Memorandum

U.S. Department
of Transportation

**Federal Highway
Administration**

6300 Georgetown Pike
McLean, Virginia 22101

Subject: **ACTION**: LTPP Directive GO-33
Addendum to LTPP Data Collection Guide -
RHB Forms for Superpave Properties

Date: February 19, 2004

From: Eric Weaver
Long-Term Pavement Performance Team

Reply to
Attn of: HRDI-13

To: Dr. Frank Meyer, PM - LTPP North Atlantic Regional Contract
Dr. Frank Meyer, PM - LTPP North Central Regional Contract
Mr. Mark Gardner, PM - LTPP Southern Regional Contract
Mr. Kevin Senn, PM - LTPP Western Regional Contract

Attached is the Long Term Pavement Performance (LTPP) Program Directive GO-33, which provides instructions for one revised and three new RHB data sheets to accommodate the Superpave properties. Please note that the five pages of attachment 2 are replacements for the existing pages of instructions in the Data Collection Guide (DCG) and the three pages of attachment 3 are to be added after the last page in Chapter 7. Please ensure that all personnel involved are aware of this new directive.

Should you have any questions or would like to discuss this directive, please do not hesitate to contact me at 202-493-3153.

Attachments (3)

LONG TERM PAVEMENT PERFORMANCE PROGRAM DIRECTIVE

For the Technical Direction of the LTPP Program

Program Area:	General Operations	**Directive Number:**	GO-33
Date:	February 19, 2004	**Supersedes:**	NA
Subject:	**Addendum to LTPP Data Collection Guide – RHB Forms for Superpave Properties**		

With the increasing use of Superpave mix design procedures for overlays on projects other than those in the SPS-9 experiment, there is a need for Superpave design properties in the RHB module.

This directive provides instructions for one revised and three new RHB data sheets to accommodate the Superpave properties. These sheets are:

- Sheet 7 (modified) Asphalt Concrete Overlay, Laboratory Mixture Design
- Sheet 65 (new) Asphalt Concrete Overlay, Superpave Aggregate Properties
- Sheet 66 (new) Asphalt Concrete Overlay, Superpave Asphalt Cement Properties
- Sheet 67 (new) Asphalt Concrete Overlay, Superpave Mixture Properties

RHB Sheet 7 has been revised to include five new fields, including Voids in Mineral Aggregate and Effective Asphalt Content, neither of which are Superpave specific. With the inclusion of these fields, the sheet now closely resembles SPS-9 Construction Data Sheet 9 (March 1997). Because this sheet still includes all the information that it did previously, it can be used for all AC overlay situations, whether or not Superpave mix design procedures are used.

RHB Sheet 65 is a new data sheet created to capture Superpave specific aggregate properties. This data sheet should be completed in addition to RHB sheets 3 and 4 for AC overlay events where Superpave design properties are known.

RHB Sheet 66 is a new data sheet created to capture Superpave specific asphalt cement properties. This data sheet should be completed in addition to RHB sheet 5 for AC overlay events where Superpave design properties are known.

Revised September 2003

RHB Sheet 67 is a new data sheet created to capture Superpave specific mixture properties. This data sheet should be completed in addition to RHB sheets 8 and 9 for AC overlay events where Superpave design properties are known.

The new data sheets and their instructions are included as attachments to be added to the existing LTPP Data Collection Guide (DCG).

There are five pages of instructions to be added to the existing DCG. Pages 7.12 and 7.13 are replacements for those pages already in the guide. The existing pages 7.12 and 7.13 need to be removed and replaced with the new pages. Pages 7.75 – 7.77 are to be added to the guide after page 7.74, which is currently the last numbered page in chapter 7.

One revised and three new data sheets will be added to the existing DCG. Sheet 7 will replace the current Sheet 7, and Sheets 65, 66, and 67 will be added to the guide after Sheet 64, currently the highest numbered RHB data sheet contained in the guide.

A new revision sheet for the front matter of the DCG is also included.

All DCGs being used by regional project personal shall be updated by the addition of the new sheets and forms contained in the directive.

Modifications to the database software to store this data will be distributed at a later date.

Prepared by: TSSC

Approved by:

Aramis Lopez, Jr.
LTPP Program Manager

REVISION DATES AND AFFECTED TEXT

Date of Revision	Extent of Revision
January 1988	"Original" version
June 13, 1988	1. Update of Chapter 1. 2. Update of Chapter 2; Chapter 2 now consists of inventory data sheets to be completed by the State Highway Agencies and related documentation. 3. Inventory data sheets to be completed by SHRP (materials and laboratory testing data) are moved to (new) Chapter 8. 4. Update to Appendix A.
August 30, 1989	1. Update of Chapter 6; inclusion of "Maintenance Guidelines for GPS Test Sections" and "Data Source Identification" descriptions into chapter text. Addition of new Data Sheet Number 2 "Maintenance Location Summary". Addition of "Grooving" to the "Grinding and Milling" Data Collection Sheet 12. 2. Update of Tables A.2, A.14, A.16, A.17, and A.18 in Appendix A; addition of Table A.22 to Appendix A.
November 6, 1989	1. Update to Section 3.2, "Skid Measurement" and Section 3.3, "Distress Survey" of Chapter 3.
December 15, 1989	1. Update of Chapter 7.
October 28, 1993	1. Update of Chapters 1, 2, 3, and 5. 2. Edit of Chapters 4, 6, 7, and 8.
February 2004	1. Update of Chapter 7.

load and 60 second load duration, in accordance with Test Method AASHTO T49 (or ASTM D5).

10. *Ring and Ball Softening Point*: The results in ^{o}F from the ring and ball softening point test for bitumens (AASHTO T53).

11. *Weight Loss*: The weight loss resulting from the laboratory aging process to the nearest one-tenth of one percent.

Asphalt Concrete Overlay, Laboratory Mixture Design (Sheet 7)

The following data items are to be derived from tests conducted on the mixture during mix design.

1. *Layer Number*: The asphalt concrete layer to be described on this sheet (from Sheet 2).

2. *Maximum Specific Gravity*: The maximum specific gravity (to the nearest thousandth) of the mixture, calculated using Equations 7.2 and 7.3.

3. *Bulk Specific Gravity*: The bulk specific gravity (to the nearest thousandth) of the mixture, compacted in the laboratory at the optimum asphalt content selected and by appropriate procedures for Marshall or Hveem stability. Use Test Method ASTM D1188 to establish the bulk specific gravity.

4. *Asphalt Content*: The optimum amount of asphalt cement added to the asphalt concrete mixture to the nearest one-tenth of one percent. This optimum asphalt content is obtained from the Marshall or Hveem Stability Testing.

5. *Air Voids*: The calculated air voids (to the nearest tenth of a percent) in the mixture, compacted in the laboratory to the optimum asphalt content and by appropriate procedures for Marshall or Hveem stability. Equation 7.4 may be used for calculating the percent air voids.

6. *Voids in Mineral Aggregate*: Enter the design void space between the aggregate particles of a compacted asphalt concrete mixture, which includes the air voids and the effective asphalt content, to the nearest 0.1%

7. *Effective Asphalt Content*: The design effective asphalt content (total asphalt content of the paving mixture minus the portion of asphalt that is lost by absorption onto the aggregate particles) as a percentage of the total mixture, to the nearest 0.1%.

8. *Marshall Stability*: The Marshall Stability (Test Method AASHTO T245 or ASTM D1559) of the mixture at optimum asphalt content in pounds.

9. *Number of Blows*: The number of blows of the compaction hammer that were applied to each end of the specimen to compact it for Marshall Stability and flow testing.

10. *Marshall Flow*: The Marshall Flow (Test Method AASHTO T245 or ASTM D1559) of the mixture at optimum asphalt content. Enter this item as the whole number of the measured hundredth of an inch (i.e. if 0.15 is measured, enter "15.").

11. *Hveem Stability*: The Hveem Stability or "stabilometer value" of the mixture at optimum asphalt content as measured with the Hveem apparatus using Test Method AASHTO T246 (or ASTM D1561).

12. *Hveem Cohesiometer Value*: The cohesiometer value of the mixture at optimum asphalt content, in grams per 25 mm width (or diameter) of specimen, obtained by Test Method AASHTO T246 (or ASTM D1561).

13. *Superpave Gyratory Compaction N_{design}*: Enter the number of revolutions of the Superpave gyratory compactor to achieve 4% air voids.

14. *Asphalt Grade*: Enter the code for the asphalt grade used in asphalt mixtures, if available. (See asphalt code sheet Table A.16 in Appendix A of the LTPP Data Collection Guide)

15. *Superpave Asphalt Binder Grade*: Enter the performance grade for the asphalt binder used.

Asphalt Concrete Overlay, Mixture Properties as Placed (Sheet 8)

This data sheet is to be completed from project records for each asphalt concrete overlay layer identified on Sheet 2 that is thicker than 0.75 inches. The data items are results from tests conducted on the mixture during or soon after construction. Calculations (i.e., percent air voids) should be made separately for individual samples, using data applicable to those samples. The test samples can be compacted in the laboratory after sampling in the field, or obtained by coring, cutting or sawing after the mixture is compacted in place. In the event that both types of samples are tested, separate data sheets should be completed for those compacted in the laboratory and those compacted in the field. Although tests are to be conducted on core samples from the field for SHRP LTPP (and reported on other data sheets), data from project files should be entered when available.

1. *Layer Number*: The asphalt concrete layer to be described on the sheet (from Sheet 2).

2. *Type of Samples*: Whether the test samples were sampled in the field and compacted in the laboratory, or removed from the compacted pavement. The codes appear on the data sheet.

3. *Maximum Specific Gravity*: The Maximum Specific Gravity (no air voids) of a mixture sampled during or soon after construction, as an average from testing of several samples according to AASHTO T209 or ASTM D2041. Where possible, several samples should be tested and the average entered. Use the resulting maximum specific gravity and the design asphalt content for the mixture to calculate the effective specific gravity of aggregate using Equation 7.2. Once the effective specific gravity of the aggregate is established, it may be used to calculate other maximum specific gravities for the mixture at other measured asphalt contents using Equation 7.3 below:

Asphalt Concrete Overlay, Superpave Aggregate Properties (Sheet 65)

This sheet contains additional information to be used with rehabilitation sheets 3 and 4 when Superpave mix design procedures are used for an asphalt concrete overlay. The following data items should be provided where available for each asphalt concrete layer identified on Sheet 2.

1. *Layer Number*: The asphalt concrete layer to be described on this sheet (from Sheet 2).

2. *Angularity*: Both the coarse and fine aggregate angularity should be determined. The coarse aggregate angularity shall be determined by determining the count percentage of aggregate with one or more and two or more crushed faces. This determination shall be performed in accordance with the Pennsylvania Test Method 621 with the results reported to the nearest 0.1 %. The fine aggregate angularity shall be determined by ASTM C1252 with the void determined reported to the nearest 0.1 %.

3. *Soundness*: The coarse and fine aggregate soundness shall be determined by AASHTO T104, with the weighted percent loss reported to the nearest 0.1 %.

4. *Toughness*: The coarse aggregate toughness shall be determined by use of the Los Angeles Abrasion Apparatus by following AASHTO T96. The wear loss determined by this method shall be reported to the nearest 0.1 %.

5. *Deleterious Materials*: The estimate of percentage of deleterious materials by weight shall be determined through use of AASHTO T112 "Clay Lumps and Friable Particles of Fine Aggregate". The test results shall be reported to the nearest 0.1 %.

6. *Clay Content*: The "clay content" will be determined by the use of the Sand Equivalent (AASHTO T176). The resulting ratio shall be recorded to the nearest 0.1 %.

7. *Thin, Elongated Particles*: The percentage by weight of aggregate that have a maximum to minimum dimension ratio of greater than 5. ASTM D4791 shall be used to determine this percentage with the results reported to the nearest 0.1 %.

Asphalt Concrete Overlay, Superpave Asphalt Cement Properties (Sheet 66)

This sheet contains additional information to be used with rehabilitation sheet 5 when Superpave mix design procedures are used for an asphalt concrete overlay. This data sheet is to be completed from available project records for each asphalt concrete layer identified on Sheet 2.

1. *Layer Number:* The asphalt concrete layer to be described on this sheet (from Sheet 2).

2. *Asphalt Grade:* The PG Grade of asphalt cement used. Space is provided on the sheet to enter the upper and lower temperature ranges of the PG Grading System.

3. *Source:* The name of the source for the asphalt cement. A list of asphalt refiners and processors is provided in Table A.14, Appendix A as taken from the Oil and Gas Journal, March 24, 1986. Space is provided to specify other sources, which may not be included in the table provided.

4. *Specific Gravity of Asphalt Cement:* The mean specific gravity of the asphalt cement reported to the nearest 0.001 when available. If unavailable, a typical specific gravity for asphalt cements produced at the source refinery may be entered. If source is unknown, enter 1.010 as a reasonable estimate. This specific gravity is measured as specified by AASHTO T228 (or ASTM D70).

5. *Dynamic Shear Rheometer Complex Modulus and Phase Angle:* The Dynamic Shear Complex Modulus reported to the nearest 0.01 kPa for the Tank processed asphalts and the Phase Angle reported to the nearest degree.

6. *Dynamic Shear Rheometer Complex Modulus and Phase Angle:* The Dynamic Shear Complex Modulus reported to the nearest 0.01 kPa for the RTFO processed asphalts and the Phase Angle reported to the nearest degree.

7. *Dynamic Shear Rheometer Complex Modulus and Phase Angle:* The Complex Modulus value reported to the nearest 1 kPa for the Pressure Aged Vessel processed asphalts and the Phase Angle reported to the nearest degree.

8. *Bending Beam Rheometer Stiffness Modulus and Slope:* The Stiffness Modulus reported to the nearest MPa and the slope reported to the 0.001.

9. *Direct Tension Tensile Strength and Tensile Strain:* The Tensile Stress reported to the nearest 0.1 kPa and the percent strain to the nearest 0.01%.

Asphalt Concrete Overlay, Superpave Mixture Properties (Sheet 67)

This sheet contains additional information to be used with rehabilitation sheets 8 and 9 when Superpave mix design procedures are used for an asphalt concrete overlay. The data items on this sheet should be provided where available for each asphalt concrete layer identified on Sheet 2.

The following data items are to be derived from tests conducted on the mixture during construction as part of the contractor/participating agency Quality Control program. Calculations should be made separately for individual samples, using data applicable to those samples.

The test samples can be compacted in the laboratory after sampling in the field, or obtained by coring, cutting, or sawing after the mixture is compacted in place. In the event that both types of samples are tested, separate data sheets should be filled out for those compacted in the laboratory and those compacted in the field.

1. *Layer Number:* The asphalt concrete layer to be described on this sheet (from sheet 2).

2. *Type of Samples:* Whether the test samples were sampled in the field and compacted in the laboratory, or removed from the compacted pavement. The codes appear on the data sheet.

3. *Frequency Sweep:* The mean Complex Modulus and Phase Angle (SHRP Designation M-003) in MPa and to the nearest 0.1 degree for Phase Angle for each of the three temperatures (4 C, 20 C and 40 C).

4. *Uniaxial Strain:* The Axial Stress and percent Strain (SHRP Designation M-003) for each of the three temperatures (4 C, 20 C and 40 C) in KPa and the nearest 0.01 % strain.

5. *Volumetric Strain:* The Confining Pressure and percent Strain (SHRP Designation M-003) for each of the three temperatures (4 C, 20 C and 40 C) in KPa and the nearest 0.01 % strain.

6. *Simple Shear:* The Axial Stress, Shear Stress and percent Strain (SHRP Designation M-003) for each of the three temperatures (4 C, 20 C and 40 C) in KPa and the nearest 0.01 % strain.

LTPP REHABILITATION DATA SHEET 7 ASPHALT CONCRETE OVERLAY LABORATORY MIXTURE DESIGN	* STATE CODE [__ __] * SHRP SECTION ID [__ __ __ __] * DATE COMPLETE (DD-MMM-YYYY) [__ __-__ __ __-__ __ __ __]

*1. LAYER NUMBER (FROM SHEET 2) [__ __]

2. MAXIMUM SPECIFIC GRAVITY (NO AIR VOIDS) (EQ 7.3) [__.__ __ __]

3. BULK SPECIFIC GRAVITY (ASTM D1188) [__.__ __ __]

4. ASPHALT CONTENT (PERCENT WEIGHT OF TOTAL MIX) [__ __.__]
(AASHTO T164 OR ASTM D2172)

5. AIR VOIDS (PERCENT) [__ __.__]

6. VOIDS IN MINERAL AGGREGATE (PERCENT) [__ __.__]

7. EFFECTIVE ASPHALT CONTENT (PERCENT) [__ __.__]

8. MARSHALL STABILITY (LBS) (AASHTO T245 OR ASTM D1559) [__ __ __ __.]

9. NUMBER OF BLOWS [__ __.]

10. MARSHALL FLOW (HUNDREDTHS OF AN INCH) [__ __ __ __.]
(AASHTO T245 OR ASTM D1559)

11. HVEEM STABILITY (AASHTO T246 OR ASTM D1561) [__ __ __.]

12. HVEEM COHESIOMETER VALUE (GRAMS/25 MM OF WIDTH) [__ __ __ __.]
(AASHTO T246 OR ASTM D1561)

13. SUPERPAVE GYRATORY COMPACTION N_{DESIGN} [__ __ __.]

14. ASPHALT GRADE (SEE ASPHALT CODE SHEET, TABLE A.16) [__ __]
OTHER (SPECIFY) _____

15. SUPERPAVE ASPHALT BINDER GRADE PG[__ __]-[__ __]

LTPP REHABILITATION DATA SHEET 65 ASPHALT CONCRETE OVERLAY SUPERPAVE AGGREGATE PROPERTIES	* STATE CODE [__ __] * SHRP SECTION ID [__ __ __ __] * DATE COMPLETE (DD-MMM-YYYY) [__ __-__ __ __-__ __ __ __]

*1. LAYER NUMBER (FROM SHEET 2) [__ __]

		ONE FACE	TWO FACES
2.	ANGULARITY		
	COARSE (% FRACTURED FACES)	[__ __.__]	[__ __.__]
	FINE (% VOIDS)		[__ __.__]
3.	SOUNDNESS		PERCENT
	COARSE (% LOSS)		[__ __.__]
	FINE (% LOSS)		[__ __.__]
4.	TOUGHNESS OF COARSE AGGREGATE (% LOSS LAR)		[__ __.__]
5.	DELETERIOUS MATERIALS (% LOSS)		[__ __.__]
6.	CLAY CONTENT (SAND EQUIVALENT, RATIO)		[__ __.__]
7.	THIN, ELONGATED PARTICLES (%)		[__.__]

LTPP REHABILITATION DATA SHEET 66 ASPHALT CONCRETE OVERLAY SUPERPAVE ASPHALT CEMENT PROPERTIES	* STATE CODE [__ __] * SHRP SECTION ID [__ __ __ __] * DATE COMPLETE (DD-MMM-YYYY) [__ __-__ __ __-__ __ __ __]

*1. LAYER NUMBER (FROM SHEET 2) [__ __]

*2. ASPHALT GRADE (SPECIFY DESIGN SHRP PG GRADING) PG[__ __]-[__ __]

*3. SOURCE (SEE SUPPLY CODE SHEET, TABLE A.14) [__ __]
(IF OTHER, SPECIFY) _____

4. SPECIFIC GRAVITY OF ASPHALT CEMENT (AASHTO T228) [__.__ __ __]

GENERAL ASPHALT CEMENT PROPERTIES (IF AVAILABLE FROM SUPPLIER)

5. DYNAMIC SHEAR RHEOMETER COMPLEX MODULUS AND PHASE ANGLE (kPa, DEG)
(TANK ASPHALT) (AASHTO TP5) [__ __.__ __] [__ __]

6. DYNAMIC SHEAR RHEOMETER COMPLEX MODULUS AND PHASE ANGLE (kPa, DEG)
(RTFO ASPHALT) (AASHTO TP5) [__ __.__ __] [__ __]

7. DYNAMIC SHEAR RHEOMETER COMPLEX MODULUS AND PHASE ANGLE (kPA, DEG)
(PAV ASPHALT) (AASHTO TP5) [__ __ __ __ __] [__ __]

8. BENDING BEAM RHEOMETER STIFFNESS MODULUS AND SLOPE (MPa, RATIO)
(PAV ASPHALT) (AASHTO TP1) [__ __ __ __] [__.__ __ __]

9. DIRECT TENSION TENSILE STRENGTH AND TENSILE STRAIN (kPa, RATIO)
(PAV ASPHALT) (AASHTO TP3) [__ __ __ __.__] [__.__ __]

LTPP REHABILITATION DATA SHEET 67 ASPHALT CONCRETE OVERLAY SUPERPAVE MIXTURE PROPERTIES	* STATE CODE [__ __] * SHRP SECTION ID [__ __ __ __] * DATE COMPLETE (DD-MMM-YYYY) [__ __-__ __ __-__ __ __ __]

*1. LAYER NUMBER (FROM SHEET 2) [__ __]

*2. TYPE OF SAMPLES [__]
MIXED IN FIELD, COMPACTED IN LABORATORY.....1
MIXED AND COMPACTED IN FIELD.....2

*3. FREQUENCY SWEEP (COMPLEX MODULUS, MPa % PHASE ANGLE, δ)
4^oC[__ __ __][__ __.__] 20^oC[__ __ __][__ __.__] 40^oC[__ __ __][__ __.__]

*4. UNIAXIAL STRAIN (AXIAL STRESS, kPa & STRAIN, mm/mm)
4^oC[__ __ __][__.__ __] 20^oC[__ __ __][__.__ __] 40^oC[__ __ __][__.__ __]

*5. VOLUMETRIC STRAIN (CONFINING PRESSURE, kPa & AXIAL STRAIN, mm/mm)
4^oC[__ __ __][__.__ __] 20^oC[__ __ __][__.__ __] 40^oC[__ __ __][__.__ __]

*6. SIMPLE SHEAR

	4^oC	20^oC	40^oC
AXIAL STRESS, kPa	[__ __ __]	[__ __ __]	[__ __ __]
SHEAR STRESS, kPa	[__ __ __]	[__ __ __]	[__ __ __]
SHEAR STRAIN mm/mm	[__.__ __]	[__.__ __]	[__.__ __]