Chapter 4
Future Demand and Land Use

This chapter summarizes the methodology used to obtain future year forecasts for various modes in the City of Beaverton.

The transportation improvement plan within Beaverton addresses existing system needs and any additional facilities that will be required to serve future growth. Metro's urban area traffic forecast model was identified as the source for determining future traffic volumes in Beaverton. This traffic forecast model translates assumed land uses into person travel, selects modes and assigns roadway volume projections, These traffic volume projections form the basis for identifying potential roadway deficiencies and for evaluating alternative circulation improvements. This section describes the forecasting process, including key assumptions and the land use scenario developed from the Comprehensive Plan designations and allowed densities. Future change of these land development variables will significantly change the future travel forecast.

PROJECTED LAND USES

Land use is a key factor in developing a functional transportation system. The amount of land that is planned to be developed, the type of land uses and how the land uses are mixed together have a direct relationship to expected demands on the transportation system. Understanding the amount and type of land use is critical to taking actions to maintain or enhance transportation system operation.

Projected land uses were developed for all areas within the urban growth boundary reflecting the Comprehensive Plan and Metro's land use assumptions for year 2015. Complete land use data sets were developed **for** the following conditions:

- Existing 1994 Conditions
- Year 2015 Conditions

Land uses were inventoried throughout Beaverton by Metro. **This** land use data base includes the number of dwelling units, number of retail employees and number of other employees. Table 4-1 summarizes the land uses for existing conditions and the future scenario. A detailed summary of the land uses for each Transportation Analysis Zone (for both the existing conditions and future scenario) is provided in the appendix.

Table 4-1
Beaverton Land Use Summary

Land Use	1994	2015	Increase	Percent Increase
Households	56,590	88,381	31,791	56%
Retail Employees	18,524	30,195	11,671	63%
Other Employees	71,241	119,675	48,434	68%

Source: Metro

At the existing level of land development, the transportation system operates without significant deficiencies in the study area. **As** land uses are changed in proportion to each other (i.e., there is a significant increase in retail employment relative to household growth), there will be a shift in the overall operation of the transportation system. Retail land uses generate higher amounts of trips per acre of land than do households and other land uses. The location and design of retail land uses in a community can greatly affect transportation system operation. Additionally, if a community is homogeneous in land use character (i.e., all employment, all residential), the system must support export of trip making. Typically, there should be **a** mix of residential, commercial, and employment type land uses so that some residents may **work** and shop locally, reducing the need for residents to travel long distances.

Table 4-1 indicates that significant growth is expected in Beaverton in the coming decades. These land use projections should be monitored to make sure that Beaverton is working to achieve a balance of land use that is compatible with the available transportation system. This **TSP** balances transportation needs with the forecasted 2015 land uses.

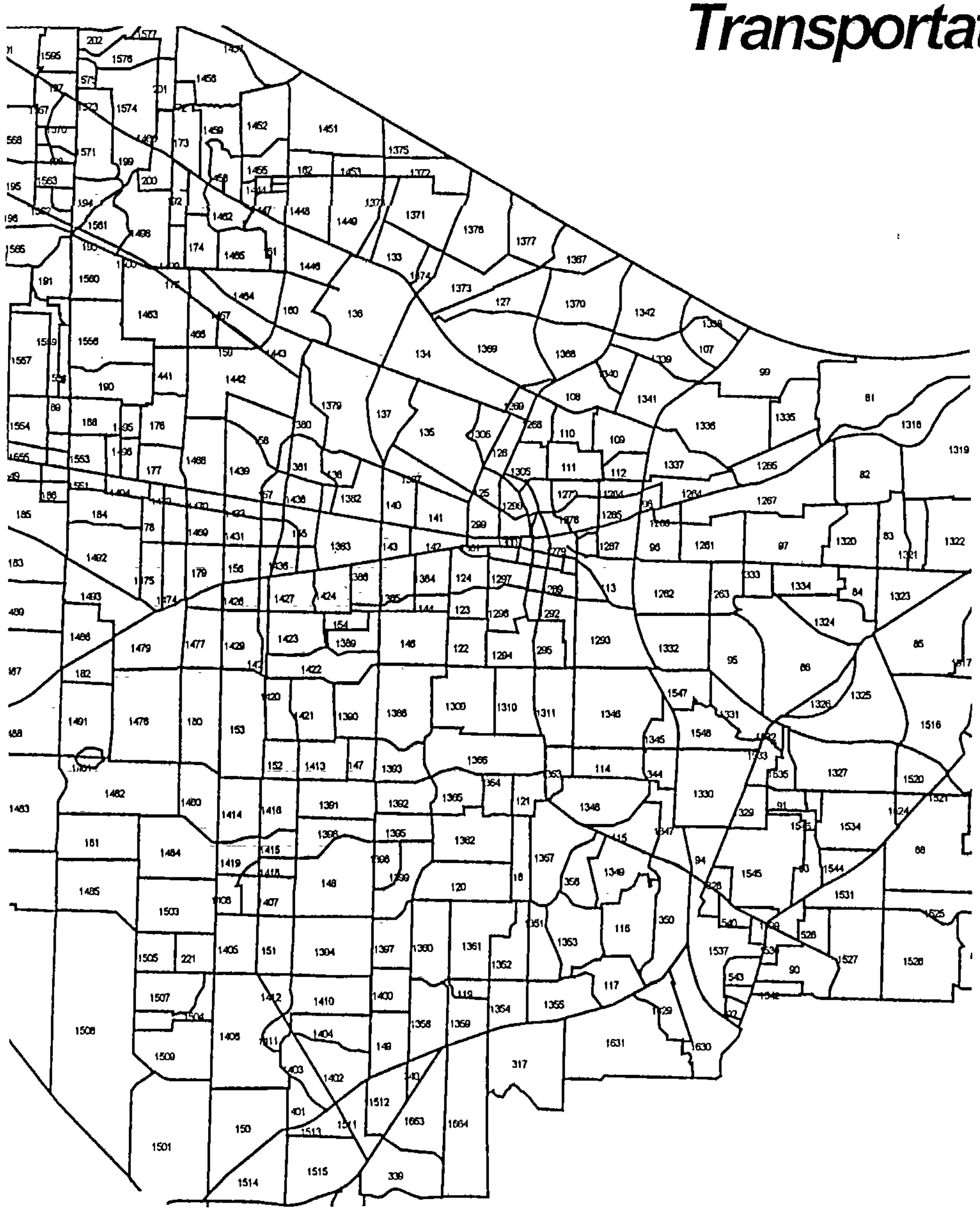
For traffic forecasting, the land use data is stratified into geographical areas called transportation analysis zones (TAZs) which represent the sources of vehicle trip generation. There are 109 Metro TAZs in Beaverton. These 109 TAZs were subdivided, as part of this plan, into 461 TAZs to more specifically represent land use in Beaverton. The disaggregated model zone boundaries are shown in Figure 4-1.

METRO AREA TRAFFIC MODEL

The development of future traffic system needs for Beaverton depends on the ability to accurately forecast travel demand resulting from estimates of future population and employment for the City.

DKS *Associates*

City of Beaverton TSP
Transportation Analysis Zones



LEGEND:

☐ Proposed Disaggregated Zone Boundary

Figure 4-1

The objective of the transportation planning process is to provide the information necessary for making decisions on when and where improvements should be made in the transportation system to meet travel demands.

Metro has developed an urban area travel demand model as part of the Regional Transportation Plan Update process to help identify street and roadway needs. Metro uses EMME/2, a computer based program for transportation planning, to process the large amounts of data for the Portland Metropolitan area. Traffic forecasting can be divided into several distinct but integrated components that represent the logical sequence of travel behavior (Figure 4-2). These components and their general order in the traffic forecasting process follow:

- Trip Generation
- Trip Distribution
- Mode Choice
- Traffic Assignment

The initial roadway network used in the traffic model was the existing streets and roadways. Future land use scenarios were tested and roadway improvements were added to mitigate traffic conditions, using programmed improvements as a starting basis. Forecasts of PM peak hour traffic flows were produced for every major roadway segment within Beaverton. Traffic volumes were projected on all arterials and most collector streets. Some local streets were included in the model, but many are represented by centroid connectors in the model process.

Trip Generation. The trip generation process translates land use quantities (in numbers of dwelling units and retail and other employment) into vehicle trip ends (number of vehicles entering or leaving a TAZ) using trip generation rates established during the model verification process. The Metro trip generation process is elaborate, entailing detailed trip characteristics for various types of housing, retail employment, non-retail employment and special activities. Typically, most traffic impact studies rely on the Institute of Transportation Engineers (ITE) research for analysis.[1] The model process is tailored to variations in travel characteristics and activities in the region, which involve high levels of trip generation and lower levels. For reference, Table **4-2** provides a summary of the evening peak hour trip rates used in the Metro model. These are averaged over a broad area and thus, are different than driveway counts represented by ITE. This data provides a reference for the trip generation process used in the model.

[1] Trip Generation **Manual, 5th** Edition, Institute of **Transportation** Engineers, 1991

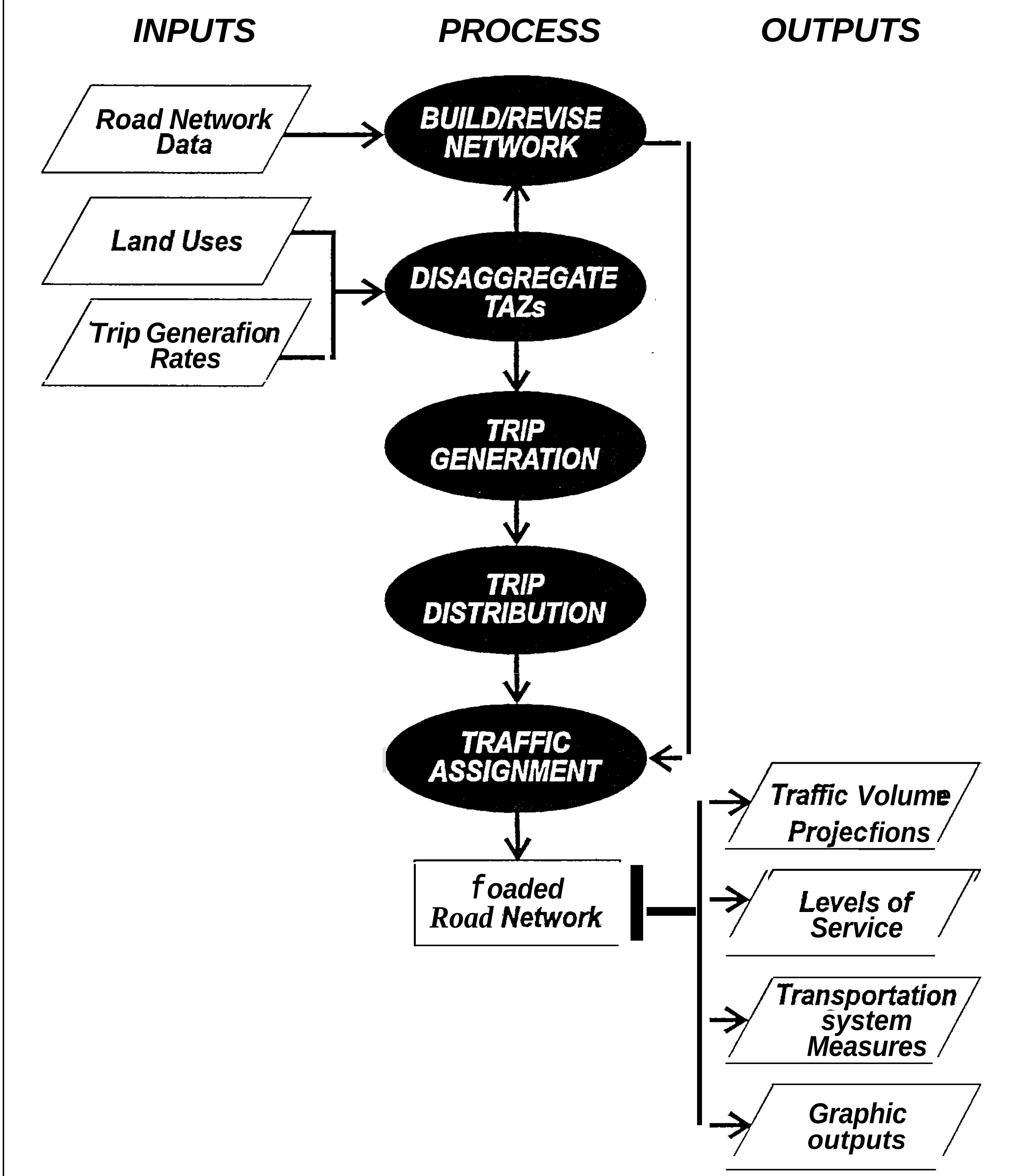


Figure 4-2
MODEL PROCESS

Table 4-2
Approximate Average PM Peak Hour Trip Rates Used in Metro Model

Unit	Average Trip Rate/Unit		
	In	out	Total
Household	0.43	0.19	0.62
Retail Employee	0.78	0.69	1.47
Other Employee	0.07	0.29	0.36

Source: Metro

Table 4-3 illustrates the estimated growth in vehicle trips generated within the Beaverton area (the area shown in Figure 4-1) between 1994 and 2015. It indicates that vehicle trip generation in Beaverton would grow by approximately 51 percent between 1994 and 2015 if the land develops according to Metro's assumptions.

Table 4-3
Existing and Future Projected Trip Generation
PM Peak Hour Vehicle Trips

	1994 Trips	2015 Trips
Beaverton area	97,934	148,070

Source: Metro

Trip Distribution. This step estimates how many trips travel from one zone in the model to any other zone. The distribution is based on the number of trip ends generated in each zone pair, and on factors that relate the likelihood of travel between any two zones to the travel time between the zones. In projecting long-range future traffic volumes, it is important to consider potential changes in regional travel patterns. Although the locations and amounts of traffic generation in Beaverton are essentially a function of future land use in the city, the distribution of trips is influenced by growth in neighboring areas such as Portland and unincorporated areas to the north, south and west of Beaverton. External trips (trips which have either an origin or destination in Beaverton and the other trip end outside Beaverton) and through trips (trips which pass through Beaverton and have neither an origin nor a destination there) were projected using trip distribution patterns based upon census data and traffic counts performed at gateways into the Metro area Urban Growth Boundary (UGB) for calibration.

Mode Choice. This is the step where it is determined how many trips will be by various modes (single-occupant vehicle, transit, carpool, pedestrian, etc.). The 1994 mode splits are incorporated into the base model and adjustments to that mode split may be made for the future scenario, depending on any expected changes in transit or carpool use. These considerations are built into the forecasts used for 2015.

Traffic Assignment. In this process, trips from one zone to another are assigned to specific travel routes in the network, and resulting trip volumes are accumulated on links of the network until all trips are assigned.

Network travel times are updated to reflect the congestion effects of the traffic assigned in each model iteration. Congested travel times are estimated using what are called "volume-delay functions" in EMME/2. There are different forms of volume/delay functions, all of which attempt'to simulate the capacity restraint effect of how travel times increase with increasing traffic volumes. The volume-delay functions take into account the specific characteristics of each roadway link, such as capacity, speed and facility type. This allows the model to reflect conditions somewhat similar to driver behavior.

Different models are actually used for auto assignment versus transit assignment. Various techniques exist for auto assignment, such as all-or-nothing, stochastic, incremental capacity restraint and equilibrium capacity restraint. The EMME/2 package, among others, uses the equilibrium capacity restraint technique, which is considered to produce the most realistic network traffic loading of all the techniques. With this technique, the auto trips are assigned iteratively to the network in such a way that the final traffic loading will closely approximate the true network "equilibrium." Network equilibrium is defined as the condition where no traveler can achieve additional travel time savings by switching routes. Between iterations, network travel times are updated to reflect the congestion effects of the traffic assigned in the previous iteration.

Transit assignment techniques are typically much simpler than auto assignment techniques in that capacity restraint effects are not considered. Transit trips are assigned in an "all-or-nothing" manner in which all of the transit trips between a particular pair of zones are assigned to the same minimum time route based on transit service characteristics such as headway and the number of stops.

Model Verification. The base 1994 modeled traffic volumes were compared against actual traffic counts across screenlines on key arterials and at key intersections. Most arterial traffic volumes were closely replicated, even down to turn movements, by the model based upon detailed calibration. Based on this performance, the model was used for future forecasting and assessment of circulation changes.

MODEL APPLICATION TO BEAVERTON

Intersection turn movements were extracted from the model at key intersections for both year 1994 and year 2015 scenarios. These intersection turn movements were not used directly, but the increment of the year 2015 turn movements over the year 1994 turn movements was applied (added) to existing (actual 1996) turn movement counts in Beaverton. Actual turn movement volumes used for future year intersection analysis can be found in the technical appendix for the **TSP.**