Project Atlas
Corridor Bottleneck Operations Study – ODOT Region 1

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Consultant

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Portland, Oregon 97201

Final Working Draft
April 2013
## Regional Recurring Bottleneck Location Summary

### I-5 Bottlenecks

<table>
<thead>
<tr>
<th>Bottleneck ID</th>
<th>Bottleneck Locations</th>
<th>Cause</th>
<th>Congestion Speed (MPH)</th>
<th>Congestion Duration (Hours)</th>
<th>See Bottleneck Detail sheet on page #</th>
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<tbody>
<tr>
<td>B1</td>
<td>5 NB: Ternwell Boulevard Entrance Ramp (AM &amp; PM)</td>
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<tr>
<td>B2</td>
<td>5 NB: Lower Boones Ferry Road Exit Ramp (AM)</td>
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<td>1.25</td>
<td>Page 3-5</td>
</tr>
<tr>
<td>B3</td>
<td>5 NB: Westbound Elgisen Road Entrance Ramp (PM)</td>
<td>X</td>
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<td>*</td>
<td>Page 3-5</td>
</tr>
<tr>
<td>B4</td>
<td>5 SB: Hood Avenue Exit Ramp (PM)</td>
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</tr>
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<td>5 SB: Nyberg Street Exit Ramp (PM)</td>
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### I-205 Bottlenecks

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<tbody>
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<td>B1</td>
<td>I-205 NB: Sandy Boulevard/Columbia Boulevard Entrance Ramp (PM)</td>
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<td>1</td>
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<tr>
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<td>I-205 NB: Westbound I-84 Entrance Ramp (PM)</td>
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<td>5.25</td>
<td>Page 3-7</td>
</tr>
<tr>
<td>B4</td>
<td>I-205 NB: Division Street Entrance Ramp and Hwy 26/Powell Blvd. Entrance</td>
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<td>2.75</td>
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</tr>
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<td>I-205 NB: Foster Road Exit Ramp (AM &amp; PM)</td>
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<td>4.25</td>
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</tr>
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<td>B8</td>
<td>I-205 SB: Stark/Washington Street Entrance Ramp (PM)</td>
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### I-84 Bottlenecks

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<td>I-84 EB: I-5 SB Entrance Ramp (AM &amp; PM)</td>
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<td>I-84 WB: I-5 Diverge (AM &amp; PM)</td>
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<td>I-84 WB: I-205 SB to I-84 WB Ramp</td>
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### I-405 Bottlenecks

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<th>Congestion Duration (Hours)</th>
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<tbody>
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<td>3</td>
<td>Page 3-12</td>
</tr>
<tr>
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<td>3</td>
<td>Page 3-12</td>
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<td>B4</td>
<td>I-405 SB: US 26 Entrance Ramp to Broadway Exit Ramp Weave (PM)</td>
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### US 26 Bottlenecks

<table>
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<th>Bottleneck ID</th>
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<td>US 26 EB: Skyline/Scolls Ferry Entrance Ramp (AM &amp; PM)</td>
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<td>Inconclusive</td>
<td>Inconclusive</td>
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<td>B3</td>
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<td>8</td>
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<td>US 26 EB: Ramp to I-405 SB (AM &amp; PM)</td>
<td>X</td>
<td>5</td>
<td>8</td>
<td>Page 3-13</td>
</tr>
<tr>
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<td>US 26 EB: Ramp to I-405 NB (AM &amp; PM)</td>
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* Construction of NB Auxiliary Lane in 2011
** Construction of SB Auxiliary Lane in 2010

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**Corridor Bottleneck Operations Study for I-5, I-205, I-84, I-405, and US 26**

---

**Overall Summary**
## Potential Regional Projects Summary

### I-5 Potential Projects

<table>
<thead>
<tr>
<th>Map ID</th>
<th>Recurring Project ID</th>
<th>Potential Solution Identified</th>
<th>Potential Regional Projects</th>
<th>Est. Cost</th>
<th>See Project Sheet on Page</th>
</tr>
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<tr>
<td>A</td>
<td>B1</td>
<td>Further Analysis</td>
<td>I-5 NB: Terwilliger Blvd. Entrance Ramp Extension.</td>
<td>$30M - $40M</td>
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<td>B</td>
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<td>C</td>
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<td>I-5 NB: Phase 2 - Nyberg Rd. Interchange to Lower Boones Ferry Rd. Interchange - Auxiliary Lane Extension</td>
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<td>D</td>
<td>B2</td>
<td>Yes</td>
<td>I-5 NB: Phase 3 - Lower Boones Ferry Rd. Interchange to Carman Dr. Interchange - Auxiliary Lane Extension</td>
<td>$17M - $21M</td>
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<td>E</td>
<td>B2</td>
<td>Project Phased</td>
<td>This Project is Phased into I-5 NB Projects B, C and D.</td>
<td>$18M - $22M</td>
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<td>F</td>
<td>B5</td>
<td>Constructed August 2012</td>
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<td>$1.25M</td>
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<td>G</td>
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<td>I-5 SB: Phase 2 - Lower Boones Ferry Rd. Exit to Lower Boones Ferry Rd. Entrance Auxiliary Lane</td>
<td>$7M - $8.5M</td>
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<td>H</td>
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<td>$10M - $18M</td>
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### I-205 Potential Projects

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<td>I</td>
<td>B3</td>
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<td>J</td>
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<td>K</td>
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### I-84 Potential Projects

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<tbody>
<tr>
<td>R</td>
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<td>Further Analysis</td>
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### I-405 Potential Projects

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<th>Potential Regional Projects</th>
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<td>$0.5M - $1.0M</td>
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   A.4 Technical Memoranda 6: Evaluation Framework for Investments to Improve Freeway Operations at Bottlenecks on I-5 & I-205
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CHAPTER 1: HOW TO USE THIS PROJECT ATLAS
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Chapter 1: How to Use This Project Atlas

This Project Atlas provides a collection of maps, tables, and project sheets that can be used in a variety of different ways, depending on the user’s needs. This combined document identifies bottleneck locations along five metro area corridors (I-5, I-205, I-84, I-405, and US 26) and correlates locations of congestion with recommended enhancement measures.

This chapter is to help the users understand and locate important information in this Project Atlas. The following sections provide a few examples of how this Project Atlas can be used, as well as detailed directions for how to read key figures throughout the document.

1.1 How is This Atlas Organized?

The Table of Contents on page iii of this Project Atlas provides a high-level overview of the document layout.

The Introduction, in Chapter 2, provides a project overview, defines the study area, and provides the methodology to identify the bottlenecks for the Atlas.

1.2 Where are the Bottlenecks and How Much do They Contribute to Congestion?

Chapter 3 deals with the identification and evaluation of bottlenecks and potential solutions. Bottlenecks are compared and evaluated in several different ways throughout the document.

How is Key Information Evaluated for Corridor Operations Bottlenecks?

The Corridor Bottleneck Operations analysis (I-5: Figures 3-2 and 3-3, I-205: Figures 3-4 and 3-5, I-84: Figures 3-6 and 3-7, I-405: Figures 3-8 and 3-9, and US26: Figures 3-10 and 3-11) provide a detailed bottleneck-specific perspective of identified bottlenecks along each metro area corridor.

These figures allow users to evaluate key information, including:

- Location
- Influence area
- Congestion duration and time periods
- Contributing factors
- Reported crashes
- Operations summary

Exhibit 1-1 provides a high-level overview of how to read the Bottleneck Operation Detail figures.

In these detailed figures, each bottleneck is labeled by its Bottleneck ID and classified by direction (northbound or southbound), time of day (AM Peak or PM Peak), and location, along with a description of the contributing factors. Each corridor has two figures, each of which is specific to one direction of travel.

Each bottleneck has an influence area that is illustrated by two dotted red lines, and within that influence area is a red-hatched activation range (the segment that contains the start of a new/confounding bottleneck). Historical crash data (5 years) from ODOT’s Online Crash Database is shown along the length of the corridor to visually assess correlations between crash frequency and lane geometry on the facilities. Next to the corridor image, the important information for each bottleneck is summarized in a text box along with the data sources that were used to identify and validate the bottleneck.

Chapter 1: How to Use This Project Atlas

How are Bottlenecks Compared Throughout the Region?

The Regional Bottleneck Summary Figure (Figure 3-12) provides a regional perspective of all identified bottlenecks along the five metro area corridors (I-5, I-205, I-84, I-405, and US 26). This figure allows users to understand the type of bottleneck, and evaluate the relative severity of congestion related to each bottleneck (duration and speed) throughout the region.

How are Potential Recommended Projects Evaluated Throughout the Region?

Table 3-1 provides a summary of the analysis and evaluation of the bottlenecks that were identified in the Regional Bottleneck Summary (Figure 3-12). From the analysis process, the bottlenecks are refined and identified as potential projects to address the bottlenecks. This table includes the potential project location, description, estimated cost of the project, and traffic analysis findings. The table has a recommended action for each potential project. The Potential Regional Projects (Figure 3-13) provide a corridor-specific perspective of identified bottlenecks along each metro area corridor (I-5, I-205, I-84, I-405, and US 26) and identifies potential solutions that have been in the analysis.

1.3 What and Where Are the Recommended Projects?

In Chapter 4, the individual recommended projects are presented by corridor and by individual project sheets. The chapter is organized by the five corridors; each corridor has a bottleneck identification figure and specific recommended projects figure. Recommended projects are compared and evaluated in several different ways throughout the document. The following sections identify the appropriate figures to use, based on the information desired.

How are Bottlenecks Compared for a Specific Corridor?

The corridor-specific Bottleneck Summary Figures (Figure 4-1, Figure 4-3, Figure 4-5, Figure 4-7, and Figure 4-9) provide a corridor-specific perspective of identified bottlenecks along each metro area corridor. These figures allow users to evaluate the relative severity of congestion related to each bottleneck (duration and speed) along a corridor.

How are Recommended Projects Evaluated for a Specific Corridor?

The corridor-specific Recommended Project Figures (Figure 4-2, Figure 4-4, Figure 4-6, Figure 4-8, and Figure 4-10) provide a corridor-specific perspective of recommended projects along each metro area corridor.

How To Read the Bottleneck and Recommended Projects Figures?

Exhibit 1-2 provides a high-level overview guide of how to read the bottlenecks and recommended projects for each corridor figures.

How is Key Information Evaluated for Each Recommended Project?

The project sheets (provided in Chapter 4) provide a detailed project-specific perspective of recommended projects along each metro area corridor.
Exhibit 1-1: How to Read the Bottleneck Detail Figures

- What do we know about each bottleneck?
- How much congestion does each bottleneck create?
- Does congestion from one bottleneck overlap with another?
- During what time periods do the bottlenecks contribute to congestion?
- What direction of travel is being considered?
- How many crashes have occurred along each segment of the corridor?
- What data was used to identify and validate the bottlenecks?
- Where does each bottleneck start and what area does it affect?

**Corridor Bottleneck Operations Study for I-5, I-205, I-84, I-405, and US 26**
Exhibit 1-2: How to Compare Bottlenecks and Recommended Projects in the Region

**Figure 4-1: I-5 Recurring Bottleneck Locations**

<table>
<thead>
<tr>
<th>Bottleneck ID</th>
<th>Recurring Bottleneck Location</th>
<th>Decision Point</th>
<th>Physical Constraint</th>
<th>Congestion Speed (MPH)</th>
<th>Congestion Duration (Hours)</th>
<th>See Bottleneck Detail Sheet on page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>I-5 NB: Terwilliger Boulevard Entrance Ramp (AM &amp; PM)</td>
<td>X</td>
<td>X</td>
<td>20</td>
<td>4</td>
<td>Page 3-5</td>
</tr>
<tr>
<td>B2</td>
<td>I-5 NB: Lower Boones Ferry Road Exit Ramp (AM)</td>
<td>X</td>
<td>X</td>
<td>30</td>
<td>1.25</td>
<td>Page 3-5</td>
</tr>
<tr>
<td>B3</td>
<td>I-5 NB: Westbound Elligsen Road Entrance Ramp (PM)</td>
<td>X</td>
<td>X</td>
<td>30</td>
<td>Inconclusive</td>
<td>Page 3-5</td>
</tr>
<tr>
<td>B4</td>
<td>I-5 SB: Hood Avenue Exit Ramp (PM)</td>
<td>X</td>
<td>X</td>
<td>10</td>
<td>2.75</td>
<td>Page 3-6</td>
</tr>
<tr>
<td>B5</td>
<td>I-5 SB: Carman Drive Lane Drop (PM)</td>
<td>X</td>
<td>X</td>
<td>10</td>
<td>2.25</td>
<td>Page 3-6</td>
</tr>
<tr>
<td>B6</td>
<td>I-5 SB: Nyberg Street Exit Ramp (PM)</td>
<td>X</td>
<td>X</td>
<td>25</td>
<td>2.5</td>
<td>Page 3-6</td>
</tr>
<tr>
<td>B7</td>
<td>I-5 SB: I-205 Entrance Ramp (PM)</td>
<td>X</td>
<td>X</td>
<td>Inconclusive</td>
<td>Inconclusive</td>
<td>Page 3-6</td>
</tr>
</tbody>
</table>

**Figure 4-2: I-5 Recommended Projects**

**Map ID** | Potential Solution Identified | Recommended Projects | Est. Cost | See Project Sheet on page # |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>I-5 B2</td>
<td>Yes</td>
<td>I-5 NB: Phase 1 - Lower Boones Ferry Exit Ramp Reconfiguration</td>
<td>$16M - $27M</td>
</tr>
<tr>
<td>C</td>
<td>I-5 B2</td>
<td>Yes</td>
<td>I-5 NB: Phase 2 - Nyberg Rd. Interchange to Lower Boones Ferry Rd. Interchange - Auxiliary Lane Extension</td>
<td>$11.5M - $13.5M</td>
</tr>
<tr>
<td>D</td>
<td>I-5 B2</td>
<td>Yes</td>
<td>I-5 NB: Phase 3 - Lower Boones Ferry Rd. Interchange to Carman Dr. Interchange - Auxiliary Lane Extension</td>
<td>$17M - $21M</td>
</tr>
<tr>
<td>F</td>
<td>I-5 B5</td>
<td>Constructed August 2012</td>
<td>5 SB: Phase 1 - Carman Dr Entrance Ramp to Lower Boones Ferry Exit Ramp - Auxiliary Lane</td>
<td>$1.35M</td>
</tr>
<tr>
<td>G</td>
<td>I-5 B6</td>
<td>Yes</td>
<td>I-5 SB: Phase 2 - Lower Boones Ferry Rd. Exit to Lower Boones Ferry Rd. Entrance Auxiliary Lane</td>
<td>$7.2M - $8.5M</td>
</tr>
<tr>
<td>H</td>
<td>I-5 B6</td>
<td>Yes</td>
<td>I-5 SB: Phase 3 - Lower Boones Ferry Rd. to I-205 Auxiliary Lane Extension</td>
<td>$10M - $16M</td>
</tr>
</tbody>
</table>

**Recommended Project Location** (indicates Potential Solution Recommendation)

**Where are the existing bottlenecks?**

**Where are the recurring bottlenecks throughout the region, and how can they be located in the Atlas?**

**Where are the recommended projects located?**

**What are the recurring bottlenecks?**

**Where are the bottlenecks throughout the region, and how can they be located in the Atlas?**

**What is the congestion speed (MPH) in the bottleneck?**

**How long does the congestion last?**

**What are the common causes of recurring bottlenecks?**

**Where are the bottlenecks throughout the region, and how can they be located in the Atlas?**

**What is the status of the potential solution?**

**What recurring bottleneck is addressed by the potential solution?**

**What are the costs of these projects?**

**Where are the recommended projects located?**

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**What are the costs of these projects?**

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**Where are the bottlenecks throughout the region, and how can they be located in the Atlas?**

**What is the congestion speed (MPH) in the bottleneck?**

**How long does the congestion last?**

**What are the common causes of recurring bottlenecks?**

**Where are the bottlenecks throughout the region, and how can they be located in the Atlas?**

**What is the status of the potential solution?**

**What recurring bottleneck is addressed by the potential solution?**

**What are the costs of these projects?**
How to Read the Recommended Project Sheets?

Each of the recommended projects has a summary sheet that presents the significant information in an organized and concise manner. Exhibit 1-3 provides a high-level overview of how to read these project sheets.

Across the top of the project sheet is the name of each recommended project, along with the Bottleneck ID, Tracking ID, and Map ID. These different ID numbers are found throughout the Project Atlas within the tables and figures. The Bottleneck ID is the number assigned to each bottleneck; the number is referenced in all regional and corridor-specific bottleneck figures in the Project Atlas. The Tracking IDs correspond with the ODOT naming convention that was used throughout the development of the recommended projects. The Map ID is the letter that was assigned to each of the recommended projects within the summary graphics and tables in the Project Atlas.

The project sheets summarize existing operational s, including the duration of congestion and queue length, as well as average speed and the density d. This information is based upon existing observations and traffic analysis (Highway Capacity Software (HCS). The project sheets also explain the key points of existing conditions, proposed improvements and the operations/safety benefits of each recommended project.

An operations diagram in the middle of the sheet illustrates the existing and proposed improvements of the traffic movements. Generally, the diagram shows the proposed improvements operations/safety benefits by reducing the traffic conflicts that result in traffic queuing and congestion.

A concept design is displayed on the right half of the sheet and includes an overview map showing the location of the project in region. The concept illustrates the conceptual layout of the improvement.

Project impacts are unique and may include, but are not limited to: right-of-way acquisition, structural changes, safety concerns, environmental impacts, and duration of construction. These impacts are a result of the preliminary design and traffic evaluation process; they are provided to give an understanding of any constraints to the project and how feasible it is to construct. If the project could benefit from additional follow-up phases, the follow-up project is listed along with its benefit and estimated cost.

1.4 What Is the Best Way to Select a Recommended Project Based on Limited Funds Available?

This Project Atlas can serve as a menu of cost-effective, small-scale (primarily $1 million to $20 million range) projects to accommodate limited funding sources. As funds become available, the corridor-specific Recommended Project Figures (Figure 4-2, Figure 4-4, Figure 4-6, Figure 4-8, and Figure 4-10) can be evaluated together to assess the highest priority projects that can be completed within the available budget.

The project sheets in Chapter 4 provide a project recommendation and project improvement with a recommended project concept. If the project analysis and evaluation were inconclusive, the project is recommended for further study.
**Exhibit 1-3: How to Read the Recommended Project Sheets**

### I-5 SB: Phase 1 - Carman Dr Entrance Ramp to Lower Boones Ferry Exit Ramp - Auxiliary Lane

#### Potential Operations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Existing</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration (hours)</td>
<td>2.25</td>
<td>1.8</td>
</tr>
<tr>
<td>Queue (miles)</td>
<td>1.8</td>
<td>1.2</td>
</tr>
<tr>
<td>Density (veh/mi/ln)</td>
<td>65</td>
<td>45</td>
</tr>
</tbody>
</table>

**Key Points**

**Existing Conditions**

Current the Carman Dr. lane drop results in queues extending to approximately the Haines St. exit ramp in all lanes. The cause of the queueing is a combination of the high volume of traffic from OR217 merging onto I-5 and the tendency of the majority of those drivers to merge quickly onto I-5, thus not fully utilizing the extent of the auxiliary lanes. An additional bottleneck exists downstream at the Hybarg W. exit ramp; however, the section of roadway between the two bottlenecks is relatively unaffected (speed greater than 35 mph).

**Proposed Improvements**

This project would extend the current lane drop just south of the Carman Dr. entrance ramp to the Lower Boones Ferry Exit ramp, where it would become a drop lane.

**Operations/Safety Benefits**

This is expected to decrease queues on I-5 from the OR217 merge by 1 lane, and reduce the queuing on OR217 approaching I-5. This is expected to result in a decrease of 1 hour of congestion along I-5.

#### Potential Follow-Up Phases

<table>
<thead>
<tr>
<th>Project Title</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-5 SB aux. lane from Lower Boones Ferry exit ramp to Lower Boones Ferry entrance ramp.</td>
<td></td>
</tr>
</tbody>
</table>

**Impacts**

- **ROW:** Would occur within existing ROW.
- **Structures:** Widening possible under existing structure.
- **Environmental:** Non-environmental impacts.

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**What are the existing conditions and issues?**

This information can be found on the bottleneck operation figures (Chapter 3).

**What are the existing operations at the bottleneck?**

This information is based upon existing observations and traffic analysis (HCS and/or VISSIM).

**Could this project have additional benefits when combined with another recommended project?**

These can be found throughout the Atlas within the tables and figures.

**Potential Follow-Up Phases**

<table>
<thead>
<tr>
<th>Bottleneck ID</th>
<th>Tracking ID</th>
<th>Map ID</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-5: BS</td>
<td>3a-1</td>
<td>G</td>
<td>$7,246 - $8,546</td>
</tr>
</tbody>
</table>
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