Pavement Performance Programming Using PMS

National Pavement Management Conference
Norfolk, Virginia
May 6-9, 2007

Mary Gayle Padmos

Montana Department of Transportation

serving you with pride

Outline

- What is the Performance Programming Process or P^3
- P^3 and MDT's Pavement Management System
- Using P^3 for Pavement Improvement Strategies

What is P^3

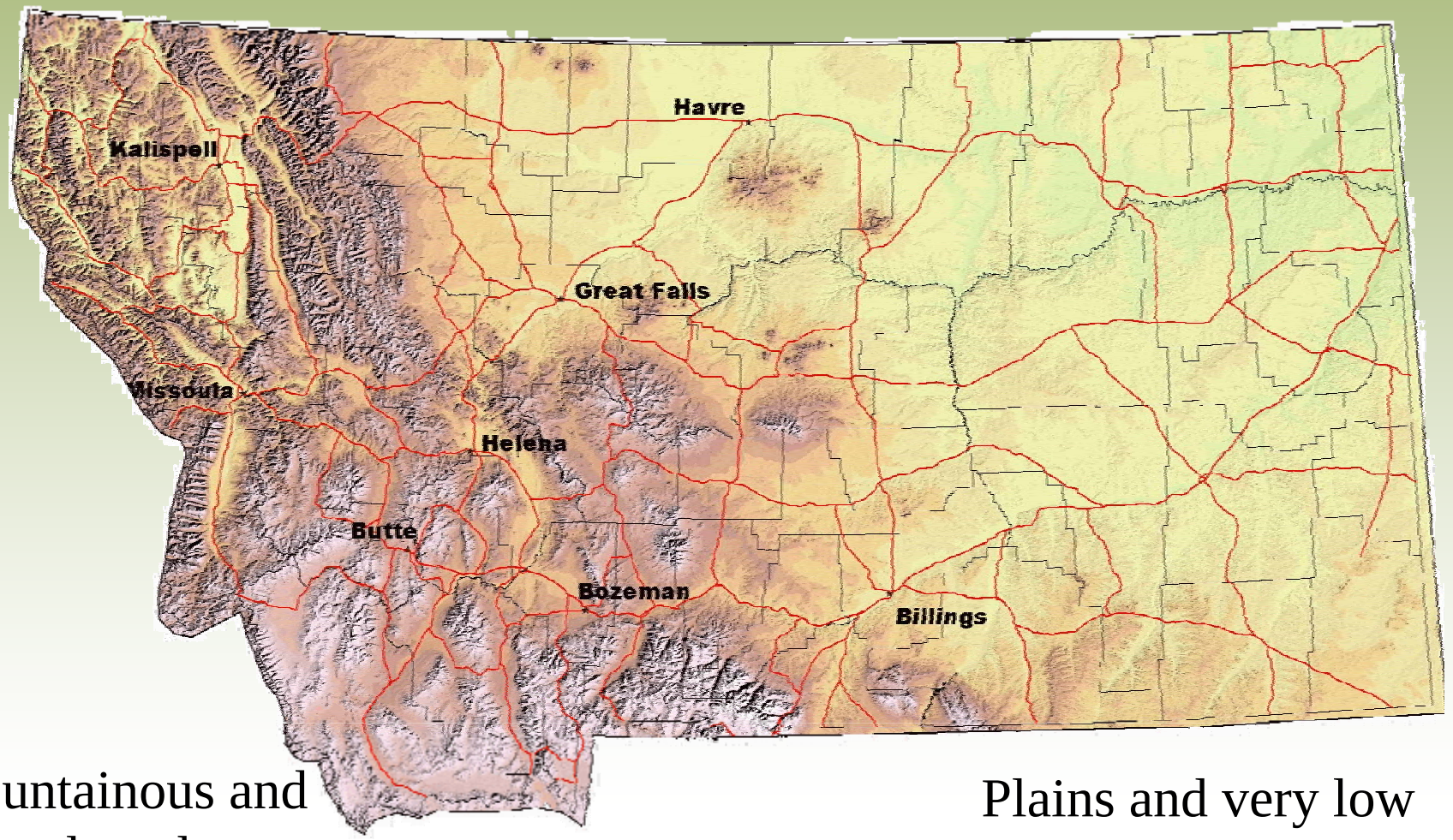
- MDT defines the Performance Programming Process as:

> "A method to develop an optimal investment plan and measure progress in moving toward strategic transportation system goals."

P^3 Background

- Developed by a cross functional team in 2000
- Addressed accountability to customers regarding increase in funding with TEA-21
- Establishes a Department wide performance measure for pavement
- Provides organizational alignment regarding funding between Headquarters and Districts
- Objectives
  - Achieve Performance Goals
  - Maintain a “Steady State Program”
  - Perform the “Right Treatment at the Right Time”

Diverse Challenges



Mountainous and more densely populated

Plains and very low population density

Pavement Performance Goals

- Objective: Preserve highway pavement condition at existing or higher levels on the Interstate, NHS and Primary Systems
- Performance Measure: Ride Index which is a measure of the quality (smoothness) of the ride as perceived by the highway user
- Target: Average ride desirable or superior, less than 5 percent of miles in unsatisfactory condition

Maintain a "Steady State Program"

Tentative Construction Program: Pavement Project Mix

Right Treatment at the Right Time

- Adopted “Guidelines for Nomination and Development of Pavement Projects” in 2001
  - FHWA allowed Federal $ for Pavement Preservation

- Developed protocol for investment strategies utilizing the Pavement Management System.

Nomination Guidelines Matrix

* CATEGORY	PREVENTATIVE MAINTENANCE			REACTIVE MAINTENANCE	REHABILITATION		RECONSTRUCTION
	Scheduled Maintenance	**Pavement Preservation**			**Minor**	**Major**	
Surface Engineering	None (≤ 60 mm Overlay)	None (<60 mm Overlay)			**Engineered**	Engineered	Engineered
Environmental Documentation	NEPA/MEPA	NEPA/MEPA			NEPA/MEPA	**NEPA**	NEPA
Geometric Design Standards	As Built	As Built			**# As Built**	As Built to Current Standards	Current Standards
Safety & Capacity Considerations	Cluster ADA	Below Statewide Ave., Pavement Age ≤ 20 yrs., PvMS analysis (1 up or down), Clear Zone, Mailboxes, ADA,	Clusters, Width, Guardrail Criteria, Slopes Geometrics, Signage		Below Statewide Average Clusters	Route Segment Width Geometrics	Full Safety and Capacity
Applied Treatments	Crack Seal Seal & Cover Overlay ≤ 60 mm Joint Seal Fog Seal Sand Seal Micro Surfacing	Crack Seal, Olay < 60 mm, Sand Seal, Rut Fill, Mill OGFC	Seal & Cover Fog Seal Micro Surfacing Mill and Fill ≤ 60 mm		≥60 mm → 90 mm **Overlay** MILL ≤ 60 mm No exposure of gravels	60 mm → 90 mm **Overlay w/Grading** Pulverize Mill Overlay Recycle If Gravel exposed Treat/Modify gravels	**Full Standards**
How Needs Identified	Scheduled Treatments	Observed Distresses			Observed Distress	Observed Distress Geometrics	Observed Operational Geometric Safety
Eligible Funding Source	Maintenance Funds	Maintenance Funds					
	State Construction	State Construction			State Construction		
	Federal Aid	Federal Aid			Federal Aid	Federal Aid	Federal Aid
Development Time	≤1 year	1-2 years			2-3	3-4	4-8

Pavement Management System and P^3

- MDT Pavement Management collects Ride, Rut, and Visual Distress on 24,000 lane miles and calculates condition annually
- Becomes the data foundation for P^3

Using the Pavement Management System

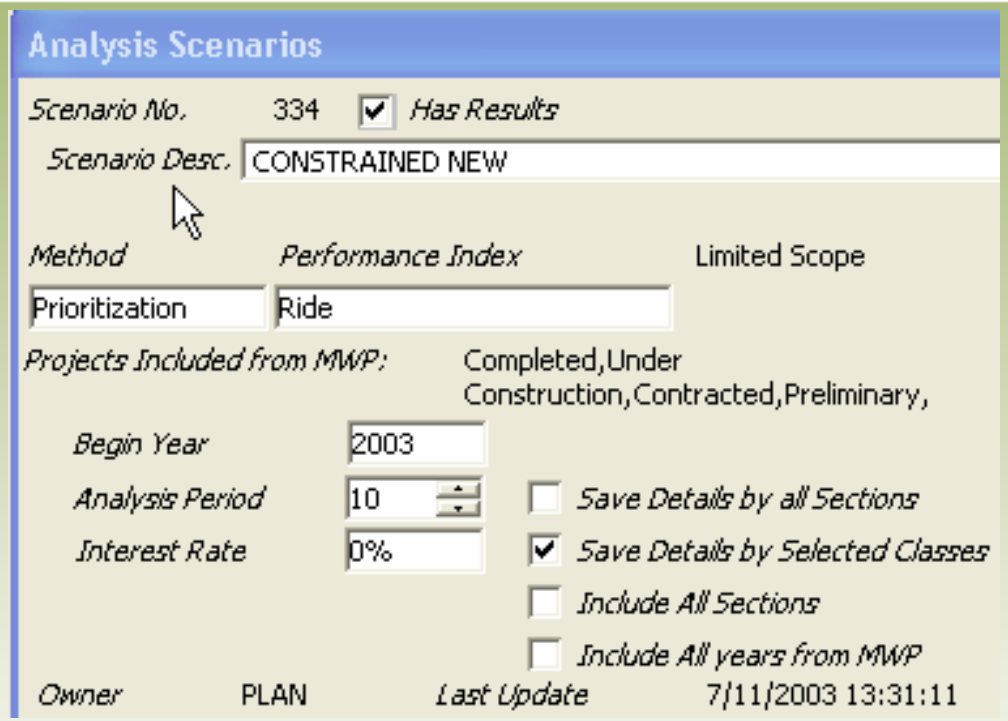
- Establishing the Master Work Program
  - A “Master Work Program (MWP)” is built to represent all projects currently under construction and new condition data not available.
  - The 5 year Tentative Construction Program is assessed into Reconstruction, Rehabilitation and Resurfacing budget categories and the individual projects are added to the MWP

Example of the MWP

Edit MWP | Move Projects | Select Scenario

Year	Route ID	Extension	Direction	Lane Id	From Point	To Point	Length	Sec Width	Add Area	Treatment	Road Structure Category	Scenario Estimated Price	Scenario Project Status	Budget categoryx
2006	C000005	None	Both	All	118.87	122.42	3.55	37	0	C_AC Minor Rehabilitation	AC Minor Rehabilitation	$0.00	Contracted	Rehabilitation
2006	C000005	None	Both	All	168.279	173.186	4.907	35	0	C_AC Crack Seal & Cover	Maintenance	$0.00	Completed	Resurfacing
2006	C000005	None	Both	All	173.186	177	3.814	40	0	C_AC Crack Seal & Cover	Maintenance	$0.00	Completed	Resurfacing
2006	C000005	None	Both	All	177	180.9	3.9	45.98	0	C_AC Thin Overlay	AC Thin Overlay	$0.00	Under Construction	Resurfacing
2006	C000006	None	Both	All	22.9	29.5	6.6	32	0	C_AC Seal & Cover	Maintenance	$0.00	Completed	Resurfacing
2006	C000006	None	Both	All	64.9	68.7	3.8	24	0	C_ Reconstruction	AC Reconstruction	$0.00	Completed	Reconstruction
2006	C000007	None	Both	All	90.967	91.449	0.482	86	0	C_AC Thin Overlay	AC Thin Overlay	$0.00	Completed	Resurfacing
2006	C000007	None	Both	All	91.449	93.02	1.571	45.46	0	C_AC Thin Overlay	AC Thin Overlay	$0.00	Completed	Resurfacing
2006	C000008	None	Both	All	93.03	96.1	3.07	68	0	C_ Reconstruction	AC Reconstruction	$0.00	Completed	Reconstruction
2006	C000008	None	Both	All	102.18	105.4	3.22	30	0	C_ Reconstruction	AC Reconstruction	$0.00	Under Construction	Reconstruction
2006	C000009	None	Both	All	20.9	31.7	10.8	22.21	0	C_ Reconstruction	AC Reconstruction	$0.00	Contracted	Reconstruction
2006	C000009	None	Both	All	39.9	52.4	12.9	22	0	C_AC Seal & Cover	Maintenance	$0.00	Under Construction	Resurfacing
2006	C000010	None	Both	All	43.2	52.23	9.03	40	0	C_AC Thin Overlay	AC Thin Overlay	$0.00	Completed	Resurfacing
2006	C000014	None	Both	All	33.1	41.7	8.6	35	0	C_AC Seal & Cover	Maintenance	$0.00	Under Construction	Resurfacing
2006	C000014	None	Both	All	55.917	63.148	7.231	26	0	C_AC Seal & Cover	Maintenance	$0.00	Under Construction	Resurfacing
2006	C000014	None	Both	All	146.081	155.157	9.076	25	0	C_AC Thin Overlay	AC Thin Overlay	$0.00	Under Construction	Resurfacing
2006	C000014	None	Both	All	155.157	160.456	5.299	24	0	C_AC Thin Overlay	AC Thin Overlay	$0.00	Under Construction	Resurfacing

Setting Up the Analysis



- Network Analysis Screen
  - Establish analysis period
  - Develop scenario scope
    - System
    - District

The Analysis

Budget

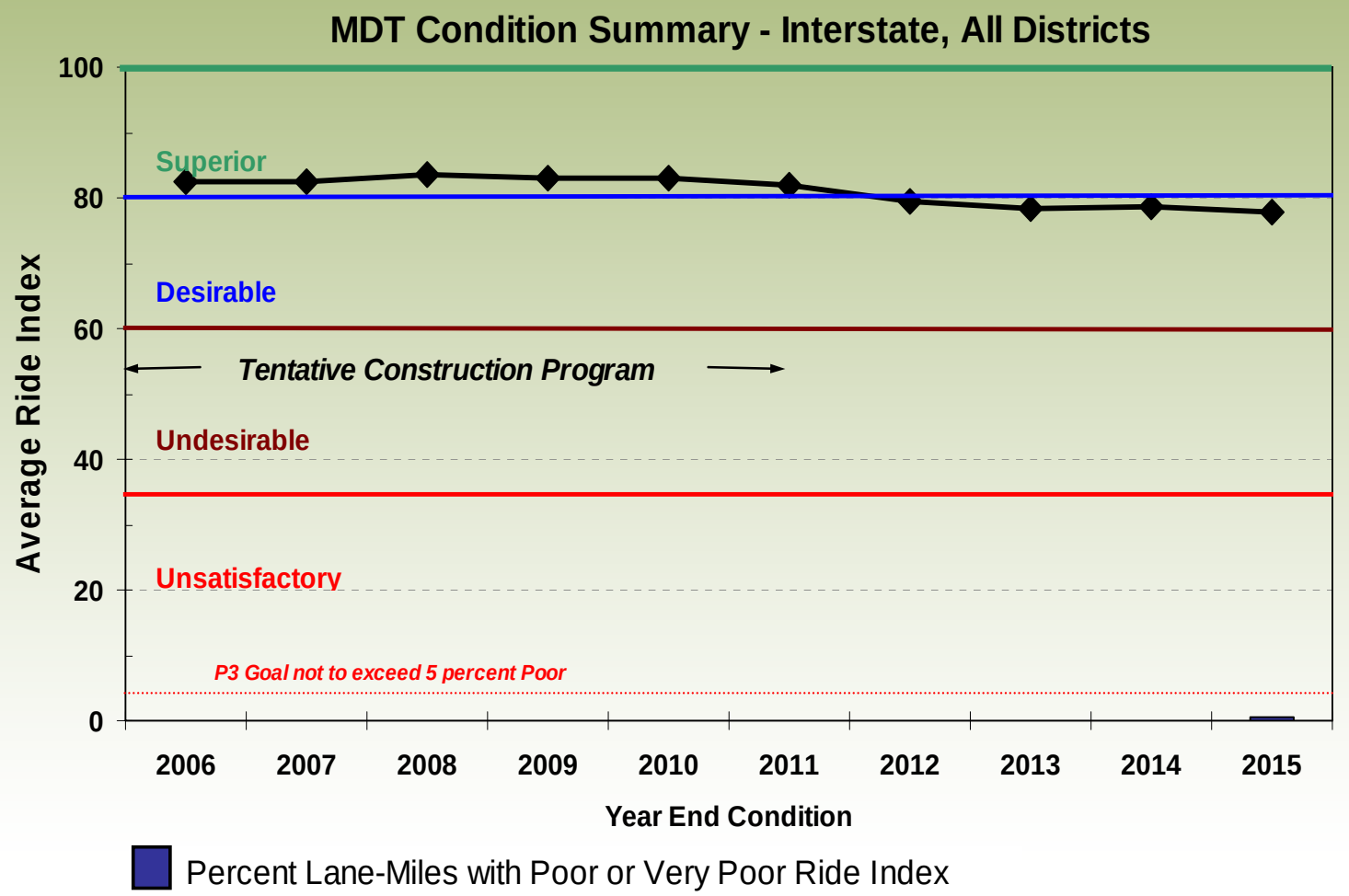
Year	Effective_Budget	Budget categoryx
2003	$23,045,671.00	Reconstruction
2003	$46,509,706.00	Rehabilitation
2003	$20,953,200.00	Resurfacing
2004	$57,934,101.00	Reconstruction
2004	$41,693,352.00	Rehabilitation
2004	$88,819,700.00	Resurfacing
2005	$88,708,128.00	Reconstruction
2005	$42,316,488.00	Rehabilitation
2005	$93,310,617.00	Resurfacing
2006	$108,369,751.00	Reconstruction
2006	$24,467,300.00	Rehabilitation
2006	$65,540,017.00	Resurfacing
2007	$114,784,872.00	Reconstruction
2007	$1,740,000.00	Rehabilitation
2007	$58,418,810.00	Resurfacing
2008	$153,353,730.00	Reconstruction
2008	$21,892,436.00	Rehabilitation
2008	$72,974,786.00	Resurfacing
2009	$48,575,407.00	Reconstruction
2009	$21,858,933.00	Rehabilitation
2009	$72,863,111.00	Resurfacing
2010	$48,108,541.00	Reconstruction
2010	$21,648,844.00	Rehabilitation

- Using the Network Analysis window in the PMS a 10 year analysis beginning with the 5 year construction plan and an additional 5 year projection is setup
- For the first 5 years - the budget for reconstruction, rehabilitation and resurfacing is entered according to the Tentative Construction Plan breakdown
- Multiple scenarios are run to determine the next 5 years budget split for the best work mix and projected pavement condition

Summary of 2006 Analysis

Measure	System	Missoula	Butte	Great Falls	Glendive	Billings	All
Average Ride Quality (Target 60-80)							
	I	80	80	79	79	79	**79**
	N	71	72	74	73	75	**73**
	P	72	70	73	72	73	**72**
	All	74	74	75	75	76	**75**
% of Pavements Poor							
	I	3%	0%	0%	0%	0%	**0%**
	N	2%	0%	0%	0%	1%	**1%**
	P	1%	1%	0%	1%	0%	**1%**
	All	**2%**	**1%**	**0%**	**0%**	**0%**	**1%**
Distribution of 2011-2015 Funds by District and System							
	I	8%	14%	3%	4%	7%	**36%**
	N	10%	2%	5%	6%	4%	**28%**
	P	11%	10%	6%	3%	7%	**37%**
	All	**29%**	**25%**	**14%**	**13%**	**18%**	**100%**
Distribution of District Funds by Work Type							
% Recon	All	51%	32%	48%	76%	35%	**46%**
% Rehab	All	34%	38%	8%	0%	35%	**27%**
% Resurf	All	15%	30%	44%	24%	30%	**27%**

Interstate Performance Graph



2006 Funding Distribution

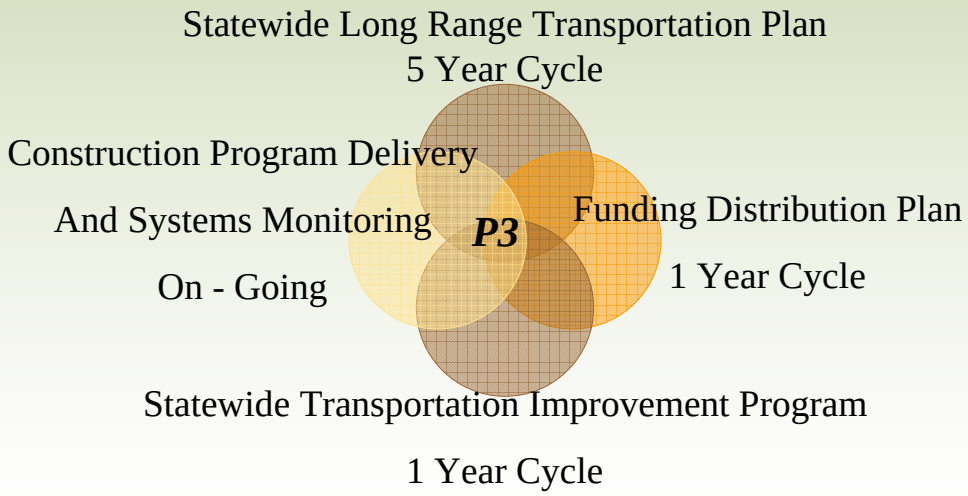
Year:	2011-2015					
	% by	% by	Distrib by Work Type			
District	System	District	Recon	Rehab	Resurf	Total
NHS Interstate	***36%***		***0%***	***63%***	***37%***	
1 - Missoula		22%	0%	78%	22%	100%
2 - Butte		38%	0%	61%	39%	100%
3 - Great Falls		8%	0%	15%	85%	100%
4 - Glendive		11%	0%	77%	23%	100%
5 - Billings		21%	0%	65%	35%	100%
NHS Non-I	***28%***		***50%***	***12%***	***38%***	
1 - Missoula		37%	65%	10%	25%	100%
2 - Butte		9%	0%	37%	63%	100%
3 - Great Falls		18%	45%	0%	55%	100%
4 - Glendive		23%	75%	0%	25%	100%
5 - Billings		13%	0%	41%	59%	100%
STP-P	***37%***		***80%***	***12%***	***9%***	
1 - Missoula		31%	72%	27%	1%	100%
2 - Butte		26%	86%	5%	9%	100%
3 - Great Falls		17%	74%	11%	15%	100%
4 - Glendive		8%	75%	0%	25%	100%
5 - Billings		18%	92%	0%	8%	100%
All Systems	***100%***		***46%***	***27%***	***27%***	

Funding Process

- Annually P^3 sets the funding categories for next year of the Tentative Construction Plan (TCP)
  - i.e. the 2006 analysis set the budget for 2011
  - Transportation Commission Adopts
- Reconstruction and rehabilitation projects are nominated in the next year's cycle (early 2007)
- The Resurfacing budget category is placed into the TCP as a plug (for 2011)
- The plug holds the funding until the two year window for Pavement Preservation projects cycle
  - i.e. in 2009 will nominate projects for 2011

Overview of MDT's Processes

- MDT has several annual and multiple year activity cycles interacting to plan, program, and deliver highway improvements
- P^3 ensures they all move in the same direction



Functional Responsibilities

- Pavement Management
  - Condition Data Collection / Analysis and pass data to Planning annually
  - Participate in project nomination reviews
- Planning
  - Use streamlined PMS Network Analysis for budget development
  - Request, review and program project nominations
- Districts
  - Monitor pavement's physical condition and use PMS Condition / Treatment Report to guide nominations
    - Nominate projects to P3 District budget assignment

Summary

- P^3 aligns financial constraints with performance objectives
- Pavement condition via PMS is the basis of the P^3 pavement budget recommendations
- Ensures MDT's highway improvement decision processes move in the same direction