

2018-2020 UPDATE OF THE

# Greater Thurston Regional Travel Demand Model



December 2020

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# Table of Contents

- Introduction.....1**
- Model Overview .....3**
- Model Update .....5**
  - Overview of Updates ..... 5
  - TAZ Structure Revisions ..... 5
  - Trip Distribution ..... 6
    - Weekday Average Conditions..... 6
    - Seasonal Component..... 7
  - Land Use ..... 7
    - Weekday Average Conditions..... 7
    - Seasonal Component..... 8
    - Sources of Land Use..... 8
  - Modes of Travel ..... 8
- Model Validation/Calibration.....9**
  - Model Calibration ..... 9
  - Model Validation..... 9
    - Model-wide Validation ..... 9
    - Seasonal Validation ..... 14
    - Screenlines..... 15
- Summary.....21**
- Appendix: Transportation Modeling 101: Explaining the Mystery  
of the Black Box .....23**

# Figures and Tables

|  |    |
|--|----|
| Figure 1: Geographic extent of the Greater Thurston Regional Model 2020.....                                       | 4  |
| Figure 2: Traffic patterns within the study area.....  | 6  |
| Figure 3: R squared correlation between GTRM model volumes and traffic<br>counts – AM Model .....                  | 10 |
| Figure 4: R squared correlation between GTRM model volumes and traffic<br>counts – PM Model .....                  | 11 |
| Figure 5: R squared correlation between GTRM model volumes and traffic<br>counts – Daily Model.....                | 12 |
| Figure 6: R squared correlation between model volumes and traffic<br>counts PM, Grays Harbor .....                 | 13 |
| Figure 7: R squared correlation between Seasonal model volumes and traffic<br>counts Friday PM, Grays Harbor ..... | 14 |
| Figure 8: Screenline locations.....  | 15 |
| <br>   |    |
| Table 1: County Distribution of Model TAZs .....   | 6  |
| Table 2: Mode Choice for Thurston County, GTRM model versus Household<br>Travel Survey .....                       | 9  |
| Table 3: Screenline Data, Weekday PM.....  | 16 |
| Table 4: Screenline Data, Weekday Daily .....  | 18 |

# Introduction

The Thurston Regional Planning Council's (TRPC's) regional travel demand model (TDM) was updated in 2015, 2017, 2018, and in 2018-2020. This report documents the 2018-2020 update.

- In 2015 major enhancements included expanding the model area to include parts of adjacent counties (Grays Harbor, Mason, Lewis, and Pierce), introduction of new modes of choice, a separate and independent truck model, and trip rates based on household cross classifications of size, income, and school aged children.
- In 2017, the model was expanded to include all of Lewis County, and renamed the Greater Thurston-Lewis County (GTLC) model.
- In 2019, the land use was updated to reflect the new regional forecast, with a base year of 2017/2018 and a future horizon of 2045. The transportation infrastructure was also updated to be consistent with the Regional Transportation Plan.
- In 2018-2020, the model was expanded to include the entirety of Grays Harbor County and renamed the Greater Thurston Regional Model (GTRM-2020).

For the 2018 – 2020 update of TRPC's travel demand model (TDM), TRPC and Grays Harbor Council of Governments (GHCOG) entered into an interlocal agreement to incorporate the entirety of Grays Harbor into TRPC's Travel Demand model and produce a Seasonal model, 2018 and 2045. Incorporating Grays Harbor County increases the sensitivity of the model in forecasting traffic into and through the Thurston County area. For GHCOG this project provides the capability to forecast long range traffic conditions within Grays Harbor. It also offers a tool for local traffic impact analysis, particularly for modeling seasonal traffic which is when Grays Harbor sees higher traffic volumes.

Updates in 2018-2020 include:

- A 2018 base year and 2045 baseline forecast scenario (consistent with the Regional Transportation Plan model update).
- A seasonal base year and forecast to model typical summer tourist trips to coastal Grays Harbor County.
- The transportation Analysis Zones (TAZs) were expanded to 1,837, providing more detail in Thurston, Pierce, and Grays Harbor Counties.
- The northern most limits of the model were moved to 92<sup>nd</sup> Street in Pierce County, removing the City of Tacoma from the model.
- Additional enhancements include a refinement of transit routes, headways, and stops.

The outputs of this project include:

- 2018 calibrated model (base year)
- 2045 model
- 2018 calibrated Seasonal model
- 2045 Seasonal model.

This report documents the update and calibration/validation for the updated TDM. The validation process establishes the credibility of the model by demonstrating its ability to replicate actual traffic patterns.

# Model Overview

TRPC's regional travel demand model is a macro model developed in the EMME modeling platform, and covers all of Thurston, Lewis and Grays Harbor counties, and parts of Pierce and Mason counties (Figure 1). Macro models are typically used to evaluate the impacts of future changes in either transportation facilities (supply) or land use location and/or quantity (demand) on the regional transportation system's level of service.

TRPC also maintains a regional dynamic traffic assignment model that is complementary to the regional travel demand model.

The GTRM-2020 has two time horizons:

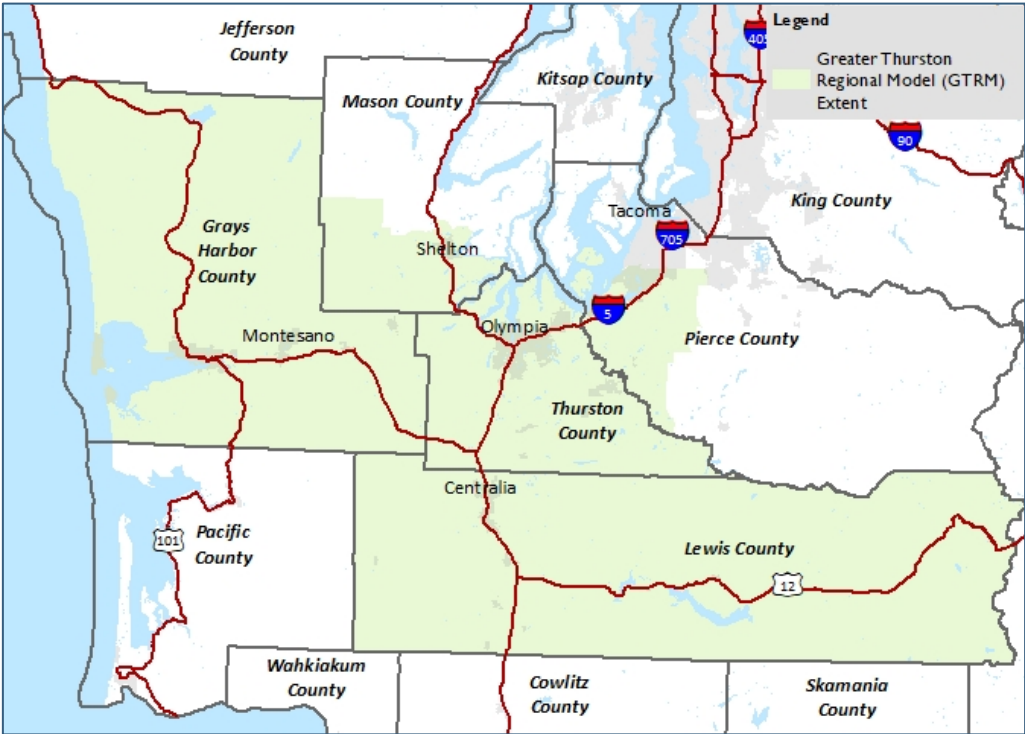
- **Current Conditions.** The current conditions model reflects 2017/2018 conditions in terms of transportation facilities, travel patterns, and land use.
- **2045 Funded Projects.** The 2045 funded projects model reflects 2045 conditions in terms of projected land use and transportation construction projects that have already received funding – therefore highly likely to be constructed by 2045.

The model provides estimates of trips (volume) and speeds (delay) in the peak hour by various modes of travel such as vehicles, trucks, transit, school buses, bicycles, and pedestrians on all major roadways and paths within the model area.

Specific assumptions included in the travel demand model include:

- Land use
- Demographics and household characteristics
- Transportation demand management
- Technology
- Transportation infrastructure

Figure 1: Geographic extent of the Greater Thurston Regional Model 2020



# Model Update

## Overview of Updates

The TDM underwent several updates to facilitate development of the GTRM-2020 model. They included:

- Incorporating Grays Harbor County into the Regional Model
  - Delineated 206 internal zones (TAZs) in Grays Harbor
  - Added roadway network
  - Added transit network
  - New average weekday traffic counts (2018), including Grays Harbor
  - New seasonal end of week traffic counts (2018) for Grays Harbor
- Adding internal zonal detail in the region
- Updating the base year data (land use and transportation network) to 2017/2018
- Developing a future year (2045)

## TAZ Structure Revisions

The evolution of the traffic analysis zone structure was as follows:

- The total number of TAZ's in the 2009 base year model was 765. An additional 8 TAZs represented the major roadways into and out of Thurston County (Externals) for a total of 773 zones.
- The 2017 model network added zonal structure for surrounding counties and their associated externals for a total of 1,299 TAZs.
- The 2019 update for the Regional Transportation Plan did not change the TAZ structure.
- The 2020 model:
  - Added 258 zones in Thurston County
  - Refined zones in Pierce County, for a net increase of 66 zones
  - Expanded the model to include the entirety of Grays Harbor County creating a new zonal structure in that area of 206 TAZs.
- There is a total of 1,837 TAZs in the 2020 model. See Table 1.

**Table 1: County Distribution of Model TAZs**

| County       | 2009 Model |          | 2017 Model Update |           |                  | 2018-2020 Model Update & Expansion |           |                  |
|--------------|------------|----------|-------------------|-----------|------------------|------------------------------------|-----------|------------------|
|              | Internal   | External | Internal          | External  | Park & Ride Lots | Internal                           | External  | Park & Ride Lots |
| Thurston     | 765        | 8        | 840               | -         | 9                | 1098                               | 0         | 9                |
| Lewis        | -          | -        | 248               | 11        | 1                | 248                                | 11        | 3                |
| Pierce       | -          | -        | 105               | 21        | 15               | 171                                | 31        | 5                |
| JBLM         | -          | -        | 23                | -         | -                | 23                                 | 0         | -                |
| Mason        | -          | -        | 14                | 7         | -                | 15                                 | 5         | 0                |
| Grays Harbor | -          | -        | 4                 | 1         | -                | 206                                | 4         | 8                |
| <b>Total</b> | <b>765</b> | <b>8</b> | <b>1,234</b>      | <b>40</b> | <b>25</b>        | <b>1,761</b>                       | <b>51</b> | <b>25</b>        |

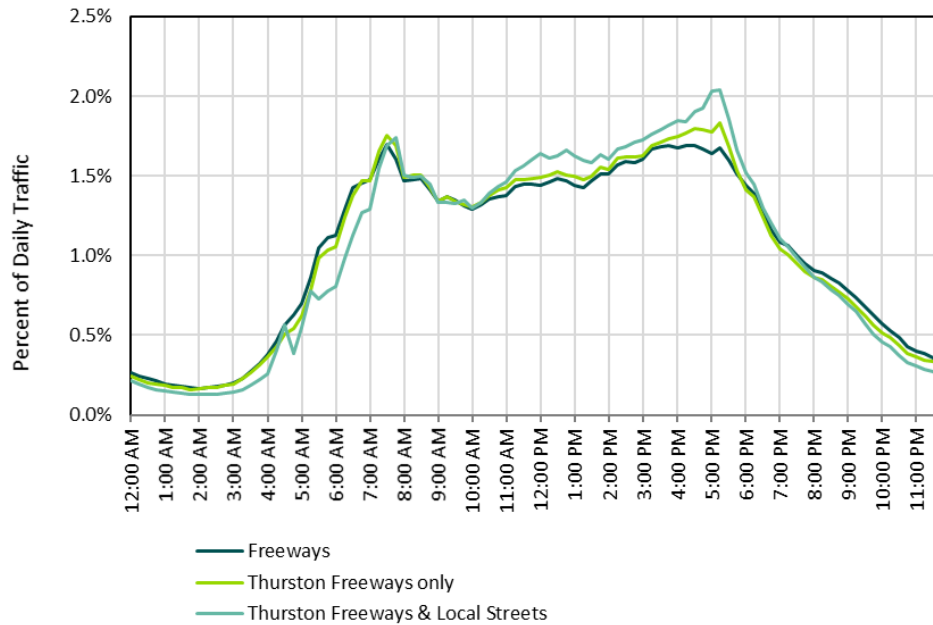
## Trip Distribution

### Weekday Average Conditions

New traffic counts were taken in 2018, with emphasis in Grays Harbor areas where the model was being newly developed. Recent traffic counts were obtained from TRPC, WSDOT, and local jurisdictions, including the cities of Lacey, Lakewood, Olympia, Tumwater, and Yelm, Thurston County, and Pierce County to determine the distribution of traffic over an average 24-hour weekday period (Figure 2).

This information was used to determine the distribution of traffic around the GTRM model AM and PM peak hour periods (7-8 AM and 4-5 PM).

**Figure 2: Traffic patterns within the study area**



## Seasonal Component

Trip generation and distribution was adjusted to model seasonal activity.

- Household trip generation – for Grays Harbor home base work trips were reduced to account for the increase in vacationing households.
- Special generation - seasonal attractions were identified and peak hour traffic was adjusted by TAZ to estimate increased traffic from households in and out of TAZs.
- Adjustments were made to travel between zones inside and outside of Grays Harbor to meet seasonal traffic counts.
- Further travel refinements were made between Grays Harbor zones to account for travel patterns between seasonal activity areas.
- K factoring was implemented for calibration/validation.

## Land Use

### Weekday Average Conditions

The GTRM model has a 2017/2018 base year and future year of 2045. The 2017 base year land use was developed with detailed population, employment, and school enrollment estimates and forecasts.

Ten land use categories are used in the model:

#### Residential Estimates

- Households
- Population in Dorms or Barracks

#### Employment Estimates

- Construction; Agriculture, Forestry and Fishing; Mining
- Manufacturing; Wholesale Trade; Transportation and Warehousing; Utilities
- Retail Trade, Accommodation and Food Services
- Finance and Insurance; Services
- Government (excluding K-12 education)
- K-12 Education

#### School Enrollment Estimates

- K12 Student Enrollment
- Full-time Equivalent (FTE) College Enrollment

Land use was developed separately for Joint Base Lewis-McChord (JBLM), the American Lake Veterans Administration Hospital, and Camp Murray by staff at the three institutions.

## Seasonal Component

The following adjustments were made to develop the seasonal land use.

- **Households** – to estimate summer weekend household occupancy, Office of Financial Management (OFM) vacant dwelling use estimates were used as a basis to occupy a percentage of the units with summer travelers.
- **Students** – K-12 student enrollment was reduced by 90 percent, the 10 percent remainder was left to account for summer school, camps, or other activities.
- **Employment** – seasonal factors for employment industries were based on the ratio of June/July/August to January/February/March covered employment data from Washington State Employment Security.

## Sources of Land Use

The travel demand models take into consideration the number of households, population, school and college enrollment, and jobs. Land use data used in the analysis comes from:

- Joint Base Lewis-McChord's land use estimates for the base
- Puget Sound Regional Council's land use forecast for Pierce County
- TRPC's adopted population and employment forecast for Thurston County
- TRPC's land use forecasts for Mason, Lewis, and Grays Harbor counties using population forecasts from Washington State Office of Financial Management

These estimates and forecasts are meant to reflect expected future conditions based on past trends, adopted land use plans, and best available data.

Further land use methodology can be found in the *2018 and 2045 Land Use for the Greater Thurston Region Transportation Demand Model*, TRPC.

## Modes of Travel

The GTRM-2020 model contains seven modes of travel, plus park and ride and three truck modes. The modes are:

- Single Occupancy Vehicle
- High Occupancy Vehicle
- Walk
- Bike
- Transit
- School Bus
- Vanpool

There were no changes to the modes during the 2018-2020 update.

# Model Validation/Calibration

The GTRM-2020 model was re-validated/calibrated after the updates. Validation/calibration consisted of two components, calibrating mode choice to the regional household travel survey, and validating the model to 2018 traffic counts.

## Model Calibration

The mode-split comparison with household travel survey is shown in Table 2.

**Table 2: Mode Choice for Thurston County, GTRM model versus Household Travel Survey**

| MODE CHOICE              | MODEL            |               | HOUSEHOLD TRAVEL SURVEY |               |
|--------------------------|------------------|---------------|-------------------------|---------------|
|                          | Daily Trips      | Percent       | Daily Trips             | Percent       |
| Single Occupancy Vehicle | 559,691          | 50.4%         | 558,082                 | 51.6%         |
| High Occupancy Vehicle   | 373,252          | 33.6%         | 389,820                 | 36.0%         |
| Walk                     | 126,288          | 11.4%         | 86,855                  | 8.0%          |
| Bike                     | 15,761           | 1.4%          | 16,761                  | 1.5%          |
| Transit                  | 19,340           | 1.7%          | 20,881                  | 1.9%          |
| School Bus               | 14,079           | 1.3%          | 7,664                   | 0.7%          |
| Vanpool                  | 2,515            | 0.2%          | 2,172                   | 0.2%          |
| <b>TOTAL</b>             | <b>1,110,927</b> | <b>100.0%</b> | <b>1,082,235</b>        | <b>100.0%</b> |

## Model Validation

Model validation is examined at the model-wide level, and at the screenline level.

### Model-wide Validation

At the model-wide level, validation is examined by looking at the correlations (R squared values) of 2018 model volumes to 2018 traffic counts at three time horizons:

- AM Peak.
- PM Peak.
- Daily.

Results are shown in Figures 3-5.

Figure 6 shows the PM Peak validation for Grays Harbor County.

**Figure 3: R squared correlation between GTRM model volumes and traffic counts – AM Model**

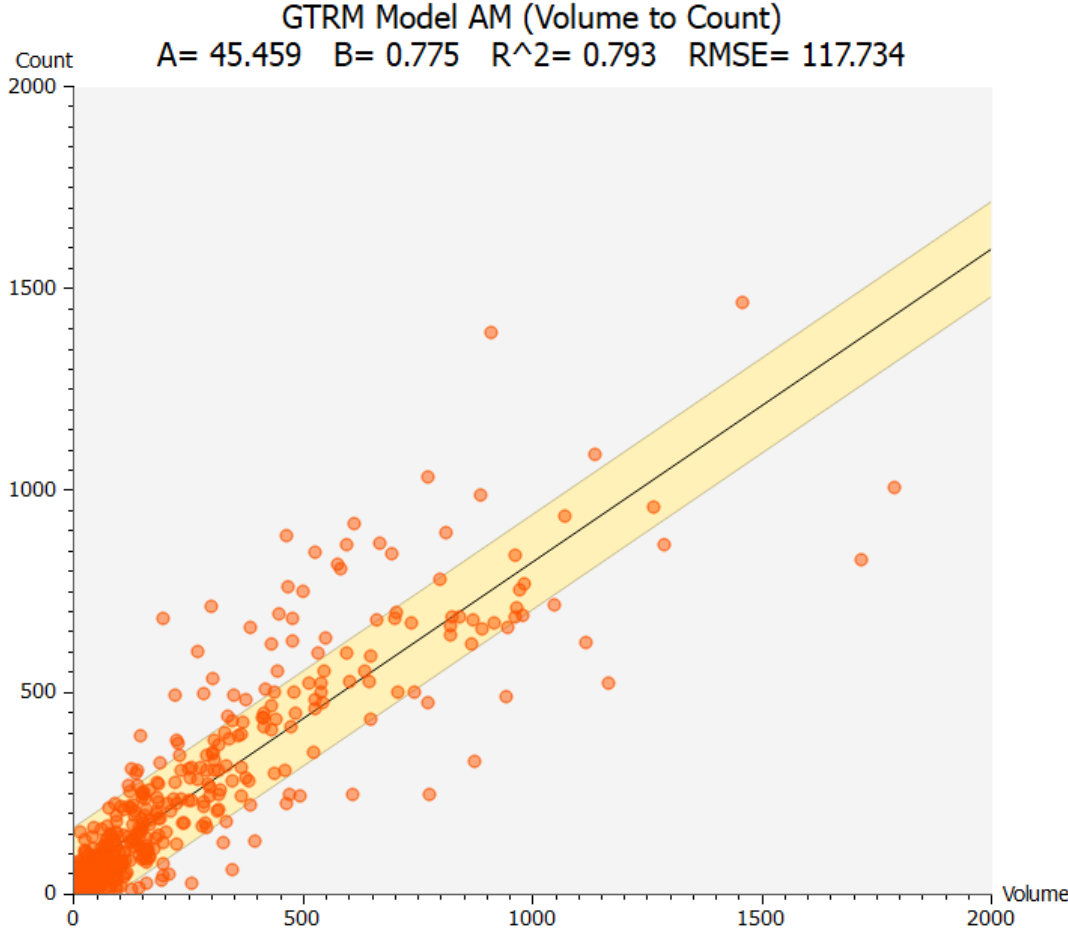
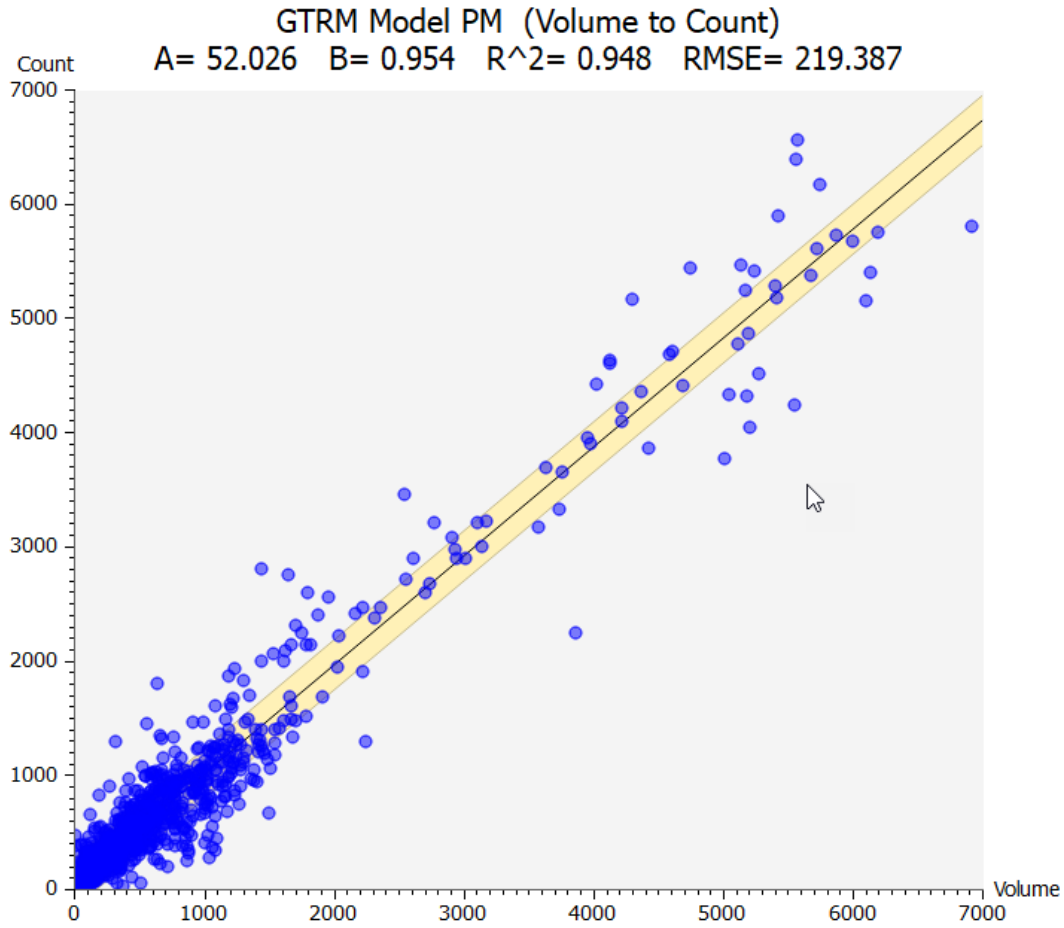
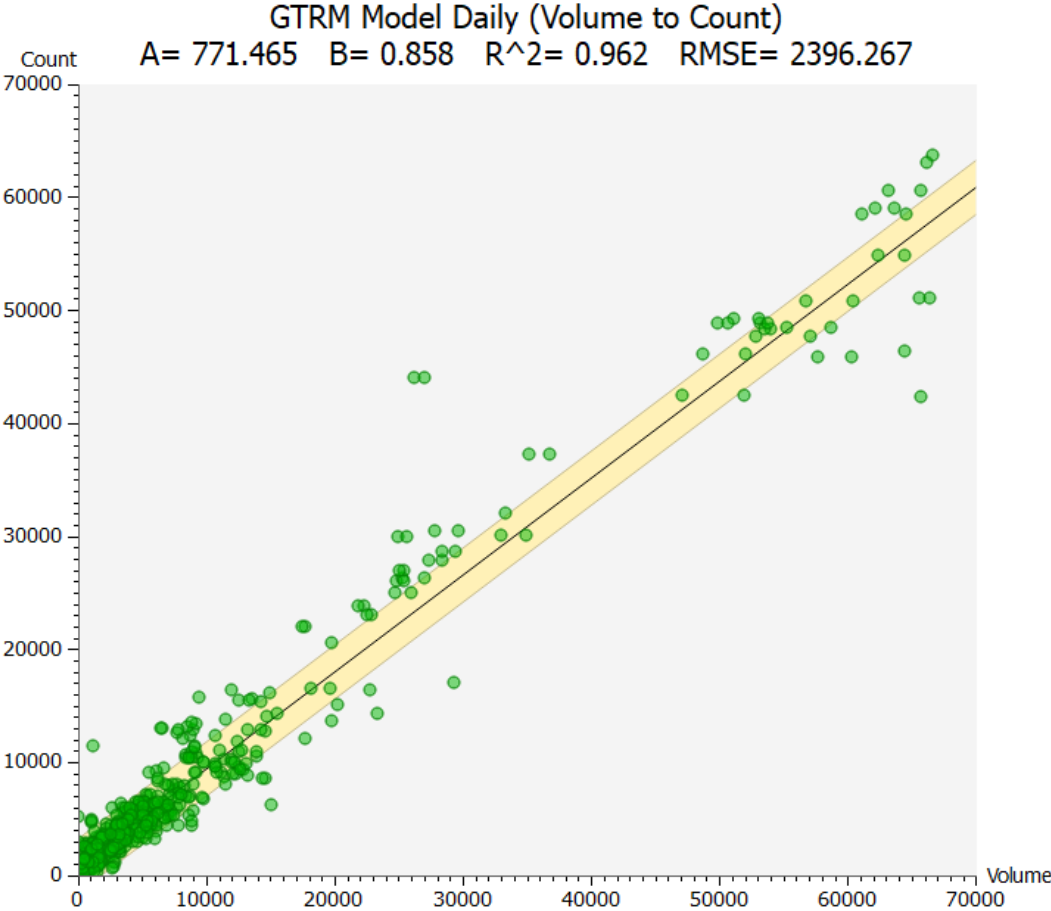


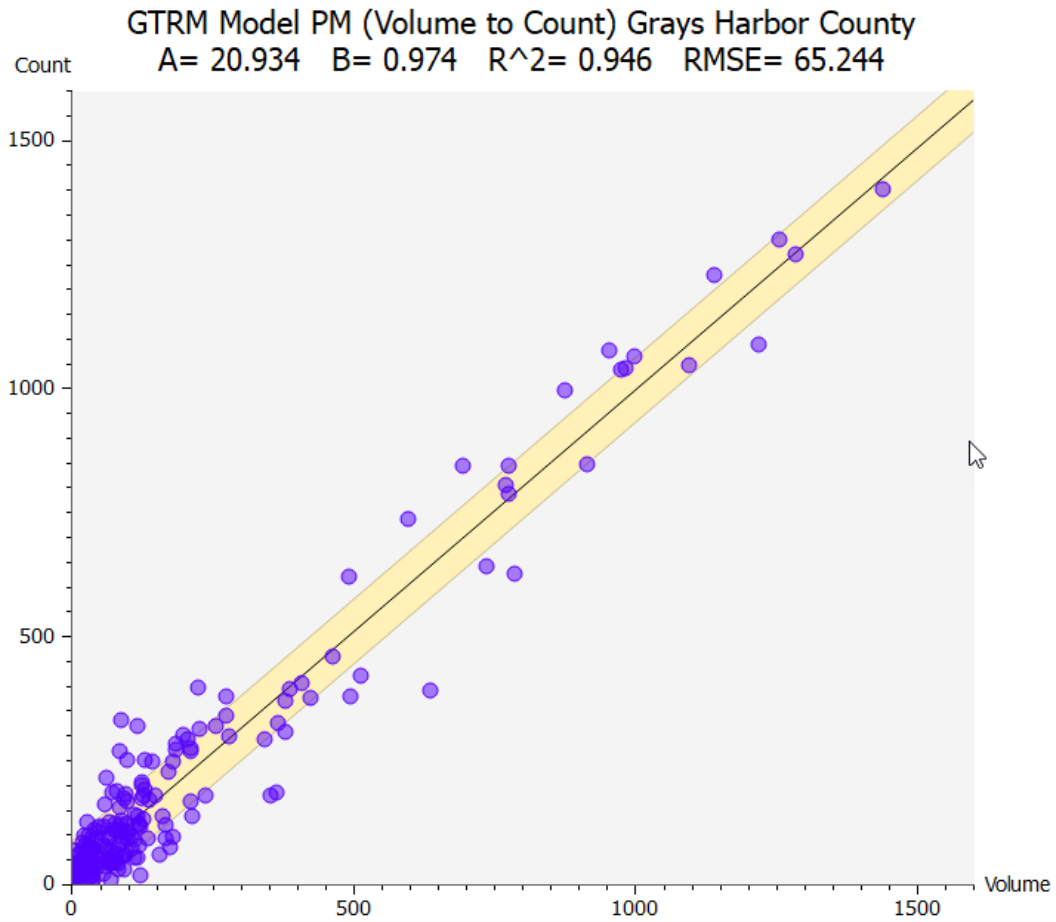
Figure 4: R squared correlation between GTRM model volumes and traffic counts – PM Model



**Figure 5: R squared correlation between GTRM model volumes and traffic counts – Daily Model**



**Figure 6: R squared correlation between model volumes and traffic counts  
PM, Grays Harbor**

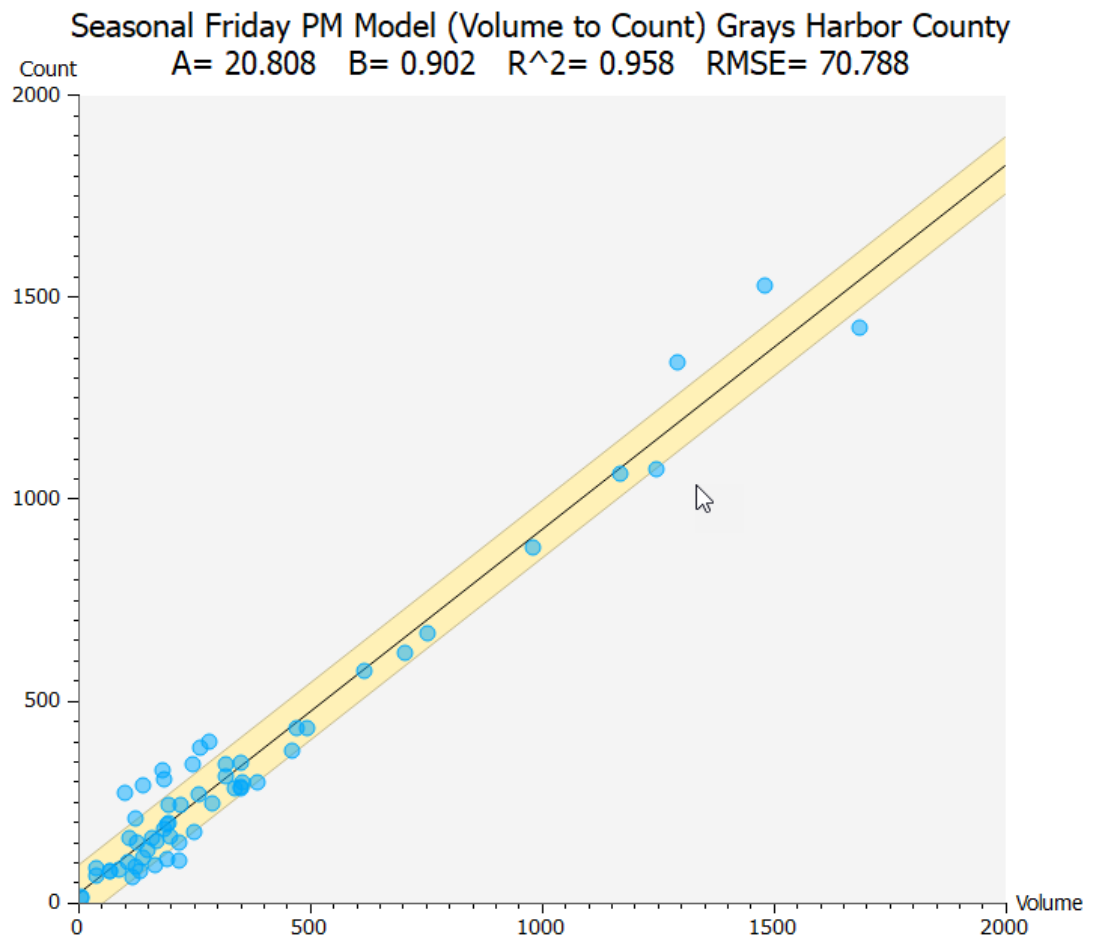


### Seasonal Validation

Additional traffic counts were collected in mid-July 2018 to capture the seasonal increase in traffic volumes in the Grays Harbor Region. A typical end of week, non-holiday, was selected to ensure not to over-estimate the seasonal traffic.

The seasonal model validation is examined by looking at the correlations of Friday 4 to 5 PM 2018 Seasonal model volumes to 2018 Friday 4 to 5 PM traffic counts, July. Utilizing the Friday 4 to 5 PM hourly counts provides an easier comparison between seasonal and non-seasonal model volumes.

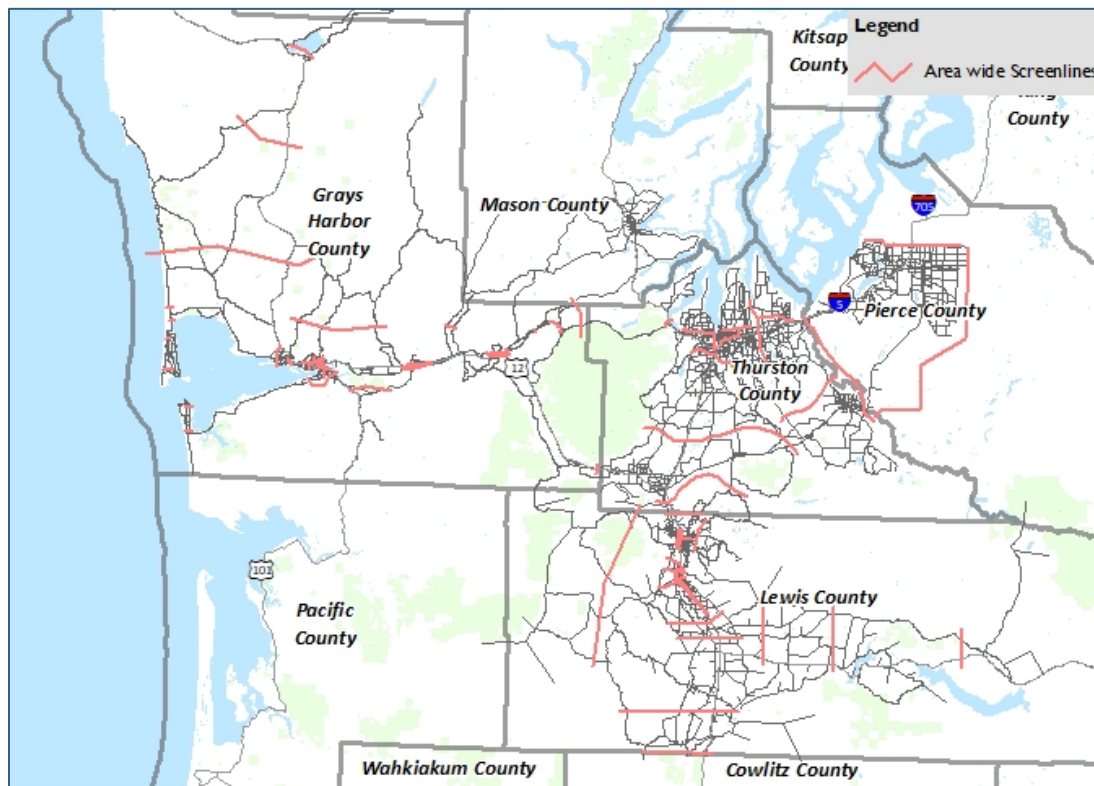
**Figure 7: R squared correlation between Seasonal model volumes and traffic counts Friday PM, Grays Harbor**



## Screenlines

Screenline model validation check is to measure hourly directional modeled link volumes along screenlines to see how they compare to traffic counts. A screenline is an imaginary line on a map that intersects with the road/street network to capture traffic in one direction of flow. The screen line sums points along the line to see how traffic flow is captured overall, rather than at discrete points on the network. Screenlines were for the general model area (areawide). In general, model developers aim to have modeled volumes within 10 percent of counts, model volumes will vary depending on facility type.

**Figure 8: Screenline locations**



**Table 3: Screenline Data, Weekday PM**

| PM   |            | OBSERVED COUNTS |        | 2018 PM MODEL |        | % DIFFERENCE |       |
|------|------------|-----------------|--------|---------------|--------|--------------|-------|
| CNTY | SCREENLINE | NB-EB           | SB-WB  | NB-EB         | SB-WB  | NB-EB        | SB-WB |
| PC   | 1          | 13,010          | 16,550 | 14,723        | 15,841 | 13%          | -4%   |
| PC   | 2          | 9,924           | 11,191 | 11,199        | 9,836  | 13%          | -12%  |
| THC  | 3          | 5,454           | 6,920  | 5,379         | 6,874  | -1%          | -1%   |
| THC  | 4          | 1,077           | 1,883  | 846           | 1,547  | -21%         | -18%  |
| THC  | 5          | 8,886           | 8,261  | 8,084         | 7,864  | -9%          | -5%   |
| THC  | 6          | 2,339           | 1,888  | 2,092         | 1,318  | -11%         | -30%  |
| THC  | 7          | 5,042           | 7,061  | 5,203         | 6,257  | 3%           | -11%  |
| THC  | 8          | 1,924           | 1,590  | 1,695         | 1,602  | -12%         | 1%    |
| THC  | 9          | 2,019           | 3,233  | 1,619         | 3,177  | -20%         | -2%   |
| THC  | 10         | 7,639           | 8,337  | 6,638         | 8,184  | -13%         | -2%   |
| THC  | 11         | 3,878           | 6,136  | 4,858         | 5,908  | 25%          | -4%   |
| THC  | 12         | 2,913           | 4,084  | 2,330         | 3,924  | -20%         | -4%   |
| THC  | 13         | 286             | 223    | 294           | 342    | 3%           | 53%   |
| THC  | 14         | 3,081           | 3,394  | 2,379         | 3,104  | -23%         | -9%   |
| THC  | 15         | 1,585           | 1,216  | 2,009         | 1,250  | 27%          | 3%    |
| LC   | 16         | 3,972           | 4,374  | 2,416         | 3,143  | -39%         | -28%  |
| LC   | 17         | 1,062           | 1,051  | 663           | 741    | -38%         | -30%  |
| LC   | 18         | 3,104           | 3,535  | 2,426         | 3,735  | -22%         | 6%    |
| LC   | 19         | 3,565           | 4,310  | 2,403         | 3,930  | -33%         | -9%   |
| LC   | 20         | 3,741           | 4,454  | 2,329         | 4,009  | -38%         | -10%  |
| LC   | 21         | 2,179           | 3,258  | 1,560         | 3,198  | -28%         | -2%   |
| LC   | 22         | 1,993           | 3,010  | 1,440         | 2,801  | -28%         | -7%   |
| LC   | 23         | 2,227           | 2,512  | 1,449         | 2,336  | -35%         | -7%   |
| LC   | 24         | 317             | 177    | 284           | 159    | -10%         | -10%  |
| LC   | 25         | 477             | 507    | 969           | 473    | 103%         | -7%   |
| LC   | 26         | 44              | 72     | 41            | 86     | -8%          | 19%   |
| LC   | 27         | 422             | 397    | 645           | 307    | 53%          | -23%  |
| LC   | 28         | 206             | 259    | 240           | 119    | 16%          | -54%  |
| LC   | 29         | 2,257           | 2,233  | 1,971         | 1,840  | -13%         | -18%  |
| LC   | 30         | 2,202           | 1,822  | 1,237         | 1,487  | -44%         | -18%  |
| LC   | 31         | 1,235           | 1,402  | 1,216         | 1,658  | -2%          | 18%   |
| LC   | 32         | 235             | 443    | 28            | 68     | -88%         | -85%  |
| LC   | 33         | 2,227           | 2,529  | 1,737         | 2,362  | -22%         | -7%   |
| GHC  | 34         | 34              | 33     | 29            | 28     | -16%         | -15%  |
| GHC  | 38         | 298             | 324    | 197           | 332    | -34%         | 3%    |
| GHC  | 36         | 159             | 328    | 168           | 147    | 6%           | -55%  |
| GHC  | 37         | 91              | 108    | 67            | 81     | -26%         | -25%  |

| PM           |            | OBSERVED COUNTS |                | 2018 PM MODEL  |                | % DIFFERENCE |            |
|--------------|------------|-----------------|----------------|----------------|----------------|--------------|------------|
| CNTY         | SCREENLINE | NB-EB           | SB-WB          | NB-EB          | SB-WB          | NB-EB        | SB-WB      |
| GHC          | 38         | 298             | 324            | 197            | 332            | -34%         | 3%         |
| GHC          | 39         | 295             | 342            | 86             | 207            | -71%         | -39%       |
| GHC          | 40         | 104             | 98             | 46             | 72             | -56%         | -27%       |
| GHC          | 41         | 179             | 113            | 127            | 56             | -29%         | -50%       |
| GHC          | 42         | 75              | 122            | 39             | 85             | -48%         | -31%       |
| GHC          | 43         | 150             | 221            | 165            | 176            | 10%          | -20%       |
| GHC          | 44         | 840             | 665            | 687            | 538            | -18%         | -19%       |
| GHC          | 45         | 1,005           | 1,066          | 873            | 838            | -13%         | -21%       |
| GHC          | 46         | 315             | 305            | 307            | 277            | -3%          | -9%        |
| GHC          | 47         | 381             | 208            | 193            | 169            | -49%         | -19%       |
| GHC          | 48         | 266             | 272            | 170            | 173            | -36%         | -36%       |
| GHC          | 49         | 107             | 70             | 36             | 19             | -66%         | -73%       |
| GHC          | 50         | 206             | 174            | 238            | 144            | 16%          | -17%       |
| GHC          | 51         | 837             | 701            | 618            | 568            | -26%         | -19%       |
| GHC          | 52         | 434             | 414            | 254            | 341            | -41%         | -18%       |
| GHC          | 53         | 229             | 172            | 132            | 87             | -42%         | -49%       |
| GHC          | 54         | 53              | 76             | 27             | 25             | -49%         | -67%       |
| GHC          | 55         | 663             | 998            | 669            | 948            | 1%           | -5%        |
| GHC          | 56         | 871             | 1,072          | 651            | 798            | -25%         | -26%       |
| GHC          | 57         | 287             | 280            | 281            | 241            | -2%          | -14%       |
| GHC          | 58         | 567             | 521            | 476            | 478            | -16%         | -8%        |
| GHC          | 59         | 1,300           | 1,400          | 953            | 920            | -27%         | -34%       |
| GHC          | 60         | 1,089           | 1,270          | 1,141          | 1,160          | 5%           | -9%        |
| GHC          | 61         | 1,900           | 1,570          | 1,360          | 1,194          | -28%         | -24%       |
| GHC          | 62         | 1,450           | 1,647          | 1,306          | 1,222          | -10%         | -26%       |
| GHC          | 63         | 1,337           | 1,197          | 936            | 966            | -30%         | -19%       |
| GHC          | 64         | 1,036           | 1,040          | 703            | 931            | -32%         | -10%       |
| GHC          | 65         | 298             | 342            | 171            | 265            | -43%         | -22%       |
| GHC          | 66         | 629             | 717            | 492            | 470            | -22%         | -34%       |
| GHC          | 67         | 620             | 1,119          | 538            | 796            | -13%         | -29%       |
| <b>TOTAL</b> |            | <b>118,925</b>  | <b>137,621</b> | <b>106,735</b> | <b>124,568</b> | <b>-10%</b>  | <b>-9%</b> |

**Table 4: Screenline Data, Weekday Daily**

| DAILY |            | OBSERVED COUNTS |         | 2018 DAILY MODEL |         | % DIFFERENCE |       |
|-------|------------|-----------------|---------|------------------|---------|--------------|-------|
| CNTY  | SCREENLINE | NB-EB           | SB-WB   | NB-EB            | SB-WB   | NB-EB        | SB-WB |
| PC    | 1          | 155,773         | 155,773 | 171,675          | 175,082 | 10%          | 12%   |
| PC    | 2          | 110,496         | 110,459 | 117,456          | 119,051 | 6%           | 8%    |
| THC   | 3          | 64,686          | 64,631  | 66,045           | 71,265  | 2%           | 10%   |
| THC   | 4          | 15,563          | 15,518  | 13,520           | 13,879  | -13%         | -11%  |
| THC   | 5          | 92,547          | 89,895  | 89,773           | 93,385  | -3%          | 4%    |
| THC   | 6          | 23,388          | 23,194  | 19,615           | 19,433  | -16%         | -16%  |
| THC   | 7          | 43,685          | 71,035  | 60,950           | 71,273  | 40%          | 0%    |
| THC   | 8          | 18,595          | 19,214  | 19,500           | 19,288  | 5%           | 0%    |
| THC   | 9          | 27,587          | 27,511  | 27,432           | 28,985  | -1%          | 5%    |
| THC   | 10         | 80,726          | 81,193  | 82,055           | 83,805  | 2%           | 3%    |
| THC   | 11         | 53,938          | 52,465  | 57,596           | 64,554  | 7%           | 23%   |
| THC   | 12         | 36,354          | 36,518  | 35,105           | 36,718  | -3%          | 1%    |
| THC   | 13         | 3,712           | 3,111   | 3,649            | 3,723   | -2%          | 20%   |
| THC   | 14         | 42,480          | 42,494  | 30,958           | 32,075  | -27%         | -25%  |
| THC   | 15         | 19,140          | 19,172  | 18,553           | 19,148  | -3%          | 0%    |
| LC    | 16         | 43,373          | 43,373  | 31,256           | 32,569  | -28%         | -25%  |
| LC    | 17         | 10,800          | 10,330  | 7,069            | 9,063   | -35%         | -12%  |
| LC    | 18         | 42,212          | 42,135  | 34,577           | 36,164  | -18%         | -14%  |
| LC    | 19         | 48,890          | 48,890  | 35,578           | 36,858  | -27%         | -25%  |
| LC    | 20         | 50,675          | 50,675  | 35,998           | 37,222  | -29%         | -27%  |
| LC    | 21         | 31,905          | 31,905  | 26,808           | 27,429  | -16%         | -14%  |
| LC    | 22         | 29,335          | 29,335  | 23,915           | 24,526  | -18%         | -16%  |
| LC    | 23         | 25,000          | 25,000  | 20,665           | 20,718  | -17%         | -17%  |
| LC    | 24         | 2,982           | 2,859   | 2,572            | 2,562   | -14%         | -10%  |
| LC    | 25         | 5,259           | 5,245   | 8,851            | 8,338   | 68%          | 59%   |
| LC    | 26         | 675             | 671     | 729              | 762     | 8%           | 14%   |
| LC    | 27         | 4,634           | 4,653   | 6,970            | 6,442   | 50%          | 38%   |
| LC    | 28         | 2,325           | 2,325   | 2,035            | 2,179   | -12%         | -6%   |
| LC    | 29         | 22,800          | 22,800  | 21,117           | 21,464  | -7%          | -6%   |
| LC    | 30         | 20,368          | 20,368  | 13,953           | 17,414  | -31%         | -15%  |
| LC    | 31         | 13,497          | 13,497  | 16,553           | 16,414  | 23%          | 22%   |
| LC    | 32         | 3,556           | 3,557   | 491              | 621     | -86%         | -83%  |
| LC    | 33         | 24,039          | 24,039  | 23,977           | 23,645  | 0%           | -2%   |
| GHC   | 34         | 312             | 304     | 319              | 321     | 2%           | 6%    |
| GHC   | 38         | 3,662           | 3,641   | 3,144            | 3,126   | -14%         | -14%  |
| GHC   | 36         | 2,596           | 2,714   | 1,899            | 1,862   | -27%         | -31%  |
| GHC   | 37         | 1,154           | 1,198   | 873              | 870     | -24%         | -27%  |

| DAILY           |    | OBSERVED COUNTS  |                  | 2018 DAILY MODEL |                  | % DIFFERENCE |            |
|-----------------|----|------------------|------------------|------------------|------------------|--------------|------------|
| CNTY SCREENLINE |    | NB-EB            | SB-WB            | NB-EB            | SB-WB            | NB-EB        | SB-WB      |
| GHC             | 38 | 3,662            | 3,641            | 3,144            | 3,126            | -14%         | -14%       |
| GHC             | 39 | 3,874            | 2,401            | 1,705            | 648              | -56%         | -73%       |
| GHC             | 40 | 1,321            | 1,307            | 683              | 681              | -48%         | -48%       |
| GHC             | 41 | 1,681            | 1,686            | 1,089            | 1,088            | -35%         | -35%       |
| GHC             | 42 | 1,448            | 1,455            | 669              | 758              | -54%         | -48%       |
| GHC             | 43 | 1,983            | 1,975            | 1,946            | 2,008            | -2%          | 2%         |
| GHC             | 44 | 9,082            | 9,101            | 6,176            | 6,322            | -32%         | -31%       |
| GHC             | 45 | 13,265           | 13,377           | 9,247            | 9,240            | -30%         | -31%       |
| GHC             | 46 | 3,673            | 3,936            | 3,165            | 3,165            | -14%         | -20%       |
| GHC             | 47 | 3,167            | 2,208            | 1,850            | 2,446            | -42%         | 11%        |
| GHC             | 48 | 3,112            | 3,059            | 1,909            | 2,007            | -39%         | -34%       |
| GHC             | 49 | 985              | 987              | 320              | 319              | -67%         | -68%       |
| GHC             | 50 | 1,892            | 2,051            | 2,139            | 2,133            | 13%          | 4%         |
| GHC             | 51 | 8,700            | 8,646            | 6,743            | 6,670            | -22%         | -23%       |
| GHC             | 52 | 4,933            | 4,802            | 3,289            | 3,507            | -33%         | -27%       |
| GHC             | 53 | 2,582            | 2,393            | 1,260            | 1,298            | -51%         | -46%       |
| GHC             | 54 | 709              | 684              | 486              | 216              | -31%         | -68%       |
| GHC             | 55 | 8,556            | 8,591            | 8,844            | 9,811            | 3%           | 14%        |
| GHC             | 56 | 9,890            | 10,070           | 8,265            | 9,219            | -16%         | -8%        |
| GHC             | 57 | 3,182            | 3,195            | 2,968            | 3,082            | -7%          | -4%        |
| GHC             | 58 | 6,769            | 6,796            | 5,413            | 5,375            | -20%         | -21%       |
| GHC             | 59 | 13,000           | 14,000           | 9,781            | 9,806            | -25%         | -30%       |
| GHC             | 60 | 14,151           | 16,737           | 11,497           | 11,949           | -19%         | -29%       |
| GHC             | 61 | 23,223           | 19,518           | 13,923           | 13,714           | -40%         | -30%       |
| GHC             | 62 | 17,406           | 20,007           | 13,127           | 14,416           | -25%         | -28%       |
| GHC             | 63 | 17,127           | 27,592           | 9,960            | 12,250           | -42%         | -56%       |
| GHC             | 64 | 13,477           | 12,889           | 8,738            | 8,936            | -35%         | -31%       |
| GHC             | 65 | 4,027            | 3,943            | 2,449            | 2,549            | -39%         | -35%       |
| GHC             | 66 | 7,842            | 7,682            | 5,630            | 5,636            | -28%         | -27%       |
| GHC             | 67 | 8,070            | 8,413            | 7,689            | 8,639            | -5%          | 3%         |
| <b>TOTAL</b>    |    | <b>1,391,508</b> | <b>1,424,839</b> | <b>1,287,333</b> | <b>1,343,248</b> | <b>-7%</b>   | <b>-6%</b> |

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# Summary

This report documents the development and validation/calibration of the Greater Thurston Regional Model. Transportation models are used to make objective, judicious and informed decisions on transportation investments. In addition, models provide a platform to assess future transportation issues, to identify potential solutions, and to evaluate the efficiency of such solutions.

Data from the regional model can be used to create sub-area models and dynamic traffic assignment (DTA) models such as within Grays Harbor:

- Model East Aberdeen road closures due to train crossings.
- The ability to model traffic signal timings downtown Aberdeen US 101 & 12 interchange and Hoquiam US 101 & SR 109 interchange.

All efforts have been made to validate the 2018-2020 model to actual data. For the base year, the models give a reasonable estimation of regional travel behavior.

All future year models are based on land use forecasts and current travel behaviors. A forecast is only as accurate as the assumptions that underlie it. They give us important information about our general direction, given what is known today. It is recognized that many other factors, beyond the forecast, may impact future travel patterns.

It should be noted that the models are statistical estimations of regional travel behavior. As such, they should only be used for generalized planning purposes. For specific investment decisions, more detailed modeling, such as operational modeling under the guidance of a professional engineer, is generally used.

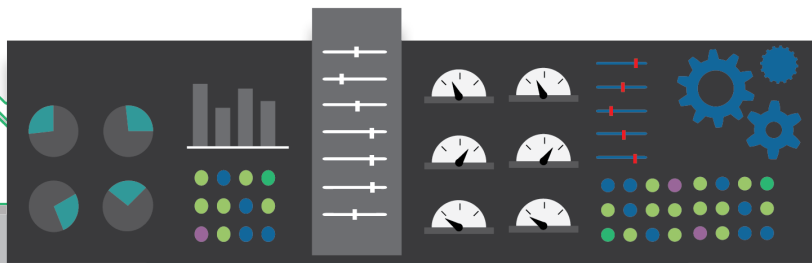
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# **Appendix: Transportation Modeling 101: Explaining the Mystery of the Black Box**

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# 101 Transportation Modeling

## Explaining the Mystery of the Black Box



### WHAT IS A TRANSPORTATION MODEL?

- A set of mathematical relationships to represent (model) the choices people make when traveling. These choices include how many trips to make, where to, and what modes. Travel demand is the combined effect of thousands of individuals making these choices.
- A tool to help planners study the impacts of alternate transportation scenarios, such as new highways, bus route changes, or parking restrictions on future travel demand, in order to make informed policy decisions.

### WHY ARE MODELS IMPORTANT?

- Federal law requires Metropolitan Planning Organizations (MPOs), including Thurston Regional Planning Council, to address at least a 20 year planning horizon, including short- and long-range strategies, to develop an integrated intermodal transportation system.

- Models provide a multimodal evaluation of the transportation, socioeconomic, environmental, and financial impacts of a transportation project.
- Model estimations help policy makers prioritize how millions of transportation dollars will be spent to ensure taxpayer dollars are used wisely.
- Utilizing the best tools available helps ensure high-quality transportation services at a reasonable cost with minimal environmental impact.

### WHAT CAN OUR TRANSPORTATION MODEL DO?

- **Forecast** the number of trips on the region's road, transit and trail networks.
- **Project** long-range traffic growth patterns by area and roadway network.
- **Highlight** the traffic impacts of new land use developments.
- **Estimate** air quality based on Vehicle Miles Traveled (VMT).
- **Evaluate** the effectiveness of various transportation project scenarios.

- **Test** policy implications of travel mode choice (Travel Demand Management).
- **Help** local jurisdiction find ways to mitigate current and future traffic capacity constraints.

### HOW DO WE KNOW THE MODEL WORKS?

- The model is adjusted to match the results of several regional travel behavior surveys as closely as possible. Surveys and data sources include:
  - 2013 South Sound Travel Survey.
  - 2010 I-5/SR-101 Origin and Destination Survey.
  - Puget Sound Regional Council's transportation model for Pierce County.
  - Regional traffic count data for vehicles.
  - Automated passenger count (APC) data for transit trips.

### MODEL LIMITATIONS

- The model is a statistical estimation of regional travel behavior. As such, it should only be used for general planning purposes.


### WHAT'S NEW IN THE MODEL


The updated Greater Thurston Region (GTR) four-step travel demand model was released in 2015. The updated model:


- Contains an enhanced non-motorized network of trails and bicycle lanes.
- Models new or enhanced travel modes, such as carpool and vanpool and trips involving park and ride lots.
- Improves travel demand estimates at key border crossing by adding 177 transportation analysis zones (TAZs) in Pierce, Grays Harbor, Lewis, and Mason Counties.
- Models travel patterns in greater detail within Thurston County, expanding to 778 transportation analysis zones from 588 (in 1995).
- Is better coordinated with the Puget Sound Regional Council's travel demand model.
- Contains the ability to model household travel behavior based on income.
- Contains a truck module.
- Will allow modeling of more travel demand management factors, including parking prices, or anticipated effects of new policies on telework.


## TAZs and Model Network


How our roads, trails, and bus routes are represented in the model

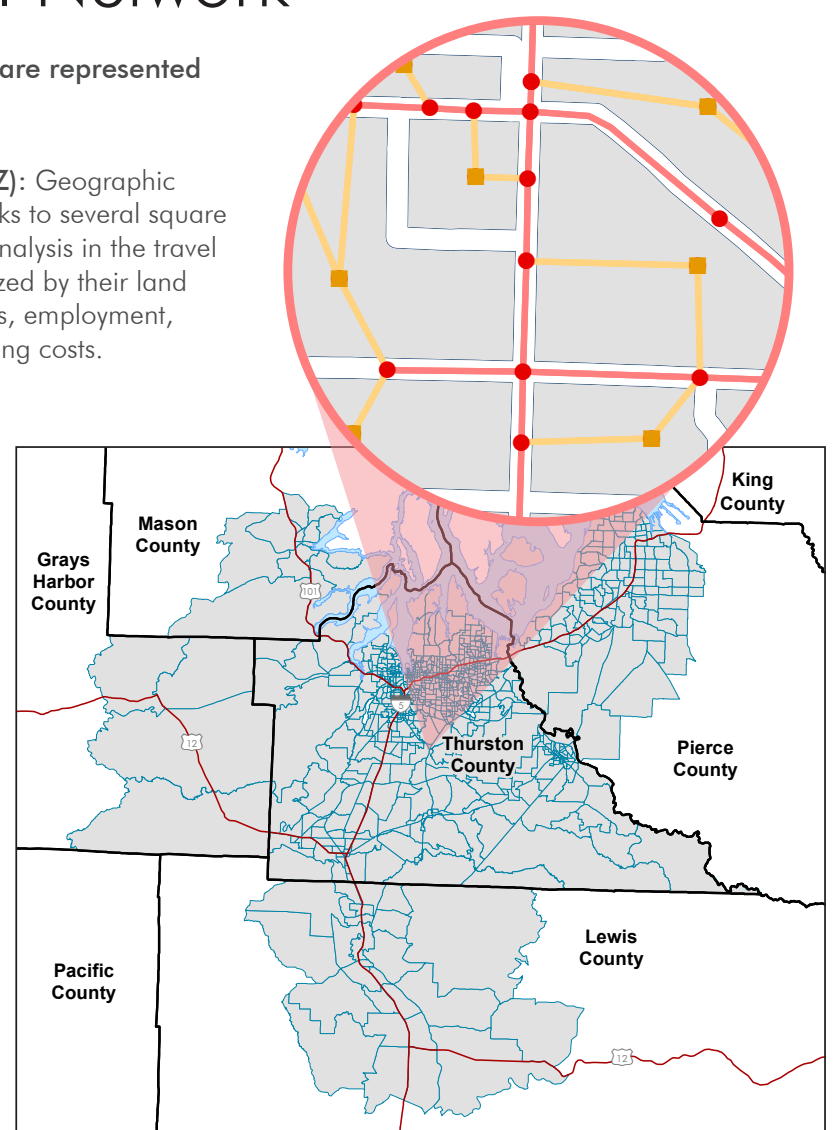
 **Transportation Analysis Zone (TAZ):** Geographic area ranging in size from a few blocks to several square miles. TAZs are the primary unit of analysis in the travel demand model. TAZs are characterized by their land use, including number of households, employment, environmental constraints, and parking costs.

 **TAZ Centroid:** Node at the center of each TAZ and the start and end point of all trips to and from that zone.

 **Centroid Connectors:** Connect TAZs with the transportation network.

 **Nodes:** Points where links meet. Some nodes represent intersections and may have defined turning restrictions.

 **Network Link:** Connected links that represent the region's streets, transit lines, bike lanes and multiuse trails. Each link contains data on length, travel speed, lanes and allowable modes of transportation.



# Four-Step Modeling Process

The Greater Thurston County Model is built using the EMME modeling platform. The four-step modeling process is explained below:

## 1 Trip Generation: How many trips will be made?

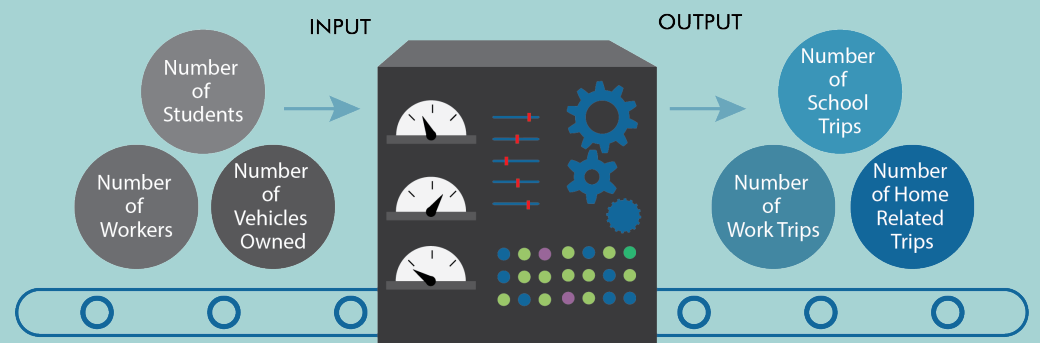
Trip generation is the first step in travel forecasting. There are two components to trip generation: trip production and trip attraction.

Trip production calculates how many trips start at each TAZ. Trip production is based on household characteristics, including the household size, income, and the number of school-aged children.

Trip attraction calculates how many trips end at each TAZ. Trip attraction is based primarily on the number and type of jobs, student enrollment, and households. Jobs are broken into the following categories:

- Construction and resources.
- Manufacturing, warehousing, transportation, communications, and utilities.
- Retail trade.
- Finance, insurance, real estate, and services.
- Government (excluding education).
- Education.

### Key Household Characteristics that Affect Trip Generation



## 2 Trip Distribution: Where do people go?

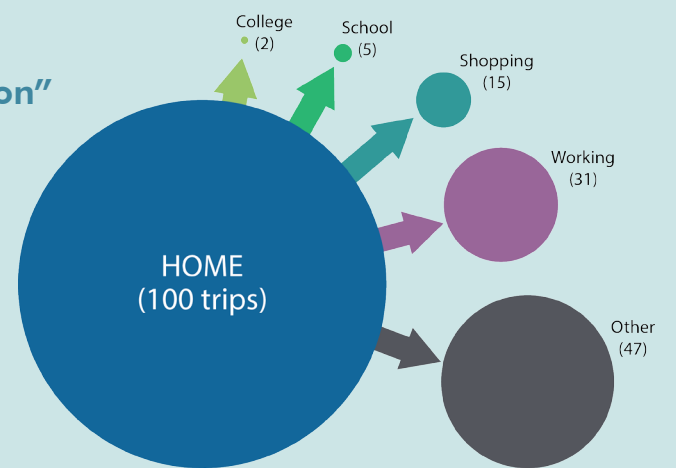
Trips have a beginning (origin) and an end (destination). Trip distribution is used to represent the process of where people choose to go (Destination Choice).

Two major factors affect trip distributions:

- Trip purpose (home to work, shopping, school (K-12 and college/university), or other, and non-home based).
- Proximity of potential destinations (including travel time and cost).

### "Destination Choice" Means "Trip Distribution"

Trips are statistically distributed to various locations (TAZs) based on purpose, land use and distance/time factors.

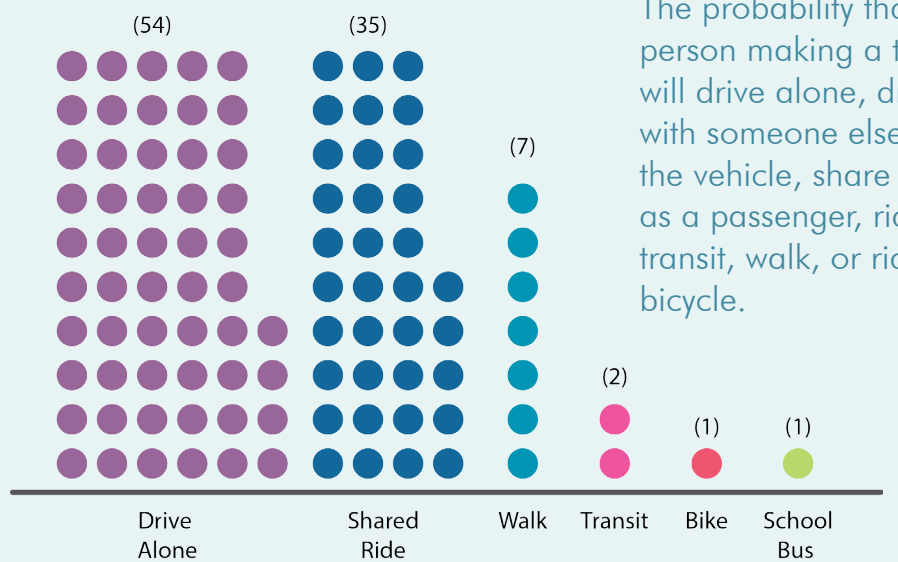


## 3 Mode Choice: What method is used for travel?

Mode choice is the process by which the model estimates how individuals will get to their destination. The model includes seven possible modes: Drive Alone, Carpool, Vanpool, Transit, Park and Ride, School Bus, Bike and Walk. The model evaluates the attractiveness of each mode to determine its relative usage. Three factors affect mode choice:

- Household characteristics, including income, and vehicle ownership.
- The accessibility and cost of travel between points, including:
  - Transit availability, travel time and cost.
  - Vehicle travel time and cost, including traffic delays, operating and parking costs.
  - Walk and bike travel time.
- Land use characteristics or development patterns at the destination:
  - Employment density within a certain transit travel time.
  - Employment density within a certain walk distance.

### Mode Choice Modeling: 100 Trips



The probability that a person making a trip will drive alone, drive with someone else in the vehicle, share a ride as a passenger, ride transit, walk, or ride a bicycle.

## 4 Trip assignment: What routes will be used?

After trips have been generated, trip distribution determined and mode choice selected, the trip must be assigned to a specific road, transit route, or trail. This process is called Trip Assignment and it is the most data intensive

and time consuming step. The model calculates the quickest route between each origin and destination, then performs several iterations of complex calculations to account for the trip start time and network capacity until an optimal equilibrium is reached. The modeler or planner can then observe the number of trips on a stretch of road for a given time of day.

