

**Utah Department of Transportation**

# **PAVEMENT PRESERVATION MANUAL – Part 1**

## **Pavement Preservation and Rehabilitation Program**



**Office of Asset Management**

**2009**

# Forward

This manual is a part of a series of documents being prepared to compile information being used in our Pavement Management program. These documents will replace our 1998 Pavement Management and Pavement Design manual. Separate design manuals are being prepared to replace that section and provide guidance on the mechanistic design method.

The focus for this manual will be information about our pavement management program. The other manuals will describe the condition data collected and types of distress seen in our pavements, the treatment strategies being used to most efficiently remedy these, and our dTIMS modeling process with the criteria being used to make these decisions.

Pavement Preservation Manuals:

Part 1 – Pavement Preservation and Rehabilitation Program

Part 2 – Pavement Condition Data

Part 3 – Preservation Treatments

Part 4 – Pavement Condition Modeling with dTIMS

Many factors influence the decisions being made on when and how to best maintain our pavements. The recent trend of increased costs and reduced funding has affected both the condition of our pavements and the strategic direction being used to manage these pavements.

Our pavements are aging, and are being subjected to continuously increasing levels of traffic. Our challenge as the stewards of our State's pavements is to select the right treatment at the right time, within our available funding limits, to maximize our pavement life. It has been well established that taking care of our pavements with well timed preservation treatments, i.e. "Good Roads Cost Less" (GRCL) strategy, is more efficient than being in a reactive repair mode of maintenance or reconstruction.

Constantly rising construction costs and the reduction of available funding has forced us to adjust our pavement management strategy by prioritizing our state highway system. The Department formed a Pavement Management Quality Improvement Team (PMQIT) to address the challenge and formulate a new pavement management strategy. The PMQIT established a 3 level priority system with different treatment strategies for each. Our Interstate strategy will be to maintain the system at the current condition levels using strict GRCL guidelines. Our high volume, non-interstate, level 1 system, will be maintained using a GRCL philosophy, as funding allows. Our low volume, level 2 System, will be maintained with chip seal projects and reactive maintenance as funding permits. It is worth noting that our revised strategy still specifies GRCL best practices on roads carrying 95% of the VMT in the state of Utah.

See our UDOT Pavement Management web page for additional information about our Pavement Management program.

See our UDOT Pavement Design and Materials Manuals for mix design and other material specifications.

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## Introduction

The Utah Department of Transportation is responsible for maintaining over 15,000 lane miles of pavement. This would not be possible without an extensive inventory of information about these pavements. Many groups within the department play a role in collecting and analyzing this information.

In addition to monitoring the pavement condition, the focus of the department's pavement management efforts have been determining the funding requirements, forecasting the future condition, and recommending an appropriate mix of projects to ensure the future condition is maintained. With the significant increase in the cost for materials over the past few years this has been a major challenge. Historically the program has been sufficient to fund the recommendations, however, this is no longer the case, and we are now faced with managing our pavements with less funding and sharply reduced buying power of our dollar.

Keeping track of where the pavement is has been a continuous challenge. In 2003 +/- all of the milepost were relocated. Maintaining route and mileage information is a never-ending activity. Caution should always be used when comparing information about a section of road from multiple years. Depending on the date and source of information, data may be off by many miles. An example is State Route 191. This route used to end at mile 253.322. It now covers the exact same pavement, but ends at mile 404.168. Historical information between mile 253 & 404 doesn't exist, except for where it has been adjusted to the new mileage.

Several significant changes are being developed as this is being written and will need to be addressed in future updates. The first will provide for contractor collected pavement condition data, including laser scanned transverse profiles for cross slope & rutting, high-resolution pavement images with automated distress analysis, integrated roadway & roadside images, along with the IRI and faulting data. This should provide complete and consistent data year to year. This will require some changes in how the condition data is indexed for modeling. The 2008 condition data and images were collected thru our first contract with Mandli Communications, for all of the state routes in the positive direction. The 2009 data will be collected under a different contract with Fugro / Roadware.

The region level Plan for Every Section database is scheduled to be replaced with a statewide Agile Asset's pavement management database. This will provide an opportunity for having a better-integrated more complete dataset for our roadways, with better access to this information.

## Organization and Contact Information

Pavement Management at UDOT is done both at a System level and at the Project level.

The statewide system level analysis is performed within the pavement management team, at the UDOT Central Complex. This team is part of the Asset Management section within the Systems Planning and Programming Division.

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Mohammad Basha: Pavement Analysis Engineer (801) 965-4315  
[mbasha@utah.gov](mailto:mbasha@utah.gov)

Russell Scovil: Pavement Condition Data Collection Engineer (801) 965-4097  
[rgscovil@utah.gov](mailto:rgscovil@utah.gov)

Frank Bernardo: Pavement Condition Data Collection Technician (801) 967-8598  
[fbernardo@utah.gov](mailto:fbernardo@utah.gov)

Each UDOT Region also has a pavement management engineer (PME) within the Region's Material's section that performs the project level analysis and pavement designs.

Region 1 PME Ogden: Dave Holmgren (801) 620-1606  
[dholmgren@utah.gov](mailto:dholmgren@utah.gov)

Region 2 PME Salt Lake City: Lonnie Marchant (801) 975-4928  
[lmarchant@utah.gov](mailto:lmarchant@utah.gov)

Region 3 PME Orem: Justin Schellenberg (801) 227-8023  
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Region 4 Asset Engineer Richfield: Kirk Thornock (435) 896-1361  
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## **Roles and Responsibilities**

Pavement Management activities within UDOT are focused on maintaining the current pavement system condition, and identifying and prioritizing future needs. These and associated efforts are divided among several work areas. These include: TRANSMAT Committee; Regions Staff and the Region Materials and Pavement Management Engineers; Central Pavement Management, Planning Statistics, Materials, and Operations. The following is a summary of the activities of each of these areas.

### **TRANSMAT Committee**

The TRANSMAT Committee has oversight for Asset Management activities in the Department. This group of Senior Leaders and Region Directors meet quarterly, to discuss policy, procedure and processes related to Pavement & Bridge Management and Pavement & Bridge Performance Measures, Targets and Goals.

### **Region Level Pavement Management**

Each Region has a Region Pavement Management Engineer (PME), who reports directly to the Region Materials Engineer (RME). The Region PME, with RME concurrence, has a lead responsibility for all pavement management activities and pavement design activities in the Region. These duties include, but are not limited to:

#### **Program Development**

- Identify and prioritize Region projects.
- Provide input for system strategy selection.
- Analyze system strategy selection performance.
- Consult with Region Engineering Team to identify, nominate, and program preservation and preventive maintenance activities.
- Ensure that current construction history information is collected through project closeout.
- Research and document construction history.
- Participate as a member of Statewide Pavement Management Engineering Team (PMET).
- In conjunction with Region Operations personnel, manage and update the Plan for Every Section (PFES) database.

#### **Project Development**

- Verify existing pavement structure.
- Pavement Type selection.
- Preliminary and final pavement design and approval.
- Review and approval of pavement designs performed by consultants.
- Technical Support for Various Functions in the Region
- Participate as a member of the Region Engineering Team.
- Participate in Semi-annual inspections.

- Provide technical guidance and details for Preconstruction, Construction, Maintenance and Consultant activities.

The Region RME has secondary responsibility for pavement management activities and pavement design activities, including, but not limited to the following:

Project development

- Final pavement design concurrence.

Technical Support

- Participate as a member of the Region Engineering Team.
- Provide materials design and support to assure construction of pavement designs meeting or exceeding the structural requirements used in the pavement design process.

The Region Operations Engineer

- Hard surface program
- Semi annual inspections

## **Central Pavement Management**

The Central Pavement Management team resides under the Central Asset Management Division within Systems Planning and Programming, and is responsible for system level pavement management functions. These duties include, but are not limited to:

- Develop pavement management and preservation priorities statewide for the Asset Management group to determine funding requirements.
- Recommend appropriate allocation of resources to maintain a properly balanced preservation program.
- Develop and maintain system level pavement management model, dTIMS CT.
- Maintain information on treatment histories for use in pavement management models.
- Analyze pavement deterioration trends.
- Maintain and update Pavement Management Manual.
- Provide support and guidance to the Statewide Pavement Management Engineering Team (PMET).
- Participate in pavement related research activities.
- Support UDOT Long Term Pavement Performance (LTPP) project responsibilities.
- Support UDOT Asset Management.

The Pavement Condition Data Collection team resides in the Central Asset Management Division, and is responsible for system level pavement condition data collection. These duties include, but are not limited to:

- Collection, processing, management and reporting of system and project level pavement condition data.

- Maintain pavement condition database.
- Training of personnel involved in the collection of pavement condition data.
- Development of QC/QA processes on all collected data.

### **Planning Statistics**

The Planning Statistics Unit resides in Central Asset Management Division, and is responsible for the statewide route inventory and traffic data. These duties include, but are not limited to:

- Collection, analysis and reporting of traffic data, including truck weights and volumes.
- Collection, compilation, and reporting of route mileage and road inventory data.
- Development of QC/QA processes on all collected data.

### **Central Materials**

The Central Materials Division resides in Project Development, and is responsible for pavement design process review and support of pavement construction processes. These duties include, but are not limited to:

- Perform process review of Region pavement design activities, pavement type selection, focusing on consistency and accuracy of materials application.
- Implementation of new materials concepts for pavement construction and rehabilitation.
- Implementation of new materials design and construction concepts.
- Implementation of the AASHTO 2002 M/E Design Guide.
- Maintain and update Pavement Design Manual.
- Maintain and update Materials Manual of Instruction.
- Data Analysis and training for material property calculations with FWD data.
- Materials Specification and Special Provision development and management.
- Oversight and coordination of UDOT LTPP project responsibilities.

### **Central Maintenance**

The Central Maintenance Division resides in the Operations Group, and is responsible for the hard surface pavement program. These duties include, but are not limited to:

- Allocation of Orange Book Preservation funding between the Regions.
- Participation in the PMET.
- Allocation of Code 1 funding for Corrective Action.
- Maintaining the MMQA maintenance performance measures.

## **Strategic Direction**

A Pavement Management Quality Improvement Team (PMQIT) was formed in April 2008 to address the challenges facing our pavement management program. After several months of meetings, the PMQIT submitted a comprehensive list of recommendations to Senior Leadership. Senior Leaders debated the pros and cons of all recommendations and ultimately adopted the following changes to our pavement management strategy:

### **Maintenance Management Levels**

The system was prioritized into three levels during 2008 using 2007 AADT:

#### **Interstate system:**

Regardless of AADT  
Miles ~935, 16%  
Lane Miles ~ 27%  
VMT ~ 53%  
ESALS ~ 55%

#### **Level 1 system:**

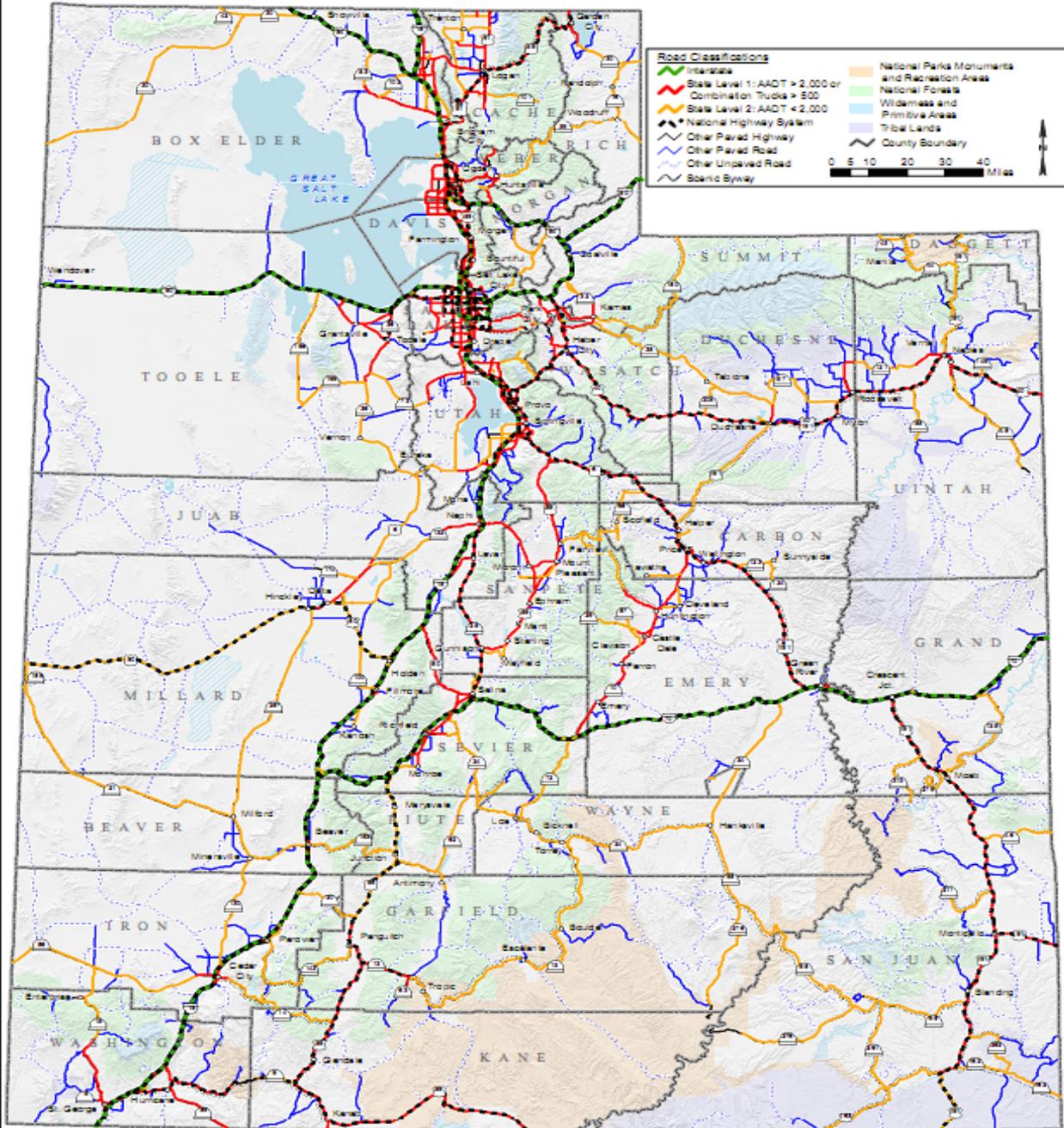
AADT > 2,000 or average daily Combination truck volumes > 500  
Miles ~ 2,150, 37%  
Lane Miles ~ 43%  
VMT ~ 43%  
ESALS ~ 39%

#### **Level 2 system:**

AADT < 2,000  
Miles ~ 2,750, 47%  
Lane Miles ~ 30%  
VMT ~ 4%  
ESALS ~ 6%

Previously the system was managed by functional class with system performance reported for the Interstate, Arterial and Collector systems. The following page has a statewide map showing the routes for each level. See our web page for links to Region level maps.

**State of Utah**  
 UTAH DEPARTMENT OF TRANSPORTATION  
**Pavement Management**  
 Strategic Direction



## **Pavement Management Strategy by Priority Level**

### **INTERSTATE AND LEVEL 1 SYSTEM:**

- The Goal for Interstate and Level 1 roads is twofold: First, is to utilize GRCL strategy on all HMA and PCCP roads that fall within an acceptable range on their respective deterioration curves; Second, Maintain the remaining Interstate and Level 1 roads in near current Ride condition for the next ten years.

Interstate and Level 1 roads which do not qualify for the GRCL strategy will be managed on a case by case basis and projects will be prioritized through a collaborative effort by Region STIP Planning Team and the Asset Management Team.

- Many of our Interstates and Level 1 roads have deteriorated to a point where they need a minor or major rehab and therefore cannot be managed by a “Good Roads Cost Less” strategy until they are reconstructed. Until funding for reconstruction is made available these roads will have to be managed on a “worst first” basis and kept in serviceable condition through “band aid” treatments.
- Funding priorities for Interstate and Level 1 roads

### **Preservation Treatments (Orange Book):**

Interstate and Level 1 roads which fall within GRCL guidelines and are on track with suggested GRCL preservation treatments will take first priority for Preservation funding. Once GRCL roads are addressed, any left over Preservation funding can be used for “Band Aid” treatments.

### **Rehabilitation / Reconstruction Treatments (Purple/Blue Book):**

All non-capacity minor/major rehabilitation or re-construction projects should be reviewed and possibly re-programmed. Rehabilitation / Reconstruction projects should be funded as a program on a year to year basis and projects should be selected, based on needs, by a collaborative effort of each Region and the Asset Management Division. Interstate and Level 1 roads, which fall within GRCL guidelines and are on track with suggested GRCL minor rehabilitation treatments, will take first priority for Rehabilitation / Reconstruction Program funding. Any remaining Rehabilitation / reconstruction funding is eligible for use on non-GRLC roads for minor rehab or “band aid” treatments.

- Utilize “Code 1” hard surface funding for pot hole patching, crack sealing and lane leveling as needed.
- Design and build PCC pavements where warranted.
- Design Perpetual Asphalt Pavements on new capacity and pavement reconstruction projects. The definition of Perpetual Pavement is a pavement designed for a 50 year structural life, which will require a program of surface seals at set intervals throughout that 50 year life of the pavement. A perpetual pavement should not require any major rehabilitation or reconstruction work for the life of the pavement.
- Use Cold-in-Place recycling and Full Depth Reclamation where the situation allows.

- Adopt a Department Stretch Goal to recycle or use on site, 100% PCC and HMA pavements, base, granular barrow, concrete curb and gutter, structural concrete, etc...

**LEVEL 2 SYSTEM:**

- Work on Level 2 roads will be limited to pot-hole patching, crack sealing, lane leveling and chip seals. Chip seals will be the only acceptable surface seals for Level 2 roads. In most cases (see the last bullet item in this section), “Code 1” Operations money will be the only funding source for Level 2 Roads. This may require an increase in the Code 1 budget and at the very least, a reallocation between Regions
- Continue with a “Reactive”, for lack of a better term, maintenance strategy and strive to seal every Level 2 surface area, on the average, every 10 years. Some roads may need to be sealed every 7 years while others can wait 12 or 15 years between seals. Leave it up to the discretion of the PME’s when a surface seal is warranted
- Utilize State Forces for chip sealing as much as possible.
- Use the “Safety Index” and SKID, along with “time since last treatment” and pavement condition to prioritize chip seal projects
- Level 2 roads with an average IRI > 170 may be eligible for a major rehabilitation project. Potential projects will be prioritized based on Overall Condition Index (OCI), AADT and % truck traffic, then selected for construction based on available funding and at the discretion of the Transportation Commission.

**Performance Measures**

The proposed Performance Measure was presented and the decision delayed until the 2008 data was available. This is a measure for Ride Quality using IRI showing % of miles rated Good (IRI < 95), Fair, and Unacceptable (IRI > 170). The target goals for System Performance with this measure will need to be established after an analysis of the system condition. It was proposed to report this for each of the management levels.

Additional performance measures are being investigated to supplement the Ride Quality to provide additional information on possibly Remaining Service Life, or Structural Adequacy.

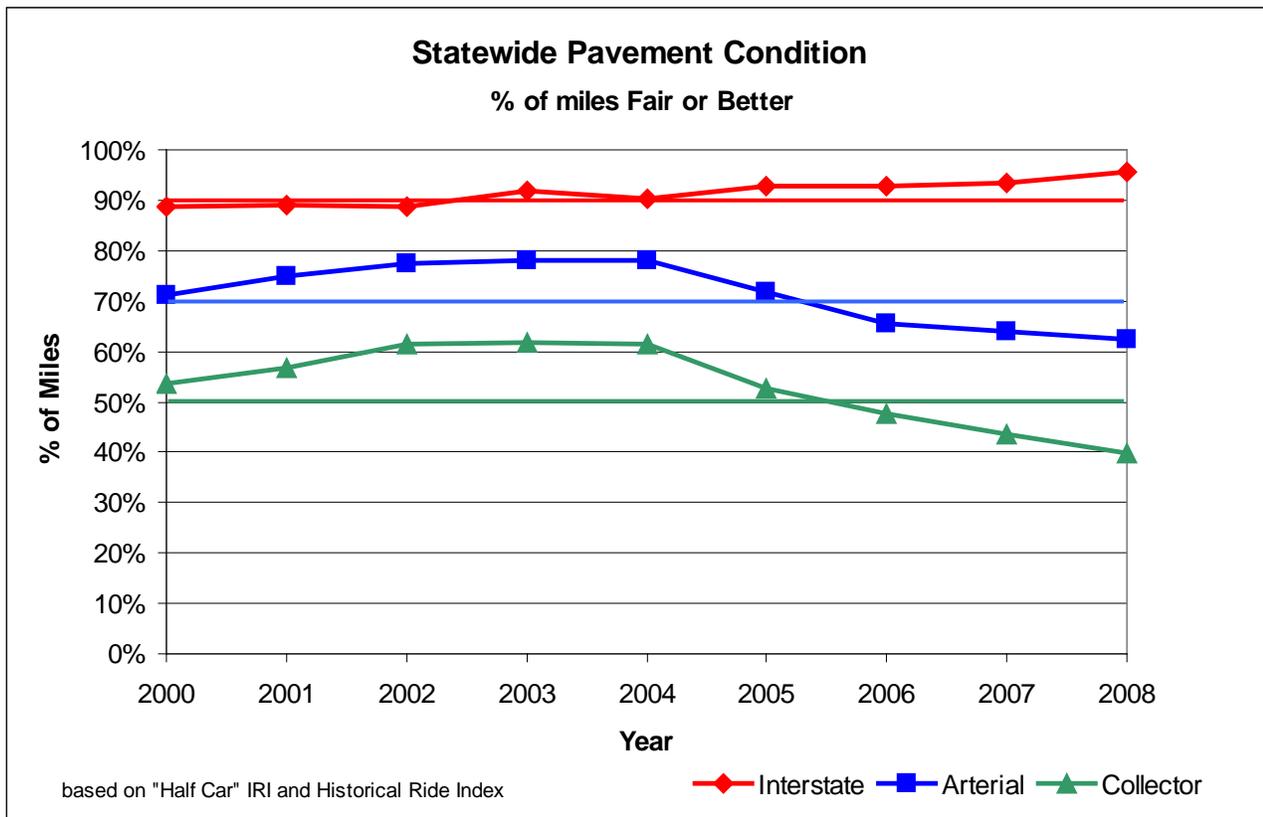
A number of performance measures are currently being used for reporting pavement condition. IRI with % VMT is being used for Stewardship reporting with FHWA<sup>1</sup>. IRI is being used for HPMS reporting. Half Car IRI is being used for Utah State GASB34 reporting<sup>2</sup>. Half Car IRI is being used for the UDOT Scoreboard and Utah State Legislative reporting<sup>3</sup>. For the past two years this has been supplemented with a Ride Quality measure using IRI that has shown the % of miles with Good, Fair and Poor IRI.

<sup>1</sup> This includes % VMT for the NHS with Good, Fair & Poor levels of IRI, as well as % VMT with Good, Fair & Poor IRI for the Interstate, and the rest of the State system.

<sup>2</sup> This is based on a historical Ride Index using the % of Miles Fair or Better.

<sup>3</sup> This is based on a historical Ride Index using the % of miles Fair or Better for the Interstate, Arterial & Collector systems.

Historical UDOT Scoreboard chart for Pavement Condition:



Individual Goals were established for each system using % miles Fair or Better. There were 90% for the Interstate system, 70% for the Arterial system, and 50% for the Collector system.

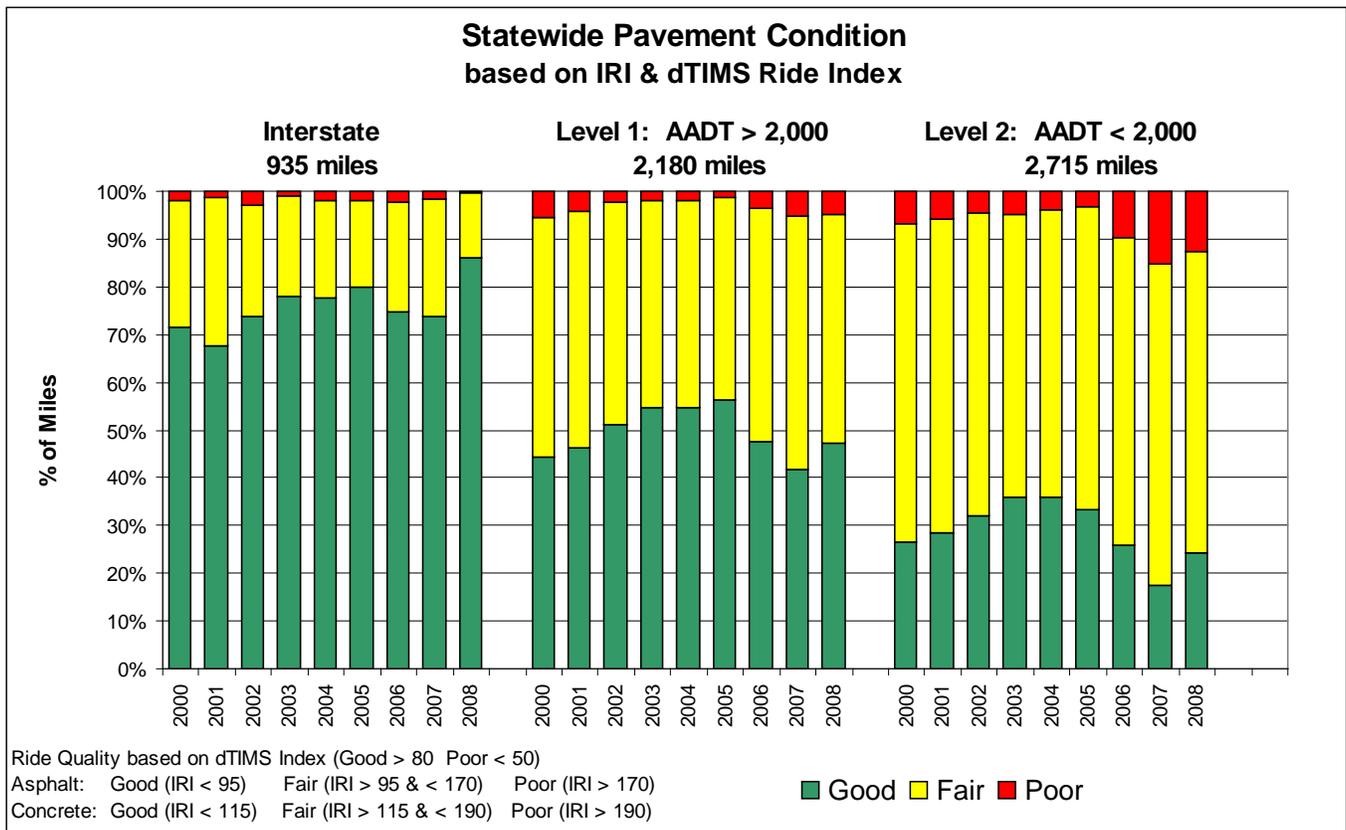
The Ride Index was historically established on a 1 to 5 scale with ratings from very poor to very good, based on seat of the pants correlation between a survey with panel members and the half-car IRI data collected at the time. An adjustment factor was introduced in 1993 when the data was first collected with a high speed profiler to correlate with the earlier data.

Ride Condition	Very Good	Good	Fair	Poor	Very Poor
Ride Index	100 to 90	90 to 70	70 to 50	50 to 30	30 to 0
RI Index	5 to 4.35	4.35 to 3.55	3.55 to 2.75	2.75 to 1.85	1.85 to 1
Asphalt HRI	0 to 42	42 to 65	65 to 93	93 to 126	126 to 466
Concrete HRI	0 to 79	79 to 103	103 to 130	130 to 163	163 to 326
Asphalt (pre 93)	0 to 45	45 to 70	70 to 100	100 to 135	135 to 500
Concrete (pre 93)	0 to 85	85 to 110	110 to 140	140 to 175	175 to 350

This reporting tool has been very useful for showing a very complex issue in an easily understood diagram. The primary value has been the trend and the relationship with the Goals.

We have observed several weaknesses with reporting our pavement condition like this and have started to also report Ride Quality information using the IRI data. Showing just the % Fair or Better is telling only a part of the story. We should also be showing the % Good and Fair, so we can relate how extensive our preservation program should be. Also, by using the IRI data we are now able to relate it to the condition modeling, providing a way to forecast this condition measure with different budget scenarios. The IRI data is on our 0 to 100 modeling index.

Recently used supplemental Ride Quality chart for Ride Quality:

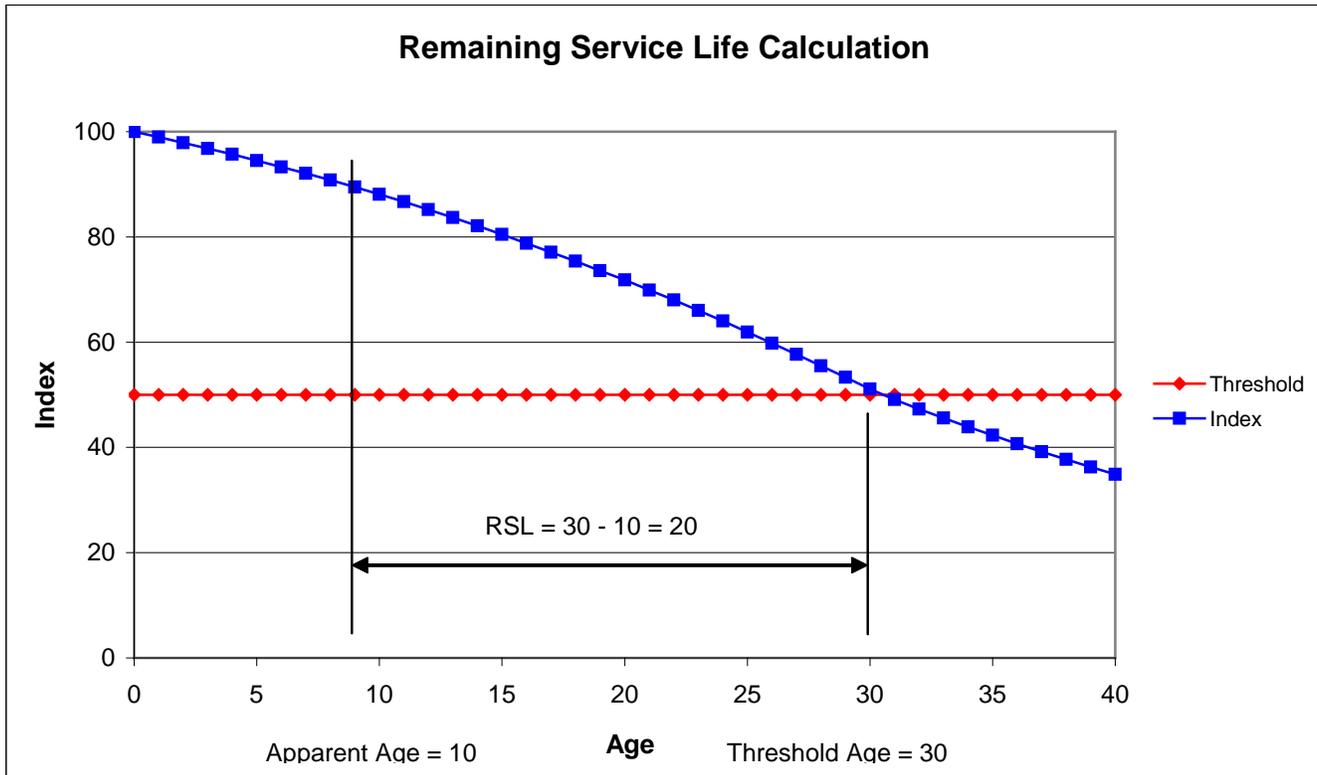


These charts are provided at the Regional level, along with condition level maps, on our web page.

## Remaining Service Life (RSL):

By monitoring the pavement condition, we can estimate the time until the deterioration reaches an unacceptable operating condition. This requires the use of the deterioration curve, the current condition index, and the threshold index. This applies to each measure of condition.

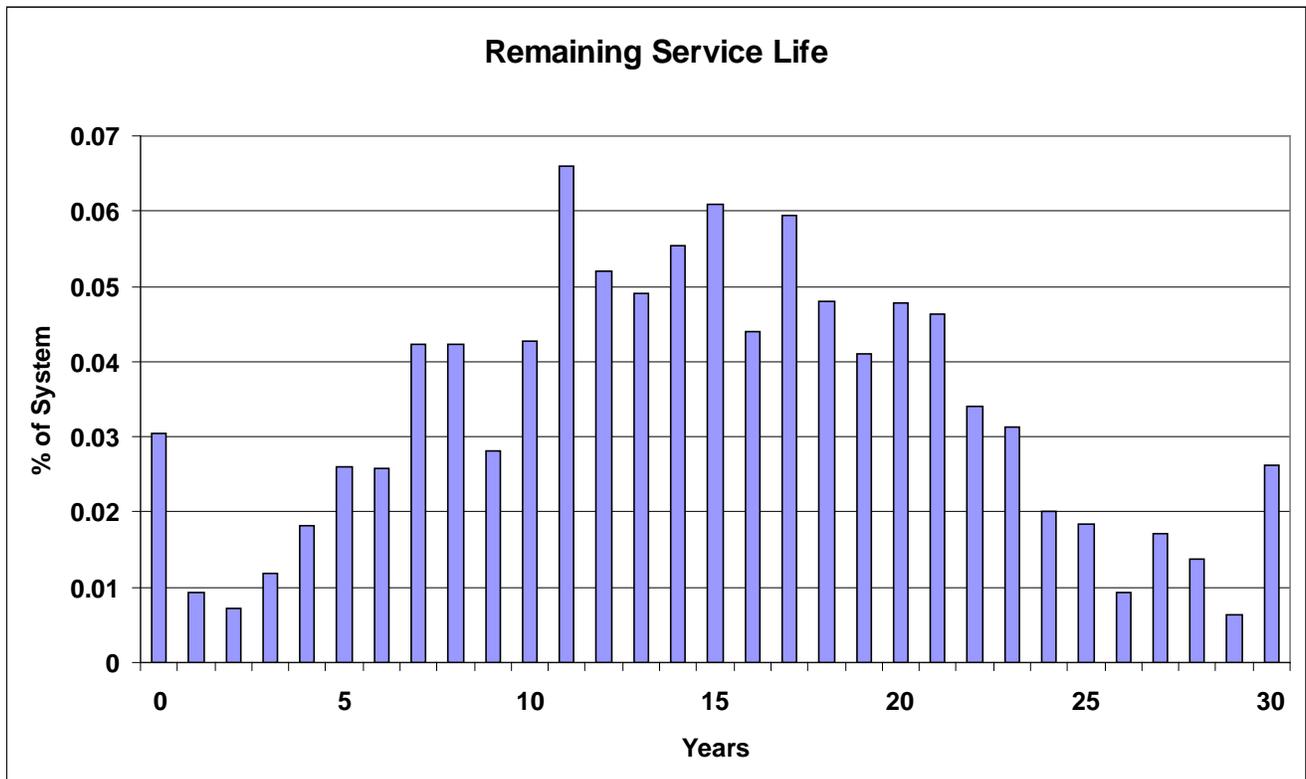
Example RSL Calculation: given Condition Index at 90



By definition, the RSL = 0 for a pavement section when the only cost effective treatment is a major rehabilitation or reconstruction. This would suggest that the condition index used is based on the “structural” life of the pavement. It needs to be understood that even when the RSL reaches 0, there could still be many years of useful life in the pavement – it would just be in an unacceptable condition.

In our current model we consider all of the condition measures, and allow the worse measure of condition to control. This is a source of confusion for us and needs some more work. The appropriate treatment and cost would be different for a pavement with RSL = 0 for fatigue cracking, compared to a pavement with RSL = 0 for rutting, or environmental cracking.

Remaining Service Life chart using 2006 condition data:



By using a long-term statewide pavement management strategy, we can apply a combination of routine maintenance, preventive maintenance, minor and major rehabilitation, and reconstruction projects to improve our pavement performance, extend the pavement life, and address structural deficiencies. With our focus to keep our good roads in good condition, and our mix of rehabilitation and preservation projects, we can maintain a balance of roads in good condition, fair condition & poor condition.

## **dTIMS Overview for System Level Condition Modeling:**

This section will provide some insight into how we model pavement condition to select an optimum program of treatments. The concepts and decisions involved are all related and interdependent. Our dTIMS model documentation in Manual – Part 4 should be read for more details on each of these concepts.

The highway system is managed in sections, primarily based on construction history. Each section then has a series of attributes that identify and characterize it. Examples include route, beginning & ending mileage, surface area, pavement type, seal type, year of last treatment...

The pavements are also grouped into different families. These are set up to model similar characteristics and performance. These are currently being set up for Interstate Asphalt, Level 1 Asphalt, Level 2 Asphalt, Interstate Concrete, Other Concrete. Previously these were Interstate Asphalt / Concrete, High-Speed Asphalt / Concrete (> 50 mph), Mid-Speed Asphalt / Concrete (40 to 50 mph), and Low-Speed Asphalt / Concrete (< 40mph)

The modeling starts with the condition data. With the model being a sophisticated set of mathematical tools, we need to convert all of the actual measured data into an Index. We use an Index with a scale from 100 to 0. The 100 index value represents the condition level for a brand new pavement. The 50 index value represents an unacceptable condition level, and where the Remaining Service Life = 0. The model documentation refers to this as the Maximum Allowable Extent; the maximum allowable level of distress before it's considered unacceptable. These "100 & 50" condition levels are set for each measure through discussions with our pavement engineers, our customers, are based on the data sets collected, and are adjusted as needed.

Qualitative condition levels are also related to the Index values, but not necessarily used in the modeling. These were initially set for 5 levels; 90 to 100 = very good, 70 to 89 = good, 50 to 69 = fair, 30 to 49 = poor & < 30 = very poor. These were then adjusted for 3 levels; 80 to 100 = good, 50 to 80 = fair & < 50 = poor. These ranges are under review and may be adjusted to better align with the treatment decisions and reporting needs.

The next concept to describe is how the condition deteriorates over time. Deterioration curves are used with the Index starting at 100 and reaching 50 over a period of time (the "design life"), and then continuing to 0. We use a set of default curves with different design lives. These represent a do nothing scenario and provide the basis for all of the modeling decisions. We currently use 4 design curves for 30, 35, 40 & 45 years for different pavement types and measures of condition.

The model can then calculate where each section is at on the deterioration curve for each measure of condition. A set of IF statements are used to model a big decision tree on what treatment to select depending on the different Index levels and pavement age. Each treatment is programmed to be *triggered* within a defined range of conditions.

The model also has a time-based rule that prohibits any follow-up treatments being triggered until a minimum amount of time has passed. This is either 6 years or 8 years depending on the type of treatment selected. This rule essentially triggers a time based treatment as soon as possible, but delays it based on condition until the most efficient time for the benefit of the overall system.

The treatments in our model are set up to represent types of projects that would be performed at similar condition levels, provide similar improvements to the condition, and cost about the same. Each treatment has a defined expression for the condition levels when they will be and won't be triggered, the amount of reset they provide for each condition measure, and their unit costs. These are currently:

- Asphalt Surface Seal - Low, Medium, or High
- Asphalt Functional Repair / Concrete Grinding
- Asphalt / Concrete Minor Rehabilitation
- Asphalt Major Rehabilitation
- Asphalt / Concrete Reconstruction

The model evaluates all possible scenarios for each section. The model selects each appropriate treatment and then *resets* the condition level and starts a new deterioration curve. The model calculates the area between these two curves as the *benefit* of the treatment, and using the treatment unit costs compares the benefit/cost with all of the other possible treatments to optimize the condition for the entire system. Multiple treatments can then be selected for the same section, depending on the analysis period modeled.

The model uses an Overall Condition Index as the measure to optimize. This is the average of the measured condition indexes.

The model can be configured to analyze different scenarios. The primary scenario each year is to determine the budget requirements to maintain the current overall condition level for a 20-year analysis period. The model scenario is then modified to determine the optimum system level treatments, given an approved budget scenario. This project list then goes to each Region to be used for selecting the STIP projects. The model is also used to determine recommended funding levels for the Orange book program and allocations between the Regions.

The relationships between the condition data, condition indexes, deterioration curves, treatments, treatment triggers, treatment costs, and index resets are what make the model a continuous work in progress. Every time one of these elements is modified, the effects on everything else need to be considered. The model requires continuous evaluation and modification to replicate observed conditions and actual practice.

## Preservation Terminology:

Our pavement program is a network level, long-term strategy comprised of several components that work together to improve pavement performance, extend pavement life and address structural deficiencies. The three major categories of activities are **Preservation, Rehabilitation** and **Reconstruction**. The following paragraphs describe these components and include additional information with examples of treatments, types of funding, and relationships to the condition modeling.

### Preservation Treatments

Preservation can be further separated into three areas: **routine maintenance, preventive maintenance** and **minor rehabilitation**

#### Corrective Maintenance:

These activities respond to immediate concerns of pavement integrity or safety. These restore the pavement to a serviceable level due to unforeseen conditions. This involves pothole repair, localized patching, edge drop-off grading, isolated concrete slab replacements, and other emergency type repairs. These efforts are typically performed with in-house forces using “Code 1” hard surface funds.

#### Routine Maintenance:

This preservation component is the pro-active day to day efforts to maintain and preserve the pavement condition at a satisfactory level. This involves crack filling, patching, isolated overlays, grading shoulders, and numerous other roadside activities for mowing, maintaining drainage, pavement markings, delineation, signing, lighting, and landscaping. These efforts are typically performed with in-house forces using “Code 1” hard surface funds, and occasionally with Preservation funds.

#### Preventive Maintenance:

This preservation component is the effort to improve the functional pavement condition and extend the service life. These activities are focused on the surface of structurally sound pavements in fair to good condition. These are primarily time-based, lower-cost treatments. This involves crack sealing, chip seals, slurry seals, micro surfacing, open graded surface courses, stone matrix asphalt overlays, thin hot mix asphalt overlays, lane leveling, concrete joint sealing, diamond grinding, and isolated partial or full depth slab repairs. These treatments typically take place through the “orange book” program, with some work done with in-house “Code 1” hard surface funds.

The condition modeling identifies these categories of treatments: surface seals-low (chip seals, slurry seals), surface seals-medium (micro surfacing), surface seals-high (open graded surface course, stone matrix asphalt overlay, bonded wearing course), functional repair (patching, leveling and thin overlays), concrete joint sealing and concrete grinding.

## Rehabilitation Treatments

These are the efforts that address structural enhancements that extend the service life and/or improve the load carrying capacity. These treatments are typically categorized as **Minor** or **Major** rehabilitation. These treatments typically take place through the Rehabilitation (Purple Book) program.

**Minor rehabilitation** is the Preservation component that addresses the functional restoration of the pavement surface primarily due to age-related environmental cracking. This involves rotomilling, hot or cold recycling, and structural hot mix asphalt overlays to replace the milled pavement.

The condition modeling identifies types of treatments in these categories: minor rehabilitation (mill & replacement overlay, concrete minor rehabilitation (slab jacking, dowel bar retrofit, and isolated partial or full depth slab repair).

**Major rehabilitation** consists of structural enhancements that both extend the service life and improve its load-carrying capability. Pavement thickness is usually increased to provide additional strength to accommodate existing or projected traffic loadings. This involves rotomilling, hot or cold recycling, and structural hot mix asphalt overlays. These treatments focused on increasing the pavement structure.

The condition modeling identifies types of treatments in these categories: major rehabilitation (mill & structural overlay).

## Reconstruction Treatments

Reconstruction is used to replace the entire pavement structure with equivalent or increased pavement thickness. This is required when the pavement has failed, become functionally obsolete (with a deficient alignment or profile), or has subgrade issues. This can be with either recycled or new materials. These projects take place through the Reconstruction (Blue Book) program.

The condition modeling identifies types of treatments in these categories: reconstruction – asphalt, reconstruction – concrete.

There is a need for consistency in the use of these definitions within the Department. Projects need to be categorized the same way in each Region, as well as in the modeling. Concepts, Scopes, STIP descriptions etc. should all have the same use of terms.

Additionally, project work is often required that goes beyond just taking care of the existing pavement. The project costs estimated from the condition modeling is not able to include additional cost for widening, slope flattening, passing lanes etc. that are commonly included in many projects. This additional work needs to be included in the project description. The additional cost also needs to be budgeted for.

## Pavement Management Funding Programs:

From the definitions that follow, a clear distinction is made between the Pavement Preservation (Orange Book) and Rehabilitation (Purple Book) Programs. These two Programs are used to contract out pavement preservation and rehabilitation projects.

The objective of the **Pavement Preservation Program** is to provide cost effective treatments that will improve the functional pavement condition and extend the service life. The hard surface maintenance portion of this Program is limited to preventive maintenance, routine maintenance and minor corrective maintenance. This program does not include either minor or major rehabilitation or reconstruction.

Typical asphalt pavement treatments include crack sealing, rejuvenation, chip seals, slurry seals, micro seals, open graded seals, rut filling, lane leveling, and thin overlays.

The **Pavement Rehabilitation Program** is to provide timely cost effective rehabilitation treatments. The scope of the projects is intentionally limited to addressing only the pavement surface. Work items are limited to pavement resurfacing and other work that is necessitated by the resurfacing. See the [Purple Book scoping document](#) for additional information.

A comparison of the scope of work between these Programs is as follows:

<u>Criteria</u>	<u>Preservation</u>	<u>Rehabilitation</u>
Design Study Report	No	Yes
Environmental Clearance	Cat. Ex. Level II	Cat. Ex. Level II
Operation Safety Report	No	Yes
Pavement Design	No	Yes
Project Cost	Under \$3,000,000	No stated limit
Rotomilling Depth	2" Max.	5" Max. (3" HMA + 2 OGSCs)
Surfacing Depth (asphalt)	1 ½ " Max.	2" - 4"
Rut Filling Depth	1" Max.	No stated Max.
Surfacing (concrete)	Joints and spalls	Limited slab repair
Concrete Slab Replacement	In isolated cases	Not extensive
Replace Texas Turndowns	Yes	Yes
ADA Curb Cuts (Ramps)	On some treatments	Yes
Highway Realignment	No	No
Relocation of Driveway	No	No
Traffic Signal Work	No	No
Storm Drainage Improvements	No	No
Bridge Work	No	No
Normal Utility Involvement	No	No
Raising Manholes	Yes	Yes
Replacing Detection Loops	Yes	Yes

## General Time Line

Our process begins in June for the fiscal year beginning the following July 1. For example, for the fiscal year 2012 allocation, the process will begin in June 2010 (because FY 2012 begins July 1, 2011).

To be consistent this section uses the term “**Preservation**” instead of “Orange Book” and “**Rehabilitative**” instead of “Purple Book” when referring to the Department’s Pavement Preservation Program. Pavement “Reconstruction” projects will follow the normal STIP development process, however they will be very difficult to fund given the current revenue stream and probably should be canceled in lieu of a major rehabilitation project.

**June - August:** Statewide Pavement Condition data collection. Central Asset Management and Vendor collect pavement surface friction (SKID), Ride (IRI), Rutting, Joint Faulting, Joint Spalling, Slab Cracking, Environmental Cracking and Wheel Path Cracking for Interstate, Level 1 and Level 2 Roads. Project level FWD data is also collected as requested.

**Ongoing with Final Changes Due September 15<sup>th</sup>:** Region PMEs update the PFES for their regions. The updates required include any revisions to pavement section limits, updates to construction dates for projects either completed or nearing completion, surface areas, etc...

**September – October:** Central Asset Management develops pavement condition indices and runs the dTIMS Pavement Model using the most likely funding scenario for the upcoming Fiscal Year. As a general rule, the dTIMS Model will use updated PFES information and current pavement condition data set.

- a. Statewide Model Run determines percentages of the overall available money (Projected from current Revenue estimates) that will be allocated to each Region and how much of that money should be spent on Preservation Pavement Projects and Rehabilitative Pavement Projects
- b. Individual Region Model Runs create a 5 year list of potential projects for each Region which should be used as a “tool” for selecting projects for the Region STIP Workshop.

**November 1<sup>st</sup>:** Central Asset Management distributes a cover letter listing an estimated dollar amount, broken out by funding category that each Region may be receiving for both the Preservation and Rehabilitative Programs. The funding listed for the Preservation Program will be for the next Fiscal year, the funding listed for the Rehabilitative Program will be for the next Funded year. The cover letter will ask for Project nominations, for both programs, not to exceed the estimated budget amounts. A 5 year project plan for both Preservation and Rehabilitative Projects, as well as pavement condition indices for those projects, will be attached to the cover letter for the Regions use.

**November – December:** Region’s develop, draft versions of Preservation and Rehabilitative project lists, as well as a list of “provisional” Preservation and Rehabilitative projects that will be considered in the event that additional funding is made available. Preservation and Rehabilitative projects should be developed through a combination of field investigation,

pavement condition indices, PFES information, dTIMS project recommendations, sound engineering judgment considering funding eligibility of each pavement section.

The draft list of Project nominations along with a request for the type and amount of funding category changes should be completed and transmitted to the Director of Asset Management by December 1<sup>st</sup>. Construction cost estimates for project nominations should be based on project estimates from well developed concept reports. Ideally, all project nominations from the Regions should be represented, in some way, shape or form, on the 5 year project plan generated from the dTIMS Model.

**First two weeks in January (depending on how the holiday falls):** Region Program Managers and PME's will meet with Central Asset Management and STIP Coordinator to review the draft list of project nominations to ensure the scope of the project jives with the pavement condition and dTIMS recommendations, and falls within the constraints of Funding Categories. The output of these meetings will be completed Preservation and Rehabilitative project nominations for Region STIP workshops as well as provisional project lists for each program

**January - February:** Region STIP Workshops

**February – April:** Central Asset Management will transmit a refined estimate of available funding to the Regions, broken out by funding category, so that the Regions have one last shot to refine estimates and project nominations before the April Commission Workshop. Please note, at this point the funding totals are still preliminary, since the final funding is not established until the Commission "Acts" on the Departments recommendations at the May Commission Meeting.

**April:** Commission Workshop. Preservation Program funding allocation is discussed and recommended for approval. Rehabilitative Program funding allocation is discussed and recommended for approval. Draft list of Rehabilitative Projects are discussed and recommended for approval. The Provisional list of Preservation and Rehabilitative Projects is discussed and finalized.

Once the Commission acts on the Preservation Program, Rehabilitative Program and Rehabilitative Project Lists, Central Asset Management sends a final memorandum to the Regions, confirming the dollar amounts for the Preservation & Rehabilitative Programs and corresponding Project nominations for each Program. At that time, Central Asset Management turns the Preservation and Rehabilitative Programs over to Program Finance to manage the projects within the approved funding constraints. However, any deletions or additions to the approved Preservation and Rehabilitative Projects lists must be approved by Central Asset Management before Program Finance makes any changes to the program funding.

**May – End of Next Fiscal Year:** Regions are given the go-ahead to proceed with Project Design, Advertisement and Construction. The timing and availability of funds will be coordinated through Program Finance, for both the Preservation and Rehabilitative Projects.

In general, any money saved through re-scoping, good bids, etc... will be re-programmed in the Region in which it was saved, as long as the color of the money matches up with the projects the Regions want to add to their Program. Program Finance, in collaboration with Central Asset

Management, will re-distribute money to the best of their ability so that the final dollar amount spent in each Region matches the original dTIMs recommendations.

Construction may begin on July 1<sup>st</sup> for State funded projects. Design and construction of federally funded projects can begin one to two weeks after the April Commission workshop.

## Links

Links of particular interest for pavement management

UDOT Pavement Management:

[Pavement Management Home Page](#)

FHWA:

Main [Pavement](#) page

[Highway Community Exchange](#) > NCHRP 1-37A MEPDG

[Turner Fairbanks](#) main page

FHWA & State Pavement / Materials Engineer [Contacts](#)

Asphalt:

[Asphalt Pavement Alliance](#)

[Washington Asphalt Pavement Alliance](#)

[National Center for Asphalt Technology](#)

Concrete:

[National Concrete Pavement Technology Center](#)

[American Concrete Pavement Association](#)

Condition Data:

Main [ProVal](#) page

University of Michigan Transportation Research Institute [Road Roughness Home Page](#)

[Back-Calculation](#) of Layer Parameters For LTPP Test Section, Flexible & Rigid

[Road Profilers User Group](#)

[FWD User Group](#)

Understanding AASHTO [Smoothness Specifications](#)

Treatments:

[Caltrans Maintenance Technical Advisory Guide](#) main page

[Washington DOT Pavement Guide](#)

Pavement Management:

[The National Center for Pavement Preservation](#)

[Texas Pavement Preservation Center](#)

[Pavement Tools Consortium](#) Interactive Pavement Guide

Links to State & National [Performance Measures](#)

Pavement Design:

TRB main [MEPDG](#) page

Washington DOT [Pavement Design Tools](#) main page

[Pavement Interactive](#) An encyclopedia of pavement knowledge, articles and on line discussion groups