Wednesday, July 17, 2013

Recent Changes to the Regional Travel Demand Model

Recent changes to Metro's Regional Travel Demand Model have resulted in forecast travel volumes in Clackamas County in 2035 that are ***less than previous forecast travel volumes***. These revised forecasts, and the adoption of new performance standards, mean that the levels of projected congestion on Clackamas County roads and the number of Clackamas County intersections projected to fail in the next 20 years has ***decreased***.

This memo reviews what the changes are and the impact they have had on the travel demand forecast.

Clackamas County is updating its Transportation System Plan (Comprehensive Plan Chapter 5). As part of this work Clackamas County conducted extensive analysis of the arterial and collector road system in the County using information from Metro's Regional Travel Demand Model and other transportation data sources.

During this multi-year TSP update process, Metro's Regional Travel Demand Model has been updated and revised, resulting in changes in forecast traffic volumes on the regional arterial and collector road system.

The major changes are listed below, followed by more detailed descriptions of each.

A. Changes in land use assumptions, which result in changes to forecast vehicle trips
    a. Distribution and number of households
    b. Distribution and amount of employment
    c. Economic composition of households
B. More detailed analysis of travel, based on increased Travel Analysis Zones (TAZs),
C. Changes in travel model trip assignments
D. Changes in total amount of employment in Clackamas County

There are three levels of modeling that have been applied during this process:

1. **Beta Forecast**: Used in winter and spring 2012 for existing and future conditions modeling for 2010 and 2035 low-build and full-build scenarios with 2-hour PM peak forecasts
2. **Gamma Forecast/2-hour PM peak**: Used in summer 2013 for Tier 1 scenario modeling for 2035 (including the projects on the draft 20-Year Capital Project List) with 2-hour PM peak forecast
3. **Gamma Forecast/1-hour PM peak:** Will be used for the next round of RTP updates in 2014with 1-hour PM peak forecast and a peak spreading algorithm

The County conducted its first round of analysis using the 2010 and 2035 Beta forecasts. This analysis identified that 44 intersections out of the 125 studied would fail to meet performance standards in 2035. When the Tier 1 Scenario was analyzed using the Gamma forecast, only five intersections were identified as failing to meet the performance standards in 2035.

Clackamas County Transportation staff and Metro Travel Modeling staff have identified the following changes between the travel models.

A. Changes in 2035 Land Use Assumptions – Households and Employment

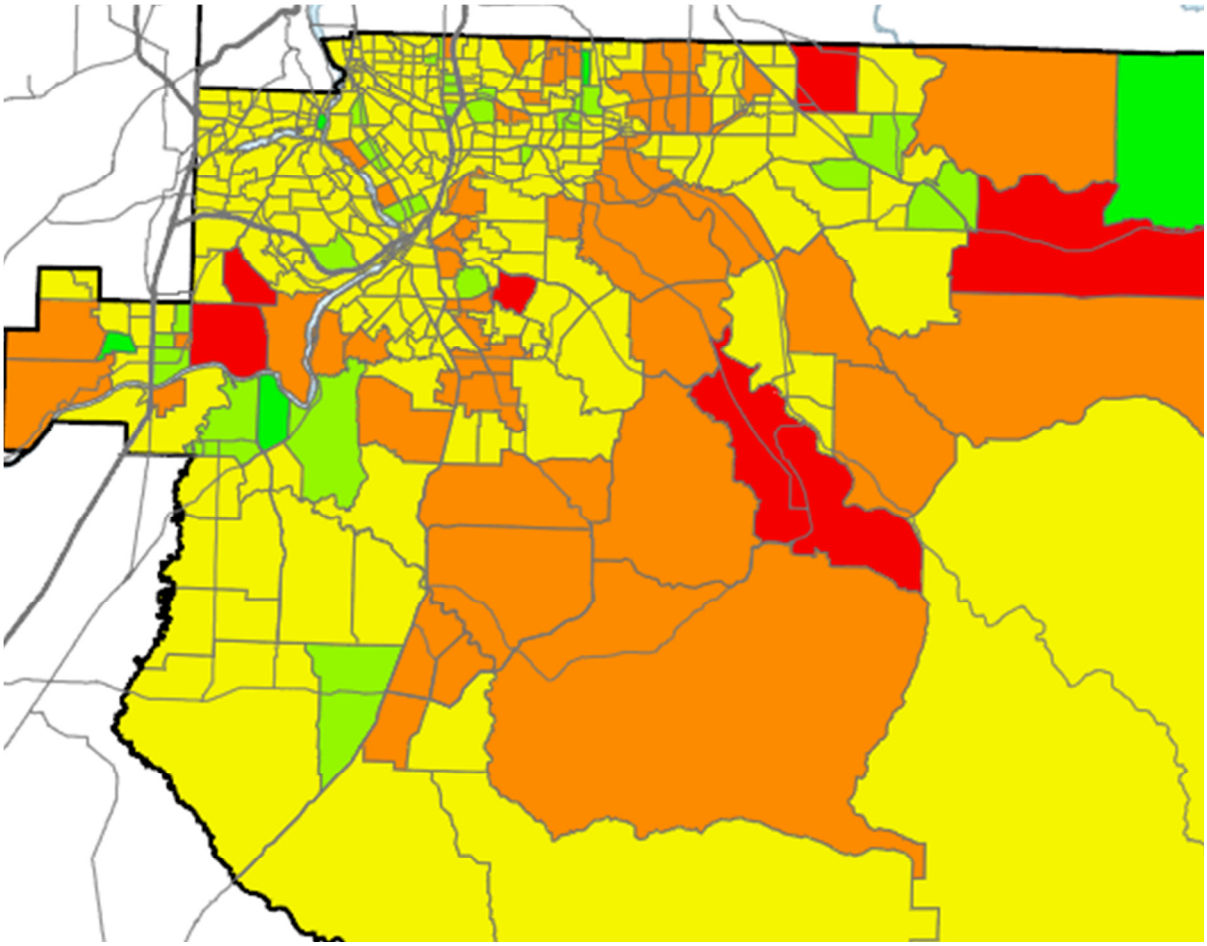
- The 2035 Gamma forecast has approximately 8,000 fewer households in Clackamas County than the 2035 Beta forecast. The final Transportation Analysis Zone (TAZ) allocations used in Metro's travel demand modeling tools for the two model runs being compared are shown below.

Total Households	2035 Beta	2035 Gamma	# Diff	% Diff
4-County* Total	1,197,568	1,168,967	-28,601	-2.4%
Clackamas County	***216,602***	***208,433***	***-8,169***	***-3.8%***

Total Employment	2035 Beta	2035 Gamma	# Diff	% Diff
4-County* Total	1,439,285	1,412,606	-26,679	-1.9%
Clackamas County	***205,960***	***210,444***	***+4,484***	***+2.2%***

The four counties are Clackamas, Clark, Multnomah and Washington.

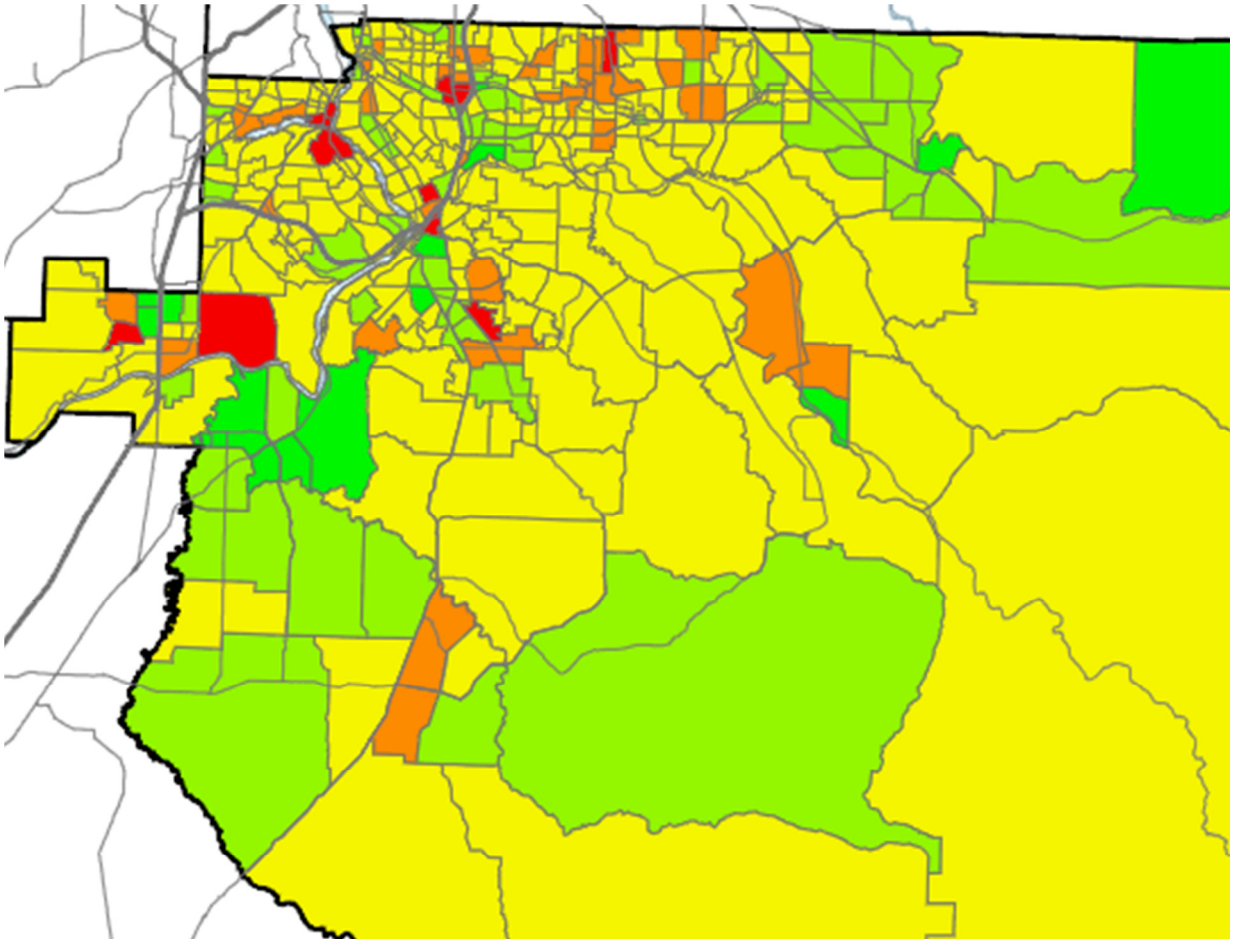
Households were redistributed within Clackamas County as shown in the map below. Red and orange indicate zones with fewer households in the Gamma forecast; green shows which zones had gains in the total number of households.



The different distribution of households results in local variations in the number of trips generated. This distribution can be described in the following terms:

- The Damascus and Estacada areas have fewer households.
- The Canby, Molalla and Sandy areas have more households.

Employment was also redistributed and increased slightly. Again, the red and orange indicate zones with less employment in the Gamma forecast while green shows the zones with gains.



There is a countywide change in the economic composition of the households between the two models, which affects the number of trips generated in the County.

- There is a general decrease in household income levels across the County, which may be related to large numbers of households with residents who are or soon will be retiring. Lower household incomes are strongly associated with reduced access to automobiles and increased demand for transit services.
- The make-up of the households in Clackamas County was changed as a result of the 2010 Census. Between the Beta and Gamma allocations, the shares of larger and higher income households were reduced somewhat, and the shares of smaller and lower income households were increased. The

percentage changes may not be large, but they are definitely contributing factors. In Metro's model, lower income households make fewer trips, own fewer cars, and are more sensitive to travel costs than higher income households.

Below are the daily trips generated by households in the travel demand model given the land use allocations:

Total Trips Produced	**2035 Beta**	**2035 Gamma**	**# Diff**	**% Diff**
4-County Total	12,330,500	11,425,400	-905,100	-7.3%
Clackamas County	***2,302,700***	***2,076,300***	***-226,400***	***-9.8%***

Total Work Trips Produced	**2035 Beta**	**2035 Gamma**	**# Diff**	**% Diff**
4-County Total	2,143,300	1,978,700	-164,600	-7.7%
Clackamas County	***426,500***	***380,300***	***-46,200***	***-10.8%***

- As a result of these changes in the 2035 land use and economic assumptions, **the total number of vehicles trips in 2035 decreased by 10%** between the Beta forecast and the Gamma forecast.

B. Changes to the Travel Model

A key component of a travel model is the Origin-Destination (O-D) Matrix which allocates all of the trips generated in a Traffic Analysis Zone (TAZ) to all of the other TAZs in the Regional Travel Model. This allocation is based on the results of a detailed travel survey of a large number of people living in the region.

- There are currently 2,162 TAZs in the Travel Demand Model.
- The old travel survey conducted in 1994 showed that 93% of all trips in Clackamas County were made by automobile. This survey data was used by the Beta model in the initial phase of the TSP update travel analysis.
- The new travel survey conducted in 2011 showed that 87.6% of all trips in the region were made by automobile. This survey data was used by the Gamma model in the Preferred Alternative travel analysis.

The following table shows how mode shares changed between 1994 and 2011 for all households.:

Mode Share by Area of Residence, 1994 vs. 2011 (source: *Metro Household Travel Survey*)

	1994	2011	1994	2011
	Region	**Region**	**Clackamas**	**Clackamas**
Single-Occupancy Vehicle (SOV)	43.4%	42.5%	46.2%	45.1%
High-Occupancy Vehicle (HOV)	43.9%	41.2%	47.0%	42.5%
Total Auto	*87.3%*	*83.8%*	*93.2%*	*87.6%*
Transit	2.9%	4.2%	1.1%	2.9%
Walk	8.7%	9.2%	5.2%	8.2%
Bike	1.1%	2.8%	0.4%	1.3%

- The survey shows that Clackamas County continues to have a higher proportion of auto trips than the 4-county region as a whole (93.2% vs. 87.3% and 87.6% vs. 83.8%). However, there were significant increases in non-auto modes between 1994 and 2011 which resulted in **an additional 5% reduction in the overall number of trips made by automobile in 2035.**
- The combined effect of these two changes to the travel model is a 15% reduction in the number of trips made by automobiles and a resulting decrease in the travel volumes shown by the model in 2035.
- The above analysis indicates that there are a number of factors contributing to the reduction of trips region-wide and in Clackamas County – fewer households, change in household composition and recalibrated mode shares. While these may not be the entire story, they explain a large amount of the differences in projected 2035 traffic volumes.

Additional Travel Model Issues

C. Travel Model Trip Assignments

- The 15% decrease in trips is based on the total daily trips.
- The model makes its forecast for the PM peak hour, which has a higher percentage of the total trips occurring by transit.
- The result of this difference is an additional reduction in auto trips of approximately 3%, which increases the total reduction of in automobile PM peak hour trips to 18%.

D. Employment Changes

- The total employment in Clackamas County increased by a few thousand jobs between the Beta forecast and the Gamma forecast.
- The change may produce shorter journey-to-work trips as people in Clackamas County households have more opportunities to be employed within the county.

The combined effect of these four factors is estimated to reduce the number of automobile trips by at least 18% from the model estimate developed as part of the TSP low-build model in the *Existing and Future Conditions Analysis*.

Model Trip Reduction and New Traffic Operations Performance Standards

- The Oregon Highway Plan (OHP) and the Regional Transportation Functional Plan (RTFP) require that the County adopt new traffic operation performance standards using a volume-to-capacity (v/c) measure.
- The combination of new performance standards and reduced travel volumes estimated by the travel model will substantially reduce the number of intersections that fail to meet the performance standards.
- **The effect of these changes is not going to solve future traffic capacity problems, but will potentially push out the time at which the problems / failures are projected to occur beyond the 20-year planning horizon.**

APPENDIX 1: Summary of Network and Model Enhancements since the last RTP Update

prepared by Metro staff, July 2013

Network Updates

- The Transportation Analysis Zone (TAZ) system was significantly modified (from 2,013 to 2,162 TAZs). The new zones are better aligned with current tax lot boundaries.
- The base year was updated from 2005 to 2010.

Updated Inputs

- 2040 design types updated to include more tiers based on findings from State of the Centers report and Transit-Oriented Development strategic plan reflecting that not all Centers and Station communities are in the same stage of development.
    - Regional Centers – from 1 to 2 tiers
    - State Communities – from 1 to 3 tiers
    - Town Centers – from 2 to 4 tiers
    - Corridors – NW 23rd adjusted to reflect high parking restrictions compared to other Corridors.
- Updated TAZ assumptions based on 2040 design types to allow for more control over policies being tested. Main Street, Corridor, Inner neighborhood all used to be in one classification. By splitting them, you can test parking policy on just corridors.
    - Parking factors – coordinated with City of Portland to reach agreement. Central City parking costs have been increasing at different rates in different parts of the city. Agreement reached to use a consistent value in the future.
    - Intersection densities recalculated to reflect new zone system
    - Transit pass factors updated to 2010$

Model Enhancements

- The last RTP update used the Ivan model.
- The East Metro Connections Plan used Joan model (version 1.0)
- The 2014 RTP update will use the Joan model (version 2.0), which was used by other planning efforts such as the SW Corridor Plan, Active Transportation Plan, and several recent TSPs.
    - Enhancements included in Joan Version 2.0 include:
        - Transit time perception
            - Wait time perception varies depending on stop type: pole, basic shelter, enhanced shelter/transit center
            - In-vehicle time perception varies depending on vehicle types: bus, street car, light rail
        - Park & Ride Lot Choice
            - A traveler considering using the park-ride mode is now given the opportunity to consider multiple lots locations. Prior, only one lot choice was offered.
        - Validation to the Portland/Vancouver Region Travel Behavior Survey

- The model was modified as necessary to make sure that parameters were effective in producing model results that reflected today's conditions. New regional mode shares will be reflected in new model to reflect change from 1997 to 2011 surveys: decrease in auto (87.3 to 83.7), increase in biking, walking and transit (12.7 to 16.2) (these numbers include travel to/from Clark County.

- Bike model
  - Formerly the regional model only factored trip distance into the decision to bike as well as some socioeconomic/demographic factors. The new model calculates a travel utility between zone pairs, and includes all streets. Bike lanes, boulevards, trails, etc. are flagged as more attractive than other routes. Consideration is given to the volume of auto traffic, number of stop signs/signals along route, number of left turns, slope, other network attributes.
  - The bike model assigns bike trips to the network, illustrating volume flows, identifies origins and destinations of users traveling along a given segment of the network, calculates bike miles traveled.
  - The tool is unique compared to most other regions because the bike mode competes with the other modes with regard to the attractiveness to the traveler. As the utility rises and the bike mode becomes more attractive, trips on other modes switch to bikes based upon the degree of change in the attractiveness.
- Peak-spreading algorithm
  - The treatment in the peak hour has been updated to better match count and survey data, providing a more realistic treatment of how travelers response to the peak period congestion
  - Captures the shoulder hour impacts as excess demand in peak periods is moved to adjacent hours
  - Permits inspections of performance on an hourly basis, e.g. 4:00-5:00, 5:00-6;00, 6:00-7:00
  - The algorithm does not impact the base year (2010) significantly. It is much more important in the future years in routes where demand far exceeds network capacity in the peak hours (volume / capacity > 1.0).
  - The algorithm uses today's 'most congested' corridors as a proxy for a future year congestion threshold. Future year demand is spread when congestion along corridors exceeds this threshold.
- Costs updated from 1994 dollars to 2010 dollars
- Airport demand model has been implemented
- Truck flows updated to reflect most recent land use forecast (Gamma)