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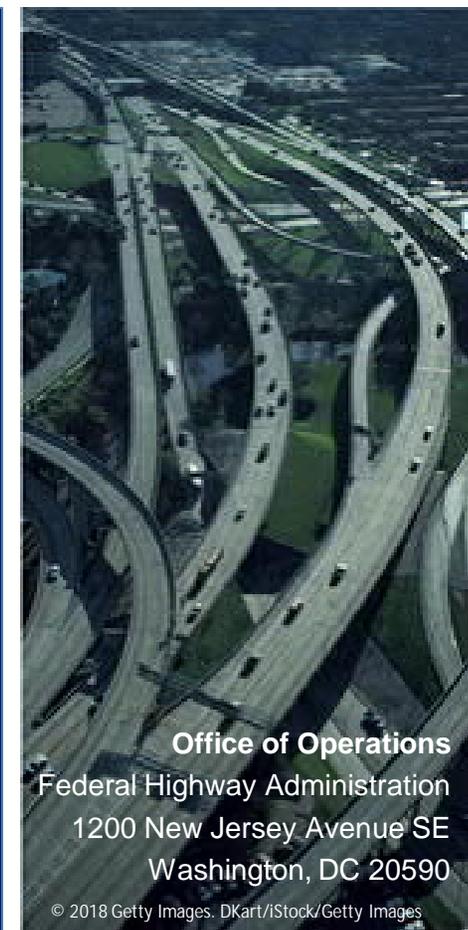


Making TSMO more Effective Through Active Management

National Operations Center of Excellence (NOCoE) Webinar
May 18, 2021



U.S. Department of Transportation
Federal Highway Administration



Office of Operations
Federal Highway Administration
1200 New Jersey Avenue SE
Washington, DC 20590

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Introductions and Webinar Purpose



Goals of the Webinar



1. Introduce the 4-step Active Management Cycle
 - Mechanism to improve any TSMO strategy
2. Introduce a self-assessment framework tool to:
 - Assess level of active management
 - Understand areas where improvements could be prioritized
3. Present a peer practitioner's perspective on the value of the framework tool
4. Show an application of the Framework Tool





Active Management: Context and Overview



Active Management Context

- A growing focus on more effective TSMO with:
 - Performance focus
 - New technology
 - Improved field and TMC procedures
 - Continuous improvement (Capability Maturity Model [CMM]/ Capability Maturity Framework [CMF])
 - Better data, analytics, forecasting
 - Transportation Systems Management and Operations (TSMO) Program Plans



Source: FHWA



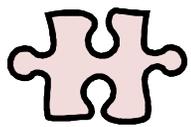
Active Management – What Is It?



- Taking a dynamic, performance-based approach to transportation management:
 - Focuses on the present and immediate future
 - Recognizes conditions vary, may not be “typical”
 - Centers on customers and their service needs
 - Recognizes system operation is 24 hours per day and 7 days a week, not just 8 am to 5 pm



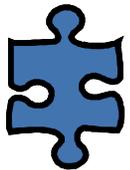
Origin: FHWA ATDM Program



- Active Demand Management (ADM): A suite of strategies intended to reduce or redistribute travel demand to alternate modes or routes. Incentivizes drivers by providing rewards for travelling during off peak hours with less traffic congestion.



- Active Traffic Management (ATM): A suite of strategies that dynamically influence travel behavior with respect to lane/facility choices to manage recurrent and non-recurrent congestion on existing facilities.



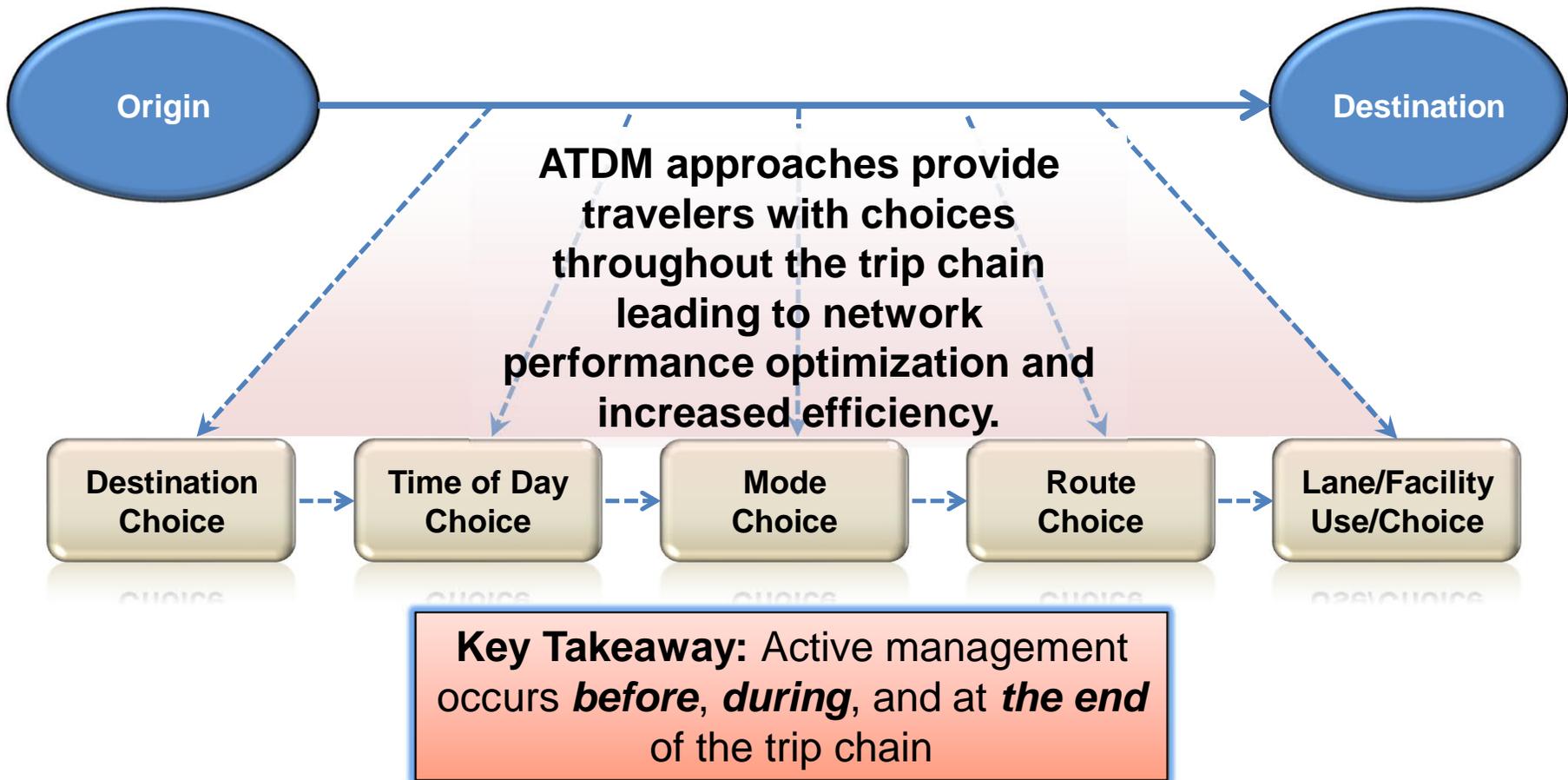
- Active Parking Management (APM): A suite of strategies designed to affect the demand on parking capacity.

Examples of ATDM Implementation Strategies

ADM	Comparative multi-modal travel times, dynamic ride-sharing, pricing, and incentive approaches.
ATM	Variable speed limits, dynamic shoulder use, queue warning, lane control.
APM	Parking pricing, real-time parking availability and reservation systems.



ATDM Throughout the Trip Chain



Source: FHWA



TSMO and Active Management



- More effective TSMO requires more sophisticated active management
- TSMO strategies generally follow a set of tactical steps
- Overlay an active management **cycle**

“Transportation agencies cannot simply provide transportation infrastructure and maintain it. They need to play a role in *actively managing* (emphasis added) transportation services and system assets to get maximum performance from the investment.”

– *Developing and Sustaining a Transportation Systems Management & Operations Mission for Your Organization: A Primer for Program Planning*

<https://ops.fhwa.dot.gov/publications/fhwah/op17017/index.htm>



Active Management Cycle



Source: FHWA

- **Monitoring the System**
 - Track transportation system status using real-time and historic data and analysis tools
- **Assessing System Performance**
 - Measure system performance using collected data and analysis tools
 - Determine if system performance is at desired level
- **Evaluating and Recommending Dynamic Actions**
 - Identify appropriate dynamic actions to improve level of active management
- **Implementing Dynamic Actions**
 - Implement recommended actions and continue to monitor system



Benefits of the Active Management Cycle



- Achieve better outcomes by
 - Improving steps in the cycle
 - Shortening latency among them
- Improve outcomes from better understanding
- Identify and respond to problems more quickly
- Increase system efficiency
- Provide timely and accurate traveler information

Reducing the latency between changing conditions and application of strategic responses improves strategy effectiveness.



Source: FHWA



Example: The Reaction Problem



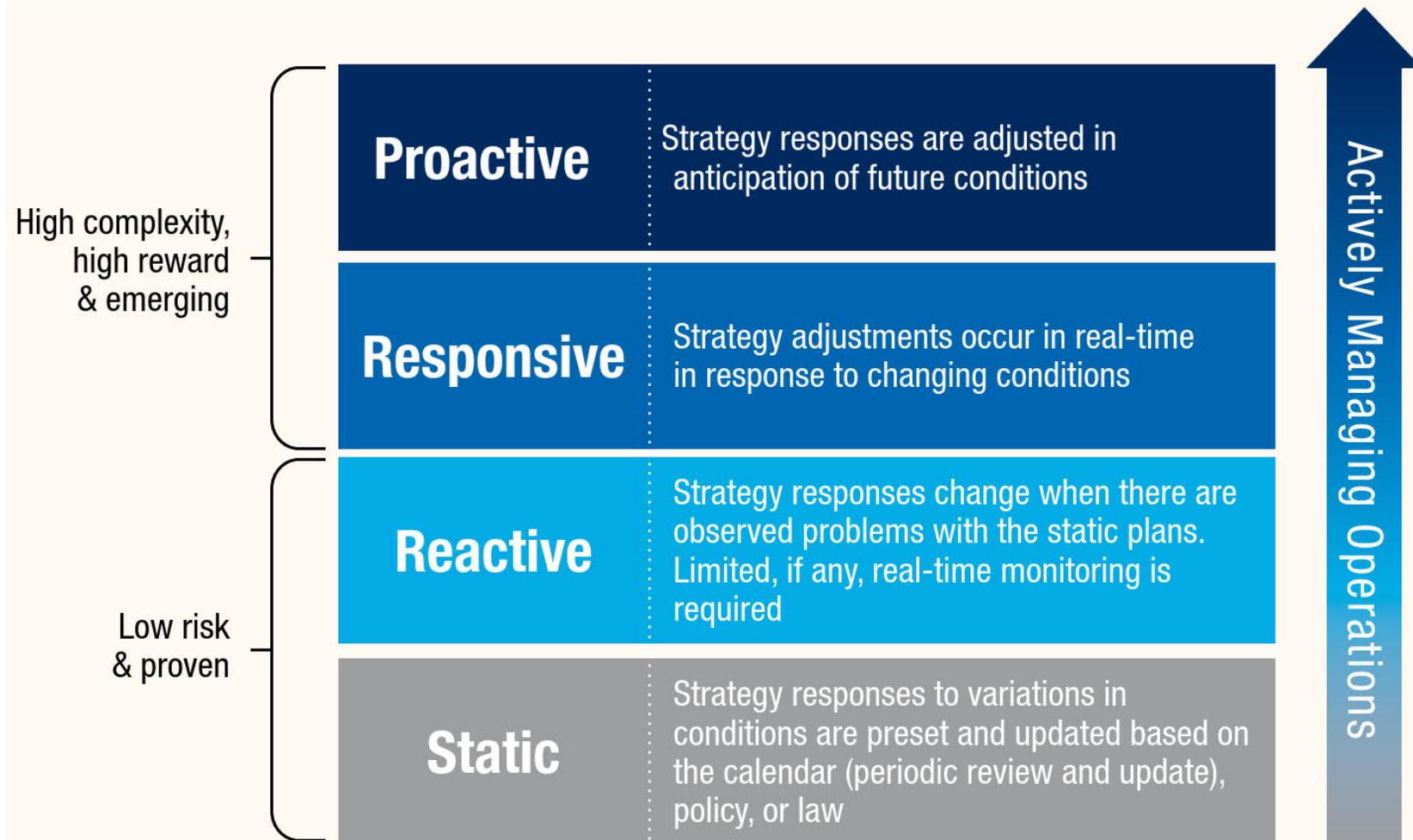
- Traffic flow breakdown point may be exceeded and little can be done to mitigate the problem
- Traffic conditions can change quickly



Source: VicRoads

Looking upstream 12

Levels of Active Management



Source: FHWA



Active Management Framework



- Combines:

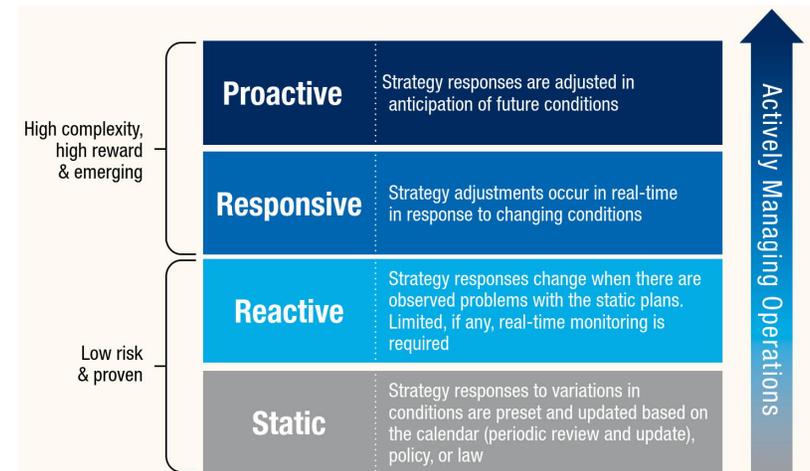
- Active Management Cycle Steps

with

- Levels of Active Management



Source: FHWA



Source: FHWA



Active Management Framework



Active Management Cycle Steps	Levels of Increasingly Active Management			
	Static	Reactive	Responsive	Proactive
Monitor System	Averages updated periodically.	Recurring performance variations and events captured.	Real-time temporal variations captured.	Anticipated or forecasted, and real-time conditions captured.
Assess System Performance	Based on averages.	Captures significant variations or events.	Captures real-time, varying conditions.	Performance is anticipated or forecasted.
Evaluate and Recommend Actions	Based on changes in average conditions.	Based on observed temporal variations.	Based on varying real-time conditions.	Based on anticipated or forecasted conditions.
Implement Dynamic Actions	Based on trend lines.	Based on regular variations and trends.	Real time to respond to real-time conditions.	Real time to anticipate forecasted conditions.

Transition Characteristics for Cycle Steps



Active Management Cycle Steps	Transition Characteristics			
	Static	Reactive	Responsive	Proactive
Monitor System	<p>No data capture from previous adjustments.</p> <p>No formal performance management.</p>	<p>Outcomes captured after set time period.</p> <p>Basic performance measurement.</p>	<p>Outcomes captured in real time.</p> <p>Comprehensive performance measurement.</p>	<p>Outcomes forecasted in real time.</p> <p>Performance informs models of real-time conditions.</p>
Assess System Performance	<p>No linkage to monitoring.</p> <p>Gaps in performance data.</p>	<p>Linkage to monitoring, but no real-time adjustment.</p>	<p>Monitored data integrated with assessment in real-time.</p>	<p>Monitored data integrated with assessment in real-time and models.</p>
Evaluate and Recommend Actions	<p>Tailored to average conditions.</p>	<p>Generalized for defined time because of latency.</p>	<p>Respond in real time to actual conditions.</p>	<p>Respond in real time to anticipated conditions.</p>
Implement Dynamic Actions	<p>Tailored to average conditions.</p>	<p>Generalized for a defined time period.</p>	<p>Respond in real time to actual conditions.</p>	<p>Respond in real time to anticipated conditions.</p>

Active Management Cycle Document



- Target audience (primary):
 - Senior managers with TSMO responsibilities
 - Traffic Management Center (TMC) managers
 - Managers of specific TSMO strategies
- Applications:
 - Specific TSMO strategy
 - TSMO program or set of strategies
 - Regional collaboration





Active Management Cycle Self-Assessment



Value of an Active Management Cycle Assessment



Stephanie Palmer, Michigan DOT



U.S. Department of Transportation
Federal Highway Administration

US-23 Flex Route- Active Traffic Management



Introduction to the Self-Assessment Framework Tool



1. Defining scope of the self-assessment
2. Conducting self-assessment
 - Assessment of individual Active Management Cycle steps and transitions between them
3. Interpreting results of self-assessment



Part 1 - Defining the scope



- Purpose and goals
- Stakeholders
- What TSMO strategy or group of strategies
- Geographic scope (facility, corridor, region, etc.)



Part 2 - Conducting the self-assessment



- Assessment of individual Active Management Cycle steps
 - Determine level of active management for each step: Monitor, Assess, Recommend, Implement
 - Consider transitions between steps



Part 3 - Interpreting the results



- General approach to improvement
- Target outcome
- Recommended guidance



Hypothetical Example Agency



- Lincoln DOT (LDOT) has a ramp metering system
- Metering rates calculated by ramp controller using:
 - Mainline detection adjacent to ramp
 - Ramp queue detectors
- LDOT monitors operation of ramp meters
 - CCTV
 - ATMS communicates with ramp controllers
 - No central ramp metering algorithm



Current Active Management Cycle Actions



- LDOT monitors the network well:
 - Real-time data
 - Actively monitors conditions and performance
- Performance metrics include:
 - Mainline travel time and travel time reliability
 - Mainline throughput
 - Ramp wait times
- Annual performance assessment
- Reviews metering parameters annually
 - Also, when noticeable problems arise
 - Modifies parameters as a result



Define Scope of Assessment



Lincoln DOT decided to assess ramp metering operations:

- Purpose and goals
 - Improve operational efficiency
- Stakeholders
 - TMC staff, local agencies, law enforcement
- TSMO strategy or group of strategies
 - Ramp metering
- Geographic scope (facility, corridor, region, etc.).
 - Region



Generic Assessment



Active Management Cycle Step	Levels in Increasingly Active Management			
	Static	Reactive	Responsive	Proactive
<p>Monitor System</p> <p>Existing practices with...</p> <ul style="list-style-type: none"> • Data collection/processing/archiving • Interval of actionable data availability • Infrastructure to collect/process/archive data • Data from previous adjustment • Passing monitoring data to assess ...permit → 	Averages updated periodically.	Recurring performance variations and events captured.	Real-time temporal variations captured.	Anticipated or forecasted, and real-time conditions captured.
<i>Assess System Performance</i>				
<i>Evaluate and Recommend Actions</i>				
<i>Implement Dynamic Actions</i>				



Example Agency Assessment Discussion



- Effective real-time monitoring
- Does not assess performance in real-time or near real-time:
 - Performance assessment scheduled annually
 - Assess performance after significant incidents and events
- Evaluate and recommend actions when assessing performance
 - Incorporate observations
- Implement improvements after recommending actions



Example - Monitor System



Active Management Cycle Step	Levels in Increasingly Active Management			
	Static	Reactive	Responsive	Proactive
<p>Monitor System Existing practices with...</p> <ul style="list-style-type: none"> • Data collection/processing/archiving • Interval of actionable data availability • Infrastructure to collect/process/archive data • Data from previous adjustment • Passing monitoring data to assess <p>...permit →</p>	Averages updated periodically.	Recurring performance variations and events captured.	Real-time temporal variations captured.	Anticipated or forecasted, and real-time conditions captured.



Assess System Performance



Active Management Cycle Step	Levels in Increasingly Active Management			
	Static	Reactive	Responsive	Proactive
<p>Assess System Performance</p> <p>Existing practices with...</p> <ul style="list-style-type: none"> • Data analytics (software, models) • Performance measurement • Most recent monitoring data from previous step • Passing assessment information to the evaluate and recommend step <p>...inform operational decisions by permitting →</p>	System performance based on averages.	System performance captures significant variations or events.	System performance captures real-time, varying conditions.	System performance is anticipated or forecasted.



Example Agency Assessment Discussion



- Effective real-time monitoring
- **Does not assess performance in real-time or near real-time:**
 - Performance assessment scheduled annually
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Example – Assess System



Active Management Cycle Step	Levels in Increasingly Active Management			
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Evaluate & Recommend Actions



Active Management Cycle Step	Levels in Increasingly Active Management			
	Static	Reactive	Responsive	Proactive
<p><i>Evaluate and Recommend Actions</i></p> <p>Operational decision-making based on...</p> <ul style="list-style-type: none"> • Policies and standards • System performance objectives • Temporal and geographic scope • Most recent assessment results from previous step • Passing recommendation on to the implement step <p>...result in recommendations that make →</p>	Recommended adjustments based on changes in average conditions.	Recommended adjustments based on observed temporal variations.	Recommended adjustments based on varying real-time conditions.	Recommended adjustments based on anticipated or forecasted conditions.



Example Agency Assessment Discussion



- Effective real-time monitoring
- Does not assess performance in real-time or near real-time:
 - Performance assessment scheduled annually
 - Assess performance after significant incidents and events
- **Evaluate and recommend actions when assessing performance:**
 - **Incorporate observations**
- Implement improvements after recommending actions



Example – Evaluate & Recommend



Active Management Cycle Step	Levels in Increasingly Active Management			
	Static	Reactive	Responsive	Proactive
<p><i>Evaluate and Recommend Actions</i></p> <p>Operational decision-making based on...</p> <ul style="list-style-type: none"> • Policies and standards • System performance objectives • Temporal and geographic scope • Most recent assessment results from previous step • Passing recommendation on to the implement step <p>...result in recommendations that make →</p>	Recommended adjustments based on changes in average conditions.	Recommended adjustments based on observed temporal variations.	Recommended adjustments based on varying real-time conditions.	Recommended adjustments based on anticipated or forecasted conditions.



Implement Actions



Active Management Cycle Step	Levels in Increasingly Active Management			
	Static	Reactive	Responsive	Proactive
<p><i>Implement Dynamic Actions</i> Operational decisions are implemented by using or applying...</p> <ul style="list-style-type: none"> • Infrastructure • Procedures and protocols • Analytics • Agency coordination • Most recent recommendation from previous step <p>...that manage system components or events and communications by making →</p>	Adjustments based on trend lines.	Adjustments based on regular variations and trends.	Adjustments made in real time to respond to real-time conditions	Adjustments in real time to respond to anticipated or forecasted conditions.



Example Agency Assessment Discussion



- Effective real-time monitoring
- Does not assess performance in real-time or near real-time:
 - Performance assessment scheduled annually
 - Assess performance after significant incidents and events
- Evaluate and recommend actions when assessing performance:
 - Incorporate observations
- **Implement improvements after recommending actions**



Example – Implement Actions



Active Management Cycle Step	Levels in Increasingly Active Management			
	Static	Reactive	Responsive	Proactive
<p><i>Implement Dynamic Actions</i> Operational decisions are implemented by using or applying...</p> <ul style="list-style-type: none"> • Infrastructure • Procedures and protocols • Analytics • Agency coordination • Most recent recommendation from previous step <p>...that manage system components or events and communications by making →</p>	Adjustments based on trend lines.	Adjustments based on regular variations and trends.	Adjustments made in real time to respond to real-time conditions	Adjustments in real time to respond to anticipated or forecasted conditions.



Lincoln DOT Self-Assessment Results



Active Management Cycle Step	Levels in Increasingly Active Management			
	Static	Reactive	Responsive	Proactive
<i>Monitor System</i>			X	
<i>Assess System Performance</i>		X		
<i>Evaluate and Recommend Actions</i>		X		
<i>Implement Dynamic Actions</i>		X		



Generic Assessment: Interpreting the Results



Result	General Improvement Approach	Target Outcome	Application Approach
<p>Consistent choices for all 4 steps in the cycle (e.g. all reactive).</p>	<p>Focus on strategies to advance all steps.</p> <p>Identify specific transitions that hold back advancement to the next level.</p>	<p>Advancement to the next level of active management.</p> <p>Stronger and more seamless linkage(s) and transitions.</p>	<p>Gain familiarity with the next level: chapter 5 – chapter 8.</p> <p>Develop strategies to advance to the next level: chapter 4.</p> <p>Understand linkages between steps and overcoming challenges: chapter 9.</p>
<p>One or two steps in the cycle are at lower levels than the others.</p>	<p>Focus on advancing lower level step(s).</p> <p>Identify specific transitions that hold back advancement to the next level.</p>	<p>Improved targeted capabilities of lower level step(s) to advance to next level.</p> <p>Stronger and more seamless linkage(s) and transitions.</p>	<p>Develop strategies to advance to the next level for the lower level steps: chapter 4.</p> <p>Understand linkages between steps and overcoming challenges: chapter 9.</p>

Example Agency: Interpreting the Results



Result	General Improvement Approach	Target Outcome	Application Approach
<p>One or two steps in the cycle are at lower levels than the others.</p>	<p>Focus on advancing lower level step(s).</p> <p>Focus on the assessing step first.</p> <p>Identify specific transitions that hold back advancement to the next level.</p> <p>Assessment conducted closer to real-time</p>	<p>Improved targeted capabilities of lower level step(s) to advance to next level.</p> <p>Stronger and more seamless linkage(s) and transitions.</p>	<p>Develop strategies to advance to the next level for the lower level steps: chapter 4.</p> <p>Understand linkages between steps and overcoming challenges: chapter 9.</p>

Develop Actions to Improve Active Management: Assess Performance



Improvement Category	Reactive to Responsive
Performance Measures and Measurement	<ul style="list-style-type: none">• Real-time data supports metrics• Performance measurement in real time
Analytics	<ul style="list-style-type: none">• Automated analytics
Transition	<ul style="list-style-type: none">• Suite of performance metrics monitored and assessed in an integrated manner• Assessment results passed to the evaluate and recommend step

What can Lincoln DOT do to improve the Assess step?

Develop Actions to Improve Active Management: Assess Performance



Improvement Category	Reactive to Responsive
Performance Measures and Measurement	<ul style="list-style-type: none">• Real-time data supports metrics• Performance measurement in real time
Analytics	<ul style="list-style-type: none">• Automated analytics
Transition	<ul style="list-style-type: none">• Suite of performance metrics monitored and assessed in an integrated manner• Assessment results passed to the evaluate and recommend step

What can Lincoln DOT do to improve the Assess step?

- Automate performance analysis
- Develop a dashboard that displays metrics in real-time
 - Mainline travel time, ramp wait times
- Implement performance metrics database
 - Improves off-line analysis for developing improvements

Results of Lincoln DOT Re-Assessment



- Effective real-time monitoring
- Assess performance in real-time
 - Dashboard allows real-time assessment
 - Assessed performance informs alternative generation and recommendation
- Evaluate and recommend actions when assessing performance:
 - Based on automated metrics, dashboard and database
- Implement improvements after recommending actions



Results of Lincoln DOT Re-assessment



Active Management Cycle Step	Levels in Increasingly Active Management			
	Static	Reactive	Responsive	Proactive
<i>Monitor System</i>			X	
<i>Assess System Performance</i>			X	
<i>Evaluate and Recommend Actions</i>			X	
<i>Implement Dynamic Actions</i>			X	

By improving the Assess System Performance step to responsive, the Evaluate and Recommend and the Implement Dynamic Actions steps improved, too!



Questions and Discussion



Thank You!



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