4 Future Forecasting Process

TRAVEL DEMAND AND LAND USE

Metro's urban area transportation forecast model is used to determine future traffic volumes in Milwaukie. This forecast model translates assumed land uses into person trips, selects travel modes and assigns motor vehicles to the roadway network. These traffic volume projections form the basis for identifying potential roadway deficiencies and evaluating alternative circulation improvements. This chapter will describe the forecasting process, including key assumptions and the land use scenario developed from the existing Comprehensive Plan designations and allowed densities.

PROJECTED LAND USE GROWTH

Land use is a key factor in developing a functional transportation system. Considerations must include the amount of land to be developed, the type of land uses that will be developed, and the relationship between mixed land uses and associated demands on the transportation system.

Projected land uses developed for the study area reflect Milwaukie's Comprehensive Plan and Metro's land use assumptions for the year 2035.[1] Complete land use data sets have been developed for the following conditions.

- Existing 2010 (base travel forecast for the region).
- Future 2035 Conditions.

The following sections summarize the forecasted growth in land uses that influence travel within the City of Milwaukie.

GROWTH WITHIN MILWAUKIE

The base year travel model is updated periodically to reflect the most current and up-to-date inputs related to land use for the region. For this study, the available base model provided by Metro represents land uses for 2010. This land use database includes the number of dwelling

[1] Metro works cooperatively with local agencies to determine local existing and future land uses that incorporate existing land uses and reflects input from local agencies. These land uses are then regionally adopted and updated when new travel demand models are developed.

units (housing), retail employees, service employees, and other employees. Table 4-1 summarizes the aggregated land use data for the 2010 base and future 2035 scenarios within the study area. This land use data is divided into smaller areas called Transportation Analysis Zones (TAZs), which contain a portion of the households, retail, service and other employees. This land use creates varying trip modes such as motor vehicle, pedestrian, bicycle and transit trips.

Table 4-1 Milwaukie TSP Study Area Land Use Summary

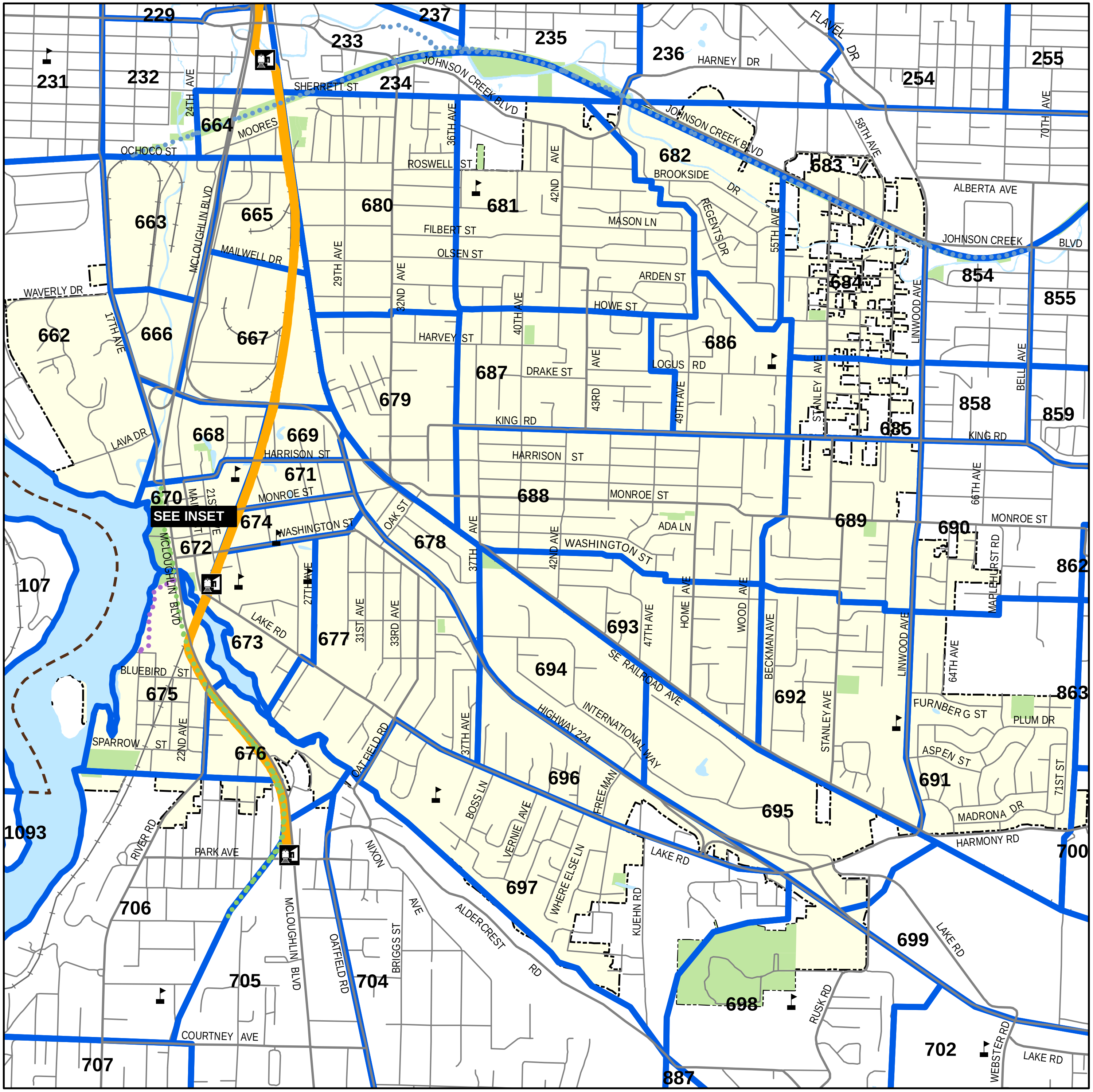
Land Use	2010	2035	Increase	Percent Increase
Households (HH)	9,791	11,668	877	19%
Retail Employees (RET)	1,405	1,902	497	35%
Service Employees (SER)	3,860	4,943	1,083	28%
Other Employees (OTH)	6,754	7,792	1,038	15%

Source: Metro (subset of TAZ data that approximates Milwaukie city limits)

The overall operation of the transportation system is affected as land uses change. Retail land use typically generates a higher number of trips per acre of land than households and other land uses during the p.m. peak period. The location and design of retail land use in a community can greatly affect future transportation system operation. Additionally, if an area within the city is homogeneous in land use character (i.e. all employment or residential), the transportation system typically supports significant trips coming to or from the area rather than within the area. Integration of residential, commercial, and employment land uses within a small geographic area promotes sustainable livability, where residents can work, shop, and play locally. Among other significant benefits, this reduces long-distance traveling by residents who would otherwise be seeking services outside their locality.

Table 4-1 displays the projected employment growth (approximately 2,600 jobs) in Milwaukie that is projected to occur over a 25-year period. The transportation system should be monitored to make sure that land uses in the plan are balanced with transportation system needs. A primary purpose of a TSP is to determine those needs and help identify transportation projects for all modes that help balance future needs with the forecasted 2035 land uses.

Within the study area there are approximately 36 TAZs used by Metro for planning purposes. The number of TAZs in the study area has increased from 31 since the last TSP update, due to Metro’s continued refinement of the regional travel demand model. The TAZ boundaries are shown in Figure 4-1.



Transportation System Plan

FIGURE 4-1

TRANSPORTATION ANALYSIS ZONES

November 2013

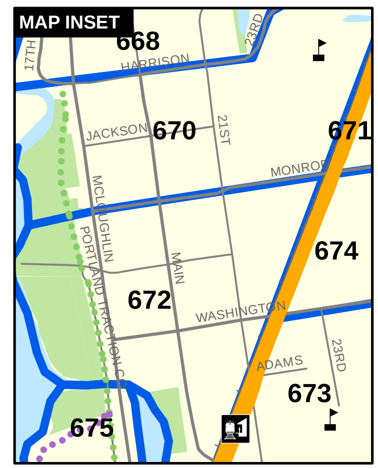
LEGEND

Transportation Analysis Zones

- Metro Beta Model Transportation Analysis Zones
- #### Transportation Analysis Zone Number

Other Map Features

- Schools
- Kellogg Creek Trail
- SpringwaterTrail
- Trolley Trail
- Light Rail Station
- Light Rail Transit
- Major Roads
- Streets
- Railroad
- County Line
- Water
- Parks
- City Limits



DKS Associates
TRANSPORTATION SOLUTIONS

0 500 1,000 2,000 3,000 4,000 Feet

METRO AREA TRANSPORTATION MODEL

Accurately forecasting travel demand of estimated future population and employment is important for determining future transportation system needs. The objective of the transportation planning process is to provide necessary information to aid decision-making of where and when transportation system improvements should be made to meet future travel demand. Metro uses VISUM, a computer-based transportation modeling program to process large amounts of data related to land use and person trips for several modes of travel for the Portland Metropolitan area. The modeling process for the Milwaukie TSP uses the 2010 and 2035 travel demand models during the 2-hour p.m. peak period to develop future forecasts within Milwaukie. These models are "Beta" versions that have been updated since the adoption of Metro's 2035 Regional Transportation Plan (RTP).[2]

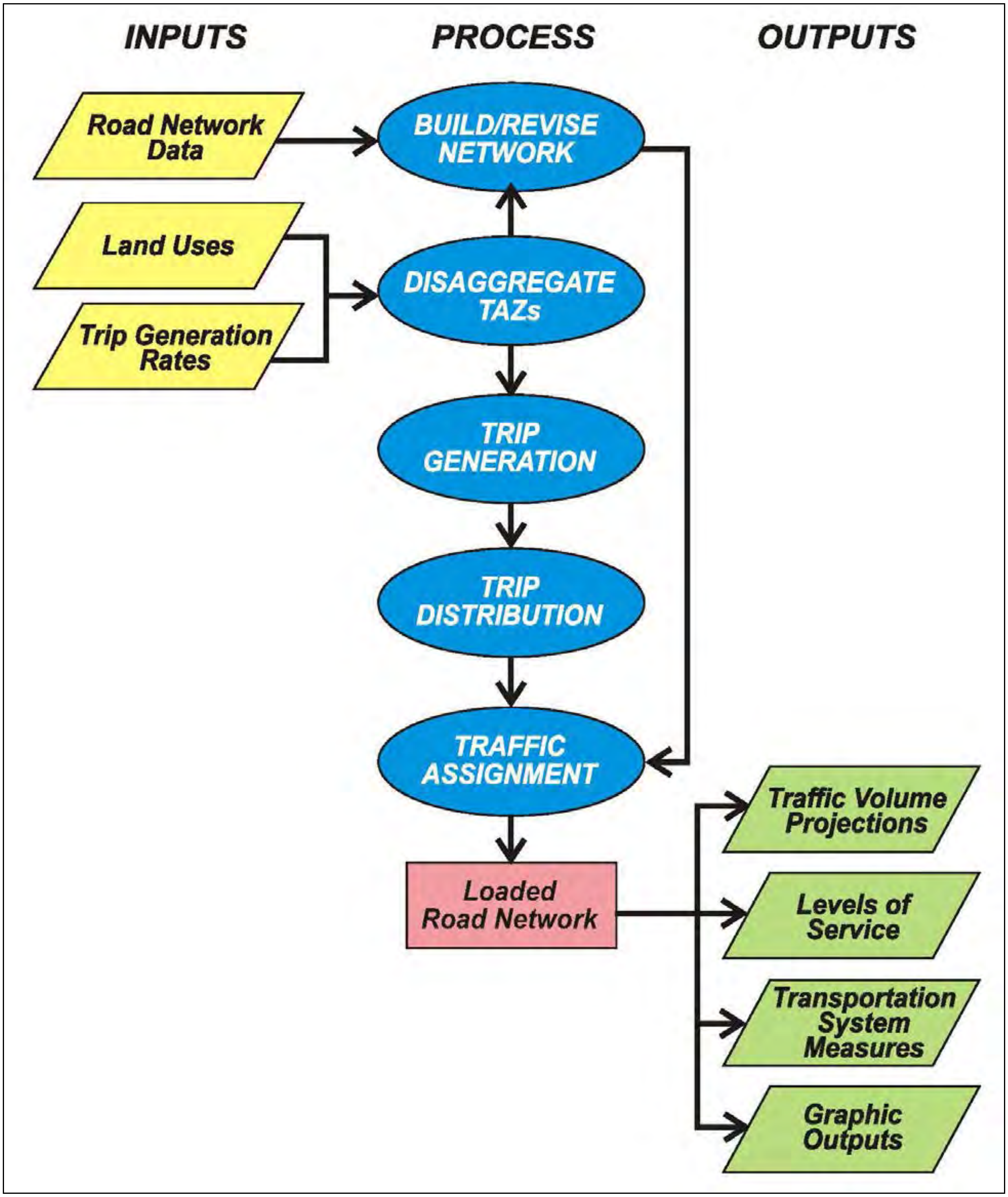
Future travel demand forecasting can be divided into several distinct, yet integrated components that represent the logical sequence of travel behavior (see Figure 4-2). These components and their general order in the traffic forecasting process are as follows:

1. **Trip Generation:** Converts land use type into total person trips.
2. **Trip Distribution:** Determines the origins and destinations within the region.
3. **Mode Choice:** Determines which mode of travel (i.e. motor vehicle, bicycle, pedestrian, transit, carpool, etc.) each trip will use.
4. **Traffic Assignment:** Assigns the trips by mode to specific routes in the transportation network that match the trip distribution locations.

The base roadway network in the existing 2010 traffic model reflects the current street and roadway system. The future 2035 roadway system in the Metro model consists of a "low build" condition that is typically consistent with the RTP financially constrained system. It includes both projects for which funding has been identified and the funded projects listed in the 2007 Milwaukie TSP. Projects in both the RTP and the TSP were then validated in the study process. Forecasts of p.m. peak period traffic flows were produced for every major roadway segment within Milwaukie. Traffic volumes were projected on all arterials and most collector streets. While most local streets are not included in the model, many are represented by TAZ connectors in the model process.

[2] Use of the Beta model is consistent with guidance from Metro. Memo: *Administrative Interpretation of 2035 Regional Transportation Plan, No 2012-2 – Guidance for Transportation System Plans and Corridor Plans about regional population and employment forecasts recommended for use in planning efforts in 2012*, John Williams, Metro, May 2, 2012.

Figure 4-2 Travel Forecasting Model Process



TRIP GENERATION

The trip generation process translates land use quantities (number of dwelling units, retail employees, service employees and other employees) 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, service, other employment, and special activities. Typically, most traffic impact studies rely on the Institute of Transportation Engineers (ITE) research for analysis.[3] The model process is tailored to variations in travel characteristics and activities in the region. For reference, Table 4-2 provides a summary of the approximate average evening peak-hour trip rates used in the Metro model. These are averaged over a broad area and do not account for pass-by trips; thus, they are different than driveway counts represented by ITE for similar land uses. This data provides a reference for the trip generation process used in the model.

Table 4-2 Approximate Average P.M. Peak Period Trip Rates Used in Metro Model

Unit	Average Trip Rate/Unit		
	In	**Out**	**Total**
Household (HH)	0.69	0.35	1.04
Retail Employee (RET)	0.89	1.23	2.12
Service Employee (SER)	0.19	0.47	0.66
Other Employee (OTH)	0.13	0.39	0.52

Source: DKS Associates/Metro Regional Travel Demand Model

Table 4-3 summarizes the total estimated 2010 and 2035 motor vehicle trips for Milwaukie as well as the estimated growth in vehicle trips during the two-hour p.m. peak period. Using the forecasted land use and calculated trip rate values, the total number of in- and out-trips can be produced for each TAZ in the region. Vehicle trips in Milwaukie are expected to grow by approximately 16% between 2010 and 2035 if the land develops according to the 2035 land use assumptions. Assuming a 25-year horizon to the 2035 scenario, this represents annualized growth rate of approximately 0.61% per year.

Table 4-3 Milwaukie Vehicle Trip Generation (2-Hour P.M. Peak Period)

	2010 Trips	**2035 Trips**	**Percent Increase**
Milwaukie TSP update Study Area	21,328	24,816	16%

Source: Metro Regional Travel Demand Model

TRIP DISTRIBUTION

This step estimates how many trips travel from one area in the model to any other area. Distribution is based on the number of trip ends generated in each TAZ zone pair, and on factors that relate the likelihood of travel between any two TAZs to the travel time between the zones.

[3] *Trip Generation Manual*, 7th Edition, Institute of Transportation Engineers, 2003.

In projecting long-range future traffic volumes, it is important to consider potential changes in regional travel patterns. Although the location and amount of traffic generation in Milwaukie are essentially a function of future land use in the city, the distribution of trips is influenced by expected congestion on roadways and regional growth, particularly in neighboring areas such as Portland, Oregon City, and the unincorporated Clackamas County areas. The model and trip distribution can also be used to help define the number of internal, external, and through trips for Milwaukie. These types of trips are as follows:

- **Internal trips** are trips that start and end within the city limits of Milwaukie.
- **External trips** are trips that either start in Milwaukie and end outside the city, or start outside the city and end within the city.
- **Through trips** are trips that pass through Milwaukie and have neither an origin nor a destination in Milwaukie.

Table 4-4 quantifies the internal, external, and through trips for all roadways within Milwaukie, as forecasted by the Metro regional travel demand model for 2010 and 2035. The number of internal versus external or through trips reveals that few people actually both live and work in Milwaukie. The much larger number of external than internal trips represents the people who live outside of Milwaukie and work in the city, or live in Milwaukie but work outside of the city. The high number of through trips through the city indicates that Milwaukie functions as a conduit for a significant number of people between their jobs and homes, both of which are outside the city limits of Milwaukie. Comparing the percentage of trips for the model year 2035 versus 2010 shows there is a slight decrease (2%) in the percentage of external trips during the p.m. peak period. It also shows that the percentage of through trips slightly increases over the 25-year time span.

Table 4-4 Milwaukie Vehicle Trip Distribution (2-Hour P.M. Peak Period)

Trip Type	2010	2035	% Change
Internal Trips (I-I)	10%	10%	0%
External Trips (X-I or I-X)	51%	49%	-2%
Through Trips (X-X)	39%	41%	+2%

Source: DKS Associates/Metro Regional Travel Demand Model

I = Internal location
X = External location

MODE CHOICE

This step in the modeling process determines how many trips will be made by various modes (single-occupant vehicle, transit, carpool, pedestrian, bicycle, etc.). The 2010 mode splits are incorporated into the base model and adjustments to that mode split may be made for a future scenario dependant upon any anticipated changes in transit or carpool use. These considerations are built into the forecasts used for 2035. Based upon analysis of the forecasted mode choice in 2035, a study was performed to determine the level of non-single-occupant-vehicle (non-SOV) mode share. The travel model provides estimates of the various modes of travel that can be generally assessed at the transportation analysis zone level. Figure 4-3 summarizes the level of non-SOV mode share estimated for 2035 using the regional travel demand forecast model in comparison to the modal targets established in the RTP through Table 1-3 of the 2008 RTP. Generally, the areas served by transit service have the highest levels of non-SOV mode choice. The targets are based on the 2040 design type for areas around the region, as follows for each design type and non-SOV target:

- Portland Central City (60-70%).
- Regional Centers, Town Centers, Main Streets, Station Communities, Corridors, Passenger Intermodal Facilities (45-55%).
- Industrial Areas, Freight Intermodal Facilities, Employment Areas, Inner Neighborhoods, Outer Neighborhoods (40-45%).

These non-SOV targets are aggregated by design type groupings (as listed above) and colored in Figure 4-3 as orange (45-55% target) and yellow (40-45% target). For each TAZ, the 2035 non-SOV share is listed. In general, the change from year 2010 is 2% growth or less. The 2035 non-SOV share for each TAZ is also colored to indicate the highest target that is satisfied (orange for 45-55% target, and yellow for 40-45% target). Note that TAZ boundaries, which are the basis for the non-SOV share data, do not directly align with the 2040 design type boundaries.

Generally, the areas served by transit service have the highest levels of non-SOV mode choice.

TRAFFIC ASSIGNMENT

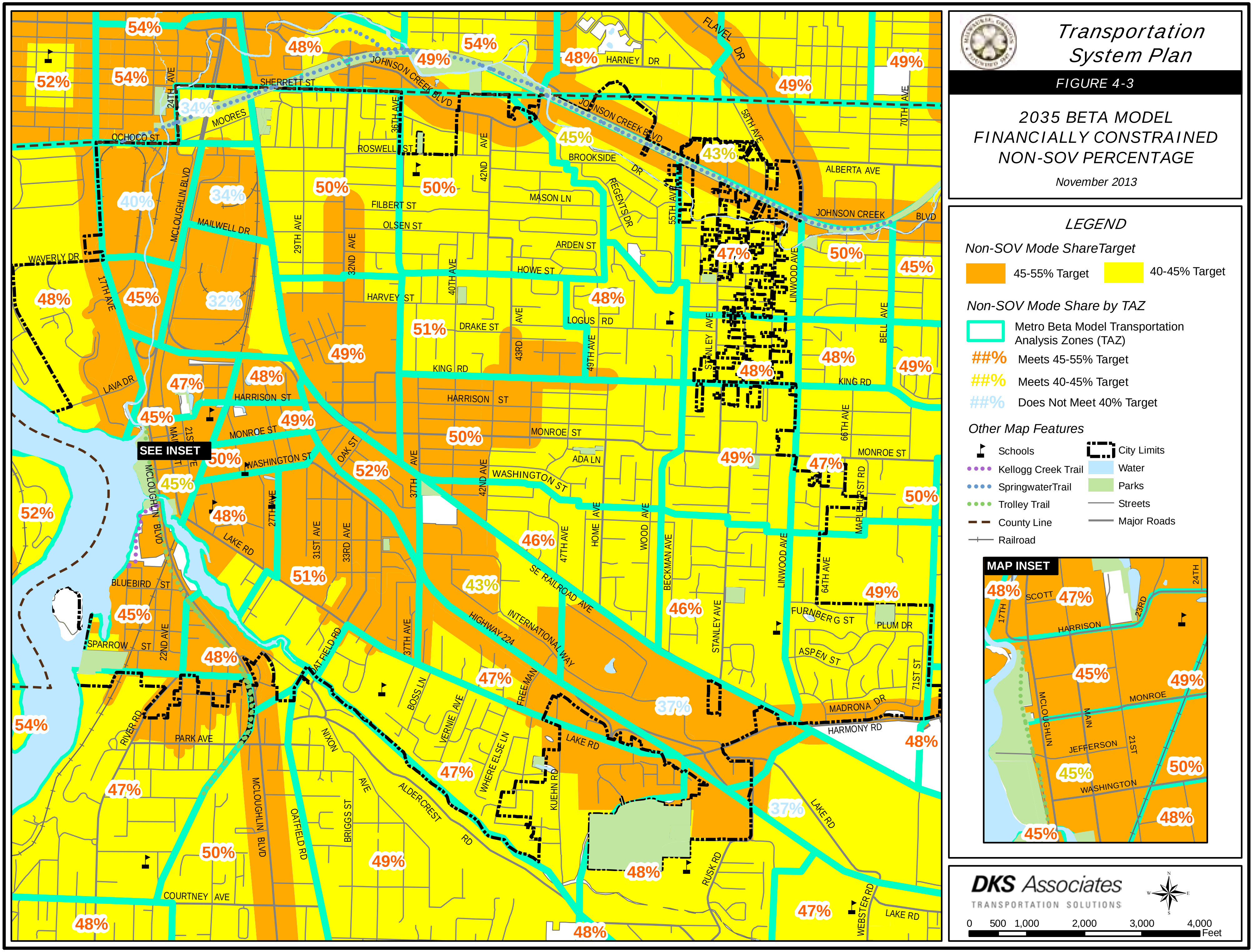
In this process, trips from one zone to another are assigned to specific travel routes in the network, and resulting trip volumes are accumulated on links of the network until all trips are assigned.

Network travel times are updated to reflect the congestion effects of the traffic assigned through an equilibrium process. Congested travel times are estimated using what are called "volume-delay functions" in VISUM. There are different forms of volume-delay functions, all of which attempt to simulate the impact of congestion on travel times (greater delay) as traffic volume increases. 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.

MODEL VERIFICATION

The base 2010 traffic volumes from the regional model were compared against actual traffic volume counts at specific locations on key arterials and at key intersections. These key intersections and corridors created "screenlines" (imaginary lines drawn across the transportation system that intersect many roadways). The screenlines are used to back-check the actual volume against the model volume to make sure that the model is predicting traffic volumes and travel patterns that reflect actual existing conditions. Most arterial traffic volumes meet screenline tolerances for forecast adequacy.[4] If roadways and/or intersection volumes are not within this tolerance, modifications to the roadway network in the base model are made to help adjust and calibrate the model to bring those volumes to within acceptable tolerance levels. These same changes in the base model are made to the future model if those changes do not conflict with a planned project in the future model (e.g., a roadway being widened or improved). Based on this performance, the existing and future models are used for future forecasting and assessment of circulation change.

[4] Typically within a 10% variance.


Transportation System Plan
FIGURE 4-3
2035 BETA MODEL FINANCIALLY CONSTRAINED NON-SOV PERCENTAGE
November 2013
LEGEND
Non-SOV Mode ShareTarget
45-55% Target
40-45% Target
Non-SOV Mode Share by TAZ
Metro Beta Model Transportation Analysis Zones (TAZ)
##% Meets 45-55% Target
##% Meets 40-45% Target
##% Does Not Meet 40% Target
Other Map Features
Schools
Kellogg Creek Trail
SpringwaterTrail
Trolley Trail
County Line
Railroad
City Limits
Water
Parks
Streets
Major Roads
MAP INSET
SCOTT
HARRISON
MONROE
JEFFERSON
WASHINGTON
MCLOUGHLIN
MAIN
21ST
17TH
23RD
24TH
DKS Associates
TRANSPORTATION SOLUTIONS
0 500 1,000 2,000 3,000 4,000 Feet
SEE INSET
JOHNSON CREEK BLVD
SHERRETT ST
OCHOCO ST
MOORES
HARNEY DR
FLAVEL DR
ROSWELL ST
BROOKSIDE DR
ALBERTA AVE
MASON LN
FILBERT ST
OLSEN ST
MAILWELL DR
ARDEN ST
WAVERLY DR
HOWE ST
HARVEY ST
LOGUS RD
DRAKE ST
KING RD
LAVA DR
HARRISON ST
MONROE ST
WASHINGTON ST
ADA LN
LAKE RD
SE RAILROAD AVE
HIGHWAY 224
INTERNATIONAL WAY
FURNBERG ST
PLUM DR
ASPEN ST
MADRONA DR
HARMONY RD
BLUEBIRD ST
SPARROW ST
PARK AVE
RIVER RD
COURTNEY AVE
MCLOUGHLIN BLVD
OATFIELD RD
BRIGGS ST
NIXON AVE
ALDERCREST RD
WHERE ELSE LN
VERNIE AVE
BOSS LN
FREEMAN
KUEHN RD
RUSK RD
WEBSTER RD
LINWOOD AVE
STANLEY AVE
BECKMAN AVE
WOOD AVE
HOME AVE
MAPLEHURST RD
BELL AVE
REGENTS DR
OAK ST
17TH AVE
22ND AVE
24TH AVE
27TH AVE
29TH AVE
31ST AVE
32ND AVE
33RD AVE
36TH AVE
37TH AVE
40TH AVE
42ND AVE
43RD
47TH AVE
49TH AVE
55TH AVE
58TH AVE
64TH AVE
66TH AVE
70TH AVE
71ST ST
54%
52%
48%
49%
34%
40%
45%
32%
50%
51%
47%
43%
46%
37%

MODEL APPLICATION TO MILWAUKIE

Intersection turn movements were extracted from the model at study area intersections for both the base year 2010 and forecast year 2035 scenarios. A "post processing" technique[5] is utilized to refine model travel forecasts to the volume forecasts utilized for 2035 intersection analysis. "Post processing" is a technique that uses existing traffic count data, base year model data, and future year model data to estimate future volumes by adding the increment of future traffic volume growth to the existing count data. This approach minimizes the effects of any model error by adding the increment of growth projected based on changes in land use to the base year counts.

[5] National Cooperative Highway Research Program (NCHRP) 255, Highway Traffic Data for Urbanized Area Project Planning and Design, Transportation Research Board, Washington DC, 1982.