DKS Associates

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Future Conditions and Needs Analysis Report

The Beaverton Transportation System Plan Update addresses existing system needs and additional facilities that are required to serve future growth. This document presents the assumptions and methodology used to project future traffic growth and identifies locations that will require additional improvements to meet the future needs of various modes of travel.

FUTURE LAND USE AND VEHICLE DEMAND

Metro's MetroScope land use model and Metro's travel demand model were used to determine future 2035 traffic volumes in Beaverton. These forecast models coordinate projected land uses with the available transportation network and estimate person travel, travel modes, and how future trips will be assigned to the roadway network. These traffic volume projections form the basis for identifying potential roadway capacity deficiencies and for evaluating alternative circulation improvements. This section describes the forecasting process including key assumptions and the land use scenario developed from the existing Comprehensive Plan designations and allowed densities.

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 areas within the urban growth boundary and reflect the Comprehensive Plan and coordination with Metro's 2035 land use projections. Complete land use data sets were developed for the following years.

- Existing 2005 Conditions (most current base land use data for the Metro region)
- Future 2035 Conditions

The base year travel model is updated periodically and for this study effort, the available base model provided by Metro was for 2005. Land uses were inventoried throughout Beaverton by the City, Washington County, and Metro. This land use database includes the number of dwelling units, the number of retail employees, and the number of other employees.

For transportation 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 101 Metro TAZs within or adjacent to the Beaverton TSP Update study area that were further refined as part of this plan. These 101 TAZs were subdivided into 464 TAZs to more specifically represent land use in Beaverton and allow forecasting of the City roadway network (Metro's model focuses on significant regional facilities). The disaggregated model zone boundaries are shown in Figure 1.

Table 1 summarizes the land uses for existing conditions and the future scenario within the Beaverton TSP Update study area. Table 1 summarizes data only the for specific land use within the 2035 Beaverton TSP study area. While these summaries only outline land use in Beaverton for the purposes of this study, the travel demand forecasts that have been evaluated reflect the regional land use growth throughout the Portland metropolitan area (including growth in areas such as North Bethany and West Bull Mountain). A detailed summary of the uses for each TAZ within the Beaverton study area is provided in the Appendix.

Table 1: Beaverton Land Use Summary

Land Use	2005	2035	Increase	Percent Increase	Percent Annual Increase
Households (HH)	67,095	96,854	29,759	44%	1.2%
Retail Employees (RET)	23,395	36,236	12,841	55%	1.5%
Other Employees (OTH)	70,318	111,448	41,130	58%	1.5%

Note: Annual growth rates from 2005 to 2035 are lower than the 1994 to 2020 annual growth rates for each land use. Annual growth rates from 1994 to 2020 were about 0.5% higher for HH and OTH, and 1% higher for RET.

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 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 or residential), the transportation system must support significant trips coming to or from the community rather than within the community. 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 1 indicates that significant growth is expected in Beaverton in the coming decades. The transportation system in Beaverton should be monitored to make sure that land uses in the plan are balanced with transportation system capacity. This TSP balances needs with the forecasted 2035 land uses.


City of Beaverton
FIGURE 1
Transportation System Plan
Transportation Analysis Zones (TAZ)
LEGEND
TSP TAZ
Metro TAZ
2008 TSP Study Area Boundary
Major Roads
Local Streets
City Limits
0 750 1,500 3,000 4,500
Feet
N
DRAFT
January 2009
DKS Associates
TRANSPORTATION SOLUTIONS
NW CORNELL RD
SW WALKER RD
SW MURRAY BLVD
NW BARNES RD
SW BARNES RD
US 26
SW CEDAR HILLS BLVD
SW JENKINS RD
SW MERLO RD
TUALATIN VALLEY HWY
SW FARMINGTON RD
SW CANYON RD
HWY 217
SW BEAVERTON HILLSDALE HWY
SW SCHOLLS FERRY RD
SW ALLEN BLVD
SW DAVIS RD
SW OAK ST
SW 170TH AVE
SW DENNEY RD
SW HART RD
SW GARDEN HOME RD
SW OLESON RD
SW BROCKMAN ST
SW WEIR RD
SW 175TH AVE
SW 125TH AVE
SW HALL BLVD
SW LOMBARD AVE
SW WESTERN AVE
SW BASELINE RD
SW 158TH AVE
SW WATSON
SW HALL
GREENWAY

Metro Area Transportation Model

A determination of future traffic system needs in Beaverton requires the ability to accurately forecast travel demand resulting from estimates of future population and employment for the City and the impact of background or through traffic growth. The objective of the transportation planning process is to provide the information necessary for making decisions on when and where improvements should be made to the transportation system to meet travel demand as developed in an urban area travel demand model as part of the Regional Transportation Plan (RTP) update process. Metro uses VISUM, a computer based program for transportation planning, to process the large amounts of data for predicting travel in the Portland Metropolitan area. For the Beaverton TSP, Metro's 2035 regional model was refined for the Beaverton area and significant network detail was added to allow forecasting for all significant City roadways (Metro's model focuses only on significant regional facilities).

Traffic forecasting can be divided into several distinct but integrated components that represent the logical sequence of travel behavior (Figure 2). These components and their general order in the traffic forecasting process are as follows:

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

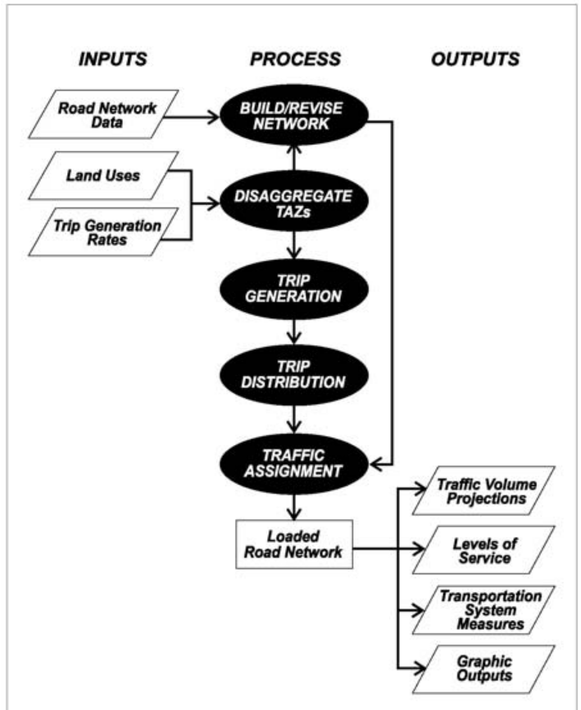
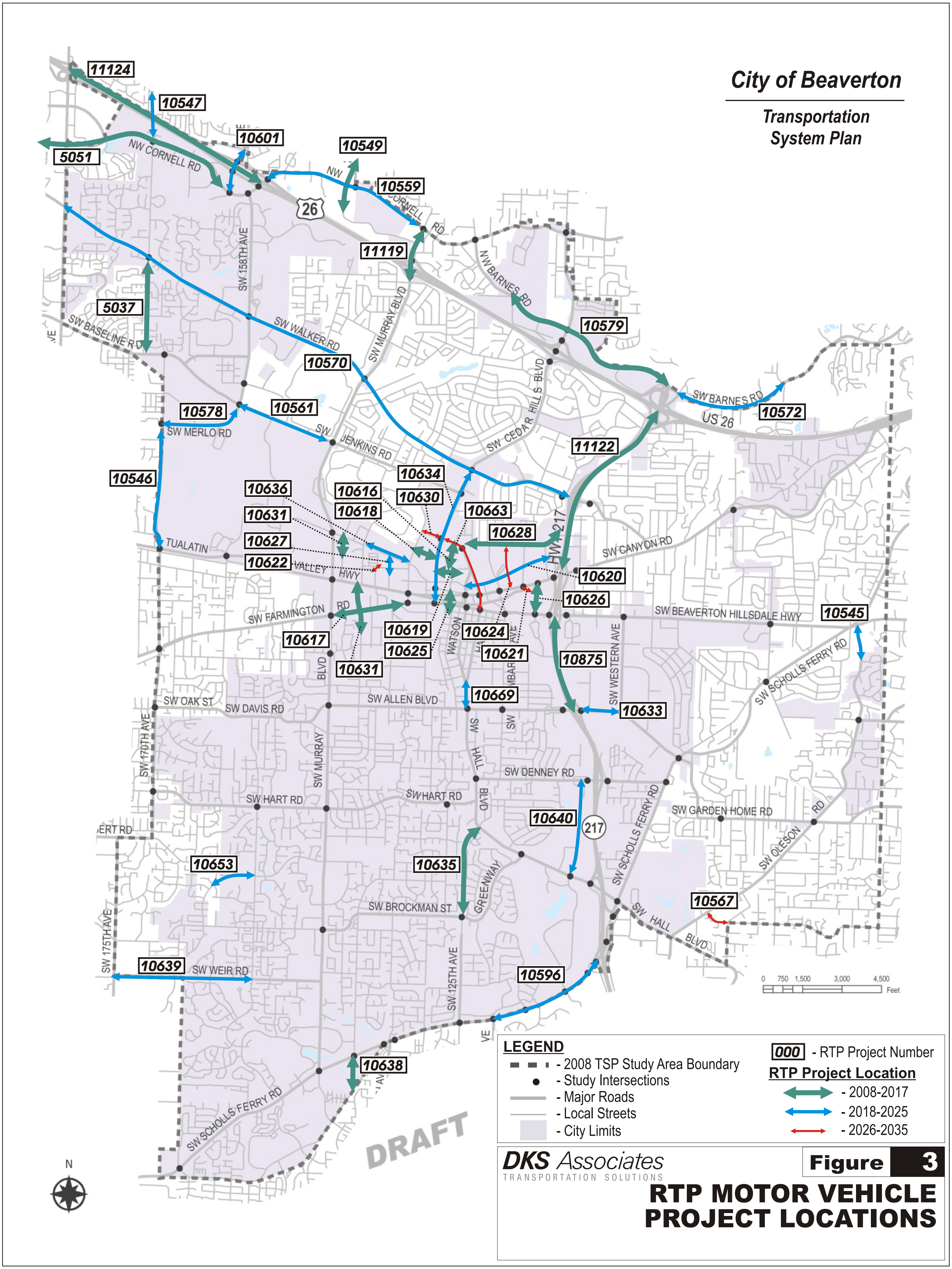


Figure 2: Model Process

The initial roadway network used in the traffic model was the existing streets and roadways. The future 2035 land use scenario was tested using the RTP Financially Constrained System improvements as a starting point. The RTP Financially Constrained improvements (those located in the Beaverton Area are listed in Table 2 and shown in Figure 3) represent projects that are expected to be funded by 2035. Funded projects on the City of Beaverton Capital Improvement Plan (CIP) were also included and listed in Table 2. Forecasts of PM peak period 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 (minor streets or driveways where trips generated at a land use are able to access major streets) in the model process.


City of Beaverton
Transportation System Plan
LEGEND
- 2008 TSP Study Area Boundary
- Study Intersections
- Major Roads
- Local Streets
- City Limits
000 - RTP Project Number
RTP Project Location
- 2008-2017
- 2018-2025
- 2026-2035
DKS Associates
TRANSPORTATION SOLUTIONS
Figure 3
RTP MOTOR VEHICLE PROJECT LOCATIONS
DRAFT
N
0 750 1,500 3,000 4,500 Feet
11124
10547
10601
5051
10549
10559
11119
5037
10570
10579
10572
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10653
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10567
10639
10596
10638
NW CORNELL RD
US 26
SW 158TH AVE
SW BASELINE RD
SW WALKER RD
SW MURRAY BLVD
NW BARNES RD
SW BARNES RD
SW CEDAR HILLS BLVD
SW MERLO RD
SW JENKINS RD
TUALATIN VALLEY HWY
HWY 217
SW CANYON RD
SW FARMINGTON RD
SW BEAVERTON HILLSDALE HWY
SW WESTERN AVE
SW SCHOLLS FERRY RD
SW OAK ST
SW DAVIS RD
SW ALLEN BLVD
SW 170TH AVE
SW HALL BLVD
SW DENNEY RD
SW HART RD
SW GARDEN HOME RD
SW OLESON RD
217
SW BROCKMAN ST
GREENWAY
SW 175TH AVE
SW WEIR RD
SW 125TH AVE
SW HALL BLVD

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Table 2: Beaverton TSP Study Area Motor Vehicle System Improvements included in the RTP Financially Constrained System* or City of Beaverton CIP

RTP #	Location	Improvement	Jurisdiction	Time-Period	Cost ($2007)
10545	Oleson Rd. south of OR10 to Scholls Ferry	Realign Oleson Rd. 500 feet to east and reconfigure Oleson intersections with OR10 and Scholls Ferry Rd.	Wash Co.	2018-2025	$30,888,000
10546	170th Ave: Alexander St. to Merlo Rd.	Widen roadway to 4 lanes with left turn lanes at major intersections and bike lanes and sidewalks.	Wash Co.	2018-2025	$28,093,000
10547	173rd/174th Under Crossing: Cornell Rd. to Bronson Rd.	Construct three-lane under crossing of Hwy. 26 with bike lanes and sidewalks.	Wash Co.	2018-2025	$58,641,000
10549	Cornell @ 143rd : Science Park Dr. to 143rd Ave.	Realign 143rd with Science Park Dr. @ Cornell as a 4-way signalized intersection.	Wash Co.	2008-2017	$12,400,000
10559	Cornell Rd: Murray Blvd. to Hwy. 26	Widen Cornell from three to five lanes with bike lanes and sidewalks.	Wash Co.	2018-2025	$40,620,000
10561	Jenkins Rd: Murray Blvd. to 158th Ave.	Widen roadway from three to five lanes with bike lanes and sidewalks.	Wash Co.	2018-2025	$15,530,000
10567	Taylors Ferry Extension: Oleson Rd. to Washington Dr.	Construct new two lane extension with bike lanes and sidewalks	Wash Co.	2026-2035	$4,390,000
10570	Walker Rd: 185th Ave. to Hwy. 217	Widen from two to five lanes with bike lanes and sidewalks.	Wash Co.	2018-2025	$89,612,000
10572	Barnes Rd: St. Vincent's Hosp. entrance to Leahy Rd.	Widen from two to five lanes with bike lanes and sidewalks.	Wash Co.	2018-2025	$8,933,000
10578	Merlo/158th: 170th Ave. to Walker Rd.	Widen roadway to five lanes with bike lanes and sidewalks	Wash Co.	2018-2025	$24,735,000
10579	Barnes to 119th: Hwy. 217 to 119th (future)	Widen to five lanes with bike lanes and sidewalks	Wash Co.	2008-2017	$30,316,000
10596	Scholls Ferry Rd: Hwy. 217 to 121st Ave.	Widen to seven lanes with bike lanes and sidewalks.	Wash Co.	2018-2025	$19,749,000
10601	Hwy. 26/Bethany Interchange: Cornell Rd. to Bronson Rd.	Rebuild overpass to accommodate additional northbound thru-lane.	Wash Co.	2018-2025	$8,720,000
10616	Rose Biggi Ave: Crescent Street to Hall Blvd.	Extend 2-lane Rose Biggi Ave. to Hall Blvd. (via Westgate Drive) to fill a gap; boulevard design; add sidewalks, bikeway (PE funded STIP Key #14400).	Beaverton	2008-2017	$3,500,000
10617	Farmington Rd: Murray Blvd. to Hocken Ave.	Construct turn lanes and intersection improvements; signalize where warranted; add bike lanes and sidewalks in gaps.	Beaverton	2008-2017	$8,700,000
10618	Dawson/Westgate: Rose Biggi Avenue to Hocken Ave	Extend 2 lane street from Hocken via Dawson and Westgate at Rose Biggi to fill a gap; realign Dawson/Westgate at Cedar Hills; add turn lanes at intersections, sidewalks, bikeway.	Beaverton	2008-2017	$8,900,000
10619	Crescent St: Rose Biggi Ave. to Cedar Hills Blvd.	Extend 2 lane Crescent from Cedar Hills to Rose Biggi Ave. to fill a gap; add sidewalks, bikeway.	Beaverton	2008-2017	$3,500,000
10620	Millikan Way: Watson Ave. to 114th Ave.	Extend 2 lane Millikan Way to 114th to fill a gap; add turn lanes at intersections, sidewalks, bikeway.	Beaverton	2018-2025	$13,800,000
10621	New street connection from Broadway to 115th Ave	Construct new 2 lane street with bikeway and sidewalks.	Beaverton	2026-2035	$4,500,000
10622	Electric to Whitney to Carousel to 144th	Connect existing streets and improve to standard with bikeways and sidewalks.	Beaverton	2026-2035	$7,200,000
10624	120th Ave: Center St. to Canyon Rd.	Construct new multimodal street with bikeways and sidewalks; turn lanes and signals as needed.	Beaverton	2026-2035	$8,900,000
10625	Rose Biggi Ave: Tualatin Valley Hwy to Broadway	Construct 2 lane boulevard extension with bikeways and sidewalks.	Beaverton	2008-2017	$3,000,000
10626	114th Ave/115th Ave: LRT to Beaverton Hillsdale Hwy/Griffith Drive	Construct 2 lane street with bike and pedestrian improvements.	Beaverton	2008-2017	$10,000,000
10627	Tualaway: Electric to Millikan	Extend existing street to Millikan with	Beaverton	2018-	$3,900,000

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RTP #	Location	Improvement	Jurisdiction	Time-Period	Cost ($2007)
		bikeways and sidewalks.		2025	
10628	Center Street and 113th Ave: Hall Blvd. to Cabot Street	Add sidewalks and bikelanes; add turn lanes where needed.	Beaverton	2008-2017	$5,400,000
10630	Hall Blvd: Hocken Ave. to Cedar Hills Blvd.	Extend Hall Blvd. from Cedar Hills to Hocken; add turn lanes at intersections, sidewalks and bikeway.	Beaverton	2026-2035	$5,500,000
10631	141st/142nd/144th: 141st Ave. to 144th Ave.	Connect streets, add bikeways, sidewalks, turns lanes and signalize as warranted.	Beaverton	2008-2017	$6,400,000
10633	Allen Blvd: Highway 217 to Western Ave.	Widen street to 4/5 lanes adding turn lanes and signals where needed, construct bike lanes and sidewalks.	Beaverton	2018-2025	$6,300,000
10634	Cedar Hills Blvd: Farmington Rd. to Walker Rd.	Add turn lanes, bike lanes and sidewalks.	Beaverton	2018-2025	$19,000,000
10635	125th Ave: Brockman St. to Hall Blvd.	Construct new multimodal street with bike lanes and sidewalks.	Beaverton	2008-2017	$13,900,000
10636	Millikan Way: 141st Ave. to Hocken Ave.	Add turn lanes as needed, bike lanes and sidewalks, signalize as warranted.	Beaverton	2018-2025	$2,600,000
10638	Davies Rd: Scholls Ferry Rd. to Barrows Rd.	Extend 2 lane street with turn lanes, bike lanes and sidewalks.	Beaverton	2008-2017	$4,900,000
10639	Weir Rd: 155th Ave. to 175th Ave.	Add turn lanes, bikelanes and sidewalks in gaps, turn lanes.	Beaverton	2018-2025	$4,100,000
10640	Nimbus Ave: Hall Blvd. to Denney Rd.	Extend 2 lane street with turn lanes, bikelanes and sidewalks.	Beaverton	2018-2025	$15,400,000
10642	Allen Blvd., Cedar Hills Blvd., Hall Blvd., Farmington Road	Adaptive Traffic Signal Systems. New signals and signal upgrades.	Beaverton	2009-2017	$10,000,000
10653	Sexton Mountain Dr: 155th Ave. to Sexton Mountain Drive	Extend 2 lane street with bikelanes and sidewalks	Beaverton	2018-2025	$2,500,000
10663	Hall Blvd: Farmington Road to Cedar Hills Blvd.	Construct bike lanes and turn lanes.	Beaverton	2018-2025	$5,200,000
10669	Hall Blvd: 12th St. to s/o Allen Blvd.	Construct bike lanes and turn lanes.	Beaverton	2018-2025	$5,200,000
10875	OR 217: Beaverton-Hillsdale Hwy. to Allen Blvd.	Braid OR 217 ramps between Beaverton-Hillsdale Highway and Allen Boulevard in both directions.	ODOT	2008-2017	$79,600,000
11119	Murray Blvd: Hwy. 26 to Cornell Rd.	Widen to 5 lanes with bike lanes and sidewalks.	Wash Co.	2008-2017	$4,770,000
11122	OR 217: US 26 to OR 8	Widen OR 217 and structures.	ODOT	2008-2017	$37,676,000
11124	US 26W: Cornell Rd to 185th Ave.	Widen US 26 to 6 lanes from Cornell Rd. to 185th Ave.	ODOT	2008-2017	$21,312,000
5037**	170th Ave/173rd Ave: Baseline Rd to Walker Rd	Widen to 3 lanes with bike lanes and sidewalks.	City/Wash. Co.	2007-2010	$8,100,000
5051**	Cornell Rd: Evergreen Pkwy to Bethany Blvd	Widen to 5 lanes with bike lanes and sidewalks.	City/Wash. Co.	2008-2009	$10,000,000
		Subtotal **Subtotal** **Subtotal**	**Beaverton** **Wash. Co** **ODOT**		**$200,400,000** **$377,397,000** **$138,588,000**
		TOTAL			**$716,385,000**

*This project list is based on the February 29th, 2008, 2035 Regional Transportation Plan, and only contains projects in the Financially Constrained Motor Vehicle System

**Funded project included on City of Beaverton Capital Improvements Plan (CIP) list

Trip Generation

The trip generation process translates land use quantities (number of dwelling units, retail, and other employment) into vehicle trip ends (number of vehicles entering or leaving a TAZ or sub-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. For reference, Table 3 provides a summary of the approximate average evening peak hour trip rates derived from Metro's model. These are averaged over a broad area for a mix of land uses and thus, are different than driveway counts represented by specific ITE data. This data provides a reference for the trip generation process used in the model.

Table 3: Approximate Average PM Peak Period (2-hr) Trip Rates

	Average Trip Rate/Unit		
Unit	**In**	**Out**	**Total**
Household (HH)	0.74	0.40	1.14
Retail Employee (RET)	0.87	1.15	2.02
Other Employee (OTH)	0.14	0.38	0.52

Source: DKS/Metro

Table 4 lists the estimated growth in vehicle trips generated[2] within the Beaverton area (the area shown in Figure 1) during the PM peak period (2-hr peak) between 2005 and 2035. It indicates that vehicle trips in Beaverton would grow by approximately 50 percent between 2005 and 2035 if the land develops according to Comprehensive Plan and MetroScope estimates. Using a 30-year horizon to the 2035 scenario, this represents an annualized growth rate of about 1.3 percent per year.

Table 4: Existing and Future Projected Vehicle Trip Generation PM Peak 2-Hour Period

	2005 Trips	**2035 Trips**
Beaverton TSP study area	145,500	214,900

Source: DKS/Metro

Trip Distribution

This forecasting step estimates how many trips travel from one zone in the model to any other zone. 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 zones. In projecting long-range future traffic volumes, it is important to consider potential

[1] *Trip Generation Manual*, 8th Edition, Institute of Transportation Engineers, Washington DC. 2008.

[2] This includes trips to/from all TAZ within the defined study area, but is NOT inclusive of some TAZ outside of the study area that were refined during the disaggregation process. Trips that travel through the study area are included in the model but these growth projections are independent of such trips.

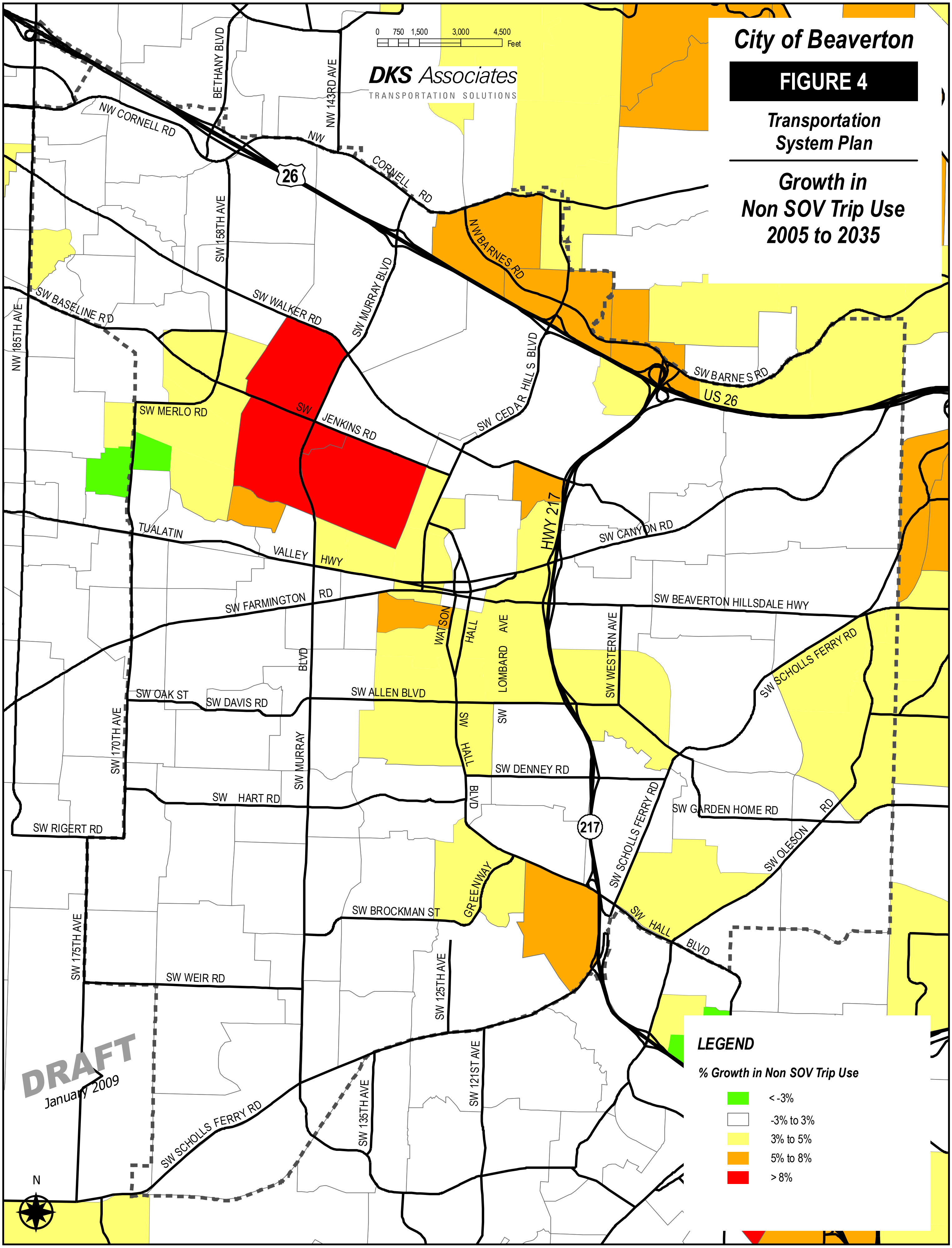
changes in regional travel patterns. Although the locations and amounts of traffic generation in Beaverton are essentially a function of future land use in the city, the distribution of trips is influenced by regional growth, particularly in neighboring areas such as Portland and Hillsboro as well as unincorporated areas to the north, south, and west of Beaverton. External trips (trips that have either an origin and not a destination in Beaverton, or have a destination but not an origin in Beaverton) and through trips (trips that 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) 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, bicycle, etc.). The 2005 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 2035.

Based upon analysis of the forecasted mode choice in 2035, an analysis was performed to determine the level of non-single occupant vehicle (non-SOV) mode share in Beaverton. The travel model provides estimates of the various modes of travel that can be generally assessed at the transportation analysis zone level.

Figure 4 shows the change in non-SOV trip percentages by Metro TAZ between 2005 and horizon year 2035. Generally the areas served by light rail transit and frequent bus service have the highest levels of non-SOV mode use. The forecasted rates indicate that the significant investment in RTP transportation improvements will, in general, achieve a 2.5 percent reduction in SOV trips in the Beaverton area, compared to the existing rates.


City of Beaverton
FIGURE 4
Transportation System Plan
Growth in Non SOV Trip Use 2005 to 2035
DKS Associates
TRANSPORTATION SOLUTIONS
0 750 1,500 3,000 4,500 Feet
LEGEND
% Growth in Non SOV Trip Use
< -3%
-3% to 3%
3% to 5%
5% to 8%
> 8%
DRAFT
January 2009
N
NW CORNELL RD
BETHANY BLVD
NW 143RD AVE
26
US 26
SW 158TH AVE
SW MURRAY BLVD
NW BARNES RD
SW BARNES RD
SW BASELINE RD
NW 185TH AVE
SW WALKER RD
SW CEDAR HILLS BLVD
SW MERLO RD
SW JENKINS RD
TUALATIN VALLEY HWY
HWY 217
217
SW CANYON RD
SW FARMINGTON RD
SW BEAVERTON HILLSDALE HWY
WATSON
HALL
LOMBARD AVE
SW WESTERN AVE
SW SCHOLLS FERRY RD
SW OAK ST
SW DAVIS RD
SW ALLEN BLVD
SW 170TH AVE
SW MURRAY
SW HALL BLVD
SW DENNEY RD
SW HART RD
SW GARDEN HOME RD
SW OLESON RD
SW RIGERT RD
GREENWAY
SW BROCKMAN ST
SW 175TH AVE
SW WEIR RD
SW 125TH AVE
SW 121ST AVE
SW 135TH AVE

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 (and major intersections), such as capacity, speed and facility type. This allows the model to reflect conditions somewhat similar to driver behavior.

Model Verification

The base 2005 modeled traffic volumes were compared against actual traffic volume counts at study intersections and along freeways based on automatic traffic recorder (ATR) data. The model data and corresponding existing counts were compared to evaluate the model accuracy[3]. Overall, volumes throughout the 2005 model network were similar to actual 2008 traffic counts, with the majority of roadways meeting tolerances for forecast adequacy. Based on this performance, the model was used for future forecasting and assessment of circulation change.

Model Application to Beaverton

Traffic volumes were extracted from the model at key intersections for both the base year 2005 and forecast year 2035 scenarios. A post processing technique following NCHRP 255 methodology[4] was used to refine model travel forecasts to the volume forecasts used for 2035 intersection analysis. These intersection turn movements were not used directly, but a portion of the growth increment of the year 2035 turn movements over the 2005 turn movements was applied (added) to existing (actual 2008) turn movement counts in Beaverton. This methodology 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. The turn movement volumes used for future year intersection analysis can be found in the technical appendix for the TSP.

[3] A regression analysis was performed to determine the ability of the base model to predict existing turn movement counts. The slope of the fitted curve (1.047) indicated that the base model projections were only about 5% higher than the actual counts. While the 2005 travel model volumes were generally higher than the actual 2008 intersection counts, most arterial traffic volumes meet screenline tolerances for forecast adequacy. Furthermore, the R^2 value of 0.88 indicates that the model turn volumes are generally consistent with the target existing counts. The raw Metro travel demand model (without local refinements such as additional street network detail and TAZ disaggregation) provides an R^2 of 0.84, with model volumes approximately 7% higher than the existing target counts, demonstrating an improvement to the model accuracy due to the refinements.

[4] *Highway Traffic Data for Urbanized Area Project Planning and Design – National Cooperative Highway Research Program Report 255*, Transportation Research Board, Washington DC. 1982.

FORECASTED FUTURE CORRIDOR CAPACITY DEFICIENCIES

The base case analysis for the forecasted 2035 growth was based on the RTP Financially Constrained Funding scenario. This scenario only includes transportation system improvements that are expected to be constructed/implemented with the current funding levels. Figure 5 shows the forecasted demand/capacity on roadways with the Beaverton 2035 TSP Study Area for this scenario. As shown in the figure, the transportation system does not have adequate roadway capacity to serve the expected future travel needs with this scenario, and Demand/Capacity (D/C) ratios exceed 1.0 system wide. Table 5 lists the forecasted D/C ratios on major roadways in the TSP study area that would exceed standards. To meet performance standards and serve future growth, the future transportation system needs significant multi-modal improvements and strategies to manage the forecasted travel demand.

Table 5: Forecasted 2035 PM Peak 2-Hour D/C Ratios (Financially Constrained Scenario)

Roadway Section	D/C Ratio
92nd Avenue/Garden Home Road from Scholls Ferry Road to 87th Avenue	2.00
153rd Avenue from Jenkins Road to Millikan Way	1.45
170th Avenue from Timberland Drive to Farmington Road	1.50
170th Avenue from Florence Street to Merlo Road	1.05
173rd Avenue from Lisa Street to Park View Boulevard	1.25
175th Avenue from Scholls Ferry Road to Rigert Road	1.35
185th Avenue from Baseline Road to Walker Road	1.20
Barnes Road from Cedar Hills Boulevard to Leahy Road	1.10
Barnes Road from Leahy Road to Burnside Road	1.95
Cornell Road from Amberglen Parkway to Bethany Boulevard	1.30
Cornell Road from Murray Road to 107th Avenue	1.15
Garden Home Road from 87th Avenue to Multnomah Boulevard	1.15
Hall Boulevard from Pamelad Road to Greenway Boulevard	1.10
Hart Road from Murray Boulevard to Hall Boulevard	1.05
Jenkins Road from Karl Braun Drive to158th Avenue	1.10
Murray Boulevard from Brockman/Beard Road to Davis Road	1.15
Murray Boulevard from 6th Street to Jekins Road	1.10
Oleson Road from Hall Boulevard to Garden Home Road	1.45
Oleson Road from Garden Home Road to Scholls Ferry Road	1.20
OR 217 from Scholls Ferry Road to Walker Road	1.10
Scholls Ferry Road from Roy Rogers Road to Teal Boulevard	1.35
Scholls Ferry Road from Barrows Road to Nimbus Avenue	1.20
Scholls Ferry Road from Crystal Street to Laurelwood Avenue	1.30
Scholls Ferry Road from Oleson Road to US 26	1.50
Walker Road from Amberglen Parkway to 167th Avenue	1.25
Walker Road from Murray Boulevard to 158th Avenue	1.30

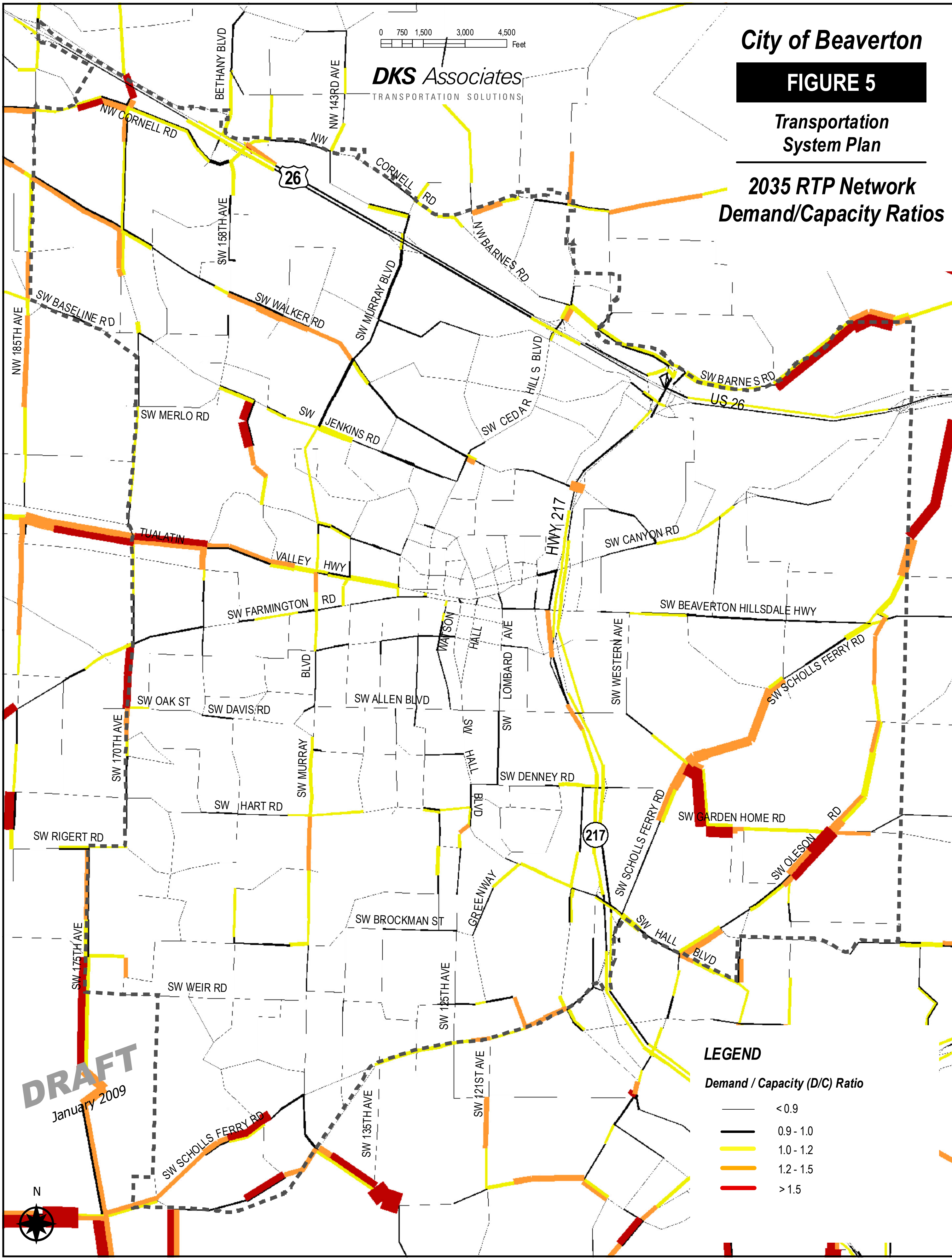
Source: DKS Associates

City of Beaverton

FIGURE 5

Transportation System Plan

2035 RTP Network Demand/Capacity Ratios



MOTOR VEHICLE NEEDS

The following sections summarize the methodology and analysis used to identify the Beaverton 2035 motor vehicle capacity needs.

Approach

Existing conditions of the motor vehicle system were identified in Beaverton TSP Chapter 3. This section summarizes the projected motor vehicle conditions and needs for year 2035. The future analysis assumes a street network that includes the Metro RTP Financially Constrained System improvements. Table 2 lists the Metro RTP Financially Constrained System motor vehicle projects within the Beaverton TSP Study area. Based on this future roadway network and the forecasting year 2035 demand, corridor travel times and intersection capacity analysis was performed in a consistent manner included in the existing conditions. For the purposes of this base analysis, signal timing for coordinated systems was assumed to remain unchanged, while cycle lengths were generally increased for locations running “free” (actuated isolated) timing plans in order to serve capacity.

Corridor Travel Times

Future 2035 PM peak hour travel times were projected along several key corridors. While current travel times were collected for these locations through travel time surveys, traffic simulation models calibrated to the base year were used to project future travel times for each location.

Intersection Operations

Projected 2035 PM peak hour intersection turn movement volumes were analyzed using the *2000 Highway Capacity Manual*[5] methodology for signalized and unsignalized intersections. The following sections describe projected 2035 conditions along several key corridors in Beaverton.

Overall intersection level of service, average intersection delay (seconds), overall v/c, and highest v/c for all lane groups are provided for each study intersection. Intersections within the corridors selected for travel time analysis were further analyzed using microscopic simulation, which allowed for additional detail due to congestion and the impacts of adjacent traffic signals. The resulting average intersection simulation delay for these locations is also listed in the following tables. Locations that do not meet applicable jurisdiction performance standards are shaded.

Queuing

Queuing analyses were performed along the major arterial study corridors by estimating the 95th percentile queue for each major movement at study intersections. This 95th percentile queue length estimates the distance that will not be exceeded in 95th percent of the traffic signal cycles during the peak hour. The 95th percentile queues that exceed the available storage are reported as “Yes” and shaded in queuing tables for each corridor that was analyze. Locations with queues that currently do not exceed storage (but would in 2035) appear in **bold** text. Various corridor locations where 95th percentile traffic queues do not currently exceed available storage are expected to exceed storage by 2035.

[5] 2000 Highway Capacity Manual, Transportation Research Board, Washington DC, 2000.

Corridor Analysis

Several arterial corridors in Beaverton were selected for detailed operational analysis that included simulated intersection delay, travel time projections, and segment queue analysis. The following sections summarize the future 2035 PM peak hour operations for each corridor. Tables are provided in each of the following sections that list operational performance, while figures are also provided that summarize the performance for the entire study area. Figure 6 shows intersection locations that are expected to exceed performance standards in 2035, even with the assumed RTP projects built, as well as facilities that would be over capacity (locations identified in Table 5), while Figure 7 summarizes intersection operations along each corridor.

Murray Boulevard

Average 2035 PM peak hour speeds along Murray Boulevard are expected to reach LOS F conditions and drop below ten miles per hour in both directions between Millikan Way and 6th Street. Speeds would be similar in the northbound direction between Scholls Ferry and Beard/ Brockman, while those in the northbound direction remain around twenty miles per hour (LOS D). Nearly all intersections along the corridor (with the exception of the signalized intersection at 6th Street) are expected to have traffic demand that exceeds available capacity. Tables 6 through 8 summarize the projected 2035 PM Peak hour operations along Murray Boulevard.

Table 6: 2035 PM Peak Period Travel Time Projections – Murray Boulevard

			2008		2035	
Route	**Direction**	**Distance (miles)**	**Time (minutes)**	**Average Speed (mph)**	**Time (minutes)**	**Average Speed (mph)**
Murray Boulevard (from Millikan to 6th)	Southbound Northbound	0.93	6.2 3.1	9 18	9.9 6.0	6 9
Murray Boulevard (from Beard to Scholls Ferry)	Southbound Northbound	1.03	3.1 5.7	20 11	3.3 5.7	19 11
Arterial level of service for a class II arterial*					**D** **E** **F**	**17 - 22** **13 – 17** **<=13**

*Class II indicates an arterial that has free flow speeds in the 35-45 mph range

Table 7: 2035 PM Peak Hour Intersection Level of Service – Murray Boulevard

Intersection	Level of Service	Average Delay	Simulation Delay	Volume / Capacity*	Jurisdictional Standard**
Murray/Cornell	F	145	-	1.32/1.32 (NBL, SBT, SBR, EBT, WBL)	0.99
Murray/US 26 west ramps	E	70.3	-	1.12/1.12 (NBL, SBR, WBR)	0.85
Murray/US 26 east ramps	E	65.2	-	1.11/1.11(NBT, NBR, SBL, EBR)	0.85

Intersection	Level of Service	Average Delay	Simulation Delay	Volume / Capacity*	Jurisdictional Standard**
Murray/Walker	F	130	-	1.23/1.23 (NBT, NBR, SBL, EBT, EBR, WBL)	0.99
Murray/Jenkins	F	165	-	1.35/1.35 (NBL, SBT, SBR, EBT, WBL)	0.99
Murray/Millikan	E	62.1	-	1.05/1.05 (NBL, SBR, EBL, WBT, WBR)	0.99
Murray/6th	C	26.1	-	0.88	0.99
Murray/Allen	E	56.5	-	1.02/1.02 (NBL, SBT, SBR, EBT, EBR, WBL)	0.99
Murray/Hart	E	69.4	-	1.10/1.10 (NBL, SBT, EBL, WBT)	0.99
Murray/Brockman/Beard	E	78.3	550	1.06/1.15 (WBT)	0.99

*Volume to capacity reported as (average intersection V/C/ worst movement V/C)
**Operational performance standards for each intersection based on jurisdictional ownership.
***Unsignalized Intersection
WBT=Westbound through movement

Table 8: 2035 PM Peak Hour Queuing along Murray Blvd

Intersection	Northbound	Southbound
	Queues Spilling Into Upstream Signalized Intersection (95th Percentile)	
Murray/Millikan	NO	NO
Murray/TV Highway/Canyon	**YES**	**YES**
Murray/BH Highway/Farmington	**YES**	**YES**
Murray/6th	**YES**	NO
Murray/Brockman/Beard	NO	**YES**
Murray/Scholls Ferry	**YES**	NO

Scholls Ferry Road

Average 2035 PM peak hour speeds are expected to reach LOS F conditions and reach approximately five miles per hour in both directions along the western portion of Scholls Ferry Road between Murray Boulevard and 125th Avenue due to increased congestion. However, speeds would remain relatively constant with existing conditions along the eastern portion of the corridor between 125th Avenue and Hall Boulevard due to widening the arterial to seven lanes between 121st Avenue and the Highway 217 Ramps. The volumes at most intersections along the corridor would exceed capacity, with a only a few exceptions, including the western portion of the widened section. While traffic queues along the western portion of Scholls Ferry Road would exceed available storage, the eastern Scholls Ferry Road corridor (Hwy 217 to 121st Ave) would generally have adequate queue storage, in part, due to widening the facility to a 7-lane section. Tables 9 through 11 summarize the projected 2035 PM Peak hour traffic operations along Scholls Ferry Road.

Table 9: 2035 PM Peak Period Travel Time Projections – Scholls Ferry Road

			2008		2035	
Route	**Direction**	**Distance (miles)**	**Time (minutes)**	**Average Speed (mph)**	**Time (minutes)**	**Average Speed (mph)**
Scholls Ferry Road	Westbound	1.09	3.9	17	9.2	7
(from Murray to 125th)	Eastbound		3.4	19	12.4	5
Scholls Ferry Road	Westbound	1.97	7.6	16	6.8	17
(from 125th to Hall)	Eastbound		5.9	20	5.9	20
Arterial level of service for a class II arterial*					**D**	**17 - 22**
					E	**13 – 17**
					F	**<=13**

*Class II indicates an arterial that has free flow speeds in the 35-45 mph range

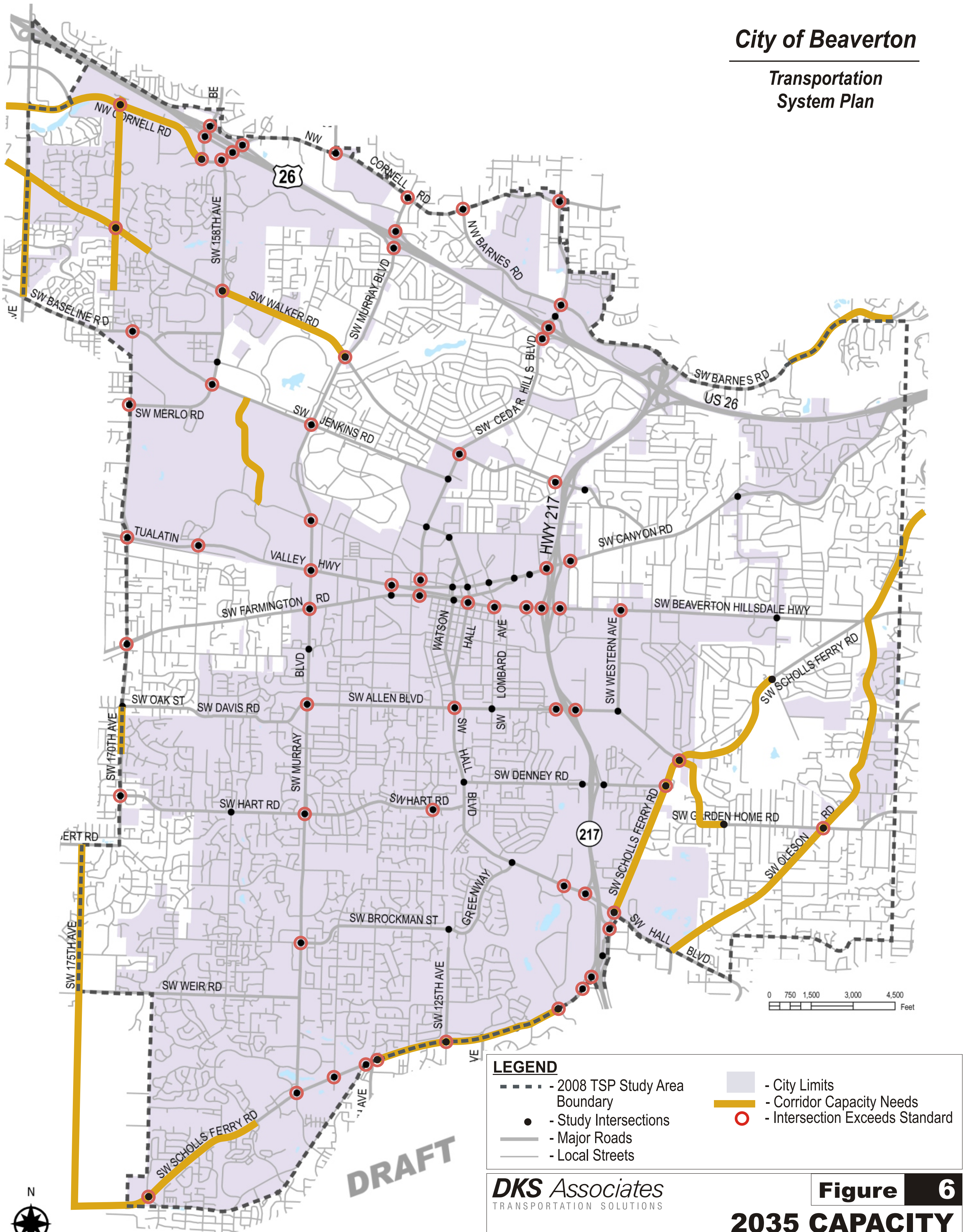
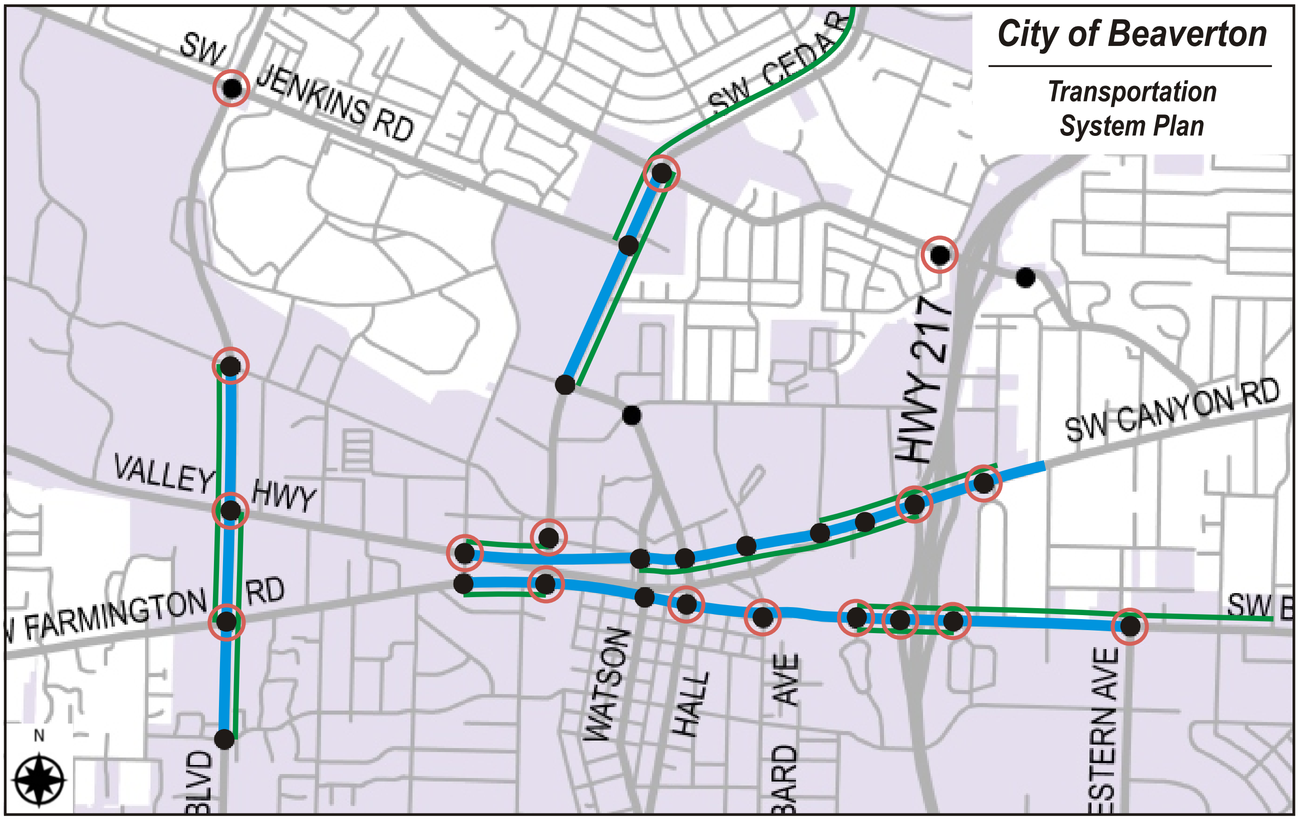
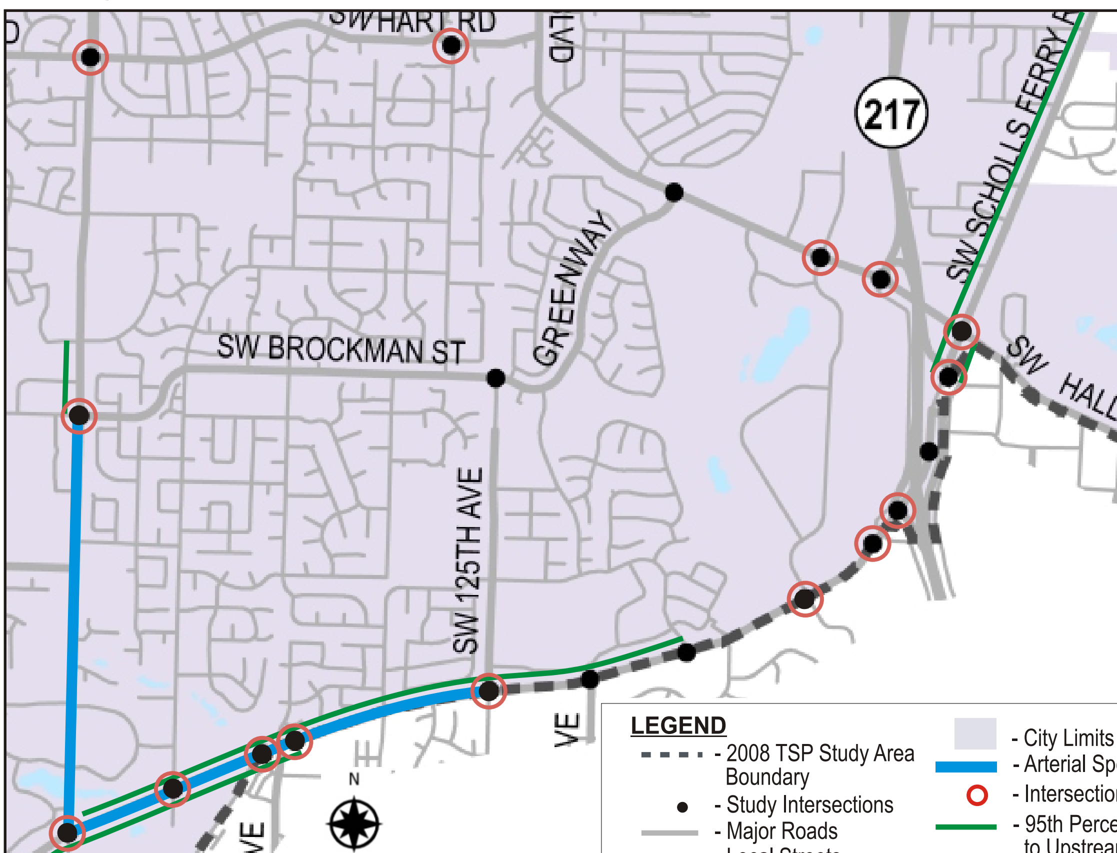


Figure 6
2035 CAPACITY DEFICIENCY LOCATIONS

Downtown



Scholls Ferry Rd



LEGEND

- 2008 TSP Study Area Boundary
- Study Intersections
- Major Roads
- Local Streets
- City Limits
- Arterial Speed LOS F
- Intersection Exceeds Standard
- 95th Percentile Queue Extends to Upstream Intersection

DKS Associates
TRANSPORTATION SOLUTIONS

Figure 7

2035 CORRIDOR OPERATIONS

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Table 10: 2035 PM Peak Hour Intersection Level of Service - Scholls Ferry Road

Intersection	Level of Service	Average Delay (sec)	Simulation Delay (sec)	Volume / Capacity*	Jurisdictional Standard**
Scholls Ferry/Laurelwood	C	28.4	-	0.90	0.99
Scholls Ferry/Allen	F	150	-	1.26/1.26 (NBL, SBT, EBT, WBL)	0.99
Scholls Ferry/Denney	F	89.2	-	1.23/1.23 (NBL, SBT, EBL, EBR)	0.99
Scholls Ferry/Hall	F	120	835	1.12/1.28 (SBL)	1.1
Scholls Ferry/Hwy 217 northbound on ramp	E	75.5	89.1	1.0/1.26 (SBT)	0.85
Scholls Ferry/Hwy 217 northbound off ramp	B	12.8	15.3	0.74/0.76	0.85
Scholls Ferry/Hwy 217 southbound ramp	C	22.8	43.2	0.75/0.91 (SBR)	0.85
Scholls Ferry/Cascade	D	37.5	190	0.94/1.62 (NBL)	0.99
Scholls Ferry/Nimbus	F	260	930	1.38/3.65 (NBT)	0.99
Scholls Ferry/Conestoga	C	22.1	33.8	0.73/0.80	0.99
Scholls Ferry/121st	C	32.8	130	0.81/0.94	0.99
Scholls Ferry/125th	F	105	375	1.21/1.64 (SBT)	0.99
Scholls Ferry/135th	F	90.5	72.2	0.98/1.28 (EBT)	0.99
Scholls Ferry/Barrows	D	45.7	110	0.93/1.24 (WBL)	0.99
Scholls Ferry/Davies	C	29.4	212.3	0.81/1.20 (NBL)	0.99
Scholls Ferry/Murray	F	140	690	1.17/1.55 (WBT)	0.99
Scholls Ferry/Barrows(west end)	E	69.0	-	1.08/1.08 (NBL, SBT, SBR, EBL, WBT, WBR)	0.99

*Volume to capacity reported as (average intersection V/C/ worst movement V/C)

**Operational performance standards for each intersection based on jurisdictional ownership. See text for details of standards by agency.

*** Unsignalized Intersection

****Movements exceeding operational standards

SBR= Southbound right movement

WBT = Westbound through movement

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Table 11: 2035 PM Peak Hour Queuing along Scholls Ferry Road

Intersection	Eastbound	Westbound
	Queues Spilling Into Upstream Signalized Intersection (95th Percentile)	
Murray/Scholls Ferry	**YES**	**YES**
Scholls Ferry/Davies	**YES**	**YES**
Scholls Ferry/Barrows	**YES**	**YES**
Scholls Ferry/135th	**YES**	**YES**
Scholls Ferry/125th	NO	**YES**
Scholls Ferry/121st	NO	**YES**
Scholls Ferry/Conestoga	NO	NO
Scholls Ferry/Nimbus	NO	NO
Scholls Ferry/Cascade	NO	**YES**
Scholls Ferry/Hwy 217 southbound ramp	**YES**	NO
Scholls Ferry/Hwy 217 northbound off ramp	NO	NO
Scholls Ferry/Hwy 217 northbound on ramp	NO	**YES**
Scholls Ferry/Hall	**YES**	**YES**

Tualatin Valley Highway/ Canyon Road

Average travel speeds during 2035 PM peak hour along Canyon Road are expected to drop substantially and reach LOS F conditions (below five miles per hour) in both directions through the Beaverton Regional Center corridor. While existing demand on Canyon Road is managed through coordinated signal timing, the increased demand on the facility and cross streets would exceed capacity limitations. Traffic flow in the eastbound direction is expected to be impeded due to vehicle queues that continue through upstream intersections. Traffic simulation indicates that delays would be especially large at the Highway 217 southbound ramp and Hocken Avenue. Tables 12 through 14 summarize the projected 2035 PM Peak hour traffic operations along Canyon Road/TV Highway.

Table 12: 2035 PM Peak Period Travel Time Projections – TV Highway/Canyon Road

			2008		2035	
Route	**Direction**	**Distance (miles)**	**Time (minutes)**	**Average Speed (mph)**	**Time (minutes)**	**Average Speed (mph)**
Canyon Road /TV Hwy	Westbound	1.47	5.3	17	22.3	4
(from Hocken to 107th)	Eastbound		5.7	15	23.4	4
Arterial level of service for a class II arterial*					**D** **E** **F**	**17 - 22** **13 – 17** **<=13**

*Class II indicates an arterial that has free flow speeds in the 35-45 mph range

Table 13: 2035 PM Peak Hour Intersection Level of Service - TV Highway/Canyon Road

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Intersection	Level of Service	Average Delay (s)	Simulation Delay (s)	Volume / Capacity*	Jurisdictional Standard**
Canyon Rd /87th	B	13.6	-	0.78	0.99
Canyon Rd /Hwy 217 northbound ramp	C	31.2	185	0.90/0.94 (WBT)	0.85
Canyon Rd /Hwy 217 southbound ramp	D	46.9	575	0.99/1.14 (SBT)	0.85
Canyon Rd /114th ***	NA/C	23.9	47.7	0.77	45 seconds
Canyon Rd /117th /Broadway	C	33.3	345	0.89	1.1
Canyon Rd /Lombard	B	11.1	85.3	0.71	1.1
Canyon Rd /Hall	C	21.8	44.1	0.81	1.1
Canyon Rd /Watson	C	32.8	255	0.83/1.02 (SBT)	1.1
Canyon Rd /Cedar Hills	D	49.6	165	0.97/1.23 (NBT)	1.1
Tualatin Valley Hwy/Canyon Rd /Hocken	D	49.7	550	0.98/1.08 (WBL)	0.99
Tualatin Valley Hwy/Murray	E	79.2	-	1.04/1.04 (NBL, SBT, EBL, EBT, EBR, WBL, WBT, WBR)	0.99
Tualatin Valley Hwy/160th	E	79.4	-	1.13/1.13 (NBL, SBT, EBL, WBT)	0.99
Tualatin Valley Hwy/170th	F	145	-	1.24/1.24 (NBL, SBT, SBR, EBL, WBT)	0.99

*Volume to capacity reported as (average intersection V/C/ worst movement V/C)
**Operational performance standards for each intersection based on jurisdictional ownership. See text for details of standards by agency.
***Unsignalized Intersection
****Movements exceeding operational standards
NB=Northbound movement

Table 14: 2035 PM Peak Hour Queuing along Tualatin Valley Hwy/Canyon Road

Intersection	Eastbound	Westbound
	Queues Spilling Into Upstream Signalized Intersection (95th Percentile)	
Canyon Rd /Hwy 217 northbound ramp	NO	**YES**
Canyon Rd /Hwy 217 southbound ramp	**YES**	**YES**
Canyon Rd/117th /Broadway	**YES**	**YES**
Canyon Rd /Lombard	**YES**	NO
Canyon Rd /Hall	**YES**	NO
Canyon Rd /Watson	**YES**	NO

Intersection	Eastbound	Westbound
	Queues Spilling Into Upstream Signalized Intersection (95th Percentile)	
Canyon Rd /Cedar Hills	NO	NO
Tualatin Valley Hwy/Canyon Rd /Hocken	NO	**YES**

Beaverton Hillsdale Highway/ Farmington Road

While average 2035 PM peak hour speeds along Farmington Road are expected to be half of existing levels and reach LOS F conditions, the drop is not expected to be as severe as along Canyon Road. Traffic queues would exceed available storage and spill into adjacent intersections in the vicinity of the Highway 217 ramps in each direction, which would lead to increased vehicle delay. Tables 15 through 17 summarize the projected 2035 PM Peak hour traffic operations along BH Highway/Farmington Road.

Table 15: 2035 PM Peak Period Travel Time Projections – BH Highway/Farmington Road

			2008		2035	
Route	**Direction**	**Distance (miles)**	**Time (minutes)**	**Average Speed (mph)**	**Time (minutes)**	**Average Speed (mph)**
Beaverton Hillsdale Hwy /Farmington Road	Westbound	1.63	5.6	17	11.7	8
(from Hocken to Western)	Eastbound		6.6	15	13.6	7
Arterial level of service for a class II arterial*					**D** **E** **F**	**17 - 22** **13 – 17** **<=13**

*Class II indicates an arterial that has free flow speeds in the 35-45 mph range

Table 16: 2035 PM Peak Hour Intersection Level of Service - Farmington Road/Beaverton-Hillsdale Highway

Intersection	Level of Service	Average Delay	Simulation Delay	Volume / Capacity*	Jurisdictional Standard**
Beaverton Hillsdale Hwy/ Laurelwood	C	22.1	-	0.83	0.99
Beaverton Hillsdale Hwy/ Western	D	54.8	385	1.09/1.13 (WBL)	0.99
Beaverton Hillsdale Hwy/ Hwy 217 northbound ramp	C	25.4	235	.86/.89 (EBL)	0.85
Beaverton Hillsdale Hwy/ Hwy 217 southbound ramp	E	74.0	205	.99/1.43 (SBT)	0.85
Beaverton Hillsdale Hwy/ Griffith	D	41.0	290	.86/1.28 (WBL)	0.98
Beaverton Hillsdale Hwy/ Farmington Rd /Lombard	E	55.1	160	.98/1.07 (WBT)	0.98
Farmington Rd /Hall	D	45.3	245	.83/1.13	0.98

Intersection	Level of Service	Average Delay	Simulation Delay	Volume / Capacity*	Jurisdictional Standard**
				(NBT)	
Farmington Rd /Watson	B	19.0	31.7	.80/.89	0.98
Farmington Rd /Cedar Hills	C	27.0	100	.74/1.04 (SBL)	0.98
Farmington Rd /Hocken	B	16.1	44.1	.68/.97	0.98
Farmington Rd/ Murray	F	110	-	1.15/1.15 (NBL, SBT, SBR, EBL, EBT, EBR, WBL, WBT, WBR)	0.98
Farmington Rd/170th	E	68.6	-	1.04/1.04 (SBT, SBR, EBL, WBT)	0.99

*Volume to capacity reported as (average intersection V/C/ worst movement V/C)
**Operational performance standards for each intersection based on jurisdictional ownership. See text for details of standards by agency.

Table 17: 2035 PM Peak Hour Queuing along Beaverton Hillsdale Hwy/Farmington Road

Intersection	Eastbound	Westbound
	Queues Spilling Into Upstream Signalized Intersection (95th Percentile)	
Beaverton Hillsdale Hwy/ Western	NO	**YES**
Beaverton Hillsdale Hwy/ Hwy 217 N ramp	**YES**	**YES**
Beaverton Hillsdale Hwy/ Hwy 217 S ramp	**YES**	**YES**
Beaverton Hillsdale Hwy/ Griffith	NO	**YES**
Beaverton Hillsdale Hwy/Farmington Rd /Lombard	NO	NO
Farmington Rd /Hall	NO	NO
Farmington Rd /Watson	NO	NO
Farmington Rd /Cedar Hills	**YES**	NO
Farmington Rd /Hocken	NO	NO

Cedar Hills Boulevard

Average 2035 PM peak hour speeds along Cedar Hills Boulevard are expected to continue to degrade, particularly in the northbound direction between Hall Boulevard and Walker Road. Intersection demand would exceed capacity along the corridor, with traffic queues in the vicinity of Jenkins Road and Walker Road extending into adjacent intersections. North of Highway 26, both Cedar Hills/Cornell Road and Cedar Hills/Barnes Road intersections are expected to require additional capacity to serve traffic demand. Tables 18 through 20 summarize the projected 2035 PM Peak hour traffic operations along Cedar Hills Boulevard.

Table 18: 2035 PM Peak Period Travel Time Projections – Cedar Hills Boulevard

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			2008		2035	
Route	**Direction**	**Distance (miles)**	**Time (minutes)**	**Average Speed (mph)**	**Time (minutes)**	**Average Speed (mph)**
Cedar Hill	Southbound	0.63	3.7	10	6.2	6
(from Walker to Hall)	Northbound		2.4	16	13.9	3
Arterial level of service for a class II arterial*					**D**	**17 - 22**
					E	**13 – 17**
					F	**<=13**

*Class II indicates an arterial that has free flow speeds in the 35-45 mph range

Table 19: 2035 PM Peak Hour Intersection Level of Service – Cedar Hills Boulevard

Intersection	Level of Service	Average Delay	Simulation Delay	Volume / Capacity*	Jurisdictional Standard**
Cedar Hills Blvd/Cornell Rd	F	98.5	-	1.25/1.25 (NBL, SBT, SBR, EBT, WBL)	0.99
Cedar Hills Blvd/Barnes	F	155	-	1.45/1.45 (NBL, SBT, SBR, EBR, WBL)	0.99
Cedar Hills Blvd/US 26 westbound ramps	C	23.7	-	0.94	0.99
Cedar Hills Blvd/US 26 eastbound ramps***	F	502	-	-	0.99
Cedar Hills Blvd/Butner	F	130	-	1.26/1.26 (NBL, SBT, SBR, EBL, EBT, EBR)	0.99
Cedar Hills Blvd/Walker	F	190	760	1.31/1.39 (NBL)	0.98
Cedar Hills Blvd/Jenkins	D	46.5	240	0.85	0.98
Cedar Hills Blvd/Hall	D	38.3	73.1	0.86	0.98

*Volume to capacity reported as (average intersection V/C/ worst movement V/C)
**Operational performance standards for each intersection based on jurisdictional ownership. See text for details of standards by agency.
***Unsignalized Intersection
****Movements exceeding operational standards

Table 20: 2035 PM Peak Hour Queuing along Cedar Hills Blvd

Intersection	Northbound	Southbound
	Queues Spilling Into Upstream Signalized Intersection (95th Percentile)	
Cedar Hills Blvd/Hall	NO	NO
Cedar Hills Blvd/Walker	**YES**	**YES**
Cedar Hills Blvd/Jenkins	**YES**	**YES**

Allen Boulevard

Existing travel times were not collected along Allen Boulevard, however the corridor was analyzed using the traffic simulation model to determine future delay and vehicle queuing levels. The simulations indicate that high delay and traffic queues will be prevalent along the corridor, particularly around the Highway 217 Ramps. Tables 21 and 22 summarize the projected 2035 PM Peak hour traffic operations along Allen Boulevard.

Table 21: 2035 PM Peak Hour Intersection Level of Service - Additional Locations

Intersection	Level of Service	Average Delay	Simulation Delay	Volume / Capacity*	Jurisdictional Standard**
Allen Blvd/Western	C	33.4	-	0.93	0.98
Allen Blvd/Hwy 217 northbound ramp	D	48.6	475	1.04, 1.07 (EBL)	0.85
Allen Blvd/Hwy 217 southbound ramp	D	36.8	245	0.95, 1.03 (SBT)	0.85
Allen Blvd/Lombard	D	35.4	120	0.87	0.98
Allen Blvd/Hall	F	83.0	320	1.12/1.19 (SBT)	0.98

*Volume to capacity reported as (average intersection V/C/ worst movement V/C)
**Operational performance standards for each intersection based on jurisdictional ownership. See text for details of standards by agency.
***Unsignalized Intersection
****Movements exceeding operational standards
EBLT=Eastbound left movement
SBT=Southbound through movement

Table 22: 2035 PM Peak Hour Queuing along Allen Blvd

Intersection	Eastbound	Westbound
	Queues Spilling Into Upstream Signalized Intersection (95th Percentile)	
Allen Blvd/Hwy 217 northbound ramp	**YES**	**YES**
Allen Blvd/Hwy 217 southbound ramp	**YES**	**YES**
Allen Blvd/Lombard	NO	NO
Allen Blvd/Hall	**YES**	**YES**

Operational Analysis of Additional Locations

Table 23 summarize the projected 2035 PM Peak hour traffic operations for additional study area intersections. Many locations reach LOS E or F and indicate that demand would exceed available capacity, particularly at intersections along Cornell Road and 170th Avenue.

Table 23: 2035 PM Peak Hour Intersection Level of Service - Additional Locations

Intersection	Level of Service	Average Delay	Simulation Delay	Volume / Capacity*	Jurisdictional Standard**
158th/Jay	C	29.4	-	0.91	0.99
158th/Walker	F	135	-	1.18/1.18	0.99

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Intersection	Level of Service	Average Delay	Simulation Delay	Volume / Capacity*	Jurisdictional Standard**
				(NBT, NBR, SBL, EBT, WBL)	
158th/Jenkins	F	155	-	1.36/1.36 (NBT, NBR, SBL, EBL, WBT, WBR)	0.99
170th/Baseline	F	150	-	1.48/1.48 (NBL, EBT, EBR, WBL)	0.99
170th/Merlo	F	275	-	1.35/1.59 (NBT, NBR, SBT, SBR,EBT, EBR, WBT)	0.99
170th/Oak	C	33.6	-	0.96	0.99
170th/Hart/Bany	D	37.2	-	1.00/1.00 (NBT, EBT, EBR)	0.99
Bethany/US 26 westbound ramp	F	180	-	1.49/1.49 (NBT, WBR)	0.85
Bethany/US 26 eastbound ramp	F	220	-	1.47/1.47 (NBT, NBR, SBL, EBL, EBT)	0.85
Cornell/Barnes/Saltzman	E	76.7	-	1.05/1.05 (NBL, SBT, EBL, WBT)	0.99
Cornell/143rd	F	155	-	1.34/1.34 (NBL, SBT, SBR, EBL, WBT)	0.99
Cornell/US 26 westbound ramp	E	71.3	-	1.07/1.07 (NBL, SBR, WBL)	0.85
Cornell/US 26 eastbound ramp	C	30.9	-	0.96/0.96 (NBT, SBL, EBL, EBT, EBR)	0.85
Cornell/158th	F	165	-	1.38/1.38 (NBR, EBT, EBR, WBL)	0.99
Cornell/Bethany	E	61.0	-	1.05/1.06 (NBT, NBR, EBL, WBT)	0.99

Intersection	Level of Service	Average Delay	Simulation Delay	Volume / Capacity*	Jurisdictional Standard**
Cornell/173rd	F	335	-	1.67/1.67 (NBL, SBT, SBR, EBT, WBL)	0.99
Denney/Hwy 217 north ramp	B	16.7	-	0.69	0.85
Denney/Hwy 217 south ramp	B	16.8	-	0.59	0.85
Garden Home/88th **	B/F	285	-		0.99
Greenway/125th	B	11.1	-	0.65	0.98
Hall/Center	C	28.2	-	0.91	0.98
Hall/Denney	C	20.4	-	0.79	0.98
Hall/Greenway	D	35.2	-	0.93	0.98
Hall/Nimbus	D	44.2	-	1.00/1.00 (NBT, NBR, EBT, EBR)	0.98
Hall/Cascade/Hwy 217 south ramp	D	51.8	-	0.98/0.98 (NBR, SBT, SBR, EBL, WBT)	0.85
Hart Rd/Sorrento Ave***	F	58.3	-	1.03	45 Seconds
Hart/155th	C	27.7	-	0.90	0.98
Oleson/Vermont	B	17.8	-	0.81	0.99
Oleson/Garden Home	F	83.7	-	1.15/1.20 (SBT, SBR, EBT,)	0.99
Walker/Hwy 217 northbound ramp	C	23.1	-	0.81	0.85
Walker/Hwy 217 southbound ramp	D	38.8	-	1.04/1.04 (SBR, EBR, WBL)	0.85
Walker/173rd	E	65.8	-	1.06/1.06 (NBL, SBT, EBT, WBL)	0.99

*Volume to capacity reported as (average intersection V/C/ worst movement V/C)
**Operational performance standards for each intersection based on jurisdictional ownership. See text for details of standards by agency.
***Unsignalized Intersection

Assessment of Need

Based upon the evaluation of intersection level of service, sixty-six of the ninety-seven study intersections would not meet operational performance standards by 2035, even with additional RTP network improvements in place. This indicates that the majority of locations (including major system corridors) will not adequately serve projected traffic growth by 2035 without additional improvements beyond those projects identified in the RTP. Only fourteen locations do not currently meet intersection operational standards under existing conditions. In addition, the amount of vehicle queues extending beyond available storage is projected to increase.

The impact of future growth would be severe without significant investment in transportation improvements. Corridors would become unmanageably congested, resulting in travel speeds below 5 MPH over long stretches of road. Poor performance on arterials and collectors would result in substantial impacts (added through traffic) to other collectors and neighborhood routes. The greatest problem areas can be grouped into the following areas:

- **Lack of east-west capacity.** Three of the key east-west routes (TV Highway, Cornell and Farmington) all experience significant congestion problems if improvements are not made.
- **Lack of connectivity.** Areas near OR 217 between Walker and Hall are the best examples, where all north-south movements must use local streets or divert to neighboring arterials. In addition, connections between Scholls Ferry Road and Oleson Road are limited.
- **Lack of intersection turning capacity.** Many intersections experience congested conditions, not the need for through capacity, but the need for additional right or left turning capacity.
- **System performance issues.** Traffic queues extending into upstream intersections along some corridors increase delay by blocking adjacent intersections so that only limited vehicles are able travel through the intersection while the signal is green. This indicates the need for system management and considering corridor needs rather than individual intersections.

PEDESTRIANS

The existing pedestrian system network map was updated from the previous TSP to reflect recent improvements and the expanded TSP Study Area. In most cases sidewalk improvements are aimed at closing gaps in the existing sidewalk network to provide connectivity rather than capacity. Generally, it is more important that a continuous sidewalk be available than it be of a certain type or size. Figure 8 shows the existing gaps in the pedestrian system along arterial and collector roadways, as well as various activity generators that have the potential to attract pedestrian use.

The 2004 RTP includes designations for pedestrian districts and transit/mixed use corridors. The RTP defines pedestrian districts as areas of high or potentially high pedestrian activity where regional policy places priority on creating a safe, direct, and attractive pedestrian environment. In general, these are areas planned for compact, mixed-use development served by transit and correspond to the following 2040 design type designations within the City of Beaverton: regional centers (RC), town centers (TC), station communities (SC), main streets, and corridors. The corresponding areas within the 2008 Beaverton TSP boundary include the Beaverton Downtown RC, the Washington Square RC, Murray Scholls TC, Raleigh Hills TC, Cedar Mill TC, and the station communities including Sunset Transit Center, 185th and Baseline, Tektronix, Beaverton Creek, Elmonica/ Merlo. Areas such as these areas should be characterized by buildings oriented to the street and by boulevard street design features such as wider sidewalks with buffering from traffic, marked street crossing at intersections, pedestrian-scale lighting, benches, bus shelters, and street trees.

Transit/mixed-use corridors are defined as priority areas for pedestrian travel that are served by good quality transit service and that will generate substantial pedestrian traffic near neighborhood-oriented retail development, schools, parks, and bus stops. These corridors should include such design features as wide sidewalks with buffering from traffic, pedestrian scale-lighting, benches, bus shelters, and street trees. The 2040 design type designation for transit/mixed-use corridors is “Corridors”. The corresponding corridor areas within the 2008 Beaverton TSP boundary include Murray Boulevard, Scholls Ferry Road, Hall Boulevard, Beaverton Hillsdale Highway/ Farmington Road, Canyon Road/ Tualatin Valley Highway, Cedar Hills Boulevard, Walker Road, and Cornell Road. The City of Beaverton Development Code regulations require new development in the pedestrian districts and transit/mixed use corridors to comply with the RTP descriptions listed above.

The most important existing pedestrian need in Beaverton is a well-connected pedestrian system within a half-mile grid of light rail transit (LRT) stations and key centers in Beaverton (parks, schools, retail, etc.). Additional needs include safe, direct and convenient access to transit and crossings of large arterial streets which act as barriers to pedestrian movement, marked crossings at major transit stops, as well as a sidewalk connectivity plan. A well-connected pedestrian system in the RTP designated pedestrian districts and transit/mixed use corridors will insure direct and logical pedestrian crossings at transit stops. The City of Beaverton should coordinate with Washington County, TriMet, Metro, and ODOT to ensure that major transit stops will be located at sites with a signalized and/or marked pedestrian crossing. In the future additional activity centers will need to be considered and interconnected with the existing pedestrian system. The ranking of pedestrian strategies from the previous TSP is listed from most important to least important:

- Connect key pedestrian corridors to schools, parks, recreational uses and activity centers (public facilities, commercial areas, etc.)
- Fill in gaps in the network where some sidewalks exist
- Pedestrian corridors to transit stations and stops
- Signalized pedestrian crossings
- Pedestrian corridors that connect neighborhoods
- Improve streets having sidewalks on one side to two sides
- As development occurs, construction of sidewalks by developers
- Pedestrian corridors that commuters might use
- Reconstruct all existing substandard sidewalks to the City of Beaverton Standards

The existing priorities may be revised through the TSP update process and feedback received through committee review.

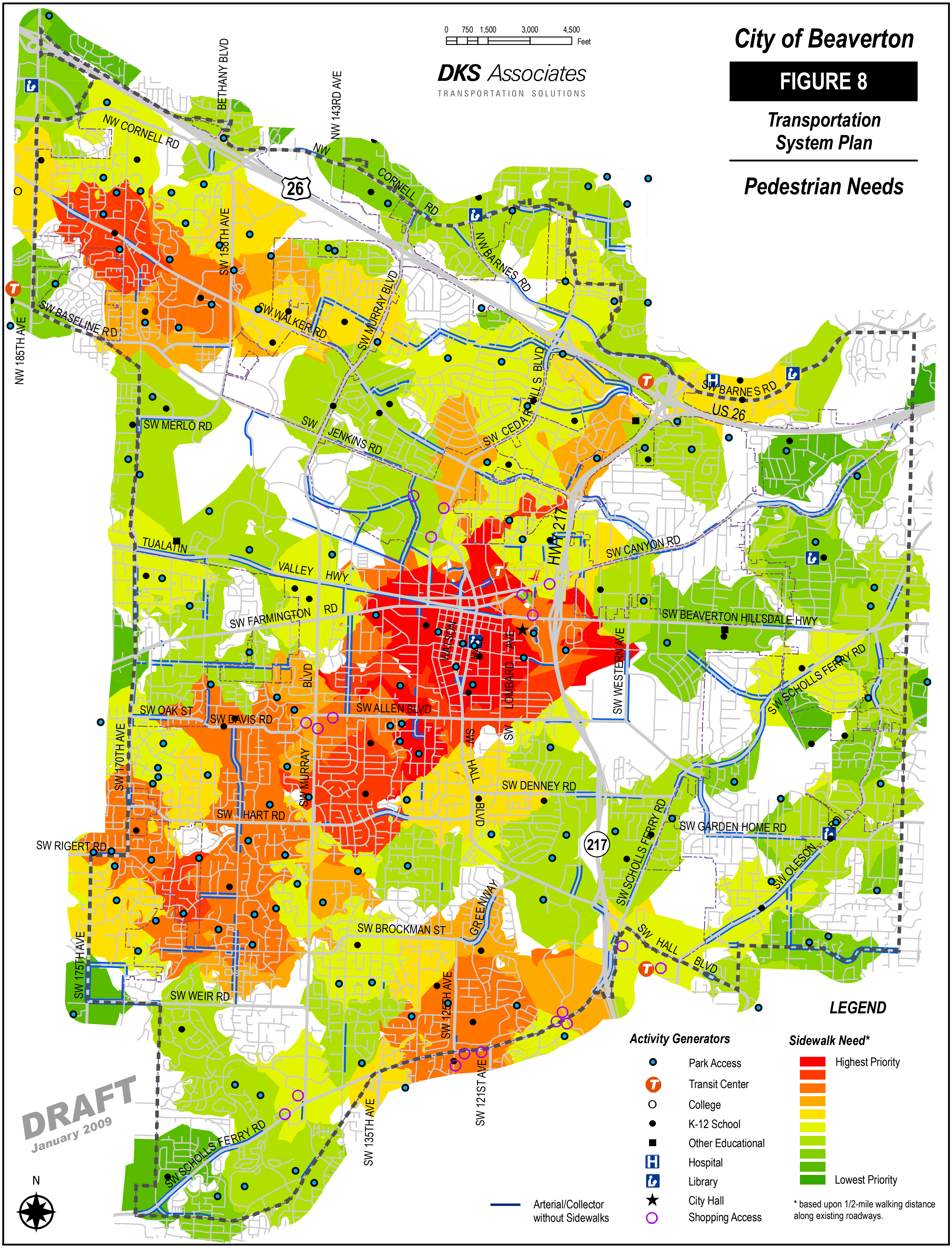
The transportation network was analyzed to determine potential sidewalk locations that would maximize the benefit of additional infrastructure by providing service to as many activity locations as possible. In Figure 8, areas that would serve the greatest number of activity generators (generally located in dense development) are indicated in red, while locations that lie outside the walking distance (assumed to be ½ mile) to activity generators (generally areas of sparse development) or would provide benefit to the least number of users are indicated in green. Sidewalk gaps that exist in red shading indicate potential locations for prioritizing sidewalk improvements or additions. The figure indicates that the highest priority need locations lie within the Beaverton Regional Center, around Walker Road/170th Avenue, and along 158th Avenue between David Road and Weir Road.

City of Beaverton

FIGURE 8

Transportation System Plan

Pedestrian Needs



BICYCLES

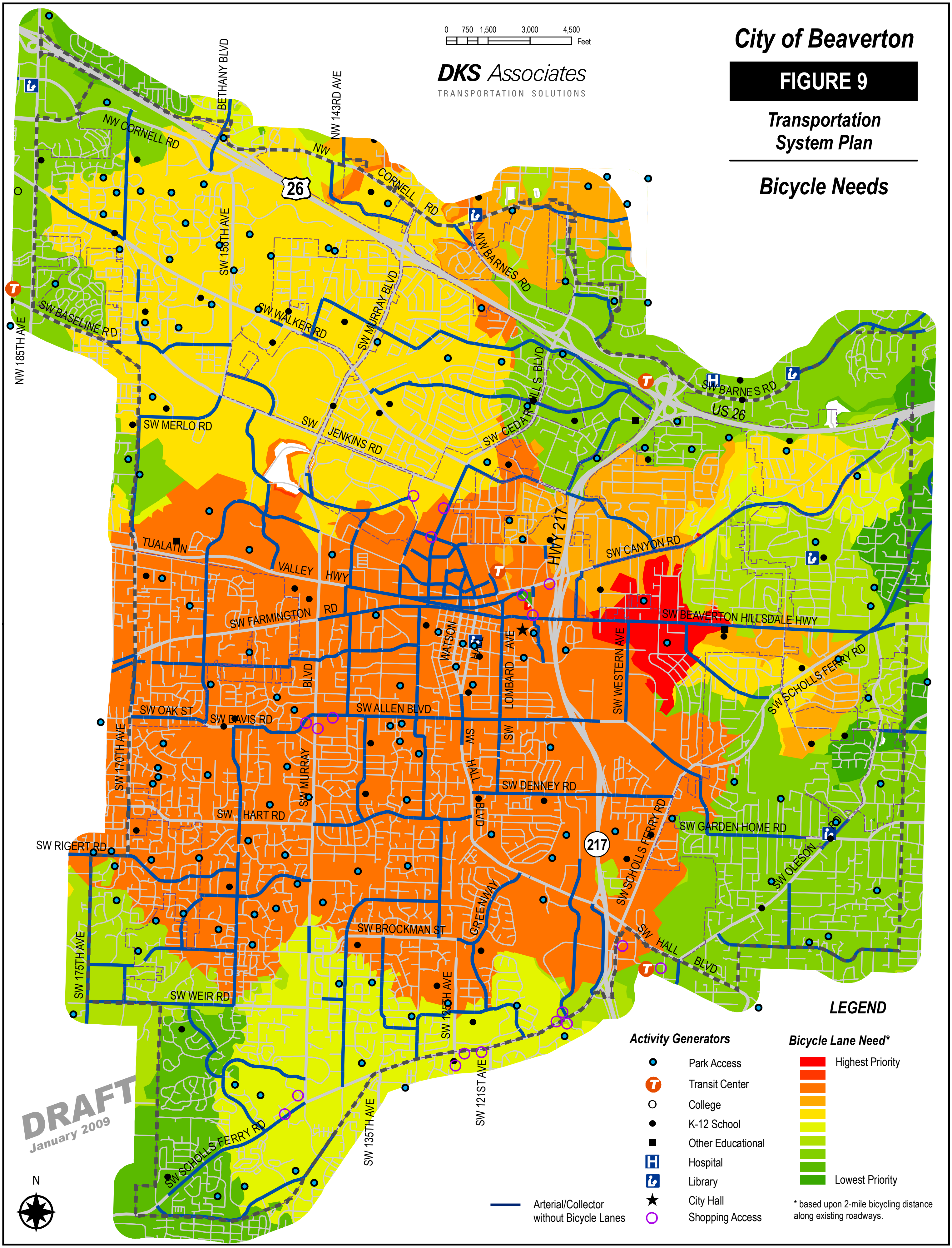
The Bicycle Master Plan has been updated from the previous TSP to include completed improvement projects and the expanded TSP Study Area. Bikeway improvements are aimed at closing the gaps in the bicycle network along arterial and collector roadways. The ranking of the bicycle strategies from the previous TSP is listed from most important to least important:

- Connect Key bicycle corridors to schools, parks, recreational uses and activity centers (public facilities, commercial areas, etc.)
- Fill in gaps in the network where some segments of bikeway exist
- Bicycle corridors that connect neighborhoods
- Construct bike lanes with roadway improvement projects
- Bicycle corridors that commuters might use
- Bicycle corridors providing mobility to and within commercial areas

These rankings may be revised through from committees through the review process. The 2004 Metro RTP includes the following bicycle functional classification system:

- <u>Regional Access Bikeway</u>: Function focuses on accessibility to and within the central city, regional centers, and larger town centers. Travel time is an important factor as these bikeways generally have high volumes.
- <u>Regional Corridor Bikeway</u>: Functions as longer routes that provide point-to-point connection between the central city, regional centers, and larger town centers. Generally higher automobile speeds and volumes than community connector bikeways.
- <u>Community Connector Bikeway</u>: Connect smaller town centers, main streets, station areas, industrial areas, and other regional attractions.
- <u>Multi-use paths with bicycle transportation function</u>: Likely to be used for commuting to work or school, accessing transit, or travelling to a store, library, or other local destination. Bicycle/pedestrian sidewalks on bridges are included in this classification. Includes physical separation from motor vehicle traffic by open space or barrier.

State policy from the Transportation Planning Rule and City of Beaverton policy require that all arterial and collector roads have bikeways. Figure 9 shows the existing gaps in the bicycle system along arterial and collector roadways, as well as various activity generators that have the potential to attract bicycle use. As with the pedestrian system, the transportation network was analyzed to determine potential bicycle lane locations that would maximize the benefit of such widening or striping by providing service to as many activity locations as possible. In Figure 6, areas that would serve the greatest number of activity generators (generally located in dense development) are indicated in red, while locations that lie outside the cycling distance (assumed to be two miles) to activity generators (generally areas of sparse development) or would provide benefit to the least number of users are indicated in green. Bicycle lane gaps that exist in red shading indicate potential locations for prioritizing improvements such as striping or widening.


City of Beaverton
FIGURE 9
Transportation System Plan
Bicycle Needs
DKS Associates
TRANSPORTATION SOLUTIONS
0 750 1,500 3,000 4,500 Feet
DRAFT
January 2009
LEGEND
Activity Generators
Park Access
Transit Center
College
K-12 School
Other Educational
Hospital
Library
City Hall
Shopping Access
Arterial/Collector without Bicycle Lanes
Bicycle Lane Need*
Highest Priority
Lowest Priority
* based upon 2-mile bicycling distance along existing roadways.
N
NW CORNELL RD
BETHANY BLVD
NW 143RD AVE
26
SW 158TH AVE
SW BASELINE RD
NW 185TH AVE
SW WALKER RD
SW MURRAY BLVD
NW BARNES RD
SW MERLO RD
SW JENKINS RD
SW CEDAR HILLS BLVD
SW BARNES RD
US 26
HWY 217
SW CANYON RD
TUALATIN VALLEY HWY
SW FARMINGTON RD
SW BEAVERTON HILLSDALE HWY
SW SCHOLLS FERRY RD
WATSON AVE
LOMBARD AVE
SW WESTERN AVE
SW OAK ST
SW DAVIS RD
SW ALLEN BLVD
SW 170TH AVE
SW MURRAY BLVD
SW HALL BLVD
SW DENNEY RD
SW HART RD
SW RIGERT RD
SW GARDEN HOME RD
217
SW OLESON RD
SW BROCKMAN ST
GREENWAY
SW 175TH AVE
SW WEIR RD
SW 125TH AVE
SW 121ST AVE
SW 135TH AVE
SW HALL BLVD

TRANSIT

In addition to current transit service, WES Commuter Rail service connecting Beaverton to Wilsonville will enhance the areas access to employment. The service is focused on peak commute periods and will potentially reduce the congestion of adjacent frequent or regional bus routes, and Highway 217. The importance of the frequent and regional bus lines in Beaverton will be enhanced as more passengers travel through Beaverton on both the MAX and WES lines leading to more passenger transfers throughout the city.

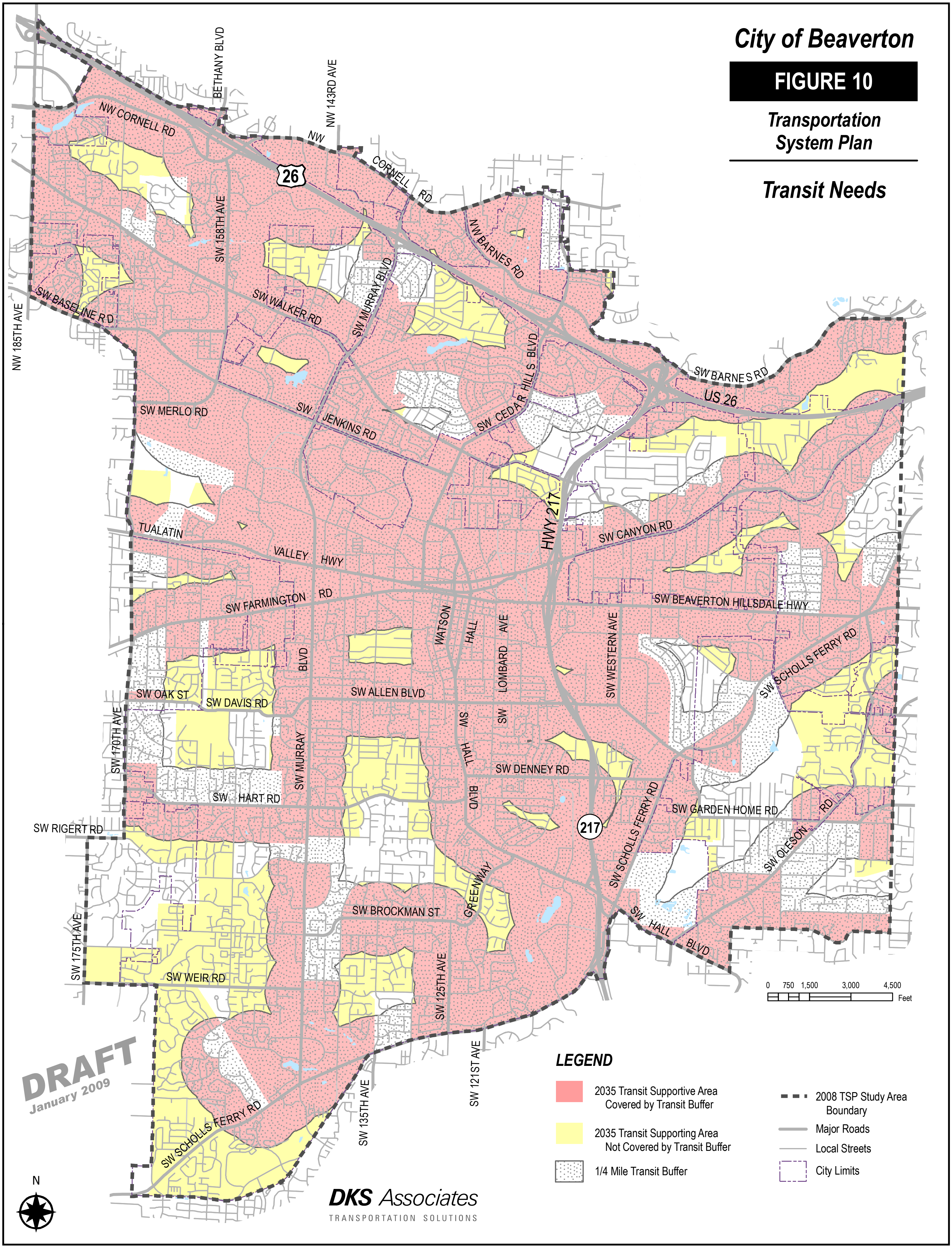
The existing transit system coverage area includes approximately 77 percent of the modeled transit supportive zones within the Beaverton TSP study area[6]. The future 2035 land use would increase the transit supportive area and the percentage of coverage to approximately 81percent (Figure 10) without an increase in service coverage.

Corridors designated as frequent bus routes by the RTP in the 2008 Beaverton TSP study area include Beaverton Hillsdale Highway, Tualatin Valley Highway, Cedar Hills Boulevard, and Hall Boulevard. Major Streets designated as regional bus routes in the 2008 Beaverton TSP study area include Barnes Road, Murray Boulevard, 185th Avenue, Walker Road, Canyon Road, Farmington Road, Lombard Avenue, Allen Boulevard, Garden Home Road, Oleson Road, and Scholls Ferry Road.

Future transit stops along several streets would further improve the coverage of the transit supportive area in Beaverton:

- 173rd Avenue between Cornell Road and Walker Road
- David Road between 170th Avenue and Murray Boulevard
- Hart Road between Murray Boulevard and Hall Boulevard
- Weir Road between Murray Boulevard and Mount Adams Drive
- Scholls Ferry Road between Loon Drive and 155th Terrace
- Oleson Road between Garden Home Road and Scholls Ferry Road

[6] Coverage is determined as the area within 0.25 miles of a bus stop or 0.50 miles of a LRT stop


City of Beaverton
FIGURE 10
Transportation System Plan
Transit Needs
LEGEND
2035 Transit Supportive Area Covered by Transit Buffer
2035 Transit Supporting Area Not Covered by Transit Buffer
1/4 Mile Transit Buffer
2008 TSP Study Area Boundary
Major Roads
Local Streets
City Limits
0 750 1,500 3,000 4,500
Feet
N
DRAFT
January 2009
DKS Associates
TRANSPORTATION SOLUTIONS
NW CORNELL RD
BETHANY BLVD
NW 143RD AVE
NW CORNELL RD
26
NW BARNES RD
SW 158TH AVE
SW BASELINE RD
SW WALKER RD
SW MURRAY BLVD
NW 185TH AVE
SW CEDAR HILLS BLVD
SW BARNES RD
US 26
SW MERLO RD
SW JENKINS RD
HWY 217
TUALATIN VALLEY HWY
SW CANYON RD
SW FARMINGTON RD
SW BEAVERTON HILLSDALE HWY
WATSON
HALL
LOMBARD AVE
SW WESTERN AVE
SW SCHOLLS FERRY RD
BLVD
SW OAK ST
SW DAVIS RD
SW ALLEN BLVD
SW 170TH AVE
SW MURRAY
SW HALL
SW
SW DENNEY RD
SW HART RD
BLVD
SW GARDEN HOME RD
SW SCHOLLS FERRY RD
SW RIGERT RD
217
SW OLESON RD
GREENWAY
SW BROCKMAN ST
SW HALL BLVD
SW 175TH AVE
SW WEIR RD
SW 125TH AVE
SW 121ST AVE
SW 135TH AVE
SW SCHOLLS FERRY RD

FREIGHT

This section summarizes the future condition and needs of the freight system.

Trucks

Efficient truck movement plays a vital role in the economical movement of raw materials and finished products. The establishment of through truck routes provides for this efficient movement while at the same time maintaining neighborhood livability, public safety, and minimizing maintenance costs of the roadway system. The through truck route map included in the Existing Conditions chapter indicates truck routes along several of the primary arterials through the study area including Hwy 217, US 26, Scholls Ferry Road, Murray Boulevard, Farmington Road and Canyon Road, among others. The objective of this route designation is to allow these routes to focus on design criteria that is “truck friendly”; i.e. 12-foot travel lanes, longer access spacing, 35-foot (or larger) curb returns, and pavement design that accommodates a larger share of trucks. A freight system reliability analysis was performed for sections of two of these routes (Farmington Road and Canyon Road) that traverse the Beaverton Regional Center. Existing travel times through these areas for the midday and PM peak hour were compared and midday travel times for 2035 were projected. The freight system reliability analysis is summarized in Table 17. Each direction of both routes currently is up to 20% faster (80 seconds or less) during the midday period. Operational improvements will be needed in the future to continue to provide corridor freight mobility.

Table 17: Freight Midday System Reliability
Relative Difference between Existing Midday and PM Peak Period Travel Time Surveys

		2008 Travel Times			2035 Travel Times	
Route	**Direction**	**Midday (minutes)**	**PM (minutes)**	**Relative Diff. (Mid-PM)/PM %**	**Midday (minutes)**	**PM (minutes)**
Canyon Road-	Westbound	4.7	5.3	-12%	20.1	22.3
(Tualaway to 106^{th})	Eastbound	5.3	5.7	-6%	21.8	23.4
Farmington Road-	Westbound	4.6	5.6	-19%	9.6	11.7
(2^{nd} to 101^{st})	Eastbound	5.2	6.6	-20%	10.8	13.6

Source: City of Beaverton/DKS Associates

Rail

The RTP designates the rail lines traveling along Highway 217 and Tualatin Valley Highway as part of the regional freight system. These lines serve many areas of regional concern including industrial areas, truck terminals, and several employment areas along the route. The freight rail lines provide additional connections to the main roadway freight truck routes. In addition the WES commuter rail service travels along much of the freight rail route along Highway 217. The train frequency along this route is expected to increase with the addition of WES commuter rail service. At-grade gated rail crossings along the south edge of Canyon Road and along Highway 217 impact existing traffic flows during train events at several major arterials (including Murray Boulevard, Farmington Road, Hall Boulevard and Scholls Ferry Road, among others). Such events would further impede traffic flow in the future and restrict capacity of these major facilities.