CONTRACTOR MIX DESIGN GUIDELINES

For

ASPHALT CONCRETE

OREGON DEPARTMENT OF TRANSPORTATION

January 2012

CONTRACTOR MIX DESIGN GUIDELINES for ASPHALT CONCRETE

These guidelines outline the procedures to be used in developing, testing, and submitting asphalt concrete mix designs for ODOT contracts and for projects with other agencies that use the version of Oregon Standard Specifications for Construction applicable to the contract (either 2002 or 2008 version). According to these specifications the contractor is responsible for developing the mix designs for all Hot Mixed Asphalt Concrete (HMAC) and Emulsified Asphalt Concrete (EAC).

The actual test procedures used to develop a mix design are available in a separate document described in Sections 1 & 2 of these guidelines.

If you have any questions about the information contained in these guidelines or any corrections to suggest, contact Mike Stennett, Assistant Pavement Materials Engineer at (503) 986-6574 or Larry Ilg, Pavement Quality & Materials Engineer (PQME) at (503)-986-3072.

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ODOT Pavement Quality & Materials Engineer
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For ASPHALT CONCRETE

1.0 SCOPE

1.1 The Oregon Standard Specifications for Asphalt Concrete 00744.13, 00745.13(a) and 00735.13 require the Contractor to develop the mix designs for HMAC and Emulsified Asphalt Concrete (EAC). For projects under an ODOT contract, the proposed mix design is submitted to the ODOT Project Manager. The ODOT Project Manager forwards the mix design to the PQME to conduct a review of the design.

1.2 This document, along with the Supplemental Test Procedures for HMAC and EAC, establishes the procedures for developing and submitting a new HMAC or EAC mixture design. It also describes procedures for submitting existing mix designs for use on a new contract. The guidelines cover Dense-Graded virgin and RAM (Recycled Asphalt Materials) mixtures and Open-Graded virgin mixtures. The design procedure for Dense-Graded Superpave mixes; Open-Graded HMAC and EAC, along with a few other procedures are in the ODOT "Supplemental Test Procedures for HMAC and EAC". See Section 2.0 "Applicable Documents" for a list of required procedures and their location.

1.3 Mix designs are reviewed by ODOT as described in Section 9.0. If the design meets all requirements, a Mix Design Review Report signed by the PQME is issued with a unique ODOT laboratory number. No report will be issued for designs that are incomplete or those not meeting specification requirements. However, the CMDT will be notified of the problem. The mix design shall be developed in an ODOT certified laboratory. ODOT may delay issuing a mix design review report until it has confirmed that the produced aggregate for the project meets the specifications. In most cases, aggregate product compliance testing must have been performed within the last twelve months on produced HMAC aggregate to meet these requirements. If the aggregate and/or RAM used to develop the mix design is determined to be unrepresentative of the materials produced for construction, all or part of the mix design may be rejected.

1.4 Existing mix designs developed or reviewed by ODOT for a project will be considered for transfer to other contracts with the written concurrence of the PQME. Mix designs must either be developed or verified within three years of the date that the Contract was advertised to be eligible for transfer. The timeline for mix design transfer reviews is the same as a "new" mix design. See Section 10.0 for the transfer policy.

2.0 APPLICABLE DOCUMENTS

Refer to the ODOT Manual of Field Test Procedures for the following test procedures. There may be modifications or special instructions relative to the AASHTO procedure.

AASHTO T 84: Specific Gravity and Absorption of Fine Aggregate

AASHTO T 85: Specific Gravity and Absorption of Coarse Aggregate

AASHTO T 166: Bulk Specific Gravity of Compacted Bituminous Mixtures using SSD Specimens

AASHTO T 209: Theoretical Maximum Specific Gravity and Density of Bituminous Mixtures

AASHTO T 283: Resistance of Compacted Bituminous Mixture to Moisture-Induced Damage

ODOT TM 323: Determination of Calibration Factors for Determining the Asphalt Binder Content of Hot Mix Asphalt by the Ignition Method

Refer to AASHTO books for the following:

AASHTO T 312: Preparing and Determining the Density of Hot-Mix Asphalt Specimens by Means of the Superpave Gyratory Compactor (See Standard in Appendix A of ODOT TM 326 in the *Manual of Field Test Procedures*)

AASHTO R 30: Mixture Conditioning of Hot-Mix Asphalt

AASHTO T 340: Determining Rutting Susceptibility of Asphalt Paving Mixtures Using the Asphalt Pavement Analyzer (APA)

AASHTO TP 71-09: Evaluation of Superpave Gyratory Compactor (SGC) Internal Angle of Gyration Using Simulated Loading

The following mix design procedures are in a separate document called “Supplemental Procedures for HMAC and EAC”. This document is available from the ODOT Construction Section and is also found on the ODOT website at http://www.oregon.gov/ODOT/HWY/CONSTRUCTION/PSIndex.shtml.

ODOT TM 313: Compressive Strength of Emulsified Asphalt Mixtures

ODOT TM 316: Adding Antistrip Additives, Lime, or Latex to Mix Design Samples

ODOT TM 318: Selection of Asphalt Content in Open-Graded Bituminous Mixtures by the Drain down Procedure

ODOT TM 319: Preparation and Characterization of Recycled Asphalt Materials for Mix Design

ODOT TM 330: Superpave Volumetric Design for Dense Graded HMAC

ODOT PTM 1: Laboratory Batching of Aggregates for HMAC Mix Design, Proficiency & Calibration Samples (Optional)

3.0 DENSE GRADED MIX DESIGNS

ODOT Standard Specifications (SP745) require that all mix designs be developed by the Superpave mix design procedure described in ODOT TM 330.

3.1 Level 3 wearing course and all Level 4 mix designs require performance testing as described in Section 4.0 of these guidelines. Results of the performance test must be submitted with the mix design.

3.2 For the Ignition Oven (T 308) measurement of the asphalt content, fabricate and deliver a set of calibration samples per ODOT TM 323 for each mix design to the ODOT Region Quality Assurance Coordinator or Region QA Lab, a set to the ODOT Central Lab, and a set to the lab that will do the quality control testing.

3.3 Refer to Section 5.0 for information about reporting dense-graded mix designs to ODOT. Section 6.0 provides information about submitting mix design material to ODOT when requested.

4.0 PERFORMANCE TESTING OF DENSE GRADED MIXES

Test each Level 3 dense graded wearing course mix and all Level 4 dense graded mixes submitted for review per AASHTO T 340 with the following exception:

- The bulk specimens will be prepared per the JMF and compacted to the gyration level for the mix level specified with a specimen height of 115.0±5.0 mm per AASHTO T 312.

The APA device must meet the requirements of AASHTO T 340 and must be equipped with an automatic rut measurement system. The APA device must be calibrated at least once per year according to the procedures in the test method. In addition, the load cell used for checking wheel loads shall be calibrated at least once per year.

Provide laboratory batched aggregate samples blended according to each JMF to be tested and samples of the appropriate grade and source of asphalt to an ODOT approved APA testing laboratory. Contact the APA testing laboratory to determine the required quantity of material.

The APA test lab shall fabricate samples according to the JMF being tested and shall perform the test according to AASHTO T 340 at a test temperature of 64°C (147 °F) for all mixes.

Submit APA test results in the format required by AASHTO T 340 to the PQME with the mix design. Identify each mix with a unique identification number, such as ODOT Lab Number or Supplier's Mix Number.

The maximum acceptable APA rut depths are as follows:

Level 3 with PG 64-22 or PG 64-28*	6.0 mm rut depth
Level 3 with PG 70-22 or PG 70-28*	5.0 mm rut depth
Level 4 with PG 64-22 or PG 64-28*	5.0 mm rut depth
Level 4 with PG 70-22 or PG 70-28*	4.0 mm rut depth

*The maximum acceptable APA rut depths are also applicable to 'ER' designated binders, at the same PG grade as shown above.

5.0 REPORTING DENSE GRADED MIX DESIGNS

5.1 Characterization of Constituent Materials and Material Properties

5.1.1 New Aggregate:

For new ("virgin") aggregate, report the following:

A) Source number,
B) Product compliance information (current & passing) for each stockpile used,
C) QL mean gradations for each new aggregate stockpile, and
D) Bulk and apparent specific gravities (G_{sb} and G_{sa}) for each individual stockpile, as well as the individual weights from each aggregate gravity test (AASHTO T 84 and T 85).

5.1.2 Recycle Asphalt Materials (RAM):

If RAM is used, establish and report the following:

A) Mean gradations and asphalt binder contents as per ODOT TM 319,
B) Individual and combined G_{sb} and G_{sa} values as per ODOT TM 319,
C) Provide RAM burn data sheets, and
D) Document the RAM source (e.g. stockpile or sampled from project).

5.1.3 Other Additives:

If other additives (e.g. lime) are used in the mix, report the following:

A) Manufacturer's mean gradation, and
B) Manufacturer's G_{sb} and G_{sa}.

5.1.4 Asphalt Binder:

Report the following information for the asphalt binder used in the mix:

A) Binder supplier and PG binder grade,
B) Binder gravity (G_b) at 60°F and 77°F (15.6°C and 25°C).
C) Mixing and placement temperature ranges, and
D) Liquid antistrip brand and percentage (if required).
E) Provide a copy of the current Supplier Temperature – Viscosity Curve.

5.2 Stage 1 Results:

5.2.1 Trial Blends:

For each trial blend provide the following information:

A) Percent of each aggregate, lime, and/or RAM stockpile.
B) Report the gradation of each trial blend, as the percent passing each sieve size, to the nearest 1% for the ¾", ½", 3/8", ¼", #4, #8, #16, #30, #50, and #100 sieves. Report the percent passing the #200 sieve to the nearest 0.1%.
C) Combined G_{sb} and G_{sa} for each trial blend.
D) 0.45 Power Curve showing the three trial blends.
E) Report Coarse and Fine Aggregate Ratios per Sub-Section 6.10.1 of ODOT TM 330-10 Amended.

5.2.2 Measured Volumetrics:

Provide the following volumetric information for the samples fabricated for each trial blend:

A) P_b, P_{ba}, P_{be},
B) G_{mm}, G_{mb}, G_{se},
C) The ratio of the Immersed Volume (B-C) to Geometric Volume, $G_{ma,}$
D) V_a, VMA, VFA,
E) P200/P_{be},
F) % Virgin Binder Replacement

5.2.3 Normalized Volumetrics:

Normalize the volumetrics to 4.0% $V_{a.}$ Graph the VMA and P_{ba} versus the passing the #8 Sieve for the trial blends and report the following:

A) P_b and P_{be},
B) V_a, VMA, and VFA,
C) P200/P_{be},
D) % Virgin Binder Replacement.

5.2.4 JMF Blend Selection and Justification:

Document which trial blend was selected for the JMF and provide a brief justification as to why the selected blend was the most appropriate choice.

5.3 Stage 2 Results

5.3.1 Batch Gradation Verification:

Verify the accuracy of the blend gradation per ODOT TM 330, Section 11.1.1 and report the results.

5.3.2 Measured Volumetrics:

Calculate the volumetrics for the mix at four different asphalt binder contents and report the following information for each binder content:

A) P_b, P_{ba}, P_{be},
B) Measured G_{mm} and G_{se} at two asphalt binder contents,
C) Back-calculated G_{mm} for each of the four binder contents,
D) Measured G_{mb} for each compacted sample,
E) The ratio of the Immersed Volume (B-C) to the Geometric Volume, G_{ma},
F) V_a, VMA, VFA,
G) P200/P_{be},
H) Percent virgin binder replacement.

5.3.3 JMF Properties:

Graph G_{mb}, G_{mm}, V_a, VFA, VMA, and P200/P_{be} as a function of asphalt binder content. Through interpolation of the graphs of measured volumetrics, determine and report the following JMF properties for the mix at the optimum asphalt content:

A) P_b, P_{ba}, P_{be},
B) G_{mm}, G_{mb},
C) V_a, VMA, VFA,
D) P200/P_{be}, VIR and
E) Note whether or not the “dryback” method for G_{mm} determination was used in developing the mix design.
F) Coarse and Fine Aggregate Ratios per Sub-Section 6.10.1 of ODOT TM 330-10 Amended for the JMF Blend,
G) Percent virgin binder replacement.

5.4 Stage 3 Results

If required, provide rut and moisture susceptibility test results for the JMF mix.

A) AASHTO T 340-10, and
B) AASHTO T 283.

5.5 Mix Design Submittal

Submit the dense-graded mix design report, to the Project Manager using the ODOT Mix Design Submittal forms available on the ODOT Pavement Services website (http://www.oregon.gov/ODOT/HWY/CONSTRUCTION/PSIndex.shtml), or other forms with a similar format that have been approved for use by ODOT Pavement Services. (Other than the ODOT Contractor Mix Design Summary cover sheet there are currently no standard forms for open-graded mix design reporting.) Sending a copy of the submittal to the Assistant Pavement Materials Engineer and/or the PQME may expedite the review process, but the submittal must be sent to the Project Manager. Also include copies of the 0.45 Power Curve(s) and the required Stage 2 graphs per 5.3.3. Correctly label the mix type to indicate the nominal maximum aggregate size, mix type and level. The CMDT must assign a unique identification number/identifier for each design submitted.

6.0 DENSE GRADED MIX DESIGN MATERIALS SUBMITTAL

6.1 Mix designs submitted for review **all have the potential of requiring verification** at ODOT's discretion according to Section 9. **If requested**, for each JMF submitted, furnish representative samples (split from the materials used for the mixture design) and a completed Form 4000 for design verification to the Department's Materials Laboratory in Salem. Mix designs for which representative samples (split from the materials used for the mixture design) are not provided, will be more difficult to verify and may be rejected. Maintain verification material splits until the mix design has been reviewed and a lab report has been distributed. Submit the requested materials as follows:

Material	Amount
Aggregate	1 – 50 pound (minimum) bag from each stockpile used (untreated) Plus 300 pounds (minimum) of aggregate stockpiles in JMF blend percentages. Example: 25% ½" - #4 → deliver 75 pounds 25% #4 - #8 → deliver 75 pounds 50% #8 – 0 → deliver 150 pounds
Asphalt Cement	6 – quarts in 1 quart metal containers

Lime (If required)	1 – 2 lb. sample
Antistripping Additive (If used)	1 – 1 pint sample in a non-metal container
RAM (Recycled Asphalt Material)	2 – 50 pound samples of RAP or RAP/RAS if the RAP and RAS will be blended as a single stockpile 1 – 10 pound sample of RAS if RAS is blended as its own stockpile

6.2 If the contract requires that a mix design be developed by ODOT, furnish representative samples to the Department's Material's Laboratory in Salem as follows:

Material	Amount
New Coarse Aggregate	16 – 50 lb. (1 bag)*
New Fine Aggregate	16 – 50 lb. (1 bag)*
RAM (if used)	4 – 50 pound samples of RAP or RAP/RAS if the RAP and RAS will be blended as a single stockpile 1 – 10 pound sample of RAS if RAS is blended as its own stockpile
Hydrated lime (if used)	1 – 2 lb.
Asphalt cement	18 – quarts in 1 quart metal containers
Antistripping additive (if used)	1 – pint in a non-metal container

* If coarse or fine aggregate is in multiple stockpiles, divide the submittal evenly between stockpiles.

6.3 For Stone Matrix Asphalt (SMA) furnish all materials noted in 6.2 and 20 lbs. of mineral filler and 2 lbs. of fiber.

7.0 OPEN GRADED MIX DESIGN

7.1 The Open-Graded Mix Design procedures are found in the document "SUPPLEMENTAL TEST PROCEDURES FOR HMAC AND EAC". Protocol and procedures for ½" and ¾" Open-Graded hot mixes, and ¾" (19 mm) Asphalt Treated Permeable Base (ATPB) are described in ODOT TM 318. The protocol and procedures for Emulsified Asphalt Concrete (EAC) cold mix are described in ODOT TM 313.

This document is available from the ODOT Construction Section and is also found on the ODOT website at http://www.oregon.gov/ODOT/HWY/CONSTRUCTION/PSIndex.shtml.

7.2 Open Graded Mix Design Report:

For Open-Graded HMAC use the same cover sheet report format as is used for dense-graded mixes (link on page 10 to applicable website). For EAC mixes include in the mix design report the percent of oil distillate (cutter) in the emulsion used to develop the mix design. Report the following information for open graded mix design submittals.

For Open-Graded HMAC, submit a mix design report, including the following information:

7.2.1 Gradation: Show to the nearest whole percent except for the No. 200 (0.075 mm.) sieve which shall be recorded to the nearest 0.1 percent.

Aggregate gradation:

Sieve	Percent Passing
1" (25 mm.)	
¾" (19 mm.)	
½" (12.5 mm.)	
3/8" (9.5 mm.)	
¼" (6.25 mm.)	
No. 4 (4.75 mm.)	
No. 8 (2.36 mm.)	
No. 16 (1.18 mm.)	
No. 30 (0.60 mm.)	
No. 50 (0.03 mm.)	
No. 100 (0.150 mm.)	
No. 200 (0.075 mm.)	

7.2.2 Final asphalt content chosen reported to the nearest 0.1 percent.

7.2.3 Brand, grade, specific gravity @ 77°F (25°C) and 60°F (15.6°C), mixing and compaction temperatures for the asphalt used in testing. Identify any antistrip additives in the asphalt.

7.2.4 Test results determined at 4.5%, 5.5%, and 6.5% asphalt for the V_a, VMA, VFA, VIR and draindown (report draindown percentages to the nearest 5%).

7.2.5 Worksheets for mixture bulk specific gravity (G_{mb}), mixture maximum gravity (G_{mm}), and aggregate specific gravity (G_{sb}) for each aggregate component.

7.2.6 Provide the TSR data from a surrogate dense graded mixture. If a dense graded JMF has been prepared for the same material sources in the last year, the results for the most recent TSR may be applied to the open graded mixture. If not, prepare TSR samples for a dense graded mix using the equivalent top size stone and materials from the same sources, which will represent the open graded mix.

For Open-Graded EAC, submit a mix design report, including the following information:

7.2.7 The Bulk Specific Gravity of the specimens.

7.2.8 The compressive strength in pounds per square inch, determined by dividing the maximum vertical load obtained during deformation at the rate specified in section 8 by the original cross-sectional area of the test specimen.

7.2.9 The nominal height and diameter of the test specimens.

7.2.10 The Index of Retained Strength (IRS) for each emulsion content calculated to the nearest integer as calculated in section 10.1.

7.2.11 The air void content (V_a) of each dry specimen based on specific gravities determined in Sections 6.1 and 9.1.

7.2.12 Recommended emulsion content as a percent of the dry weight of aggregate.

7.2.13 Percentage of oil distillate contained in the emulsion sample.

8.0 OPEN GRADED MIX DESIGN MATERIALS SUBMITTAL

8.1 The ODOT Central Lab **may** verify mix designs according to Section 9. **If requested**, for each JMF submitted, furnish representative samples (split from the materials used for the mixture design) and a completed Form 4000 for design verification to the Department's Materials Laboratory in Salem as follows:

Material	Amount
Aggregate	1 – 50 pound (minimum) bag from each stockpile used(untreated) Plus 300 pounds (minimum) of aggregate stockpiles in JMF blend percentages. Example: 25% ½" - #4 → deliver 75 pounds 25% #4 - #8 → deliver 75 pounds 50% #8 – 0 → deliver 150 pounds
Asphalt Binder	4 – quarts in 1 quart containers
Lime (if required)	1 – 2 lb. sample
Antistripping Additive (if required)	1 - pint in a non-metal container

9.0 REVIEW OF CONTRACTOR MIX DESIGNS

9.1 General

By specification ODOT retains the right to review all bituminous mix designs proposed for use on the State Transportation System. ODOT recognizes that the risk associated with each paving application varies. Therefore, the extent of each mix design review will be in accordance with these potential risks.

9.2 Dense Graded Mix Design Review

All dense graded mix designs will be reviewed for accuracy, completeness, reasonableness*, compliance with specifications and compliance with the mix design guidelines. If the submittal is incomplete, the 10-day review period for the ODOT Construction Section does not start until the submittal materials are completed and accurate. ODOT retains the right to perform one or more tests on submitted material to verify the design, including, but not limited to the following:

- Aggregate gradation
- Aggregate and RAM specific gravity
- Maximum specific gravity of mix
- Bulk specific gravity of mix
- Tensile Strength Ratio
- Optimum asphalt content

The type of tests performed, if any, will be determined by a risk assessment based on the aggregate source, CMDT experience, use of the mix and reasonableness* of the mix design and its test results.

*Examples of items that will be checked for reasonableness include, but are not limited to Stage 1 versus Stage 2 results, the Immersed to Geometric Ratios of bulk samples, the difference between the Gma & Gmb for bulk samples, ensuring that calculations were done correctly and that the volumetric data follows the expected trends.

9.3 Open Graded Mix Design Review

The standard process for reviewing open graded mix designs will include the following:

- Review of the mix design documents and calculations

The review process may include the following split sample testing:

- Fine and coarse aggregate G_{sb}
- Geometric G_{mb}, V_a, VMA, and VFA @ 4.5, 5.5, and 6.5% asphalt
- Drain down and G_{mm} at 4.5, 5.5, and 6.5% asphalt

9.4 **Allowable Differences**

The agency may request Mix Design Verification testing to validate some or all mix design information submitted. The results will be considered acceptable if the testing performed by the ODOT Central Lab falls within the tolerances identified below.

Test Procedure	Allowable Difference (±)
AASHTO T 84 Bulk Specific Gravity (dry)	0.066
AASHTO T 85 Bulk Specific Gravity (dry)	0.038
AASHTO T 166 Bulk Specific Gravity	0.020
AASHTO T 209 Specific Gravity	0.019
AASHTO T 283 Tensile Strength Ratio	10 units
ODOT Drain down (open graded)	5%
ODOT Film Coating (EAC)	5%

9.4.1 If results do not fall within the allowable differences, the PQME will work with the CMDT to determine the cause of the difference. If there are significant differences between ODOT test results and contractor test results, the mix design may be returned to the CMDT for reevaluation and testing.

10.0 EXISTING MIX DESIGN GUIDELINES (TRANSFERS)

10.1 **General**

A mix design (dense-graded or open-graded) reviewed and accepted for a previous or current ODOT project may be proposed in writing for use on a new project. Acceptance of the mix design will be based on meeting the following requirements and is subject to final approval by the PQME.

10.2 **All existing mix designs must meet the following to be considered for transfer:**

- The proposed mix design is of the type and level required for the new project.
- The original mix design was either developed or verified within three years of the date that the Contract was advertised to be eligible for transfer.
- Aggregate to be used for mix on the new project is from the same source. Other materials are substantially the same as those used in the original project. **If the original mix design is more than one year old, provide current aggregate and RAM specific gravities.** (This requirement may only be waived by Pavement Services when data shows that gravities are

aggregate added to the stockpiles since the crush at the time of the last aggregate gravity testing.)

- Aggregate has passed product compliance testing as required by the ODOT "Manual of Field Test Procedures" - Section 4A.

- There were no pertinent restrictions placed on transferring the mix design when it was originally reviewed or previously transferred.

- Adjustments made to asphalt content or gradation targets during production are reflected in the proposed design.

- Materials placed under the original mix design are not currently under investigation for mix related premature distress.

- Mix designs that utilize RAS will be required to show that the maximum binder replacement limit has not been exceeded with current RAS/RAM stockpiles.

10.3 **Dense-graded mix designs must also meet the following:**

- The mix design was developed according to the Superpave mix design procedures outlined in ODOT TM 330 at the appropriate number of gyrations for the current contract.

- Mix produced following the design met the Mix Design Verification (MDV) criteria shown in Specification Section 00745.16 within the past 12 months and met the JMF requirements of 00745.13(b) (the 00745.13(b) requirements may be waived at the discretion of the PQME).

- Blend percentages will not change by more than 10% from the original mix design, unless data is submitted to support the change.

- If the mix design is more than two years old, Stage 2 testing must be performed to verify or re-establish the optimum binder content with updated/corresponding target Rice and Bulk information. (This requirement may be waived by Pavement Services.)

- Mix designs with a decrease in binder grade (e.g. PG 70-22 to PG 64-22), or a change from an ER designated binder to a non-ER (e.g. PG70-22ER to PG70-22) may require a new APA Rut Test and a new TSR.

- Mix designs with an increase in binder content under production of 0.4% or more will require a new APA Rut Test.

- Mix designs with a decrease in binder content under production of 0.4% or more will require a new TSR.

- If the target binder content changed under production more than 0.4%, then a new abbreviated Stage 2 is required. The new abbreviated Stage 2 will require volumetric checks at a minimum of two asphalt cement contents 0.5% apart. The two asphalt cement contents must bracket the design air void target (normally V_a = 4.0%). For each asphalt cement content, run one G_{mm} and replicate G_{mb}'s. The abbreviated Stage 2 data must meet all the requirements of ODOT TM 330 as applicable. This includes back-calculated G_{mm}'s and replicate G_{mb} requirements. Report all results as required under Section 5.3 above.

10.4 **Level 3 Dense-graded wearing course mix designs and all Level 4 Dense-graded mix designs must also meet the following:**

- The mix design meets APA rut depth criteria listed in Section 4.0 when tested according to AASHTO T 340-10 with the grade of asphalt required for the current contract. (This requirement may be waived by Pavement Services through the Project Manager's Office for some changes in asphalt grade and/or formulation.)

10.5 **Existing mix designs with changes to asphalt grade or source**

- Existing open-graded designs with changes to the asphalt grade or asphalt source are not acceptable. A new mix design must be developed.

- For dense-graded mix designs if the asphalt supplier or asphalt grade has changed from the original design, the requirements of 00745.13 must be met.

10.6 **Submitting the Request to Use an Existing Mix Design**

- Submit a request to use an existing mix design in writing to the ODOT Project Manager with the following information:

- Identity of the mix design by ODOT Number.

- Note any adjustments made to the asphalt content, gradation or change in stockpile(s) from the original design during production of the mix.

- Confirm the source and grade of asphalt to be used on the new project (if source or grade has changed, include test records for the additional testing required under sub-Section 10.5). Provide a current Temperature – Viscosity curve.

- Provide summary of recent MDV test data for dense-graded mix designs.

- For designs over 1 year old, provide updated aggregate and RAM specific gravity work. If the mix design utilizes RAS, provide documentation verifying that the virgin binder replacement limit will not be exceeded.

- For designs over 2 years old, provide updated Stage 2 work per 10.3 along with a batching verification sheet, unless waived by Pavement Services through the Project Manager's Office.

- Provide additional datasheets to verify work done to meet the applicable requirements of Section 10.3 for dense graded mix designs.

11.0 CMDT Proficiency

11.1 General

The purpose of the CMDT Proficiency program is to establish or modify current testing parameters as presented in the *Supplemental Test Procedures for HMAC and EAC* and *Contractor Mix Design Guidelines*, raise awareness of quality testing practices in the lab environment and identify problem areas in the mix design process, the equipment used for the testing or technicians performing mix design work for the agency. In addition to this, the results may be used for research purposes for testing procedures and their validity or viability among the population of laboratories involved in the ODOT mix design process. Test results will be shared with the participants, so that each CMDT may measure their testing or testing process with that of other technicians participating in the program and potentially identify test procedure problems or faulty equipment issues.

11.2 CMDT Proficiency Tests

The primary testing skills required for the development of a mix design include the measurement of aggregate gravities (AASHTO T 84 & 85), the effective batching of materials and mixing of binder, aggregate and sometimes RAM to a target gradation, the effective preparation and bulking of HMAC bulk specimens (AASHTO T 312 and AASHTO T 166/275) and the Rice Gravity Test (AASHTO T 209). In addition to these tests the competent performance of several other tests are required to verify the properties of the mix and mix components (e.g. AASHTO T 283, ODOT TM 319 for most ODOT mixes and ODOT TM 323). Proficiency testing will usually involve some, or all of the primary mix design test procedures, but may include other test procedures/methods involved in the mix design process.

11.3 Submittal of results

Results are to be submitted to the Assistant Pavement Materials Engineer by e-mail, or FAX # 503-986-3096, with a ‘cc’ to the Pavement Quality/Materials Engineer.

11.4 Allowable Tolerances

The proficiency results will be analyzed and a Z-Score given with an associated rating for each applicable test result. A Z-score rating of 4 or 5 implies a reasonable test result versus the population. If the CMDT results have a Z-score rating of 3 or less, then a letter must be submitted explaining the possible reasons for the deviation from the sampling’s mean, and plans to correct/address those issues.