



## Transportation Sensitivity Analysis

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February 2015

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## Introduction

This memorandum documents the sensitivity analysis completed to identify the potential transportation impacts associated with Recommended Land Use and Infrastructure Option (Recommended Option) for the Tigard Triangle Redevelopment Strategy by comparing that to the existing zoning within the Triangle. If the changes in zoning generate the same or less trips than the existing zoning the proposed option is assumed to have no significant effect on the transportation infrastructure, thereby meeting the requirements of the Transportation Planning Rule (TPR) as dictated in section 660-012-0060 of the Oregon Administrative Rule (OAR). The sensitivity analysis evaluated the following options (described in greater detail following Table 1 on page 2):

- Existing Zoning, which maintains the existing zoning in the Triangle;
- Option 1: Refine Site Design Standards. This option maintains the existing zoning, but modifies some site design standards, such as floor area ratios;
- Option 2: Refine Site Design Standards and increase Land Use Densities (Recommended Option). This option is the Recommended Option developed through the public process alternative development and refinement process.

## Organization of this Memorandum

This memorandum is organized into the following sections:


- **Findings** that identify the potential number of trips generated by each option and whether or not each option has a significant effect on the transportation infrastructure
- **Land Use and Infrastructure Options** that describes the three options proposed for the Triangle: Existing Zoning, Option 1 and Option 2 (Recommended Option); and
- **Transportation Impact Evaluation** that illustrate the proposed street cross sections, if they are different than what is currently identified in the Tigard Triangle Plan District.

There are several maps attached that help illustrate each option. These include:


- Study Area
- Primary Land Use Functions by option
- Roadway Network by option

## Findings

The evaluation of the land use and transportation options in this memorandum focuses on a review of trip generation potential of the three options. Trip generation is based on the Institute of Transportation Engineers (ITE) Trip Generation Handbook (9<sup>th</sup> Edition) with adjustments to trip distribution patterns from the Metro travel demand model and trip assignment changes associated with each option. The determination of potential transportation impacts for the Options 1 and 2 is based on the net new trips for the build options compared to the existing zoning.

- As shown in **Table 1**, Option 2 (Recommended Option) produces an increase in net new trips compared to existing zoning. As a result, Option 2 may have an effect on the transportation infrastructure compared to the existing zoning.
- Even though  Option 2 has a higher trip generation than the existing zoning, Option 2

reduces reliance on single occupancy vehicles through more multimodal mixed use land use zoning, which reduces the amount of general commercial zoned land, increases the amount of mixed use residential and retail development, and employs transit oriented design and management policies. These changes in land use encourage walking, bicycling, and transit use, which meet the goals of Metro's *Urban Growth Management Functional Plan* Title 6 requirements, allowing it to qualify for a 30 percent mixed use trip reduction credit.

- As a result of the increase in net new trips, the City of Tigard and the Oregon Department of Transportation may consider pursuing a Multimodal Mixed –Use Area (MMA) designation. To support the MMA designation, the project team has completed a queuing analysis of the OR-217 off-ramp  OR-99W and SW 72<sup>nd</sup> Avenue. The queuing analysis is documented in a separate memorandum.

**Table 1. Trip Generation Summary for All Options**

	PM Peak Hour	Daily
Existing Zoning	2,083	21,438
Option 1	3,134	32,862
Option 2 (Recommended Option)	2,192	22,486
<b>Net New Trips Option 2 compared to Existing Zoning</b>	<b>109</b>	<b>1,048</b>

## Land Use and Infrastructure Options

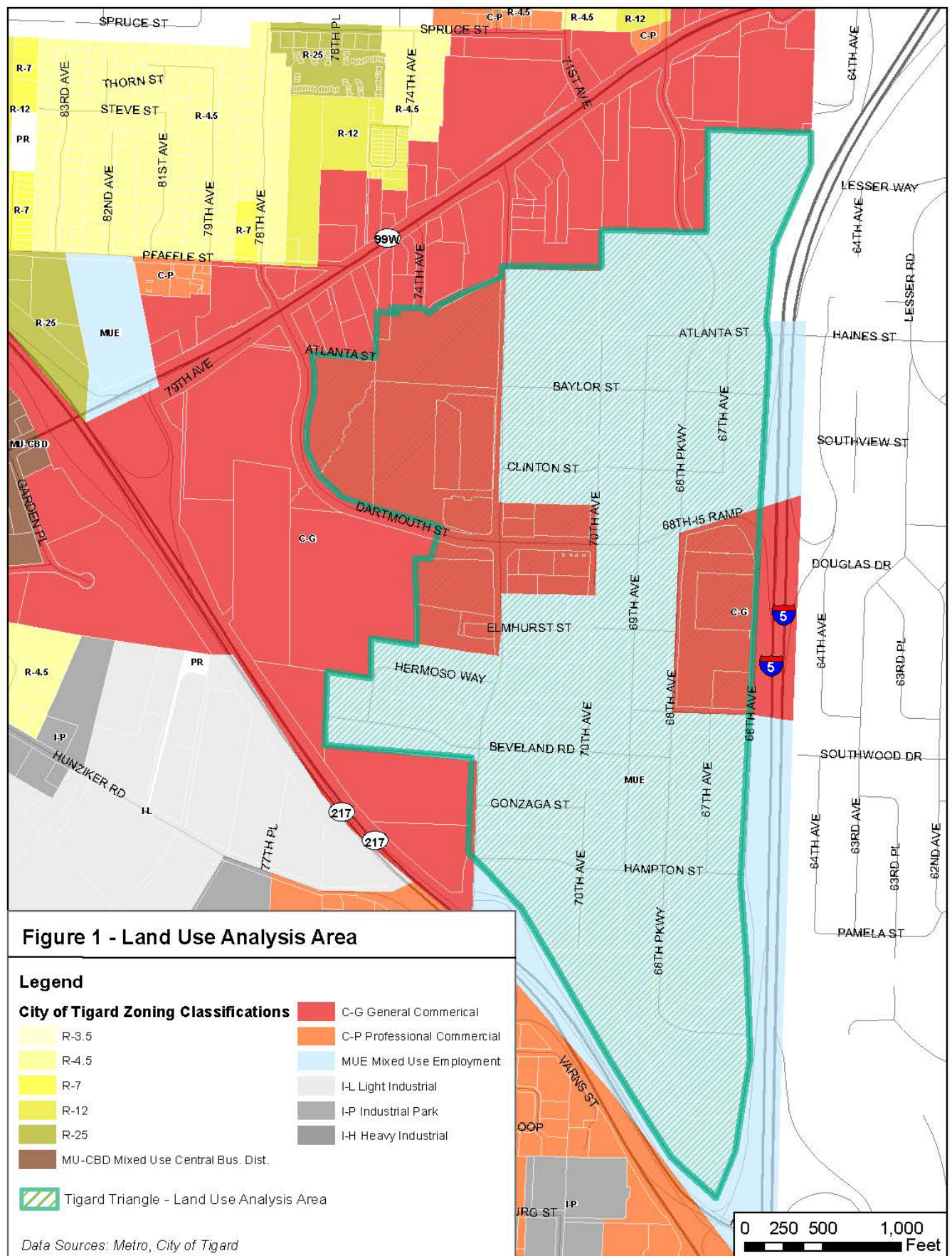
This section provides a summary of the development of the land use and infrastructure options where potential zoning or site design standards changes are proposed, as illustrated on Figure 1. Three options are evaluated in this memorandum.

### Existing Zoning

The *Existing Conditions Report* (September 2013) provided an analysis of the existing zoning and development standards within the Triangle. That information served as the basis for considering a range of potential land use and infrastructure options. Existing zoning in the Tigard Triangle is primarily composed of Mixed-Use Employment (MUE), which permits both commercial and multifamily residential development, and General Commercial (C-G), which permits large format retail development.

The C-G zone also permits a limited amount of multifamily residential uses as part of a planned development. The Tigard Community Development Code also includes zone-specific development standards (building height, setbacks, and landscaping) and citywide requirements related to parking, tree canopy, and street/utility improvements. In addition, there are design standards specific to properties within the Triangle.





## Option 1: Refine Site Design Standards – Keep Zoning

### *Land Use Components of Option 1*

Option 1 maintains the existing densities allowed in the MUE and CG zoning districts, and no changes to permitted uses are proposed except for restrictions on auto-oriented uses such as drive-throughs, gas stations and other uses that are not pedestrian oriented. Existing densities within the Triangle, if developed to the maximum extent possible, are adequate to provide a transit and pedestrian oriented environment, but the existing design requirements limit development potential even under current density standards. Changes to design standards would maximize the development potential without requiring significant changes in the development code. Key components of Option 1 include:

- Generally maintaining the currently allowed land use densities:
- Changing site design requirements to permit more lot coverage:

## Option 2: Refine Site Design Standards and increase Land Use Densities

### *Land Use Components of Option 2*


Option 2 increases land use densities from what is currently allowed in the MUE zoning district. Densities proposed are similar to other mixed use areas of Tigard such as Washington Square and Downtown Tigard. In addition, some areas that are currently zoned for general commercial uses would change to residential/mixed use. Option 2 incorporates all features of Option 1. Key components of Option 2 include:

- Within the area identified on Figure 1, Change general commercial zoning to residential/mixed use;
- Modifying site design requirements to permit more lot coverage, and in some areas, permitting taller buildings;

## Comparing the Land Use Options

**Table 2** compares the estimated new commercial and mixed use square footage and housing units for each land use option to develop trip generation estimated and associated transportation impacts of each option. As described in the land use and infrastructure options, above, primary land uses (e.g., residential, mixed use, commercial, and campus) provide density and development assumptions for how an area might develop given the current and proposed development, its location in the Triangle, and market assumptions about demand for specific types of development. The goal of the plan is to identify zoning and site development standards that will accommodate a variety of land uses. Because of the potential flexibility of zoning and permitted uses within the Triangle, the project team made assumptions based on a market feasibility study completed for this project that identified how the Triangle would likely develop. Assumptions for each option are summarized in Table 2.

**Table 2. Land Use Development Assumptions By Alternative**

	Existing Zoning		Option 1: Modify Site Design Standards		Option 2: Recommended Land Use Option			
	MUE	CG	MUE <sup>5</sup>	CG	Mixed Use Triangle (MUT)			
	Mixed Use-Employment	General Commercial	Mixed Use-Employment	General Commercial	Townhome / Apartments	Mixed Use	Mixed Use-High	Campus and Education
<b>Residential Density du/acre</b>	25 du/acre	0	25 du/acre	0	16 du/ac	30	50	NA
<b>Maximum Building Heights</b>	45 feet		45	45	55 feet	55 feet	75 feet	75 feet
<b>Floor Area Ratio</b>	.40:1 <sup>4</sup>		1:1	.40:1	NA (residential only)	1.0:1 <sup>1</sup>	1.5:1 <sup>2</sup>	 1 <sup>3</sup>
<b>Ground Floor Retail/Flex space</b>		NA	10% of ground floor	NA	NA	10% of ground floor		NA

1. Assumes that 100 percent of development will be mixed use residential or residential mixed-use. No office is assumed.

2. Assumes that 20 percent of mixed use is office, with the remaining 80 percent being mixed use residential.

3. Assumes that 100 percent of development will be mixed use office. No residential is assumed.

4. Assumes that 20 percent of the floor area is retail.

5. Assumes the following development mix: 30% multifamily; 60 percent office; 10 percent mixed use with ground floor retail

Determination of the amount of development potential was based on the assumptions identified in Table 2 and other variables that affect the amount of land available within the area proposed for zoning and site development modifications. Additional inputs included:

- Parcels with high improvement values and are already at the densities proposed under the Recommended Option were assumed to remain as they are today.
- All general commercial (GC) land within the study boundary (Figure 1) is assumed to redevelop.
- For vacant and redevelopable parcels, 25 percent of the gross acreage was removed to account for parks, off-street parking, landscaping, etc. Street right-of-way was removed prior to calculating development potential.
- Maximum residential densities identified in Table 2 were used to calculate the number of residential units rather than assuming high or low units per acre. Residential densities vary by option, with higher densities assumed under Option 2.
- Commercial and institutional square footage amounts were developed by calculating the average number of floors and parcel coverage. Floor area ratios coupled with maximum heights by subarea were used to determine the potential office square footage.

This methodology resulted in the total square footage and the number of residential units for each land use under each option, shown in Table 3. The land use options were evaluated using GIS based scenario planning tools that take into account a variety of assumptions such as constrained lands, floor area ratio, parcel coverage, building heights, and other development assumptions.

**Table 3. Net New Development Potential by Land Use Option**

Scenario	Buildable (sq. ft.)		Potential Units	Potential (sq. ft.)	Potential (sq. ft.)	Potential Retail (sq. ft.)
Existing Zoning	8,508,713	5,944,829	1,326	383,022	406,073	
Option 1	8,487,764	5,923,881	1,262	298,343	994,483	321,440
Option 2	8,487,764	5,923,881	2,195		1,087,930	240,275

The underlying assumptions for each option described earlier also become clearer when viewing the scenario planning outputs. Key results of the scenario analysis show that:

- Option 1 generally provides a similar amount of residential units and commercial square footage as the existing zoning conditions.
- Option 1 significantly increases potential office and mixed use development opportunities due to increases in FAR and site coverage compared to the existing zoning.
- Option 2 more than doubles the amount residential units, compared to other options.
- Option 2 reduces the amount of commercial square footage because it assumes that some commercial areas transition into mixed use development, resulting in an increase of both housing units and mixed use development potential.
- Option 1 provides significantly more commercial land with less housing than Option 2. Option 2 provides a denser, mixed use development pattern than Option 1 or under existing zoning.

## Evaluation of Transportation Impacts

This section evaluates the potential transportation impacts associated with the land use assumptions in **Table 3**. The evaluation transportation evaluation started with estimating the trip generation for each option and comparing that trip generation to the trip generation for the existing zoning. If an option generates the same or less trips than the existing zoning, the option is considered to have not significant impacts on the transportation system and no transportation analysis was performed.

### Trip Generation

Initial gross trip generation was based on the Institute of Transportation Engineers (ITE) Trip Generation Handbook (9<sup>th</sup> Edition) with adjustment based on trip distribution patterns from the Metro travel demand model and trip assignment changes associated with each option. The trip generation evaluation was broken into the following steps.

1. Gross trip generation
2. Internal trip reduction
3. Pass-by trip reduction
4. Mixed use reduction
5. Net new trip generation

The determination of potential transportation impacts for the build options is based on the net new trip for the build options compared to existing zoning.



## Gross Trip Generation

Gross trip generation is based on trip generation rates from the ITE Trip Generation Handbook (9<sup>th</sup> Edition) the land uses assumed for each scenario. Both daily and PM peak hour trip generation were calculated for each option. **Table 4** provides a summary of the assumed gross trip generation rates for each land use type.

**Table 4. ITE Trip Generation Rates**

Land Use	ITE Code	ITE Rate*	
		PM Peak Hour	Daily
Office (Per 1,000 sq. ft.)	710 General Office	1.49	11.03
General Commercial (Per 1,000 sq. ft.)	820 Shopping Center	3.71	42.7
High-Rise Condo (Per Dwelling Unit)	232 Condo/Townhouse	0.38	4.18
Condo/Townhouse (Per Dwelling Unit)	230 Condo/Townhouse	0.52	5.81
Retail Mixed Use Flex Space Office (Per 1,000 sq. ft.)	826 Specialty Retail	2.71	44.32

## Internal Trip Reduction

ITE trip generation methodology allows for a reduction in the gross trip production for trips that are internal to the project area and do not impact the transportation system outside the project area. ITE provides a procedure to calculate internal trip reductions based on the amount of compatible land uses in the project area. For example a home to office trip or office to restaurant trip could be made internal to the project area. However, the ITE procedures are based on observations at single multi-use development sites and are not applicable to a larger community planning area like the Tigard Triangle. Using the ITE procedures would result in internal trip reduction rates that underrepresent the transportation impacts of land use in the Tigard Triangle study area.

To get a more realistic estimate of internal trips and the associated trip changes, the Metro travel demand model is a better tool as it is designed to look at travel demand at a community and regional level. The sum of the trips being made between and internal to the Transportation Analysis Zones (TAZs) that make up the Tigard Triangle study area in the Metro model estimate of the internal trip potential in the Tigard Triangle. The Metro year 2010 model shows 6.7 percent of trips are internal to the three TAZs that represent the Tigard Triangle under the existing zoning. The Metro year 2035 model show an internal trip rate of 9.7 percent for Tigard Triangle, which is more representative of Options 1 and 2. Based on the Metro travel demand models, **Table 5** shows the internal trip reduction rate used for each of the option. The internal reduction rate is applied to the gross trip production.

**Table 5. Internal Trip Reduction Rate**

Land Use	Internal Trip Reduction Rate
Existing Zoning	6.7 %
Option 1	9 %
Option 2 (Recommended Option)	9 %

### Pass-by Trip Reduction

Pass-by trips are vehicle trips that are already on the roadway for a different primary trip purpose but also represent a trip to a Tigard Triangle land use as a secondary trip. An example would be a driver stopping at a convenience store on their way home from work. The trip from work to home is the primary trip and would be made regardless of the convenience store being there. Stopping at the convenience store is also a trip but it is not a new trip and does not add additional impact on the transportation system outside of the additional turns in and out of the convenience store. The trip to the convenience store is a pass-by trip and is subtracted from the non-internal trips to get net new trips on the transportation system.

The ITE Trip Generation Handbook provided pass-by rates for some land use types. For this study, the shopping center rate (code 820) was used for both the general commercial and retail flex space as it is the most representative of the land use types available. The average shopping center pass-by rate of 34 percent was used for the existing zoning, Option 1, and Option 2 based on table F.9 of the Trip Generation Handbook, 3<sup>rd</sup> Edition. **Table 6** shows the pass-by reduction rate used for each option.

**Table 6. Pass-by Trip Reduction Rate**

Land Use	Pass-by Reduction Rate*
Existing Zoning	34 %
Option 1	34 %
Option 2 (Recommended Option)	34 %

\*Rate includes pass-by and diverted link trips

### Mixed Use Reduction

Title 6 of Metro's Urban Growth Management Functional Plan (Metro Code Sections 3.07.610 –3.07.650) allows Centers, Corridors, Station Communities and Main Streets to take an automatic reduction of 30 percent below the vehicular trip generation rates recommended by the Institute of Transportation Engineers when analyzing the traffic impacts, pursuant to OAR 660-012-0060, if the jurisdiction adopts a boundary for the area, land use regulations allow and promote a mix of uses and a plan to achieve the non-single occupancy vehicle mode share targets in the Regional Transportation Functional Plan including:

- 1) Transportation system designs for streets, transit, bicycles, and pedestrians;
- 2) A transportation system or demand management plan; and
- 3) A parking management program for the Center, Corridor, Station Community or Main Street.

In reviewing the three options for the Tigard Triangle, it appears that the Recommended Option meets the requirements of Metro's Urban Growth Management Functional Plan. The plan meets these requirements because:

- The City of Tigard will identify a Town Center boundary for the area where the proposed zone changes and design standards modifications are proposed. Within the Town Center boundary:
  - Auto dependent uses will be restricted;
  - The proposed land use development pattern is pedestrian focused and transit supportive;
  - Off-street parking minimums will be reduced. Additionally, the Tigard Triangle Redevelopment Strategy recommends developing a long-term parking management plan that identifies steps to manage parking demand;
  - Additional road, bicycle and pedestrian connections will be incorporated into the City's Transportation System Plan, Parks and Trails Master Plans.

For these reasons, applying the 30 percent mixed use reduction for Option 2 is warranted because it meets the requirements of Title 6 of Metro's Urban Growth Management Functional Plan. The 30 percent reduction is applied to the gross ITE trip generation to get the net new trips. Per ODOT direction no additional pass-by reduction was taken in applying the 30 percent mixed use reduction. **Table 7** shows the mixed use reduction rate used for each option.

**Table 7. Mixed Use Reduction Rate**

Land Use	Pass-by Reduction Rate*
Existing Zoning	0 %
Option 1	0 %
Option 2 (Recommended Option)	30 %

### Net New Trips

With the gross trip generation and trip reductions for internal trips, pass-by trips and net new trips were calculated for each option. In addition, the net new trips for Option 2 were calculated using a 30 percent mixed use reduction of the gross trips and a pass-by reduction. **Tables 8-10** provide a summary of the trip generation for the existing zoning, Option 1 and Option 2 (Recommended Option), respectively.

**Table 8. Existing Zoning Trip Generation Summary**

Land Use	ITE Code	Units	PM Peak Hour	Daily
Office	710 General Office	406,073    s.f.	605	4,479
Internal Trips (6.7%)*			41	300
Net New Trips			565	4,179
General Commercial	820 Shopping Center	383,022    s.f.	1,421	16,355
Internal Trips (6.7%)*			95	1,096
Pass-By Trips (34%)**			451	5,188
Net New Trips			875	10,071
Dwelling Units	230 Condo/Townhouse	1,326    Units	690	7,704
Internal Trips (6.7%)*			46	516
Net New Trips			643	7,188
Retail Flex space	826 Specialty Retail	0    s.f.	0	0
Internal Trips (6.7%)*			0	0
Pass-By Trips (34%)**			0	0
Net New Trips			0	0
Trips Generated			2,716	28,538
Internal Trips			182	1,912
Pass-By Trips			451	5,188
Net New Trips			2,083	21,438

NOTES:

\* Internal trips based on 2010 VISUM travel demand model for Tigard Triangle area

\*\* Pass-By trip percentages were based on table F.9 of the Trip Generation Handbook, 3<sup>rd</sup> Edition.



**Table 9. Option 1 Trip Generation Summary**

Land Use	ITE Code	Units	PM Peak Hour	Daily
Office	710 General Office	994,483    s.f.	1,482	10,969
Internal Trips (9%)*			133	987
Net New Trips			1,348	9,982
General Commercial	820 Shopping Center	298,343    s.f.	1,107	12,739
Internal Trips (9%)*			100	1,147
Pass-By Trips (34%)**			342	3,942
Net New Trips			665	7,651
Dwelling Units	230 Condo/Townhouse	1,262    Units	656	7,332
Internal Trips (9%)*			59	660
Net New Trips			597	6,672
Retail Flex space	826 Specialty Retail	321,440    s.f.	871	14,246
Internal Trips (9%)*			78	1,282
Pass-By Trips (34%)**			270	4,408
Net New Trips			523	8,556
Trips Generated			4,116	45,287
Internal Trips			370	4,076
Pass-By Trips			612	8,349
Net New Trips			3,134	32,862

NOTES:

\* Internal trips based on 2035 VISUM travel demand model for Tigard Triangle area

\*\* Pass-By trip percentages were based on table F.9 of the Trip Generation Handbook, 3<sup>rd</sup> Edition.

**Table 10. Option 2 Trip Generation Summary**

Land Use	ITE Code	Units		PM Peak Hour	Daily
Office	710	1,087,930	s.f.	1,621	12,000
Internal Trips (9%)*	General Office			146	1,080
Net New Trips				1,475	10,920
General Commercial	820	0	s.f.	0	0
Internal Trips (9%)*	Shopping Center			0	0
Pass-By Trips (34%)**				0	0
Net New Trips				0	0
Dwelling Units	232	2,012	Units	765	8,410
Internal Trips (9%)*	High-Rise			69	757
Net New Trips	Condo/Townhouse			696	7,653
Dwelling Units	230	183	Units	95	1,063
Internal Trips (9%)*	Condo/Townhouse			9	96
Net New Trips	e			87	968
Retail Flex space	826	240,275	s.f.	651	10,649
Internal Trips (9%)*	Specialty Retail			59	958
Pass-By Trips (34%)**				201	3,295
Net New Trips				391	6,396
Trips Generated				3,132	32,122
Internal Trips				282	2,891
Pass-By Trips				201	3,295
Net New Trips				2,649	25,936
Using 30% mixed use reduction					
Trips Generated				3,132	32,122
Mixed use reduction (30%)				940	9,637
Net New Trips				2,192	22,486

**NOTES:**

\* Internal trips based on 2035 VISUM travel demand model for Tigard Triangle area

\*\* Pass-By trip percentages were based on table F.9 of the Trip Generation Handbook, 3<sup>rd</sup> Edition.

## Conclusion

As shown in **Table 11**, Option 2 (Recommended Option) produces an increase in net new trips compared to the Existing Zoning Option. As a result, Option 2 may have an effect on the transportation system compared to the existing zoning.

**Table 11. Trip Generation Summary for All Options**

Net New Trips	PM Peak Hour	Daily
Existing Zoning	2,083	21,438
Option 1	3,134	32,862
Option 2 (Recommended Option)	2,192	22,486
<b>Net New Trips Option 2 compared to Existing Zoning</b>	<b>+109</b>	<b>+1,048+</b>

# Transportation Sensitivity Analysis

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## Supporting Maps



## Study Areas

City of Tigard Oregon

### Primary Study Area

## Secondary Study Area

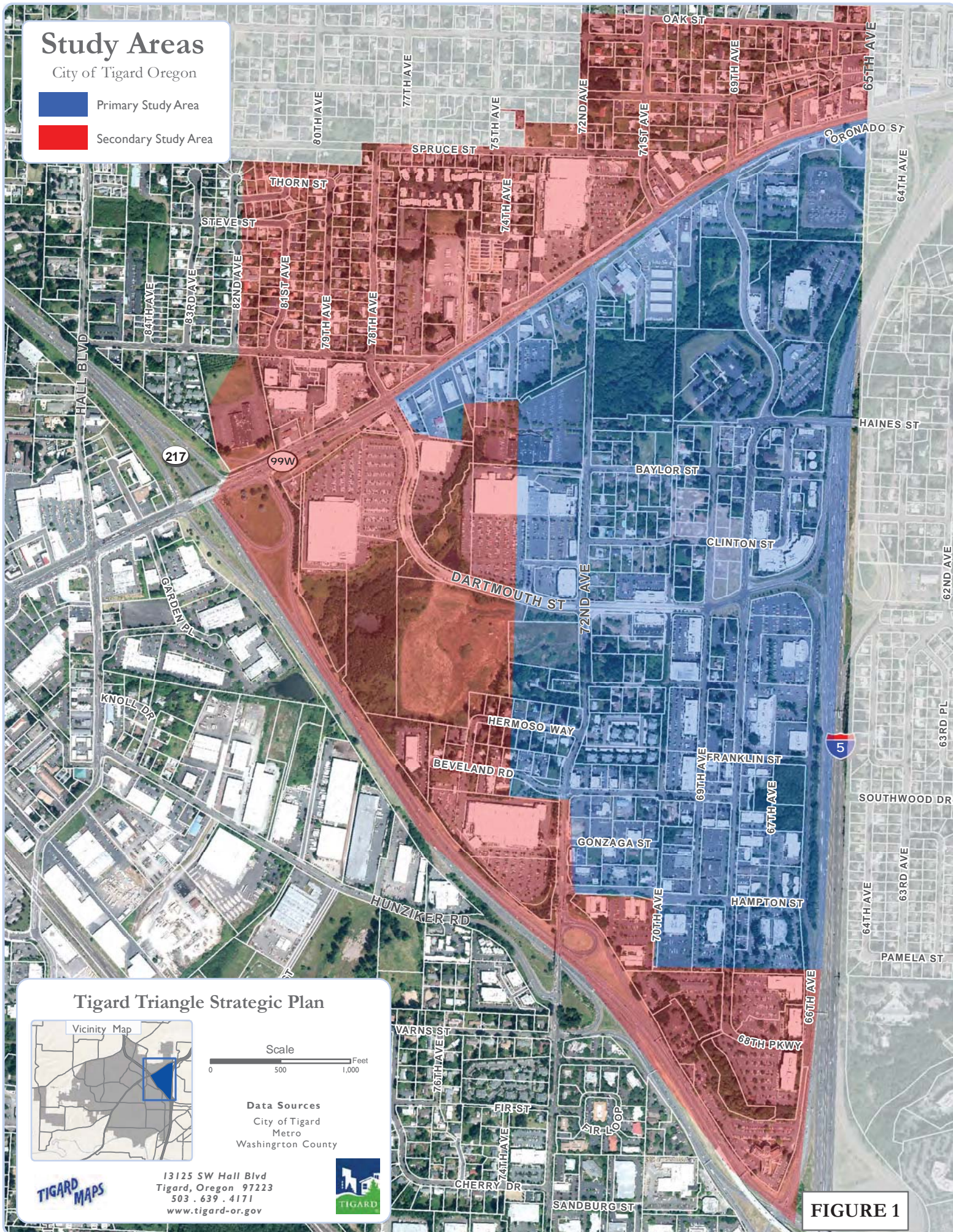


FIGURE 1



# Zoning Classifications

City of Tigard Oregon

R-3.5 10,000 Sq Ft Min Lot Size	C-G General Commercial
R-4.5 7,500 Sq Ft Min Lot Size	C-P Professional Commercial
R-7 5,000 Sq Ft Min Lot Size	MUE Mixed Use Employment
R-12 3,050 Sq Ft Min Lot Size	I-L Light Industrial
R-25 1,480 Sq Ft Min Lot Size	I-P Industrial Park
MU-CBD Mixed Use Central Bus Dist	I-H Heavy Industrial

## Overlay Zones

Planned Development Overlay

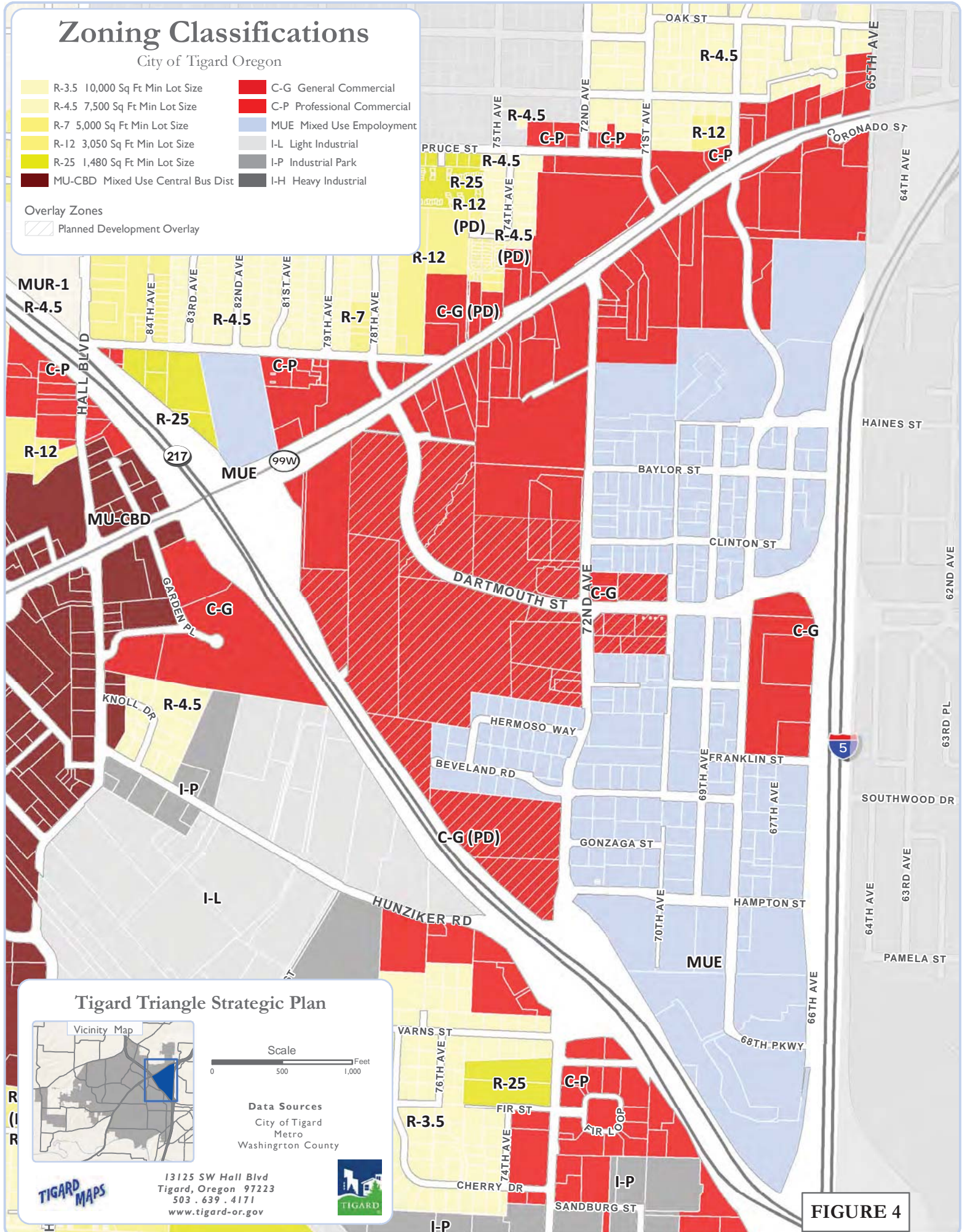
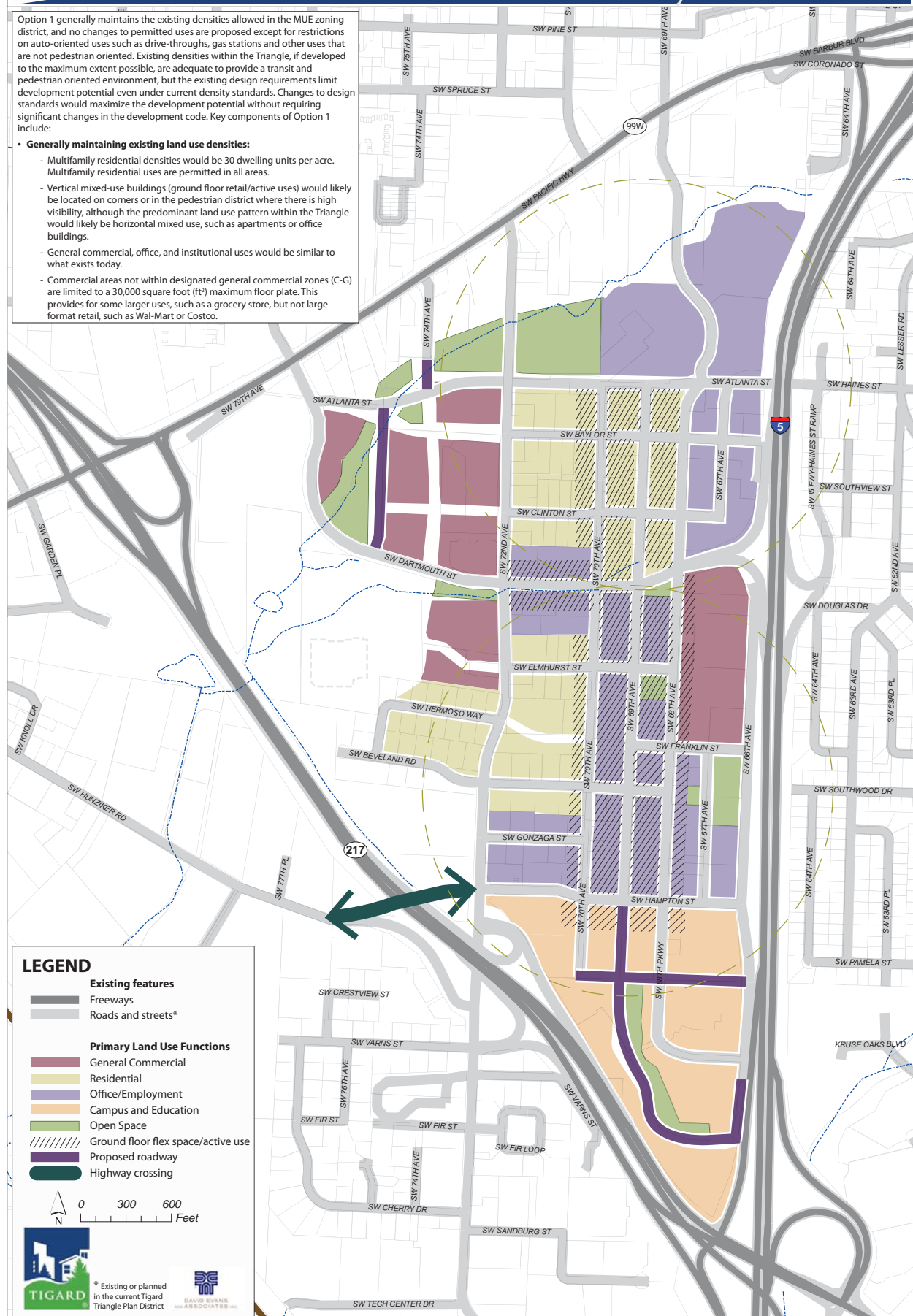


FIGURE 4

Option 1 generally maintains the existing densities allowed in the MUE zoning district, and no changes to permitted uses are proposed except for restrictions on auto-oriented uses such as drive-throughs, gas stations and other uses that are not pedestrian oriented. Existing densities within the Triangle, if developed to the maximum extent possible, are adequate to provide a transit and pedestrian oriented environment, but the existing design requirements limit development potential even under current density standards. Changes to design standards would maximize the development potential without requiring significant changes in the development code. Key components of Option 1 include:

• **Generally maintaining existing land use densities:**

- Multifamily residential densities would be 30 dwelling units per acre. Multifamily residential uses are permitted in all areas.
- Vertical mixed-use buildings (ground floor retail/active uses) would likely be located on corners or in the pedestrian district where there is high visibility, although the predominant land use pattern within the Triangle would likely be horizontal mixed use, such as apartments or office buildings.
- General commercial, office, and institutional uses would be similar to what exists today.
- Commercial areas not within designated general commercial zones (C-G) are limited to a 30,000 square foot (ft²) maximum floor plate. This provides for some larger uses, such as a grocery store, but not large format retail, such as Wal-Mart or Costco.

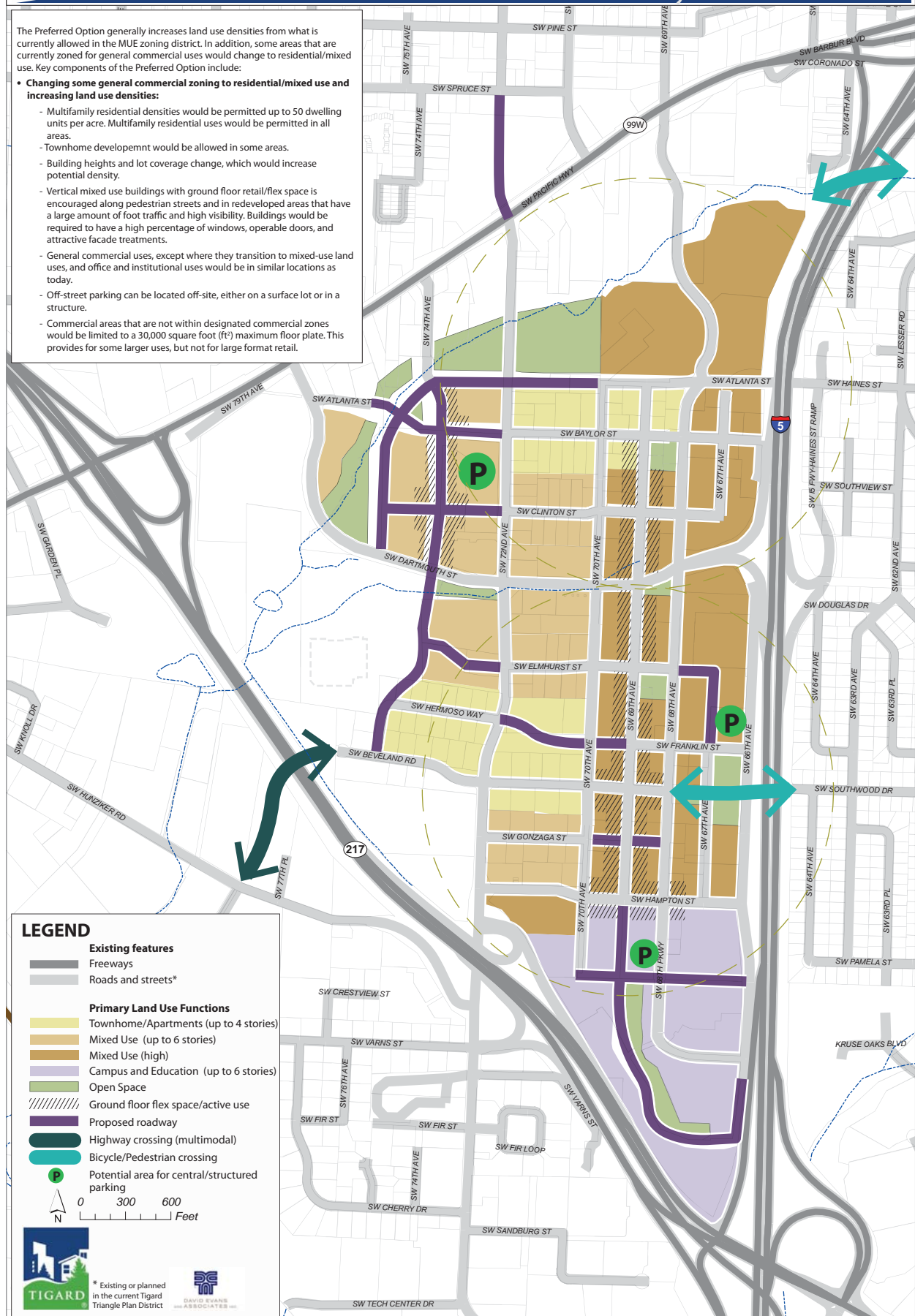




The Preferred Option generally increases land use densities from what is currently allowed in the MUE zoning district. In addition, some areas that are currently zoned for general commercial uses would change to residential/mixed use. Key components of the Preferred Option include:

• **Changing some general commercial zoning to residential/mixed use and increasing land use densities:**

- Multifamily residential densities would be permitted up to 50 dwelling units per acre. Multifamily residential uses would be permitted in all areas.
- Townhome development would be allowed in some areas.
- Building heights and lot coverage change, which would increase potential density.
- Vertical mixed use buildings with ground floor retail/flex space is encouraged along pedestrian streets and in redeveloped areas that have a large amount of foot traffic and high visibility. Buildings would be required to have a high percentage of windows, operable doors, and attractive facade treatments.
- General commercial uses, except where they transition to mixed-use land uses, and office and institutional uses would be in similar locations as today.
- Off-street parking can be located off-site, either on a surface lot or in a structure.
- Commercial areas that are not within designated commercial zones would be limited to a 30,000 square foot (ft²) maximum floor plate. This provides for some larger uses, but not for large format retail.



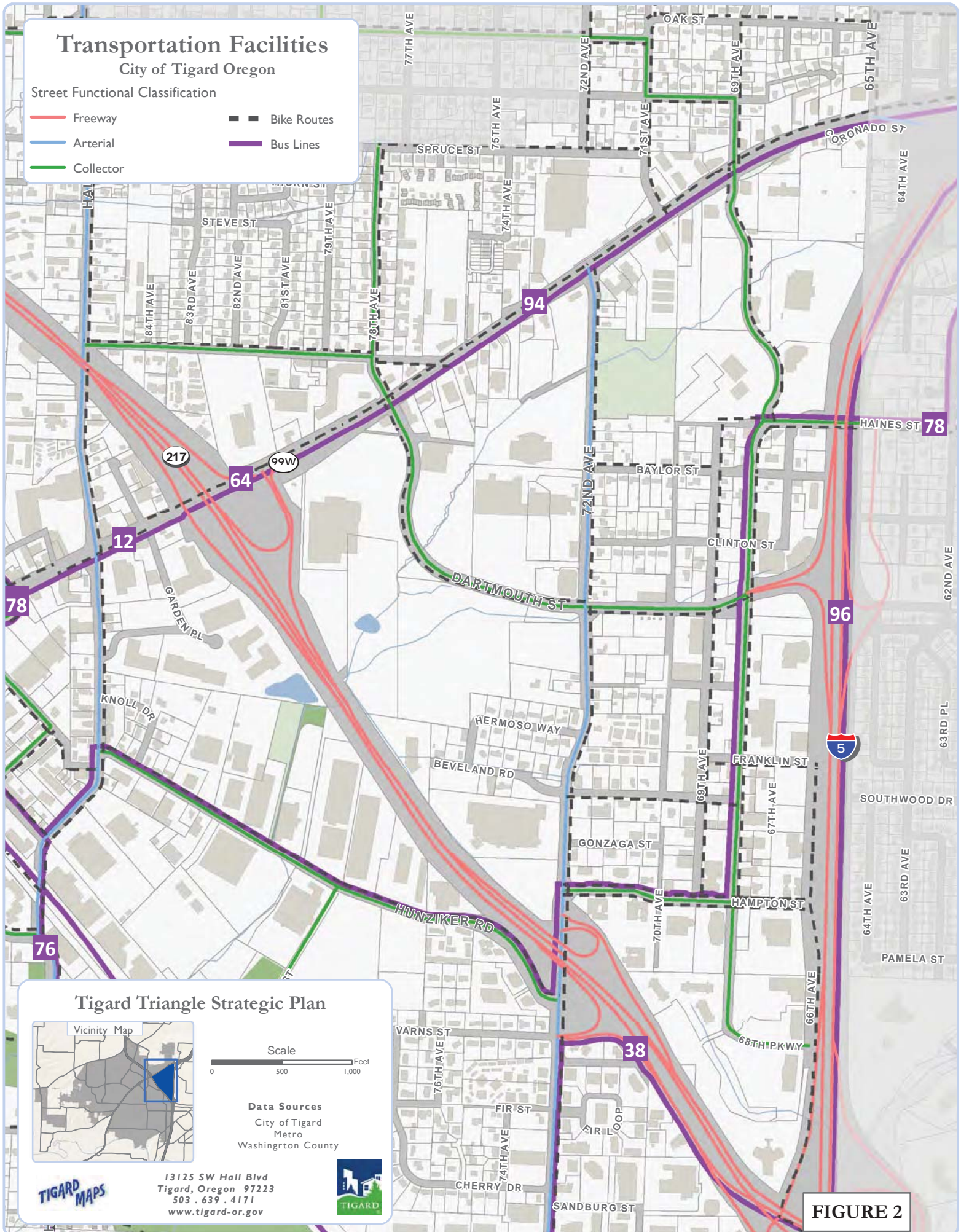


# Transportation Facilities

City of Tigard Oregon

## Street Functional Classification

- Freeway
- Arterial
- Collector
- - - Bike Routes
- Bus Lines



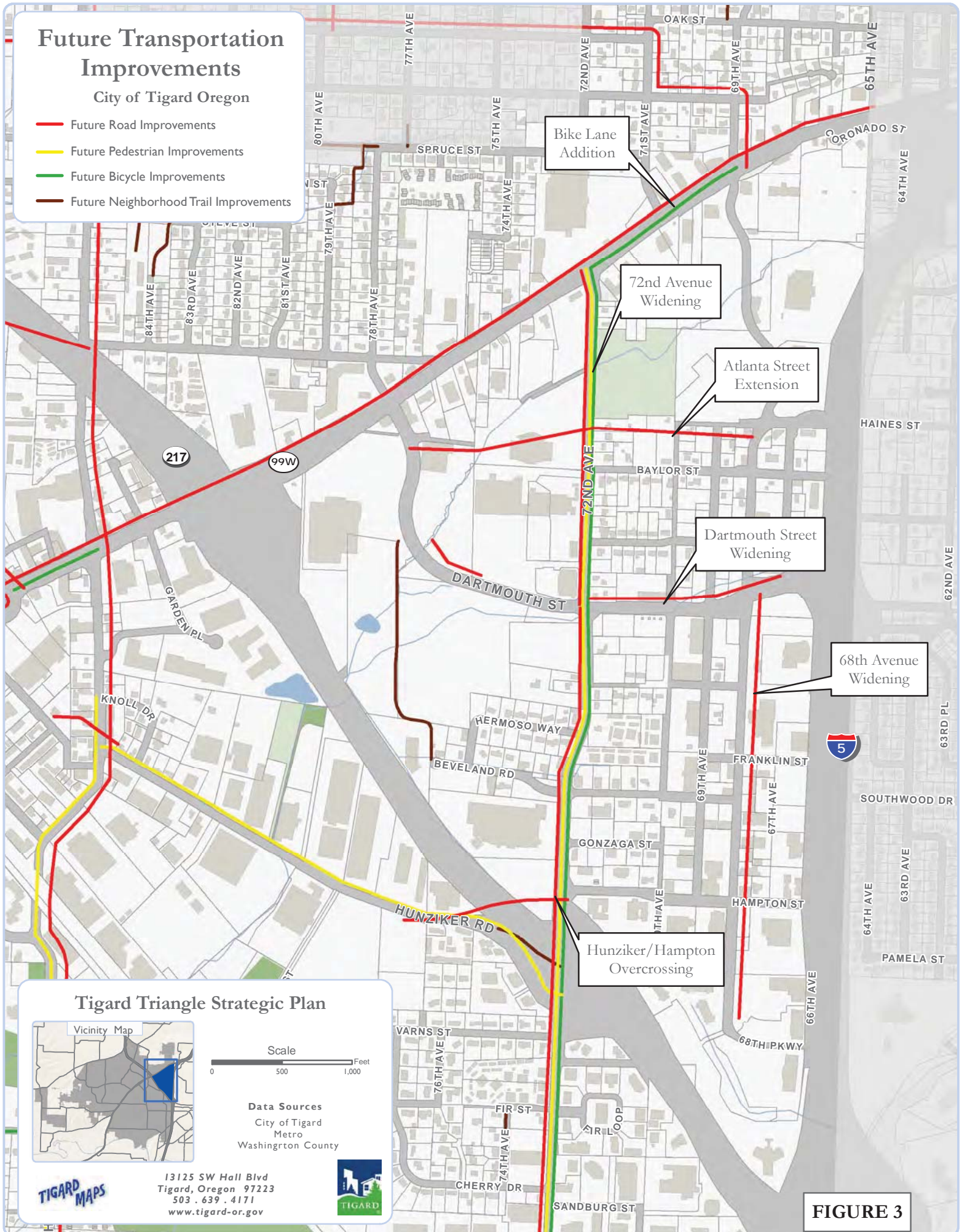
**FIGURE 2**



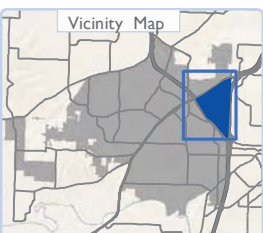
# Future Transportation Improvements

City of Tigard Oregon

- Future Road Improvements
- Future Pedestrian Improvements
- Future Bicycle Improvements
- Future Neighborhood Trail Improvements



## Tigard Triangle Strategic Plan



Scale  
0 500 1,000 Feet

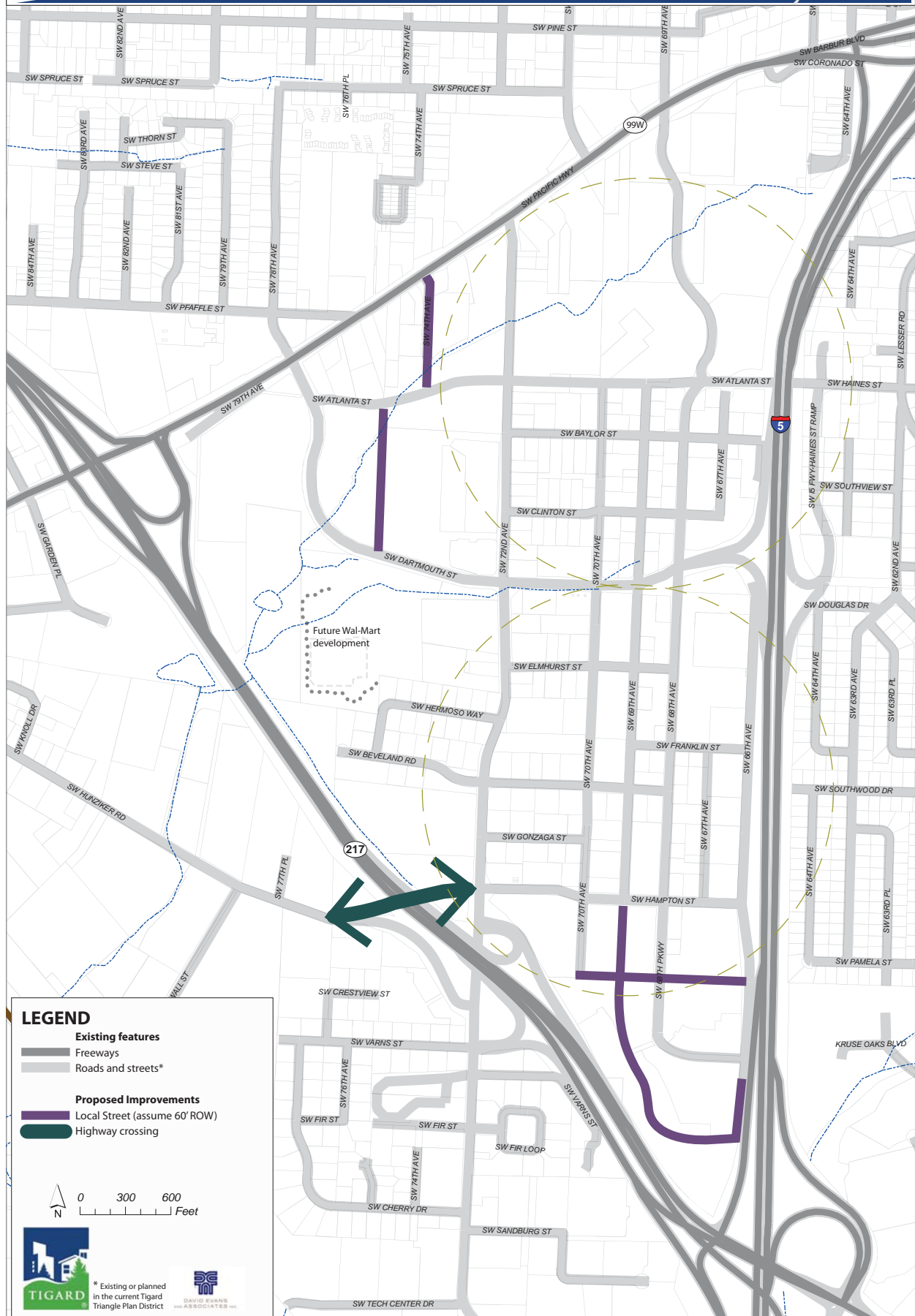
Data Sources  
City of Tigard  
Metro  
Washington County

TIGARD MAPS

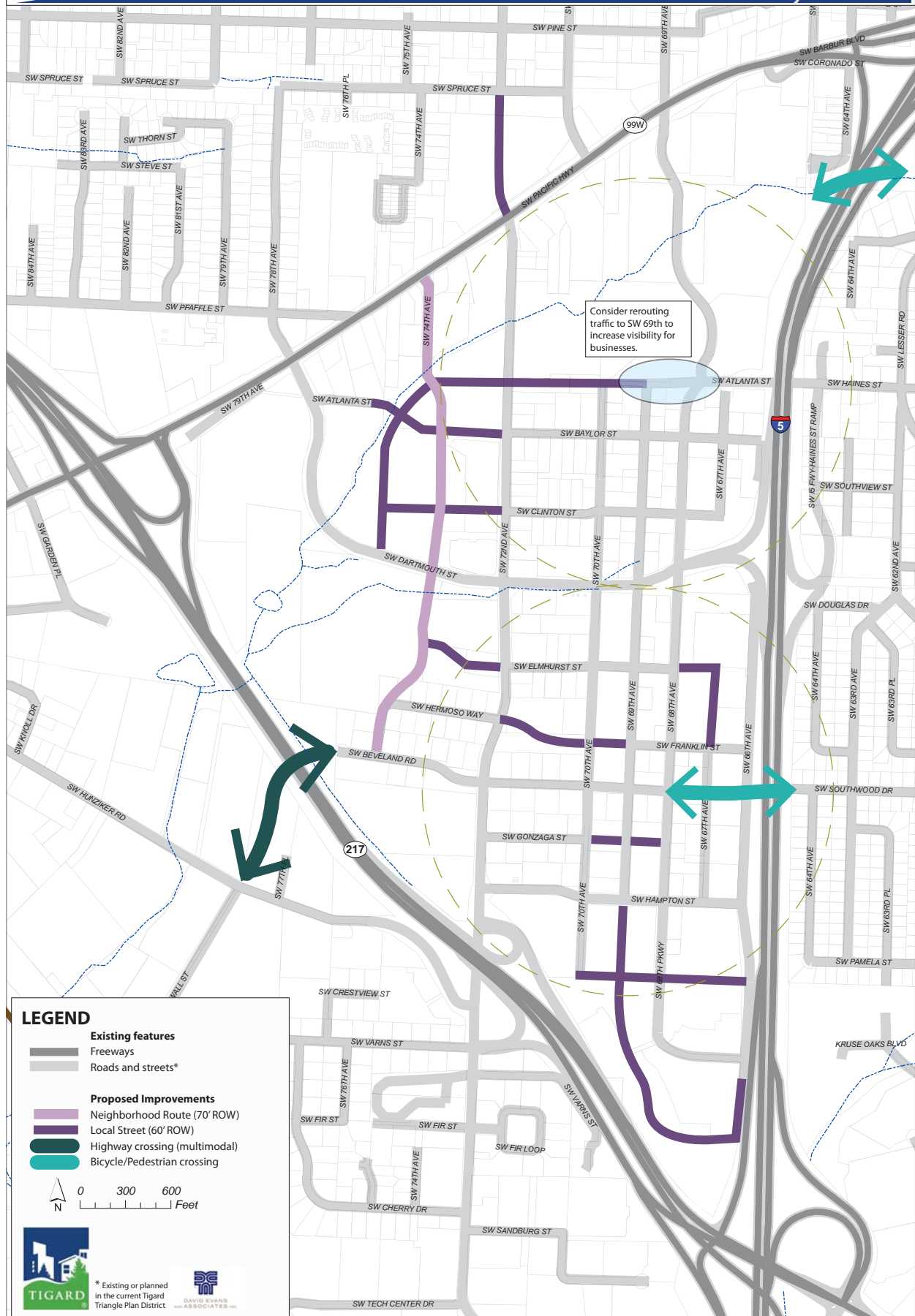
13125 SW Hall Blvd  
Tigard, Oregon 97223  
503 . 639 . 4171  
www.tigard-or.gov



FIGURE 3









# City of Tigard Tigard Triangle STRATEGIC PLAN

**DATE:** February 27, 2015

**TO:** Cheryl Caines, City of Tigard  
Tom McGuire, City of Tigard  
Mike McCarthy, City of Tigard  
Lidwien Rahman, ODOT  
Doug Baumgartner, ODOT

**FROM:** Scott Harmon, David Evans and Associates, Inc.

**SUBJECT:** **DRAFT OR-217 Off-Ramp Queuing Analysis**

**PROJECT:** ODOT0000-0801 - Tigard Triangle Strategic Redevelopment Plan

**COPIES:** File

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## Introduction

This memorandum documents the queuing analysis completed to identify the potential transportation impacts associated with Recommended Land Use and Infrastructure Option (Recommended Option) for the Tigard Triangle Redevelopment Strategy. The queuing analysis has been completed because of the anticipated slight increase in net new trips produced in the study area by the Recommended Option. The queuing analysis will support a Multimodal Mixed-Use Area (MMA) designation should the City of Tigard and the Oregon Department of Transportation (ODOT) choose to seek an MMA.

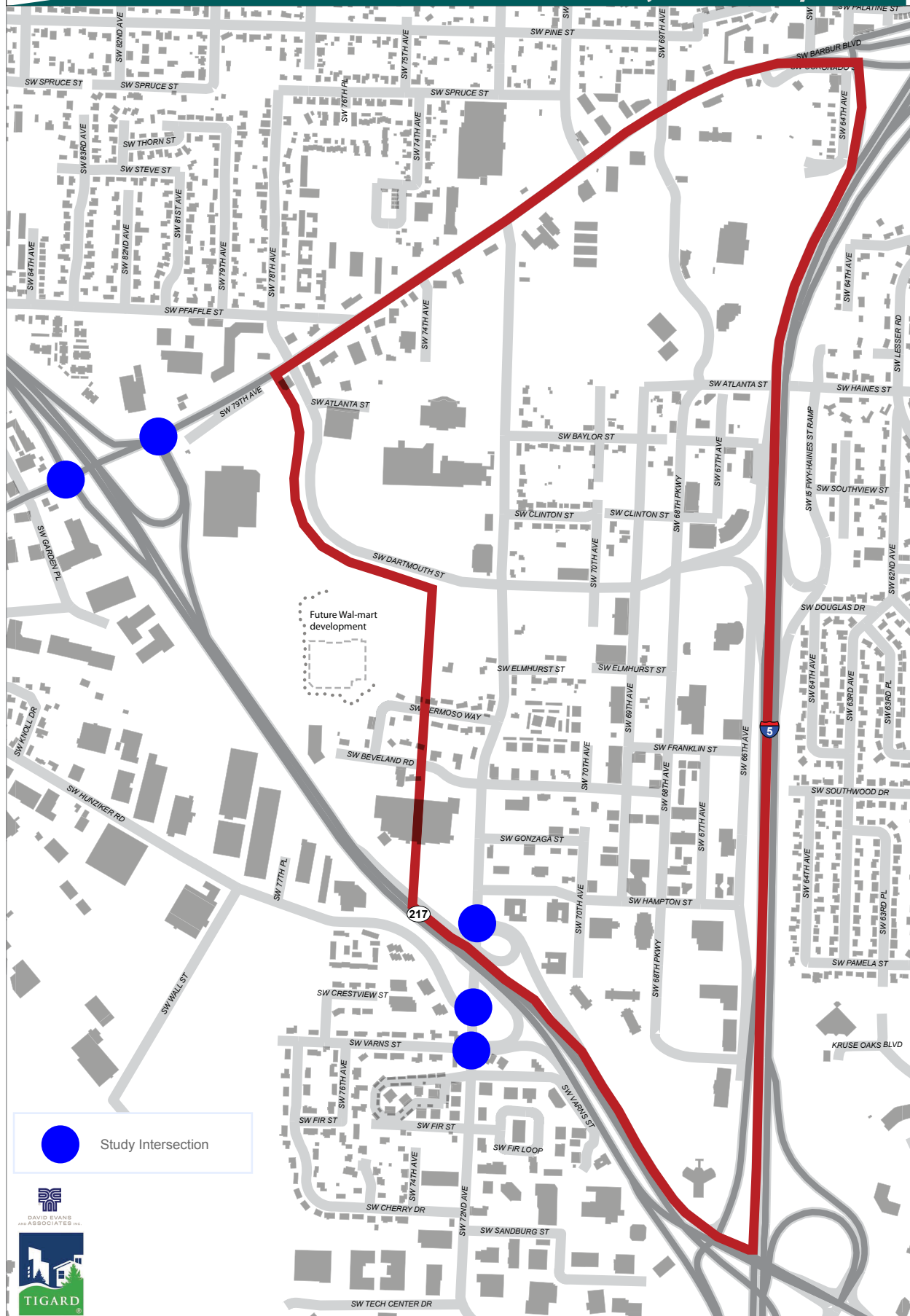
## Study Area

For the queuing analysis, five intersections were modeled in the vicinity of the project area, shown on Figure 1 and listed below:

- OR-99W at OR-217 Northbound Ramp Terminal
- OR-99W at OR-217 Southbound Ramp Terminal
- SW 72<sup>nd</sup> Avenue at OR-217 Northbound Ramp Terminal
- SW 72<sup>nd</sup> Avenue at SW Hunziker Street
- SW 72<sup>nd</sup> Avenue at OR-217 Southbound Ramp Terminal

## 2035 Tigard Triangle Trip Generation

Land use and trip generation assumptions for various land uses were summarized in detail in the Transportation Sensitivity Analysis Memorandum, (February 2015, under separate cover). Table 1 below lists the assumed land uses and the net new trips for the Recommend Option (Option 2, assuming a 30% mixed use reduction per Title 6 of Metro's Urban Growth Management Functional Plan):



**Table 1: Recommended Option Assumptions**

<b>Recommend Option Assumption:</b>	
Gross Buildable Area (sq. ft.)	8,487,764
Net Buildable Area (sq. ft.)	5,923,881
Potential New Dwelling Units	2,195
Potential General Commercial (sq. ft.)	0
Potential Office Floor Area (sq. ft.)	1,087,930
Potential Retail Mixed Use Flex Space Floor Area (sq. ft.)	240,275
PM Peak Hour Net New Trips	2,192
Daily Net New Trips	22,486

## 2035 Volume Development

The volume development methodology is a seven step process based on the methodology and procedures outlined in ODOT's Transportation Planning and Analysis Unit's (TPAU) Analysis Procedures Manual (APM) and NCHRP 255. The seven steps are summarized below:

1. Determine Existing Peak Hour
2. Seasonally Adjust Existing Traffic Counts
3. Determine Background Growth using Metro's Regional Travel Demand Model
4. Grow Existing Volumes to 2035 Background Volumes
5. Determine Trip Distribution for Tigard Triangle Zone Change
6. Apply Trip Distribution to Trips from Tigard Triangle Zone Change
7. Add Tigard Triangle Zone Change Trips to 2035 Background Volumes

A detailed explanation of each step is summarized in the memorandum titled 2035 Volume Development Methodology (attached for reference). Final 2035 traffic volumes are included in Table 2 below:

**Table 2: 2035 with Tigard Triangle Recommended Option Traffic Volumes**

<b>Intersection:</b>	<b>OR-99W (E-W) @</b>	<b>OR-99W (E-W) @</b>	<b>SW 72<sup>nd</sup> Ave (N-S)</b>	<b>SW 72<sup>nd</sup> Ave (N-S)</b>	<b>SW 72<sup>nd</sup> Ave (N-S)</b>
	<b>217 NB (N-S)</b>	<b>217 SB (N-S)</b>	<b>@ 217 NB (E-W)</b>	<b>@ SW Hunziker St (E-W)</b>	<b>@ 217 SB (E-W)</b>
Eastbound Left	0	0	0	100	25
Eastbound Thru	1,830	1,680	0	0	5
Eastbound Right	420	260	0	265	5
Westbound Left	0	60	385	0	120
Westbound Thru	1,860	2,045	0	0	5
Westbound Right	780	0	450	0	150
Northbound Left	245	0	0	165	5
Northbound Thru	0	0	675	1,095	1,085
Northbound Right	135	0	520	0	140
Southbound Left	0	570	435	0	335
Southbound Thru	0	5	1,000	915	820
Southbound Right	0	265	0	470	25
<b>Total Entering Volume</b>	<b>5,270</b>	<b>4,885</b>	<b>3,465</b>	<b>3,010</b>	<b>2,720</b>

The step by step volume development table is attached for reference.

## Queuing Analysis

Once 2035 traffic volumes were developed, volumes were input into Synchro/SimTraffic version 9. Synchro and SimTraffic settings were entered according to Chapters 8 and Chapter 9 of the APM. Existing signal timing provided by ODOT Region 1 staff was used as a starting point for the analysis. Adjustments were made at the intersection of SW 72<sup>nd</sup> Avenue and the OR-217 northbound off-ramp to provide additional green time for the off-ramp movement. This adjustment was made to reduce the amount queuing that would occur on the off-ramp. Ten seeds were simulated for both the existing and adjusted signal timing. Results are based on the average of all 10 runs for both timing scenarios. Based on the direction of ODOT Region 1 staff, only queuing for OR-217 off-ramps is reported in this memorandum. Table 3 below includes the 2035 with Tigard Triangle Recommend Option 95<sup>th</sup> percentile queue lengths:

**Table 3: 95th Percentile Queuing Results**

Locaton	Existing Timing 95% Queue (ft.)	Adjusted Timing 95% Queue (ft.)
OR-99W @ 217 Northbound Off-Ramp		
Northbound Left	500	500
Northbound Right	175	175
OR-99W @ 217 Southbound Off-Ramp		
Southbound Left	350	350
Southbound Left/Thru	375	375
Southbound Right	175	175
SW 72 <sup>nd</sup> Ave @ OR-217 Northbound Off-Ramp		
Westbound Left	>1,250*	600
Westbound Right	>1,250*	275
SW 72 <sup>nd</sup> Ave @ OR-217 Southbound Off-Ramp		
Westbound Left/Thru	175	175
Westbound Right	150	125

\* 95% queue extends past painted exit gore on collector-distributor system.

Synchro signal timing and SimTraffic queuing outputs are attached with additional details for reference.

## Next Steps

With the completion of the queuing analysis summarized in Table 3 and based on direction from ODOT staff, the next steps are for ODOT staff to calculate the safe stopping sight distance and determine where queuing exceeds this distance. In instances where the 95<sup>th</sup> percentile queue exceeds the safe stopping sight distance, ODOT and City of Tigard staff will need to determine the appropriate mitigation to reduce the 95<sup>th</sup> percentile queue.

Initials: CMG

Attachments: Memorandum – 2035 Volume Development Methodology  
Memorandum – Transportation Sensitivity Analysis  
PM Turning Movement Volume Development  
Synchro Existing Signal Timing  
SimTraffic Existing Timing Queuing Outputs  
Synchro Adjusted Signal Timing  
SimTraffic Adjusted Timing Queuing Outputs

File Name: P:\O\ODOT00000801\0600INFO\0670Reports\6LL\_MMA\_Trans\_Analysis&RecsRpt\Tigard Triangle Queuing Analysis 02-27-2015.docx