RESEARCH & IMPLEMENTATION SERVICES UPDATE – March 2016

Implementation of Research for Transportation Excellence

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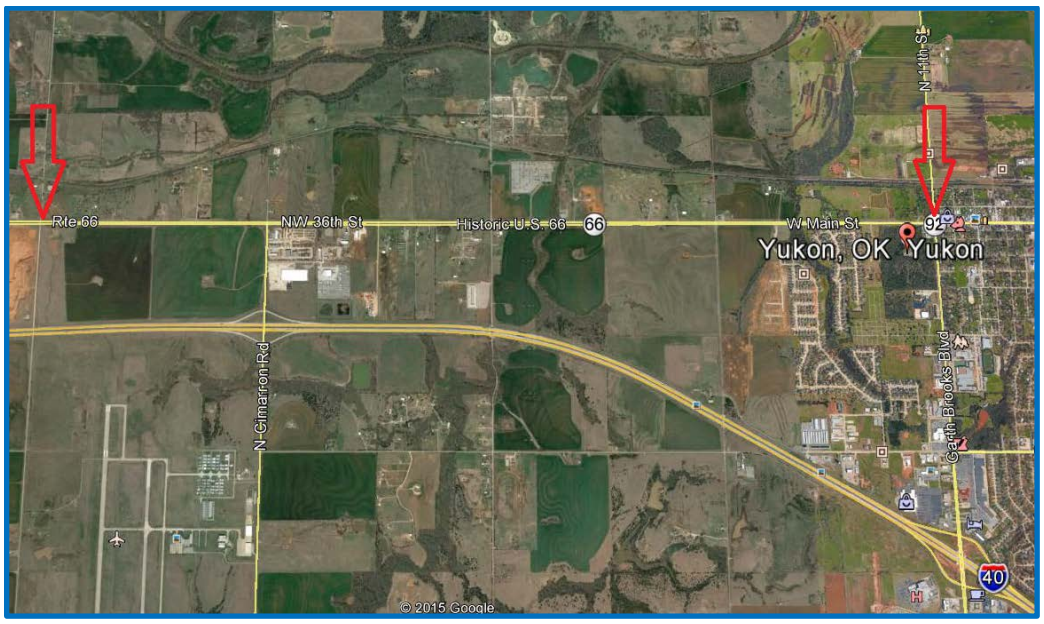

Figure 1. SPS-10 Site Location on State Highway 66 in Yukon, Oklahoma

Long Term Pavement Performance (LTPP) Program
Specific Pavement Study 10 (SPS-10)
Warm Mix Asphalt (WMA) Experiment (SP&R 2115)

The Long Term Pavement Performance (LTPP) Program of the Federal Highway Administration (FHWA) recently initiated a new program, Specific Pavement Study 10 (SPS-10) WMA Experiment.

With 2,509 LTPP test sections throughout North America, the FHWA designed the SPS-10 WMA experiment to evaluate warm mix asphalt (WMA) mixtures relative to conventional hot mix asphalt. The SPS-10 WMA experiment provides a broad range of factors for evaluating short term and long term pavement performance.

At the Oklahoma Department of Transportation (ODOT), Transportation Manager Bryan Cooper (from the Materials and Research Division) worked with Division Four Leadership to nominate and champion the SPS-10 WMA experiment.

Cooper explains that the LTPP program has been collecting data on Oklahoma's asphalt and concrete test sections for over 25 years.

Any researcher, pavement designer, or engineer in our industry can access this information at www.infopave.com

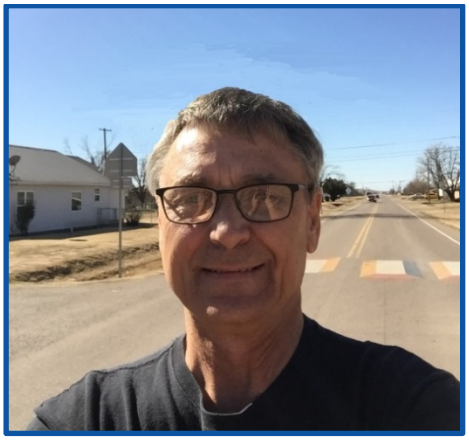

Figure 2. Transportation Manager Bryan Cooper

Selecting the Project Location

A section of SH-66 in Canadian County scheduled for an asphalt overlay met the requirements for the experiment. The Yukon Residency construction office for ODOT is conveniently located near the center of the project.

Figure 3. ODOT chose 4.08 miles of Historic Route 66 for the LTPP SPS-10 WMA Experiment.

Located on the edge of town, the site is mostly undeveloped, with an average daily traffic count of 5300. The existing pavement is full depth asphalt.

High Speed Devices for Collecting Data

Researchers use high speed devices to collect extensive data. Before construction of the SPS-10 sites, the Oklahoma State University (OSU) research team pursued these goals:

- Understand the short-term and long term performance of the six warm mix asphalt technologies used in Oklahoma
- Provide technical guidance for the implementation of warm mix asphalt for ODOT

The OSU research team used these devices to collect four types of data:

HIGH SPEED DEVICES	**Pavement Cracking**	**Pavement Rutting**	**Pavement Macrotexture**	**Pavement Friction**
PaveVision3D	Y	Y		
AMES High Speed Profiler			Y- High Speed	
Grip Tester				Y

Figure 4. High Speed Devices used to collect four types of data

Since the existing pavement had numerous cracks, researchers wanted to compare existing cracks with future cracks to determine:

- Will cracks at the lower level cause future surface cracking?
- Will long term fatigue cause future surface cracking?

Prior to construction, scanning the SPS-10 project road surface for cracks and rutting was necessary.

Dr. Kelvin Wang with Oklahoma State University (OSU) has developed the PaveVision 3D Ultra Laser Imaging Vehicle with some of the best pavement imaging equipment available.

Although this equipment has excellent resolution and crack detection capabilities, OSU continues to improve this equipment.

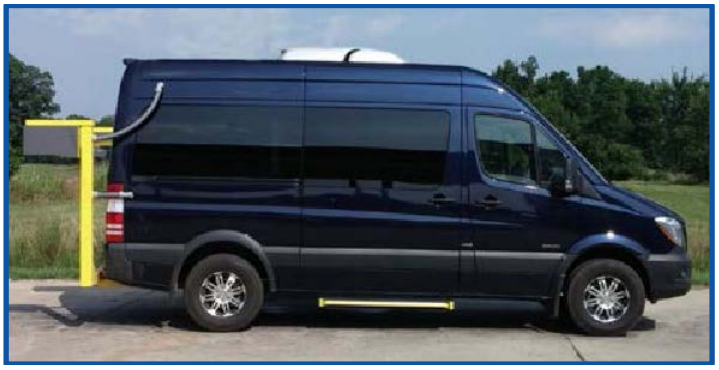

Figure 5. PaveVision 3D Ultra Laser Imaging Vehicle

Static Devices for Collecting Data

Researchers use static devices to measure macro-texture, micro-texture, and skid resistance as well as pavement deflection in response to a static load.

Pavement friction helps to ensure skid resistance, that is, the ability of the pavement surface to prevent the loss of tire traction. Surface macrotexture is a predominant contributor to wet pavement safety. The OSU research team used these static devices to collect two types of data.

For each macrotexture testing, the OSU research team calculated:

- Mean texture depth
- Mean profile depth
- Estimated texture depth

STATIC DEVICES	Pavement Macrotexture	Pavement Friction
LS-40 Surface Scanner	Y - Static	
Sand Patch Method	Y - Static	
Dynamic Friction Tester		Y

Figure 6. Static devices used to collect two types of data

Researchers use mean texture depth and mean profile depth to characterize pavement macrotexture. Comparing the LS-40 Surface Scanner and the Sand Patch method, there is no significant difference between these two mean profile depth data sets.

Collecting Samples and Testing

Prior to construction, Fugro, the FHWA contractor for Region 6, collected samples of the existing asphalt, subgrade, and base material.

Fugro assists government transportation departments with the application of new technologies and methods for collecting roadway data. Their assistance includes monitoring conditions and identifying deficiencies.

	Description	As FHWA contractor for Region 6, Fugro collected all samples
Layer 4	Experimental Asphalt Concrete	6" Cores for Core Examination and Thickness (after construction)
Layer 4	Experimental Asphalt Concrete	15 five-gallon buckets of un-compacted AC mix (during construction)
Layer 3	Original Hot Mix Asphalt Concrete	Bulk sample from the test pit 6" Cores for Core Examination and Thickness
Layer 2	Unbound Base	150 pound Bulk Sample
Layer 1	Subgrade	150 pound Bulk Sample and Moisture Content Jar

Figure 7. Samples collected from Layers 1, 2, 3, & 4

Constructing Overlays

Under the SPS-10 initiative, the contractor milled 1.5 to 2.0 inches.

On 6 November 2015, the contractor used a shuttle buggy, or material transfer device to construct overlays for all six of the SPS-10 experimental sections in one day.

The six experimental sections were restricted to the westbound outside lane.

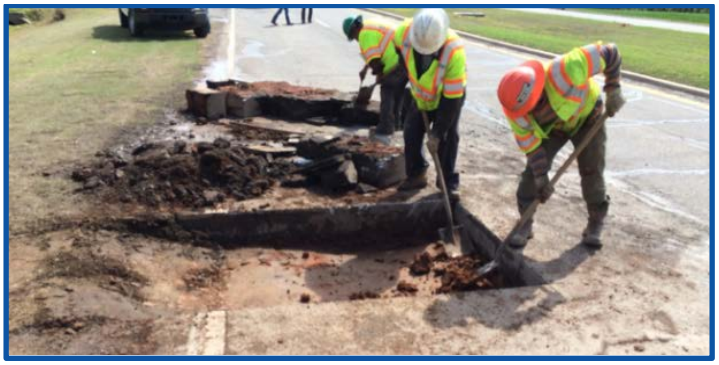

Figure 8. Test Pit to obtain Bulk sample from Layer 3

Required Sections

1) Hot Mix Asphalt (PG70-28) 12%RAP, 3%RAS.
2) WMA S4, Evotherm additive.
3) WMA S4, Foamed, Astec double barrel green.

Supplemental Sections

(with mixes chosen by Division 4)

1) WMA S4 (PG64-22)
   with Evotherm / Evoflex used a rejuvenator* for a Performance Grade (PG) change.
2) WMA S4 (PG58-28)
   with Evotherm, using a 58 binder.*
3) Stone Matrix Asphalt (SMA) ½" (PG70-28)
   Evotherm, without fibers typically used to combat draindown issues.

*First time ODOT has used a rejuvenator and a 58 binder.

Figure 9. A material transfer device used to construct six overlays in one day

Before construction, the OSU research team used the Dynamic Cone Penetrometer for field testing all four layers of Supplementary Test Section 400A62.

The OSU research team:

- Performed an Elevation Survey for Layers 3 and 4
- Measured in situ density for Layer 4

At ODOT, the Materials and Research Division is investigating the Semi-Circular Beam Test as a reliable screening tool for:

- Predicting long term performance prior to approving asphalt mixes
- Selecting fatigue resistant mixes, improving long term durability

Eventually, these improvements will be added to the LTPP Database. The LTPP Database includes structure, service conditions, and performance of the test sections under study.

Future Research

In the future, researchers will evaluate the short term and long term performance of Warm Mix Asphalt at the SPS-10 site in Yukon.

At the University of Oklahoma, supplemental research includes comparing lab-mixed asphalt to plant-mixed asphalt in terms of measuring impact of fatigue properties.

In the future, the OSU research team intends to:

- Compare the two mean profile depth data sets with future data collection
- Evaluate the long term performance of the SPS-10 mixes by collecting data bi-annually for a period of five years

Figure 10. Sign indicating Strategic Highway Research Program (SHRP) Section 6 of the LTPP WMA Experiment

In January 2016, the Transportation Research Board met in Washington D.C.

During his presentation of the SPS-10 WMA Experiment for the LTPP Project, Materials and Research Division Engineer Scott Seiter, P.E., expressed his appreciation to:

- Jack Springer with the FHWA
- Jerry Delieden with Fugro
- T.J. Campbell Company, Contractor
- El Reno Residency
- Division Four
- Bryan Cooper with ODOT (received the Safe, Economical, Effective (SEE) Award in 2015)

Scott Seiter stated: Everyone collaborated well in working through all of the details involved with the nomination process, and in the planning and construction phases of the project.

Researchers for Oklahoma's SPS-10 WMA experiment will continue to study warm mix asphalt mixtures relative to conventional hot mix asphalt using a broad range of factors for evaluating short term and long term pavement performance.