MOVING FORWARD
TV HIGHWAY
ENHANCED TRANSIT AND ACCESS PLAN

FINAL REPORT
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Acronyms and Abbreviations

BAT	Business Access and Transit
CPO	Community Participation Organization
HCT	High Capacity Transit
HDM	Highway Design Manual
NHS	National Highway System
ODOT	Oregon Department of Transportation
PNWR	Portland & Western Railroad
ROW	Right-of-Way
RTP	Regional Transportation Plan
SPIS	Safety Prioritization Index System
TAG	Technical Advisory Group
TSP	Transit Signal Priority

Executive Summary

The Moving Forward Tualatin Valley (TV) Highway Plan will help guide investment to efficiently and effectively improve multi-modal travel options while preserving the important mobility and freight functions of TV Highway (OR 8) within the project area (Figure 1). The Plan identifies deficiencies in transit travel time/reliability, gaps in the bicycle and pedestrian networks, barriers to safely accessing transit and destinations along the corridor, and barriers to connecting the corridor to adjacent neighborhoods. The Plan develops and evaluates multi-modal corridor concepts intended to balance the identified study area needs and achieve the Plan's goals and desired outcomes.

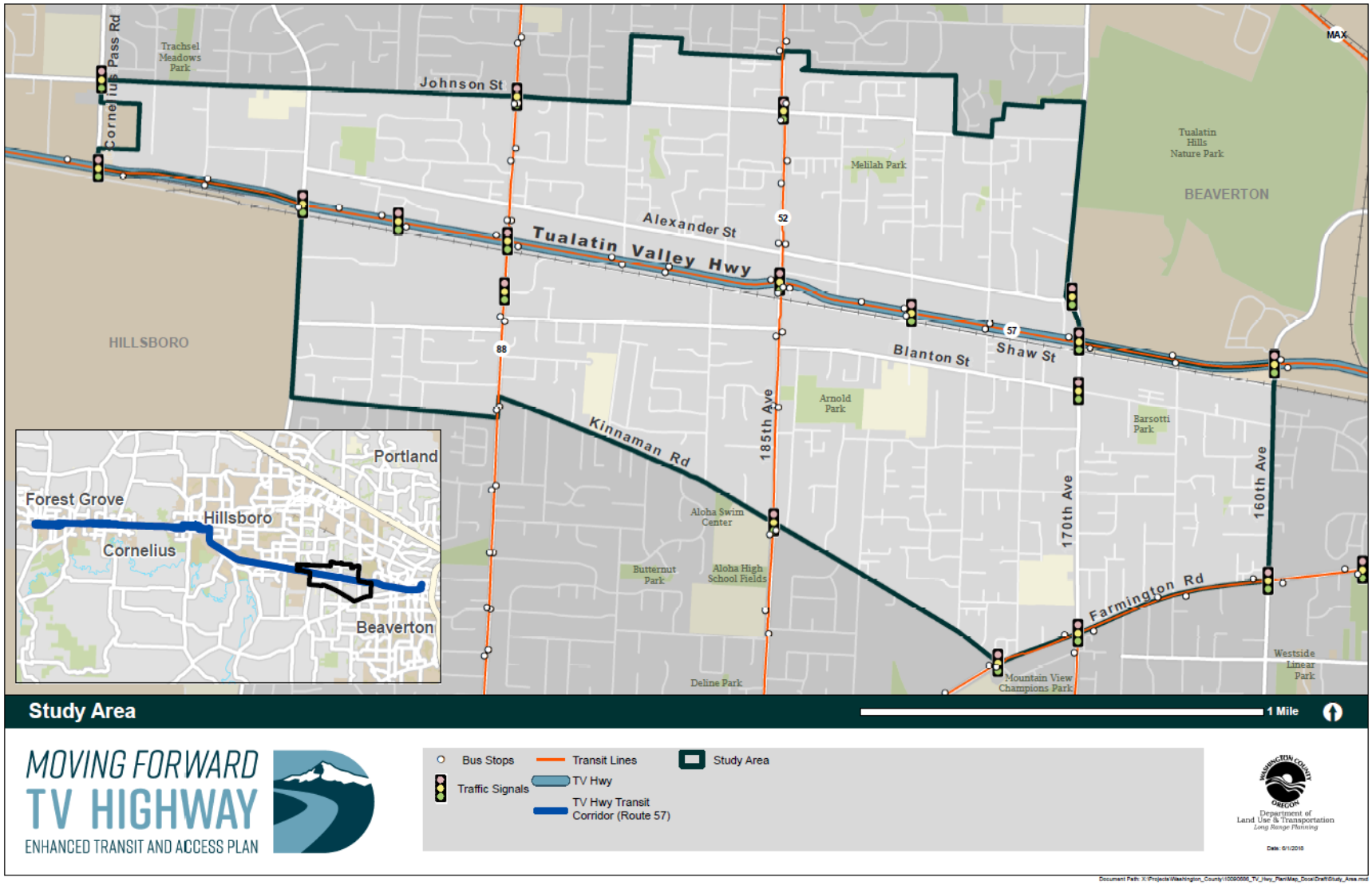
Project Background

TV Highway connects Forest Grove to Beaverton and traverses four cities as well as urban and rural unincorporated Washington County. TV Highway is a major link in the regional roadway system, classified as part of the National Highway System (NHS), critical to regional economy, defense, and mobility. The corridor has been the subject of many state, regional, and local planning efforts to identify needs, opportunities, and actions to improve safety and mobility, including being identified as a Regional High Capacity Transit (HCT) corridor.

The TV Highway corridor developed over many decades. In Aloha, as development occurred in and around the corridor, traffic congestion increased, resulting in travel delays for corridor users, including riders on TriMet's Line 57, which connects Forest Grove to the Beaverton Transit Center. Today, Aloha is characterized by automobile-oriented commercial strip development interspersed with multi- and single-family housing. Intel, the largest employer in the area, operates a large fabrication facility located on TV Highway near SW 198th Avenue. Smaller businesses are located on stand-alone properties or within suburban-format shopping centers. However, the central portion of Aloha (around TV Highway and SW 185th Avenue) is a designated Town Center[1], which is envisioned as a walkable, vibrant and transit supportive area with a mix of commercial, residential, and civic uses.

[1] Designated by Metro in 1995 in the 2040 Growth Concept. The remainder of TV Highway is designated as a 2040 Corridor.

Figure 1. Project Study Area Corridor



Project Need

The results of the existing corridor conditions suggest a series of needs to improve safety and multi-modal mobility within the study area. The following five factors contribute to the need for investment along TV Highway to improve multi-modal safety, transit service effectiveness and transit access:

1. **High crash corridor:** TV Highway is designated as a High Injury Corridor in the Portland Metro region with a 5-year average crash rate that was **nearly 3 times the statewide average for suburban highways and 2.5 times the regional average** for arterial roadways.[2][3] Between 2012 and 2014, 5 of the top 15 ranked Safety Prioritization Index System (SPIS) intersections in the county were located along the study corridor. Approximately **one-third of all fatal and serious injury crashes along the TV Highway corridor involved a person walking or bicycling**. Approximately 84 percent of all pedestrian-involved crashes occurred within 250-feet of a bus stop.

2. **Slow transit travel time limiting ridership growth:** 2018 estimated **transit travel time in the PM peak hours between Cornelius Pass Road and SW Murray Boulevard is more than 140 percent longer than auto travel time** along the study corridor, impacting existing riders traveling through the corridor, limiting attractiveness for choice riders and impacting access to destinations along the corridor. Transit delay is primarily caused by signalized intersection congestion and delay, and will only get worse as traffic continues to grow over time. **Substandard bus stops result in slower boarding procedures and longer dwell times**, contributing to overall transit delay.

3. **Gaps in sidewalks, ADA ramps, lighting and crossings accessing transit:** Bus stop access conditions for riders are deficient in many aspects. Approximately **48 percent of TV Highway is missing sidewalks in the study area**, while 84 percent of the 38 ADA ramps along TV Highway evaluated (approximately 47 percent of total ADA ramps) within the study corridor ranked as "poor". **Nearly all bus stops along TV Highway's south side are functionally isolated** from nearby pedestrian and bicycle connections, resulting in people often crossing TV Highway at uncontrolled locations.

4. **Incomplete bicycle facilities connecting to transit:** The lack of a complete bicycle network within the study area linking transit with residences, points of interest, and commercial centers presents user comfort and safety issues and is a broader deterrent to transit use. Approximately **63 percent of the major street network in the study area lack standard bike lanes**. **Nearly all existing facilities are unprotected** and hinder the ability to attract regular bike ridership.

[2] 2016 State Highway Crash Rate Tables, August 2018
[3] Regional Transportation Safety Strategy

5. **Impact to neighborhood livability, healthy living and economic opportunities:** Line 57 ranks tenth in the TriMet system in terms of providing access to communities of concern, jobs, housing, and social services.[4] Communities in the study area have above average concentrations of low-income population, people of color, limited English language proficiency residents, and youth populations. Approximately **75 percent of all study corridor transit trips begin or end within a quarter mile of TV Highway**.[5] The combination of nearly 40,000 vehicles per day, more than a 70-foot crossing distance with limited enhanced pedestrian crossings, 35 to 45 mile per hour posted speed limits, and the adjacent rail line **creates barriers between the communities to the north and south**. This limits corridor walkability and neighborhood connectivity needed for safe and convenient transit access.

Project Goals

Project goals for the TV Highway corridor focus on achieving the agency partners' desired outcomes to improve the mobility and access needs of the corridor. These goals reflect priorities established through previous planning efforts including the 2014 *TV Highway Corridor Plan*, and have been refined to focus on the specific needs this Project is aiming to address:

1. **Safety**: Improve safety and health for all users traveling within, through and to the study area.
2. **Social Equity:** Improve access, mobility, and connectivity for historically underserved communities and help address disparities concentrated in low-income communities.
3. **Multi-modal mobility**: Create a transportation corridor that helps meet county and regional objectives to provide efficient and effective mobility for people and goods while reducing vehicle miles travelled and providing convenient transportation options.
4. **Connectivity**: Create connections that reduce barriers, improve transit access, and remove gaps in the local networks for walking and biking.
5. **Livability:** Strengthen economic vitality and neighborhood livability through improvements to travel options along the corridor.

Corridor Concept Evaluation

The Moving Forward TV Highway Plan evaluated four enhanced transit corridor concepts aimed at addressing the project goals and needs while evaluating the associated tradeoffs and opportunities presented with each concept.

Each of the four design concepts are unique in design, operations, and circulation assumptions, which are critical to explore trade-offs and inform the comparative evaluation. However, all four concepts include common facility elements to improve transit access, operations, and overall corridor safety. The common elements that provide corridor consistency and balance needs include:

- **Improved transit service** with higher frequencies serving all corridor stations on demand

[4] Source: TriMet, 2017.
[5] Between October 2016 and March 2017, 212 transit riders were surveyed while on-board TriMet's Line 57.

- **Evenly spaced transit stations** approximately 1/4 mile apart and placed in high visibility locations near existing or planned signalized pedestrian crossings[6]
- **Higher capacity, BRT-style vehicles** with lower floors and all-door boarding
- **Enhanced transit station design** with enhanced shelters, passenger amenities/furnishings, near-level boarding, all-door boarding, off-board fare payment, and far-side placement, all to minimize time spent dwelling and improve the passenger waiting experience
- **Transit signal priority (TSP)** to give transit vehicles some level of preference moving through intersections thereby improving speed and reliability
- **Separated and protected bike lanes** between intersections and enhanced bike facilities at intersections
- **Improved sidewalks** on the north side of the corridor and sidewalk improvement to access transit stations and businesses on the south side of the corridor
- **Enhanced pedestrian crossings** to provide the ability to safely cross the corridor and reach corridor transit stations
- **Pedestrian-scale lighting** to improve pedestrian visibility and reduce pedestrian crashes
- **New pedestrian rail crossings** grade separated from the adjacent rail line to improve access to the corridor from south side neighborhoods
- **Raised and landscaped median** along certain stretches of the corridor to reduce vehicular crashes and provide a safe refuge for crossing pedestrians
- **Reduced lane widths** to shorten the pedestrian crossing distance, repurpose roadway space for other modes, and encourage slower speeds on the corridor, all while maintaining a 29-foot "hole in the air" for critical freight mobility

Table 1 summarizes the concepts being evaluated. The concepts are unique in transit operating environment (including level of transit priority and dedicated space), cross section dimensions, footprint, and impacts to corridor operations. While each of these design concepts explored the application of various transit treatments on TV Highway through the study area, features from each of these concepts are recommended to be explored on a segment by segment basis to develop a refined concept.

[6] Proposed station locations are only representative and will require additional siting and constraint evaluation for most feasible placement.

Table 1. Concept Summary

Concept	Concept Summary	Evaluation Summary
Enhanced Transit	• Maintains general purpose traffic circulation • Transit generally travels in mixed traffic, and utilizes spot-level improvements (using existing or extended right-turn lanes as optional queue bypass) to improve transit speed/reliability	Higher rated concept due to improvements in safety, transit operations, access, and overall mobility. More flexible and most cost-effective option. ***Recommended Action*: Select features from this concept for additional refinement and application to locations along corridor.**
Corridor Business Access and Transit (BAT) Lanes	• Maintains general purpose traffic circulation • Transit travels in new BAT lane adjacent to general purpose travel lane (westbound only) •	Lower rated concept due to property impact, cost, and wider crossing distance. ***Recommended Action*: Remove full corridor concept from consideration, but consider BAT lanes at specific locations along TV Hwy, where feasible.**
One-Way Couplet	• Circulated general purpose traffic as a one-way couplet using TV Highway eastbound and Alexander Street westbound • Transit travels in both directions in dedicated lanes on TV Highway • Requires Alexander Street to serve as a state highway and freight route	Lower rated concept due to cost, circulation impacts, lack of political/ community support, and limited readiness ***Recommended Action*: Remove full corridor concept from consideration.**
Center Running Transit	• Maintains general purpose traffic circulation, although turns are restricted since transit uses center lane • Transit travels in center lane in both directions, requiring high degree of operational complexity and technology	Moderately rated concept due to technical complexity, access impact (including turning left turns), cost, and limited flexibility to minimize property impacts. ***Recommended Action*: Select features from this concept for additional refinement and application to locations along corridor.**

Recommended Corridor Concept Plan

The preferred concept (composed of a hybrid of several concepts detailed in Table 2 and illustrated in Figures Figure 2 - Figure 5) was developed based on the results of the preliminary evaluation, community and technical steering committee input. Proposed transit station locations are only representative and will require additional siting and constraint evaluation for most feasible placement.

Table 2. Draft Recommended Corridor Concept Project List

Segment	Location	Proposed Improvement
Corridor-Wide		• Install raised median at warranted locations, while maintaining or improving left turn access at signalized intersections • Install pedestrian-scale lighting adjacent to transit stations and pedestrian crossings • Provide protected and separated bike lanes and improved sidewalks along the corridor • Improve sidewalk gaps within ¼ mile of each proposed transit station
160th Ave – 192nd Ave	Segment-Wide	• Center running transit operations from east of 160th Ave to 192nd Ave • Most driveways will be restricted to right-in/right-out combined with U-turn movements at each signalized intersection
	TV Hwy/160th Ave	• Transit signal priority • Single center station serving both directions, providing pedestrian crossing refuge • Allow U-turn movements in eastbound and westbound directions
	TV Hwy/St. Mary's/165th Ave	• Limit driveway access to right-in/right-out • No transit stations or enhanced pedestrian crossing
	TV Hwy/170th Ave	• Transit signal priority • Single center station serving both directions, providing pedestrian crossing refuge • Allow U-turn movements in eastbound and westbound directions
	TV Hwy/174th Ave	• New traffic signal with transit signal priority • Single center station serving both directions, providing pedestrian crossing refuge • Allow U-turn movements in eastbound and westbound directions
	TV Hwy/178th Ave	• Transit signal priority • Single center station serving both directions, providing pedestrian crossing refuge • Allow U-turn movements in eastbound and westbound directions • Grade-separated pedestrian rail crossing on south side of intersection
	TV Hwy/185th Ave	• Transit signal priority • Single center station serving both directions, providing pedestrian crossing refuge • Allow U-turn movements in eastbound and westbound directions
	TV Hwy/187th Ave	• No transit stations or enhanced pedestrian crossing • Limit intersection access to right-in/right-out/left-in
	TV Hwy/192nd Ave	• New traffic signal with transit signal priority • Single center station serving both directions, providing pedestrian crossing refuge • Allow U-turn movements in eastbound and westbound directions • Grade-separated pedestrian rail crossing on south side of intersection
192th Ave – 209th Ave	TV Hwy/198th Ave	• Eastbound and westbound right turn pocket for transit queue bypass in both directions • Far side/curbside stations in both directions • Allow U-turn movements in eastbound and westbound directions • Transit signal priority
	TV Hwy/Intel Campus Dwy/ 204th Ave	• Far side/curbside stations in both directions • Allow U-turn movements in eastbound and westbound directions • Transit signal priority

Segment	Location	Proposed Improvement
	TV Hwy/209th Ave	• Westbound right turn pocket for transit queue bypass • Far side/curbside stations in both directions • Allow U-turn movements in eastbound and westbound directions • Transit signal priority
209th Ave – Cornelius Pass Rd	TV Hwy/214th Ave	• Enhanced pedestrian crossing • Far side/curbside stations in both directions • Limit driveway access to right-in/right-out/left-in • Grade-separated pedestrian rail crossing on south side of intersection
	TV Hwy/216th Ave	• Limit driveway access to right-in/right-out/left-in
	TV Hwy/Cornelius Pass Rd	• • Far side/curbside stations in both directions • Allow U-turn movements in eastbound and westbound directions • Transit signal priority

Figure 2. Draft Recommended Corridor Concept

Figure 3. Draft Recommended Corridor Concept – 160th Ave to 192nd Ave

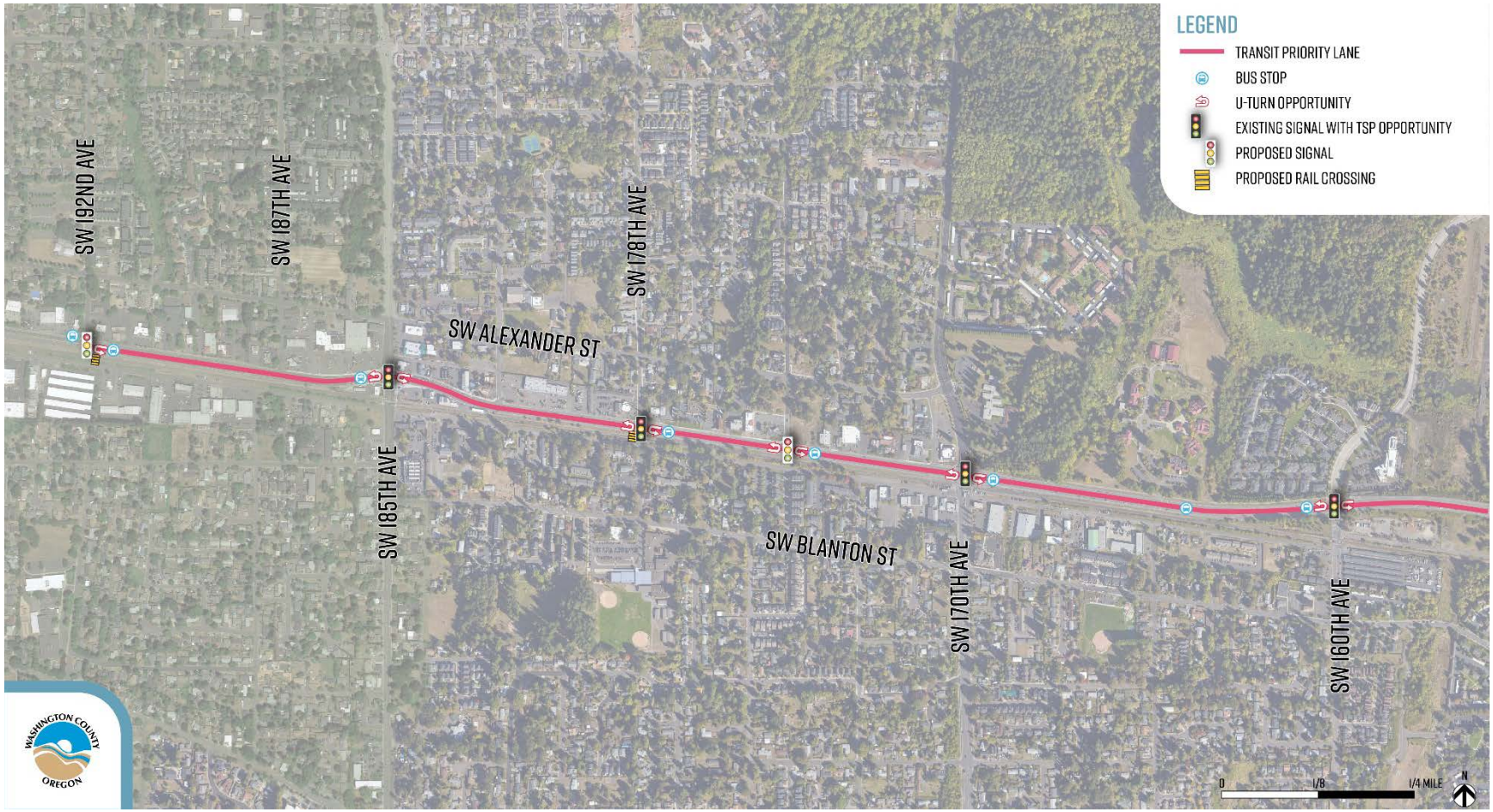


Figure 4. Draft Recommended Corridor Concept – 192nd Ave to 209th Ave

Figure 5. Draft Recommended Corridor Concept – 209th Ave to Cornelius Pass Rd

The proposed cross sections reflective of the center running transit operation between 160th Avenue and 192nd Avenue are shown below. Figure 6 illustrates the proposed typical center running cross section between stations. Figure 7 illustrates the proposed center running cross section at center station locations. The cross sections maintain a 29-foot "hole in the air" allowance for freight mobility in both directions along TV Highway since the corridor is designated as a National Highway System (NHS) facility.

Figure 6. Proposed Typical Cross Section for Center Running Transit Operation (160th Ave – 192nd Ave)

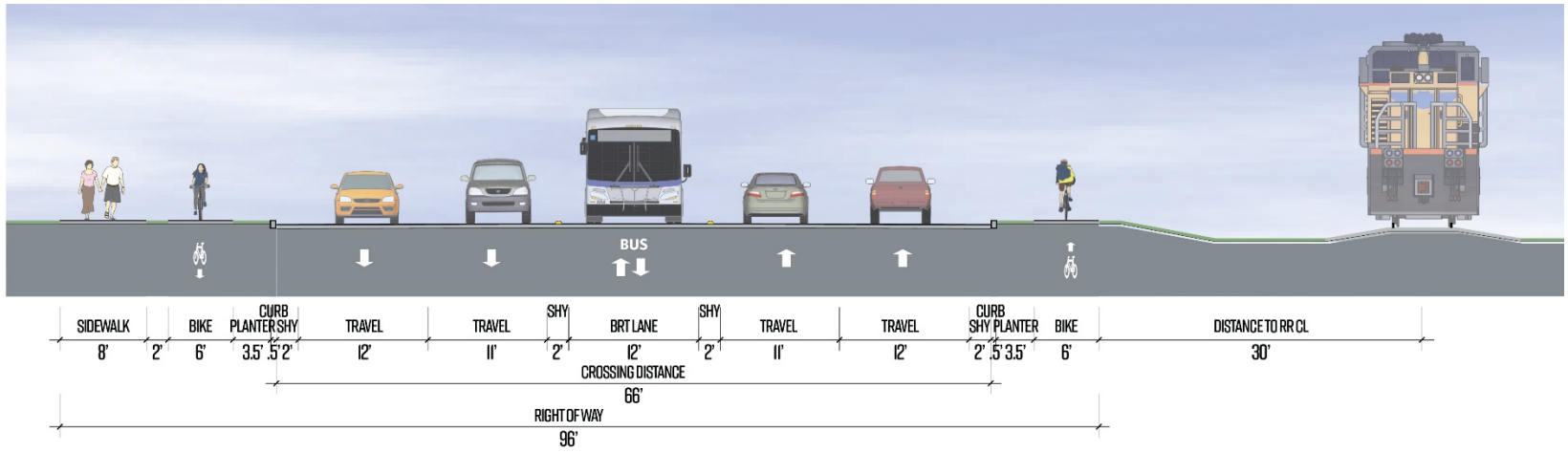
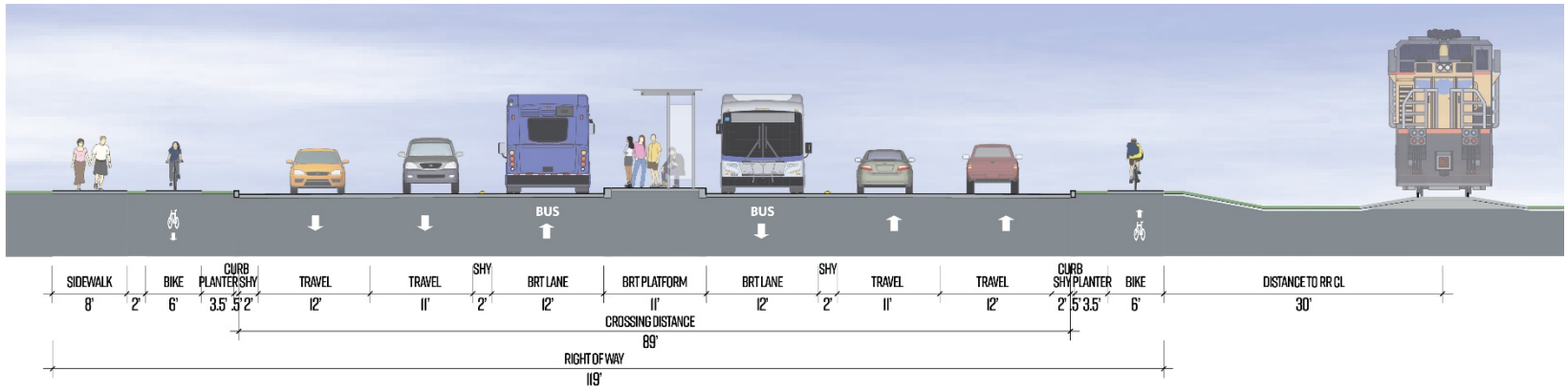


Figure 7. Proposed Center Station Cross Section for Center Running Transit Operation (160th Ave – 192nd Ave)



The proposed cross sections reflective of the curbside transit operation with transit operating in general purpose between 192nd Avenue and Cornelius Pass Road are also shown below. Figure 8 illustrates the proposed typical cross section for this segment, Figure 9 illustrates the proposed constrained cross section for this segment, and Figure 10 illustrates the proposed cross section at a typical intersection for this segment. The transition between the two segments will require specific signal operations to facilitate the change in operation between center running and curbside/general purpose running.

Figure 8. Proposed Typical Cross Section for Curbside Running Transit Operation (192nd Ave – Cornelius Pass Rd)

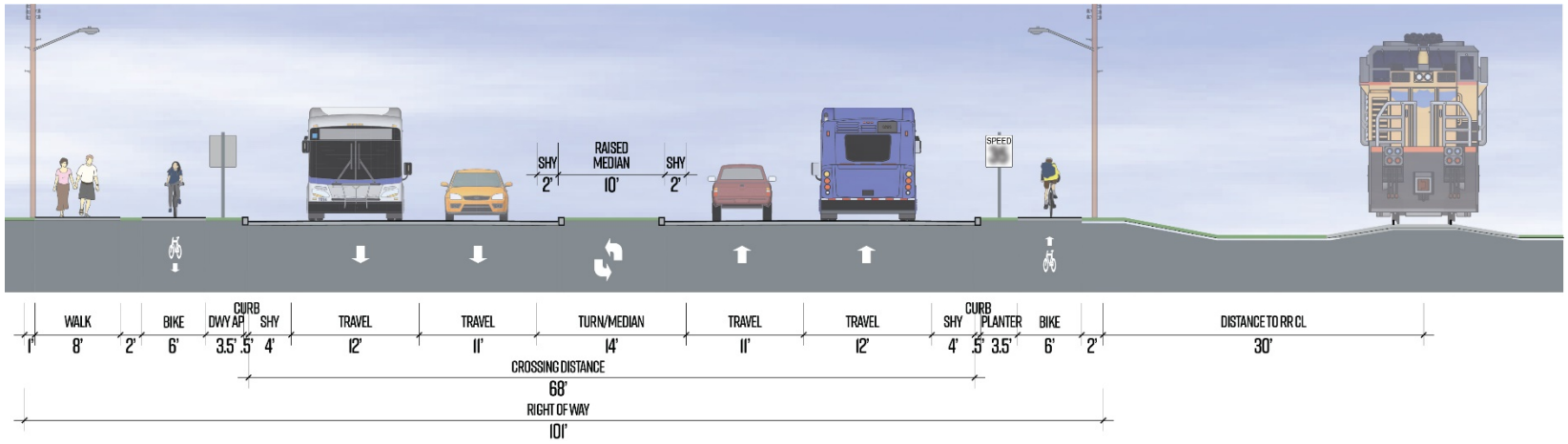


Figure 9. Proposed Constrained Cross Section for Curbside Running Transit Operation (192nd Ave – Cornelius Pass Rd)

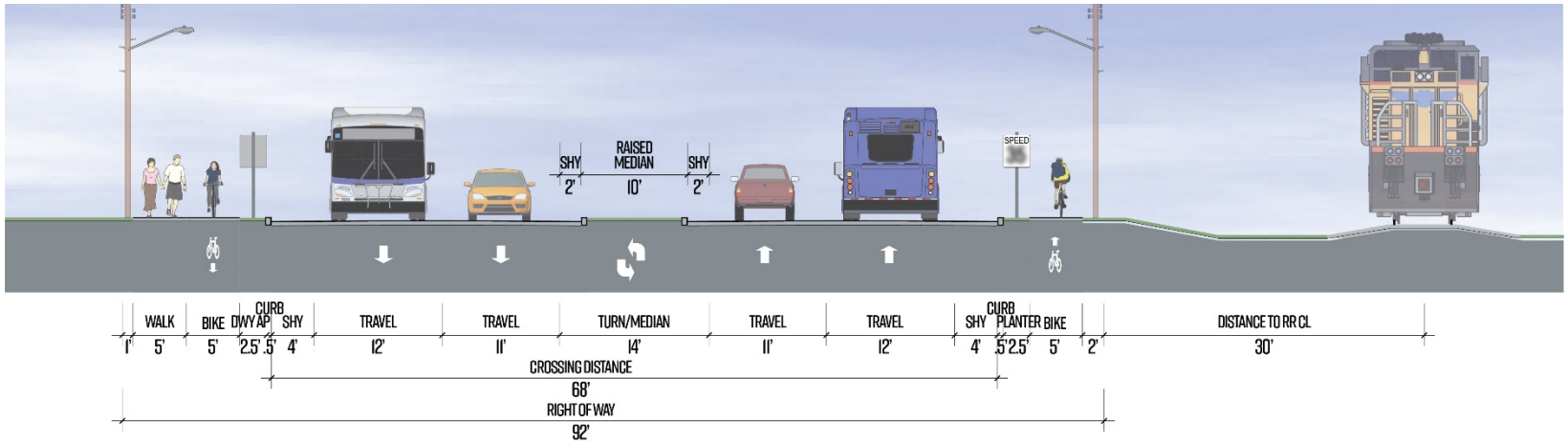
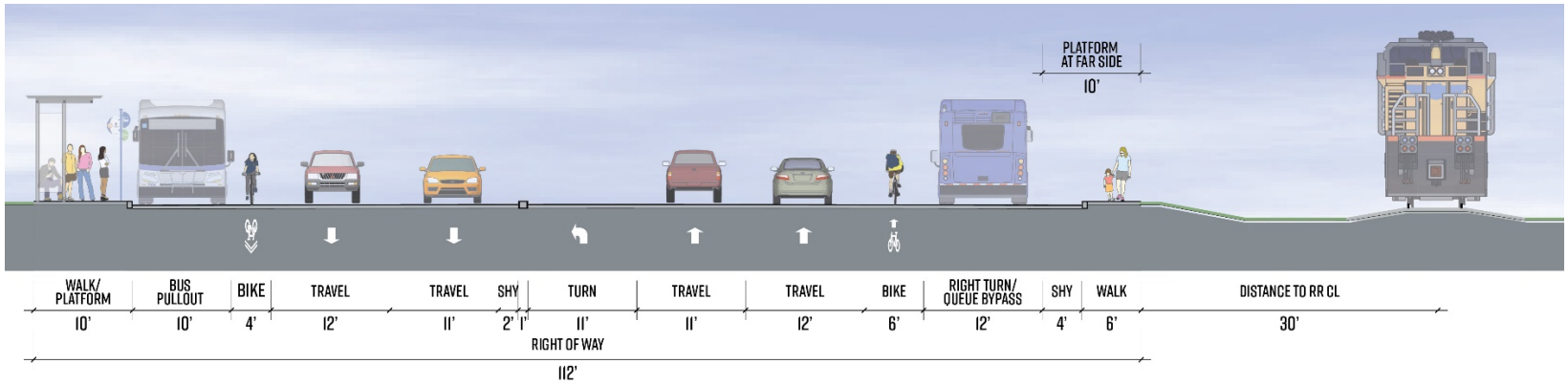


Figure 10. Proposed Cross Section for Curbside Running Transit Operations at Typical Intersections (192nd Ave – Cornelius Pass Rd)



Specific recommendations for improvements to fill sidewalk gaps needed to access proposed transit station locations are illustrated in Figure 11. These recommended sidewalk improvements fill in gaps within 1/4 mile of each proposed transit station location along the study corridor.

Figure 11. Proposed Study Corridor Sidewalk Improvements

1 Project Background

The Moving Forward TV Highway Plan will help guide investment to efficiently and effectively improve multi-modal travel options while preserving the important mobility and freight functions of TV Highway (OR 8). The Plan identifies deficiencies in transit travel time/reliability, gaps in the bicycle and pedestrian networks, barriers to safely access transit and destinations along the corridor, and barriers to connecting the corridor to adjacent neighborhoods. The Plan developed and evaluate multi-modal corridor concepts intended to balance the identified study area needs and achieve the Plan's goals and desired outcomes.

TV Highway serves many transportation functions for multiple travel modes. It is a major link in the regional roadway system and is a designated over-dimensional truck route. As development has occurred in and around the corridor, traffic congestion has increased, resulting in travel delays for corridor users, including riders on TriMet's Line 57, which connects Forest Grove to the Beaverton Transit Center.

Currently there are many congested intersections along the corridor, which cause travel delay for all motorized travelers, including freight, transit, and general purpose traffic. Congestion and travel delay is anticipated to increase as areas like South Hillsboro[7] develop and travel demand in the corridor increases. In addition, the corridor is identified in Metro's draft Regional Transportation Safety Strategy and County's draft Safety Action Plan as a high crash corridor. Incomplete facilities for walking and biking in this corridor, including sidewalk gaps, poor ramp conditions, and unprotected bike lanes, contribute to safety, access, and mobility concerns.

Local and regional policies seek to reduce reliance on private motor vehicles for travel, and increase use of transit, bicycling, and walking -- with a goal of a threefold increase in use of these modes between 2010 and 2035. TV Highway is identified as a regional 2014 Regional Transportation Plan (RTP) Mobility Corridor and a Future HCT Corridor linking Beaverton and Forest Grove. Improved transit services and facilities, along with improved access to transit stops, will improve mobility and safety in the corridor. Transit improvements will also help to achieve transportation goals adopted by the County and other agencies responsible for transportation and development along the TV Highway corridor.

1.1 Project Purpose

The Moving Forward TV Highway – Enhanced Transit and Access Plan studied the feasibility of enhanced transit service in the TV Highway corridor, primarily within unincorporated Washington County between

[7] South Hillsboro is expected to include approximately 8,000 housing units to ultimately provide housing for nearly 20,000 residents, 2 mixed-use town and village centers providing a mix of shopping, service, and gather spaces, and 286 acres of new parks and open spaces. The development area is expected to be complete by 2021.

SW Cornelius Pass Road and SW 160th Avenue. The TV Highway corridor was selected as a "Next Phase Regional Priority Corridor" in Metro's 2035 High Capacity Transit (HCT) System Plan and has been the subject of substantial state, regional, and local planning work in recent years. The County, in partnership with the ODOT, undertook a corridor refinement study to define feasible transit concepts, identify needed access improvements such as bicycle and pedestrian facilities and highway crossings to potential transit stations along the corridor within the study area, and lay the groundwork for the corridor to be elevated to a regional priority HCT corridor.

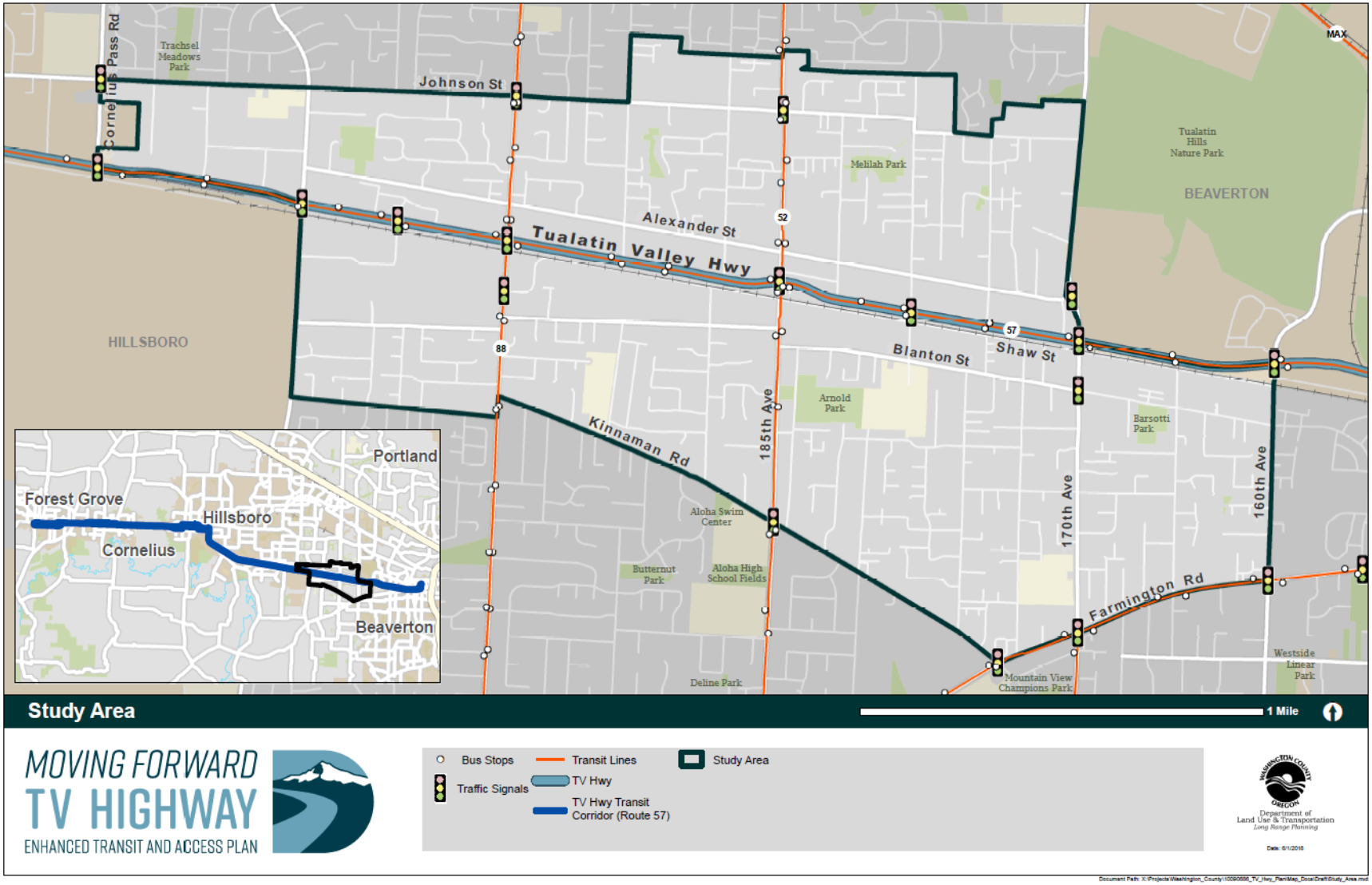
1.2 Study Area

The project is located in the Aloha-Reedville area of urban unincorporated Washington County between the cities of Hillsboro and Beaverton. The study area consists of the east-west TV Highway corridor from SW Cornelius Pass Road (on the west) to SW 160th Avenue/Millikan Way (on the east) – a distance of approximately 3 miles. The northern and southern limits of the study area are bounded by Johnson Street and Blanton Street, respectively, representing the potential "walkshed" of future HCT service operating along TV Highway. Figure 12 illustrates the Moving Forward TV Highway study area corridor.

The TV Highway corridor developed over many decades. Today, the corridor is characterized by automobile-oriented commercial strip development interspersed with multi- and single-family housing. Intel, the largest employer in the study area, operates a large fabrication facility located on TV Highway near SW 198th Avenue. Smaller businesses are located on stand-alone properties or within suburban-format shopping centers. The central portion of the study area (around TV Highway and SW 185th Avenue, from SW 192nd Avenue to SW 170th Avenue) is within the Town Center designated by Metro in 1995 and in the 2040 Growth Concept. The remainder of TV Highway is designated as a 2040 Corridor.

TV Highway is the dominant transportation feature in the study area, carrying 35,000 to 40,000 vehicles per day on its 5-lane cross-section. TriMet's Line 57 (a frequent service line with the highest ridership of any bus line in Washington County) operates along TV Highway, linking central Forest Grove to central Beaverton. This line carries an average of 7,500 passengers on weekdays, 5,820 on Saturdays and 4,710 on Sundays (Spring 2016, TriMet). The Portland & Western Railroad (PNWR) runs parallel and adjacent to TV Highway. The PNWR poses accessibility and connectivity challenges for neighborhoods to the south of TV Highway, and right-of-way (ROW) restrictions for improvements to TV Highway. Alexander Street runs parallel to TV Highway approximately 400 feet north of TV Highway. This lightly-travelled County collector road offers the possibility of a pedestrian-scale "Main Street" environment that could anchor a Town Center in the vicinity of TV Highway and SW 185th Avenue. Within the study area, the street pattern beyond Alexander Street is not a grid and discontinuous, further emphasizing TV Highway's importance for community and regional mobility.

Figure 12. Project Study Area Corridor



1.3 Project Goals

Project goals for the TV Highway corridor through Aloha focus on safety for all modes and exploring strategies to improve transit. The corridor has been the subject of many state, regional, and local planning efforts to identify needs, opportunities, and actions to improve safety, mobility, and guide a path forward to improvement, including being identified as a Regional High Capacity Transit (HCT) corridor. These goals reflect priorities established through previous planning efforts including the 2014 *TV Highway Corridor Plan*, and have been refined to focus on the specific needs this project is aiming to address. The following list of goals tie directly to the identified project needs, which have guided the development of the corridor design concept(s):

1. **Safety**: Improve safety and health for all users traveling within, through and to the study area.
2. **Social Equity:** Improve access, mobility, and connectivity for historically underserved communities and help address disparities concentrated in low-income communities.
3. **Multi-modal mobility**: Create a transportation corridor that helps meet county and regional objectives to provide efficient and effective mobility for people and goods while reducing vehicle miles travelled and providing convenient transportation options.
4. **Connectivity**: Create connections that reduce barriers, improve transit access, and remove gaps in the local networks for walking and biking.
5. **Livability:** Strengthen economic vitality and neighborhood livability through improvements to travel options along the corridor.

2 Existing and Future Conditions

2.1 Demographics

According to TriMet, Line 57 along TV Highway ranks tenth in the TriMet system in terms of providing access to communities of concern, jobs, housing, and social services. Relative to other lines in the TriMet system, Line 57 scores particularly high in serving multiple communities of concern (low-income, people of color, limited English language proficiency residents, seniors and youth), and provides a high level of access to affordable housing and services. There are 65,000 residents with 45 percent of the population below 200 percent of the poverty line located in census block groups that are within a quarter-mile of the entire Line 57 route between Forest Grove and Beaverton. In addition, there are almost 30,000 jobs within quarter-mile, with nearly 60 percent earning less than $40,000 per year.[8]

In comparison to both the Portland Metropolitan region and County as a whole, communities in the study area have above average concentrations of low-income population, people of color, limited English language proficiency residents, and youth populations. Hispanic/Latino residents are the dominant people of color group (accounting for more than 25 percent of the residents in certain Census Block Groups in the area), followed by residents of Korean, Somali, Vietnamese, and African-American descent.

Table 3 compares various demographic groups that are traditionally more likely to depend on transit between different geographies along the corridor and within the study area. Within a 1/4 mile of the corridor inside the study area, populations below the federal poverty level, minority populations, and youth populations are represented higher than the other geographies.

Table 3. Corridor and Study Area Demographics

	Total Population	Poverty Population	Minority Population	Elderly Population	Youth Population	Zero Car Households	Total Households
1/4 Mile Corridor Buffer	37,012	7,883	18,967	3,726	10,707	1,807	12,643
		21.3%	**51.2%**	**10.1%**	**28.9%**	**14.3%**	
Study Area	18,317	4,126	9,322	1,292	5,641	276	5,603
		22.5%	**50.9%**	**7.1%**	**30.8%**	**4.9%**	
1/4 Mile Corridor Buffer within Study Area	9,361	2,272	5,056	617	2,942	151	2,831
		24.3%	**54.0%**	**6.6%**	**31.4%**	**5.3%**	

Source: 2016 American Community Survey 5 Year estimates

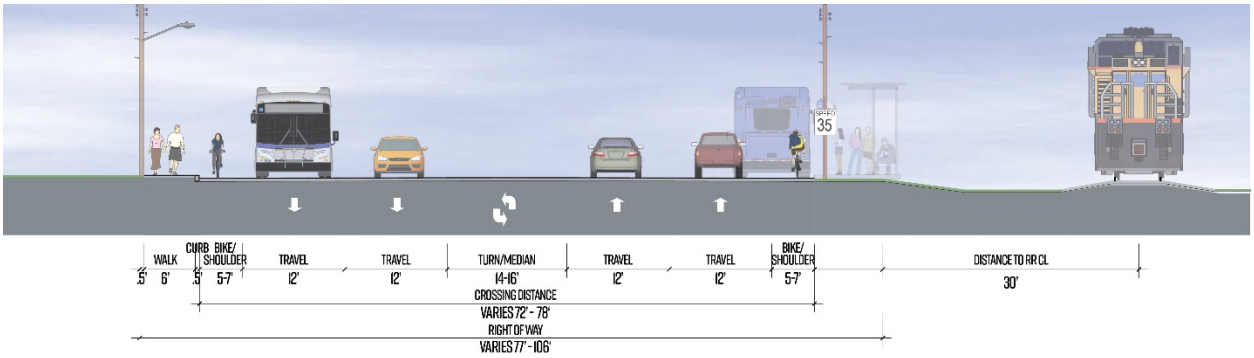
2.2 Existing Corridor Cross Section

Arterial corridors that lack adequate pedestrian crossings are a typical impediment to accessing transit, particularly along segments of TV Highway. Figure 13 illustrates the typical existing cross section of TV Highway within the study area and shows the typical width of roadway transit riders and pedestrians need to cross in order to access bus stops on either side of the road. As shown, the corridor includes

[8] Source: 2015 American Community Survey 5-year estimates and Census Longitudinal Employer-Household Dynamics

consistent sidewalks existing only on the north side, unprotected bike lanes adjacent to the outside travel lanes in both directions, striped two-way left-turn lanes, and many bus stops at locations without sufficient sidewalk or pedestrian crossings. The corridor is adjacent to an existing PNWR rail line, which poses accessibility and connectivity challenges for neighborhoods to the south of TV Highway, and ROW restrictions for improvements to much of the study corridor. The ROW width shown represents a range given the variety and inconsistency of ROW widths that currently exist along the study corridor.

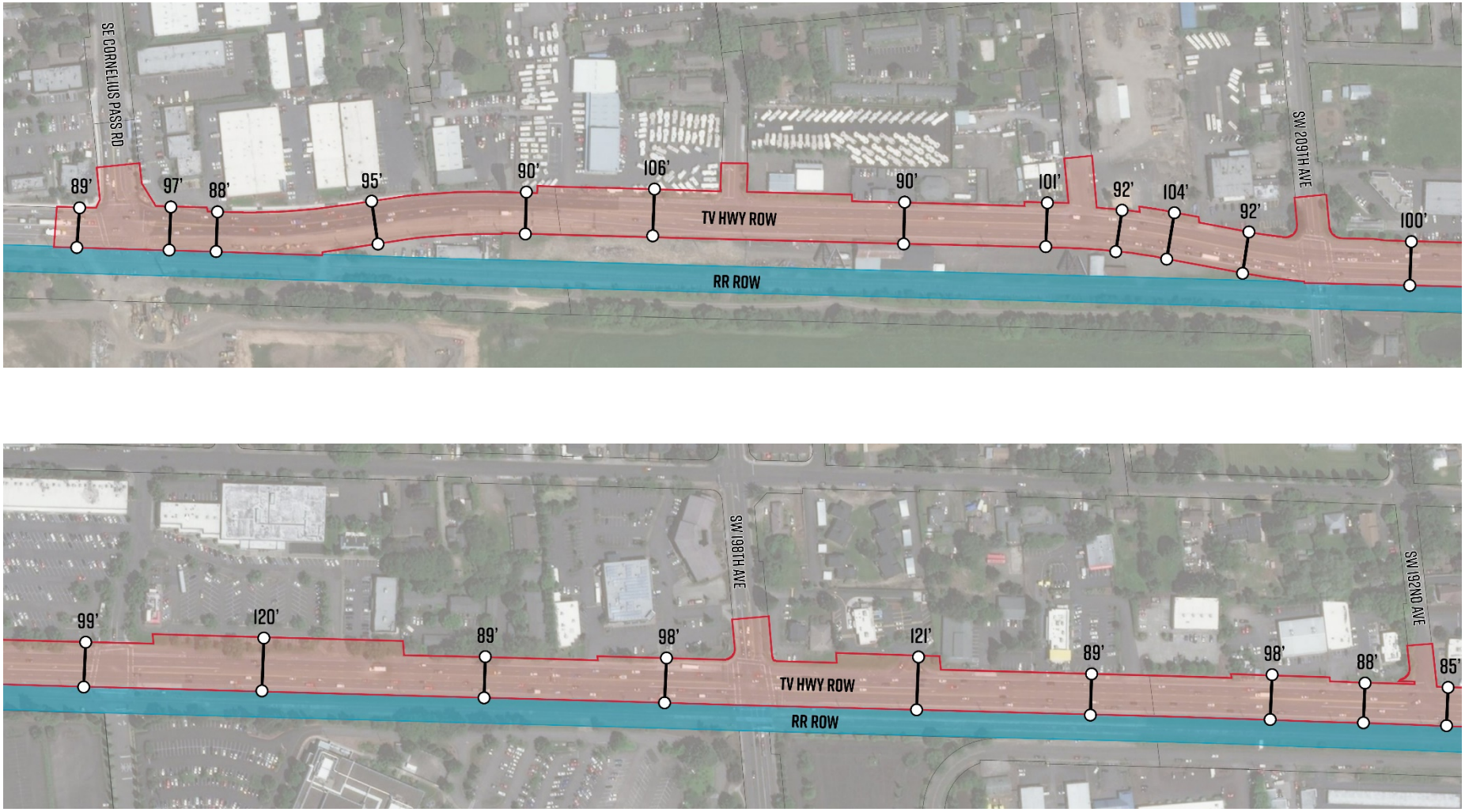
Figure 13. Existing TV Highway Cross Section



The existing conditions present many safety and mobility challenges including long pedestrian crossing distances with limited pedestrian-scale lighting; lack of sufficient transit amenities and inconvenient access to many bus stops; pedestrian barriers with utility/light poles along the existing sidewalks; and unprotected bike lanes adjacent to travel lanes along much of the corridor.

Figure 14 illustrates the approximate existing ROW width at select locations along TV Highway within portions of the study area, specifically Cornelius Pass Road to 209th Avenue and Intel Driveway to 192nd Avenue. As shown, ROW widely varies at many locations, which presents both opportunities and constraints for improvement considerations. Preliminary concept development considers these ROW constraints by identifying locations that can accommodate both typical and constrained cross sections to minimize impact to properties on the north side and the rail ROW on the south side of the corridor.

Figure 14. Existing ROW Widths at Select Corridor Segments (Approximate)



2.3 Safety Conditions

ODOT maintains a Safety Prioritization Index System (SPIS) that classifies roadway segments into Categories 1 through 5 (with 5 having the worst safety record). TV Highway is designated as a Category 5 road, which equates to more than 10 crashes per 5-mile segment over a 3-year period. Approximately one-third of all fatal and serious injury crashes along the TV Highway corridor involved a person walking or bicycling; these crashes most commonly occurred between SW 170th and 198th avenues. The 5-year average crash rate along TV Highway was 30 percent higher than crash rates for similar ODOT facilities throughout the rest of the state.

Washington County also maintains a SPIS list for intersections where the county has jurisdiction over at least one approaching segment. Table 4 shows all intersections measured in the County SPIS. These locations are ranked according to crash frequency, crash rate (per entering vehicles) and crash severity. During the 2012-2014 period, 5 of the top 15 ranked intersections in the county were located within the study area, all of which are along TV Highway. Other safety concerns are more difficult to measure, such as the lack of pedestrian or bicycling activity in locations where there are no designated facilities or existing facilities are perceived as unsafe or uncomfortable. In these cases, statistics may not show a record of pedestrian or bicycle crashes, but the lack of safe facilities creates a condition that needs to be addressed.

Table 4. Study Area Intersections in County SPIS (2012-2014)

SPIS Rank	Primary Street	Cross Street
5	TV Highway	185th Avenue
9	TV Highway	198th Avenue
11	TV Highway	209th Avenue
12	TV Highway	178th Avenue
15	TV Highway	170th Avenue
43	Farmington Rd	170th Avenue
46	TV Highway	192nd Avenue
56	Cornelius Pass Rd	Johnson Street
64	TV Highway	187th Avenue
100	Alexander Street	187th Avenue
110	Farmington Rd	Kinnaman Road
113	185th Avenue	Johnson Street
124	TV Highway	214th Avenue
141	185th Avenue	Kinnaman Rd
154	TV Highway	Cornelius Pass Rd
195	170th Avenue	Shaw Street
217	192nd Avenue	Johnson Street
233	170th Avenue	Blanton Street
235	185th Avenue	Blanton Street (East)
237	198th Avenue	Alexander Street
270	TV Highway	174th Avenue
273	Blanton Street	188th Avenue
296	198th Avenue	Kinnaman Road (East)

2.3.1 Corridor Crash Assessment

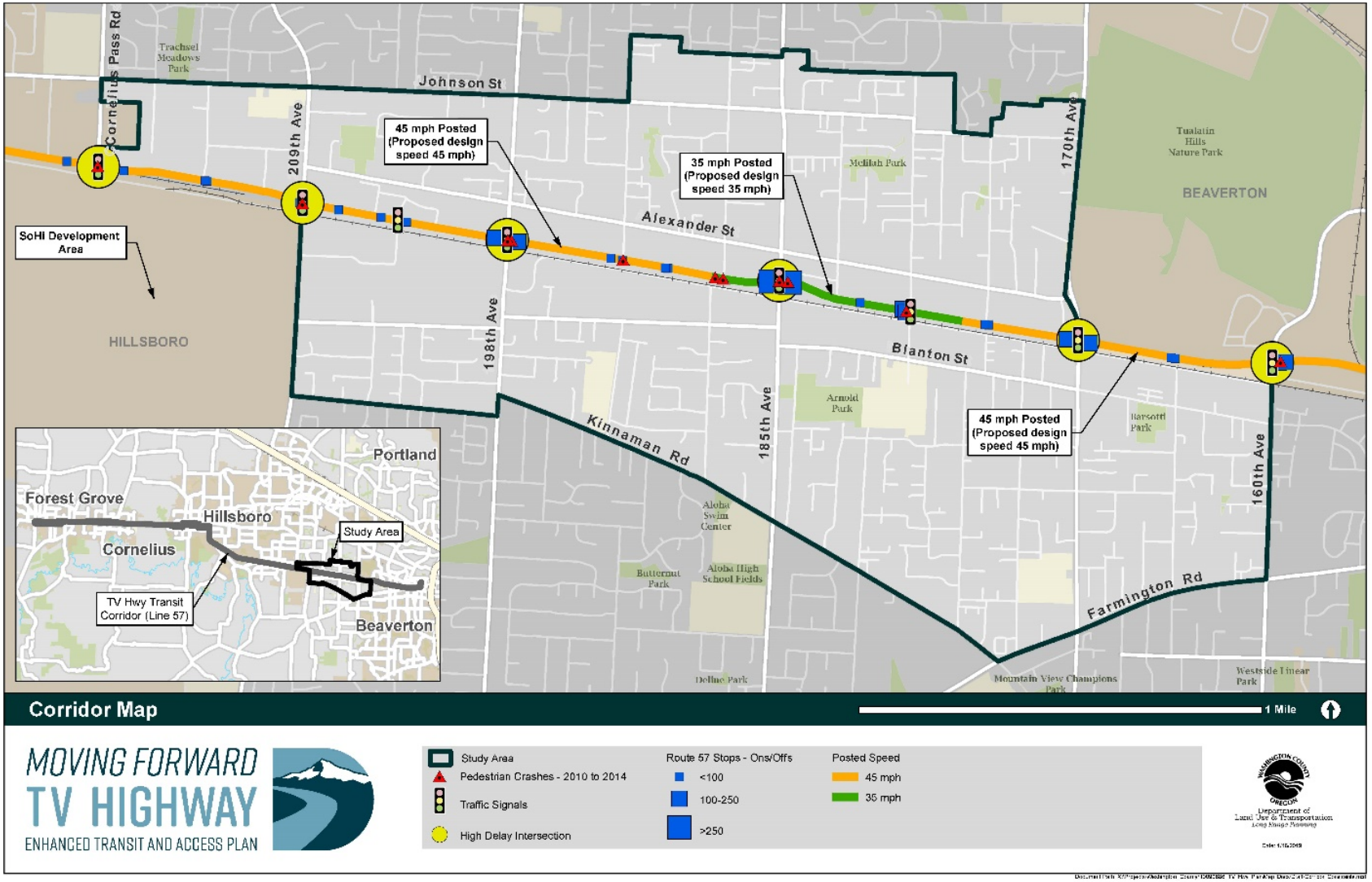
Reviewing study area crash history assists in identifying certain locations that may warrant safety improvements, particularly those within proximity of bus stops. Using crash data in Washington County between 2010 and 2014, Table 5 below compares crash history between the study area corridor and all of Washington County for different travel modes. Approximately 84% of all pedestrian crashes occurred within 250 feet of a study area corridor bus stop, suggesting the importance of safety improvements for pedestrians to access transit.

Table 5. Study Area Crash History (2010-2014)

Crash Category	MFTVH Study Area Corridor*	Washington County	Percent of Total along Study Area Corridor
Total Crashes	920	33,107	2.8%
Pedestrian Crashes	19	522	3.6%
Pedestrian Crashes within 250 feet of bus stops	16	N/A	N/A
Bicycle Crashes	17	553	3.1%
Severe Crashes	30	670	4.5%
Fatal Crashes	2	75	2.7%

Figure 15 illustrates the posted speed limits along the study corridor in addition to the crash frequency. Posted speed limits are generally 45 miles per hour along the study area corridor, with the exception of a segment within proximity of 185th Avenue, which includes a posted speed limit of 35 miles per hour.

Figure 15. Study Corridor Posted Speed Limits and Crashes



2.4 Multi-Modal Conditions

2.4.1 Transit Service Conditions

TriMet Line 57 Service Description

Currently, TV Highway is served by TriMet Line 57, which is a Frequent Service bus route between Forest Grove and Beaverton Transit Center. Stops are spaced on average every quarter-mile along the full line. It has the highest ridership of any bus line in Washington County and ninth in the entire TriMet bus network, with over 7,500 average weekday boardings.[9] Line 57 is also the seventh most productive bus line in the system, with over 50 boarding rides per vehicle hour. Line 57 provides offers the longest span of service among all buses in the county with 24 hours of service on weekdays, Saturdays, and Sundays, at a typical frequency of 15 minutes. However, frequencies are slightly lower during early morning hours (4-6 a.m.) and substantially lower during late evening hours (10 p.m.-4 a.m.).

TriMet Line 57 Ridership Patterns

Nearly two-thirds of the line's total ridership is on the portion of Line 57 between Beaverton and Hillsboro transit centers, which includes the study area for this plan. Ridership is typically highest during the PM peak period in both directions. Figure 16 shows spring 2017 weekday stop-level activity at each stop along the entirety of Line 57. Stop-level ridership is highest at major transfer locations, including the Beaverton Transit Center, Hillsboro Transit Centers, and at stops within proximity of other north/south bus lines (e.g., 185th Avenue). However, based on TriMet's 2017 fare survey, only 29 percent of Line 57 riders transfer to another line, most requiring only one transfer. Passenger activity tends to be boarding focused heading toward the Hillsboro Transit Center from Forest Grove in the inbound direction and toward the Hillsboro Transit Center from Beaverton in the outbound direction. Table 6 details the 27 stops within the study area, ridership, monthly wheelchair lifts, and specific stop features. Stops within the study area generate 1,260 average weekday boardings (Spring 2017), or approximately 17 percent of total Line 57 average weekday ridership. The top five stops with the highest combined passenger activity (boardings + alightings), which as notable for their features of having better access and near signalized crossing facilities, account for nearly 70 percent of all passenger activity within the study area. These stops are located in both directions at 198th Avenue, 185th Avenue, 178th Avenue, 170th Avenue, and Millikan Way/160th Avenue.

[9] TriMet Transit Profile for Line 57 Memorandum, October 2016.

Figure 16. TriMet Line 57 Average Weekday Stop-Level Passenger Activity (Spring 2017)

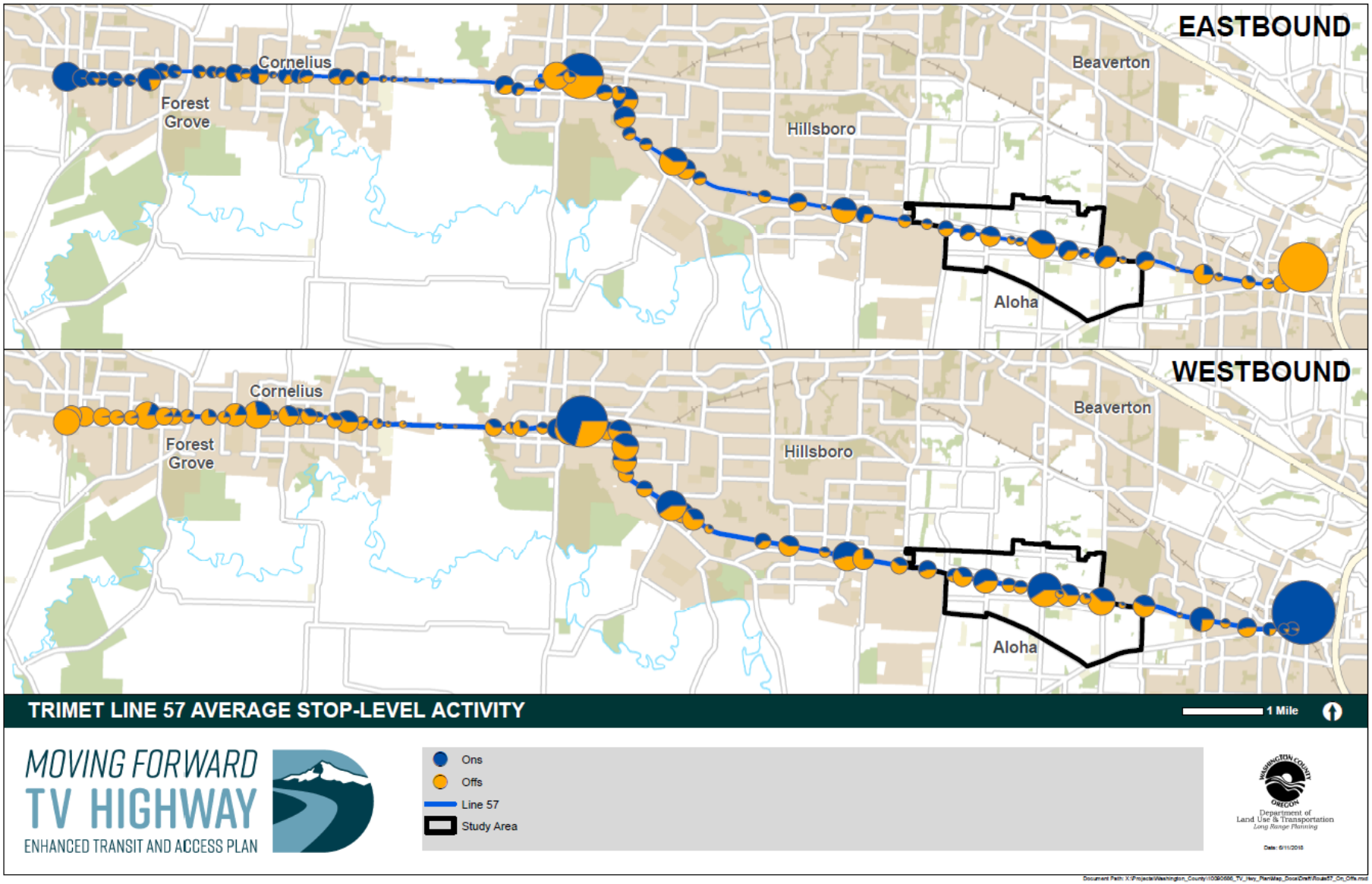


Table 6. Line 57 Stops in Study Area (Spring 2017)

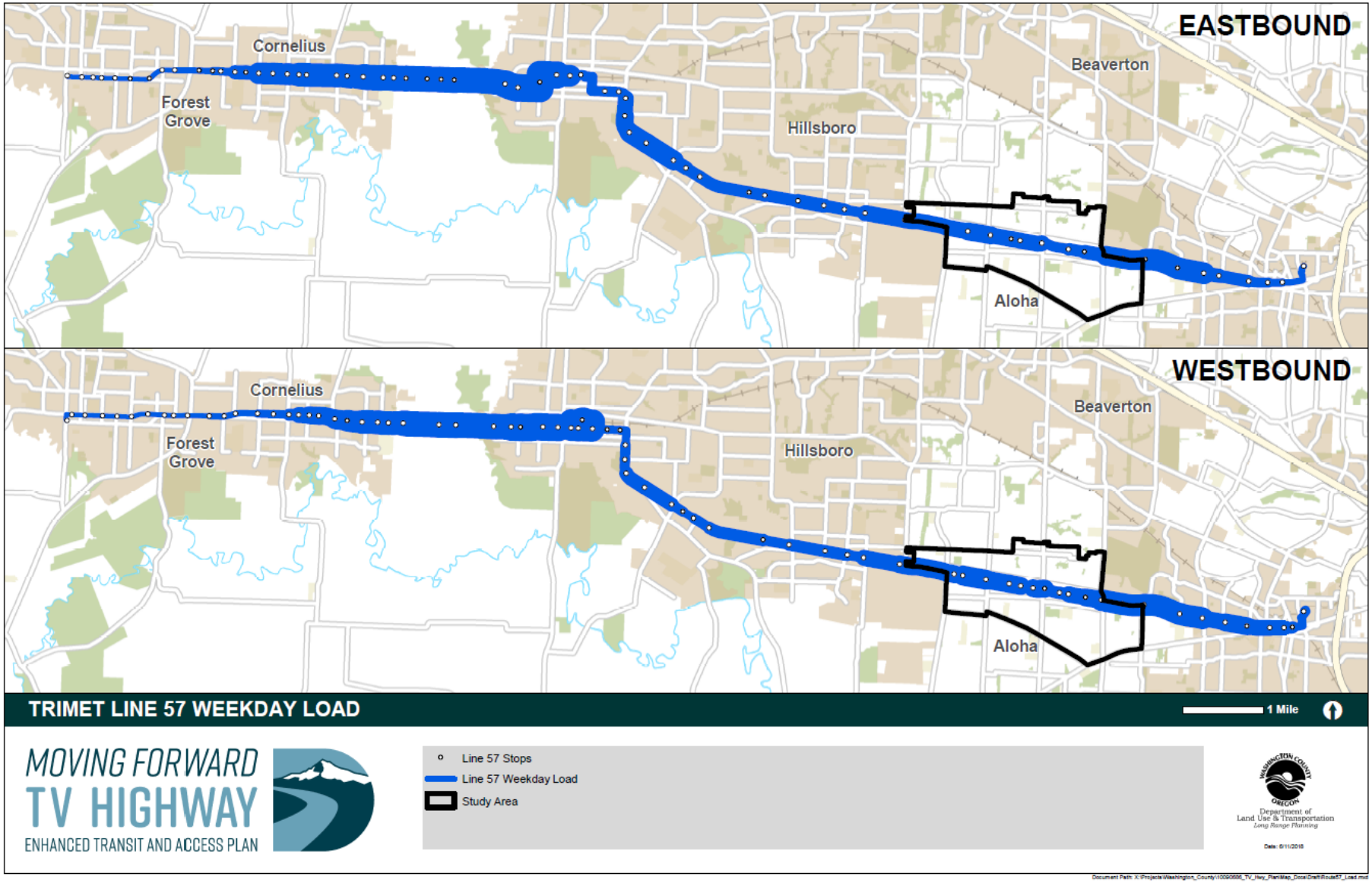
Stop Location	Direction	Boardings	Alightings	Monthly Wheelchair Lifts	Stop Features
SW Tualatin Valley Hwy and Cornelius Pass Rd/75th Avenue	Eastbound	26	31	4	Farside, pullout, sidewalk, no shelter, removed 400' from signalized crosswalk
	Westbound	28	44	12	Farside, in-lane, sidewalk, no shelter, removed 330' from signalized crosswalk
SW Tualatin Valley Hwy and SW 214th Avenue	Eastbound	18	21	1	Farside, in-lane, no sidewalk, no shelter, no crosswalk
	Westbound	45	36	5	Nearside, in-lane, sidewalk, no shelter, no crosswalk
SW Tualatin Valley Hwy and 209th Avenue	Eastbound	43	38	8	Nearside, in-lane, sidewalk, shelter, signalized crosswalk
	Westbound	26	22	8	Nearside, in-lane, sidewalk, no shelter, removed 450' from signalized crosswalk
SW Tualatin Valley Hwy and Market Centre	Eastbound	52	34	9	Farside, pullout, sidewalk, shelter, signalized crosswalk
	Westbound	34	63	17	Farside, pullout, sidewalk, no shelter, signalized crosswalk
SW Tualatin Valley Hwy and 198th Avenue	Eastbound	61	75	20	Farside, in-lane, sidewalk, shelter, signalized crosswalk, transfer with Line 88
	Westbound	88	64	34	Farside, pullout, sidewalk, shelter, signalized crosswalk, transfer with Line 88
SW Tualatin Valley Hwy and 192nd Avenue	Eastbound	8	14	0	Mid-intersection, in-lane, no sidewalk, no shelter, no crosswalk
	Westbound	24	25	3	Farside, in-lane, sidewalk, shelter, no crosswalk
SW Tualatin Valley Hwy and 189th Avenue (Burger King)	Eastbound	12	12	0	Midblock, in-lane, no sidewalk, no shelter, no crosswalk
	Westbound	22	24	4	Midblock, in-lane, sidewalk, no shelter, no crosswalk
SW Tualatin Valley Hwy and 185th Avenue	Eastbound	112	166	30	Farside, pullout, sidewalk, shelter, signalized crosswalk, transfer with Line 52
	Westbound	175	120	42	Farside, pullout, sidewalk, shelter, signalized crosswalk, transfer with Line 52
SW Tualatin Valley Hwy and Aloha Villa	Westbound	6	11	1	Midblock, in-lane, sidewalk, no shelter, no crosswalk
SW Tualatin Valley Hwy and 178th Avenue	Eastbound	84	48	27	Nearside, in-lane, sidewalk, shelter, signalized crosswalk
	Westbound	46	80	24	Farside, in-lane, sidewalk, shelter, signalized crosswalk
SW Tualatin Valley Hwy and 174th Avenue	Eastbound	24	15	0	Nearside, in-lane, no sidewalk, no shelter, no crosswalk
	Westbound	10	21	0	Nearside, in-lane, sidewalk, no shelter, no crosswalk
SW Tualatin Valley Hwy and 170th Avenue	Eastbound	110	63	42	Farside, pullout, sidewalk, shelter, signalized crosswalk
	Westbound	72	120	44	Farside, pullout, sidewalk, shelter, signalized crosswalk
SW Tualatin Valley Hwy and St Mary's Home	Eastbound	7	10	1	Nearside, in-lane, no sidewalk, no shelter, unsignalized crosswalk
	Westbound	4	7	0	Farside, in-lane, limited sidewalk, no shelter, unsignalized crosswalk
SW Tualatin Valley Hwy and 160th Avenue/Millikan Way	Eastbound	71	48	10	Farside, pullout shared with bike lane, sidewalk, shelter, signalized crosswalk
	Westbound	52	70	7	Nearside, pullout shared with right turn lane, sidewalk, shelter, signalized crosswalk

NOTE: Shading indicates the top five stops with the highest combined passenger activity (boardings + alightings) within the study area, which account for nearly 70 percent of all passenger activity within the study area.

Figure 17 illustrates the spring 2017 average weekday load in each direction of Line 57. Passenger loads are important to review to determine capacity deficiencies and locations with high passenger turnover may warrant additional review. In both directions of travel, passenger loads tend to be heaviest between Cornelius and Hillsboro, likely due to the interaction of Line 57 with the MAX Blue Line at the Hillsboro Transit Center. Line 57 service does not typically experience overcrowding, with the exception of a few trips during the PM peak in the westbound direction. Overall, the study area experiences fairly steady passenger load in both directions, with a bi-directional weekday average load of approximately 2,105, slightly higher than the total Line 57 bi-directional weekday average load of 1,970.

The 2017 Washington County Futures Study compared future transit demand using Metro's Travel Demand Model with a set of different transit investment packages with varying assumed capacity. The Study identified future overcapacity transit conditions during the PM peak immediately west of the Beaverton Transit Center along TV Highway, even with BRT investment on TV Highway. The proposed BRT investment on TV Highway is not expected to accommodate projected demand, unless additional light rail and commuter rail service is introduced into the Washington County transit network (Package C).

Figure 17. TriMet Line 57 Average Weekday Load (Spring 2017)



2.4.2 Line 57 Service Operations

All Line 57 trips run the full 17-mile length on weekdays and weekends and serve all existing bus stops, meaning no express or limited service exists. The average runtime for Line 57 varies by time of day, as the one-way trip time from end to end of the line is about 20 minutes longer in the PM peak hour (68 minutes) than it is in the late night/early morning (47 minutes). This is generally due to delays that can stem from increased stop activity and higher demand traffic flow.

Moreover, just under 90 percent of trips on Line 57 arrived on time (defined as arriving either 1 minute early or up to 5 minutes late), making Line 57 the most reliable Frequent Service line (including MAX light rail) in TriMet's system. Three percent of Line 57 trips arrived earlier than 1 minute, while 7 percent arrived over 5 minutes late. The lowest on-time performance was observed heading westbound between 2-3 PM (76 percent) and 5-6 PM (79 percent).

Based on TriMet time point segment vehicle data average, Line 57 speeds show that the service is generally operating at just over 20 miles per hour without dwell time in each direction, which is higher than the average speed for all of TriMet's Frequent Service Line of 15.5 miles per hour. In addition, transit operations "heat maps" were produced by TriMet for the Regional Enhanced Transit Concept Pilot Program project development workshops. The maps illustrate the operational performance of TriMet Line 57 buses in each direction of travel, with operational hot spots along the corridor indicated from the 50th percentile (median) travel speeds. Figure 18 and Figure 19 illustrate eastbound and westbound 50th percentile (average) speeds without dwell time at all locations along Line 57 during weekday operations in fall 2017. These maps are effective ways to identify specific locations that may benefit from peak hour or all day transit priority treatments. Within the study area, the following findings and congested locations are observed:

- In general, travel speeds indicate that eastbound traffic is dominant during AM peak period, and the westbound traffic is heavier during PM peak period.
- The buses experience significant delay at signalized intersections along the corridor.
- The TV Highway/185th Avenue intersection is a major bottleneck and experiences the most delay throughout the day, for both directions.
- Other locations that experience considerable delay are at Millikan Way, 170th Avenue, 198th Avenue, 209th Avenue, and Cornelius Pass Road. The predominant direction of the congested conditions is eastbound in the morning and westbound in the afternoon.

Figure 18. Line 57 Eastbound Median Speeds (Fall 2017)

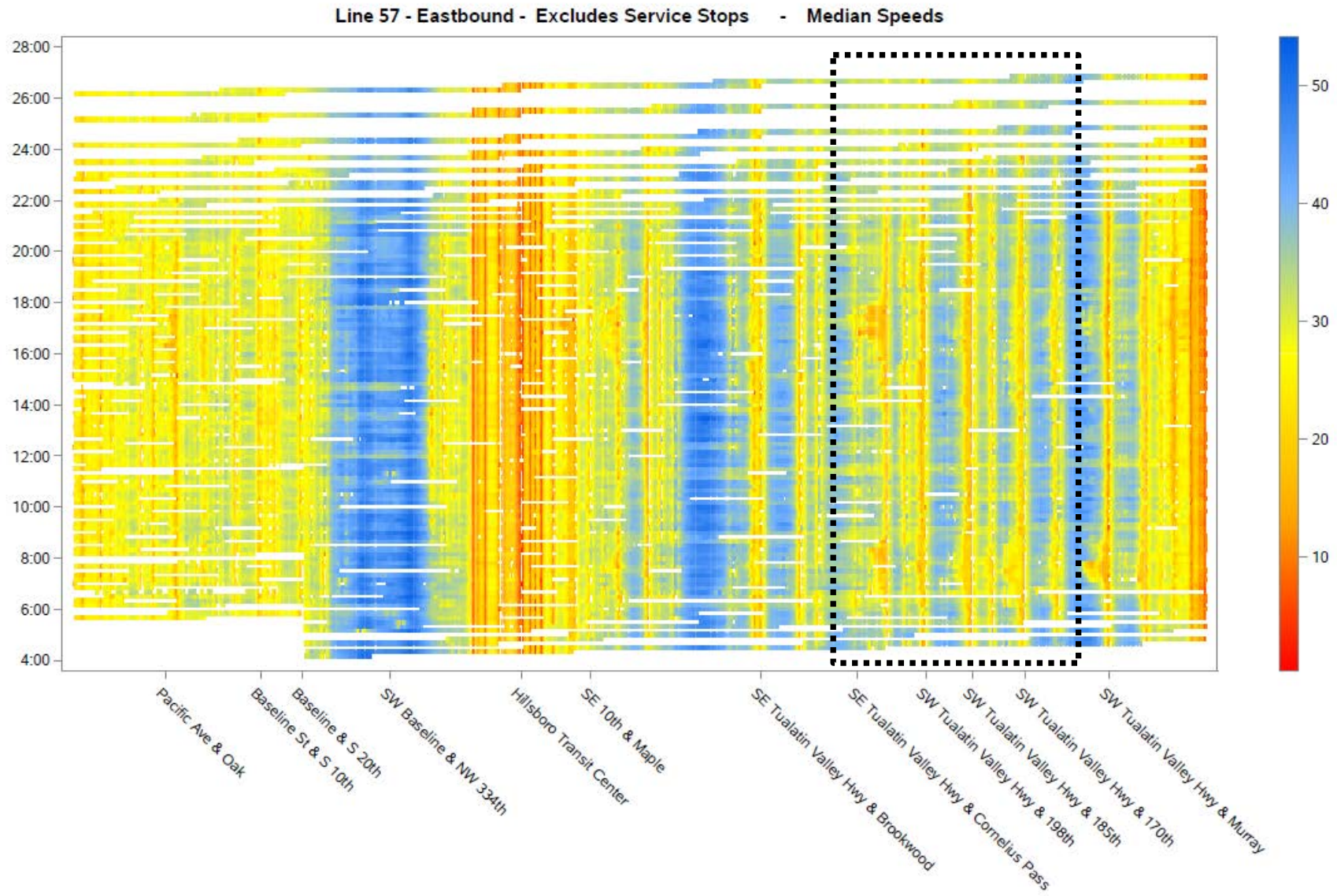
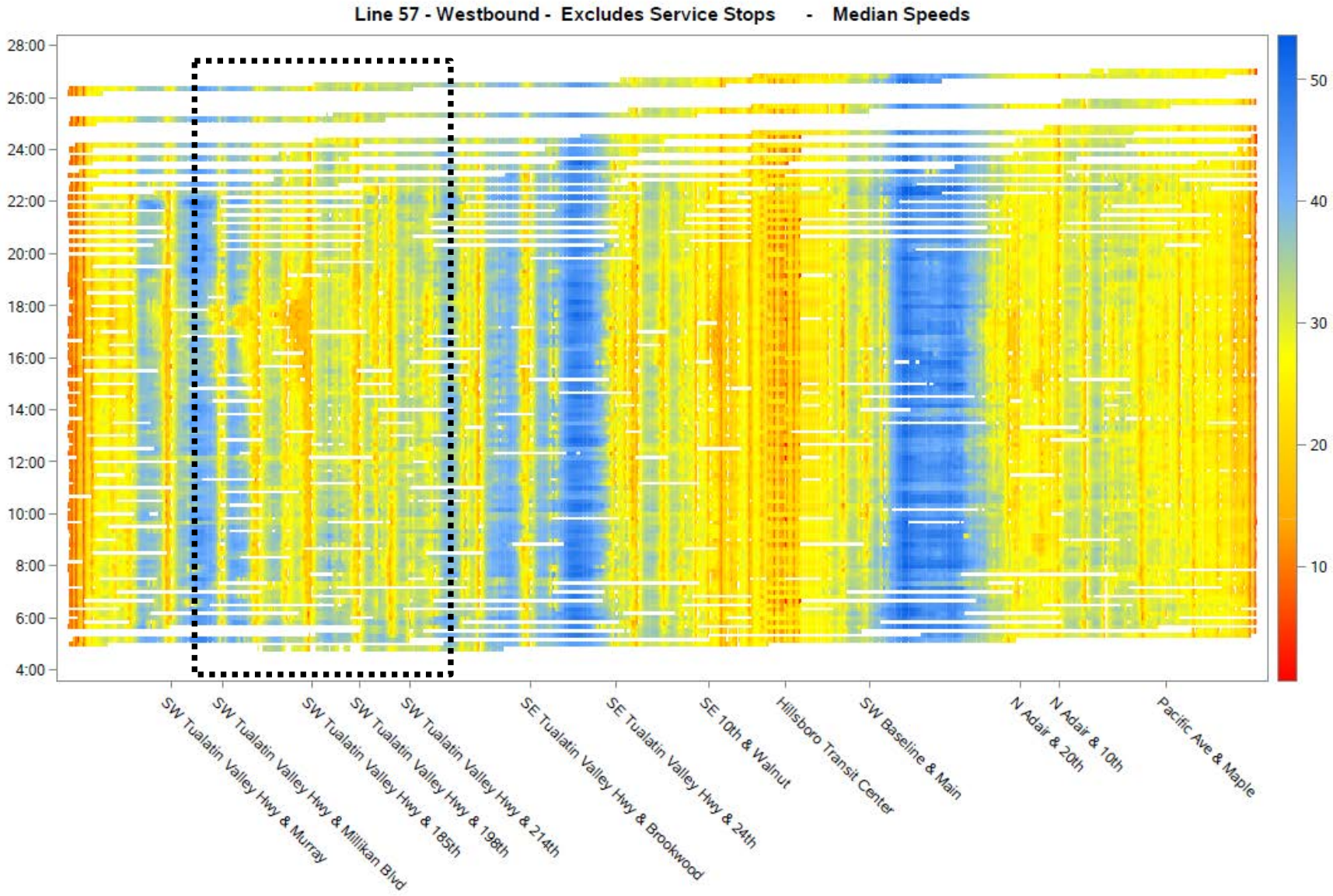


Figure 19. Line 57 Westbound Median Speeds (Fall 2017)



Additional “heat maps” were developed to assess transit travel time reliability. TriMet measures travel time reliability for each time point segment by measuring the percent change in speeds between the 10th percentile (slowest) and 90th percentile (fastest) in each direction. The larger differences in speeds indicate the times and locations where buses experience the highest unreliability in travel times. It should be noted that a location with high travel time unreliability does not necessarily indicate high delay. Instead, travel time reliability indicates the day-to-day variation of vehicle speed at a location and may help identify places where traffic operations can be improved for consistency. Figure 20 and Figure 21 illustrate eastbound and westbound 50th percentile (average) speeds without dwell time at all locations along Line 57 during weekday operations in fall 2017. Within the study area, the following locations are identified as highly unreliable spots:

- Westbound traffic is highly unreliable during PM peak period, especially from Millikan Way approaching 170th Avenue.
- Eastbound traffic is unreliable during AM peak period at most of the signalized intersections, especially near Millikan Way and 209th Avenue.
- Eastbound traffic is also unreliable during PM peak period between Cornelius Pass Road and 209th Avenue.

Figure 20. Line 57 Eastbound Travel Time Reliability (Fall 2017)

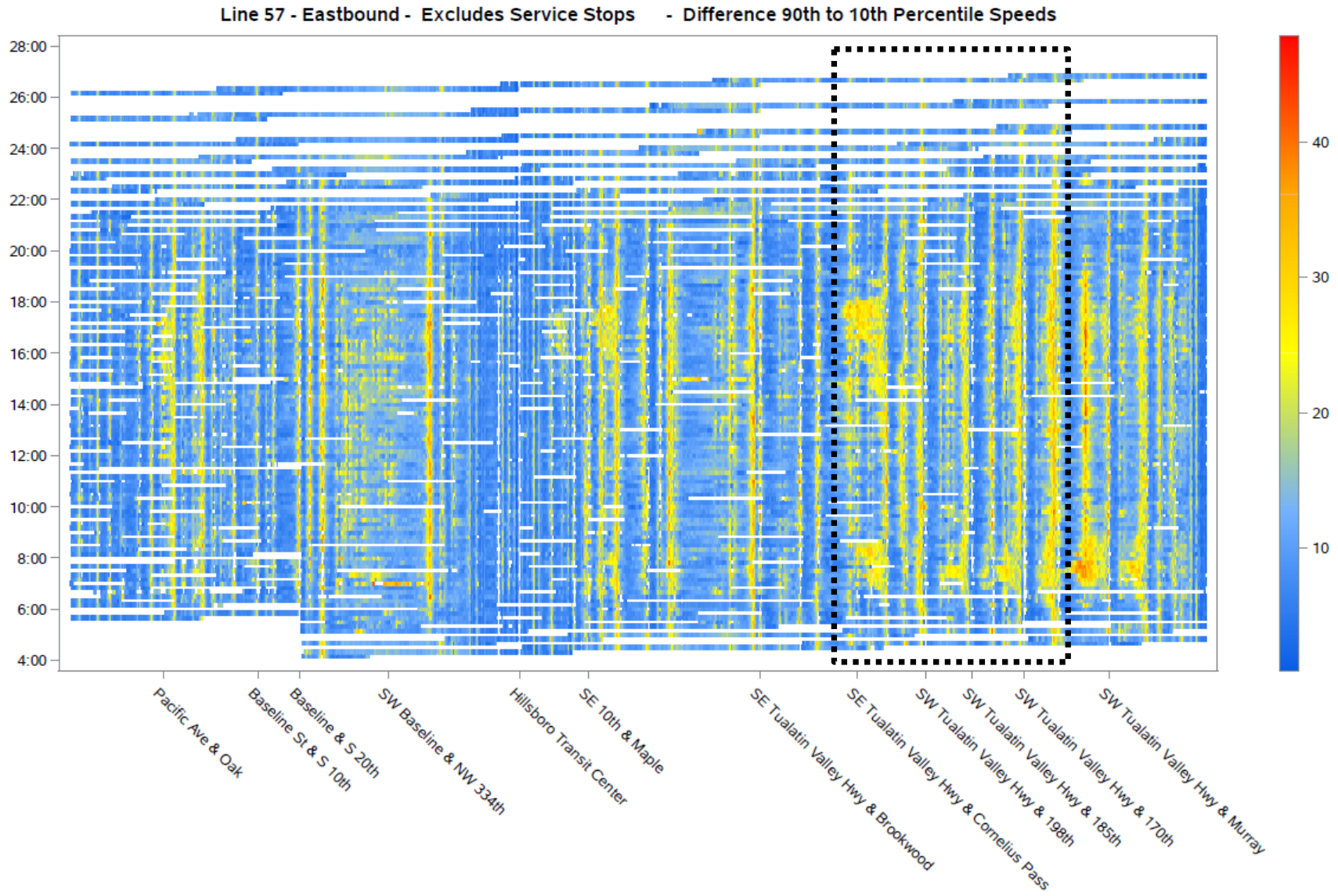
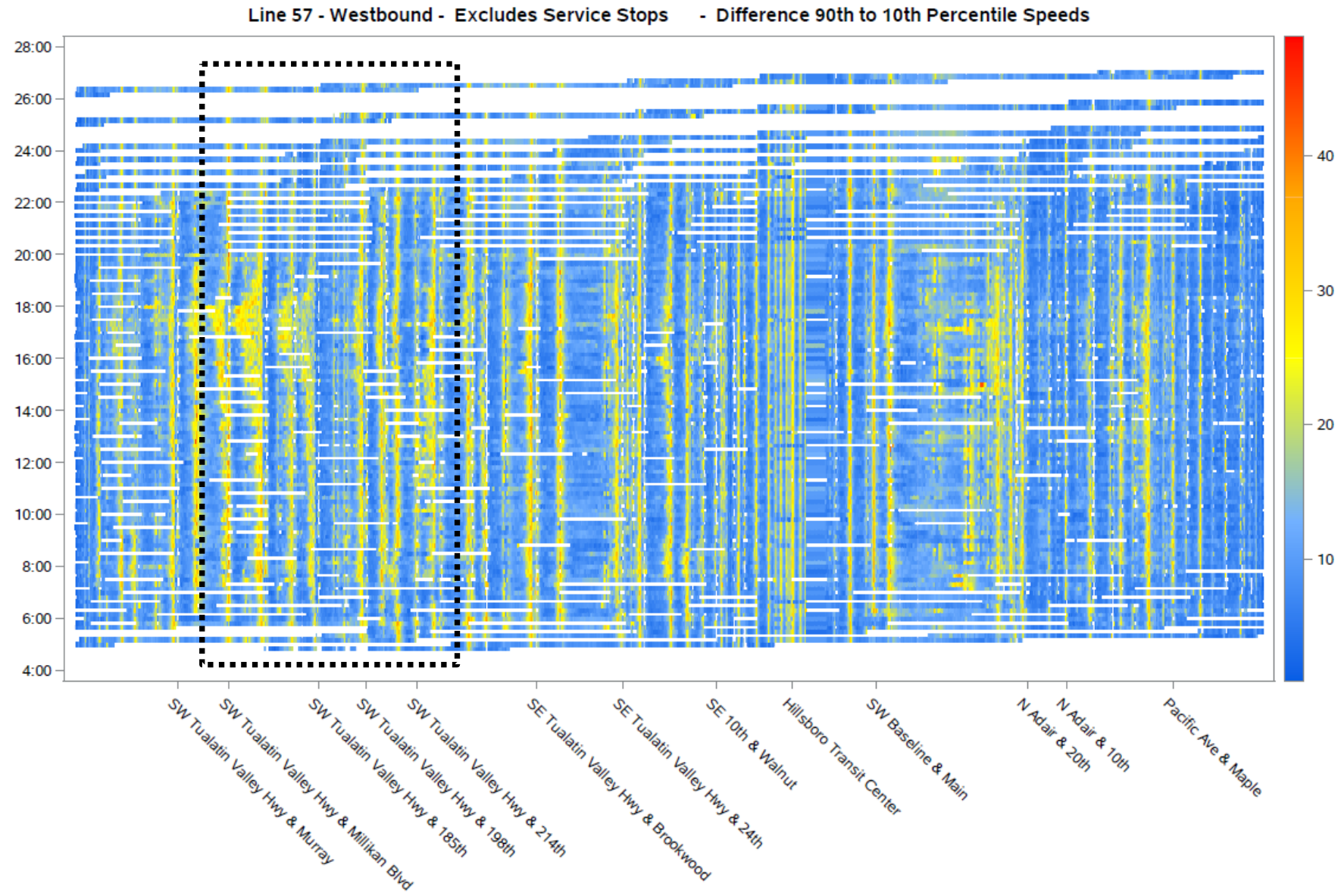


Figure 21. Line 57 Westbound Travel Time Reliability (Fall 2017)



Based on the results of spring 2016 Line 57 vehicle data, Table 7 details the top five segments in each direction that have the largest difference in 10th and 90th percentiles speeds, indicating locations where congestion may be impacting bus travel time reliability.

Table 7. Travel Time Reliability at Select Study Area Locations (Spring 2016)

Direction	Stop Segments	Travel Time Reliability (%)*
Eastbound	214th to 209th	64
	Market Centre (204th) to 198th	66
	189th to 185th	64
	174th to 170th	70
	St. Mary's Home (165th) to 160th	65
Westbound	St. Mary's Home (165th) to 170th	70
	174th to 178th	59
	Aloha Villa (181st) to 185th	73
	192nd to 198th	61
	214th to 75th	58

*Source: TriMet, spring 2016. *Percent difference between 10th and 90th percentile speeds*

Connecting Lines

TriMet Lines 52 and 88 intersect with Line 57 within the study area. Line 52 runs north and south on 185th Street and east and west on Farmington Road, connecting the Portland Community College Rock Creek Campus to the Beaverton Transit Center. It runs weekdays every 15-20 minutes, and every 25-30 minutes on weekends. Line 88 connects the Willow Creek/SW 185th Transit Center in Aloha to the Beaverton Transit Center. It runs every 30 minutes on weekdays, and every hour on weekends. Line 52 connects with Line 57 at 185th Avenue and TV Highway, the highest passenger activity location within the study area. This location serves as a high activity center for both trip ends and transfers. Based on TriMet's 2017 fare survey, Line 57 had the second highest transfer rate to/from Line 52, behind the MAX Blue line. Line 88 connects with Line 57 at 198th Avenue and TV Highway, a location with above average passenger activity in the study area.

Line 57 Ridership Patterns

Figure 22 illustrates the origin/destination density of all Line 57 responses from the 2016/17 TriMet on-board survey. Origin and destination density is highest within a quarter-mile of the Line 57 corridor and within proximity of Metro 2040 regional and town centers, including Aloha. Approximately 56 percent of all Line 57 origins and destinations occur within a quarter-mile of the Line 57 bus line corridor, whereas 75 percent of all origins and destinations within the study area occur within a quarter-mile of the Line 57 corridor. Thirty-seven percent of all study area origins and destinations are identified as transfers, as these trips are noticeably farther away from a reasonable walking distance and are assumed to ride other lines that intersect with Line 57 within the study area.

Figure 22. 2016-17 TriMet Line 57 On-Board Survey Origin/Destination Density

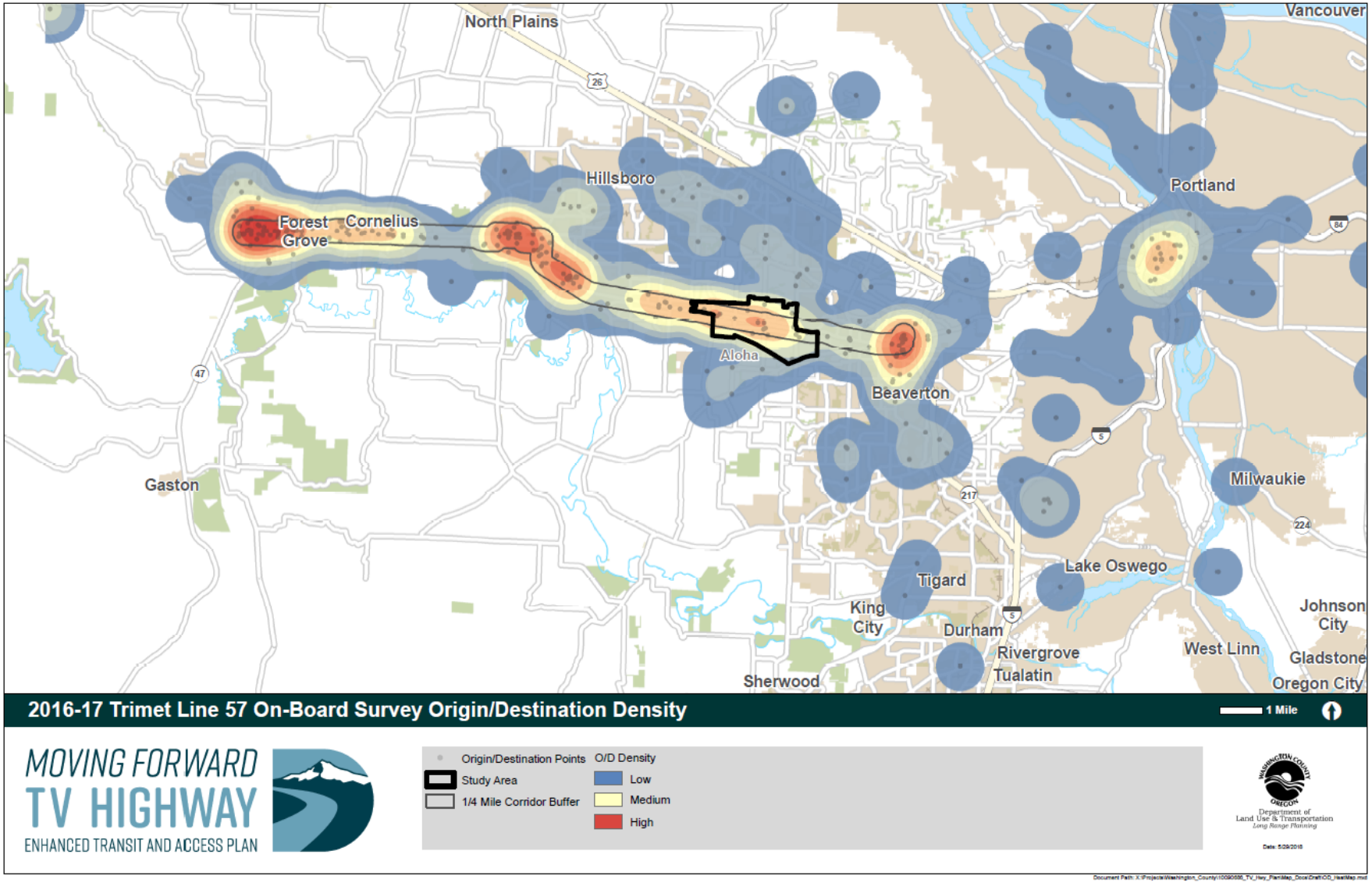
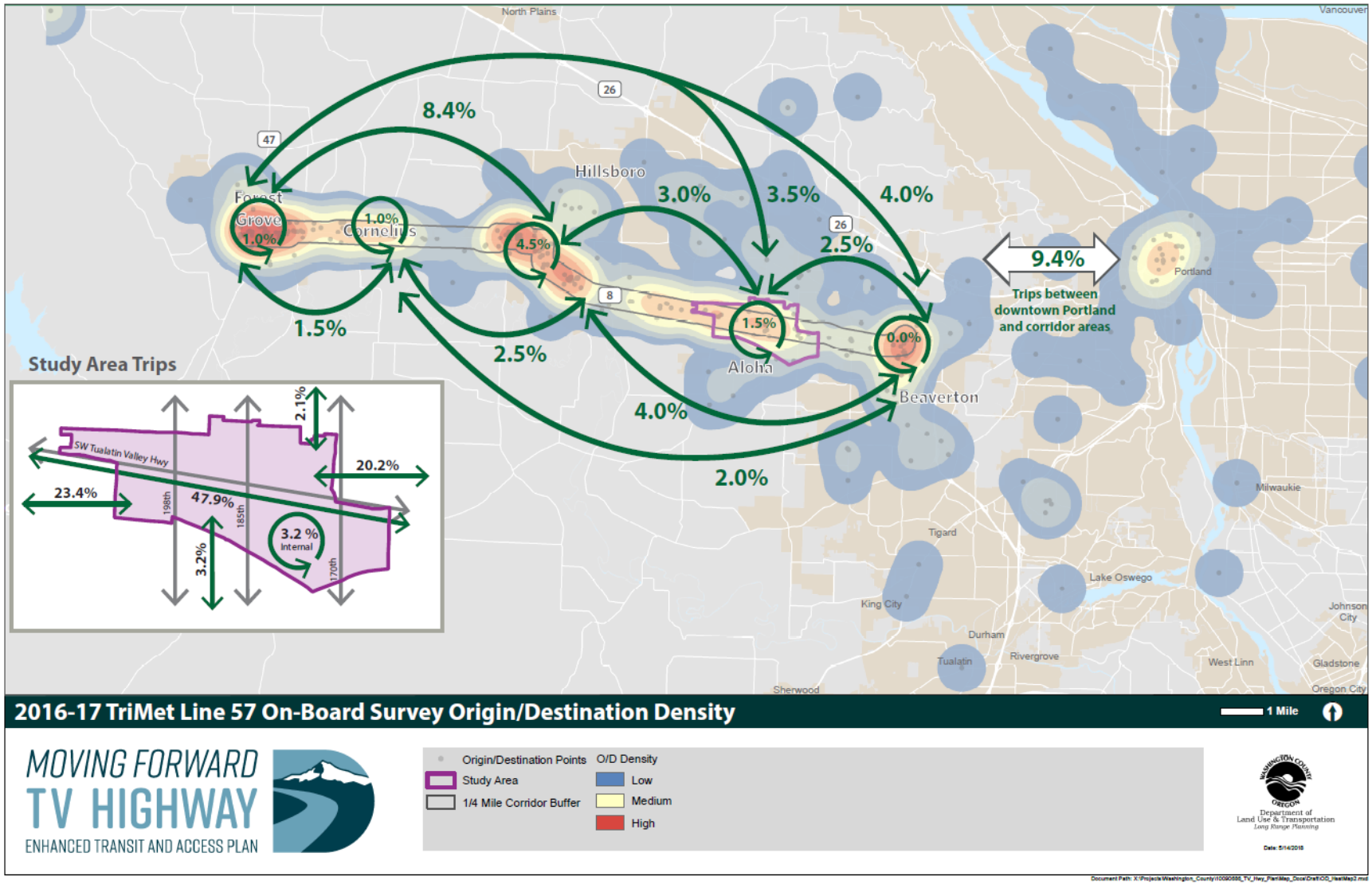


Figure 23 highlights the percentage of survey origin/destination trips between major destinations along the Line 57 corridor. Approximately 50 percent of all responses traveled between the Metro 2040 regional and town centers, suggesting the importance of Line 57 as a corridor-based service, but also as a connection to other lines in the TriMet network. Survey responses that started trips, ended trips, or traveled through the study area are also illustrated in Figure 23. Nearly half (48 percent) of trips travel directly through the study area without stopping, whereas a combined 45 percent of trips travel to/from east and west of the study area. This suggests the importance of both access to stops within the study area, and transit operational efficiency through the study area.

Figure 23. Major Line 57 Origin/Destination Patterns

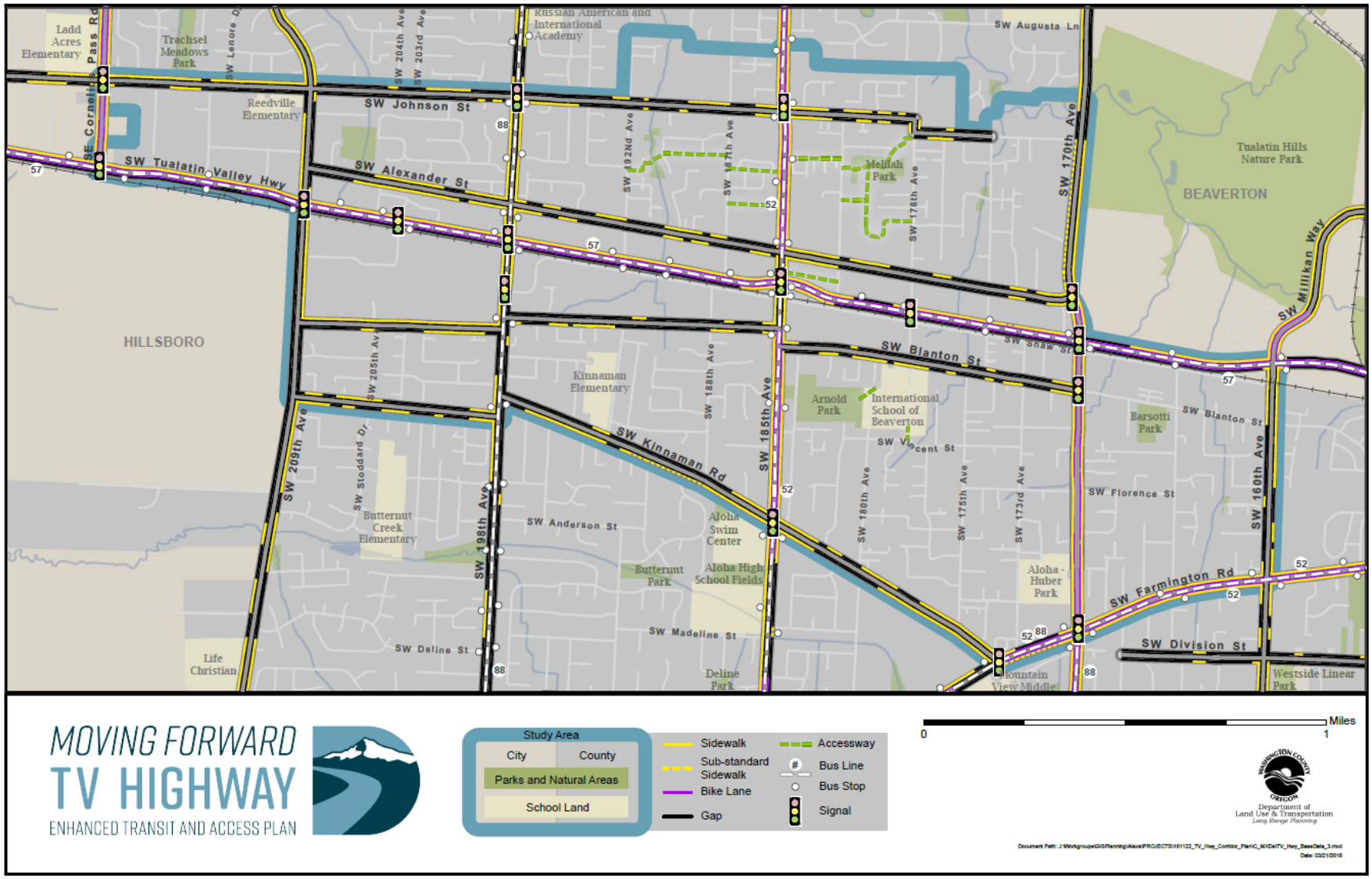


2.4.3 Access Conditions

Figure 24 illustrates the existing facility conditions within the study area, including bike lane gaps, sidewalk gaps, and substandard facility conditions. Community members who currently do not utilize the bus service along TV Highway indicated that access concerns represented the largest barrier to transit ridership.[10] Sidewalks that connect to bus stops were ranked as the most important factor among six options that would make transit use on TV Highway easier and more convenient. Bus shelters that provide protection from the weather ranked as the second most important; safer crossings to reach bus stops along TV Highway ranked fourth.

[10] Aloha Tomorrow Report (2017)

Figure 24. Existing Study Area Facility Conditions



Sidewalks

With a general lack of a pedestrian infrastructure on the south side of TV Highway for the majority of its length within the study area, TV Highway presents challenging conditions for pedestrians, particularly while accessing Line 57 eastbound stops. Desire paths are used to cross over the PNWR freight rail line and access to the neighborhoods south of TV Highway in the study area. There are approximately 19 informal crossings of the rail line. Major gaps in the pedestrian network, where sidewalks are missing or substandard, exist throughout the study area (Figure 24). Notable gaps include on 170th Avenue, 198th Avenue, 209th Avenue accessing TV Highway as well as Farmington Road, Alexander Street, Johnson Street and Kinnaman Road running parallel to TV Highway. Inconsistent development patterns have also resulted in discontinuous sidewalks in multiple locations.

Bikeways

While dedicated bike lanes run along the eastbound and westbound shoulders of TV Highway throughout the study area, there are other intermittent bikeway gaps located on 170th Avenue, 185th Avenue, 198th Avenue, 209th Avenue, Farmington Road, and Kinnaman Road, where bicycle facilities are missing or substandard. Along the south side of TV Highway, the lack of separation between the existing bike lane and passenger waiting areas at Line 57 stops poses potential safety concerns for both cyclists and pedestrians. Elsewhere, people on bicycles using sidewalks to access transit face the same access barriers as pedestrians. The lack of a complete network linking transit with residences, points of interest, and commercial centers presents user comfort and safety issues and is a broader deterrent to transit use.

Bus Stop Access

Table 8 lists bus stops located at unsignalized intersections or midblock locations without adjacent enhanced pedestrian crossings. At present, only one marked pedestrian crossing within the entire study area serves a bus stop at an unsignalized intersection (TV Highway at St Mary's Home). Signalized crossings along TV Highway are spaced approximately every third of a mile, while the density of bus stops, intersecting streets, and commercial destinations create additional crossing demands between these signals. Given the general lack of sidewalks and enhanced crossings, nearly all bus stops along TV Highway's south side are functionally isolated from nearby pedestrian and bicycle connections. This results in people often crossing TV Highway at uncontrolled locations to reach a stop, including at night when the largely unlit corridor poses visibility challenges.

Table 8. Bus Stops Not Served by Enhanced Pedestrian Crossings within Study Area

Bus Stop Location	Location Type	Bus Line(s) Served
Farmington at 165th	Unsignalized intersection	52, 88
TV Hwy. at 174th	Unsignalized intersection	57
TV Hwy. (between 187th and 192nd)	Midblock	57
TV Hwy. at 192nd	Unsignalized intersection	57
TV Hwy. at 214th	Unsignalized intersection	57
185th (south of Pike)	Unsignalized intersection	52
185th at Blanton	Midblock (S-shaped turn)	52, 57
185th at Alexander	Unsignalized intersection	52, 57
185th (south of Cascade)	Unsignalized intersection	52
185th at Lars Terrace	Unsignalized intersection	52

Bus Stop Location	Location Type	Bus Line(s) Served
185th at Sandra Lane	Unsignalized intersection	52
198th at Kinnaman	Unsignalized intersection	88
198th at Blanton	Unsignalized intersection	88, 57
198th (between TV Hwy. and Alexander)	Midblock	88, 57
198th at Trelane	Unsignalized intersection	88

Improved pedestrian crossings at these locations could enhance user comfort and safety by making crossing movements more predictable. Additionally, wayfinding signage could help pedestrians navigate to these marked arterial crossings. Finally, while several transit stops include existing supportive infrastructure (e.g., landing pads, shelters, rider information), adding these features to stops where they currently do not exist could improve the transit passenger environment.

Figure 25 shows two bus stops within the study area, one with sufficient bus stop access and facilities conditions (185th Avenue eastbound) and another with deficient bus stop access and facility conditions (174th Avenue eastbound).

Figure 25. Existing Study Area Bus Stop Access Conditions

The eastbound bus stop at 185th Avenue and TV Highway includes striped and signalized pedestrian crossings and sufficient sidewalk to safely access transit.

The eastbound bus stop at 174th Avenue and TV Highway lacks sidewalks and striped crossings to safely and effectively access transit.

ADA Conditions

In addition to inconsistent sidewalk development, the majority of existing sidewalks are not equipped with functional curb ramps for people of all ages and abilities. ODOT completed an ADA assessment of

curb ramp conditions along the TV Highway corridor in 2017. Approximately 81 ramps were identified along TV Highway within the study area; of these, 38 (47 percent) were evaluated for condition. Of those evaluated, 84 percent ranked as "poor" and the remaining 16 percent ranked as "good" (none of the curb ramps evaluated received a "fair" ranking).[11] ODOT's curb ramp inventory recorded two additional instances along TV Highway in which a sidewalk segment begins without a curb ramp (just east of 170th Avenue and just east of 174th Avenue). The inventory also documented four intersections that are "incomplete" (intersections served by an insufficient number of curb ramps). All of these instances occurred at unsignalized intersections: the TV Highway entrance to Saint Mary's Home for Boys (two missing ramps), TV Highway at 192nd Avenue (one missing ramp), and TV Highway at 214th Avenue (one missing ramp). It is important to note that only existing curb ramps at signalized intersections were evaluated for condition. The project team assumes that, outside of the four instances of "incomplete" intersections recorded, the remaining unsignalized intersections along TV Highway within the study area contain the appropriate number of curb ramps. However, the condition of existing curb ramps at these unsignalized intersections has not been evaluated. Furthermore, the inventory did not include curb ramps along adjacent streets within the study area. Table 9 lists the signalized intersections that were evaluated and found to have poor curb ramp conditions.

Table 9. Curb Ramps in "Poor" Condition at Signalized Intersections within Study Area

Intersection Along TV Highway	Number of Curb Ramps	Number in Poor Condition	Percent in Poor Condition
TV Hwy. and 160th (Millikan Way)	8	8	100
TV Hwy. and 170th	8	6	75
TV Hwy. and 178th	4	4	100
TV Hwy. and 185th	7	2	29
TV Hwy. and 198th	4	4	100
TV Hwy. and 209th	5	5	100
TV Hwy. and Cornelius Pass	2	2	100
Total	38	32*	84

Source: ODOT 2017.
*The final curb ramp deficiency documented in the study is located just west of the 160th Avenue intersection of TV Highway, where the existing sidewalk ends at a curb ramp in poor condition. This was the only curb ramp deficiency recorded that is not located at a signalized intersection.

2.4.4 Traffic Conditions

Existing and future traffic conditions are important to review within the study area as they relate to likely impacts to transit operations. This section provides a qualitative review of existing and projected future traffic conditions within the study area.

Existing intersection count data was collected at 16 signalized intersections within the study area between Tuesday, March 20th and Thursday, March 22nd, 2018. Turning movements were collected from 4:30 p.m. to 6:30 p.m. to capture PM peak hour activity. Existing count data was collected for the

[11] ODOT ADA inventory field data (2017)

following intersections, noting where multiple days' worth of data were collected to observe traffic variability at specific locations:

- TV Highway at Cornelius Pass Road (two count days)
- TV Highway at 209th Avenue (one count day)
- TV Highway at Intel Aloha Campus Entrance (one count day)
- TV Highway at Walgreens Driveway (one count day)
- TV Highway at 198th Avenue (one count day)
- TV Highway at 192nd Avenue (one count day)
- TV Highway at 187th Avenue (one count day)
- TV Highway at 185th Avenue (two count days)
- TV Highway at 182nd Avenue (one count day)
- TV Highway at 178th Avenue (one count day)
- TV Highway at 174th Avenue (one count day)
- TV Highway at 170th Avenue (two count day)
- TV Highway at Levi Anderson/St. Mary's Home (one count day)
- TV Highway at 160th Avenue (one count day)
- 185th Avenue at Alexander Street (one count day)
- 185th Avenue at Shaw Street (one count day)

The intersection with the highest overall entering volumes in the p.m. peak hour was TV Highway at 170th Avenue, with over 5,000 vehicles. The segment of TV Highway between 160th Avenue and 170th Avenue carried the highest volumes, with over 2,000 vehicles in the peak (westbound) direction.

A preliminary review of publicly available congestion data (Google traffic) is consistent with Line 57 operational data, as discussed later in section 2.4.2 above. The most congested locations on TV Highway in the PM. peak hour are:

- Westbound approaching the 170th Avenue signalized intersection
- Westbound approaching the 185th Avenue signalized intersection
- Eastbound approaching the 209th Avenue intersection

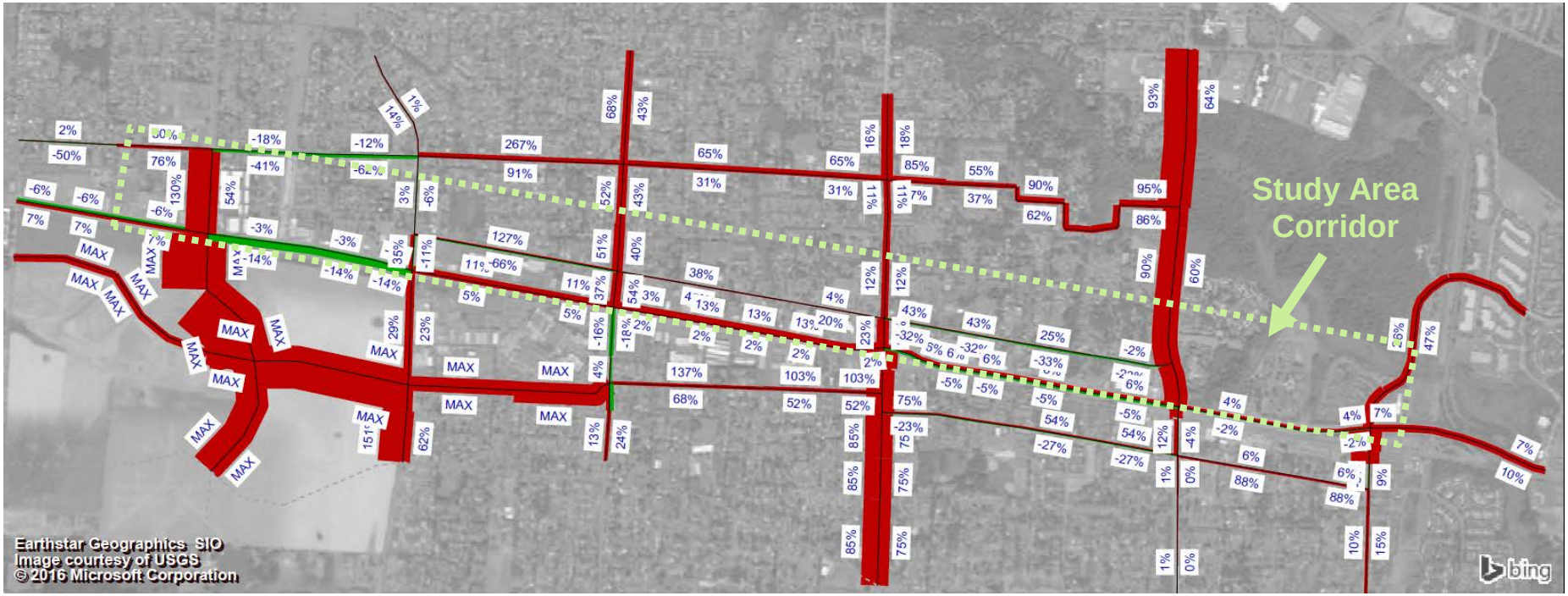
Future growth within the study area was assessed using Washington County's west side p.m. peak hour model, which has a base year of 2015 and a future horizon year of 2035. A plot showing traffic growth within the study area between 2015 and 2035 is shown in Figure 26. Traffic growth in the study area is highest on facilities that connect to TV Highway such as:

- 170th Avenue north of TV Highway
- 185th Avenue south of TB Highway
- New network connections in the South Hillsboro area, south of the Cornelius Pass Road intersection with TV Highway.

Growth on TV Highway itself is limited in the model because even under base year conditions, it is operating near capacity. Traffic growth is highest westbound between 185th Avenue and 198th Avenue, with about 13 percent growth between 2015 and 2035.

Based on the p.m. peak hour travel demand model outputs, the westbound congested locations are likely to become worse over time, while the eastbound location, between Cornelius Pass Road and 209th Avenue, may improve due to new parallel network connectivity to the south.

Figure 26. Projected Study Area Traffic Growth



2.4.5 Freight Conditions

The corridor is currently classified as an ODOT Urban Principal Arterial and designated as part of the National Highway System (NHS), critical to regional economy, defense, and mobility. NHS designated facilities carry specific design and operational requirements. In addition, TV Highway is an important freight corridor for the region and will need to consider freight and mobility design standards. For this reason, the corridor must maintain a 29 foot "hole in the air" for freight mobility in both directions along TV Highway, pursuant to ORS 366.215.

According to a 2016 report by ODOT on traffic volumes and vehicle classification in 2016, trucks account for approximately 2.6 percent of traffic on TV Highway between SW 160th Avenue and Cornelius Pass Road, shown in Table 10, below. This percentage is average for arterials of its size. Types of trucks that frequent this section of highway include Class 5, Class 6, Class 9, and Class 10. Over-dimensional vehicles (classes 4 through 13) account for a total of 3.43 percent of all traffic. Class 5 vehicles (2-axle trucks) account for the majority of the over-dimensional vehicles (1.32 percent).

Table 10. Traffic Volumes by Vehicle Classification

Vehicle Class	Vehicle Class Percentage	Volume
Class 1-3: Motorcycles, cars and vans	96.57	39,111
Class 4: Buses	0.83	336
Class 5-13: Trucks	2.6	1,054

Source: ODOT 2016.

3 Project Need

The results of the existing corridor conditions suggest a series of needs to improve safety and multi-modal mobility within the study area. The following five factors contribute to the need for investment along TV Highway to improve multi-modal safety, transit service effectiveness and transit access:

1. **High crash corridor:** TV Highway is designated as a High Injury Corridor in the Portland Metro region. The 5-year average crash rate along the TV Highway corridor within the study area was **nearly 3 times the statewide average for suburban highways and 2.5 times the regional average** for arterial roadways.[12][13] TV Highway is designated as a Category 5 SPIS road, which equates to more than 10 crashes per 5-mile segment over a 3-year period. During the 2012-2014 period, 5 of the top 15 ranked SPIS intersections in the county were located along the study corridor. Approximately **one-third of all fatal and serious injury crashes along the TV Highway corridor involved a person walking or bicycling**. Along the study corridor, approximately 84 percent of all pedestrian crashes occurred within 250-feet of a bus stop, suggesting the importance of safety improvements for pedestrians to access transit.

2. **Slow transit travel time limiting ridership growth**: 2018 estimated transit travel time in the PM peak hours between Cornelius Pass Road and SW Murray Boulevard is more than 140 percent longer than auto travel time along the study corridor, impacting existing riders traveling through the corridor, limiting attractiveness for choice riders and impacting access to destinations along the corridor. Transit delay is primarily caused by signalized intersection congestion and delay, and will only get worse as traffic continues to grow over time. Certain congested signalized intersections along the corridor cause transit travel time delay and reliability deficiencies during typical commute peak hours. Furthermore, substandard bus stops result in slower boarding procedures and longer dwell times, contributing to overall transit delay. TV Highway is constrained and presents challenges for geometric and operational transit priority treatments and stop improvements. Improving transit travel time along TV Highway will assist in achieving the Regional Transportation Plan target to triple the transit mode share of the region's overall trips.[14]

3. **Gaps in sidewalks, ADA ramps, lighting and crossings accessing transit:** Bus stop access conditions for riders are deficient in many aspects, including ADA ramps, crossings, and sidewalks at bus stops. Approximately **48 percent of TV Highway is missing sidewalks in the study area**. 84 percent of the 38 ADA ramps along TV Highway evaluated (approximately 47 percent of total ADA ramps) within the study corridor ranked as "poor" and the remaining 16 percent ranked as "good" (none of the curb ramps evaluated received a "fair" ranking). Given the general lack of sidewalks, ADA ramp deficiencies, and limited enhanced roadway crossings, **nearly all bus stops along TV Highway's south side (where the railroad is located) are**

[12] 2016 State Highway Crash Rate Tables, August 2018
[13] Regional Transportation Safety Strategy
[14] Source: Oregon Metro, *Draft 2018 Regional Transit Strategy*, 29 June 2018, p 80.

functionally isolated from nearby pedestrian and bicycle connections. This results in people often crossing TV Highway at uncontrolled locations to reach a stop, including at night when the largely unlit corridor poses visibility challenges.

4. **Incomplete bicycle facilities connecting to transit:** The lack of a complete bicycle network within the study area linking transit with residences, points of interest, and commercial centers presents user comfort and safety issues and is a broader deterrent to transit use. Approximately **37 percent of the major street network in the study area has bike lanes**. Another 15 percent of the major street network will be retrofitted with bike lanes in the next five years. **Nearly all of these facilities are unprotected** and hinder the ability to attract regular bike ridership.

5. **Impact to neighborhood livability, healthy living and economic opportunities:** Line 57 ranks tenth in the TriMet system in terms of providing access to communities of concern, jobs, housing, and social services.[15] In comparison to both the Portland Metropolitan region and county as a whole, communities in the study area have above average concentrations of low-income population, people of color, limited English language proficiency residents, and youth populations. Approximately **75 percent of all study corridor transit trips begin or end within a quarter mile of TV Highway**.[16] The combination of nearly 40,000 vehicles per day, more than a 70-foot crossing distance with limited enhanced pedestrian crossings, 35 to 45 mile per hour posted speed limits, and the adjacent rail line **creates barriers between the communities to the north and south**. This limits corridor walkability and neighborhood connectivity needed for safe and convenient transit access.

Figure 27 illustrates community response to corridor safety and mobility needs, which aligns with the identified needs stated above.

[15] Source: TriMet, 2017.
[16] Between October 2016 and March 2017, 212 transit riders were surveyed while on-board TriMet's Line 57.

Figure 27. Community Response to Corridor Safety and Mobility Needs

4 Corridor Concept Development

Moving Forward TV Highway evaluated four enhanced transit corridor strategies aimed at addressing the project goals and needs while evaluating the associated tradeoffs and opportunities presented with each concept. These concepts include both design elements that are consistent across all of the concepts and some elements that are unique to each concept alternative. The Moving Forward TV Highway concepts were developed using a combination of committed, planned, and newly proposed improvements along the study corridor. The TV Highway corridor has a number of committed and planned projects, many of which focus on improving transit mobility, bicycle/pedestrian access to transit, and overall multi-modal operations within the Moving Forward TV Highway study area. These projects were funded through various local, regional, and state sources, and targeted for implementation in the next three to five years. Additional mobility and access improvement needs have been identified to create a safe, reliable, and user friendly set of travel options along the TV Highway corridor.

The Moving Forward TV Highway Plan recommended design concept to improve current multi-modal conditions, balance the mobility and safety needs for all modes, accommodate overall mobility functions, and create consistency along the corridor for all users, to the greatest extent possible. The design concepts focus on specific modal deficiencies and considerations for its varying cross section constraints and opportunities. The following parameters have been included in the concept development process:

- Provide consistent cross section that accommodates multimodal users while balancing safety, operations, access and mobility.
- Incorporate transit priority enhancements and access improvements while minimizing ROW impacts.
- Position transit stations in locations that provide better operational efficiency for transit and satisfactory access for transit riders.
- Provide new and improved enhanced bike and pedestrian facilities to fill gaps along most of the corridor.
- Identify improved crossing treatments and lighting to reduce pedestrian crashes and provide greater pedestrian comfort by adding enhanced pedestrian crossing treatments, reduced crossing distances, improved visibility for pedestrians, and enhanced transit access.

4.1 Concept Development Framework

TV Highway represents a roadway segment with travel patterns that have evolved over time from a lightly developed suburban arterial to a highly utilized urban thoroughfare serving a wide range of multimodal users. This facility is currently under ODOT jurisdiction, traversing multiple different communities with varying speeds and context. The conceptual cross sections were developed in accordance with ODOT Highway Design Manual (HDM) design standards for an urban arterial roadway. The cross sections were modified to consider corridor constraints, while providing enhancements to balance the needs of all corridor users. The cross sections vary along the corridor given the differences in corridor ROW and the unique constraints that exist at different locations. The following corridor-wide considerations influenced the development of the cross sections:

1. Pre-existing corridor designations: TV Highway is an Urban Principal Arterial and designated as part of the National Highway System (NHS), important to regional economy, defense, and mobility. NHS designated facilities carry specific design and operational requirements. In addition, TV Highway is an important freight corridor for the region, and will need to consider freight and mobility design standards.
2. The intersections along the corridor are owned and operated by ODOT and require specific capacity targets to maintain efficient throughput.
3. The posted speed varies between 35 and 45 miles per hour within the study area.
4. The corridor concept incorporates a design speed of 35/45 mph, which aligns with the existing posted speeds.
5. All alterations within the state highway ROW are subject to the ODOT Highway Design Manual standards and approvals unless there is a jurisdictional transfer. The concept includes many non-standard design elements which will require design exceptions. This design concept is also subject to review and approval by the ODOT State Traffic/Roadway Engineer and will necessitate further discussions relating to speed and design.
6. All signal modifications, proposed new signals and enhanced pedestrian crossings are subject to review and approval by the ODOT State Traffic/Roadway Engineer unless there is a jurisdictional transfer.
7. All modifications within Public Rail Crossings require Rail Orders obtained through the ODOT Rail and Public Transit Division requiring coordination with the railroad.

4.2 Common Elements for All Concepts

Each of the four design concepts are unique in design, operations, and circulation assumptions, which are critical to explore trade-offs and inform the comparative evaluation. However, all four concepts include common facility elements to improve transit access, operations, and overall corridor safety. The common elements that provide corridor consistency and balance the needs are discussed below.

4.2.1 Transit Elements

Transit Service Improvements

To accommodate anticipated passenger demand and to encourage frequent passenger use, the transit service along TV Highway is assumed to operate with headways of approximately 12 minutes during peak times in the near term, 10 minute peak/12 minute off-peak by 2027, and 10 minutes all day by 2040.[17] The service will serve all stations along the corridor and stop on-demand. Skip-stop/limited-stop service was considered for the corridor, however, based on the observed passenger trip patterns and revised stop spacing, the service would be more effective in serving riders by stopping at all proposed

[17] Based on Metro's Regional Transportation Plan modeling assumptions

station locations on-demand. Using existing ridership data and TriMet on-board survey data, existing Line 57 riders ride shorter distances than what a skip-stop/limited-stop service would provide, thereby limiting service accessibility and ridership growth.

Transit Station Locations

Stations are assumed to be evenly spaced approximately 1/4 mile apart and placed at high visibility locations near existing or planned enhanced pedestrian crossings, near signalized intersections, and within close proximity of transfer locations for N/S bus routes. Improved station locations will provide immediate benefit in pedestrian safety to access transit, since the stations will be placed in more visible and safety locations. The station spacing may require some stop consolidation, which will benefit transit travel time by limiting time spent at stations. The concepts assume consolidating a few existing midblock stops resulting in an assumed reduction in dwell time as buses will make fewer total stops within the corridor.[18] Proposed station locations are only representative and will require additional siting and evaluation for most feasible placement.

Transit Vehicle Assumptions

The type and size of transit vehicles provide input into the design of proposed stations along the corridor, but also are key to promoting efficient operations. For purposes of concept development along the study corridor, 60 foot articulated BRT-style vehicles have been assumed. These vehicles include lower floors and all-door boarding, both facilitating a faster boarding procedure at stations.

Transit Station Design

Transit stations are assumed to be designed to provide the opportunity to minimize time spent dwelling for boarding passengers, enhance pedestrian access to transit stations, and improve the passenger experience waiting for and boarding vehicles. Transit station improvements are anticipated to reduce dwell times and improve the transit travel times by between 5 and 6 percent along the study corridor. The stations should be designed with a platform approximately 9-12 feet wide, and 60-70 feet long, depending on location and concept. Where possible, bike lanes should be integrated behind or though the platform approximately 3-5 feet wide, depending on the station design and adjacent facilities. Curb side and center running operation generally include similar station dimensions, although center operation may have fewer platforms since both directions of transit travel can share the same station platform from either side. Stations on TV Highway will require bus pullouts given the posted speed of the corridor.

The design concepts assumes an improved station typical for BRT-style improvements, with a station footprint large enough to accommodate enhanced shelters, passenger amenities/furnishing, and tactile boarding zones along the platform edge. Station areas (a combination of a 10 foot bus pullout, platform, waiting areas/shelter, and bike lanes) are assumed to be a total of 24 feet in width. Station designs include the following design assumptions:

[18] Stop ID 5593 (18882-19040 TV Hwy) eastbound and stop IDs 5592 (Aloha Villa) and 5594 (18882-19040 TV Hwy) westbound,

- **Near-Level Boarding**: Station platform heights are raised slightly higher than an adjacent curb to more closely meet the height of the vehicle door. This provides easier and faster access to transit vehicle doors, since time spent dipping the vehicle and deploying mobility device ramps is minimized. Near-level boarding minimizes overall station dwell time, improving transit speed and reliability.

Near-level Boarding Platform (Source: C-TRAN)

- **All-Door Boarding**: All-door passenger boarding allows riders to board and alight using all of the doors of a transit vehicle, reducing time spent at stations loading passengers. All-door boarding minimizes overall station dwell time, improving transit speed and reliability.
- **Off-Board Fare Payment**: Off-board fare payment provides the opportunity for passengers to purchase tickets and tap electronic fare payment prior to boarding a transit vehicle. This minimizes the time passengers spend paying for transit fares after boarding a vehicle, since the transit operator does not have to manage the fare payment process. Off-board fare payment minimizes overall station dwell time, improving transit speed and reliability.
- **Far-side station placement**: Buses typically move more efficiently through signalized intersections when a station is placed on the far side of the intersection. Enhanced stations are assumed to be located at all major signalized intersections along the corridor, with the preferred placement far-side of the intersection in both directions. Stations are assumed to be located approximately 1/4 mile apart within the Moving Forward TV Highway study corridor, consistent with the Aloha Tomorrow Plan.

Transit Signal Priority (TSP)

TSP uses a variety of signal technologies to give transit vehicles some level of preference moving through intersections. TSP technology enables communication between transit vehicles and traffic signals to alter signal timing/phasing or trigger exclusive transit signal phasing. Depending on the level of priority, traffic signals determine if the signal can adjust for an “early green” or “truncated red” to give an approaching transit vehicle priority to move through a signalized intersection. TSP can either be unconditional (always allowing equipped transit vehicles some level of TSP) or conditional (only allowing equipped transit vehicles some level of TSP if the vehicle is running behind schedule). TSP reduces transit delay at signalized intersections, facilitates exclusive transit signal phases, and improves corridor operations. Signal operations at each location along the corridor may require unique timing plans to

allow for effective TSP functionality. TSP can typically be added without affecting the overall roadway width and can function with most modern signal equipment.
Study corridor traffic signals and vehicles are assumed to be equipped with state-of-the-art TSP technology to improve transit travel time and reliability. TSP is expected to provide some transit travel time and auto travel time benefit in the east/west direction on TV Highway. However, TSP on TV Highway may impact traffic operations on cross streets, particularly at 160th/170th/185th/209th Avenues and Cornelius Pass Road. These locations have a relatively high level of traffic demand approaching these intersections north and south of TV Highway.

4.2.2 Bicycle Elements

While dedicated bike lanes run along the eastbound and westbound shoulders of TV Highway throughout the study area, there are other intermittent bikeway gaps at many locations along the corridor. The study corridor currently has unprotected bike lanes on both sides immediately adjacent to the outside travel lane. Along the south side of TV Highway, the lack of separation between the existing bike lane and passenger waiting areas at Line 57 stops poses potential safety concerns for both cyclists and pedestrians. Elsewhere, people on bicycles using sidewalks to access transit face the same access barriers as pedestrians. The lack of a complete network linking transit with residences, points of interest, and commercial centers presents user comfort and safety issues and is a broader deterrent to transit use.

Given the high volumes and speeds on TV Highway, separated bicycle facilities are proposed as the desired treatment for this mode of travel. Directional raised bike lanes, also known as cycle tracks, are the recommended treatment as this will allow for a physical separation between bicycles and motor vehicles while avoiding the crash risks associated with bi-directional bicycle facilities conflicting with multiple accesses. This particular type of bike treatment, including the addition of a raise curb and planter, are shown to increase rider comfort and attract a wider spectrum of users than shoulder bike lanes. In addition, raised directional cycle tracks create more intuitive conflict points at driveways as compared to separated shared use paths that support bi-directional bicycle traffic. The proposed corridor concept assumes 6 foot raised and protected bike lanes in typical locations and a 5 foot bike lane in constrained locations.

Intersection Treatments

At signalized intersections, several options are being considered to evaluate the tradeoffs between bicycle comfort and operational effectiveness of both transit and vehicle movement on TV Highway. The typical cross section assumes a physically separated and elevated bike facility. The study considers both right side separated bike lanes with bike signal phasing and typical left side bike lanes. Generally, separated right side bike lanes are recommended to be carried forward as part of the recommended concept. There are certain tradeoffs between locating the bike lane approaching an intersection inside between the right turn pocket and the adjacent through lane (Figure 28) versus curbside of the adjacent right turn lane (Figure 29). Both options result in the same amount of ROW impact, however, they require unique operations at traffic signals which may impact overall intersection functionality. The curbside option will require an exclusive bike signal phase, which may limit opportunities for transit priority treatments in the east/west direction. Inside bike lane placement will require a shared bus/bike

pullout zone (assumed to be 14 feet total width, or 10 foot bus pullout with a 4 foot bike passing area) and 10 foot platform. Curbside bike lane placement assumes station design to integrate a bike lane through the station area, with a 10 foot bus pullout, a 4 foot step-out zone adjacent to the curb, a 3 foot constrained bike lane, and a 7 foot station waiting area equipped with shelter and other amenities.

Figure 28. Inside Bike Lane Configuration

Figure 29. Outside Bike Lane Configuration

Inside Bike Lane Configuration Tradeoffs	Outside Bike Lane Configuration Tradeoffs
• Does not require an exclusive bike signal approaching the intersection, which will not impact intersection operations. • The lack of bike signal may improve the opportunity for transit vehicles to use turn pockets for priority purposes (unless porkchops are included). • Inside bike lane is less protected approaching the intersection and is placed between the right turn pocket and through lane. • Receiving lane will be shared with a bus pullout zone. • Bike lane will not be placed through the boarding area, eliminating the conflict between pedestrians accessing transit and cyclists traveling through the area.	• Requires an exclusive bike signal, which may impact intersection operations and limit the ability for transit to regularly use turn pockets for priority purposes. • Outside bike lane provides more protection and comfort for cyclists traveling through intersection. • Bike lane remains protected on the receiving side of the intersection. Receiving bike lane will not share zone with bus pullout, limiting conflicts with buses. • Bike lane will integrate with transit station area, which may create conflict between transit riders and cyclists.

4.2.3 Pedestrian Elements

Sidewalk Improvements

TV Highway presents challenging conditions for pedestrians, due to the general lack of a pedestrian infrastructure on the south side of TV Highway for the majority of its length within the study area (particularly while accessing Line 57 eastbound stops). Many locations along the corridor include substandard sidewalks, limiting access to transit and access to safely walking along/across the corridor. The existing typical cross section includes a 6-foot standard sidewalk on the north side and limited sidewalk on the south side of the corridor. The concept assumes an 8-foot continuous bi-directional sidewalk on the north side of the corridor. The south side only includes sidewalks between transit stations and enhanced pedestrian crossings, and at existing businesses on the south side. In constrained locations, a narrower 5-foot sidewalk may be considered.

Enhanced Pedestrian Crossings

Enhanced pedestrian crossing treatments provide additional safety benefits for pedestrians crossing TV Highway. The location of enhanced pedestrian crossings should be placed at feasible locations to safely connect pedestrians to transit stations, and should be placed to avoid vehicle turning conflicts. The type of enhanced pedestrian crossings should be signalized to improve legibility and protection, and may include pedestrian half signals or full signals. Enhanced pedestrian crossings may present tradeoffs between pedestrian access to transit and transit speed/reliability. The signal technology present at enhanced pedestrian crossing may require transit vehicles to reduced speed or stop whenever the crossing is in use. However, the enhanced pedestrian crossings are critical to improve access to transit stations. The placement of both will be considered in unison to balance transit access and transit speed/reliability.

Lighting

Pedestrian-scale lighting is assumed to be installed along the corridor to improve pedestrian visibility and reduce pedestrian crashes, particularly adjacent to transit stations and pedestrian facilities.

New Pedestrian Rail Crossings

There are multiple locations of unofficial pedestrian crossings along the Portland and Western freight rail line providing access between neighborhoods to the south and TV Highway. A review of the study area identified approximately 19 informal crossings of the rail line. These locations are currently being used to access TV Highway, but the crossings are unpermitted and unsanctioned. It is assumed that in the vicinity of transit station locations identified within the Moving Forward TV Highway Plan, deterrent fencing to prohibit the unlawful crossing of the existing railroad ROW would be required.

The Plan has identified several potential locations for new permitted pedestrian rail crossings to study further. These crossings would provide better access to enhanced transit stations for passengers traveling from the neighborhoods south of the corridor. Grade separated and at-grade, pedestrian-only

rail crossings to connect TV Highway to the south side of the rail line are being considered at 214th Avenue, 192nd Avenue, and 178th Avenue. It is assumed that any grade separated crossings will require fencing to separate pedestrian access from the rail line and encourage pedestrians to cross the existing railroad tracks at designated crossing locations.

4.2.4 Roadway Elements

Median Treatments/Access Management

The existing median within the study corridor is a 14 to 16 foot striped two-way left-turn lane that also transitions to left turn lanes at many intersections. While the two-way left-turn lane provides ample business access to the north side of the corridor, it impacts both vehicular and pedestrian safety. Left turning vehicles may not see pedestrians walking alongside the corridor as they are looking for gaps in oncoming traffic. Center turn lanes also increase crossing distances without providing pedestrian refuges and potentially leaves pedestrians stuck in the middle of the road without physical protection. Additionally, due to the high traffic volumes, users experience insufficient gaps to accommodate left turning movements to and from the multiple access points along TV Highway. The proposed cross section assumes a 14 foot median lane with some locations equipped with a raised and landscaped median (without trees that may limit pedestrian visibility). Raised medians provide visual cues which help to reduce vehicular speeds. Raised medians eliminate the potential for crashes due to left turning movements thus improving safety by reducing conflicts between all travel modes. Raised medians can also serve as a safe refuge for pedestrians crossing the corridor at undesignated enhanced pedestrian crossings, while managing business access to minimize conflicts for turning vehicles. A raised median will require further identification of turn lane locations to provide sufficient intersection turning movements and more concentrated business access.

Opportunities are present to manage corridor access by consolidating driveways on the north side of the corridor. Given the high frequency of driveways along the north side of the corridor, consolidation may yield significant safety benefits to all corridor users. In particular, consolidation could reduce the number of conflicts between pedestrians and cyclists traveling along the north side of the corridor with vehicles turning into and out of driveways. Access management may also provide a speed/reliability benefit for transit operations by limiting the friction between turning vehicles and transit vehicles traveling along TV Highway. Refinement of the corridor access management strategy and driveway placement is outside the scope of this concept plan and should be considered as part of future corridor refinements.

Lane Widths

General purpose travel lanes along TV Highway within the study corridor are currently 12 feet wide. The lane widths for the developed concept assume 11 foot inside and 12 foot outside lane widths for general purpose travel lanes, which slightly narrows the cross section to improve pedestrian access to transit stations on both sides of the corridor by reducing crossing distances. Narrow lane widths have been shown to reduce speeds and help minimize potential ROW impacts within this constrained corridor.

Shoulder Widths

Shoulder widths vary along the corridor and also serve as unprotected bike lanes. The shoulder widths along TV Highway are generally 5 to 7 feet wide within the study area. Since protected and separated bike and pedestrian facilities are proposed on both sides of the corridor, the assumed shoulder width is narrowed to 4 feet in both directions between the outside travel lane and the curb. Similar to narrowing the lane widths, a reduction in shoulder width reduces the perceived roadway width, which encourages motorists to drive more slowly. Narrow shoulders also reduce crossing distances, which helps to improve pedestrian safety and comfort, and minimizes potential ROW impacts. The assumed left side shy distance is 2 feet between the inside travel lane and the proposed median treatment described above. The proposed shoulder widths maintains a 29 foot "hole in the air" for freight mobility in both directions along TV Highway, pursuant to ORS 366.215.

4.3 Additional Considerations for Evaluation

The following considerations and constraints influence the preliminary corridor concepts and should be considered as part of the evaluation and corridor refinement opportunities:

- **Intersection configuration:** The corridor is constrained with properties on the north and rail ROW on the south. Additional exploration and refinement is required with respect to the location of the bike facility, size and location of transit stations, turn pocket lengths, and tree placement. This requires specific requirements and challenges for intersections, including the requirement for "pock chop" islands (raised islands for signal poles and crossing guards) in the eastbound direction. In specific locations that are warranted, turn pockets may need to be extended to provide enough room for a transit vehicle to utilize a turn pocket as an intersection queue bypass. Tree placement at signalized intersections near rail crossings should be avoided to improve visibility of signs and pedestrians crossing these locations.
- **Rail ROW:** Rail ROW encroachment should be explored to accommodate corridor improvements and minimize property impacts on the north side of the corridor. Encroachment may be required at several locations along the corridor, particularly at intersections where the corridor footprint is larger, to accommodate added geometric and modal features. The far side station platform may require rail encroachment to limit property impacts on the north side of the corridor. Avoiding any rail encroachment will require the entire intersection to shift north and result in a higher impact to corridor properties on the north side. Intersection "pork chop" islands limit opportunities for eastbound queue bypass and BAT (Business Access and Transit) lanes. Appendix A illustrates conceptual layouts of impacts to property ROW for conditions if rail ROW is not encroached and if rail ROW is encroached.
- **Property impacts:** All four of the design concepts require some level of widening for either specific locations or along the entire corridor. Property and building impacts are expected for all concepts, some greater than others. Property impacts and ROW acquisition costs will be considered in future corridor refinements to explore tradeoffs with operational and access benefits.
- **Funding opportunities:** Funding opportunities will depend on the corridor improvement approach. The corridor may be competitive for several Federal funding sources, including FTA's Capital Investment Grant Program and USDOT's Better Utilizing Investments to Leverage

Development (BUILD) Grant program, in addition to various state, regional, and local funding sources. Funding already programed for corridor projects may be able to be used as a local match to federal funding sources. Funding scenarios will be explored in more detail in subsequent efforts for corridor project development.

- **Public and Stakeholder Engagement:** Consolidated results from a recent project open house, technical advisory meetings/subteam meetings, steering committee meetings, and targeted engagement meetings have been used to inform preferences on corridor design concepts. See Appendix B for public and stakeholder engagement report.

4.4 Design Concepts

The study area of TV Highway provides a unique combination of opportunities and constraints throughout different locations within the corridor. Descriptions of four design concepts and their unique features (beyond the assumed elements listed in Section 4.2) are detailed in this section.

4.4.1 Concept 1: Enhanced Transit Concept

Concept 1 maintains general purpose travel in both directions on TV Highway and Alexander Street. It also assumes transit operation in mixed traffic lanes for most of the corridor. Intersections provide opportune locations for transit priority treatments, such as queue bypasses/jumps in turn pockets. Figure 30 illustrates the initial enhanced transit corridor concept proximity within the study area. Figure 31 illustrates the conceptual cross section for TV Highway, noting that transit priority measures (including turn pocket lengths) to facilitate transit speed/reliability improvements will be explored in subsequent efforts for this Plan and other corridor studies. The cross section for this concept is subject to additional review and refinement, particularly with respect to placement of non-motorized facilities, turn pocket length/placement, and cross section dimensions.

Figure 30. Enhanced Transit Corridor Concept Map

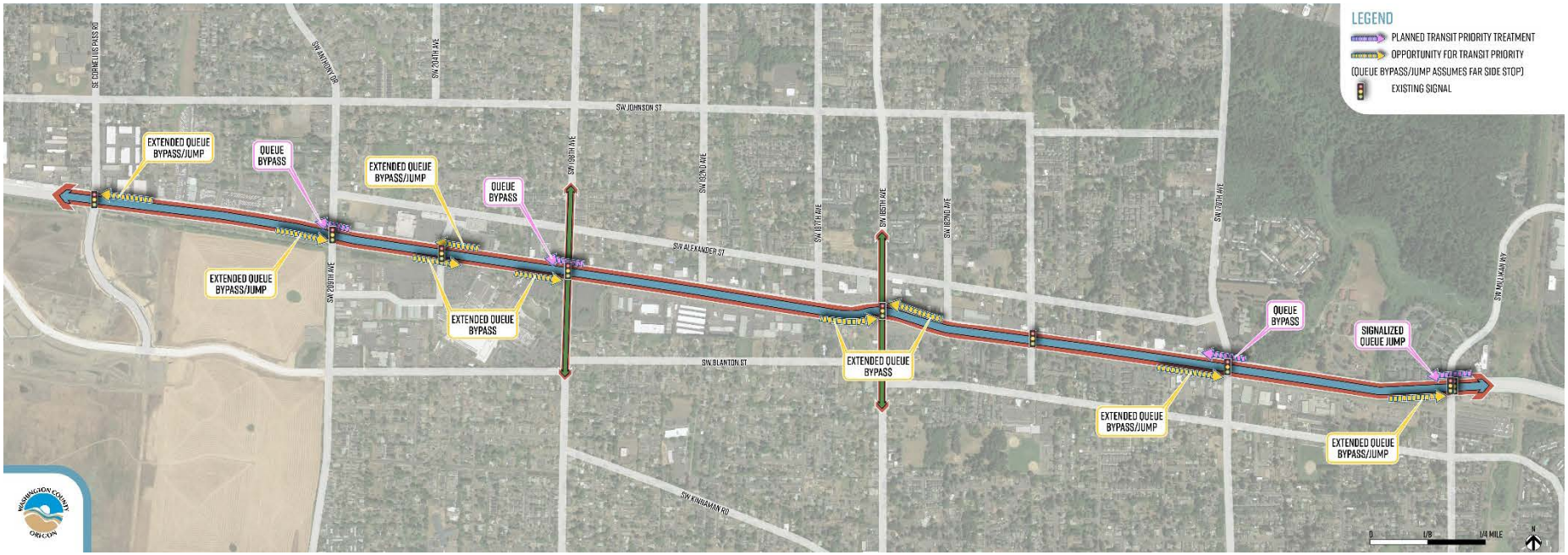


Figure 31. Enhanced Transit Concept Typical Cross Section

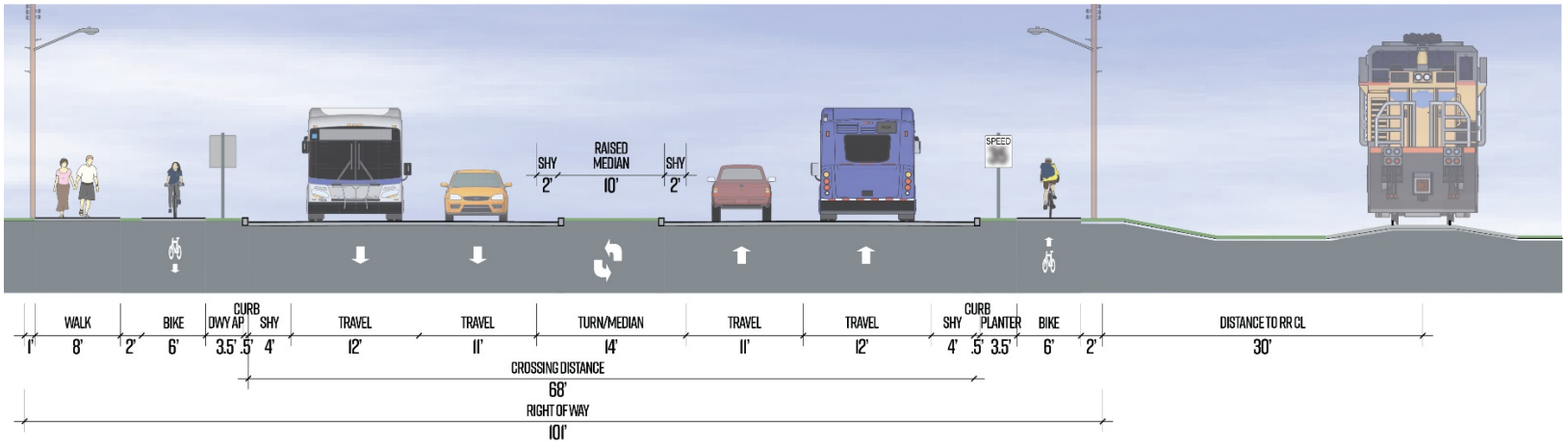


Table 11 shows the specific treatments considered for the corridor and at each location.

Table 11. Enhanced Transit Concept Treatments

Location	Treatments
Corridor-Wide	• Raised median, with openings at signalized intersections and warranted unsignalized intersections (U-turns allowed at signalized intersections) • TSP equipped at all signals, with timing parameters adjusted to minimize cross street delay • Improved and protected continuous sidewalk on north side of corridor • Separated and protected bike lanes on both sides of corridor
TV Hwy/160th Ave	• Far side transit stations in both directions • Westbound signalized queue jump • Eastbound queue bypass lane • U-turn allowance
TV Hwy/165th Ave	• Far side transit stations in both directions • New enhanced pedestrian crossing on east side of intersection • EB left-in only
TV Hwy/170th Ave	• Far side transit stations in both directions • Eastbound/westbound queue bypass lanes • U-turn allowance
TV Hwy/174th Ave	• Far side transit stations in both directions • New enhanced pedestrian crossing on east side of intersection • EB left-in only
TV Hwy/178th Ave	• Far side transit stations in both directions • New grade separated pedestrian crossing over rail line • U-turn allowance
TV Hwy/185th Ave	• Far side transit stations in both directions • Option for either new EB/WB right turn lanes (queue bypass) or center transit lane • U-turn allowance
TV Hwy/192nd Ave	• Far side transit stations in both directions • New enhanced pedestrian crossing on east side of intersection • New grade separated pedestrian crossing over rail line • EB left-in only
TV Hwy/198th Ave	• Far side transit stations in both directions • Eastbound/westbound queue bypass lanes • U-turn allowance
TV Hwy/Intel Campus Dwy	• Far side transit stations in both directions • Eastbound/westbound queue bypass lanes • U-turn allowance
TV Hwy/209th Ave	• Far side transit stations in both directions • Eastbound/westbound queue bypass lanes • U-turn allowance
TV Hwy/214th Ave	• Far side transit stations in both directions • New enhanced pedestrian crossing on east side of intersection • New grade separated pedestrian crossing over rail line • EB left-in only
TV Hwy/Cornelius Pass Rd	• Far side transit stations in both directions • New westbound right turn lane with queue bypass • U-turn allowance

Table 12 shows the planning level cost estimates and corridor property impacts based on the proposed cross section. Additional information related to the planning level cost estimate is provided in Appendix C.

Table 12. Enhanced Transit Concept Cost and Property Impacts

Construction Cost Estimate	Total Capital Costs	Total ROW Acquisition[2]	Buildings Impacted
$50,491,000 - $61,712,000	$82,677,000 - $101,050,000	310,000 – 435,000 sf	21

Note: Cost estimate does not include ROW and is based on planning level costs and quantities.

Table 13 describes tradeoffs for the Enhanced Transit concept, which provides additional qualitative input into the comparative evaluation of the design concepts.

Table 13. Enhanced Transit Concept Tradeoffs

Opportunities	Constraints
• TSP at signals and intersection modifications may provide speed and reliability improvements at locations in highest need. • Moderate property impact at locations that warrant extended turn pockets for transit priority purposes. • May be quicker to implement and more cost-effective since improvements are spot specific. • Improvements may include some new enhanced pedestrian crossings and refuges to improve safety and comfort. • Creates protected and separated bike facilities on TV Highway. • Business and residential access is largely maintained due to limited dedicated transit lanes. • Raised median provides access management improvement and pedestrian crossing refuge with a shorter crossing distance	• Cross section may require widening at intersections with increased crossing distance for pedestrians crossing TV Highway. • Cross section widening may require encroachment onto rail ROW. • Cross section assumes some widening is required, particularly at intersections, which may result in property impact. • Transit priority measures, particularly queue by-pass lanes, do not provide long segments of exclusive lanes, which may limit speed/reliability improvement over time as traffic demand increases along the corridor.

Additional opportunities will be explored in subsequent studies to enhance transit travel time by investigating additional spot intersection improvements. One of the primary points of delay for transit within the study area is a result of congested signalized intersections along the corridor. There may be an opportunity to repurpose left turn pockets and signal phases to be transit only at several congested and geometrically constrained intersections (including 185th Avenue). This may provide benefit for transit speed and reliability without required significant intersection widening. Traffic circulation and operational impacts will need to be assessed as part of future studies to identify opportunities to reroute the displaced left turning demand via alternate routes.

4.4.2 Concept 2: Corridor Business Access and Transit (BAT) Lane Concept

Concept 2 assumes a BAT lane on the north side of TV Highway to provide improved transit priority and maintain property driveway access to corridor businesses.[19] BAT lanes are not being considered on the south side of the corridor due to identified fatal constraints related to railroad ROW encroachment and intersection "pork chop" islands required to accommodate railroad crossing gates in the eastbound direction. Figure 32 illustrates the conceptual BAT lane typical cross section, which assumes widening the corridor on the north side for the extent of the study area, which is expected to require significant property acquisition and potential building impacts. Transit travel time in the westbound direction is expected to improve as a result of the introduction of a BAT lane. The crossing distance on TV Highway will increase, impacting pedestrian comfort and safety, although the introduction of raised median at various location may mitigate this potential safety issue. This concept assumes a standard bike lane adjacent to the outside travel lane with no separation and limited protection. Similar to Concept 1, the cross section for this concept is subject to additional review and refinement, particularly with respect to non-motorized facility improvements. Table 14 shows the specific treatments considered for the corridor and at each location.

Figure 32. BAT Lane Concept Typical Cross Section

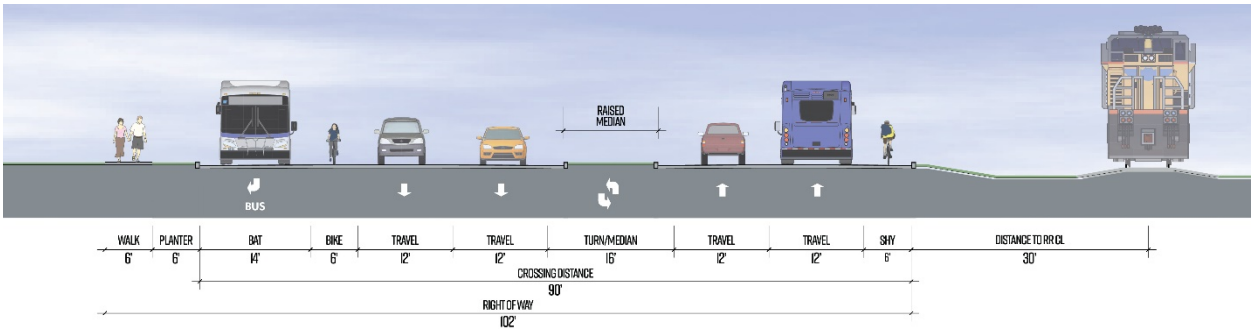


Table 14. BAT Lane Concept Treatments

Location	Treatments
Corridor-Wide	• Raised median, with openings at signalized intersections and warranted unsignalized intersections (U-turns allowed at signalized intersections) • TSP equipped at all signals, with timing parameters adjusted to minimize cross street delay • Improved and protected continuous sidewalk on north side of corridor • Protected bike lanes on both sides of corridor
TV Hwy/160th Ave	• Far side transit stations in both directions • U-turn allowance
TV Hwy/165th Ave	• Far side transit stations in both directions • New enhanced pedestrian crossing on east side of intersection • EB left-in only
TV Hwy/170th Ave	• Far side transit stations in both directions • U-turn allowance
TV Hwy/174th Ave	• Far side transit stations in both directions

[19] This concept assumes the dimensions developed in the City of Hillsboro's *TV Highway Corridor Refinement Plan* developed in July 2014.

Location	Treatments
	• New enhanced pedestrian crossing on east side of intersection • EB left-in only
TV Hwy/178th Ave	• Far side transit stations in both directions • New grade separated pedestrian crossing over rail line • U-turn allowance
TV Hwy/185th Ave	• Far side transit stations in both directions • New EB/WB right turn lanes for queue bypass • U-turn allowance
TV Hwy/192nd Ave	• Far side transit stations in both directions • New enhanced pedestrian crossing on east side of intersection • New grade separated pedestrian crossing over rail line • EB left-in only
TV Hwy/198th Ave	• Far side transit stations in both directions • U-turn allowance
TV Hwy/Intel Campus Dwy	• Far side transit stations in both directions • U-turn allowance
TV Hwy/209th Ave	• Far side transit stations in both directions • U-turn allowance
TV Hwy/214th Ave	• Far side transit stations in both directions • New enhanced pedestrian crossing on east side of intersection • New grade separated pedestrian crossing over rail line • EB left-in only
TV Hwy/Cornelius Pass Rd	• Far side transit stations in both directions • U-turn allowance

Table 15 shows the planning level cost estimates and corridor property impacts based on the proposed cross section. Additional information related to the planning level cost estimate is provided in Appendix C.

Table 15. BAT Lane Concept Cost and Property Impacts

Construction Cost Estimate	Total Capital Cost	Total ROW Acquisition[2]	Buildings Impacted
$54,847,000 - $67,035,000	$89,750,000 - $109,695,000	380,000 – 490,000 sf	36

Note: Cost estimate does not include ROW and is based on planning level costs and quantities.

Table 16 details tradeoffs between opportunities and constraints for the BAT lane concept, which provides additional qualitative input into the comparative evaluation of the design concepts.

Table 16. BAT Lane Concept Tradeoffs

Opportunities	Constraints
• TSP at signals and intersection modifications may provide speed and reliability improvements at locations in highest need. • Improvements may include some new enhanced crossings and pedestrian refuges to improve safety and comfort. • Transit priority is moderately improved in the westbound direction only with a BAT lane, providing speed and reliability improvements. • Business and residential access is largely maintained due to the nature of a BAT lane.	• Cross section will require widening and increased crossing distance for pedestrians crossing TV Highway to access transit stations and/or destination on both sides. • Cross section assumes widening along the entire stretch of the study corridor, resulting in significant property and building impact. • Bike lanes are assumed to be adjacent to travel lanes and may not provide the best protection and rider comfort. • Limited transit speed and reliability improvements in the eastbound direction without an eastbound BAT lane.

4.4.3 Concept 3: One-Way Couplet Concept

Concept 3 assumes converting TV Highway and Alexander Street into a one-way couplet between 209th Avenue and 170th Avenue. General purpose traffic is assumed to travel eastbound on TV Highway and westbound on Alexander Street, which will require a series of new traffic signals and roadway improvements. Removing westbound travel on TV Highway creates opportunity to repurpose the roadway space to allow transit to operate in both directions along the south side of TV Highway in dedicated transit lanes. Figure 33 illustrates the one-way couplet concept proximity within the study area. Figure 34 and Figure 35 illustrate the conceptual cross sections for both Alexander Street and TV Highway, respectively. Table 17 shows the specific treatments considered for the corridor and at each location.

Figure 33. One-Way Couplet Concept Map

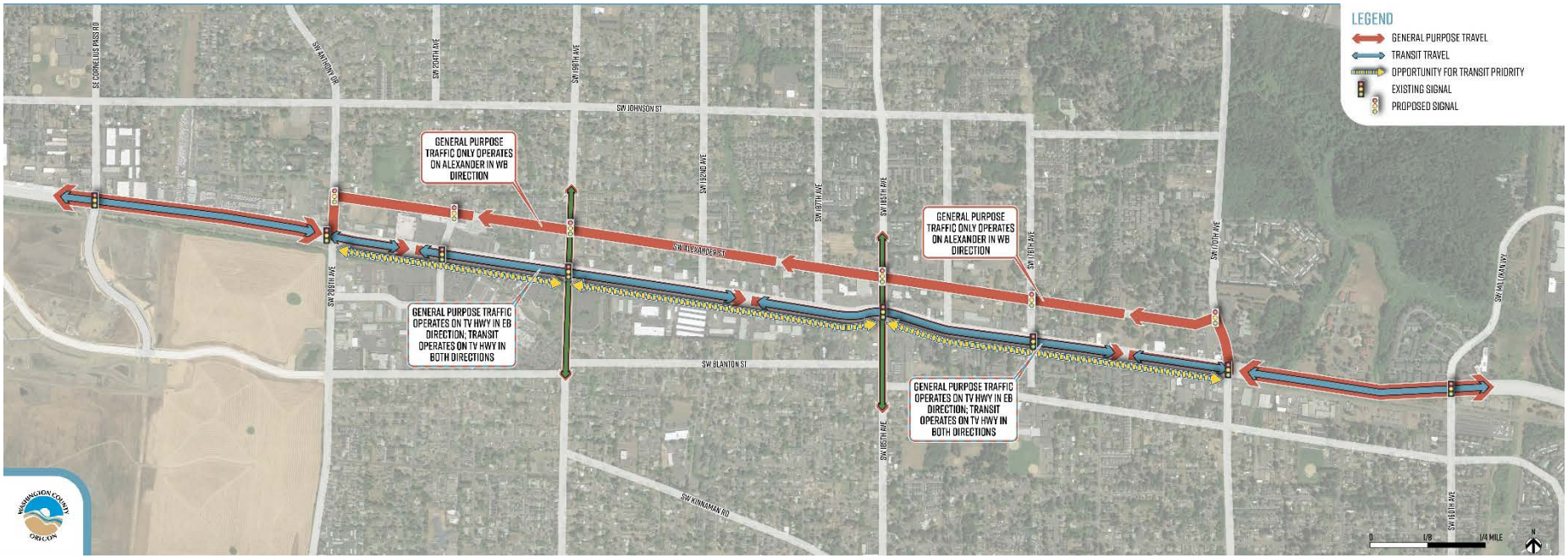


Figure 34. One-Way Couplet Concept on Alexander Street

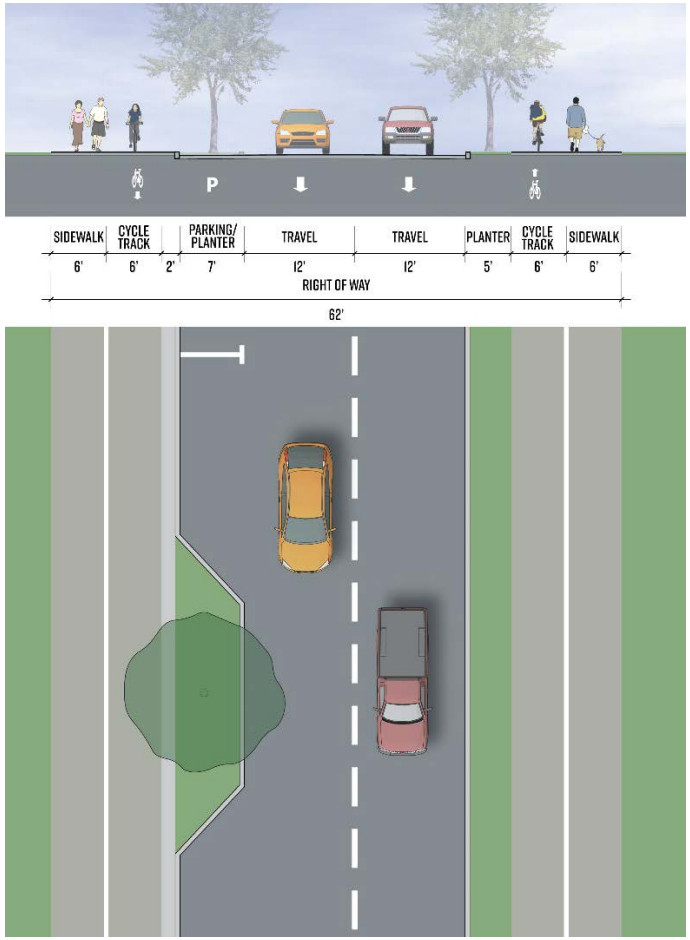


Figure 35. One-Way Couplet Concept on TV Highway

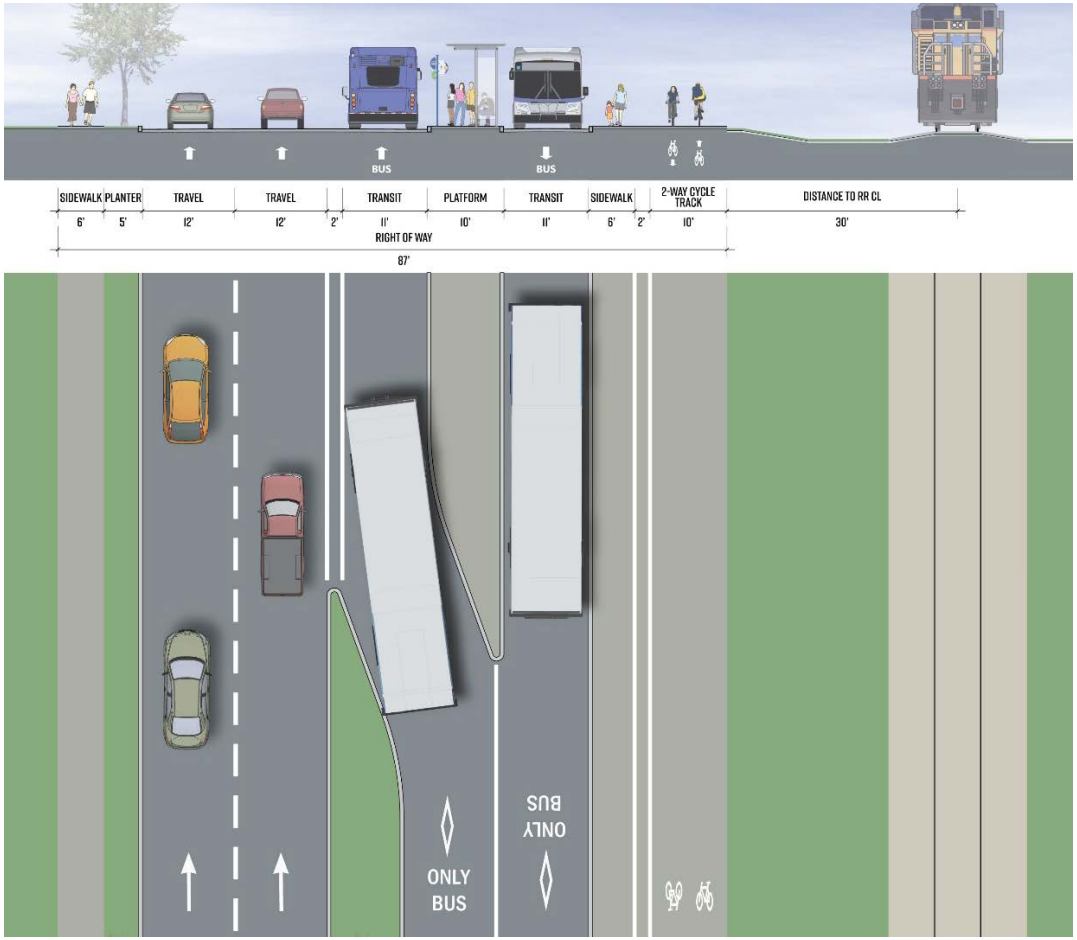


Table 17. One-Way Couplet Concept Treatments

Location	Treatments
170th Ave to 209th Ave (TV Hwy)	• 2-lanes one way eastbound general travel • Two-way dedicated transit lanes with raised separation from adjacent auto lanes • TSP equipped at all signals, with timing parameters adjusted to minimize cross street delay • Improved and protected continuous sidewalk on both sides of corridor • Protected and separated two-way cycle track on south side of corridor
170th Ave to 209th Ave (Alexander St)	• 2-lanes one way westbound general travel • Improved and protected sidewalk and bike lanes • New signals along Alexander St may be warranted for circulation and business access
TV Hwy/160th Ave	• Far side transit stations in both directions
TV Hwy/165th Ave	• Far side transit stations in both directions • Enhanced pedestrian crossing to access transit station and cross TV Hwy
TV Hwy/170th Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing to access transit station and cross TV Hwy • Intersection requires complex operations and design improvements for couplet portal
TV Hwy/174th Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing to access transit station and cross TV Hwy
TV Hwy/178th Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing to access transit station and cross TV Hwy • New grade separated pedestrian crossing over rail line
TV Hwy/185th Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing to access transit station and cross TV Hwy
TV Hwy/192nd Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing to access transit station and cross TV Hwy • New grade separated pedestrian crossing over rail line
TV Hwy/198th Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing to access transit station and cross TV Hwy
TV Hwy/Intel Campus Dwy	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing to access transit station and cross TV Hwy
TV Hwy/209th Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing to access transit station and cross TV Hwy • Intersection requires complex operations and design improvements for couplet portal
TV Hwy/214th Ave	• Far side transit stations in both directions • New enhanced pedestrian crossing on east side of intersection • New grade separated pedestrian crossing over rail line
TV Hwy/Cornelius Pass Rd	• Far side transit stations in both directions

Table 18 shows the planning level cost estimates and corridor property impacts based on the proposed cross section. Additional information related to the planning level cost estimate is provided in Appendix C.

Table 18. One-Way Couplet Concept Cost and Property Impacts

Construction Cost Estimate	Total Project Cost Estimate	Total ROW Acquisition[2]	Buildings Impacted
$61,637,000 - $75,335,000	$100,778,000 - $123,174,000	110,000 – 150,000 sf (Combined couplet)	5

Note: Cost estimate does not include ROW and is based on planning level costs and quantities.

Table 19 describes tradeoffs between opportunities and constraints for the one-way couplet concept, which provides additional qualitative input into the comparative evaluation of the design concepts.

Table 19. One-Way Couplet Concept Tradeoffs

Opportunities	Constraints
• Exclusive transit lanes dedicated to each direction of travel improves travel time and reliability. Dedicated transit lanes will maintain optimal speed and reliability as general purpose traffic congestion increases over time. • Shortens crossing distance for pedestrians on TV Highway with new center transit stations serving both directions of transit travel. • Reduces modal conflicts by creating one-way general purpose travel on TV Highway and Alexander Street. • Minimizes corridor footprint on TV Highway by repurposing existing road space. Minimizes the potential of encroaching on rail ROW on the south side. • Maintains general purpose capacity with travel on both TV Highway and Alexander Street. • Creates protected and separated bike facilities on both TV Highway and Alexander Street.	• Requires Alexander Street to be widened to effectively serve couplet operations, which may impact adjacent properties and business/residential access. • May require facility transfer agreements. • Modifies property access within the couplet. • Requires the introduction of additional signals on TV Highway and Alexander Street for progression and circulation purposes. • Results in complex operations at couplet portals by transitioning two-way operations to one-way couplet operations. • High capital cost given the improvement to two parallel streets. • Couplet intersection geometry would result in large intersections to effectively accommodate freight movements and high vehicular volumes anticipated for the corridor.

4.4.4 Concept 4: Single Bi-Directional Transit Lane Concept

Concept 4 assumes repurposing the center two-way left turn lane on TV Highway into a single bi-directional transit guideway. Figure 36 illustrates conceptual renderings of station areas for single bi-directional operations that may be considered on TV Highway. This option will require stations to be placed in the center of the roadway at specific locations to allow buses to pass each other. This option may also minimize the footprint required since it repurposes the center lane and will not require curbside bus pullouts and stations. Single bi-directional lane operations along TV Highway will require robust assessment of corridor operations at signalized intersections in order to better understand the resulting signal operational performance and characterize the potential redirection of left turning vehicles from TV Highway. Displacement of the left turning vehicle movement was assumed to facilitate more effective station placement and to minimize ROW impacts. Figure 37 and Figure 38 illustrate the conceptual single bi-directional lane cross sections, one at a typical, non-station area and the other at a station area. Similar to other concepts, the cross section for this concept is subject to additional review and refinement, particularly with respect to placement of station locations and intersection treatments.

Figure 36. Single Bi-Directional Transit Lane Operation Renderings

Figure 37. Single Bi-Directional Lane Concept Cross Section (Typical)

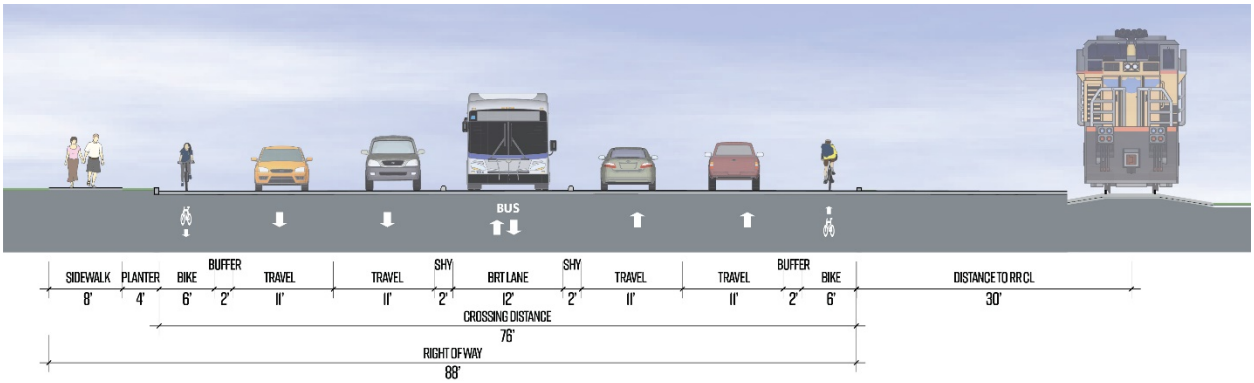


Figure 38. Single Bi-Directional Lane Concept Cross Section (At Station)

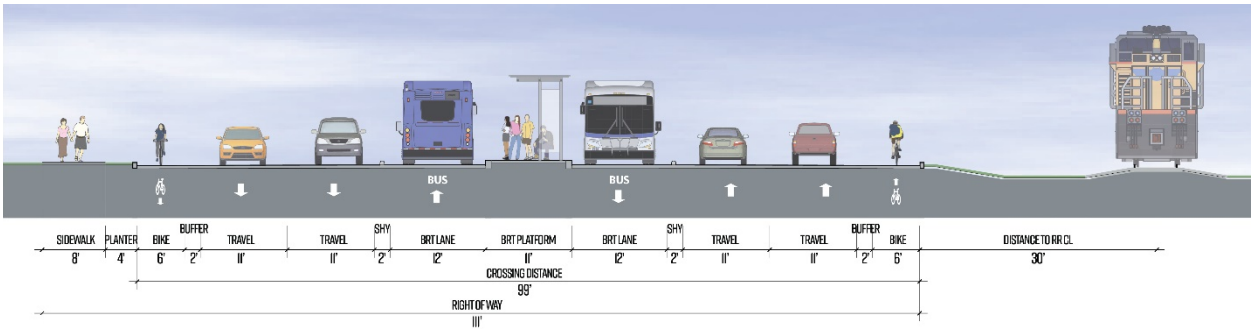


Table 20 shows the specific treatments considered for the corridor and at each location.

Table 20. Single Bi-Directional Lane Concept Treatments

Location	Treatments
Corridor-Wide	• Repurpose existing center two-way left turn lane for bi-directional transit operations • TSP equipped at all signals, with timing parameters adjusted to minimize cross street delay • Improved and protected continuous sidewalk on north side of corridor • Transit stations will serve a pedestrian refuge to safely cross TV Hwy • Protected bike lanes on both sides of corridor
TV Hwy/160th Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing or direct access to existing crosswalk to access transit station • U-turn allowance
TV Hwy/165th Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing to access transit station • Right-in/Right-out only
TV Hwy/170th Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing or direct access to existing crosswalk to access transit station • U-turn allowance
TV Hwy/174th Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing to access transit station • Right-in/Right-out only
TV Hwy/178th Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing or direct access to existing crosswalk to access transit station • New grade separated pedestrian crossing over rail line • U-turn allowance
TV Hwy/185th Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing or direct access to existing crosswalk to access transit station • U-turn allowance
TV Hwy/192nd Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing to access transit station • New grade separated pedestrian crossing over rail line • Right-in/Right-out only
TV Hwy/198th Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing or direct access to existing crosswalk to access transit station • U-turn allowance
TV Hwy/Intel Campus Dwy	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing or direct access to existing crosswalk to access transit station • U-turn allowance
TV Hwy/209th Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing or direct access to existing crosswalk to access transit station • U-turn allowance
TV Hwy/214th Ave	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing to access transit station • New grade separated pedestrian crossing over rail line • Right-in/Right-out only
TV Hwy/Cornelius Pass Rd	• Shared transit station platform for both directions of travel • Enhanced pedestrian crossing or direct access to existing crosswalk to access transit station • U-turn allowance

Table 21 shows the planning level cost estimates and corridor property impacts based on the proposed cross section. Additional information related to the planning level cost estimate is provided in Appendix C.

Table 21.Single Bi-Directional Lane Concept Cost and Property Impacts

Construction Cost Estimate	Total Project Cost Estimate	Total ROW Acquisition[2]	Buildings Impacted
$50,424,000 - $61,630,000	$82,567,000 - $100,915,000	360,000 – 500,000 sf	21

Note: Cost estimate does not include ROW and is based on planning level costs and quantities.

Table 22 describes tradeoffs between opportunities and constraints for the single bi-directional transit lane concept, which provides additional qualitative input into the comparative evaluation of the design concepts.

Table 22. Single Bi-Directional Transit Lane Concept Tradeoffs

Opportunities	Constraints
• Exclusive transit lane improves travel time and reliability. Dedicated transit lane will maintain optimal speed and reliability as general purpose traffic congestion increases over time. • Station areas may provide opportunity for additional pedestrian crossings along TV Highway. These stations will shorten crossing distance for pedestrians on TV Highway. • Depending on peak-oriented traffic patterns, single bi-directional lane may allow for peak direction transit operations, where the lane is only used by one direction of travel during certain times of day depending on need.	• Single bi-directional lane may result in some transit delays as transit vehicles are required to wait for on-coming vehicles to use bus lane. • Operation will require abundant signaling technology, detection, signage, and striping to minimize the occurrence of collisions. • Station areas will require a wider footprint to accommodate two bus lanes and station platforms. • Stations may need to be positioned away from existing signalized intersections and existing rail crossings to minimize impact to left turning vehicles. • May impact median access (left turns) to adjacent properties. • Intersection design and operations may be complex once left turn lanes are introduced adjacent to single bi-directional bus lanes. • TSP may provide benefit to east-west transit travel time, but may impact north-south operations depending on the TSP parameters. TSP on TV Highway may impact traffic operations on all major cross streets, particularly at 160th, 170th, 185th, and 209th Avenues and Cornelius Pass Road.

Appendix D illustrates conceptual layouts of single bi-directional lane concept operations at TV Highway and 185th Avenue, showing the preliminary footprint of this concept with several design options, including the following:

1. Intersection with a transit station located on one side of the intersection adjacent to the crosswalk, with removed left turns in one direction and a new transit-only phase to allow transit vehicles to operate in the center lane through the intersection. This option requires a wider footprint, removal of some left turn movements, and closer walking distance for passengers to transfer to the north-south transit route on 185th Avenue.
2. Intersection with transit station behind the left turn lanes to maintain left turn movements in both directions and minimize the intersection footprint. This option will also test a new transit-only phase for transit vehicles to operate in the center lane through the intersection. This option

requires some widening (although less than Option 1), maintaining left turning in both directions, but increases the walking distance for passengers to transfer to the N/S transit route on 185th Avenue.

5 Concept Evaluation

The evaluation process uses a set of measures that both quantitatively and qualitatively assess the design concepts to inform tradeoffs, assist in identifying preferred transit operations, and access treatments and solutions. The design concepts were evaluated to enable the project team to determine which concept(s) will be carried into further analysis and refinement. Evaluation measures to compare transit operations and assess design concepts are described in Table 23. The measures were developed with consideration of the goals listed above, identified project needs, and other applicable guidance.[20]

Table 23. Evaluation Criteria

Evaluation Criteria	Evaluation Approach
Safety Improvements	Rating based on improvements in access to transit; non-motorized separation/protection from adjacent auto lanes; non-motorized modes comfort; other safety improvements
Capital Cost	Rating based on planning level cost estimate using a preliminary line item cost buildup of roadway, signal, and transit facility improvement cost, including contingency
Transit Travel Time Improvement	Rating based on transit travel time impacts resulting from the level of transit priority included in each design concept
Auto Travel Time Impact	Rating based on impacts to auto travel time resulting from operational adjustments to other modes and/or out of direction travel required
Property Impact	Rating based on square foot estimate of adjacent parcel impact and the number of buildings potentially impacted by the assumed cross sections
Business & Residential Access	Rating based on the level of impact from business/residential access restrictions, circulation changes, and/or driveway impacts

The assessment includes a three-scale rating of each evaluation criteria for each concept option. The rating compares each option to the baseline condition of no improvement. Table 24 describes the evaluation key for each of the six evaluation criteria considered in the comparative assessment.

Table 24. Evaluation Key

Evaluation Criteria	Green	Yellow	Purple
Safety Improvements	Best safety improvements for all modes	Moderate safety improvements for all modes	Some safety improvements for all modes
Capital Cost	Lower capital cost	Moderate capital cost	Higher capital cost
Transit Travel Time Improvement	Best transit travel time improvements	Moderate transit travel time improvements	Some transit travel time improvements
Auto Travel Time Impact	Lower auto travel time impact	Moderate auto travel time impact	High auto travel time impact
Property Impact	Less property impact	Moderate property impact	Greater property impact
Business & Residential Access	Less impact to access	Moderate impact to access	Greater impact to access

The results of the high-level comparative evaluation for the four design concepts using the evaluation criteria described above are detailed in Table 25.

[20] Including Metro's *Draft Transit System Expansion Policy* Public Review Draft, June 28, 2018.

Table 25 High-Level Comparative Evaluation Results

		Safety Improvement		Capital Cost		Transit Travel Time Improvement		Auto Travel Time Impact		Property Impact		Business and Residential Access Impact	
Concept	Enhanced Transit		Moderate-high safety improvements with enhanced pedestrian features, raised median, and protected/separated bike lanes and sidewalks.		Relatively moderate cost estimate due to some widening, non-motorized facility improvements, and additional safety features. $83M - $101M Capital Cost		Limited transit exclusivity will limit transit travel time improvement, especially as traffic demand grows		Limited auto travel time impact since transit will operate in mixed flow operations with general purpose. TSP may actual improve auto travel in the E/W direction.		Moderate property impact depending on length of turn pocket extensions and some widening at key locations. 310-435K sf ROW and 21 building impacts		Maintains access to corridor businesses and residences, unless a center median is introduced at several key locations.
	Corridor BAT Lane		Moderate-low safety improvements with separate sidewalks, but a wider cross section and unprotected bike lanes limit safety benefits.		Relatively high-moderate cost estimate due to continuous widening on TV Highway required to accommodate BAT lane. $90M - $110M Capital Cost		Improved transit priority with BAT lanes yet still shared with right turning vehicles accessing corridor driveways		Limited auto travel time impact since transit will operate in mixed flow operations with general purpose. TSP and moving right turning vehicles into the BAT lane may actual improve auto travel in the E/W direction.		High property impact due to assumed continuous BAT lane on north side of corridor, which requires an additional 14-foot lane along the study corridor. 350-490K sf ROW and 36 building impacts		Maintains access to corridor businesses and residences with a BAT lane, unless a center median is introduced at several key locations.
	One-Way Couplet		Moderate-high safety improvements due to narrowing of TV Highway cross section, improved non-motorized separation, and improved pedestrian environment. Couplet may also reduce modal conflicts along TV Highway. New modal conflicts may result with this concept.		Relatively highest cost estimate due to improvements to both TV Highway and Alexander Street. $101M - $123M Capital Cost		Exclusive travel lanes in both directions will provide best improvement in transit travel time and reliability		Out of direction travel in westbound direction combined with complex intersection operations at the couplet portals may impact auto travel time.		TV Highway will have minimal property impact since road space will be repurposes. Alexander St, however, will require moderate property acquisition. 110-150K sf ROW and 5 building impacts		Restricts bi-directional access to intersections due to the nature of a one-way couplet. Out of direction travel may be required to access destination along the couplet.
	Single, Bi-Directional Lane		Moderate safety improvements with enhanced pedestrian features, and reduction of vehicle turning conflicts by center lane restriction.		Relatively moderate cost estimate due to the removal of the raised median to accommodate center running transit operations and station cost reduction with center stations shared by both directions of transit. $83M - $101M Capital Cost		Exclusive lane shared by both directions of travel will provide good improvements in transit travel time, although some operational delay will exist from vehicles waiting to use lane if opposing direction is using lane		Moderate auto travel time impact due to the introduction of exclusive transit phase at study corridor intersections. Left turning movements may also be impacted at select locations.		Property impact may be minimal at locations without a station, however at station areas, footprint may result in some property impacts. 360-500K sf ROW and 21 building impacts		Single bi-directional lane may restrict some turning access to/from destination on TV Highway. However, left turn movements may be maintained at several signalized locations to allow U-turning to reach corridor destinations.

5.1 Basis of Evaluation

The evaluation results of several of the key criteria are based upon more detailed quantitative information. Results for capital cost and property impact are described below.

5.1.1 Capital Cost

The cost estimate evaluation rating is based on planning level capital cost estimate for each of the four concepts using the preliminary cross sections and order of magnitude line item cost categories and quantities. Table 26 details the planning level cost estimate range for each of the four concepts, noting that ROW cost is not included in these estimates. Construction cost estimates include construction labor materials and contingency, whereas the total capital cost estimates include the construction cost estimate, preliminary engineering, construction engineering, and reimbursable utilities. These cost estimates assume no encroachment on rail ROW on the south side of the corridor. Appendix C details the estimate breakdown of cost for each of the four alternatives, including categories, unit costs, quantities, and allowances for contingency. It should be noted that these cost estimates do not include ROW costs associated for permanent or temporary ROW required for each design alternative.

Table 26. Planning Level Cost Estimates[1,2]

Concept	Construction Cost Estimate	Total Capital Costs
Enhanced Transit	$50,491,000 - $61,712,000	$82,677,000 - $101,050,000
Corridor BAT Lane	$54,847,000 - $67,035,000	$89,750,000 - $109,695,000
One-Way Couplet	$61,637,000 - $75,335,000	$100,778,000 - $123,174,000
Single, Bi-Directional Lane	$50,424,000 - $61,630,000	$82,567,000 - $100,915,000

[1]ROW cost is not included in the cost estimates. Estimated ROW impacts are described below.
[2]Grade separated pedestrian crossings are not included in estimate

5.1.2 Property Impact

Property impact areas were evaluated based on a square foot estimate of adjacent parcel acquisition and the number of buildings potentially impacted by the assumed cross sections. Table 27 details the estimated property and building impacts for each design concept. These estimated property impacts assume no encroachment on rail ROW on the south side of the corridor.

Table 27. Estimated Property Impact

Concept[1]	Total ROW Acquisition[2]	Buildings Impacted
Enhanced Transit	310,000 – 435,000 sf	21
Corridor BAT Lane	350,000 – 490,000 sf	36
One-Way Couplet	40,000 – 55,000 sf (TV Hwy WB)	4
	70,000 – 95,000 sf (Alexander St. EB)	1
	110,000 – 150,000 sf (Combined couplet)	5
Single, Bi-Directional Lane	360,000 – 500,000 sf[3]	21

[1]Typical cross section accounts for nominal roadway ROW section width, additional width may be required at intersections depending on alternative.
[2]ROW acquisition approximated based on GIS parcel maps, no easement is assumed to be obtained along railroad ROW.
[3]ROW acquisition assumes cross sections at stations and cross section without station.

5.1.3 Modeling Analysis Results

Future traffic conditions analysis assists in identifying likely opportunities and potential impacts to transit operations. Traffic analysis for the PM peak hour was conducted for future no-build conditions and a series of build conditions to test benefits and impacts of transit improvement concepts. The PM peak hour represents peak conditions in the westbound direction. Therefore, additional analysis in the AM peak-direction condition heading eastbound will be required as part of future studies. The analysis tools, methodologies, and results of build conditions analysis are included in the project traffic analysis results memo separate from this document. Travel time and queuing conditions were reported at study corridor intersections to identify likely constraints and opportunities with various transit priority features. The following summarizes key results from the traffic analysis:

- Existing dwell time accounts for approximately 23 percent of transit travel time in the westbound direction and 40 percent of transit travel time in eastbound direction. The proposed station dwell time of 20 seconds at each station is modeled to reduce transit travel time by between 5 and 6 percent in either direction. Additionally, by consolidating existing midblock stops, including stop ID 5593 (18882-19040 TV Hwy) eastbound and stop IDs 5592 (Aloha Villa) and 5594 (18882-19040 TV Hwy), westbound buses will experience less total dwell time as buses will make fewer total stops within the corridor.
- In the future no-build condition, the corridor is projected to operate at congested conditions for westbound traffic with extended queues at most intersections, which will hamper transit speed and reliability performance. Westbound through traffic queues are anticipated to greatly exceed the length of existing turn pockets, limiting opportunities to use as queue bypass lanes without substantial lengthening of existing turn lanes. However, TSP technologies provide an opportunity for extended green time of through travel lanes, which would provide the potential for a reduction in the total transit delay as compared to signals that did not operate using TSP. Figure 39 illustrates the future no-build queuing conditions model results during the PM peak hour, which shows the congestion conditions in all directions of travel at the major signalized intersections along the corridor, particularly at 160th, 170th, 185th, and 209th Avenues and Cornelius Pass Road.
- Extended westbound queue bypass lanes with TSP at all signalized intersections provide the best benefit for transit vehicles while minimizing the impact on motor vehicles. The change in transit travel times among the different scenarios is primarily attributed to the varying queue bypass lane lengths that would result in the ability to provide physical space for the transit vehicles to pass the through traffic queues, which are anticipated to grow substantially in the peak hour over the 2040 planning horizon. This analysis assumed some lengthening of the westbound queue bypass lanes, but not extending beyond the full length of the projected queuing. The westbound travel time results suggest that longer queue bypass lanes would result in slightly more benefit to transit travel times. While longer bypass lanes would provide the most benefit in transit travel times as compared to only some lengthening, this approach would also increase cost and ROW impact necessary to lengthen turn pockets.
- TSP may provide benefit to east-west operations for transit and auto travel, although TSP allowance may impact north-south operations, particularly at 160th, 170th, 185th, and 209th Avenues and Cornelius Pass Road.

- The traffic analysis included an assessment of different scenarios relative to queue bypass lanes and potential BAT lanes. While the scenario that assumes a higher level of investment in transit priority treatments provides the greatest benefit for transit with longer queue bypass lanes and BAT lanes, it comes with significant impact to ROW. The lower-end investment analysis shows that substantial transit benefit can be achieved with approximately a 50 percent travel time savings while impacting less ROW with shorter queue bypass lanes.
- The existence of pork chop right-turn islands would slightly impact the travel time for eastbound transit vehicles based on the results described above. This is due to the inability to provide physical space for the buses to bypass the through movement queues. Although the PM analysis results do not show a significant difference in eastbound transit travel time, the transit operations are expected to experience more significant delay in the AM peak period due to eastbound congestion and therefore may have more benefit than shown in the PM analysis.
- Center running transit operations were tested at 170th Avenue and 198th Avenue. At 170th Avenue, intersection operations may improve slightly although critical movements may experience longer delays. At 198th Avenue, intersection operations may experience longer delays.

Figure 39. Future No-Build PM Peak Queuing Conditions

5.2 Concept Evaluation Summary

Table 28 summarizes each concept that was evaluated. The concepts are unique in transit operating environment (including level of transit priority and dedicated space), cross section dimensions, footprint, and impacts to corridor operations. While each of these design concepts explore a corridor-wide application of various transit treatment strategies, features from each of these concepts are recommended to be explored on a segment by segment basis to develop a refined concept.

Table 28. Concept Summary

Concept	Concept Summary	Evaluation Summary
Enhanced Transit	• Maintains general purpose traffic circulation • Transit generally travels in mixed traffic, and utilizes spot-level improvements to improve transit speed/reliability • Transit travel time improvement is not as ideal due to limited level of transit dedication • More flexibility to minimize property impact and cost to construct	Higher rated concept due to improvements in safety, transit operations, access, and overall mobility. More flexible and most cost-effective option. ***Recommended Action: Select features from this concept for additional refinement and application to locations along corridor.***
Corridor BAT Lanes	• Maintains general purpose traffic circulation • Transit travels in new BAT lane adjacent to general purpose travel lane • BAT lane is not feasible along most of the corridor given the width required and impact to property and rail ROW • Highest level of building and property impact	Lower rated concept due to property impact, cost, and wider crossing distance. ***Recommended Action: Remove full corridor concept from consideration, but consider BAT lanes at specific locations along TV Hwy, where feasible.***
One-Way Couplet	• Circulated general purpose traffic as a one-way couplet using TV Highway eastbound and Alexander Street westbound • Transit travels in both directions in dedicated lanes on TV Highway • Relatively minimal footprint on TV Highway, although highest cost given the improvements required on Alexander Street • Requires Alexander Street to serve as a state highway and freight route	Lower rated concept due to cost, circulation impacts, lack of political/ community support, and limited readiness ***Recommended Action: Remove full corridor concept from consideration***
Single Bi-Directional Lanes (Median Running)	• Maintains general purpose traffic circulation, although turns are restricted since transit uses center lane • Transit travels in center lane in both directions, requiring high degree of operational complexity and technology • Station locations at intersections and transfer points require significant widening/potential property impact and may not be feasible	Moderately rated concept due to technical complexity, access impact (including turning left turns), cost, and limited flexibility to minimize property impacts. ***Recommended Action: Select features from this concept for additional refinement and application to locations along corridor.***

6 Public and Stakeholder Engagement

Public and stakeholder engagement for the corridor provides key input on preferences, support, and endorsement of corridor improvement concepts and project list refinement. Consolidated results from a recent project open house, technical advisory meetings, technical subteam meetings, steering committee meetings, and targeted engagement meetings have been used to inform preferences on corridor design concepts.

6.1 Partner Coordination

6.1.1 Technical Advisory Group (TAG)

Four Technical Advisory Group (TAG) meetings, including representatives from:

- Washington County LUP
- ODOT Region 1
- TriMet
- Metro
- City of Beaverton
- City of Hillsboro
- Tualatin Valley Fire & Rescue
- Tualatin Hills Park & Recreation District

In addition, the project engaged agency technical staff through several sets of subteam meetings to discuss transit improvements, traffic impacts, and agency coordination.

6.1.2 Executive Committee

Three Executive Committee Meetings, including representatives from:

- Washington County LUP
- ODOT Region 1
- TriMet
- Metro
- City of Beaverton
- City of Hillsboro

6.1.3 Additional Coordination

The project was presented to other governing bodies and groups, including:

- Washington County Planning Commission
- Board of County Commissioners
- Aloha Business Association
- Community Participation Organization (CPO) 6, Aloha/Cooper Mountain/Reedville

6.2 Open House

On April 3, 2019, Washington County held the Aloha Community Planning open house at the Aloha Grange (3425 SW 185th Ave, Beaverton, OR) to highlight the Moving Forward TV Highway: Enhanced Transit and Access Plan, as well as the Aloha Tomorrow Implementation Ordinance. The open house was designed to inform the community and gather feedback on both of these projects, with each presented on separate sides of the room. For the Moving Forward TV Highway project, the main purpose was to gather input from the local community about corridor mobility needs and four potential design concepts for the corridor and which kinds of improvements are most important to the community. More than 125 people attended the open house and 46 people left written comments about the Moving Forward TV Highway Project.

6.2.1 Event Details

The event was open to the public from 6 p.m. – 8 p.m. and was drop-in style, allowing attendees to move around the room at their own pace and come and go as they pleased. Several County and agency partner staff were available to provide context and answer questions. The area dedicated to the Moving Forward TV Highway Project consisted of 10 display boards (Appendix E), with background information, proposed concepts, and interactive activities for providing feedback. A comment area in the center of the room provided space for people to answer survey questions on a comment card and give open-ended feedback.

The main objective was to present and solicit feedback on each of the four proposed concepts for the TV Highway Corridor.

6.2.2 Public Participation and Feedback

Demographics

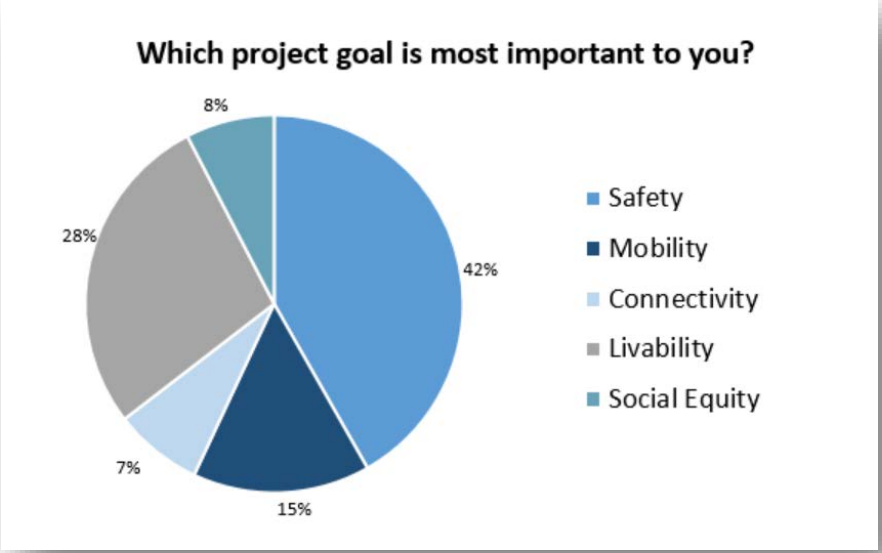
Participants were encouraged to provide their thoughts on a comment card, which included optional demographic questions. Of those who answered these questions:

- 85 percent said they live in Washington County.
- Most were between the ages of 45-64 years old (55 percent).
- 65 percent said they were white. The next highest grouping were those who preferred not to answer (16 percent) and Asian American (10 percent).
- 56 percent were female; 34 percent were male.
- 19 percent have a Bachelor's degree; 13 percent have a post-grad degree; and 18 percent have an Associate's degree.

Concept Preferences and Improvement Priorities

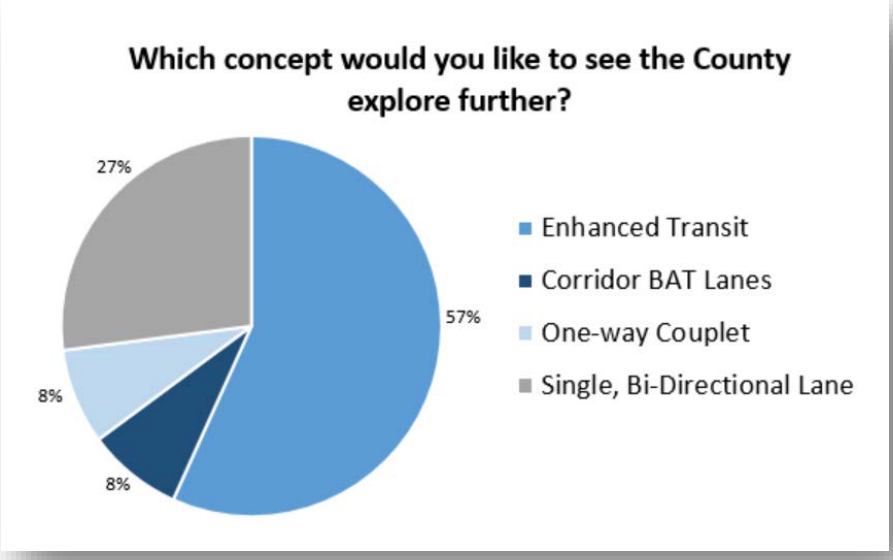
Attendees were also encouraged to participate in an interactive exercise in which they were given dot stickers to place on a display board to indicate preference or priority. In the first exercise, the public was presented with the five project goals and asked to mark which was most important to them (Figure 40). Of these goals, most people (33) said safety was the most important to them, followed by livability (22).

Figure 40. Project Goals Preference



Participants were also asked to identify which of the four design concepts they wanted the County to explore further (Figure 41). The majority of those who participated (21 people) said they supported the Enhanced Transit concept. The Single, Bi-Directional Lane was the second-most popular with 10 votes.

Figure 41. Project Concept Preference



General Comments

Of the 46 open-ended comments received, most related to the following themes:

- Concerns with and/or opposition to the TV Highway and Alexander Street Couplet concept

- Concern with the possible impacts of restricting turning movements along TV Highway
- Concern with safety and access to stations in the center of the roadway for the center-running transit concept
- Desire for improved traffic conditions and reducing conflict between buses and cars
- Strong desire for improved sidewalks and lighting on parallel streets (specifically Blanton, Alexander and Johnson)
- Desire for improved pedestrian crossings and safer bike lanes
- Concerns about designing for future growth, traffic, and congestion in the area

The results of the dot exercises and comments provide input into the Moving Forward TV Highway recommended concept plan and subsequent efforts to improve safety and mobility along the TV Highway corridor.

6.3 Engagement Meeting

On May 7, 2019, DHM Research facilitated a small group discussion with community members regarding the future of the Tualatin Valley Highway. The primary focus was the section of TV Highway in Aloha. Participants were recruited by Washington County through a variety of outreach efforts. Three people attended the session - a small business owner who commutes to the project area several times a week, an executive of a construction company whose employees regularly truck materials through the project area, and a local resident who leads a nonprofit that advocates for active transportation options. The participants all lived or worked in the study area. The session consisted of both written exercise and group discussions.

6.3.1 Key Findings

- The participants had negative views about the current condition of TV Highway and believed that the problems will worsen unless significant improvements are made.
- The participants would like TV Highway to evolve into a more pedestrian-friendly corridor that supports multimodal transportation options, while also supporting efficient vehicular traffic.
- The values that the participants want to guide TV Highway planning decisions include congestion relief, balancing multiple transportation modes, and being welcoming to all transportation modes.
- The participants advocated for improvements to public transportation along TV Highway that would make getting to and from transit stops safer and that would improve overall traffic flow.
- Reactions to the TV Highway recommended concept were mostly positive, with some concerns about impacts to adjacent streets and the overall balance of proposed projects.
- The participants broadly supported the recommended concept, and hopeful that the combination of projects would both improve traffic flow and safety for all users. Participants also expressed some concern that the multiple benefits may not be apparent to all community members. They advised the need to communicate to the public how improvements to pedestrians, cyclists, and public transportation riders will benefit drivers.

7 Recommended Corridor Concept

The preferred concept (composed of a hybrid of several concepts) was developed based on the result of the preliminary evaluation and public and stakeholder engagement. The recommended corridor concept is detailed in Table 29 and illustrated in Figures Figure 42 - Figure 45. Proposed station locations are only representative and will require additional siting and evaluation for most feasible placement.

Table 29. Draft Recommended Corridor Concept Project List

Segment	Location	Proposed Improvement
Corridor-Wide		• Install raised median at warranted locations, while maintaining or improving left turn access at signalized intersections • Install pedestrian-scale lighting adjacent to transit stations and pedestrian crossings • Provide protected and separated bike lanes and improved sidewalks along the corridor • Improve sidewalk gaps within ¼ mile of each proposed transit station
160th Ave – 192nd Ave	Segment-Wide	• Center running operations from east of 160th Ave to 192nd Ave • Most driveways will be restricted to right-in/right-out combined with U-turn movements at each signalize intersection
	TV Hwy/160th Ave	• Transit signal priority • Single center station serving both directions, providing pedestrian crossing refuge • Allow U-turn movements in eastbound and westbound directions
	TV Hwy/St. Mary's/ 165th Ave	• Limit driveway access to right-in/right-out • No transit stations or enhanced pedestrian crossing
	TV Hwy/170th Ave	• Transit signal priority • Single center station serving both directions, providing pedestrian crossing refuge • Allow U-turn movements in eastbound and westbound directions
	TV Hwy/174th Ave	• New traffic signal with transit signal priority • Single center station serving both directions, providing pedestrian crossing refuge • Allow U-turn movements in eastbound and westbound directions
	TV Hwy/178th Ave	• Transit signal priority • Single center station serving both directions, providing pedestrian crossing refuge • Allow U-turn movements in eastbound and westbound directions • Grade-separated pedestrian rail crossing on south side of intersection
	TV Hwy/185th Ave	• Transit signal priority • Single center station serving both directions, providing pedestrian crossing refuge • Allow U-turn movements in eastbound and westbound directions
	TV Hwy/187th Ave	• No transit stations or enhanced pedestrian crossing • Limit intersection access to right-in/right-out/left-in
	TV Hwy/192nd Ave	• New traffic signal with transit signal priority • Single center station serving both directions, providing pedestrian crossing refuge • Allow U-turn movements in eastbound and westbound directions • Grade-separated pedestrian rail crossing on south side of intersection
Seg 4. 192nd Ave – 209th Ave	TV Hwy/198th Ave	• Eastbound and westbound right turn pocket for transit queue bypass in both directions • Far side/curbside stations in both directions • Allow U-turn movements in eastbound and westbound directions • Transit signal priority
	TV Hwy/Intel Campus Dwy/204th Ave	• Far side/curbside stations in both directions • Allow U-turn movements in eastbound and westbound directions • Transit signal priority

Segment	Location	Proposed Improvement
	TV Hwy/209th Ave	• Westbound right turn pocket for transit queue bypass • Far side/curbside stations in both directions • Allow U-turn movements in eastbound and westbound directions • Transit signal priority
5. 209th Ave – Cornelius Pass Rd	TV Hwy/214th Ave	• Enhanced pedestrian crossing • Far side/curbside stations in both directions • Limit driveway access to right-in/right-out/left-in • Grade-separated pedestrian rail crossing on south side of intersection
	TV Hwy/216th Ave	• Limit driveway access to right-in/right-out/left-in
	TV Hwy/Cornelius Pass Rd	• Westbound right turn pocket for transit queue bypass in both directions • Far side/curbside stations in both directions • Allow U-turn movements in eastbound and westbound directions • Transit signal priority

Figure 42. Draft Recommended Corridor Concept

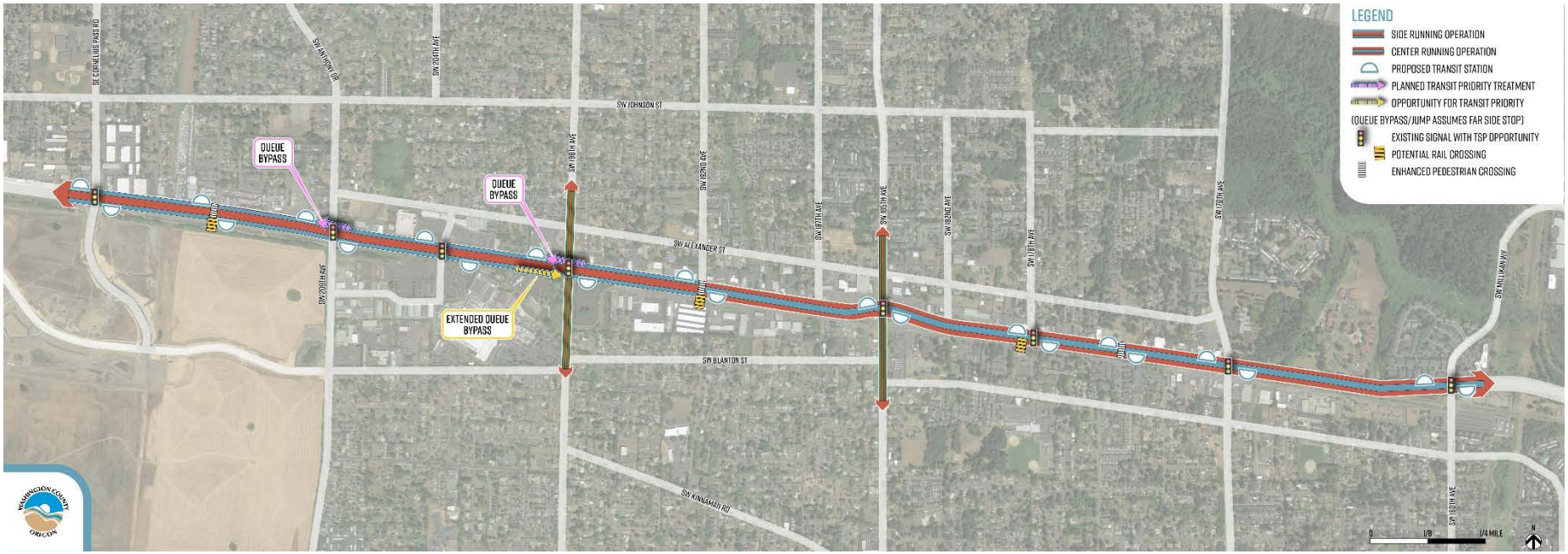


Figure 43. Draft Recommended Corridor Concept – Segment 1-3 Center Running Option

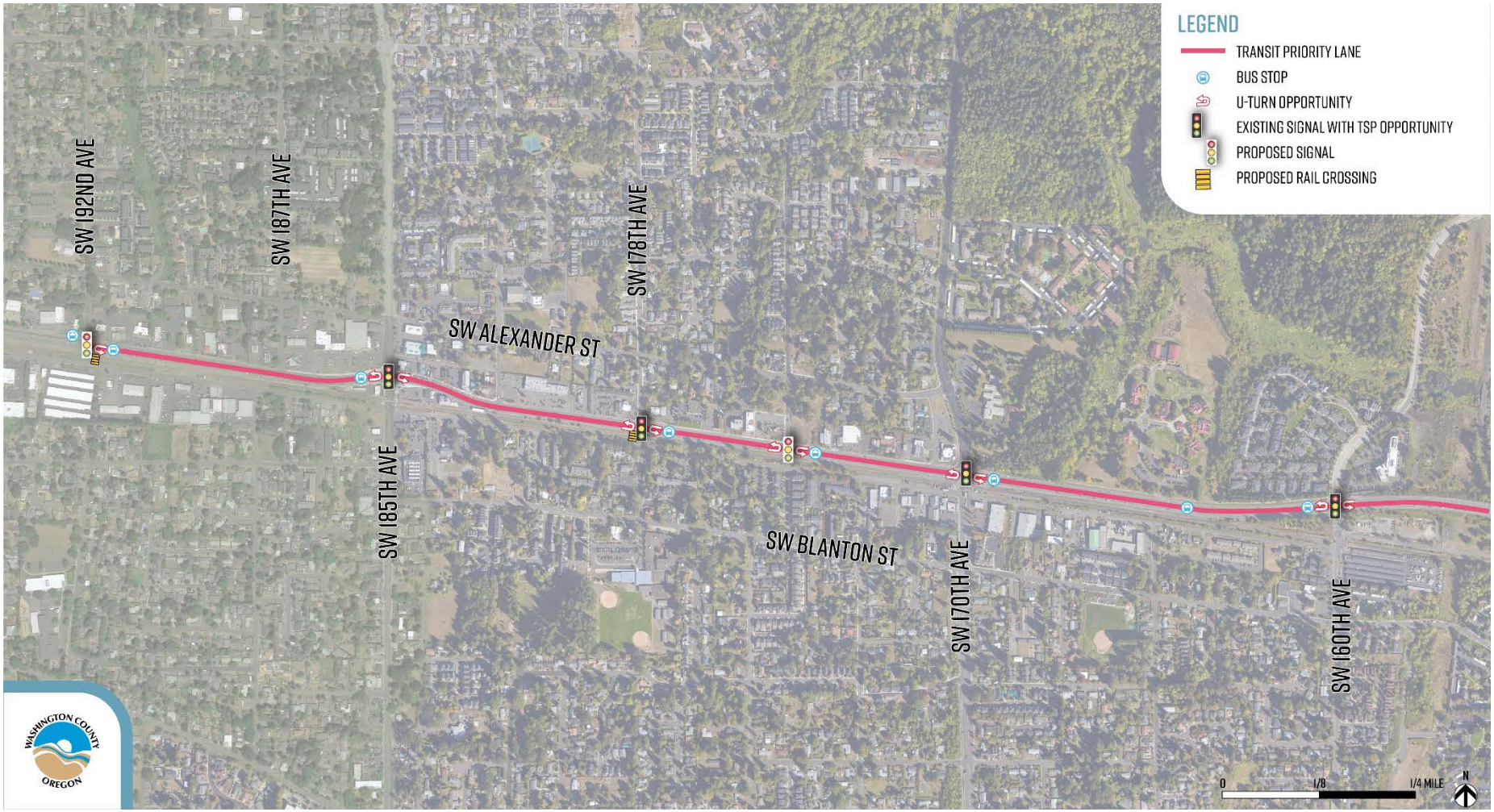


Figure 44. Draft Recommended Corridor Concept – Segment 4

Figure 45. Draft Recommended Corridor Concept – Segment 5

The proposed cross sections reflective of the center running transit operation between 160th Avenue and 192nd Avenue are shown below. Figure 46 illustrates the proposed typical center running cross section between stations. Figure 47 illustrates the proposed center running cross section at center station locations. The cross sections maintain a 29-foot "hole in the air" allowance for freight mobility in both directions along TV Highway since the corridor is designated as a National Highway System (NHS) facility.

Figure 46. Proposed Typical Cross Section for Center Running Transit Operation (160th Ave – 192nd Ave)

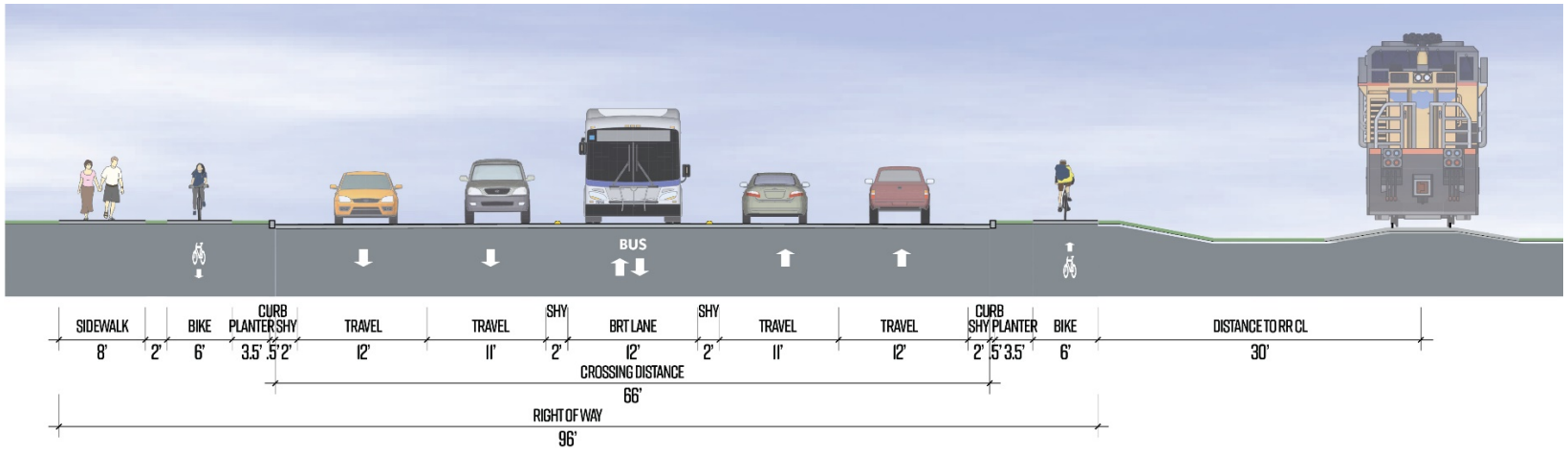
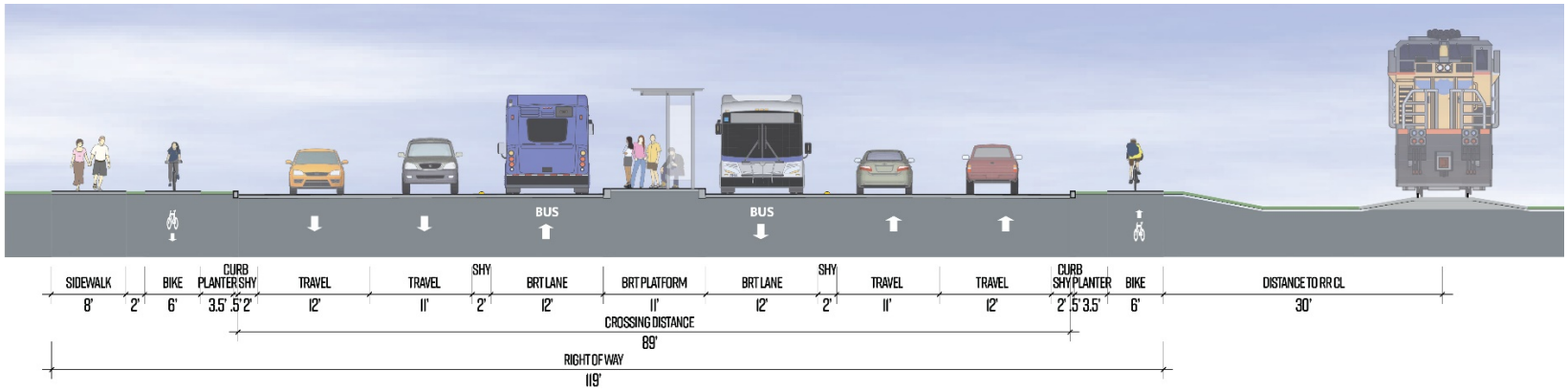


Figure 47. Proposed Center Station Cross Section for Center Running Transit Operation (160th Ave – 192nd Ave)



The proposed cross sections reflective of the curbside transit operation with transit operating in general purpose between 192nd Avenue and Cornelius Pass Road are also shown below. Figure 48 illustrates the proposed typical cross section for this segment, Figure 49 illustrates the proposed constrained cross section for this segment, and Figure 50 illustrates the proposed cross section at a typical intersection for this segment. It should be noted that the transition between the two segments will require specific signal operations to facilitate the change in operation between center running and curbside/general purpose running.

Figure 48. Proposed Typical Cross Section for Curbside Running Transit Operation (192nd Ave – Cornelius Pass Rd)

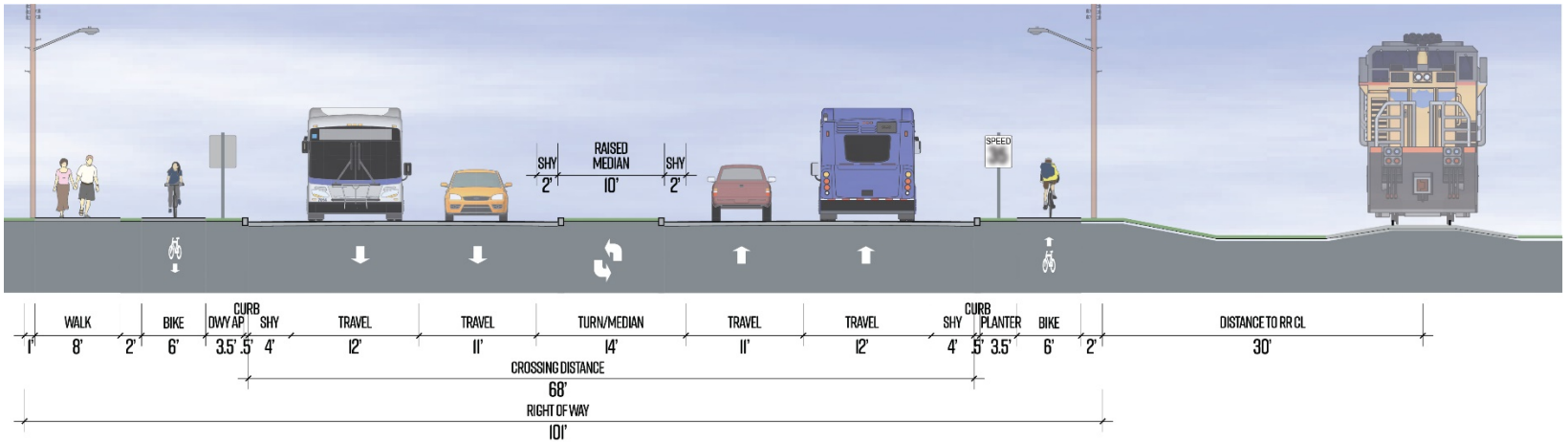


Figure 49. Proposed Constrained Cross Section for Curbside Running Transit Operation (192nd Ave – Cornelius Pass Rd)

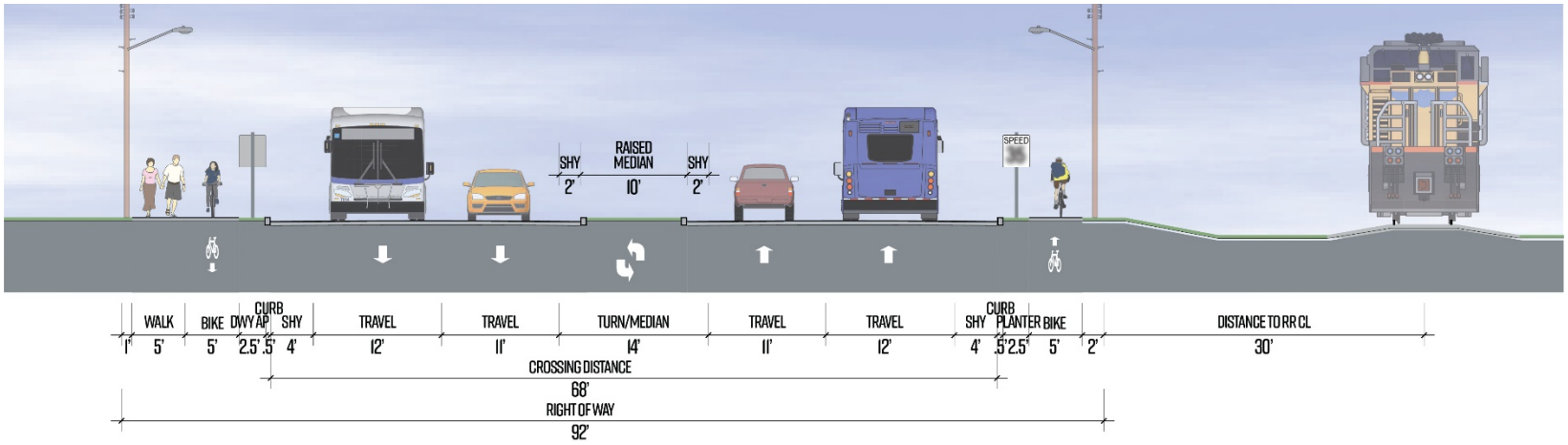


Figure 50. Proposed Cross Section for Curbside Running Transit Operations at Typical Intersections (192nd Ave – Cornelius Pass Rd)

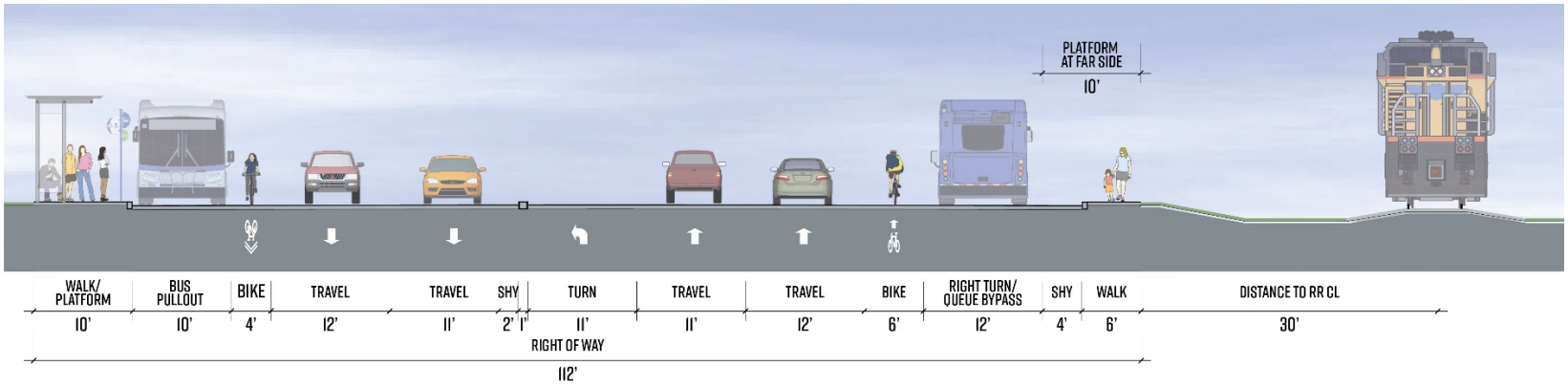


Table 30 shows the planning level cost estimates and corridor property impacts based on the proposed cross sections. Cost estimates for the preferred concept were based upon the cost estimates developed for the enhanced transit concept and the single bi-directional lane concept, which are included in Appendix C.

Table 30.Recommended Concept Cost and Property Impacts

Construction Cost Estimate	Total Project Cost Estimate	Total ROW Acquisition[2]	Buildings Impacted
$50,458,000 - $61,671,000	$82,622,000 - $100,983,000	335,000 – 470,000 sf	21

Note: Cost estimate does not include ROW and is based on planning level costs and quantities.

Specific recommendations for improvements to fill sidewalk gaps needed to access proposed transit station locations are illustrated in Figure 51. These recommended sidewalk improvements fill in gaps within 1/4 mile of each proposed transit station location along the study corridor.

Figure 51. Proposed Study Corridor Sidewalk Improvements

8 Near Term Actions

A series of near term actions are recommended as follow up items to refine recommendations in the Moving Forward TV Highway Plan and support successful implementations of corridor improvements. These include:

1. **Initiate Corridor Project Development**, which will refine recommendations from Moving Forward TV Highway and apply features to the full 18-mile TV Highway/OR8 corridor. This effort will coordinate various corridor STIP projects, other regional and local corridor projects, and will seek to achieve a concept design and associated cost estimate for improvement.
2. **Amend the Washington County Transportation System Plan (TSP),** which currently includes TV Highway as a refinement corridor. The recommendations included in Moving Forward TV Highway will provide updates to the corridor refinement for purposes of adoption into the County's TSP.
3. **Coordinate directly with the corridor railroad authority.** The facility improvement concepts shown in this study will require additional analysis, review, and approvals prior to implementation. Specifically, any improvements including additional transit priority lanes, turn lanes, or intersection modifications will require revised intersection preemption plans and analysis and a new railroad crossing order will be required. Any permanent infrastructure such as transit stations located within the rail right-of-way will require railroad approval and may require additional mitigations, including but not limited to access control fencing, and may not receive final approval from the railroad. Any new at-grade crossings for either vehicular or pedestrian will be subject to the requirements of the railroad at the time of application and would likely be conditional upon the closure of multiple existing crossings. Grade separated pedestrian crossings would likely not require closure of existing at-grade railroad crossings, but may require additional mitigations, such as access control fencing.
4. **Consider policy implications required to implement TV Highway facility improvements,** including design exception requirements, potential jurisdictional transfer opportunities, and coordination with other local and regional plans and funding opportunities. Additional description of potential policy implications is described below.

8.1 Design Exceptions

The recommended corridor design concepts will require design exceptions depending on jurisdictional ownership. Design standards respective of lane width, sidewalk width, shoulder width, and other treatments will need to be examined in greater detail to identify specific design exceptions that will be required. Washington County is revising the County-wide Roadway Design Standards, which will provide an opportunity to align recommended projects in Moving Forward TV Highway with the updated Roadway Design Standards.

8.2 Jurisdictional Transfer Opportunity

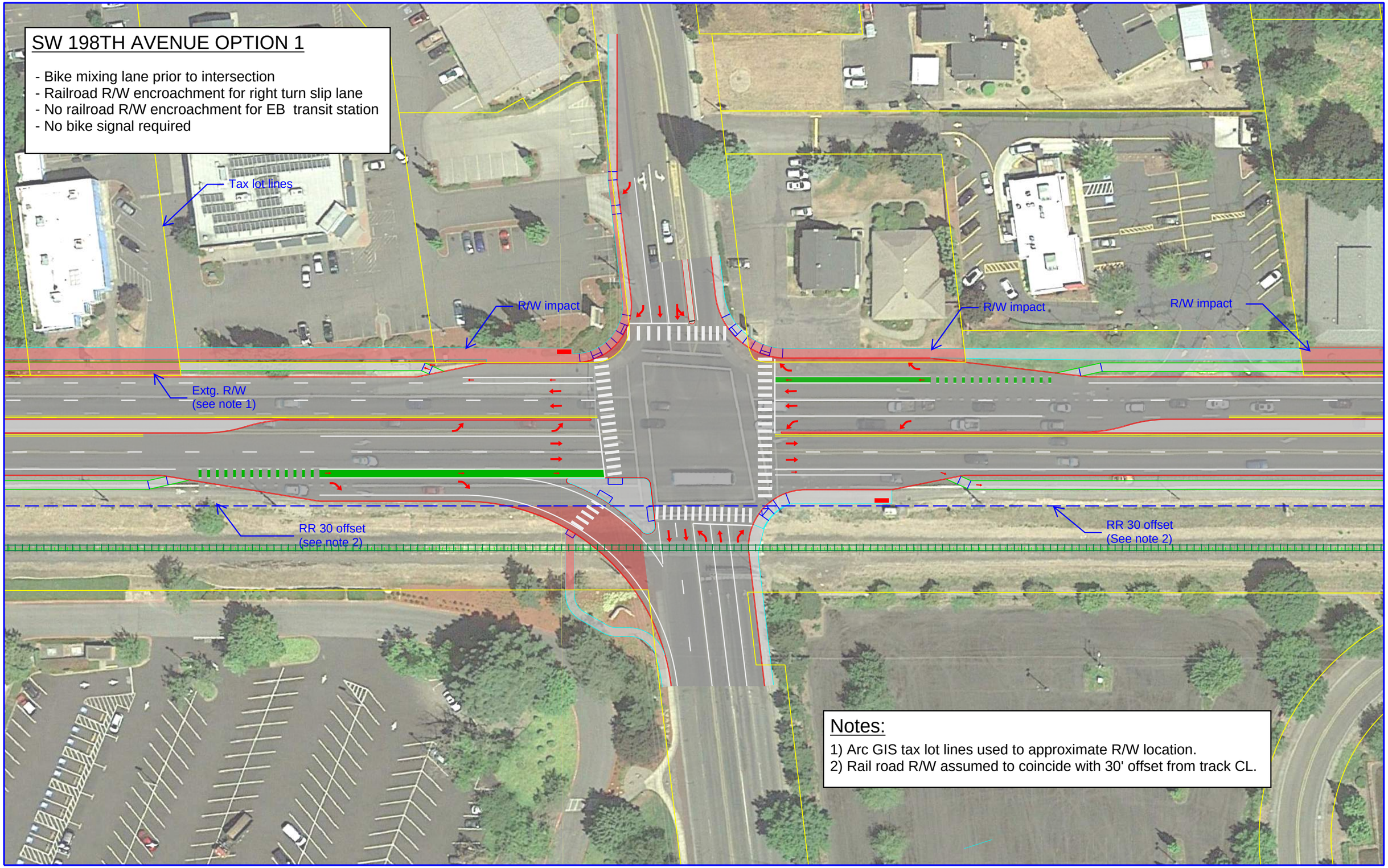
A series of preliminary implementation considerations have been identified to explore the opportunities and constraints in designing and constructing the preferred cross sections along the existing corridor depending on facility ownership. Each implementation strategy has different trade-offs, such as design flexibility and overall ease of implementation. The following two implementation considerations will be further explored in subsequent efforts for the Moving Forward TV Highway Plan and other corridor studies:

1. **Maintain ODOT ownership of highway corridor, which:**
    a) May increase design approval process for cross section deviation from ODOT design standards, including design concurrence during planning.
    b) May provide through the design exception process some flexibility for a slightly narrower cross section from typical ODOT design standards, particularly with adjustments to median, shoulder/bike lane and shy distance.
    c) May limit opportunity for signal timing changes to allow for more robust level of transit signal priority.
    d) Likely keeps the maintenance and operational responsibilities with ODOT after construction.
    e) Typically requires purchasing ROW acquisition in fee take versus easement.
    f) Requires ODOT process for access management implementation.
    g) Requires compliance with federal, state, and rail authority policies, including NHS design requirements, requirement pursuant to ORS 366.215, and rail order requirements as applicable.
2. **Transfer ownership from ODOT to Washington County via a formal jurisdictional transfer, which:**
    a) May provide the highest flexibility for a narrower cross section to better accommodate the mobility and safety needs of all corridor users within the constrained ROW in accordance with local design standards and local design speeds (e.g., Washington County Road Design Standards).
    b) Eliminates ODOT design exception approvals.
    c) Improves the opportunity for signal timing changes to allow for more robust level of transit signal priority.
    d) Would require a formal negotiation and legal process to transfer ownership from ODOT to Washington County.
    e) Would require Washington County to take responsibility for maintenance and operations of the facility.
    f) Provides the opportunity for ROW easement versus fee take.
    g) Requires compliance with federal, state, and rail authority policies, including NHS design requirements, requirements pursuant to ORS 366.215, and rail order requirements as applicable.

MOVING FORWARD
TV HIGHWAY
ENHANCED TRANSIT AND ACCESS PLAN

Appendix A

Rail ROW Impact Concept Layouts



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Rotation: 351.5243° Scale: 1"=60'

SW 198TH AVENUE OPTION 3

- Bike mixing lane prior to intersection
- Approximately 8.5' railroad R/W encroachment for EB transit station
- Approximately 4' railroad R/W encroachment for right turn slip lane
- No bike signal required

Tax lot lines

R/W impact

R/W impact

R/W impact

R/W impact

Extg. R/W
(see note 1)

RR 30 offset
(see note 2)

Railroad R/W
encroachment

Railroad R/W
encroachment

RR 30 offset
(See note 2)

Notes:

1) Arc GIS tax lot lines used to approximate R/W location.
2) Railroad R/W assumed to coincide with 30' offset from track CL.

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Rotation: 351.5243° Scale: 1"=60'

MOVING FORWARD
TV HIGHWAY
ENHANCED TRANSIT AND ACCESS PLAN

Appendix B

Public and Stakeholder Engagement Report

1 Public and Stakeholder Engagement

Public and stakeholder engagement for the corridor provides key input on preferences, support, and endorsement of corridor improvement concepts and project list refinement. Consolidated results from a recent project open house, technical advisory meetings, technical subteam meetings, steering committee meetings, and targeted engagement meetings have been used to inform preferences on corridor design concepts.

1.1 Partner Coordination

1.1.1 Technical Advisory Group (TAG)

Four Technical Advisory Group (TAG) meetings, including representatives from:

- Washington County LUP
- ODOT Region 1
- TriMet
- Metro
- City of Beaverton
- City of Hillsboro
- Tualatin Valley Fire & Rescue
- Tualatin Hills Park & Recreation District

In addition, the project engaged agency technical staff through several sets of subteam meetings to discuss transit improvements, traffic impacts, and agency coordination.

1.1.2 Executive Committee

A project steering committee was convened to provide guidance on technical and policy issues. Three Executive Committee meetings were held during the duration of the project and included representatives from:

- Washington County Land Use & Transportation
- ODOT Region 1
- TriMet
- Metro
- City of Beaverton
- City of Cornelius
- City of Hillsboro
- City of Forest Grove

1.1.3 Additional Coordination

The project was presented to other governing bodies and community groups, including:

- Washington County Planning Commission
- Board of County Commissioners
- Aloha Business Association
- Community Participation Organization (CPO) 6, Aloha/Cooper Mountain/Reedville
- Reedville Presbyterian Church

1.2 Online Engagement

Washington County hosted the project website (www.movingforwardtvhwy.com). Project related materials and public events were posted to the project website. The project website included a comment box that afforded the opportunity to submit project related comments. Over 170 people signed up to the interested parties list to receive project updates. The project team received a total of six comments via the website.

1.3 Open House

On April 3, 2019, Washington County held the Aloha Community Planning open house at the Aloha Grange (3425 SW 185th Ave, Beaverton, OR) to highlight the Moving Forward TV Highway: Enhanced Transit and Access Plan, as well as the Aloha Tomorrow Implementation Ordinance. The open house was designed to inform the community and gather feedback on both of these projects, with each presented on separate sides of the room. For the Moving Forward TV Highway project, the main purpose was to gather input from the local community about corridor mobility needs and four potential design concepts for the corridor and which kinds of improvements are most important to the community. More than 125 people attended the open house and 46 people left written comments about the Moving Forward TV Highway Project.

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proposed concepts, and interactive activities for providing feedback. A comment area in the center of the room provided space for people to answer survey questions on a comment card and give open-ended feedback.

The main objective was to present and solicit feedback on each of the four proposed concepts for the TV Highway Corridor.

1.3.2 Public Participation and Feedback

Demographics

Participants were encouraged to provide their thoughts on a comment card, which included optional demographic questions. Of those who answered these questions:

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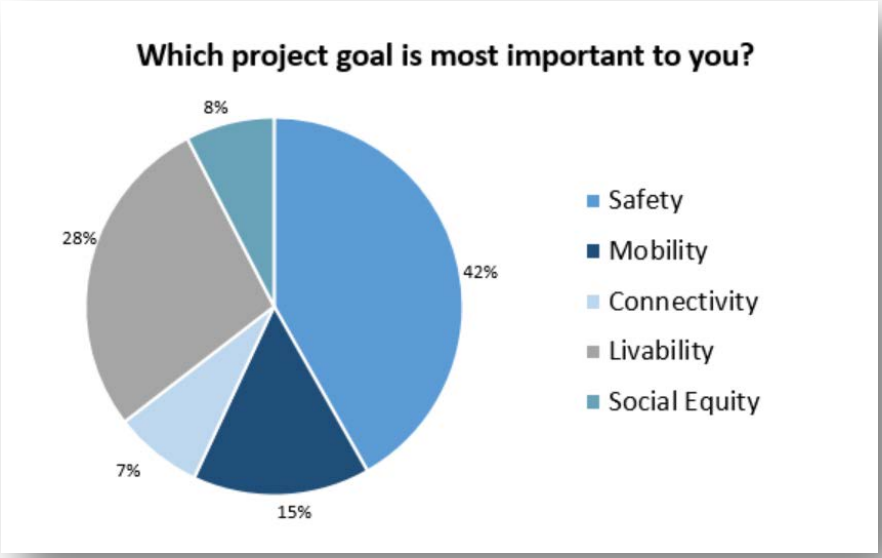
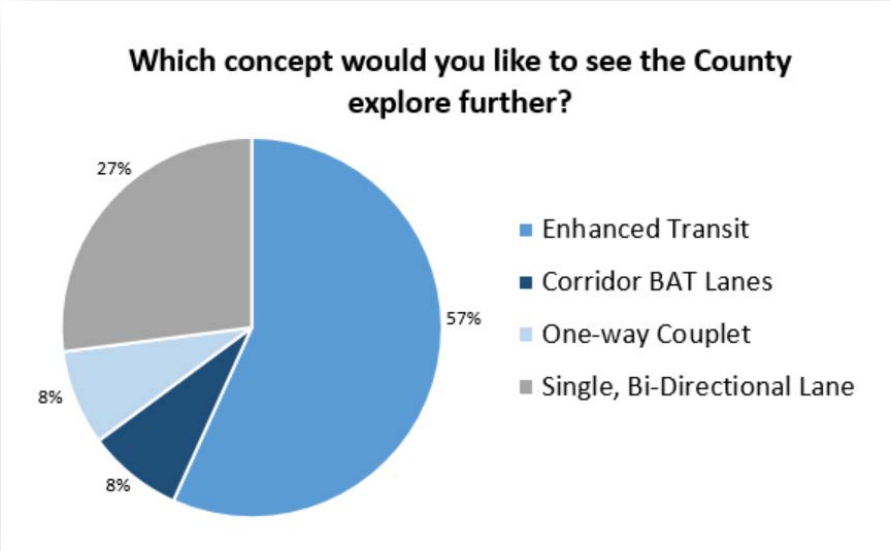
Attendees were also encouraged to participate in an interactive exercise in which they were given dot stickers to place on a display board to indicate preference or priority. In the first exercise, the public was presented with the five project goals and asked to mark which was most important to them (Figure 40). Of these goals, most people (33) said safety was the most important to them, followed by livability (22).

Figure 1. Project Goals Preference



Participants were also asked to identify which of the four design concepts they wanted the County to explore further (Figure 41). The majority of those who participated (21 people) said they supported the Enhanced Transit concept. The Single, Bi-Directional Lane was the second-most popular with 10 votes.

Figure 2. Project Concept Preference



General Comments

Of the 46 open-ended comments received, most related to the following themes:

- Concerns with and/or opposition to the TV Highway and Alexander Street Couplet concept
- Concern with the possible impacts of restricting turning movements along TV Highway
- Concern with safety and access to stations in the center of the roadway for the center-running transit concept
- Desire for improved traffic conditions and reducing conflict between buses and cars
- Strong desire for improved sidewalks and lighting on parallel streets (specifically Blanton, Alexander and Johnson)
- Desire for improved pedestrian crossings and safer bike lanes
- Concerns about designing for future growth, traffic, and congestion in the area

The results of the dot exercises and comments provide input into the Moving Forward TV Highway recommended concept plan and subsequent efforts to improve safety and mobility along the TV Highway corridor.

1.4 Engagement Meeting

On May 7, 2019, DHM Research facilitated a small group discussion with community members regarding the future of the Tualatin Valley Highway. The primary focus was the section of TV Highway in Aloha. Participants were recruited by Washington County through a variety of outreach efforts. Three people attended the session - a small business owner who commutes to the project area several times a week, an executive of a construction company whose employees regularly truck materials through the project area, and a local resident who leads a nonprofit that advocates for active transportation options. The participants all lived or worked in the study area. The session consisted of both written exercise and group discussions.

1.4.1 Key Findings

- The participants had negative views about the current condition of TV Highway and believed that the problems will worsen unless significant improvements are made.
- The participants would like TV Highway to evolve into a more pedestrian-friendly corridor that supports multimodal transportation options, while also supporting efficient vehicular traffic.
- The values that the participants want to guide TV Highway planning decisions include congestion relief, balancing and being welcoming to all transportation modes.
- The participants advocated for improvements to public transportation along TV Highway that would make getting to and from transit stops safer and that would improve overall traffic flow.
- Reactions to the TV Highway recommended concept were mostly positive, with some concerns about impacts to adjacent streets and the overall balance of proposed projects.
- The participants broadly supported the recommended concept, and hopeful that the combination of projects would both improve traffic flow and safety for all users. Participants also expressed some concern that the multiple benefits may not be apparent to all community members. They advised the need to communicate to the public how improvements to pedestrians, cyclists, and public transportation riders will benefit drivers.

Appendix C

Draft Concept Planning-Level Cost Estimates

Unit Price Descriptions

ITEM	DESCRIPTION	UNIT
Drainage		
Storm Water Conveyance	Includes new catch basins, storm sewer pipe, manholes (one flow control and one manhole over existing storm sewer), trench resurfacing, adjustment, removal and abandonment of existing storm structures.	Lump Sum
Treatment	Includes treatment and abatement facilities for storm water runoff. Costs include excavation for detention basin and installation of outlet control structures.	Lump Sum
Pavement		
Full Depth Paving	Includes clearing and grubbing, excavation or embankment, and removal of structures. Assumes Subgrade preparation, 12-inches of aggregate base, and 8-inches of ACP.	Square Foot
2" Grind/Inlay (With Mod)	Existing ACP in good condition located within proposed ACP section to receive grind and inlay. Cost include cold plane pavement removal, application of emulsified asphalt tack coat, and installation of 2-inches of ACP.	Square Foot
2" Leveling Overlay	Application of 2-inch lift ACP and for the purpose of re-grading roadway drainage crown. Cost includes ACP, emulsified asphalt tack coat, and all associated work.	Square Foot
Parking/Driveway Paving Restoration	Includes restoration of driveways and parking areas immediately adjacent to roadway. Costs include grading, subgrade preparation, and application of one to two lifts of 2-inch ACP.	Square Foot
Concrete Bus Pullouts	Includes 10' wide x 60' long reinforced concrete bus pullout with taper at each station location. Cost includes general excavation and materials for related work.	Each
Concrete Walks and Features		
Retaining Walls- MSE	Assumed portion of corridor requires vertical retaining features ranging from 1' to 2' in height in order to maintain ADA compliant sidewalk. Costs include excavation, subgrade preparation, aggregate base and reinforced PCC.	Square Foot
Curb	Includes standard concrete curb with 7" exposure. Cost includes general excavation for related work.	Linear Feet
Sidewalk and Driveway	Includes 4-inch unreinforced PCC, aggregate base, and subgrade preparation for sidewalks, driveways, and cycletrack. Cost includes general excavation for related work.	Square Foot
Additional Cost for Curb Ramps	Additional cost associated with grading and construction of curb ramps. Assumes 8 individual curb ramps required per intersection	Each
Island and Traffic Separators	Includes 4-inch unreinforced PCC, aggregate base, subgrade preparation and curbs for raised traffic separator. Cost includes general excavation for related work.	Square Foot

Traffic Features		
Enhanced Transit Stops	Includes all work associated with construction of enhanced transit facility. Costs include base rock, concrete curb & gutter, platform concrete and ADA ramps leading to platform. Cost also includes station furnishings, electrical work for communications, and site specific lane markings. Unit cost provided by Tri-Met.	Each
Railroad Crossing Improvements	Includes railroad crossing arms for vehicles and pedestrians, as well as the additional signal system requirements for a railroad crossing at one intersection location. Cost includes raised concrete splitter island for slip lane, and railroad crossing pavement section.	Each
New Signal	Includes the signal system and all appurtenances (poles, wiring, detection devices, etc.) for one intersection.	Each
New RRFB Crossing	Includes the rectangular rapid flashing beacon (RRFB) pedestrian crossing system and all appurtenances (poles, wiring, pedestrian pushbuttons, advance warning devices, etc) for one intersection.	Each
Illumination	Includes installation of underground conduit, luminaires and pole foundations for illumination system. Estimate determined per linear feet of associated illumination costs of similar projects.	Linear Feet
Signing and Striping	Includes longitudinal corridor pavement marking as well as estimated advance warning, guide, and regulatory signs throughout corridor. Cost includes sign posts and foundation work.	Lump Sum
Miscellaneous		
Street Peripherals	Peripherals to include the planting or maintain of new and existing trees, vegetation, and grass. Costs to include mulch, seed, fertilizer and all associated costs. Cost also includes roadway furnishings, such as trash cans, benches, and artwork. Cost assumed to be approximately 4% of civil construction costs.	LS
Railroad Fencing, 8-ft Chain Link	8-ft chain link fencing spanning entire corridor along railroad right-of-way. Cost includes labor, fence materials & appurtenances, and all associative earthwork.	LF
Mobilization	Mobilization and demobilization of labor and equipment. Assumed to be 10% of total construction cost.	%
Temporary Traffic Control	Pedestrian, bicyclist and vehicle traffic to be maintained throughout the construction effort. Cost includes temporary paving, traffic delineators, striping, and signing. Assumed to be 8% of total construction cost.	%

Additional Costs

ITEM	DESCRIPTION
Contingency Factor	General Contingency for Construction Costs of 50%.
Escalation (per year)	Increase of prices given an inflation rate 3.0% and assumed construction year of 2025 (current year 2019).
Preliminary Engineering	Preliminary Engineering: 25%
Construction Engineering	Construction Engineering: 18%
Reimbursable Utilities	Reimbursable Utilities: LS placeholder, *Reimbursable status not known*

PROJECT DATA				
	Project Name	Alt 1: Enhanced Corridor Transit		
	Highway Name	Tualatin Valley Highway		
	County/City	Washington County		
	Estimate Type	Concept Planning Level	**Estimated By**	HDR

		Unit	Quantity	Unit Cost	Cost
Capital Cost - Order of Magnitude Unit Pricing	**Drainage**				
	Storm water conveyance	LF of roadway	16,400	$ 155.00	$ 2,542,000.00
	Treatment	SF of Impervious	1,444,000	$ 1.00	$ 1,444,000.00
	Pavement				
	Full Depth Paving	SF	478,000	$ 10.00	$ 4,780,000.00
	2" Grind/Inlay (With Mod)	SF	665,000	$ 2.00	$ 1,330,000.00
	Parking/Driveway Paving Restoration	SF	120,000	$ 8.00	$ 960,000.00
	Concrete Bus pullouts	SF	22,000	$ 15.00	$ 330,000.00
	Structures				
	Retaining Walls - MSE	SF	3,700	$ 85.00	$ 314,500.00
	Concrete walks and features				
	Curb	LF	32,800	$ 30.00	$ 984,000.00
	Sidewalk and driveway	SF	334,800	$ 8.00	$ 2,678,400.00
	Additional Costs for Curb Ramps	EA	152	$ 1,000.00	$ 152,000.00
	Islands and Traffic Separators	SF	119,500	$ 9.00	$ 1,075,500.00
	Traffic Features				
	Enhanced Transit Stops	EA	24	$ 250,000.00	$ 6,000,000.00
	Railroad Crossing Improvements	EA	8	$ 80,000.00	$ 640,000.00
	New Signal	EA	8	$ 375,000.00	$ 3,000,000.00
	New RRFB crossings	EA	4	$ 80,000.00	$ 320,000.00
	Illumination	LF of roadway	16,400	$ 140.00	$ 2,296,000.00
	Signing and Striping	LS	1	$ 250,000.00	$ 250,000.00
	Miscellaneous				
	Streetscape Peripherals	LS	ALL	$ 1,160,000.00	$ 1,160,000.00
	Railroad Fencing, 8-ft Chain Link	LF	16,400	$ 25.00	$ 410,000.00
	Mobilization	%	1	10%	$ 3,741,000.00
	Temporary Traffic Control	%	1	8%	$ 2,993,000.00
	Project Subtotal				$ 37,400,400.00
	Project Scope Contingencies	%	1	50%	$ 18,701,000.00
	CONSTRUCTION ESTIMATE TOTAL				$ 56,101,400.00
Other Costs	Escalation (per year)	%	2019 to 2025	3.0%	$ 10,887,000.00
	Preliminary Engineering	%	1	25%	$ 14,026,000.00
	Construction Engineering	%	1	18%	$ 10,099,000.00
	Reimbursable Utilities	LS	All	$ 750,000.00	$ 750,000.00
	TOTAL PROJECT ESTIMATE				***$ 91,863,400***

PROJECT DATA				
	Project Name	Alt 2: Corridor BAT Lane		
	Highway Name	Tualatin Valley Highway		
	County/City	Washington County		
	Estimate Type	Concept Planning Level	**Estimated By**	HDR

		Unit	Quantity	Unit Cost	Cost
Capital Cost - Order of Magnitude Unit Pricing	**Drainage**				
	Storm Water Conveyance	LF of roadway	16,400	$ 165.00	$ 2,706,000.00
	Treatment	SF of Impervious	1,608,000	$ 1.00	$ 1,608,000.00
	Pavement				
	Full Depth Paving	SF	839,000	$ 10.00	$ 8,390,000.00
	2" Grind/Inlay (With Mod)	SF	665,000	$ 2.00	$ 1,330,000.00
	Parking/Driveway Paving Restoration	SF	120,000	$ 8.00	$ 960,000.00
	Concrete Bus pullouts	SF	22,000	$ 15.00	$ 330,000.00
	Structures				
	Retaining Walls - MSE	SF	3,700	$ 85.00	$ 314,500.00
	Concrete walks and features				
	Curb	LF	32,800	$ 30.00	$ 984,000.00
	Sidewalk and driveway	SF	135,500	$ 8.00	$ 1,084,000.00
	Additional Costs for Curb Ramps	EA	152	$ 1,000.00	$ 152,000.00
	Islands and Traffic Separators	SF	140,900	$ 9.00	$ 1,268,100.00
	Traffic Features				
	Enhanced Transit Stops	EA	24	$ 250,000.00	$ 6,000,000.00
	Railroad Crossing Improvements	EA	8	$ 80,000.00	$ 640,000.00
	New Signal	EA	8	$ 375,000.00	$ 3,000,000.00
	New RRFB crossings	EA	4	$ 80,000.00	$ 320,000.00
	Illumination	LF of roadway	16,400	$ 140.00	$ 2,296,000.00
	Signing and Striping	LS	1	$ 250,000.00	$ 250,000.00
	Miscellaneous				
	Streetscape Peripherals	LS	ALL	$ 1,270,000.00	$ 1,270,000.00
	Railroad Fencing, 8-ft Chain Link	LF	16,400	$ 25.00	$ 410,000.00
	Mobilization	%	1	10%	$ 4,063,000.00
	Temporary Traffic Control	%	1	8%	$ 3,251,000.00
	Project Subtotal				$ 40,626,600.00
	Project Scope Contingencies	%	1	50%	$ 20,314,000.00
	CONSTRUCTION ESTIMATE TOTAL				$ 60,940,600.00
Other Costs	Escalation (per year)	%	2019 to 2025	3.0%	$ 11,826,000.00
	Preliminary Engineering	%	1	25%	$ 15,236,000.00
	Construction Engineering	%	1	18%	$ 10,970,000.00
	Reimbursable Utilities	LS	All	$ 750,000.00	$ 750,000.00
	TOTAL PROJECT ESTIMATE				***$ 99,722,600***

PROJECT DATA				
Project Name	Alt 3: One-way Couplet			
Highway Name	Tualatin Valley Highway			
County/City	Washington County			
Estimate Type	Concept Planning Level		**Estimated By**	HDR

Capital Cost - Order of Magnitude Unit Pricing		Unit	Quantity	Unit Cost	Cost
	Drainage				
	Storm Water Conveyance (TV Hwy)	LF of roadway	16,400	$ 150.00	$ 2,460,000.00
	Storm Water Conveyance (Alexander)	LF of roadway	10,300	$ 135.00	$ 1,390,500.00
	Treatment	SF of Impervious	1,864,000	$ 1.00	$ 1,864,000.00
	Pavement				
	Full Depth Paving	SF	401,400	$ 10.00	$ 4,014,000.00
	2" Grind/Inlay (With Mod)	SF	1,044,000	$ 2.00	$ 2,088,000.00
	2" Leveling Overlay	SF	257,500	$ 2.00	$ 515,000.00
	Parking/Driveway Paving Restoration	SF	120,000	$ 8.00	$ 960,000.00
	Concrete Bus pullouts	SF	22,000	$ 15.00	$ 330,000.00
	Structures				
	Retaining Walls - MSE	SF	1,300	$ 85.00	$ 110,500.00
	Concrete walks and features				
	Curb	LF	53,400	$ 30.00	$ 1,602,000.00
	Sidewalk and driveway	SF	582,000	$ 8.00	$ 4,656,000.00
	Additional Costs for Curb Ramps	EA	232	$ 1,000.00	$ 232,000.00
	Islands and Traffic Separators	SF	140,900	$ 9.00	$ 1,268,100.00
	Traffic Features				
	Enhanced Transit Stops	EA	24	$ 250,000.00	$ 6,000,000.00
	Railroad Crossing Improvements	EA	8	$ 80,000.00	$ 640,000.00
	New Signal	EA	8	$ 375,000.00	$ 3,000,000.00
	New RRFB crossings	EA	4	$ 80,000.00	$ 320,000.00
	Illumination	LF of roadway	26,700	$ 140.00	$ 3,738,000.00
	Signing and Striping	LS	1	$ 250,000.00	$ 250,000.00
	Miscellaneous				
	Streetscape Peripherals	LS	ALL	$ 1,590,000.00	$ 1,590,000.00
	Railroad Fencing, 8-ft Chain Link	LF	16,400	$ 25.00	$ 410,000.00
	Mobilization	%	1	10%	$ 4,566,000.00
	Temporary Traffic Control	%	1	8%	$ 3,653,000.00
	Project Subtotal				$ 45,657,100.00
	Project Scope Contingencies	%	1	50%	$ 22,829,000.00
	CONSTRUCTION ESTIMATE TOTAL				$ 68,486,100.00
Other Costs	Escalation (per year)	%	2019 to 2025	3.0%	$ 13,290,000.00
	Preliminary Engineering	%	1	25%	$ 17,122,000.00
	Construction Engineering	%	1	18%	$ 12,328,000.00
	Reimbursable Utilities	LS	All	$ 750,000.00	$ 750,000.00
	TOTAL PROJECT ESTIMATE				***$ 111,976,100***

PROJECT DATA				
	Project Name	Alt 4: Bi-Directional Center Transit		
	Highway Name	Tualatin Valley Highway		
	County/City	Washington County		
	Estimate Type	Concept Planning Level	**Estimated By**	HDR

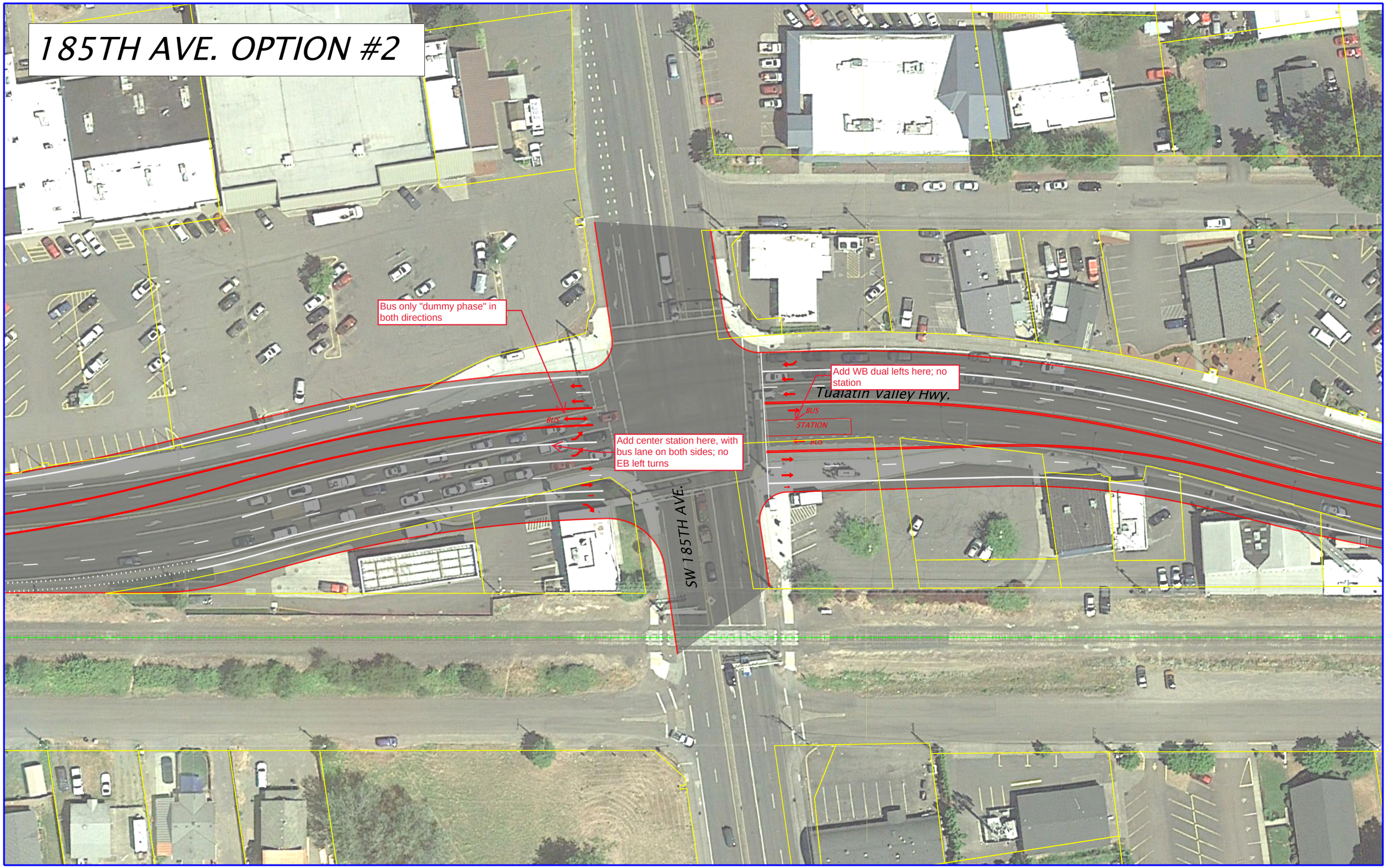
		Unit	Quantity	Unit Cost	Cost
Capital Cost - Order of Magnitude Unit Pricing	**Drainage**				
	Storm Water Conveyance	LF of roadway	16,400	$ 155.00	$ 2,542,000.00
	Treatment	SF of Impervious	1,444,000	$ 1.00	$ 1,444,000.00
	Pavement				
	Full Depth Paving	SF	766,000	$ 10.00	$ 7,660,000.00
	2" Grind/Inlay (With Mod)	SF	812,000	$ 2.00	$ 1,624,000.00
	Parking/Driveway Paving Restoration	SF	120,000	$ 8.00	$ 960,000.00
	Concrete Bus pullouts	SF	22,000	$ 15.00	$ 330,000.00
	Structures				
	Retaining Walls - MSE	SF	3,700	$ 85.00	$ 314,500.00
	Concrete walks and features				
	Curb	LF	32,800	$ 30.00	$ 984,000.00
	Sidewalk and driveway	SF	334,800	$ 8.00	$ 2,678,400.00
	Additional Costs for Curb Ramps	EA	152	$ 1,000.00	$ 152,000.00
	Islands and Traffic Separators	SF	2,000	$ 9.00	$ 18,000.00
	Traffic Features				
	Enhanced Transit Stops	EA	12	$ 350,000.00	$ 4,200,000.00
	Railroad Crossing Improvements	EA	8	$ 80,000.00	$ 640,000.00
	New Signal	EA	8	$ 375,000.00	$ 3,000,000.00
	New RRFB crossings	EA	4	$ 80,000.00	$ 320,000.00
	Illumination	LF of roadway	16,400	$ 140.00	$ 2,296,000.00
	Signing and Striping	LS	1	$ 250,000.00	$ 250,000.00
	Miscellaneous				
	Streetscape Peripherals	LS	ALL	$ 1,180,000.00	$ 1,180,000.00
	Railroad Fencing, 8-ft Chain Link	LF	16,400	$ 25.00	$ 410,000.00
	Mobilization	%	1	10%	$ 3,359,000.00
	Temporary Traffic Control	%	1	8%	$ 2,989,000.00
	Project Subtotal				$ 37,350,900.00
	Project Scope Contingencies	%	1	50%	$ 18,676,000.00
	CONSTRUCTION ESTIMATE TOTAL				$ 56,026,900.00
Other Costs	Escalation (per year)	%	2019 to 2025	3.0%	$ 10,872,000.00
	Preliminary Engineering	%	1	25%	$ 14,007,000.00
	Construction Engineering	%	1	18%	$ 10,085,000.00
	Reimbursable Utilities	LS	All	$ 750,000.00	$ 750,000.00
	TOTAL PROJECT ESTIMATE				***$ 91,740,900***

MOVING FORWARD
TV HIGHWAY
ENHANCED TRANSIT AND ACCESS PLAN

Appendix D

Single Bi-Directional Lane Concept Layouts

185TH AVE. OPTION #2



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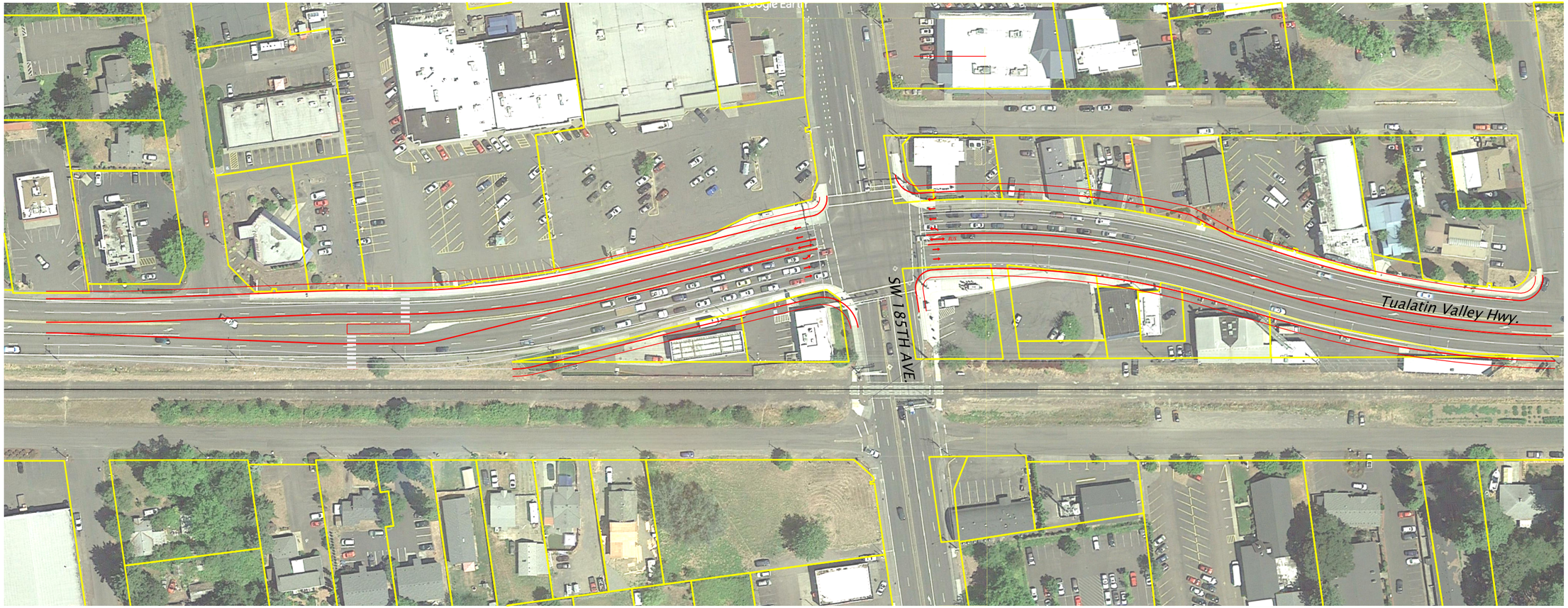
185TH AVE. OPTION #3



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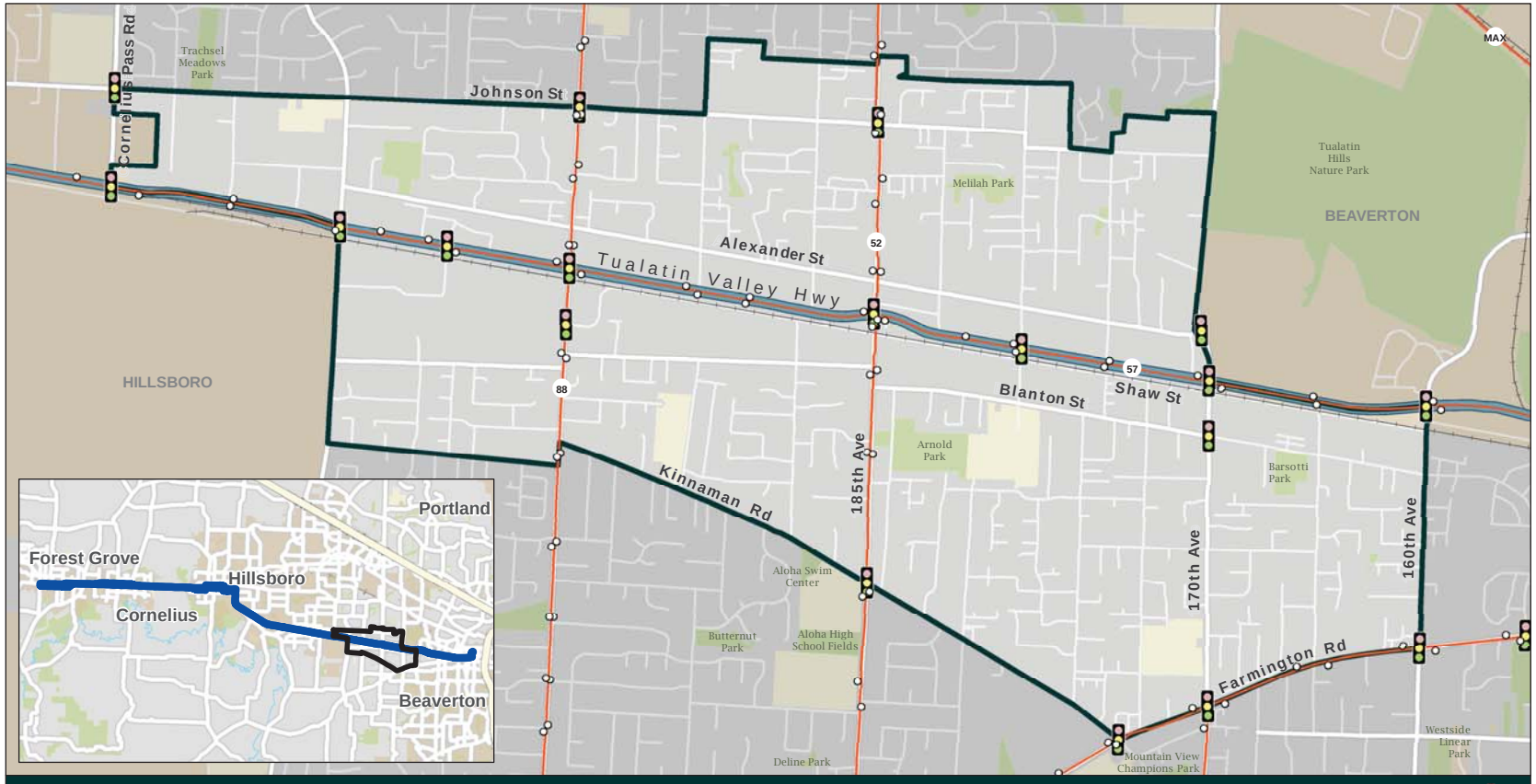
Appendix E

Open House Display Boards

MOVING FORWARD
TV HIGHWAY
ENHANCED TRANSIT AND ACCESS PLAN

STUDY AREA

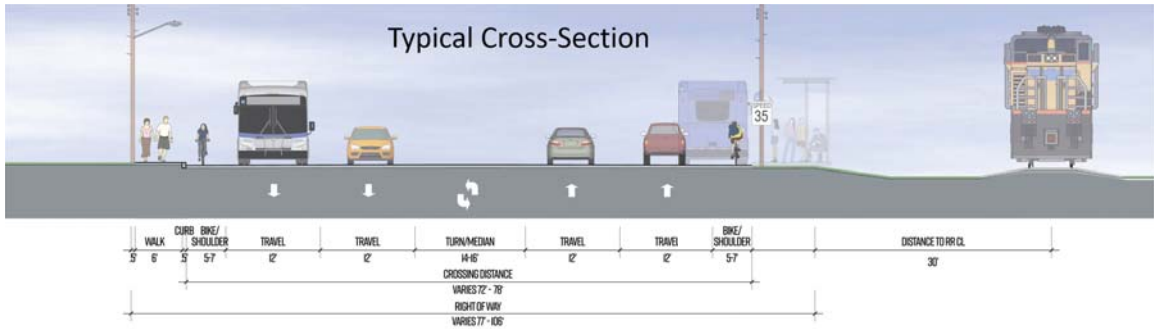
WASHINGTON COUNTY OREGON

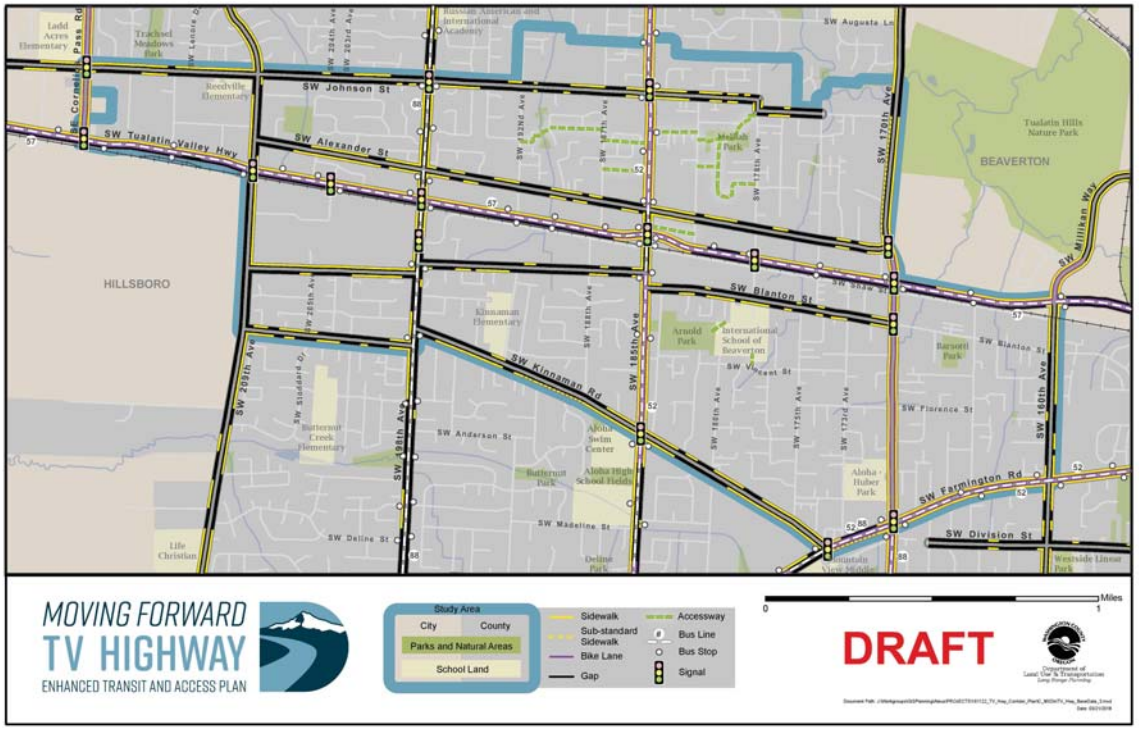


MOVING FORWARD
TV HIGHWAY
ENHANCED TRANSIT AND ACCESS PLAN

EXISTING CONDITIONS

WASHINGTON COUNTY OREGON





- Long crossing distance
- High speeds
- Unprotected bike lanes
- Lack of sufficient sidewalks
- Inadequate transit stop access
- Railroad constraints
- Lack of sufficient lighting

MOVING FORWARD
TV HIGHWAY
ENHANCED TRANSIT AND ACCESS PLAN

CORRIDOR NEEDS

WASHINGTON COUNTY OREGON

1. High-Crash Corridor

- Crash rate nearly 3 times the statewide and 2.5 time regional average

2. Slow Transit Travel Time Limiting Ridership Growth

- Transit travel time is nearly 150% more than auto travel time

3. Gaps in Sidewalks, Lighting and Protected Crossings Accessing Transit

- 48% of TV Hwy in study area is missing sidewalks

4. Incomplete Bicycle Facilities Connecting Transit

- Only 37% of major street network in study area has bike lanes

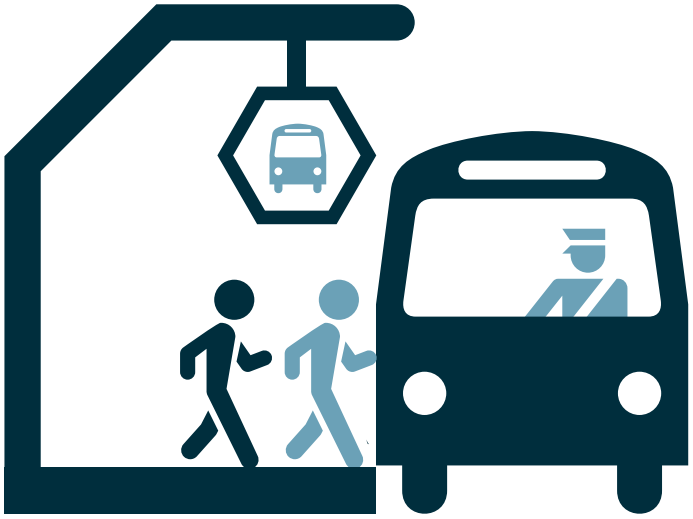
5. Impact to Neighborhood Livability, Healthy Living and Economic Opportunity

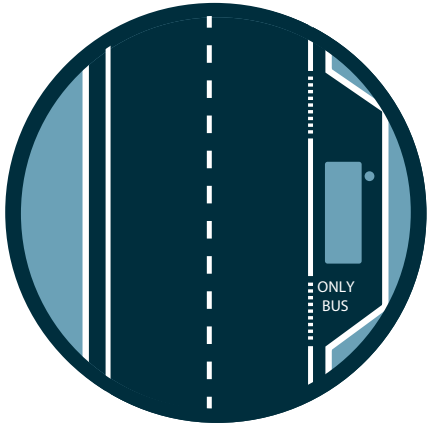
- 75% of study corridor transit trips begin or end within a quarter mile of TV Hwy

MOVING FORWARD
TV HIGHWAY
ENHANCED TRANSIT AND ACCESS PLAN

COMMON ELEMENTS

WASHINGTON COUNTY OREGON





- **BUS STOP AMENITIES INCLUDING:** Near-level boarding, all-door boarding, off-board fare payment, real time information
- **ACCESS IMPROVEMENTS INCLUDING:** Separated sidewalks, enhanced crossings, improved lighting, and protected and separated bike lanes
- **BUS PULLOUTS**

MOVING FORWARD
TV HIGHWAY
ENHANCED TRANSIT AND ACCESS PLAN

WHAT DOES "GETTING AROUND SAFELY" MEAN TO YOU?

WASHINGTON COUNTY OREGON

"I think that sidewalks with lighting are HUGE! We love to walk our kiddos to the food carts, but we are juggling big drainage ditches or cars and, it's nerve wracking."

"Pedestrian crossings of the railroad. You can see the desire lines all along the tracks. Making some of these ADA accessible, especially for this low-income area that seems to rely heavily on transit, would be a socially responsible action."

"Protected turning lanes, protected bus turnouts, well-lit roads, wider roads, protected bike lanes and sidewalks available in all locations."

Good traffic flow
More crosswalks
Improved bus stops
Traffic calming
Slower traffic speeds
Traffic lights
Streetlights
More vehicle lanes
Safe intersections
Sidewalks
Provide more parking
Provide turn lanes
Bike Lanes
Speed monitoring & enforcement
Better signs
Pedestrian/bike overpass or underpass
Visible lane markings
Improve bus pull-ins
Buffered bike lanes

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MOVING FORWARD
TV HIGHWAY
ENHANCED TRANSIT AND ACCESS PLAN

PROJECT GOALS

WASHINGTON COUNTY OREGON

SAFETY

- Improve safety and health for all users

SOCIAL EQUITY

- Connect underserved communities to opportunity

MOBILITY

- Efficient and effective mobility for all modes

CONNECTIVITY

- Improve transit access, connectivity and consistency

LIVABILITY

- Strengthen economic vitality and neighborhood livability

MOVING FORWARD
TV HIGHWAY
ENHANCED TRANSIT AND ACCESS PLAN

PROJECT GOALS

WASHINGTON COUNTY OREGON

MARK THE PROJECT GOAL THAT IS MOST IMPORTANT TO YOU.

SAFETY	
SOCIAL EQUALITY	
MOBILITY	
CONNECTIVITY	
LIVABILITY	

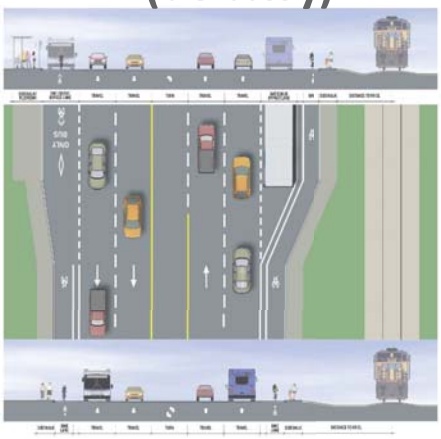
MOVING FORWARD
TV HIGHWAY
ENHANCED TRANSIT AND ACCESS PLAN

INITIAL CONCEPTS

WASHINGTON COUNTY OREGON

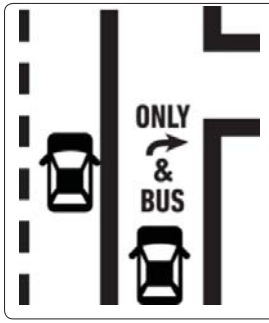
Enhanced Transit Concept

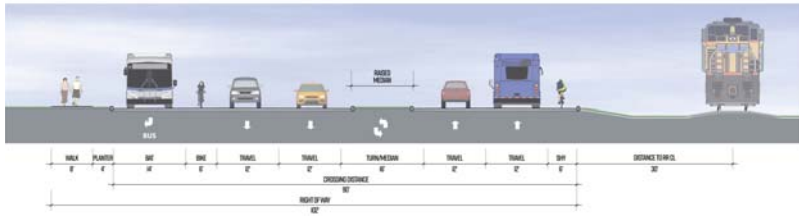
(TV Hwy)



Corridor BAT Lanes

(TV Hwy)





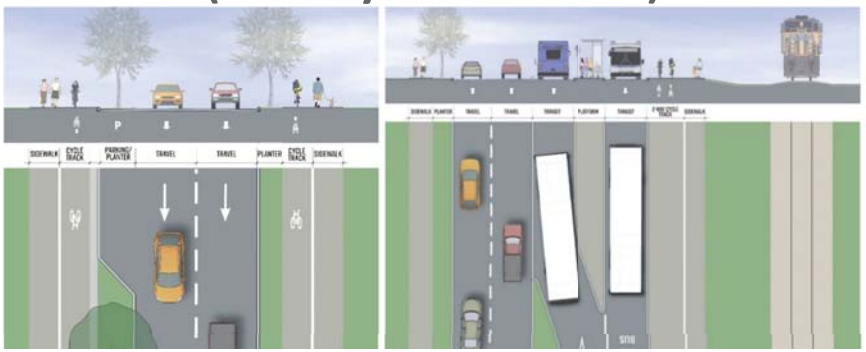
BAT = Business access and transit lane

Single Bi-Directional Transit Lane

(TV Hwy)

One-way Couplet

(TV Hwy & Alexander)



MOVING FORWARD
TV HIGHWAY
ENHANCED TRANSIT AND ACCESS PLAN

COMPARATIVE ASSESSMENT

WASHINGTON COUNTY OREGON

ALTERNATIVES / EVALUATION CRITERIA	SAFETY	CAPITAL COST	TRANSIT TRAVEL TIME IMPROVEMENT	CAR TRAVEL TIME IMPACT	PROPERTY IMPACT	BUSINESS & RESIDENTIAL ACCESS
ENHANCED TRANSIT	Some safety improvements for all modes	Moderate capital cost	Best transit travel time improvement	Low car travel time impact	Less property impact	Less access restriction
CORRIDOR BAT LANES	Some safety improvements for all modes	Some safety improvements for all modes	Moderate transit travel time improvement	Low car travel time impact	Some property impact	Less access restriction
ONE-WAY COUPLET	Best safety improvement for all modes	Some safety improvements for all modes	Best transit travel time improvement	Some car travel time impact	Moderate property impact	Moderate access restriction
SINGLE, BI-DIRECTIONAL LANE	Moderate safety improvements for all modes	Moderate capital cost	Best transit travel time improvement	Moderate car travel time impact	Best property impact	Some access restriction

EVALUATION KEY

Best safety improvement for all modes	Moderate safety improvements for all modes	Some safety improvements for all modes
Lower capital cost	Moderate capital cost	Higher capital cost
Best transit travel time improvement	Moderate transit travel time improvement	Some transit travel time improvement
Low car travel time impact	Moderate car travel time impact	High car travel time impact
Less property impact	Moderate property impact	Greater property impact
Less access restriction	Moderate access restriction	Greater access restriction

MOVING FORWARD
TV HIGHWAY
ENHANCED TRANSIT AND ACCESS PLAN

PICK A CONCEPT

WASHINGTON COUNTY OREGON

MARK THE CONCEPT YOU SUPPORT THE COUNTY EXPLORING FURTHER:

ENHANCED TRANSIT	
CORRIDOR BAT LANES	
ONE-WAY COUPLET	
SINGLE, BI-DIRECTIONAL LANE	

Washington County Department of Land Use & Transportation

Planning and Development Services Division

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