

Tools for Staying Ahead of the Curve

Today's Presenters

Eric Ross

FHWA- Office of Infrastructure
TPM Engineer
Eric.Ross@dot.gov

Nathaniel Coley

FHWA- Office of Infrastructure
Economist
Nathaniel.Coley@dot.gov

Esther Strawder

FHWA-Office of Safety
Safety Specialist
Esther.Strawder@dot.gov

Michael Nesbitt

FHWA- Office of Infrastructure
Stakeholder Engagement Liaison
Michael.Nesbitt@dot.gov



Tools for Staying Ahead of the Curve

LCCA and RealCost in Map-21/TPM

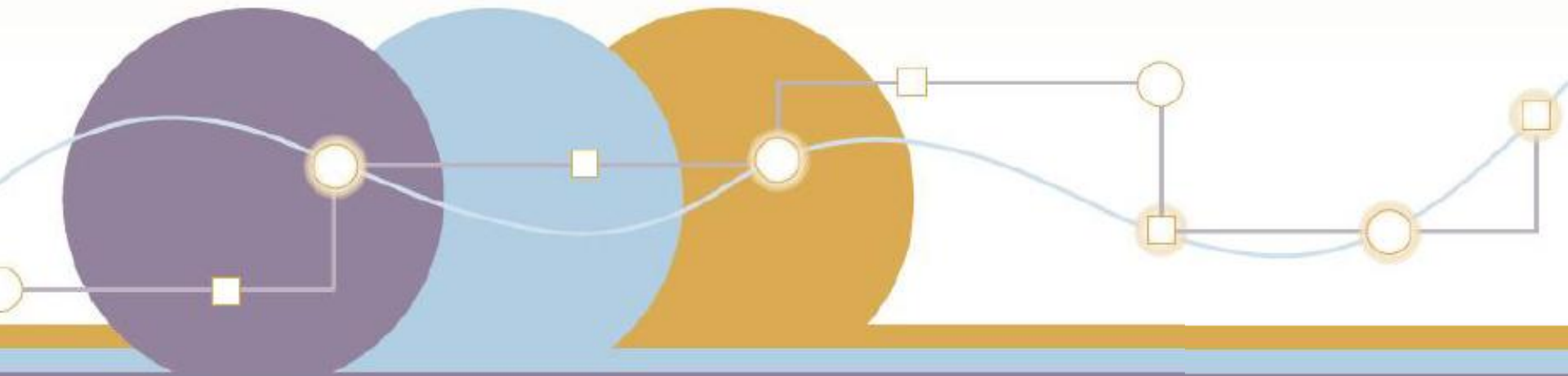
TPM Exchange

Office of Transportation Performance Management
March 25, 2013

Eric Ross

Eric.Ross@dot.gov

Transportation Performance Management Engineer

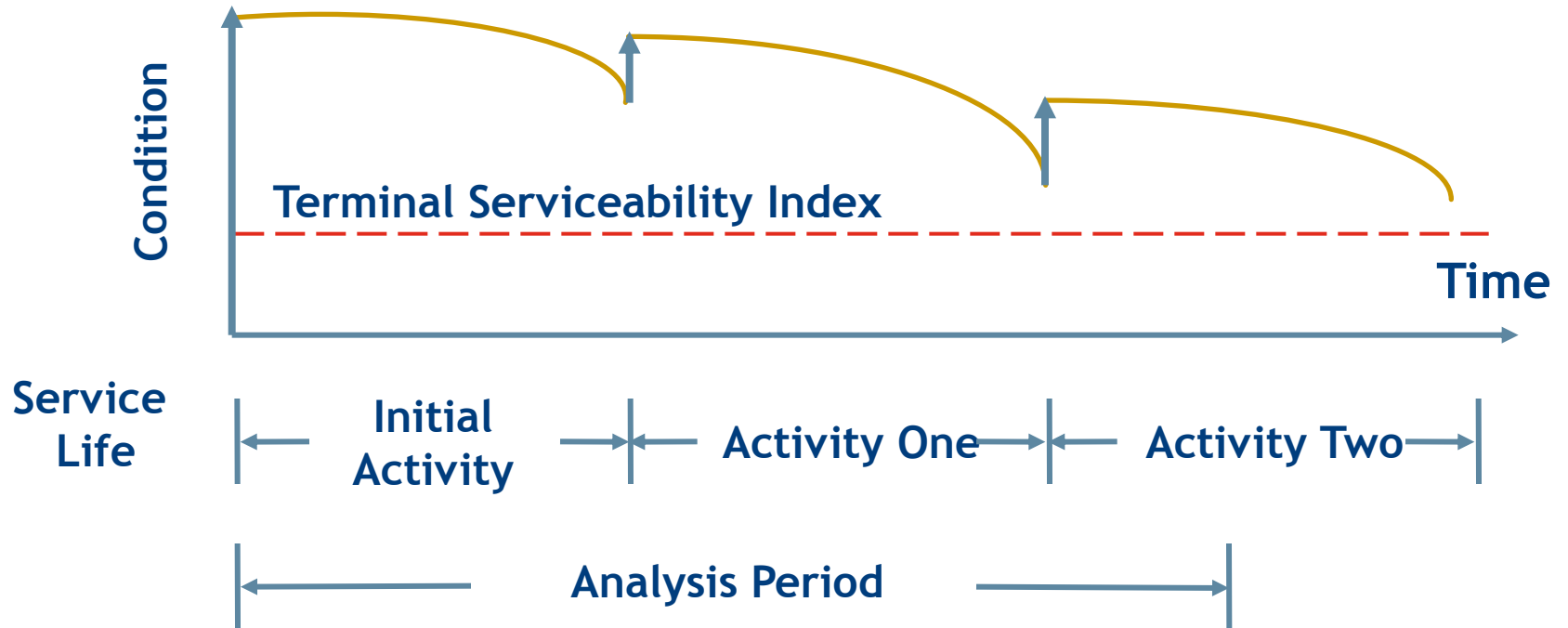


LCCA and RealCost in Map-21/TPM

- LCCA
 - Economic Analysis
 - Compares Different Alternatives
 - Discount Rates
- What Do you need?
 - Agency costs
 - Design, Activity timing,**
 - Structural Life, Functional Life,**
 - Analysis Period,**
 - User Costs
 - Activity Duration, Capacities,**
 - Speeds, ADT, Operating Costs, ...**



Life Cycle



When will the future maintenance and rehabilitation costs be incurred?



Computing Life-Cycle Costs

Present Value =
of Costs

$$\sum_{k=0}^N \left[(\text{Cost}_k) \times \left[\frac{1}{(1+d)^{n_k}} \right] \right]$$

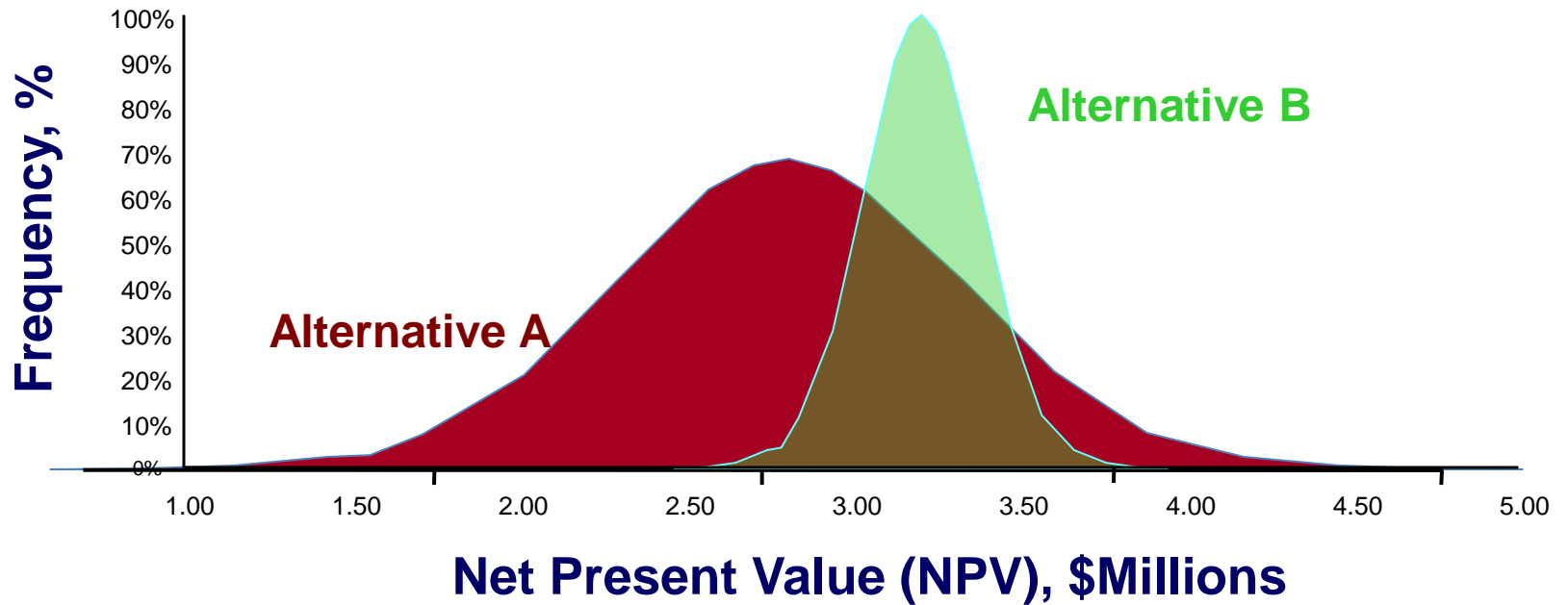


Present Value
Factor

Cost = Cost of the activity
N = length of analysis period
d = discount rate
 n_k = year of expenditure



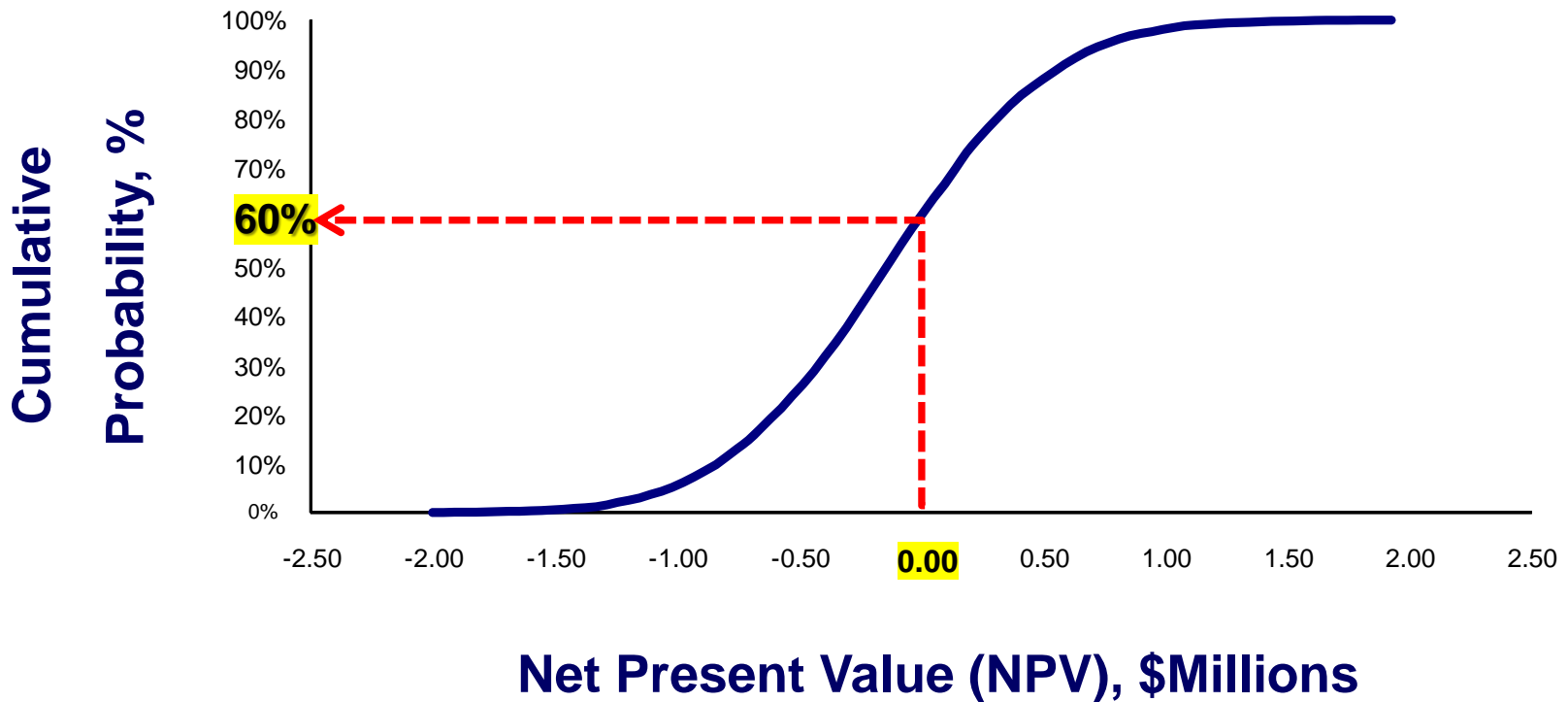
Probabilistic Approach



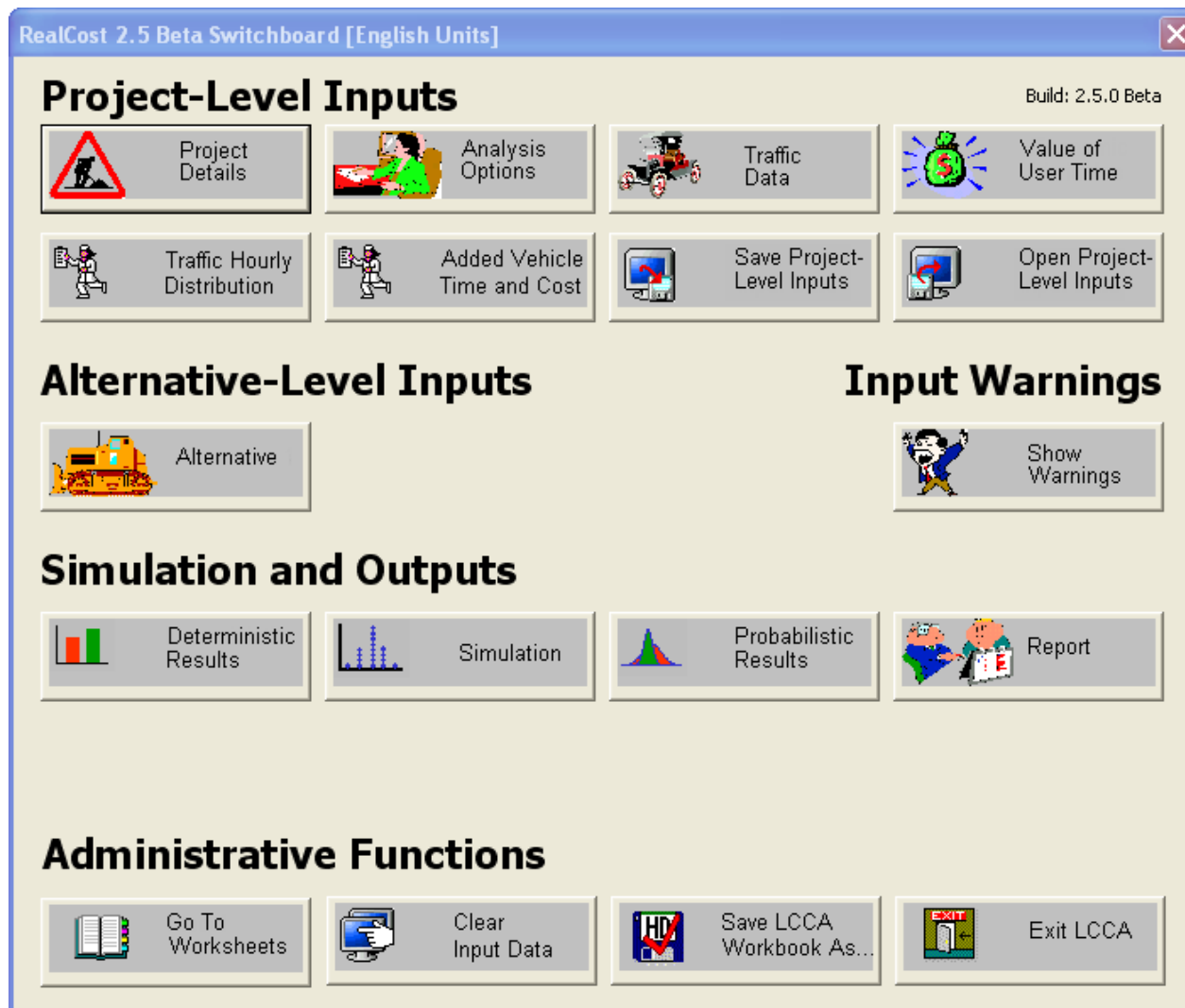
Difference Distribution Curve

Alt A – Alt B

60% of the Time Alternative A will be Less than Alternative B.

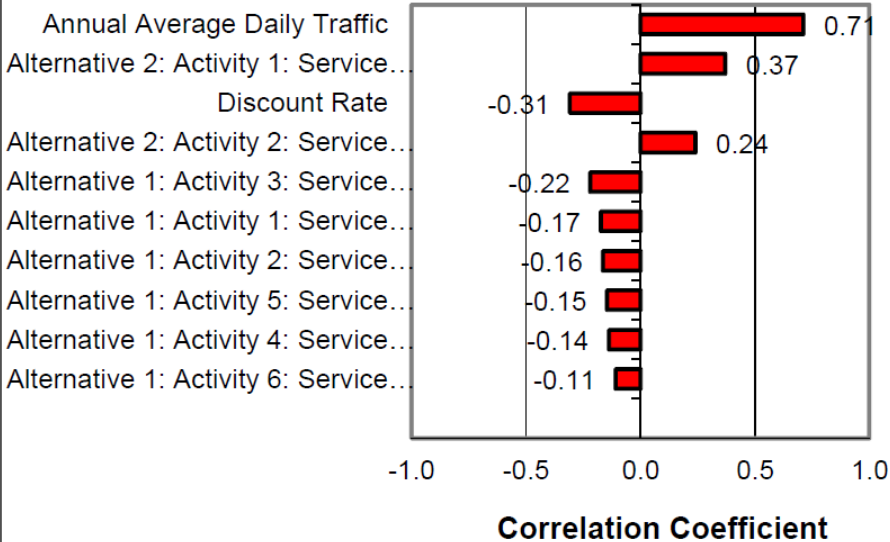


LCCA Software - RealCost™

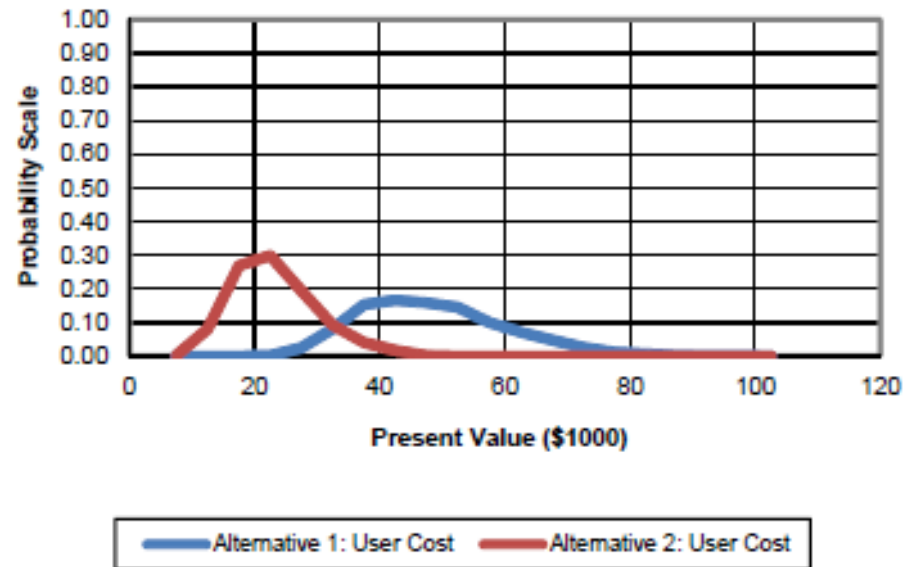


Total Cost (Present Value)	Alternative 1: HMA PAVEMENT (Night Work)		Alternative 2: PCC PAVEMENT (Night Work)	
	Agency Cost (\$1000)	User Cost (\$1000)	Agency Cost (\$1000)	User Cost (\$1000)
Mean	\$6,428.98	\$48.50	\$6,529.46	\$23.19
Standard Deviation	\$565.53	\$11.59	\$368.93	\$6.77
Minimum	\$4,550.47	\$23.26	\$5,291.57	\$7.83
Maximum	\$8,147.40	\$97.03	\$7,742.34	\$62.46

User Cost - Difference (Alt 1- Alt 2)



User Cost



Tools for Staying Ahead of the Curve

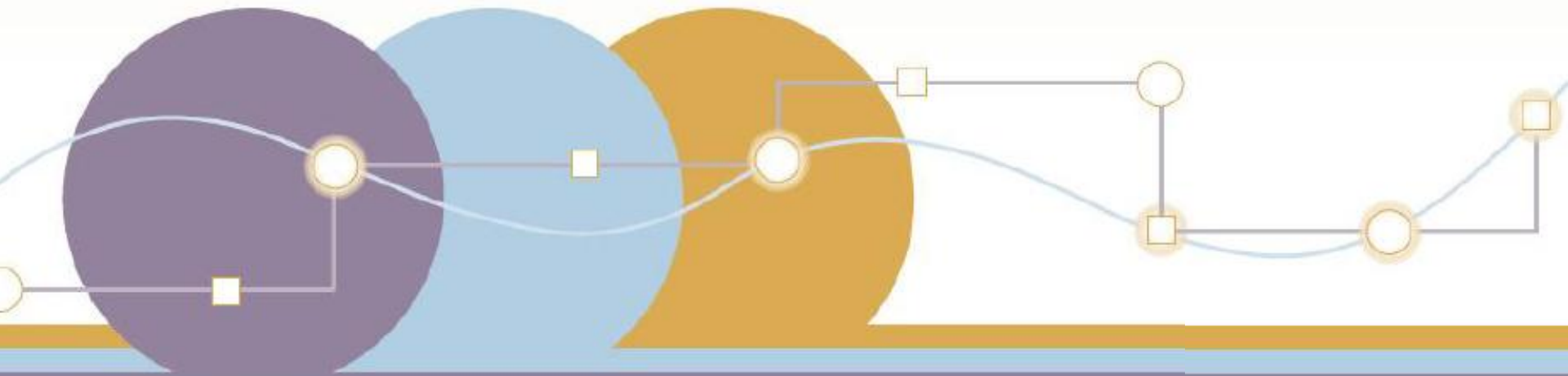
Benefit-Cost Analysis

An Investment/Economic Analysis Tool

TPM Exchange

Office of Transportation Performance Management
March 25, 2013

Nathaniel D. Coley, MBA
Structural Engineer/Economist
Office of Transportation Performance Management



Why Investment/Economic Analysis?



- System demands far outweigh available & expected resources
- Links accountability to decision making
- Proven process for evaluating alternatives
- MAP-21 Requirements
“link investments to outcomes”
 - Investment Plans
 - Performance-Based Plans
 - Financial Plans



Analyzing Transportation Decisions

- We typically evaluate objectives individually but program projects as a package of objectives

Crash
Modification
Factors

Other Areas

Congestion
Reduction

Bridge/Pavement
Investments

Emissions
Reductions



Analyzing Transportation Decisions

- We need to evaluate investment decisions on a project by project bases considering all factors



Analyzing Transportation Decisions

Building a Program or Plan

	Benefit – Cost Ratio	Safety ROI	Life-Cycle Costs	Environmental ROI
Overall Project Merit	7.3	\$2.3m -234 crashes Avoided	5.1mil	\$3.1m Or NO _x
Overall Project Merit	2.1	\$2.3m -234 crashes Avoided	7.1mil	\$7m Or CO
Overall Project Merit	.03	\$2.3m -234 crashes Avoided	15.1mil	\$1.9m Or NO _x
Overall Project Merit	-2	\$2.3m -234 crashes Avoided	22.1mil	\$5.3m Or NO _x



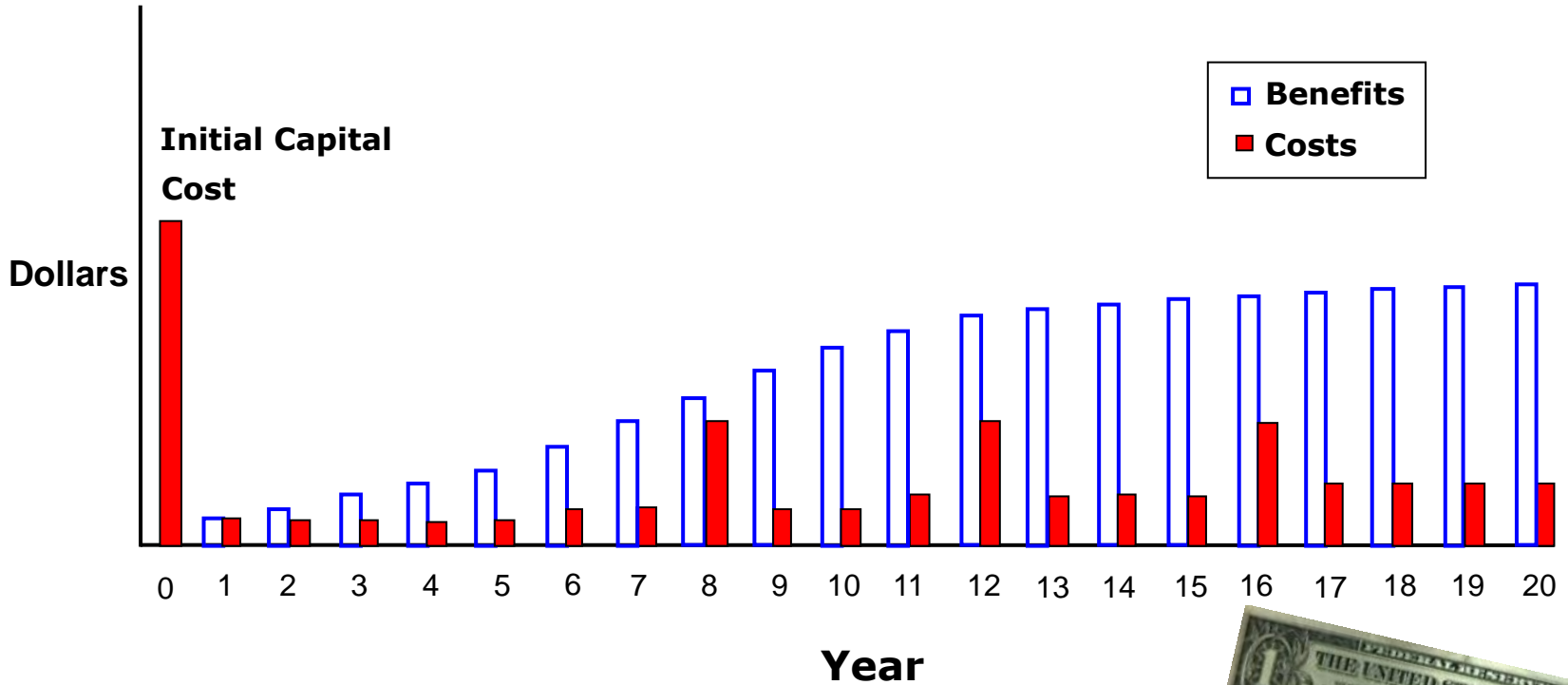
Economic/Investment Analysis

For public agencies benefit-cost analysis results describe ROI.

Traditional benefit cost analysis and ROI analysis for transportation includes user benefits (time, cost, safety) for travelers and select environmental effects (air, quality, noise) along with capital, operations, and maintenance(O&M) costs.



Economic/Investment Analysis



Example Benefits

- Reduced Accident Costs
- Reductions in Delay Costs
- Reduced noise or emissions



We monetize benefits & account for the changing value of a dollar over time



Economic/Investment Analysis: Tools

- **BCA.NET:** web-based project-level benefit-cost analysis tool

U.S. Department of Transportation
Federal Highway Administration

BCA.Net Highway Project Benefit-Cost Analysis System
Office of Asset Management

Navigation Bar and Menu (Ctrl+1) ==> >Manage >Strategies >Project >Parameters >Scenario >Simulation **Results** >Admin Help Logout

Current Settings ==> User: dbrod Dataset: Initial Project: US-88 Improvement Design Alt.1 Scenario: Base, with ranges Results: US-88 Design

Results: US-88 Design Alt. 1

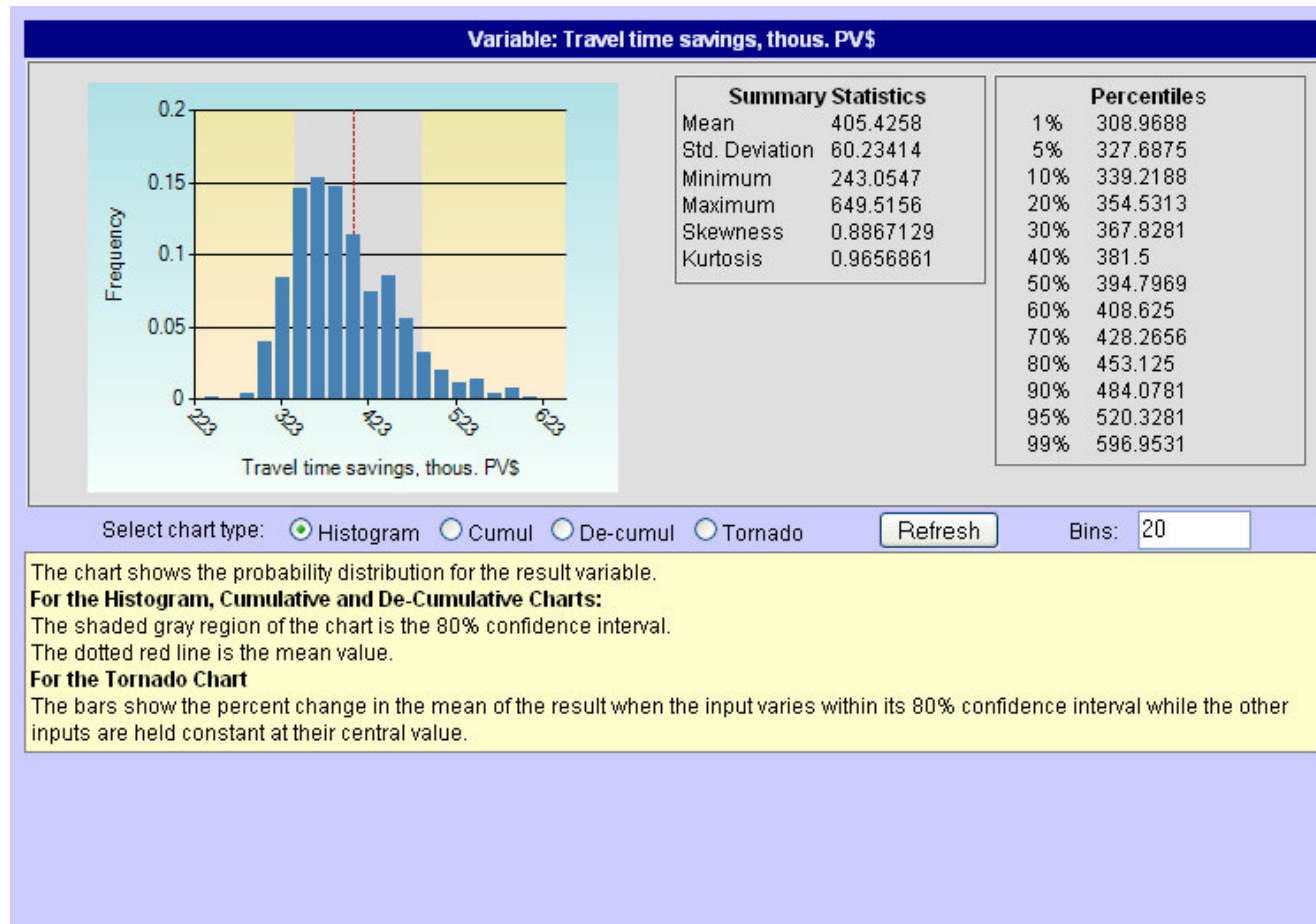
Selected results data group: Benefit-Cost Summary

	Variable	Mean Value	Standard Deviation
View	Travel time savings, thous. PV\$	88.3	14.82222
View	Vehicle operating cost savings, thous. PV\$	77.2	9.594951
View	Safety benefits, thous. PV\$	-2.9	0.4961381
View	Environmental benefits, thous. PV\$	0.0	0
View	Project residual value, thous. PV\$	121.1	7.057887
View	Disbenefit of traffic disruption from construction, thous. PV\$	0.0	0
View	Total benefits, thous. PV\$	283.8	24.80117
View	Of this, benefits to new users, thous. PV\$	0.0	0.004338904
View	Total costs, thous. PV\$	1129.7	51.36357
View	Net benefits, thous. PV\$	-846.0	46.4683
View	Benefit-cost ratio	0.25	0.01990146
View	Rate of return, percent	-6.19	0.5805153



Economic/Investment Analysis: Tools

- **BCA.NET:** web-based project-level benefit-cost analysis tool



Economic/Investment Analysis: Tools

- **BCA.NET:** web-based project-level benefit-cost analysis tool
- **Surface Transportation Efficiency Analysis Model:** corridor-level benefit cost analysis tool for large transportation projects

Surface Transportation Efficiency Analysis Model

File Edit Run Results Help

MODEL PARAMETERS

- Value of Time
 - In-Vehicle
 - Walk and Wait
 - Discount Rate
 - Cost per Gallon of Fuel
 - Fuel Consumption Rates
 - Non-Fuel Highway User Cost Per Mile
 - Emission Costs Per Ton
 - HC Emission Rates Per Vehicle Mile
 - CO Emission Rates Per Vehicle Mile
 - NOx Emission Rates Per Vehicle Mile
 - PM10 Emission Rates Per Vehicle Mile
 - Cost Per Accident
 - Emissions Per Cold Start
 - Cold Starts Per Vehicle Trip
 - Fatality Rates
 - Injury Rates
 - PDO Crash Rates
 - Noise Damage Costs
 - Other Mileage-Based External Costs
 - Non-Mileage Based External Costs
 - Transit Agency Unit Costs

In-Vehicle Value of Time

Restore Defaults

Mode	\$/Hour
Auto	6
Truck	24.64
Carpool	6
Local Bus	6
Express Bus	6
Light Rail	6
Heavy Rail	6
Other	6

Scenario: C:\STEAM\EXAMPLE\SCENARIO4.INP Output: Market Sector: Bus 12:01 PM



Economic/Investment Analysis: Tools

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Surface Transportation Efficiency Analysis Model

File Edit Run Results Help

Scenario Results - C:\STEAM\EXAMPLE\SCENARIO.OUT

SCENARIO OUTPUT - Any City, USA

Input File - C:\STEAM\EXAMPLE\SCENARIO2.IMP
 Output File - C:\STEAM\EXAMPLE\SCENARIO.OUT
 Time Stamp - Mon Jun 09 10:01:00 AM

TRAVEL DEMAND	AUTO	TRUCK	CPool	L-BUS	X-BUS	L-RAIL	H-RAIL	OTHER	TOTAL
WMT (Million WMT/yr)									
Base Case	6744.8	159.0	29.3	0.0	0.0	0.0	0.0	0.0	6933.2
Improvement Case	6789.6	159.0	32.1	0.0	0.0	0.0	0.0	0.0	6961.5
Change	44.8	0.7	2.8	0.0	0.0	0.0	0.0	0.0	48.2
Person Trips (Million/yr)									
Base Case	1425.1	4.4	4.7	12.5	0.0	10.3	0.0	0.0	1457.0
Improvement Case	1425.2	4.4	4.9	12.4	0.0	10.0	0.0	0.0	1457.1
Change	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.4
Person Hours (Million/yr)									
Base Case	499.2	4.7	2.9	0.0	0.0	0.0	0.0	0.0	506.8
Improvement Case	492.7	4.4	3.0	0.0	0.0	0.0	0.0	0.0	490.1
Change	-16.5	-0.3	0.1	0.0	0.0	0.0	0.0	0.0	-16.7
TONS OF EMISSIONS									
WMT Related Emissions (Tons/yr)									
Base Case									
HC	20152.5	520.0	77.5	0.0	0.0	0.0	0.0	0.0	20750.0
CO	161685.0	4025.0	615.0	0.0	0.0	0.0	0.0	0.0	166325.0
NOx	12792.5	1862.5	55.0	0.0	0.0	0.0	0.0	0.0	14710.0
PM10	297.5	267.5	2.5	0.0	0.0	0.0	0.0	0.0	567.5

Scenario: Output: Market Sector: 12:12 PM



Economic/Investment Analysis: Tools

- **BCA.NET:** web-based project-level benefit-cost analysis tool
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- **NBIAs:** System level bridge needs assessment tool



Economic/Investment Analysis: Tools

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NBIAS Bridge Viewer Utility State: Massachusetts

Bridge Number	Full Bridge ID	District	County	Functional Class	Year Built	Lanes On	Lanes Under	Design Load	Structure Flared
4965	251Y01016476MHDNBI	05	001	16	1970	02	02	4	0
4964	251Y01015477MHDNBI	05	001	16	1970	02	02	4	0
4963	251Y01014473MHDNBI	05	001	12	1971	02	00	4	0
4962	251Y01013478MHDNBI	05	001	12	1970	02	00	4	0
4961	251Y01012478MHDNBI	05	001	12	1970	03	02	4	1
4960	251Y0100748FMHDNBI	05	001	16	1954	02	04	4	0
4959	251Y0100647AMHDNBI	05	001	12	1954	03	02	4	0
4958	251Y01005475MHDNBI	05	001	12	1966	02	02	4	0
4957	251Y01005474MHDNBI	05	001	12	1953	02	02	4	0
4956	251W460113YKMHDNBI	05	021	16	1965	02	03	4	0
4955	251W460113YJMHDNBI	05	021	16	1965	02	03	4	0
4954	251W460103RYMHDNBI	05	021	11	1966	04	02	6	0

Inventory Scenario

On/Under	Route Signing Prefix	Level of Service	Vertical Clearance Inventory	Bypass Length	Functional Class	NHS On/Off	Lanes On	ADT Total	Year of ADT	Approach Road Wid
1	2	1	9999	007	12	1	02	023000	2003	0116

Tracing Enabled

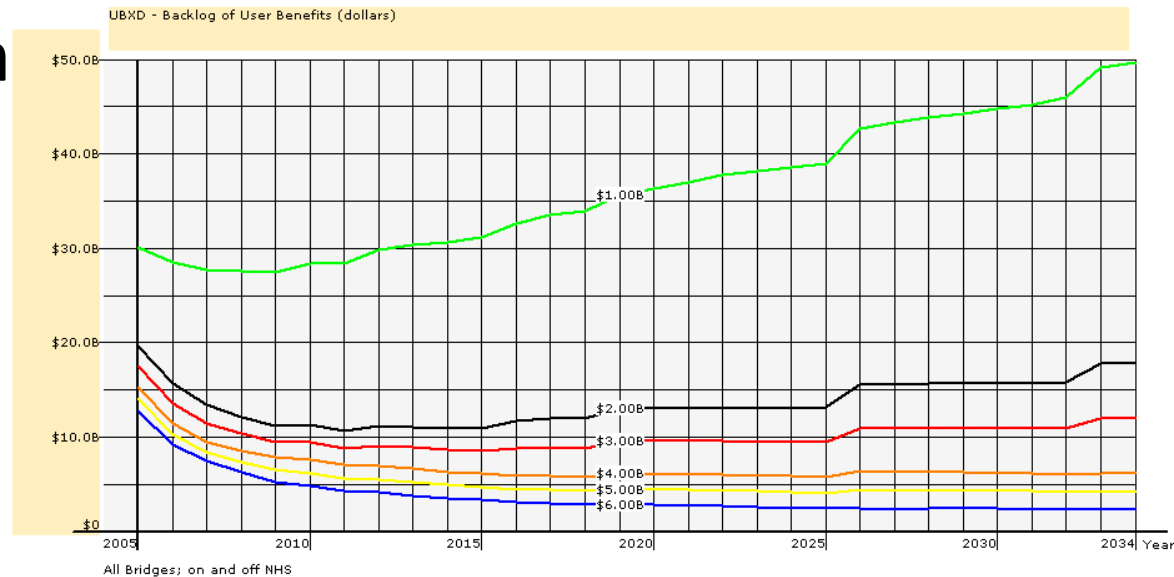
Element Number	Element Name	Quantity	Pct 1	Pct 2	Pct 3	Pct 4	Pct 5
22	Concrete Deck - Protected w/ Rigid Overlay	380.90	100	0	0	0	0
107	Painted Steel Open Girder/Beam	175.80	100	0	0	0	0
215	Reinforced Conc Abutment	36.77	100	0	0	0	0
301	Pourable Joint Seal	36.77	100	0	0	0	0
311	Moveable Bearing (roller, sliding, etc.):	6.00	100	0	0	0	0
313	Fixed Bearing	6.00	100	0	0	0	0
331	Reinforced Conc Bridge Railing	58.60	100	0	0	0	0

Database: 'NBIAS Training'. Statistics: 4955 structures.



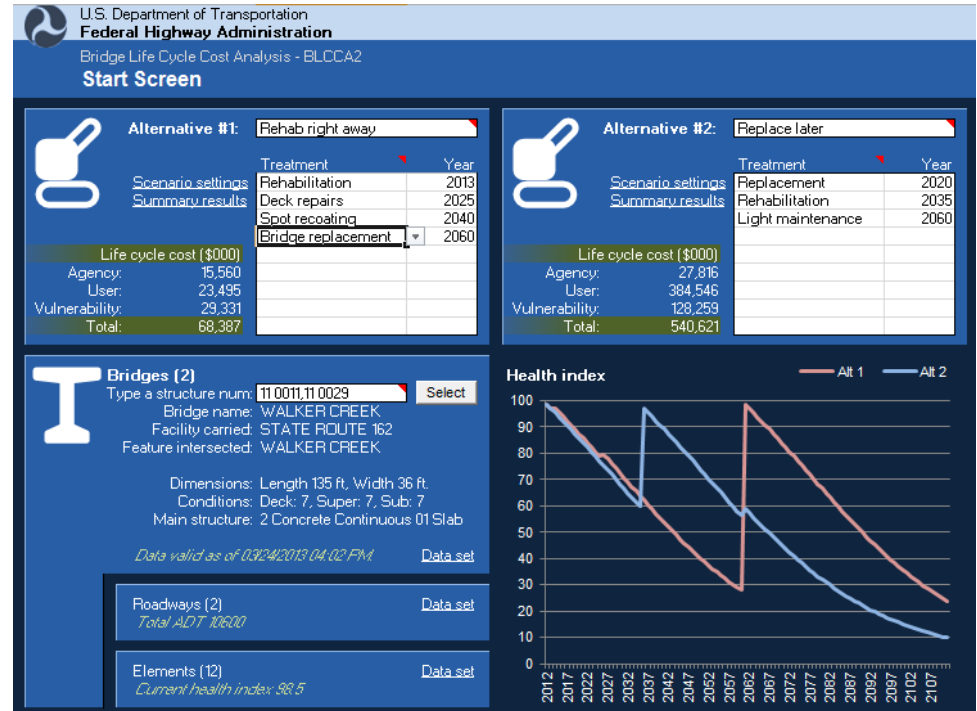
Economic/Investment Analysis: Tools

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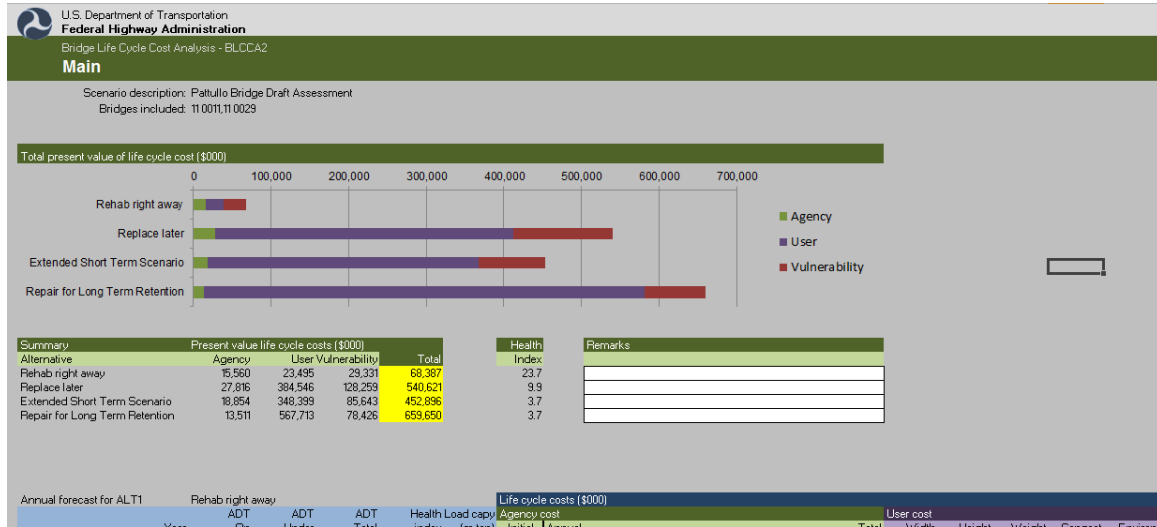
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- **BLCCA2: Bridge Life-Cycle Cost Analysis**



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Nathaniel D. Coley Jr.

Federal Highway Adm.

Washington, DC

NColey@dot.gov

202-366-2171

<http://www.fhwa.dot.gov/infrastructure/asstmgmt/economic.cfm>



Tools for Staying Ahead of the Curve

HSM and Related Analysis Tools

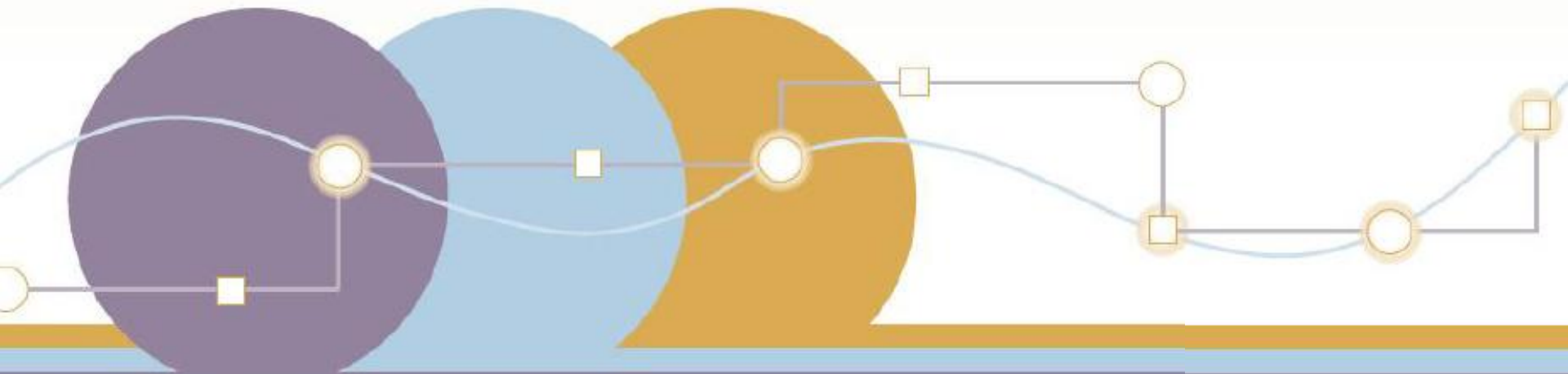
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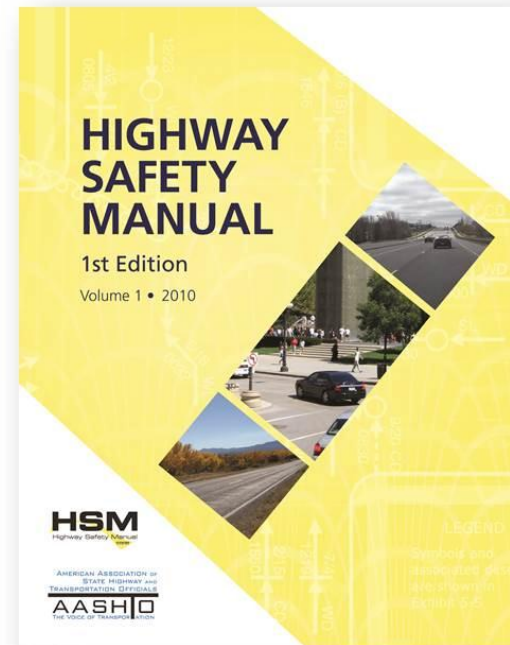
Esther Strawder

Safety Specialist, FHWA- Office of Safety



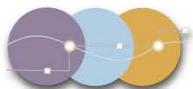
What is the HSM?

- The HSM is a tool for estimating safety performance of design and traffic control elements being evaluated in the project development process
- The HSM introduces a science-based approach that allows safety to be quantitatively evaluated alongside traffic operations, environmental impacts and construction costs
- Provides analytical tools and techniques for quantifying the potential effects on crashes as a result of decisions made in planning, design, operations, and maintenance



HSM Related Analysis Tools

HSM Section	Related Tools	Web links
Part B: Roadway Safety Management Process	<i>SafetyAnalyst</i>	www.safetyanalyst.org
Part C: Predictive Methods	IHSDM	www.ihsdm.org
Part D: Crash Modification Factors (CMFs)	CMF Clearinghouse	cmfclearinghouse.org



How do the tools relate to HSM?



- **Safety Analyst** provides a set of software tools used by state and local highway agencies for the highway safety management process documented in Part B of the HSM
- **Safety Analyst** can be used by highway agencies to improve their programming of site-specific highway safety improvements.
- The *IHSDM* Crash Prediction Module (CPM) provides a faithful software implementation of the crash prediction methods documented in Part C of the HSM
- **IHSDM** is a suite of software analysis tools for evaluating safety and operational effects of geometric design decisions on highways



CMF Clearinghouse

Crash Modification Factors Clearinghouse - Windows Internet Explorer

http://www.cmfclearinghouse.org/

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Crash Modification Factors Clearinghouse

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Quick Search

enter search term(s)

- narrow by countermeasure category -

- narrow by crash type -

- narrow by crash severity -

- narrow by roadway type -

[Advanced Search](#) [Need Help?](#) **Search CMFs**

Highway Safety Manual

The first edition of the Highway Safety Manual is now available! Find out how to order a copy and see news related to the HSM.

1 2 3 4

Recently Added CMFs

Improve pavement friction (increase skid resistance)	Install chevron signs on horizontal curves	Install raised median
CMF: 0.866	CMF: 0.84	CMF: 0.75
CRF: 13.4	CRF: 16	CRF: 25
	Crash type: Non-	Crash type: All

A crash modification factor (CMF) is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site. The Crash Modification Factors Clearinghouse houses a Web-based database of CMFs along with supporting documentation to help

Done Internet 100%



QUESTIONS

Ray Krammes – Data & Analysis Team Leader

Ray.Krammes@dot.gov

(202) 366-2175

Mshadoni Smith – HSM & Analysis Tools POC

Mshadoni.Smith@dot.gov

(202) 366-7105

Esther Strawder – Integration & Planning POC

Esther.Strawder@dot.gov

(202) 366-6836

Karen Scurry – CMF Clearing House

Karen.Scurry@dot.gov

(609) 637-4207

Clayton Chen – IHSDM

Clayton.Chen@dot.gov

(202) 493-3054



Tools for Staying Ahead of the Curve

MAP-21 Website

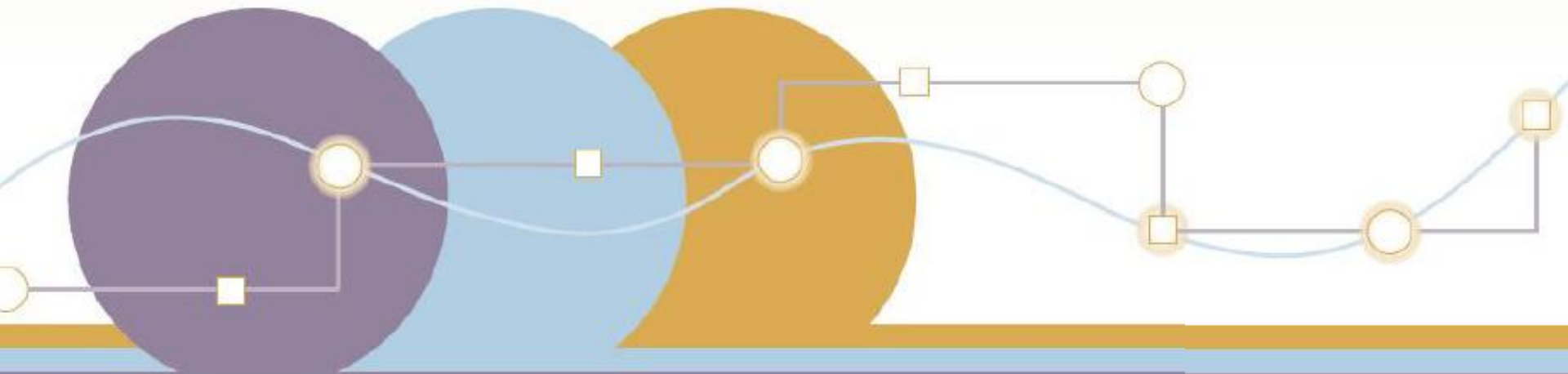
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March 25, 2013

Michael Nesbitt

Stakeholder Engagement Liaison



U.S. Department of Transportation
Federal Highway Administration

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MAP-21

Moving Ahead for Progress in the 21st Century

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Funding Tables
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Guidance

MAP-21, the Moving Ahead for Progress in the 21st Century Act (P.L. 112-141), was signed into law by President Obama on July 6, 2012. Funding surface transportation programs at over \$105 billion for fiscal years (FY) 2013 and 2014, MAP-21 is the first long-term highway authorization enacted since 2005.

MAP-21 is a milestone for the U.S. economy and the Nation's surface transportation program. By transforming the policy and programmatic framework for investments to guide the system's growth and development, MAP-21 creates a streamlined and performance-based surface transportation program and builds on many of the highway, transit, bike, and pedestrian programs and policies established in 1991.

To view PDF files, you can use the [Acrobat® Reader®](#).

Recently Added

- 2/22 - [Railway-Highway Crossings Program Reporting Guidance](#)
- 2/22 - [Highway Safety Improvement Program Reporting Q and As](#)
- 2/13 - [Highway Safety Improvement Program Reporting Guidance](#)
- 2/13 - [Older Drivers and Pedestrians Special Rule Interim Guidance and Q and As](#)

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Federal Highway Administration

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Summary

Q & A

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MAP-21

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- Q & A**
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Questions & Answers

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- **Infrastructure**
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 - [Suballocation \(updated 1/7/2013\)](#)
 - [Bridge](#)
 - [Performance Management](#)
 - [Construction Contracts](#)
 - [Buy America](#)
 - [Preconstruction / Value Engineering](#)
 - [Asset Management](#)
 - [Ferry Boats](#)
 - [Stewardship and Oversight](#)
 - [Emergency Relief](#)
 - [Pavement Materials](#)
 - [Application Development Highway System \(added 12/27/2012\)](#)

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- Guidance



MAP-21 - Moving Ahead for Progress in the 21st Century

Summary	Performance Management Questions & Answers
Q & A	Posted 9/25/2012
Fact Sheets	
Cross Reference	Question 1: Please describe the process that USDOT will utilize to solicit input in the establishment of performance measures?
Reports	Answer 1: USDOT is planning to provide opportunities for stakeholders to contribute their input regarding the measures required under 23 U.S.C. 150(c) (newly-established by section 1203 of MAP-21). Information will be provided on the USDOT and FHWA websites soon with more information on these opportunities. In addition, stakeholders can provide their input regarding the required measures by contacting Francine Shaw Whitson by phone at (202) 366-8028, by email at FSWhitson@dot.gov , or mail at Federal Highway Administration, 1200 New Jersey Ave., SE, Washington, D.C. 20590.
Presentations	Also, for the notice of proposed rulemaking (NPRM), 23 U.S.C. 150(c)(2) requires the Secretary to provide no less than 90 days for the public to comment on the NPRM. The Secretary is also required to take into consideration any comments relating to a proposed regulation received during that comment period.
Legislation	Question 2: Are States required to set performance targets? If so, when are they due?
Funding Tables	Answer 2: States are required to establish targets that reflect the measures established by the USDOT under 23 U.S.C. 150(c), where applicable. A State may, as appropriate, provide for different targets for urbanized and rural areas. To ensure consistency, States must, to the maximum extent practicable, coordinate with the relevant MPO and with providers of public transportation in an urbanized area not represented by an MPO. The State must establish these targets within than 1 year after the USDOT final rule on performance measures. (23 U.S.C. 135 & 150)
Webinars	Question 3: Are MPOs required to set performance targets? If so, when are they due?
Guidance	Answer 3: Metropolitan Planning Organizations (MPOs) are required to establish targets for each measure established in 23 U.S.C. 150(c), where applicable. MPOs are required to establish targets in coordination with the relevant State/s and, to the maximum extent practicable, with providers of public transport transportation no later than 180 days after the date on which the relevant State/s or the provider of public transportation establishes their performance targets. (23 U.S.C. 134)
	Question 4: MAP-21 sets forth a limited set of areas in which USDOT can establish performance measures. Does USDOT have authority to establish measures for other areas?
	Answer 4: USDOT is limited under MAP-21 to establishing national measures on which the States must report to only those listed in the new 23 U.S.C. 150(c).



MAP-21

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- [Appalachian Development Highway System](#) (PDF, 13 KB)
- [Apportionment](#) (PDF, 97 KB)
- [Bridge and Tunnel Inspection](#) (PDF, 27 KB)
- [Congestion Mitigation and Air Quality Improvement Program \(CMAQ\)](#) (PDF, 38 KB)
- [Construction of Ferry Boats and Ferry Terminal Facilities](#) (PDF, 20 KB)
- [Emergency Relief](#) (PDF, 23 KB)
- [Metropolitan Planning](#) (PDF, 27 KB)
- [National Highway Performance Program \(NHPP\)](#) (PDF, 45 KB)
- [Performance Management](#) (PDF, 37 KB)
- [Railway-Highway Crossings](#) (PDF, 22 KB)
- [Significant Freight Provisions](#) (PDF, 33 KB)
- [Highway Use Tax Evasion](#) (PDF, 18 KB)
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- [Surface Transportation Program \(STP\)](#) (PDF, 37 KB)
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Performance Management

Program purpose

A key feature of MAP-21 is the establishment of a performance- and outcome-based program. The objective of this performance- and outcome-based program is for States to invest resources in projects that collectively will make progress toward the achievement of the national goals.

Statutory citation(s): MAP-21 §§1106, 1112-1113, 1201-1203; 23 USC 119, 134-135, 148-150

National policy in support of performance management

"Performance management will transform the Federal-aid highway program and provide a means to the most efficient investment of Federal transportation funds by refocusing on national transportation goals, increasing the accountability and transparency of the Federal-aid highway program, and improving project decision-making through "[§1203; 23 USC 150(a)]

National performance goals

Establishes national performance goals for the Federal-aid highway program in seven areas:

[§1203; 23 USC 150(b)]

Goal area	National goal
Safety	To achieve a significant reduction in traffic fatalities and serious injuries on all public roads
Infrastructure condition	To maintain the highway infrastructure asset system in a state of good repair
Congestion reduction	To achieve a significant reduction in congestion on the National Highway System
System reliability	To improve the efficiency of the surface transportation system
Freight movement and economic vitality	To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development
Environmental sustainability	To enhance the performance of the transportation system while protecting and enhancing the natural environment



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MAP-21 - Moving Ahead for Progress in the 21st Century

Summary	Cross Reference
Q & A	
Fact Sheets	Division A--Federal-Aid Highways and Highway Safety Construction Programs
Cross Reference	Title I--Federal-Aid Highways
Reports	Subtitle A--Authorizations and Programs
Presentations	1101. Authorization of appropriations.
Legislation	<ul style="list-style-type: none"> ◦ Highway authorization table
Funding Tables	1102. Obligation ceiling.
Webinars	<ul style="list-style-type: none"> ◦ FY 2013 Obligation Limitation Distribution Notice ◦ FY 2013 Redistribution of Certain Authorized Funds (lop-off distribution) ◦ Obligation Limitation Qs & As
Guidance	1103. Definitions.
	<ul style="list-style-type: none"> ◦ Miscellaneous Operations and Freight Provisions Qs & As ◦ National Highway System

Subtitle B--Performance Management

[Transportation Performance Management website](#)

1201. Metropolitan transportation planning.

- [Planning Qs & As](#)
- [Fact Sheet: Metropolitan Planning](#)
- [Metropolitan Planning Funds Guidance](#)

1202. Statewide and nonmetropolitan transportation planning.

- [Planning Qs & As](#)
- [State Planning and Research Fact Sheet](#)
- [Fact Sheet: Statewide and Nonmetropolitan Transportation Planning](#)

1203. National goals and performance management measures.

- [Performance Management Qs & As](#)
- [Fact Sheet: Performance Management](#)

1110. Highway use tax evasion projects.

- [Highway Use Tax Evasion Projects Fact Sheet](#)

1111. National bridge and tunnel inventory and inspection standards.

- [Bridge and Tunnel Inspection Fact Sheet](#)
- [Bridge Qs & As](#)

1112. Highway safety improvement program.

- [HSIP Fact Sheet](#)
- [HSIP Guidance](#)
- [HSIP Qs & As](#)
- [High Risk Rural Road Guidance](#)



TPM and MAP-21

Engagement

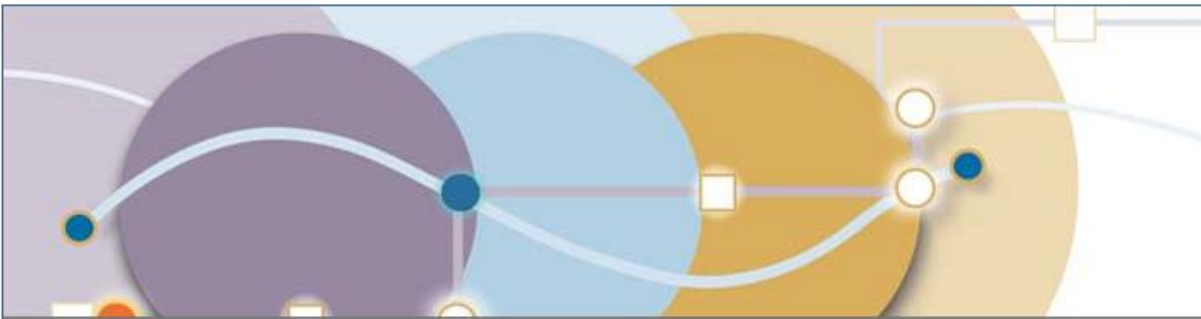
Resources

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Transportation Performance Management



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What is TPM?

Transportation Performance Management is a strategic approach that uses system information to make investment and policy decisions to achieve national performance goals.



What is TPM?



WSDOT's Effective Communication of Performance Drives Results



Rhode Island Collaborating for Performance



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- [MAP-21 Performance Requirements Summary](#)
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Engagement

- [Rulemaking Stakeholder Engagement](#)
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News and Events

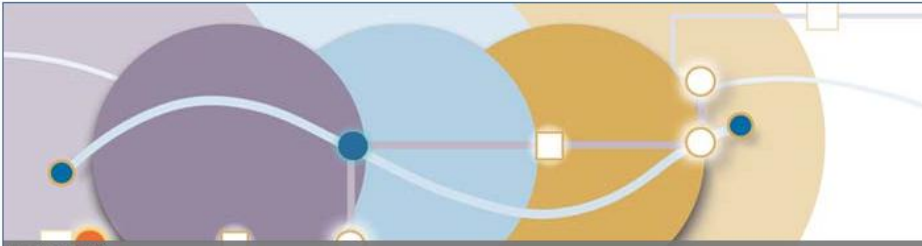
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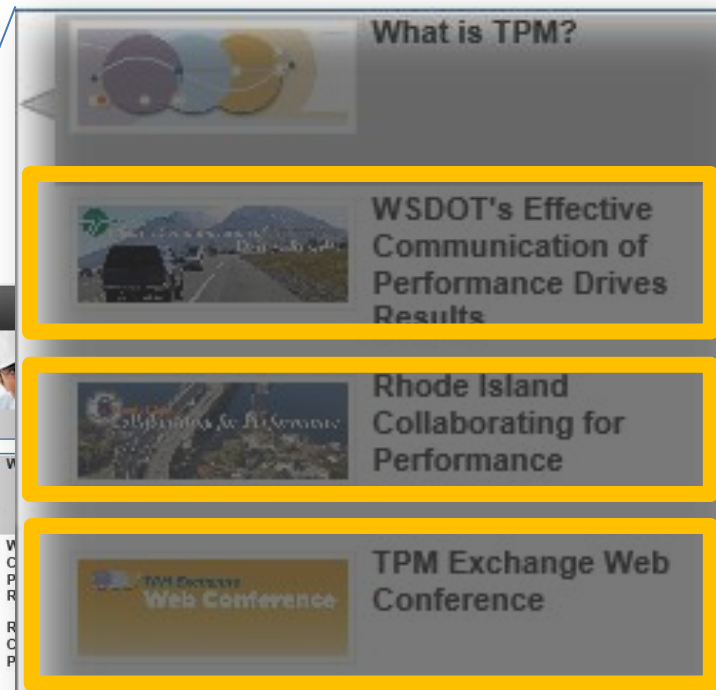
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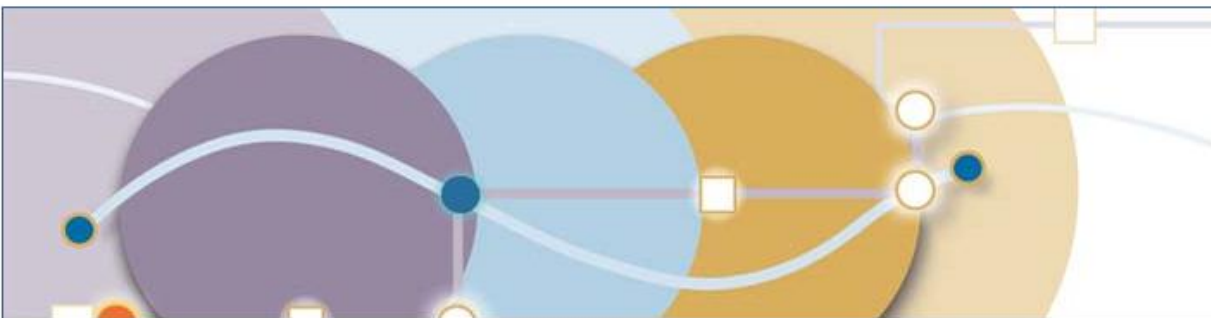
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What is TPM?

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Transportation Performance Management

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Noteworthy Practices

Many state and local agencies are successfully implementing innovative approaches to Transportation Performance planning, implementation, and evaluation. The individual case studies provide summaries of each practice, key accomplishments, results, and contact information for those interested in learning more.

- [North Carolina Refining a Performance Management System](#) (.pdf, 0.6 mb) **NEW!**
- [Pennsylvania Evaluating Performance Measures](#) (.pdf, 0.4 mb) **NEW!**
- [Performance-based Planning Case Studies](#)
- [Rhode Island Collaborating for Performance](#) (.pdf, 0.5 mb)
- [Virginia's Dashboard: Driving VDOT Success](#) (.pdf, 0.5 mb) **NEW!**
- [Washington State's Effective Communication of Performance Drives Results](#) (.pdf, 0.5 mb) **NEW!**
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Contacts

- [Tashia Clemons](#)



Do you want to learn more about collaborating on performance management with regional partners?

Contact

Michael Nesbitt

202-366-1179

Michael.Nesbitt@dot.gov



***Do you have a Noteworthy Practice or
Upcoming Event to share?***

Contact

Eric Ross

202-366-3975

Eric.Ross@dot.gov

Tashia J. Clemons

202-366-1569

Tashia.Clemons@dot.gov



Questions?

Thank You!

www.fhwa.dot.gov/tpm

