Columbia River CROSSING

VISSIM
Calibration & Validation

Presentation to the Modeling Working Group

August 8, 2006

Presentation Outline

- Study area
- VISSIM model
- Data used in model development
- Calibration goals
- Validation results

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Study Corridor

- I-5 corridor from Pioneer Street in Ridgefield to the Marquam Bridge in Portland

- 23-mile corridor with 25 interchanges

VISSIM Model

- Microscopic/stochastic simulation model

- Link/connector network structure

- Driver behavioral model

  (4 driving modes)

  - Free driving
  - Approaching
  - Following
  - Braking

I-5 at Marine Drive

Why We Chose VISSIM?

- Powerful multi-model modeling capabilities
- Can simulate unique operational conditions
  - HOV lanes
  - Toll lanes
  - Exclusive lanes
  - Merging/diverging segments
  - Weaving segments
  - Interacting bottlenecks
  - Ramp meters
- 3D animation features
- Existing VISSIM model from the I-5/Delta Park Study

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Data Used in VISSIM Model Development

- Highway geometry

- Traffic control

- Traffic flow

Geometric Data Used in Model Development:

- Number of mainline & ramp lanes

- Ramp locations

- Lane additions and drops

- Auxiliary lanes

- Weaving sections

- Highway curvature

- Data obtained from aerial photographs, design plans, and site visits

Traffic Control Used in Model Development:

- Traffic signal timing sheets from WSDOT, ODOT, and City of Portland

- Ramp meter rates from ODOT and WSDOT

- Unsignalized intersection control identified from aerial photos and site visits

- Posted speed limits

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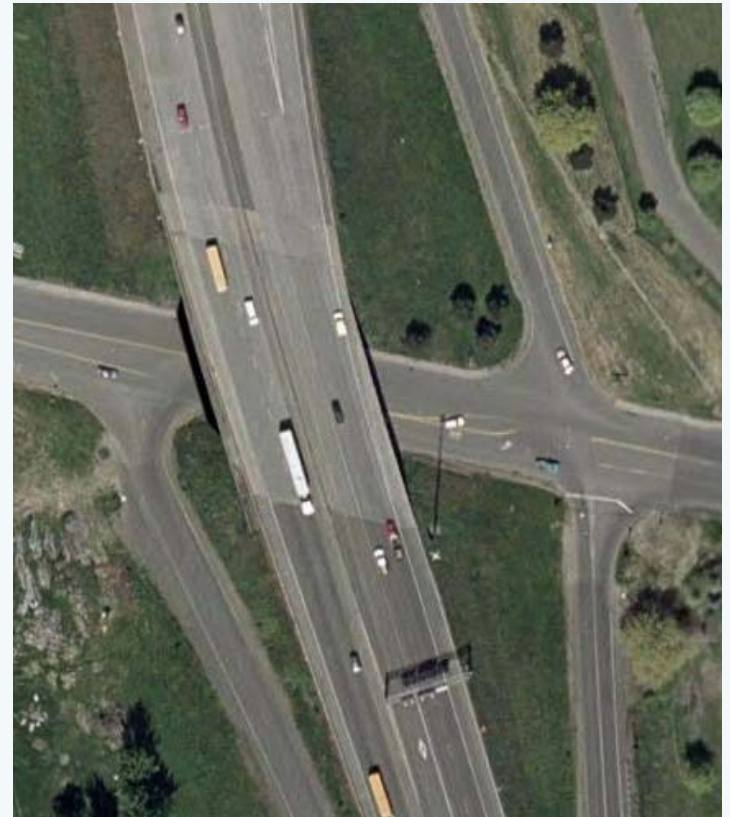
Traffic Flow Data Used in Model Development:

- Ramp/ramp terminal turning movement counts (84 ramps)

- I-5 mainline vehicle classification counts (10 locations)

- Lane utilization/speed counts (10 locations)

- Travel time runs (4-hour peak periods along I-5 & I-205)

- Auto occupancy (4-hour peak periods at Evergreen Blvd.)

- Origin-destination surveys (peak period-peak direction within BIA)
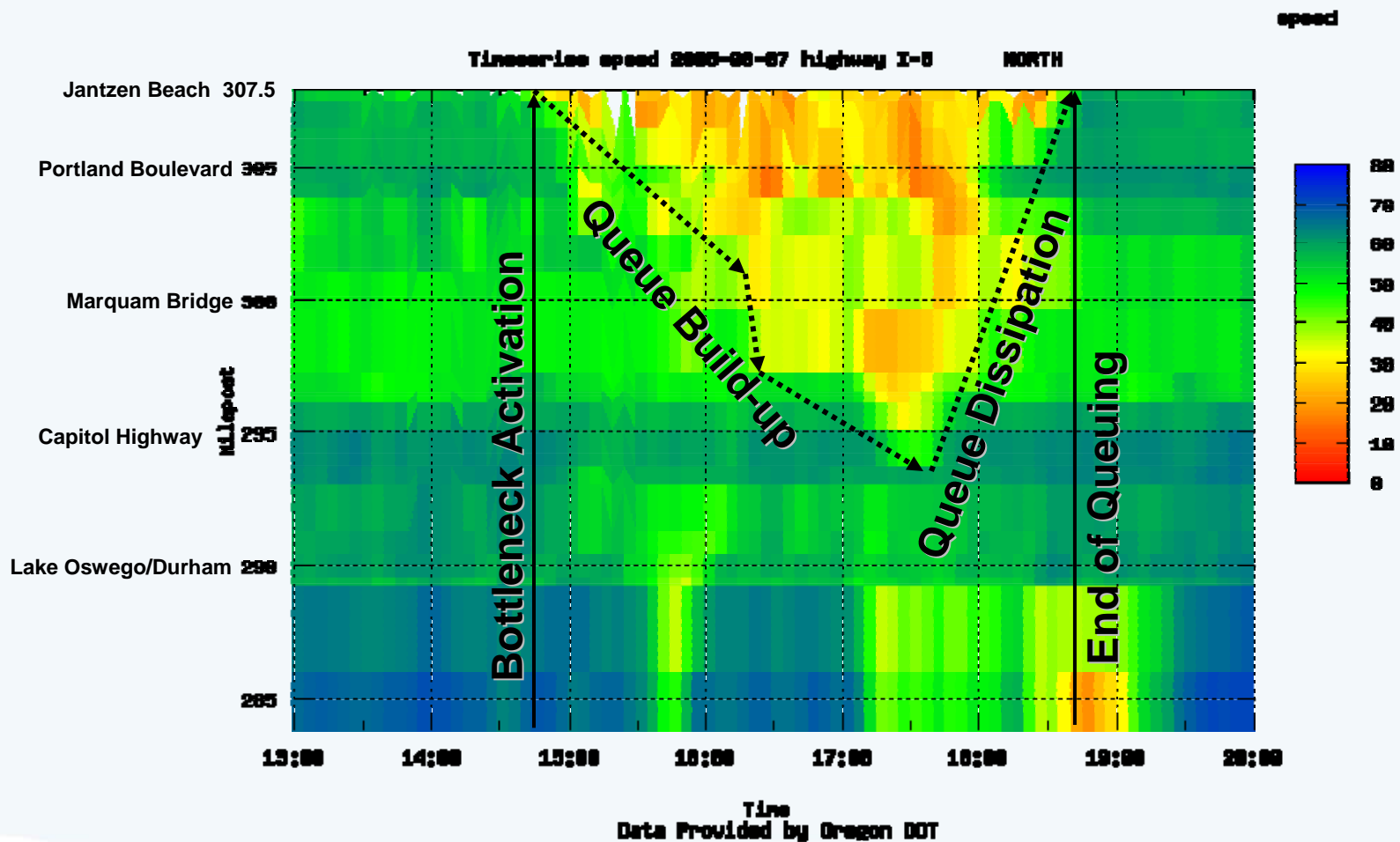
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Calibration Goals:

Goal 1 - Identification of AM and PM peak period recurring bottlenecks and queuing

Goal 2 - Modeled capacity to be within 10% of field measurements

Goal 3 - Model link versus observed flows and travel time meet widely used micro-simulation criteria

Goal 4 - Visually acceptable on- and off-ramp queuing

Goal 5 - Modeled average speeds to be within the acceptable range of observed speeds on the mainline links

Goal 6 - Visually acceptable utilization of the lanes at the lane drop locations and the HOV lane

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Goal 1 – Peak Period Recurring Bottlenecks

Bottleneck locations, activation and dissipation times, and queue extents were identified using:

- Inductive loop detector data

- Real time speed maps

- Road cameras/data collection videos
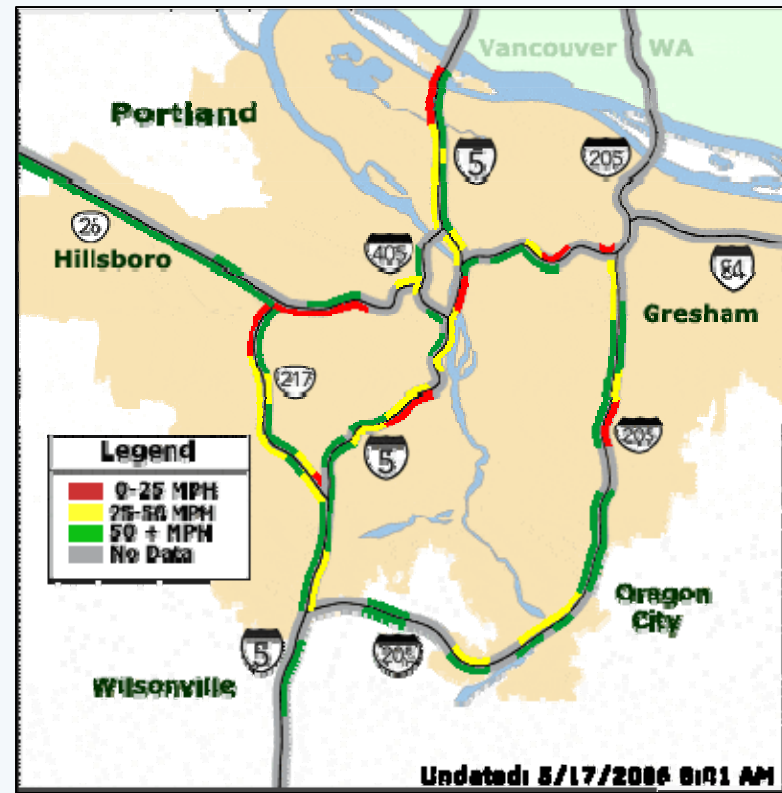
- I-5/Delta Park queue and speed diagrams

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Inductive Loop Detector Data

Source: http://portal.its.pdx.edu/index.php

Real Time Speed Maps

WSDOT

ODOT

Road Cameras

I-5 at Mill Plain in Vancouver, WA
© WSDOT   May 2, 2006 8:34 AM
TripCheck.com   Milepost 1.00

I-5 at Victory
Updated May 9 2006 08:00:01 AM   Camera 83
ODOT
TripCheck.com   Milepost 306.80

I-5 at SR-14 in Vancouver, WA
© WSDOT   May 9, 2006 8:00 AM
TripCheck.com   Milepost .00

I-5 at Portland Blvd.
Updated May 16 2006 08:40:20 AM   Camera 50
ODOT
TripCheck.com   Milepost 304.90

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I-5 Southbound

39th St. OFF
39th ON
SR 500 ON
4th Plain OFF
4th Plain ON
Mill Plain OFF
Mill Plain ON
SR 14 OFF
SR 14 /Washington St. ON
Columbia River
Jantzen Beach OFF
Jantzen Beach ON
Marine Drive OFF
Marine Drive ON
Interstate Ave./Victory OFF
Victory Blvd. ON
Columbia Blvd. ON
Lombard WB ON
Lombard EB ON
Portland Blvd. OFF
Portland Blvd. ON
Alberta/Going St. OFF
Alberta St. ON
Going St. ON
I-405 OFF
Greeley Ave. ON
I-405 ON
Broadway OFF
Weidler ON
I-84 OFF

6:00 - 6:15 AM   6:15 - 6:30 AM   6:30 - 6:45 AM   6:45 - 7:00 AM

HOV Termination/Mill Plain Weave Area Issues:
1) Queue forms around 6:25 AM in two GP lanes.
2) Queue quickly extends north of project area.

Columbia River Bridge Issues:
1) Initial queue forms near middle of Col. River Bridge.
2) More significant queuing forms on outside lane due to impacts associated with SR 14 short merge.
3) Delta Park queue combines with Columbia River Bridge queue before 7:00 a.m. For the remaining morning commute the Columbia River Bridge bottleneck is hidden within the Delta Park queue.

Delta Park Issues:
1) Queue forms at lane drop prior to 6:15 AM.
2) Queue backs up rapidly towards Col. River Bridge.
3) The Delta Park queue overcomes the Col. River Bridge queue prior to 7:00 a.m.

Portland/Alberta Area Issues:
1) No issues prior to 7:00 a.m.

Rose Quarter Area Issues:
1) No issues but minor weaving issues at Weidler/ I-84 weave.

Notes:
Bottlenecks (6:00 - 7:00 AM)
- Delta Park lane drop forms before 6:15 a.m.
- Columbia River Bridge forms before 6:30 a.m.
- HOV termini near Mill Plain forms before 6:30 a.m.

Lane Utilization Impacts:
- Delta Park queue initially forms in two southbound left lanes leaving access to Marine Drive and Interstate Avenue Off-ramps. Near the end of the hour the queue encompasses all three lanes limiting accesses to these two major off-ramps.
- Initial queuing on Columbia River Bridge forms in slow lane due to the short merge at SR 14. Queuing eventually crosses all three lanes.
- Mill Plain queuing forms in two GP lanes and extends beyond project area prior to 6:45 a.m. HOV lane remains free flowing length of study area.

LEGEND
- 0 - 10 MPH
- 11 - 20 MPH
- 21 - 30 MPH
- 31 - 40 MPH
- 41 - 50 MPH
- > 51 MPH

Not To Scale

///// Extent of Queue

DRAFT as of 2-26-04

I-5 Southbound

39th St. OFF
39th ON
SR 500 ON
4th Plain OFF
4th Plain ON
Mill Plain OFF
Mill Plain ON
SR 14 OFF
SR 14 /Washington St. ON
Columbia River
Jantzen Beach OFF
Jantzen Beach ON
Marine Drive OFF
Marine Drive ON
Interstate Ave./Victory OFF
Victory Blvd. ON
Columbia Blvd. ON
Lombard WB ON
Lombard EB ON
Portland Blvd. OFF
Portland Blvd. ON
Alberta/Going St. OFF
Alberta St. ON
Going St. ON
I-405 OFF
Greeley Ave. ON
I-405 ON
Broadway OFF
Weidler ON
I-84 OFF

7:00 - 7:15 AM   7:15 - 7:30 AM   7:30 - 7:45 AM   7:45 - 8:00 AM

HOV Termination/Mill Plain Weave Area Issues:
1) Queue extends north of project area past 8:00 a.m.
2) Queuing forms in auxiliary lane around 6:45 a.m. and continues through 8:00 a.m.

Columbia River Bridge Issues:
1) The Columbia River Bridge queue is hidden within the Delta Park queue through 8:00 a.m.

Delta Park Issues:
1) The Delta Park queue extends beyond the Columbia River Bridge queue prior to 7:00 a.m. and lasts throughout the hour.

Portland/Alberta Area Issues:
1) Queue forms in outside lane around 7:00 a.m.
2) Queuing in outside lane is caused by traffic preparing for the I-5/ I-405 4-2-2 split.
3) Queue backs up to Lombard Street by 8:00 a.m.

Rose Quarter Area Issues:
1) Minor weaving issues at Weidler/ I-04 weave throughout morning commute.
2) Queuing starts to form near lane drop just south of Weidler Off-ramp by 7:30 a.m.
3) Queue extends to I-405 on-ramp by 8:00 a.m.

Notes:
Bottlenecks (7:00 - 8:00 AM)
- Delta Park, Columbia River Bridge, and HOV termini bottlenecks remain throughout entire hour.
- Portland/Alberta area bottleneck forms prior to 7:15 a.m.
- Rose Quarter area bottleneck forms prior to 7:30 a.m.

Lane Utilization Impacts:
- Queuing north of Delta Park is three lanes wide throughout the hour.
- Initial queuing near the Portland/Alberta area forms in the outside lane. The queue is caused by traffic preparing for the I-5/ I-405 split as well as consecutive short merge on-ramps.
- Queuing near the Rose Quarter starts near the lane drop and within the hour influences all three travel lanes south of I-405 Off-ramp.

LEGEND
- 0 - 10 MPH
- 11 - 20 MPH
- 21 - 30 MPH
- 31 - 40 MPH
- 41 - 50 MPH
- > 51 MPH

Not To Scale

///// Extent of Queue

DRAFT as of 2-26-04

Goal 1 – Peak Period Recurring Bottlenecks

Bottleneck locations, activation and dissipation times, and queue extents were identified using:

- Inductive loop detector data

- Real time speed maps

- Road cameras/data collection videos
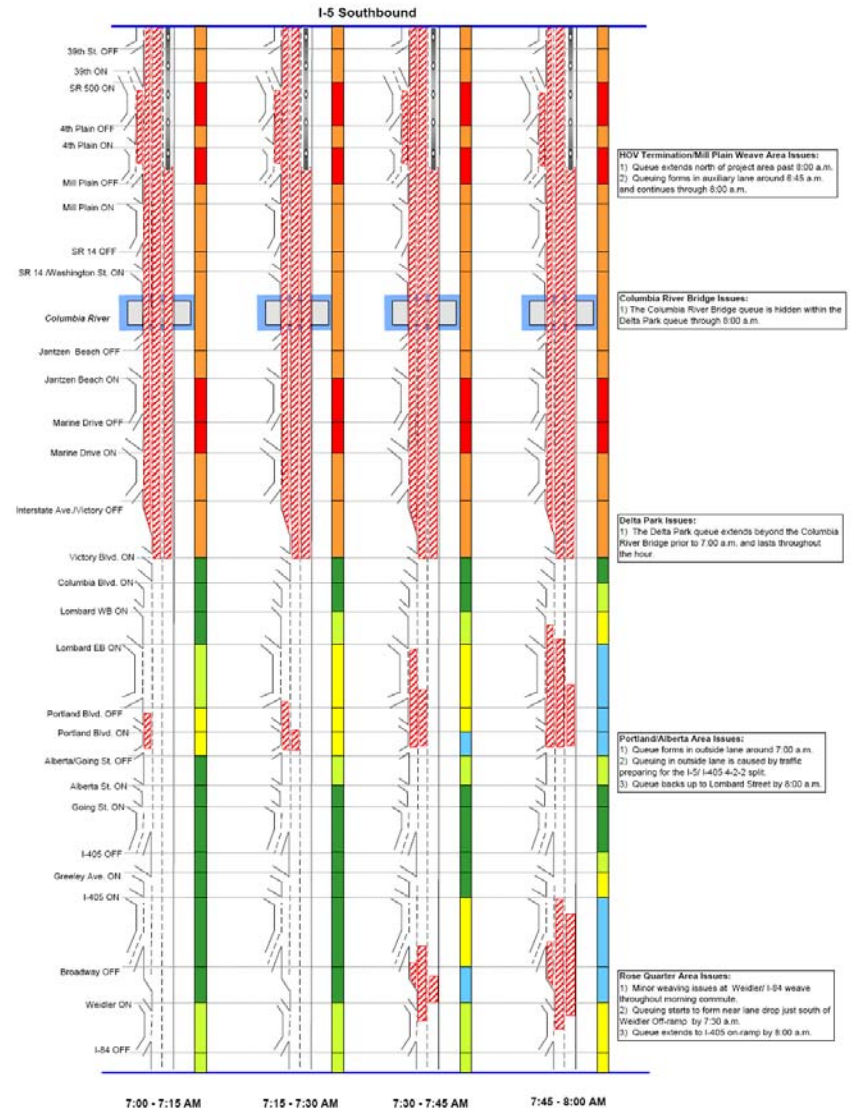
- I-5/Delta Park queue and speed diagrams

Goal 1 Met

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Goal 2 – Modeled vs. Field Capacity Within 10% at Key Locations

- Delta Park lane drop – Southbound

  - Field 3,300-3,400   - Modeled 3,400   - Diff. 0%

- Interstate Bridge – Northbound and Southbound

  - Field 5,200-5,500   - Modeled 5,100   - Diff. 2-8%

Goal 2 Met

Goal 3 – Modeled vs. Field Flows & Travel Time

Validation Criteria Thresholds Comparison - Four Hours Total AM Peak						
Criteria	Criteria Threshold	% Met Target	Southbound		Northbound	
			% Met	Pass/Fail	% Met	Pass/Fail
Link Volumes						
< 700 vph	100 vph	> 85%	100%	Pass	100%	Pass
Between 700 & 2,700 vph	15%	> 85%	100%	Pass	100%	Pass
> 2,700 vph	400 vph	> 85%	85%	Pass	100%	Pass
GEH Statistic	5	> 85%	91%	Pass	100%	Pass
Sum of Link Volumes						
Sum of All Links	5%	-	-	Pass	-	Pass
GEH Statistic	< 5	> 85%	-	Pass	-	Pass
Travel Time						
Travel Paths	15%	-	-	Pass	-	Pass

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Goal 3 – Modeled vs. Field Flows & Travel Time Cntd.

Validation Criteria Thresholds Comparison - Four Hours Total PM Peak						
Criteria	Criteria Threshold	% Met Target	Southbound		Northbound	
			% Met	Pass/Fail	% Met	Pass/Fail
Link Volumes						
< 700 vph	100 vph	> 85%	100%	Pass	100%	Pass
Between 700 & 2,700 vph	15%	> 85%	100%	Pass	100%	Pass
> 2,700 vph	400 vph	> 85%		Pass	89%	Pass
GEH Statistic	< 5	> 85%	100%	Pass	92%	Pass
Link Volumes						
Sum of All Links			-	-	Pass	-	Pass
GEH Statistic	< 5	> 85%	-	Pass	-	Pass
Travel Time						
Travel Paths	15%		-	-	Pass	-	Pass

Goal 3 Met

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Goal 4 – Visually Acceptable Ramp Queuing

- I-5 AM at SR-14/Bridgehead (7:00-8:00 AM)

WSDOT Camera

VISSIM Model

Goal 5 – Modeled vs. Field Speeds

- Modeled speeds were compared with:

  - Web based real time speed maps

  - I-5/Delta Park speed diagrams

  - Field measured travel times

Goal 5 Met

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Goal 6 – Visually Acceptable Lane Utilization

- VISSIM driver behavior parameters adjusted to match lane utilization at HOV, lane drop, and merge locations
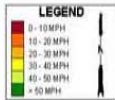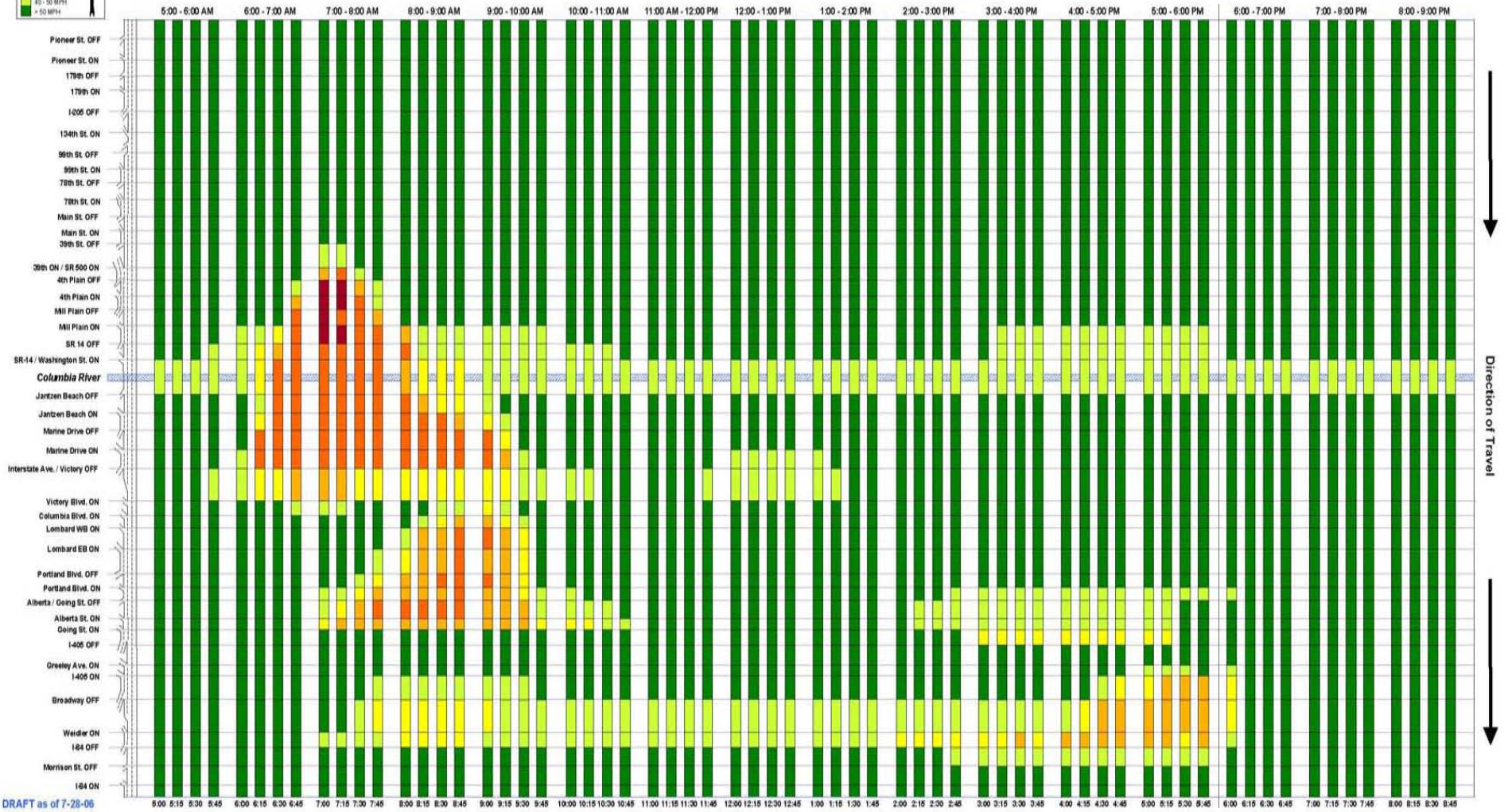

WSDOT Camera

VISSIM Model

Next Steps

- 2030 No Build conditions

- 2030 Build Alternatives

- Development of 16-hour speed profiles

- Summarize performance measures

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Existing 2005 16 Hour Speed Profile

I-5 Corridor - Calibrated Existing 2005 Conditions Southbound Speed Profiles: 5:00 AM - 9:00 PM

I-5 Corridor - Calibrated Existing 2005 Conditions Northbound Speed Profiles: 5:00 AM - 9:00 PM