



## MEMORANDUM

Date: June 9, 2017; revised July 18, 2017; Revised August 4, 2017  
To: Anne Hill, Rich Eisenhauer, and Christine Leon, PBOT  
From: Don Samdahl and Kendra Breiland, Fehr & Peers  
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**Subject: Summary of Single Family and Multifamily TSDC Rates-REVISION**

SE16-0459

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*This revision includes a correction to the memo submitted on June 9, 2017. On page 4, paragraph 4, the text was amended as follows:*

*This analysis demonstrates that dwelling units with more people living in them generate more person trips; but there is no evidence to establish a direct correlation between the number of ~~people in~~ **person trips made** by the household and household square footage.*

*The remainder of the memo is unchanged.*

This memorandum summarizes the analysis used to determine the TSDC rates for single family and multiple family residential land uses. It also includes a comparison with the methodology used in the Parks SDC rates.

### **TSDC Rates**

A major shift in this TSDC program update is setting rates based on directly observed person trip data, rather than current established vehicle trip data. This shift better captures the full spectrum of travel in Portland, which includes a strong mix of walking, biking, taking transit, carpooling, and driving alone. To the extent that observed person trip data were available, as was the case with the multifamily dwellings, we used them in the TSDC calculations. Where new person trip data were not available, as in the case of single family dwellings, we obtained vehicle trip counts and factored them to represent person trip estimates as the best practice. Also, the TSDC program shifts to using PM peak hour trip rates, since the available person trip counts were typically only available for peak period conditions, and this is when the transportation system is most congested, according to current available data.

### Single Family Rates

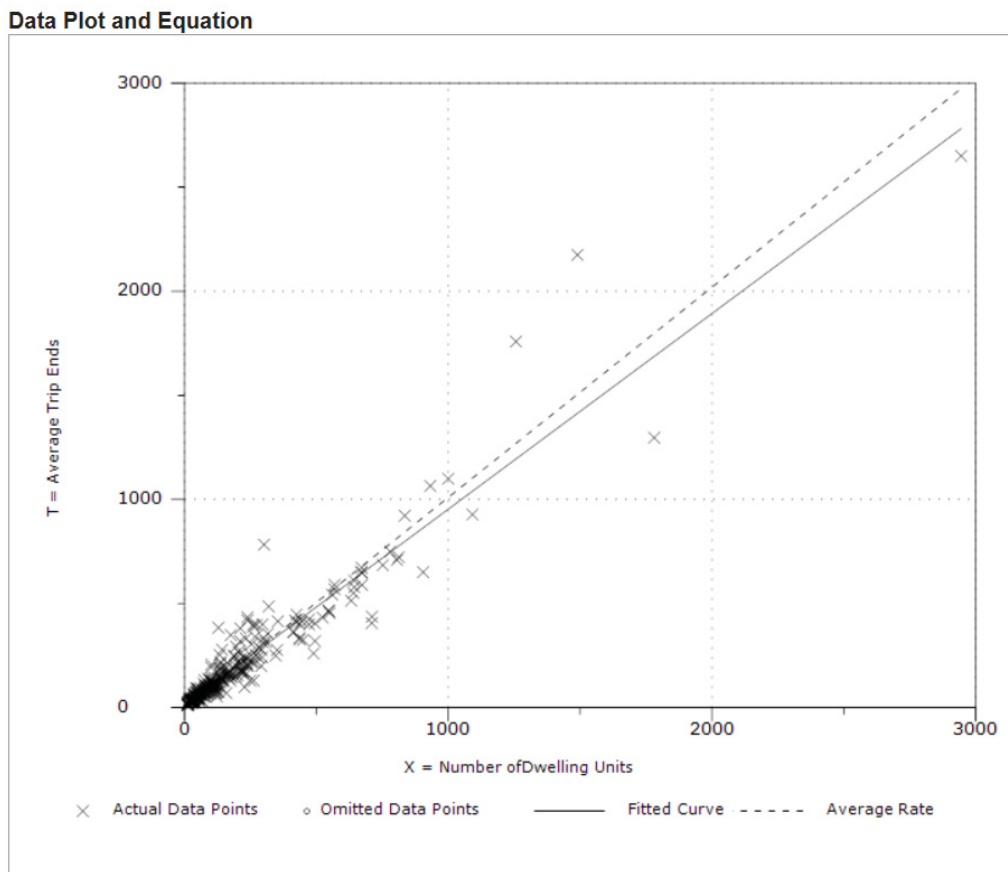


The single family person trip generation rate was derived by factoring vehicle trip data into person trips using industry-standard travel demand assumptions. The vehicle trip rate was obtained from the Institute of Transportation Engineers *Trip Generation* report (9<sup>th</sup> Ed, 2012), the most comprehensive set of nationwide travel data currently available. The surveys were conducted at 321 sites nationally over several years. The trip rates are given as vehicle trips/dwelling unit, with no stratification based on size or location.

The average PM peak hour vehicle trip rate is 1.0 vehicles/dwelling, using the data plots as shown in **Figure 1**.

**Figure 1- Vehicle Trip Rate Plot for Single Family Houses (PM Peak Hour)**

(Source: Institute of Transportation Engineers, 2012)



To zoom into the graph, drag the mouse to select the desired area.

The vehicle trip data were then converted to person trips using estimates of the percentage of trips made by vehicles (mode share) and average persons per vehicle (see equation below).



*ITE Vehicle Trip Rate per Dwelling Unit= 1.0 trips per PM peak hour*

*Multiply by the Average Persons per Vehicle= 1.17 (assumed typical value for survey site locations)*

*Divide by the % of Trips Made by Vehicles= 0.95 (assumed typical value for survey site locations)*

*Result= (1.0 x 1.17)/0.95= 1.23 PM peak hour person trips per dwelling unit*

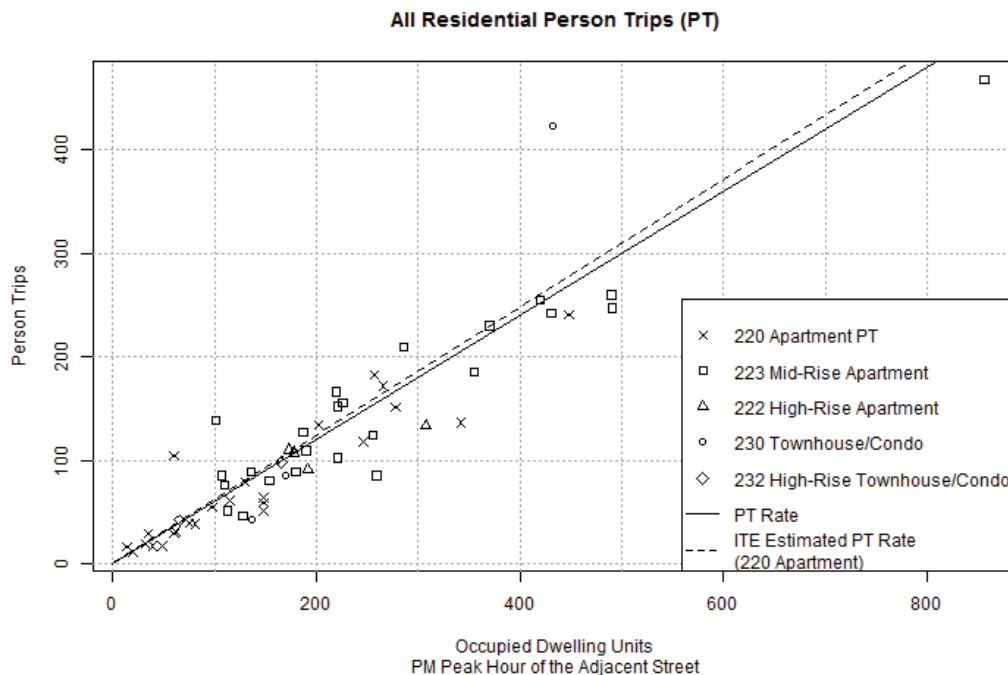
The resulting PM peak hour person trip rate was determined to be 1.23 trips/dwelling unit.

### Multiple Family Rates

Multiple family trip generation data were based on almost 100 surveys in Portland, California, and Washington, D.C. over the past two years. These surveys counted person trips directly. The resulting PM peak hour person trip rate was 0.6 trips/dwelling unit. There was no significant difference between person trip rates across the five multifamily land uses. Note that none of the data available were stratified by household square footage or number of rooms. It is not recommended by the national data collection protocols to split the data.

**Figure 2- Person Trip Rates for Multiple Family Residential (PM Peak Hour)**

(Source: Portland State University Compilation, 2017)





### Residential Person Trip Rates Based on Square Footage

The study team examined whether the person trip rates could be stratified based on household square footage, similar to what was done for the Parks SDC (see text box).

There are no trip generation survey count data available nationally or locally that stratifies person trip rates by house square footage size or bedroom distributions. The closest comparison to the Parks SDC analysis was research from Portland State University that looks at the person trip rates by number of people in a household for single family and multifamily dwellings. This analysis was from the Oregon Household Activity Survey (OHAS, 2010-2012) and included only households located in the City of Portland. The data allowed the researchers to calculate average home-based person trip rates for each residential housing type by the number of people in the household. These rates were then compared against average household person trip rates to evaluate the proportionate difference between “average” households and households with different numbers of persons.

#### Parks SDC Rates

The Parks SDC rates for residential uses were stratified by unit size as follows:

- Less than 700 square feet
- 700-1,199 square feet
- 1,200-1,699 square feet
- 1,700-2,199 square feet
- 2,200 or more square feet

The rates varied based on the average number of persons per dwelling unit using data gathered by Portland State University’s Population Research Center from the 2011 American Housing Survey.

**Figure 3** shows a relative comparison of PM peak period person trip rates based on persons per household. The vertical axis (Person Trips Generated, % of Average) represents the average person trip rate for each household type (single family and multifamily). The average single family household has 2.4 people and generates 1.4 PM peak hour person trips. The average multifamily household has 1.5 people and generates 0.8 PM peak hour person trips. The red and blue bars display what percentage the person trip rate is by persons per household (shown in the horizontal axis), compared to the average household size in the survey. For example, a five-person single family house generated 245% of the average single family rate, or 2.45 times the rate for a house with 2.4 persons. Conversely, a single family house with two persons generates 82% of the average single household. Similar relationships were evident for multiple family dwellings.

This analysis demonstrates that dwelling units with more people living in them generate more person trips; but there is no evidence to establish a direct correlation between the number of people in person trips made by the household and household square footage. Thus, we cannot differentiate trip rates by the physical size of the dwelling. Also note that OHAS data does not consider visiting trips—person trips generated by visitors or deliveries. It is likely these average rates are slightly underestimating the overall activity happening on a site per dwelling unit.

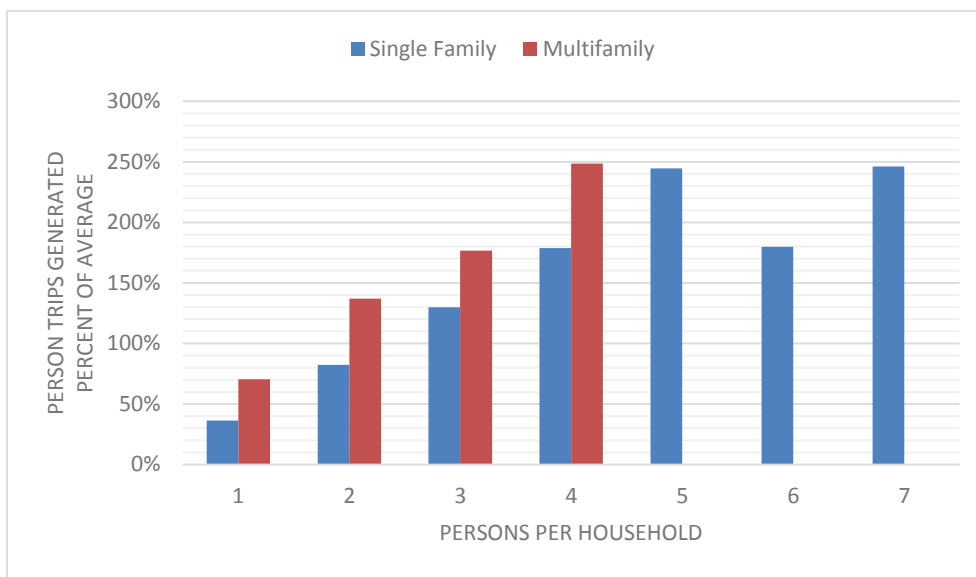
However, the study team recognized that very small houses are more likely to contain fewer people and generate somewhat lower numbers of person trips. This situation is somewhat reflected in the multiple family trip rates, which are lower partially because they have fewer



people on average compared to an average single family house. In order to reflect this likely situation with very small single family houses (i.e. less than 1,000 square feet), the study team used expertise from TREC and PSU researchers to apply trip rates that are approximately 50% less than a typical single family house rate, or comparable to the multifamily trip rate. There are no other data available to support further gradation of rates by housing size.

**Figure 3- Comparison of Relative Person Trip Rates by Persons per Household**

(Source: OHAS data compiled by PSU researchers; Graph produced by Fehr & Peers)



### Conclusion

The TSDC rates for single family and multifamily dwelling units are based on the best available national and regional trip generation survey data. Actual person trip surveys are used when they met our objective.

Rate methodologies are adopted by Council, based on technical policy objectives. PBOT's objective is to maintain a clear distinction using scientifically supportable data in developing the rate methodology. In the case of residential land uses, while data are available that demonstrate a relationship between the number of people in a household and the trip generation rate, there are no similar data comparing trip rates by household square footage. The project team estimated a TSDC rate for very small houses (i.e. less than 1,000 square feet) that was similar to the rate charged for multifamily units. However, there are no available data to justify further stratifying the TSDC single family rates based on square footage.