Long-Term Pavement Performance Warm-Mix Asphalt Study Final Report, Volume III: SPS-10 Nomination Guidelines

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U.S. Department of Transportation
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Research, Development, and Technology
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LTPP™

FOREWORD

Warm-mix asphalt (WMA), an innovative material that is part of the Federal Highway Administration Every Day Counts program, has been implemented by State highway agencies throughout the United States. WMA covers a variety of categories, each designed to allow for the production and compaction of asphalt concrete at temperatures lower than conventional hot-mix asphalt (HMA).

Recognizing that a knowledge gap exists in the comparison of WMA and HMA over the performance life of each type of pavement, the Long-Term Pavement Performance (LTPP) program initiated this research to design a national experiment to study the performance of WMA relative to HMA. New test sections will be recruited into the LTPP program under the designation of the specific pavement studies (SPS)-10 experiment called "Warm Mix Asphalt Overlay of Asphalt Pavement Study."

The purpose of this volume of the report series is to document the guidelines for nominating candidate projects and outlines participation requirements for the SPS-10 experiment for the LTPP program. This experiment is designed to capture information on the short- and long-term performance of WMA relative to HMA. This experiment has been structured to ensure consistency and compatibility with the existing LTPP program objectives and database while addressing information gaps regarding WMA performance. The intent of the SPS-10 experiment is to capture not only field performance but also laboratory test data that will provide both user-agencies and researchers a better understanding of the potential benefits of WMA. Collectively, this information could be used for performance prediction.

Mark Swanlund
Acting Director, Office of Infrastructure
Research and Development

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
	NOTE: volumes greater than 1,000 L shall be shown in m^3			
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2,000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	$candela/m^2$	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2,000 lb)	T
		TEMPERATURE (exact degrees)		
°C	Celsius	1.8C+32	Fahrenheit	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m2	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	2.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003)

LONG-TERM PAVEMENT PERFORMANCE WARM-MIX ASPHALT STUDY PROJECT REPORT SERIES

This volume is the third of six volumes in this research report series. Volume I is the final report, and volume II through volume VI contain detailed information about the design and operations of the experiment. The following list contains the volumes of this series:

Volume	Title	Report Number
I	Long-Term Pavement Performance Warm-Mix Asphalt Study, Volume I: Final Report	FHWA-HRT-22-018
II	Long-Term Pavement Performance Warm-Mix Asphalt Study Final Report, Volume II: SPS-10 Experimental Matrix and Research Plan	FHWA-HRT-22-019
III	Long-Term Pavement Performance Warm-Mix Asphalt Study Final Report, Volume III: SPS-10 Nomination Guidelines	FHWA-HRT-22-020
IV	Long-Term Pavement Performance Warm-Mix Asphalt Study Final Report, Volume IV: SPS-10 Materials Sampling and Testing Requirements	FHWA-HRT-22-021
V	Long-Term Pavement Performance Warm-Mix Asphalt Study Final Report, Volume V: SPS-10 Performance Monitoring Guide	FHWA-HRT-22-022
VI	Long-Term Pavement Performance Warm-Mix Asphalt Study Final Report, Volume VI: SPS-10 Construction Documentation Guide	FHWA-HRT-22-023

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LIST OF ABBREVIATIONS

AADT	annual average daily traffic
AASHTO	American Association of State and Highway Transportation Officials
AC	asphalt concrete
ESAL	equivalent single axle load
FHWA	Federal Highway Administration
GPS	global positioning system
HMA	hot-mix asphalt
LTPP	Long-Term Pavement Performance
MEPDG	Mechanic-Empirical Pavement Design Guide
PCI	pavement condition index
PG	performance-graded
RAP	recycled asphalt pavement
RSC	regional support contractor
SHRP	Strategic Highway Research Program
SPS	Specific Pavement Studies
WIM	weigh-in-motion
WMA	warm-mix asphalt

CHAPTER 1. PARTICIPATION AND PROJECT SELECTION

This report provides guidelines and information for nominating candidate projects for the Long-Term Pavement Performance (LTPP) program Specific Pavement Studies (SPS)-10 Warm-Mix Asphalt (WMA) experiment and outlines participation requirements. Detailed project nomination forms and instructions are included in this report. Details of the experimental design and study factors are described in volume II of this report series (Puccinelli et al. 2022).

PARTICIPATION REQUIREMENTS

State and provincial highway agencies considering participating in the SPS-10 experiment must be willing to perform the following activities:

- Construct the test sections described in the experimental design document found in volume II (Puccinelli et al. 2022). Test sections to be constructed include one section using conventional hot-mix asphalt (HMA) designed according to the agency's current mix design and two sections using different WMA technologies. All test sections on a project must be constructed during the same construction season. The treatments within the length of the test sections must be applied across all lanes in the direction of travel.

- Provide traffic information. For an SPS-10 section, a continuously operating permanent device for classification and weight data is preferred. This level of data collection is desired for two reasons: to provide the accurate traffic loading measurements required to develop mechanistic and mechanistic/empirical design models and to provide the base data necessary to understand the intricacies of the interactions among pavement, traffic load, and environment.

  Although data collection on the site continuously over the year is preferred, sites without continuous weigh-in-motion (WIM) equipment will still be considered. The minimum recommended data collection effort for each site is 2 w of continuous classification data 4 times per year (a total of 8 w of classification data per year). It is the agency's responsibility to ensure collected data are representative and account for seasonal variation, weekday/weekend differences, and inconsistent truck loading patterns throughout the year. Complete details on traffic data collection can be found in chapter 3 of this report.

  When nominating a project location, the location of existing WIM equipment should be considered. Sites where existing WIM equipment can be used to capture the traffic loading would allow for traffic data to be captured without the installation of additional equipment.

- Perform and/or provide for drilling, coring, and sampling of in-place pavement materials used in the test sections. Costs for this work are to be borne by the participating agency. LTPP regional support contractor (RSC) staff will be onsite to perform sample logging and sample shipment. Testing of samples will be performed by the Federal Highway Administration (FHWA) or its contractors.

- Prepare plans, specifications, quantities, and all other documents necessary as part of the agency's contracting procedure. The agency must also provide construction control, inspection, and management in accordance with its standard quality control and assurance procedures. RSC staff will be onsite during construction to perform documentation required by LTPP.

- Provide periodic traffic control for onsite data collection activities, such as drilling and materials sampling, distress surveys, deflection testing, and other monitoring activities.

- Coordinate maintenance activities on the test sections to prevent application of premature treatments that alter the characteristics of the test sections and limit their use in the study.

- Notify FHWA LTPP RSC before the application of overlays or other such treatments when any of the test sections reach an unsafe condition or become a candidate for rehabilitation. As much lead time as possible is needed to allow recording of the terminal condition of the test sections.

- Provide and maintain signing and marking of test sites.

If State or provincial highway agency personnel would like to discuss the details of these participation requirements, they should contact the LTPP RSC for their region.

PROJECT SELECTION CRITERIA

The following criteria will be considered in evaluating candidate projects for inclusion in this experiment:

- The construction project must be of sufficient length to accommodate all the experimental test sections. The experimental design requires a minimum of 243.8 m (800 ft) per section, with a core monitoring section of 152.4 m (500 ft) that will be used for future nondestructive performance monitoring. A 15.2-m (50-ft) buffer on each side of the monitoring area will be included to separate the destructive sampling area from the monitoring area. The destructive sampling area will consist of 30.5 m (100 ft) on each side of the monitoring area. The sampling area will be built at the same time and to the same specifications as the monitoring area to allow material sampling without disturbing the 152.4-m (500-ft) monitored area and will consist of the outside lane (i.e., truck lane) only. Transition zones are required between test sections and must be a minimum of 2,483.8 m (800 ft) long. The project will require at least three different mixes (one HMA and two WMA) to be produced at the same plant. Each mix may be placed on the test section only after the plant has reached steady-state operation, which may require long transitions between the sections, use of the mix for some other purpose, or disposal of the mix before the plant achieves steady-state operation. The contractor must establish rolling patterns/compactive effort requirements to meet construction specifications. The minimum project length is 1,219 m (4,000 ft) but may be longer if more than the minimum number of sections are built or if the transition zones are longer than the minimum length. The same compaction equipment must be used on all three test sections.

- Other than the mix properties of the surface layer, all other properties of the test sections should be as similar as possible. If the construction project is a resurfacing project, variation in the preconstruction condition, pavement layer thicknesses, and subgrade properties should be minimal. Areas with unusual distress types should be avoided.

- Traffic flow over all the test sections on a project should be uniform. All sections should carry the same traffic stream. Intersections, rest stops, on-off ramps, weaving areas, quarry entrances, and so forth should be avoided on and between test sections on a project.

- Test sections should be located on portions of the project that are relatively straight and have a uniform vertical grade. Horizontal curves greater than 3 degrees and vertical grades greater than 4 percent should be avoided.

- It is highly desirable that the portion of the project that includes the proposed test sections be opened to traffic at the same time.

- Ideally, all test sections should be located on shallow fills. The entire length of each test section, however, should be located completely on either a cut or a fill. Cut-fill transitions and side hill fills should be avoided.

- Culverts, pipes, and other substructures beneath the pavement should be avoided within the limits of each test section. It is recommended that subsurface structures, if required, be located in the transition zones between test sections.

- Pavements that are excessively underdesigned or overdesigned for existing site conditions should be avoided. As a general guide, the design life should be between 10 and 20 yr, as determined using the agency's standard design procedure. The accepted range of overlay thicknesses is 51 to 102 mm (2 to 4 inches).

- Any open-graded friction courses or surface treatments (i.e., chip seals, slurry seals) should be removed via milling before the SPS-10 overlay is placed.

- Pre-overlay repairs may be performed in accordance with the State or provincial highway agency's standard practice. The repairs should be consistent throughout the project so as not to add variability between test sections.

- Tack coats must be used between lifts and between the original surface and overlay.

- Road sections that have been widened or those with added lanes or added shoulders are not desirable for the SPS-10 experiment.

- Existing pavements with retrofitted edge drains are not desirable.

- The project must not have a curb and gutter within 1.8 m (6 ft) of the outside edge of the pavement adjacent to the test lane.

- The test sections should be placed in the outside test lane and must be 3.7 m (12 ft) wide with a consistent and uniform thickness.

- The type, extent, and severity of distress should be relatively uniform over the project. Test sections must be located to avoid areas of unusual distress occurrences on the project. It is desired that the type of distress and performance of the pavement are typical for the agency. Unique performance and deterioration should be avoided to the extent possible.

By minimizing the influence of other factors (such as changes in the existing pavement structure, subgrade, traffic patterns, and drainage characteristics), these criteria and considerations will help identify projects in which the relative performance of the test sections is due to the differences in the asphalt concrete (AC) mix of the surface layer.

Section homogeneity is important to the success of the experiment. For resurfacing projects, homogeneity includes the subgrade, existing pavement structure, and existing condition. Construction history records, while valuable, often do not fully reflect the variability of in-service pavements. It is requested that the agency evaluate the homogeneity of potential projects before nominating them and include the evaluation results with its submission. Tools to evaluate homogeneity include distress surveys, falling weight deflectometer testing, and ground-penetrating radar testing.

It is recognized that projects containing all of the desirable characteristics are not always readily available. Each candidate site will be evaluated individually to determine the extent of compliance with the desired criteria and usefulness to the experiment. Deviation from the desired project characteristics may be necessary to obtain sufficient projects for the experiment. For example, projects will be considered where it is not possible to locate all of the test sections completely in either cuts or fills. In this case, it may be necessary to locate some test sections in cuts and others in fills. Also, on a project in rolling terrain with limited distance between intersections, it may be necessary to locate a test section over a shallow cut-fill transition (less than 3 m [9.8 ft] difference). Generally, engineering judgment will be used to evaluate the impact of such nonuniformities on test section performance.

The criteria and considerations presented in this document will be used to evaluate and rank candidate projects in cases where more than the required number of projects are available. They can also be used as a guide by an agency to identify candidate projects in its jurisdiction that are most suitable for nomination.

Special consideration will be given to projects that include test sites that are located near existing SPS or General Pavement Studies experiments.

CHAPTER 2. NOMINATION PROCEDURE AND FORMS

NOMINATION PROCEDURE

State or provincial highway agencies desiring to participate in the SPS-10 experiment should review candidate projects and evaluate them against the criteria and considerations presented in this document. A minimum of two test sites is being sought for each row in table 1, the final experimental matrix for SPS-10. Under certain conditions, additional projects might be included in one or more of the experimental design cells, as represented by the rows of table 1.

Table 1. Final experimental matrix for SPS-10.

Moisture	Temperature	Traffic	Number of Projects
Wet	Freeze	High	2
Wet	Freeze	Low	2
Wet	No freeze	High	2
Wet	No freeze	Low	2
Dry	Freeze	High	2
Dry	Freeze	Low	2
Dry	No freeze	High	2
Dry	No freeze	Low	2

Note: Projects consist of an HMA control section and two different WMA categories (foaming process and chemical).

Project acceptance will be performed sequentially over time. Decisions on acceptance will be made by the "Latest Date for Approval Notification from FHWA" to be furnished by the nominating agency on the nomination forms contained in this document. Nominating agencies should set this date as late as possible to allow for review of other projects nominated for the same experiment design cell and selection of the best-suited sites for this experiment. Agencies should coordinate their nomination of projects through FHWA LTPP RSC.

NOMINATION FORMS

The following are instructions for completion of the SPS-10 candidate project nomination and instruction forms. Each form is referenced according to a sheet letter designation.

SHEET A. GENERAL PROJECT INFORMATION

This sheet includes information on project location, significant dates, and design traffic.

State/Province

Enter the State or province in which the project is located.

SHRP ID

FHWA will assign this four-digit Strategic Highway Research Program (SHRP) identifier if the project is selected for inclusion in the SPS-10 experiment and will be used as a project reference number.

Project Location

This portion of the form provides information on the location of the candidate project. In this document, a project refers to the overall construction project. Test sections refer to 152.4-m (500-ft) portions of the project in which the experimental pavement structures are constructed and monitored over time.

Route Number

Enter the number assigned to the route on which the project is located. The common number used on maps and highway signs should be provided to avoid confusion.

Route Signing

Check the appropriate designation for the route on which the project is located. If the project is located on a road other than an interstate, U.S., State, or county route, please write in the appropriate designation in the space provided with a short explanation. For example, a farm-to-market signed route should be entered as "FM—Farm to Market." This designation should refer to how the route is signed and indicated on general highway maps.

Project Location

Enter the start and end mileposts or milepoints of the portion of the project that is considered suitable for the construction of the test sections. Mileposts or milepoints refer to reference locations signed or marked along the route in the field. If the route is signed with kilometer posts, enter the appropriate kilometer post numbers (scratch out milepost and write kilometer post on the form). The start and end station locations are not required but are requested for use in locating the portion of the project proposed for the experimental sections on the plans.

Location Description

Provide a written description of the location of the start of the project referenced to permanent landmarks, such as signed highway intersections, signed or labeled bridges, underpasses, overpasses, rest areas, and railroad crossings. The objective is to provide a reference for field

crews to locate the section in the field easily. Distances from a landmark located before the section (in the direction of travel) and a landmark located after the start of the section should be specified. For example, "The start of the project is 2.2 km north of overpass 20-45-43; the intersection with I–71 is located 3.3 km north of the start of the project" (assuming the direction of travel is northbound).

GPS Coordinates

Enter the global positioning system (GPS) latitude and longitude coordinates (in degrees, minutes, and seconds to the nearest tenth of a second [0.1"]) of the location of the start of the project.

Direction of Travel

Check the box that describes the direction of travel of the lane proposed for the LTPP experiment. The direction of travel should be as the route is signed. For example, if the lane is on I–71, only northbound or southbound should be chosen, even if the route trends mostly east-west within the project limits.

Facility Type

Check the box "Divided" if there is a median, curb, or another permanent barrier between the directions of traffic.

Number of Lanes

For an undivided road, enter the total number of lanes in both directions. For a divided road, enter the number of lanes in the project direction.

County

Enter the county or county-level governmental jurisdiction unit in which the project is located. If the project is located in more than one county, indicate the county first encountered in the direction of travel.

Highway Agency District Number

Enter the number that identifies the highway agency's district, division, or region in which the project is located.

Distance to Nearest Weather Station

Enter the distance in miles to the nearest fully operational and permanent weather station. The weather stations operated by the National Oceanic and Atmospheric Administration and the National Weather Service are preferred.

Significant Dates

Latest Date of Approval Notification from FHWA

Enter the latest date that FHWA can notify the agency of acceptance of a project into the experiment. This date represents the latest date that an agency can start the preparation of construction specifications and contractual documents to have the test sections constructed. This date should be a realistic absolute latest date that provides FHWA with the longest time possible to evaluate and coordinate other candidate projects so that the best geographical spread and most suitable projects are included in the experiment.

Contract Letting Date

Enter the actual date the contract is scheduled for letting.

Estimated Construction Start Date

Enter the date on which construction on the portion of the project containing the test sections is expected to begin. This date is important for scheduling preconstruction activities, such as section marking, deflection tests, and so forth.

Estimated Date Test Sections Opened to Traffic

Indicate the expected date on which the test sections will be opened to traffic.

Estimated Construction Completion Date

Enter the scheduled date for completion of construction of the project on which the LTPP test sections are located. In some instances, the estimated dates for opening the test sections to traffic and for completion of construction will be the same.

Traffic

AADT (in project lane)

Enter the estimate of the annual average daily traffic (AADT) for all vehicles in the project lane only.

Percent Heavy Trucks and Combinations

Enter the ratio of trucks and heavy combinations to total vehicles (AADT) expressed to the nearest tenth of a percent. This count excludes all pickups, panels, and other two-axle, four-tire trucks. This number is for the traffic in the project lane only.

Annual 18-kip ESALs (in project lane)

Provide the design average application rate of heavy truck loadings, in 18-kip equivalent single axle load (ESAL) applications, in the study lane of the proposed project. The value should be the design number of ESAL applications divided by the duration of the design period.

Design Life (years)

Enter the length of the design life, in years, used for estimating the traffic used in the pavement design of the project.

Traffic Equipment

Permanent WIM installed that can be applied to test sections? (Y or N)

Indicate whether an existing permanent WIM is installed within close proximity to the proposed location. The WIM must be in the same direction of travel and have the same traffic loadings/patterns as the site location.

WIM Location

Provide the milepost and direction of travel of the installed WIM.

WIM Type/Manufacturer

Provide information on the type of WIM equipment installed.

Last Calibration Date of WIM

Provide the date of the last known calibration of the WIM equipment.

Does agency agree to provide a minimum of 2 w of classification data, 4 times per year (total 8 w)?

If a permanent, full-time WIM is not currently available for the proposed location, please indicate whether the agency is willing to collect temporary classification data for 2 w, 4 times per year.

Sheet A. SPS-10 Candidate Project Nomination and Information

STATE/PROVINCE: _____
SHRP ID: _____ (to be assigned by FHWA if project is selected)

General Project Information

Project Location

Route Number	_____
Route Signing	☐ Interstate ☐ U.S. ☐ State ☐ County ☐ Other _____
Project Location	Start Milepost _____ End Milepost _____ Begin Station _____ End Station _____
Location Description	_____ _____
GPS Coordinates	Latitude _____ Longitude _____
Direction of Travel	☐ North Bound ☐ South Bound ☐ West Bound ☐ East Bound
Facility Type	☐ Divided ☐ Undivided
Number of Lanes (total # in both directions if undivided)	_____
County	_____
Highway Agency District Number	_____
Distance to nearest Weather Station (miles)	_____

Project Type

☐ New Construction ☐ Flexible Resurfacing ☐ Rigid Resurfacing

Significant Dates

Latest Date of Approval Notification from FHWA	_____
Contract Letting date	_____
Estimated Construction Start Date	_____
Estimated Date Sections Opened to Traffic	_____
Estimated Construction Completion Date	_____

Traffic

AADT (in project lane)	_____
Percent Heavy Trucks and Combinations	_____
Annual 18-kip ESALs (in project lane)	_____
Design Life (years)	_____

STATE/PROVINCE: _____
SHRP ID: _____ (to be assigned by FHWA if project is selected)

Traffic Equipment

Permanent WIM installed that can be applied to test sections? (Y or N)	___
WIM Location:	Milepost: ____ Direction of Travel: _____
WIM Type/Manufacturer:	_____
Last Calibration Date of WIM:	_____
Does Agency agree to provide a minimum of 2 weeks of classification data, 4 times per year (total 8 weeks)? (Y or N)	___

SHEET B. PAVEMENT DESIGN INFORMATION, RESURFACING

The purpose of this sheet is to provide information on the State or provincial highway agency's typical pavement resurfacing design for the project site. Information should represent the pavement structure for the project as a whole, without special consideration of the test sections (i.e., what the agency would construct if the project is not included in the SPS-10 experiment).

State/Province

Enter the State or province in which the project is located.

SHRP ID

FHWA will assign this four-digit SHRP identifier if the project is selected for inclusion in the SPS-10 experiment and will be used as a project reference number.

Design Method

If this project was designed using the Mechanistic-Empirical Pavement Design Guide (MEPDG) (AASHTOWare Pavement ME Design) (AASHTO 2020) or the American Association of State Highway and Transportation Officials (AASHTO) 1993 design procedure (AASHTO 1993), check the appropriate box. Otherwise, describe the design method in the space provided.

Design Life

Enter the design life of the pavement structure in years.

Existing Pavement Condition

Enter the condition of the existing pavement. If available, please provide the pavement condition index (PCI) as determined using ASTM D6433 (ASTM 2020). If another methodology was used, please describe it in the space provided for "Other." If no objective description of the pavement condition is available, please describe it as good, fair, or poor.

Predominant Distress Type

Enter the most significant distress on the section, and the distress of most importance in determining the need for resurfacing and the design of the resurfacing. For example, if the section exhibits both alligator cracking and weathering, alligator cracking should be entered here.

Date Existing Surface Opened to Traffic

Enter the date the existing surface layer was placed. Consider only structural layers and ignore fog seals and surface treatments.

Design Layer Structure

Layer Number

This layer number convention starts with the naturally occurring subgrade as layer 1 and progresses to the pavement surface as the highest numbered layer. Each unique material above the subgrade is assigned a layer number and corresponding material type code. Fabrics, surface treatments, and other thin layers should be included.

Layer Description

Describe the layer in general terms. Examples include “select fill,” “aggregate base,” and “hot mix.” Please use generally understood terms and avoid agency-specific descriptions.

Material Type Class Code

The two-digit codes identifying the type of material in each layer of the pavement structure are shown in table 2 through table 7. The intent is a general identification of materials for classification and project selection purposes.

Thickness (inches)

Enter the thickness of the existing layer in inches. Provide the full thickness of the layer as it exists preconstruction, even for layers that will be reduced in thickness or removed entirely during construction.

Required Overlay Thickness (inches)

Enter the thickness of the required overlay to meet the design life, as determined using the pavement design methodology used. Please do not round up the thickness. The intent is to obtain the actual thickness of pavement materials required to meet the design life to the precision provided by the pavement design method used.

Design Overlay Thickness (inches)

Enter the thickness of overlay material that the agency intends to specify in construction documents. Typically, this will be the required thickness rounded up to reflect actual construction practices.

Depth of Milling/Grinding (inches)

Enter the depth of milling/grinding (if any) of the existing pavement surface.

Estimated Base Repair Quantity (percent)

Enter the percentage of the area of the project that will require base repairs or other excavation below the postmilling surface.

Other Preconstruction Repairs

Describe any other pre-overlay repairs that the agency intends to perform other than milling/grinding and base repair.

Sheet B. SPS-10 Candidate Project Nomination and Information

STATE/PROVINCE: _____
SHRP ID: _____ (to be assigned by FHWA if project is selected)

Pavement Design Information
Resurfacing

Design Method ☐ MEPDG ☐ AASHTO 93 ☐ Other _____
Design Life (years) _____
Existing Pavement Condition _____
Condition Assessment Method ☐ PCI (ASTM D6433) ☐ Other _____
Predominant Distress Type: _____
Date Existing Surface Opened to Traffic: _____

Existing Layer Structure

Layer No.[1]	Layer Description	Material Code[2]	Thickness (in)[3]
1	**Subgrade**		
2			
3			
4			
5			
6			
7			
8			
9			

Notes:
1. Layer 1 is the naturally occurring subgrade soil. The pavement surface will have the largest assigned layer number
2. Refer to Tables 2 through 7 for material class codes
3. If the depth to a rigid layer (such as bedrock) is known, enter it here. Otherwise leave blank.

Required Overlay Thickness (in) _____
Design Overlay Thickness (in) _____
Depth of Milling/Grinding (in) _____
Estimated Base Repair Quantity (%) _____
Other Pre-Construction Repairs _____
_____
_____

Table 2. Pavement surface material type classification codes.

Material Type	Code
Hot-mixed, hot-laid AC, dense-graded	01
Hot-mixed, hot-laid AC, open-graded (porous friction course)	02
Sand asphalt	03
Jointed plain portland cement concrete	04
Jointed reinforced portland cement concrete	05
Continuously reinforced portland cement concrete	06
Prestressed portland cement concrete	07
Fiber-reinforced portland cement concrete	08
Plant-mix, cold-laid emulsified asphalt material	09
Plant-mix, cold-laid cutback asphalt material	10
Single surface treatment	11
Double surface treatment	12
Hot-recycled central plant mix AC	13
Central plant-mix, cold-laid recycled AC	14
Mixed-in-place, cold-laid recycled AC	15
Heater scarification/recompaction recycled AC	16
Jointed plain recycled portland cement concrete	17
Jointed reinforced recycled portland cement concrete	18
Other	19

Table 3. Base and subbase material type classification codes.

Material Type	Code
No base (pavement directly on subgrade)	21
Uncrushed gravel	22
Crushed stone, gravel, or slag	23
Sand	24
Soil–aggregate mixture, predominantly fine-grained soil	25
Soil–aggregate mixture, predominantly coarse-grained soil	26
Soil cement	27
Cement aggregate mixture	37
Lean concrete (<3 sacks/yd^3)	38
Recycled portland cement concrete	39
Sand–shell mixture	40
Limerock, caliche (soft carbonate rock)	41
Lime-treated subgrade soil	42
Cement-treated subgrade soil	43
Pozzolanic–aggregate mixture	44

Table 4. Bituminous bound base and subbase material type classification codes.

Material Type	Code
Dense-graded, hot-laid, central plant mix	28
Dense-graded, cold-laid, central plant mix	29
Dense-graded, cold-laid, mixed-in-place	30
Open-graded, hot-laid, central plant mix	31
Open-graded, cold-laid, central plant mix	32
Open-graded, cold-laid, mixed-in-place	33
Recycled AC, plant mix, hot-laid	34
Recycled AC, plant mix, cold-laid	35
Recycled AC, mixed-in-place	36
Sand asphalt	46

Table 5. Fine-grained subgrade material type classification codes.

Material Type	Code
Clay (liquid limit >50)	51
Sandy clay	52
Silty clay	53
Silt	54
Sandy silt	55
Clayey silt	56

Table 6. Coarse-grained subgrade material type classification codes.

Material Type	Code
Sand	57
Poorly graded sand	58
Silty sand	59
Clayey sand	60
Gravel	61
Poorly graded gravel	62
Clayey gravel	63
Shale	64
Rock	65

Table 7. Thin seal and interlayer material type classification codes.

Material Type	Code
Chip seal coat	71
Slurry seal coat	72
Fog seal coat	73
Woven geotextile	74
Nonwoven geotextile	75
Stress-absorbing membrane interlayer	77
Dense-graded AC interlayer	78
Aggregate interlayer	79
Open-graded AC interlayer	80
Chip seal with modified binder (excluding absorbing membrane)	81
Sand seal	82
Asphalt rubber seal coat (stress-absorbing membrane)	83
Sand asphalt	84
Other	85

SHEET C. MIX INFORMATION

The purpose of this sheet is to provide information on the AC mixes that the agency intends to use as part of the experiment. Mixes used on portions of the project outside the section boundaries are not relevant to this form.

State/Province

Enter the State or province in which the project is located.

SHRP ID

FHWA will assign this four-digit SHRP identifier if the project is selected for inclusion in the SPS-10 experiment and will be used as a project reference number.

General Mix Design Information

The information required for this section will be the same for the HMA mix and the two core section WMA mixes.

Nominal Maximum Aggregate Size (millimeters)

Enter the nominal maximum aggregate size of the mixes in millimeters.

RAP Content (percent)

Enter the quantity of recycled asphalt pavement (RAP) to be used in the mixes, expressed in terms of binder replacement as percent by total binder in the mix.

Rubber Content (percent)

Enter the quantity of rubber to be used in the mixes, expressed as percent by total binder in the mix.

Total Binder Content (percent)

Enter the total quantity of binder, including virgin binder, binder from RAP, and rubber, expressed as percent by total weight of mix.

Mix-Design Method

Enter the mix-design method that the agency intends to use. If Superpave, check the box provided. Otherwise, check “Other” and enter the mix-design method in the space provided.

HMA Control Section

The information in this section applies to the HMA control section only.

Binder Grade

Enter the binder grade to be used on the HMA control section. If this is a performance-graded (PG) binder, check the box provided. Otherwise, check "Other" and enter the name of the grading system.

WMA Sections

The information in these sections applies to the two core WMA sections only.

WMA Technology

Check the appropriate box for the WMA technology to be used on the section.

Additive Type

Describe the specific type of additive to be used. Use trade names as appropriate. Leave this space blank if a foaming process is to be used.

Additive Dosage Rate

Enter the dosage rate of the additive, including the basis of measurement (e.g., "percent by weight of mix" or "percent by weight of binder"). Leave this space blank if a foaming process is to be used.

Supplemental Sections

If the agency intends to build supplemental sections, enter the relevant information in the places provided.

WMA Technology

Check the appropriate box for the WMA technology to be used on the section.

Additive Type

Describe the specific type of additive to be used. Use trade names as appropriate. Leave this space blank if a foaming process is to be used.

Additive Dosage Rate

Enter the dosage rate of the additive, including the basis of measurement (e.g., "percent by weight of mix" or "percent by weight of binder"). Leave this space blank if a foaming process is to be used.

Other Variations

If variations from the information specified in Sheets A, B, or C are intended for this section, describe them here. Examples include variation in RAP content, variation in binder content or grade, or variation in overlay thickness.

Sheet C. SPS-10 Candidate Project Nomination and Information

STATE/PROVINCE: _____
SHRP ID: _____ (to be assigned by FHWA if project is selected)

Mix Information

General Mix Design Information

Nominal Maximum Aggregate Size, mm _____
RAP Content, % _____
Rubber Content, % _____
Total Binder Content, % _____
Mix Design Method ☐ Superpave ☐ Other _____

HMA Control Section

Binder Grade _____
Binder Grade Basis ☐ PG ☐ Other _____

WMA Section 1

WMA Technology ☐ Foaming Process ☐ Chemical Additive
Additive Type _____
Additive Dosage Rate _____

WMA Section 2

WMA Technology ☐ Foaming Process ☐ Chemical Additive
Additive Type _____
Additive Dosage Rate _____

☐ Supplemental Section 1

WMA Technology ☐ Foaming Process ☐ Foaming Additive ☐ Chemical Additive ☐ Organic Additive
Additive Type _____
Additive Dosage Rate _____
Other Mix Variation _____

☐ Supplemental Section 2

WMA Technology ☐ Foaming Process ☐ Foaming Additive ☐ Chemical Additive ☐ Organic Additive
Additive Type _____
Additive Dosage Rate _____
Other Mix Variation _____

Sheet C. SPS-10 Candidate Project Nomination and Information

STATE/PROVINCE: _____
SHRP ID: _____ (to be assigned by FHWA if project is selected)

☐ **Supplemental Section 3**

WMA Technology ☐ Foaming Process ☐ Foaming Additive ☐ Chemical Additive ☐ Organic Additive
Additive Type _____
Additive Dosage Rate _____
Other Mix Variation _____

☐ **Supplemental Section 4**

WMA Technology ☐ Foaming Process ☐ Foaming Additive ☐ Chemical Additive ☐ Organic Additive
Additive Type _____
Additive Dosage Rate _____
Other Mix Variation _____

☐ **Supplemental Section 5**

WMA Technology ☐ Foaming Process ☐ Foaming Additive ☐ Chemical Additive ☐ Organic Additive
Additive Type _____
Additive Dosage Rate _____
Other Mix Variation _____

☐ **Supplemental Section 6**

WMA Technology ☐ Foaming Process ☐ Foaming Additive ☐ Chemical Additive ☐ Organic Additive
Additive Type _____
Additive Dosage Rate _____
Other Mix Variation _____

Note: If more than 6 supplemental sections are built, the section numbers will change from "2 to 6" to "7 to 11," continuing the process to cover each supplemental section.

SHEET D. TEST SECTION LAYOUT

This sheet includes detail on the layout of the LTPP experimental test sections.

State/Province

Enter the State or province in which the project is located.

SHRP ID

This four-digit SHRP identifier will be assigned by FHWA if the project is selected for inclusion in the SPS-10 experiment and will be used as a project reference number.

Test Section Layout

Total Number of Test Sections

Enter the total number of test sections planned for the project, including the three core sections and any supplemental sections.

Number of Test Sections on Cut and Fill

The as-built plan and profile sheets for the candidate project should be reviewed to determine the nature of the suitable locations for the test sections. It is preferred that all test sections be located entirely in either a fill or a cut. Potential test sections should be 243.8 m (800 ft) long to enable sampling of the subgrade and the pavement materials without disturbing the 152.4-m (500-ft) long monitored sections. If all test sections can be located completely in a cut or fill, place a checkmark on the appropriate line. If it is not possible to locate all test sections entirely in fills or cuts and it is necessary to locate some test sections in cuts and some in fills within the project, indicate the number of potential locations in cuts and the number of potential locations in fills.

Maximum Transition Between Test Sections

Indicate the maximum transition (in feet) possible between consecutive test sections to locate all the test sections within the project limits.

Vertical Grade

Enter the average vertical grade slope, in percent, for the portion of the project on which the test sections are located. Downgrades (in the direction of travel) should be indicated as a negative value. If the test sections are located on varying slopes, provide information under “Comments on Deviations from Desired Site Location Criteria” on the range of differences in the vertical slopes between the test section sites.

Horizontal Curvature

Check the box if the test sections are located on a tangent section or indicate the horizontal degree of curvature at the test site. Provide a brief description under “Comments on Deviation from Desired Site Location Criteria” if some sections are located on tangents and others on

horizontal curves. Provide information on any differences in the cross slopes of test sections due to superelevations on horizontal curves.

Comments on Deviations from Desired Site Location Criteria

Provide brief comments describing significant deviations from the desired site location criteria presented in this document. Include in these comments items such as the following:

- Unusual traffic patterns.
- Intersections between test sections.
- Substructures beneath test sections.
- Test section locations at cut–fill transitions.

Sheet D. SPS-10 Candidate Project Nomination and Information

STATE/PROVINCE: _____
SHRP ID: _____ (to be assigned by FHWA if project is selected)

Test Section Layout

Total Number of Test Sections _____
Number of Test Sections Entirely on: Cut _____ Fill _____
Maximum Transition Between Consecutive Test Sections, feet _____
Average Vertical Grade, % (+ upgrade, - downgrade) _____
Horizontal Curvature, degrees: _____ ☐ Tangent

Comments on Deviations from Desired Site Location Criteria _____

CHAPTER 3. TRAFFIC DATA COLLECTION GUIDELINES

This chapter contains traffic data collection guidelines for the SPS-10 experiment. Quality traffic data are critical in assessing the vehicle loading on pavements. To quantify traffic loading, LTPP uses vehicle volume by classification data to determine the number of heavy and light vehicles using a roadway, as well as the variability in volume during different periods (time of day, day of week, and time of year). Individual vehicle weight data are summarized to determine the distribution of axle weights by class of vehicle. When combined, these datasets provide the necessary information to measure or estimate vehicle loads directly at test sites.

EQUIPMENT LOCATION

Traffic data must be collected at or near the WMA test site in the same direction of travel and in the LTPP lane. If the equipment is not located at the site, it should be in close proximity to the WMA test site, either upstream or downstream. The intent is to measure the same vehicles that cross over the test site, so the traffic data collection equipment must be placed away from interchanges and off-ramps or on-ramps between the equipment location and the SPS-10 project.

EQUIPMENT TYPE

The individual State or provincial highway agency will determine the type of sensor to use to collect the traffic data at each test site. The Transportation Research Board LTPP Expert Task Group on Traffic Data Collection and Analysis strongly recommends using permanently mounted sensors whenever possible, even when only short-duration counts are being taken. The LTPP SPS Traffic Data Collection Pooled-Fund Study has demonstrated that correctly installed and maintained permanent equipment yields more reliable results, particularly for WIM data (Walker 2012). Permanent equipment also reduces the cost of repeated equipment setup, allows for longer data collection efforts, requires less staff time per data collection session, and reduces the exposure of data collection personnel to hazardous situations (e.g., the need to provide traffic control during portable sensor placement or the placement of data collection sensors in the roadway without traffic control).

EQUIPMENT CALIBRATION

The State or provincial highway agency should have a well-documented calibration plan that is consistently followed to ensure that the collected data represent the traffic traveling over the test site. As long as a documented calibration plan is followed, portable and permanent equipment data will be accepted.

In addition to calibrating the equipment, the highway agency should monitor the equipment output to determine if or when an additional calibration is needed. If the equipment fails or experiences calibration drift, the agency should plan to repair the equipment within 1 mo. Data should not be submitted for times during which the equipment is not properly calibrated.

Forms and procedures for completing the required LTPP Traffic Sheet 16, Data Collection Equipment Calibration, are detailed in the *LTPP Traffic Data Collection and Processing Guide*, Version 1.3 (Ostrom 2012).

TRAFFIC DATA TYPES AND COLLECTION FREQUENCY

The monitored traffic data submitted to LTPP must consist of the following: volume counts, volume counts by vehicle class, truck weights, and ancillary information that supports the data.

Continuous data collection for classification and weight data from permanent WIM equipment is preferred at the WMA test site for two very important reasons. First, it will provide accurate traffic loading measurements that are required to develop mechanistic and mechanistic/empirical design models. Second, it will provide the base data necessary to better understand the intricacies of the interactions among pavement, traffic load, and environment. However, if the State or provincial highway agency is unable to collect continuous classification and weight data, potential project locations nominated to the SPS-10 experiment will be considered based on the amount and type of traffic data available. At a minimum, 2 w of continuous classification data 4 times per year (a total of 8 w of classification data) should be collected. The highway agency is responsible for making sure collected data are representative and account for seasonal variation, weekday/weekend differences, and inconsistent truck loading patterns that may occur throughout the year.

TRAFFIC DATA SUBMITTAL

Traffic data collected at the WMA test site must be reported and submitted to LTPP in the format defined in the latest version of the FHWA *Traffic Monitoring Guide* (FHWA 2016). All monitored data and ancillary information may be submitted electronically to LTPP. It is preferred for the data to be submitted by the agency monthly; however, the data will be accepted if submitted quarterly.

The agency must identify each file using the file naming convention in place for current LTPP data. Examples are C530200.C1N or W530200.C1N. The following describes the characters used in this file naming convention:

- The first character represents whether the file contains weight (W) or classification (C) data.
- The second and third characters represent the State/province code (53).
- The fourth through seventh characters represent the site identification number (0200).
- The first character of the extension represents the month of count (C = January).
- The second character of the extension represents the day of count (1 = first day of the month).
- The third character of the extension represents the year of count (N = 2013).

This filename will allow LTPP to enter the data, store and retrieve the data, and provide a data tracking mechanism.

The highway agency should keep the submitted data for at least 10 yr, and in no circumstances should traffic data be discarded by an agency before LTPP confirms that the data were successfully loaded.

SHEET 10: TRAFFIC VOLUME AND LOAD ESTIMATE UPDATE—NO SITE COUNT

If a WMA test site does not have weight data, the agency must submit an LTPP Traffic Sheet 10. A Sheet 10 records the AADT and ESAL estimates for test sections during the monitoring period when no other site-specific or site-related traffic volume classification count and weight data were collected or classification data but no weight data were collected. For the WMA test site, submitting one Sheet 10 per year is sufficient. Forms and procedures for Sheet 10: Traffic Volume and Load Estimate Update – No Site Count are detailed in the *LTPP Traffic Data Collection and Processing Guide*, Version 1.3 (Ostrom 2012).

REFERENCES

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Ostrom, B. 2012. *LTPP Traffic Data Collection and Processing Guide, Version 1.3.* Report No. FHWA-HRT-09-051. Washington, DC: Federal Highway Administration.

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Walker, D. 2012. *LTPP Directive TDP-36, Issuance of LTPP Field Operations Guide for SPS WIM Sites, Version 1.0*. Washington, DC: Federal Highway Administration.

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