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Technical Memorandum

March 1, 2024 Project# 27929

To: Courtney Furman
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From: Megan Mannion, Caleb Cox, PE, Susan Wright, PE, Cedomir Jesic, PE, Kittelson & Associates, Inc.
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RE: Tiedeman Avenue Multimodal Study

CONCEPT DESIGN ALTERNATIVES MEMORANDUM

The purpose of this memorandum is to document the development of the preferred design concept for improvements to SW Tiedeman Avenue from Greenburg Road to Walnut Street. This memo documents the alternatives development and evaluation process and includes:

- Key Issues,
- Project Goals,
- Existing Conditions,
- Concept Design Alternatives
- Key Design Considerations
- Public Involvement Summary, and
- Project Evaluation Criteria and Performance Measures.

Recommendations

Tiedeman Avenue / Tigard Street

Alternative 5 (Traffic Signal, add separate NB and SB left turn lanes, and remove WB right turn lane) and Alternative 6 (Mini Roundabout) were both identified as viable options at Tiedeman Avenue / Tigard Street. The team progressed both alternatives to 30% design plans to better understand the ROW impacts, cost and feasibility of the two alternatives. The Roundabout was determined to be the preferred alternative; however, the Traffic Signal remains a viable option. The final intersection configuration will be determined when the project continues to final design and right-of-way options and utility conflicts are further explored.

Tiedeman Avenue / Greenburg Road / North Dakota Street

Alternative 4, a traffic signal at North Dakota Street coordinated with the existing Greenburg Road signal, was identified as the preferred alternative at the Tiedeman Avenue / Greenburg Road and Tiedeman Avenue / North Dakota Street intersections and was progressed to 30% design plans. Additionally, a VISSIM microsimulation model of the alternative was developed to better understand the impacts of the closely spaced traffic signals. This analysis is included in Attachment H.

Tiedeman Avenue Preferred Cross Section

Cross section Alternative A4, a 55-foot ROW with multi-use paths on both sides, was identified as the preferred cross-section. At locations where a 55-foot cross section is not feasible, particularly just south of Tigard Street where the right-of-way (ROW) is very narrow, Alternative B2, the 50-foot ROW alternative that maintains the multi-use path on both sides, but removes the planter strip is recommended. While these were the preferred typical cross sections, variations occur along the corridor due to intersection transitions, on-street parking, available right-of-way, and other existing conditions.

Study Area

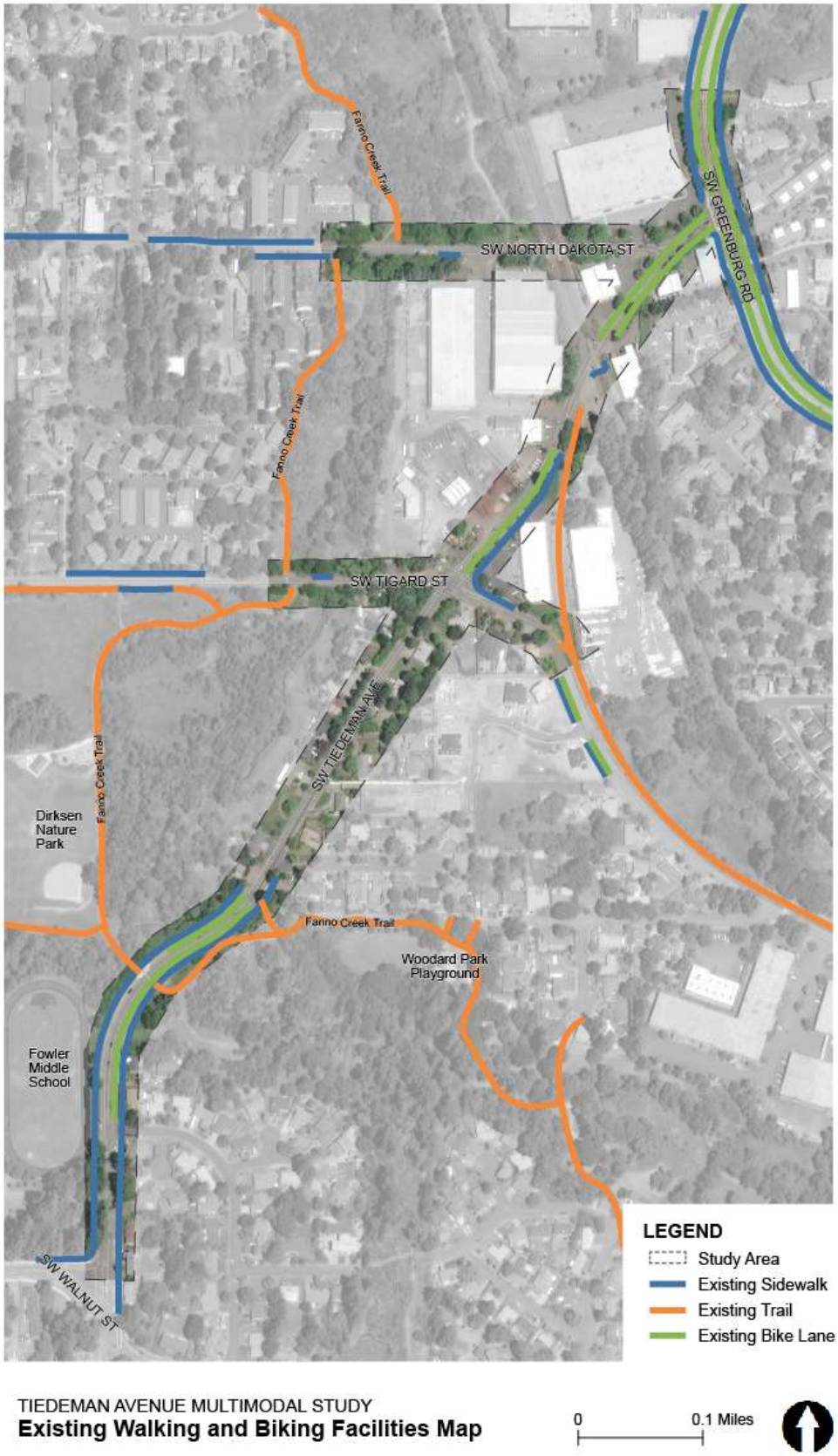
The study area includes Tiedeman Avenue, from Greenburg Road (to the north) to Walnut Street (to the south). Additionally, key intersections in the corridor were evaluated including: Tiedeman Avenue/Greenburg Road, Tiedeman Avenue/North Dakota Street, and Tiedeman Avenue/Tigard Street. Key destinations within the study area include the Fanno Creek Trail (runs north-south), and Dirksen Nature Park and Fowler Middle School (located at the south end of the study area). Figure 1 illustrates the study area.

Key Issues

The following key issues are present within the study area:

- Significant sidewalk and bike facility gaps along Tiedeman Avenue create a lack of connections to nearby trails, Fowler Middle School, across the railroad tracks, and to Greenburg Road.
- Skewed intersection geometry at Tiedeman Avenue/North Dakota Street creates safety issues.
- Existing grade differentials near the D-Bat PDX West site, near the Tiedeman Avenue railroad crossing, and at some residential driveways along the corridor may make widening and tying into existing topography more challenging.
- There are long delays for the North Dakota Street approach at the Tiedeman Avenue/North Dakota Street intersection during peak hours. The railroad crossing on North Dakota Street further complicates traffic movement.
- Residents regularly observe speeding vehicles through the corridor.
- There is a lack of stormwater facilities in the area and proximity to Fanno Creek complicates this further.
- ROW widths vary widely through the corridor, with some areas having ROW as narrow as 40 feet wide.
- Coordination is needed with adjacent projects including the North Dakota Street and Tigard Street bridge replacements.
- There are many existing mature trees near the ROW.
- Proximity of driveways to the Tiedeman Avenue/Tigard Street intersection may be difficult to redesign if the intersection is reconfigured.

Figure 1: Study Area



Project Goals

The goals of the Greenburg Road/Tiedeman Avenue Study include:

- Identify a preferred cross section for Tiedeman Avenue that integrates solutions for multimodal transportation, safety, and operations, while balancing impacts to public utilities, private properties, and local businesses.
- Improve pedestrian and bike connectivity to regional trails in the area.
- Improve traffic operations, queueing, safety, and circulation at the study intersections.
- Prepare 30% design plans that lay the framework for final design and construction of the improvements.

Existing Conditions

Site Conditions and Adjacent Land Uses

Within the study area, Tiedeman Avenue is a two-lane roadway with a posted speed limit of 25 mph. The presence of sidewalks and bike lanes varies throughout the corridor. The existing ROW varies along Tiedeman Avenue ranging between 40 feet to 65 feet. An existing bridge crossing Fanno Creek (located between Tigard Street and Fowler Middle School) has an existing 60 foot ROW.

Fowler Middle School is located at the south end of the study area and the southern half of the Tiedeman Avenue is primarily characterized by residential property, parks, and trails. North of the Tiedeman Avenue / Tigard Street intersection, adjacent land-uses shift to primarily commercial through the northern extent of the study area at Greenburg Road and Tiedeman Avenue.

Bike/Pedestrian Facilities

Figure 1 above displays the existing pedestrian and bike facilities within the study area. As shown, there are significant pedestrian and bike facility gaps along Tiedeman Avenue, particularly between Greenburg Road and the Fanno Creek Trail crossing. There are three Fanno Creek Trail crossings – on Tiedeman Avenue, Tigard Street, and North Dakota Street. All three existing crossings have continental crosswalk striping. The Fanno Creek Trail crossing at Tiedeman Avenue has an RRFB with a pedestrian push button.

There is an existing bike conflict at Tiedeman Avenue/Greenburg Road where cyclists traveling southbound on Greenburg Road must merge across a high volume right turn trap lane in order to continue straight.

Freight Routes and Heavy Vehicles

A review of the Tigard Transportation System Plan (TSP), Washington County TSP, and ODOT TransGIS found that no section of the study area is within a designated freight route. However, there are industrial land-uses on Tigard Street east of the study area that likely rely upon Tiedeman Avenue for access to Greenburg Road and ultimately Highway 217. At the intersection of Tiedeman Avenue and Tigard Street, the NW curb return has a large radius to allow for a WB-67 design vehicle to navigate the WB right-turn movement. Tiedeman Avenue between Walnut Street and Tigard Street is primarily residential and no heavy vehicle needs have been identified for this section. Typical design vehicles in this context include a school bus, firetruck, and SU-30.

Field Visit Observations

The Kittelson project team, HDR, and City staff conducted a site visit in November 2022. The field visit observations are provided in *Attachment A*. The team used these observations to identify potential opportunities within the study area that informed the concept design development.

Environmental

A desktop review was completed to identify existing environmental resources within the study area. Regardless of the selected alternative, several permits will be required for the Project. If the Project is federally funded or requires a federal permit, compliance with the National Environmental Policy Act (NEPA) would be required. Existing resources in and adjacent to the study area and potential permits required for the Project are summarized below and shown in Figure 14.

Existing Resources

Wetlands and Waterbodies

There are three perennial streams identified by the National Hydrography Dataset (NHD) within and immediately adjacent to the study area: Fanno Creek, Summer Creek, and Ash Creek. The National Wetlands Inventory (NWI) shows wetlands mapped surrounding the streams mentioned above. A field investigation would be required to identify and delineate wetland and waterbody boundaries prior to Project construction.

Cultural Resources

The Oregon State Historic Preservation Office (SHPO) Historic Sites Database lists one resource within the study area: the H.E. Cowgill water tower at 10525 Tigard Street. The water tower is listed on the National Register of Historic Places (NRHP) as eligible/contributing. No other mapped resources are listed on the database. However, any building aged 45 years or older is eligible for listing. There are several buildings in the study area that meet the age criteria.

Archaeological sites are not publicly available, and it is unknown whether or not archaeological resources have been found within the study area. The majority of the study area has been previously disturbed with the construction of the existing roads. There are patches of undisturbed lands that would have a high likelihood of presence of archaeological resources given their proximity to streams.

Endangered Species

The USFWS Information for Planning and Consultation (IPaC) tool shows the following species listed under the Endangered Species Act (ESA) as potentially occurring within or near the Project area: northern spotted owl, streaked horned lark, Fender's blue butterfly, monarch butterfly, Kincaid's lupine, Nelson's checker-mallow, and Willamette Daisy. Due to the urban environment, there is likely no suitable habitat for any of the species listed above and the project would likely result in no effect to listed terrestrial species. Aquatic ESA-listed species have been identified in the study area in Fanno Creek, Summer Creek, and Ash Creek, including the following species:

- Fanno Creek: Coho salmon, coastal cutthroat trout, steelhead, and Pacific lamprey
- Summer Creek: steelhead, coastal cutthroat trout, and Pacific lamprey
- Ash Creek: steelhead, coastal cutthroat trout

Hazardous Materials

DEQ's Facility Profiler lists four current and previous hazardous materials sources within or immediately adjacent to the study area. A hazardous waste generator is located on North Dakota Street, and three Environmental Cleanup Site Information (ECSI) sites are located on Tiedeman Avenue. Two of the ECSI sites have a status of no further action required, while the third ECSI site has a status of suspect site requiring further investigation.

Parks

Several parks and recreation resources surround the study area, including City of Tigard's Dirksen Nature Park and Woodard Park, as well as Fanno Creek Trail. The city also has existing property for a planned neighborhood park (Bagan Park) on the east side of Greenburg Road, north of Ash Creek. This park is planned to be the terminus of the planned Ash Creek Trail that would extend east from the park.

Railroad Crossings

Both Tiedeman Avenue and North Dakota Street have existing at grade crossings of the Portland and Western Railroad that must be accommodated within the planning process.

The rail line is owned and operated by Portland and Western Railroad, a subsidiary of the Genesee and Wyoming. The P&W operates both freight and passenger trains along this line daily. The passenger trains are operated under contract to TriMet, along what is known as the WES (Westside Express Service) between Beaverton and Wilsonville. Aggregate train counts through the affected crossings are up to 37 trains per day, with 10 passenger trains scheduled in each direction daily. The track has a maximum operating speed of 60 mph based upon the DOT Crossing Inventory data.

Both existing crossings are of a modern standard with full signalization and cross arms across the primary lanes of traffic. In addition to the MUTCD standard signs and crossing protections, both crossings have supplemental signal with flashing light to warn eastbound traffic to avoid stopping on tracks due to potential queuing at the Tiedeman intersection.

The Tiedeman Avenue railroad crossing only has an existing sidewalk on the east side of the road today. Design alternatives that include adding a sidewalk on the west side of Tiedeman Avenue should include a new pedestrian crossing over the tracks, similar to the existing east side crossing. This may require a modification to the existing Construction and Maintenance Agreement for this railroad crossing.

Intersection Operations

Existing intersection conditions including traffic operations and crash analysis at the study intersections are provided in the *Traffic Analysis Memorandum (Attachment B)*.

Concept Design Alternatives

Design alternatives for Tiedeman Avenue were split into two categories for evaluation - intersection alternatives and cross-section alternatives. Ultimately, the various intersection and cross-section alternatives were combined into a corridor-wide preferred alternative and developed into 30% design plans.

The following alternatives were considered as part of this study:

Intersection Alternatives

The team explored potential intersection alternatives with sketch level designs. *See Attachment C for preliminary design sketches of the intersection alternatives.*

Through initial feasibility screening and discussions with the City, the team selected the intersection alternatives discussed below to advance through the alternatives analysis and traffic analysis. *Attachment D includes design concepts for the intersection alternatives. Attachment B, Traffic Analysis Memorandum, includes the existing and future year traffic operations of the alternatives listed below.*

Tiedeman Avenue / Tigard Street

The following are the intersection alternatives evaluated as part of the alternatives analysis and traffic analysis for the intersection of Tiedeman Avenue/Tigard Street:

1. No Build – Pedestrian and bike improvements only, no added lanes
2. Improved All Way Stop Control – Add separate NB and SB left turn lanes
3. Traffic Signal – No added lanes
4. Traffic Signal – Add separate NB and SB left turn lanes
5. Traffic Signal – Add separate NB and SB left turn lanes and remove WB right turn lane
6. Mini Roundabout

Alternative 1. No build (pedestrian and bike improvements only)

Alternative 1 maintains the existing traffic control and vehicle lane configurations at the Tigard Street / Tiedeman Avenue intersection but adds pedestrian and bike facility improvements. The concept design for Alternative 1 is shown in Figure 2 below and reflects the following key design features:

- Multi-use paths on all legs of the intersection providing connections to the Fanno Creek Trail, Heritage Trail, and Tiedeman Avenue.
- Bike ramps on the east and west intersection legs to transition from standard on-street bikes lanes to the proposed multi-use paths.
- Curb extensions on the east and west legs of the intersection to shorten crossing distance and improve pedestrian visibility.

Figure 2: Tiedeman Avenue / Tigard Street – Alternative 1

Alternative 2. Improved AWSC – Add separate NB and SB left turn lanes

Alternative 2 maintains the existing traffic control at the Tigard Street / Tiedeman Avenue intersection but adds northbound and southbound left turn lanes and realigns the eastbound approach. Additionally, the alternative adds pedestrian and bike facility improvements. The concept design for Alternative 2 is shown in Figure 3 below and reflects the following key design features:

- Northbound and southbound left turn lanes to increase capacity and delay the need to signalize.
- Realign the eastbound approach to eliminate the existing skew.
- Multi-use paths on all legs of the intersection providing connections to the Fanno Creek Trail, Heritage Trail, and Tiedeman Avenue.
- Bike ramps on the east and west intersection legs to transition from standard on-street bikes lanes to the proposed multi-use paths.
- Curb extensions on the east and west legs of the intersection to shorten crossing distance and improve pedestrian visibility.

Figure 3: Tiedeman Avenue / Tigard Street – Alternative 2

Alternative 3. Traffic Signal

Alternative 3 signalizes the intersection and realigns the eastbound approach at Tigard Street / Tiedeman Avenue. Additionally, the alternative adds pedestrian and bike facility improvements. The concept design for Alternative 3 is shown in Figure 4 below and reflects the following key design features:

- Signalize the intersection to increase capacity and reduce delay.
- Realign the eastbound approach to eliminate the existing skew.
- Multi-use paths on all legs of the intersection providing connections to the Fanno Creek Trail, Heritage Trail, and Tiedeman Avenue.
- Bike ramps on the east and west intersection legs to transition from standard on-street bikes lanes to the proposed multi-use paths.
- Curb extensions on the east and west legs of the intersection to shorten crossing distance and improve pedestrian visibility.

Figure 4: Tiedeman Avenue / Tigard Street – Alternative 3

Alternative 4. Traffic Signal and add separate NB and SB left turn lanes

Alternative 4 signalizes the intersection, adds northbound and southbound left turn lanes, and realigns the eastbound approach. Additionally, the alternative adds pedestrian and bike facility improvements. The concept design for Alternative 4 is shown in Figure 5 below and reflects the following key design features:

- Signalize the intersection to increase capacity and reduce delay.
- Northbound and southbound left turn lanes to reduce queuing and improve safety.
- Realign the eastbound approach to eliminate the existing skew.
- Multi-use paths on all legs of the intersection providing connections to the Fanno Creek Trail, Heritage Trail, and Tiedeman Avenue.
- Bike ramps on the east and west intersection legs to transition from standard on-street bikes lanes to the proposed multi-use paths.
- Curb extensions on the east and west legs of the intersection to shorten crossing distance and improve pedestrian visibility.

Figure 5: Tiedeman Avenue / Tigard Street – Alternative 4

Alternative 5. Traffic Signal, add separate NB and SB left turn lanes, and remove WB right turn lane

Alternative 5 signalizes the intersection, adds northbound and southbound left turn lanes, removes the existing westbound right turn lane, and realigns the eastbound approach. Additionally, the alternative adds pedestrian and bike facility improvements. The concept design for Alternative 5 is shown in Figure 6 below and reflects the following key design features:

- Signalize the intersection to increase capacity and reduce delay.
- Northbound and southbound left turn lanes to reduce queuing and improve safety.
- Remove existing westbound right turn lane.
- Realign the eastbound approach to eliminate the existing skew.
- Multi-use paths on all legs of the intersection providing connections to the Fanno Creek Trail, Heritage Trail, and Tiedeman Avenue.
- Bike ramps on the east and west intersection legs to transition from standard on-street bikes lanes to the proposed multi-use paths.
- Curb extensions on the east and west legs of the intersection to shorten crossing distance and improve pedestrian visibility.

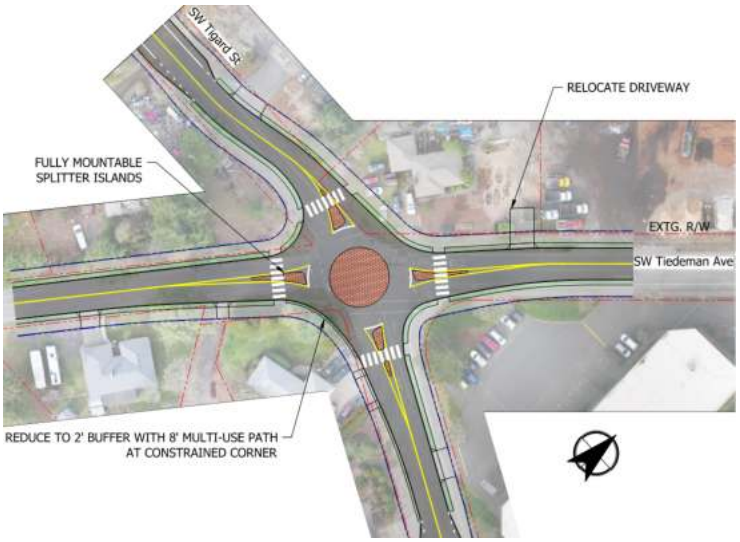
Figure 6: Tiedeman Avenue / Tigard Street – Alternative 5

Alternative 6. Mini Roundabout

Alternative 6 converts the intersection to a mini roundabout and adds pedestrian and bike facility improvements. The concept design for Alternative 6 is shown in Figure 7 below and reflects the following key design features:

- Mini roundabout with an inscribed diameter of 90 feet.
- Fully mountable center island and splitter islands to facilitate truck traffic.
- Multi-use paths on all legs of the intersection providing connections to the Fanno Creek Trail, Heritage Trail, and Tiedeman Avenue.
- Bike ramps on the east and west intersection legs to transition from standard on-street bikes lanes to the proposed multi-use paths.

Figure 7: Tiedeman Avenue / Tigard Street – Alternative 6



Tiedeman Avenue / Greenburg Road / North Dakota Street

The following are the intersection alternatives evaluated as part of the alternatives analysis and traffic analysis for the intersections of Tiedeman Avenue/Greenburg Road/North Dakota Street:

1. No Build – Pedestrian and bike improvements only, no added lanes
2. Improved Two-Way Stop Control – Add separate EB right turn lane
3. Improved Two-Way Stop Control – Restricted EB left turns
4. Traffic Signal
5. Dogbone Roundabout

Alternative 1. No build (pedestrian and bike improvements only)

Alternative 1 maintains the existing traffic control and vehicle lane configurations at the Greenburg Road / Tiedeman Avenue / North Dakota Street intersection but adds pedestrian and bike facility improvements. The concept design for Alternative 1 is shown in Figure 8 below and reflects the following key design features:

- Bike ramps on the north and south legs of the Greenburg Road intersection for cyclists traveling southbound to mitigate the conflicts with southbound right-turning vehicles.
- Multi-use paths along the west side of Greenburg Road integrated with the bus pullout area on the south leg of the intersection to mitigate the Bus/Bike conflicts.
- A bike signal at the intersection for southbound cyclists.
- Multi-use path connections to the Tiedeman Avenue corridor.

Figure 8: Tiedeman Avenue / Greenburg Road / North Dakota Street – Alternative 1

Alternative 2. Improved Two-Way Stop Control with Eastbound Right-Turn Lane

Alternative 2 adds an eastbound right turn lane at the Tiedeman Avenue / North Dakota Street intersection, plus adds pedestrian and bike facility improvements. The concept design for Alternative 2 is shown in Figure 9 below and reflects the following key design features:

- Eastbound right turn lane at North Dakota Street.
- Bike ramps on North Dakota Street to transition from standard on-street bikes lanes to the proposed multi-use paths.
- Bike ramps on the north and south legs of the Greenburg Road intersection for cyclists traveling southbound to mitigate the conflicts with southbound right-turning vehicles.
- Multi-use paths along the west side of Greenburg Road integrated with the bus pullout area on the south leg of the intersection to mitigate the Bus/Bike conflicts.
- A bike signal at the intersection for southbound cyclists.
- Multi-use path connections to the Tiedeman Avenue corridor.

Figure 9: Tiedeman Avenue / Greenburg Road / North Dakota Street – Alternative 2

Alternative 3. Improved Two-Way Stop Control with Restricted Eastbound Left-Turns

Alternative 3 restricts the eastbound left turn at the Tiedeman Avenue / North Dakota Street intersection, plus adds pedestrian and bike facility improvements. The concept design for Alternative 3 is shown in Figure 10 below and reflects the following key design features:

- Restrict the eastbound left turn movement from North Dakota Street. Construct a median island and traffic separator on Tiedeman Avenue to enforce this restriction.
- Add an eastbound left turn lane on Tiedeman Avenue onto North Dakota Street.
- Bike ramps on North Dakota Street to transition from standard on-street bikes lanes to the proposed multi-use paths.
- Bike ramps on the north and south legs of the Greenburg Road intersection for cyclists traveling southbound to mitigate the conflicts with southbound right-turning vehicles.
- Multi-use paths along the west side of Greenburg Road integrated with the bus pullout area on the south leg of the intersection to mitigate the Bus/Bike conflicts.
- A bike signal at the intersection for southbound cyclists.
- Multi-use path connections to the Tiedeman Avenue corridor.

Figure 10: Tiedeman Avenue / Greenburg Road / North Dakota Street – Alternative 3

Alternative 4. Traffic Signal

Alternative 4 signalizes the intersection of Tiedeman Avenue / North Dakota Street and adds pedestrian and bike facility improvements. Given the close proximity to the existing traffic signal at Greenburg Road this signal would require direct coordination between the two closely spaced signals. The concept design for Alternative 4 is shown in Figure 11 below and reflects the following key design features:

- Signalize the intersection of Tiedeman Avenue / North Dakota Street and coordinate with existing traffic signal at Greenburg Road.
- Add a northbound left turn lane on Tiedeman Avenue onto North Dakota Street.
- Bike ramps on the north and south legs of the Greenburg Road intersection for cyclists traveling southbound to mitigate the conflicts with southbound right-turning vehicles.
- Multi-use paths along the west side of Greenburg Road integrated with the bus pullout area on the south leg of the intersection to mitigate the Bus/Bike conflicts.
- A bike signal at the intersection for southbound cyclists.
- Multi-use path connections to the Tiedeman Avenue corridor.

Figure 11: Tiedeman Avenue / Greenburg Road / North Dakota Street – Alternative 4

Alternative 5. Dogbone Roundabout

Alternative 5 proposes a single lane "dogbone" roundabout at the intersection of Greenburg Avenue / Tiedeman Avenue / North Dakota Street. The concept design for Alternative 5 is shown in Figure 12 below and reflects the following key design features:

- Single lane "dogbone" roundabout.
- Reconstruct multiple driveways to tie in with proposed intersection footprint.
- Multi-use path connections to the Tiedeman Avenue corridor.

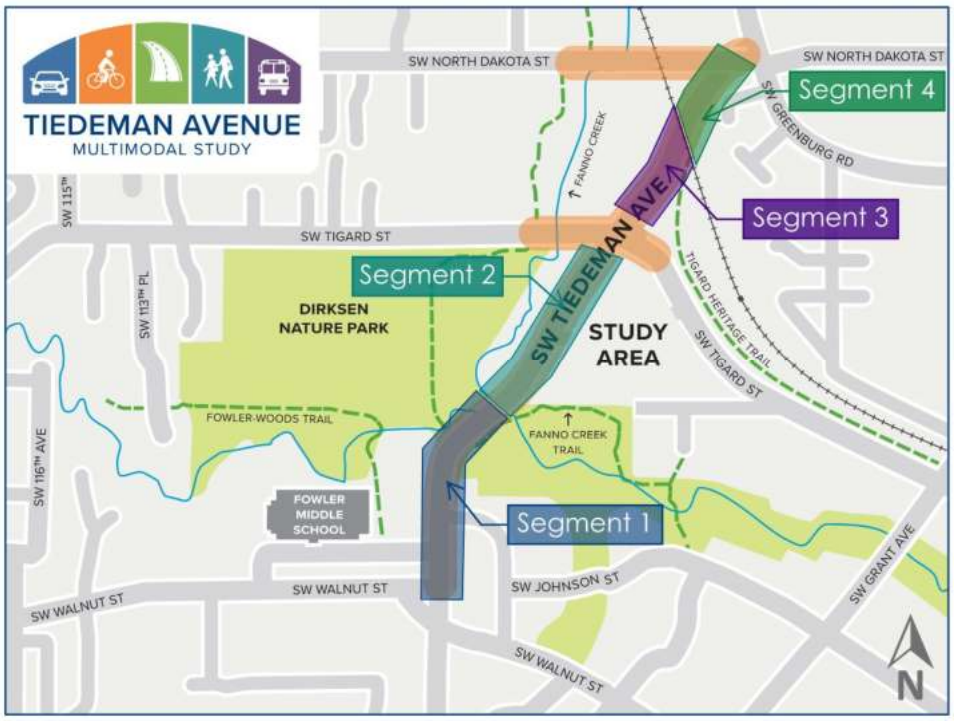
Figure 12: Tiedeman Avenue / Greenburg Road / North Dakota Street – Alternative 5

Tiedeman Avenue Cross Section Alternatives

Several cross-section alternatives have been developed that illustrate different pedestrian and bike facility options for the corridor. Tiedeman Avenue has varying ROW widths, contexts, and adjacent land uses, so a "one-size fits all" approach will likely not be practical. For the purposes of the study, the corridor has been divided into 4 unique segments and the proposed cross-section alternatives will be evaluated with a context sensitive approach for each segment. The four segments are shown in Figure 13 below and are as follows (starting at the south end):

- Segment #1: Walnut Street to Fanno Creek Bridge
- Segment #2: Fanno Creek Bridge to Tigard Street
- Segment #3: Tigard Street to Railroad Tracks
- Segment #4: Railroad Tracks to Greenburg Road

Figure 13: Tiedeman Avenue Segments



City of Tigard Standard Cross Section

Per the City of Tigard Municipal Code, the standard cross section for a collector roadway is 58 feet to 62 feet wide with standard bike lanes, a landscape buffer, and standard sidewalks, as shown in Exhibit 1 below. This cross section provided a starting point for developing cross section alternatives. Public outreach indicated a strong preference for bike facilities separated from vehicle traffic, either multi-use path or buffered bike lane, and landscaping. As such, the standard City cross section was not the most appropriate to meet the priorities of the users. A summary of the public outreach results are further detailed in the *Public Involvement* section of this memorandum. Ultimately, it was determined that Alternative A4, a 55-foot ROW with multi-use paths on both sides, shown in Exhibit 2, was the preferred cross section, which is further outlined in the *Evaluation Criteria and Performance Measures* section. Table 4, in the *Evaluation Criteria and Performance Measures* section provides a comparison of the city's standard cross-section to the preferred cross-section utilizing evaluation criteria and performance measures consistent with the project goals. The following section describes all of the alternative cross-sections considered.

Exhibit 1 – City of Tigard Standard Cross Section

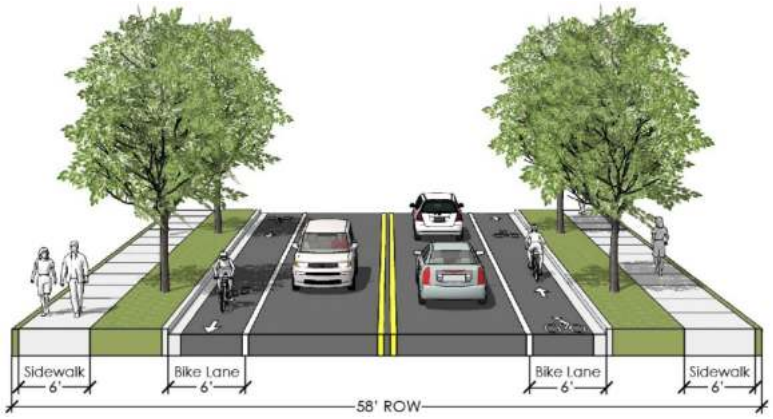
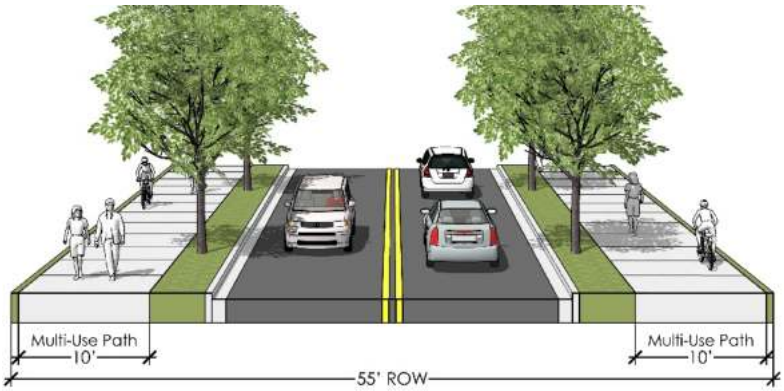


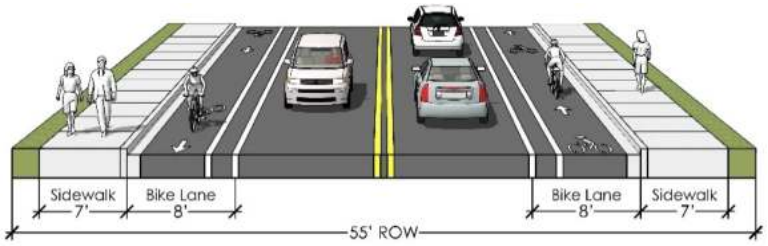
Exhibit 2 – Preferred Cross Section (Alternative A4)



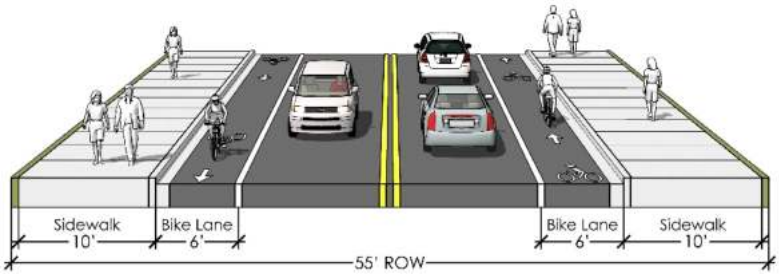
55' Alternatives

The team considered five 55-foot-wide cross section alternatives. The 55-foot width represents the best-case-scenario ROW width. All cross sections include two travel lanes, but vary in the pedestrian and bike facilities, for example, offering a standard bike lane versus buffered bike lanes versus multi-use path.

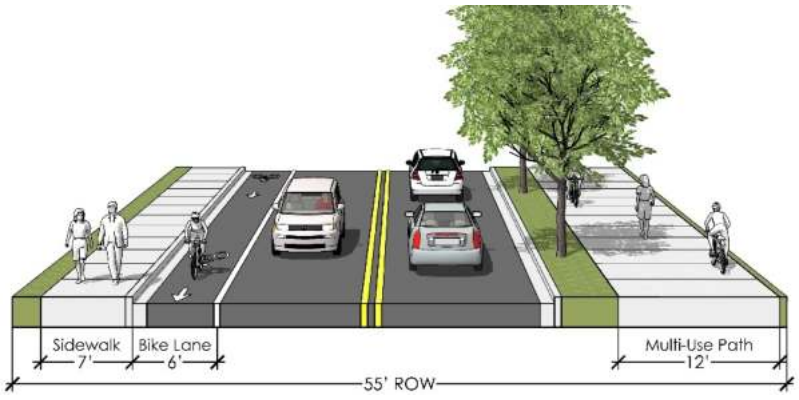
Alternative A1 | 55' ROW with 8' Buffered Bike Lanes & 7' Sidewalk (both sides)



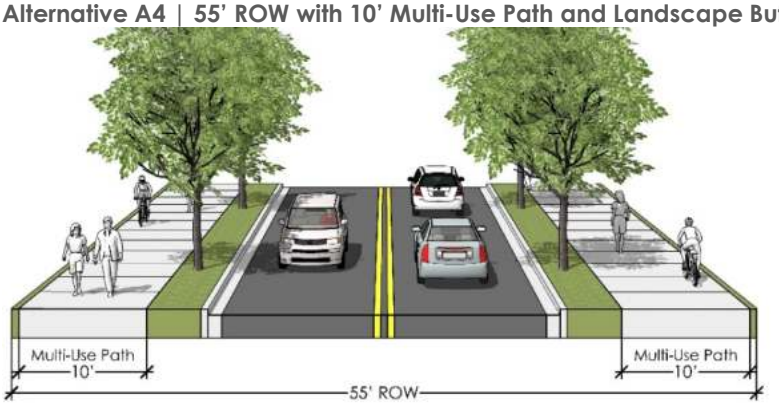
Alternative A2 | 55' ROW with 6' Bike Lanes & 10' Sidewalk (both sides)



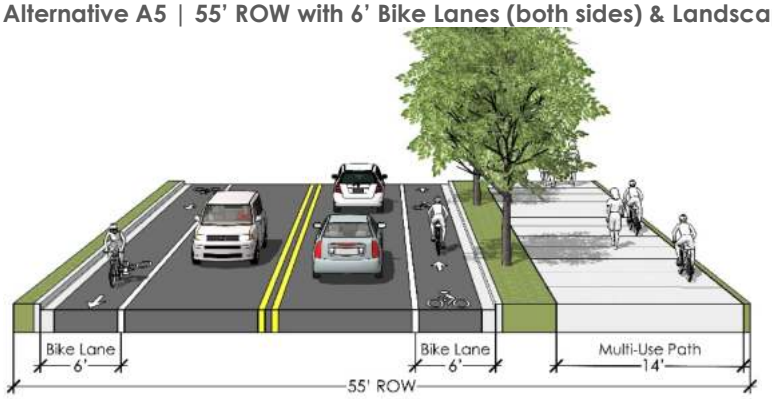
Alternative A3 | 55' ROW with 7' Sidewalk + 6' Bike Lane (one side) & Landscape Buffer + 12' Multi-Use Path (one side)



Alternative A4 | 55' ROW with 10' Multi-Use Path and Landscape Buffer (both sides)



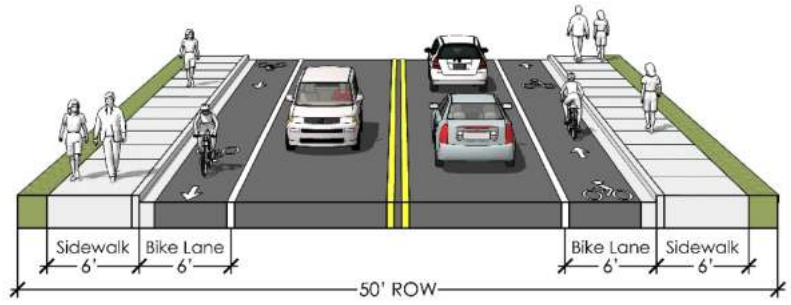
Alternative A5 | 55' ROW with 6' Bike Lanes (both sides) & Landscape Buffer + 14' Multi-Use Path (one side)



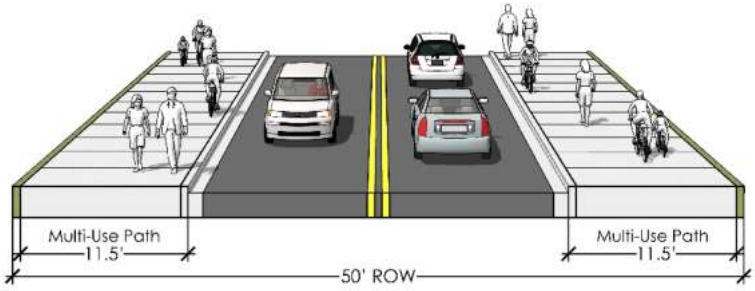
50' ROW Alternatives

Understanding there are constrained areas along the corridor, particularly just south of Tigard Street where the street is primarily residential, the team identified five cross section alternatives for the 50' constrained sections.

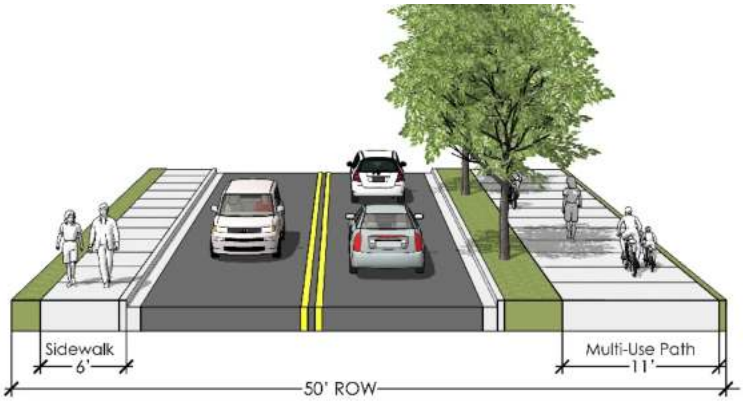
Alternative B1 | 50' ROW with 6' Bike Lanes & 6' Sidewalks (both sides)



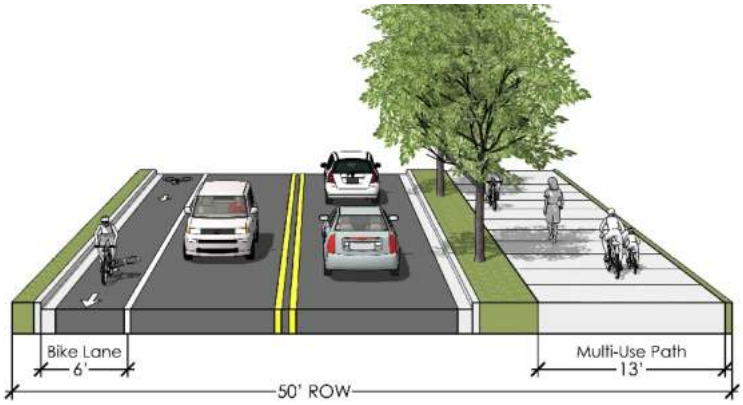
Alternative B2 | 50' ROW with 11.5' Multi-Use Path (both sides)



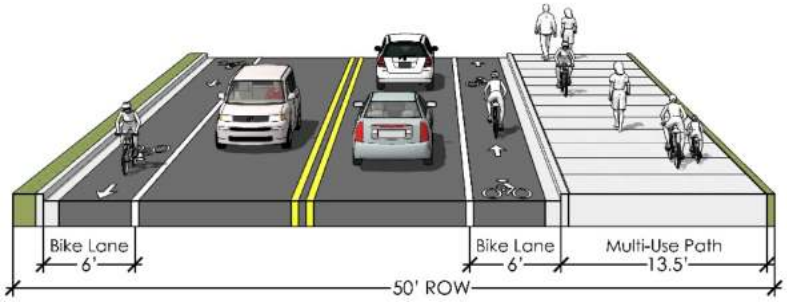
Alternative B3 | 50' ROW with 6' Sidewalk (one side) & Landscape Buffer + 11' Multi-Use Path (one side)



Alternative B4 | 50' ROW with 6' Bike Lane (one side) & Landscape Buffer + 13' Multi-Use Path (one side)



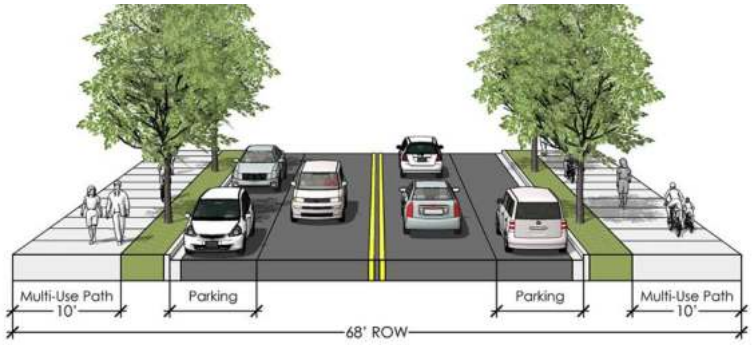
Alternative B5 | 50' ROW with 6' Bike Lanes (both sides) & 13' Multi-Use Path (one side)



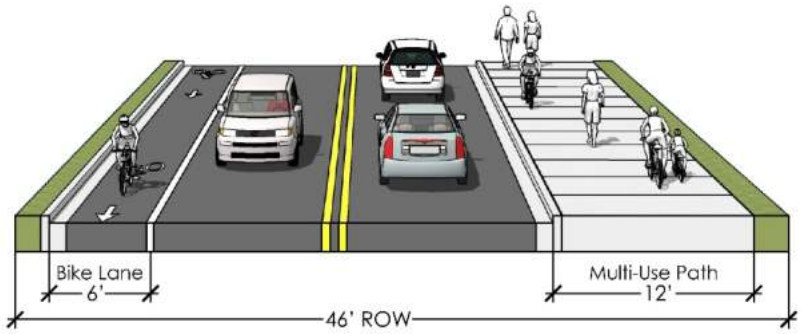
Additional Alternatives

Given the range of available ROW, the team identified two additional cross sections that represent options for where there is existing on-street parking and where existing ROW is below 50'. Alternative C1 represents a segment where there is available space to provide on-street parking, particularly near the Dirksen Fields and Fanno Creek Trail crossing, where parking exists today. Alternative C2 represents a 46' ROW alternative, the most constrained cross section, that could be considered where a 50' ROW may not be possible.

Alternative C1 | 68' ROW with Parking & Multi-Use Path (both sides)



Alternative C2 | 46' ROW with 6' Bike Lane (one side) & 12' Multi-Use Path (one side)



Key Design Considerations

Pedestrian Crossings

There are three Fanno Creek Trail crossings within the study area at Tiedeman Avenue, Tigard Street, and North Dakota Street, as shown in Figure 1. The existing crossing at Tiedeman Avenue has RRFBs and curb extensions. The Fanno Creek Trail crossings at Tigard Street and North Dakota Street have crosswalk striping, but no additional enhancements. The *Traffic Analysis Memorandum,* provided in Attachment B, completed a crosswalk assessment and recommends the following crossing enhancements at Tigard Street and North Dakota Street:

- Restripe high visibility pavement markings and install pedestrian crossing warning sign per the Manual on Uniform Traffic Control Devices (MUTCD – Reference 6)
- Install street lighting along North Dakota and Tigard Streets at the Fanno Creek Trail crossings based on ODOT standards for the roadway
- Install Rectangular Rapid-Flashing Beacon (RRFB)
- Install curb extensions.

Additionally, the City has plans to construct a neighborhood park at Bagan Park, located north of the project on east side of Greenburg Road at Ash Creek. Bagen Park is also planned to be the terminus of the planned Ash Creek Trail. To facilitate connectivity to the Fanno Creek Trail and the Heritage Trail, the project will include a crosswalk at the north side of the Greenburg Road/ Tideman Avenue intersection. The City should plan to widen the east sidewalk on Greenburg Road from the signal at Tiedeman Avenue to Bagan Park. This will provide an enhanced pedestrian connection to the Fanno Creek Trail and Heritage Trail from the Ash Creek Trail and Bagan Park.

Finally, the City has identified the desire for an enhanced crossing at 106th Drive near Fowler Middle School at the south end of the study area. Open house attendees expressed support for an enhanced crossing at this location.

Railroad Crossings

Depending upon the roadway cross section geometry selected, there are potential options that would use existing crossing infrastructure and reduce the overall cost of improvements.

The location of a joint ped/bike crossing would be offset from the roadway at the crossing to accommodate the required vehicular crossing signalization hardware (like the existing ped/bike crossing on the west side of Tiedeman Avenue), but bike lane alternatives can potentially maintain their position alongside the roadway, utilizing the same crossing gate arm hardware as the vehicular traffic lanes. Doing so will however likely require the relocation and modification of the crossing gate hardware to provide for the inclusion of the bike lane width.

Tiedeman Road Crossing

The Tiedeman crossing has an extended pre-cast concrete crossing panel surface that not only provides for the existing ped/bike crossing to the east but has a similar extension to the west that could function for a ped/bike crossing constructed along the north side of the roadway. It is expected that these crossing surfaces could be maintained and utilized for bike/ped traffic outside of the existing crossing gates, but if

bike lanes are to be located adjacent to the vehicular lanes, adjustments to the crossing gate hardware would be required.

The existing Tiedeman crossing features a pedestrian crossing along the east side of the roadway with an offset railing barrier (aka chicane) along the sidewalk. The use of the offset barrier forces users to turn and face the tracks while crossing, enhancing visibility of approaching rail traffic.

The use of the existing offset barrier at Tiedeman is an effective method forcing the attention of the pedestrians and bikes to make note of crossing but does limit the throughput of the sidewalk or multi-use pathway as in general only one person, or multiple persons moving in the same direction can navigate through the railing at the same time. Bike riders will typically have to dismount to navigate the railing due to the tight geometry and can only do so one rider/bike at a time.

The use of smaller gate arms and flashers for protection of the ped/bike crossings are the desirable alternative to the offset barrier as they provide positive protection of the crossing for all traffic, but do not otherwise impede the use of the sidewalk or multi-use path within the presence of rail traffic. The installation of secondary crossing gates would be an expense to the project but can potentially be mitigated with the re-use of the existing vehicular crossing gate hardware and the installed crossing panels. In the case of the extended crossing panels, the existing vehicular roadway and crossing protections could remain in place, with the additional hardware for protection of the ped/bike crossing added.

With the elimination of the offset railings, the ped/bike paths can be kept parallel to the roadway and afforded significant width across the existing crossing panels to either side of the roadway. Elimination of bike lanes adjacent to the vehicular lanes would be most practical here, with the bikes directed into a multi-use pathway at the crossing to preserve the existing roadway width.

North Dakota Street Crossing

The existing North Dakota Street crossing has some extension of pre-cast panels to either side, but not to the same extent as Tiedeman Avenue. Based upon the space required for the vehicular crossing gate hardware, it can be expected that provision of pedestrian or joint-use crossings on either side of North Dakota will require the extension of the crossing panels on that respective side.

The existing ROW along North Dakota is limiting however and the impacts to adjacent landowners, utilities, and other externalities adjacent to the crossing are more likely to influence the decision to construct the pedestrian crossings on one or both sides of the roadway.

If the existing geometry of the vehicular roadway along North Dakota Street can be maintained, it is possible that the existing crossing infrastructure can be retained, with augmentation for joint ped/bike facilities protected with the installation of smaller gate arms and flashers dedicated to the joint-use crossing. The limited ROW along North Dakota Street would likely preclude the use of offset railings on either side of the roadway.

The City is currently working on a project to update the North Dakota Street bridge over Fanno Creek. This project has already begun coordination with ODOT Rail as the proposed improvements will extend through the railroad crossing. The Tiedeman Avenue study will defer to the North Dakota Street project for all coordination with ODOT Rail.

Quiet Zone

The establishment of a quiet zone for both railroad crossings would be expected to provide for the addition of Site Safety Measures (SSM) that would help reduce risk index for the intended quiet zone crossings. These safety measures have been undertaken in neighboring municipalities to Tigard along the same rail line and can involve multiple measures.

Three of the most common safety enhancements are:

- the installation of median barriers to limit vehicles from driving around lowered gates
- installation of quad gates, which provide for positive protection across the entire roadway surface,
- installation of wayside horns, which while still noise emitting, are focused at the roadway, which permits the use of lower overall horn volumes.

The two crossings under consideration would be readily enhanced by any of these common SSM, with a varying level of cost depending upon the approach. Generally, the additional median barriers are typically the most economical solution, but can be limited in application by the presence of side streets and driveways that can require an open median. The commercial driveways to the south on both sides of the Tiedeman crossing could limit the installation of a median barrier if multiple turning movements in and out of the driveways are maintained.

Environmental Permitting

The following sections summarize potential permitting needs identified as part of the 10% concept design effort. Additional analysis was completed at the 30% design. See Attachment E, *Federal, State, and Local Regulatory Requirements Memorandum* for additional information.

Potential Permits

Local

If the Project has no federal nexus (federal funding or federal permits required), local permits will still be required, as the study area is under the jurisdiction of the City of Tigard. The study area is zoned as residential, parks and recreation, industrial, and mixed uses. Land within the study area is designated as "sensitive lands" due to the presence of streams and creeks; therefore, any impacts to sensitive lands would require a Type II Land Use Approval. Any tree removal would also require a Tree Removal Permit. Development within the floodplain of Fanno Creek would require a Floodplain Development Permit, which would require a certification demonstrating that no rise in the base flood elevation would occur from the project. Widening a street would require a Public Facilities Improvement Permit. Additional building permits may be required.

State

Wetlands and Waters

If there are impacts to any wetlands or waters that are jurisdictional to the Oregon Department of State Lands (DSL), a Removal-Fill permit would be required.

Stormwater

Permits that may be required for the Project regardless of a federal nexus would include a National Pollutant Discharge Elimination System (NPDES) 1200-C permit from the Oregon Department of Environmental Quality (DEQ) for more than one acre of ground disturbance.

Hazardous Materials

A Phase I Hazardous Materials Survey would be required to identify potential hazardous materials within the study area. Additional investigation of the hazardous materials sources identified above as well as the entire study area would be required to determine where soil sampling should occur. Soil sampling would be required in areas known or thought to have been previously impacted by hazardous materials to identify and characterize existing contaminants. Disposal options can then be identified depending on levels of existing contamination.

Federal

If the Project has a federal nexus (i.e., via federal permit (USACE) or federal funds (Federal Highway Administration [FHWA]), compliance with NEPA would be required and additional permits may be needed. Because the Project would not likely cause significant environmental impacts, the NEPA classification is assumed to be either a Programmatic Categorical Exclusion (PCE) or a Categorical Exclusion (CE). These classifications require documentation that provides evidence and analysis that significant environmental impacts would not occur. Additional federal permits/authorizations are summarized below.

Wetlands and Waterbodies

If impacts to any jurisdictional wetlands or waterbodies would occur as a result of the Project, a Section 404 permit from the US Army Corps of Engineers (USACE) would be required. A Section 404 permit requires a Section 401 Water Quality Certification issued by DEQ.

Cultural Resources

Compliance with Section 106 of the National Historic Preservation Act (NHPA) is required for federalized projects. A baseline survey and report would be required for historic resources to identify any potential resources and determine eligibility for listing in the NRHP. A baseline survey and report would also be required for archaeological resources. If resources are determined to be present within the study area, a Finding of Effect would require concurrence from SHPO.

Endangered Species

A field survey would be required to confirm the presence or absence of ESA-listed species. Given the urban setting, it is unlikely that any terrestrial ESA-listed species are present in the study area. A No Effect Determination would be required if a field survey results in confirmation of species absence. Impacts to wetlands or waters could affect ESA-listed aquatic species. Additionally, stormwater runoff from new impervious surfaces created for the Project can affect aquatic species downstream. Aquatic species impacts could be addressed through the Federal Aid Highway Program (FAHP) Programmatic Agreement or the Standard Local Operating Procedures for Endangered Species (SLOPES).

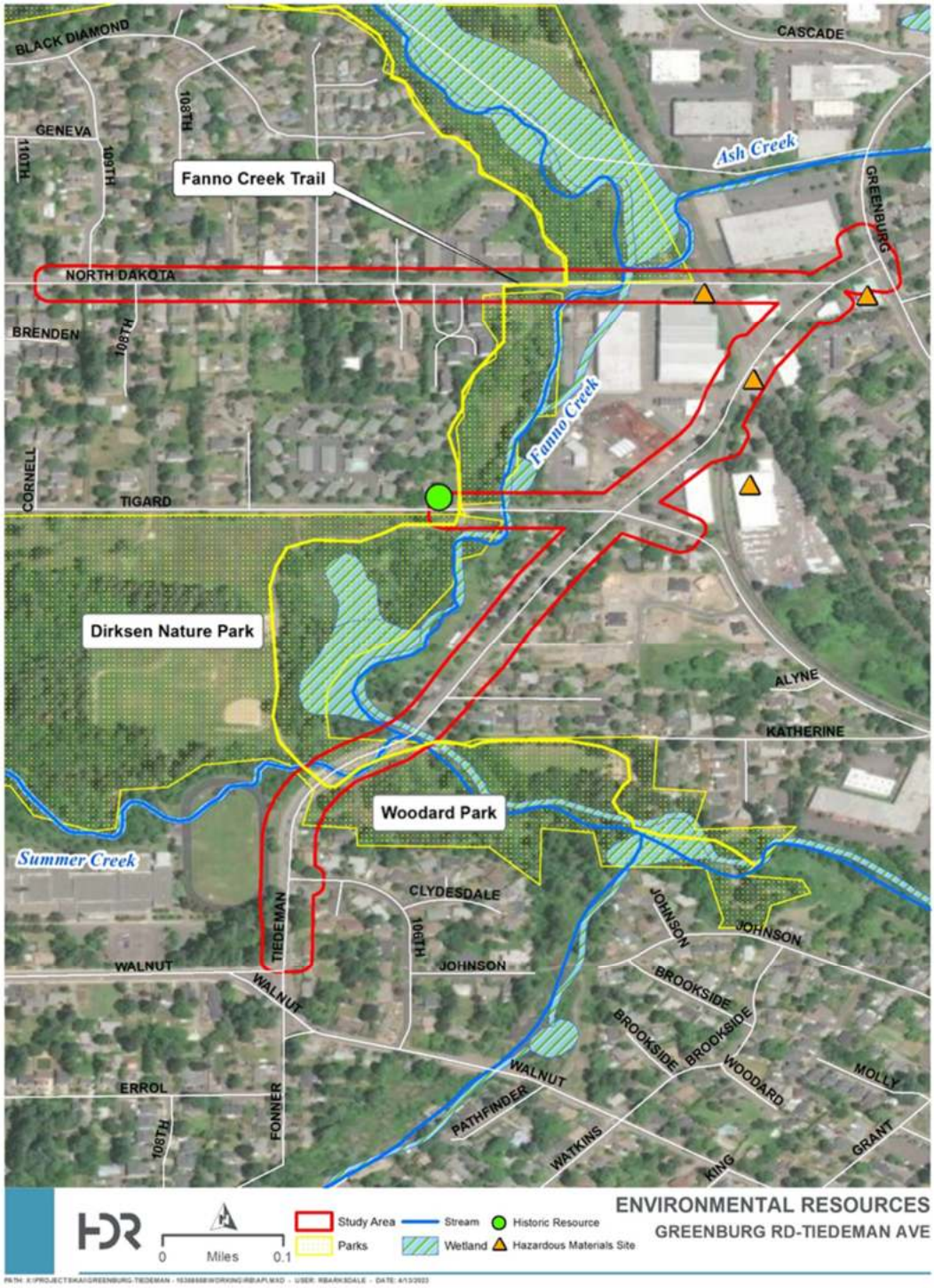
Section 4(f)

If there is a FHWA nexus, the Project would be subject to Section 4(f) evaluation if there are impacts to any recreation resources. Impacts to Section 4(f) properties are designated as a "use," and can include permanent ROW acquisition that transfers land as part of a transportation process; a permanent easement; or a temporary occupancy during construction. A *de minimis* impact involves a determination of no adverse effect from the use of a Section 4(f) property. An evaluation would be required that documents the impacts. Concurrence with the evaluation would be required from SHPO.

Section 6(f)

Woodard Park is also designated as a Section 6(f) resource in addition to a Section 4(f) and would require coordination with the National Park Service (NPS) if impacts were to occur, regardless of a federal nexus. For example, ROW acquisition from the park would result in the conversion of parkland, requiring NPS approval. Section 6(f) process requires extensive coordination with NPS and can result in a lengthy and costly process, alternatives that can avoid impacts to Woodard Park would be preferred.

Figure 14: Existing Environmental Resources



Storm Water Management

Managing stormwater runoff is an important design element to consider early in the project development process. The stormwater design will need to comply with Clean Water Services (CWS) flow control/water quantity (hydromodification) and water quality criteria. A combination of three different stormwater management approaches may be explored based on the 55' R.O.W. cross-section alternatives, including:

- A single extended dry detention pond (can be multiple if necessary)
- LIDA Planters within the ROW
- Underground detention pipe and mechanical treatment

Table 1 summarizes the anticipated storm water facilities needed for differing cross sections assuming impermeable pavement.

Table 1: Storm Water Facilities for Cross Section Alternatives with *Impermeable Surfaces*

Section Alternative	Pond			Planter		48" Pipe	Storm Filter Vault	
	Area (sq-ft)	Depth (ft)	Volume (cu-ft)	Area (sq-ft)	Unit Area (sq-ft/ft)	Length (ft)	Cartridges	Dimensions (ft x ft)
A1	9,100	4	26,000	18,306	3.24	2,070	20	8x14
A2	9,800	4	29,000	20,340	3.60	2,310	22	8x14
A3	8,600	4	25,000	18,984	3.36	1,990	20	8x14
A4	7,500	4	21,000	16,950	3.00	1,680	16	8x11
A5	9,900	4	29,000	21,018	3.72	2,310	22	8x14

With the planter column, the unit area column is the square-footage of planter needed per foot of roadway. For example: if we need a planter that's 30 sq-ft/ft, then we need a 15-foot planter strip on either side of the roadway.

The team also analyzed alternatives assuming the separated sidewalk/multi-use path surfaces were *permeable* (porous asphalt, pervious concrete, permeable pavers, etc.) as a means to reduce the required treatment areas. The anticipated stormwater facilities are summarized in Table 2.

Table 2: Storm Water Facilities for Cross Section Alternatives with *Permeable Surfaces*

Section Alternative	Pond			Planter		48" Pipe	StormFilter Vault	
	Area (sq-ft)	Depth (ft)	Volume (cu-ft)	Area (sq-ft)	Unit Area (sq-ft/ft)	Length (ft)	Cartridges	Dimensions (ft x ft)
A1	8,300	4	24,000	11,865	2.10	1,910	15	8x11
A2	7,500	4	21,000	10,509	1.86	1,680	14	6x12
A3	6,100	4	16,000	8,984	1.59	1,280	12	6x12
A4	3,800	4	9,000	6,102	1.08	720	8	8x6
A5	7,800	4	22,000	11,526	2.04	1,760	14	6x12

Additional storm water analysis was completed to support the 30% design. This analysis can be found in the Drainage Design Memorandum (Attachment F).

Speed Treatments

Speeding along Tiedeman Avenue was a common concern expressed by the public during the online survey and open house. The team explored options to implement speed treatments into the proposed intersection concepts and cross section alternatives.

The intersection concepts incorporate speed management strategies such as curb extensions and narrowing the vehicle travel lane. The roundabout alternatives specifically would provide speed management by forcing slower speeds through the roadway geometry. The Tiedeman Avenue cross sections incorporate speed management by providing curbs and narrowing the vehicle travel lanes. Finally, RRFBs at all Fanno Creek Trail crossings would promote slower speeds.

Additional speed treatments that could be considered in addition to the intersection and cross section design including speed tables and speed feedback signs.

Tree Inventory and Potential Impacts

In June 2023 Morgan Holen & Associates completed a tree inventory along Tiedeman Avenue to collect data on existing trees within the study area, understand potential impacts to these trees with the preliminary design concepts, and identify "high priority" trees to preserve. The tree inventory identified the following impacts:

- Thirty-five trees were identified as the highest priority for preservation based on their species, size, and condition. Of these 35 trees, 19 are classified as high priority and 16 are classified as moderate priority.
- Two trees are classified as high risk. Both high risk trees are located on the east side of the Fanno Creek bridge on Tiedeman Avenue. One meets the City of Tigard definition of hazardous. While the other tree does not meet the qualifications to be rated as hazardous, it is flagged as a tree with increased risk.

- The grove of firs in front of Fowler Middle School at the south end of the study area will likely need to be protected as an intact group. Removal of the edge trees would likely have a negative impact on the adjacent trees.

See *Attachment G* for additional information on the tree data collected.

Additionally, Morgan Holen & Associates reviewed the 30% design plans in January 2024 to access the potential tree impacts of the proposed design. All inventoried trees were classified as "Likely to Remove", "Requires Further Analysis", or "Likely to Retain". This information was incorporated into the 30% design plans.

Public Involvement

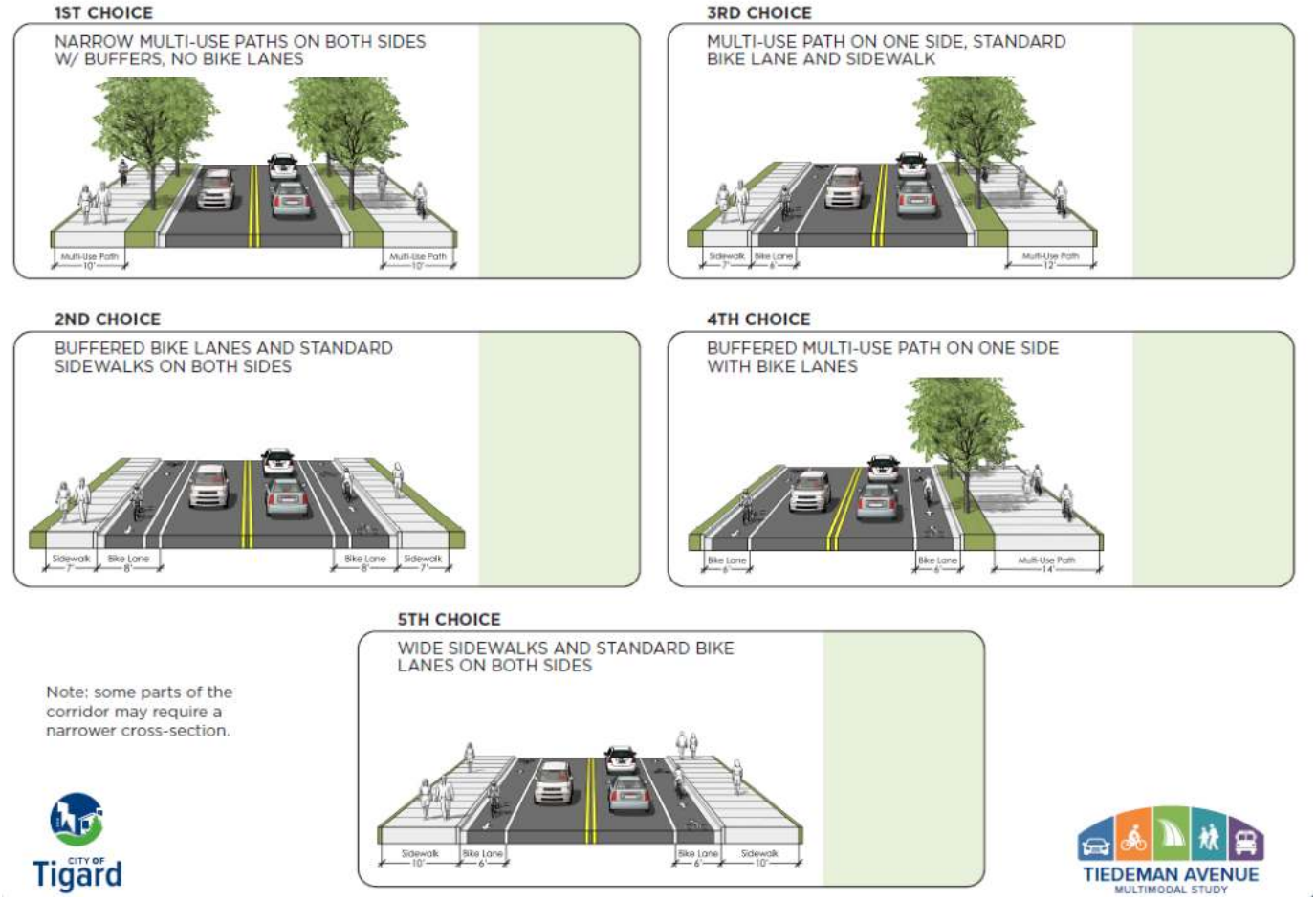
Online Surveys

In February 2023 the City of Tigard conducted an online public survey to better understand the community's priorities for Tiedeman Avenue. The City received 173 responses. Thirty five percent of the respondents walk or bike along Tiedeman Avenue on a daily or weekly basis. The most popular destination was the Fanno Creek Trail, which over half of respondents use at least once a week. Additionally, over a quarter of respondents travel to Fowler Middle School, Dirksen Nature Park, and Tigard Heritage Trail at least once a week. Eighty-five percent of respondents indicated they would walk or bike more along Tiedeman Avenue if facilities were improved.

Respondents were asked about their preferred walking and biking facilities for the corridor. Results showed a strong preference for a multi-use path (73) or buffered bike lane (68) over a standard bike lane (32). Additionally, respondents favored a multi-use path (61) or buffered sidewalk (47) over a wide sidewalk (39) or standard sidewalk (26).

The survey asked respondents to rank their preferred cross section alternatives. The results reinforce a preference for cross sections with a multi-use path or buffered bike lanes, as shown in Exhibit 3.

Exhibit 3: Tiedeman Avenue Cross Section Alternatives



Respondents were also asked to describe additional concerns or desired improvements for Tiedeman Avenue and the intersections at Tigard Street, North Dakota Street, and Greenburg Road. Major themes from the comments include:

- The desire to preserve existing trees along the corridor, include landscaping in the new design, or explore opportunities for attractive stormwater swales (6)
- Feeling unsafe or uncomfortable walking, running, or biking along the existing corridor and the need for sidewalk infill, bike lanes, or additional lighting (21)
- Strong preference for separated bike facilities (buffered or MUP) from vehicle traffic (19). Some respondents also expressed a preference for a separate path for people walking and biking (4).
- Many respondents emphasized the need to design for families and/or children, given the proximity to Fowler Middle School and nearby parks (19).
- Need for enhanced crossings, including RRFBs or raised crosswalks (4)
- Concern over the parking on Tiedeman Road near Fowler Middle School and Dirksen Fields. Some respondents expressed concern for on street parking (6) and others highlighted the need for parking or a waiting area in front of Fowler Middle School and the sports fields (2).
- Many respondents noted high speeds on Tiedeman Avenue and recommended traffic calming measures such as narrowing the lanes, speed bumps, etc. (16)
- Intersection of Tiedeman Avenue/Tigard Street feels unsafe, interest in roundabout, signal, or flashing red light at this location (5)

- Intersection of Tiedeman Avenue/North Dakota feels unsafe (4)
- Noted the dangerous SB bike lane merging with SBR turn lane at Greenburg Road/Tiedeman Avenue (1)

Finally, respondents used an interactive map to identify transportation needs within the study area. The following needs were flagged by the community:

- Tiedeman Avenue:
    - Need for enhanced crossing at Fanno Creek Trail Crossing (raised?)
    - Crosswalk needed at 106th Drive (near Fowler Middle School)
    - Need for formal school drop off/pick up lane near Fowler Elementary
- North Dakota Street:
    - Misalignment of Fanno Creek Trail here is a safety concern. Need for improved wayfinding or improved crossing
    - Need for sidewalk infill
    - Need for traffic calming
- Tigard Street:
    - Need for enhanced crossing such as RRFB, painted crossing, or pavement to emphasize crossing
    - Speeding
    - Need for sidewalk connection from Heritage Trail to Tiedeman Avenue/Tigard Street intersection
- Greenburg Road/Tiedeman Avenue:
    - Need for pedestrian and bike improvements, specifically the southbound bike lane
    - Roundabout location
- North Dakota/Tiedeman Avenue:
    - Challenging intersection for all users, general need from improvements
    - Sight distance issues from utility poles
    - Vehicles making a SBR at Greenburg Road/Tiedeman Avenue often traveling fast
- Tigard Street/Tiedeman Avenue:
    - Low visibility, difficult to see both vehicles and pedestrians/bikes
    - Need for signal, roundabout or traffic calming

Open House

In April 2023, Kittelson & Associates and the City of Tigard hosted an open house at Fowler Middle School to share the preliminary cross section and intersection alternatives with the community and collect feedback on the public's priorities. Approximately 25 people attended the open house. Participants provided feedback by voting for a preferred alternative, as shown in Figures 15 – 17, completing a feedback sheet, or through conversations with the project team members.

Attendees were asked to vote for their preferred Tiedeman Avenue/Tigard Street intersection alternative. As shown in Figure 15, Alternative 1, an all-way stop-control with additional northbound and southbound turns lanes and Alternative 4, a roundabout, were the most favored.

Additionally, attendees voted for their preferred intersection alternative at Tiedeman Avenue/North Dakota Street and Greenburg Road as shown in Figure 16. Alternative 4, the dual roundabout, received the most number of votes, but Alternative 1, adding a southbound right turn lane also received votes.

Figure 15: Tiedeman Avenue/Tigard Street Intersection Alternatives Board

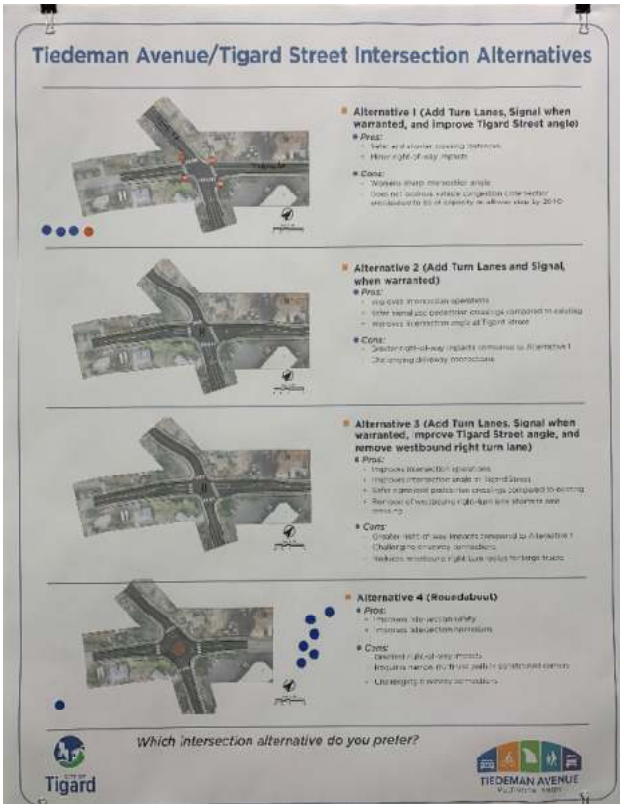
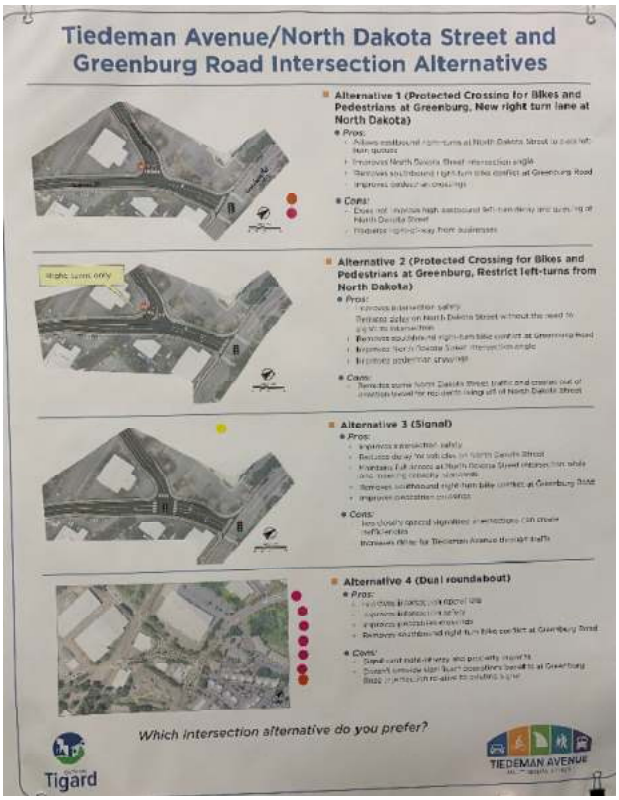
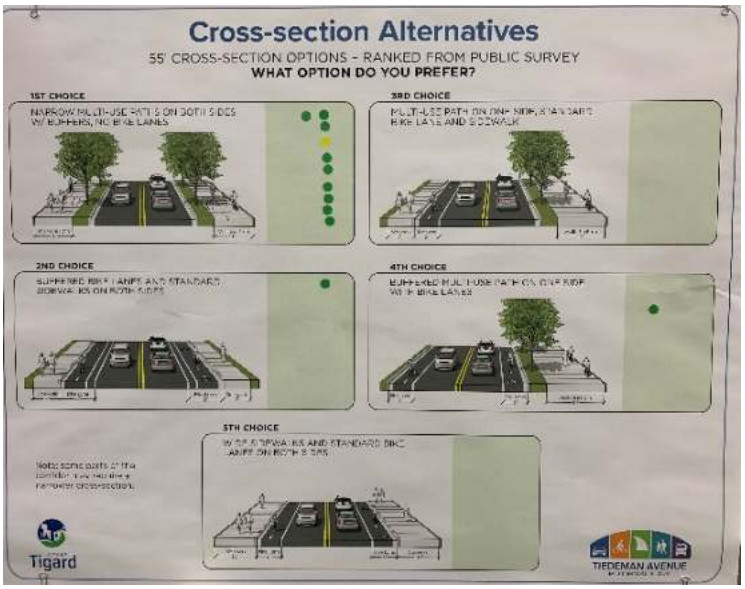


Figure 16: Tiedeman Avenue/North Dakota Street and Greenburg Road Intersection Alternatives Board



Finally, attendees voted for their preferred 55' cross section alternative for Tiedeman Avenue. As shown in Figure 17, attendees overwhelmingly favored the cross section with a landscape buffer and multi-use path on both sides of the roadway, which is consistent with the online surveying results from February 2023.

Figure 17: Tiedeman Avenue Cross-section Alternatives Board



Other themes the team heard from attendees via formal comment response cards or during conversations at the open house include:

- Speeding on Tiedeman Avenue is a major concern for residents living off of Tiedeman Avenue. Participants suggested speed management treatments including speed bumps, lane narrowing, and additional police speed enforcement.
- A general concern about ROW impacts to properties directly off of Tiedeman Avenue. Some attendees expressed support for a modified section, particularly along the constrained portion south of Tigard Street. Recommendations included providing a sidewalk on one side and bike lane on the other or providing a sidewalk rather than a full muti-use path.
- Support for bike lanes with buffers from vehicles.
- One attendee supported the need to future proof the North Dakota Street intersection and another participant expressed concerns for restricting the eastbound left out (alternative 2).
- One attendee noted existing queues at the Tigard Street intersection during the peak hour and general support for the roundabout alternative.
- Support for improvements near Fowler Elementary school including additional school zone signs with flashers and the enhanced crossing at 106th Street.
- One participant noted that existing parking near Fowler Middle School and Dirksen Park obstructs site distance. Another participant expressed support for maintaining the parallel parking in this section.

Evaluation Criteria / Performance Measures

Table 3 summarizes the proposed evaluation criteria and performance measures for the cross section and intersection design alternatives for the Greenburg Road/Tiedeman Avenue Study.

- **Evaluation Criteria** are derived from the goals and needs identified for the study.
- **Performance Measures** are the measures used to assess the evaluation criteria.
- **Description** includes the purpose and general explanation for the evaluation criteria, connecting the criteria to the specific community values for the study.

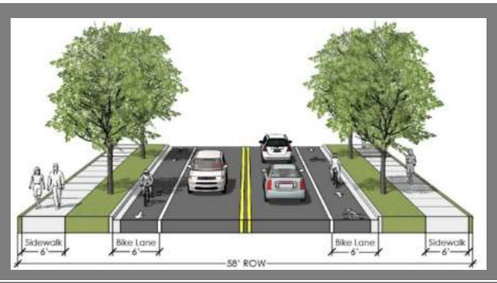
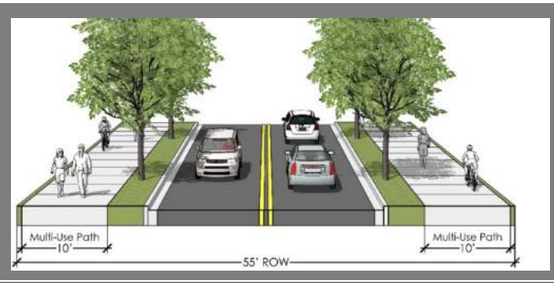
Table 3: Evaluation Criteria and Performance Measures

Evaluation Criteria	Description	Performance Measures
Costs & Impacts	The project minimizes cost (ROW, stormwater, utilities, etc.) relative to project benefits. There are no major maintenance concerns with the proposed project. *The project is compatible with the selected alternative at other locations.*	• Cost (Roadway footprint, cost of materials) • Impacts to Private Property • Stormwater Management • Impacts to Natural Resources (trees, waterways, wetlands, etc.) • Maintenance • *Compatibility with Alternatives at Other Locations*
Connectivity	The project provides connectivity to existing facilities.	• Pedestrian Connectivity • Bike Connectivity • Trail Connectivity
Community Support	The project receives positive community support and aligns with community priorities gathered from public surveying.	• Public Opinion from Surveying
User Experience	The project provides comfortable facilities for people walking and biking.	• Pedestrian Level of Traffic Stress (PLTS) • Bike Level of Traffic Stress (BLTS)
Safety	The project provides safety countermeasures that reduce the frequency of fatal and severe injury crashes and encourage slower speeds, which reduce crash severity.	• Crash Modification Factors (CRFs)
Traffic Operation	*The intersection alternative provides a future year condition which meets City Operating Standards.*	• *City Operating Standards*

Italicized = Only considered for the intersection alternative evaluations

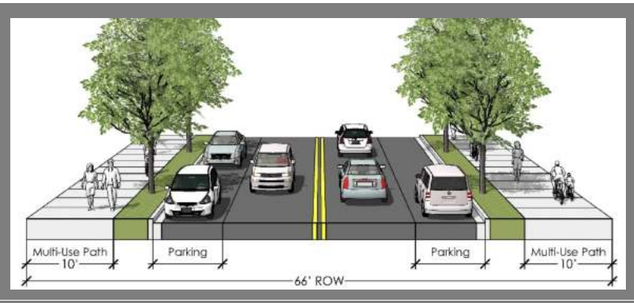
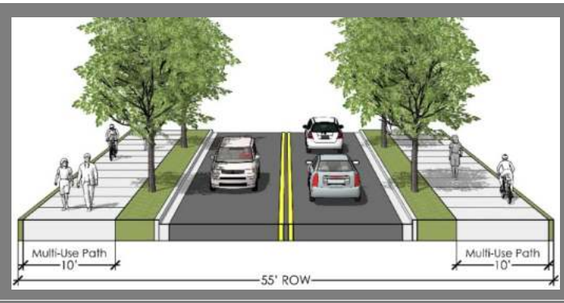
Table 4 shows the city's standard cross-section versus the preferred cross section, as discussed further in the *Tiedeman Avenue Cross Section Alternatives* section. Tables 5, 6 and 7 summarize the evaluation of the cross-section alternatives for Segments 1, 2 and 3, respectively. Segment 4 was not evaluated as the cross section is heavily dependent on the intersection configurations. Table 8 summarizes the evaluation of the intersection alternatives at Tiedeman Avenue/Tigard Street. Table 9 summarizes the evaluation of the intersection alternatives at the Greenburg Road/Tiedeman Avenue and Tiedeman Avenue/North Dakota Street intersections.

Table 4: Evaluation Criteria Scoring – City Standard Cross Section & Preferred Cross Section

Evaluation Criteria	Performance Measures		
		City of Tigard Standard Section (58'-62' ROW): Bike Lane, Landscape Buffer, and Sidewalk (both sides)	**Alternative A4 (55' ROW): Multi-Use Path with Landscape Buffer (both sides)**
Cost & Impacts	Construction Cost	Poor (-1) – Larger roadway footprint	Fair (+0) – Large roadway footprint, but smaller than City Standard Section
	Impacts to Private Property	Poor (-1) – Greater right-of-way impacts at most sections of the corridor	Fair (+0) – Some right-of-way impacts at some sections along the corridor
	Stormwater Management	Fair (+0) – Requires a greater amount of stormwater treatment as Alternative E, but a portion of the stormwater can be treated at the source using landscape buffers for infiltration	Good (+1) – A portion of the stormwater can be treated at the source using landscape buffers for infiltration
	Impacts to Natural Resources (Trees, Waterways, Wetlands)	Poor (-1) – Will likely impact more existing trees than Alternative E	Fair (+0) – Will likely impact some existing trees
	Maintenance	Poor (-1) – More striping and asphalt for maintenance, plus landscape buffer will require maintenance	Fair (+0) – Landscape buffer will require maintenance
	Costs & Impacts Weighted Score	**-4*(1/5) = -0.8**	**+1*(1/5) = +0.2**
Connectivity	Pedestrian Connectivity	Good (+1) – Sidewalk provided on both sides	Good (+1) – Multi-use path provided on both sides
	Bike Connectivity	Good (+1) – Bike Lanes provided on both sides	Good (+1) – Multi-use path provided on both sides
	Trail Connectivity	Good (+1) – Direct connection to trails on both sides	Good (+1) – Direct connection to trails on both sides
	Connectivity Weighted Score	**+3*(1/3) = +1**	**+3*(1/3) = +1**
Community Support	Public Opinion from Surveying	Fair (+0) – While this cross section provides a landscape buffer, it does not provide a buffered bike lane, which was a high priority from the online surveying and open house	Good (+1) – This cross section received the greatest support at the open house and provides a buffered bike facility.
	Property Owner	-	-
	Community Support Weighted Score	**+0*(1) = 0**	**+1*(1) = +1**
User Experience	Bicycle Level of Traffic Stress	Good (+1) – BLTS 3 to BLTS 1 (both sides)	Good (+1) – BLTS 3 to BLTS 1 (both sides)
	Pedestrian Level of Traffic Stress	Good (+1) – PLTS 4 to PLTS 2 (both sides)	Good (+1) – PLTS 4 to PLTS 2 (both sides)
	User Experience Weighted Score	**+2*(1/2) = +1**	**+2*(1/2) = +1**
Safety	**Crash Reduction Factors**	Fair (+0) – Sidewalk = 20%, Street Trees = 10%	Good (+1) – Sidewalk = 20%, Street Trees = 10%, Cycle Track = 59%
	Safety Weighted Score	**+0*(1) = 0**	**+1*(1) = +1**
Overall Weighted Score		**+1.2**	**+4.2**

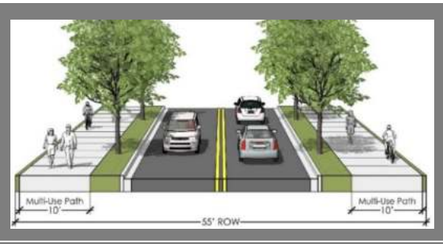
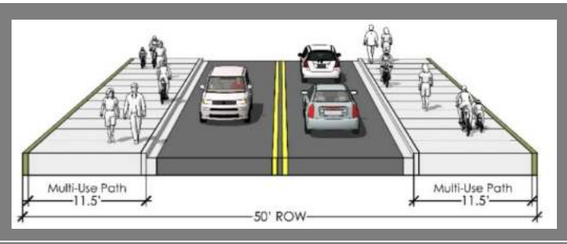
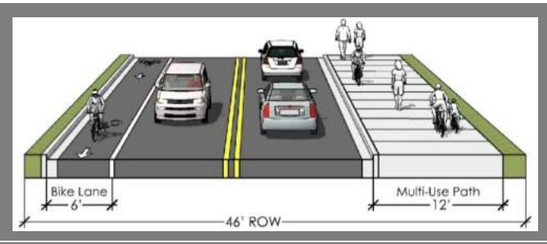
Green = Good, Yellow = Fair, Red = Poor

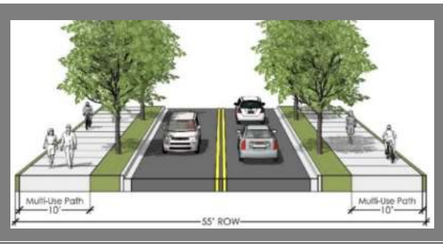
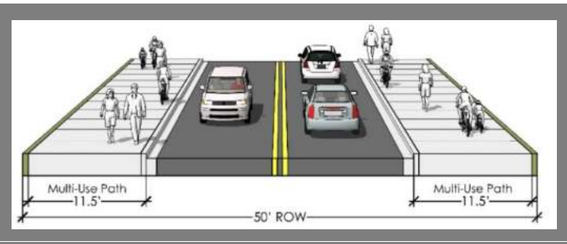
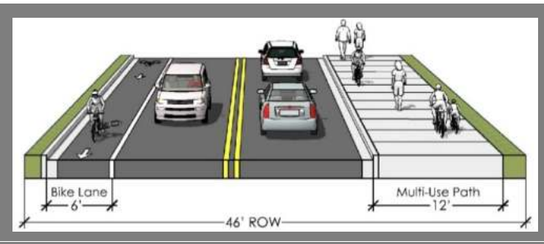
Table 5: Evaluation Criteria Scoring – Tiedeman Avenue Segment 1 (Walnut St to Fanno Creek Bridge) Cross Section Alternatives

Evaluation Criteria	Performance Measures		
		Alternative C1 (66' ROW): Multi-Use Path with Landscape Buffer and Parking Lane (both sides)	**Alternative A4 (55' ROW): Multi-Use Path with Landscape Buffer (both sides)**
Cost & Impacts	Construction Cost	Poor (-1) – Larger roadway footprint	Fair (+0) – Large roadway footprint, but smaller than Alternative X
	Impacts to Private Property	Fair (+0) – Minor ROW impacts	Good (+1) – No ROW impacts
	Stormwater Management	Fair (+0) – Requires a greater amount of stormwater treatment as Alternative E, but a portion of the stormwater can be treated at the source using landscape buffers for infiltration	Good (+1) – A portion of the stormwater can be treated at the source using landscape buffers for infiltration
	Impacts to Natural Resources (Trees, Waterways, Wetlands)	Fair (+0) – Will likely impact few existing trees	Good (+1) – Unlikely to impact existing trees
	Maintenance	Poor (-1) – More striping and asphalt for maintenance, plus landscape buffer will require maintenance	Fair (+0) – Landscape buffer will require maintenance
	Costs & Impacts Weighted Score	**-2*(1/5) = -0.4**	**+3*(1/5) = +0.6**
Connectivity	Pedestrian Connectivity	Good (+1) – Multi-use path provided on both sides	Good (+1) – Multi-use path provided on both sides
	Bike Connectivity	Good (+1) – Multi-use path provided on both sides	Good (+1) – Multi-use path provided on both sides
	Trail Connectivity	Good (+1) – Direct connection to trails on both sides	Good (+1) – Direct connection to trails on both sides
	Connectivity Weighted Score	**+3*(1/3) = +1**	**+3*(1/3) = +1**
Community Support	Public Opinion from Surveying	Good (+1) – Providing parking for Fowler Middle School and Dirksen Park was a priority from the online survey	Fair (+0) – This cross section received the greatest support at the open house and provides a buffered bike facility, but does not provide parking, which was a priority from the online open house
	Property Owner	Fair (+0) – Received no feedback from adjacent property owners	Fair (+0) – Received no feedback from adjacent property owners
	Community Support Weighted Score	**+1*(1/2) = +0.5**	**+0*(1/2) = +0**
Non-Motorized User Experience	Bicycle Level of Traffic Stress	Good (+1) – BLTS 3 to BLTS 1 (both sides)	Good (+1) – BLTS 3 to BLTS 1 (both sides)
	Pedestrian Level of Traffic Stress	Good (+1) – PLTS 4 to PLTS 1 (both sides)	Fair (+0) – PLTS 4 to PLTS 2 (both sides)
	User Experience Weighted Score	**+2*(1/2) = +1**	**+1*(1/2) = +0.5**
Safety	**Crash Reduction Factors**	Good (+1) – Sidewalk = 20%, Street Trees = 10%, Cycle Track = 59%	Good (+1) – Sidewalk = 20%, Street Trees = 10%, Cycle Track = 59%
	Safety Weighted Score	**+1*(1) = +1**	**+1*(1) = +1**
Overall Weighted Score		**+3.1**	**+3.1**

Green = Good, Yellow = Fair, Red = Poor

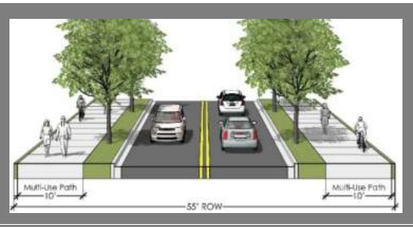
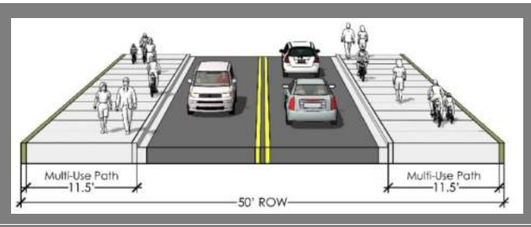
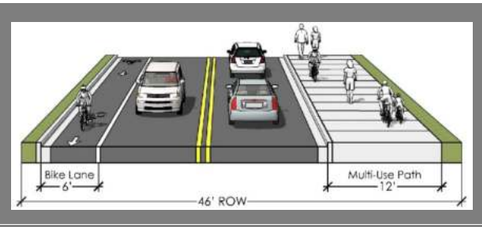
Table 6: Evaluation Criteria Scoring – Tiedeman Avenue Segment 2 (Fanno Creek Bridge to Tigard St) Cross Section Alternatives

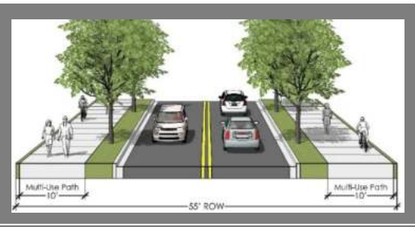
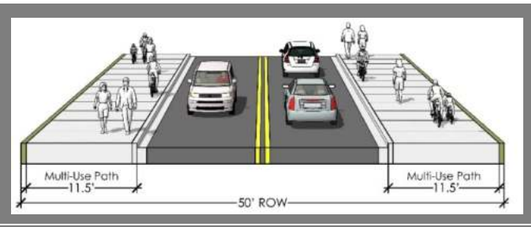
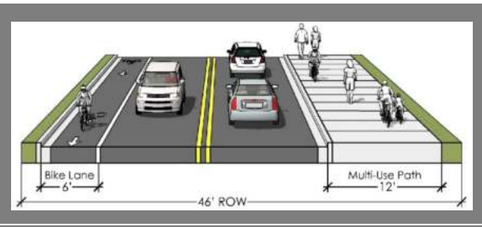
Evaluation Criteria	Performance Measures			
		Alternative A4 (55' ROW): Multi-Use Path with Landscape Buffer (both sides)	**Alternative B2 (50' ROW): Multi-Use Path without Landscape Buffer (both sides)**	**Alternative C2 (42'- 50' ROW): Bike Lane (one side) and Multi-Use Path with buffer (one side)**
Cost & Impacts	Construction Cost	Poor (-1) – Largest roadway footprint	Fair (+0) – Smaller roadway footprint than Alt. E	Good (+1) – Smallest roadway footprint
	Impacts to Private Property	Poor (-1) – Greatest impacts to multiple residential frontages	Fair (+0) – Moderate impacts to multiple residential frontages	Good (+1) – Minimizes impacts to residential frontages
	Stormwater Management	Good (+1) – A portion of the stormwater can be treated at the source using landscape buffers for infiltration	Poor (-1) – Requires the same stormwater treatment as Alt.E, but stormwater must be conveyed to an alternative location for treatment	Fair (+0) – Less impervious area equals reduction in storm water runoff volume compared to Alt E and E1. Omitting or using a one-sided landscape strip provides less opportunity for treatment at the source.
	Impacts to Natural Resources (Trees, Waterways, Wetlands)	Fair (+0) – Will likely impact existing trees	Fair (+0) – Will likely impact existing trees	Good (+1) – Minimizes impacts to existing trees and other resources with a smaller ROW footprint
	Maintenance	Fair (+0) – Landscape buffer will require maintenance	Good (+1) – Low maintenance effort	Fair (+0) – More striping and asphalt for maintenance, plus landscape will require maintenance
	Costs & Impacts Weighted Score	**-1*(1/5) = -0.2**	**0*(1/5) = 0**	**+3 *(1/5) = +0.6**
Connectivity	Pedestrian Connectivity	Good (+1) – Multi-use path provided on both sides	Good (+1) – Multi-use path provided on both sides	Fair (+0) – One sided pedestrian facility
	Bike Connectivity	Good (+1) – Multi-use path provided on both sides	Good (+1) – Multi-use path provided on both sides	Good (+1) – Multi-use path on one side, bike lane on other side.
	Trail Connectivity	Good (+1) – Direct connection to trails on both sides	Good (+1) – Direct connection to trails on both sides	Fair (+0) – One sided pedestrian facility provides a less direct connection to trails
	Connectivity Weighted Score	**+3*(1/3) = +1**	**+3*(1/3) = +1**	**+1*(1/3) = +0.33**
Community Support	Public Opinion from Surveying	Good (+1) – This cross section received the greatest support at the open house and provides a buffered bike facility.	Fair (+0) – The community expressed support for separate bike facilities, but omitting the landscape buffer makes this less desirable than Alt E.	Fair (+0) – The community expressed support for separate bike facilities, but one-sided separated facilities makes this less desirable than Alt E.
	Property Owner	Poor (-1) – Property owners have expressed concern over large roadway footprint and property impacts	Fair (+0) – Property owners acknowledge this option reduces impact but would still like to see a smaller footprint.	Good (+1) – Property owners expressed support for one sided facilities at the open house with the goal of reducing property impacts.
	Community Support Weighted Score	**+0*(1/2) = +0**	**0*(1/2) = 0**	**+1*(1/2) = +0.5**
Non-Motorized User Experience	Bicycle Level of Traffic Stress	Good (+1) – BLTS 3 to BLTS 1 (both sides)	Good (+1) – BLTS 3 to BLTS 1 (both sides)	Good (+1) – Improves BLTS from 3 to 1 (east side and west side)
	Pedestrian Level of Traffic Stress	Good (+1) – PLTS 4 to PLTS 2 (both sides)	Good (+1) – PLTS 4 to PLTS 2 (both sides)	Fair (+0) – Improves PLTS from 4 to 2 (east side) and remains PLTS 4 (west side)
	User Experience Weighted Score	**+2*(1/2) = +1**	**+2*(1/2) = +1**	**+1*(1/2) = +0.5**

Evaluation Criteria	Performance Measures			
		Alternative A4 (55' ROW): Multi-Use Path with Landscape Buffer (both sides)	**Alternative B2 (50' ROW): Multi-Use Path without Landscape Buffer (both sides)**	**Alternative C2 (42'- 50' ROW): Bike Lane (one side) and Multi-Use Path with buffer (one side)**
Safety	**Crash Reduction Factors**	Good (+1) – Sidewalk = 20%, Street Trees = 10%, Cycle Track = 59%	Fair (+0) – Sidewalk = 20%, Cycle Track = 59%	Fair (+0) – Sidewalk = 20%, Street Trees = 10%, Bike Lane = 36%, Cycle Track = 59%
	Safety Weighted Score	**+1*(1) = 1**	**+0*(1) = +0**	**+0*(1) = +0**
Overall Weighted Score		**+2.8**	**+2.0**	**+1.93**

Green = Good, Yellow = Fair, Red = Poor

Table 7: Evaluation Criteria Scoring – Tiedeman Avenue Segment 3 (Tigard St to North Dakota St) Cross Section Alternatives

Evaluation Criteria	Performance Measures			
		Alternative A4 (55' ROW): Multi-Use Path with Landscape Buffer (both sides)	**Alternative B2 (50' ROW): Multi-Use Path without Landscape Buffer (both sides)**	**Alternative C2 (42'- 50' ROW): Bike Lane (one side) and Multi-Use Path with variable buffer (one side)**
Cost & Impacts	Construction Cost	Poor (-1) – Largest roadway footprint	Fair (+0) – Smaller roadway footprint than Alt. E	Good (+1) – Smallest roadway footprint
	Impacts to Private Property	Fair (+0) – Minor impacts to commercial properties	Good (+1) – Minor to no impacts to commercial properties	Good (+1) – Minor to no impacts to commercial properties
	Stormwater Management	Good (+1) – A portion of the stormwater can be treated at the source using landscape buffers for infiltration	Poor (-1) – Requires the same stormwater treatment as Alt. E, but stormwater must be conveyed to an alternative location for treatment	Fair (+0) – Less impervious area equals a reduction in storm water runoff volume compared to alternatives E and E1. Although omitting or using a one-sided landscape strip provides less opportunity on treatment at the source.
	Impacts to Natural Resources (Trees, Waterways, Wetlands)	Fair (+0) – Will likely impact few existing trees	Good (+1) – Minimizes impacts to existing trees and other resources with a smaller ROW footprint	Good (+1) – Minimizes impacts to existing trees and other resources with a smaller ROW footprint
	Maintenance	Fair (+0) – Landscape buffer will require maintenance	Good (+1) – Low maintenance effort	Fair (+0) – More striping and asphalt for maintenance, plus landscape will require maintenance
	Costs & Impacts Weighted Score	**0*(1/5) = 0**	**2*(1/5) = +0.4**	**+3 *(1/5) = +0.6**
Connectivity	Pedestrian Connectivity	Good (+1) – Multi-use path provided on both sides	Good (+1) – Multi-use path provided on both sides	Fair (+0) – One sided pedestrian facility
	Bike Connectivity	Good (+1) – Multi-use path provided on both sides	Good (+1) – Multi-use path provided on both sides	Good (+1) – Multi-use path on one side, bike lane on other side.
	Trail Connectivity	Good (+1) – Direct connection to trails on both sides	Good (+1) – Direct connection to trails on both sides	Fair (+0) – One sided pedestrian facility provides a less direct connection to trails
	Connectivity Weighted Score	**+3*(1/3) = +1**	**+3*(1/3) = +1**	**+1*(1/3) = +0.33**
Community Support	Public Opinion from Surveying	Good (+1) – This cross section received the greatest support at the open house and provides a buffered bike facility.	Fair (+0) – The community expressed support for separate bike facilities, but omitting the landscape buffer makes this less desirable than Alt E.	Fair (+0) – The community expressed support for separate bike facilities, but one-sided separated facilities makes this less desirable than Alt E.
	Property Owner	Fair (+0) – Received no feedback from adjacent property owners	Fair (+0) – Received no feedback from adjacent property owners	Fair (+0) – Received no feedback from adjacent property owners
	Community Support Weighted Score	**+1*(1/2) = +0.5**	**+0*(1/2) = 0**	**+0*(1/2) = 0**
Non-Motorized User Experience	Bicycle Level of Traffic Stress	Good (+1) – BLTS 3 to BLTS 1 (both sides)	Good (+1) – BLTS 3 to BLTS 1 (both sides)	Good (+1) – Improves BLTS from 3 to 1 (east side and west side)
	Pedestrian Level of Traffic Stress	Good (+1) – PLTS 4 to PLTS 2 (both sides)	Good (+1) – PLTS 4 to PLTS 2 (both sides)	Fair (+0) – Improves PLTS from 4 to 2 (east side) and remains PLTS 4 (west side)
	User Experience Weighted Score	**+2*(1/2) = +1**	**+2*(1/2) = +1**	**+1*(1/2) = +0.5**

Evaluation Criteria	Performance Measures			
		Alternative A4 (55' ROW): Multi-Use Path with Landscape Buffer (both sides)	**Alternative B2 (50' ROW): Multi-Use Path without Landscape Buffer (both sides)**	**Alternative C2 (42'- 50' ROW): Bike Lane (one side) and Multi-Use Path with variable buffer (one side)**
Safety	**Crash Reduction Factors**	Good (+1) – Sidewalk = 20%, Street Trees = 10%, Cycle Track = 59%	Fair (+0) – Sidewalk = 20%, Cycle Track = 59%	Fair (+0) – Sidewalk = 20%, Street Trees = 10%, Bike Lane = 36%, Cycle Track = 59%
	Safety Weighted Score	**+1*(1) = +1**	**+0*(1) = +0**	**+0*(1) = +0**
Overall Weighted Score		**+3.5**	**+2.4**	**+1.53**

Green = Good, Yellow = Fair, Red = Poor

Table 8: Evaluation Criteria Scoring – Tiedeman Avenue / Tigard Street Intersection Alternatives

Evaluation Criteria	Performance Measures	Alternative 1: No Build (Ped/bike facilities only)	Alternative 2: AWSC w/ NB & SB Left-Turn Lanes	Alternative 3: Traffic Signal	Alternative 4: Traffic Signal w/ NB & SB Left-Turn Lanes	Alternative 5: Traffic Signal w/ NB & SB Left-Turn Lanes and WBR Removal	Alternative 6: Roundabout
Cost & Impacts	Construction Cost	Good (+1) – Smallest footprint with lowest cost	Fair (+0) – Larger footprint to add NB & SB left-turn lanes will be more costly than Alt 1.	Good (+1) – Same smaller footprint as Alt 1, but the signal will add some cost.	Fair (+0) – Cost of traffic signal, plus larger footprint than Alterative 1 and 3	Fair (+0) – Cost of traffic signal, plus larger footprint than Alternatives 1 and 3	Poor (-1) – Largest footprint and construction cost
	Impacts to Private Property	Good (+1) – Least impacts to properties	Fair (+0) – Minor property impacts	Good (+1) – Least impacts to properties	Fair (+0) – Minor property impacts	Fair (+0) – Minor property impacts	Poor (-1) – Greatest property impacts
	Impacts to Natural Resources (Trees, Waterways, Wetlands)	Good (+1) – Smaller footprint minimizes impacts	Fair (+0) – Larger footprint will impact more trees	Good (+1) – Smaller footprint minimizes impacts	Fair (+0) – Larger footprint will impact more trees	Fair (+0) – Larger footprint will impact more trees	Fair (+0) – Larger footprint will impact more trees
	Maintenance	Good (+1) – Stop-controlled intersections typically require very little maintenance.	Good (+1) – Stop-controlled intersections typically require very little maintenance.	Fair (+0) – Traffic signals require regular maintenance and re-timing effort.	Fair (+0) – Traffic signals require regular maintenance and re-timing effort.	Fair (+0) – Traffic signals require regular maintenance and re-timing effort.	Good (+1) – Roundabouts typically require very little maintenance, especially when the central island does not have landscaping
	Costs & Impacts Weighted Score	**+4*(1/4) = +1**	**+1*(1/4) = +0.25**	**+3*(1/4) = +0.75**	**+0*(1/4) = 0**	**+0*(1/4) = 0**	**-1*(1/4) = -0.25**
Community Support	Public Opinion from Surveying	Good (+1) – Alternative received positive responses at the open house	Fair (+0) – Alternative received neutral responses at the open house	Fair (+0) – Alternative received neutral responses at the open house	Fair (+0) – Alternative received neutral responses at the open house	Fair (+0) – Alternative received neutral responses at the open house	Good (+1) – Alternative received positive responses at the open house
	Community Support Weighted Score	**+1*(1) = +1**	**+0*(1) = 0**	**+0*(1) = 0**	**+0*(1) = 0**	**+0*(1) = 0**	**+1*(1) = +1**
Safety	Crash Reduction Factors	Fair (+0) – Curb extensions = 30%	Fair (+0) – Curb extensions = 30%	Good (+1) – Curb extensions = 30%, Traffic Signal = 44%	Good (+1) – Curb extensions = 30%, Traffic Signal & Left Turn Lanes = 61%,	Good (+1) – Curb extensions = 30%, Traffic Signal & Left Turn Lanes = 61%,	Good (+1) – Roundabout = 82%
	Safety Weighted Score	**+0*(1) = 0**	**+0*(1) = 0**	**+1*(1) = +1**	**+1*(1) = +1**	**+1*(1) = +1**	**+1*(1) = +1**
Traffic Operations	City Operating Standards	Poor (-1) – Overcapacity during the PM peak hour for future 2040 traffic conditions	Fair (+0) – LOS D for future 2040 traffic conditions	Good (+1) – LOS B for future 2040 traffic conditions	Good (+1) – LOS B for future 2040 traffic conditions	Good (+1) – LOS B for future 2040 traffic conditions	Good (+1) – LOS B for future 2040 traffic conditions
	Traffic Operations Weighted Score	**-1*(1) = -1**	**+0*(1) = 0**	**+1*(1) = +1**	**+1*(1) = +1**	**+1*(1) = +1**	**+1*(1) = +1**
Overall Weighted Score		**+1**	**+0.25**	**+2.75**	**+2**	**+2**	**+2.75**

Green = Good, Yellow = Fair, Red = Poor

Table 9: Evaluation Criteria Scoring – Greenburg Road / Tiedeman Avenue / North Dakota Street Intersection Alternatives

Evaluation Criteria	Performance Measures	Alternative 1: No Build (Ped/bike facilities only)	Alternative 2: Improved TWSC w/ EB Right-Turn Lane	Alternative 3: Improved TWSC w/ Restricted EB Left-Turns	Alternative 4: Traffic Signal (Coordinated w/ Greenburg Road Signal)	Alternative 5: Dogbone Roundabout
Costs & Impacts	Construction Cost	Good (+1) – Smallest footprint with lowest cost	Fair (+0) – Larger footprint for EB right-turn lanes will be more costly than Alt 1.	Good (+1) – Small footprint with added cost for EB left-turn restriction	Poor (-1) – Similar footprint to Alt. 1, but the signal will add some cost	Poor (-1) – Largest footprint, greatest cost project
	Impacts to Private Property	Good (+1) – Minor impacts to commercial properties	Fair (+0) – Minor impacts to commercial properties, but more significant than Alt. 1	Fair (+0) – Minor impacts to commercial properties, but more significant than Alt. 1	Good (+1) – Minor impacts to commercial properties	Poor (-1) – Major impacts
	Impacts to Natural Resources (Trees, Waterways, Wetlands)	Good (+1) – Smaller footprint minimizes impacts	Fair (+0) – Greater footprint than Alt. 1 likely to have tree impacts	Good (+1) – Smaller footprint minimizes impacts	Good (+1) – Smaller footprint minimizes impacts	Fair (+0) – Large footprint will likely have tree impacts
	Maintenance	Good (+1) – Stop-controlled intersections typically require very little maintenance.	Good (+1) – Stop-controlled intersections typically require very little maintenance.	Good (+1) – Stop-controlled intersections typically require very little maintenance.	Fair (+0) – Traffic signals require regular maintenance and re-timing effort.	Good (+1) – Roundabouts typically require very little maintenance.
	Compatibility with Alternatives at Other Locations	TBD	TBD	TBD	TBD	TBD
	Costs & Impacts Weighted Score	**+4*(1/4) = +1**	**+1*(1/4) = +0.25**	**+3*(1/4) = +0.75**	**+1*(1/4) = +0.25**	**-1* (1/4) = -0.25**
Community Support	Public Opinion from Surveying	Fair (+0) – Received neutral feedback at open house	Fair (+0) – Received neutral feedback at open house	Poor (-1) – Restricting the EB left-out raised concerns with some of the community	Fair (+0) – Received neutral feedback at open house	Good (+1) – Roundabout received positive feedback at open house
	Community Support Weighted Score	**+0*(1) = 0**	**+0*(1) = 0**	**-1*(1) = -1**	**+0*(1) = 0**	**+1*(1) = +1**
Safety	Crash Reduction Factors	Fair (+0) – Enhanced crossing = 20%	Fair (+0) – Enhanced crossing = 20%	Good (+1) – Enhanced crossing = 20%, Left-turn Lane=33%	Good (+1) – Enhanced crossing = 20%, Traffic Signal = 44%	Good (+1) – Roundabout = 82%
	Safety Weighted Score	**+0*(1) = 0**	**+0*(1) = 0**	**+1*(1) = +1**	**+1*(1) = +1**	**+1*(1) = +1**
Traffic Operations	City Operating Standards	Poor (-1) – LOS F for future year 2040 traffic conditions	Poor (-1) – LOS F for future year 2040 traffic conditions	Good (+1) – LOS C for future 2040 traffic conditions	Good (+1) – LOS B for future 2040 traffic conditions	Poor (-1) – LOS F for future 2040 traffic conditions
	Traffic Operations Weighted Score	**-1*(1) = -1**	**-1*(1) = -1**	**+1*(1) = +1**	**+1*(1) = +1**	**+0*(1) = -1**
Overall Weighted Score		**0**	**-0.75**	**+1.75**	**+2.25**	**+0.75**

Green = Good, Yellow = Fair, Red = Poor

The preferred segment alternatives carried forward to the 30% design are listed below. Note these represent the standard cross sections for each segment, however variations are likely due to intersection transitions, final parking locations, available right-of-way, or other existing conditions.

- Segment #1: Walnut Street to Fanno Creek Bridge
    - Alternative C1 (66' ROW): Multi-Use Path with Landscape Buffer and Parking Lane (both sides
- Segment #2: Fanno Creek Bridge to Tigard Street
    - Alternative B2 (50' ROW): Multi-Use Path without Landscape Buffer (both sides)
- Segment #3: Tigard Street to Railroad Tracks
    - Alternative A4 (55' ROW): Multi-Use Path with Landscape Buffer (both sides)
- Segment #4: Railroad Tracks to Greenburg Road
    - Alternative A4 (55' ROW): Multi-Use Path with Landscape Buffer (both sides)

The preferred intersection alternatives, determined based on overall weighted score, public feedback, and feasibility include:

- Tiedeman Avenue/Tigard Street Intersection
    - Alternative 5: Traffic Signal w/ NB & SB Left-Turn Lanes and WBR Removal
    - Alternative 6: Roundabout
- Greenburg Road / Tiedeman Avenue / North Dakota Street Intersection
    - Alternative 4: Traffic Signal (Coordinated w/ Greenburg Road Signal)

The 10% concept design with the preferred segment and intersection alternatives listed above can be found in Attachment I.

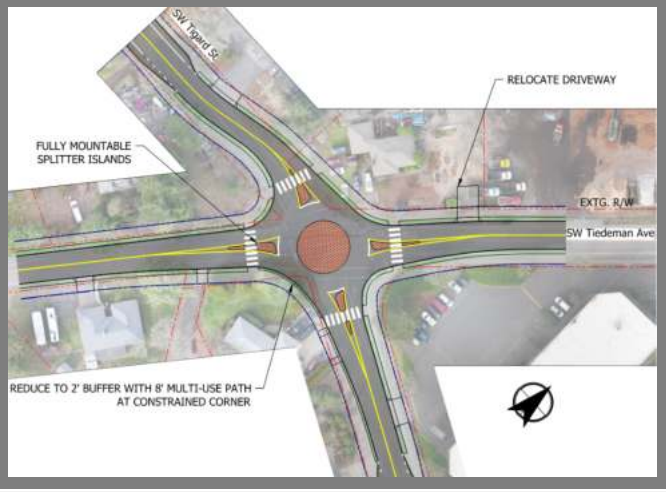
A VISSIM model was created to further understand the operations and interactions between the closely spaced signalized intersections at Greenburg Road / Tiedeman Avenue and Tideman Avenue / North Dakota Street. Operations are projected to be worse at the Tideman Avenue / North Dakota Street intersection in the VISSIM analysis compared to the previous Synchro analysis due to how the signal timing was adjusted for coordination with the signal at Greenburg Road; however, the traffic signal alternative for North Dakota Street was still found to be feasible and was progressed to 30% design. The results of the VISSIM model are provided in Attachment H.

Table 10 provides a detailed comparison of the Tiedeman Avenue / Tigard Street intersection alternatives at the 10% concept level design.

Tiedeman Avenue/Tigard Street Intersection

Alternatives 5 and 6 were both advanced for the Tideman Avenue/Tigard Street intersection to 30% design. Table 10 summarizes the key differences between the two alternatives at the conclusion of the 10% design phase.

Table 10: Tiedeman Avenue / Tigard Street – Intersection 10% Concept Alternatives Comparison

Alternative 5: Traffic Signal w/ NB & SB Left-Turn Lanes and WBR Removal	Alternative 6: Roundabout
	
PROS: ■ Improves 2040 intersection operations from V/C=1.04 (LOS E) to V/C=0.49 (LOS B) during the PM peak hour ■ Improves existing skew at Tigard Street ■ Removal of WBR turn lane shortens east leg pedestrian crossing	**PROS:** ■ Improves 2040 intersection operations from V/C=1.04 (LOS E) to V/C=0.55 (LOS B) during the PM peak hour ■ Very low vehicle queues of 100 feet or less ■ Best crash reduction potential for vehicles ■ Received the most positive feedback during the open house
CONS: ■ Longer 2040 AM and PM peak hour 95th percentile queueing at the eastbound and westbound approach, including: • EB=175' (AM) • WB= 150 (AM) 250' (PM) ■ ROW impacts, but less than Alt. 6* ■ Driveway connections near intersection are challenging but feasible ■ Reduces WBR turn radius for trucks	**CONS:** ■ Requires greater ROW impacts including setback damages* ■ Requires narrowing the multi-use path at constrained corners ■ Driveway connections will be challenging. Property owner may lose access to their garage. ■ Pedestrian crossings are yield controlled

*Specific ROW impacts were determined during the 30% design process

Both intersection alternatives for the Tiedeman Avenue / Tigard Street intersection (Alternatives 5 and 6) were evaluated based on the 30% designs to compare the difference in right-of-way impacts, provide a cost comparison for the two alternatives, and understand overall feasibility. The additional information from the 30% design includes:

- The 30% design cost estimate for the total Tiedeman Avenue Multimodal Study project is $40,230,250 with a traffic signal at Tiedeman Avenue / Tigard Street and $40,029,840 with a roundabout at Tiedeman Avenue / Tigard Street, a difference of $200,410, which is negligible given the overall project cost.
- The traffic signal alternative requires approximately 3,486 SF more right-of-way acquisition than the roundabout. However, the roundabout includes more significant right-of-way impacts to two properties. These impacts may result in property line setback damages and the loss of use of a garage. Ten properties are within the influence area of the intersection and would be impacted by either design. A comparison of the property impacts is provided in Table 11.

Table 11: Tiedeman Avenue / Tigard Street Intersection Alternatives 30% Design Right-of-Way Comparison

Taxlot ID	Acquisition Type	Traffic Signal (SF)	Roundabout (SF)	Difference (Traffic Signal - Roundabout) (SF)
1S134DD_1200	Residential Right-of-Way	591	430	161
	Public Utility Easement	2110	2116	-6
1S134DD_1100	Residential Right-of-Way	3,652	1,292	2,360
	Public Utility Easement	9,594	10,839	-1,245
1S134DD_102	Commercial Right-of-Way	2,702	2,879	-177
1S135CB_500	Commercial Right-of-Way	3,169	2,543*	626
	Public Utility Easement	967	883	84
1S135CB_400	Commercial Right-of-Way	990	0	990
	Public Utility Easement	1618	1612	6
1S135CB_600	Commercial Right-of-Way	2,942	2,332	610
1S135CC_4700	Residential Right-of-Way	100	1,141**	1,041
1S135CC_200	Residential Right-of-Way	72	210	-138
1S135CC_400	Residential Right-of-Way	193	832	-819
1S135CC_500	Residential Right-of-Way	688	695	-7
Total		**29,388**	**24,120**	**3,486**

*Proposed ROW acquisition would result in a violation of building setback requirements defined in the City of Tigard Municipal Code. The project would be responsible for paying for damages associated with the code violation.
**Proposed ROW acquisition would result in a loss of use of garage. The project would be responsible for paying for damages associated with the loss of use.

The evaluation criteria were revisited after the 30% design was complete to help select the preferred intersection alternative. Table 12 provides a summary of the updated evaluation criteria scoring.

Table 12: 30% Design Evaluation Criteria Scoring – Tiedeman Avenue / Tigard Street Intersection Alternatives

Evaluation Criteria	Performance Measures	Alternative 5: Traffic Signal w/ NB & SB Left-Turn Lanes and WBR Removal	Alternative 6: Roundabout
Cost & Impacts	Construction Cost	Fair (+0) – Difference in cost of total project with traffic signal or roundabout is negligible.	Fair (+0) – Difference in cost of total project with traffic signal or roundabout is negligible.
	Impacts to Private Property	Fair (+0) – The signal has slightly greater total right-of-way impacts (in SF) but the overall impacts to individual properties is minimal.	Poor (-1) –The roundabout has slightly less total right-of-way impacts (in SF), the impacts to one property are significant and may require setback violations or loss of garage use.
	Impacts to Natural Resources (Trees, Waterways, Wetlands)	Fair (+0) – The traffic signal and roundabout intersection footprints are similar and will have similar impact to trees.	Fair (+0) – The traffic signal and roundabout intersection footprints are similar and will have similar impact to trees.
	Maintenance	Fair (+0) – Traffic signals require regular maintenance and re-timing effort.	Good (+1) – Roundabouts typically require very little maintenance, especially when the central island does not have landscaping
	Costs & Impacts Weighted Score	**+0*(1/4) = 0**	**0*(1/4) = 0**
Community Support	Public Opinion from Surveying	Fair (+0) – Alternative received neutral responses at the open house	Good (+1) – Alternative received positive responses at the open house
	Community Support Weighted Score	**+0*(1) = 0**	**+1*(1) = +1**
Safety	Crash Reduction Factors	Good (+1) – Curb extensions = 30%, Traffic Signal & Left Turn Lanes = 61%,	Good (+1) – Roundabout = 82%
	Speed Reduction	Fair (+0) – The traffic signal does not offer speed reduction benefits through the intersection, especially during off-peak hours when the signal may sit on green for the mainline.	Good (+1) – Roundabouts provide speed management by forcing slower speeds through the roadway geometry.
	Safety Weighted Score	**+1*(1/2) = +0.5**	**+2*(1/2) = +1**
Traffic Operations	City Operating Standards	Good (+1) – LOS B for future 2040 traffic conditions	Good (+1) – LOS B for future 2040 traffic conditions
	Traffic Operations Weighted Score	**+1*(1) = +1**	**+1*(1) = +1**
Overall Weighted Score		**+1.5**	**+3.0**

The Roundabout was determined to be the preferred intersection alternative due to the overall weighted score, public feedback, and conversations with City staff. However, the Traffic Signal remains a viable option. The final intersection configuration will be determined when funding for the project is identified and it advances to final design. Right-of-way options and utility conflicts will also be evaluated further at that time.

Attachments

Attachment A: November 2022 Field Visit Notes
Attachment B: Traffic Analysis Memorandum
Attachment C: Preliminary Intersection Alternatives Sketches
Attachment D: Intersection Design Concepts
Attachment E: Federal, State, and Local Regulatory Requirements Memorandum
Attachment F: Drainage Design Memorandum
Attachment G: Tiedeman Avenue Tree Inventory
Attachment H: VISSIM Analysis
Attachment I: 10% Concept Design