Making the Most of a Capacity Constrained Metro Area Freeway System

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Introduction

Regional growth
Percent change from 2015-2017
Sources: U.S. Census, Oregon Employment Department, Metro, ODOT corridor total

- Daily vehicle hours of delay: 67.2K (+20.0%)
- Hours of congestion: 112.3 (+13.4%)
- Employment: 1.15M (+3.3%)
- Population: 2.40M (+0.2%)
- Freeway length: 567 (+9.6%)
- 568 miles (+0.2%)
- 80.7K hours
- 127.3 hours
- 1.26M jobs
- 2.48M people

While the population has grown by 3.3%, hours of congestion have increased 13.4%, and daily vehicle hours of delay have increased 20.0%. There has been less than 1% growth in freeway lane miles.

Source: ODOT: Portland Region Traffic Performance Report 2018
Three Projects – One Mission

Case Study 1:
Corridor Bottleneck Operations Study (C-BOS) - 2009-2013

Case Study 2:
Region 1 Active Traffic Management Strategy (ATM) - 2014-2016

Case Study 3:
Corridor Bottleneck Operations Study 2 (C-BOS2) – 2017-2019

Mission: To reduce primary and secondary incidents, smooth speeds, reduce the duration of congestion, and increase throughput.
Data Collection

- PORTAL Loop Detector Data (Portland Oregon Regional Transportation Archives Listing)
- Crash Data
- Traffic Cameras
- Travel-Time Runs
- Field Observations
- Metro Regional Travel Demand Forecasts (VISUM)
- Corridor VISSIM Models
- INRIX/HERE
- Geometric Data
  - Horizontal/Vertical Curvature
  - Interchange Spacing
  - Ramp Spacing
  - Shoulder Widths
  - Signing
- Staff Experience/Familiarity
Initial Screening – PORTAL
Initial Screening – Utilizing Existing Data
Bottleneck/Congestion Identification & Validation

4. Division Street On-ramp and Hwy 26/Powell Boulevard ON Ramp (AM & PM)

**Influence Area**: Division Avenue ON Ramp to north of Hwy 26/Powell Boulevard OFF Ramp

**Congestion Duration**: 2.75 hours daily (7:15-6:15 AM and 4:30-6:15 PM)

**Contributing Factors**: AM bottleneck is confined to the Hwy 26/Powell Boulevard ON Ramp merge. PM bottleneck spans both the Division Avenue ON Ramp and Hwy 26/Powell Boulevard ON Ramp.

**Influence Area Crashes**: Rate: 0.42 per MVMT; Frequency: 83 crashes; 1 Fatality

**Operations Summary**: Between Division Street ON Ramp and Highway 26/Powell Boulevard ON Ramp.

- **Speed**: Bottleneck activation speeds drop as low as 15 mph (AM) and 10 mph (PM).
- **Volume (2007 ADT)**: Mainline: 66,530; Powell ON Ramp: 9,750; Division ON Ramp: 7,890
- **Volume (2008 AM Peak Hour)**: Mainline: 5,050; Powell ON Ramp: 820; Division ON Ramp: 520
- **Volume (2008 PM Peak Hour)**: Mainline: 4,550; Powell ON Ramp: 730; Division ON Ramp: 570

**Observations**: AM queues are confined to the Hwy 26/Powell ON Ramp merge point. In the AM queues recover north of the Hwy 26/Powell /Division OFF Ramp. PM queues occur at both ON ramps (Division and Hwy 26/Powell). The combined queue ends north of Hwy 26/Powell Boulevard/Division Street OFF Ramp. Camera observations suggest that the bottleneck at the Hwy 26/Powell ON Ramp lingers after the Division Street ON Ramp improves.

**Data Sources**: [Comprehensive data from various sources]

and/or travel time videos
Safety and Reliability Index (SRI) - Explained

Planning Time Index
Worst 15 min of Day
Referencing the 80th percentile

<table>
<thead>
<tr>
<th>Rank</th>
<th>Freeway Section</th>
<th>PTI</th>
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<tbody>
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<td>1</td>
<td>I-5 SB-405 (N) to I-84</td>
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**LEGEND**

- **PTI**
  - 1.00 - 1.25
  - 1.25 - 1.50
  - 1.50 - 2.00
  - 2.00 - 2.50
  - >2.50
Safety and Reliability Index (SRI) - Explained

Crashes Per Mile

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<td>I-5 SB I-405 to I-405 (S)</td>
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<td>US 26 WE I-405 to Sylvan</td>
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<td>US 26 WB Sylvan to 217</td>
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</table>

LEGEND

Crashes per Mi.

- < 25
- 25 - 30
- 30 - 50
- 50 - 75
- 75 - 100
- 100 - 150
- > 150
Safety and Reliability Index (SRI) = Crash Rate * Worst PTI

SRI weighting factor:
Crash rate range: 15 - 227 = Scale of 15.13
PTI range: 1.04 - 4.43 = Scale of 4.26

15.13 / 4.26 = 3.55
Crash rate weighted 3.55 times the PTI.
Safety and Reliability Index (SRI) - Explained

- Planning Time Index
  Worst 15 min of Day
  Referencing the 80th percentile

  **High PTI:** 2.74

- Crashes Per Mile
  2008 - 2012

  **Low Crash:** 31

- Safe and Reliable Index = Crash Rate * Worst PTI

  **Low SRI:** 85
Safety and Reliability Index (SRI) - Explained

Planning Time Index
Worst 15 min of Day
Referencing the 80th percentile

High PTI
3.42

Crashes Per Mile
2008 - 2012

High Crash
254

Safe and Reliable Index = Crash Rate * Worst PTI

High SRI
869
Design Panel Sessions: A Team of Experts

- Generally include:
  - Look beyond design standards & evaluate driver behaviors that contribute to concerns
  - Propose a range of potential improvements for each corridor for further evaluation
  - Initial screening to accelerate process
Types of Bottleneck Improvements Considered

- Re-striping
- Auxiliary lanes
- Ramp extensions
- Ramp closures
- Braided ramps
- Collector-distributor roads
- Improved signage (placement and visibility)
- Traveler information signs (queue warning and variable speed)
- Acceleration and Deceleration Lanes
- Targeted Shoulder widening/shoulder conversions
- Ramp terminal intersection improvements
Project Evaluation Methodology

- What tool should we use?
  - Appropriateness
    - Merge/diverge/weave
    - Intersection type
    - Upstream or downstream influences
  - Budget and Timeline
    - Small budget or quick timeline lends to qualitative assessment (AKA: engineering judgment)
    - Medium budget or reasonable timelines lends to high level quantitative assessment (HCS)
    - Large budget and longer timelines lends to a thorough quantitative assessment (VISSIM)
  - Availability of existing models
    - With a small or medium budget and timeline it is possible to expedite the VISSIM analysis through the use of already created models.
Completed Project:
I-84 WB: I-5 NB and I-5 SB Diverge Re-Striping
Documentation: ATM

ATM Project Atlas
Active Traffic Management Strategy - ODOT Region 1

Let's Keep it Moving

August 2016
Corridor Bottleneck Operations Study 2
2019 Project Atlas

Purpose and Need
The project area consists of the intersection between Ellingson Road and North Interstate 5 in Portland. The existing conditions include

- **Traffic Volume:**
  - Ellingson Road: 36,000 vehicles per day
  - North Interstate 5: 55,000 vehicles per day

- **Existing Bottlenecks:**
  - Left-turn lane at Ellingson Road
  - Right-turn lane at I-5

- **Current Issues:**
  - Traffic congestion during peak hours
  - Safety concerns at the intersection

Proposed Project and Benefit
The proposed project includes

- **Construction:**
  - Widening of Ellingson Road
  - Improving traffic flow
  - Enhancing safety

- **Expected Benefits:**
  - Reduced congestion
  - Improved traffic flow
  - Increased safety

Cost Estimate
The total cost of the project is $34.5M, with an additional $4.5M for contingencies.

Related Projects
- **Project Area:**
  - Ellingson Road
  - North Interstate 5

- **Adjacent Areas:**
  - Portland
  - Other nearby highways

Findings
The project is expected to reduce congestion and improve safety at the intersection, leading to a decrease in accidents and improved travel times. The project is scheduled for completion in 2022.
Questions We Have Heard:

Do these improvements add to the capacity of the freeway?
No.....CBOS improvements do not add thru capacity to the freeway system. The CBOS improvements are designed to improve operations and safety at localized recurring bottleneck locations. By improving these locations the existing through lanes operated better.

Will these improvements to the freeway just encourage more thru trips?
No.....CBOS improvements are designed to address specific bottleneck areas. They do not attract more thru trips to the freeway system. These improvements do improve safety, and can reduce diversion and out of direction travel.
Lessons Learned

- Ability to adapt data collection plans and maximize use of available data can help leverage limited budgets/schedules.

- Big data increases confidence in findings and supports decision makers, but can also lead to getting “lost in the weeds”. Use big data with focus and caution.

- Multidisciplinary design panel helped efficiently identify feasible lower-cost solutions.

- Focused use of VISSIM can be cost effectively applied to higher-level/region-wide studies.

- Summary-level figures/maps can be more valuable than a lengthy report.

- Project atlas serves as a cheat sheet when funding opportunities arise.
Questions?

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