

## **FY2007 ODOT RESEARCH PROBLEM STATEMENTS**

### **MATERIALS**

- Problem Title : Development and Comparison of Alternative Approaches in the Determination of the Chemical Manipulation of Soils and Pavement Design Inputs
- Problem Title : Database of Pedological Survey Information
- Problem Title : Longitudinal Joint Density and Permeability in Asphalt Concrete
- Problem Title : Determination of Reasonable and Prudent Modulus of Rupture Values for Typical ODOT Concrete Mix Designs
- Problem Title : Investigating the effects on concrete quality by optimizing concrete mix designs to produce the most cost efficient paving mixes
- Problem Title : Field Verification of Desired Structural Values of Stabilized Sub-grade Designs
- Problem Title : Oils in Asphalt Mixes
- Problem Title : Investigate the use of alternate materials (instead of HMAC) for non-erodible base courses underneath concrete pavements

### **DESIGN & CONSTRUCTION**

- Problem Title : Investigate the Performance of UTW Projects on US-69 Near McAlester to Provide Longer Term Rehabilitation Options for Lower Volume Roadways
- Problem Title : Calibrate and Validate the Inputs Needed to Implement the Mechanistic-Empirical Pavement Design Guide

### **MAINTENANCE**

- Problem Title : Investigate causes of premature longitudinal cracking on some new DJCP

### **PLANNING**

- Problem Title : Statewide Level-of-Service Map and Model
- Problem Title : GIS Layer for Transportation and Economic Statistics
- Problem Title : Rail Needs Assessment
- Problem Title : Future effects of Rail Freight capacity on Oklahoma's highway system
- Problem Title : Truck Weight Enforcement

### **BRIDGE**

- Problem Title : None at this time

### **ENVIRONMENT**

- Problem Title : None at this time

### **TRAFFIC & SAFETY**

- Problem Title : Modeling of 85th Percentile Speed for Rural Highways for Enhanced Traffic Safety
- Problem Title : A Study of Real Time Advance Warning of Highway Speed Conditions via Multi-Color Dynamic Roadside Map Display



## Planning & Research Problem Statement

## Materials

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**Problem Title :** Development and Comparison of Alternative Approaches in the Determination of the Chemical Manipulation of Soils and Pavement Design Inputs

**Problem Statement:**

Determining during the design phase what soils will be encountered on a project has long been a problem especially for determining pavement design inputs and specifying chemical manipulation. The current process has produced an unacceptable amount of additional burden on ODOT, contractors and suppliers in the form of change orders. ODOT Materials Div Soils Lab has developed a table for use as a guideline for using chemical additives according to the soil type encountered on the project. This is OHD L-50. Consider expanding study using this table to improve its accuracy.

**Contact:**

Oklahoma Department of Transportation  
Planning & Research Division  
200 N. E. 21<sup>st</sup> Street, Room 3-A7  
Oklahoma City, Oklahoma 73105-3204  
Phone (405) 521-2671, (405) 521-6917 fax  
E-Mail [spr@odot.org](mailto:spr@odot.org)



## Planning & Research Problem Statement

Materials

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**Problem Title :** Database of Pedological Survey Information

**Problem Statement:**

Develop a database of pedological information from past pedological surveys performed by ODOT on a county by county basis.

**Contact:**

Oklahoma Department of Transportation  
Planning & Research Division  
200 N. E. 21<sup>st</sup> Street, Room 3-A7  
Oklahoma City, Oklahoma 73105-3204  
Phone (405) 521-2671, (405) 521-6917 fax  
E-Mail [spr@odot.org](mailto:spr@odot.org)



## Planning & Research Problem Statement

## Materials

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**Problem Title :** Longitudinal Joint Density and Permeability in Asphalt Concrete

**Problem Statement:**

Low density at longitudinal joints causes asphalt pavements to deteriorate more quickly. The low density allows water to enter the pavement section, increasing its susceptibility to stripping. ODOT does not currently have a test method or specification directly targeting a solution to this problem.

The research should detail ways other agencies are dealing with this problem. It should provide test data documenting a representative sampling of densities at and around the longitudinal joint on a representative sampling of asphalt roadways. It should correlate, if possible, field permeability testing with longitudinal joint density. It should recommend a definitive method to perform field permeability tests.

The research should involve a literature search documenting the ways other agencies are dealing with this problem. It should also involve field work and laboratory testing to provide information around which a test method and/or specification could be written. The field testing should determine the density on top of and around longitudinal joints. Field permeability tests should be performed in the same areas and correlated.

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Planning & Research Division  
200 N. E. 21<sup>st</sup> Street, Room 3-A7  
Oklahoma City, Oklahoma 73105-3204  
Phone (405) 521-2671, (405) 521-6917 fax  
E-Mail [spr@odot.org](mailto:spr@odot.org)



## Planning & Research Problem Statement

Materials

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**Problem Title :** Determination of Reasonable and Prudent Modulus of Rupture Values for Typical ODOT Concrete Mix Designs

**Problem Statement:**

Determine what modulus of rupture value can be used comfortably in concrete mix designs for concrete pavements on ODOT projects. This information is needed for the Mechanistic Empirical Pavement Design Input.

Other references:

<http://onlinepubs.trb.org/onlinepubs/millennium/00105.pdf>

[http://www.pavement.com/Concrete\\_Pavement/Technical/FATQ/Construction/Strength\\_Tests.asp](http://www.pavement.com/Concrete_Pavement/Technical/FATQ/Construction/Strength_Tests.asp)

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Planning & Research Division  
200 N. E. 21<sup>st</sup> Street, Room 3-A7  
Oklahoma City, Oklahoma 73105-3204  
Phone (405) 521-2671, (405) 521-6917 fax  
E-Mail [spr@odot.org](mailto:spr@odot.org)



## Planning & Research Problem Statement

## Materials

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**Problem Title :** Investigating the effects on concrete quality by optimizing concrete mix designs to produce the most cost efficient paving mixes

**Problem Statement:**

Investigate the effects on concrete quality by optimizing concrete mix designs to produce the most cost efficient paving mixes.

Concrete pavement mixes often exceed minimum strength requirements substantially, likely due to low w/cm ratios required for slip-form operations.

This project should include independent flexural strength testing of project produced paving mixes to determine/validate 28-day design strength.

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Planning & Research Division  
200 N. E. 21<sup>st</sup> Street, Room 3-A7  
Oklahoma City, Oklahoma 73105-3204  
Phone (405) 521-2671, (405) 521-6917 fax  
E-Mail [spr@odot.org](mailto:spr@odot.org)



## Planning & Research Problem Statement

Materials

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**Problem Title :** Field Verification of Desired Structural Values of Stabilized Sub-grade Designs

**Problem Statement:**

Verify in the field that the designed structural values are achieved after stabilization of subgrades.

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Oklahoma City, Oklahoma 73105-3204  
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**Planning & Research  
Problem Statement**

**Materials**

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**Problem Title :** Oils in Asphalt Mixes

**Problem Statement:**

Investigate the effect of ODOT approved oils being substituted for another in the asphalt mix.

Look to see if stripping or other detrimental effects occur by changing from one brand to another.

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Phone (405) 521-2671, (405) 521-6917 fax  
E-Mail [spr@odot.org](mailto:spr@odot.org)



## Planning & Research Problem Statement

## Materials

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**Problem Title :** Investigate the use of alternate materials (instead of HMAC) for non-erodible base courses underneath concrete pavements

**Problem Statement:**

HMAC is specified by default as a non-erodible base for concrete pavements and may prove to be an unnecessary expense if other materials will suffice. The policy requiring HMAC likely came about due to the faulting of undoweled plain jointed concrete pavement designs placed on top of fine-grained materials susceptible to pumping or fine aggregate bituminous bases that may have experienced AC stripping do to movement at the joints. Now that ODOT includes dowels in all jointed designs, evaluate whether HMAC is still the best base.

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Oklahoma City, Oklahoma 73105-3204  
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## Planning & Research Problem Statement

## Design & Construction

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**Problem Title :** Investigate the Performance of Ultra Thin Whitetopping (UTW) Projects on US-69 Near McAlester to Provide Longer Term Rehabilitation Options for Lower Volume Roadways

**Problem Statement:**

Investigate the performance of UTW projects on US-69 near McAlester to provide longer term rehabilitation options for lower volume roadways.

Perform research on one or all of the Ultra-Thin Whitetopping (UTW) Projects on US-69 near McAlester. Possible deliverables would include: number of ESAL's supplied to date, distress survey, projection of ESAL's until failure or some other milestone (such as major repair), cost efficiency versus conventional whitetopping and maintenance requirement to date versus previous rehabilitation projects.

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Planning & Research Division  
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## Planning & Research Problem Statement

## Design & Construction

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**Problem Title :** Calibrate and Validate the Inputs Needed to Implement the Mechanistic-Empirical Pavement Design Guide

**Problem Statement:**

Calibrate and validate the inputs needed to implement the Mechanistic-Empirical Pavement Design Guide (MEPDG). A sensitivity analysis should be performed to identify the order of importance of these inputs and limit this phase of research to those inputs most crucial to obtaining a proper design.

The MEPDG is a new product resulting from the efforts initiated by the AASHTO Joint Task Force on Pavements and the National Cooperative Highway Research Program (NCHRP) to enhance and improve existing pavement design procedures. This Design guide will eventually replace the AASHTO 1993 Guide that is currently being used by most states (including ODOT).

The MEPDG performance models were calibrated and validated primarily using data from the Long Term Pavement Performance (LTPP) program. Each agency has to also undertake a local calibration effort to verify the accuracy of the national calibration coefficients for the specific local conditions, and recalibrate the models if necessary. This is not a simple task and will require a great deal of effort to evaluate the inputs needed to accurately reflect the uniqueness of pavement needs for the Oklahoma system.

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## Planning & Research Problem Statement

Maintenance

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**Problem Title :** Investigate causes of premature longitudinal cracking on some new DJCP

**Problem Statement:**

Investigate causes of premature longitudinal cracking on some new DJCP. Determine the loss of utility caused by cracking. Two locations where a longitudinal crack appeared shortly after construction are:

SH-99 North of Seminole

US-77 North of Norman.

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## Planning & Research Problem Statement

Planning

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**Problem Title :** Statewide Level-of-Service Map and Model

**Problem Statement:**

Develop a statewide level-of-service (LOS) map, database and associated model to provide LOS on each highway of the State Highway System. LOS should follow the LOS definitions in the Highway Capacity Manual.

Develop a map for GIS uses and model for continual updating. GIS uses must be compatible with ODOT GIS system.

Develop the scale criteria for the map, but the scale should include ODOT control sections.

This information will be used with the development of the next long range plan for 2010 (SITP). The 2005 SITP index of chapter links can be found at:

<http://www.okladot.state.ok.us/hqdiv/p-r-div/25yearplan/index.htm> .

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## Planning & Research Problem Statement

Planning

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**Problem Title :** GIS Layer for Transportation and Economic Statistics

**Problem Statement:**

Develop a GIS system layer for transportation statistics to interface with socio-economic statistics such as population, educational level, income levels, employment levels within specified distances of transportation facilities (highways, transit systems, rail facilities, airports) for development of economic development proposals. Other economic development statistics and characteristics may need to be defined.

Close cooperation with Oklahoma's economic development agencies and personnel will be required.

GIS uses must be compatible with the ODOT GIS system.

This information will be used with the development of the next long range plan for 2010 (SITP). The 2005 SITP index of chapter links can be found at:

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## Planning & Research Problem Statement

Planning

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**Problem Title :** Rail Needs Assessment

**Problem Statement:**

Inventory and assess the needs of the Oklahoma rail system. Primary attention should be paid to the State-owned rail system. Identify rail strengths and weakness. Assess State system for new higher-load rail hoppers and interconnectivity with private rail lines and facilities. Expand existing GIS capable inventory of rail facilities. GIS uses must be compatible with ODOT GIS System.

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Oklahoma City, Oklahoma 73105-3204  
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E-Mail [spr@odot.org](mailto:spr@odot.org)



## Planning & Research Problem Statement

Planning

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**Problem Title :** Future effects of Rail Freight capacity on Oklahoma's highway system

**Problem Statement:**

During the Statewide Intermodal Transportation Plan (SITP) development, Rail and Freight capacity are of a concern in the Nation's Rail System and to their potential impact on Oklahoma's rail and highway systems. Investigate these concerns and potential effects, and provide solutions to problems identified.

The 2005 SITP index of chapter links can be found at:

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**Planning & Research  
Problem Statement**

**Planning**

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**Problem Title :** Truck Weight Enforcement

**Problem Statement:**

Develop a deployment plan for an economical but most effective mix of fixed weigh stations, mobile enforcement, WIM's, virtual enforcement, and possible other technologies to provide optimum monitoring of Oversize/Overweight vehicles to reduce damage to Oklahoma's roads and bridges.

Reference also 'Weigh Station Study' and 'HB 1967 Cost - Presentation pts2'

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Planning & Research Division  
200 N. E. 21<sup>st</sup> Street, Room 3-A7  
Oklahoma City, Oklahoma 73105-3204  
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E-Mail [spr@odot.org](mailto:spr@odot.org)



## Planning & Research Problem Statement

Bridge

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**Problem Title :** None at this time

**Problem Statement:**

**Contact:**

Oklahoma Department of Transportation  
Planning & Research Division  
200 N. E. 21<sup>st</sup> Street, Room 3-A7  
Oklahoma City, Oklahoma 73105-3204  
Phone (405) 521-2671, (405) 521-6917 fax  
E-Mail [plan-res@odot.org](mailto:plan-res@odot.org)



**Planning & Research  
Problem Statement**

**Environment**

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**Problem Title :** None at this time

**Problem Statement:**

**Contact:**

Oklahoma Department of Transportation  
Planning & Research Division  
200 N. E. 21<sup>st</sup> Street, Room 3-A7  
Oklahoma City, Oklahoma 73105-3204  
Phone (405) 521-2671, (405) 521-6917 fax  
E-Mail [plan-res@odot.org](mailto:plan-res@odot.org)



## Planning & Research Problem Statement

## Traffic & Safety

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**Problem Title :** Modeling of 85th Percentile Speed for Rural Highways for Enhanced Traffic Safety

**Problem Statement:**

Traffic operations on two-lane rural highways and setting realistic speed limits are some of the difficult tasks faced by the Oklahoma Department of Transportation (ODOT). For such highways, overtaking slower vehicles is possible only by the use of the opposing lane where site distance and gap in the opposing traffic stream play a key role. While, in most states, including Oklahoma, the 85th percentile speed is used as a major factor in determining posted speeds for rural highways, other factors such as pavement width, type and width of shoulder, topography, weather, roadside development, and accident experience also play an important role in determining posted speeds. In recent years neural network models have been used successfully for many engineering problems, including modeling 85th percentile speeds in rural highways in Kansas. Similar models are needed for Oklahoma for enhanced traffic safety on rural highways in the state. A neural network model based on appropriate pavement, traffic and environmental data can be an effective tool for ODOT to enhance traffic safety in the state. Research is needed to develop such a model.

This project will help revise a model that was developed by OU for ODOT in 1996. This model will produce an effective tool for ODOT to enhance traffic safety within the State of Oklahoma.

**Contact:**

Oklahoma Department of Transportation  
Planning & Research Division  
200 N. E. 21<sup>st</sup> Street, Room 3-A7  
Oklahoma City, Oklahoma 73105-3204  
Phone (405) 521-2671, (405) 521-6917 fax  
E-Mail [spr@odot.org](mailto:spr@odot.org)



**Planning & Research  
Problem Statement**

**Traffic &  
Safety**

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**Problem Title :** Advanced Voice and Multimedia Communications System for the ODOT ITS Network

**Problem Statement:**

Investigate the potential improvements to the ODOT ITS Network by using an Advanced Voice and Multimedia Communications System. This would be used to enhance the ability to coordinate responses to traffic incidents between ODOT and emergency responders.

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Planning & Research Division  
200 N. E. 21<sup>st</sup> Street, Room 3-A7  
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Phone (405) 521-2671, (405) 521-6917 fax  
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