Automating Variable Speeds with Real Time Traffic and Weather

Presentation for 2014 TexITE Fall Meeting

Renee Hurtado, PE, PTOE
(co-authored by Jim Peters, PE, PTOE)

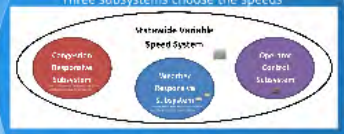
35 years DKS Celebrating

1. Project Background

2. Planning

3. Variable Speed System

Three subsystems choose the speeds



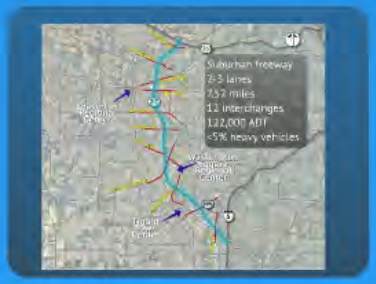
4. Other Integrated Systems

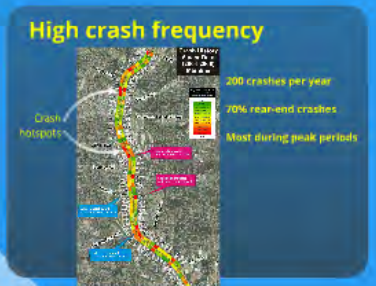
Curve Warning

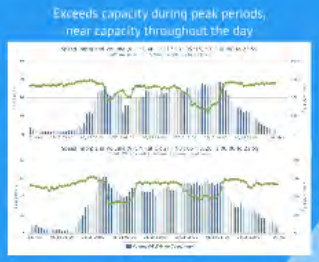
5. Planned Variable Speed Systems

Three Oregon Variable Speed Systems Are Active In 2014

1. Project Background

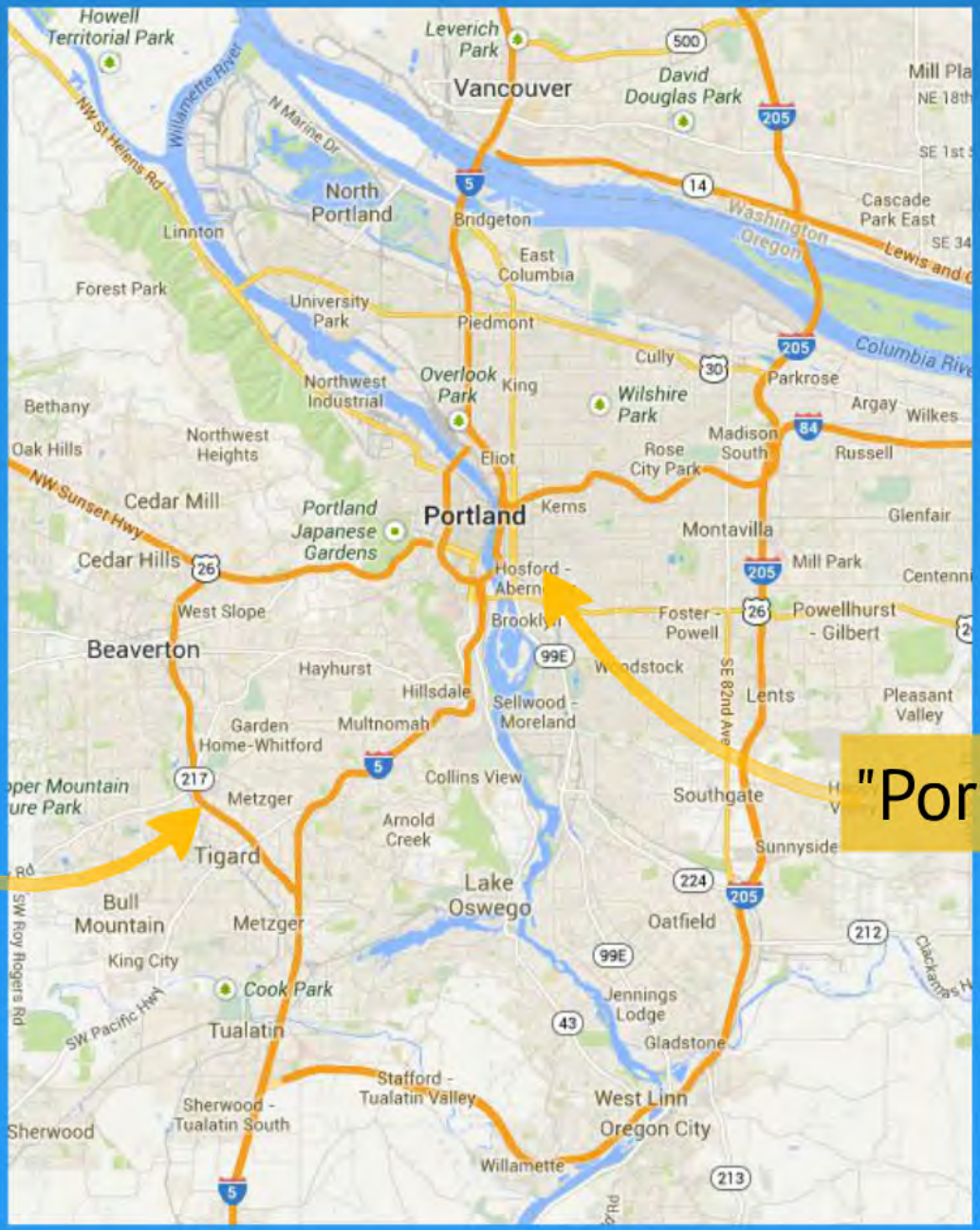




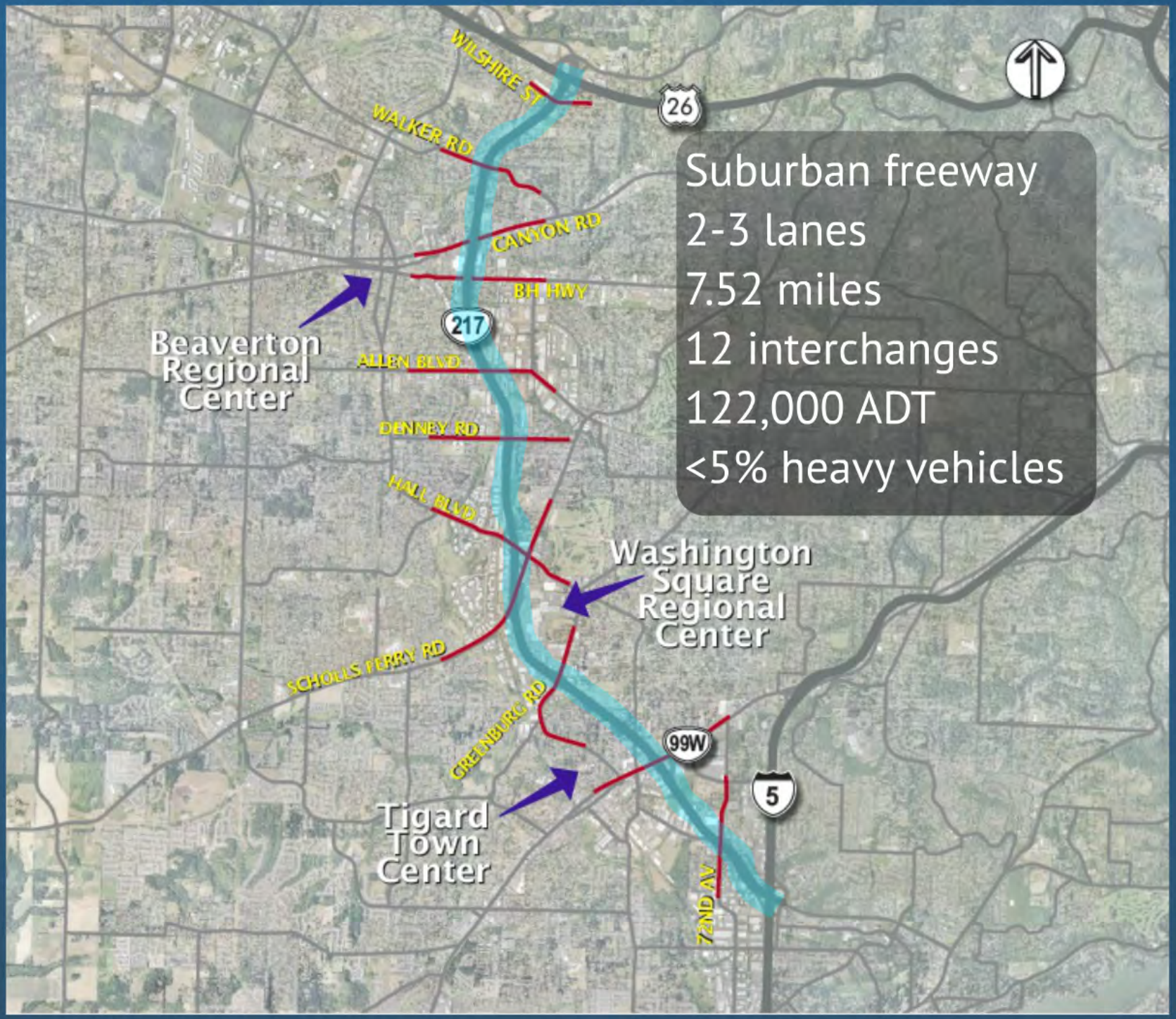


2. Plan

Oregon Route 217

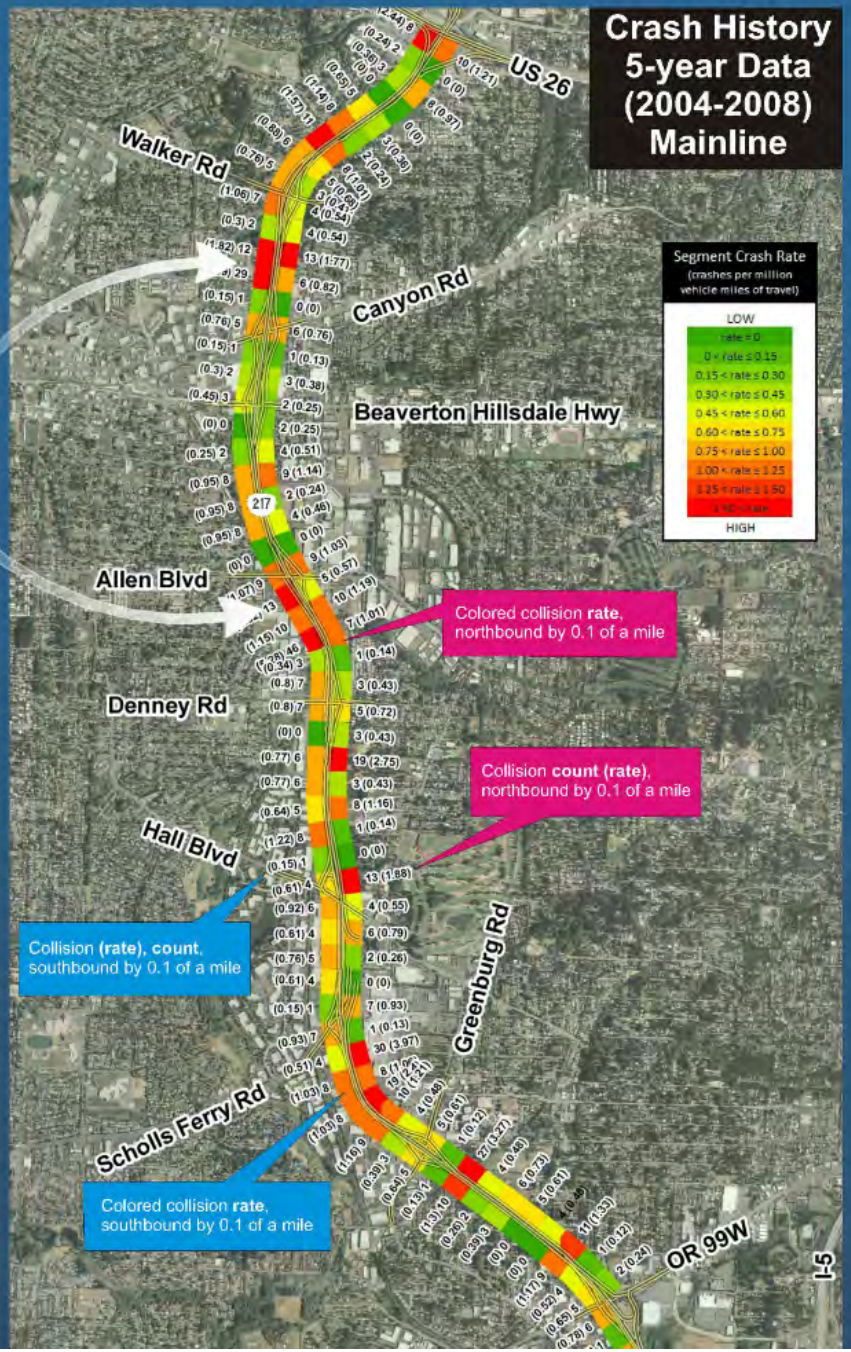


"Portlandia"


WILSHIRE ST
WALKER RD
26
CANYON RD
BH HWY
217
Beaverton Regional Center
ALLEN BLVD
DENNEY RD
HALL BLVD
Washington Square Regional Center
SCHOLLS FERRY RD
GREENBURG RD
99W
5
Tigard Town Center
72ND AV
Suburban freeway
2-3 lanes
7.52 miles
12 interchanges
122,000 ADT
<5% heavy vehicles

High crash frequency

Crash hotspots

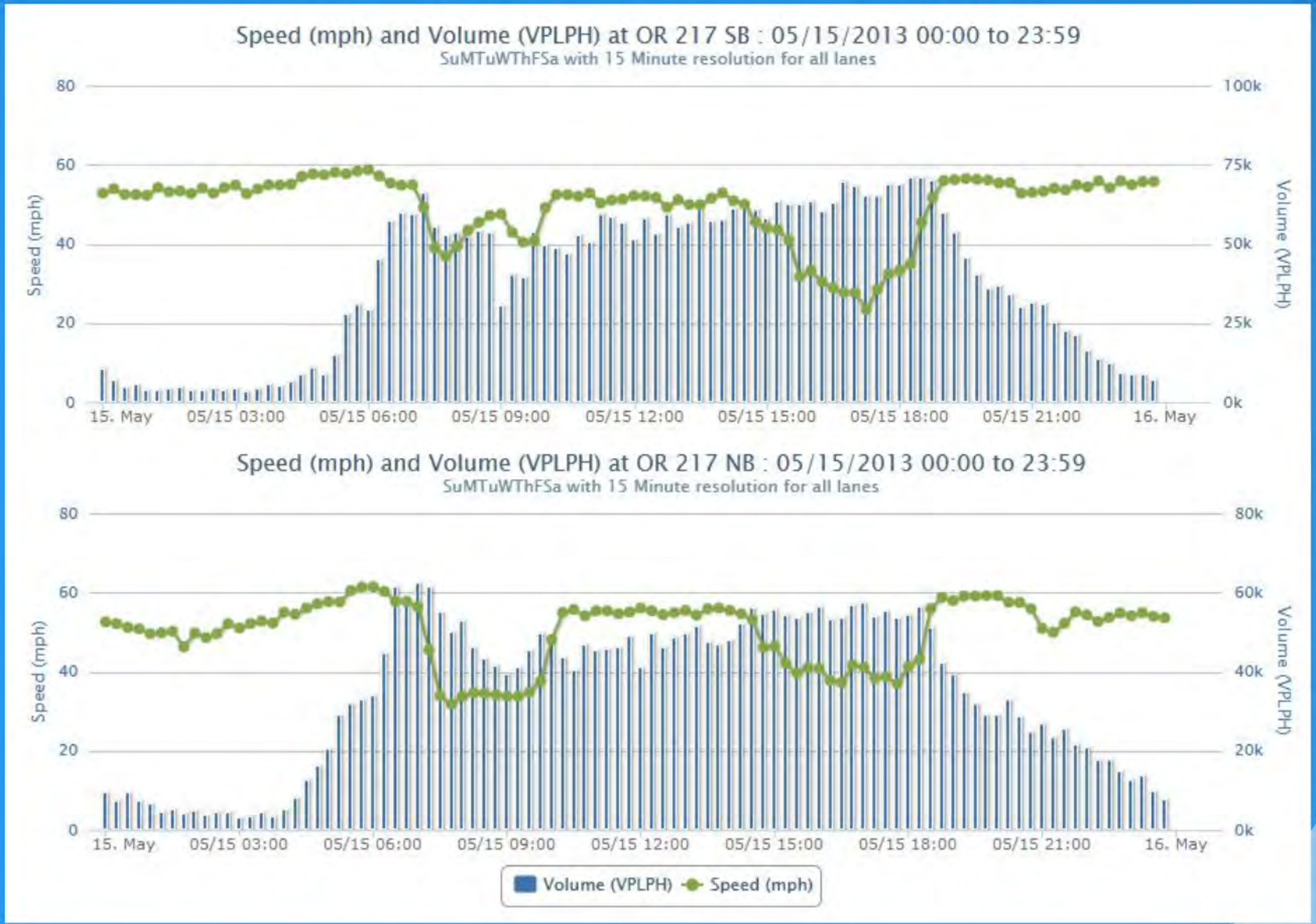


200 crashes per year

70% rear-end crashes

Most during peak periods

Exceeds capacity during peak periods, near capacity throughout the day



2. Planning

Planned solution (2004)

More capacity: add lanes and braid ramps

$1 billion for 7.5 miles

ITS Solutions

Affordable improvements we can build today with immediate traveler benefit

- Variable advisory speeds
- Curve warning system
- Queue warning system
- Travel time information
- Updated adaptive ramp metering

Total cost:
1% of $1 Billion

Actual Improvements Implemented: 2004 to 2013

- Added auxiliary lane (1 mile)

Targeted Safety Improvements

1) Decrease primary factors contributing to collisions:
   - last second avoidance maneuvers
   - panic braking

2) Reduce secondary collisions

3) Improve system reliability and allow the highway to operate better

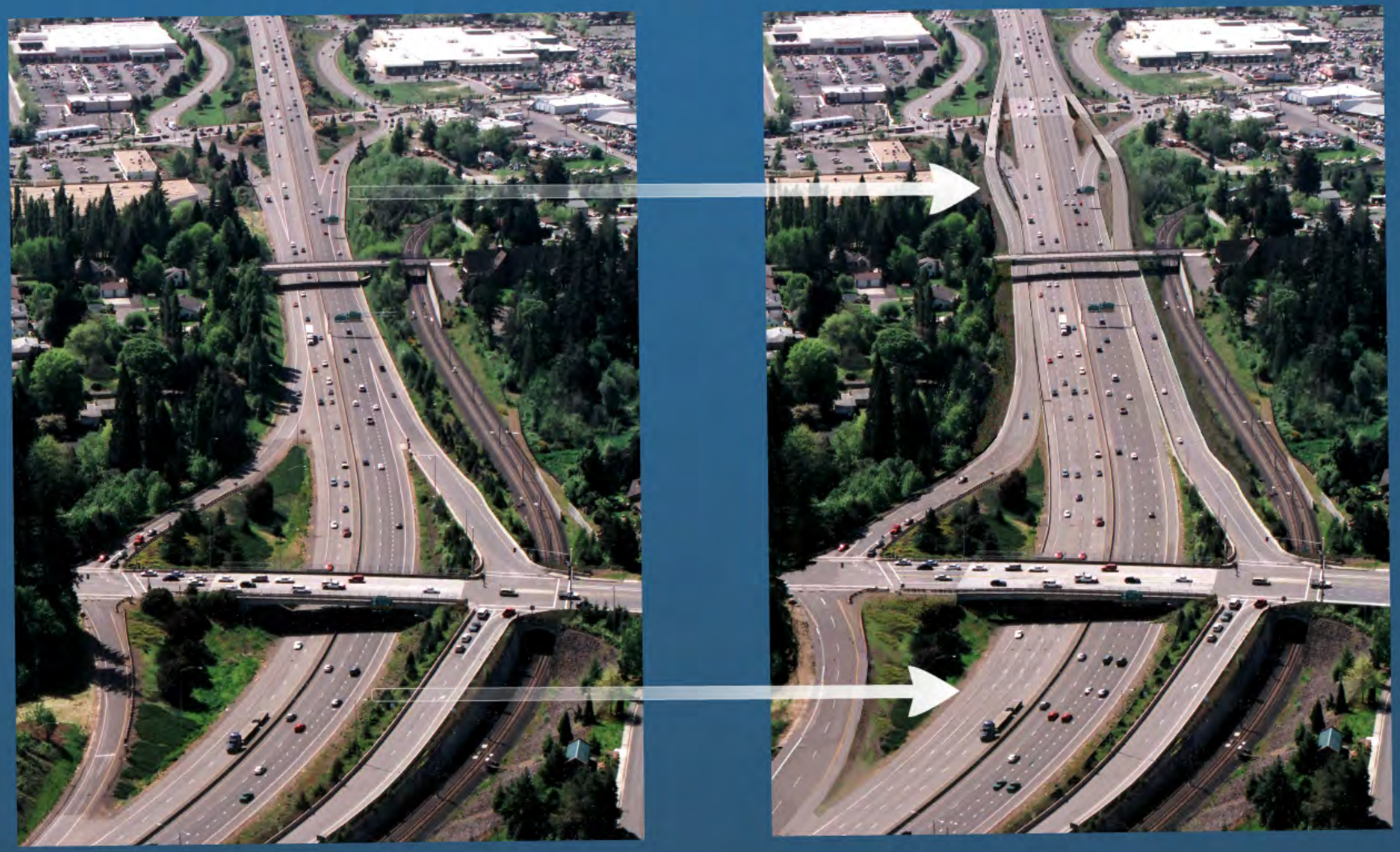
New planning goals
(Let's be realistic)

1) Find a lower cost strategy to improve conditions now.

2) Be consistent with the long-term corridor plan.

Planned solution (2004)

More capacity: add lanes and braid ramps



$1 billion for 7.5 miles

Actual Improvements Implemented: 2004 to 2013

- Added auxiliary lane (1 mile)

New planning goals
(Let's be realistic)

1) Find a lower cost strategy to improve conditions now.

2) Be consistent with the long-term corridor plan.

Targeted Safety Improvements

1) Decrease primary factors contributing to collisions:

- last second avoidance maneuvers
- panic braking

2) Reduce secondary collisions

3) Improve system reliability and allow the highway to operate better

ITS Solutions

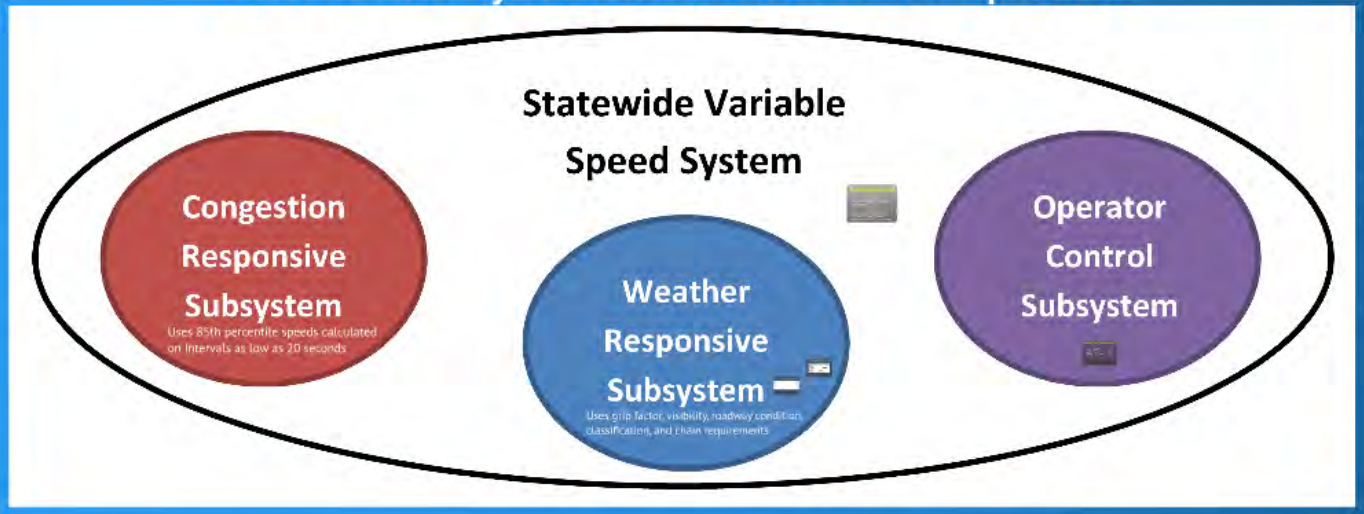
Affordable improvements we can build today, with immediate traveler benefit:

- Variable advisory speeds
- Curve warning system
- Queue warning system
- Travel time information
- Updated adaptive ramp metering

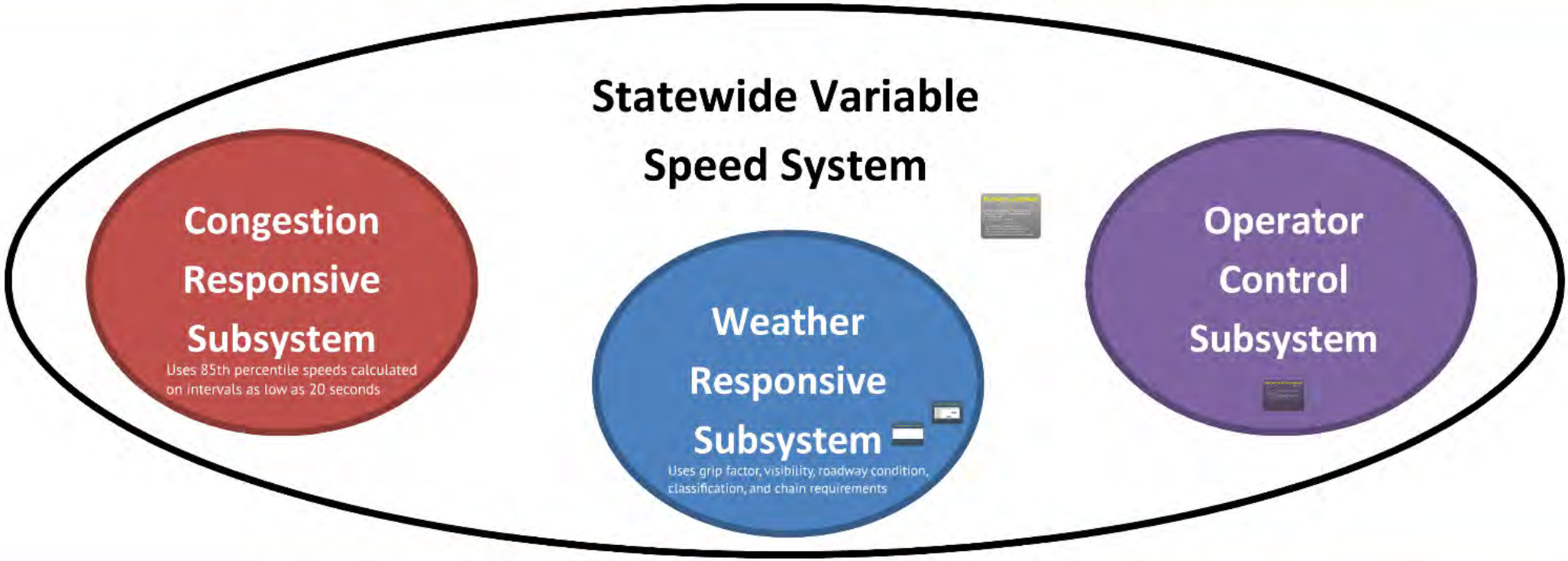
Total cost:
1% of $1 Billion

3. Variable Speed System

Three subsystems choose the speeds



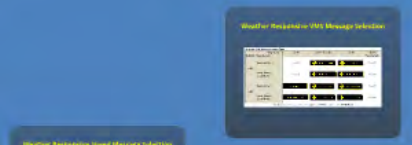
Three subsystems choose the speeds



Congestion Responsive Subsystem

Uses 85th percentile speeds calculated on intervals as low as 20 seconds

Weather Responsive Subsystem



Uses grip factor, visibility, roadway condition, classification, and chain requirements

Weather Responsive Speed Message Selection

Weather Speed Lookup Tables

Visibility \ Grip Factor	> 0.70 (Dry to Wet)	0.70 > X > 0.30 (Very Wet)	< 0.30 (Snow or Ice)
> 500'	Speed Limit	Speed Limit - 10 MPH	Speed Limit - 20 MPH
< 500'	Speed Limit - 10 MPH	Speed Limit - 20 MPH	Minimum Speed

Visibility \ Chain Condition	B or B1 (Towing or > 10,000 lbs)	C (Chains Required)
> 500'	45 MPH	35 MPH
< 500'	35 MPH	Minimum Speed

* The lowest generated speed from the two tables is used

Weather Responsive VMS Message Selection

Weather VMS Message Lookup Table

Visibility	Grip Factor / Classification	> 0.70	0.70 > X > 0.30	< 0.30	Chain Requirement
> 500'	Moist or Wet	(None)	USE CAUTION	USE CAUTION	(None)*
	Frosty, Snowy, Icy, or Slushy	(None)	ICE USE CAUTION	ICE USE CAUTION	(None)*
< 500'	Moist or Wet	LOW VISIBILITY	USE CAUTION	USE CAUTION	(None)*
	Frosty, Snowy, Icy, or Slushy	LOW VISIBILITY	ICE USE CAUTION	ICE USE CAUTION	(None)*

*Snow zone chain requirement messages for VMS will come from ATMS/TOCS

Humans optional

all systems fully automated

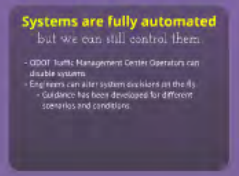
Why?

- Only Engineers can alter traffic control devices
- Operators at ODOT's Traffic Management Center are not Engineers
- Engineers are not staffed 24/7

Benefits

- Reacts quickly to changing conditions
- Automated systems not easily distracted, and continue operating during high workloads
- Will not forget to turn off when no longer needed

Operator Control Subsystem



Systems are fully automated

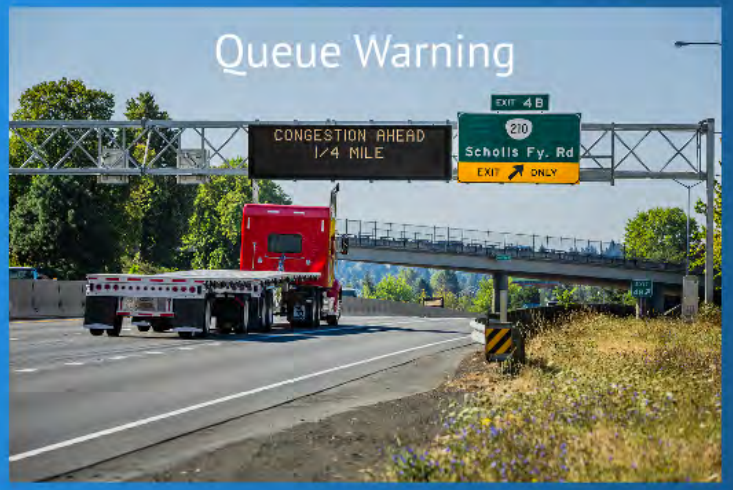
but we can still control them

- ODOT Traffic Management Center Operators can disable systems
- Engineers can alter system decisions on the fly
  - Guidance has been developed for different scenarios and conditions

4. Other Integrated Systems

Curve Warning

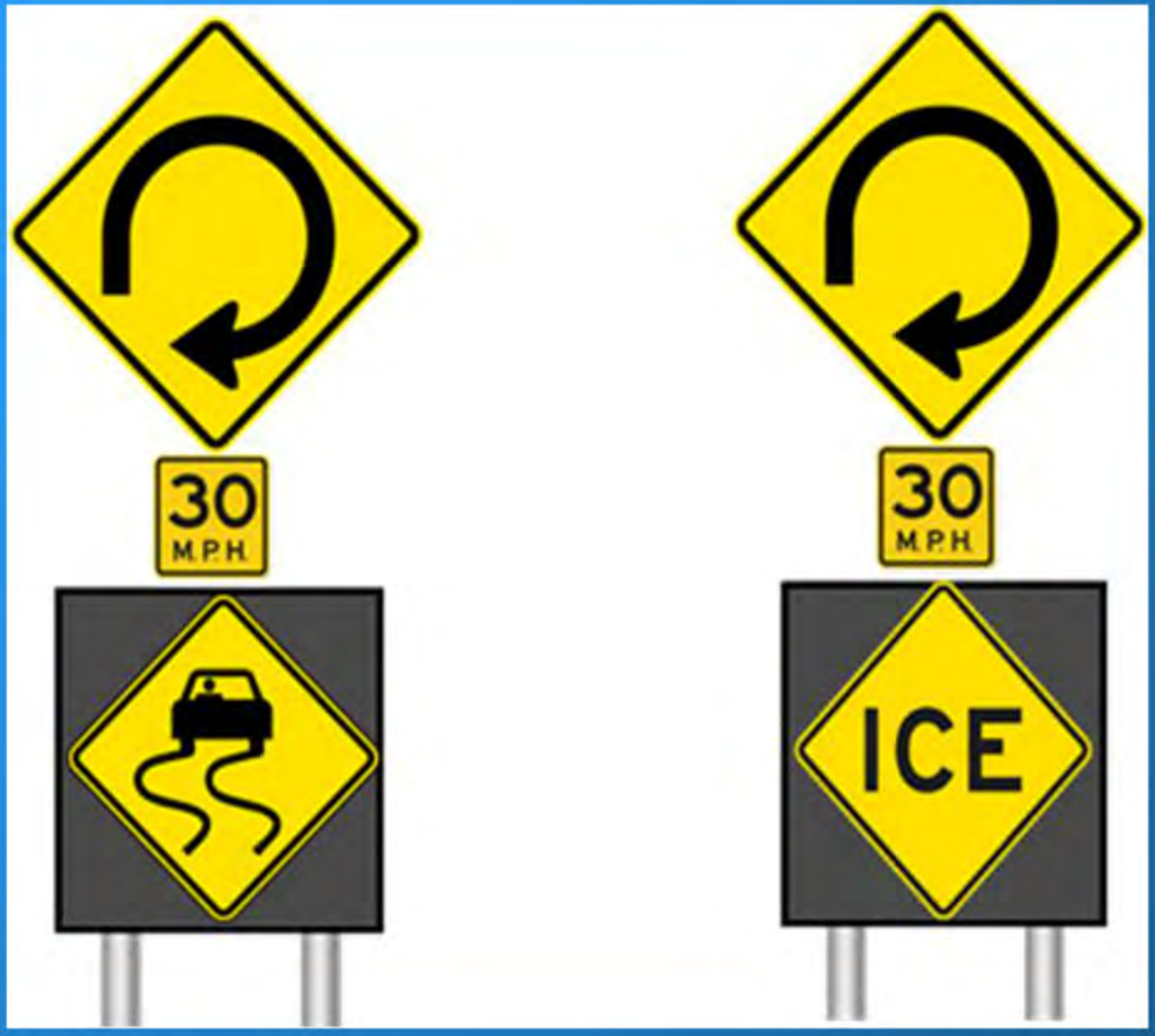
Queue Warning



Travel Times

Adaptive Ramp Metering

Curve Warning



Queue Warning

Travel Times

Adaptive Ramp Metering

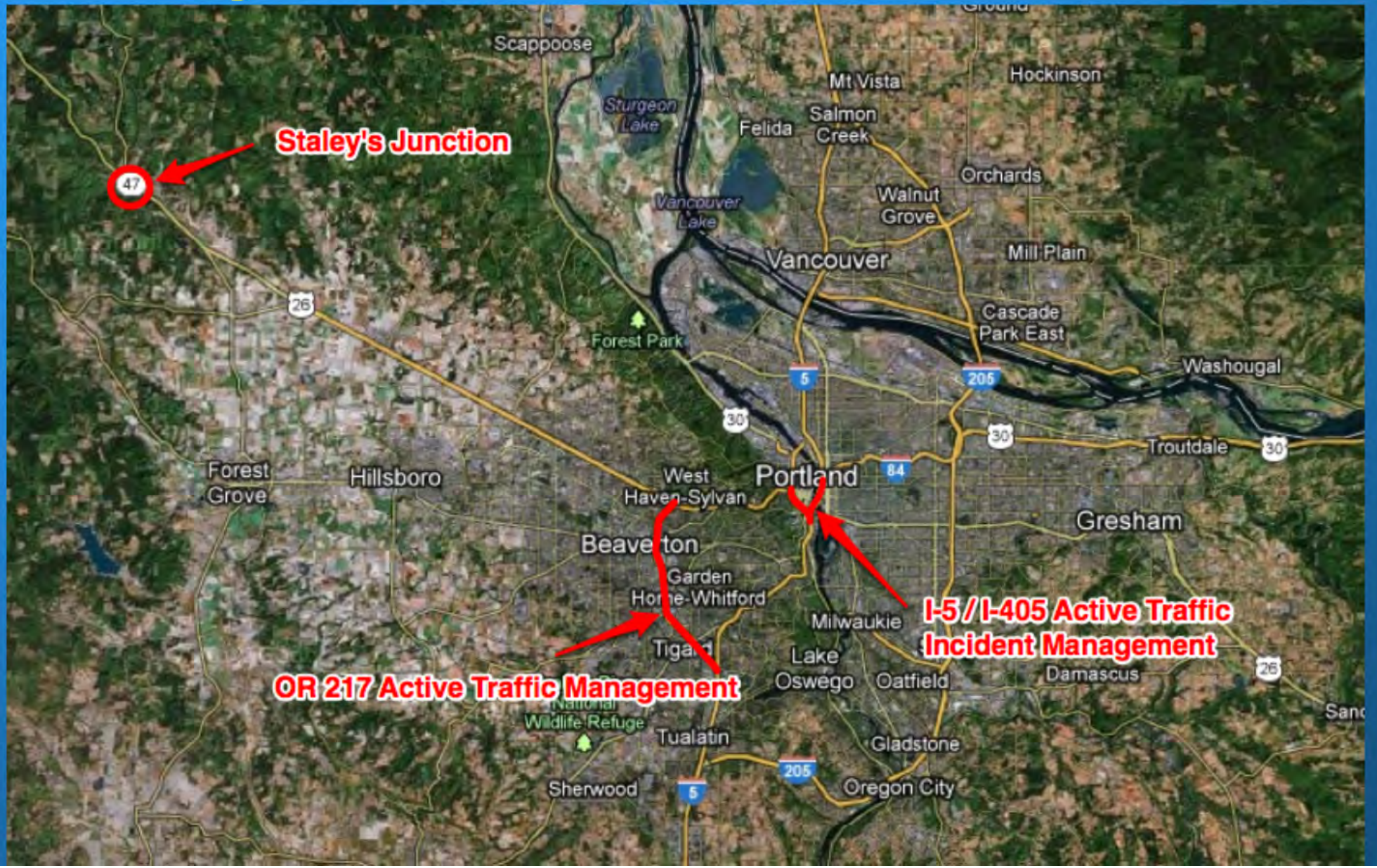
5. Planned Variable Speed Systems

Three Oregon Variable Speed Systems Are Active in 2014

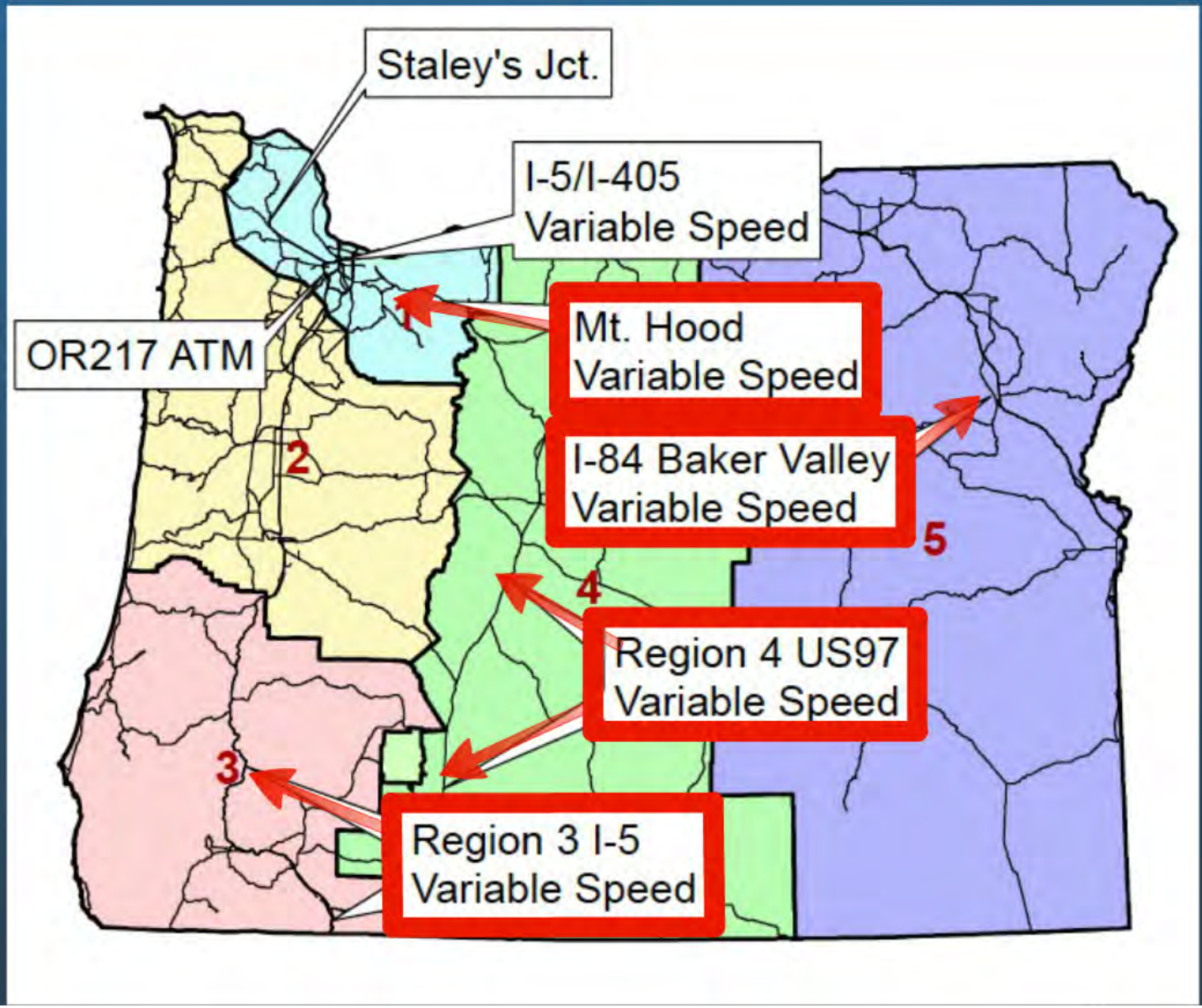
More Variable Speed Systems Are Being Planned

ne/

Three Oregon Variable Speed Systems Are Active in 2014



More Variable Speed Systems Are Being Planned



https://www.tripcheck.com/realtime/