additives to produce a roadway that meets the Department's specifications.

2.2. The end result of a successful mix design is a recommended mixture of aggregate and asphalt binder. This recommended mixture, which also includes aggregate gradation and asphalt binder type, is the job mix formula (JMF).

2.3. A JMF is a recipe for the plant to make. The mix design is the development of that recipe. A mistake in the design process can disrupt a project's schedule dramatically and have a big impact to the overall quality of the finished roadway. The development of the JMF is a QC process. It is the Contractor's responsibility to ensure that their mix design and resulting JMF will result in a mix that meets the contract requirements as determined by the Department's testing.

> **Note:** A JMF is only as good as the information that was used to develop it. A good mix design can help limit issues in production.

2.4. The mix design evaluation is for the Department to use to validate that the recipe was properly developed and the resulting JMF appears that the mix produced will meet the contract requirements.

3. REFERENCE DOCUMENTS

3.1. AASHTO Standards

- M 323, Superpave Volumetric Mix Design
- R 30, Mixture Conditioning of Hot-Mix Asphalt (HMA)
- R 35, Superpave Volumetric Design for Asphalt Mixtures
- R 76, Reducing Samples of Aggregate to Testing Size
- R 90, Sampling Aggregate Products
- T 11, Materials Finer Than 75-pm (No. 200) Sieve in Mineral Aggregates by Washing
- T 27, Sieve Analysis of Fine and Coarse Aggregates

- T 84, Specific Gravity and Absorption of Fine Aggregate
- T 85, Specific Gravity and Absorption of Coarse Aggregate
- T 166, Bulk Specific Gravity (G_{mb}) of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens
- T 209, Theoretical Maximum Specific Gravity (G_{mm}) and Density of Hot Mix Asphalt (HMA)
- T 312, Preparing and Determining the Density of Asphalt Mixture Specimens by Means of the Superpave Gyratory Compactor
- T 324, Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)
- T 331, Bulk Specific Gravity (G_{mb}) and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method

3.2. Idaho Standards:

- IT 144, Specific Gravity and Absorption of Fine Aggregate Using Automatic Vacuum Sealing Method
- IT-146, Determination of Recycled Asphalt Pavement (RAP) Aggregate Dry Specific Gravity G_{sb}
- Standard Specifications for Highway Construction

3.3. WAQTC/Idaho FOPs

- R 76, Reducing Samples of Aggregate to Testing Size
- R 90, Sampling Aggregate Products
- T 11, Materials Finer Than 75-pm (No. 200) Sieve in Mineral Aggregates by Washing
- T 27, Sieve Analysis of Fine and Coarse Aggregates
- T 166, Bulk Specific Gravity (G_{mb}) of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens
- T 209, Theoretical Maximum Specific Gravity (G_{mm}) and Density of Hot Mix Asphalt (HMA)
- T 312, Preparing and Determining the Density of Asphalt Mixture Specimens by Means of the Superpave Gyratory Compactor
- WAQTC TM 13, Volumetric Properties of Hot Mix Asphalt
- WAQTC TM 14, Laboratory Prepared Asphalt Mixture Specimens

3.4. ASTM Standards

- D8159, Automated Extraction of Asphalt Binder From Asphalt Mixtures (Asphalt Analyzer)
- D8255, Determination of cracking Tolerance Index of Asphalt Mixture Using the Indirect Tensile cracking Test at Intermediate Temperature

3.5. *Other Standards*

- Asphalt Institute MS-2, Asphalt Mix Design Methods, 7th Edition

4. SPECIFIC GRAVITY OF AGGREGATE AND RAP

4.1. Use the bulk dry specific gravity of aggregate (G_{sb}) established by the Department for each stockpile when developing the mix design and performing calculations.

5. MIX DESIGN REQUIREMENTS

5.1. Develop a Superpave mix design in accordance with AASHTO R 35 that will result in a plant-produced mixture that meets the contract requirements.

5.2. The mix design must be developed by an individual that is qualified by the Department as a Superpave mix design technician (SPMDT).

5.2.1. The specific tests required during the mix design process must be performed by an individual qualified by the Department for the specific test method.

5.3. The mix design must be reviewed, approved, signed, and sealed by an Idaho-licensed professional engineer responsible for the mix design.

5.4. Use a Department-qualified Superpave mix design laboratory for developing the design.

6. MIX DESIGN REPORT REQUIREMENTS

6.1. Provide a single job mix formula (JMF) reported on an ITD-774 form.

6.2. Attach all supporting documentation and data used in developing the JMF.

6.2.1. Include signature(s) and WAQTC/PE license number(s) for testers and reviewers on each sheet.

Note: The design will be reviewed by the Department in accordance with Idaho IR 151. Ensure that the report has all information required to complete the review. Incomplete or missing information will result in rejection of the mix design.

7. MIX DESIGN SUBMITTAL

7.1. Submit the mix design and all supporting documentation via email to mixdesigns@itd.idaho.gov and the Engineer.

7.2. Each mix design submitted for approval must be accompanied by a Microsoft® Excel® electronic version of the ITD-774 form specific to the mix design.

7.3. Only 1 mix design per email notification will be accepted. Submit the mix design for evaluation a minimum of 5 business days before paving is scheduled to begin.

7.4. Upon submittal, the Department will give the mix design a unique identifier number. This will be the mix design number. Keep this number for your records.

8. AMENDING THE MIX DESIGN

8.1. If the mix design is required to be amended per 405.03.B.1.b.i.1, amend the mix design the following process:

8.1.1. Each page of the mix design that is revised or added is required to include the project key lead number, bid item number, date of revision, and means of identifying the revision. The amendment is required to be signed and dated by the Contractor's representative who is responsible for developing the mix design and subsequently signed and dated when approved by the Engineer.

8.2. Amending the mix design or JMF is not allowed once the mix design has been approved by the Department.

9. APPROVED MIX DESIGNS

9.1. The Department will maintain a list of approved mix designs listed by Department generated mix design number. Mix designs are not approved for use unless they are listed.

Idaho Standard Practice for

Superpave Mix Design Evaluation

IDAHO Designation: IR-151-21

1. SCOPE

1.1. This practice describes the procedures for evaluating a Superpave mix design, mix design requirements, and the time required to perform the evaluation.

1.2. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the user's responsibility of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations before use.*

2. BACKGROUND

2.1. When reviewing a mix design, it is important to keep in mind the following:

2.2. A mix design is solely a function of quality control (QC). A mix design is developed to find a combination of aggregates, recycled materials, asphalt, and additives to use to produce a roadway that meets the Department's specifications.

2.3. The end result of a successful mix design is a recommended mixture of aggregate and asphalt binder. This recommended mixture, which also includes aggregate gradation and asphalt binder type is the job mix formula (JMF).

2.4. A JMF is a recipe for the plant to make. The mix design is the development of that recipe. A mistake in the design process can disrupt a project's schedule dramatically and have a big impact to the overall quality of the finished roadway. However, developing the JMF is a QC process. It is the Contractor's responsibility to ensure that their mix design and resulting JMF will result in mix that meets the contract requirements.

Note: A JMF is only as good as the information that was used to develop it. A good mix design can help limit issues in production.

2.5. The mix design evaluation is for the Department to use to validate that the recipe was properly developed and the resulting JMF appears that the mix produced will meet the contract requirements.

3. REFERENCE DOCUMENTS

3.1. *Idaho Procedures:*

- IT-150, Superpave Volumetric Mix Design
- Standard Specifications for Highway Construction

4. SUBMITTAL OF MIX DESIGN

4.1. The Contractor must submit the asphalt mix design in accordance with Idaho IR 150.

5. RECEIPT OF MIX DESIGN SUBMITTAL

5.1. Upon receipt of the mix design submittal, the mix design will be given a unique identifier number.

6. REVIEW OF MIX DESIGN SUBMITTAL

6.1. The Department will review all Superpave mix designs proposed for use before use. The Department recognizes the risk associated with each paving application varies. Therefore, the extent of each mix design review will be in accordance with these potential risks.

6.2. The mix design will be reviewed by the Engineer, the Central Materials Laboratory, and the State Construction and Materials Engineer.

6.3. The reviewers may contact the mix designer or the professional engineer responsible for the mix design during the review process for further information or clarifications.

6.4. All mix designs will be reviewed for the following:

6.4.1. Accuracy.

6.4.2. Completeness.

6.4.3. Reasonableness. Examples of items that will be check for reasonableness include, but are not limited to, ensuring that calculations were done correctly and that the volumetric data follows the expected trends (i.e., binder absorption not being dependent on asphalt content).

6.4.4. Compliance with specifications.

6.4.5. Compliance with Idaho IR 150.

6.5. When amendments are made to the mix design submittal, the current review will be ended and the amended mix design will be considered a new submittal.

6.5.1. Amendments must meet the requirements of Idaho IR 150.

7. REVIEW OF PREVIOUSLY USED MIX DESIGNS

7.1. A mix design reviewed and accepted for a previous or current project may be submitted in writing for use on a new project. Acceptance of the mix design will be based on meeting the following requirements in addition to the requirements of Section 3:

7.1.1. The proposed mix design is of the type required for the new project.

7.1.2. The mix produced on previous projects utilizing the proposed mix design was of good quality (e.g., the combined average PWL on all the previous project(s) was ≥ 90 PWL for all mix quality characteristics).

7.1.3. The mix design is not classified as expired in accordance with 405.03.B.2 of the Standard Specifications.

8. MIX DESIGN REVIEW TIMEFRAME

8.1. The Department will review the mix design within 5 business days after receiving the full submittal package.

9. APPROVAL OF MIX DESIGN

9.1. The Department will maintain a list of approved mix designs. Upon approval, the mix design will be placed on this list.

10. REJECTION OF MIX DESIGN

10.1. The Department will notify the Contractor upon rejection of a mix design via email.

10.1.1. The Department will provide details as to why the mix design was rejected.

10.2. Notification of the rejection will be sent to the email address given on the ITD-774 form.

Idaho Standard Practice for

ASPHALT MIXTURES QUALITY CONTROL PLAN (QCP) DEVELOPMENT AND IMPLEMENTATION

IDAHO Designation: IR-152-21

1. PURPOSE

1.1. The purpose is to establish minimum requirements for the Contractor's quality control system and quality control plan (QCP) for asphalt mixtures. It is intended that these requirements be used as a procedural guide in detailing the inspection, sampling, and testing deemed necessary to maintain compliance with the Department's specifications. The Department and the Contractor must hold a pre-pave meeting and document the decisions and agreements made. An example of a pre-pave meeting agenda is provided in the Appendix. Conducting a thorough pre-pave meeting increases partnership as well as it can only increase the likelihood of success of each party.

2. SCOPE

2.1. This procedure is applicable to the production and construction of asphalt mixtures.

3. REFERENCE DOCUMENTS

3.1. Idaho Standards

- IR 158, Quality Control Plan Development.
- IR 160, Evaluation and Approval of HMA Plants and Equipment.
- IR 155, Procedures for Checking Asphalt Drum Mix Plants

4. GENERAL REQUREMENTS

4.1. As stated in the Standard Specifications for Highway Construction, a QCP must be developed by the Contractor/producer and submitted in writing to the Engineer at the preconstruction conference. Acceptance of the QCP by the Engineer will be contingent upon its concurrence with the Standard Specifications and this standard method. For this reason, the QCP will clearly describe the methods by which the quality control program will be conducted. For example, the items to be controlled, tests to be performed, testing frequencies, sampling locations, and techniques will be included with each item listed separately. Also include a table stating what actions will occur when test results indicate specification limits are approached or exceeded. See Table 1 at end of this guide for an example. Also, a detailed plan of action regarding disposition of non-specification material will be included. Such a plan will provide for immediate notification of all parties involved in the Quality Assurance process in the event nonconforming situations are detected. Example 1. HMA Quality Control Plan may be used as an example.

4.2. Inspection and testing records must be maintained, kept current, and made available for review by Department personnel throughout the life of the contract. All other documentation (e.g., date of inspections, tests performed, temperature measurements, and accuracy, calibration or re-calibration checks performed on production of testing equipment) will be recorded.

4.3. The Contractor will maintain standard equipment and qualified personnel in accordance with the contract and specification requirements for the item(s) being produced.

5. QUALITY CONTROL PLAN

5.1. Operation quality control plans will be submitted for each contract/project to the Engineer for review and approval. Include a Plant Quality Control Plan that meets the requirements of Idaho IR 160. Distribution of the approved quality control plans will be made by the Engineer.

5.2. Example 1. HMA Quality Control Plan is provided only as an acceptable template that contains the required information is attached.

6. ADDENDA TO THE QUALITY CONTROL PLAN

6.1. Addenda are defined as an addition or deletion to the QCP. Each page of the QCP that is revised is required to include the project key lead number, date of revision, and means of identifying the revision. The addenda are required to be signed and dated by the Contractor’s representative who is responsible for insuring that all items of work will comply with Department Specifications and subsequently signed and dated when approved by the Engineer.

Table 1: Example of QC Actions to Implement When Approaching or Exceeding Specification Limits

Test Description	Test Method	QC Action Limits		Situation		Action
		Single Test	4-Point Moving Avg. or Daily Avg.	Single Test	4-Point Moving Avg. or Daily Avg.	
Binder Content, P_b	FOP for AASHTO T 168 and FOP for AASHTO R 47 and FOP for AASHTO T 308 and FOP for AASHTO T 329	± 0.6	± 0.3	Approaching Limit	Approaching Limit	Discuss with hot mix plant, operator, and may suspend construction process
Aggregate Gradation	FOP for AASHTO T 30 (wash method used for all gradation measurements)	NA	C-JMF	4 percent on +#4 2 percent on -#4	Approaching Limit	Increase frequency of tests and prepare for process modification
Air Voids @ N_{design}, P_a	WAQTC TM 13	± 1.0%	NA	2 tests over ± 1%	NA	Initiate C-JMF Modifications
VMA @ N_{design}	WAQTC TM 13	≤ 1% min	≥ min	3 tests over ± 1%	Approaching Limit	Discuss with the Engineer & Process Modification
Dust Proportion, DP	WAQTC TM 13	NA	≥ min ≤ max	Approaching Limit	Approaching Limit	Modify C-JMF
G_{mm}	FOP for AASHTO T 168 and FOP for AASHTO R 47 and FOP for AASHTO T 209 (Bowl Method)	C-JMF	C-JMF	Approaching Limit	Approaching Limit	Modify C-JMF or Redesign
G_{se}	WAQTC TM 13	C-JMF	C-JMF	Approaching Limit	Approaching Limit	Modify C-JMF or Redesign
Rut Depth, mm	AASHTO T 324	≥ min	NA	Approaching Limit	NA	Discuss with the Engineer & initiate investigation, modification, or redesign
Stripping, passes	AASHTO T 324	≥ min	NA	Approaching Limit	NA	Discuss with the Engineer & initiate investigation, modification, or redesign
Cracking, FI	AASHTO TP 124	≥ min	NA	Approaching Limit	NA	Discuss with the Engineer & initiate investigation, modification, or redesign
Mainline Density	Idaho IR 156, and FOP for AASHTO T 355 or FOP for AASHTO T 343	NA	≥ min	Approaching < 92%	≤ 100% Pay	Notify the Engineer

Note: When 2 consecutive test results fail or if any of the 4-point moving average values fail, production will be suspended and the situation discussed with the Engineer. The process will be corrected before production resumes.

EXAMPLE 1

HMA Quality Control Plan – General Overview (Details provided in PrePave Meeting/Project Specific)

NOTE: This is provided only as an acceptable template; other options/formats are acceptable

Date:
To: (RESIDENT ENGINEER)
From: (CONTRACTOR(s) NAME)
Subject: HMA Quality Control Plan

1. Project Information

1.1. We are submitting our HMA Quality Control Plan, developed in accordance with Idaho IR 152, Idaho IR, 158, and Idaho IR 160 for:

Project Number:____________________
Lead Key Number:__________________
Date Submitted:____________________

1.2. (NAME) is responsible for ensuring that all items of work will comply with the contract and Department specifications.

2. Hot Plant

2.1. General Information:

Make:______________________________

Type:______________________________

Address of Plant:______________________

2.2. The hot plant operation is under the direction of (NAME) who can be contacted at (ADDRESS, EMAIL, AND TELEPHONE).

2.3. Current calibration and verification status of plant and history of plant inspection program attached in Exhibit A.

2.4. The Hot Plant Quality Control Plan, developed in accordance with Idaho IR 160 and approved on (DATE) by (NAME OF PERSON(s)) is attached in Exhibit B.

3. Mix Designs

3.1. Mix designs will be the responsibility of (NAME OF PERSON(s)), WAQTC number (NUMBER(s)).

3.2. The HMA design(s) to be used are attached in Exhibit C.

3.3. Before production, (NAME), (WAQTC NUMBER), will submit our HMA mix design for each type of mix in accordance with the contract and specifications by (DATE). Only allowable and approved materials will be incorporated in the mix.

4. Delivery and Placement

4.1. The field operation is under the direction of (NAME) who can be contacted at (ADDRESS, EMAIL, AND TELEPHONE).

4.2. (LIST OF EQUIPMENT TYPE, MAKE).

4.3. (DETAILED DESCRIPTION OF THE PRODUCTION AND PLACEMENT PROCESS).

5. Quality Control Sampling and Testing,

5.1. The laboratory performing quality control testing is (LAB QUALIFICATION NUMBER), located at (LOCATION).

5.2. The quality control program is under the direction of (NAME OF PERSON), who can be contacted at (ADDRESS, EMAIL, AND TELEPHONE).

5.3. During the placement operations of the HMA pavement we will perform at a minimum quality control tests per attached schedule. Sampling and testing is the responsibility of (NAME(s), WAQTC number (NUMBER(s)).

5.4. Sampling and testing is the responsibility of (NAME OF PERSON(s)), WAQTC number (NUMBER(s)).

5.5. During the production operations of the HMA (NAMES) will perform, at a minimum, quality control tests in accordance with the attached schedule. Also attached are the proposed method to select locations and/or times for sampling. See Exhibit D.

5.6. All testing will be completed by (NAME(s)), (WAQTC NUMBER(s)), within (HOURS) hours of sampling and all original documentation of results will be completed on the attached original documentation forms. See Exhibit E.

5.7. Testing reports and original source documents will be reviewed and checked by (NAME(s)), (WAQTC NUMBER(s)), within (HOURS) hours of testing being completed. All reporting will be completed on the attached forms. See Exhibit F.

EXAMPLE 1 (CONTINUED)
HMA Quality Control Plan

6. Records.

6.1. Testing reports and all backup documentation will be located at (LOCATION) for review by the Department between the hours of (TIME) and (TIME) during the life of the contract/project.

6.2. Testing reports and all backup documentation will be located at (LOCATION) for review by the Department between the hours of (TIME) and (TIME) for (YEARS) after the completion of the project.

7. Notifications.

7.1. Any material found to be noncomplying will be addressed by (NAME) who will notify the Engineer immediately.

7.2. (NAME) will notify appropriate Department personnel at least 48 hours before any work is to begin.

8. Nonconforming Material.

8.1. (STATE THE PROCESS FOR DISPOSITION OF NONCONFORMING MATERIAL)

8.2. See the Exhibit G for what actions will occur when test results indicate specification limits are approached or exceeded.

Attachments:

Exhibit A – Current calibration and verification status of plant and history of plant inspection program

Exhibit B – Hot Plant Quality Control Plan

Exhibit C – HMA Mix Design

Exhibit D – Minimum QC Testing Schedule, Sampling and Testing Methods, and Location(s)

Exhibit E – Original Test Documentation Form Template(s)

Exhibit F – Test Reporting Form Template(s)

Exhibit G – Table of QC actions when approaching or exceeding specification limits

Idaho Standard Practice for

Split Sample Comparison

IDAHO Designation: IR-153-21

1. SCOPE

1.1. This Standard Practice is used to compare 2 or more sets of test results in order to measure the testing variability of different parties (e.g., Department vs. Contractor).

2. BACKGROUND

2.1. There are 4 primary components or sources of inherent variability in individual test results for material samples. These components of inherent variability are:

- Sampling Variability
- Testing Variability
- Material Variability
- Construction Variability

2.1.1. **Sampling variability** is caused by variation that is inherent in the sampling methods or procedures used to obtain a material sample. Even when the person obtaining a sample carefully follows standard sampling methods or procedures, some amount of sampling variability will occur.

2.1.2. **Testing variability** is the result of variation inherent in performing a test method and variation inherent in the test equipment. Even when the person performing a test carefully follows standard testing methods and even when the test equipment is properly calibrated, some amount of testing variability will occur.

2.1.3. **Material variability** is essentially due to the inherent variation that naturally exists in a given material. It is quite unrealistic to expect perfect homogeneity in any raw or processed source of construction materials (e.g., soils, aggregate, HMA, PCC, steel, paint). The inherent variation for most construction materials, on a relative basis, is usually small.

2.1.4. **Construction variability** is the result of variation that is inherent in production methods and construction operations. The largest amount of construction variability is generally attributed to the production and placement process.

2.1.5. Additional construction variability (i.e., beyond the expected or accepted range) can be introduced through inconsistent production methods and construction operations. This is why good, consistent quality control, both at the source/plant and in the field, is essential in minimizing the amount of construction variability as a component of overall inherent variability.

2.1.6. Additional sampling variability and testing variability (i.e., beyond the expected or accepted range) can be introduced through deviations from standard sampling method and test procedures by the person(s) performing the sampling and testing, or as a result of test equipment that is not properly calibrated or properly functioning. Sampling and testing variability, combined, have been stated as comprising up to 50 percent of the total overall variation in test results. Specification limits were developed to take standard sampling and testing variability into account. However, it is important not to compound or add to the expected range of inherent variability due to sloppy practices. Consistent and careful adherence to proper sampling and testing procedures can minimize these two components of overall inherent variability.

3. REFERENCE DOCUMENTS

2.1 *AASHTO Standards*

- FOP for R 90, Sampling of Aggregates
- R 76, Reducing Samples of Aggregates to Testing Size
- T 255, Total Evaporable Moisture Content of Aggregate by Drying
- FOP for T 27, Particle Size Distribution of Aggregate
- FOP for T 11, With Materials Finer than 75um (No. 200) Sieve in Mineral Aggregate by Washing
- T 335, Determining the Percentage of Fracture in Coarse Aggregate
- T 176, Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test
- R 97, Sampling Asphalt Mixtures
- R 47, Reducing Samples of Hot Mix Asphalt (HMA) to Testing Size
- T 329, Moisture Content of Hot Mix Asphalt (HMA) by Oven Method
- T 308, Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method
- T30, Mechanical Analysis of Extracted Aggregate
- T 209, Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt Paving Mixtures
- T 167, Standard Method of Test for Compressive Strength of Hot Mix Asphalt
- T 166, Bulk Specific Gravity of Compacted Hot Mix Asphalt using Saturated Surface-Dry Specimens
- R 30, Mixture Conditioning of Hot-Mix Asphalt (HMA)
- FOP for R 66, Sampling Asphalt Materials
- T 164, Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
- T 319, Quantitative Extraction and Recovery of Asphalt Binder from Asphalt Mixtures
- T 303, Lime for Asphalt Mixtures
- T 312, Asphalt Mixture Specimens by Means of the Superpave Gyratory Compactor
- T 324, Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)
- T 33, Bulk Specific Gravity and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method
- R 79, Standard Practice for Rapid Drying of Compacted Asphalt Specimens Using Vacuum Drying Apparatus
- T 269, Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
- T 283, Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage
- TM 13, Volumetric Properties of Hot Mix Asphalt

- R 67, Sampling Asphalt Mixtures after Compaction (Obtaining Cores)
- T 309, Temperature of Freshly Mixed Portland Cement Concrete
- T 119, Slump of Hydraulic Cement Concrete
- T 121, Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
- T 152, Air Content of Freshly Mixed Concrete by the Pressure Method
- T 23, Method of Making and Curing Concrete Test Specimens in the Field
- T 265, Laboratory Determination of Moisture Content of Soils
- T 99, Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and 305-mm (12-in.) Drop
- T 180, Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and 457-mm (18-in.) Drop
- T 85, Specific Gravity and Absorption of Course Aggregate
- T 355, Determining the Percentage of Fracture in Coarse Aggregate
- T 310, In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- T 272, One-Point Method for Determining Maximum Dry Density and Optimum Moisture
- T 304, Uncompacted Void Content of Fine Aggregate
- R 64, Standard Practice for Field Sampling and Fabrication of 50-mm (2-in) Cube Specimens using Grout (Non-Shrink) or Mortar
- T 359, Pavement Thickness by Magnetic Pulse Induction

ASTM Standards

- FOP for D 4791, Flat and Elongated Particles in Coarse Aggregate
- D 1075, Standard Test Method for Effect of Water on Compressive Strength of Compacted Bituminous Mixtures (Immersion-Compression)
- D 6857, Standard Test Method for Maximum Specific Gravity and Density of Bituminous Paving Mixtures Using Automatic Vacuum Sealing Method
- D 8159, Standard Test Method for Automated Extraction of Asphalt Binder From Asphalt Mixtures (Asphalt Analyzer™)
- D 8225, Standard Method of Test for Determination of Cracking Tolerance Index of Asphalt Mixture Using the Indirect Tensile Cracking Test at Intermediate Temperature

Idaho Standards

- IT 13, Measuring Mortar-Making Properties of Fine Aggregate Idaho
- IT 15, Degradation
- IT 72, Evaluating Cleanness of Cover Coat Material
- IT 74, Vibratory Spring-Load Compaction for Coarse Granular Material
- IT 116, Disintegration of Quarry Aggregates (Ethylene Glycol)
- IT 144, Specific Gravity and Absorption of Fine Aggregate Using Automatic Vacuum Sealing (CoreLok) Method
- IT 61, Sampling and Viscosity Testing Emulsified Asphalt Binders in the Field

- IT 146, Determination of Reclaimed Asphalt Pavement (RAP) Aggregate Bulk (Dry) Specific Gravity (G_{sb})
- IR 128, Sampling Concrete for Chloride Analysis
- IT 131, Total Chloride Content of Hardened Concrete by Gran Plot Method
- IT 133, Determination of the Rate of Evaporation of Surface Moisture from Concrete
- IR 143, Field Sampling of Hydraulic Cement and Fly Ash
- IT 147, Measuring Texture Depth of Portland Cement Concrete Using a Tire Tread Depth Gauge
- IR 7, Inspecting/Sampling Paint and Curing Compound
- IT 121, Determining Total Solids-Latex Percent
- IT 8, Resistance R-Value and Expansion Pressure of Compacted Soils and Aggregates
- IR 162, Taking Undisturbed Soil Samples for Laboratory Consolidation, Shear and Permeability Tests
- Idaho Transportation Department Quality Assurance Manual

WAQTC Standards

- TM 13, Volumetric Properties of Hot Mix Asphalt
- TM 2, Sampling Freshly Mixed Concrete
- IR 87, Pavement Straightedge Procedures
- IT 120, Determining Volume of Liquids in Horizontal or Vertical Storage Tanks

4. SUMMARY OF THE PRACTICE

4.1. This practice describes the testing and analysis needed to perform a comparison of split samples tested by different parties against an allowable degree of test result difference attributed to testing variability.

5. TERMINOLOGY

5.1. *Individual Split Sample Acceptable Range*— The allowable tolerance between individual split sample test results when properly sampled and split.

5.2. *Paired t-Test*— Uses the difference between each pair of tests of the split samples and determines whether the difference is much different from zero.

5.3. *Split Increment*— A representative portion of a split sample that is larger than the minimum size needed for a single party to perform the desired testing.

5.4. *Split Sample*— A sample that will be used for split sample comparison testing.

6. MATERIAL SAMPLING AND SPLITTING AND TESTING

6.1. Obtain a sample in accordance with the Department's approved sampling procedure.

6.1.1. Ensure that the sample is large enough for each party to receive a split increment larger than the minimum sample size.

6.2. Split each sample in accordance with the Department's approved splitting procedure.

6.2.1. Ensure that each split increment meets the minimum sample size for the testing to be performed.

6.3. Each party will test in accordance with Department's approved testing procedures.

6.4. Repeat steps 6.1 to 6.3 until the desired number of split samples are obtained to perform the analysis.

Note: It is recommended to compare a minimum of 3 split samples for material that will be subject to statistical based acceptance (e.g., HMA, aggregates)

7. COMPARISON OF RESULTS

7.1. Compare the split increments for each split sample using the D2S limits (Section 9).

7.2. Compare the sets of split increments for all split samples using the paired t-test (Section 8).

Note: The D2S comparison is simple and can be done for each split sample that is obtained. However, this procedure compares only 2 test results (from one split sample), and is not very powerful due to the limited amount of data being evaluated. The paired t-test, compares multiple sets of split samples, and is a better method for comparison since this test uses the differences between multiple pairs of tests and determines whether the average difference is statistically different from zero.

7.3. Use the ITD-1237 form to perform and report the comparison.

7.4. When differences in results have been identified, the parties will collaborate and investigate to determine the source of the inconsistency and make necessary corrections.

7.5. The possible source of the inconsistencies and any corrections made will be documented on the ITD-1237 form.

8. PAIRED T-TEST COMPARISON (RECOMMENDED)

8.1. Determine the individual difference between split sample test results (X_{dif}) for each split sample.

$$\mathrm{x_{dif}} = \mathrm{x}_A - \mathrm{x}_B$$

Where:

X_{dif} = Individual difference between split sample test results.

X_A = Party A's individual test value.

X_B = Party B's individual test value.

Note: This difference is not the absolute difference, it is the algebraic difference. The subtraction (i.e., Party A's test value minus Party B's test value) is performed in the same direction for every set of split samples.

8.2. Determine the mean of the differences between the split sample test results, calculated as follows:

$$\overline{\mathrm{X}}_{\mathrm{dif}} = \frac{(\mathrm{x_{dif1}} + \mathrm{x_{dif2}} + \ldots \mathrm{x_{dif\,n}})}{\mathrm{n}}$$

Where:

$\overline{X}_{dif}$ = Mean of the differences between the split sample test results.

n = Number of split samples.

8.3. Compute the standard deviation of the differences between the split sample test results, calculated as follows:

$$S_{dif} = \sqrt{\frac{\sum(x_{dif} - \overline{X}_{dif})^2}{n - 1.0}}$$

Where:

S_{dif} = Standard deviation of the differences between the split sample test results.

8.4. Compute the paired t-statistic (t_{pair}) using the following equation:

$$t_{pair} = \frac{|\overline{X}_{dif}|}{\left(\frac{S_{dif}}{\sqrt{n}}\right)}$$

8.5. Compute the degrees of freedom (df). The degrees of freedom are the number of sample pairs (n) minus one, used to compute the t-statistic.

$$df = n - 1$$

8.6. Determine the two-tailed probability distribution (P-value) for the 2 data sets using the degrees of freedom (df) for a two-tailed t-test.

8.7. Compare the P-value to α (0.05).

8.7.1. If the P-value is greater than α, the paired t-test passes. There is reason to believe that the paired test results are similar and it can be concluded they are from the same population. (i.e., no differences in testing has been identified)

8.7.2. If the P-value is less than α, the paired t-test fails. The difference between the paired test results of the split samples is greater than is likely to occur from chance and therefore the results are not similar. (i.e., difference in testing has been identified)

9. D2S COMPARISON

9.1. Determine the individual difference between split sample test results (X_{dif}).

$$x_{dif} = x_A - x_B$$

Where:

X_{dif} = Individual difference between split sample test results.

X_A = Party A's individual test value.

X_B = Party B's individual test value.

9.1.1. For aggregates, compare X_{dif} to the QA Manual Table 390.01.1.

9.1.2. For concrete, compare X_{dif} to the QA Manual Table 390.01.2.

9.1.3. For HMA, compare X_{dif} to Table 1 in this method.

9.1.4. For all other materials, compare X_{dif} to the precision statement in the test method performed (if available).

9.2. If X_{dif} is greater than the individual split sample acceptable range, they are considered outside of allowable tolerances. (i.e., a difference in testing has been identified)

Table 1 – Allowable HMA Single Individual Split Sample Variations

Test Method	**Quality Characteristic**	**Acceptable Range of Split Sample Results**
AASHTO T 308	Asphalt Content (%)	0.15
AASHTO T 30	95 to 100% passing a sieve	1.6
	40 to 94% passing a sieve	3.5
	25 to 39% passing a sieve	2.4
	10 to 24% passing a sieve	2.3
	5 to 9% passing a sieve	1.6
	2 to 4% passing a sieve	1.2
	0 to 1% passing a sieve	0.9
AASHTO T 209	G_{mm}	0.012
AASHTO T 166	G_{mb}	0.017
WAQTC TM 13	G_{se}	0.012
	P_a	0.30
	VMA	0.30
	DP	0.15

10. EXAMPLES

10.1. A Department lab and a Contractor lab performed a split sample comparison on 5 samples. The table below presents the split sample test results for theoretical maximum specific gravity (G_{mm}) to determine whether a difference exists between the Department's and the Contractor's results.

Example 10.1 – AASHTO T 209 Results			
Split Sample Number	Contractor's Results	Department's Results	Difference (X_{dif})
1	2.396	2.405	-0.009
2	2.368	2.374	-0.006
3	2.377	2.381	-0.004
4	2.395	2.390	0.005
5	2.381	2.379	0.002
		$\overline{X}_{dif}$ =	-0.0024
		S_{dif} =	0.00577
		P-value =	0.405

10.1.1. Conclusion: Since the calculated P-value is greater than 0.05 (Section 8) and the X_{dif} of each test is less than the individual split sample acceptable range (Section 9), the split sample comparison indicates that there is not a significant difference in testing between these labs.

Idaho Standard Practice for

Nuclear Density Gauge Correlation

IDAHO Designation: IR-154-21

1. SCOPE

1.1. This Standard Practice is used to determine the nuclear density gauge correlation for each nuclear gauge used for acceptance testing.

1.2. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the user's responsibility of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations before use.*

2. REFERENCE DOCUMENTS

2.1 *AASHTO Standards*

- FOP for T 355, Method A, In-Place Density of Asphalt Mixtures by Nuclear Methods
- FOP for R 67, Sampling Asphalt Mixtures After Compaction (Obtaining Cores)
- FOP for T 166, Method A, Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface Dry Specimens
- T 331, Bulk Specific Gravity and Density of Compacted Asphalt Mixtures using Automatic Vacuum Sealing Method

2.2 *Idaho Standards*

- Idaho IR 148, Stratified Random Sampling

3. SUMMARY OF THE PRACTICE

3.1. The bulk specific gravity (G_{mb}) of the core is a physical measurement of the in-place asphalt mixture and can be compared with the nuclear density gauge readings. Comparing the core value to the corresponding gauge values, a correlation can be established.

3.2. The correlation can then be used to adjust the gauge readings to the in-place density of the cores. The core correlation is gauge-specific and must be determined without traffic allowed on the pavement between nuclear density gauge readings and obtaining the core. When using multiple nuclear density gauges, each gauge will be correlated to the core locations before removal of the core.

3.3. Correlation of the nuclear density gauge with pavement cores must be made on the first lot of paving (within 24 hours) or anytime a change of the testing conditions occurs (see Section 8).

Note: *The Department must correlate all gauges that will be used for acceptance testing for each gauge correlation section.*

4. APPARATUS

4.1. *Density Gauge*─ With accessory equipment as specified in FOP for AASHTO T 355.

4.2. *Coring Equipment*─ With accessories as specified in FOP for AASHTO R 67 for collecting 6-inch diameter pavement cores.

4.3. *Measuring Device*─ Approved measuring device capable of measuring gauge correlation section and sub-section lengths.

5. TERMINOLOGY

5.1. *Gauge Correlation Section*─ Pavement placed during production paving that is used to correlate the nuclear density gauge(s) used for acceptance. The gauge correlation section must be constructed to the same placement width and thickness and on the same underlying material as the course it represents.

5.2. *Gauge Correlation Sub-Section*─ A portion of the gauge correlation section in equal-length to other sub-sections that is represented by a single test location.

5.3. *Job Mix Formula* (JMF)─ End result of a successful mix design that is the Contractor's selected mixture to be produced and includes the aggregate gradation and asphalt binder percentage.

5.4. *Test Location*─ The stratified random location within a gauge correlation sub-section where testing will be performed.

5.5. *Test Site Density*─ The uncorrected density reading taken on the compacted pavement after finish rolling is complete at a test site for correlation to cores. It is obtained by using the test procedure specified in FOP for AASHTO T 355 without applying a gauge correlation factor. Filler material must be applied as required in the procedure before taking test site density readings.

5.6. *Stratified Random Sampling* ─Method used to ensure the specimens for the sample are obtained from throughout the test section, and are not concentrated in one portion of the test section. All sample locations will be determined by the Engineer using a random sampling system in accordance to Idaho IR 148.

6. PROCEDURE

6.1. *Determine the gauge correlation section and testing locations as follows:*

6.1.1. Gauge correlation for each correlation section will be within the first 1,000 tons and consist of a minimum of 1,000 feet of production and anytime there is a change of conditions (Section 8).

6.1.2. Divide the total length of the gauge correlation section into 10 equal-length sub-sections.

6.1.3. Identify a test location for each gauge correlation sub-section in accordance with IR 148.

6.2. *Determine the in-place density using the nuclear density gauge for each test location as follows:*

6.2.1. Determine in-place density using the nuclear density gauge(s) for each test location in accordance with FOP for AASHTO T 355.

Note: *It is recommended that the Contractor's QC personnel also determine in-place density at each test location to develop a correlation factor for QC purposes.*

6.2.2. The ITD-820 form will be used by the Department personnel as the original source document to record the test site densities for each gauge at each test location.

6.3. *Determine the bulk specific gravity (G_{mb}) for each sub-section as follows:*

6.3.1. After the pavement has cooled sufficiently to avoid deformation during coring, the Contractor will obtain 1 core at each test site from each segment in accordance with FOP for AASHTO R 67 in the Engineer's presence. The Engineer will immediately receive the cores. The relative position of the core to the nuclear gauge readings for each test location is illustrated in Figure 1.

Note: The Contractor may core for quality control purposes.

6.3.2. Determine the G_{mb} of each core in accordance with FOP for AASHTO T 166 Method A or AASHTO T 331.

Note: *Determine the G_{mb} of all cores for the gauge correlation section using the same procedure.*

6.3.2.1. Determine the bulk density of the each core by multiplying G_{mb} by 62.245 lb/ft^3 and report the value to the nearest 0.1 lb/ft^3.

6.3.3. The ITD-820 form from Section 6.2.2 will be used by the Department personnel as the chain of custody documentation and the original source document used to record the G_{mb} of each core.

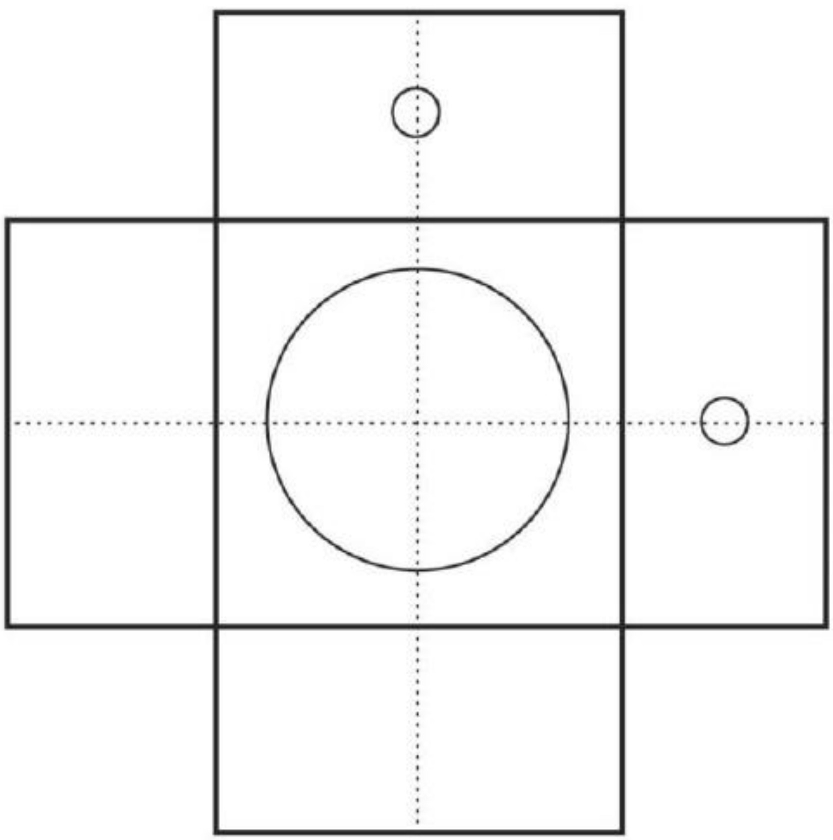


Figure 1. *Footprint of the gauge test site. Core location in the center of the test site.*

7. CALCULATION OF CORRELATION

7.1. *Calculate a correlation factor for the nuclear gauge reading as follows*:

7.1.1. Calculate the difference between the core density and nuclear gauge density at each test site to the nearest 0.1 lb/ft^3. Calculate the average difference and standard deviation of the differences for the entire data set to the nearest 0.1 lb/ft^3.

7.1.2. If the standard deviation of the differences is equal to or less than ±2.5 lb/ft^3, the correlation factor applied to the nuclear density gauge reading will be the average difference calculated in Section 7.1.1.

7.1.3. If the standard deviation of the differences is greater than ±2.5 lb/ft^3, the test location with the greatest variation from the average difference must be eliminated from the data set, and the data set properties and the correlation factor recalculated following Sections 7.1.1 and 7.1.2.

If the standard deviation of the modified data set still exceeds the maximum specified in Section 7.1.2, additional test sites will be eliminated from the data set, and the data set properties and the correlation factor will be recalculated following Sections 7.1.1 and 7.1.2. If the data set consists of less than 5 test locations, additional test sites must be established.

8. CHANGE OF CONDITIONS

8.1. A correlation factor is valid only for:

8.1.1. A specific project.

8.1.2. A specific JMF.

8.1.3. For the specific nuclear density gauges correlated.

8.1.4. Specific gauge thickness setting.

8.1.5. Specific gauge mode setting.

8.1.6. Specific underlying material.

8.1.7. Specific pavement thickness.

8.1.8. A specific pavement lift.

8.1.9. A specific calendar year.

8.2. Re-correlation of the gauge must occur when any of the above conditions change.

9. REPORT

9.1. The Department will report the results of testing on the ITD-820 form.

9.2. Project information.

9.3. Make, model, and serial number of the nuclear density gauge.

9.4. Stratified, random numbers.

9.5. Location of test and thickness of layer tested.

9.6. Underlying material.

9.7. Mixture type.

9.8. JMF identification.

9.9. Date.

9.10. Density standard.

9.11. Gauge readings.

9.12. Name and signature of individual performing AASHTO T 355.

9.13. Name and signature of individual performing AASHTO R 67.

9.14. Name and signature of individual performing AASHTO T 166 or T 331.

9.15. Nuclear gauge correlation to 0.1 lb/ft^3.

Idaho Standard Practice for

Procedures for Checking Asphalt Mix Plant Calibrations

IDAHO Designation: IR-155-21

1. SCOPE

1.1. These procedures are used in conjunction with the Department's Standard Specifications for Highway Construction for checking asphalt drum mix plants to assess plant conformance. This procedure is used for original plant approval, annual plant approval, after plant relocation (if necessary), or trouble shooting. If, at any time the Engineer has reason to believe plant calibration should be checked and provides documentation supporting the reason(s), only the meter(s) or scale(s) in question will be considered verified if the indicated metered or scaled amount, at a production rate within the range stated in the Plant Quality Control Plan, is confirmed when within ±1.0% of the actual scaled or measured amount. Some variations from this procedure may be necessary depending upon the configuration of the plant, including volumetric plants.

1.1.1. Volumetric plants are defined as those plants that meter some or all constituent materials using volumetric metering, such as a volumetric asphalt meter rather than a mass flow meter, or aggregate feeder gate and conveyor speed settings rather than individual belt scales.

1.2. All calibration procedures stated below are required to be completed in the Department's presence for plant verification, unless the Department waives, in writing, witness of calibration. Documentation will be provided to the Department that the tests have been completed and meet specification tolerances. If the Engineer requests how to read and interpret the plant information provided, the Contractor will inform the Engineer.

1.3. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the user's responsibility of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations before use. All individuals must comply with the Contractor's safety program requirements at the plant.*

2. MEASURING DEVICES

2.1. Any weighing device used for payment must meet Section 109.01.A.6.b.

2.2. All measuring devices must meet the current edition of the National Institute of Standards and Technology Handbook 44, except as modified by Table 2.1. The Contractor must provide all personnel and equipment for calibrating measuring devices.

2.3. Balance and zero conditions of scales must be checked daily, and at any other time requested by the Department. The Engineer may, at any time, direct that any measuring device be tested by the producer or an outside agency if there is any doubt about the accuracy of the measuring device. Certificates of inspection must be posted in a prominent place in the plant, and a copy must be promptly submitted to the Engineer.

2.4. Production plant tolerances must meet the following table:

Table 2.1

Material	Measurement Tolerance [a]	Unit of Measure
Aggregate	0.2%	Weight
RAP	0.2%	Weight
Asphalt	0.2%	Weight or Volume
Additives	0.5%	Weight or Volume

[a] Measurement tolerance equals the smallest scale or meter graduation divided the quantity or volume measured (e.g., 20-pound graduations / 10,000 pounds measured = 0.2%)

3. BELT SCALES ON COLD FEEDERS

3.1. Use a certified scale(s) to check each individual belt scale, including RAP, at its high production rate and low production rate, as stated in the Plant Quality Control Plan. The Contractor will determine the amount of material needed to ensure plant calibration is accurate within ±1.0%. A minimum of 2 tests will be run at each range to check for repeatability and eliminate any outliers.

3.2. ***Plant Test Procedure:***

3.2.1. Each bin and its belt scale are tested individually.

3.2.2. Some plants may have to use a zero percent moisture input to ensure accuracy.

3.2.3. Check the belt scale accuracy at both high range and low range by running material over the belt scale and checking the indicated computer weight (accumulator) against the actual net weight of the material in the truck.

3.2.4. The allowable error must not exceed ±1.0% from the certified truck scale weight.

3.2.5. The final belt scale (totalizer) will be checked at its high production rate and low production rate, as stated in the Plant Quality Control Plan. The Contractor will determine the amount of material needed to ensure plant calibration is accurate within ±1.0%

4. BELT SCALE ON VOLUMETRIC PLANTS

4.1. ***Plant Test Procedure:***

4.1.1. The final belt scale will be tested using two high-production rate runs and two low-production rate runs as stated in the Plant Quality Control Plan. The allowable error must not exceed ±1.0%.

5. FEEDER BINS ON VOLUMETRIC PLANTS

5.1. Use a certified scale(s) to check each individual volumetric feeder, including RAP, gate setting and underbelt speed, at its high production rate and low production rate, as stated in the Plant Quality Control Plan. The Contractor will determine the amount of material needed to ensure plant calibration is accurate within ±1.0%. A minimum of 2 tests will be run at each range to check for repeatability and eliminate any outliers.

5.2. Test Procedure:

5.2.1. Each bin and its gate setting(s) and underbelt speed(s) are tested individually.

5.2.2. Record the gate setting and underbelt speed at both high range and low range by running material over the belt scale and recording the indicated computer weight or the actual net weight of the material in the truck divided by the run time and record the tons per hour for those settings.

6. ASPHALT METER ACCURACY

6.1. The asphalt meter is checked at its estimated high production rate and low production rate, as stated in the Plant Quality Control Plan. Run 2 checks at each rate.

6.2. ***Test Procedure:***

6.2.1. Enter the correct specific gravity or lb/gal and temperature for the liquid asphalt being used for the test into the computer system. The Contractor will determine the amount of material needed to ensure plant calibration is accurate within ±0.5%. Follow the manufacturer's recommendation for calibration of the asphalt meter or the asphalt metering system. The calibration tank must be certified or verified with test weights before calibrating the asphalt meter.

6.2.2. Check the asphalt meter accuracy at the high range and low range by running material through the meter and checking the indicated computer weight (accumulator) against the actual net weight of the material in the truck or calibration tank. For volumetric meters, convert the actual net weight to volume using the specific gravity and correcting for temperature.

A minimum of 2 test runs at the high production rate and low production rate will provide repeatability and eliminate any outliers.

7. BAGHOUSE FINES RETURN SYSTEM

7.1. If baghouse fines are returned, the returns will be in accordance with the quality control plan.

8. MINERAL FILLER SYSTEM

8.1. If mineral filler (e.g., lime, other mineral additive) is added separately and does not come into contact with the other aggregates until it is in the drum mixer, it is handled in the same manner as the asphalt meter check.

Note: *This is not the baghouse fines return system. The fines in the baghouse fines return system has contact with the other aggregates before reaching the drum mixer.*

8.2. *Materials and Equipment:*

8.2.1. Calibration vessel, container, or truck with sufficient capacity for calibrating mineral filler.

8.3. *Test Procedure:*

8.3.1. The mineral filler is pumped through its meter into a tared calibration vessel where it is weighed on an approved scale and compared against the quantity as recorded by the plant automation. The Contractor will determine the amount of material needed to ensure mineral filler calibration is accurate within ±5.0%.

9. ANTI-STRIP ADDITIVE CALIBRATION

9.1. Anti-stripping additive calibration check must be performed in a manner satisfactory to the Engineer; at both the high and low production rates and all percentages of additive addition in accordance with the Plant Quality Control Plan. The Contractor will determine the amount of material needed to ensure anti-strip additive calibration is accurate within ±0.5%.

10. NO-FLOW SYSTEM

10.1. Aggregate, RAP, mineral filler system, and asphalt interlocks must issue an audible alarm if a no-flow situation occurs.

10.2. *Test Procedure:*

10.2.1. The no-flow test will be run on each cold feed bin including RAP.

10.2.2. Material will be placed in the bin, and the bin will be allowed to run empty. An audible alarm must immediately occur.

10.2.3. The asphalt and mineral filler systems will be placed in a "No-Flow" condition or otherwise halted and an audible warning must immediately occur.

11. REPORTS

11.1.1. After the plant calibration and/or verification is complete, the Contractor will supply the Engineer with a printout of all calibration numbers which verify the calibration of the system and show that it meets all Department specifications. The Engineer will sign and date a copy for the Contractor to retain.

11.1.2. The Contractor will supply upon request either a display or printout of all calibration numbers that verify the calibration of the system has not changed since the annual calibration and still meets Department specifications.

Idaho Standard Practice for

Determining Rolling G_{mm}

IDAHO Designation: IR-156-21

1. SCOPE

1.1. This Standard Practice is used to determine the maximum theoretical specific gravity (G_{mm}) used for calculating percent compaction of in-place density during production paving.

1.2. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the user's responsibility of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations before use.*

2. REFERENCE DOCUMENTS

2.1 *AASHTO Standards*

- FOP for T 209, Bowl Method, Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
- FOP for T 355, In-Place Density of Asphalt Mixtures by Nuclear Method
- FOP for R 97, Sampling Asphalt Mixtures
- FOP for R 47, Reducing Samples of Hot Mix Asphalt to Testing Size

2.2 *Idaho Standards*

- Idaho IR 148, Stratified Random Sampling
- Idaho IR 125, Acceptance Test Strip for Hot Mix Asphalt (HMA)

3. SUMMARY OF THE PRACTICE

3.1. The maximum theoretical specific gravity (G_{mm}) for determining the percent compaction will be determined using a rolling, consecutive 2-lot average (i.e., the most recent 2 completed lots) of the Department's acceptance test results. For the first 2 lots of production paving, the average G_{mm} from the test strip is used for determining percent compaction.

4. PROCEDURE

4.1. *Determine the rolling G_{mm} for each lot as follows:*

4.1.1. For the first 2 lots of production paving, use the average of all Department acceptance G_{mm} results from the test strip.

Note: The Department must provide the G_{mm} preliminary results before production the next day to the Contractor.

4.1.2. For all other lots of production paving, use the average of all Department acceptance G_{mm} results from the previous 2 lots.

Note: For previously used mix designs, use the average of Lot 1 results of the current project for the first 2 lots of production paving.

4.2. The rolling G_{mm} established in this procedure is used for performing the calculations in the FOP for AASHTO T 355 for the current lot.

5. PROCEDURE FOR TEST RESULT CHALLENGE

5.1. When test result challenge resolution is performed in accordance with Subsection 106.07 of the Standard Specifications, the original Department acceptance test results are replaced with the challenge resolution test results and the rolling G_{mm} for the subsequent lots will be re-determined.

5.2. The rolling G_{mm} established in 5.1 will be used for performing the calculations in place of the G_{mm} determined in Section 4.

6. EXAMPLE

6.1. The table below presents the G_{mm} results from the samples for the first 4 completed lots of production paving. Lot 1 was the test strip. The rolling G_{mm} for the first 5 lots are calculated as follows:

6.1.1. Lot 1 rolling G_{mm} = 2.402 (average of lot 1 combined G_{mm})

6.1.2. Lot 2 rolling G_{mm} = 2.402 (average of lot 1 combined G_{mm})

6.1.3. Lot 3 rolling G_{mm} = 2.399 (average of lot 1 and lot 2 combined G_{mm})

6.1.4. Lot 4 rolling G_{mm} = 2.398 (average of lot 2 and lot 3 combined G_{mm})

6.1.5. Lot 5 rolling G_{mm} = 2.392 (average of lot 3 and lot 4 combined G_{mm})

Lot Number	Sample Number	Combined G_{mm}
1	1	2.396
1	2	2.410
1	3	2.401
2	4	2.395
2	5	2.419
2	6	2.389
2	7	2.391
2	8	2.392
3	9	2.381
3	10	2.422
3	11	2.398
4	12	2.379
4	13	2.388
4	14	2.391
4	15	2.385

Idaho Standard Practice for

QUALITY CONTROL PLAN (QCP) DEVELOPMENT AND IMPLEMENTATION

IDAHO Designation: IR-158-21

1. SCOPE

1.1. The purpose of this guide is to establish minimum requirements for the Contractor's quality control system and quality control plan (QCP). It is intended that these requirements be used as a procedural guide in detailing the inspection, sampling, and testing deemed necessary to maintain compliance with the Department's specifications.

2. GENERAL REQUIREMENTS

2.1. As stated in the Standard Specifications for Highway Construction, a QCP must be developed by the Contractor/producer and submitted in writing to the Engineer at the preconstruction conference. Acceptance of the QCP by the Engineer will be contingent upon its concurrence with the Standard Specifications and this standard method. For this reason, the QCP will clearly describe the methods by which the quality control program will be conducted. For example, the items to be controlled, tests to be performed, testing frequencies, sampling locations, and techniques will be included with each item listed separately. Also include a table stating what actions will occur when test results indicate specification limits are approached or exceeded. See Table 1 at end of this guide for an example. Also, a detailed plan of action regarding disposition of non-specification material will be included. Such a plan will provide for immediate notification of all parties involved in the Quality Assurance process in the event nonconforming situations are detected. Example 1. Quality Control Plan may be used as an example.

2.2. Inspection and testing records must be maintained, kept current, and made available for periodic review by Department personnel throughout the life of the contract. All other documentation (e.g., date of inspections, tests performed, temperature measurements, and accuracy, calibration or re-calibration checks performed on production of testing equipment) will be recorded.

2.3. The Contractor will maintain standard equipment and qualified personnel in accordance with the contract and specification requirements for the item(s) being produced.

3. QUALITY CONTROL PLAN

3.1. Operation quality control plans will be submitted for each contract/project to the Engineer for approval. Distribution of the approved quality control plans will be made by the Engineer.

3.2. Follow Example 1. Quality Control Plan as a general guideline but at a minimum include the following:

3.2.1. Contract bid item covered by the quality control plan.

3.2.2. Sampling location and techniques.

3.2.3. Sampling plan.

3.2.4. Tests and test methods.

3.2.5. Testing frequencies.

3.2.6. Testing forms to be used.

3.2.7. Inspection frequencies and areas of inspection.

3.2.8. Detailed description of production and placement equipment and methods.

3.2.9. Detailed calibration processes and procedures (if applicable)

3.2.10. Documentation procedures, including:

3.2.10.1. Inspection and test record requirements and document management.

3.2.10.2. Temperature measurements.

3.2.10.3. Accuracy, calibration, or recalibration checks performed on production or testing equipment.

3.2.11. QC personnel, including the company official ultimately responsible for the quality of work.

4. ADDENDA TO THE QUALITY CONTROL PLAN

4.1. Addenda are defined as an addition or deletion to the QCP. Each page of the QCP that is revised is required to include the project key lead number, bid item number, date of revision, and means of identifying the revision. The addenda are required to be signed and dated by the Contractor's representative who is responsible for insuring that all items of work will comply with Department Specifications and subsequently signed and dated when approved by the Engineer.

EXAMPLE 1

¾” Aggregate Type B Base Quality Control Plan

Date:
To: (RESIDENT ENGINEER)
From: (CONTRACTOR(s) NAME)
Subject: 3/4” Aggregate Type B for Base Quality Control Plan

1. Project Information

1.1. We are submitting our Quality Control Plan, developed in accordance with Idaho IR 158 for:

Project Number:____________________
Lead Key Number:__________________
Bid Item Number:__________________
Date Submitted:____________________

1.2. (NAME) will be responsible for insuring that all items of work will comply with the contract and Department specifications.

2. Material Source

2.1. General Information:

Source Number:______________________

Address of Source:____________________

2.2. The aggregate source operation is under the direction of (NAME) who can be contacted at (ADDRESS, EMAIL, AND TELEPHONE).

2.3. (DETAILED DESCRIPTION OF THE PRODUCTION PROCESS)

3. Delivery and Placement

3.1. The field operation is under the direction of (NAME) who can be contacted at (ADDRESS, EMAIL, AND TELEPHONE).

3.2. (LIST OF EQUIPMENT TYPE, YEAR, MAKE, MODEL)

3.3. (DETAILED DESCRIPTION OF THE PLACEMENT PROCESS)

4. Quality Control Sampling and Testing,

4.1. The laboratory performing quality control testing is (LAB QUALIFICATION NUMBER), located at (LOCATION).

4.2. The quality control program is under the direction of (NAME OF PERSON), who can be contacted at (ADDRESS, EMAIL, AND TELEPHONE).

4.3. During the production operations of the aggregate we will perform at a minimum quality control tests per attached schedule. Sampling and testing will be the responsibility of (NAME(s), WAQTC number (NUMBER(s)).

4.4. During the placement operations of the aggregate (NAMES) will perform, at a minimum, quality control tests in accordance with the attached schedule. Also attached are the proposed method to select locations and/or times for sampling.

4.5. All testing will be completed by (NAME(s)), (WAQTC NUMBER(s)), within (HOURS) hours of sampling and all original documentation of results will be completed on the attached original documentation forms.

4.6. Testing reports and original source documents will be reviewed and checked by (NAME(s)), (WAQTC NUMBER(s)), within (HOURS) hours of testing being completed. All reporting will be completed on the attached forms.

5. Records.

5.1. Testing reports and all backup documentation will be located at (LOCATION) for review by the Department between the hours of (TIME) and (TIME) during the life of the contract/project.

5.2. Testing reports and all backup documentation will be located at (LOCATION) for review by the Department between the hours of (TIME) and (TIME) for (YEARS) after the completion of the project.

6. Notifications.

6.1. Any material found to be noncomplying will be addressed by (NAME) who will notify the Engineer immediately.

6.2. (NAME) will notify all appropriate Department personnel at least 48 hours before any work is to begin.

7. Nonconforming Material.

7.1. (STATE THE PROCESS FOR DISPOSITION OF NONCONFORMING MATERIAL)

Table 1: Example of QC Actions to Implement When Approaching or Exceeding Specification Limits

Test Description	Test Method	QC Action Limits		Situation		Action
		Single Test	4-Point Moving Avg. or Daily Avg.	Single Test	4-Point Moving Avg. or Daily Avg.	
Aggregate Gradation	FOP for AASHTO T 27 and AAHTO T 11	NA	Approaching Limit	5 percent on +#4 3 percent on -#4	Approaching Limit	Increase frequency of tests and prepare for process modification
Sand Equivalent	FOP for AAHTO T 76	NA	Approaching Limit	NA	Approaching Limit	Increase frequency of tests and prepare for process modification

Note: When 2 consecutive test results fail or if any of the 4-point moving average values fail, production will be suspended and corrective action will be taken. The process will be corrected before production resumes.

Idaho Standard Practice for

QUALITY CONTROL PLAN (QCP) REVIEW PROCESS

IDAHO Designation: IR-159-19

1. SCOPE

1.1. The purpose of this process is to establish a standard for reviewing the Contractor's quality control plan (QCP).

2. REFERENCE DOCUMENTS

2.1. Idaho Standards:

- IR 152, Asphalt Mixtures Quality Control Plan (QCP) Development and Implementation
- IR 155, Procedures for Checking Asphalt Drum Mix Plant Calibrations
- IR 158, Quality Control Plan Development and Implementation

2.2. Standard Specifications for Highway Construction

2.3. Quality Assurance Manual

2.4. Laboratory Operations Manual

3. GENERAL REQUIREMENTS

3.1. As stated in the Department's Standard Specifications for Highway Construction, a QCP must be developed in accordance with Idaho IR 158 and in concurrence with the Standard Specifications applicable to the bid item by the Contractor/producer and submitted in writing to the Engineer at the preconstruction conference. Acceptance of the QCP by the Engineer will be contingent upon its concurrence with the Standard Specifications and this standard method.

4. MINIMUM REQUIREMENTS OF A QUALITY CONTROL PLAN

4.1. Requirements shown in Idaho IR 158.

4.2. Subsection 106.03.A.2 of the Standard Specifications

4.3. Requirements of the contract bid item covered by the quality control plan (e.g., subsection 405.03.C of the Standard Specifications).

4.4. Sampling location and techniques.

4.5. Sampling plan.

4.6. Tests and test methods.

4.7. Testing frequencies.

4.8. Testing forms to be used, including examples.

4.9. Inspection frequencies and areas of inspection.

4.10. Detailed description of production and placement equipment and methods.

4.11. Detailed calibration processes and procedures (if applicable).

4.12. Documentation procedures, including:

4.12.1. Inspection and test record requirements and document management.

4.12.2. Temperature measurements.

4.12.3. Accuracy, calibration, or recalibration checks performed on production or testing equipment.

4.13. QC personnel, including the company point of contact responsible for the quality of work.

4.14. Processes for addressing non-conforming material.

5. REVIEW OF THE QUALITY CONTROL PLAN

5.1. Review the quality control plan to ensure it meets the minimum requirements in Section 4 and that adequate quality control measures are in place for the specific project.

6. REVIEW OF ADDENDA TO THE QUALITY CONTROL PLAN

6.1. Addenda are defined as an addition or deletion to the QCP. Each page of the QCP that is revised is required to include the project key lead number, bid item number, date of revision, and means of identifying the revision. The addenda are required to be signed and dated by the Contractor's representative who is responsible for insuring that all items of work will comply with the Department's specifications.

6.2. Review addenda to the quality control plan to ensure the revised QCP meets the minimum requirements and that adequate quality control measures are in place for the specific project.

7. APPROVAL OF THE QUALITY CONTROL PLAN

7.1. The QCP and each addenda will be approved only once the minimum requirements have been met.

7.2. The QCP, and addenda if applicable, as approved by the Department, is binding upon the Contractor as a contract requirement.

Idaho Standard Practice for

DEVELOPMENT, EVALUATION, AND APPROVAL OF HMA PLANT QUALITY CONTROL PLANS

IDAHO Designation: IR-160-21

1. SCOPE

1.1. This procedure covers requirements for plants producing hot mix asphalt (HMA) or warm mix asphalt (WMA) paving mixtures. The requirements in this procedure are the minimum requirements for a plant to meet 405.03.E of the Department's Standard Specifications for Highway Construction ("Standard Specifications").

1.2. *This procedure may involve hazardous materials, operations, and equipment and may not address all of the safety problems associated with the use of the test method. It is the user's responsibility to establish the appropriate safety and health practices and determe the applicability of regulatory limitations before use. All individuals must comply with the Contractor's safety program requirements at the plant.*

2. REFERENCE DOCUMENTS

2.1. AASHTO Standards:

- M 156, Standard Specifications for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
- R 66, Sampling Asphalt Materials
- T 19M/T 19, Bulk Density ("Unit Weight") and Voids in Aggregate
- T 27, Sieve Analysis of Fine and Coarse Aggregates
- T 30, Mechanical Analysis of Extracted Aggregate
- T 84, Specific Gravity and Absorption of Fine Aggregate
- T 166, Bulk Specific Gravity (G_{mb}) of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens
- R 97, Sampling Asphalt Mixtures
- T 209, Theoretical Maximum Specific Gravity (G_{mm}) and Density of Hot Mix Asphalt (HMA)
- T 283, Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage
- T 308, Determining the Asphalt Binder Content of Asphalt Mixtures by the Ignition Method
- T 312, Preparing and Determining the Density of Asphalt Mixture Specimens by Means of the Superpave Gyratory Compactor

3. TERMINOLOGY

3.1. Check—A specific type of inspection or measurement performed on equipment or materials to indicate compliance with the stated criteria (e.g., lime check, calibration check of the cold feed system).

3.2. Continuous Mix Plant—A manufacturing facility for producing asphalt paving mixtures that continuously proportions the aggregate, asphalt binder, RAP, and other chosen additives into the mix by a continuous volumetric or mass proportioning system without definite batch intervals.

3.3. Drum Mix Plant—A manufacturing facility for producing asphalt paving mixtures that continuously proportions the aggregate, heats and dries it in a rotating drum, adds any chosen additives, and simultaneously mixes the material with a controlled amount of asphalt binder.

3.4. Batch Plant - A manufacturing facility for producing asphalt paving mixtures that proportions and mixes the aggregate, asphalt binder, RAP, and other chosen additives into the mix by in discrete batches.

3.5. Hot Mix Plant (or Plant)—Any manufacturing facility used to produce asphalt paving mixtures.

3.6. Interlock—A system whereby plant production will be interrupted when any one of the interlocked raw material constituents fails to meet the targeted requirements established within the specifications or plant requirements.

3.7. Baghouse fines (dust) - That portion of the aggregate removed during drying and heating by the hot gas stream that accumulates in the particulate emission control baghouse. For purposes of this definition, aggregate removed from the hot gas stream by intermediate collectors such as knockout boxes is not considered baghouse fines.

3.8. Mineral Filler—A finely divided mineral product with a maximum of 3 percent retained on the 0.800 mm (No. 30) sieve and at least 70 percent of which will pass a 0.075 mm (No. 200) sieve. The most common mineral fillers include pulverized limestone, other stone dust, hydrated lime, portland cement, fly ash, and certain natural deposits of finely divided mineral matter. Baghouse fines are not considered mineral filler.

4. PLANT REQUIREMENTS

4.1. Prerequisite for Plant Approval:

4.1.1. Inspection of Equipment—The plant owner or manager will schedule an inspection of the plant facilities to determine compliance with this standard. The equipment will be maintained in a satisfactory operating condition and be capable of its intended function at all times during production.

4.1.2. Quality Control Program—Each plant will have a quality control program and have a designated person to administer the program. This program will include the testing and control of the individual component materials and the final product produced at the plant. Plant operations will be conducted in a manner to ensure a uniform product is produced which will meet specified requirements.

4.1.3. Truck Scales—Scales must meet the requirements of 109.01.A.6.b of the Standard Specifications.

4.1.4. Uniformity—The plant must be capable of producing homogenous asphalt mixtures even though the individual components include such diverse materials as various sizes of aggregate from stockpiles, reclaimed asphalt pavement (RAP), asphalt binder, and other admixtures, as required by the mix design.

5. WEIGHT MEASURING SYSTEMS

5.1. Furnish (at the Contractor’s expense) certified scales to weigh bulk asphalt plant mixtures, regardless of the type of weight measuring system used for payment.

5.2. Ensure that the documentation for certified scales complies with state and/or federal requirements. Platform scales must be certified at a minimum annually. Certified scales must be certified/re-certified if they are moved, re-calibrated, or relocated.

5.3. Each platform scale system must be capable of taring truck weights with each load.

5.4. When not using platform scales, provide calibrated weighing devices that record the mixture’s net weight delivered to the truck. Weighing devices will be calibrated at a minimum before the start of the paving season and each time a plant is moved to a new location. A net weigh system will include, but is not limited to, the following:

5.4.1. Hopper weigh system that delivers asphalt mixture directly to the truck.

5.5. The weighing system used to determine the net weight will have a printing system used in conjunction with automatic mixing systems. All printing systems must be approved by the engineer.

5.6. Verify adequate installation of the net weight scale mechanism or device by the manufacturer to ensure acceptable performance and operation.

5.7. Provide information on the project tickets per Section 109.01 of the Standard Specifications.

5.8. Certify the accuracy of the weighing system by an approved registered scale service person at least once annually or whenever the plant is moved or relocated.

6. EQUIPMENT FOR PREPARATION OF ASPHALT BINDER

6.1. Tanks for storage of asphalt binder must provide adequate capacity and means to ensure proper continuous circulation between the individual storage tank and proportioning units during the entire operating period.

6.2. The delivery and metering system for the asphalt binder must have adequate capacity to provide proper continuous flow between the storage tank, proportioning unit, and mixing equipment during the entire operating period.

6.3. Storage tank capacity and operation must allow for continuous operation of the plant and uniform temperature of the asphalt binder when it is introduced into the aggregate. Metering devices must be calibrated in accordance with Idaho IR 155. Any additives based on liquid volume or mass flow must be interlocked with an audible alarm system.

6.4. A sampling valve must be provided in the asphalt binder injection lines connecting the storage tanks to the asphalt binder control unit. The valve will be located in such a manner as to allow for adequate safety for the person obtaining the sample and to allow the Department to safely witness sampling.

6.5. Any tank used for storing polymer-modified asphalt binders must be equipped with an agitation system or circulation system to ensure the liquid asphalt is maintained in a homogenous state without separation.

6.6. The mechanisms used to introduce WMA additives to asphalt mixtures at the hot mix plant must be capable of uniformly feeding and metering the additive. WMA additives typically consist of additives added at the binder production facility, dry material added through cold feeds, or water injection. Depending on the type of WMA process, the plant must be equipped with automatic controls to monitor the feed system and interrupt plant production if there is an interruption in the feed process. Equipment used to produce WMA must be approved by the Engineer before mixture production.

7. COLD AGGREGATE FEEDERS

7.1. A mechanism that must be capable of uniformly feeding the aggregates into the dryer to ensure uniform production and temperature. The mechanism must be capable of accurately combining aggregates from different storage bins.

7.2. Cold bins for storing aggregates before proportioning will be monitored to ensure that bins do not become empty or restricted. The bins will be interlocked so that a production interruption will occur or an audible warning will sound if an interruption in supply of material from any cold feed bin occurs.

7.3. Adequate and convenient facilities must be provided for obtaining samples of the full flow of aggregate from the total of the bins.

7.4. Control will be based on frequent samples from each component aggregate as well as samples taken from the combined cold aggregate feeders.

7.5. All plants are to be equipped with a means of diverting aggregate on the conveyor belt away from the dryer and into an empty haul truck for cold bin calibration purposes.

8. RECLAIMED ASPHALT PAVEMENT (RAP)

8.1. The recycled mixture will be a homogenous mixture of RAP, virgin aggregate, hydrated lime (if required), asphalt binder, and any additives. If recycling capability is required, the plant will be equipped with mechanical means for feeding the desired weight of RAP into the mix.

8.2. RAP bins for storing material before proportioning will be monitored to ensure that the bins do not become empty or restricted. The bins will be interlocked so that a production interruption will occur or an audible warning will sound if any interruption in supply of material from any cold feed bin occurs.

8.3. Adequate and convenient facilities will be provided for obtaining samples of the full flow of RAP material from the total of the bins.

8.4. Use a hot mix plant for the recycling process with necessary modifications to process the recycled material. The ratio of the RAP to virgin aggregate will be controlled by weight.

8.5. For drum and continuous mix plants, use electronic belt weighing devices to monitor the flow of RAP and the flow of virgin aggregate.

8.6. Equip plants with an interlocking system of feeders and conveyors that synchronize the RAP flow with the virgin aggregate flow. Ensure that the electronic controls monitor the flow rates indicated by the belt weighing devices and automatically maintain the desired ratio at varying production rates. Design the RAP feeder bins, conveyor system, and auxiliary bins (if used) to prevent the material from segregating and sticking. RAP will be screened before crossing the weigh bridge with a 2-inch to 3-inchscreen.

9. EMISSIONS CONTROLS FOR DUST COLLECTOR FINES

9.1. A dust collection system must be provided. The system will be made to waste the material collected, or to return all or any part of the collected material uniformly to the mixture.

9.2. Other emissions, with the exception of water vapor, , will be controlled to be in compliance with applicable environmental limits.

9.3. *Control the dust collection as follows:*

9.3.1. When collecting airborne aggregate particles and returning them to the mixture, ensure the return system delivers the desired portion of the collected dust uniformly into the aggregate mixture and wastes the excess.

10. SURGE AND STORAGE SYSTEMS

10.1. *Provide surge and storage bins as follows:*

10.1.1. Ensure that bins for asphalt mixture storage are insulated and have a working seal, top, and bottom to prevent outside air infiltration and to maintain an inert atmosphere during storage to ensure the asphalt mixture maintains temperature at the working temperature. Bins not intended for storage may be used as surge bins to hold asphalt mixtures for part of the working day; however, empty these surge bins completely at the end of each working day.

10.1.2. Ensure that surge and storage bins can retain a predetermined minimum level of mixture in the bin when trucks are loaded. The determination of the minimum mixture level will be based on minimizing mixture segregation and any other pertinent operational constraints.

10.1.3. Ensure that surge and storage systems do not contribute to mix segregation, loss of homogeneity, lumpiness, temperature loss, draindown, or stiffness.

10.2. A plant may be permitted to store asphalt mixtures in a silo after prior evaluation and approval by the Engineer. Use will conform with all limitations on retention time, type of mixture, heater operation, silo atmosphere, mix level, mix draindown time, or other characteristics set forth in the applicable specifications.

10.3. Approval of silos may be removed or restrictions may be applied if it is determined the silo contributes to segregation, does not maintain temperature, or fails in any other way to provide a homogeneous mix.

11. MINERAL FILLER

11.1. *When mineral filler is required as a mixture ingredient:*

11.2. Use a separate feed system to proportion the required quantity into the mixture with uniform distribution.

11.3. *Control the feeder system with a proportioning device that meets the following:*

11.3.1. Is accurate to within ±5 percent of the filler required by weight.

11.3.2. Has a convenient and accurate means of calibration.

11.3.3. Interlocks or audible/visual alarms with the aggregate feed or weigh system to maintain the correct proportions for all rates of production.

11.4. Provide flow indicators or sensing devices for the mineral filler system and interlock them with the plant controls to interrupt mixture production if the mineral filler introduction fails to meet the required target value after no longer than 60 seconds.

11.5. *Add mineral filler to the mixture as follows, according to the plant type:*

11.5.1. Continuous Plants Using Dryer Drum Mixtures—Add the mineral filler so that the dry mixing is accomplished no less than 18 inches before the addition of the asphalt binder and ensure that the filler does not become entrained into the air stream of the dryer.

12. HYDRATED LIME TREATMENT SYSTEM

12.1. *When hydrated lime is required as a mixture ingredient:*

12.2. Use a separate bin and feed system to store and proportion the required quantity into the mixture.

12.3. Ensure that the aggregate is uniformly coated with hydrated lime at least 18 inches before the addition of the asphalt binder to the mixture. Ensure the hydrated lime does not become entrained in the exhaust system of the dryer or plant.

12.4. *Control the feeder system with a proportioning device that meets the following:*

12.4.1. Is accurate to within ±10 percent of the hydrated lime required by weight.

12.4.2. Has a convenient and accurate means of calibration.

12.4.3. Interlocks or audible/visual alarms with the aggregate feed or weigh system to maintain the correct proportions for all rates of production to ensure mixture produced is properly treated with lime.

12.5. Provide flow indicators or sensing devices for the hydrated lime system and interlock or audible/visual alarms them with the plant controls to interrupt mixture production if hydrated lime introduction fails to meet the required target value after 60 seconds.

13. FIBER SUPPLY SYSTEM

13.1. *When stabilizing fiber is required as a mixture ingredient:*

13.2. Use a separate bin and/or feed system to store and uniformly proportion by weight the required quantity of fiber into the mixture.

13.3. Control the feeder system with a proportioning device that meets the following:

13.3.1. Is accurate to within ±10 percent of the fiber required by weight. Automatically adjust the feed rate to maintain the material within this tolerance at all times.

13.3.2. Has a convenient and accurate means of calibration.

13.3.3. Provides in-process monitoring, consisting of a digital display of output of feed rate, in pounds (kilograms) per min, to verify feed rate.

13.3.4. Interlocks or audible visual alarms with the aggregate feed or weigh system to maintain the correct proportions for all rates of production.

13.4. Provides flow indicators or sensing devices for the fiber system and interlocks them with the plant controls to interrupt mixture production if the fiber introduction fails to meet the required target value.

13.5. *Introduce the fiber as follows, according to the plant type:*

13.5.1. When a continuous or dryer-drum-type plant is used, add the fiber uniformly to the aggregate and disperse it before the injection of the asphalt binder. Ensure the fibers will not become entrained in the exhaust system of the dryer.

14. CALIBRATION OF PLANT EQUIPMENT

14.1. Calibration of the plant must meet Idaho IR 155.

14.2. *Calibration will occur, at a minimum:*

14.2.1. If the material changes, or if a plant component supply system effecting the ingredient proportions has been repaired, replaced, or adjusted, recalibrate the proportions.

14.3. *Calibrate the mixing plant as follows:*

14.3.1. Before producing mixture for the project, calibrate by scale weight the electronic sensors or settings for proportioning the mixture ingredients.

14.3.2. Calibrate the ingredient proportioning for the anticipated range of production rates as shown in the Plant QCP. Do not operate outside the calibration range without first calibrating the proportioning systems for the new range of production rates.

15. THERMOMETRIC EQUIPMENT

15.1. Provide appropriate recording thermometers, of suitable temperature ranges, to accurately assess the temperature of the asphalt mixture at or near the discharge point. Harden the thermometer mechanism as necessary to ensure durability of the device and continuous operation. Thermometers must be calibrated by the manufacturer for the full range of mixture production temperatures. The thermometers must be verified periodically during production to ensure their accuracy.

15.2. Measure the temperature at the discharge chute of the dryer and record the temperature data automatically.

16. DEVELOPING AND MAINTAINING A PLANT QUALITY CONTROL PLAN

16.1. Develop and maintain a Plant Quality Control Plan (Plant QCP). The plant must have an approved Plant QCP prior to the plant being used on Department projects. This plan must address each section of this procedure and describe how these requirements will or will not be met.

16.1.1. If any of the minimum requirements cannot be met; describe in detail why, and how, the plant will mitigate any adverse effects from deviation of this procedure's minimum requirements.

16.2. See Section 19 (Plant QCP template) for a template of the plant quality control plan.

17. PLANT QCP REVIEW

17.1. The Department will review the Plant QCP at a minimum of once per calendar year.

17.2. Review the Plant QCP to ensure all requirements in the previous sections are met or that adequate processes and procedures are in place to mitigate any adverse effects (See Section 16.1.1)

18. PLANT QCP APPROVAL

18.1. If the Plant QCP review finds that the plant's quality control plan is sufficient to ensure a quality product will be produced, the Plant QCP will be approved.

18.2. If the Plant QCP is approved, return a signed copy of the Plant QCP to the plant. The approval is valid for one calendar year.

Company Name:
Year:

Plant Quality Control Plan

Quality Control Plan Administrator

Name

Contact Information

Reviewed By:
Reviewed Date:

Approved By:
Approval Date:

Quality Control Plans for Plants

Template

1. Plant Description
    a. Plant Type (Drum/Batch)
    b. Plant Address
    c. Detailed narrative meeting the requirements of Subsection 17.1 and 17.1.1

2. Plant Laboratory Personnel
    a. Qualified Personnel/Contact Information/WAQTC#/ Exp. Date (Scanned Copy)

3. Laboratory Qualification
    a. Idaho Lab Qualification Number
        i. Date last completed
        ii. Certification Posted in Laboratory
    b. AMRL accreditation (if applicable)
        i. Date last completed

4. Plant Inspection
    a. Performed Yearly
        i. Certification is posted at plant
    b. Plant complies with Idaho IR 160

5. Truck Scales
    a. Calibration Frequency
    b. Testing agency – copies on file

6. Plant Weighing/Measuring Devices
    a. Calibration frequency
    b. Testing agency – copies on file

7. Aggregate Stockpiles
    a. Construction Method
        i. Separation/Labeling
        ii. Segregation Control
        iii. Moisture Control (if applicable)
    b. Testing (method/frequency)

8. RAP stockpile
    a. Construction methods of stockpiles
        i. Separation/Labeling
        ii. Segregation Control
        iii. Moisture Control (if applicable)

    b. Testing (method/frequency)

9. Plant Mix Temperatures
    a. Plant Monitor/Control
    b. Temperature checks

10. Binder
    a. Storage
    b. Hauling
    c. Sampling (include location)
    d. Source Change – Notification/Start-up testing
    e. List how corrective action will be taken

11. Asphalt Mix Design
    a. Responsibility

12. Asphalt Mix Sampling
    a. Location for QC
    b. Plant check processes and procedures
    c. Sampling frequency
        i. Low tonnage (< 200 tons)
        ii. > 200 tons

13. Mix Gradation
    a. Test method

14. Asphalt Content
    a. Test method

15. Volumetric Properties
    a. Test methods

16. Mix Diagnostic and Corrective Action Plan
    a. Items to address: #13-15, and on-site density

17. Project Records – Idaho Standard Specs. 106.03.A.2.
    a. Maintain and make avalable to the Engineer upon request complete records (including hand written worksheets) of sampling, testing, actions taken to correct problems, and quality control inspection results. Provide copies of the Reports when requested.
    b. Control Charts

18. Truck Loading
    a. Loading method
    b. Segregation control

19. Warm Mix Capabilities (if applicable)
    a. Plant used for WMA?

    b. Type: Foamed, Additive, etc.
    c. Operation (e.g. rate(s), temperatures, etc.)

20. Anti-Strip
    a. Type/Brand
    b. Method of dosing

It is hereby certified that the information contained in this Plant Quality Control Plan meets the requirements of Idaho IR 160.

Company Name:

Signature:

First & Last Name:

Quality Control Plan Administrator

Title VI Special Provisions

In compliance with the United States Department of Transportation (USDOT) Standard Title VI/Non-Discrimination Assurances (DOT Order No. 1050.2A):

"The Idaho Transportation Department, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 US.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award."

During the performance of work covered by this Contract, the Contractor for themselves, their assignees and successors in interest agree as follows to adhere to Appendix A and E of the USDOT Standard Title VI/Non-Discrimination Assurances:

APPENDIX A

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

1. **Compliance with Regulations:** The contractor (hereinafter includes consultants) will comply with the Acts and the Regulations relative to Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Federal Highway Administration (FHWA), as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.

2. **Non-discrimination:** The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR Part 2 l.

3. **Solicitations for Subcontracts, Including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor's obligations under this contract and the Acts and the Regulations relative to Non-discrimination on the grounds of race, color, or national origin.

4. **Information and Reports:** The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Recipient or the Federal Highway Administration (FHWA), to be pertinent to ascertain compliance with such Acts, Regulations, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the contractor will so certify to the Recipient or the Federal Highway Administration (FHWA), as appropriate, and will set forth what efforts it has made to obtain the information.

5. **Sanctions for Noncompliance:** In the event of a contractor's noncompliance with the Nondiscrimination provisions of this contract, the Recipient will impose such contract sanctions as it or the Federal Highway Administration (FHWA) may determine to be appropriate, including, but not limited to:

   a. withholding payments to the contractor under the contract until the contractor complies; and/or

   b. cancelling, terminating, or suspending a contract, in whole or in part.

6. **Incorporation of Provisions:** The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the

Regulations and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as the Recipient or the Federal Highway Administration **(**FHWA) may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request the Recipient to enter into any litigation to protect the interests of the Recipient. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

APPENDIX E

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

Pertinent Non-Discrimination Authorities:

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et seq., 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin); and 49 CFR Part 21.
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Federal-Aid Highway Act of 1973, (23 U.S.C. § 324 et seq.), (prohibits discrimination on the basis of sex);
- Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 et seq.), as amended, (prohibits discrimination on the basis of disability); and 49 CFR Part 27;
- The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 et seq.), (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982, (49 USC § 4 71, Section 4 7123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131-12189) as implemented by Department of Transportation regulations at 49 C.F.R. parts 37 and 38;
- The Federal Aviation Administration's Non-discrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures discrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;
- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U .S.C. 1681 et seq).

REQUIRED CONTRACT PROVISIONS
FEDERAL-AID CONSTRUCTION CONTRACTS

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under title 23, United States Code, as required in 23 CFR 633.102(b) (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services). 23 CFR 633.102(e).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider. 23 CFR 633.102(e).

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services) in accordance with 23 CFR 633.102. The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in solicitation-for-bids or request-for-proposals documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract). 23 CFR 633.102(b).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract. 23 CFR 633.102(d).

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. 23 U.S.C. 114(b). The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors. 23 U.S.C. 101(a).

II. NONDISCRIMINATION (23 CFR 230.107(a); 23 CFR Part 230, Subpart A, Appendix A; EO 11246)

The provisions of this section related to 23 CFR Part 230, Subpart A, Appendix A are applicable to all Federal-aid construction contracts and to all related construction subcontracts of $10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR Part 60, 29 CFR Parts 1625-1627, 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding $10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR Part 60, and 29 CFR Parts 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with 23 U.S.C. 140, Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d et seq.), and related regulations including 49 CFR Parts 21, 26, and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR Part 230, Subpart A, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal Employment Opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (*see* 28 CFR Part 35, 29 CFR Part 1630, 29 CFR Parts 1625-1627, 41 CFR Part 60 and 49 CFR Part 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140, shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR Part 35 and 29 CFR Part 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract. 23 CFR 230.409 (g)(4) & (5).

b. The contractor will accept as its operating policy the following statement:

> "It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, sexual orientation, gender identity, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action or are substantially involved in such action, will be made fully cognizant of and will implement the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer or other knowledgeable company official.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to ensure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs (i.e., apprenticeship and on-the-job training programs for the geographical area of contract performance). In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. 23 CFR 230.409. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established thereunder. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, sexual orientation, gender identity, national origin, age, or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors, suppliers, and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurances Required:

a. The requirements of 49 CFR Part 26 and the State DOT's FHWA-approved Disadvantaged Business Enterprise (DBE) program are incorporated by reference.

b. The contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:
(1) Withholding monthly progress payments;
(2) Assessing sanctions;
(3) Liquidated damages; and/or
(4) Disqualifying the contractor from future bidding as non-responsible.

c. The Title VI and nondiscrimination provisions of U.S. DOT Order 1050.2A at Appendixes A and E are incorporated by reference. 49 CFR Part 21.

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women.

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of more than $10,000. 41 CFR 60-1.5.

As prescribed by 41 CFR 60-1.8, the contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location under the contractor's control where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding $2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size), in accordance with 29 CFR 5.5. The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. 23 U.S.C. 113. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. 23 U.S.C. 101. Where applicable law requires that projects be treated as a project on a Federal-aid highway, the provisions of this subpart will apply regardless of the location of the project. Examples include: Surface Transportation Block Grant Program projects funded under 23 U.S.C. 133 [excluding recreational trails projects], the Nationally Significant Freight and Highway Projects funded under 23 U.S.C. 117, and National Highway Freight Program projects funded under 23 U.S.C. 167.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 “Contract provisions and related matters” with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages (29 CFR 5.5)

a. *Wage rates and fringe benefits.* All laborers and mechanics employed or working upon the site of the work (or otherwise working in construction or development of the project under a development statute), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of basic hourly wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. As provided in paragraphs (d) and (e) of 29 CFR 5.5, the appropriate wage determinations are effective by operation of law even if they have not been attached to the contract. Contributions made or costs reasonably anticipated for bona fide fringe benefits under the Davis-Bacon Act (40 U.S.C. 3141(2)(B)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.e. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics must be paid the appropriate wage rate and fringe benefits on the wage determination for the classification(s) of work actually performed, without regard to skill, except as provided in paragraph 4. of this section. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph 1.c. of this section) and the Davis-Bacon poster (WH–1321) must be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b. *Frequently recurring classifications.* (1) In addition to wage and fringe benefit rates that have been determined to be prevailing under the procedures set forth in 29 CFR part 1, a wage determination may contain, pursuant to § 1.3(f), wage and fringe benefit rates for classifications of laborers and mechanics for which conformance requests are regularly submitted pursuant to paragraph 1.c. of this section, provided that:

(i) The work performed by the classification is not performed by a classification in the wage determination for which a prevailing wage rate has been determined;

(ii) The classification is used in the area by the construction industry; and

(iii) The wage rate for the classification bears a reasonable relationship to the prevailing wage rates contained in the wage determination.

(2) The Administrator will establish wage rates for such classifications in accordance with paragraph 1.c.(1)(iii) of this section. Work performed in such a classification must be paid at no less than the wage and fringe benefit rate listed on the wage determination for such classification.

c. *Conformance.* (1) The contracting officer must require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract be classified in conformance with the wage determination. Conformance of an additional classification and wage rate and fringe benefits is appropriate only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is used in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) The conformance process may not be used to split, subdivide, or otherwise avoid application of classifications listed in the wage determination.

(3) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken will be sent by the contracting officer by email to *DBAconformance@dol.gov*. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

(4) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer will, by email to *DBAconformance@dol.gov*, refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30–day period that additional time is necessary.

(5) The contracting officer must promptly notify the contractor of the action taken by the Wage and Hour Division under paragraphs 1.c.(3) and (4) of this section. The contractor must furnish a written copy of such determination to each affected worker or it must be posted as a part of the wage determination. The wage rate (including fringe benefits where appropriate) determined pursuant to paragraph 1.c.(3) or (4) of this section must be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

d. *Fringe benefits not expressed as an hourly rate.* Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor may either pay the benefit as stated in the wage determination or may pay another bona fide fringe benefit or an hourly cash equivalent thereof.

e. *Unfunded plans.* If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided,* That the Secretary of Labor has found, upon the written request of the contractor, in accordance with the criteria set forth in § 5.28, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

f. *Interest.* In the event of a failure to pay all or part of the wages required by the contract, the contractor will be required to pay interest on any underpayment of wages.

2. Withholding (29 CFR 5.5)

a. *Withholding requirements.* The contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for the full amount of wages and monetary relief, including interest, required by the clauses set forth in this section for violations of this contract, or to satisfy any such liabilities required by any other Federal contract, or federally assisted contract subject to Davis-Bacon labor standards, that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to Davis-Bacon labor standards requirements and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld. In the event of a contractor's failure to pay any laborer or mechanic, including any apprentice or helper working on the site of the work all or part of the wages required by the contract, or upon the contractor's failure to submit the required records as discussed in paragraph 3.d. of this section, the contracting agency may on its own initiative and after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with paragraph

2.a. of this section or Section V, paragraph 3.a., or both, over claims to those funds by:

(1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(2) A contracting agency for its reprocurement costs;

(3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(4) A contractor's assignee(s);

(5) A contractor's successor(s); or

(6) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

3. Records and certified payrolls (29 CFR 5.5)

a. *Basic record requirements* (1) *Length of record retention.* All regular payrolls and other basic records must be maintained by the contractor and any subcontractor during the course of the work and preserved for all laborers and mechanics working at the site of the work (or otherwise working in construction or development of the project under a development statute) for a period of at least 3 years after all the work on the prime contract is completed.

(2) *Information required.* Such records must contain the name; Social Security number; last known address, telephone number, and email address of each such worker; each worker's correct classification(s) of work actually performed; hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act); daily and weekly number of hours actually worked in total and on each covered contract; deductions made; and actual wages paid.

(3) *Additional records relating to fringe benefits.* Whenever the Secretary of Labor has found under paragraph 1.e. of this section that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in 40 U.S.C. 3141(2)(B) of the Davis-Bacon Act, the contractor must maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits.

(4) *Additional records relating to apprenticeship.* Contractors with apprentices working under approved programs must maintain written evidence of the registration of apprenticeship programs, the registration of the apprentices, and the ratios and wage rates prescribed in the applicable programs.

b. *Certified payroll requirements* (1) *Frequency and method of submission.* The contractor or subcontractor must submit weekly, for each week in which any DBA- or Related Acts-covered work is performed, certified payrolls to the contracting agency. The prime contractor is responsible for the submission of all certified payrolls by all subcontractors. A contracting agency or prime contractor may permit or require contractors to submit certified payrolls through an electronic system, as long as the electronic system requires a legally valid electronic signature; the system allows the contractor, the contracting agency, and the Department of Labor to access the certified payrolls upon request for at least 3 years after the work on the prime contract has been completed; and the contracting agency or prime contractor permits other methods of submission in situations where the contractor is unable or limited in its ability to use or access the electronic system.

(2) *Information required.* The certified payrolls submitted must set out accurately and completely all of the information required to be maintained under paragraph 3.a.(2) of this section, except that full Social Security numbers and last known addresses, telephone numbers, and email addresses must not be included on weekly transmittals. Instead, the certified payrolls need only include an individually identifying number for each worker (*e.g.,* the last four digits of the worker's Social Security number). The required weekly certified payroll information may be submitted using Optional Form WH–347 or in any other format desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division website at *https://www.dol.gov/sites/dolgov/files/WHD/legacy/files/wh347/.pdf* or its successor website. It is not a violation of this section for a prime contractor to require a subcontractor to provide full Social Security numbers and last known addresses, telephone numbers, and email addresses to the prime contractor for its own records, without weekly submission by the subcontractor to the contracting agency.

(3) *Statement of Compliance.* Each certified payroll submitted must be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor, or the contractor's or subcontractor's agent who pays or supervises the payment of the persons working on the contract, and must certify the following:

(i) That the certified payroll for the payroll period contains the information required to be provided under paragraph 3.b. of this section, the appropriate information and basic records are being maintained under paragraph 3.a. of this section, and such information and records are correct and complete;

(ii) That each laborer or mechanic (including each helper and apprentice) working on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification(s) of work actually performed, as specified in the applicable wage determination incorporated into the contract.

(4) *Use of Optional Form WH–347.* The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH–347 will satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(3) of this section.

(5) *Signature.* The signature by the contractor, subcontractor, or the contractor's or subcontractor's agent must be an original handwritten signature or a legally valid electronic signature.

(6) *Falsification.* The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under 18 U.S.C. 1001 and 31 U.S.C. 3729.

(7) *Length of certified payroll retention.* The contractor or subcontractor must preserve all certified payrolls during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

c. *Contracts, subcontracts, and related documents.* The contractor or subcontractor must maintain this contract or subcontract and related documents including, without limitation, bids, proposals, amendments, modifications, and extensions. The contractor or subcontractor must preserve these contracts, subcontracts, and related documents during the course of the work and for a period of 3 years after all the work on the prime contract is completed.

d. *Required disclosures and access* (1) *Required record disclosures and access to workers.* The contractor or subcontractor must make the records required under paragraphs 3.a. through 3.c. of this section, and any other documents that the contracting agency, the State DOT, the FHWA, or the Department of Labor deems necessary to determine compliance with the labor standards provisions of any of the applicable statutes referenced by § 5.1, available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and must permit such representatives to interview workers during working hours on the job.

(2) *Sanctions for non-compliance with records and worker access requirements.* If the contractor or subcontractor fails to submit the required records or to make them available, or refuses to permit worker interviews during working hours on the job, the Federal agency may, after written notice to the contractor, sponsor, applicant, owner, or other entity, as the case may be, that maintains such records or that employs such workers, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available, or to permit worker interviews during working hours on the job, may be grounds for debarment action pursuant to § 5.12. In addition, any contractor or other person that fails to submit the required records or make those records available to WHD within the time WHD requests that the records be produced will be precluded from introducing as evidence in an administrative proceeding under 29 CFR part 6 any of the required records that were not provided or made available to WHD. WHD will take into consideration a reasonable request from the contractor or person for an extension of the time for submission of records. WHD will determine the reasonableness of the request and may consider, among other things, the location of the records and the volume of production.

(3) *Required information disclosures.* Contractors and subcontractors must maintain the full Social Security number and last known address, telephone number, and email address of each covered worker, and must provide them upon request to the contracting agency, the State DOT, the FHWA, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or other compliance action.

4. Apprentices and equal employment opportunity (29 CFR 5.5)

a. *Apprentices* (1) *Rate of pay.* Apprentices will be permitted to work at less than the predetermined rate for the work they perform when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship (OA), or with a State Apprenticeship Agency recognized by the OA. A person who is not individually registered in the program, but who has been certified by the OA or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice, will be permitted to work at less than the predetermined rate for the work they perform in the first 90 days of probationary employment as an apprentice in such a program. In the event the OA or a State Apprenticeship Agency recognized by the OA withdraws approval of an apprenticeship program, the contractor will no longer be permitted to use apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(2) *Fringe benefits.* Apprentices must be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringe benefits must be paid in accordance with that determination.

(3) *Apprenticeship ratio.* The allowable ratio of apprentices to journeyworkers on the job site in any craft classification must not be greater than the ratio permitted to the contractor as to the entire work force under the registered program or the ratio applicable to the locality of the project pursuant to paragraph 4.a.(4) of this section. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph 4.a.(1) of this section, must be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under this section must be paid not less than the applicable wage rate on the wage determination for the work actually performed.

(4) *Reciprocity of ratios and wage rates.* Where a contractor is performing construction on a project in a locality other than the locality in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyworker's hourly rate) applicable within the locality in which the construction is being performed must be observed. If there is no applicable ratio or wage rate for the locality of the project, the ratio and wage rate specified in the contractor's registered program must be observed.

b. *Equal employment opportunity.* The use of apprentices and journeyworkers under this part must be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

c. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. 23 CFR 230.111(e)(2). The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeyworkers shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract as provided in 29 CFR 5.5.

6. Subcontracts. The contractor or subcontractor must insert FHWA-1273 in any subcontracts, along with the applicable wage determination(s) and such other clauses or contract modifications as the contracting agency may by appropriate instructions require, and a clause requiring the subcontractors to include these clauses and wage determination(s) in any lower tier subcontracts. The prime contractor is responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this section. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and may be subject to debarment, as appropriate. 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract as provided in 29 CFR 5.5.

9. Disputes concerning labor standards. As provided in 29 CFR 5.5, disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility. a. By entering into this contract, the contractor certifies that neither it nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of 40 U.S.C. 3144(b) or § 5.12(a).

c. The penalty for making false statements is prescribed in the U.S. Code, Title 18 Crimes and Criminal Procedure, 18 U.S.C. 1001.

11. Anti-retaliation. It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under the DBA, Related Acts, this part, or 29 CFR part 1 or 3;

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under the DBA, Related Acts, this part, or 29 CFR part 1 or 3; or

d. Informing any other person about their rights under the DBA, Related Acts, this part, or 29 CFR part 1 or 3.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

Pursuant to 29 CFR 5.5(b), the following clauses apply to any Federal-aid construction contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchpersons and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek. 29 CFR 5.5.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph 1. of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages and interest from the date of the underpayment. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchpersons and guards, employed in violation of the clause set forth in paragraph 1. of this section, in the sum currently provided in 29 CFR 5.5(b)(2)* for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph 1. of this section.

* $31 as of January 15, 2023 (See 88 FR 88 FR 2210) as may be adjusted annually by the Department of Labor, pursuant to the Federal Civil Penalties Inflation Adjustment Act of 1990.

3. Withholding for unpaid wages and liquidated damages

a. *Withholding process.* The FHWA or the contracting agency may, upon its own action, or must, upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor so much of the accrued payments or advances as may be considered necessary to satisfy the liabilities of the prime contractor or any subcontractor for any unpaid wages; monetary relief, including interest; and liquidated damages required by the clauses set forth in this section on this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act that is held by the same prime contractor (as defined in § 5.2). The necessary funds may be withheld from the contractor under this contract, any other Federal contract with the same prime contractor, or any other federally assisted contract that is subject to the Contract Work Hours and Safety Standards Act and is held by the same prime contractor, regardless of whether the other contract was awarded or assisted by the same agency, and such funds may be used to satisfy the contractor liability for which the funds were withheld.

b. *Priority to withheld funds.* The Department has priority to funds withheld or to be withheld in accordance with Section IV paragraph 2.a. or paragraph 3.a. of this section, or both, over claims to those funds by:

(1) A contractor's surety(ies), including without limitation performance bond sureties and payment bond sureties;

(2) A contracting agency for its reprocurement costs;

(3) A trustee(s) (either a court-appointed trustee or a U.S. trustee, or both) in bankruptcy of a contractor, or a contractor's bankruptcy estate;

(4) A contractor's assignee(s);

(5) A contractor's successor(s); or

(6) A claim asserted under the Prompt Payment Act, 31 U.S.C. 3901–3907.

4. Subcontracts. The contractor or subcontractor must insert in any subcontracts the clauses set forth in paragraphs 1. through 5. of this section and a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor is responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs 1. through 5. In the event of any violations of these clauses, the prime contractor and any subcontractor(s) responsible will be liable for any unpaid wages and monetary relief, including interest from the date of the underpayment or loss, due to any workers of lower-tier subcontractors, and associated liquidated damages and may be subject to debarment, as appropriate.

5. Anti-retaliation. It is unlawful for any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, or to cause any person to discharge, demote, intimidate, threaten, restrain, coerce, blacklist, harass, or in any other manner discriminate against, any worker or job applicant for:

a. Notifying any contractor of any conduct which the worker reasonably believes constitutes a violation of the Contract Work Hours and Safety Standards Act (CWHSSA) or its implementing regulations in this part;

b. Filing any complaint, initiating or causing to be initiated any proceeding, or otherwise asserting or seeking to assert on behalf of themselves or others any right or protection under CWHSSA or this part;

c. Cooperating in any investigation or other compliance action, or testifying in any proceeding under CWHSSA or this part; or

d. Informing any other person about their rights under CWHSSA or this part.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System pursuant to 23 CFR 635.116.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term "perform work with its own organization" in paragraph 1 of Section VI refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions: (based on longstanding interpretation)

(1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;

(2) the prime contractor remains responsible for the quality of the work of the leased employees;

(3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and

(4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract. 23 CFR 635.102.

2. Pursuant to 23 CFR 635.116(a), the contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. Pursuant to 23 CFR 635.116(c), the contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract. (based on long-standing interpretation of 23 CFR 635.116).

5. The 30-percent self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements. 23 CFR 635.116(d).

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR Part 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract. 23 CFR 635.108.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR Part 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704). 29 CFR 1926.10.

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR Part 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 11, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT (42 U.S.C. 7606; 2 CFR 200.88; EO 11738)

This provision is applicable to all Federal-aid construction contracts in excess of $150,000 and to all related subcontracts. 48 CFR 2.101; 2 CFR 200.327.

By submission of this bid/proposal or the execution of this contract or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, subcontractor, supplier, or vendor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal Highway Administration and the Regional Office of the Environmental Protection Agency. 2 CFR Part 200, Appendix II.

The contractor agrees to include or cause to be included the requirements of this Section in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements. 2 CFR 200.327.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost $25,000 or more – as defined in 2 CFR Parts 180 and 1200. 2 CFR 180.220 and 1200.220.

1**. Instructions for Certification – First Tier Participants:**

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction. 2 CFR 180.320.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default. 2 CFR 180.325.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances. 2 CFR 180.345 and 180.350.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900-180.1020, and 1200. "First Tier Covered Transactions" refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction. 2 CFR 180.330.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold. 2 CFR 180.220 and 180.300.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. 2 CFR 180.300; 180.320, and 180.325. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. 2 CFR 180.335. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (https://www.sam.gov/). 2 CFR 180.300, 180.320, and 180.325.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default. 2 CFR 180.325.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.335;.

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property, 2 CFR 180.800;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification, 2 CFR 180.700 and 180.800; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default. 2 CFR 180.335(d).

(5) Are not a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(6) Are not a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability (USDOT Order 4200.6 implementing appropriations act requirements).

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal. 2 CFR 180.335 and 180.340.

* * * * *

3. **Instructions for Certification - Lower Tier Participants:**

(Applicable to all subcontracts, purchase orders, and other lower tier transactions requiring prior FHWA approval or estimated to cost $25,000 or more - 2 CFR Parts 180 and 1200). 2 CFR 180.220 and 1200.220.

a. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances. 2 CFR 180.365.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180, Subpart I, 180.900 – 180.1020, and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. “First Tier Covered Transactions” refers to any covered transaction between a recipient or subrecipient of Federal funds and a participant (such as the prime or general contract). “Lower Tier Covered Transactions” refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). “First Tier Participant” refers to the participant who has entered into a covered transaction with a recipient or subrecipient of Federal funds (such as the prime or general contractor). “Lower Tier Participant” refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated. 2 CFR 1200.220 and 1200.332.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the $25,000 threshold. 2 CFR 180.220 and 1200.220.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the System for Award Management website (https://www.sam.gov/), which is compiled by the General Services Administration. 2 CFR 180.300, 180.320, 180.330, and 180.335.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment. 2 CFR 180.325.

* * * * *

4. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

a. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals:

(1) is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency, 2 CFR 180.355;

(2) is a corporation that has been convicted of a felony violation under any Federal law within the two-year period preceding this proposal (USDOT Order 4200.6 implementing appropriations act requirements); and

(3) is a corporation with any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted, or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability. (USDOT Order 4200.6 implementing appropriations act requirements)

b. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant should attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed $100,000. 49 CFR Part 20, App. A.

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000 and that all such recipients shall certify and disclose accordingly.

XII. USE OF UNITED STATES-FLAG VESSELS:

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, or any other covered transaction. 46 CFR Part 381.

This requirement applies to material or equipment that is acquired for a specific Federal-aid highway project. 46 CFR 381.7. It is not applicable to goods or materials that come into inventories independent of an FHWA funded-contract.

When oceanic shipments (or shipments across the Great Lakes) are necessary for materials or equipment acquired for a specific Federal-aid construction project, the bidder, proposer, contractor, subcontractor, or vendor agrees:

1. To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels. 46 CFR 381.7.

2. To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, 'on-board' commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (b)(1) of this section to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Office of Cargo and Commercial Sealift (MAR-620), Maritime Administration, Washington, DC 20590. (MARAD requires copies of the ocean carrier's (master) bills of lading, certified onboard, dated, with rates and charges. These bills of lading may contain business sensitive information and therefore may be submitted directly to MARAD by the Ocean Transportation Intermediary on behalf of the contractor). 46 CFR 381.7.

ATTACHMENT A - EMPLOYMENT AND MATERIALS PREFERENCE FOR APPALACHIAN DEVELOPMENT HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS ROAD CONTRACTS (23 CFR 633, Subpart B, Appendix B) This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.

ZURICH AMERICAN INSURANCE COMPANY
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY
FIDELITY AND DEPOSIT COMPANY OF MARYLAND
POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That the ZURICH AMERICAN INSURANCE COMPANY, a corporation of the State of New York, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, a corporation of the State of Illinois, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND a corporation of the State of Illinois (herein collectively called the "Companies"), by **Robert D. Murray, Vice President**, in pursuance of authority granted by Article V, Section 8, of the By-Laws of said Companies, which are set forth on the reverse side hereof and are hereby certified to be in full force and effect on the date hereof, do hereby nominate, constitute, and appoint Misty Witt**,** its true and lawful agent and Attorney-in-Fact, to make, execute, seal and deliver, for, and on its behalf as surety, and as its act and deed: **any and all bonds and undertakings,** and the execution of such bonds or undertakings in pursuance of these presents, shall be as binding upon said Companies, as fully and amply, to all intents and purposes, as if they had been duly executed and acknowledged by the regularly elected officers of the ZURICH AMERICAN INSURANCE COMPANY at its office in New York, New York., the regularly elected officers of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at its office in Owings Mills, Maryland., and the regularly elected officers of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at its office in Owings Mills, Maryland., in their own proper persons.

The said Vice President does hereby certify that the extract set forth on the reverse side hereof is a true copy of Article V, Section 8, of the By-Laws of said Companies, and is now in force.

IN WITNESS WHEREOF, the said Vice-President has hereunto subscribed his/her names and affixed the Corporate Seals of the said **ZURICH AMERICAN INSURANCE COMPANY, COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and FIDELITY AND DEPOSIT COMPANY OF MARYLAND**, this 29th day of January, A.D. 2024.

ATTEST:
ZURICH AMERICAN INSURANCE COMPANY
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY
FIDELITY AND DEPOSIT COMPANY OF MARYLAND

By: Robert D. Murray
Vice President

Dawn E Brown

By: Dawn E. Brown
Secretary

State of Maryland
County of Baltimore

On this 29th day of January, A.D. 2024, before the subscriber, a Notary Public of the State of Maryland, duly commissioned and qualified, **Robert D. Murray, Vice President and Dawn E. Brown, Secretary** of the Companies, to me personally known to be the individuals and officers described in and who executed the preceding instrument, and acknowledged the execution of same, and being by me duly sworn, deposeth and saith, that he/she is the said officer of the Company aforesaid, and that the seals affixed to the preceding instrument are the Corporate Seals of said Companies, and that the said Corporate Seals and the signature as such officer were duly affixed and subscribed to the said instrument by the authority and direction of the said Corporations.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my Official Seal the day and year first above written.

Genevieve M. Maison

GENEVIEVE M. MAISON
NOTARY PUBLIC
BALTIMORE COUNTY, MD
My Commission Expires JANUARY 27, 2025

EXTRACT FROM BY-LAWS OF THE COMPANIES

"Article V, Section 8, Attorneys-in-Fact. The Chief Executive Officer, the President, or any Executive Vice President or Vice President may, by written instrument under the attested corporate seal, appoint attorneys-in-fact with authority to execute bonds, policies, recognizances, stipulations, undertakings, or other like instruments on behalf of the Company, and may authorize any officer or any such attorney-in-fact to affix the corporate seal thereto; and may with or without cause modify of revoke any such appointment or authority at any time."

CERTIFICATE

I, the undersigned, Vice President of the ZURICH AMERICAN INSURANCE COMPANY, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing Power of Attorney is still in full force and effect on the date of this certificate; and I do further certify that Article V, Section 8, of the By-Laws of the Companies is still in force.

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the ZURICH AMERICAN INSURANCE COMPANY at a meeting duly called and held on the 15th day of December 1998.

RESOLVED: "That the signature of the President or a Vice President and the attesting signature of a Secretary or an Assistant Secretary and the Seal of the Company may be affixed by facsimile on any Power of Attorney...Any such Power or any certificate thereof bearing such facsimile signature and seal shall be valid and binding on the Company."

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at a meeting duly called and held on the 5th day of May, 1994, and the following resolution of the Board of Directors of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at a meeting duly called and held on the 10th day of May, 1990.

RESOLVED: "That the facsimile or mechanically reproduced seal of the company and facsimile or mechanically reproduced signature of any Vice-President, Secretary, or Assistant Secretary of the Company, whether made heretofore or hereafter, wherever appearing upon a certified copy of any power of attorney issued by the Company, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seals of the said Companies, this 13th day of December, 2024.

Colonial American Casualty and Surety Company CORPORATE SEAL
ZURICH AMERICAN INSURANCE COMPANY CORPORATE SEAL 1977 NEW YORK
Fidelity and Deposit Company of Maryland CORPORATE SEAL 1890

Thomas O. McClellan
Vice President

TO REPORT A CLAIM WITH REGARD TO A SURETY BOND, PLEASE SUBMIT A COMPLETE DESCRIPTION OF THE CLAIM INCLUDING THE PRINCIPAL ON THE BOND, THE BOND NUMBER, AND YOUR CONTACT INFORMATION TO:

Zurich Surety Claims
1299 Zurich Way
Schaumburg, IL 60196-1056
www.reportsfclaims@zurichna.com
800-626-4577