DTA Simulation Model

Project Experience:

TRPC – Smart Corridors Project

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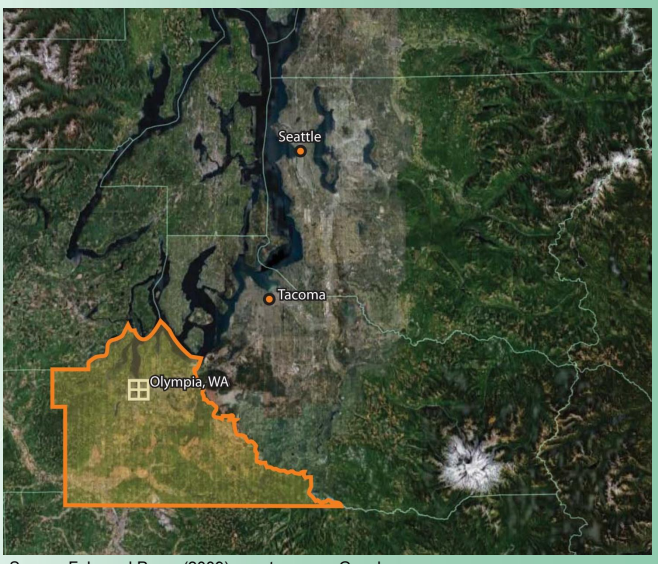
Overview

- Thurston Regional Planning Council (TRPC) is an intergovernmental board made up of local government jurisdictions within Thurston County in Washington State
- County has an area of 727 sq miles and a population of 245,300
- The county is the home of the State's Capitol, City of Olympia
- The county's population is expected to be 373,000 in 2030

Geography



Source: Fehr and Peers (2009); courtesy map Google

Project Background

- Congestion Mitigation and Air Quality (CMAQ) grant
- TRPC policy makers decided to focus on two strategic corridors
- Best options to reduce PM10 in support of their ITS architecture
  - coordinated signal timing and optimization
  - transit signal priority (TSP)
- Two strategic corridors were chosen from the Regional Transportation Plan (RTP) that are problematic for Intercity Transit's on-time performance goals

Study Corridors

Project Objectives

- To improve multi-modal transportation operations on the two corridors
- To evaluate signal coordination and optimization
- To evaluate transit signal priority
- To integrate arterial/freeway management
- To reduce PM10 (particulate matter) emissions in the corridors.

Why DTA Model?

- TRPC's Travel Demand Model has limitations as any other 4-step model
- TRPC wants a tool that will help them evaluate ITS options and study operational characteristics
- Regional concept of traffic operations and to develop a model for the county with DTA for the benefit of jurisdictions

DTA Model Development

- NETWORK
- TRIP TABLES
- INTERSECTION CONTROLS
- INTERSECTION GEOMETRY
- VALIDATION & CALIBRATION

DTA Model Development

- NETWORK
  - Entire network brought into DTA model from Travel Demand Model
  - Refined the network to add missing intersections on the corridors
  - Modified all centroid connectors for the zones around two corridors to reflect field conditions
  - Verified link attributes
  - Network properties in DTA model:
    - 800 centroids
    - 2500 regular nodes
    - 8000 links
    - 20 transit lines (study corridors only)
- TRIP TABLES
  - Trip tables brought from Travel Demand Model
  - The modes are SOV, HOV & Truck

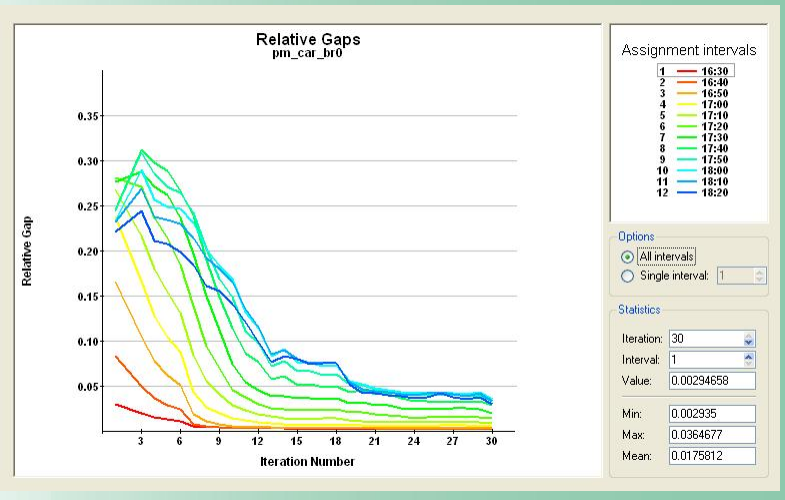
DTA Model Development

- INTERSECTION CONTROLS
  - Coded on two study corridors first
  - For all the intersections within the buffer zone of a few blocks from the corridors
  - 81 signals & 67 stopped controls
- INTERSECTION GEOMETRY
  - Approaches to the intersections were modified to reflect field conditions
  - Added right and left turn lane pockets where needed

DTA Model Development

- Validation / Calibration
  - Validated and calibrated the existing year model (study corridors and I-5 primarily)
    - Based on link counts
    - Based on turn move counts
    - Based on travel time on corridors
  - Queuing at hot spots

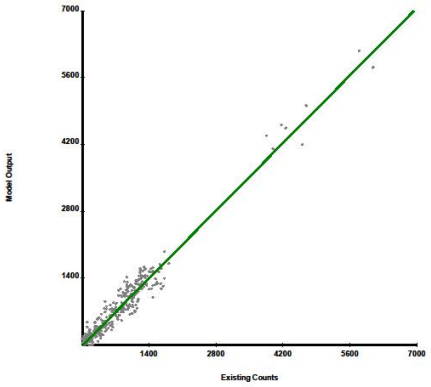
Model Convergence



Existing Model Validation / Calibration – Link Volume

Including I-5

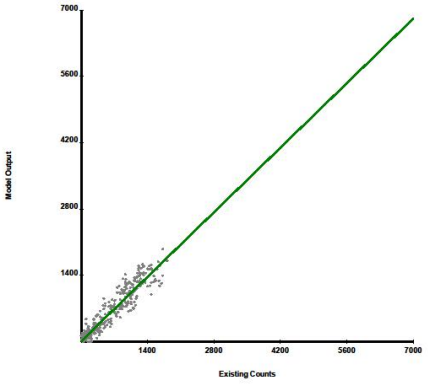
R Squared = 0.955, Slope = 1.01



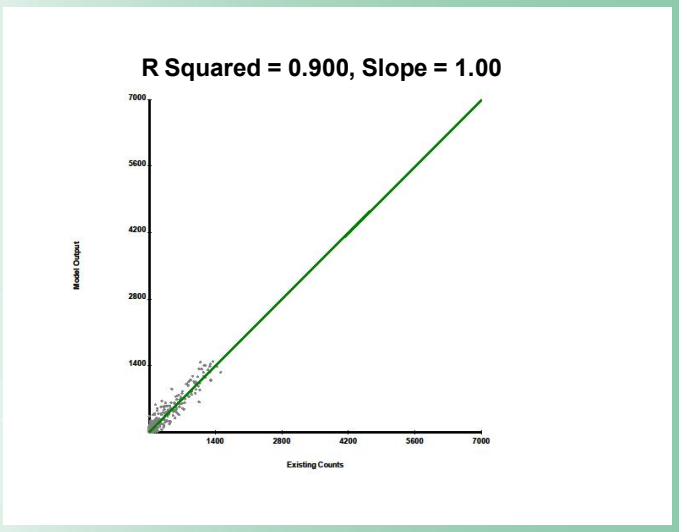
Existing Model Validation / Calibration – Link Volume

Excluding I-5

R Squared = 0.894, Slope = 0.97

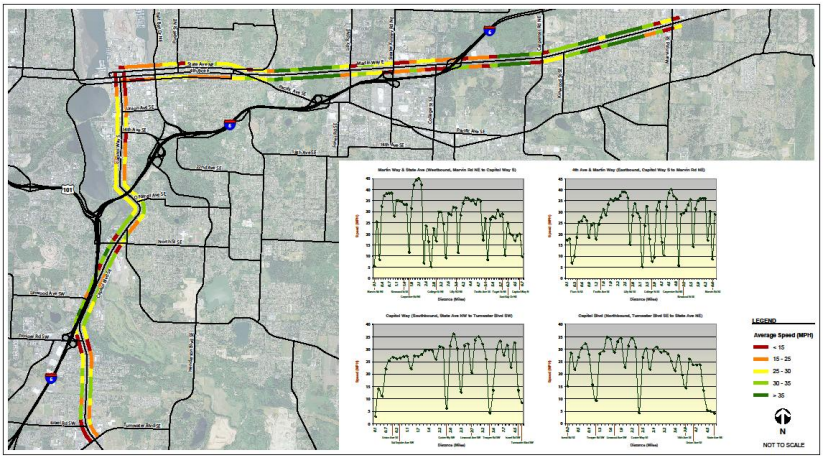


Existing Model Validation / Calibration – Turn Movement



Existing Condition

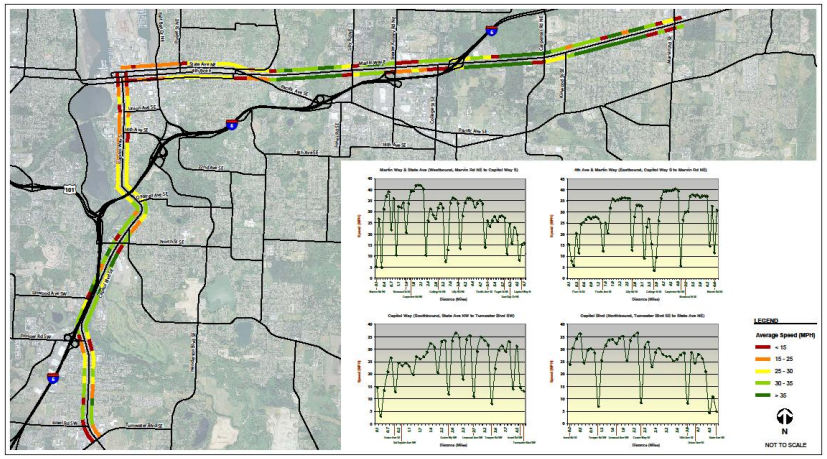
- **Weekday** Observed Travel Speed (mph)



THURSTON COUNTY SMART CORRIDOR - TRAVEL TIME (AVERAGE WEEKDAY)
FIGURE X

Existing Condition

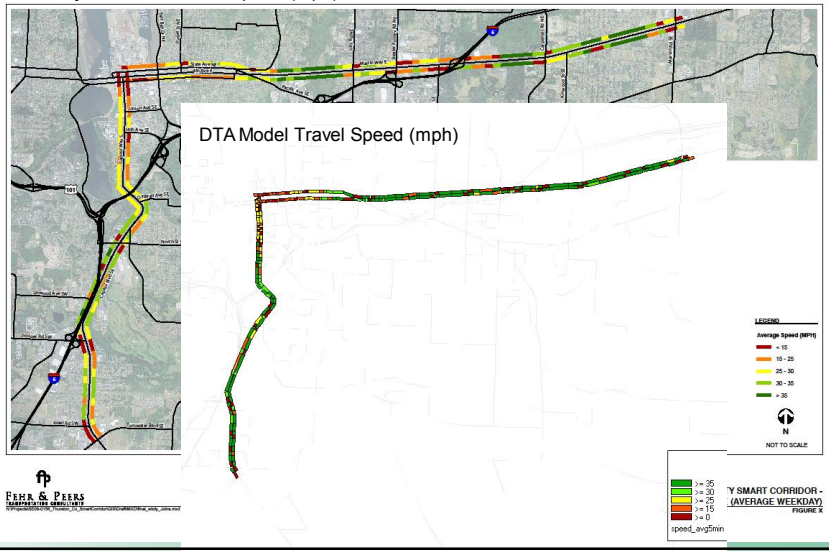
- **Saturday** Observed Travel Speed (mph)



THURSTON COUNTY SMART CORRIDOR - TRAVEL TIME (WEEKEND)
FIGURE X

Comparison of Travel Speed

Weekday Observed Travel Speed (mph)



Y SMART CORRIDOR - (AVERAGE WEEKDAY)
FIGURE X

Existing Model Validation / Calibration – Travel Time

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Observed Travel Time (sec)

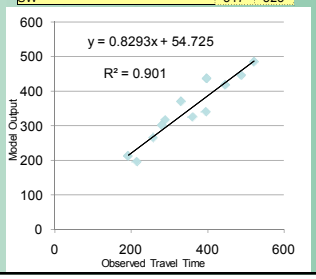
Martin Way SE	WB	EB
500 Ft. E of Marvin Rd NE - I-5 SB Ramps	521	488
I-5 SB Ramps - Pacific Ave SE	397	446
State Ave NE		
Pacific Ave SE - Capitol Way S	257	N/A
4th Ave S		
Capitol Way S - Pacific Ave SE	N/A	280
Capitol Way S/Capitol Blvd S	**NB**	**SB**
State Ave NE - Carlyon Ave SE	395	330
Carlyon Ave SE - Linwood Ave SW	214	192
Linwood Ave SW - Tumwater Blvd SW	289	360

Model Travel Time (sec)

Martin Way SE	WB	EB
500 Ft. E of Marvin Rd NE - I-5 SB Ramps	485	447
I-5 SB Ramps - Pacific Ave SE	437	418
State Ave NE		
Pacific Ave SE - Capitol Way S	265	N/A
4th Ave S		
Capitol Way S - Pacific Ave SE	N/A	301
Capitol Way S/Capitol Blvd S	**NB**	**SB**
State Ave NE - Carlyon Ave SE	341	370
Carlyon Ave SE - Linwood Ave SW	196	212
Linwood Ave SW - Tumwater Blvd SW	317	325

Travel Time Comparison (Model-Observed) /Observed

Martin Way SE	WB	EB
500 Ft. E of Marvin Rd NE - I-5 SB Ramps	-6.9%	-8.4%
I-5 SB Ramps - Pacific Ave SE	10.1%	-6.3%
State Ave NE		
Pacific Ave SE - Capitol Way S	3.1%	N/A
4th Ave S		
Capitol Way S - Pacific Ave SE	N/A	7.5%
Capitol Way S/Capitol Blvd S	**NB**	**SB**
State Ave NE - Carlyon Ave SE	-13.7%	12.1%
Carlyon Ave SE - Linwood Ave SW	-8.4%	10.4%
Linwood Ave SW - Tumwater Blvd SW	9.7%	-9.7%



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Existing Model Validation / Calibration – Queuing

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Lane queues at Lilly Rd / Martin Way intersection

Source: Snapshot from the DTA model simulation

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Why DTA Model??

- More realistic traffic simulation
  - Lane based simulation
  - Traffic congestion / queuing
  - Intersection delays
- Region-wide traffic operation model
- Hot spot identification
- Corridor analysis
- Incident management
- Work zone analysis
- Evacuation plan

Comparison of Speed Output

Travel Demand Model

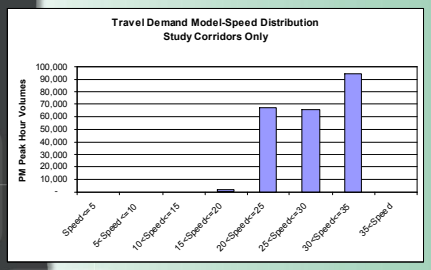
Link Congested Speed (mph)	Total Link Volume per hour
Speed<=5	-
5<Speed<=10	-
10<Speed<=15	-
15<Speed<=20	1,711
20<Speed<=25	67,544
25<Speed<=30	65,538
30<Speed<=35	94,199
35<Speed	-

DTA Model

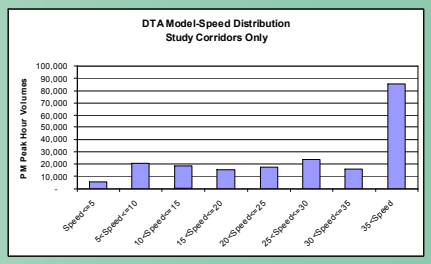
Link Congested Speed (mph)	Total Link Volume Total (One Hour)
Speed<=5	5,450
5<Speed<=10	20,719
10<Speed<=15	18,250
15<Speed<=20	15,858
20<Speed<=25	17,720
25<Speed<=30	24,168
30<Speed<=35	16,089
35<Speed	85,330

Comparison of Speed Output

Travel Demand Model



DTA Model



Lessons Learned

- Data needs
- Network resolution
- Validation/Calibration

Do you have any questions on this presentation or related issues?

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