

TECHNICAL MEMORANDUM

Date: June 14, 2019 Project #: 23147

To: Dayna Webb, PE
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City of Oregon City
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From: Kristine Connolly, PE, Fred Wismer, PE, Alyssa Loveday and Caleb Cox

Project: Molalla Avenue – Beaver Creek Road to Trails End Highway (OR 213)

Subject: Traffic Analysis Memorandum

PROJECT BACKGROUND

Molalla Avenue is a key corridor for connecting Oregon City's downtown to business and college campuses. The roadway bisects a primarily residential area to the west, and commercial area to the east. Currently, the corridor is uncomfortable, unwelcoming and unaccommodating for those who are walking, biking or accessing transit. The project will improve Molalla Avenue between Beaver Creek Road and Trails End Highway (OR 213), creating a corridor that better accommodates all users. This technical memorandum describes the traffic analysis performed to support the project design which includes continuous bicycle lanes, Americans with Disability Act (ADA) compliant sidewalks and ramps, access management, traffic signal replacement and installation, street trees and lighting, transit amenities and safer street crossings.

STUDY SCOPE

This section provides an overview of the study intersections, time periods, traffic analysis methodology, applicable operating standards, and the structure of this technical memorandum.

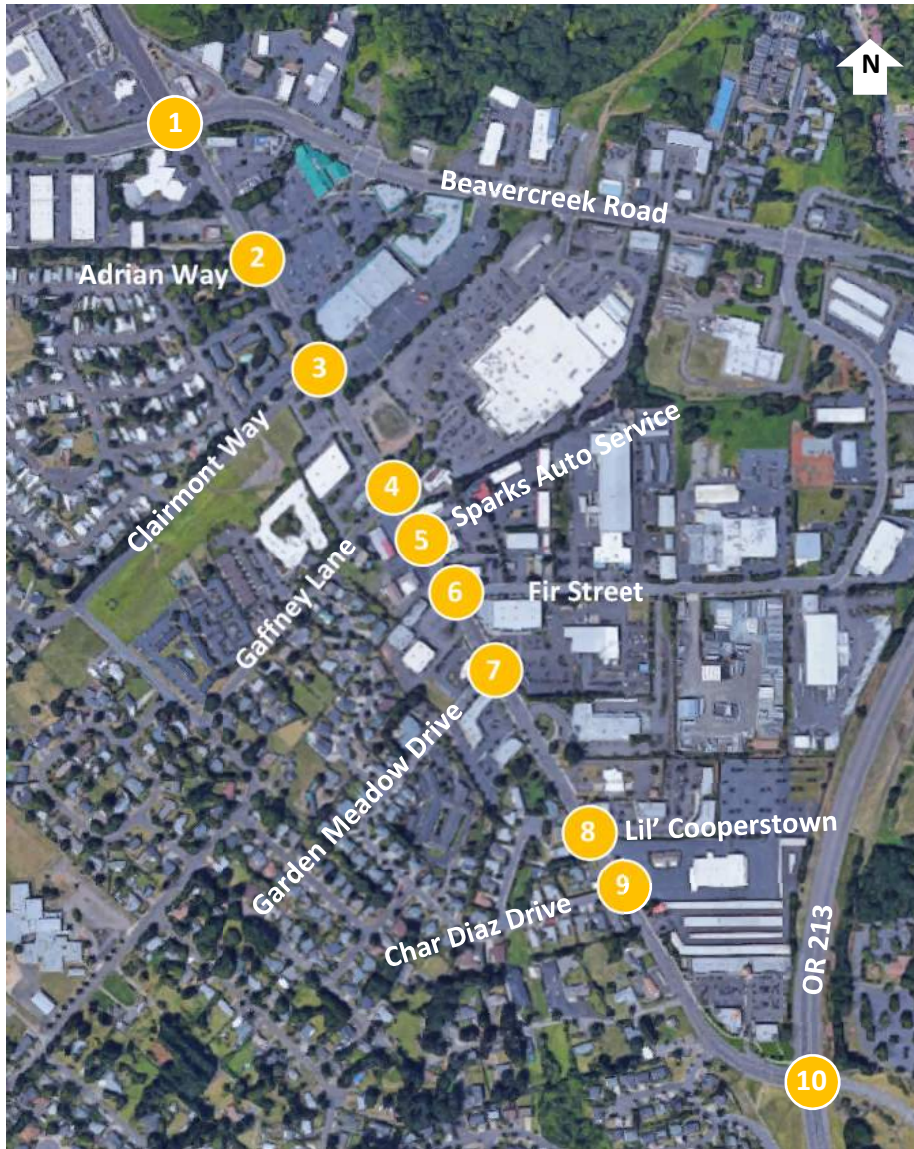
Study Intersections

Ten study intersections were included in this analysis, as shown in **Exhibit 1** and listed below:

1. Molalla Avenue & Beaver Creek Road
2. Molalla Avenue & Adrian Way
3. Molalla Avenue & Clairmont Way

4. Molalla Avenue & Gaffney Lane
5. Molalla Avenue & Sparks Auto Service Access
6. Molalla Avenue & Fir Street
7. Molalla Avenue & Garden Meadow Drive
8. Molalla Avenue & Lil' Cooperstown Access
9. Molalla Avenue & Char Diaz Drive
10. Molalla Avenue & OR 213

Exhibit 1. Study Intersections



Analysis Periods

The weekday mid-day and evening peak hour traffic volumes represent the highest traffic volumes during the day. Manual turning-movement counts were obtained at the study intersections in November 2018 during typical travel conditions (non-holiday traffic, no extreme weather, and local schools in session). The traffic volumes used in this analysis were collected on a typical mid-week day during the mid-day

(12:00 to 2:00 PM) and evening (4:00-6:00 PM) peak time periods. The mid-day and evening system peak hours were determined to be 12:00 to 1:00 PM and 4:00 to 5:00 PM, respectively. *Appendix "A" includes the count data at each of the study intersections.*

Analysis Methodology

All level-of-service analyses described in this report were performed in accordance with the procedures stated in the *2000 Highway Capacity Manual (HCM)*. *A description of level-of-service and the criteria by which they are determined is presented in Appendix "B."* Appendix "B" also indicates how level-of-service is measured and what is generally considered the acceptable range of level-of-service.

The operational analyses were performed using the *Synchro 10* traffic analysis software. *Synchro* is a software package that analyzes individual signalized and unsignalized intersections; it also enables modeling and optimizing traffic signal timings along a corridor.

Peak 15-minute flow rates were used in the evaluation of all intersection levels of service to provide analyses based on a reasonable worst-case scenario. For this reason, the analyses reflect conditions that are only likely to occur for 15 minutes out of each average peak hour.

Operating Standards

The existing mobility target for Molalla Avenue set forth in Oregon City's 2013 transportation system plan (TSP) is based on volume-to-capacity ratio (v/c). The v/c ratio is a measure that reflects mobility and quality of travel. It compares roadway demand (vehicle volumes) with roadway supply (carrying capacity). For example, a v/c of 1.0 indicates the roadway facility is operating at its capacity. An intersection can have an overall v/c ratio of less than 1.0 yet have v/c ratios greater than 1.0 for individual movements where it may take more than one signal cycle to get through the intersection and queues build up. The following mobility target is set forth in the 2013 TSP for each study intersection:

For streets located outside the Oregon City Regional Center, but designated on the Arterial and Thoroughway Network in the Regional Transportation Plan, the following mobility standard should be applied:

- *During the highest one-hour period of the day (typically but not always during the evening peak period between 4 and 6 PM): a maximum v/c ratio of 0.99 shall be maintained at all intersections. For signalized intersections, this standard applies to the intersection as a whole. For unsignalized intersections, this standard applies to the worst movement.*
- *For the second hour (either the hour before or hour after the peak hour): a maximum v/c ratio of 0.99 shall be maintained at all intersections. For signalized intersections, this standard applies to the intersection as a whole. For unsignalized intersections, this standard applies to the worst movement.*

Scope of Study

The remaining sections of this report address the following transportation issues:

- Crash data analysis for the most recent five-year period;
- Year 2018 existing traffic volumes and conditions during the weekday mid-day and PM peak hours;
- Forecast year 2040 traffic volumes and conditions during the weekday mid-day and PM peak hours;
 - Estimation of average daily traffic (ADT);
 - 95th percentile queuing analysis for the study intersections during the weekday mid-day and PM peak hours to determine storage length needs;
 - Signal warrant analysis at the Molalla Avenue & Fir Street intersection;
 - Evaluation of pedestrian crossings along Molalla Avenue at Adrian Way, Garden Meadow Drive and Char Diaz Drive;
 - Recommendations for raised median installation;
 - Considerations for bus stop consolidation and/or relocation; and,
- Conclusions and recommendations.

TRAFFIC SAFETY

The crash history for the study intersections was obtained from the Oregon Department of Transportation (ODOT) for the 5-year period from January 1, 2012 to December 31, 2016. The data was reviewed in an effort to identify potential safety issues. **Table 1** summarizes the crashes reported at the study intersections. *Appendix "C" contains the ODOT crash data.*

Table 1. Study Intersection Crash History (January 2012 through December 2016)

Intersection	Crash Type						Crash Severity		Total Crashes
	Rear-End	Angle / Turning	Sides-swipe	Backing	Pedestrian	Other	Non-Fatal	PDO	
Beavercreek Rd/Molalla Ave	23	29	1	1	-	1	31	24	55
Adrian Wy/Molalla Ave	1	-	-	-	-	-	1	-	1
Clairmont Wy/Molalla Ave	10	5	-	-	1	-	13	3	16
Gaffney Ln/Molalla Ave	7	3	1	-	4	-	9	6	15
Fir St/Molalla Ave	3	1	-	-	-	-	2	2	4
Garden Meadow Dr/Molalla Ave	3	-	-	-	-	-	2	1	3
Char Diaz Dr/Molalla Ave	-	1	-	-	-	-	1	-	1
OR 213/Molalla Ave	17	12	-	1	-	1	17	14	31

As shown in **Table 1**, there were five reported crashes involving pedestrians, four occurring in the vicinity of the Gaffney Lane/Molalla Avenue intersection. There was one crash involving a bicyclist and vehicle. There were no reported crashes involving a fatality during the analysis period considered. Below is a more detailed discussion of the intersections with larger percentage of injury and pedestrian crashes.

Of the 29 angle/turning crashes at the Beaver Creek Road/Molalla Avenue intersection; 20 of the crashes came from vehicles making improper left turns and colliding with opposing vehicles going straight. There was also one turning crash involving a right-turning vehicle hitting a bicyclist. The bicyclist was continuing straight, and the right-turning vehicle did not have right of way over the bicycle.

As shown in **Table 1**, there were 13 non-fatal injury crashes at the Clairmont Way/Molalla Avenue intersection. Twelve of the 13 crashes were injury C, which is classified as possibly injury – complaint of pain related to the crash. One crash was injury B, or non-incapacitating injury. All five angle/turning and the pedestrian crashes resulted in injury crashes. The pedestrian crash at the Clairmont Way/Molalla Avenue intersection was due to driver inattention turning right as a pedestrian was crossing at the intersection.

The Gaffney Lane/Molalla Avenue intersection accounted for over 50% pedestrian crashes along this corridor. Three of the four crashes resulted in injury C. In all three crashes the vehicle failed to yield to right of way as they made a left-turn as the pedestrian crossed the street. The fourth crash was injury A, resulting in the pedestrian becoming incapacitated. In that case, the pedestrian was illegally in the roadway and was not visible.

Critical crash rates were calculated for each of the study intersections following the analysis methodology presented in ODOT's *SPR 667 Assessment of Statewide Intersection Safety Performance*. SPR 667 provided average crash rates at a variety of intersection configurations in Oregon based on number of approaches and traffic control types. The average crash rate represents the approximate number of crashes that are "expected" at a study intersection. Additionally, this average crash rate was used to calculate the critical crash rate for each study intersection, based on the *Highway Safety Manual* methodology. The critical crash rate is calculated for each intersection based on the average crash rate for each facility and serves as a threshold for further analysis.

Table 2 summarizes the critical crash rate for each intersection and compares those values to the observed crash rate. Per ODOT, if the observed crash rate at the study location exceeds the critical rate, it is a possible indication that the location is exceeding average crash rates.

As shown in **Table 2**, the observed crash rate at most intersections is less than the critical crash rate. However, two intersections exceed the critical crash rate: Beaver Creek Road/Molalla Avenue and Clairmont Way/Molalla Avenue. The remainder of this report identifies several operational improvements which will contribute to improving the safety of these two intersections.

Table 2. Intersection Crash Rate Assessment

Location	Total Crashes	Critical Crash Rate by Intersection Type	Critical Crash Rate by Volume	Observed Crash Rate at Intersection ¹	Observed Crash Rate > Critical Crash Rate?
Beavercreek Rd/Molalla Ave	55	0.63	0.54	0.92	Yes
Adrian Wy/Molalla Ave	1	0.34	0.45	0.03	No
Clairmont Wy/Molalla Ave	16	0.69	0.45	0.48	Yes
Gaffney Ln/Molalla Ave	15	0.69	0.44	0.44	No
Fir St/Molalla Ave	4	0.35	0.46	0.14	No
Garden Meadow Dr/Molalla Ave	3	0.27	0.37	0.11	No
Char Diaz Dr/Molalla Ave	1	0.37	0.38	0.04	No
OR 213/Molalla Ave	31	0.63	0.54	0.52	No

Note: ¹ Crash rate is calculated as the number of crashes per million entering vehicles. Average daily traffic volumes were estimated using PM peak hour total entering volume at the intersection.

Additionally, crash data was obtained along Molalla Avenue over the 5-year analysis period in two segments; thirteen crashes (ten rear-end and three angle/turning) were reported between Gaffney Lane and Fir Street, and five crashes (one rear-end and four angle/turning) were reported between Garden Meadow Drive and Char Diaz Drive. Considering the relatively short distance of 450 feet between Gaffney Lane and Fir Street, these crashes were reviewed to identify any potential trends.

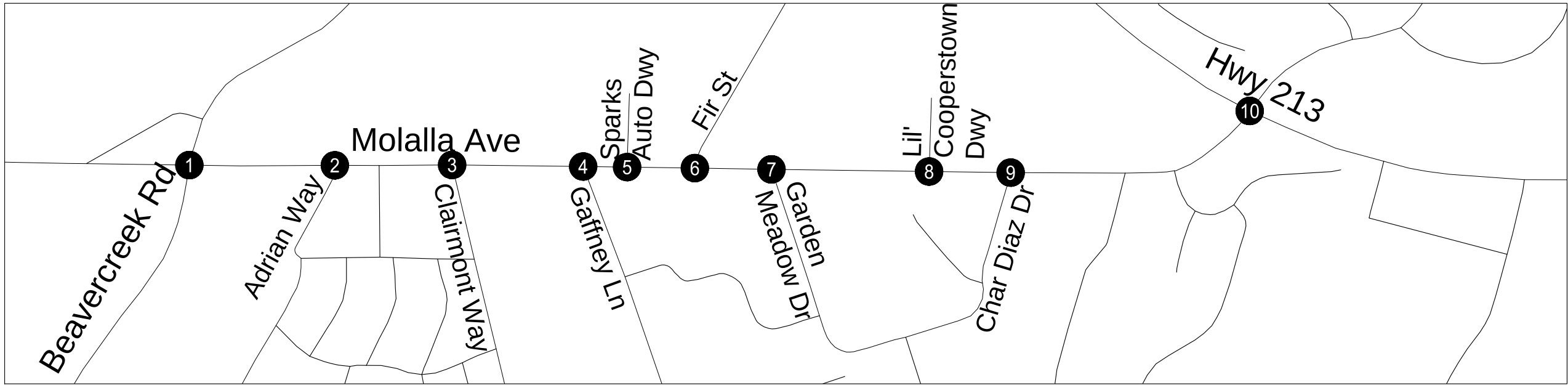
Of the three angle/turning crashes in the Gaffney Lane and Fir Street segment, all three crashes were left-turning vehicles turning in front of oncoming traffic when they did not have the right of way. Seven of the ten rear-end crashes resulted from vehicles failing to avoid vehicles in front of them (one of them resulting from slippery conditions and two that were forced impacts from one vehicle pushing another one into a third vehicle).

Along the segment between Garden Meadow Drive and Char Diaz Drive, one right-turning vehicle struck a bicyclist resulting in an injury A crash. The vehicle turning did not yield to right of way.

EXISTING TRAFFIC VOLUMES & OPERATIONS

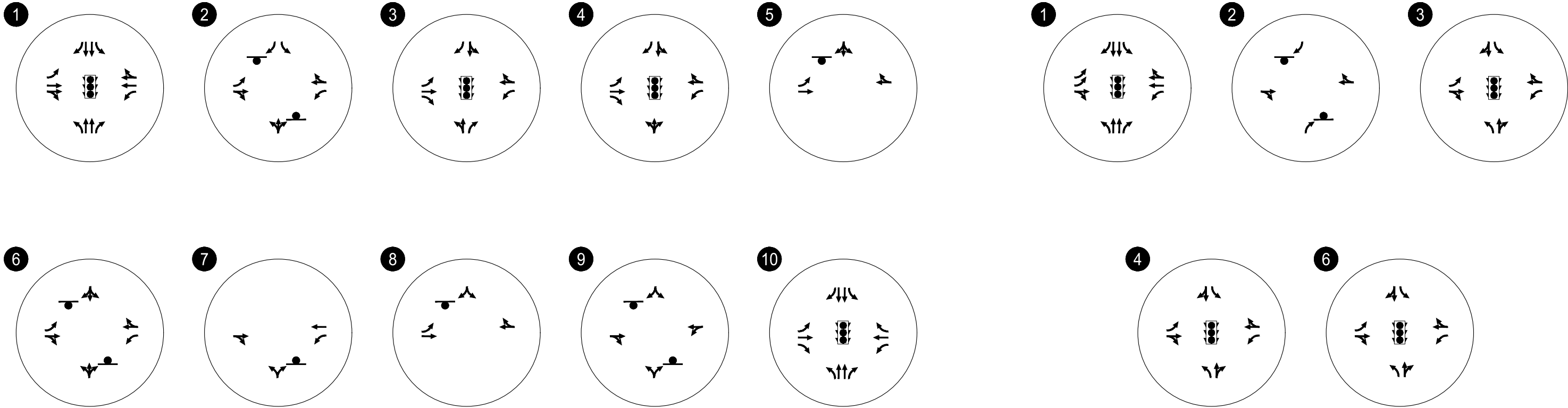
The existing conditions analysis identifies the current operational characteristics of roadways within the study area. These conditions will be compared with future conditions later in this report. Kittelson & Associates, Inc. staff visited the corridor in January 2019 to observe land uses, existing traffic operations, and transportation facilities in the study area.

Figure 1 illustrates the existing and assumed future lane configuration and traffic control devices at each of the study intersections.



EXISTING

PROPOSED



LEGEND

#

- Study Intersection

- Traffic Signal

- Stop Sign

Existing and Proposed Lane Configurations & Traffic Control Devices
Oregon City, Oregon

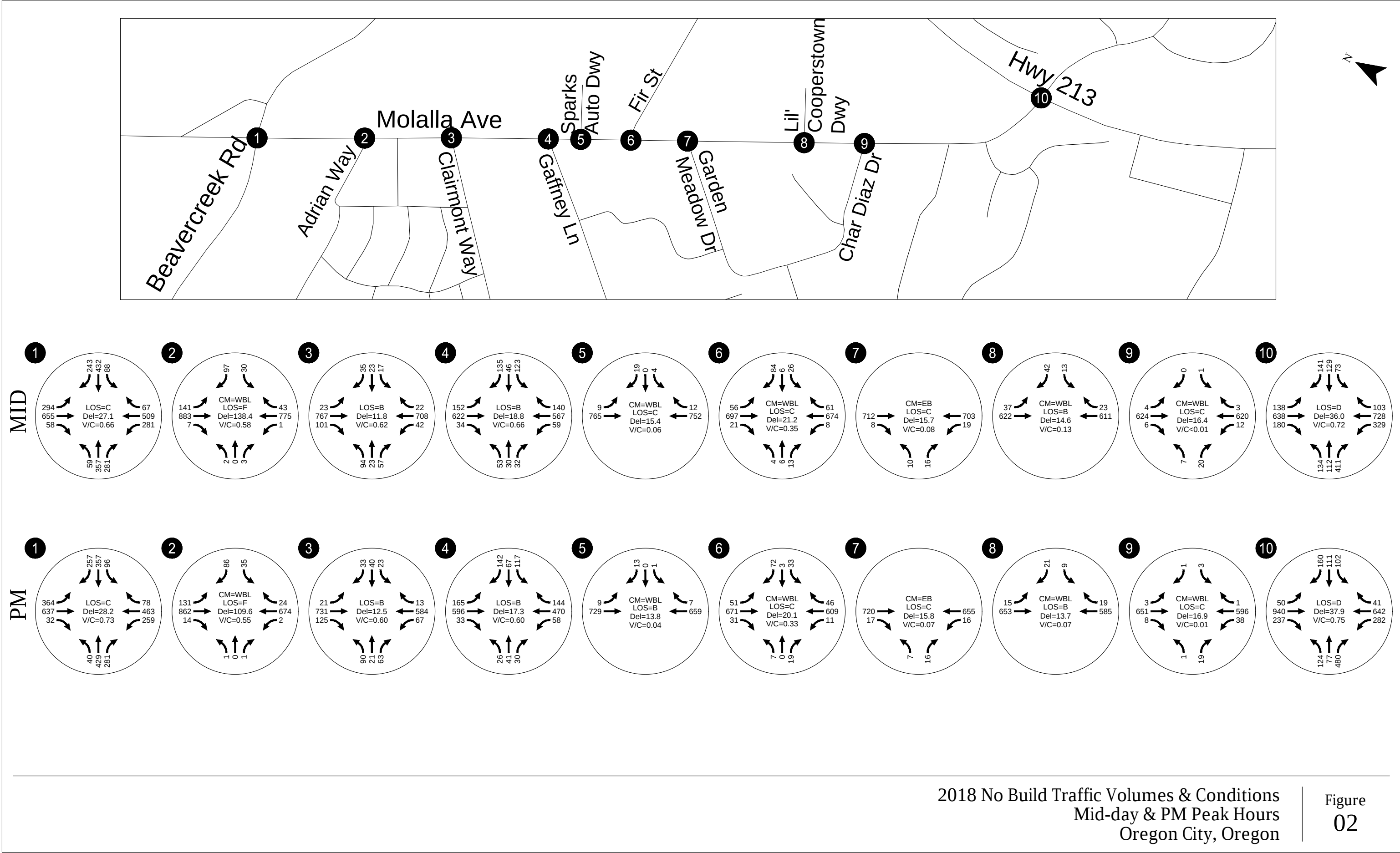
Figure
01

An analysis of existing traffic counts without any transportation improvements was conducted. The results of this “No Build” analysis are summarized in **Figure 2**. As shown in **Figure 2**, all study intersections operate acceptably under existing conditions. However, the side street movements on Adrian Way experience significant delay in both the mid-day and PM peak hours. *The full 2018 No Build Synchro reports can be found in Appendix “D”.*

For the “Build” analysis, the following adjustments were made to the Synchro model:

- Molalla Avenue at Beaver Creek Road:
 - Conversion of the inside southbound through lane on Molalla Avenue to form a second southbound left-turn lane
 - Corresponding shift in traffic to Beaver Creek Road/OR 213 from Molalla Avenue (described in more detail below)
 - Signal timing and phasing modifications
- Molalla Avenue at Adrian Way:
 - Installation of median on Molalla Avenue to prohibit left-turn movements and through movement across Molalla Avenue
 - Corresponding shift in traffic volumes (described in more detail below)
- Clairmont Way:
 - Removal of southbound dedicated right turn lane on Molalla Avenue
 - Addition of exclusive eastbound and westbound left-turn lanes and permitted/protected left-turn phasing
- Gaffney Lane:
 - Removal of southbound dedicated right turn lane on Molalla Avenue
 - Addition of exclusive eastbound and westbound left-turn lanes and permitted/protected left-turn phasing
- Fir Street: Installation of a traffic signal (warrant analysis provided later in this memorandum)

The goal of this project is to increase safety for bicyclists and pedestrians along the Molalla Avenue corridor. The outcome of this goal and associated improvements (e.g., narrower lanes, more enhanced crossings) will likely result in diverting vehicle traffic back to higher order facilities (e.g., Beaver Creek Road and OR 213). The addition of a second southbound left-turn lane at Beaver Creek Road (coupled with wayfinding improvements) is expected to increase the attractiveness and decrease the travel time required to use the Beaver Creek Road/OR 213 intersection rather than Molalla Avenue for travel south of the project area. Future growth will also make Molalla Avenue a less appealing route due to increased congestion. As such, a portion of traffic volumes on Molalla were rerouted to Beaver Creek Road and OR 213 to account for this expected shift in travel patterns.

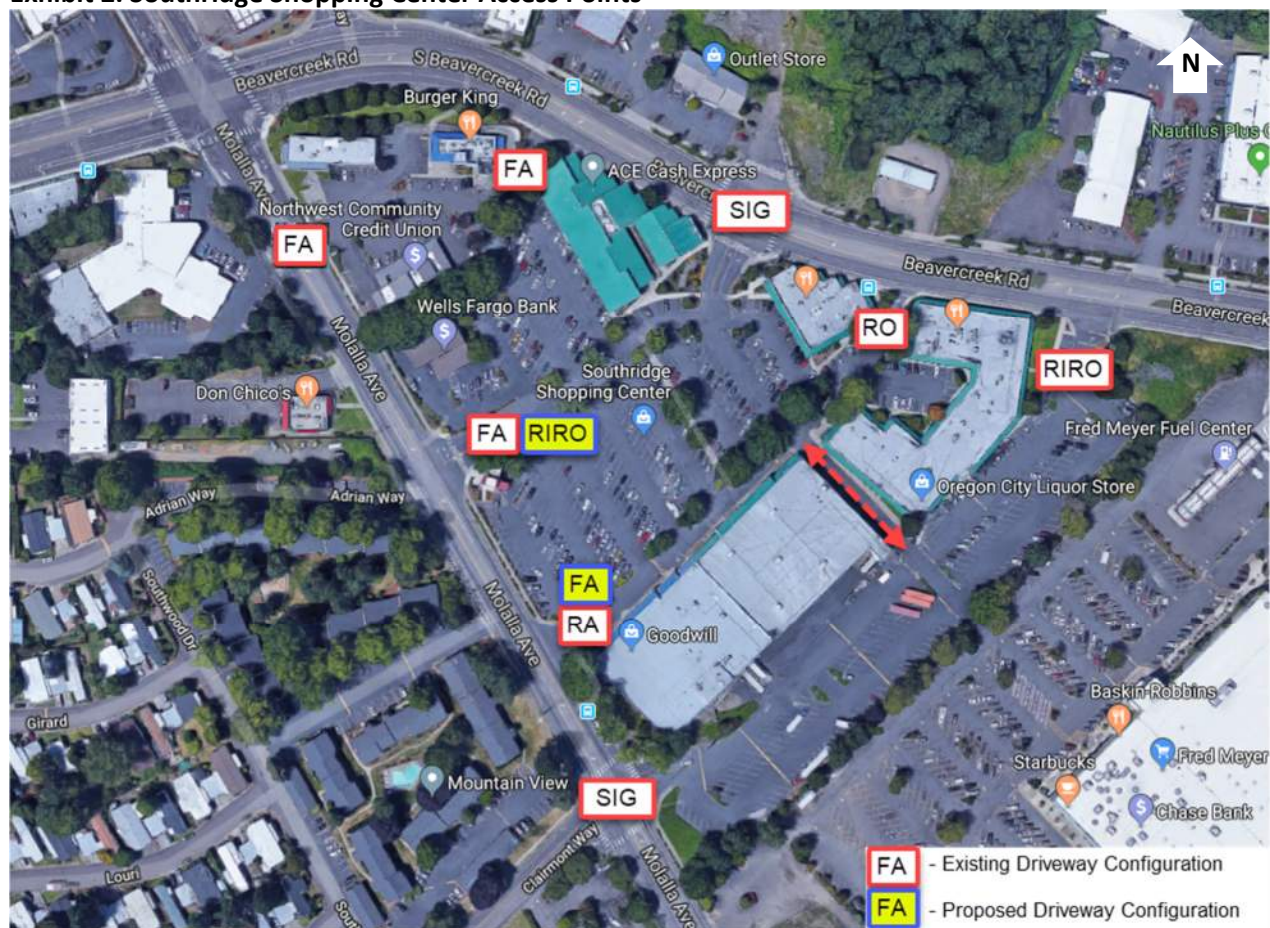


2018 No Build Traffic Volumes & Conditions
Mid-day & PM Peak Hours
Oregon City, Oregon

Figure 02

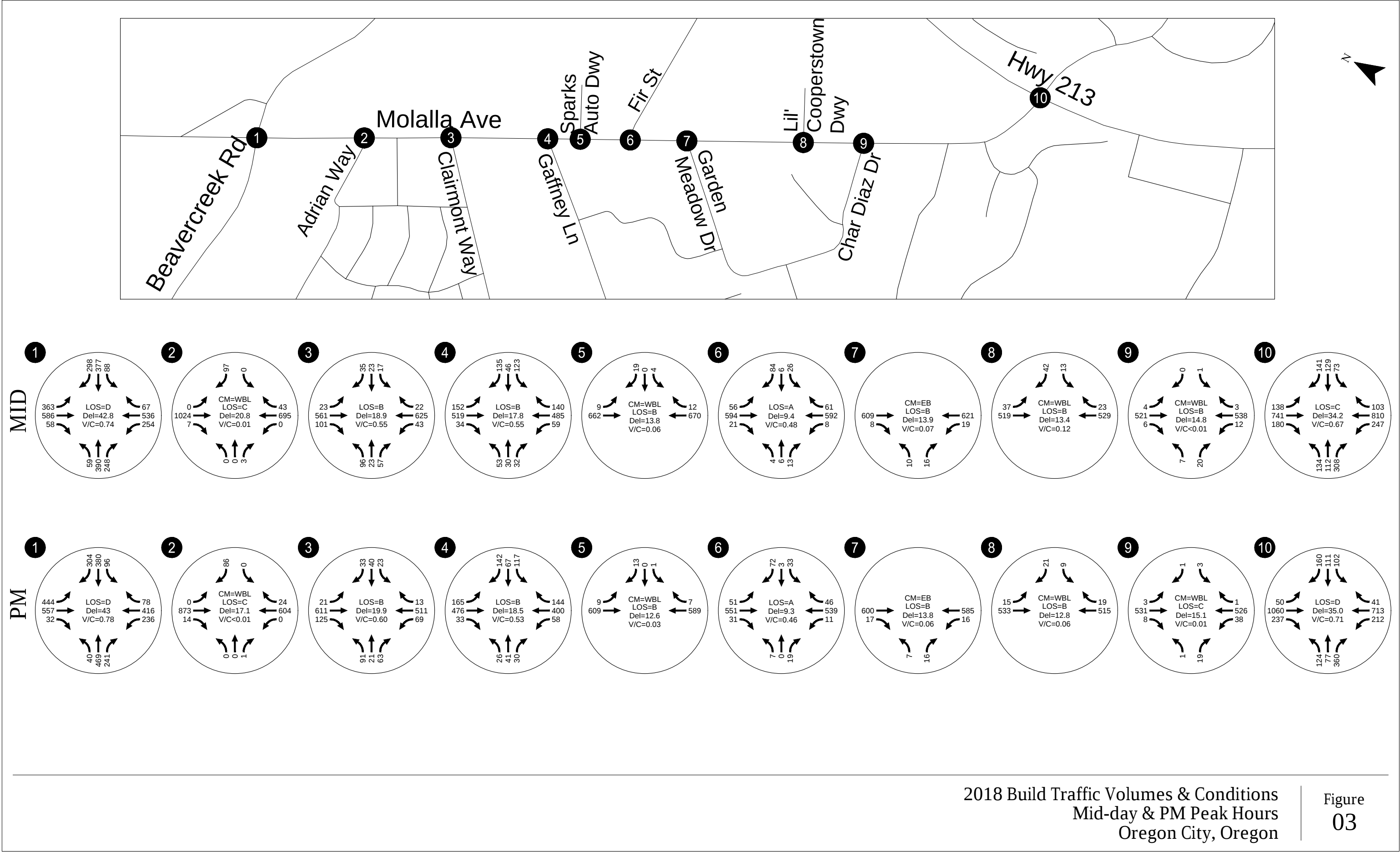
The distance between Beavercreek Road and Adrian Way is approximately 500 feet. Currently, there is approximately 200 feet of striped storage for the northbound left-turn at Beavercreek Road. Based on the results of the existing conditions analysis, 2018 Build traffic volumes require almost 350 feet of storage. This northbound left-turn queue will continue to grow in future. An additional 100 feet of deceleration length would also be required. In order to provide adequate storage and deceleration for the northbound left-turn volumes, turning movements at the Adrian Way and the commercial driveway must be restricted to right-in/right-out. The secondary commercial access would be consolidated and relocated to provide for left-turn movements approximately 200 feet south of this location. The developments in the southeast quadrant of the Beavercreek Road/Molalla Avenue intersection will continue to have several opportunities to complete all movements with limited additional travel distance via an existing signal on Beavercreek Road, two right-in/right-out accesses and two full access driveways (see Exhibit 2). Residential trips would be rerouted to the signal at Clairmont Way.

Exhibit 2. Southridge Shopping Center Access Points



Abbreviation Legend: FA = Full Access Driveway; SIG = Traffic Signal; RIRO = Right In/Right Out Only Driveway; RO = Right Out Only Driveway RA = Restricted Access (Left & Right In/Right Out) Driveway (*Image Source: Google Maps*)

The results of this “Build” analysis are summarized in **Figure 3**. As shown in **Figure 3**, all intersections operate acceptably with the above improvements. *The full 2018 Build Synchro reports can be found in Appendix “D”.*



2018 Build Traffic Volumes & Conditions
Mid-day & PM Peak Hours
Oregon City, Oregon

Figure
03

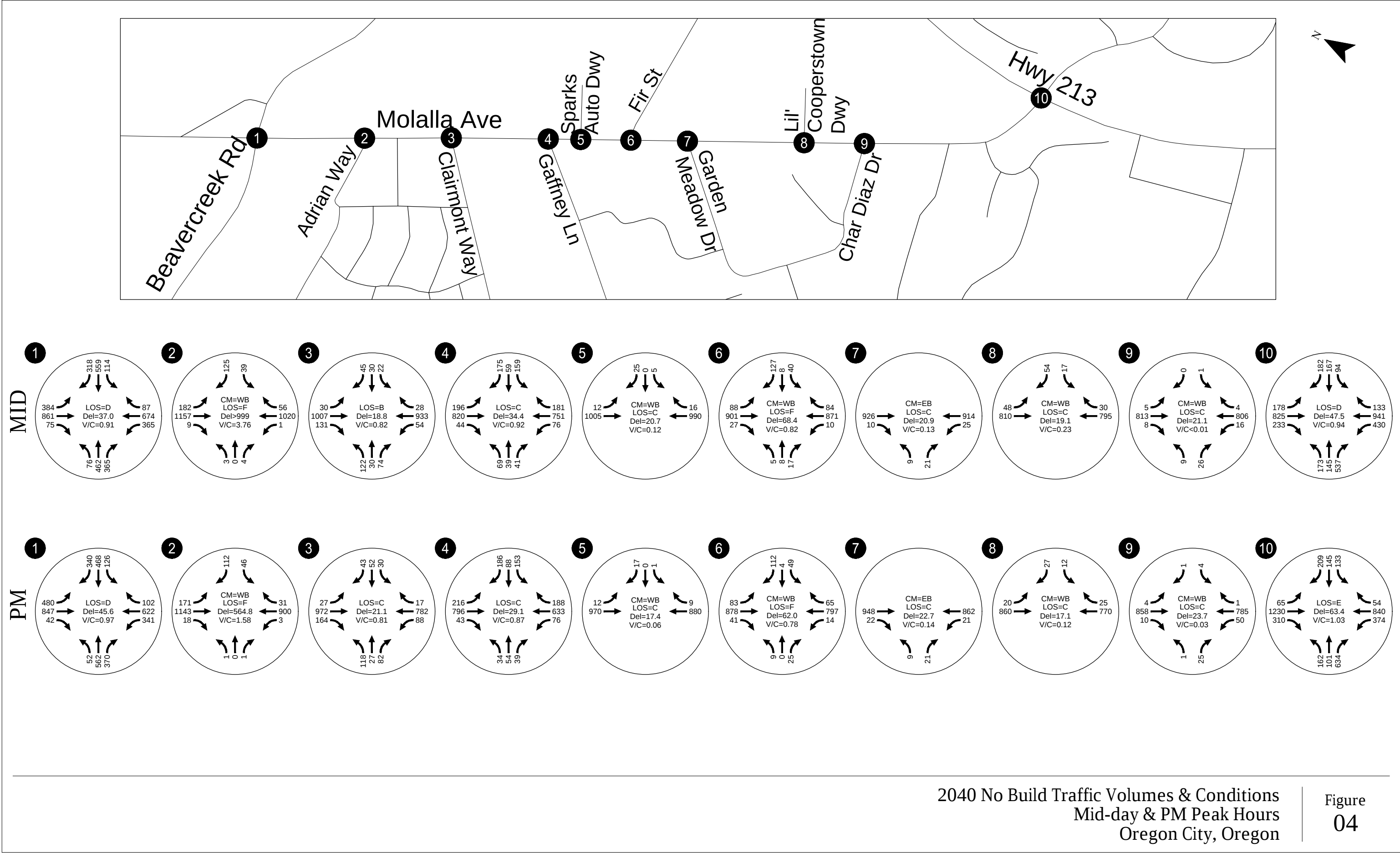
2040 TRAFFIC VOLUMES & OPERATIONS

Oregon Metro provided 2015 Base Year and 2040 Future Year mid-day and PM peak hour model runs with turn movement volumes for Molalla Avenue at Beavercreek Road, Clairmont Way, Gaffney Lane and OR 213. These volumes reflect the most current land use assumptions and include full build-out of Oregon City's urban growth boundary areas in addition to growth in the rest of the region, including through traffic from outlying communities. *These plots can be found in "Appendix E".* An annual linear mid-day growth rate of 1.33% and PM growth rate of 1.40% were calculated from the volumes and applied to the count data to produce 2040 turning movement volumes at each of the ten study intersections. In-process trips associated with the planned relocation of the Oregon City Public Works Operations Center to 13995 Fir Street were also added to the study intersections. Based on direction from Oregon City and review of the December 2017 TIA prepared by DKS for the development, a rate of 1.15 peak hour trips per employee was applied to the expected 73 full-time and 20 seasonal staff.

The results of the 2040 "No Build" and "Build" analyses are summarized in **Figures 4 and 5**, respectively. As shown in **Figures 4**, the Beavercreek Road and OR 213 intersection is expected to exceed capacity in the PM peak hour in the "No Build" condition. Additionally, the Adrian Way intersection experiences increased side street delay in both the mid-day and PM peak hours. With the previously identified proposed improvements, all intersections are forecast to operate acceptably under 2040 conditions. *The full 2040 conditions Synchro reports can be found in "Appendix F".*

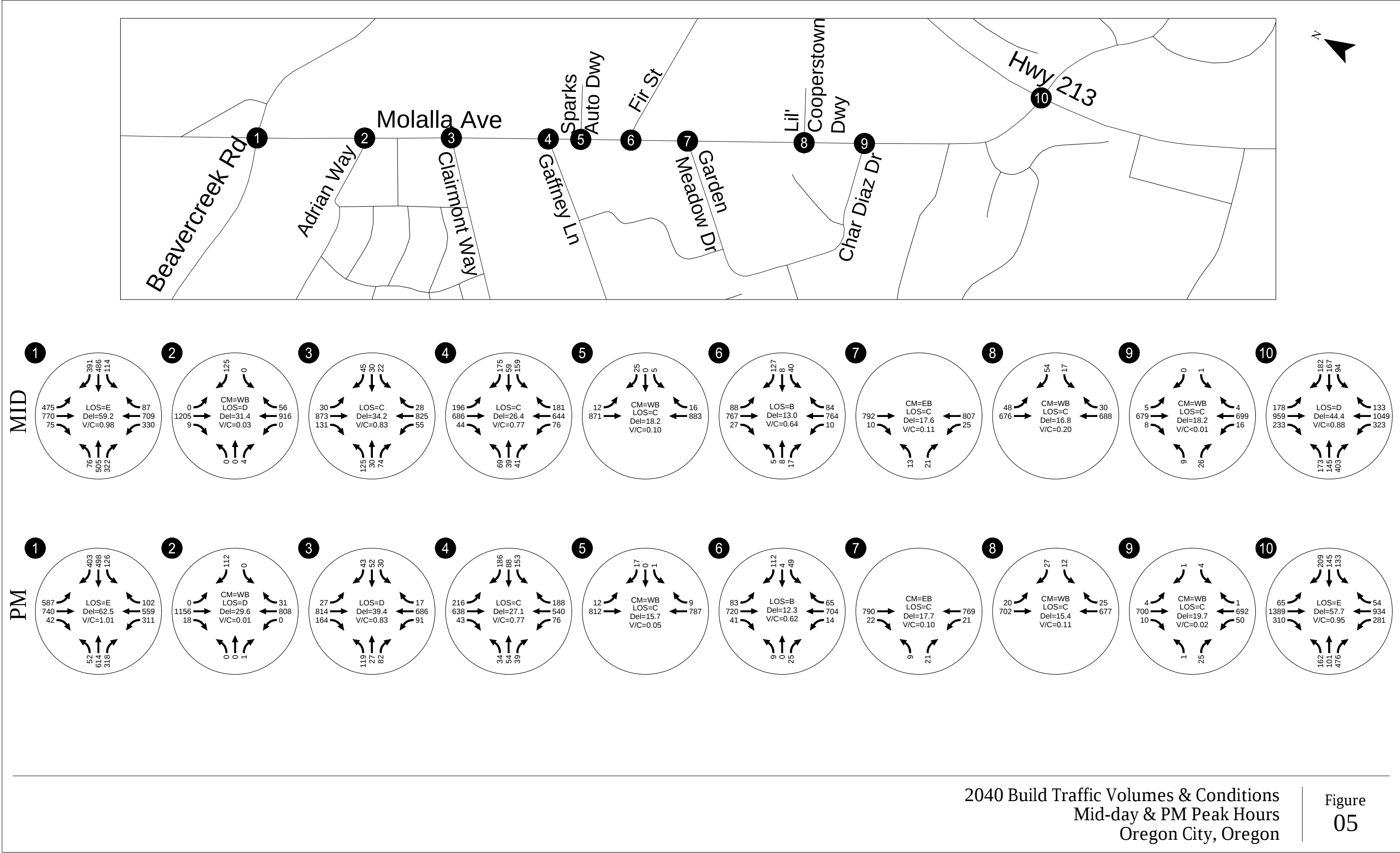
Average Daily Traffic

24-hour bi-directional tube count data was collected on Molalla Avenue for seven days. From this data, the average daily traffic (ADT) in 2018 was determined to be 13,548. A 2040 ADT of 18,018 was estimated by applying a 1.5% annual rate (to account for background growth and in-process development) to the daily volume counted along the corridor. A truck percentage of 7% was also determined from this count data.



2040 No Build Traffic Volumes & Conditions
Mid-day & PM Peak Hours
Oregon City, Oregon

Figure
04



2040 Build Traffic Volumes & Conditions
Mid-day & PM Peak Hours
Oregon City, Oregon

Figure 05

Queuing Analysis

Queue lengths were evaluated at each of the study intersections to identify potential queue spillback occurring during year 2040 weekday mid-day and PM peak hours.

Table 3 summarizes 95th percentile left-turn queue lengths estimated by *Synchro 10* along Molalla Avenue at the each of the study intersections for the Year 2040 “Build” conditions. The 95th percentile queue lengths represent the worst-case queue that occurs 5% of the time during the peak hour.

Table 3. 95th Percentile Queuing Analysis – Year 2040 “Build” Conditions

Intersection	Movement	95 th Percentile Queue Length		Recommended Storage
		Mid-day Peak Hour	PM Peak Hour	
Molalla Avenue & Beavercreek Road (single NBL)	NBL	445'	478'	500'
	NBT	400'	315'	500'
Molalla Avenue & Beavercreek Road (dual NBL)	NBL	207'	201'	400'
	NBT	400'	315'	400'
Molalla Avenue & Clairmont Way	SLB	20'	19'	50'
	NBL	39'	63'	75'
Molalla Avenue & Gaffney Lane	SLB	71'	83'	100'
	NBL	37'	45'	50'
Molalla Avenue & Fir Street	SLB	24'	36'	50'
	NBL	5'	10'	50'
Molalla Avenue & Garden Meadow Drive	NBL	3'	3'	50'
Molalla Avenue & Char Diaz Drive	NBL	1'	5'	50'

As shown in **Table 3**, the northbound left-turn queue at Beavercreek Road exceeds the existing storage length (approximately 200 feet) in 2040. The recommended storage length for the northbound left-turn lane to accommodate 2040 projected traffic volumes on Molalla Avenue at Beavercreek Road is 500 feet.

With the addition of a second northbound left-turn lane, the recommended storage length for dual left-turn lanes would be 225 feet (or 400 feet if desired to get around the northbound through queue), with an additional 100 feet for deceleration. Through a sensitivity analysis, it was determined that a second northbound left-turn lane will be required to provide adequate storage and intersection capacity by 2031.

Signal Warrant Analysis

Based on observations of delay for vehicles making a left-turn from Fir Street onto Molalla Avenue, a signal warrant analysis was performed. The Manual on Uniform Traffic Control Devices (MUTCD) provides guidelines for justifying the installation of traffic signals based on traffic conditions, pedestrian characteristics, crash experience, and physical characteristics of the location. The signal warrant analysis for this study focused on the vehicular volume warrants, using the existing and 2040 traffic volumes.

The results of the signal warrant analysis show that the Fir Street intersection currently meets warrants for a traffic signal. *The detailed results of the signal warrant analysis are included in “Appendix G”.*

Pedestrian Crossing Evaluation

This corridor is unique because it consists of primarily residential neighborhoods on the west side, and industrial and retail developments on the east side. The spacing of pedestrian crossings along the corridor currently ranges from approximately 500 to 2,000 feet. There is a strong desire to reduce the distance between crossings and space them as evenly as possible along the corridor. The intent of these crossings is to reduce the walking distance required for pedestrians to access a legal marked crossing, especially for those getting off TriMet buses on the west side of Molalla Avenue and needing to cross the street to get to retail shops on the east side.

Preliminary locations identified for enhanced pedestrian actuated crosswalks are as follows:

- Molalla Avenue & Adrian Way
- Molalla Avenue & Garden Meadow Drive
- Molalla Avenue & Char Diaz Drive

The National Cooperative Highway Research Program (NCHRP) Report 562 *Improving Pedestrian Safety at Unsignalized Crossings* provides a methodology for evaluating appropriate levels of crosswalk protection. The methodology considers the traffic volumes, travel speeds, crossing width, and pedestrian crossing volumes. The NCHRP Report 562 method was applied to the three proposed crossing locations using existing traffic conditions. The following were input parameters in the evaluation of each proposed crossing location:

- Traffic volumes during the pedestrian peak hour (Existing year 2018 counts)
- 85th percentile speed of 33 mph (measured on Molalla Avenue between Garden Meadow Drive and Fir Street).
- Pedestrian crossing distance
- Pedestrian volumes during the pedestrian peak hour (Existing year 2018 counts).

Based on existing pedestrian volumes, enhanced pedestrian actuated crossings are not necessarily warranted at the proposed locations. *The detailed results of the NCHRP 562 analysis are included in "Appendix H"*. However, further considerations need to be made for the context of each crossing location to determine if these types of pedestrian treatments are truly warranted. There is potential for increased demand with regional growth and residential and commercial development occurring along the corridor, as well as induced demand which may occur as a result of the presence of safe crossings along the corridor. With relocation of TriMet bus stop locations near marked pedestrian crossings, there is also a potential for consolidation of pedestrian trips at these locations.

The project team adjusted the original proposed crossing locations slightly in order to provide more equal spacing along the corridor. The new proposed crossings are:

- Just south of Adrian Way
- Just south of the US Post Office entrance on Molalla Ave
- Halfway between Char Diaz Drive and Lazy Creek Lane

These locations can be seen **Figure 6**.

With the installation of a traffic signal at Fir Street and an enhanced pedestrian actuated crossing just south of the post office, the existing marked crossing at Garden Meadow Drive should be removed.

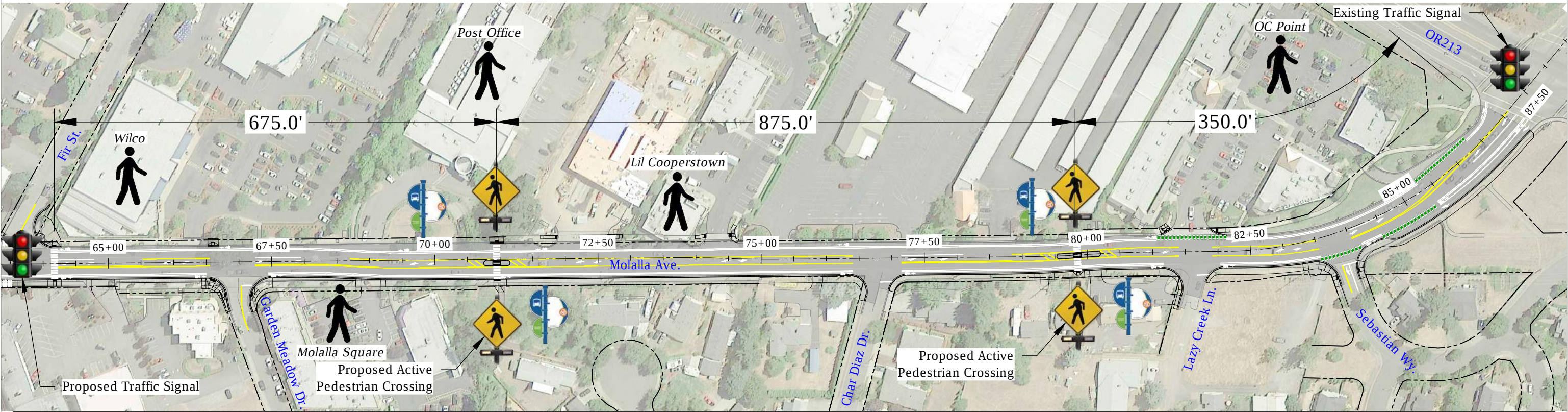
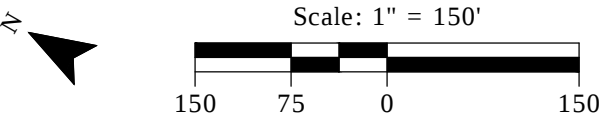
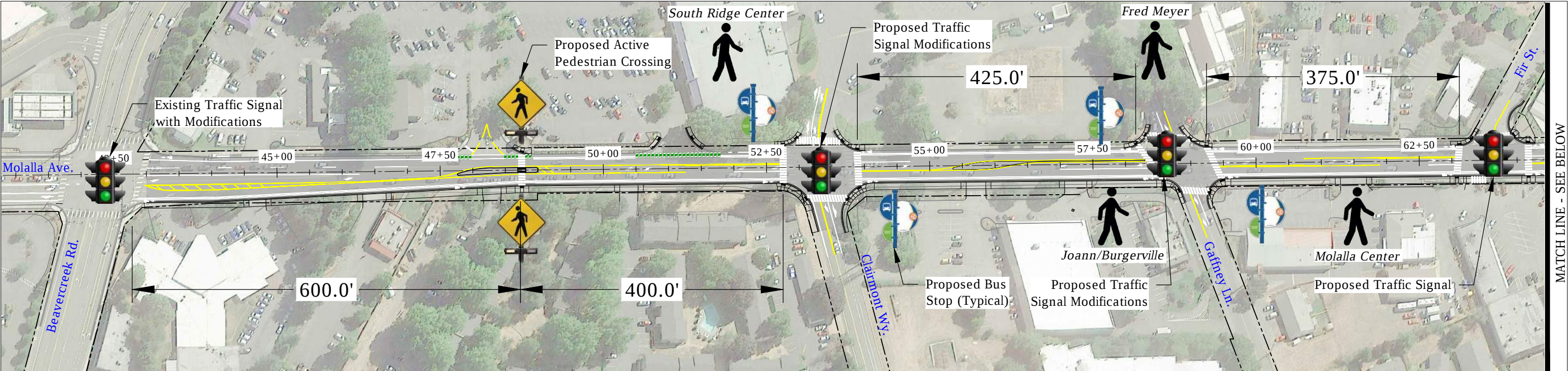
Raised Median Installation

Existing and 2040 traffic volumes at Adrian Way cause significant delay for vehicles turning left out of the commercial driveway. As indicated by green bars in **Figures 6 and 7**, in conjunction with the pedestrian crossing at Adrian Way it is also recommended that a raised median be installed at this location for pedestrian safety, restricting left-turns from Adrian Way and the commercial driveway to the east. The secondary commercial access would be consolidated and relocated to provide for left-turn movements approximately 200 feet south of this location. Residential trips would be rerouted to the signal at Clairmont Way. This would also allow for lengthening the northbound left-turn lane at Beavercreek Road to provide additional storage for 95th percentile queues.

Similarly, raised medians are also recommended at the other two enhanced pedestrian crossing locations where businesses have alternative access for performing left-turn maneuvers. No access closures or relocations would be necessary in conjunction with the installation of these medians.

Bus Stop Considerations

There are currently five TriMet bus stops in both directions along Molalla Avenue. With the addition of enhanced pedestrian crossings, TriMet bus stops would be consolidated and relocated as shown in **Figures 6 and 7** to be placed in conjunction to utilize the new crossings. The consolidation to three bus stops will decrease travel time and delay for TriMet passengers, and the relocation to pedestrian crossing locations will allow them to more safely reach their destinations on either side of Molalla Avenue.



Overall Project Map
City of Oregon City

Figure
6

CONCLUSIONS & RECOMMENDATIONS

Based on the results of this traffic analysis, the following changes are recommended in conjunction with the Molalla Avenue project:

- Convert the inside southbound through lane on Molalla Avenue at Beavercreek Road to provide a second left-turn lane.
- Lengthen the existing northbound left-turn lane on Molalla Avenue at Beavercreek Road to provide 350 feet of queue storage. By 2031, develop a second northbound left-turn lane, replacing the signal pole on the northeast corner of the intersection.
- Install a raised median on Molalla Avenue just south of the northbound left-turn lane(s) at Beavercreek Road, restricting turning movements from Adrian Way and the commercial driveway to right-in/right-out.
- Stripe exclusive eastbound and westbound left-turn lanes with permitted/protected left-turn phasing at Clairmont Way and Gaffney Lane.
- Install a traffic signal at Fir Street.
- Install enhanced pedestrian actuated crossings at the following three locations:
 - Just south of Adrian Way
 - Just south of the US Post Office entrance on Molalla Avenue
 - Halfway between Char Diaz Drive and Lazy Creek Lane
- Install raised medians at each of the proposed enhanced pedestrian actuated crossings.
- Remove the existing marked crossing at Garden Meadow Drive.
- Consolidate and relocate existing TriMet bus stops to provide a stop in each direction at each of the proposed enhanced pedestrian actuated crossing locations.

Please reference **Figure 6** for these changes.

ATTACHMENTS

- Appendix A: Traffic Count Data
- Appendix B: Description of Level-of-Service Methods and Criteria
- Appendix C: Existing Crash Data
- Appendix D: 2018 Operations Worksheets
- Appendix E: Model Data
- Appendix F: 2040 Operations Worksheets
- Appendix G: Signal Warrant Worksheets
- Appendix H: NCHRP 562 Worksheets

The full 60% Traffic Analysis Memorandum, including Attachments is available on the Molalla Avenue Streetscape Project webpage:

<http://bit.ly/molallaave>