

Slide 1 - TSM&O Evaluation Operations Analysis



# TSM&O Evaluation Operations Analysis

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REGION TRAFFIC REPRESENTATIVE TRAINING

JUNE 2016

## Slide 2 - Topics



## Topics

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- Purpose and Goals of training
- Review of TSM&O Evaluation purpose and goals
- Overview of Operational Analysis
  - Review sections of operational analysis
  - Case study applications
- Available Resources and Training
- Discussion

## Slide 3 - Introduction



## Introduction

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- Reminder of what TSMO is/why we are here
- Context of this training
  - Not the be-all and end-all training for operational analysis
  - Each segment of the TSM&O Operational Analysis may require more detailed training
  - TSM&O career progression mapping

## Slide 4 - Goals of Training

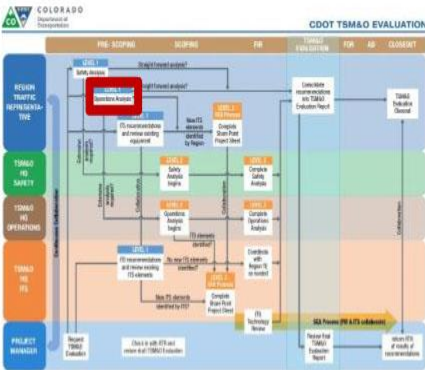


## Goals of Training

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- Demonstrate the capability to complete each section of the TSMO Evaluation – Operations Analysis.
- Determine when it is okay to bypass lines of the evaluation.
- Recognize internal and external resources that may be called upon for assistance in completing the TSMO operational analysis.

Slide 5 - Perform Level 1 Operations Analysis



The diagram, titled "CDOT TSMO EVALUATION", is a flowchart with five main vertical sections: REGION TRAFFIC REVENUE/TIME, TSMO TO SAFETY, TSMO TO OPERATIONS, TSMO TO ITS, and PROJECT BUDGET. Each section contains various sub-processes and decision points, such as "Check for TSMO", "Evaluate impacts", and "Develop TSMO Plan". A red box highlights the "Check for TSMO" step in the first section. A large blue arrow points from this diagram towards the right.

## Perform Level 1 Operations Analysis

**OPERATIONS ANALYSIS - General Information**

Name of PPT filling out this form: \_\_\_\_\_  
Project name: \_\_\_\_\_

**Level 1 Operations Analysis**

Purpose: A comprehensive quality assurance process to provide opportunities to use TSMO strategies to improve operational performance in terms of capacity, safety, mobility, and maintenance. Each project must be evaluated to ensure that comprehensive operational improvements are being considered as part of the project. The reviewer should consider the following when assessing projects for the Level 1 Operations Analysis portion of the TSMO Evaluation. In addition to this form, consider the results of the Level 1 Safety, and Level 1 ITS Analysis.

**Data and Modeling**

	Begin MP	End MP	Route	Comments	Recommendations	Check box to include in Level 2 analysis
Are there any count stations in the area that highlight specific peak traffic times?	<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A			<input type="checkbox"/>
Are there any traffic design issues that may impact operations specified in the ACD?	<input type="radio"/> Yes	<input type="radio"/> No				<input type="checkbox"/>
If yes, list here and identify. If yes, were additional observations in comments column and/or add recommendations in recommendations column. Use + to add text or - to remove extra text.						
Are we existing and future projected traffic data using _____?						<input type="checkbox"/>
COVDIS and _____ are there?	<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A			
Recurring delay congestion patterns?	<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A			
Recurring seasonal congestion patterns?	<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A			
Non-recurring or special event congestion?	<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A			
Operational issues related to heavy vehicles (e.g. turning, lane changes)?	<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A			
Directional peak hour traffic volumes that exceeds one another?	<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A			
Significant Buses and Pedestrian users present or known about?	<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A			
Planning Time Index values higher than expected compared to similar facilities?	<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A			
Peak Time Index values higher than expected compared to similar facilities?	<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A			
Other (describe in comments column and/or add recommendations in recommendations column. Use + to add text or - to remove extra text.						
Does the scope and complexity of the project warrant further evaluation of traffic, operations, safety, and ITS with use of the _____?						

Navigation: [Introduction](#) [Project Overview](#) [Safety Analysis](#) [ITS Analysis](#) [Operations Analysis](#) [Operations Level 2 Core](#) [Recommendations](#)

Slide 6 - Level 1 Operational Analysis



# Level 1 Operational Analysis

## Purpose of Analysis

Evaluate operating conditions within a project area including:

- Integrating operational improvements within the context of a project (that may not be focused on operational improvement).
- Providing a standardized process and documentation via the TSM&O Evaluation tool.
- Noting the issues considered to support recommendations.

**OPERATIONS ANALYSIS - General Information**

Level 1 Operational Analysis

**Data and Modeling**

	Begin MP	End MP	Rate	Comments	Recommendations	Check box for include in Level 2 analysis
Did these two count stations in the area that highlight specific peak traffic hours?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
Were any traffic design issues that may impact operations identified in your report?	<input type="radio"/>	<input type="radio"/>				<input type="checkbox"/>
If yes, list them and specify if they were addressed (checked in comments column) and/or add recommendations in recommendations column. Use a red box or - to remove entire row.						
Review existing and future projected traffic data using TRIS and other applicable software						<input type="checkbox"/>
Identify bottlenecks in the project area?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
Recurring delay congestion patterns?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
Recurring seasonal congestion patterns?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
Non-recurring or isolated event congestion?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
Operational issues related to heavy vehicle loading, turning path conflicts?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
Issues with specific turning movements?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
Exceeding peak hour traffic volumes that necessitate an analysis?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
Significant Busside and Pedestrian lanes present or proposed?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
Planning Time index values higher than accepted compared to similar facilities?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
Other identified in comments column and/or add recommendations in recommendations column. Use a red box or - to remove entire row.						

## Slide 7 - Operational Analysis Process



## Operational Analysis Process

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### Level 1 Analysis

- Answer each question with “Yes”, “No”, or “N/A”
- **TSM&O Evaluation Folder** – Used to save relevant supporting traffic data (INRIX, OTIS, etc.)
- **Comments column** – Used to add relevant information supporting the decision-making process
  - Highlight key issues, data or background information
- **Recommendations column** – Used to add specific recommendations
  - Recommendations should only be made in the recommendations column
    - Carried forward into the Recommendations Tab

## Slide 8 - Evaluation – When to Bypass



## Evaluation – When to Bypass

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### When Can Evaluation Topics be Bypassed?

- **Data and Modelling** – Traffic data, travel pattern or type of modelling are not applicable to the project area.
- **Operational Conditions and Strategies:**
  - Condition or strategy is not applicable to the type of roadway being reviewed (e.g. freeway, urban arterial, rural highway)
  - Certain types of road users may not be present in the project area (e.g. transit, heavy vehicles, trains/railroad crossing), pedestrian, cyclist).
    - Must still comply with CDOT policies, e.g. pedestrian and cyclist policy
- **Coordination/Collaboration** – Stakeholder groups that are not applicable to area or scope of project.



## Slide 9 - Data and Modeling



## Data and Modeling

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### Section 1: Data and Modeling

- Purpose:
  - Documenting existing known data sets or existing traffic models (e.g. traffic models developed for prior projects)
  - Identify data that was considered as part of the Level 1 Operational Analysis
  - Identify key operational issues (e.g. traffic patterns, time periods, etc.)
- Example CDOT R2 - US 24 overlay project
  - Resurfacing and intersection reconstruction project

## Slide 10 - Data and Modeling Example



## Data and Modeling Example

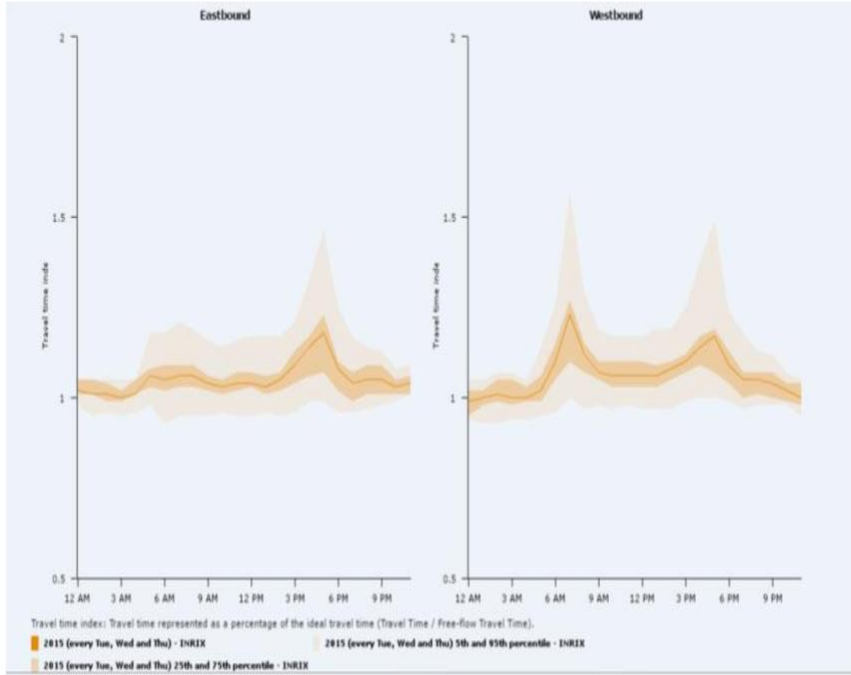
- **Example CDOT R2 - US 24 Project**
  - Project scope
    - Resurfacing – westbound lanes of US 24.
    - Reconstruction of US 24/Garrett Rd intersection, including signal modification.
  - Suburban commuter route northeast of Colorado Springs
  - A bottleneck was identified at the US 24 / Garrett Rd signalized intersection.



Slide 11 - Travel Time Index in Project Area



# Travel Time Index in Project Area



Slide 12 - Data and Modeling Example



# Data and Modeling Example

Data and Modeling						
		Begin MP	End MP	Comments	Recommendations	Check box to include in Level 2 analysis
Are there any count stations in the area that highlight specific peak traffic times?	<input checked="" type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A	314.59	319.64	Highway functions as suburban commuter route. Weekday morning peak (6-9 am) Weekday evening peak (3-6 pm)		
Were any traffic design issues that may impact operations identified in Form 463?  If Yes, list here and identify if they were addressed (describe in comments column and/or add recommendations in recommendations column). Use + to add rows or - to remove extra rows. <input type="button" value="-"/> <input type="button" value="+"/>  Review existing and future projected traffic data using QTB, COGNOS, and INRIX. Are there:	<input type="radio"/> Yes <input checked="" type="radio"/> No					<input type="checkbox"/>
Identifiable bottlenecks in the project area?	<input checked="" type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A	318.44		Signalized intersection at US 24 & Garrett.	Implement Florida-T operation previously designed with project 19682.	
Recurring, daily congestion patterns?	<input checked="" type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A	318.44		Signalized intersection at US 24 & Garrett.	Implement Florida-T operation previously designed with project 19682.	
Recurring, seasonal congestion patterns?	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A					
Non-recurring or special event congestion?	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A					
Operational issues related to heavy vehicles (e.g. turning path conflicts)?	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A					
Issues with specific turning movements?	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A					

Slide 13 - Data and Modeling Example (cont.)



## Data and Modeling Example (cont.)

Data and Modeling						
		Begin MP	End MP	Comments	Recommendations	Check box to include in Level 2 analysis
Directional peak hour traffic volumes that repropagate one another?	<input checked="" type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A	314.59	319.64	70% directional distribution favoring southbound during week-day morning 78% directional distribution favoring northbound during week-day evening		
Significant Bicycle and Pedestrian users present or known issues?	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A			No known issues.		
Planning Time Index values higher than expected compared to similar facilities?	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A			Peak hour near 1.5		
Travel Time Index values higher than expected compared to similar facilities?	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A			Peak hour near 1.2		
Other (describe in comments column and/or add recommendations in recommendations column). Use + to add rows or - to remove extra rows. <input type="button" value="-"/> <input type="button" value="+"/>						
Does the scope and complexity of the project warrant further analysis of traffic, queuing, delay, and LOS with any of the	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A			Analysis conducted as part of previous project 19682		<input type="checkbox"/>
If so, indicate here:						
Traffic Analysis (Synchro, Tru-Traffic, HCM)	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A					
Microsimulation (VISSIM, CORSIM, SimTraffic)	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A					
Travel demand data (origin-destination data)	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A					
Other (describe in comments column and/or add recommendations in recommendations column). Use + to add rows or - to remove extra rows. <input type="button" value="-"/> <input type="button" value="+"/>	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A					<input type="checkbox"/>
Have any of these tools been initiated? If so, which ones?	<input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/> N/A					

Slide 16 - Operational Conditions & Strategies



## Operational Conditions & Strategies

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### Operational, Geometric, and Road User Conditions

### Operational Strategies

#### Purpose of Sections 2 and 3

- Review a range of potential Operational Conditions and Strategies that the project may consider

Example - Plum Creek Parkway and I-25 Interchange

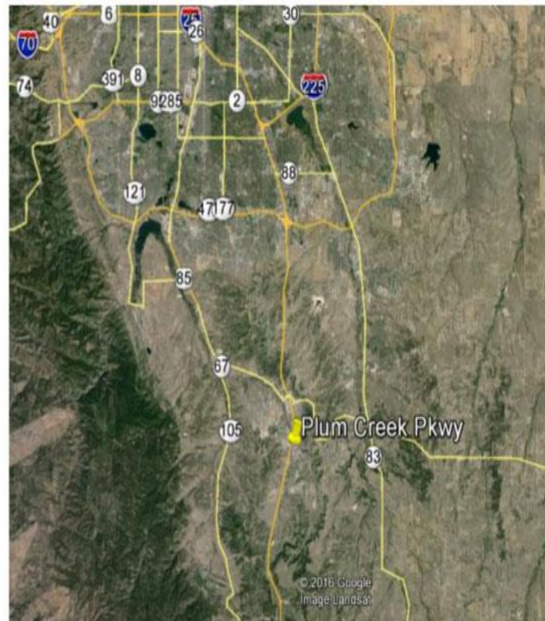
## Slide 17 - Plum Creek Parkway/I-25 Example



## Plum Creek Parkway/I-25 Example

### Context:

- Plum Creek Pkwy/I-25 Interchange in Castle Rock
- Local agency initiated project
- Key Issues: heavy directional traffic
  - Towards I-25 northbound in AM Peak
  - Away from I-25 southbound in the PM Peak Period



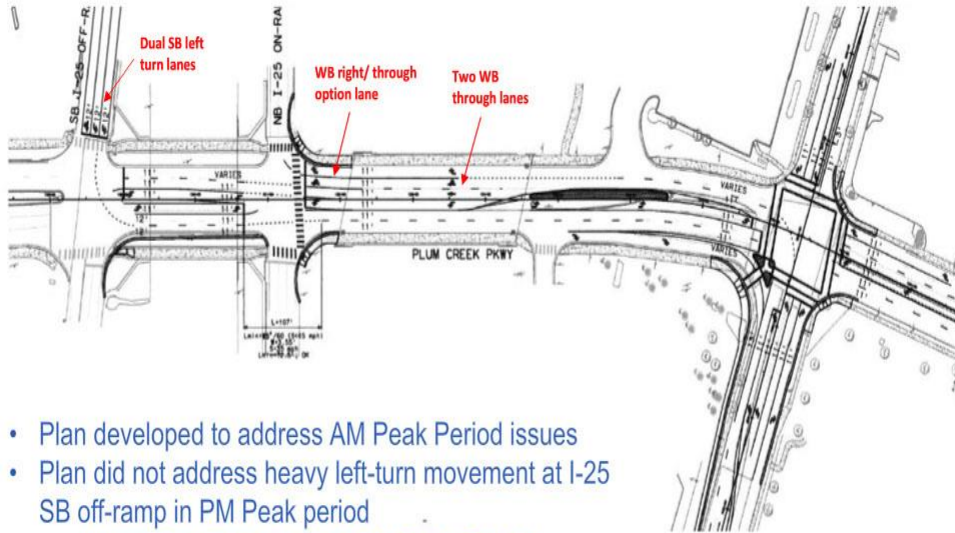


## Slide 18 - Plum Creek Parkway Example



## Plum Creek Parkway Example

### Original Proposal: Plum Creek Parkway Interchange with I-25



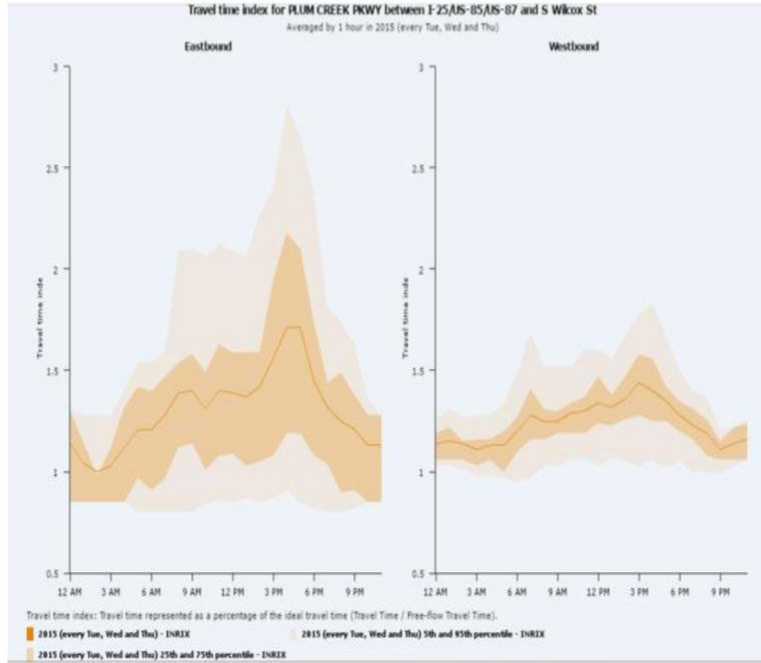
- Plan developed to address AM Peak Period issues
- Plan did not address heavy left-turn movement at I-25 SB off-ramp in PM Peak period
  - Movement near failure in PM Peak Period



Slide 19 - Travel Time Index in Project Area



# Travel Time Index in Project Area



Slide 20 - Key Considerations for L1 Analysis



## Key Considerations for L1 Analysis

Section	Consideration	Response	Comments	Recommendations
Operational, Geometric and Road User Conditions	Can improvements to lane geometry be made to better serve existing and future traffic demand?	Yes	Challenging to balance the needs of AM and PM Peak	Consider options to improve lane geometry
	Can the current project incorporate signing and striping improvements to improve positive guidance?	Yes	Signing and striping improvements may be required to support lane assignment changes	Consider signing and striping improvements to support improved lane geometry
	Can improvements to how the roadway connects/integrates into the existing roadway, i.e., lane utilization/demand and lane merge/diverge with existing upstream and downstream traffic be incorporated into the project?	Yes	Unbalanced lane utilization due to traffic movements to 25 northbound in the AM peak and from I-25 southbound affects traffic upstream of the project area	Consider methods of addressing unbalanced lane utilization
Operational Strategies	Lane Assignment	Yes	Merits considering adjusting lane assignment by time of day	Consider options for developing dynamic lane assignment
	Active Traffic Management	Yes	Explore ATM approaches to lane assignment	Consider ATM approaches to dynamic lane assignment
	Traffic Signal Detection	Yes	May need to modify traffic signal detection at the Wilcox St signal	Consider detection needs of dynamic lane assignment
	Signing Improvements	Yes		Consider signing improvements to support dynamic lane assignment
	Alternative Intersection Treatments	Yes		Consider time of day changes to approach lanes at Wilcox St signal

## Slide 21 - Bypassed Items



## Bypassed Items

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**It is likely that not all operational strategies will apply to a project area**

- Some may be bypassed if they aren't applicable to a project

### Considerations

- What type of roadway is being reviewed
  - e.g. Freeway, urban arterial, rural highway)?
- What types of road users are present?
- Types of intersections present?

## Slide 22 - Bypassed Items



## Bypassed Items

### Not applicable to Plum Creek Pkwy project area:

- Ramp metering strategies
- Peak period shoulder lanes
- Managed access lanes
- Continuous flow metering
- Railroad crossing improvements
- Transit improvements
- On-street parking modifications

### Requires further review:

### Not bypassed, policy implications

- Bicycle, Pedestrian and ADA Improvements
- Work Zone Safety and Mobility

Slide 23 - Plum Creek Parkway Example



# Plum Creek Parkway Example

## Dynamic Lane Assignment Permits PM Peak Period Improvements



## Slide 27 - Coordination/Collaboration



## Coordination/Collaboration

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### Purpose

- Provides a checklist of stakeholders for the RTR to identify where coordination/collaboration are needed.
- List is passed on as information to the PM.
  - PM's responsibilities are to consider recommendations over the course of the project.
- Although coordination/collaboration is included in the operational analysis, it may apply to Safety and ITS.

### Example

- Coordination/Collaboration for a small scale project in rural area

Slide 28 - Example – Coordination/Collaboration



## Example – Coordination/Collaboration

Coordination/Collaboration						
	Begin MP	End MP	Ramp	Comments	Recommendations	Check box to include in Level 2 analysis
Has input from applicable internal CDOT stakeholders related to capacity, safety, mobility, and maintenance on the project corridor been requested and documented?						<input type="checkbox"/>
Incident Manager in Project Area	<input checked="" type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A		Obtain input on the project from incident manager in project area	
Corridor/Area Operations Manager	<input checked="" type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A		Obtain input from the Corridor/Area Operations Manager	
Region Access Manager	<input checked="" type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A		Obtain input on the project from the Region Access Manager	
CTMC (or other operations centers, if applicable)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A			
Maintenance Supervisor	<input checked="" type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A		Obtain input on the project from the Maintenance Supervisor	
Public Information Offices	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A			
Project Managers of Adjacent Projects	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A			
Special Events	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A			
Venues	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A			
<a href="#">Region Bike &amp; Pedestrian Representatives</a> <sup>(4)</sup>	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A			
Other (describe in comments column and/or add recommendations in recommendations column). Use + to add rows or - to remove extra rows. <input type="button" value="-"/> <input type="button" value="+"/>						<input type="checkbox"/>



Slide 29 - Example



# Example

Coordination/Collaboration						
	Begin MP	End MP	Ramp	Comments	Recommendations	Check box to include in Level 2 analysis
Considering the scope and complexity of the project, has input from applicable external stakeholders been requested and documented?						<input type="checkbox"/>
City and County Agencies <input checked="" type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A				Pitkin County	Obtain input from Pitkin County on the project.	
Transit Agencies <input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A						
MPO and TPR <input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A						
School Districts <input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A						
Law Enforcement <input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A						
Local Businesses <input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A						
Special Events <input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A						
Venues <input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A						
Other (describe in comments column and/or add recommendations in recommendations column). Use + to add rows or - to remove extra rows. <input type="button" value="-"/> <input type="button" value="+"/> <input type="checkbox"/>						
Is there a current IGA for maintenance responsibilities in the project area? <input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A						
Is a new or modified IGA required to address maintenance responsibilities following project completion? <input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> N/A						<input type="checkbox"/>



## Slide 30 - Available Resources and Training



## Available Resources and Training

### Resources

- TSM&O Evaluation Message Board
- Contact CDOT HQ
  - [Dot\\_tsmoeval@state.co.us](mailto:Dot_tsmoeval@state.co.us)
- Other resources are noted at the bottom of the Operational Analysis Section



### Training

- INRIX Training
- Future training for specific topics in the Operational Analysis Section
- TSM&O career progression map

Slide 31 - Optional File Download



# Optional File Download

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Would you like a copy of this file to reference?

Slide 33 - End of Training



## End of Training

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# Thank You for Participating



Thank you to Regions 1 and 2 for assistance with developing the examples include in the training.