Technical Memorandum #11 –Draft

DATE: November 7, 2016

TO: Corvallis TSP Project Management Team and Stakeholders

FROM: John Bosket & Mat Dolata, DKS Associates

SUBJECT: **Corvallis Transportation System Plan Update**
Task 5.1 Future Traffic Forecast

The purpose of this memorandum is to summarize methods and assumptions applied to traffic volume forecasting in the future baseline scenario for the Corvallis Transportation System Plan (TSP) planning horizon year of 2040. The future traffic volume forecasts are a key component for understanding travel demand trends and will be used in the future conditions performance analysis in Technical Memoranda #12 and #13, as well as in the evaluation of solutions later in the project.

Travel Demand and Land Use Relationship

Understanding the influence of area land uses on the transportation system is a key factor in transportation system planning. The amount of land that is to be developed, the types of land uses, and their proximity to each other directly affect transportation system demand.

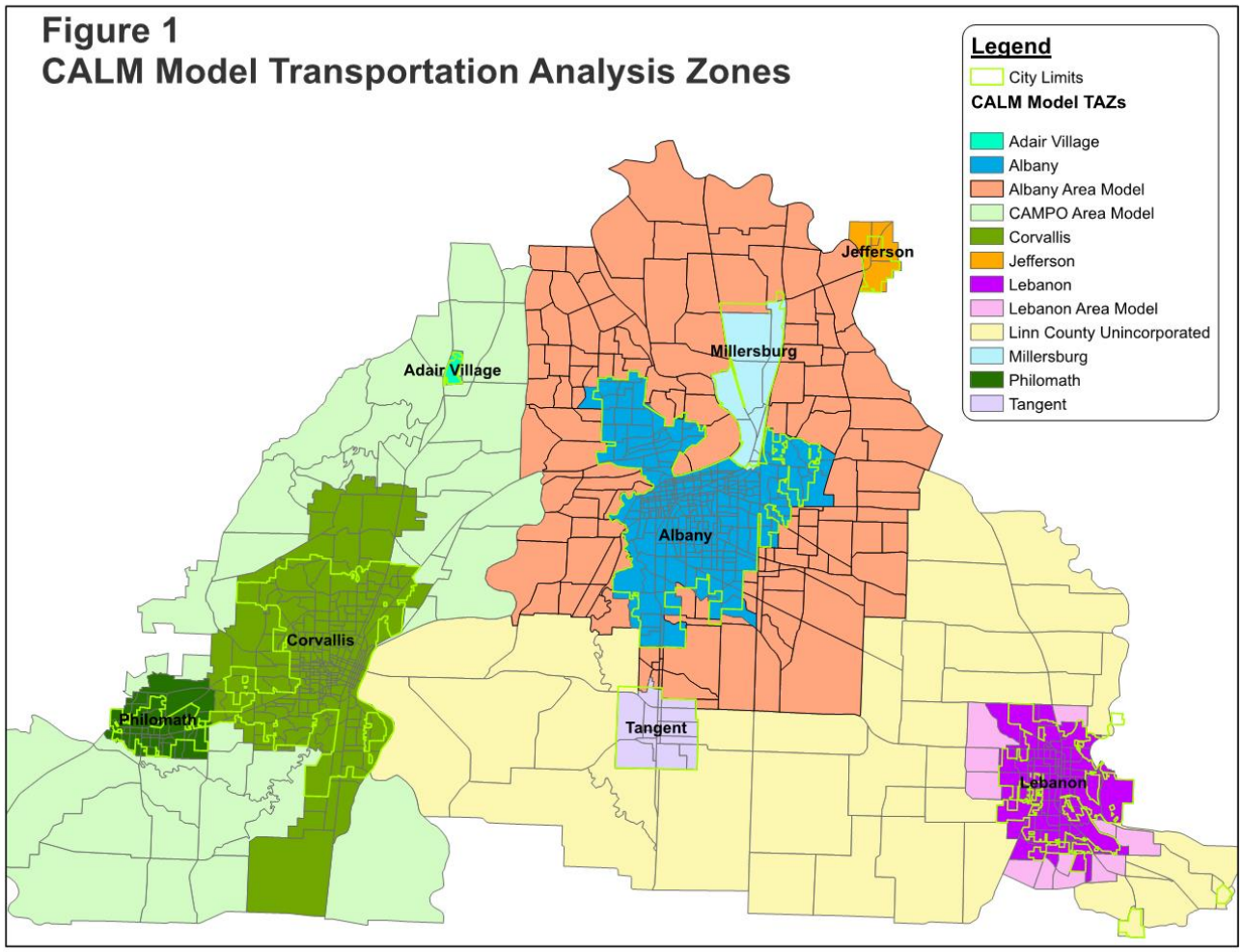
As land uses change in proportion to each other (e.g., a significant increase in employment relative to household growth), there may be a shift in the overall utilization of the transportation system. If an area within the city is homogeneous in land use character (e.g., exclusively employment or residential), it is more likely that more and longer trips will be made to and from that area. In contrast, a mix of residential, commercial, and employment land uses in close proximity may reduce the need for vehicle trips or at least reduce their length. The location and design of retail land uses in particular, can affect future transportation system operation, as retail land uses typically generate more p.m. peak hour trips per acre than households and other land uses.

CALM Travel Demand Model

The Corvallis Albany Lebanon Model (CALM) travel demand model is the primary tool used in this project to determine future traffic volumes in Corvallis. The Oregon Department of Transportation (ODOT) developed and will maintain the CALM model, which translates estimated land uses into person trips, selects travel modes, and assigns motor vehicle trips to the roadway network. The CALM model was developed to estimate daily and p.m. peak hour vehicle and non-vehicle demand for base year (2010) and future year (2040) transportation system scenarios.

The CALM model represents Corvallis, Albany, Lebanon and surrounding communities including portions of unincorporated Linn and Benton Counties (see Figure 1)[1]. Some of these areas were previously represented in three separate travel demand models. Combining these areas allows CALM to better capture regional influences between the surrounding communities because the model estimates demand based on future growth and development patterns, including motor vehicle traffic passing through the region (e.g., I-5, OR 99W, US 20, OR 34).

Figure 1
CALM Model Transportation Analysis Zones



[1] Taken from *Memorandum: CALM Input Data Development – Task 3.1 Process and Technical Procedures*, prepared by DKS Associates, June 19, 2014

Three key structural elements of CALM that help estimate future traffic are described below:

- **Transportation Analysis Zones (TAZs).** The model area is split into 930 internal regional TAZs and 23 external zones[2]. Each internal TAZ represents a small subarea of the model with unique land use attributes that represent the number of households (including travel behavior-influencing characteristics such as household income) and the number and type of employees within the zone. These land use attributes determine the intensity and directionality of trips generated in the zone.
- **Transportation Network.** The model includes a network of links that generally represents the major transportation system (typically collector roads and above) in the model area. Each link is coded with attributes (e.g., speed and capacity) that approximate the function of existing roadways (for the base year and future year) and programmed roadway improvements (those with committed funding already identified) for the future year. Each TAZ is connected to links in the model at points that approximate where travelers are expected to enter the network.
- **Specialized University Model.** CALM includes a special university model to account for the travel impacts of Oregon State University (OSU) on the region. This model accounts for university related travel patterns such as residential clustering, mode use, time-of-day, and parking supply. The model also allows multi-stop trips by simulating travel patterns by person. The university component provides a higher level of detail within Corvallis as well as the regional interaction of students and employees who live outside of Corvallis.

ODOT staff has coordinated with OSU staff on developing and refining inputs to the CALM model. This coordination is intended to ensure that the model appropriately represents the most recent available information from the OSU Master Plan update and recent changes in campus operations since the 2010 base year model scenario was created.

Traffic forecasts and operations analysis results (presented in Technical Memorandum #12) will be reviewed by OSU representatives to ensure that the long-range analysis is reasonable and does not conflict with any aspects of the Master Plan update.

For the purposes of long-range planning for the TSP, City staff decided to use a 2040 enrollment forecast of 28,500 OSU students. It is important to note that OSU is not responsible for or limited by growth assumptions made for TSP purposes that go well beyond their 10-year planning horizon.

[2] The TAZ system was developed by ODOT based in part on the TAZ structures from travel demand models developed for the Corvallis Area Metropolitan Planning Organization, Albany, and Lebanon. The TAZs are designed to represent geographic areas with common loading characteristics onto the regional transportation network.

Future Transportation Network

The baseline future scenario, or 2040 TSP "No Build" scenario, assumes a very limited number of transportation system improvements have been made to the existing condition, including only those future projects that are considered to have committed funding for construction by 2040. The purpose of this scenario is to establish a "financially committed" system that represents the baseline conditions for identifying needs of the future system, without assuming any unfunded improvements will be constructed. The following projects are assumed to be financially committed by 2040 and were included in the No Build model scenario:

- Realignment of NW 9th Street at NW Elks Drive – NW 9th Street alignment will be shifted westward to align with NW Samaritan Drive as part of the Good Samaritan Regional Medical Center campus expansion. This improvement will also include widening of OR 99W from NE Conifer Boulevard to NW Elks Drive to provide four travel lanes.[3]
- Marys River-Crystal Lake Drive Shared-Use Path – approximately 2,000 feet of a shared-use path will be constructed between the Marys River bicycle bridge and Crystal Lake Drive.

The following project was also included in the No Build future scenario as it was constructed during the summer of 2016, after the existing conditions analysis (2015 baseline) was completed:

- SW 35th Street Sidewalks and Railroad Crossing – improvements to SW 35th Street between SW Western Boulevard and SW Jefferson Way include widening of the roadway to accommodate bike lanes and sidewalk facilities and reconstruction of the SW 35th Street approaches for a more gradual transition across the railroad tracks.[4]

[3] These improvements are expected to be completed by Good Samaritan Hospital with planned development that is considered to be "financially committed" by City of Corvallis staff.
[4] Railroad crossing improvements (including construction of crossing arms and signalization that meets current rail safety guidelines) will be performed by ODOT in coordination with City improvements (to 35th Street approaches and bicycle and pedestrian facilities). Funding for this portion is not considered committed.

Forecast Land Use

The baseline future scenario in the 2040 CALM model represents one potential land use scenario for the Corvallis TSP study area. Complete land use data sets were developed for both the 2010 base year scenario and 2040 future year scenario. The future year scenario was developed to evaluate transportation strategies for the TSP planning horizon.

The future land use scenario represented in the 2040 CALM model No Build scenario reflects one potential outcome. The project team recognizes the uncertainty inherent to assumptions about land use development and community growth.

The future land use scenario represents a "best guess" for the sake of analyzing the needs of the transportation system and for evaluating the impacts of alternative strategies. The future land use scenario is based on the adopted Corvallis Comprehensive Plan. The 2040 CALM model land use scenario was developed with input and review from agency staff from the City of Corvallis, Corvallis Area Metropolitan Planning Organization, and Benton County.

Corvallis recently completed a separate land use evaluation in the Housing Needs Analysis and Economic Opportunities Analysis with a planning horizon of 2036 and will be updating the Comprehensive Plan over the next year. The TSP future land use scenario does not constrain the assumptions or outcomes of the Comprehensive Plan update. Following adoption of the Comprehensive Plan update, the TSP future land use assumptions will be reevaluated to ensure they are in alignment.

It is important to note that Technical Advisory Committee and Steering Committee direction on TSP strategies and solutions do not necessarily reflect endorsement of the land use forecasts or associated expectations about the future.

Table 1 summarizes the aggregated land use scenario inputs (TAZ data aggregation) within the Corvallis TSP update study area[5] for 2010 and 2040. The 2040 scenario reflects significant employment growth (approximately 17,200 new jobs) in Corvallis, along with approximately 14,300 new residents.

Table 1: Corvallis TSP Study Area (UGB) Land Use Summary

Land Use	2010	2040	Increase	Percent Increase
Population	57,387[6]	71,694	14,307[7]	25%
Households	23,494	30,558	7,064	30%
Employees (Total)	29,460	46,686	17,226	58%
-Retail Employees	5,604	7,841	2,237	40%
-Other Employees (Non-Retail)	23,856	38,845	14,989	63%

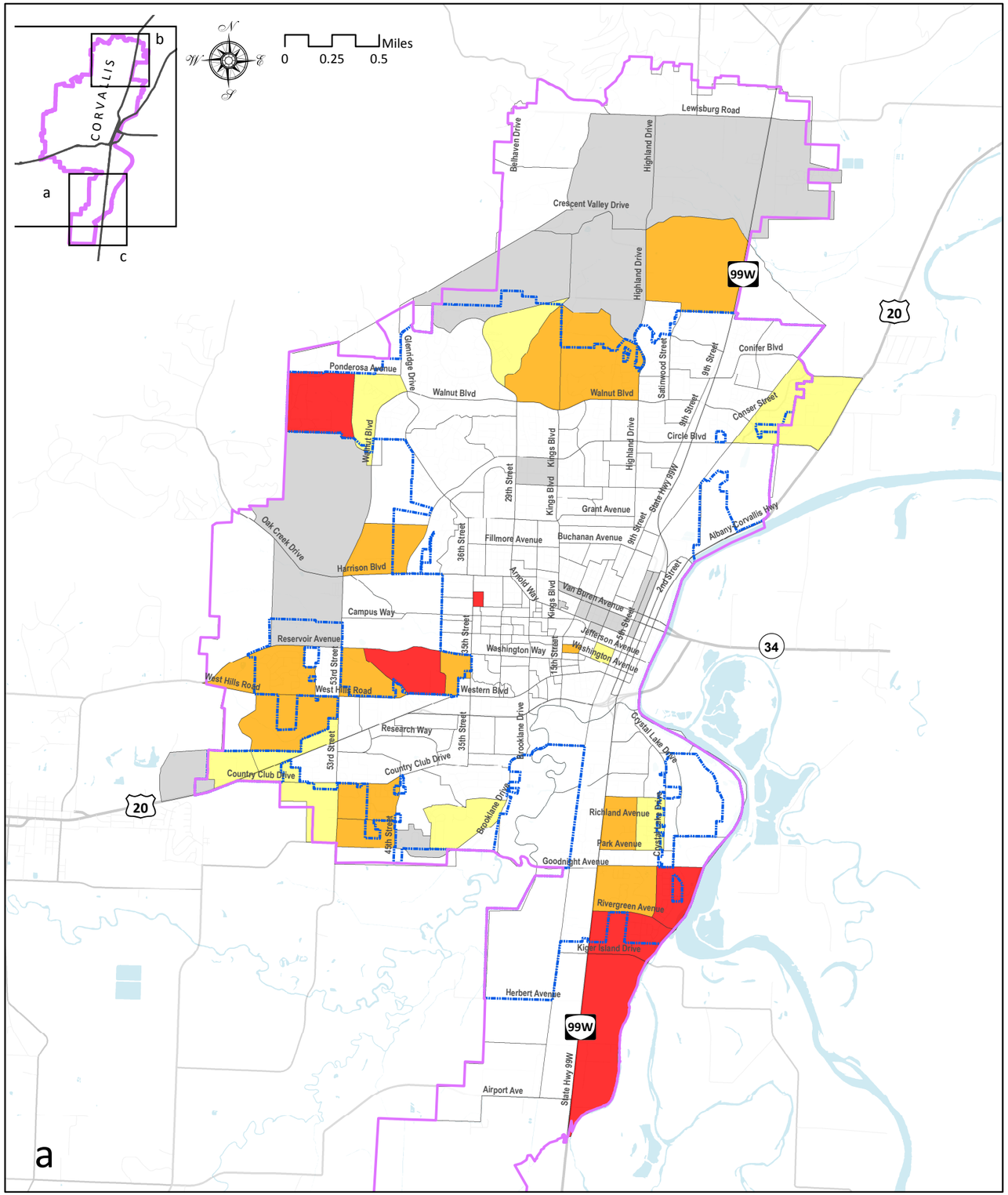
SOURCE: CALM land use data (ODOT)

The aggregated land use totals shown in Table 1 for the year 2040 scenario are allocated to a series of smaller geographic areas called TAZs. Each TAZ contains a portion of the households and employees within the entire study area. Figures 2 and 3 illustrate the growth in households and employees, respectively for each TAZ within the Corvallis urban growth boundary to show how projected growth is assumed to be distributed.

[5] The TSP study area aligns approximately with the Corvallis Urban Growth Boundary (UGB). The land use data presented is an aggregation of CALM TAZs whose boundaries do not precisely match the UGB limits. Therefore, the land use totals presented should be considered approximations.

[6] Note that the 2010 population value for the Corvallis TSP study area differs from the census population for the city (54,338) because it includes land in TAZ boundaries that cover the UGB limits.

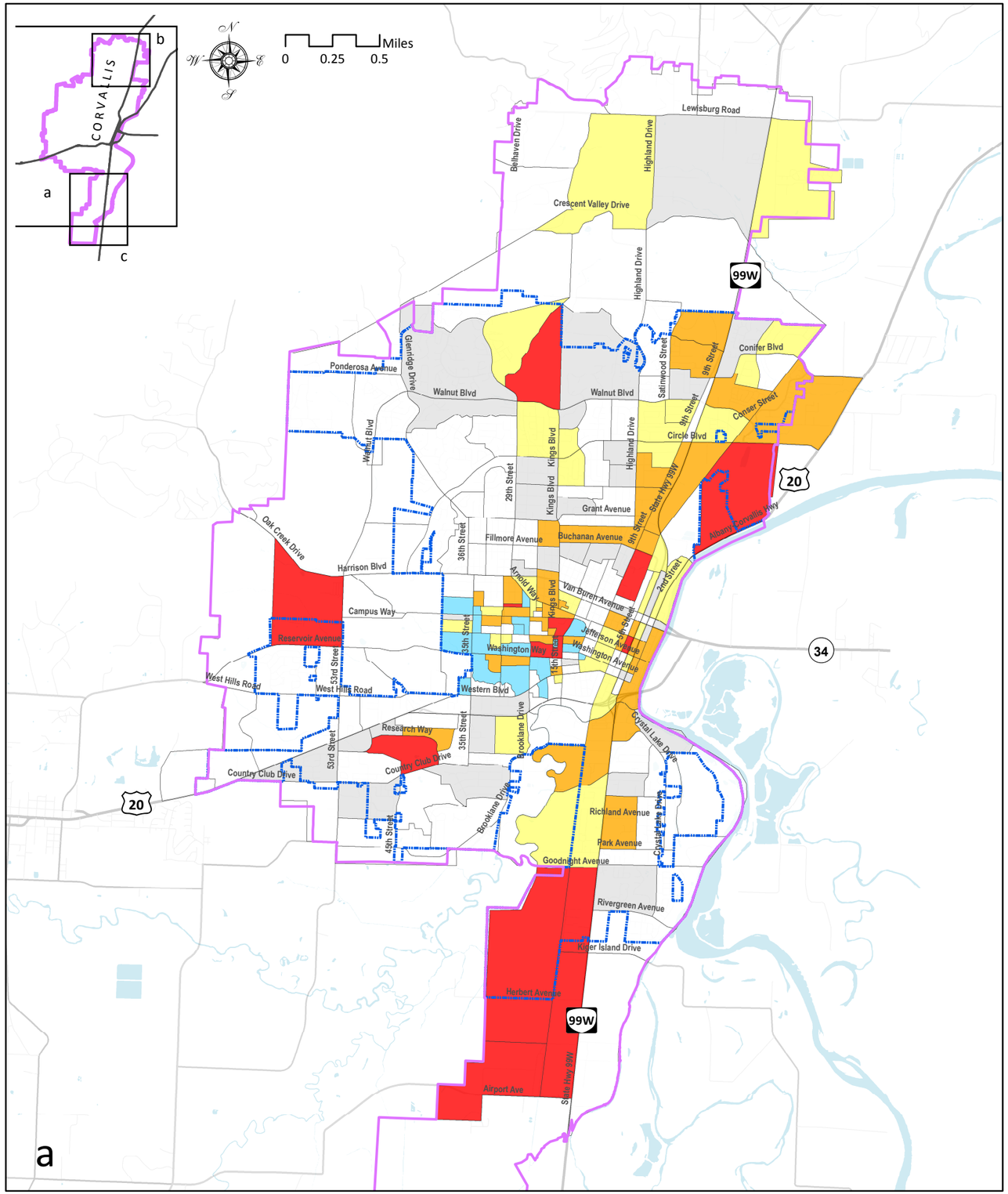
[7] The population growth identified is consistent with adopted population projections for Benton County which indicate 23% population growth between 2010 and 2040 (or a net increase of 19,315 residents) as identified in *Forecasts of Oregon's County Populations and Components of Change 2010-2050* (State of Oregon Office of Economic Analysis, 2013).

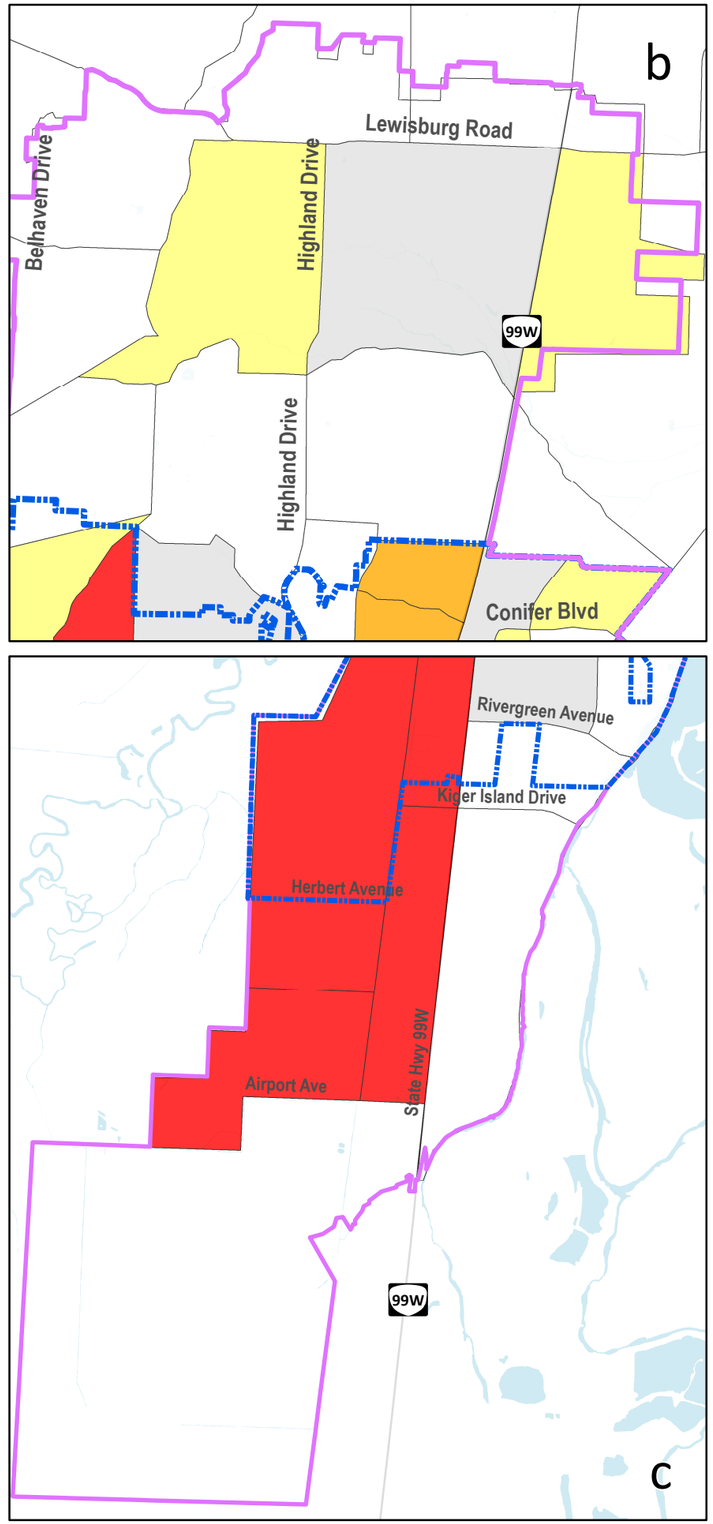


CORVALLIS
TRANSPORTATION SYSTEM PLAN

1 Household Growth Scenario (2010 to 2040)

Source: CALM Travel Demand Model (ODOT)





CORVALLIS
TRANSPORTATION SYSTEM PLAN

2 Employment Growth Scenario (2010 to 2040)

Source: CALM Travel Demand Model (ODOT)

Legend

Employment Growth
(Transportation Analysis Zone total)

- -240 - -21
- -20 - 20
- 21 - 50
- 51 - 100
- 101 - 300
- 301 - 1060

City Limit

Urban Growth Boundary

Forecast Travel Demand

Future travel demand forecasting can be divided into several distinct but integrated components that represent the logical sequence of travel behavior. These components and their general order in the traffic forecasting process are described below.

Trip Generation

The trip generation process translates land use scenario quantities (households and employees) into person trip ends (number of people entering or leaving a TAZ) using trip rates established during the model verification process and based on real-world travel behavior survey data and roadway traffic volume counts. The CALM trip generation process is elaborate, entailing detailed trip characteristics for various types of housing and employment. The model process is tailored to variations in travel characteristics and activities in the region.

Trip Distribution

This step estimates how many trips travel from one area in the model to any other area. Distribution is based on factors that relate the likelihood of travel between any two TAZs 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 amount of traffic generation in Corvallis 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 Albany, Philomath, and Lebanon as well as the unincorporated areas in Benton County and Linn County.

The model and trip distribution can also be used to help define the number of internal, external, and through trips for the City of Corvallis. These types of trips are as follows:

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

Mode Choice

This step in the modeling process determines how many trips will be made by various modes (motor vehicle, transit, pedestrian, bicycle, etc.). The trips between zones developed in the Trip Distribution step are split between the different travel modes based on the calculated attractiveness of each mode for each trip (origin and destination pair). The attractiveness of each mode for each trip is calculated based on the following factors:

- Travel Time (in-vehicle, transit access, transit wait, etc.)

- Cost (parking, the presence or absence of a transit fare, the cost for gas and insurance to operate an auto, etc.)
- Other travel mode characteristics (reliability, safety, comfort, etc.)
- Person/Household characteristics (income, auto ownership, age, etc.)
- Trip purpose characteristics (shopping, number of stops, etc.)

The mode choice model creates mode-specific trip tables showing travel between the TAZ zone pairs. Table 2 summarizes the daily trip ends by each mode for Corvallis zones in the 2010 and 2040 model scenarios. The mode share is not expected to change significantly in Corvallis in the No Build scenario, with the exception of a small (two percent) increase in drive-alone trip share.

Table 2: Corvallis TSP Study Area Daily Trip Mode Share

Travel Mode	2010 Trip Ends	2040 Trip Ends	2010 Mode Share	2040 Mode Share	Mode Share Change
Drive - Alone	206,318	284,513	40.2%	42.2%	2.0%
Drive - Shared Ride	95,936	124,563	18.7%	18.5%	-0.2%
Transit (Bus)	10,146	14,008	2.0%	2.1%	0.1%
Bike	54,210	67,667	10.6%	10.0%	-0.5%
Walk	142,705	179,774	27.8%	26.7%	-1.2%
School Bus	3,795	3,995	0.7%	0.6%	-0.1%
Total	513,111	674,521	100.0%	100.0%	-

NOTE: Mode share values shown in Table 2 may not align with mode share data previously presented in Technical Memorandum #7. The values from Technical Memorandum #7 were obtained from the US Census and represent commute mode choice only. The values shown in Table 2 were obtained from household surveys and represent daily mode choice, which includes many trip types other than commuting.

SOURCE: CALM regional travel demand model (ODOT)

Traffic Assignment

In this process, vehicle 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,” 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, traffic control, and facility type. This allows the model to reflect conditions somewhat similar to driver behavior.

Forecast Traffic Volume Growth

The future land use scenario assumes an increase in the number of households and employees in the model area which results in an increase to the overall number of trips generated. While trip growth for all modes is estimated, it is the more detailed assignment of vehicle trips on the street network that is needed for analysis of key roadway bottlenecks and congested corridors.

Vehicle Trips

Table 3 summarizes the total p.m. peak hour motor vehicle trip ends for Corvallis zones in 2010 and 2040 scenarios, as well as for all CALM model zones combined. The number of vehicle trips in Corvallis zones is expected to grow by approximately 40 percent between 2010 and 2040 scenarios if the land develops according to the modeled land use assumptions. This vehicle trip growth is between the projected increase in households (30 percent) and employment (58 percent) identified in Table 1.

Table 3: P.M. Peak Hour Vehicle Travel Demand*

Model Area	2010 Trip Ends	2040 Trip Ends	Change	Percent Change
Corvallis TSP Study Area*	31,773	44,586	12,813	40%
CALM (All Zones)	100,170	141,871	41,701	42%

* Includes trips into Corvallis from outside UGB area or trips destined outside of UGB. Trips entirely within Corvallis count as 2 trip ends, while trips with an origin or destination outside of Corvallis count as 1 trip end.

SOURCE: CALM regional travel demand model (ODOT)

Roadway Traffic Volume

Forecasts of p.m. peak period traffic flows were produced for every major roadway segment within Corvallis. Traffic volumes were projected on all arterials and most collector streets. Some local streets were included in the CALM model scenarios, but many are represented by TAZ connectors in the model process.

Intersection Traffic Volume

CALM model volumes were extracted at study area intersections for both the base year 2010 and forecast year 2040 scenarios. A “post processing” technique was utilized to refine model travel forecasts for the volume forecasts used for the 2040 intersection analysis.

Post processing is a methodology that uses existing count data together with base year and future year model data to help determine future volumes. The increment of growth in volumes between the future and

base year models is added to the existing count data[8]. This methodology minimizes the effects of model error by adding the increment of growth to the base year counts. The approach is consistent with National Cooperative Highway Research Program Report NCHRP Report 765[9].

The post processing intersection turn movement volumes for the 2040 No Build scenario are documented in the appendix. Volumes were developed for two future conditions: the average weekday the 30th highest annual hour volume[10]. Factors are applied to average weekday volumes to estimate 30th highest annual hour volume conditions, consistent with the methodology outlined during the Existing Conditions analysis.[11]

ODOT mobility targets are typically evaluated for 30th highest annual hour volume conditions. Average weekday forecasts are developed in order to prepare for potential evaluation of alternative mobility targets. Alternative mobility targets can be applied where long-term capacity improvements (i.e., roadway expansion) may not be realistic or desirable. By applying mobility targets to average weekday conditions (instead of 30th highest annual hour conditions) more congestion may be accepted and communities may consider alternative strategies to constructing capacity improvements. Providing traffic volumes for both conditions allows a wider range of TSP strategies to be considered.

[8] Traffic volume growth from the CALM model is scaled to account for difference in traffic count and model base year (2010).
[9] *Analytical Travel Forecasting Approaches for Project-Level Planning and Design - National Cooperative Highway Research Program Report 765,* Transportation Research Board, Washington D.C., 2014.
[10] The 30th highest annual hour volume is intended to represent traffic volumes that would be present during the 30th busiest hour in the calendar year.
[11] *Corvallis Transportation System Plan Update Technical Memorandum – Traffic Analysis Methods and Assumptions*, prepared by DKS Associates, July 14, 2016.