

# Appendix C: Adjustments to Model Outputs for Walk/Bike Trips

Most transportation planning models, including Portland's, are designed to develop data for motorized modes (auto, transit) only. Walk and bicycle trips are not usually important outputs for most applications since the bulk of transportation investment is in highway or transit projects. Hence, model calibration and validation efforts generally concentrate on the auto and transit modes.

The LUTRAQ alternative, however, focuses in part on the pedestrian and bicycle environment of new developments. Walk and bike trips are important measures of the performance of the alternative, and the traditional modeling focus on motorized trips must be expanded to include them. The model enhancements developed during the LUTRAQ study, including measures of the pedestrian environment and development density, are designed to, in part, refocus the model on these non-motorized travel modes. These enhancements, however, only partially correct existing modeling biases against walk and bike travel.<sup>1</sup>

The Portland area model is based on a 1985 travel survey. Since this survey was designed to support traditional modeling efforts in the Portland area, walk and bike trips were not a primary concern. It appears that compared to some surveys in other areas, walk and bike trips may have been under-reported in the Portland survey and are therefore underestimated in the Portland model. This shortcoming has not significantly affected previous model applications for the planning of transportation projects in the area since these projects have not focused on non-motorized trips. It is felt that for the most part, the missing walk/bike trips are not susceptible to shifts to other modes due to changes in service characteristics, especially considering that they are predominantly short trips. It appears that the reintroduction of the unreported walk trips into the model would have little effect on auto and transit related outputs including traffic volumes, vehicle miles and hours of travel, and transit ridership.

This section describes the under-reporting of walk/bike trips in the Portland survey, other areas in which the Portland model underestimates walk/bike trips, and the adjustment procedures adopted to address these issues.

## Under-Reporting of Walk/Bike Trips in the Portland Travel Survey

To determine the degree of under-reporting of walk/bike trips in the Portland survey data, the Portland data were compared to San Francisco Bay area survey data as reported in *The Effect of Neo-traditional Neighborhood Design on Travel Characteristics* by Jack Peers, et al of Fehr and Peers Associates.

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<sup>1</sup>. For information on the model enhancements made as part of the LUTRAQ project, see 1000 Friends of Oregon, *Making the Land Use, Transportation, Air Quality Connection*, Vol. 4, *Model Modifications* (Portland, Oregon, 1996), Ch. 1.

Fehr and Peers summarized the Bay area survey data for “standard suburban” and “traditional” neighborhoods, representing less and more pedestrian friendly areas, respectively. These classifications were compared to the most pedestrian friendly and least pedestrian friendly areas, respectively, of metropolitan Portland. The comparison between the Bay Area and Portland data is shown in Table C-1.

Table C-1: Comparison of Portland and San Francisco Data

	Portland		San Francisco	
	Pedestrian Friendly	Pedestrian Non-Friendly	Pedestrian Friendly	Pedestrian Non-Friendly
<b>Trips/Household</b>	9.06	9.82	9.00	11.03
<b>Walk/Bike Mode Shares</b>				
Home Based Work	7%	3%	6%	5%
Home Based Non-Work	16%	7%	20%	13%
Total Home Based	13%		5%	
Non-Home Based Work	2%	0%	28%	9%
Non-Home Based Non-Work	4%	2%	21%	9%
Total All Trips	17%		8%	

The number of person trips per household is comparable for the pedestrian friendly zones between the Portland (9.1 trips/household) and Bay Area (9.0) surveys. For pedestrian non-friendly areas this number rises to 9.8 in Portland, apparently due to household size and income considerations. The corresponding number for the Bay Area for pedestrian non-friendly zones is 11.0. This is undoubtedly due at least in part to the greater income differential between pedestrian friendly and non-friendly zones for the Bay Area (23% vs. 16% for Portland). Household size is not reported in the Fehr and Peers paper. It is likely that the difference in person trips for the Bay Area is due primarily to income and household size considerations, as appears to be the case for Portland. Another possibility is that the Bay Area data contain more non-home based trips; this is discussed below.

In terms of the percentage of trips made by the walk/bike mode, the Portland data show a greater difference between pedestrian friendly and non-friendly areas for both home based work and home based non-work trips than do the Bay Area data. The Bay Area data show little difference between the walk/bike shares for work trips from pedestrian friendly and non-friendly zones (6% vs. 5%); for Portland, a significant difference was noted (7% vs. 3%). For home based non-work trips, again the difference is greater for Portland: 16% vs. 7% for Portland, 20% vs. 13% for the Bay Area. The Portland data reflect the differences between pedestrian friendly and non-friendly areas as evident in the Bay Area.

For non-home based trips, the Bay Area data indicate much more travel by the walk/bike mode than do the Portland data. For both work based trips (28% for pedestrian friendly areas, 9% for non-friendly areas) and non-home non-work trips (28%, 9%), the Bay Area data show not only more walk/bike trips, but a greater difference between the two types of areas, than the Portland data. For Portland, the corresponding numbers are 4% (pedestrian

friendly) and 2% (pedestrian non-friendly) for non-home based non-work trips. For non-home based work trips, the average over the entire survey is only 2.1% for the walk/bike share (for this trip type, data were not available disaggregated into pedestrian friendly/non-friendly shares).

The large differences between the walk/bike shares for Portland and San Francisco non-home based trips deserve further consideration. All non-home based trips are chained trips, and the mode choice depends on the original mode choice from home. For example, 38% of home based work trips from Bay Area pedestrian friendly areas were made by non-auto modes; the number is 19% for Portland. The market of travelers for whom autos are (for the most part) not available for work based trips in Portland is half of that in the Bay Area. This does not, however, entirely explain the difference between the Portland and Bay Area data.

Perhaps a better way of examining the difference is by noting that the auto/non-auto shares for non-home based trips reflect those for the corresponding home based trips in the San Francisco data. For home based work trips, 38% use modes other than auto in pedestrian friendly zones, 10% in pedestrian non-friendly zones; for non-home based work trips these percentages are 39% and 12%. The non-auto shares for work trips are similar whether or not the trips are home based. In Portland, the home based work non-auto share is 10% for all trips, but only 5% for non-home based work trips. The non-auto share for home based work trips is 19% in pedestrian friendly areas, 8% in non-pedestrian friendly areas. For non-home based work trips, however, these percentages drop to 4% and 2%, respectively. It appears that there may be a number of non-home based trips made by modes other than auto missing from the survey; these are most likely walk/bike trips. The only other explanation for this anomaly would be that those leaving home for work without autos are somehow acquiring them for work trips made during the day. While there may be some cases where this is true, the practice is probably not wide spread enough to account for the entire discrepancy between modes for home based and non-home based work trips.

For home based non-work trips, the non-auto shares in the Bay Area are 35% and 17% for pedestrian friendly and non-friendly areas respectively; for non-home based non-work: 32% and 10%. The non-home based shares are roughly 80% of the corresponding home based shares. In Portland, the home based non-work non-auto shares are 26% and 17%, respectively, in pedestrian friendly and non-friendly zones; the respective shares for non-home based trips are 7% and 3%. This implies a larger number of non-work non-auto trips reported in the Bay Area and an under-reporting of walk/bike trips, as was the case for non-home based work trips.

In summary, there appears to be a slight under-reporting of walk/bike trips for home based non-work trips and a more significant under-reporting for non-home based trips.

## **Underestimation of Walk/Bike Trips in the Portland Model**

After the Portland model was enhanced as part of the LUTRAQ project, the model performed much better in estimating walk/bike mode shares. Even so, there is some evidence of underestimation of certain walk/bike trips. For home based walk/bike trips, the model replicated the survey results well except for the most pedestrian friendly zones. For these

zones the model estimated the walk/bike share as 6.2%; the survey indicated 7.3% walk/bike trips for the same zones, an error of 1.1%. For home based other trips, the model consistently underestimated walk/bike trips in all zones, but even more so in pedestrian friendly zones. For the least pedestrian friendly zones, the error was 0.4%. The error was 1.8% for zones with an “above average” pedestrian environment, and it was 2.8% for the most pedestrian friendly zones.

The mode shares for school trips must also be examined. The existing procedure used in Metro's model is to apply fixed percentages to school trips for each mode. While this replicates the 1985 survey data very closely, it does not consider the increased propensity to walk and bike in the TODs proposed in the LUTRAQ alternative, especially if a school is located in or at the edge of a TOD. The 1985 survey data shows a much higher walk/bike mode share for school trips in pedestrian friendly areas.

## **Adjustments to Mode Outputs for Walk/Bike Trips**

This section describes the adjustments that were made to the model outputs to reflect the under-reporting and underestimation of walk/bike trips.

### **Home Based Work Trips**

Increase walk/bike shares 1.1% for the pedestrian friendly zones. No other correction is needed as Portland and Bay Area numbers are comparable.

### **Home Based Non-work Trips**

Increase the number of walk/bike trips by 4% for the total trips for all zones. This will make the total walk/bike shares for pedestrian friendly areas consistent with the Bay Area mode shares while preserving the greater difference between the pedestrian friendly and non-friendly areas. On top of that increase, add 2.8% to the walk/bike share for the most pedestrian friendly zones, 1.8% for the remaining above average pedestrian friendly zones, and 0.4% for the other zones.

### **Home Based School Trips**

For the most pedestrian friendly zones in the LUTRAQ alternative (i.e., TODs), use the walk/bike share (42.7%) from the survey for the most pedestrian friendly zones in Portland.

### **Home Based College Trips**

No adjustment.

### **Non-Home Based Trips**

For different levels of pedestrian friendliness, determine the home based non-auto shares for work and non-work trips. Determine a correction factor for each purpose based on 80% of the ratio between the home based and non-home based shares and apply to the walk/bike percentage for non-home based trips. The additional walk/bike trips would be added to the total trips; the number of auto and transit trips would be unaffected (although the shares would decrease).

**Example (from the survey data)**

For home based non-work trips in pedestrian friendly areas, the non-auto percentage is 20.2%; for non-home based non-work trips the share is 6.5% (3.8% transit, 2.7% walk/bike). The factor:  $(0.202)/0.065*(0.80)=2.5$ . So the walk/bike percentage would increase from 2.7% to 6.8%.

