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TECHNICAL MEMORANDUM #2

Date: September 29, 2021 Project #: 23021.015

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Karla Antonini; City of Hillsboro

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Project: OR 8: SW Adams Ave. SE 10th Ave and SE Baseline – SE Maple St. (K18004)

Subject: **TM #2: Transportation Existing Conditions and Future No-Build**

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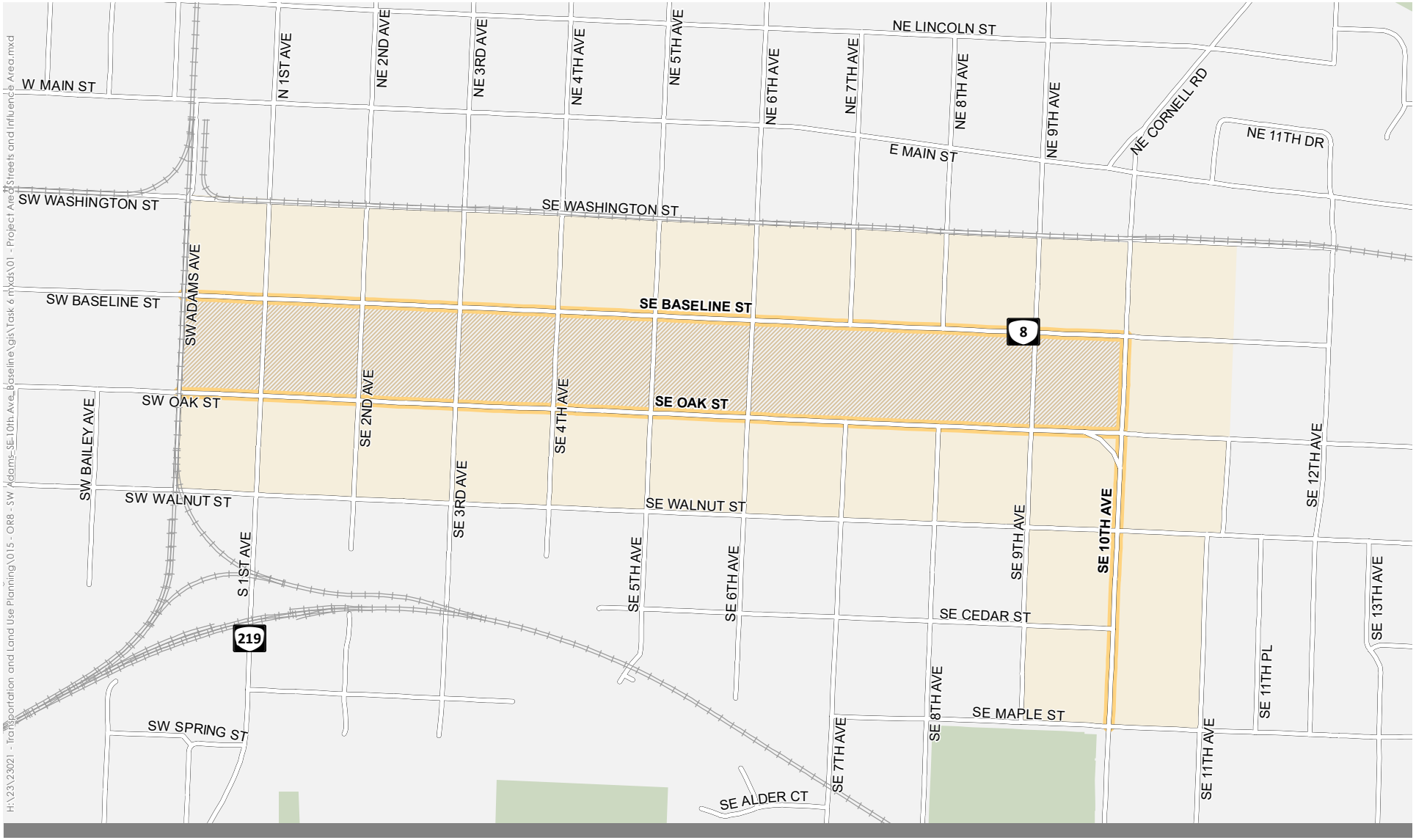
PURPOSE

This memorandum summarizes the existing and future no-build conditions on Oak Street and Baseline Street (between Adams Street and 10th Avenue) and 10th Avenue (between Baseline Street and Maple Street). The existing and planned active transportation system, including facilities for people walking, biking, and taking transit, and the existing and future no-build vehicular system, including freight and passenger vehicle facilities, traffic analysis, and parking, were evaluated. Based on this evaluation, this memorandum identifies gaps, deficiencies, and related concerns within the existing and future no-build transportation system.

- A gap is defined as a missing link in the network, such as a walking or biking route that is missing sidewalk or bicycle facility.
- A deficiency is defined as a facility that does not meet the standard or is insufficient to meet the users' needs, for example locations with pedestrian ramps that do not meet Americans with Disabilities Act (ADA) standards, poor transit accessibility, or an intersection that is operating over capacity based on its mobility target.
- A related concern is a factor contributing to greater risk, such as locations identified in the top 40% of the statewide pedestrian and bicycle systemic safety risk.

PROJECT STUDY AREA

The OR 8: SW Adams Ave. SE 10th Ave and SE Baseline – SE Maple St. (OR 8: Oak/Baseline/10th Avenue Corridor Study) project area is located within downtown Hillsboro, which is targeted for high-density job growth and residential/mixed-use development with a high-capacity transit station-area character. The project area focuses on Oak Street, Baseline Street, and 10th Avenue. The influence area considers the adjacent area within a one-block radius, as shown in Figure 1.



Project Area Streets

Project Area

Influence Area

Parks and Open Spaces

0 500 Feet

Figure 1

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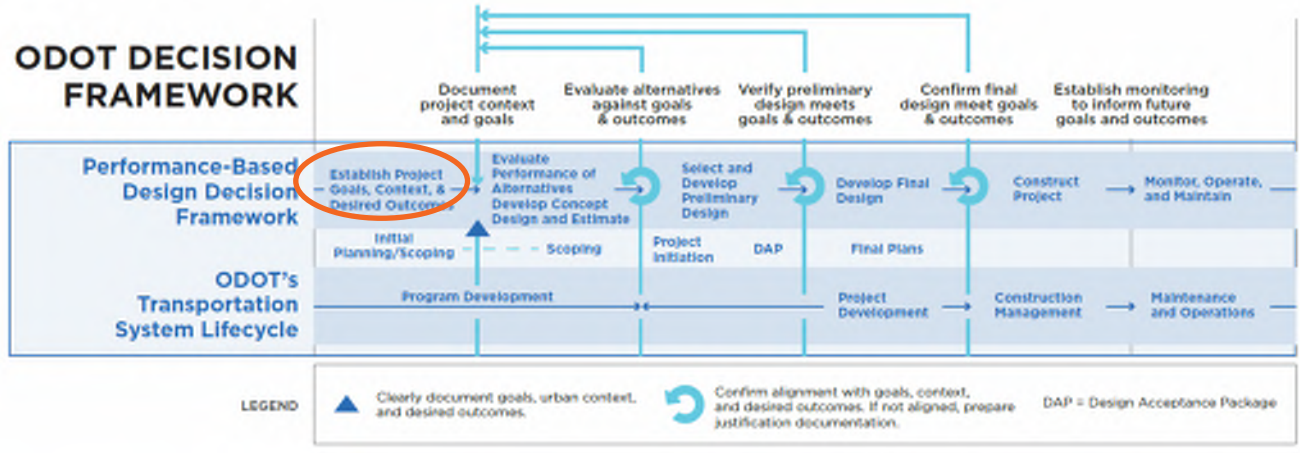
Project Area and Influence Area
Hillsboro, Oregon

Blueprint for Urban Design

The Oregon Department of Transportation (ODOT) Blueprint for Urban Design (BUD – Reference 1) establishes guiding principles and design considerations for state highways based on the adjacent urban context of the roadway. As identified in ODOT's Decision Framework (Figure 2), the initial step in the performance-based approach is to establish project goals, context, and desired outcomes.

Figure 2: A Performance-Based Approach to ODOT Project Flow



As further summarized in Figure 2, it is essential to "clearly document goals, urban context, and desired outcomes" before moving on to evaluating the performance of alternatives and the development of concept design and estimates.

Prior establishing the urban context for OR 8 Oak/Baseline 10th Avenue, a Corridor Vision was drafted and informed by adopted City planning documents[1], community input, and OR 8 stakeholder interviews. The Corridor Vision for OR 8: Oak/Baseline/10th Avenue has informed the selection of the urban context for OR 8 (Reference 2).

The OR 8: Oak/Baseline/10th Avenue Corridor Study will follow the guidance provided in the BUD to identify existing and future gaps and deficiencies and inform multimodal facility selection.

OR 8: Oak/Baseline/10th – Urban Context

The urban context for OR 8 (Oak Street, Baseline Street, and 10th Avenue) was informed by the guiding principles, goals, and objectives summarized in City planning documents, including the City of Hillsboro Downtown Framework Plan (Reference 3), City of Hillsboro Transportation System Plan (TSP) (Reference 4), and Hillsboro 2035 Community Plan (Reference 5).

[1] City of Hillsboro Downtown Framework Plan, City of Hillsboro Transportation System Plan, City of Hillsboro 2035 Community Plan, City of Hillsboro Comprehensive Plan.

The Project Management Team (PMT) selected ***Traditional Downtown/Central Business District (CBD)*** as the BUD context for the OR 8 (Oak Street, Baseline Street, and 10th Avenue) project. This selection was informed by existing and future desired contexts, ODOT's recommended urban context for the OR 8 corridor, review of City planning documents, and the draft Oak/Baseline/10th Avenue Corridor Vision Statement.

Traditional Downtown/Central Business District Description – Blueprint for Urban Design

The following is an excerpt from the Blueprint for Urban Design:

"Traditional Downtown/Central Business District*: To best serve all users, vehicle speeds should be 25 mph or below, and higher levels of congestion are expected. Transit stops should be placed at frequent intervals, and transit priority treatments can help with transit mobility, even in congested conditions. Bicycle and pedestrian facilities should be relatively wide and comfortable to serve anticipated users. Curbside uses are important and may include loading/unloading, parking (vehicles, bicycles, etc.), and other uses. Landscaping and street trees, following ODOT placement and spacing guidelines, are appropriate in this context."*

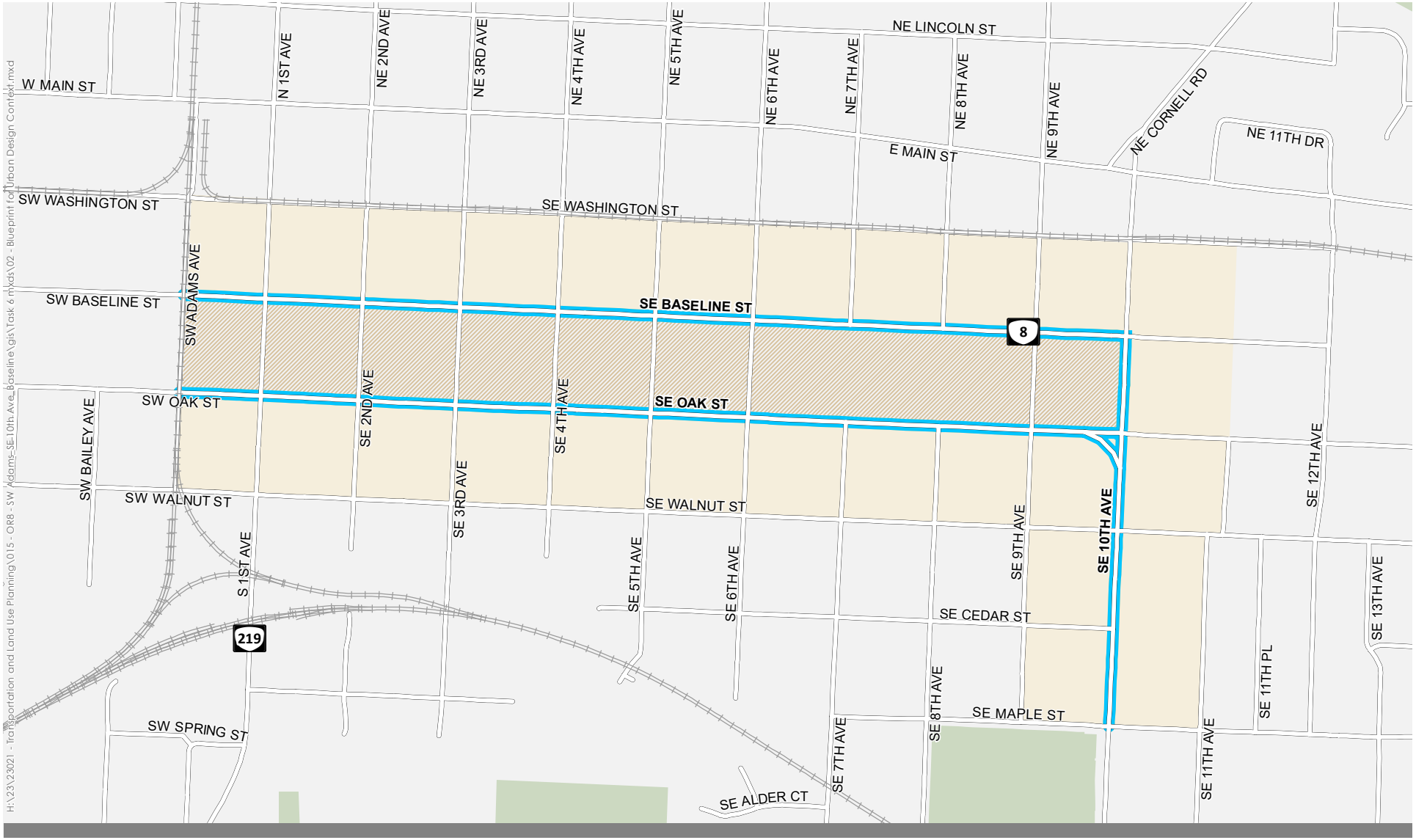
Table 1 summarizes the general modal considerations for the Traditional Downtown/Central Business District context as identified in the ODOT BUD (Reference 1).

Table 1: Traditional Downtown/Central Business District – General Modal Considerations

Motorist	Freight	Transit	Bicyclist	Pedestrian
Low	Low	High	High	High

Figure 3 illustrates the OR 8 (Oak Street, Baseline Street, and 10th Avenue) urban design context extents.

Appendix A includes a summary of information discussed with the PMT to establish an urban context.



Traditional Downtown/Central Business District

Project Area

Influence Area

Parks and Open Spaces

0 500 Feet

Figure 3

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Blueprint for Urban Design Context
Hillsboro, Oregon

EXISTING ACTIVE TRANSPORTATION SYSTEM

The following section provides an inventory of the existing active transportation system. Active transportation is defined as human powered modes of transportation, including walking, biking, rolling, and accessing transit. The City and ODOT provided an inventory of the existing active transportation system including walking, biking, rolling, and transit infrastructure and amenities. Gaps and deficiencies are identified where, according to ODOT and/or City data, infrastructure is constrained or does not meet the City's, ODOT, or Americans with Disabilities Act (ADA) requirements.

Table 2 provides a summary of guidance for active transportation facilities based on the ODOT BUD (BUD, Reference 1) and Highway Design Manual (HDM, Reference 6). Where there are discrepancies between guidance provided in the BUD and the HDM, the project will follow the context-sensitive guidance of the BUD. Additional detail about guidance and existing facilities along Oak Street, Baseline Street, and 10th Avenue is provided in the following sections.

Table 2: Summary of Facility Guidance for Active Transportation Facilities

Facility	BUD Guidance[1]	HDM Guidance	Other Guidance
Sidewalk	• Sidewalks should provide ample space for sidewalk activity (e.g., sidewalk cafes, transit, shelters).	• Standard width for sidewalks is six feet; minimum clear width is four feet. Within CBDs, the standard width of sidewalks is 10 feet.	
Crosswalk	• The target pedestrian crossing spacing range is 250 to 550 feet (one-two blocks).	• Urban state highways should provide a safe and convenient pedestrian crossing no less frequent than every quarter mile. • Crossing improvements should be no closer than 300 feet from the nearest signalized crosswalk.	
Bulb-Outs	• Bulb-outs are recommended within the transition realm. • They are recommended for target speed areas up to 30 mph within urban areas.	• Curb extensions are used in conjunction with on-street parking. • Mid-block curb extensions may be considered where pedestrians frequently cross between midblock generators on both sides of the road.	
Pedestrian Ramps	• No specific guidance is provided.	• The HDM refers to the ADA Standards for Accessible Design and the Public Right-Of-Way Accessibility Guidelines (PROWAG) for providing facilities that people with limited mobility and sight can use.	• The ramp design must meet specific criteria related to width, length, cross-slope, running slope, warning features, and transitions. (PROWAG, Reference 7) • ODOT has created state standards and specifications for the design and construction of ADA curb ramps that comply with the 2011 Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way.
Bike Lanes	• Start with wide, separated bicycle facilities and consider roadway characteristics to establish the width of the facilities.	• Bike lanes are recommended along urban and suburban roadways where traffic volumes greater than 1,500 ADT and traffic speeds greater than 20 miles per hour. • The level of physical separation between the biking facilities and the vehicle travel lanes is dependent on the speed and volume of vehicle traffic.	
Shared Lane Markings ("Sharrows")	• Shared lanes should only be used where operating speeds are 25 mph or lower. • Since not all bicyclists are comfortable sharing a lane with traffic, a project team can also look beyond the roadway in question and consider the larger network in developing alternatives	• Recommended context for sharrows is along roadways with traffic volumes less than 1,500 ADT or with speeds less than 20 mph.	
Transit Stops and Amenities	• No specific guidance is provided.	• Bus stops should utilize sites that maximize transit efficiency, encourage safe pedestrian crossings, offer proximity to activity centers, satisfy the general spacing requirements, minimize the disruption to other street traffic, including bicycles, and provide convenient connections to other modes.	• Per ODOT's Analysis Procedures Manual (APM) (Reference 8), amenities can increase ridership or encourage riders to wait longer, especially if frequencies are greater than 15 minutes. • Per TriMet's *Bus Stops Guidelines* (Reference 9), in general seating should be considered for stops with at least 12 daily boardings and passenger shelters at stops with at least fifty daily boardings. A pole and bus stop sign are required.

[1]BUD guidance is provided for facilities in the Traditional Downtown/Central Business District Urban Context, which was established in the section above.

Existing and Planned Pedestrian System

Information on the type and location of walking infrastructure was obtained from ODOT and City GIS data. The GIS data was updated to include information based on Google Earth aerial views and the project team site visit. Figure 4 illustrates the existing and planned walking and rolling facilities in the influence area.

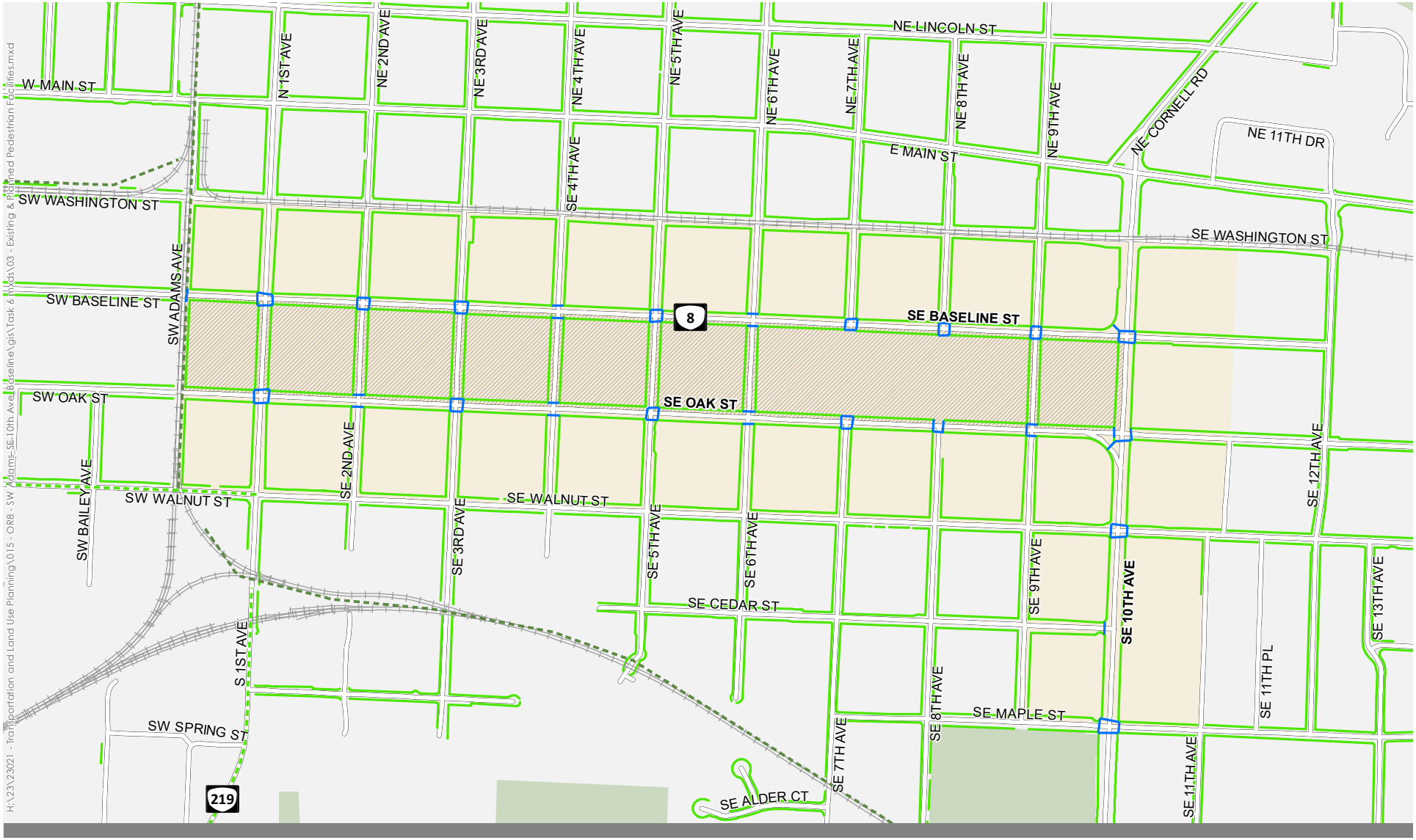
Sidewalks

Sidewalks are the most fundamental element of the pedestrian system. Sidewalks are typically constructed of concrete and separated from the roadway by a curb and gutter and sometimes by landscaping strip, bike facility, and/or on-street parking. The unobstructed travel way for people walking and rolling on a sidewalk should be clear of utilities, signposts, fire hydrants, vegetation, and street furnishings. A buffer between the sidewalk and vehicle travel lane, such as the landscape strips shown in the images below, increases the comfort of the walking and rolling experience.

Sidewalks are provided along both sides of Baseline Street, Oak Street, and 10th Avenue within the project area. The width of sidewalks ranges from five to nine feet and the sidewalk condition is generally "fair" to "good". Landscape buffers vary from zero to eight feet wide and includes trees, landscaping, and hard surfaces. There are plans for new sidewalk in the influence area, as shown in Figure 4.

Sidewalk on 10th Avenue (south of Walnut Street)

Sidewalk on SE Oak Street (east of 6th Avenue)



Existing Sidewalk
Existing Crosswalk
Planned Regional Trail
Planned Sidewalk
Project Area
Influence Area
Parks and Open Spaces

0 500 Feet

Figure 4

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Existing and Planned Pedestrian Facilities
Hillsboro, Oregon

Facility Guidance for Sidewalks

Blueprint for Urban Design

Based on the guidance identified in the BUD (Reference 1) for the ***Traditional Downtown/Central Business District (CBD)*** context, sidewalks should provide ample space for sidewalk activity (e.g., sidewalk cafes, transit, shelters).

Oregon Bicycle and Pedestrian Design Guide

According to the Bicycle and Pedestrian Design Guide (Reference 10) provided in the ODOT HDM (Reference 6), the standard width for sidewalks is six feet and the minimum clear width[2] of a pedestrian access route within a sidewalk is four feet. Within CBDs the standard width for sidewalks is 10 feet, and the preferred sidewalk width in high use business areas is 14-16 feet.

Regional Trails

There are no existing regional trails in the influence area, but there is a plan for a multiuse path or shared-use trail connecting Hillsboro, Cornelius, Forest Grove, and Banks. This plan, the Council Creek Regional Trail Master Plan[3], envisions a multiuse pathway that can be used for people walking, biking, and using other nonmotorized modes for both recreational and transportation purposes.

Facility Guidance for Regional Trails

Blueprint for Urban Design

The BUD (Reference 1) does not provide direct recommendations for facility width and buffering for regional trails or shared-use pathways. The BUD's recommendations to provide ample space for sidewalk activity apply.

Highway Design Manual

According to the HDM (Reference 6), "though shared-use paths are intended for many users, the bicycle is the appropriate design vehicle because of its higher travel speeds." To meet ADA requirements, "the grade of shared use pathways should not exceed 5%." Where a path is parallel and adjacent to a roadway,

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[2] Clear width is defined as the area free of all obstructions and typically includes a shy distance from vertical features, such as the face of a building. In constrained areas around obstacles that cannot be moved, a minimum passage of four feet must be maintained for a maximum length of 200 feet.

[3]More information about the Council Creek Regional Trail can be accessed here: https://www.oregonmetro.gov/sites/default/files/2016/03/01/Council-Creek-Regional-Transfer-Plan-20150801.pdf

there should be a buffer of at least five feet between the path and the roadway, or a physical barrier should be installed.

Crosswalks

In Oregon, as per the ODOT *Location of Crosswalks on State Highways,* every intersection is a legal crossing, whether it is marked or unmarked. Exceptions exist only in specific circumstances, such as if the crosswalk is closed or at diverging ramps (Reference 11). Marked crosswalks serve as a designated space for people to cross the roadway. There are two commonly used forms of marked crosswalks: "transverse" crosswalks and "continental" or "zebra" crosswalks.

Transverse Crosswalk at Walnut Street/10th Avenue

Transverse Crosswalk at Oak Street/1st Avenue

Currently, there are marked "transverse" crossings at all signalized intersections along Oak Street, Baseline Street, and 10th Avenue within the influence area, except at the intersection of 10th Avenue / Washington Street. There are curb ramps at the unsignalized intersections of Oak Street and Baseline Street, but no crosswalk markings across either Oak Street or Baseline Street at these unsignalized locations. A gap of approximately 1,250 feet is located along Oak Street between 7th Avenue and 10th Avenue where no marked crosswalks are provided.

Enhanced Crossings

Enhanced crossings provide additional delineation and increase visibility for people crossing at mid-block or unsignalized crossings by increasing driver awareness of pedestrian facilities and alerting them that a person is crossing the roadway. Common enhanced crossing treatment types include bulb-outs, rectangular rapid flashing beacons, and pedestrian hybrid beacons.

Currently, there are no enhanced crossing facilities located along Oak Street, Baseline Street, or 10th Avenue within the project area.

Facility Guidance for Crosswalks and Enhanced Crossings

Blueprint for Urban Design[4]

Based on the guidance identified in the BUD (Reference 1) for ***Traditional Downtown/CBD*** context, the target pedestrian crossing spacing range is 250 to 550 feet (one to two blocks).

Highway Design Manual

According to the HDM (Reference 6), developed, urban state highways should provide a safe and convenient pedestrian crossing no less frequent than every quarter mile. Crossing improvements should also be no closer than 300 feet from the nearest signalized crosswalk.

National Cooperative Highway Research Program Report 562

National Cooperative Highway Research Program (NCHRP) Report 562: Improving Pedestrian Safety at Unsignalized Crossings (Reference 12) provides guidelines for pedestrian crossing treatments. This guidance includes worksheets that consider speed, volumes of people crossing the street, crossing distance, expected motorist compliance at crossings in the region to recommend crossing treatments.

Bulb-Outs

Bulb-outs or "curb extensions" extend the sidewalk into the parking or landscape strip to narrow the crossing distance for people walking across a roadway. Bulb-outs are commonly located at corners; however, they can be installed at mid-block crossing locations. Bulb-outs enhance pedestrian safety by increasing pedestrian visibility, creating shorter crossing distances, and slowing turning vehicles.

There are no bulb-outs along Oak Street, Baseline Street, or 10th Avenue within the project area.

Facility Guidance for Bulb-Outs

Blueprint for Urban Design

The BUD (Reference 1) recommends the use of bulb-outs or "curb extensions" as a design element consideration within the transition realm (the space between the front of sidewalk and edge of parking). Curb extensions are also recommended treatments for target speed areas up to 30 mph within urban areas.

4 The guidance for target pedestrian crossing spacing is shorter in the BUD than in the HDM. This project will rely on the guidance of the BUD for target pedestrian crossing spacing.

Highway Design Manual

The HDM (Reference 6) identifies curb extensions as a design element that can improve signal head alignment and stop sign placement and provide a safety benefit by reducing the time it takes people to cross the street. Mid-block curb extensions may be considered where people frequently cross the road.

Pedestrian Ramps

Pedestrian curb ramps and tactile warning pads are necessary for pedestrian crossings to be compliant with ADA standards. Pedestrian ramps provide access for people walking and rolling. According to ODOT's statewide assessment of ADA pedestrian ramps, most pedestrian ramps along Oak Street and Baseline Street between Adams Avenue and 10th Avenue are in "Poor" condition. Figure 5 presents the inventory of pedestrian ramp locations and conditions[5].

Pedestrian ramp at Oak Street/8th Avenue

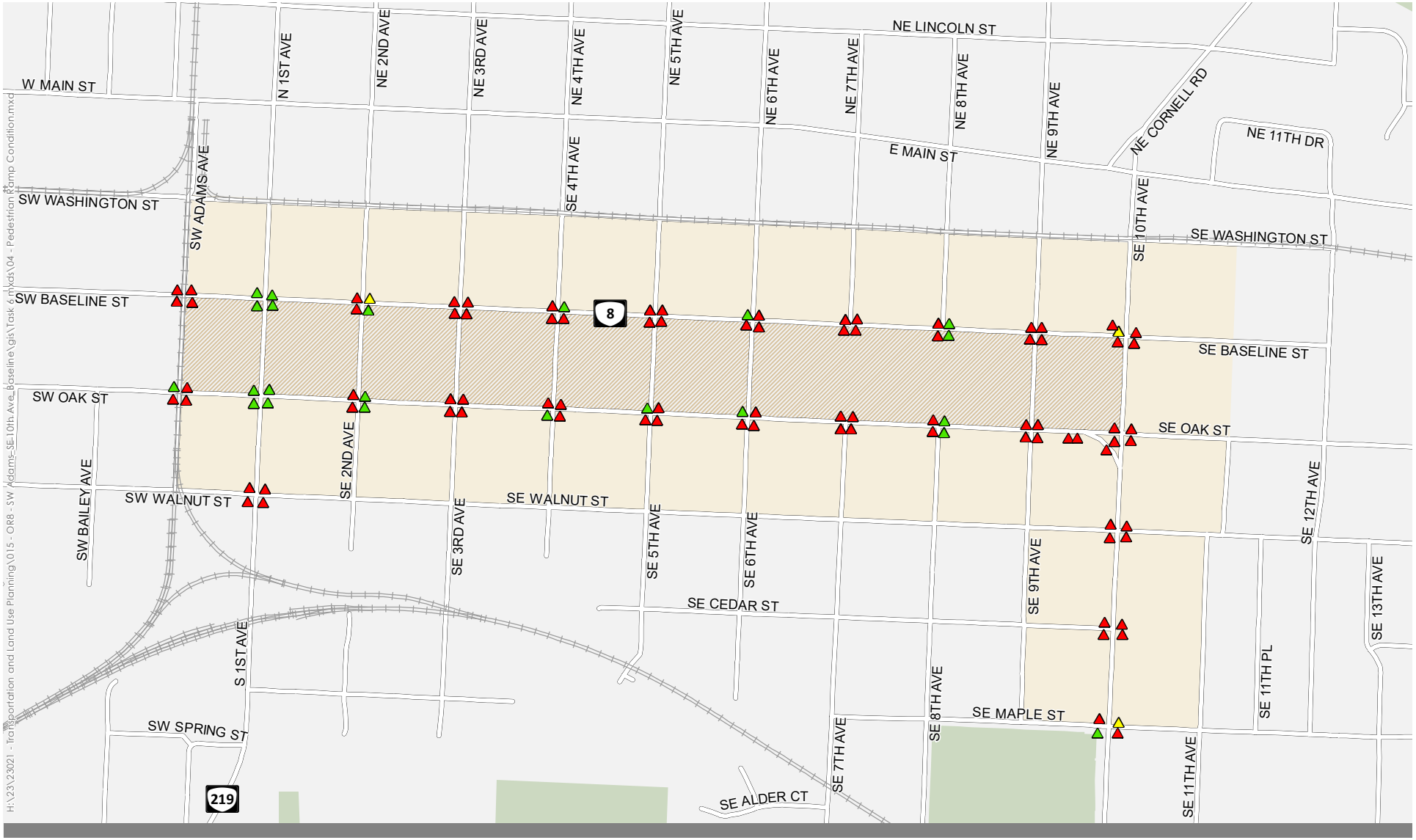
Pedestrian ramp at Baseline Street/3rd Avenue

Facility Guidance for Pedestrian Ramps

2011 Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way

ODOT has created state standards and specifications for the design and construction of ADA curb ramps that comply with the 2011 Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (Reference 7), a nationally recognized ADA compliance document. These standards and specifications set by ODOT ensure that the pedestrian curb ramps comply with ADA accessibility requirements. The ramp design must meet specific criteria related to width, length, cross-slope, running slope, warning features, and transitions.

[5] The ODOT ramp inventory was updated according to PMT guidance to reflect the new ramps constructed as part of intersection improvement projects at 1st Avenue / Oak Street and 1st Avenue / Baseline Street.



Ramp Condition: Good
Ramp Condition: Fair
Ramp Condition: Poor
Project Area
Influence Area
Parks and Open Spaces

0 500 Feet

Figure 5

Pedestrian Ramp Condition (Per ODOT Inventory) Hillsboro, Oregon

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Existing Pedestrian Activity – Strava[6]

To understand relative pedestrian activity in the corridor, a Strava Heatmap was developed to show the activity level ("heat") made by aggregated, public activities over the last two years[7]. The data is an aggregate of people tracking their runs and walks with Strava and can be used to understand patterns of routes people are taking today.

Figure 6 illustrates the Strava Heatmap data for Strava user pedestrian activity in downtown Hillsboro. Today, there is a relatively low amount of Strava user pedestrian activity along Oak Street and Baseline Street and a relatively high amount of Strava user activity on Main Street and 12th Avenue. There is also a high amount of Strava user activity on Maple Street (near Shute Park, the Aquatic Center and Library).

Existing Pedestrian Activity – Traffic Counts

Figure 7 illustrates existing volumes of pedestrian activity at the project area intersections during the weekday PM peak period (4:00 PM to 6:00 PM).[8]

The majority of pedestrian activity occurs near Shute Park (9th Avenue/Maple Street and 10th Avenue/Maple Street), along 10th Avenue (at Oak Street, Baseline Street, Walnut Street and Maple Street), and the OHSU Hillsboro Medical Center Campus (Baseline Street/7th Avenue and Baseline Street/8th Avenue).

In the future, it is anticipated that pedestrian activity in the project area will continue to increase as land use changes and redevelopment occur. In particular, the multiuse redevelopment of Block 67 (the block between Baseline Street, Washington Street, 6th Avenue and 7th Avenue), the expansion of the OHSU Health Hillsboro Medical Center and the Pacific University Hillsboro Campus, and growth in residential densities south of Oak/Baseline and in the area along the study area segment of 10th Avenue is anticipated to increase pedestrian crossing demand. It may also increase use of transit stops in the influence area.

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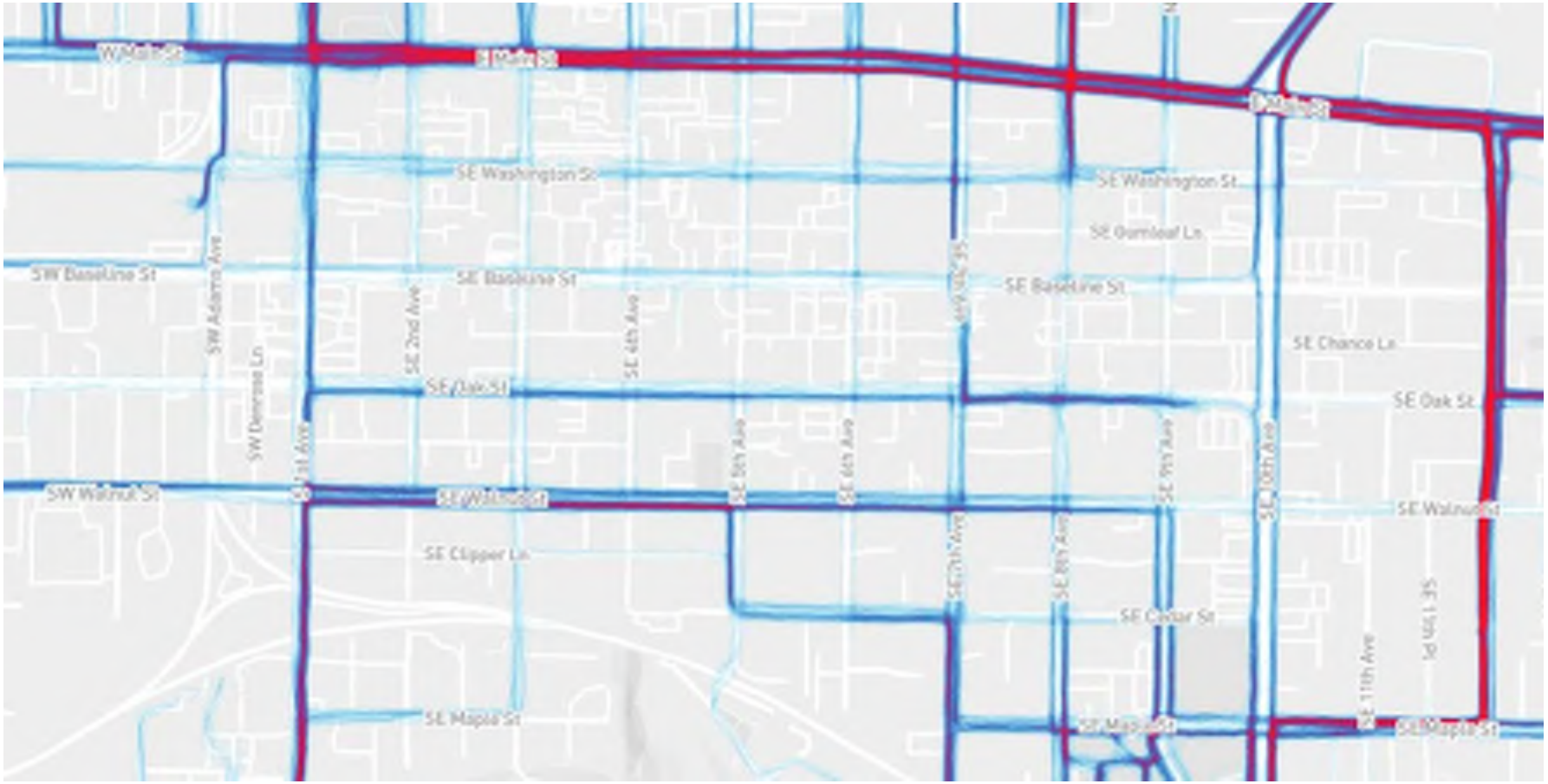
[6] Strava data only records activity for people using the app and may be biased towards recreational activities, people with more discretionary income, and employees that work in the area, among others.

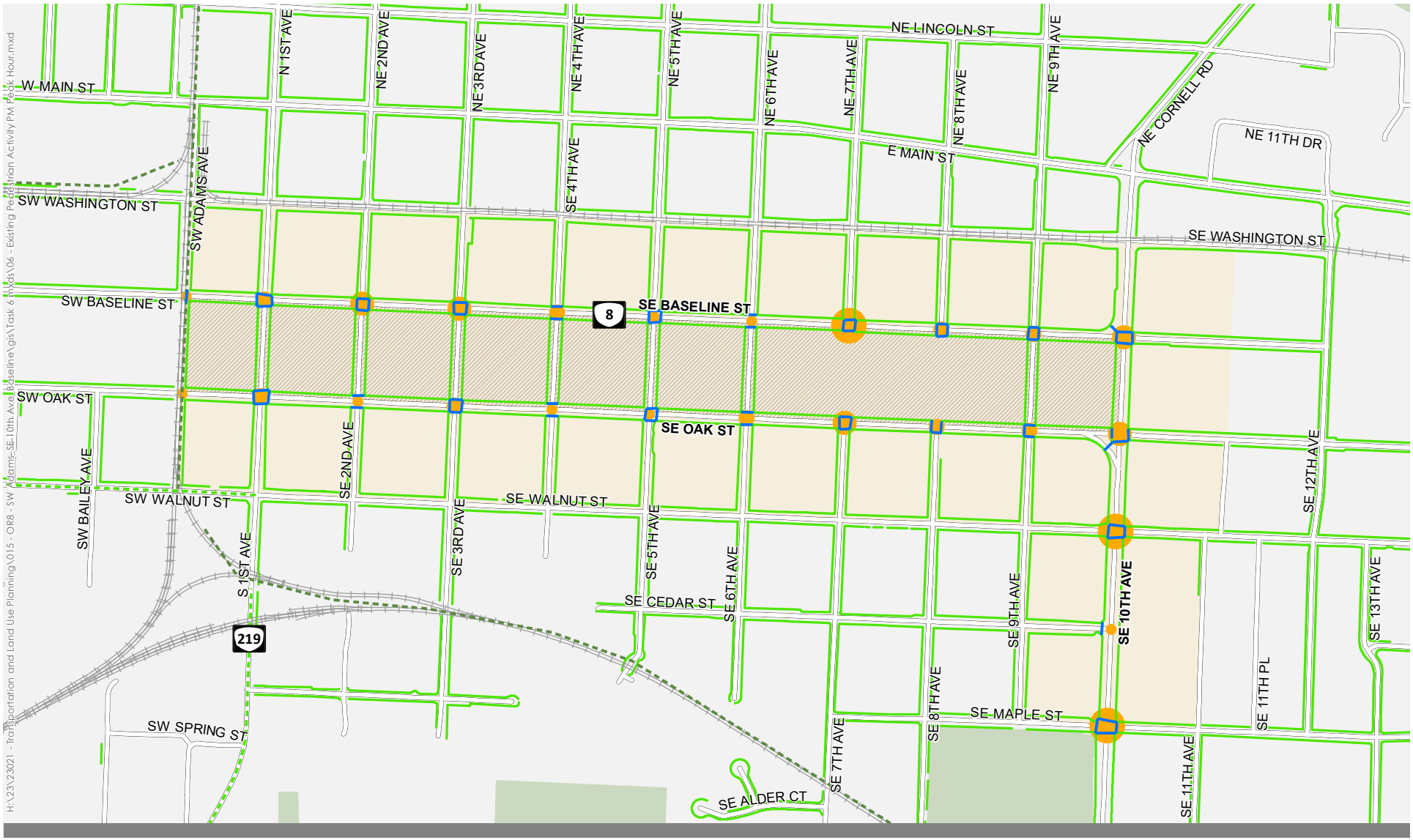
[7] Robb, D. (2018, April 4). *Building the global heatmap*. Medium. https://medium.com/strava-engineering/the-global-heatmap-now-6x-hotter-23fc01d301de.

[8] Pedestrian counts were collected on February 5th, 2020, prior to the pandemic. The low that day was 39 degrees Fahrenheit and the high was 48 degrees, with light rain falling until mid-morning, mostly cloudy conditions in the late afternoon, and sunset at 5:23 PM. Pedestrian activity tends to increase with warmer and drier weather and longer daylight hours; as such, these measured volumes are considered to represent the low end of the pedestrian activity level for a typical day between late spring and early fall.

Figure 6: Strava Heatmap—Pedestrian Activity



Lower Activity **Higher Activity**



PM Peak Hour Activity

- <=20
- 20-40
- 40-60
- >60

- Existing Sidewalk
- Existing Crosswalk
- Planned Regional Trail
- Planned Sidewalk
- Project Area
- Influence Area
- Parks and Open Spaces

0 500 Feet

Figure 7

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Existing Pedestrian Activity PM Peak Hour (February 5, 2020) Hillsboro, Oregon

Existing Bicycle System

The following section describes the existing biking system. Information on the type and location of biking infrastructure was obtained from ODOT and City GIS data. The GIS data was updated to include information based on Google Earth aerial views. Figure 8 presents the existing and planned bicycle facilities in the influence area. The only planned bicycle facilities in the influence area are the Council Creek Regional Trail and the Hillsboro to Banks Regional Trail, described in the Existing and Planned Pedestrian System above.

Bicycle Facilities

Bicycle facilities, such as bike lanes, designate exclusive space for people biking by using physical separation, pavement markings, and/or signage. Typical bicycle facility design can range in width and buffer space or vertical separation between the bike lane and vehicle lane. Bike lanes must always be well-marked to call attention to their designated use by bicyclists and drivers.

There are no existing or planned bike lanes in adopted City planning documents on Baseline Street or Oak Street. There are existing partial bike lanes along 10th Avenue between Walnut Street and Maple Street.

Bike Lane on 10th Avenue (north of Maple Street)

Bike Lane on 10th Avenue (south of Cedar Street)

Facility Guidance for Bicycle Facilities

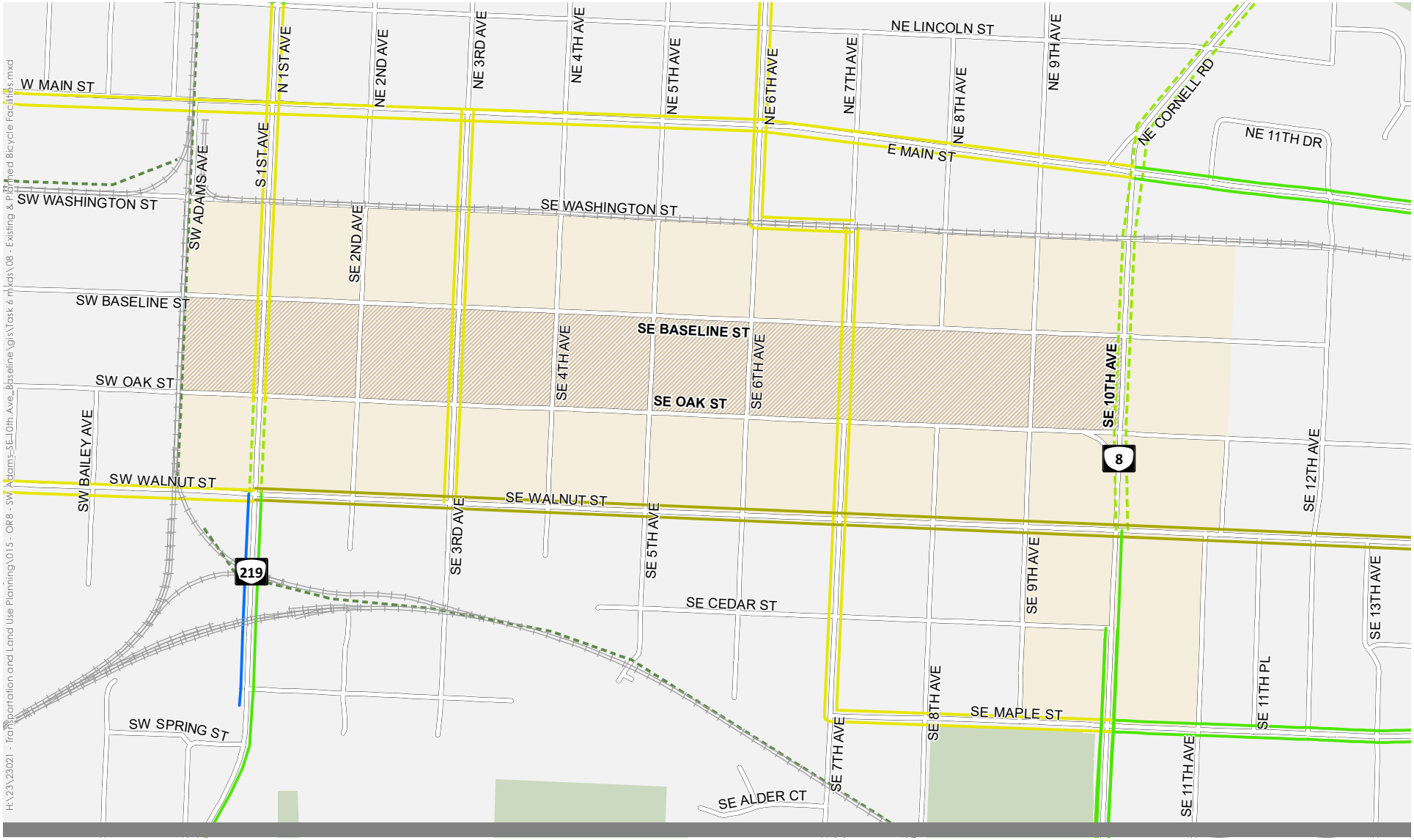
Blueprint for Urban Design

Based on the guidance identified in the BUD (Reference 1) for the ***Traditional Downtown/CBD*** context, when planning for new bicycle facilities, it is recommended to start with wide, separated bicycle facilities and consider roadway characteristics, such as vehicular speed, number of lanes, and lane widths, to establish the width of the facilities.

Oregon Bicycle and Pedestrian Design Guide

The Oregon Bicycle and Pedestrian Design Guide (Reference 10) sets the standard for bike lane widths at six feet, with a minimum width of four feet on open shoulders or five feet from the face of curb, guardrail, or parked cars.

According to the Oregon Bicycle and Pedestrian Design Guide (Reference 10), bike lanes, cycle tracks, and buffered bike lanes are recommended along urban and suburban roadways where traffic volumes greater than 1,500 ADT and traffic speeds greater than 20 miles per hour. The level of physical separation between the biking facilities and the vehicle travel lanes is dependent on the speed and volume of vehicle traffic.



Existing Bike Lane
Existing Shoulder > 5'
Existing Bicycle Way
Existing Bicycle Boulevard
Planned Bike Lane
Planned Regional Trail
Project Area
Influence Area
Parks and Open Spaces

0 500 Feet

Figure 8

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Existing and Planned Bicycle Facilities
Hillsboro, Oregon

Existing Bicycle Activity – Strava Data

Like with the pedestrian activity, a Strava Heatmap was developed to show the bicycle activity level ("heat") made by aggregated, Strava user activities over the last two years. Figure 9 shows the Strava Heatmap for people biking in downtown Hillsboro. There is a relatively high amount of cycling activity along Main Street, Walnut Street, 1st Avenue, 7th Avenue, and Maple Street. There is a relatively low amount of cycling activity along Baseline Street.

Existing Bicycle Activity – Traffic Counts

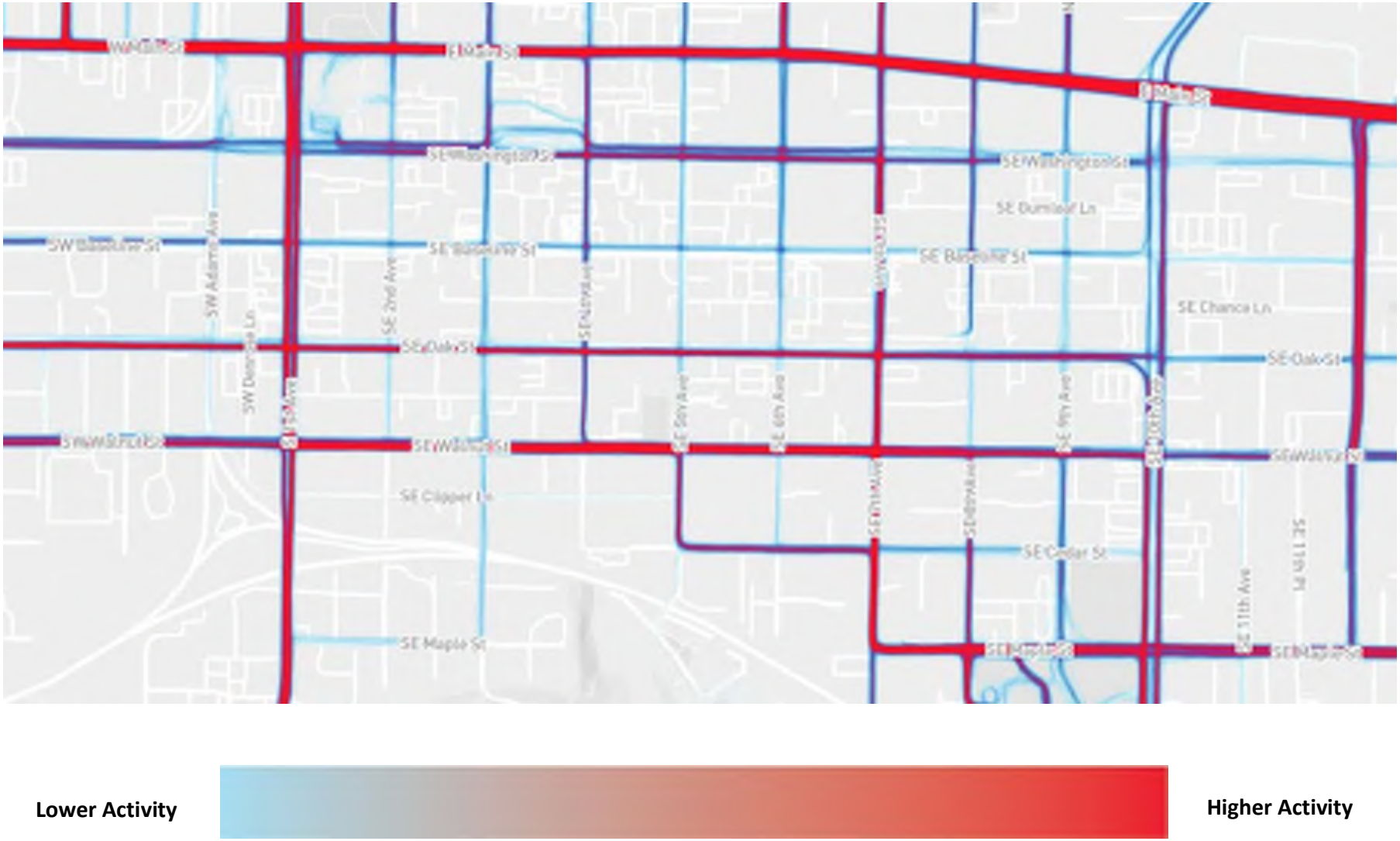
Figure 10 illustrates the existing volumes of bicycle activity at project area intersections during the PM peak period (4:00 PM to 6:00 PM).[9]

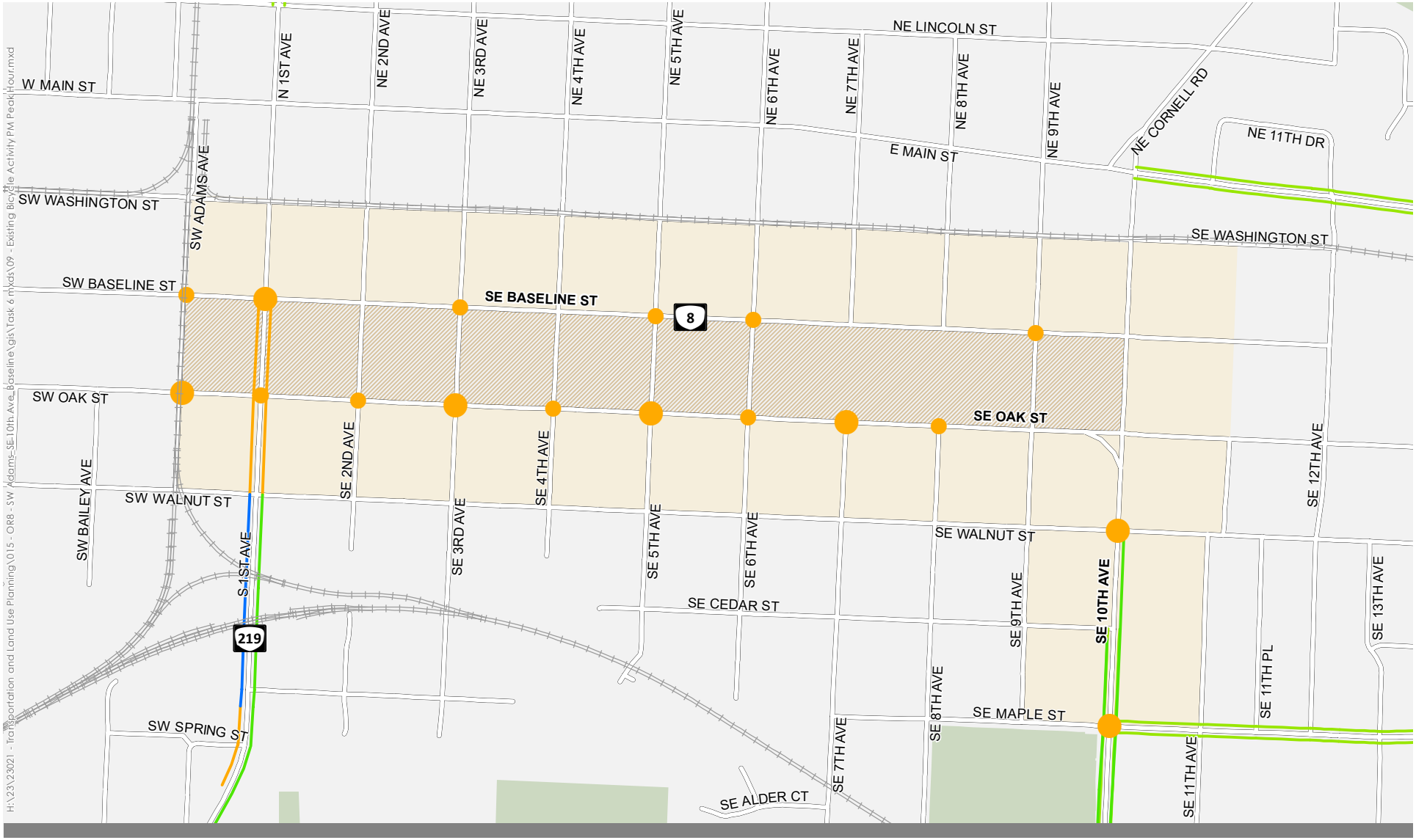
The intersections of Baseline Street/1st Avenue, Oak Street/Adams Avenue, Oak Street/3rd Avenue, Oak Street/5th Avenue, Oak Street/7th Avenue, 10th Avenue/Walnut Street, and 10th Avenue/Maple Street had three or more people biking in the PM peak hour. The other intersections along Baseline Street, Oak Street, and 10th Avenue in the study area had two or less people biking in the PM peak hour.

In the future, it is anticipated that people biking will continue to use lower stress, parallel routes to Oak Street and Baseline Street, such as Walnut Street, until safe and comfortable facilities are provided along Oak Street and Baseline Street. An increased desire to bike in downtown Hillsboro is expected as a result of the planned Council Creek Regional Trail, which would connect downtown Hillsboro to Forest Grove, Cornelius and Banks, likely beginning on Washington Street in downtown.

[9] Turning movement counts were collected on February 5th, 2020, prior to the pandemic. Again, weather conditions on that date included a low of 39 degrees Fahrenheit and a high was 48 degrees, with light rain falling until mid-morning, mostly cloudy conditions in the late afternoon, and sunset at 5:23 PM. Bicycle activity tends to increase with warmer and drier weather and longer daylight hours; as such, these measured volumes are considered to represent the low end of the bicycle activity level for a typical day between late spring and early fall.

Figure 9: Strava Heatmap—Bicyclist Activity





PM Peak Hour Activity

- 1-2
- 3-4

- Existing Bike Lane
- Existing Shoulder > 5'
- Existing Shared Lane

- Project Area
- Influence Area
- Parks and Open Spaces

0 500 Feet

Figure 10

Existing Bicycle Activity PM Peak Hour (February 5, 2020) Hillsboro, Oregon

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Existing Transit System

The following section describes the existing and planned transit system. Information on route locations and frequency was obtained from ODOT GIS data. Information on ridership was obtained from TriMet.

Transit Routes and Ridership Data

TriMet Routes 57 (TV Hwy/Forest Grove), 48 (Cornell), and 47 (Main/Evergreen) travel along Baseline Street, Oak Street and/or 10th Avenue in the project area. Route 57 runs all day with a peak frequency of 15 minutes or less[10]. Route 47 runs from 6 AM to 8 PM with a peak frequency of 30-45 minutes. Route 48 runs from 5 AM to 9 PM with a peak frequency of 30-45 minutes.[11] There are 13 transit stops serving these routes in the influence area. Figure 11 illustrates the existing transit routes and stops in the influence area.

Table 3 presents the weekday fall 2019 boardings and alightings for the transit stops in the influence area, as well as monthly LIFT paratransit rides.[12] Figure 12 presents a map of total daily boardings and alightings by stop location.

Table 3: Transit Stop Boardings and Alightings

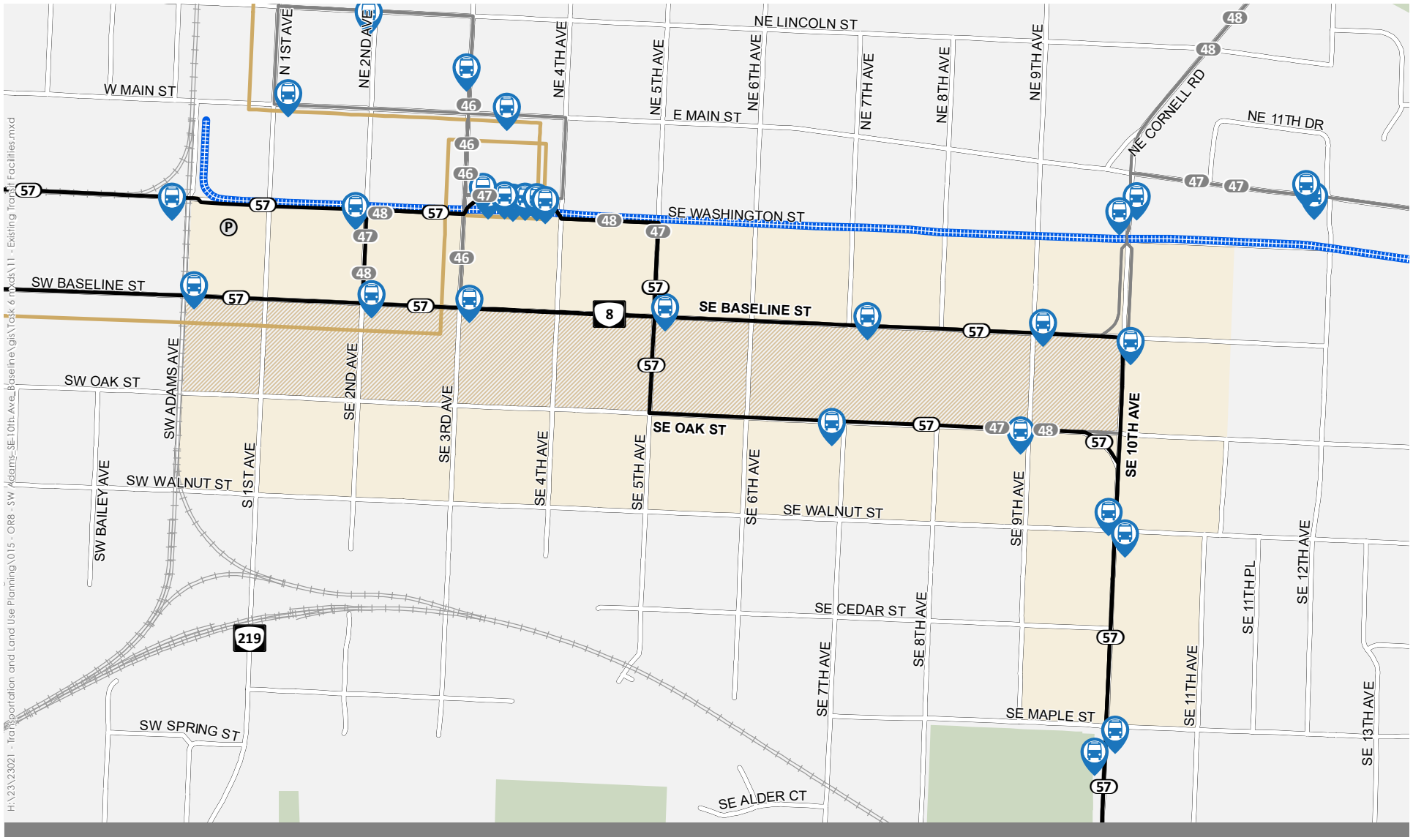
Stop Name	Stop ID	Route	Daily Boardings[1]	Daily Alightings[1]	Daily Total[1]	Monthly Lifts
Baseline Street & Adams Avenue (WB)	259	57	75	12	87	10
Baseline St & 2nd Avenue (WB)	280	47, 48, 57	112	156	268	55
Baseline Street & 3rd Avenue (WB)	304	47, 48, 57	68	123	191	12
Baseline Street & 5th Avenue (WB)	307	47, 48, 57	12	35	57	12
Baseline Street & 7th Avenue (WB)	308	47, 48, 57	38	75	113	419
Baseline Street & 9th Avenue (WB)	310	47, 48, 57	71	130	201	41
10th Avenue & Baseline Street (NB)	6502	47, 48	59	3	62	6
10th Avenue & Walnut Street (SB)	6500	57	134	75	209	29
10th Avenue & Walnut Street (NB)	6499	57	76	95	171	27
10th Avenue & Maple Street (NB)	6495	57	70	74	144	30
10th Avenue & Maple Street (SB)	6496	57	81	63	144	28
Oak Street & 7th Avenue (EB)	4123	47, 48, 57	72	41	113	21
Oak Street & 9th Avenue (EB)	4125	57	18	47	65	20

[1]Ridership data from fall 2019

[10] For more information about TriMet bus service in the influence area, visit https://trimet.org/bus/index.htm

[11] Frequencies and service hours are taken from 2019 schedules, which represents service prior to the COVID-19 pandemic.

[12] Data from 2019 is used due to reduced ridership in 2020 as a result of the COVID-19 pandemic.



Park n' Ride

Bus Stops

Frequent Service Bus Route

Standard Service Bus Route

Intercity Transit

Blue Line

Project Area

Influence Area

Parks and Open Spaces

0 500 Feet

Figure 11

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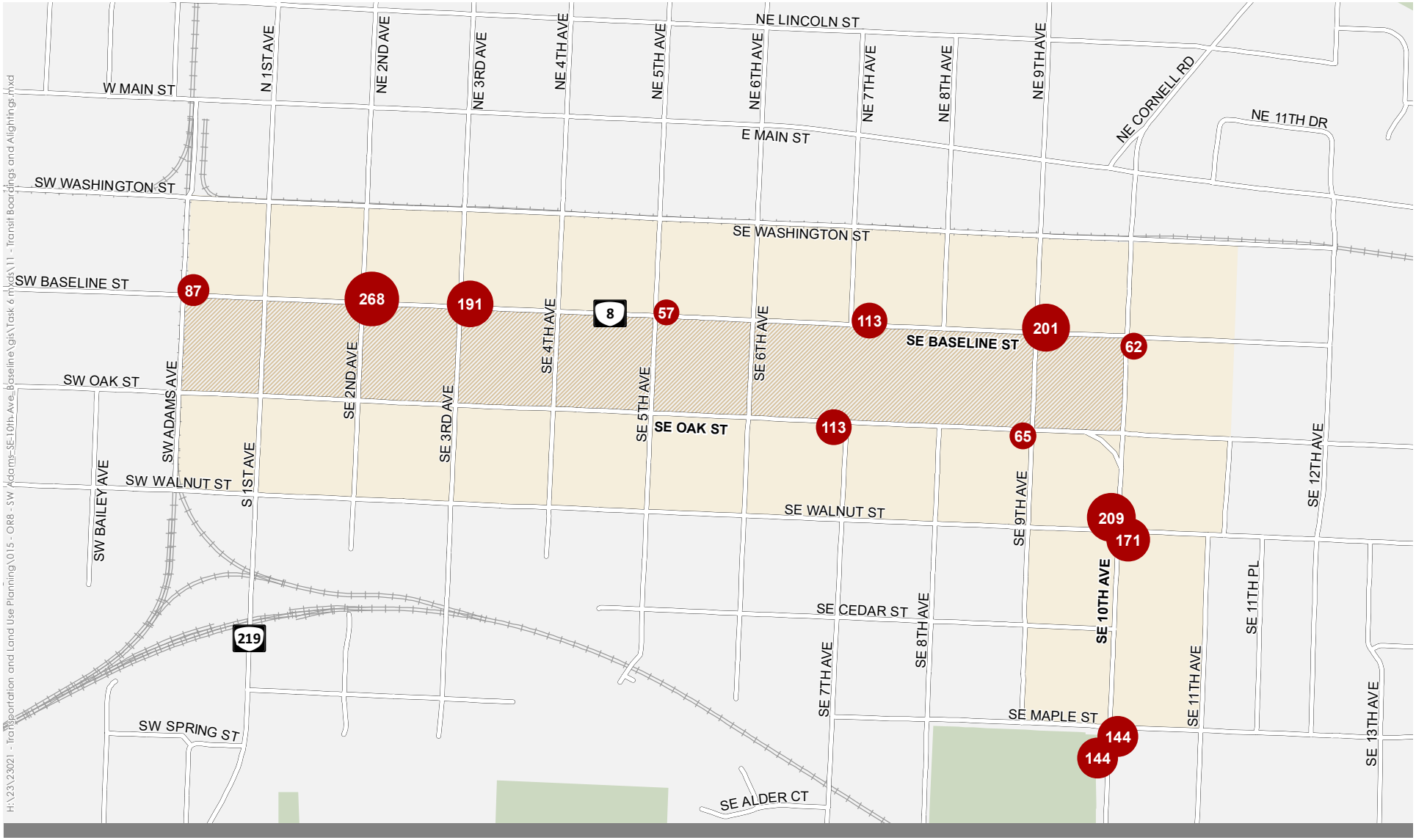
Existing Transit Facilities
Hillsboro, Oregon



100 Daily Boardings and Alightings

Project Area

Influence Area

Parks and Open Spaces

0 500 Feet

Figure 12

Transit Boardings and Alightings (Fall 2019) Hillsboro, Oregon

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Transit Stop Locations

ODOT's HDM (Reference 6) provides guidance on bus stop location selection, choice of far-side, near-side, and mid-block bus stops, and special treatments. In CBDs, a spacing ranging of 330-1000 feet is recommended. Factors such as traffic and rider safety, bus operation, and proximity to major trip generators should be used to determine stop locations.

Bus stops are generally located at intersections, where they can be placed near-side or far-side. They may also be placed mid-block. At signalized intersections, the HDM allows either a near-side stop or a far-side stop on facilities with multiple lanes. At unsignalized intersections, however, a far-side stop is preferred for facilities with multiple lanes. The study streets (Oak Street, Baseline Street, and 10th Avenue) have multiple lanes that allow vehicles to pass a stopped bus, therefore far-side stops are preferred at unsignalized intersections as they minimize conflicts between buses and turning vehicles traveling in the same direction and minimizes sight distance problems on approaches to the intersection. At signalized locations, however, either stop type is appropriate.

Special treatments include bus pullouts and curb extensions. Bus pullouts are provided on high-volume and/or high-speed arterial, though may not be appropriate on multi-lane, one-way streets as there can be sufficient gaps in traffic to allow traffic to pass around a stopped bus. The HDM states that pullouts should be considered on all state highways, with the treatment most appropriate when one or more of the following situations exist:

- Average vehicle speed exceeds 40 mph
- Traffic in the curb lane exceeds 250 vehicles during the peak hour
- History of a high rate of crashes, particularly rear-end crashes
- More than 5 bus stops per hour
- Passenger boardings exceed 30 boardings per hour
- Transit provider desires an area for dwelling time
- A bike lane is present or in a high bike use area

On Oak Street, Baseline Street, and 10th Avenue, traffic volumes per lane do exceed 250 vehicles during the peak hour and there is a prevalence of rear-end crashes.

Curb extensions should be considered along streets with on-street parking in areas with high pedestrian use. In conjunction with a bus stop, bus operations and passenger access can be facilitated. Near side curb extensions are usually the width of a parking lane and of sufficient length to allow passengers to use the front and back doors of a bus.

All stops in the study area are near-side stops with no pull-outs or curb extensions provided.

Transit Stop Amenities

Transit amenities include trash receptacles, lighting, on-street customer information, seating, and benches. Recommendations for transit stops and amenities are provided by the TriMet Bus Stops Guidelines (Reference 9).

Trash receptacles are optional and placed only at sheltered bus stops. Receptacles should be considered at stops with high ridership, transfer locations, and places where the potential for accumulating trash is apparent. Lighting is optional and usually consists of overhead lighting oriented towards the bus stop boarding area and bus shelter lighting, with a goal of 1.5 – 2 foot candles of light around the bus stop area. There was not sufficient data provided to analyze lighting for transit stops in the project area.

On-street customer information includes bus stop signs, information units, and Transit Tracker platform displays. A bus stop sign with a consistent style and pole, as well as the Stop ID number, are required at all stops. Information units, including a schedule and route map, are required at stops with bus shelter or at locations with high ridership (undefined in the guidelines), transfer points, transit centers, and transit generators. Route maps and/or Quick Response (QR) Codes[13] can be affixed to a sign or placed inside the bus shelter. A Transit Tracker, which displays automated bus arrival times, are located at high-volume transit stops, and can also be accessed via mobile phone.

Seating is a basic transit amenity that provides a location for people to wait to board a bus. According to the TriMet Bus Stop Guidelines, benches may be considered where ADA accessibility is provided, placement does not compromise safety (not too close to the street or cause a tripping hazard), or placement does not compromise safety or accessibility for users by posing a tripping hazard or reducing the clear width of sidewalk to less than four feet. The following seating types are recommended:

- A 4-foot Shelter Bench is placed in a TriMet shelter.
- A 6.5-foot Premium Bench can be placed at stops with a minimum of 25 daily boardings and in business and retail districts where shelters are not appropriate.
- A 6-foot Ad Bench can be placed at any stops lacking amenities and are placed for ad exposure or for TriMet's exposure.
- A Simme Seat can be placed at stops with a minimum of 12 daily boardings ad are mounted on bus stop poles. These are appropriate at locations with curb tight sidewalks.

Shelters provide a covered waiting area at the stop location. Passenger shelters must be designed to meet ADA requirements and should be located to provide safe and convenient pedestrian connections with nearby destinations. Coordination of shelter placement with sidewalk and other pedestrian improvement projects planned by ODOT or local agencies is encouraged.

[13] QR Codes can be used to connect passengers to information about transit schedule, purchasing fares, and to real-time information about delays and changes.

According to the TriMet Bus Stop Guidelines, shelters may be recommended in the following scenarios:

- Stops with 50 or more daily boardings
- Stops with 35 or more daily boardings on routes where peak headways are greater than seventeen minutes
- Stops with 20 or more daily boardings and located in proximity to senior housing
- Stops with of 15 weekday LIFT (TriMet's paratransit service) boardings and 4% LIFT usage
- Where shelters funded and maintained by others
- Where development of large new activity centers is projected to have transit stops meet ridership criteria
- Consolidated bus stops where combined ridership totals increase likelihood of shelter placement

Shelter Types 'B', (8.5 by 4.5 by 8 feet) or 'A' (8.5 by 2.5 by 8 feet) are recommended with more than 50 daily boardings. Larger shelters are recommended with more than 100 boardings.

Existing site conditions and pedestrian infrastructure, public right-of-way availability, accessibility and safety issues, and other concerns must be reviewed and addressed before future bus shelter placements are confirmed.

Per ODOT's Analysis Procedures Manual (APM) (Reference 8), amenities such as benches, shelters, larger landing areas for mobility-impaired users, arrival/departure information, and illumination can increase ridership or encourage riders to wait longer, especially if frequencies are greater than 15 minutes. In addition, the APM recommends safe and nearby crossings at bus stops, as most bus stops come in pairs and require crossing a street to access the opposite direction.

Table 4 presents the project area TriMet transit stop names, stop ID, route, and amenities.

Table 4: Transit Stops

Stop Name	Stop ID	Route[1]	Existing Amenities
Baseline Street & Adams Avenue (WB)	259	57	Sign, Bus Shelter, Bench
Baseline Street & 2nd Avenue (WB)	280	47, 48, 57	Sign, Bus Shelter, Bench, Route Map
Baseline Street & 3rd Avenue (WB)	304	47, 48, 57	Sign[2]
Baseline Street & 5th Avenue (WB)	307	47, 48, 57	Sign, Route Map
Baseline Street & 7th Avenue (WB)	308	47, 48, 57	Sign, Route Map
Baseline Street & 9th Avenue (WB)	310	47, 48, 57	Sign, Bus Shelter, Bench, Route Map
10th Avenue & Baseline Street (NB)	6502	47, 48	Sign, Bench, Route Map
10th Avenue & Walnut Street (SB)	6500	57	Sign, Bus Shelter, Bench, Route Map
10th Avenue & Walnut Street (NB)	6499	57	Sign, Bus Shelter, Bench, Route Map
10th Avenue & Maple Street (NB)	6495	57	Sign, Bus Shelter, Bench, Route Map
10th Avenue & Maple Street (SB)	6496	57	Sign, Bus Shelter, Bench, Route Map
Oak Street & 7th Avenue (EB)	4123	47, 48, 57	Sign, Bus Shelter, Bench, Route Map
Oak Street & 9th Avenue (EB)	4125	57	Sign, Route Map

[1]Route 57: 57-TV Hwy/Forest Grove; Route 47: 47-Mina/Evergreen, Route 48: 48-Cornell

[2]Small sign attached to route marker sign

Safety Performance near Transit Stops

The ODOT Statewide Priority Index System (SPIS) identifies sites along state highways where safety issues warrant further investigation. The SPIS is a method developed by ODOT for identifying hazardous locations on state highways through consideration of crash frequency, crash rate, and crash severity. Sites identified within the top 15 percent are investigated by ODOT staff and reported to the Federal Highway Administration (FHWA). Table 5 presents SPIS locations at transit stops.

All of the stops on 10th Avenue and Oak Street are top 15% SPIS locations, as well as two stops on Baseline Street (at Adams Avenue and 9th Avenue).

Table 5: SPIS Percentages at Transit Stops

Stop Name	Stop ID	SPIS Percent[1]
Baseline Street & Adams Avenue (WB)	259	90%
Baseline Street & 2nd Avenue (WB)	280	N/A
Baseline Street & 3rd Avenue (WB)	304	N/A
Baseline Street & 5th Avenue (WB)	307	N/A
Baseline Street & 7th Avenue (WB)	308	N/A
Baseline Street & 9th Avenue (WB)	310	95%
10th Avenue & Baseline Street (NB)	6502	90%
10th Avenue & Walnut Street (SB)	6500	85%
10th Avenue & Walnut Street (NB)	6499	85%
10th Avenue & Maple Street (NB)	6495	95%
10th Avenue & Maple Street (SB)	6496	95%
Oak Street & 7th Avenue (EB)	4123	95%
Oak Street & 9th Avenue (EB)	4125	95%

[1]Reports the highest SPIS classification (85% and higher) from SPIS 2017, SPIS 2018, and SPIS 2019 within 100 feet of the intersection.

Bus Rapid Transit

In 2020, Metro proposed Measure 26-218, which would have funded approximately 150 transportation projects in Multnomah, Washington, and Clackamas counties, including four bus rapid transit (BRT) projects. One of these, the Tualatin Valley Highway BRT line, was proposed for TriMet's Line 57-TV Hwy/Forest Grove route. The 17-mile bus line currently has stops on Baseline Street, Oak Street, and 10th Avenue in the project area, and connects Beaverton, Aloha, Hillsboro, Cornelius, and Forest Grove. Pre-pandemic, the line served about 45,500 trips a week. The proposed BRT line could potentially have stations at the following locations:

- Washington Street and Adams Avenue
- Baseline Street and Adams Avenue
- Hillsboro Transit Center
- 10th Avenue and Walnut Street
- Oak Street and 7th Avenue **or** Oak Street and 9th Avenue
- Baseline Street and 7th Avenue **or** Baseline Street and 9th Avenue

The BRT project would also include investments in transit signal priority; queue jump signals and bypass lanes; Business and Transit (BAT) lanes; bus fleet upgrades to 60-foot articulated electric buses; stations with shelters and real-time arrival information and bus pullouts; and upgraded sidewalks, bike facilities, and pedestrian crossings.

MAX Line

The TriMet MAX Blue line connects Hillsboro, via the Hillsboro Central/SE 3rd Avenue Transit Center[14], located one block north of the project site, to the entire metropolitan region. In fall 2019, this station saw an average of 724 daily boardings and 51 daily alightings in the eastbound direction, and 49 daily boardings and 811 daily alightings in the westbound direction on a weekday.[15] The Transit Center also serves TriMet Bus Routes 46 (North Hillsboro), 47 (Main/Evergreen), 48 (Cornell), and 57 (TV Hwy/Forest Grove), which all have stops in the project area.

EXISTING VEHICULAR SYSTEM

The BUD (Reference 1) establishes a framework for determining the urban context along state roadways. The Urban Context for the corridor was established as ***Traditional Downtown/CBD***. According to this designation, the general modal considerations for people walking and biking are "High" and the modal considerations for motorists and freight are "Low".

Motor vehicle traffic volumes and crash data were used to inform the multimodal analysis. A summary of existing motor vehicle conditions—including appropriate freight considerations and parking occupancy along Baseline Street, Oak Street, and 10th Avenue—is provided in the following sections.

Motor Vehicle Facilities

Functional Classification

Baseline Street, Oak Street, and 10th Avenue are state facilities classified as *Urban Other Principal Arterial*. Under the Washington County TSP, Baseline Street, Oak Street, and 10th Avenue are classified as *Arterial*. Main Street, Walnut Street, and 5th Avenue are City of Hillsboro facilities classified as *Collector*.

Freight Classification

Baseline Street, Oak Street, and 10th Avenue are not designated as freight routes within the project influence area according to the Oregon Highway Plan (OHP) (Reference 15). They are designated as Reduction Review Routes (RRR), subject to the Oregon Revised Statue (ORS) 366.215. They are also designated as Over-Dimensional Truck Routes in the City of Hillsboro and Washington County TSPs and as Roadway Connectors by the Metro Regional Freight Strategy (Reference 4, Reference 13, Reference 14).

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[14] Transit Centers (trimet.org)

[15] TriMet MAX Light Rail passenger Census – Fall 2019

Oregon Revised Statute 366.215

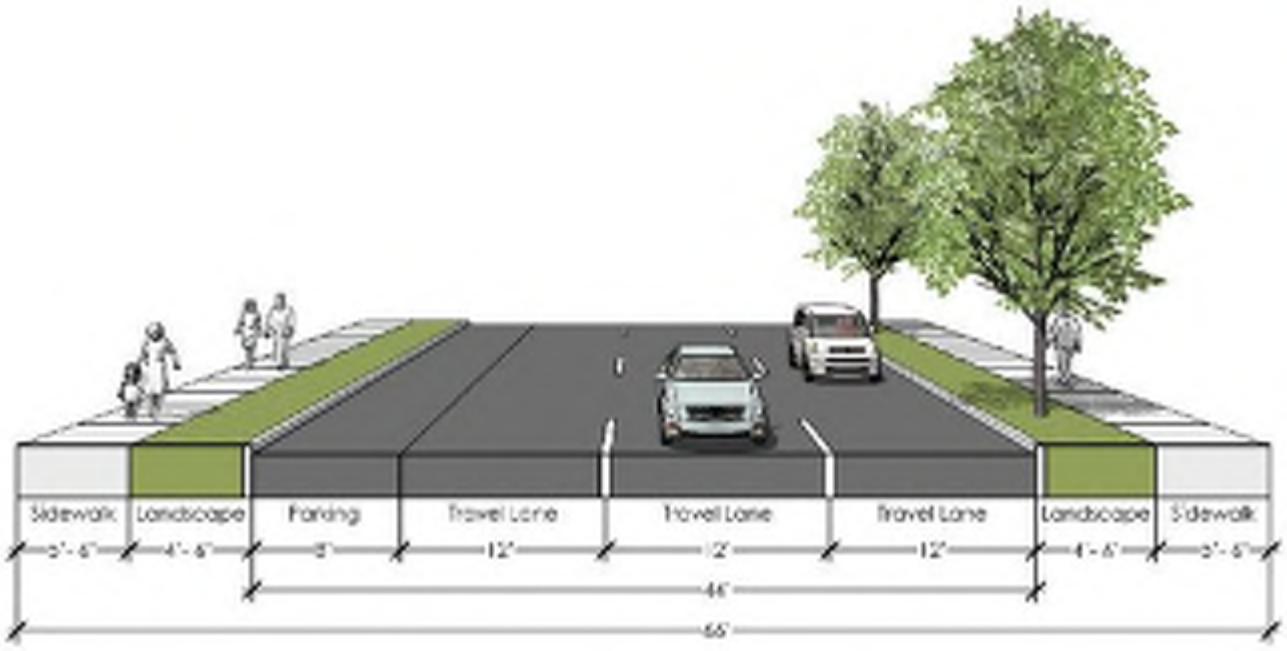
ORS 366.215 states that the Oregon Transportation Commission (OTC) may not permanently reduce the "vehicle-carrying capacity" of an identified freight route also known as a "Reduction Review Route" (RRR) unless safety or access considerations require the reduction, or a local government requests an exemption. Vehicle carrying capacity refers to the vertical and horizontal clearances of a highway section that physically carries motor vehicles. The vertical clearance and horizontal clearance for freight along OR 8 is limited by traffic signals and street curbs, respectively. To date, ODOT has indicated that no vehicle-carrying capacity limitation has been identified for this segment of the highway.

Since OR 8 is designated as an RRR, a review of potential reductions to vehicle-carrying capacity will be required for all proposed actions on Baseline Street, Oak Street, and 10th Avenue. According to ODOT's ORS 366.215 Implementation Guidance (Reference 16), "it is best to wait until project implementation to follow the [Stakeholder Forum] review process. For these situations, the Concept Plan must identify the reduction review route in the plan area and provide the following statement or equivalent: *Planning concept potentially reduces vehicle-carrying capacity of the highway; further evaluation of the project design will be required at the time of implementation to ensure compliance with ORS 366.215*."

Existing Cross Section

Existing cross sections were produced for Oak Street, Baseline Street, and 10th Avenue to illustrate the roadway section elements, features, and dimensions. These cross sections are representative of future no-build conditions.

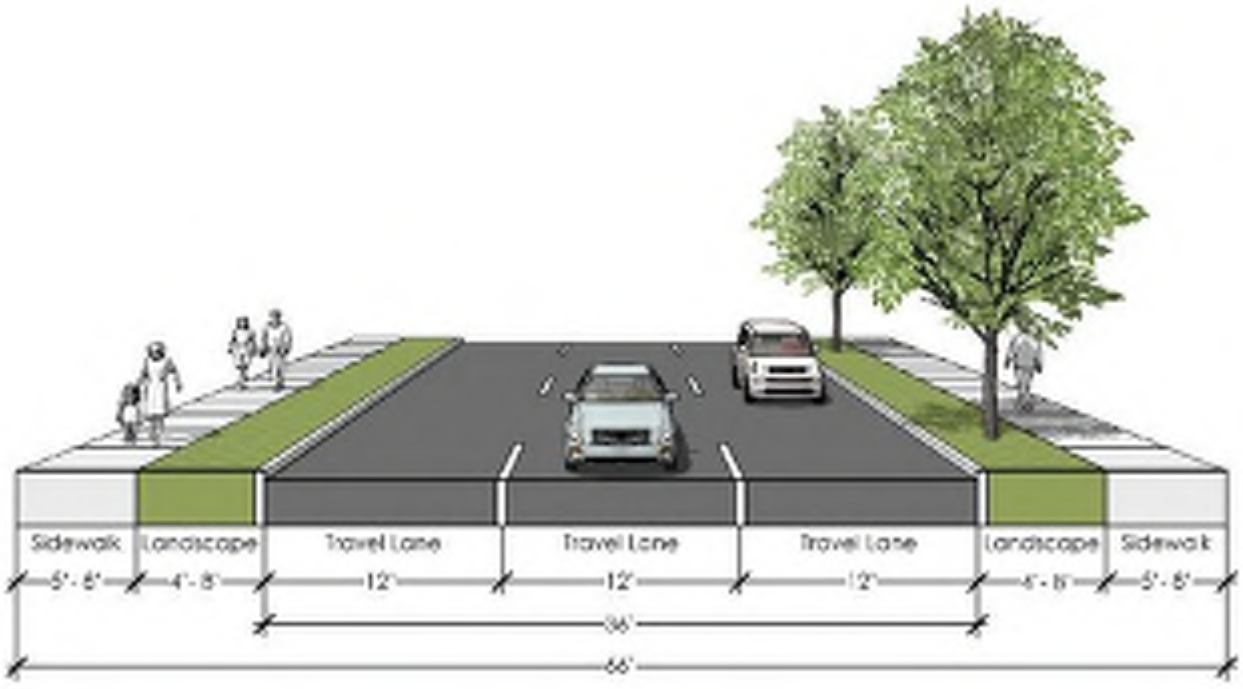
Figure 13: Oak Street – Facing West[16]



As illustrated in Figure 13, the typical existing cross section for Oak Street includes three (3) travel lanes, space for one parking lane, and sidewalks on both sides of the roadway separated by a landscape buffer. The sidewalk and landscaping widths vary depending on the location along the corridor. Based on observations during the project team's site visit (under COVID pandemic conditions), parking along Oak Street was underutilized.

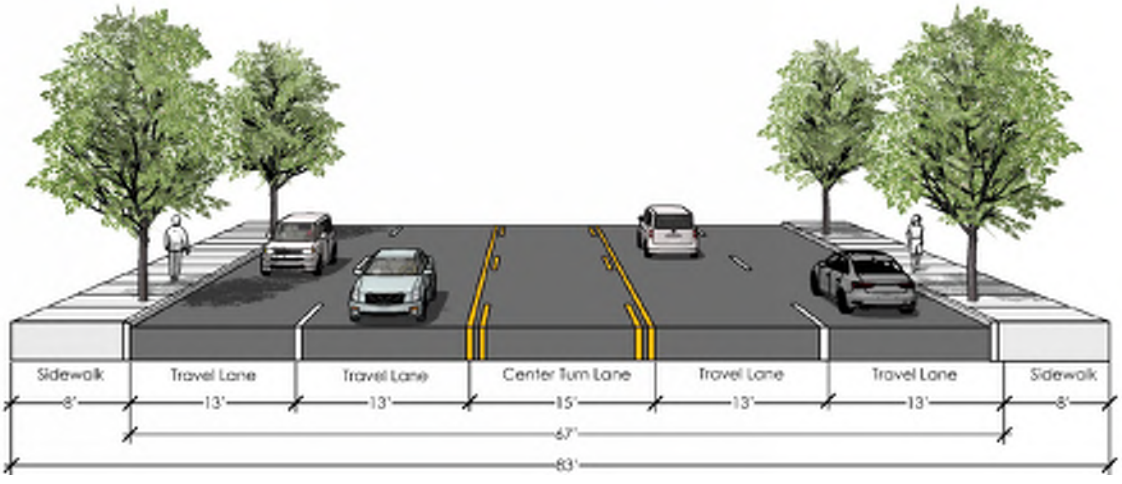
[16] "Parking is not provided on Oak Street east of 9th Avenue; however, the cross-sectional width is the same for this segment."

Figure 14: Baseline Street – Facing East



As illustrated in Figure 14, the typical existing cross section for Baseline Street includes three (3) travel lanes, and sidewalks on both sides of the roadway separated by a landscape buffer. The sidewalk and landscaping widths vary depending on the location along the corridor.

Figure 15: 10th Avenue - Facing North



As illustrated in Figure 15, the typical existing cross section for 10th Avenue includes four (4) travel lanes, one (1) two-way center turn lane, and sidewalks on both sides of the roadway. There are also bike lanes located along segments of 10th Avenue, but they do not span the full extents of the influence area.

Average Annual Daily Traffic

According to ODOT TransGIS, the Average Annual Daily Traffic (AADT) along Baseline Street ranges from 14,600 to 15,900. Along Oak Street the AADT is higher; it ranges from 16,400 to 17,600. Parallel streets have substantially lower volumes: along Walnut Street the AADT ranges from 4,500 to 7,100 and along Main Street the AADT ranges from 7,600 to 9,400. AADT along 10th Avenue in the project area ranges from 25,400 to 32,500.

Posted Speed

Posted speed for Baseline Street and Oak Street is 30 mph. The posted speed along cross-streets in the project area ranges between 20-30 mph. The posted speed along 10th Avenue between Walnut Street and Maple Street is 35 mph. Figure 16 illustrates the posted speed in the influence area.

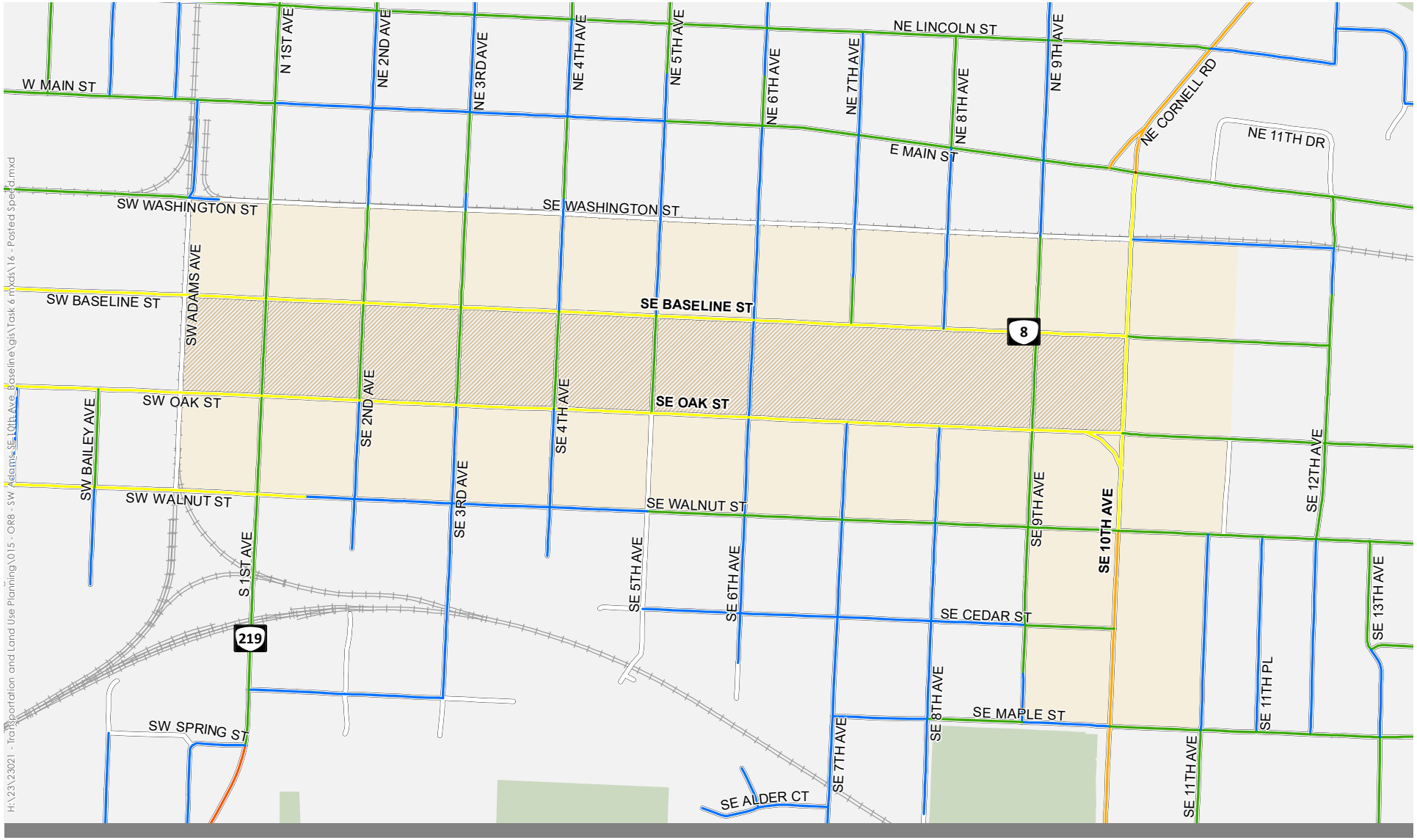


Figure 16

KITTELSON & ASSOCIATES

Posted Speed
Hillsboro, Oregon

Traffic Analysis

The following section provides a summary of existing traffic demand data (provided by the City) for the weekday PM peak period, including vehicular, freight, pedestrian, and bicycle movement counts and speed, delay, corridor travel time, and emissions.

Traffic Demand Data

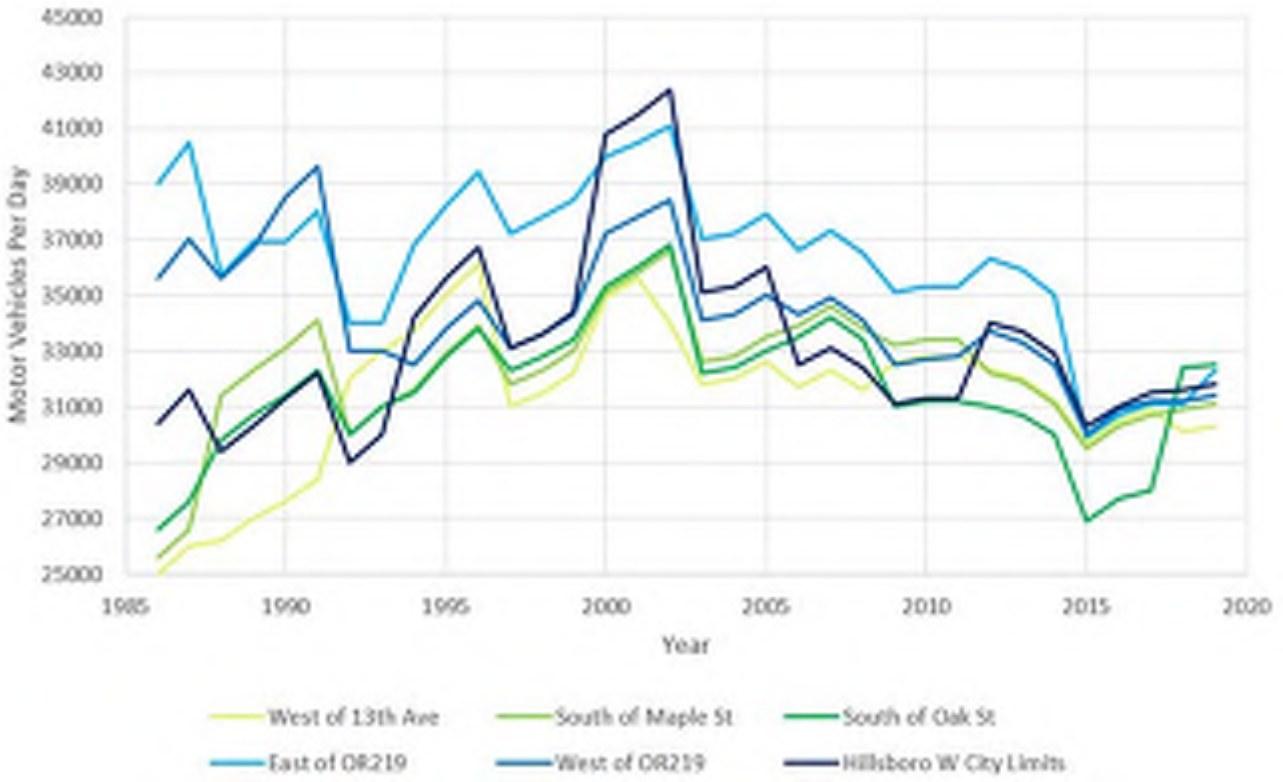
Existing Traffic Volumes

Traffic counts were collected in February 2020 (prior to travel pattern changes related to the COVID-19 pandemic). Appendix B summarizes the existing (year 2020) PM peak hour turning movement volumes at the study intersections on Oak Street, Baseline Street, and 10th Avenue. PM peak hour traffic volumes on Baseline Street range from approximately 1,300 to 1,675 vehicles, while volumes on Oak Street range from approximately 1,450 to 1,550 vehicles. The bi-directional PM peak hour volume on 10th Avenue ranges from approximately 2,400 to 2,825 vehicles.

The existing (year 2020) traffic volumes through downtown Hillsboro are lower than volumes counted in prior years. Chart 1 below shows the change in traffic volumes between 1986 and 2019 along OR 8 based on ODOT Automatic Traffic Recorder data, with a general downward trend since approximately 2002. Potential reasons for the decrease in traffic could include:

- Drivers shifting to other routes to avoid congestion elsewhere
- Shifts in major employment centers since 2002 (such as the Intel campus moving from Aloha to north Hillsboro)
- Enhancements to transit options with the opening of the MAX Blue line
- Land use and transportation policies encouraging non-single occupancy vehicle travel

Chart 1: OR 8 Average Daily Traffic Volume (1986-2019)



Specifically, critical movements on 10th Avenue at Oak Street and Baseline Street are lower than counts taken in prior years, as listed in Table 6. Select traffic counts over various years show the downward trend in traffic volume for these movements. The critical movements where 2020 traffic volumes have shown a consistent decrease in volume are bolded in Table 6. The movements exhibiting the largest drop in volume are movements to/from Oak Street/Baseline Street and 10th Avenue.

Table 6: Key Intersection Turning Movement Count Differences

Intersections	Movement	Traffic Count[1]				
		2002	2005	2010	2016	2020[2]
10th Avenue/ Oak Street	**Northbound Thru**	1282	1384	-	1174	**1065**
	Southbound Thru	409	407	-	560	572
	Eastbound Right	1208	1139	-	965	**813**
10th Avenue/ Baseline Street	**Northbound Left**	960	890	861	-	**731**
	Southbound Thru	358	384	428	-	547
	Southbound Right	393	328	405	-	457

[1]Counts were collected over various months, no seasonal adjustment factors were applied due to the commuter-based nature of traffic.

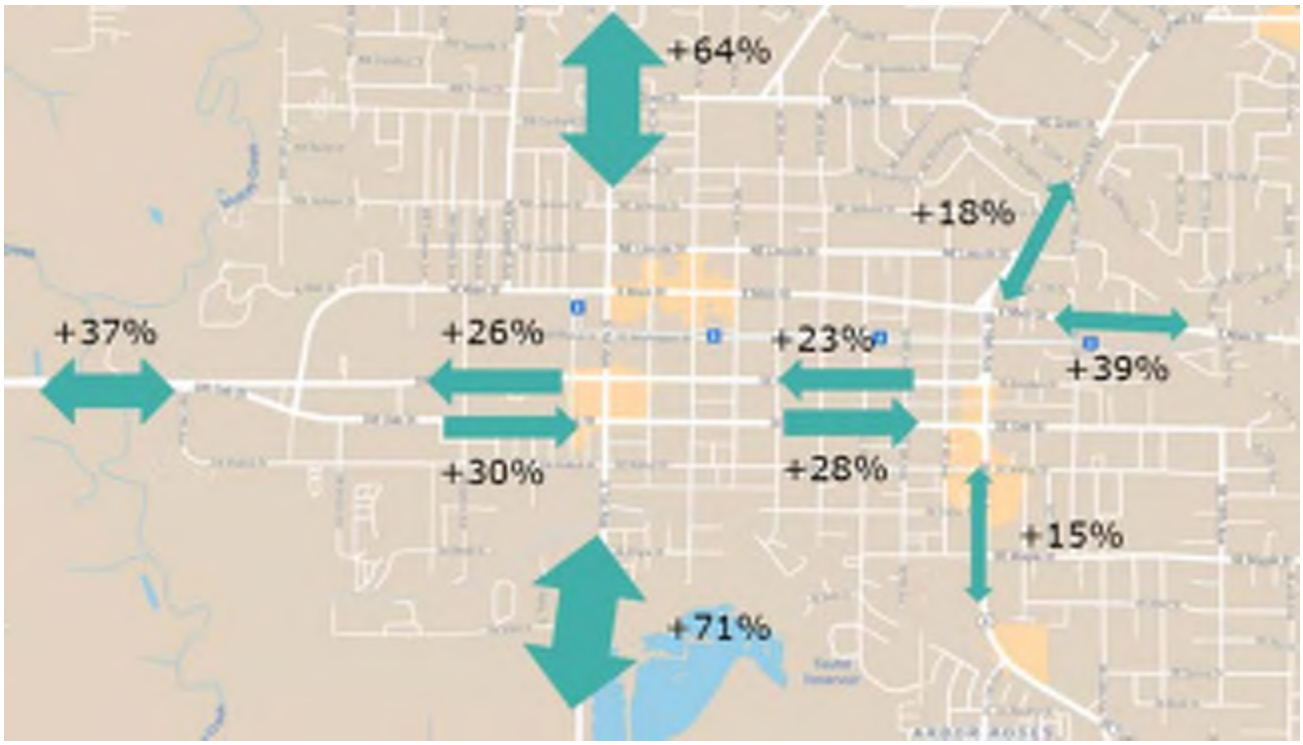
[2] Traffic counts collected in February 2020 (prior to travel pattern changed related to the COVID-19 pandemic).

Future Design Demand

As part of the Hillsboro Downtown Solutions Project, a Visum mesoscopic (meso) model was developed for the entire downtown Hillsboro area consistent with the Washington County regional travel demand model provided by the county in 2019 at the onset of the Hillsboro Downtown Solutions Project. Future year (2040) no-build traffic volumes were previously forecast at each of the study intersections. This analysis utilized the same future traffic volumes for consistency between projects.

Figure 17 shows the approximate growth in traffic volumes on key gateways entering the downtown area. The largest proportion of growth occurs on 1st Avenue, with more through trips on 1st Avenue (OR 219). There is also substantial growth forecast between Hillsboro and Cornelius/Forest Grove to the west on OR 8, with more moderate traffic volume growth on Oak Street and Baseline Street through downtown. The growth along Oak Street and Baseline is largely contributed to moderate regional growth stemming from Cornell Road to the north and OR 8 (TV Hwy) to the south, and substantial growth along Main Street/Baseline Road to the east.

Figure 17: Approximate Traffic Volume Growth (2020 to 2040) Weekday PM Peak Hour



The future no-build model (year 2040) intersection turning movement traffic volumes are shown in Appendix C. Within the study area, year 2040 weekday PM peak hour traffic volumes on Baseline Street range from approximately 1,425 to 2,075 vehicles, while volumes on Oak Street range from approximately 1,675 to 1,925 vehicles. The total year 2040 weekday PM peak traffic volume on 10th Avenue ranges from approximately 2,775 to 3,250 vehicles.

Speed Data

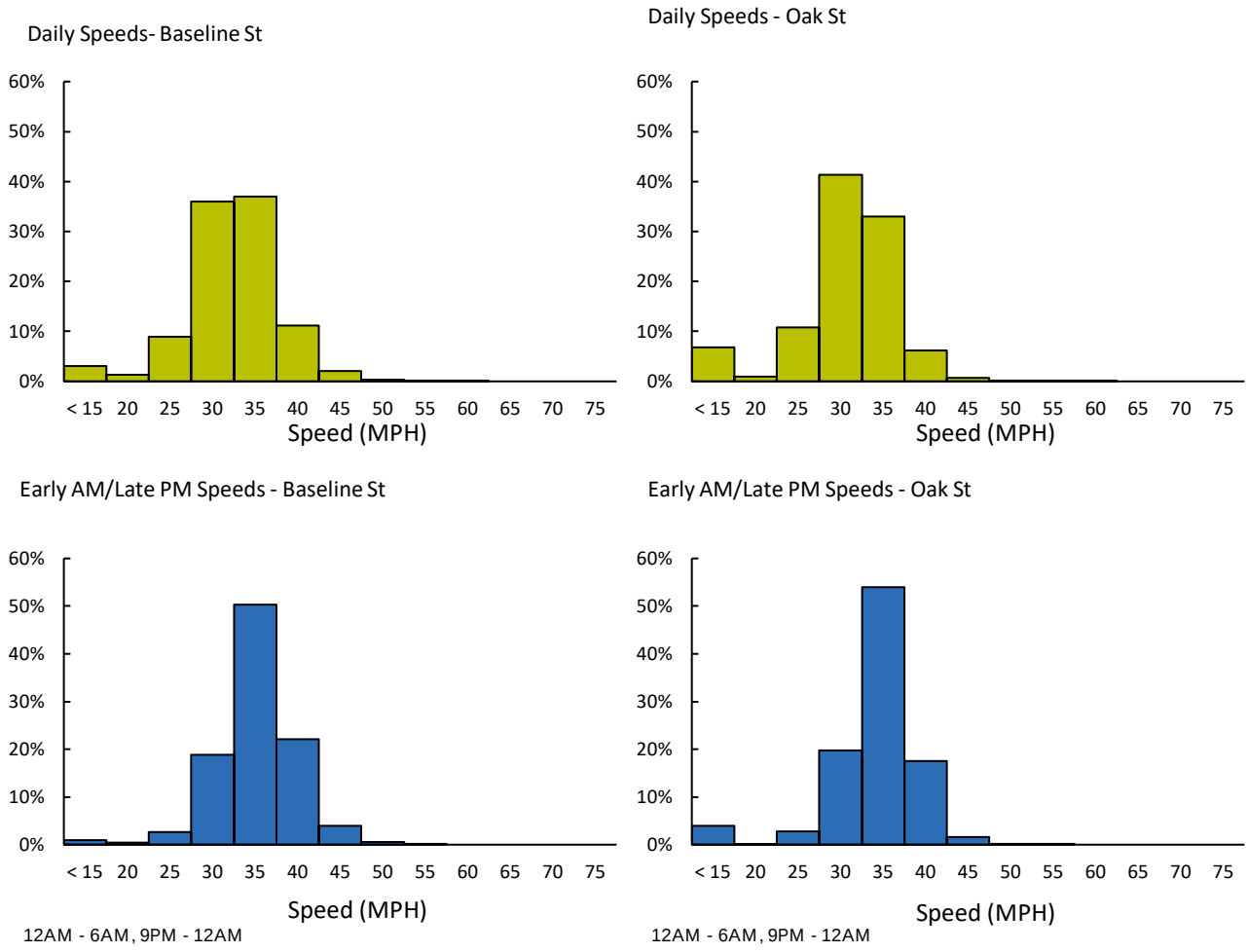
Vehicle speed data was collected midblock east and west of the Oak Street/6th Avenue and Baseline Street/6th Avenue intersections by pneumatic tube. The data was collected over a 24-hour period on Wednesday June 9th, 2021 and is summarized in Table 5. The ODOT Speed Zone Manual (Reference 17) states that in urban areas, the 50th percentile speed is an appropriate speed for determining speed zones due to the different crash types and a higher prevalence of vulnerable road users.

Table 7. Posted Speed Limit and Measured 50th and 85th Percentile Speed for Oak & Baseline Streets

Location	Posted Speed Limit	50th Percentile Speed	85th Percentile Speed	24-Hour Volume
Oak Street (west of 6th Avenue)	30 MPH	29 MPH	34 MPH	15,754
Baseline Street (west of 6th Avenue)	30 MPH	31 MPH	35 MPH	14,798

The 50th percentile speed for both corridors is within one MPH of the posted speed limit, which suggests the roadway's posted speed limit has been adequately set. Vehicles driving in excess of the speed limit occurs more often in the early morning or late evening, as illustrated below in Figure 17.

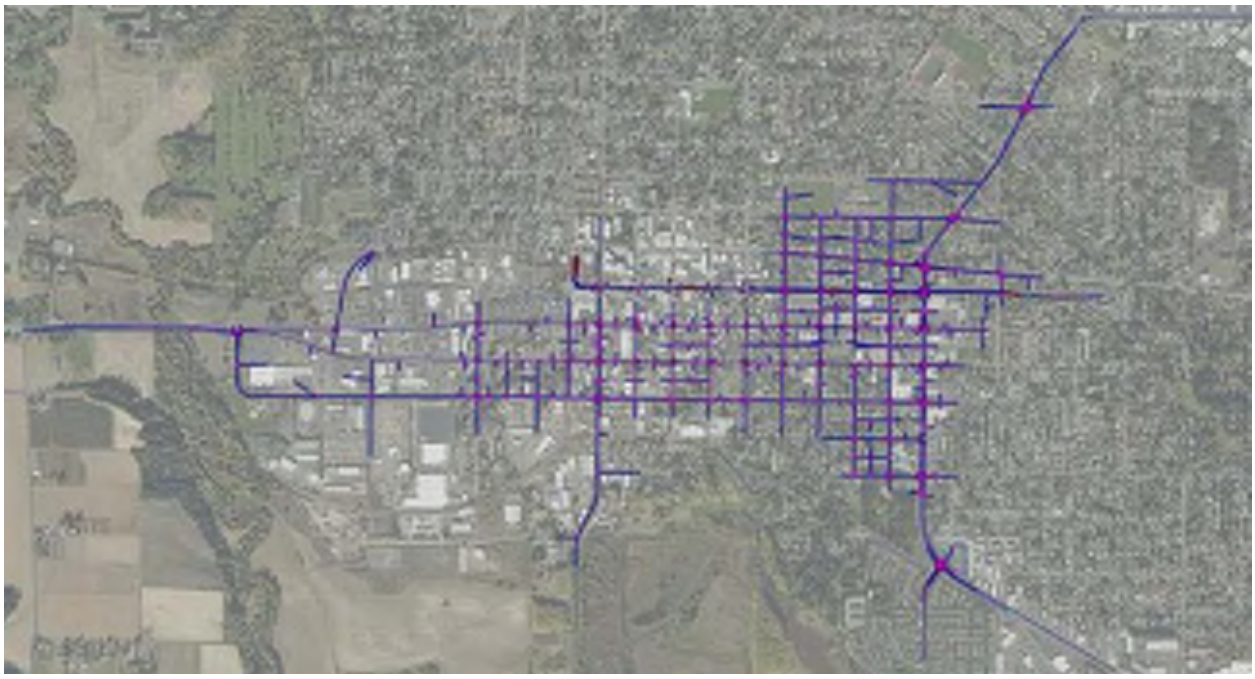
Figure 18: Speed Profiles for Daily and Late Night and Early Morning at Oak Street and Baseline Street



System Operations

The Hillsboro Downtown Solutions Project created, a VISSIM microsimulation model for the entire downtown Hillsboro area (shown in Figure 19 below). The microsimulation model provides a detailed look at system operations on OR 8/Oak Street/Baseline Street in the downtown area. The model calibration was conducted in accordance with the ODOT Protocol for VISSUM Simulation (Reference 18), The traffic demand data used in the modeling process is the same data listed above. The existing conditions (year 2020) and future no-build model (year 2040) results were documented as part of the Hillsboro Downtown Solutions project. A summary of the system operations results is provided below.

Figure 19: VISSIM Project Area



Corridor Travel Times and Average Speed

Four segments were analyzed in the microsimulation model to determine the existing and future no-build travel time and average speed:

- OR 8/331st Avenue (west of Hillsboro) to 10th Avenue/Oak Street
- OR 8/331st Avenue (west of Hillsboro) to OR 8/River Road
- 10th Avenue/Oak Street to OR 8/331st Avenue (west of Hillsboro)
- OR 8/River Road to OR 8/331st Avenue (west of Hillsboro)

Table 8 below lists the model travel time and average speed. In general, travel times are expected to increase by 11 to 16 percent compared to the future no-build conditions (with average travel speeds decreasing) due to the increased traffic demand and congestion on OR 8.

Table 8: Corridor Travel Times and Average Speed– PM Peak Hour

Segment		Field Data Travel Time (mins)	Existing Model		Future No-Build Model		VISSIM Model Difference	
From	To		Travel Time (mins)	Speed (mph)	Travel Time (mins)	Speed (mph)	Travel Time (mins)	Speed (mph)
OR 8 / 331st Ave	10th Ave / Oak St	5:42	5:25	24	5:59	21	+0:34 (10%)	-3 (-13%)
OR 8 / 331st Ave	OR 8 / River Rd	7:27	7:50	22	9:05	19	+1:15 (16%)	-3 (-14%)
10th Ave / Oak St	OR 8 / 331st Ave	6:21	5:30	24	6:06	22	+0:36 (11%)	-2 (-8%)
OR 8 / River Rd	OR 8 / 331st Ave	08:55	7:44	22	8:50	20	+1:06 (14%)	-2 (-9%)

Fuel Consumption and Emissions

Fuel consumption and emissions were also summarized from the microsimulation models. These numbers are based on Mobile 6 Methodology (Reference 19) and should be used for comparative purposes and not for absolute values of emissions and fuel consumption. As shown in Table 9, emissions and fuel consumptions increase in the future no-build from the existing model. The emissions and fuel consumptions in the future increase by about 65 percent as a result of increased demand and delay. Note this evaluation does not take into account improvements in fleet economy and electric vehicle market share over time.

Table 9: Model Emissions and Fuel Consumption – PM Peak Hour

Model Emissions and Fuel Consumption	Existing	No-Build	% Change
Emissions CO (grams)	124,925	205,480	+64%
Emissions NO_X (grams)	24,275	39,975	+65%
Emissions VOC (grams)	28,975	47,625	+64%
Fuel Consumption (gal)	1,780	2,930	+65%

Intersection Operations

Intersection operations were analyzed in Synchro software using Highway Capacity Manual 6th Edition (HCM 6, Reference 20) methodology. Measures used for the intersection operations analysis include Level of Service (LOS), delay, and volume-to-capacity (v/c) ratio. LOS is a "report card" rating (A through F) based on average delay experienced by vehicles at the intersection. Mobility targets for OR 8 are based on the OHP (Reference 15), which sets a v/c ratio target of 1.10 for the first hour and 0.99 for the second hour in regional centers, such as downtown Hillsboro.

Table 10 lists the intersection operations results for existing and future no-build conditions. For future no-build conditions, intersection split timing was optimized but no change was assumed for pedestrian calls. All intersections under existing 2020 and future 2040 no-build conditions are forecast to operate within the v/c ratio target for all highway approaches. Side-street approaches that are stop-controlled experience the greatest delays, which is common for such intersection control types in urban areas.

Table 10. Intersection Operations – PM Peak Hour

Intersection	Control Type	Existing			Future No-Build		
		V/C	LOS	Delay (s)	V/C	LOS	Delay (s)
10th Ave / Maple St	Signal	0.75	A	9	0.89	B	11
10th Ave / SE Cedar St	TWSC	0.49/0.34	C/C	15/24	0.56/0.70	C/F	19/51
10th Ave / SE Walnut St	Signal	0.90	B	11	1.02	B	15
10th Ave / SE Oak St	Signal	0.77	C	34	0.86	D	38
10th Ave / SE Baseline St	Signal	0.71	D	49	0.82	D	52
SE Baseline St / SE 9th Ave	TWSC	0.28/0.74	A/F	8/67	0.30/ 1.11	A/F	8/175
SE Baseline St / SE 8th Ave	Signal	0.40	B	18	0.48	B	19
SE Baseline St / SE 7th Ave	Signal	0.48	B	18	0.70	C	21
SE Baseline St / SE 6th Ave	TWSC	0.32/1.08	A/F	8/182	0.38/1.80	A/F	8/488
SE Baseline St / SE 5th Ave	Signal	0.46	B	19	0.57	C	21
SE Baseline St / SE 4th Ave	TWSC	0.34/0.18	A/A	0/0	0.41/0.23	A/A	0/0
SE Baseline St / SE 3rd Ave	Signal	0.77	C	20	0.91	C	24
SE Baseline St / SE 2nd Ave	Signal	0.45	C	20	0.56	C	25
SE Baseline St / S 1st Ave	Signal	0.72	C	20	0.85	C	24
SW Baseline St / SW Adams Ave	TWSC[1]	0.05/0.00	A/A	0/0	0.06/0.00	A/A	0/0
SW Oak St / SW Adams Ave	TWSC[1]	0.32/0.60	A/F	8/60	0.38/0.89	A/F	8/131
SE Oak St / S 1st Ave	Signal	0.78	B	15	1.01	D	35
SE Oak St / SE 2nd Ave	TWSC	0.35/0.12	A/C	8/19	0.45/0.17	A/C	8/24
SE Oak St / SE 3rd Ave	Signal	0.44	B	18	0.55	C	20
SE Oak St / SE 4th Ave	TWSC	0.3/ 0.15	A/C	0/20	0.44/0.21	A/D	8/26
SE Oak St / SE 5th Ave	Signal	0.43	B	18	0.53	C	21
SE Oak St / SE 6th Ave	TWSC	0.37/0.70	A/F	8/130	0.45/0.78	A/F	9/144
SE Oak St / SE 7th Ave	Signal	0.47	B	19	0.59	C	23
SE Oak St / SE 8th Ave	TWSC	0.32/0.03	A/C	0/19	0.38/0.08	A/C	0/24
SE Oak St / SE 9th Ave	TWSC	0.34/0.59	A/F	8/101	0.41/0.70	A/F	9/126
TSWC Intersection operations shown by Worst Major approach/Minor approach							

[1] Railroad crossing

Queuing and Congestion

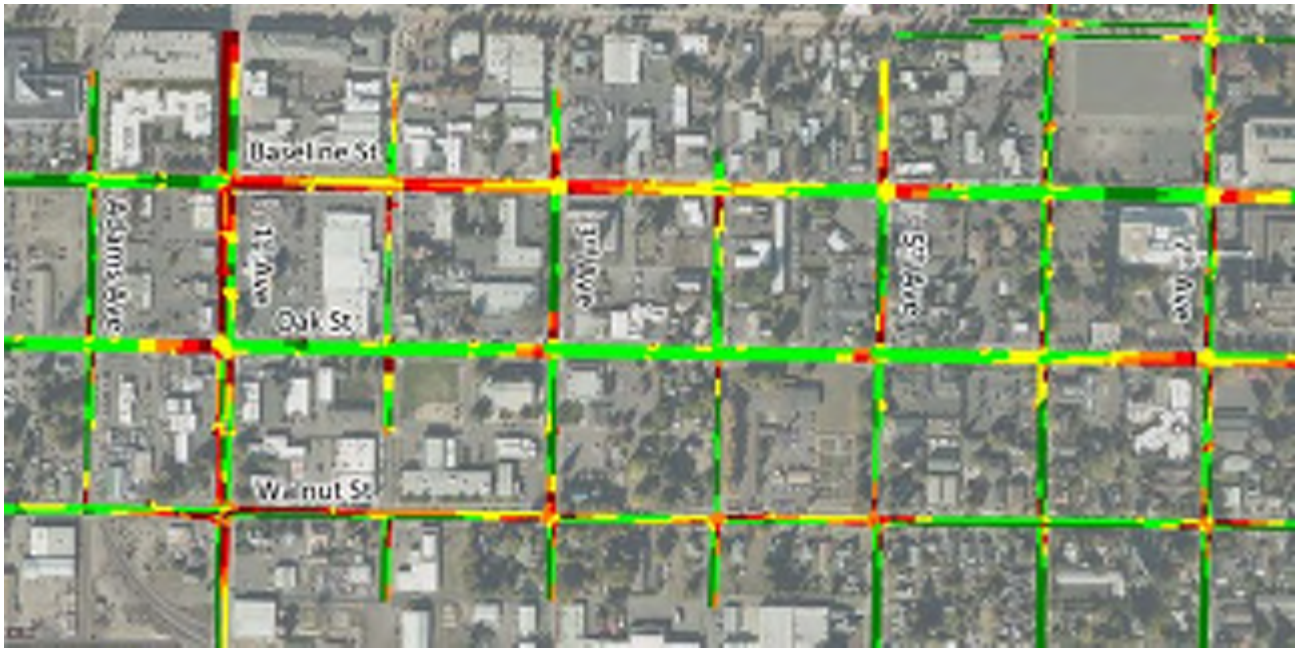
The VISSIM model was also used to measure delay relative to desired speed as an indicator of congestion. The delay is measured as a percentage of travel time for a given roadway segment. The figures in Appendix D show the relative delay (queues) for each 15-minute interval during the 4-6 PM analysis period, as averaged over 10 simulations. The colors shown in these figures indicate the following approximate queue states:

- Dark Green = Free flow, no delay (delay less than 5% of travel time)
- Light Green = Slight slowing (5-20%)
- Yellow = Increased slowing, but not yet stop and go (20-40%)
- Orange = Furthest extent of stop and go queues, rough approximation of 95th percentile queue (40-60%)
- Red = Fluctuates between low-speed flow and stopped queue (60-80%)
- Dark Red = Stop and go queue during the entire 15-minutes peak interval (delay greater than 80% of travel time)

Figure 20 and Figure 21 below compare the congestion on Oak Street and Baseline Street between Adams Avenue and 7th Avenue. The figures show the existing and future no-build congestion for the most congested 15-minute interval (5:15 PM to 5:30 PM). Under the future no-build conditions, queueing on 1st Avenue worsens. Vehicular demands at the 1st Avenue/Walnut Street and 1st Avenue/Oak Street intersections under future no-build conditions cause queues to spillback on the southbound approach of 1st Avenue and on the westbound approach of Baseline Street. Stop and go queues from 1st Avenue to 3rd Avenue on Baseline Street are shown under future no-build conditions. There is also queueing westbound on Walnut Street in part due to the forecast demand operating through shared-lane operations with a permissive left turn at 1st Avenue.

Figure 20: Existing Conditions (Year 2020) Congestion Plot – from Adams Avenue to 7th Avenue

Figure 21: Future No-Build Conditions (Year 2040) Congestion Plot – from Adams Avenue to 7th Avenue



To quantify the queueing on OR 8, average and 95th percentile queues were measured for the one-hour system peak hour (4:30 PM to 5:30 PM) using the microsimulation model (VISSIM). To calculate 95th percentile queues, queue length data was collected from the VISSIM model with a 120-second interval to reflect queues that form while traffic flow is impeded. The 95th percentile queue was then calculated using a percentile function in Excel. Queue lengths are reported for each study intersection in Appendix D while select queues at select study intersections are reported in Table 11 below.

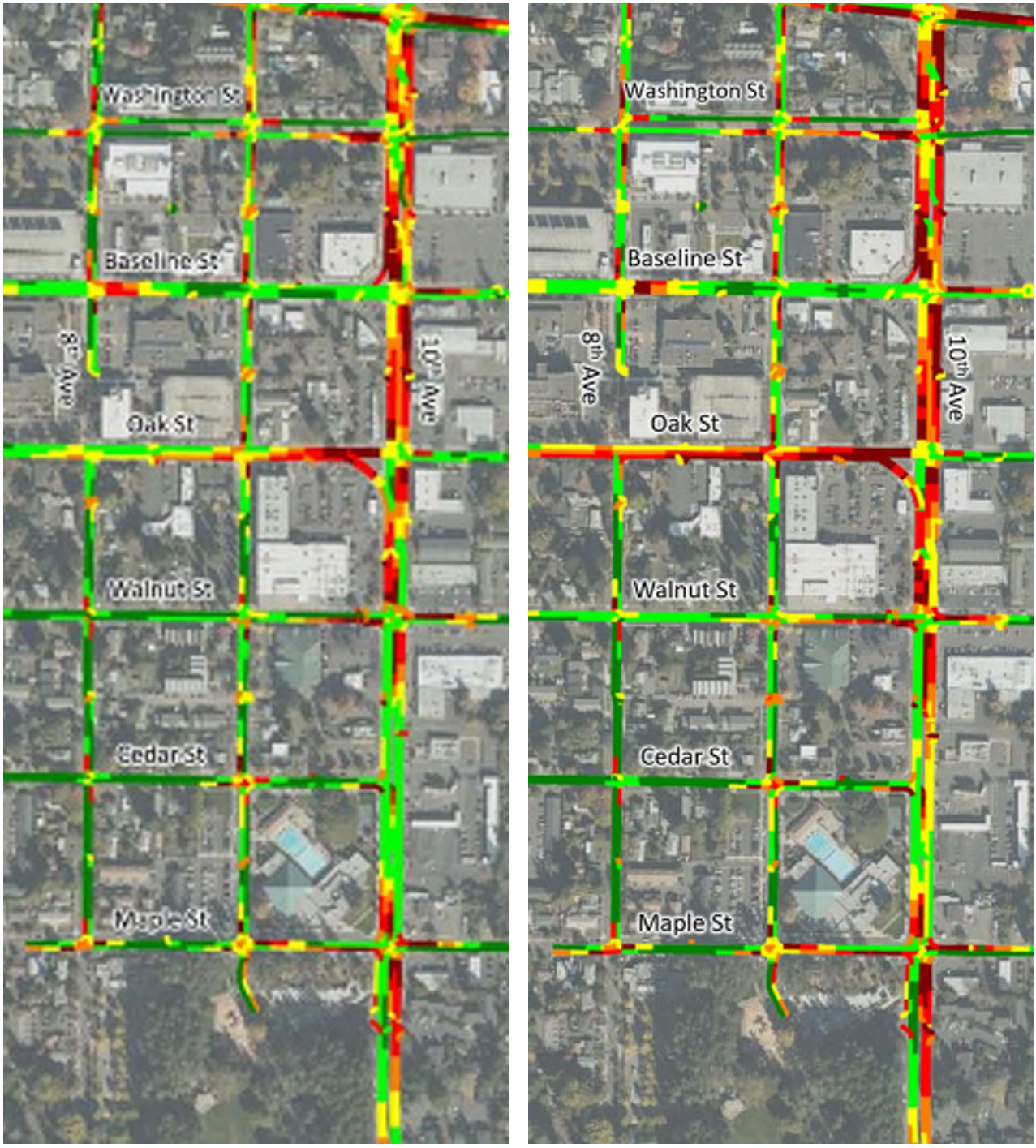
Table 11: Intersection Queuing - PM Peak Hour

Intersection	Control Type	Critical Movement	Storage (ft)A	Existing		Future No-Build	
				Average Queue (ft)	95th Percentile Queue (ft)	Average Queue (ft)	95th Percentile Queue (ft)
10th Ave / Baseline St	Signal	NBTL	385	**395**	**475**	410	**475**
		SBR	370	315	**540**	345	**580**
10th Ave / Oak St	Signal	EBR	350	355	800	705	1305
		NBT	390	150	355	220	540
SE Baseline St / 1st Ave	Signal	WB	390	50	145	320	470
		SBT	850	290	570	1490	1835
		NBTL	385	95	200	120	375
SE Oak St / 1st Ave	Signal	EB	1450	105	220	175	395
		SBL	385	145	**475**	475	**515**
		SBT	385	205	**475**	475	**515**
		NBT	395	70	135	90	205

Figure 22 shows a comparison of the estimated congestion on OR 8 (Oak Street-Baseline Street-10th Avenue) between 8th Avenue and Maple Street. Under future no-build conditions, congestion on Oak Street approaching 10th Avenue could increase, with stop and go queues extending beyond current conditions. Northbound queuing on 10th Avenue approaching Maple Street also increases.

Figure 22: OR 8 Congestion Plot from 8th Avenue to Maple Street:

Left = Existing Conditions (Year 2020); Right = Future No-Build Conditions (Year 2040)



Traffic Signal Timing and Progression Analysis

Today, the signalized intersections on Oak Street and Baseline Street are pretimed to run at a 55-second cycle length with offsets intended to enhance progression for eastbound and westbound traffic. 10th Avenue traffic signals are coordinated and running at 110-second cycle lengths. However, at 10th Avenue and Washington Street, the MAX Blue line frequently preempts the traffic signal, causing spikes in queueing during the weekday PM peak period and resulting in the signal temporarily going out of coordination. Given that MAX Blue line headways are typically every 15 minutes during the weekday PM peak hour, this corresponds to approximately one preemption every five traffic signal cycles.

Based on qualitative field observations, progression quality along Oak Street and Baseline Street is favorable to highly favorable based on the proportion of vehicle arriving on green. The relatively low volumes on the side streets along with the pretimed signals allow for this progression on Oak Street and Baseline Street between 1st Avenue and 10th Avenue. Oak Street has an arterial bandwidth of 16 seconds while Baseline Street is nine seconds during the weekday PM peak hour.

Along 1st Avenue, the signals are timed to allow for progression in the southbound direction with a bandwidth of 22 seconds between Baseline Street and Oak Street. There is no progression bandwidth for northbound.

Progression through the 10th Avenue intersections currently operates poorly with three seconds of bandwidth for north and southbound traffic. This is caused by the intersections of 10th /Baseline and 10th/Oak where there are frequent turning movements that conflict with the through movements of 10th Avenue. This is a fairly common outcome when an arterial couplet terminates into a crossing two-way arterial.

Parking

The following section provides a summary of existing parking supply within the project influence area and identifies the City's policies and code requirements.[17]

Comprehensive Plan Parking Policies

The Hillsboro Comprehensive Plan (Reference 21) provides several policies related to parking, but does not include any minimum parking supply requirements. Policy T 4.9 is to "establish and maintain context-

[17] According to the scope of work, the consultant was to provide a summary of parking needs for current and future development based on City code requirements. As described in Appendix E, City code provides parking requirements based on use, number of rooms, and surface areas of buildings. There is not sufficient data available to estimate the parking required by code for existing and future development, therefore this memorandum focuses on an inventory of existing parking facilities and local code requirements.

sensitive standards to ensure appropriate parking capacity for all modes, while also considering parking management for the efficient use of resources." To provide for higher density mixed-use development, the Hillsboro Comprehensive Plan has policies for areas zoned Station Community Planning Area. This policy is to include "provisions that reduce off-street parking requirements within Station Community Planning Areas." This is the designation applied to the study area.

Municipal Code

The City of Hillsboro, Oregon Municipal Code 12.50.320 sets the required vehicle parking spaces based on land use according to zones. Appendix E provides a table with the minimum and maximum vehicle parking spaces for commercial uses required by city code.

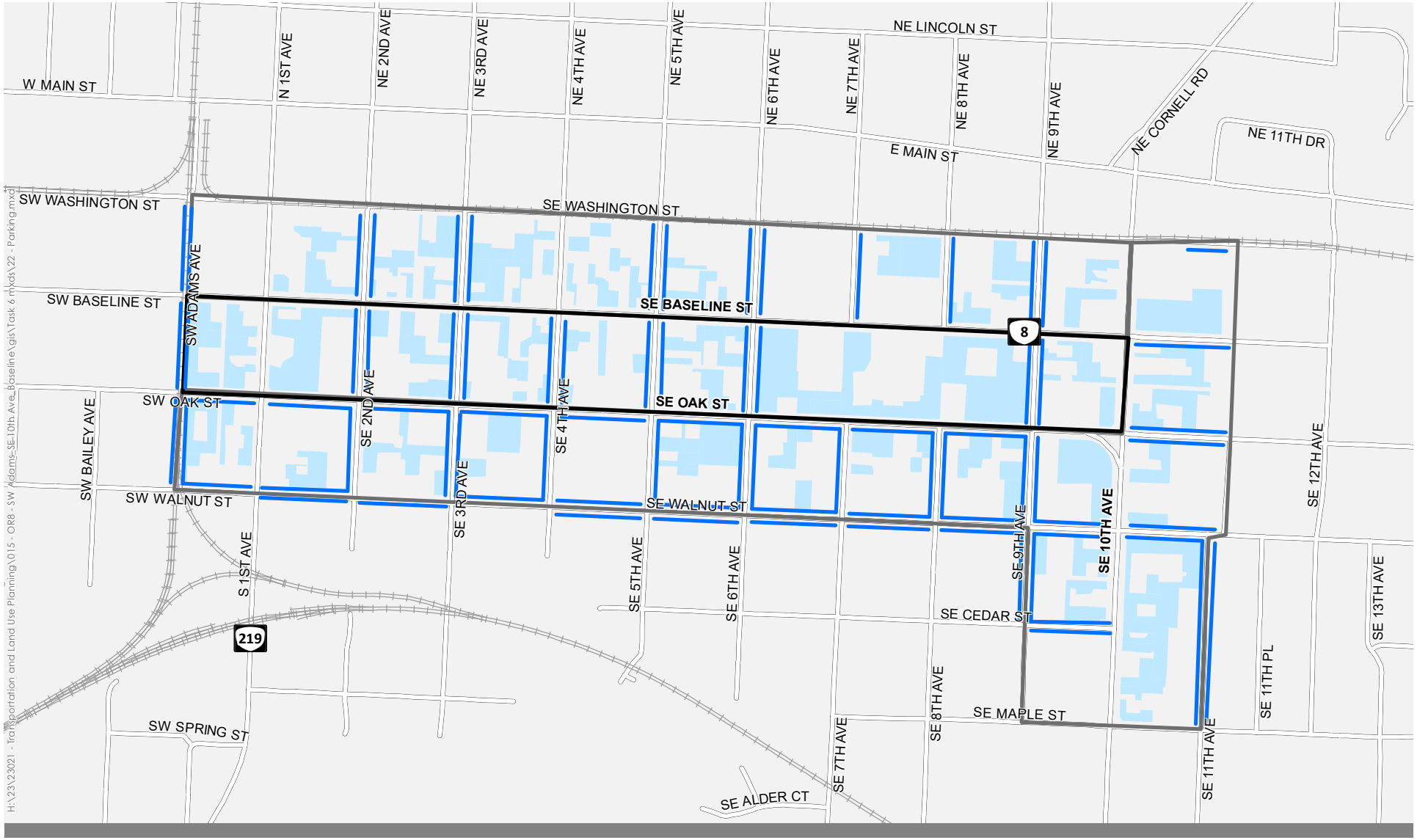
Existing Parking Facilities

The location of on-street and off-street parking is provided in Figure 23. The location of on-street parking data between 7th Avenue and 10th Avenue was provided in the draft Hillsboro Parking Study (2020) (Reference 22). The location of on-street parking data between Adams Avenue and 6th Avenue and off-street parking was provided by the City of Hillsboro.

Based on the parking data provided, there are total of 3,890 off-street parking stalls and 1071 on-street parallel parking spaces in the influence area. Approximately half of block faces in the influence area allow on-street parallel parking[18]: there is on-street parallel parking located along Oak Street, Walnut Street, and a majority of the parallel streets in the influence area. Parking along the Avenue streets is limited to 2-hour time stays. There is no on-street parking located along Washington Street, Baseline Street, or 10th Avenue in the influence area.

A majority of the influence area is zoned Station Community Commercial. As described in the Comprehensive Plan Policies section above, the policy for this zoning is to reduce off-street parking requirements in this area.

[18] According to the data available, 81 out of 152 block faces in the influence area allow on-street parking.



On-Street Parking

Off-Street Parking

Influence Area

Project Area

0 500 Feet

Figure 23

Existing Parking Facilities
Hillsboro, Oregon

KITTELSON & ASSOCIATES

SAFETY ANALYSIS

The safety analysis included a review of historical crash data and systemic safety risk factors present in the influence area.

Crash Analysis

The five most recent years of available crash data (January 1, 2014 to December 31, 2018) were provided by ODOT's Crash Analysis and Reporting Unit and reviewed for the study intersections and segments in the project area. The segments analyzed were:

- Baseline Street between Adams Avenue and 10th Avenue and all intervening intersections
- Oak Street between Adams Avenue and 10th Avenue and all intervening intersections
- 10th Avenue between Baseline Street and Maple Street and all intervening intersections

The data was analyzed for a variety of factors including crash location, severity, type, and characteristics to identify potential crash patterns or area-wide trends.

Additional attention was directed toward locations identified as top 5% or 10% locations from the most recent three (3) Safety Priority Index System (SPIS) site listings. Table 12 summarizes the reported crash history by crash type and Table 13 summarizes the reported crash history by injury severity along Oak Street, Baseline Street, and 10th Avenue. Figure 24 illustrates the locations of reported crashes between January 1, 2014 and December 31, 2018 within the vicinity of the project area.[19]

[19] Crashes that occurred at the same location may be mapped on top of one another, therefore some icons may represent multiple crashes.

Table 12: Reported Crash History by Crash Type (January 1, 2014 to December 31, 2018)

Study Location	Crash Type							Total Number of Crashes
	Angle	Pedestrian	Bicycle[2]	Rear-end	Sideswipe-overtaking	Turning Movement	Misc.	
Intersections								
Oak St/Adams Ave	3	0	0	0	1	5	0	9
Oak St/1st Ave	29	1	1	7	1	20	2	61
Oak St/2nd Ave	3	0	0	0	0	5	0	8
Oak St/3rd Ave	23	2	0	5	0	3	0	33
Oak St/4th Ave	2	0	0	1	2	1	1	7
Oak St/5th Ave	3	0	0	1	0	0	0	4
Oak St/6th Ave	2	0	1	3	0	0	0	6
Oak St/7th Ave	7	1	1	2	0	4	0	15
Oak St/8th Ave	0	1	0	0	1	0	0	2
Oak St/9th Ave	23	1	0	1	1	4	0	30
Oak St/10th Ave	11	0	1	10	1	26	4	53
Baseline St/Adams Ave	22	2	0	3	0	5	0	32
Baseline St/1st Ave	0	1	0	6	1	9	0	31
Baseline St/2nd Ave	0	1	0	5	0	0	1	7
Baseline St/3rd Ave	4	1	0	5	0	1	2	13
Baseline St/4th Ave	18	0	0	0	0	6	0	24
Baseline St/5th Ave	9	0	0	2	0	4	0	15
Baseline St/6th Ave	9	0	0	1	0	1	1	12
Baseline St/7th Ave	7	0	0	1	1	2	0	11
Baseline St/8th Ave	1	1	0	6	0	4	1	13
Baseline St/9th Ave	14	1	0	4	2	8	0	29
Baseline St/10th Ave	3	0	0	8	9	24	0	44
10th Ave/Walnut St	7	3	0	8	1	14	0	33
10th Ave/Cedar St	0	1	1	1	1	1	0	**5**
10th Ave/Maple St	6	4	0	14	1	5	0	30
Subtotal	**220**	**21**	**5**	**94**	**23**	**152**	**12**	**497**
Segments[1]								
Baseline St (between Adams Ave and 10th Ave)	0	0	1	18	28	15	2	64
Oak St (between Adams Ave and 10th Ave)	0	2	0	28	24	7	6	67
10th Ave (between Baseline St and Maple St)	1	1	1	39	23	3	4	72

[1]The extents of the roadway segments are between Adams Avenue and 10th Avenue for Oak Street and Baseline Street and between Baseline Street and Walnut Street for 10th Avenue. Segment crashes and intersection crashes are reported separately.

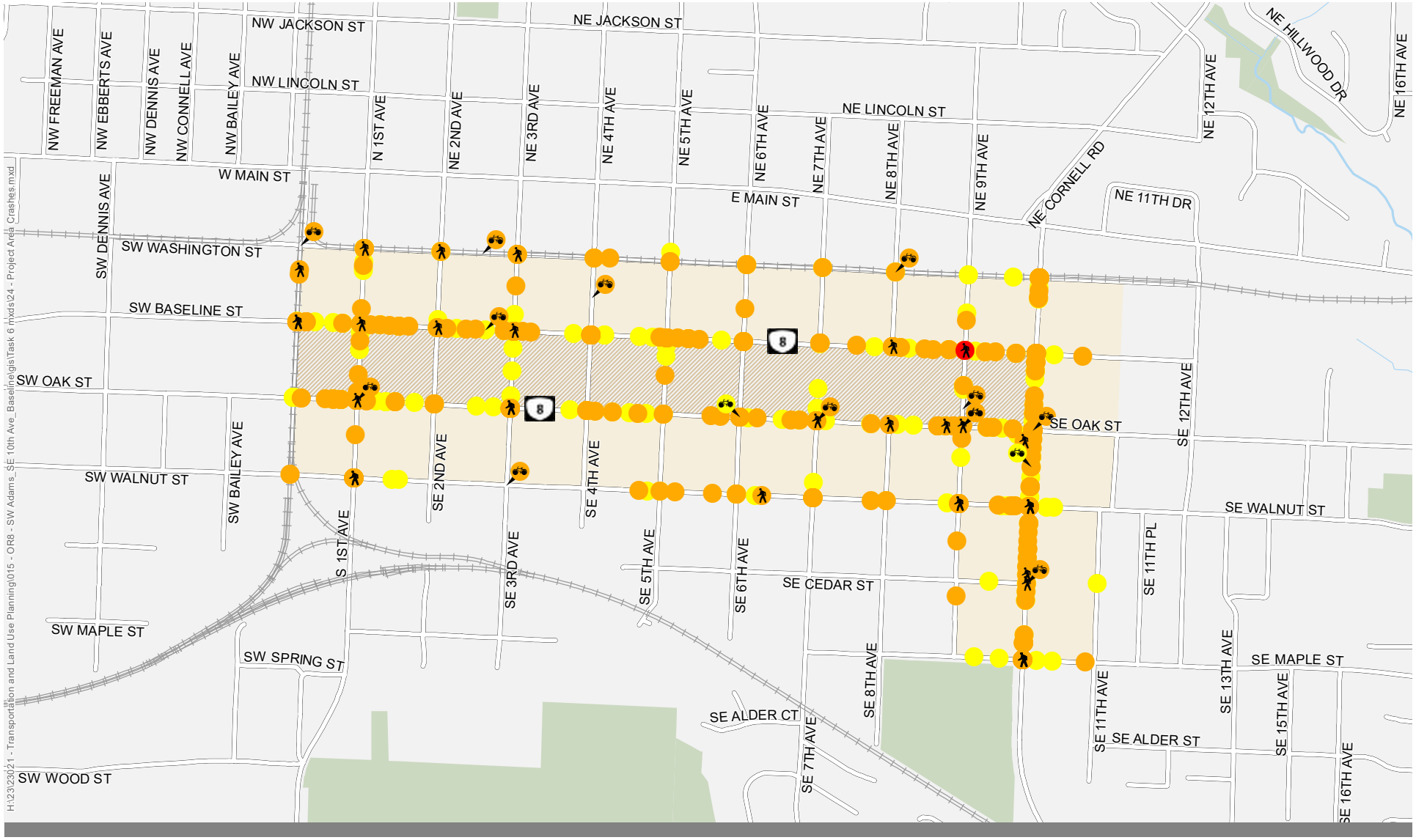
[2]Bicycle crashes were not reported as separate crash types. For the purposes of this table, bicycle crashes were removed from the crash type category they were categorized in.

Table 13: Reported Crash History by Crash Severity (January 1, 2014 to December 31, 2018)

Study Location	Crash Severity					Total Number of Crashes	SPIS Percent[2]
	Fatality	Serious Injury (A)	Moderate Injury (B)	Minor Injury (C)	PDO		
Intersections							
Oak St/Adams Ave	0	0	0	0	9	9	N/A
Oak St/1st Ave	0	2	9	23	27	61	95%
Oak St/2nd Ave	0	0	0	4	4	8	N/A
Oak St/3rd Ave	0	0	6	16	11	33	90%
Oak St/4th Ave	0	0	1	3	3	7	N/A
Oak St/5th Ave	0	0	1	1	2	4	95%
Oak St/6th Ave	0	0	2	3	1	6	N/A
Oak St/7th Ave	0	0	5	6	4	15	95%
Oak St/8th Ave	0	0	1	1	0	2	N/A
Oak St/9th Ave	0	1	3	15	11	30	95%
Oak St/10th Ave	0	0	3	26	24	53	95%
Baseline St/Adams Ave	0	0	4	15	13	32	90%
Baseline St/1st Ave	0	1	2	17	11	31	95%
Baseline St/2nd Ave	0	0	0	3	4	7	N/A
Baseline St/3rd Ave	0	0	4	4	5	13	N/A
Baseline St/4th Ave	0	0	2	12	10	24	N/A
Baseline St/5th Ave	0	0	3	7	5	15	N/A
Baseline St/6th Ave	0	0	1	6	5	12	N/A
Baseline St/7th Ave	0	0	3	3	5	11	N/A
Baseline St/8th Ave	0	0	0	8	5	13	N/A
Baseline St/9th Ave	1	0	3	13	12	29	95%
Baseline St/10th Ave	0	0	2	17	25	44	90%
10th Ave/Walnut St	0	1	4	10	18	33	85%
10th Ave/Cedar St	0	0	0	2	3	5	N/A
10th Ave/Maple St	0	0	2	18	10	30	95%
Segments[1]							
Baseline St (between Adams Ave and 10th Ave)	0	0	6	26	32	64	See above
Oak St (between Adams Ave and 10th Ave)	0	0	4	27	36	67	See above
10th Ave (between Baseline St and Maple St)	0	0	4	33	35	72	See above

[1]The extents of the roadway segments are between Adams Avenue and 10th Avenue for Oak Street and Baseline Street and between Baseline Street and Walnut Street for 10th Avenue. Segment crashes and intersection crashes are reported separately.

[2]Reports the highest SPIS classification (90% and higher) from SPIS 2017, SPIS 2018, and SPIS 2019 within 100 feet of the intersection.



Injury Crash Bike Involved

Property Damage Only Bike Involved

Fatal Crash Ped Involved

Injury Crash

Injury Crash Ped Involved

Property Damage Only

Project Area

Influence Area

Parks and Open Spaces

0 500 Feet

Figure 24

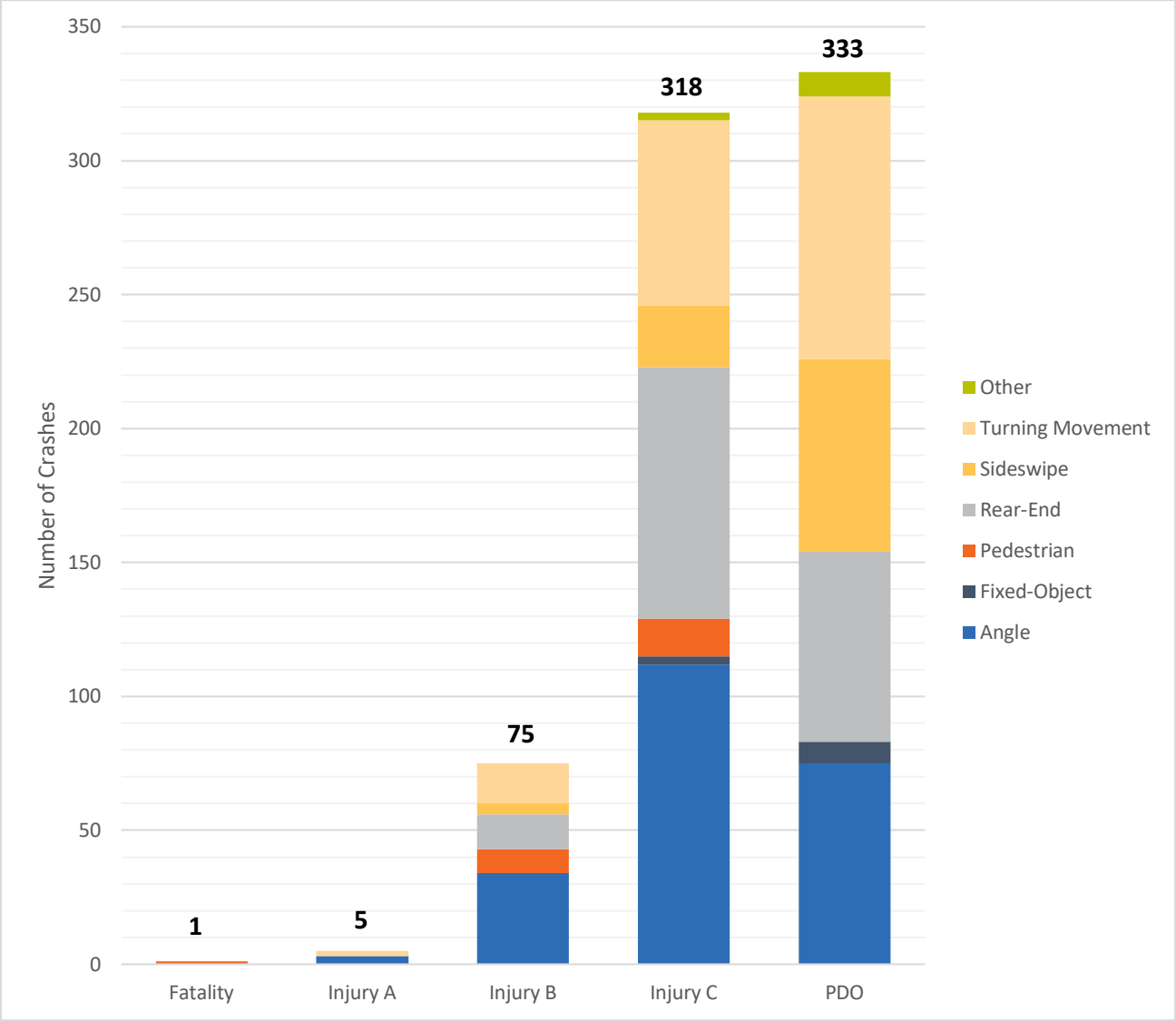
Project Area Crashes
(January 1, 2014 - December 31, 2018)
Hillsboro, Oregon

KITTELSON & ASSOCIATES

Crash Type & Severity

Chart 2 illustrates influence area injury crashes by severity and crash type.

Chart 2: Reported Crashes – Crash Type and Severity



As shown in Chart 2, there was one fatality, involving a pedestrian, and five Injury A crashes[20]. The fatality occurred at the intersection of Baseline Street/9th Avenue in June 2016 during daylight hours. The crash occurred between a car and a pedestrian and involved an improper change in traffic lanes and inattention by the motorist. There was no evidence of alcohol or drug use by the motorist.

Two of the Injury A crashes occurred at the Oak Street/1st Avenue intersection in 2015. Both were angle-related crashes that occurred in daylight with no pedestrians and bicyclists involved. One crash resulted in four injured individuals (one Injury A, two Injury B, and one Injury C) and the second resulted in one Injury A. There was a recent project at Oak Street/1st Avenue and Baseline Street/1st Avenue that changed left-turn phasing and upgraded the signals to address safety concerns. This will likely reduce number and severity of crashes at these locations.

Another Injury A crash occurred at the Oak Street/9th Avenue intersection in 2014. It was an angle-related crash that occurred in daylight, under cloudy weather with a wet road surface condition and no pedestrians or bicyclists involved. The crash resulted in four injuries (one Injury A, one Injury B, and two Injury C). Another Injury A crash occurred at the Baseline Street/1st Avenue intersection in 2015. It was a turning-movement-related crash that occurred at dusk with no pedestrians or bicyclists involved. The crash resulted in two injuries (one Injury A and one Injury B). The final Injury A crash occurred at the 10th Avenue/Walnut Street intersection in 2017. It was a turning-movement-related crash that occurred in daylight with no pedestrians or bicyclists involved. The crash resulted in three injuries (one Injury A and two Injury B).

About 90% of reported crashes in the project area were either property damage only (PDO) or Injury C. The most common crash type was angle for all injury severities. PDO crashes were more likely to be sideswipe or turning-movement related than the more severe injury types, while Injury A and Injury B were more related to angle crashes.

No trends were found that indicate that lighting, weather, or speed were major contributory factors to reported crashes in the study area.

[20] The KABCO scale for crash severity defines levels of injury severity. Fatal injuries include deaths that occur within thirty days following injury in a motor vehicle crash. Injury A injuries are severe and include skull fractures, internal injuries, broken or distorted limbs, unconsciousness, severe lacerations, severe burns, and unable to leave the scene without assistance. Injury B injuries are moderate and include visible injuries such as a "lump" on the head, abrasions, and minor lacerations. Injury C injuries are minor and include hysteria, nausea, momentary unconsciousness, and complaint of pain without visible signs of injury. PDO (property damage only) crashes result in no fatality or injury. See: https://www.itsmr.org/tssr-glossary/kabco-scale/

Intersection Crashes

About 75% of reported crashes occurred at intersections, with Oak Street/1st Avenue (61), Oak Street/10th Avenue (53), and Baseline Street/10th Avenue (44) having the most crashes. Chart 3 presents these three intersections subdivided by highest injury severity. The Oak Street/1st Avenue intersection had the highest percent of Injury A and Injury B crashes (3% and 15%, respectively).

Chart 3: Intersections with Highest Number of Crashes by Injury Severity

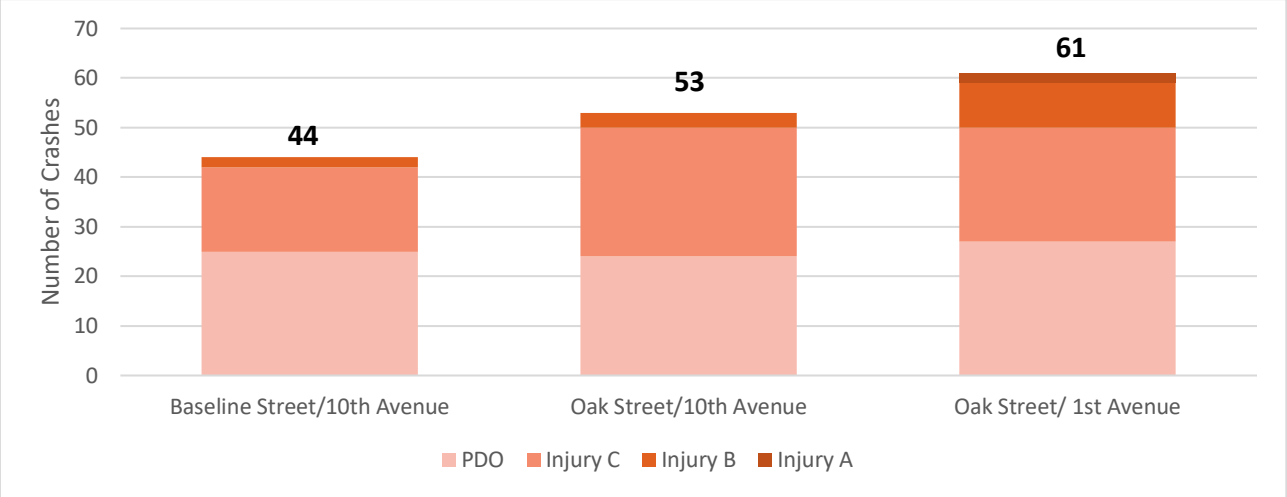
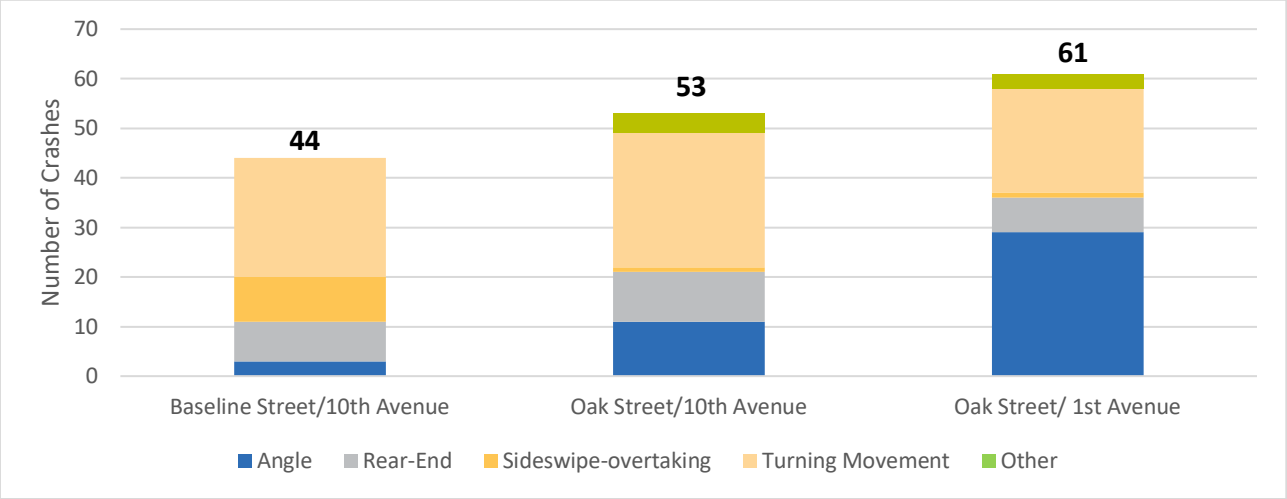


Chart 4 presents the three highest-crash intersections subdivided by crash type. At the Baseline Street/10th Avenue and Oak Street/10th Avenue intersections, turning movement crashes are the most common crash type, at 55% and 51%, respectively. At the Oak Street/1st Avenue intersection, the most common crash type is angle-related at 48% of all crashes. As previously mentioned, a recent project added left-turn phasing, which reduces the probability of future angle crashes.

Chart 4: Intersections with Highest Number of Crashes by Crash Type



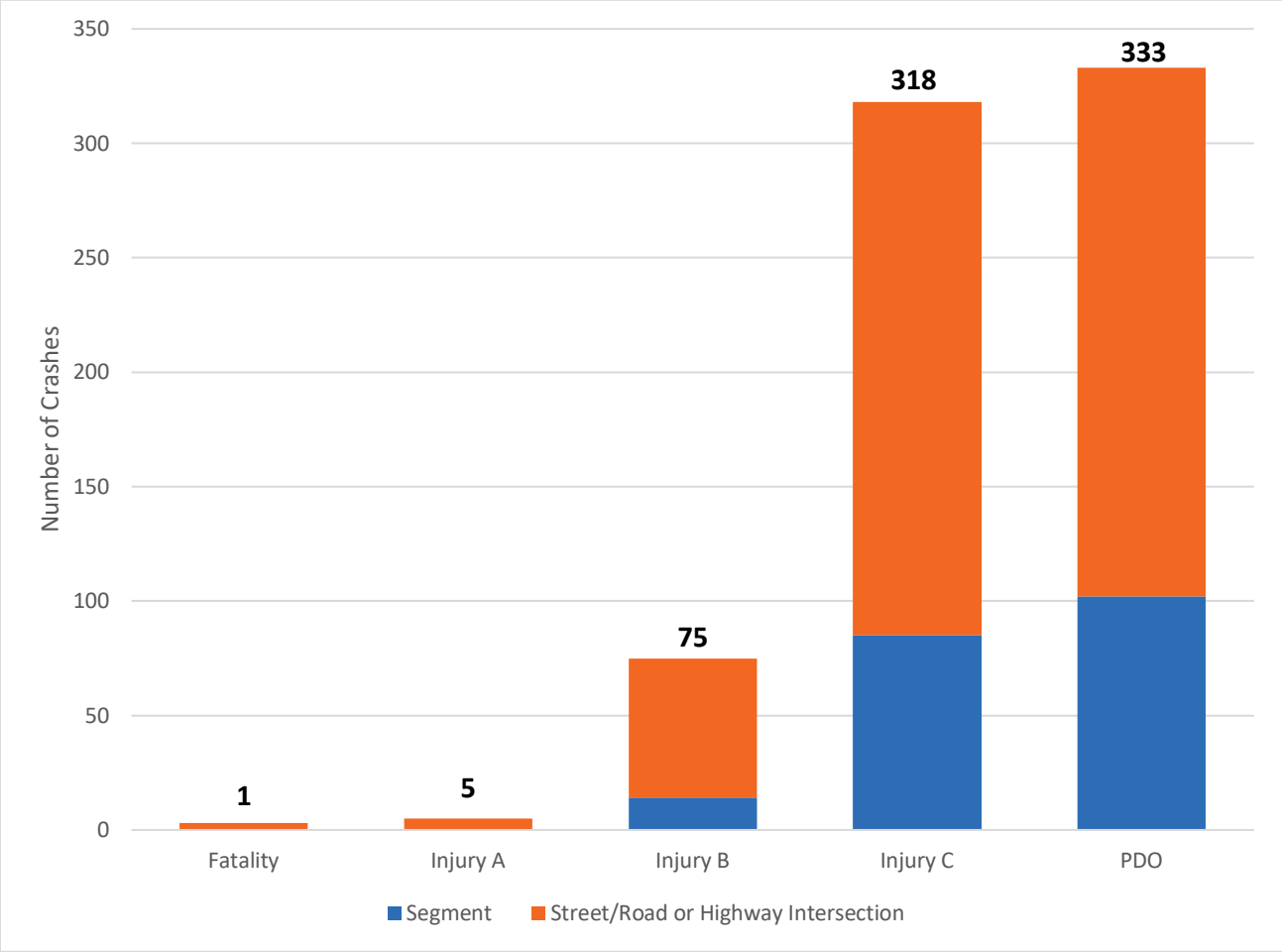
Crash Severity by Location

About 87% of reported crashes at intersections were Injury C or PDO crashes.

Chart 5 presents the injury severity on segments and intersections in the influence area. About 75% of reported crashes were recorded at intersections (531), with the rest located along the segments (201). Reported crashes at intersections within the influence area were also more likely to yield a higher injury severity compared to crashes on segments.

On segments, there were no fatalities or Injury A crashes. About 51% of reported crashes were PDO and 42% were Injury C, with the rest being Injury B. About 87% of reported crashes at intersections were Injury C or PDO crashes.

Chart 5: Injury Severity on Segments and at Intersections



The following crashes were reported during the five-year period along Baseline Street, Oak Street, and 10th Avenue:

- Baseline Street: 64 crashes reported
- Oak Street: 67 crashes reported
- 10th Avenue: 72 crashes reported

Crash Severity

Chart 6 presents reported crash severity by roadway segment. About 43% of reported Injury B crashes occurred on Baseline Street followed by 29% on Oak Street and 29% on 10th Avenue. No fatalities or Injury A crashes were reported on any segment (one fatality occurred at an intersection).

Chart 6: Injury Severity by Roadway Segment

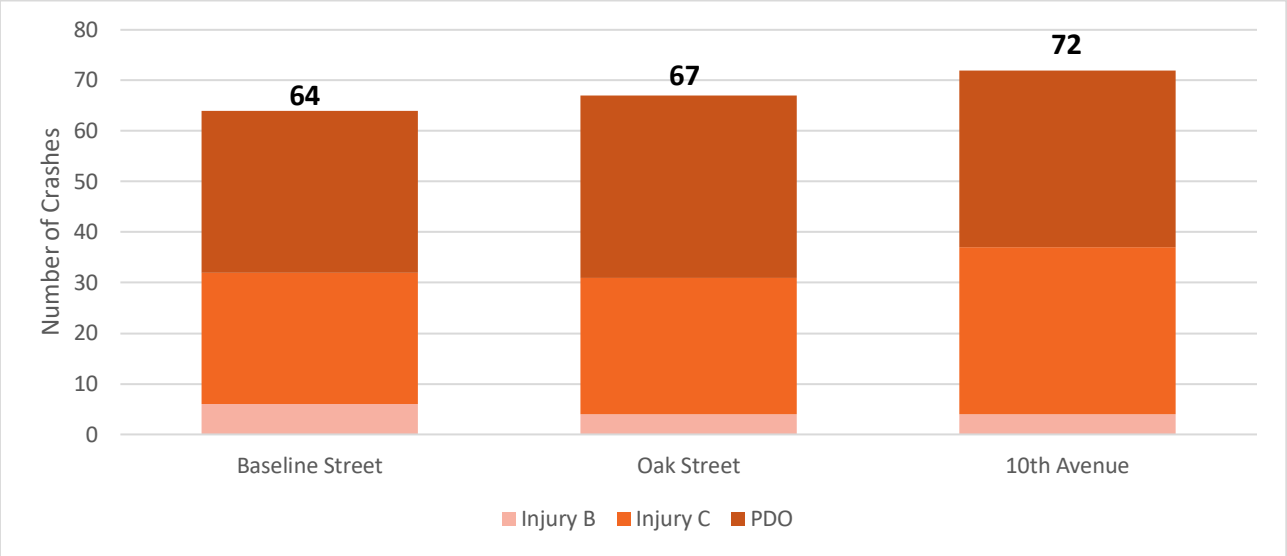


Chart 7 presents the reported crash type by roadway. On Baseline Street, sideswipe crashes are the most common (44% of reported crashes), followed by rear-end crashes (28%) and turning movement crashes (25%). On Oak Street and 10th Avenue, rear-end crashes are the most common, at 42% of reported crashes on Oak Street and 54% of reported crashes on 10th Avenue.

Chart 7: Crash Type by Roadway Segment

Bicycle Crashes

On Baseline Street between Adams Avenue and 10th Avenue, there was one reported bicycle-related crash in the five-year study period, resulting in minor injuries (Injury C). The crash occurred at a driveway on the segment and was caused by a turning vehicle not yielding the right-of-way. This type of crash is common in areas where people traveling by bicycle use the sidewalk due to a lack of bicycle lanes.

On Oak Street between Adams Avenue and 10th Avenue, there were six (6) reported bicycle-related crashes in the five-year study period. Three of these crashes were related to turning movements of vehicles, with two angle crashes and one sideswipe crash. Four of the crashes resulted in an Injury B, one resulted in an Injury C, and one was reported as PDO only. There was one bicycle crash at the intersection of 1st Avenue, one at the intersection of 6th Avenue, one at the intersection of 7th Avenue, two at the intersection of 9th Avenue, and one at the intersection of 10th Avenue.

On 10th Avenue between Baseline Street and Maple Street[21], there were three reported bicycle-related crashes in the five-year study period, all involving turning vehicles. These crashes resulted in an Injury B, Injury C, and PDO. There was one bicycle crash at the intersection of Oak Street, one at the intersection of Cedar Street, and one on a driveway along the segment.

Pedestrian Crashes

On Baseline Street between Adams Avenue and 10th Avenue, there were seven reported pedestrian-related crashes in the five-year study period. Five of the crashes were caused by a vehicle not yielding the right of-way, one was caused by reckless driving, and one was caused by an improper change of traffic lanes. The crash caused by the improper change of traffic lanes in a no-passing zone occurred at the intersection of Baseline Street with 9th Avenue and resulted in a pedestrian fatality. There were also two Injury B crashes and four Injury C crashes. All recorded pedestrian crashes occurred at intersections. There were two pedestrian crashes at the intersection of Adams Avenue, one at the intersection of 1st Avenue, one at the intersection of 2nd Avenue, one at the intersection of 3rd Avenue, one at the intersection of 8th Avenue, and one at the intersection of 9th Avenue.

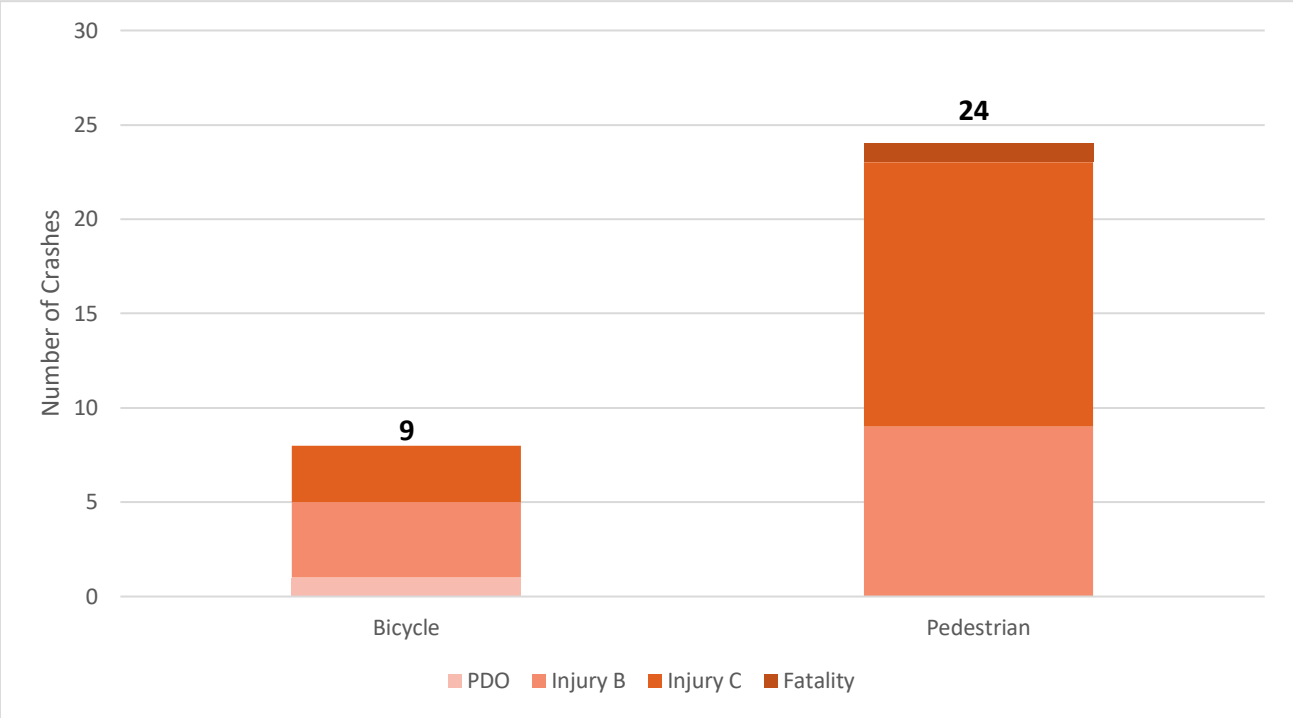
On Oak Street between Adams Avenue and 10th Avenue, there were eight reported pedestrian-related crashes in the five-year study period. Most of these crashes were related to vehicles not yielding the right-of-way, with two caused by vehicles disregarding the traffic signal. Three of the crashes were associated with an Injury B severity and five with an Injury C severity. Six of the crashes occurred at an intersection and two along the segment. There was one pedestrian crash at the intersection of 1st Avenue, two at the intersection of 3rd Avenue, one at the intersection of 7th Avenue, one at the intersection of 8th Avenue, and one at the intersection of 9th Avenue.

[21] The intersections of 10th Avenue/Baseline Street and 10th Avenue/Oak Street are not included here.

On 10th Avenue between Baseline Street and Maple Street, there were ten reported pedestrian-related crashes in the five-year study period. Most of these crashes were related to vehicles not yielding the right-of-way, with one caused by a vehicle disregarding the traffic signal and one caused by motorist inattention. The crash caused by motorist inattention occurred at the intersection of Walnut Street and resulted in a pedestrian fatality (in 2019). Four of the crashes were associated with an Injury B severity and five with an Injury C severity. Nine of the pedestrian crashes occurred at an intersection and one on a driveway along the segment.

Chart 8 presents the influence area bicycle and pedestrian crashes by injury severity.

Chart 8: Bicycle and Pedestrian Crashes by Injury Severity



2019 Fatalities

There were two reported fatalities that occurred in 2019 that were not included in the charts and tables above. One resulted from an angle crash between a passenger car and a truck at the intersection of Baseline Street and 1st Avenue. It resulted in the fatality of the passenger of the car and an Injury C to the driver of the car, with no reported injuries to the driver of the truck. The crash was caused by a disregarded traffic signal and reckless driving.

The second fatality occurred at 10th Avenue and Walnut Street between a passenger car and a pedestrian crossing the intersection. It resulted in the death of a pedestrian and no reported injuries to the driver of the car and was caused by inattention of the pedestrian.

Safety Priority Index System

The ODOT Statewide Priority Index System (SPIS) identifies sites along state highways where safety issues warrant further investigation. The SPIS is a method developed by ODOT for identifying hazardous locations on state highways through consideration of crash frequency, crash rate, and crash severity. Sites identified within the top 15 percent are investigated by ODOT staff and reported to the Federal Highway Administration (FHWA).

Per the most recent SPIS lists, most of 10th Avenue between Oak Street and Walnut Street, as well as the 10th Avenue/Maple Street intersection are in the top 5% of SPIS sites. Segments of Baseline Street around 1st Avenue and 9th Avenue and most intersections on Oak Street are in the top 5% of SPIS locations. There are several locations that are in the top 10% of SPIS sites, including the approaches to the Oak Street/ 3rd Avenue and Baseline Street/10th Avenue intersections. Figure 25 presents the 2017-2019 SPIS locations for the influence area.

SPIS Locations by Percentile

- 95% - 100%
- 90% - 94.99%

- Parks and Open Spaces
- Project Area
- Influence Area

0 500 Feet

Figure 25

SPIS Locations (SPIS 2017, 2018, and 2019) Hillsboro, Oregon

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Pedestrian and Bicycle Systemic Safety Risk Analysis

In 2020, ODOT completed the *Oregon DOT Statewide Pedestrian and Bicycle Plan* (Reference 23), a systemic safety analysis aimed at identifying high risk locations for pedestrian and bicycle crashes along the state highway system.

The objective of the *Oregon DOT Statewide Pedestrian and Bicycle Plan* was to update the *ODOT Pedestrian and Bicycle Safety Implementation Plan* (Reference 24) and inform future iterations of ODOT's All Roads Transportation Safety (ARTS) program. Systemic safety, opposed to the traditional crash history, allows practitioners to proactively identify high risk sites for potential safety improvements based on specific risk factors. Locations identified as top 20% based on the risk factor screening correspond to the highest risk locations throughout the state, whereas locations in the lowest 20% correspond to the lowest risk locations throughout the state. A summary of the risk factors used as part of the *Oregon DOT Statewide Pedestrian and Bicycle Plan* is described below.

Pedestrian Risk Analysis

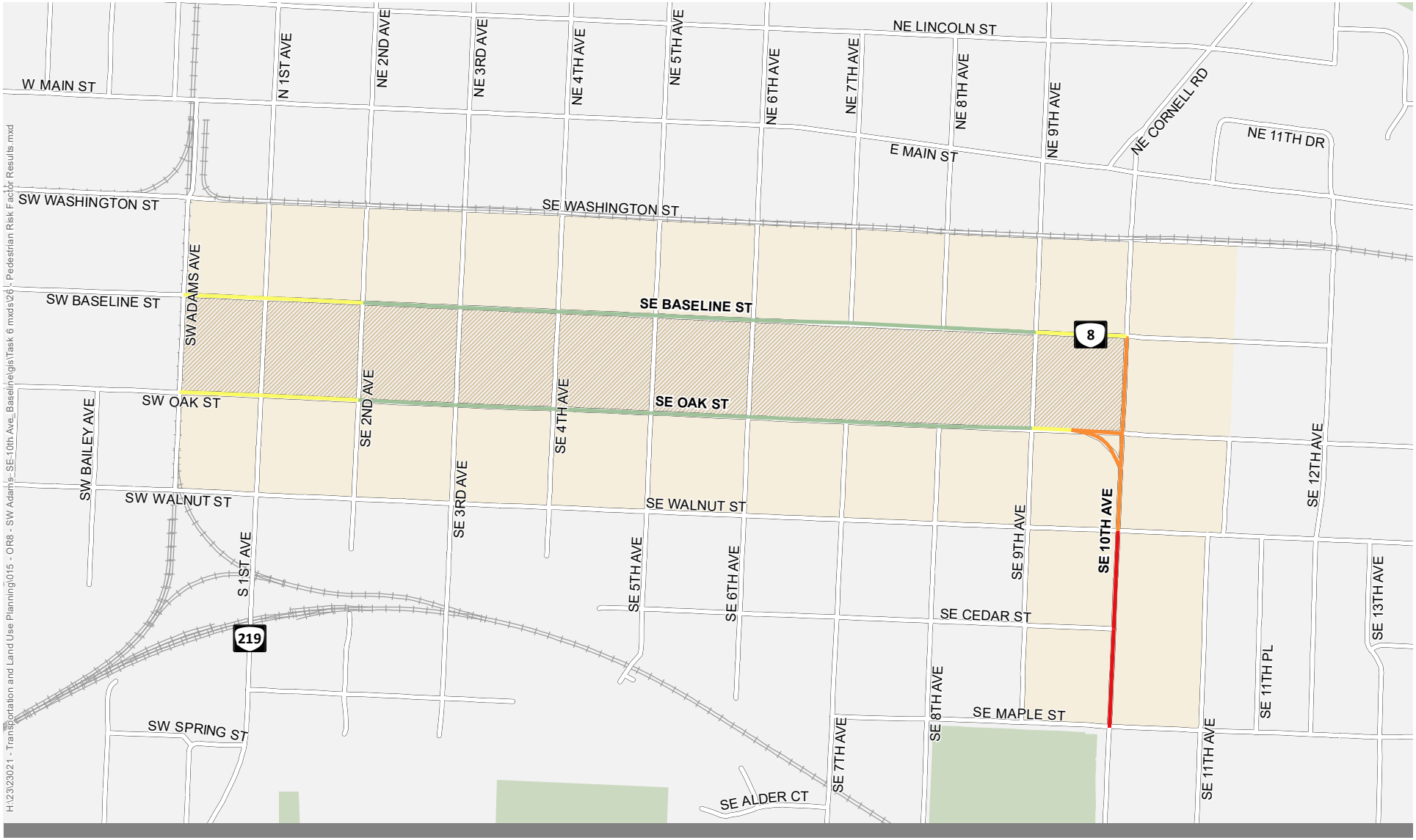
Figure 26 illustrates the results of the pedestrian risk analysis conducted as part of ODOT's statewide systemic safety analysis along the project extents for the influence area. The segments of Oak Street and Baseline Street between 2nd Avenue and 9th Avenue are in the fourth 20% for pedestrian risk factors. 10th Avenue is in the top 20% and second 20% for pedestrian risk factors. The pedestrian risk factors used as part of the analysis include:

- Principal Arterial
- Number of Lanes (>=Four Lanes)
- High-Access Density
- No Sidewalks (or Only One Side)
- Posted Speed (>=35mph)
- Mixed Use Zoning
- Proximity to Schools (one mile)
- Proximity to Transit Stops (1/4 mile)
- High Population over the Age of 64

Bicycle Risk Analysis

Figure 27 illustrates the results of the bicycle risk analysis conducted as part of ODOT's statewide systemic safety analysis along the project extents for the influence area. Within the influence area Baseline Street, Oak Street, and 10th Avenue are within the top 20% and second 20% for bicycle risk factors. The bicycle risk factors used as part of the analysis include:

- Principal Arterial
- Minor Arterials
- Number of Lanes (>=Four Lanes)
- High-access Density
- No Bike Lane
- Posted Speed (>=35mph)
- Mixed Use Zoning
- Proximity to Schools (one mile)
- Proximity to Transit Stops (1/4 mile)
- High Population over the Age of 64



Pedestrian Risk Score

- Top 20%
- Second 20%
- Third 20%
- Fourth 20%
- Lowest 20%
- Project Area
- Influence Area
- Parks and Open Spaces

0 500 Feet

Figure 26

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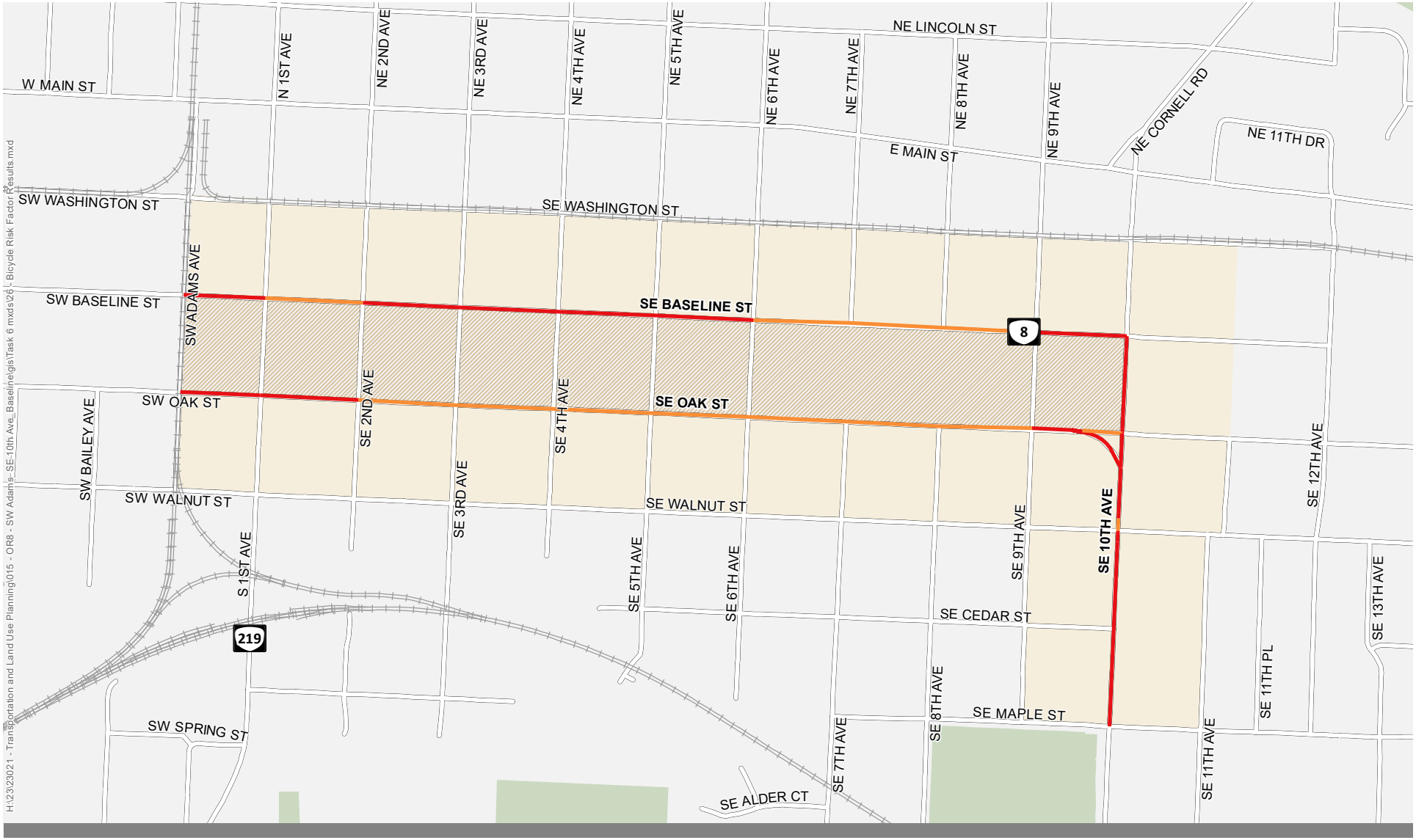
Pedestrian Risk Factor Results
Hillsboro, Oregon



Bicycle Risk Score

- Top 20%
- Second 20%
- Third 20%
- Fourth 20%
- Lowest 20%

- Project Area
- Influence Area
- Parks and Open Spaces

0 500 Feet

Figure 27

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Bicycle Risk Factor Results
Hillsboro, Oregon

SUMMARY OF GAPS AND DEFICIENCIES

The following section describes the project area multimodal transportation system gaps and deficiencies. Strategies and recommendations to address the project area gaps and deficiencies will be identified as part of *TM#4: Draft Concept Design Memorandum.* Addressing these gaps and deficiencies, in the context of the designated BUD urban context*,* ***Traditional Downtown/CBD***, will support solutions that reflect the modal priorities*.*

Pedestrian Facility Gaps and Deficiencies

Key findings of the existing and future no-build pedestrian facility gaps and deficiencies are summarized below and illustrated in Figure 28.

Sidewalks

Portions of sidewalk are missing on Adams Avenue between Baseline Street and Walnut Street and on Walnut Street between Adams Avenue and 1st Avenue. Sidewalks are also missing on a portion of 8th Avenue between Oak Street and Walnut Street, as well as 11th Avenue between Oak Street and Maple Street. In addition, sidewalk less than ten feet wide (or sidewalks that do not meet the minimum clear width of four feet) do not meet the guidance from the BUD (Reference 1), the HDM (Reference 6), and/or the standards set by ODOT's Bicycle and Pedestrian Design Guide (Reference 10). In addition, guidance from the BUD (Reference 1) recommends considering pedestrian scale lighting. Portions of the sidewalk without adequate lighting could be considered deficiencies in the sidewalk network.

Crossings

Signalized crossings with high-moderate volumes of pedestrian activity are lacking safety improvements, such as leading pedestrian interval (LPI) phasing and no-turn on red signage. In addition, eleven (11) intersections have been identified that do not include striped crossings:

- Baseline Street and Adams Avenue
- Baseline Street and 4th Avenue
- Baseline Street and 6th Avenue
- Baseline Street and 9th Avenue
- 10th Avenue and Cedar Street
- Oak Street and Adams Avenue
- Oak Street and 2nd Avenue
- Oak Street and 4th Avenue
- Oak Street and 6th Avenue
- Oak Street and 8th Avenue
- Oak Street and 9th Avenue

Project Area

Influence Area

Parks and Open Spaces

Gaps

Missing Sidewalk

Deficiencies

Ramp Condition: Fair

Ramp Condition: Poor

Crossing Deficiency

Sidewalk <10' Wide

Related Concerns

Top 20% Pedestrian Risk Score

Second 20% Pedestrian Risk Score

Injury Crash Ped Involved

0 500 Feet

Figure 28

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Pedestrian Facility Gaps and Deficiencies
Hillsboro, Oregon

ODOT conducted an investigation in the summer of 2016 to analyze and make recommendations for the unmarked crosswalks on Baseline Street and Oak Street from 10th Avenue to 7th Avenue. There were three intersections with unmarked crosswalks identified: Baseline Street/9th Avenue, Oak Street/9th Avenue, and Oak Street/8th Avenue.

Based on the results of the study, ODOT made recommendations to improve safety at these intersections. At Baseline Street/9th Avenue, ODOT recommended working with TriMet to explore opportunities for relocating the bus stop to a signalized intersection. However, a crosswalk was not recommended due to the proximity to a signalized intersection (at both 10th Avenue and 8th Avenue), the higher than usual vehicle crash history, and the high amount of lane changes occurring at the intersection. However, the Region 1 2024-2027 STIP program recommends installing pedestrian crossing flashing beacons, a median island, lighting, signing, and crosswalk striping as part of the Pedestrian and Bicycle Safety Improvements project (ID 15).[22] This location is a frequent crossing for people, especially families and youth travelling without parents, connecting neighborhoods to the north and northwest directly to community facilities at Shute Park.

At Oak Street/9th Avenue, ODOT recommended decreasing lane widths and reducing crossing distances to 36 feet, which could warrant a marked crosswalk with enhanced signage. Decreasing the crossing distance could be achieved through curb extensions or bulb-outs.

At Oak Street/8th Avenue, a marked crosswalk was not recommended due to the proximity of the proposed marked crosswalk at Oak Street & 9th Avenue described above.

Based on the BUD (Reference 1), the target pedestrian crossing spacing range is 250 to 550 feet, or about one-to-two blocks. All other unmarked crossings in the study area do not meet this standard. In particular, intersections with transit stops and unmarked crossings have a need for a safe crossing, such as Baseline Street/Adams Avenue and Oak Street/9th Avenue.

Pedestrian Ramps

While there are no missing pedestrian ramps in the project area, the majority of pedestrian ramps are in "poor" condition according to a recent ODOT assessment. All ramps will need to be brought to current ADA standards, with corners with single ramps requiring design exceptions. This includes bringing ramps in poor condition to meet a "good" ramp condition status, as per the 2011 Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (Reference 7).

[22] For more information on the Region 1 2024-2027 STIP Safety program, see: R1 STIP Safety Program

Safety

The following intersections are identified as top 10% SPIS locations:

- Oak Street/1st Avenue
- Oak Street/3rd Avenue
- Oak Street/5th Avenue
- Oak Street/7th Avenue
- Oak Street/9th Avenue
- Oak Street/10th Avenue
- Baseline Street/Adams Avenue
- Baseline Street/1st Avenue
- Baseline Street/9th Avenue
- Baseline Street/10th Avenue
- 10th Avenue/Walnut Street
- 10th Avenue/Maple Street

The three intersections with the highest number of crashes are Oak Street/1st Avenue (61), Oak Street/10th Avenue (53), and Baseline Street/10th Avenue (44). Improvements were made to Oak Street/1st Avenue since the presented data was gathered, including improved pedestrian ramps, a protected left-turn lane on 1st Avenue, and signal improvements. Safety countermeasures should be prioritized at the other intersections to minimize risk and increase separation for people walking.

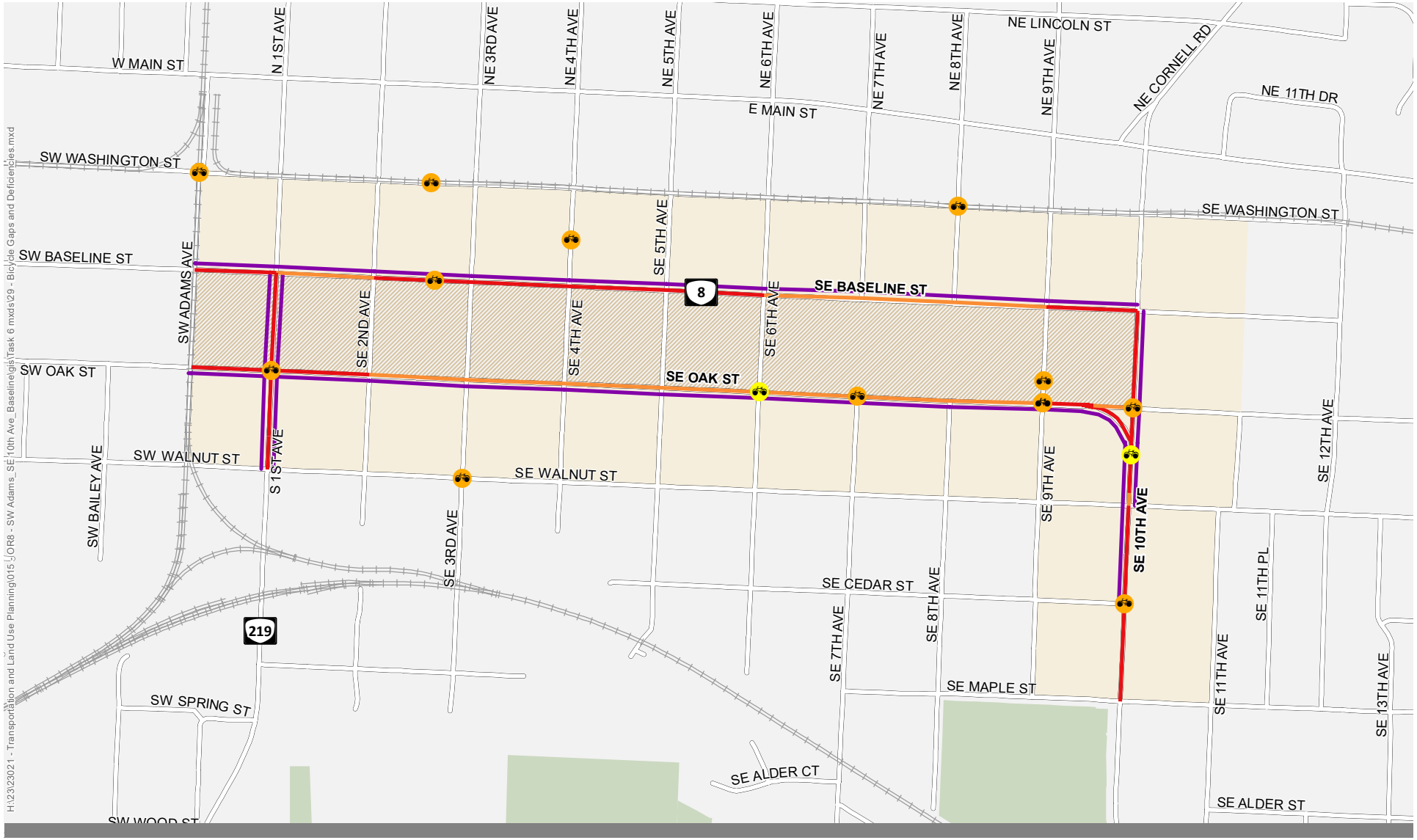
Based on the Pedestrian Rick Factor results, 10th Avenue between Baseline Street and Maple Street is identified as a top 40% statewide risk location for pedestrians. Given that 10th Avenue has higher vehicular speeds and volumes, and a high number of crashes, intersection treatments and upgrades to pedestrian facilities should be prioritized along 10th Avenue.

Bicycle Facility Gaps and Deficiencies

Key findings of the existing and future no-build bicycle facility gaps and deficiencies are summarized below and illustrated in Figure 29.

Bike Lanes

There are no bike lanes on Baseline Street, Oak Street, sections of 10th Avenue or on nearby parallel routes in the project area. The existing facilities do not meet guidance provided by the BUD (Reference 1), which recommend separated bicycle facilities, or ODOT's Bicycle and Pedestrian Design Guide (Reference 10), which recommends a minimum of six-foot bike lanes along state highways within urbanized areas. Based on the Bicycle Rick Factor results, Baseline Street, Oak Street, and 10th Avenue are identified as top 40% statewide risk locations for bicyclists, indicating that these three streets are high risk sites for potential safety improvements based on specific risk factors.



Project Area

Influence Area

Parks and Open Spaces

Gaps

Missing Bicycle Facility

Related Concerns

Top 20% Bicycle Risk Score

Second 20% Bicycle Risk Score

Injury Crash Bike Involved

Property Damage Only Bike Involved

0 500 Feet

Figure 29

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Bicycle Facility Gaps and Deficiencies
Hillsboro, Oregon

Transit Facility Gaps and Deficiencies

Key findings of the existing and future no-build transit facility gaps and deficiencies are summarized below and illustrated in Figure 30.

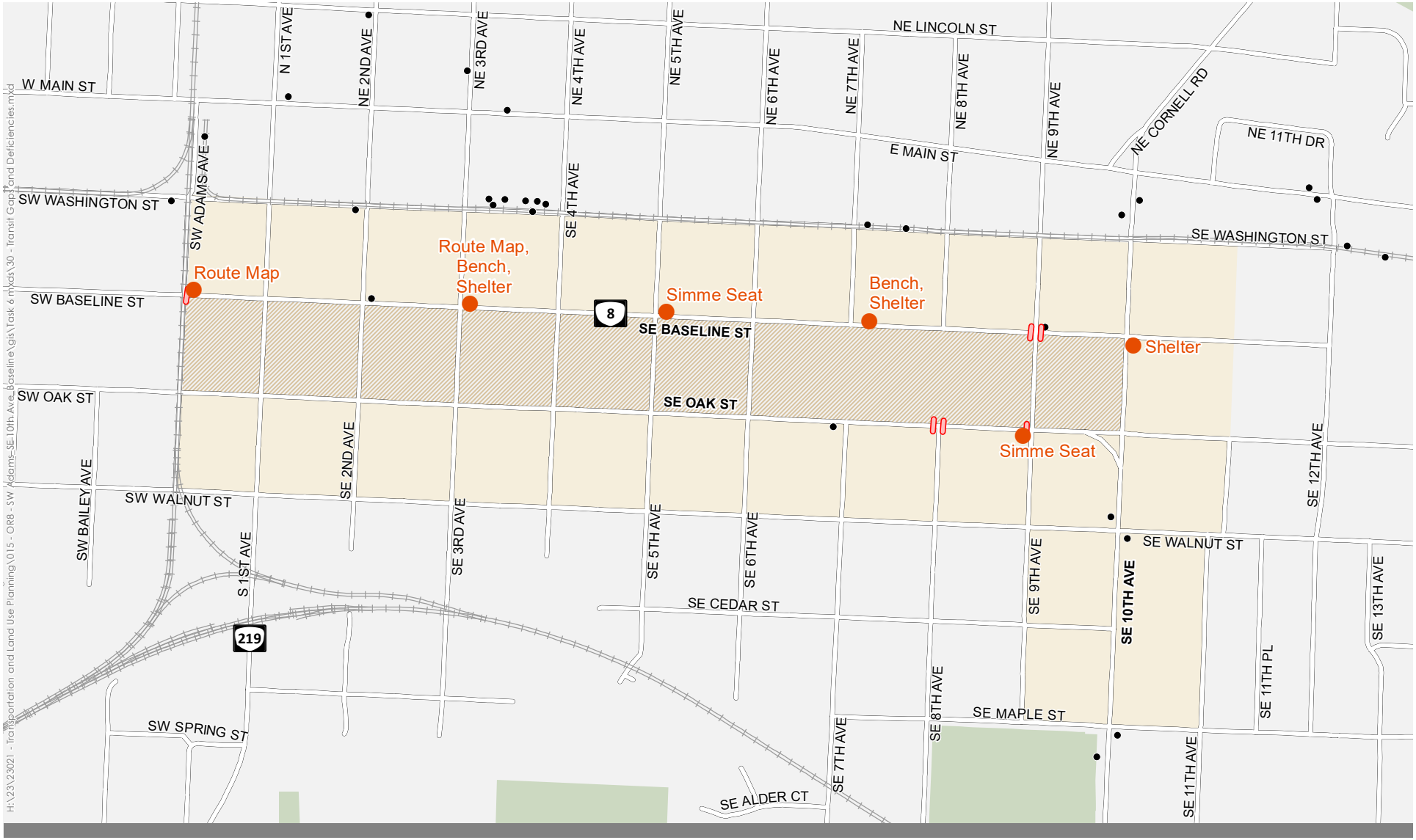
Transit Stops and Amenities

ODOT's HDM (Reference 6) sets recommendations for locations of transit stops. According to the HDM, either a near-side or far-side stop can be placed at signalized intersections with multiple lanes. All stops in the study area are near-side stops, which are appropriate at the signalized intersections. The stops at Baseline Street/Adams Avenue, Baseline Street/9th Avenue, and Oak Street/9th Avenue are located at unsignalized intersections with multiple lanes, in which a far-side stop is preferred. In addition, no bus pullouts are present at any stops, but based on HDM guidance, should be considered at far-side stops.

General guidance for transit stops and amenities is provided in TriMet's Bus Stop Guidelines (Reference 9). All transit stops should be equipped with a route sign and Stop ID. In general, transit stops with 50 or more daily boardings are recommended to have bus shelters. Transit stops with 12 or more boardings per day are recommended to have seating. Based on boarding data provided by TriMet for stops in the study area, the intersections presented in Table 14 are recommended to be upgraded.

Table 14: Missing Transit Stop Amenities

Stop Name	Missing Amenities	Standard from TriMet
Baseline Street & Adams Avenue	Route Map	Route maps required for stops with bus shelters.
Baseline Street & 3rd Avenue	Route Map, Bus Shelter, Bench	68 daily boardings. Bus shelter recommended for stops with more than 50 daily boardings. 4-foot Shelter Bench and route map required for stops with bus shelters.
Baseline Street & 5th Avenue	Simme Seat	12 daily boardings. Simme seat recommended for stops with more than 12 daily boardings.
Baseline Street & 7th Avenue	Bus Shelter, Bench	38 daily boardings and a peak frequency of 30 minutes for Routes 47 and 49. Shelter recommended for stops with more than 35 daily boardings and with routes having a peak headway of greater than 17 minutes. 4-foot Shelter Bench required for stops with bus shelters. In addition, the close proximity to the Tualtiy Hospital may warrant a bench.
10th Avenue & Baseline Street	Bus Shelter	59 daily boardings. Bus shelter recommended for stops with more than 50 daily boardings. Utilize existing bench or install new bench.
Oak Street & 9th Avenue	Simme Seat	18 daily boardings. Simme seat recommended for stops with more than 12 daily boardings.



Project Area

Influence Area

Parks and Open Spaces

Transit Stops

Gaps

Missing Crosswalk Near Transit Stop

Deficiencies

Transit Stops with Amenity Upgrade Needs

0 500 Feet

Figure 30

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Transit Facility Gaps and Deficiencies
Hillsboro, Oregon

Vehicular Facility Gaps and Deficiencies

Key findings of the existing and future no-build vehicular system gaps and deficiencies are summarized below.

Intersection Operational Results

While the focus of this concept plan is OR 8, a broader examination of intersection operations has been reported for added context. It is understood that gaps and deficiencies elsewhere in the transportation network (for each mode) may contribute to issues on OR 8, but are beyond the purview of this project to address.

1st Avenue (OR 219): Walnut Street to Washington Street

Under existing PM peak conditions, southbound queuing approaching Oak Street for the southbound through and left turn lane experienced a 95th percentile queue length that occasionally fills the block leading to short duration cycle failures for the southbound through movement at the 1st Avenue/Baseline Street intersection. The average southbound queue length from Oak Street extends half the block towards Baseline Street.

Substantial growth is forecast along the 1st Avenue (OR 219) corridor under future no-build conditions. The HCM analysis identified the southbound through movements on 1st Avenue at Walnut Street and Oak Street as at or exceeding capacity under future no-build conditions. There are approximately 850 vehicles per hour forecast southbound at Walnut Street, nearing single lane capacity. Under future no-build conditions, the existing 55-second cycle length was maintained along Oak Street and Baseline Street while Walnut Street was changed from free running to a 110-second coordinated cycle length to provide the best progression possible southbound on 1st Avenue. The combination of the short cycle length at Oak Street and the half-cycle progression through Walnut Street results in frequent queue spillback on 1st Avenue across Baseline Street under future no-build conditions (average southbound queue extending beyond Lincoln Street). This queue spillback results in westbound queueing on Baseline Street in the left lane and southbound queueing on 1st Avenue spilling back to north of Main Street. The single southbound through lane on 1st Avenue south of Baseline Street results in a lane imbalance north of Baseline Street today. Vehicles are observed turning left from Baseline Street or crossing southbound on 1st Avenue across Baseline Street into the left southbound lane to get through the traffic signal at Baseline Street. Many of these vehicles then need to merge into the right lane to proceed across Oak Street. This merging behavior between Baseline Street and Oak Street degrades the effective flow rate already impacted by the short cycle length.

Walnut Street/1st Avenue

There are no reported intersection or queuing deficiencies at 1st Avenue and Walnut Street under existing conditions; however, there may be under future no-build deficiencies. In addition to the 1st Avenue issues at Walnut Street described above, the shared-lane operations with permissive left turn phasing results

in safety issues for all modes along with substantial queuing. The westbound left turn v/c exceeded capacity in the HCM analysis even with the de facto left turn lane. This issue was confirmed in the VISSIM model with westbound queuing on Walnut Street. The eastbound approached assumed a de facto right turn pocket along with a shared through-left lane. This lane combination is critical to the operation at this intersection.

10th Avenue: Maple Street to Baseline Street

The queue analysis shows that under existing conditions northbound 10th Avenue average and 95th percentile queues extend from Baseline Street through Oak Street but not to Walnut Street.

Under future no-build conditions, the intersections along 10th Avenue from Maple Street to Baseline Street continue to meet mobility standards. This is an improvement over prior studies along this corridor where higher traffic counts and regional forecasts resulted in higher demands where the adopted Transportation System Plan recommended taking draconian measures to reduce single occupancy vehicle demand and reduce the emissions of greenhouse gases in alignment with local, regional and statewide goals. Based on the HCM capacity analysis no additional widening along 10th Avenue is needed to meet mobility standards. While mobility standards are met along this segment under 2040 PM conditions, there is still delay with queue spillback between intersections, primarily northbound between Walnut Street and Baseline Street. The northbound 10th Avenue queue from Maple Street is expected to extend through 11th Avenue. On Walnut Street at 10th Avenue, the 95th percentile queue is expected to extend back to between 9th Avenue and 8th Avenue and this assumes a de facto right turn slip lane to 10th Avenue. These deficiencies are in addition to the bicycle and pedestrian network gaps discussed above.

NEXT STEPS

The project team will use the findings presented in this memorandum, along with input from the Project Management Team, Project Advisory Committee, Technical Advisory Committee, and the public, to develop evaluation criteria and evaluate alternative design concepts to address the gaps and deficiencies present in the project study area.

APPENDICES

1. Appendix A: Blueprint for Urban Design Context Selection Presentation
2. Appendix B: Existing (year 2020) PM Peak Hour Turning Movement Volumes
3. Appendix C: Future No-Build Model (year 2040) Intersection Turning Movement Volumes
4. Appendix D: Relative Delay (Queues) for Each 15-Minute Interval
5. Appendix E: Hillsboro Parking Code and Zoning Data

REFERENCES

1. ODOT *Blueprint for Urban Design (BUD)*

2. *Oak/Baseline/10th Avenue Corridor Draft Vision Statement*

3. City of Hillsboro *Downtown Framework Plan*

4. City of Hillsboro *Transportation System Plan (TSP)*

5. City of Hillsboro *2035 Community Plan*

6. ODOT *Highway Design Manual (HDM)*

7. United States Access Board *2011 Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG)*

8. ODOT *Analysis Procedures Manual (APM)*

9. TriMet *Bus Stops Guidelines, July 2010 Revision*

10. ODOT *Oregon Bicycle and Pedestrian Design Guide*

11. ODOT *Location of Crosswalks on State Highways*

12. National Cooperative Highway Research Program (NCHRP) *Report 562: Improving Pedestrian Safety at Unsignalized Crossings*

13. Washington County *Transportation System Plan (TSP)*

14. Metro *Regional Freight Safety*

15. ODOT *Oregon Highway Plan (OHP)*

16. ODOT *Oregon Revised Statute (ORS) 366.215 Implementation Guidance*

17. ODOT *Speed Zone Manual*

18. ODOT *Protocol for VISSUM Simulation*

19. Environmental Protection Agency *Mobile 6th Methodology*

20. Transportation Research Board *Highway Capacity Manual, 6th Edition*

21. City of Hillsboro *Comprehensive Plan*

22. Draft Downtown Hillsboro Parking Study (Pending, 2020)

23. ODOT *Oregon Bicycle and Pedestrian Plan*

24. ODOT *Pedestrian and Bicycle Safety Implementation Plan*

Appendix A
Blueprint for Urban Design
Context Selection Presentation

Hillsboro OREGON

Oregon Department of Transportation

OR 8: Oak/Baseline/10th Avenue Corridor Study (K18004)

Project Management Meeting (PMT) #4

ODOT Blueprint for Urban Design

- Establishing the Urban Context

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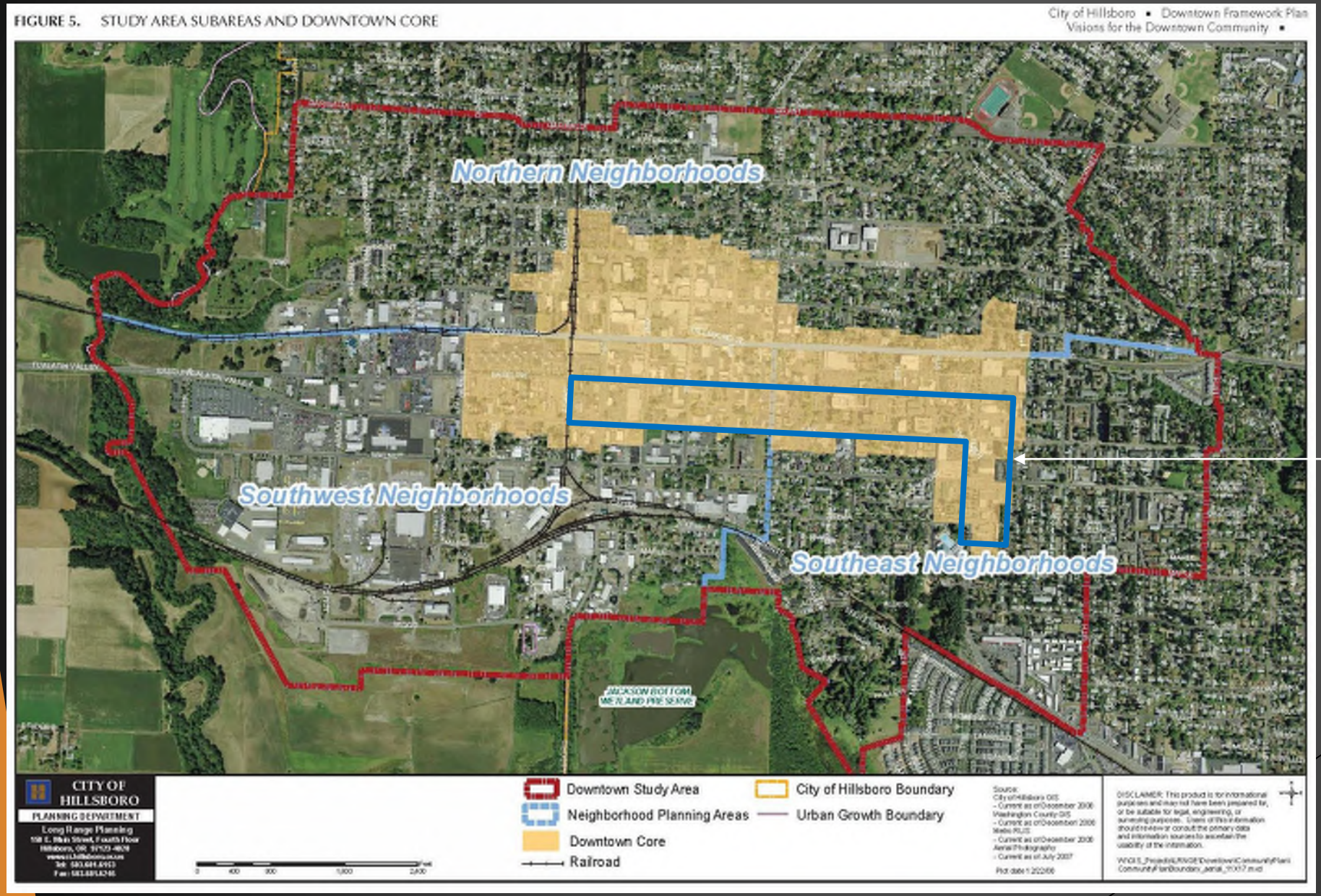
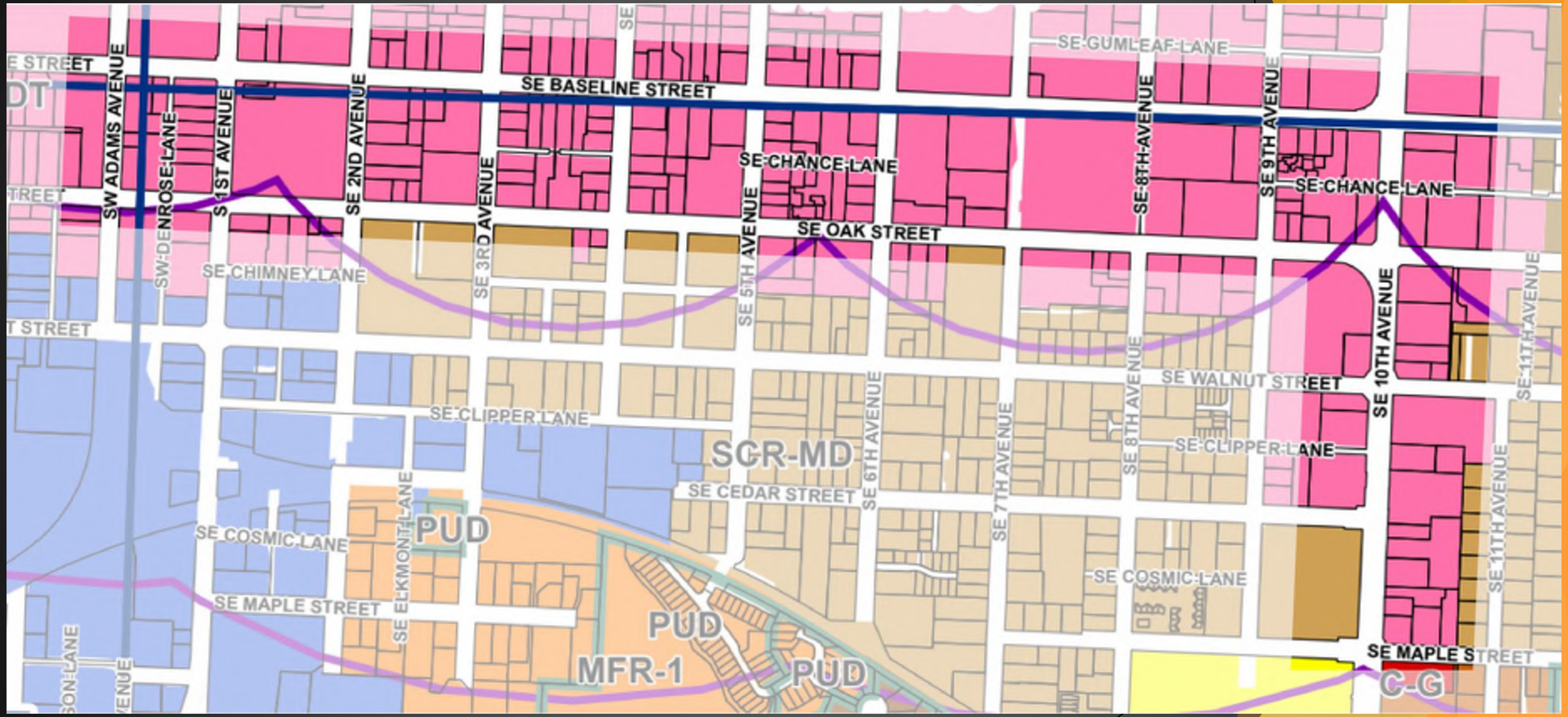
City of Hillsboro Downtown Framework Plan



Study Area within "SCC-DT Zone"

City of Hillsboro Zoning Atlas



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SCC-DT	Station Community Commercial - Downtown		
I-G	Industrial - General	SCR-MD	Station Community Residential - Medium Density

ODOT Blueprint for Urban Design

- Establishing the Urban Context

Land Use Context	**Setbacks** *Distance from the building to the property line*	**Building Orientation** *Buildings with front doors that can be accessed from the sidewalks along a pedestrian path*	**Land Use** *Existing or future mix of land uses*	**Building Coverage** *Percent of area adjacent to right-of-way with buildings, as opposed to parking, landscape or other uses*	**Parking** *Location of parking in relation to the building along the right-of-way*	**Block Size** *Average size of blocks adjacent to the right-of-way*
Traditional Downtown/CBD	Shallow/None	Yes	Mixed (residential Commercial, Park/Recreation)	High	On-street/ garage/shared in back	Small, consistent block structure
Urban Mix	Shallow	Some	Commercial fronting, residential behind or above	Medium	Mostly off-street/Single row in front/In back/ On side	Small to medium blocks
Commercial Corridor	Medium to Large	Sparse	Commercial, Institutional, Industrial	Low	Off-street/In front	Large blocks, not well defined
Residential Corridor	Shallow	Some	Residential	Medium	Varies	Small to medium blocks
Suburban Fringe	Varies	Varies	Varied, interspersed development	Low	Varies	Large blocks, not well defined
Rural Community	Shallow/None	Some	Mixed (Residential, Commercial, Institutional, Park/Recreation)	Medium	Single row in front/In back/ On side	Small to medium blocks

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Establishing the Urban Context

- Oak and Baseline Streets (Adams to 10th Avenue)

Between Adams and 10th Avenue, **adjacent zoning** is primarily *Station Community Commercial – Downtown* and *Station Community Residential – Mixed Use*. **Building setbacks** are primarily *shallow* with *on-street parking* along Oak and *off-street shared parking* for commercial use elsewhere. Most **buildings are oriented** to the *roadway* and **building coverage** ranges from *medium to high* with *medium* **consistent block sizes.**

Based on the existing context, review of previous City planning documents, ODOT's recommended urban design classification, input received from the stakeholder interviews as well as the envisioned modal priorities identified in the draft corridor vision, **Traditional Downtown/CBD** is recommended as the BUD context that is most appropriate for Oak and Baseline Street between Adams and 10th Avenue

Establishing the Urban Context

- 10th Avenue (Baseline to Maple Street)

Between Adams and 10th Avenue, **adjacent zoning** is primarily *Station Community Commercial – Downtown* and *Station Community Residential – Mixed Use*. **Building setbacks** are primarily *shallow* with *off-street shared parking* for commercial use. Most **buildings are oriented** to the *roadway*. **Building coverage** ranges is *medium* with medium **block sizes.**

Based on the existing context, review of previous City planning documents, ODOT's recommended urban design classification, input received from the stakeholder interviews as well as the envisioned modal priorities identified in the draft corridor vision, **Traditional Downtown/CBD** is recommended as the BUD context that is most appropriate for 10th Avenue between Baseline and Maple Street.

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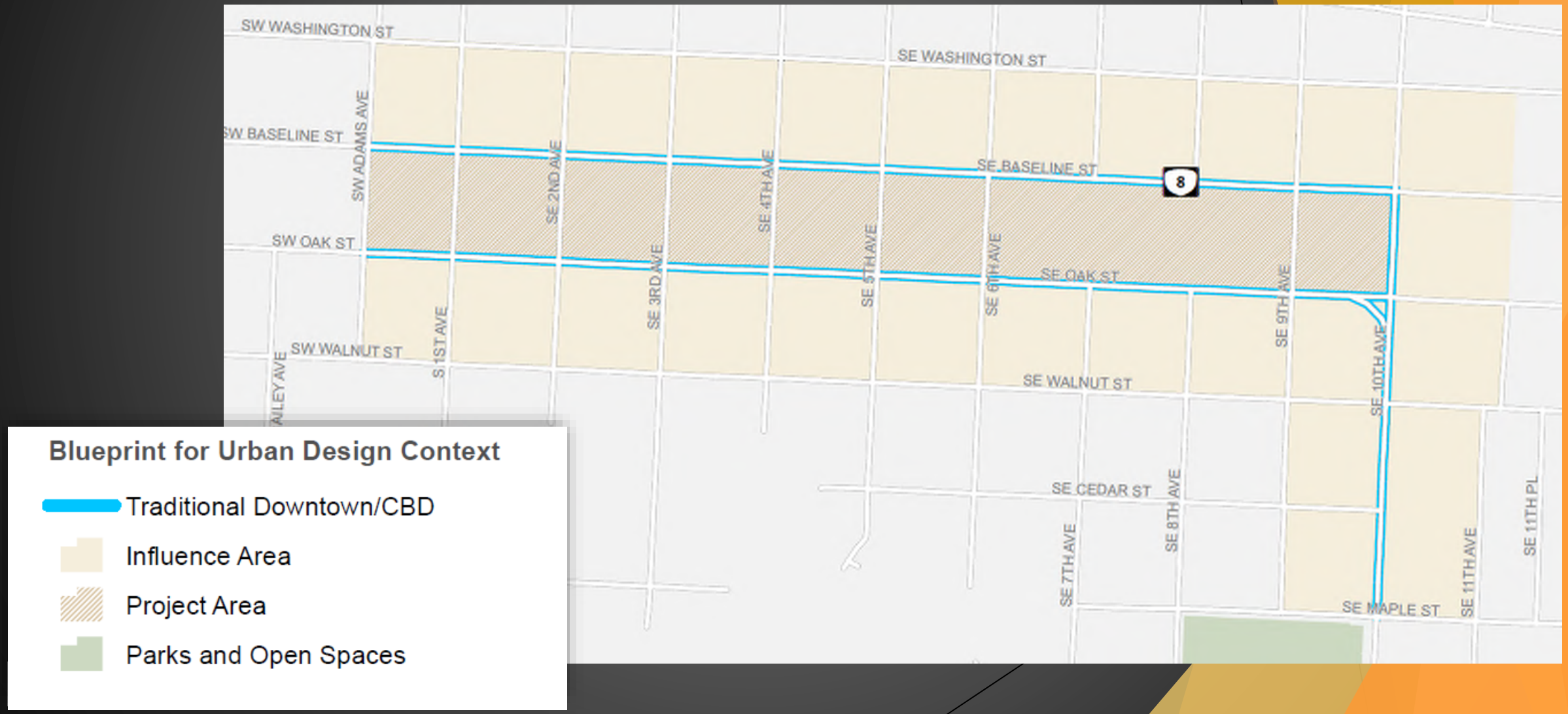
ODOT's Recommended Urban Context

- OR8 (Oak/Baseline/10th Avenue)



General Modal Considerations

- Baseline/Oak/10th Avenue

Land Use Context	Motorist	Freight	Transit	Bicyclist	Pedestrian
Traditional Downtown/CBD	**Low**	**Low**	**High**	**High**	**High**
Urban Mix	Medium	Low	High	High	High
Commercial Corridor	High	High	High	Medium	Medium
Residential Corridor	Medium	Medium	Low	Medium	Medium
Suburban Fringe	High	High	Varies	Low	Low
Rural Community	Medium	Medium	Varies	High	High

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General Modal Considerations

- Baseline/Oak/10th Avenue

*"**Traditional Downtown/Central Business District**: To best serve all users, vehicle speeds should be 25 mph or below, and higher levels of congestion are expected. Transit stops should be placed at frequent intervals, and transit priority treatments can help with transit mobility, even in congested conditions. Bicycle and pedestrian facilities should be relatively wide and comfortable to serve anticipated users. Curbside uses are important and may include loading/unloading, parking (vehicles, bicycles, etc.), and other uses. Landscaping and street trees, following ODOT placement and spacing guidelines, are appropriate in this context."*

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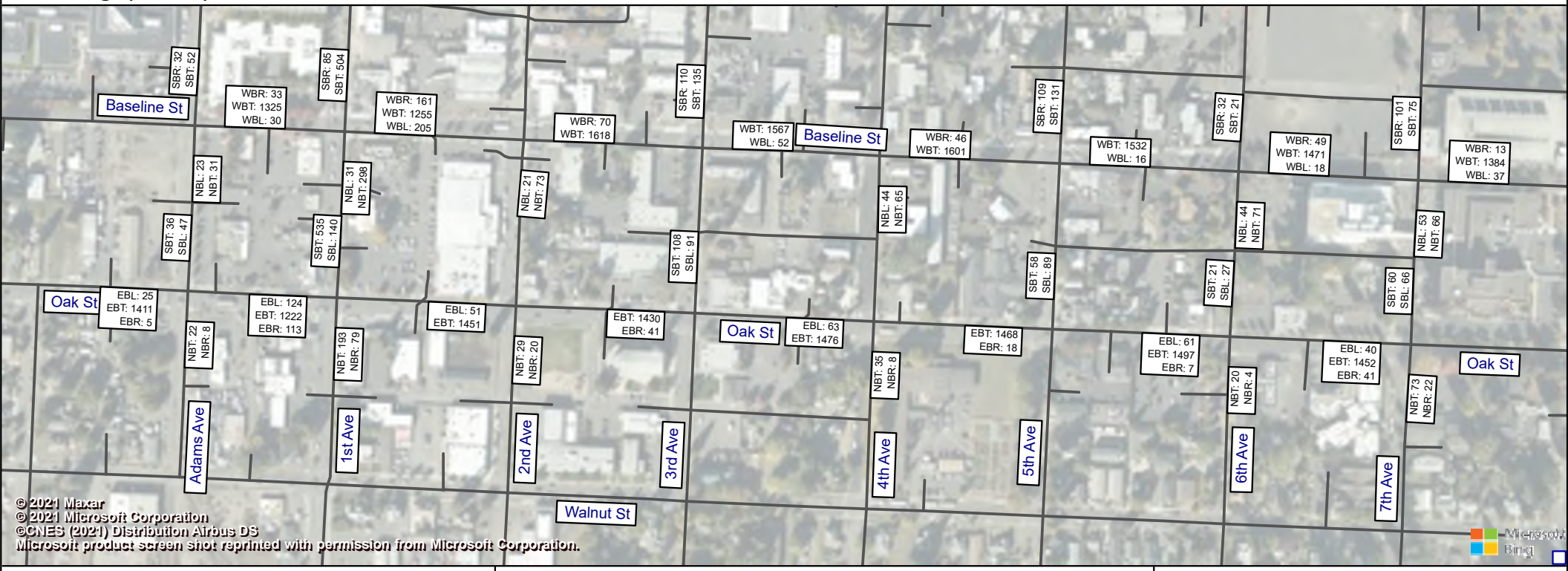
General Discussion

- Does the PMT agree with the recommendation of **Traditional Downtown/Central Business District** for Oak and Baseline Streets?
- Does the PMT agree with the recommendation of **Traditional Downtown/Central Business District** for 10th Avenue?

KITTELSON & ASSOCIATES

Appendix B
Existing (year 2020) PM Peak
Hour Turning Movement Volumes

Existing (2020) Traffic Volumes



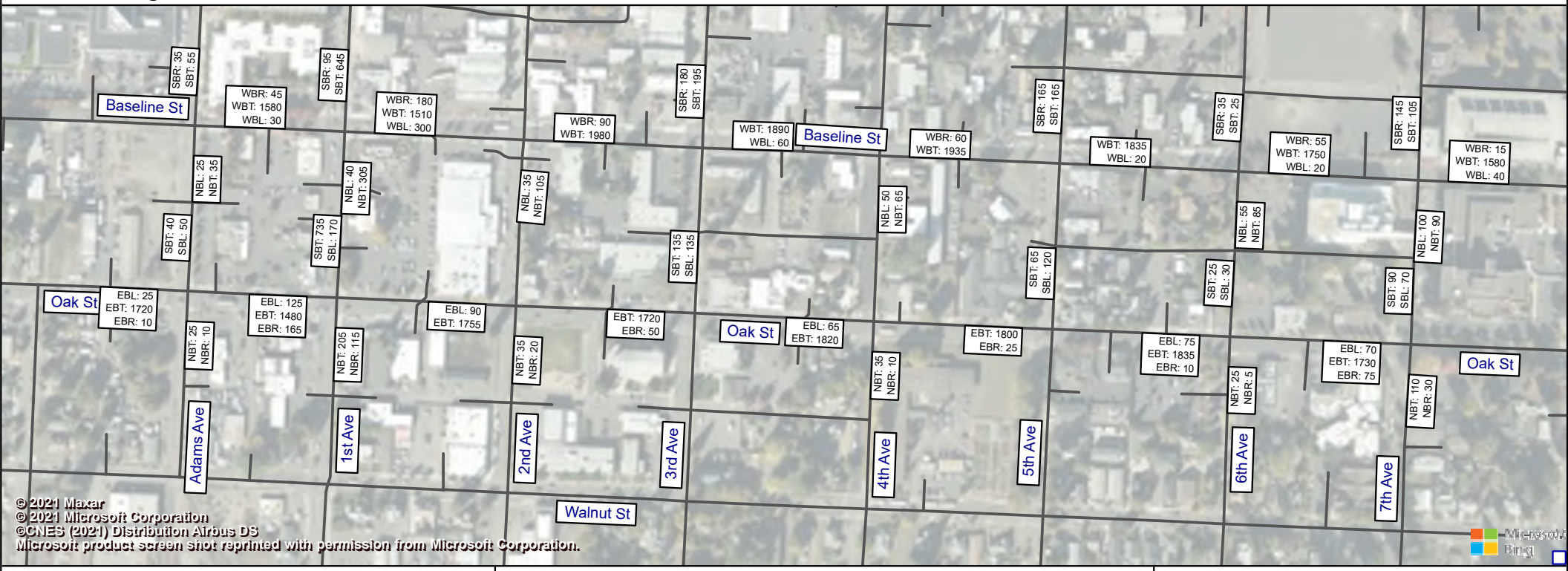
2020 Existing Traffic Volumes	OR 8 from Adams Avenue to 7th Avenue	03.06.2021/14:54:45

Existing (2020) Traffic Volumes

2020 Existing Traffic Volumes	OR 8 from 8th Avenue to Maple Street	03.06.2021/15:01:11

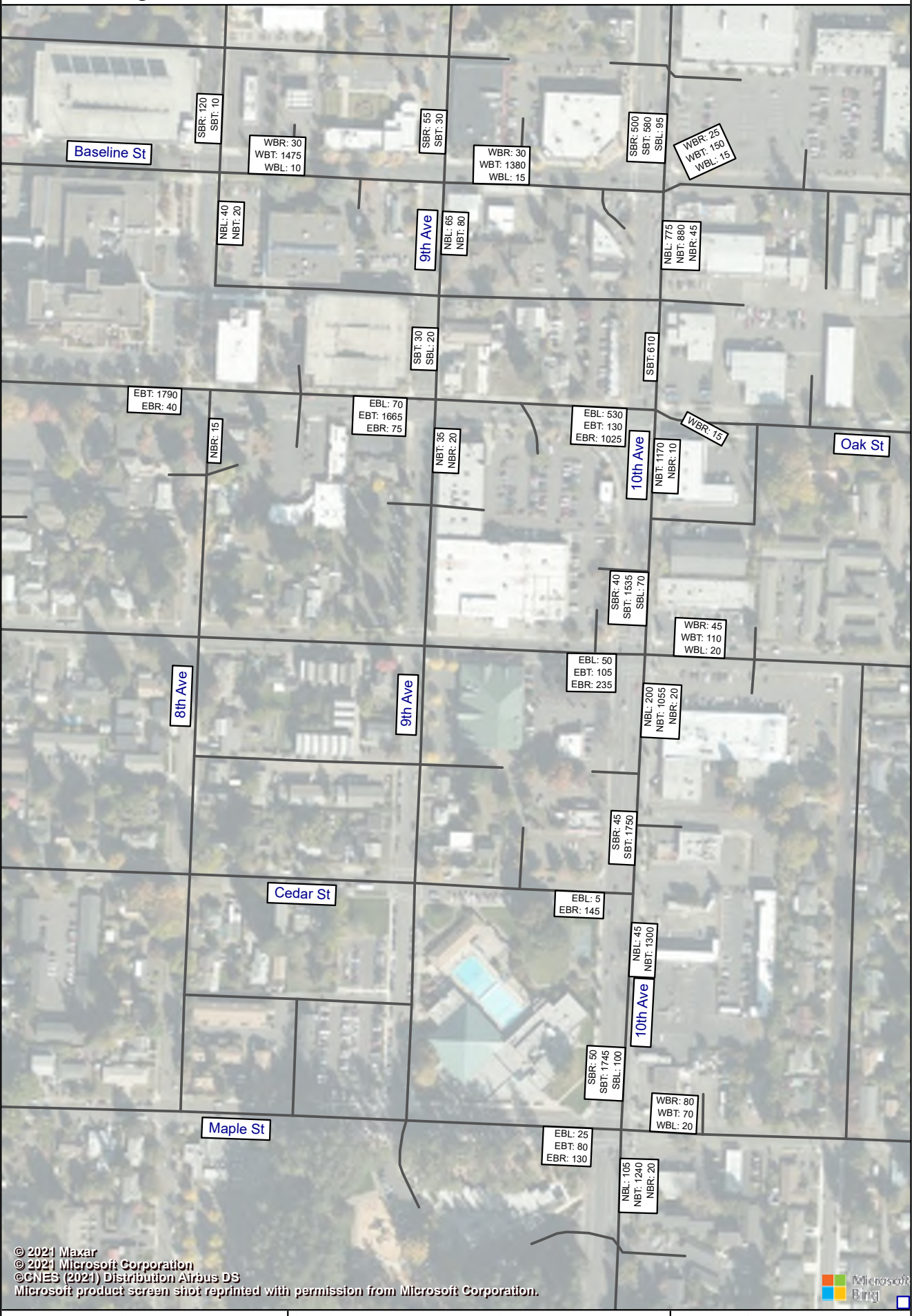
Appendix C
Future No-Build Model (year 2040) Intersection Turning Movement Volumes

2040 Design Hour Traffic Volumes - No-Build



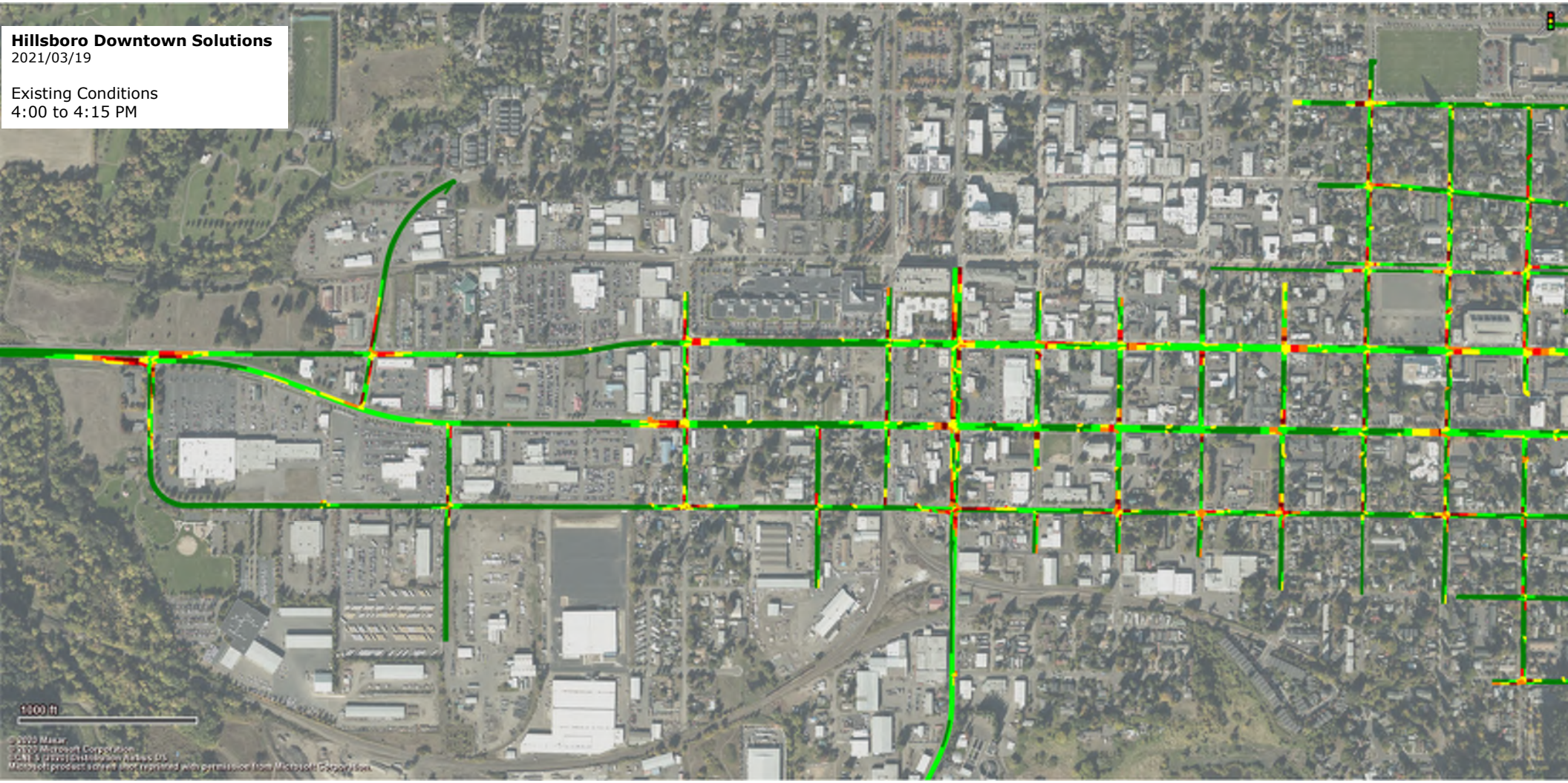
2040 No-Build Traffic Volumes	OR 8 from Adams Avenue to 7th Avenue	03.06.2021/14:56:27

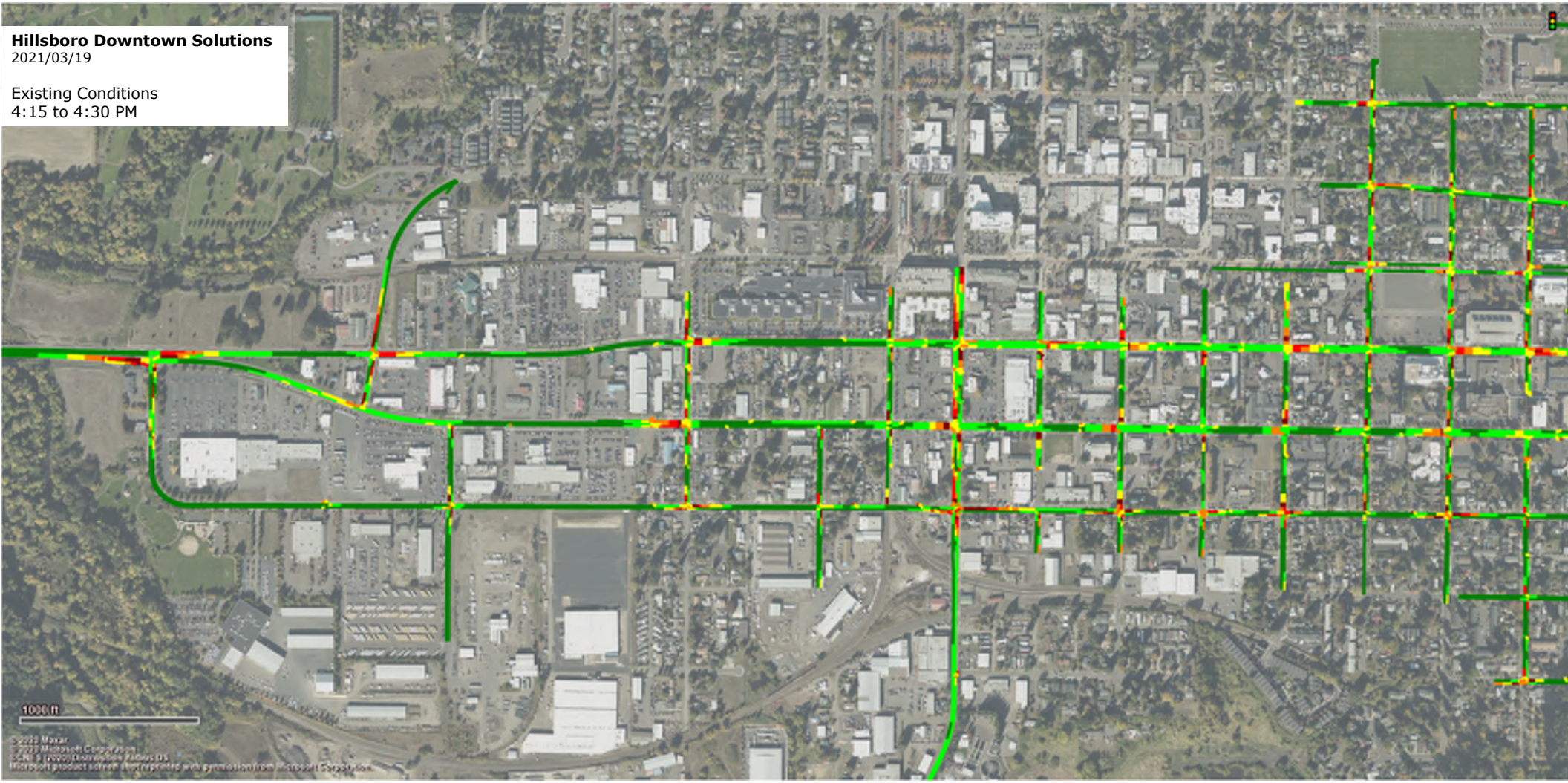
2040 Design Hour Traffic Volumes - No-Build

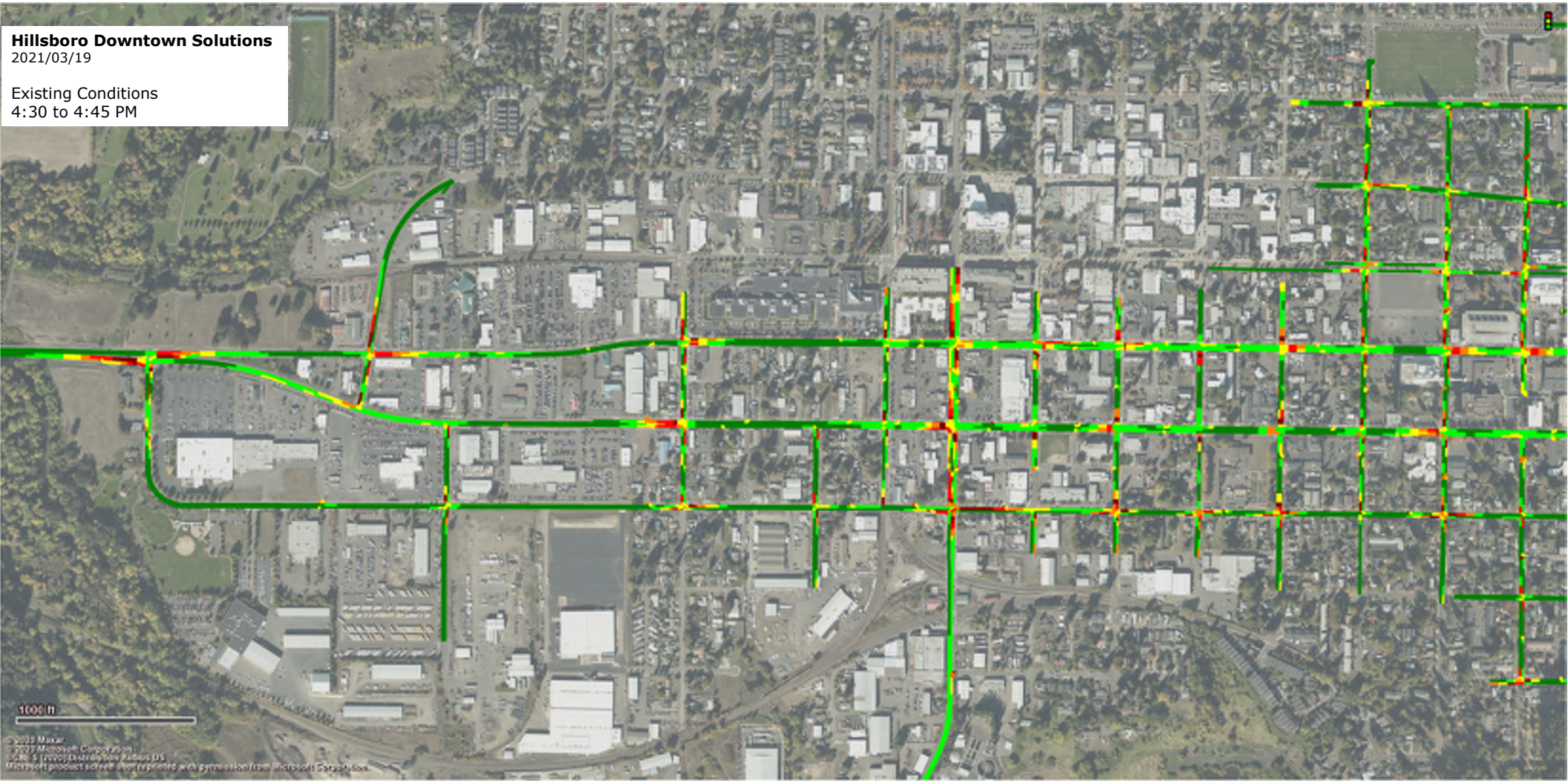


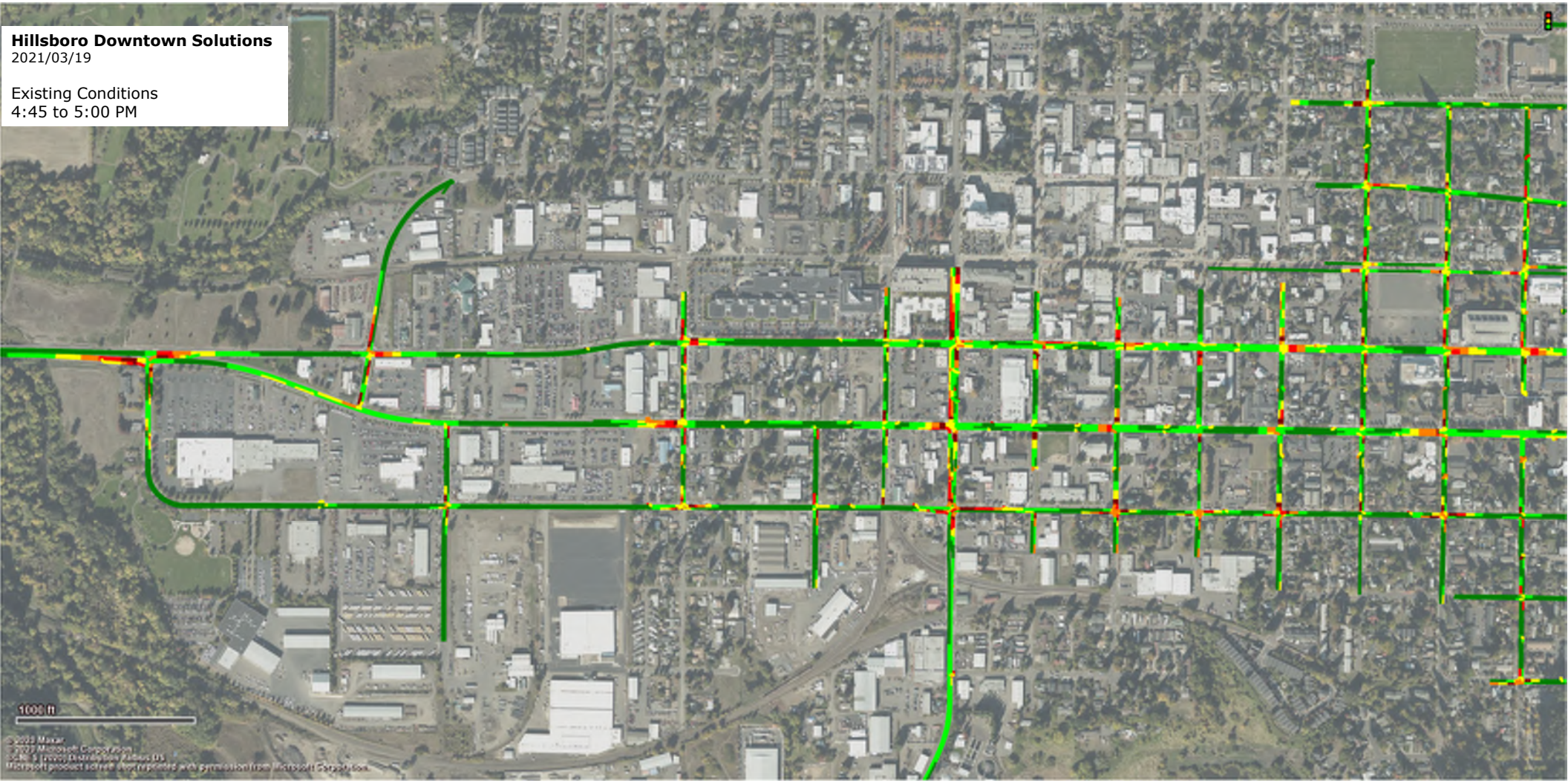
2040 No-Build Traffic Volumes	OR 8 from 8th Avenue to Maple Street	03.06.2021/14:59:37

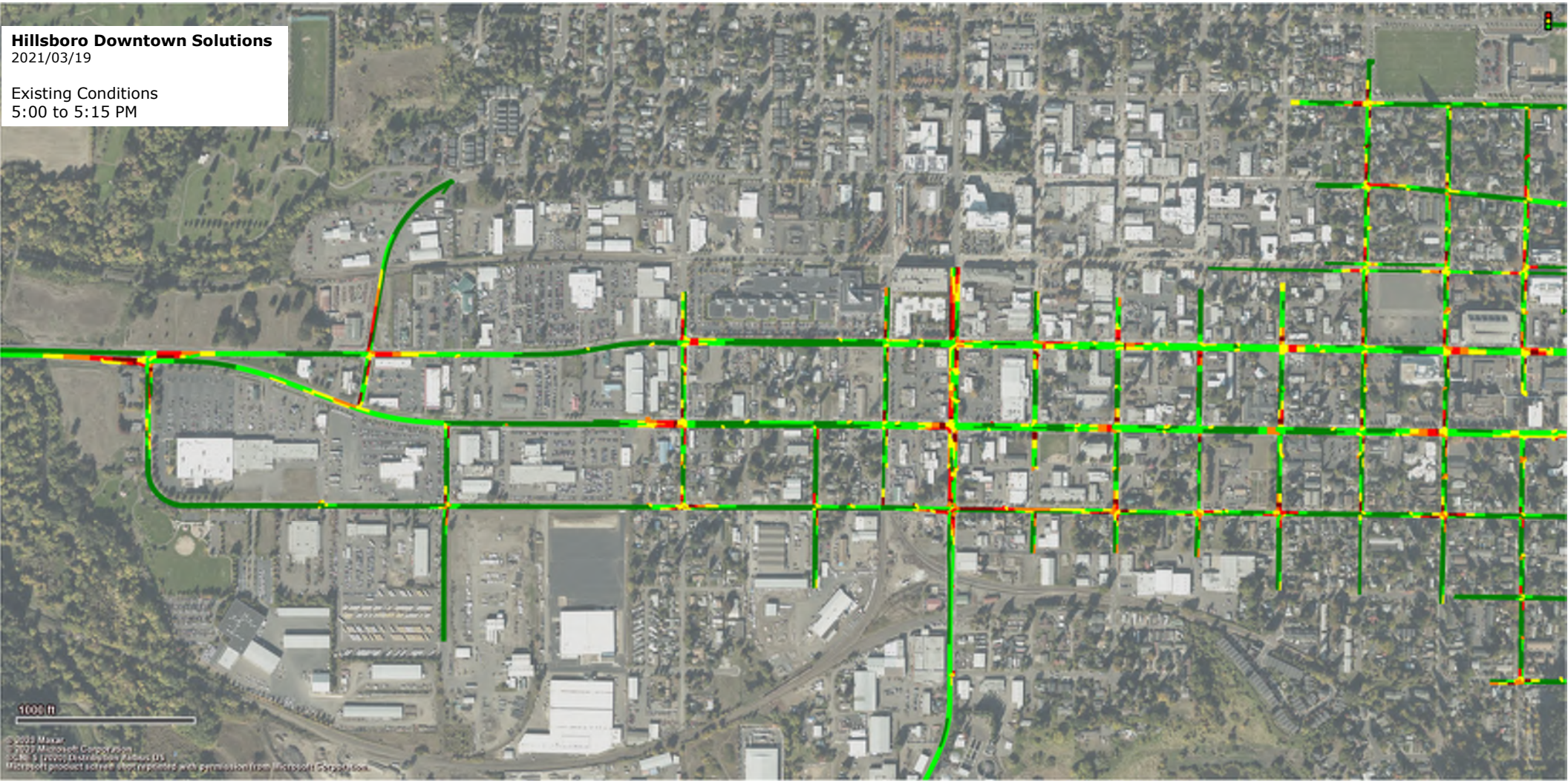
Appendix D
Relative Delay (Queues) for Each 15-Minute Interval

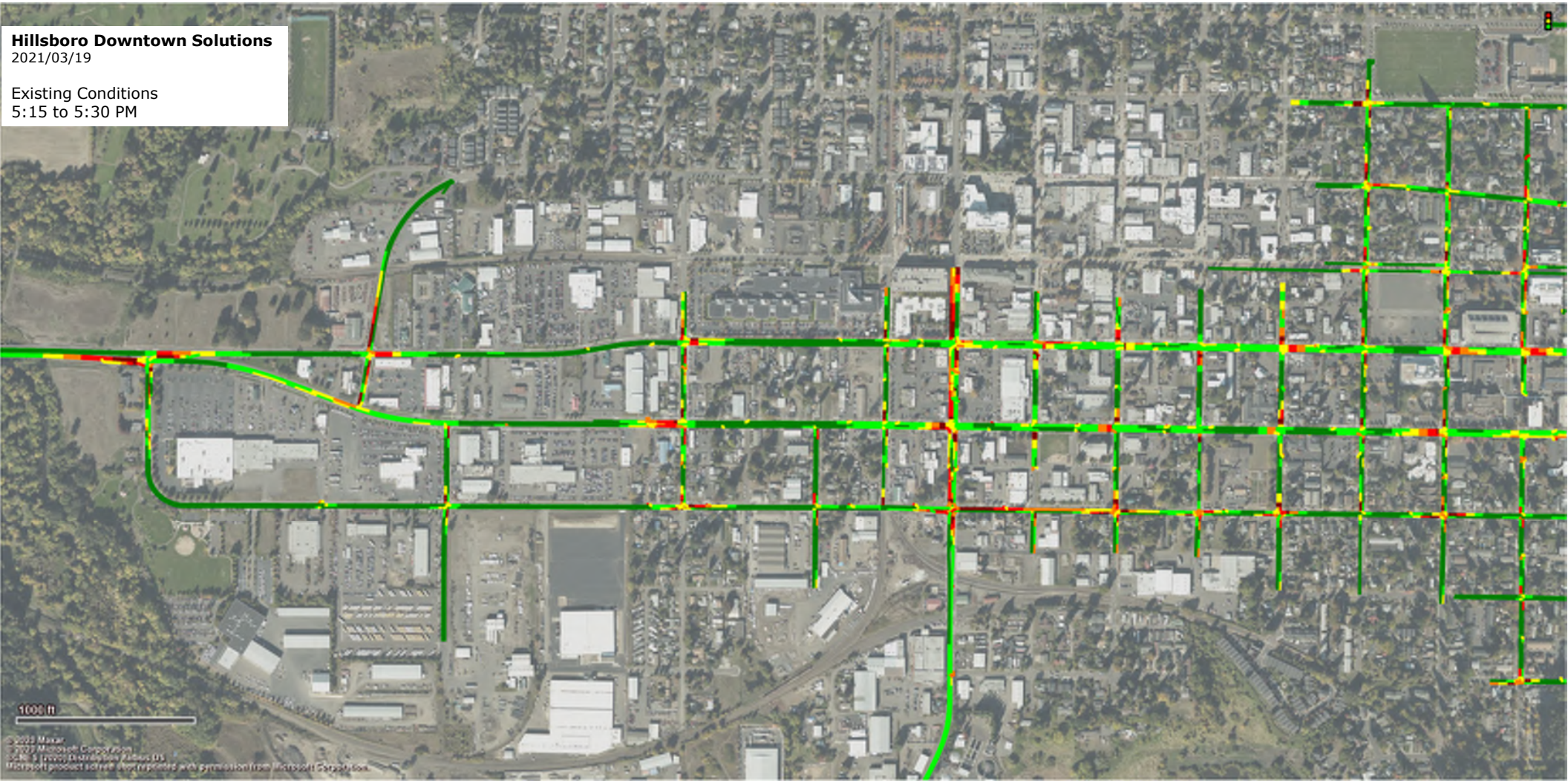

Hillsboro Downtown Solutions
2021/03/19
Existing Conditions
4:00 to 4:15 PM
1000 ft

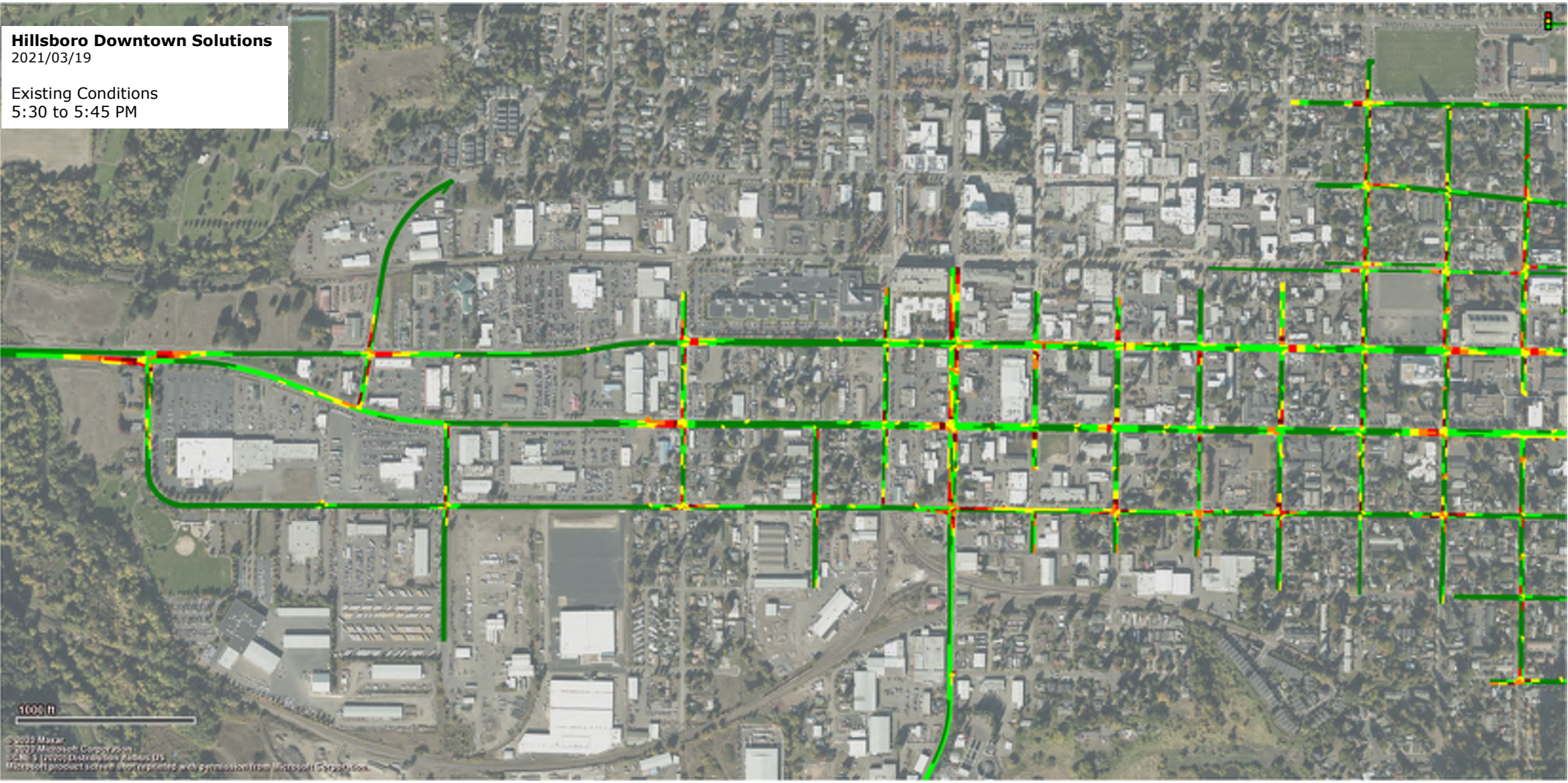

Hillsboro Downtown Solutions
2021/03/19
Existing Conditions
4:15 to 4:30 PM
1000 ft

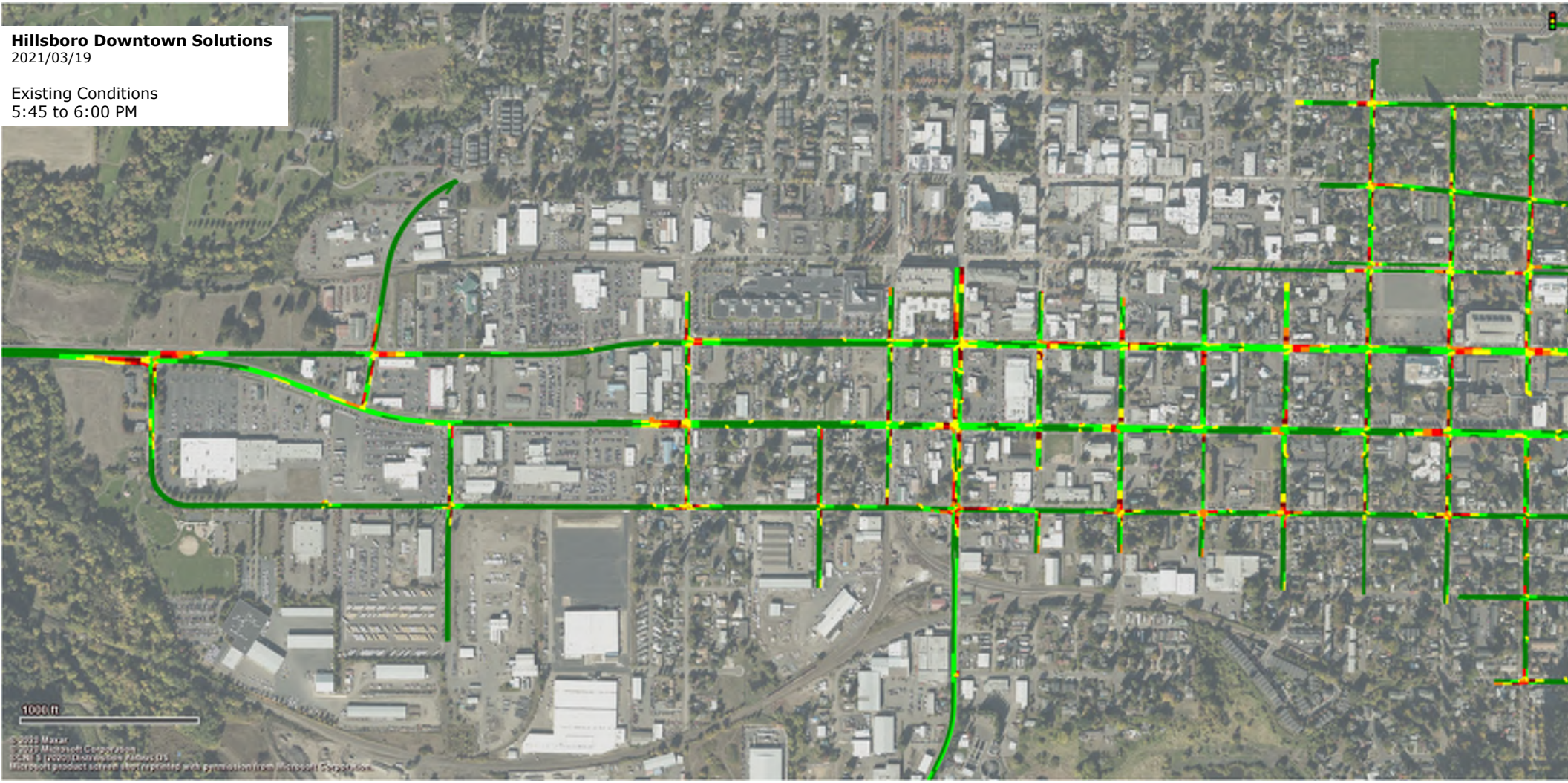

Hillsboro Downtown Solutions
2021/03/19
Existing Conditions
4:30 to 4:45 PM
1000 ft

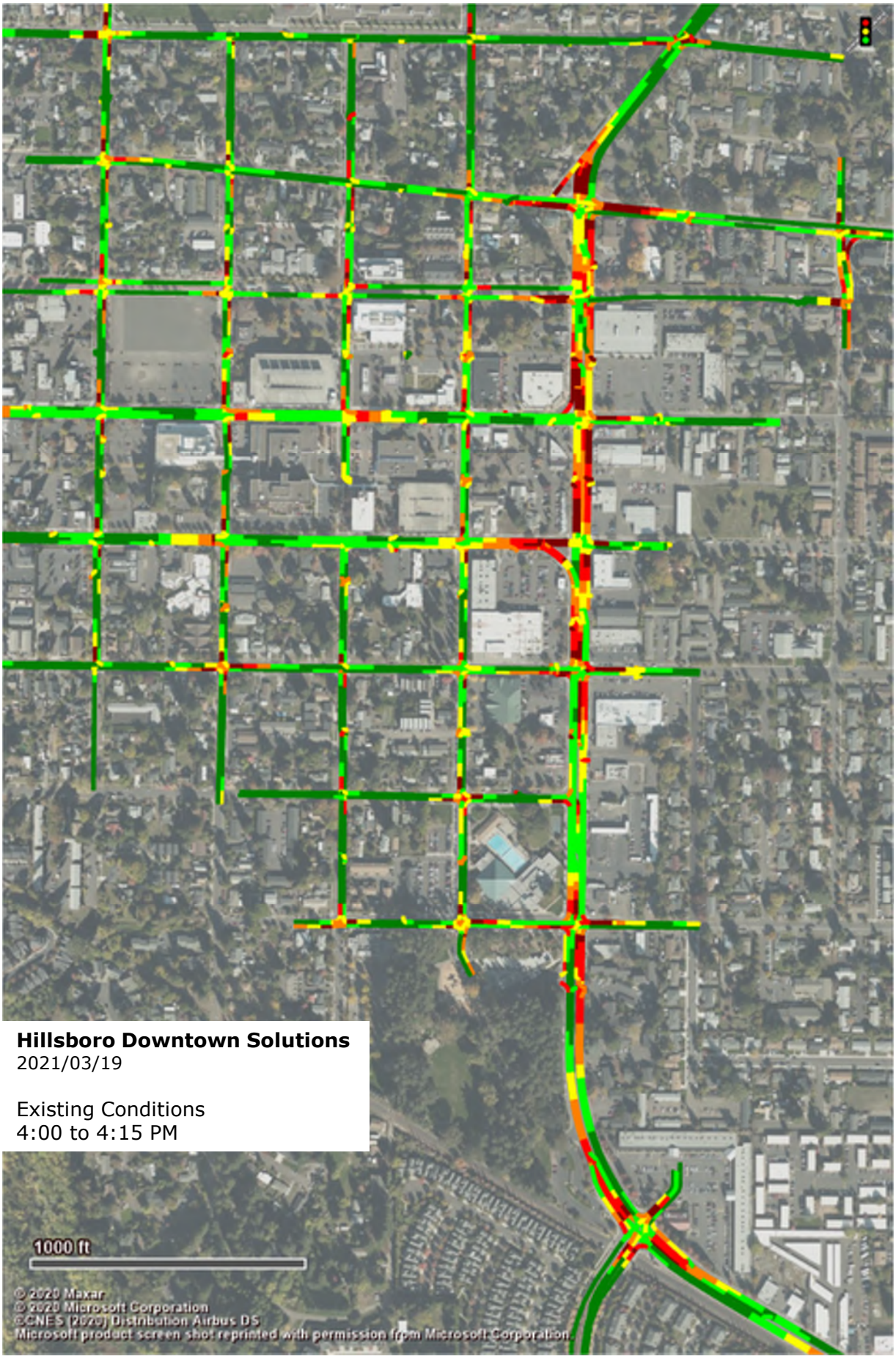

Hillsboro Downtown Solutions
2021/03/19
Existing Conditions
4:45 to 5:00 PM
1000 ft


Hillsboro Downtown Solutions
2021/03/19
Existing Conditions
5:00 to 5:15 PM
1000 ft


Hillsboro Downtown Solutions
2021/03/19
Existing Conditions
5:15 to 5:30 PM
1000 ft

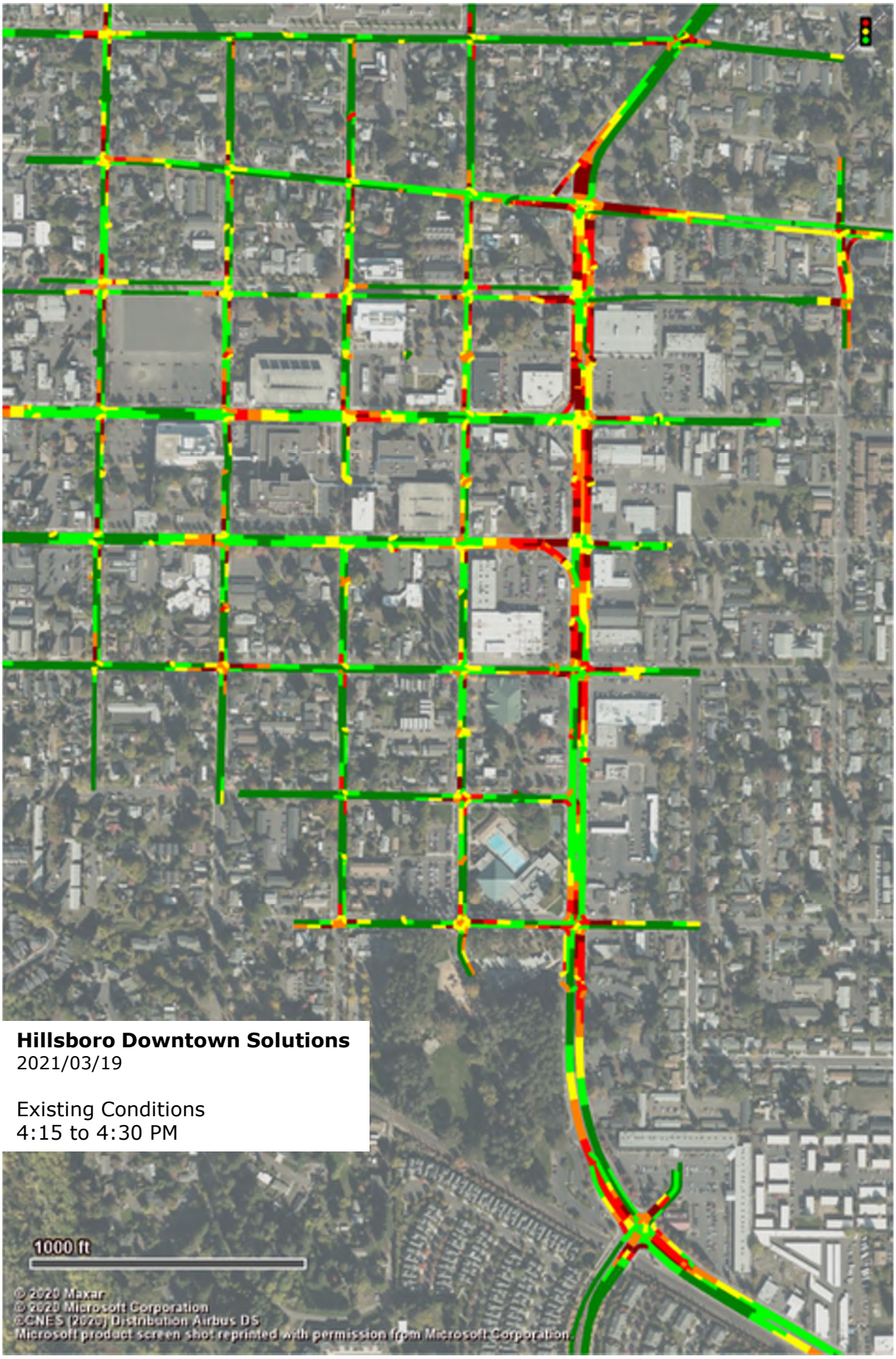

Hillsboro Downtown Solutions
2021/03/19
Existing Conditions
5:30 to 5:45 PM
1000 ft


Hillsboro Downtown Solutions
2021/03/19
Existing Conditions
5:45 to 6:00 PM
1000 ft



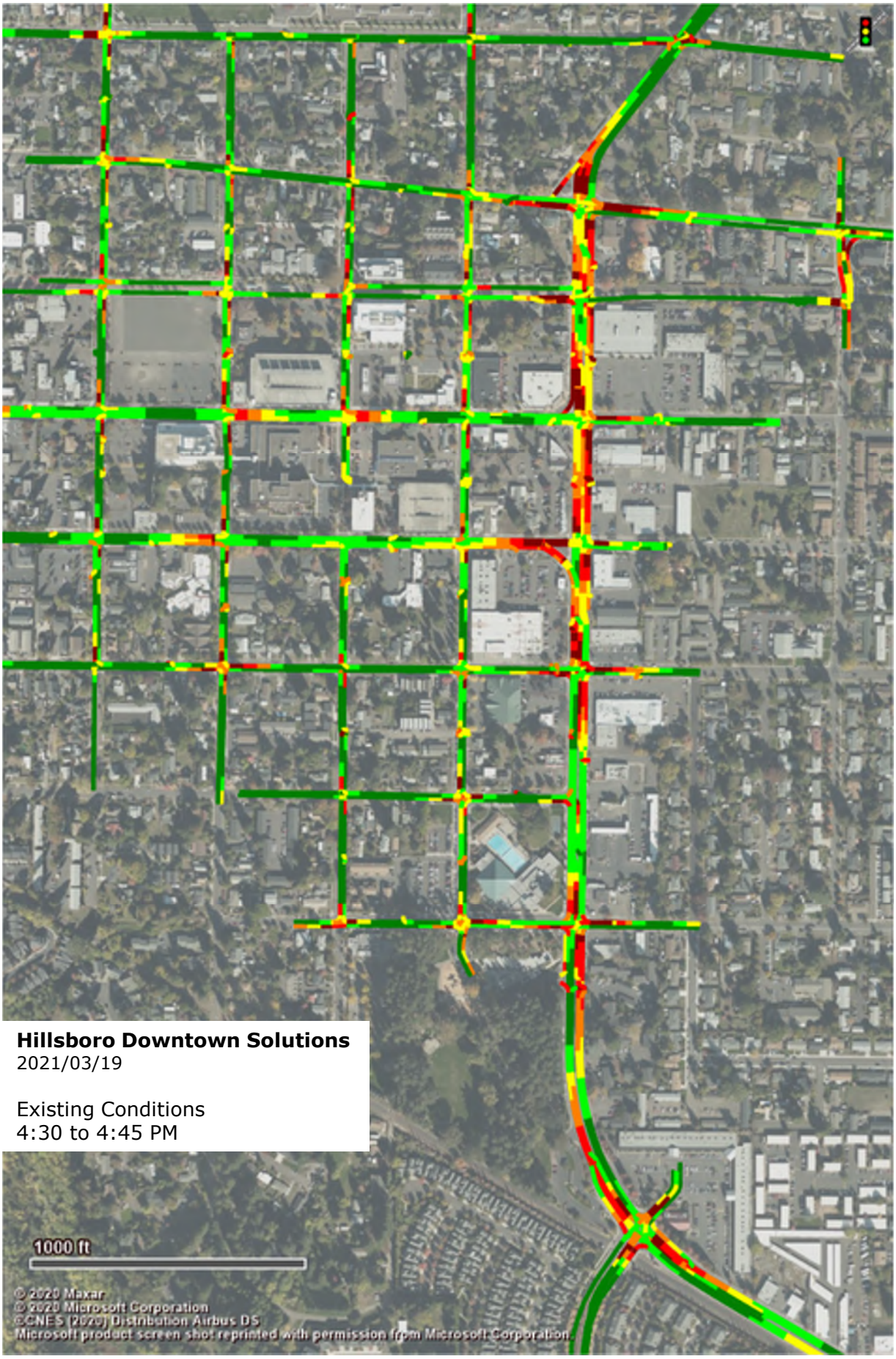
Hillsboro Downtown Solutions
2021/03/19

Existing Conditions
4:00 to 4:15 PM



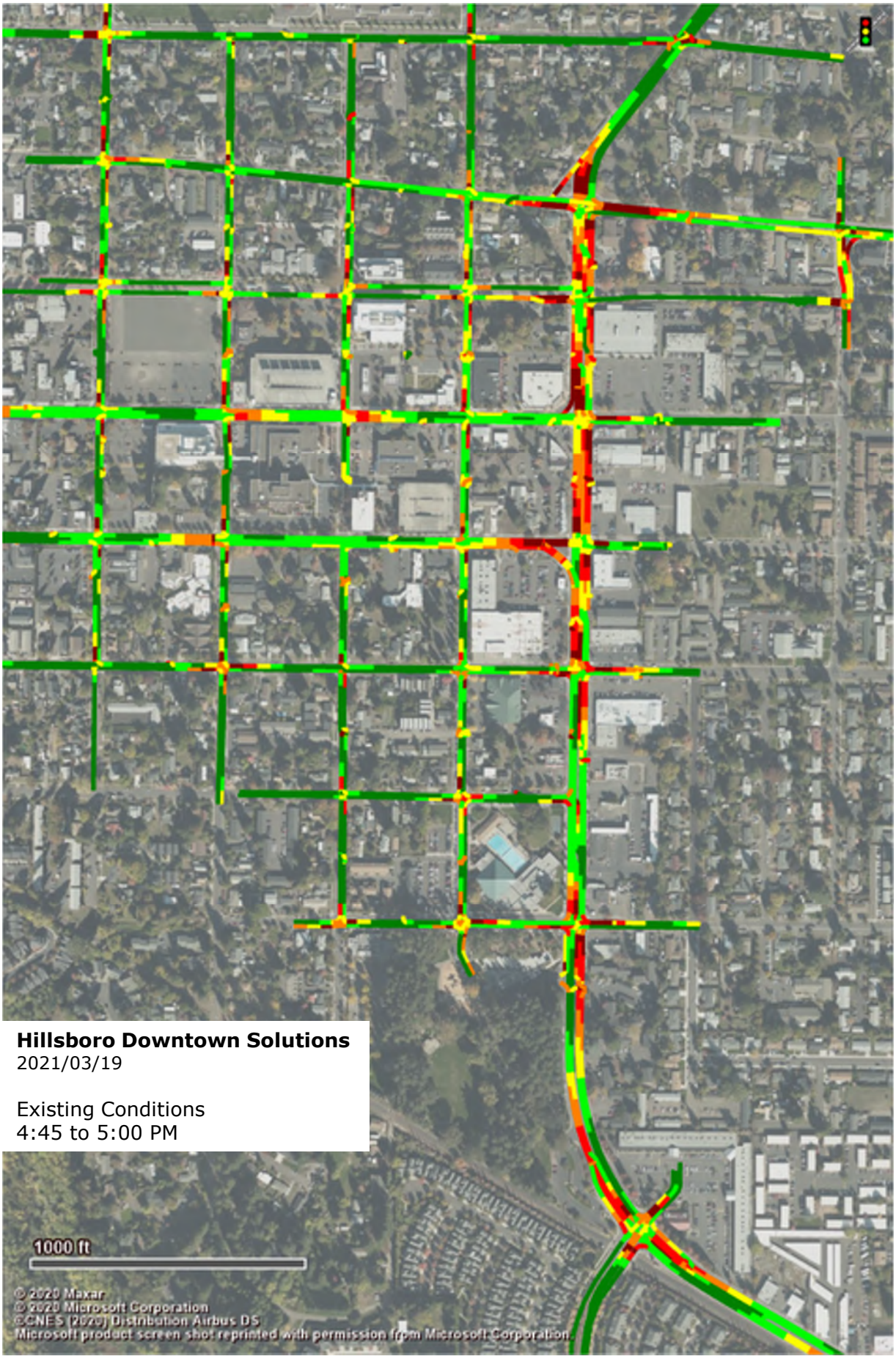
Hillsboro Downtown Solutions
2021/03/19

Existing Conditions
4:15 to 4:30 PM



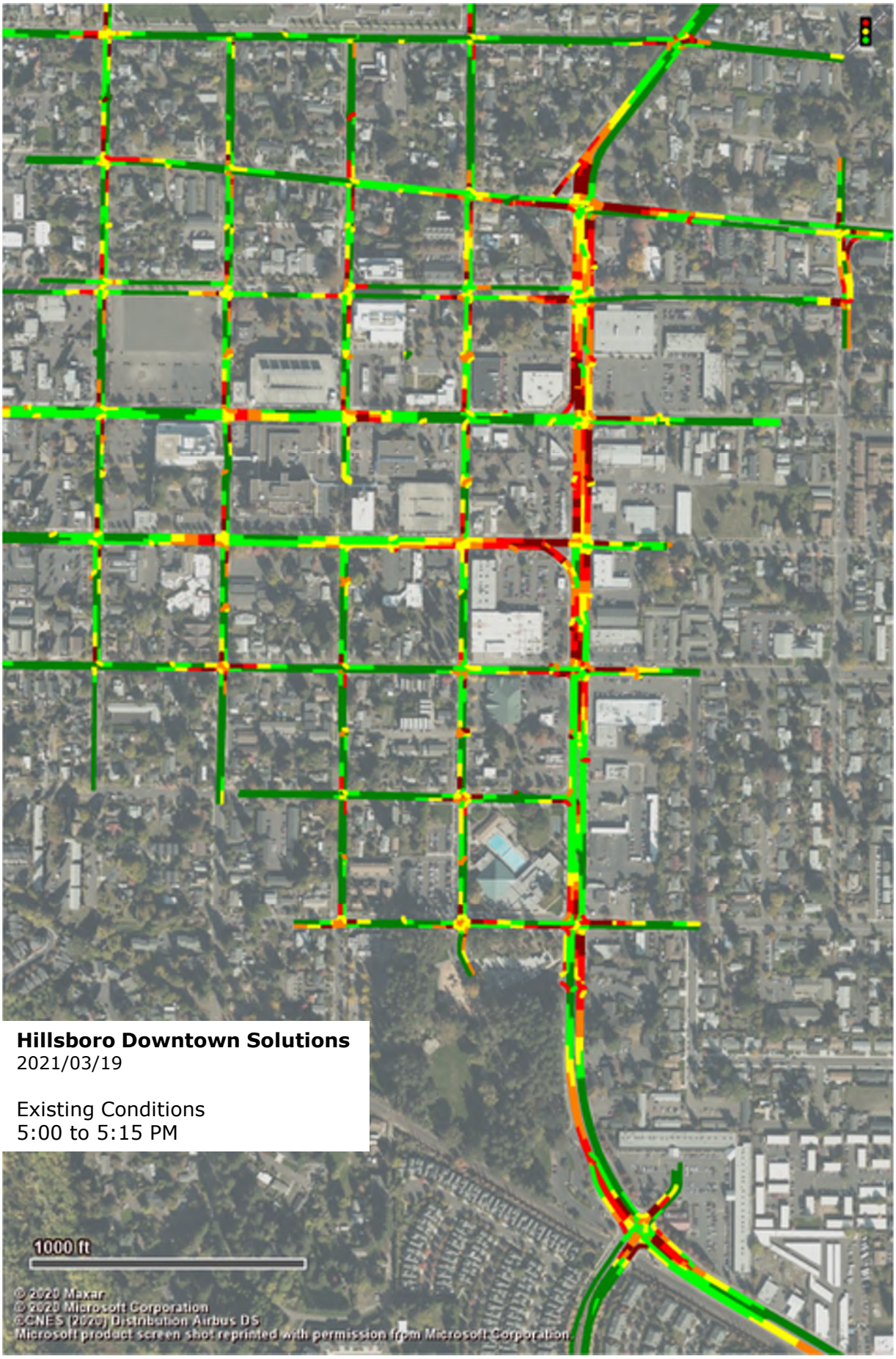
Hillsboro Downtown Solutions
2021/03/19

Existing Conditions
4:30 to 4:45 PM



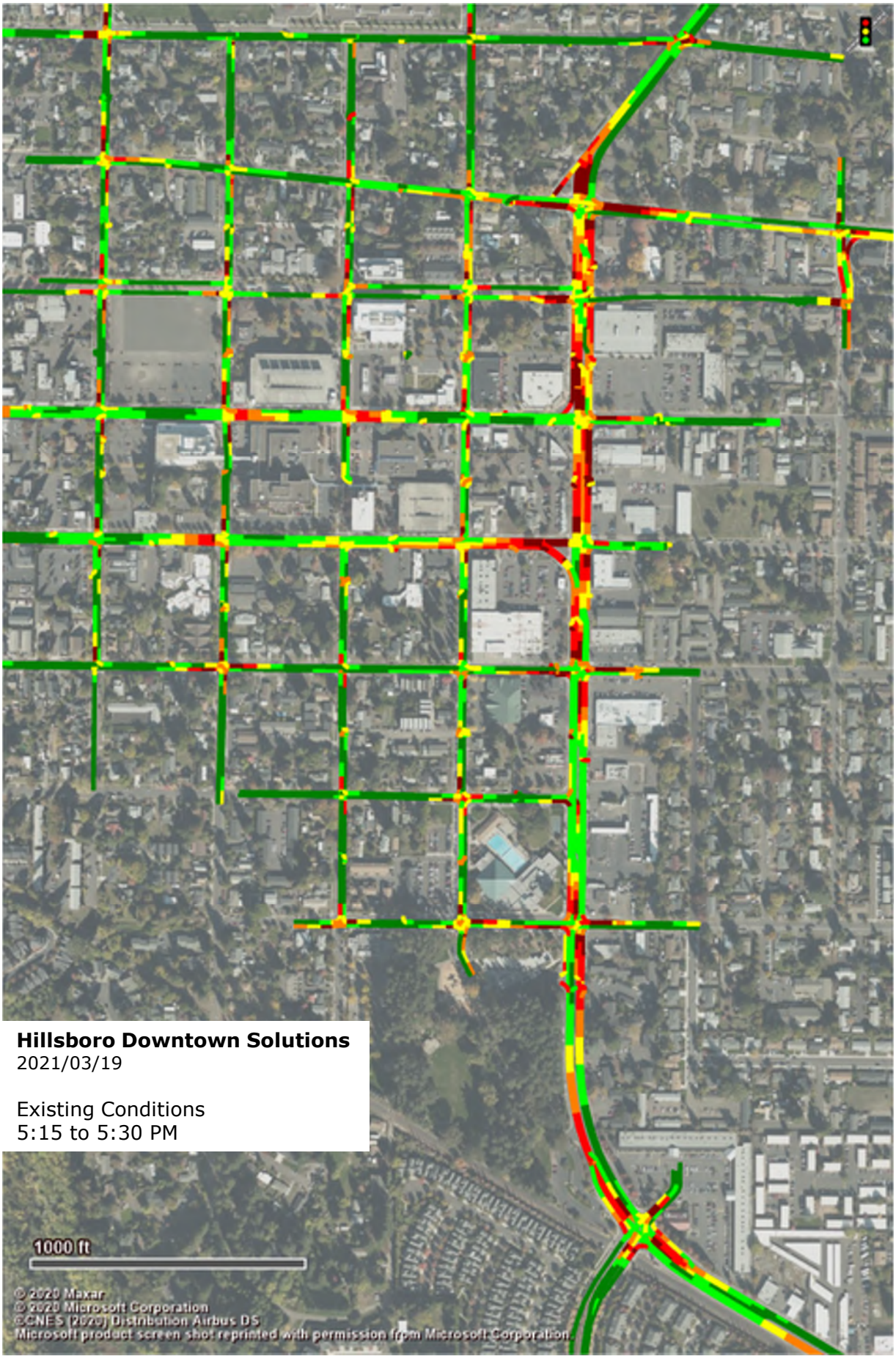
Hillsboro Downtown Solutions
2021/03/19

Existing Conditions
4:45 to 5:00 PM



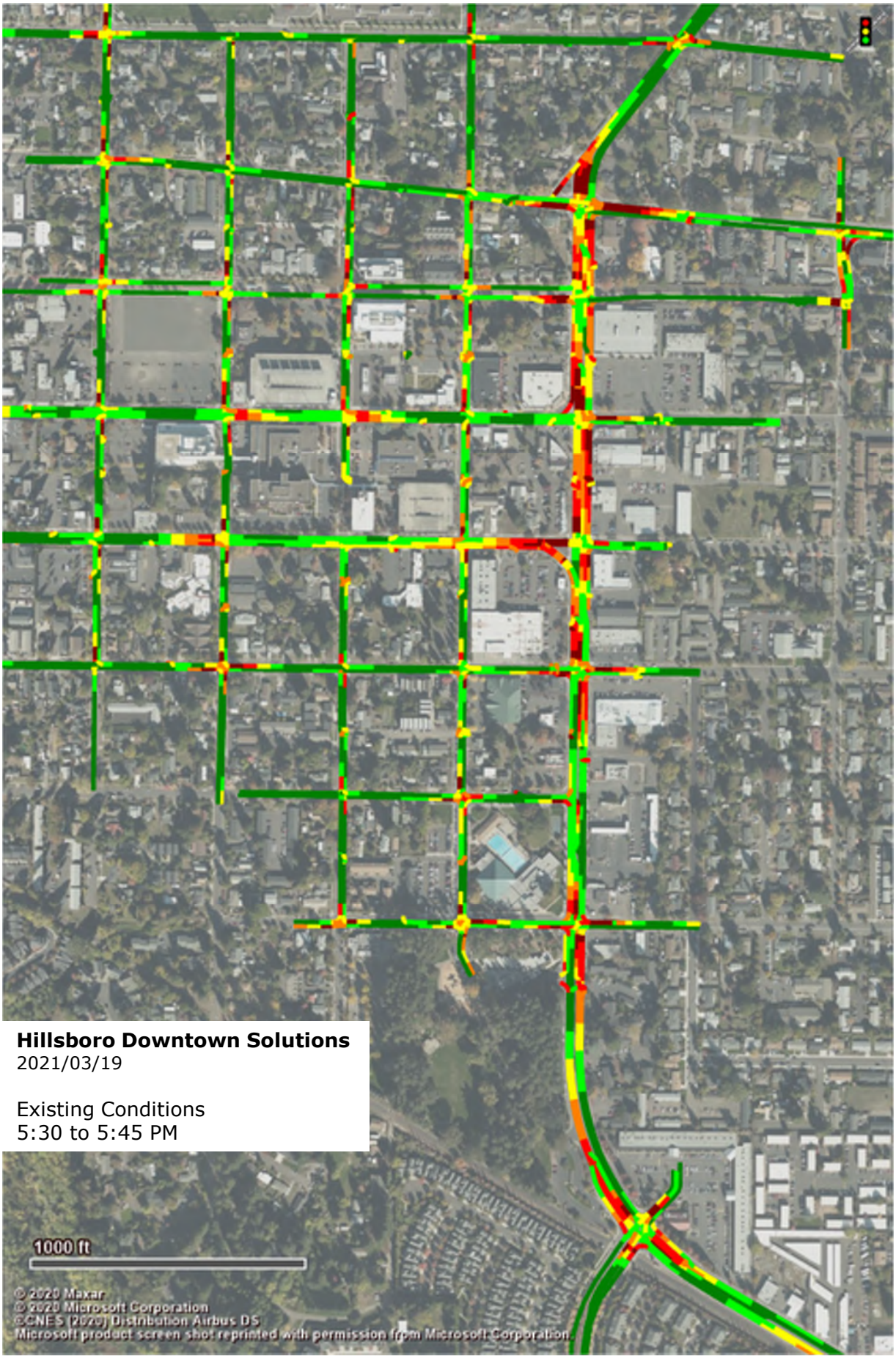
Hillsboro Downtown Solutions
2021/03/19

Existing Conditions
5:00 to 5:15 PM



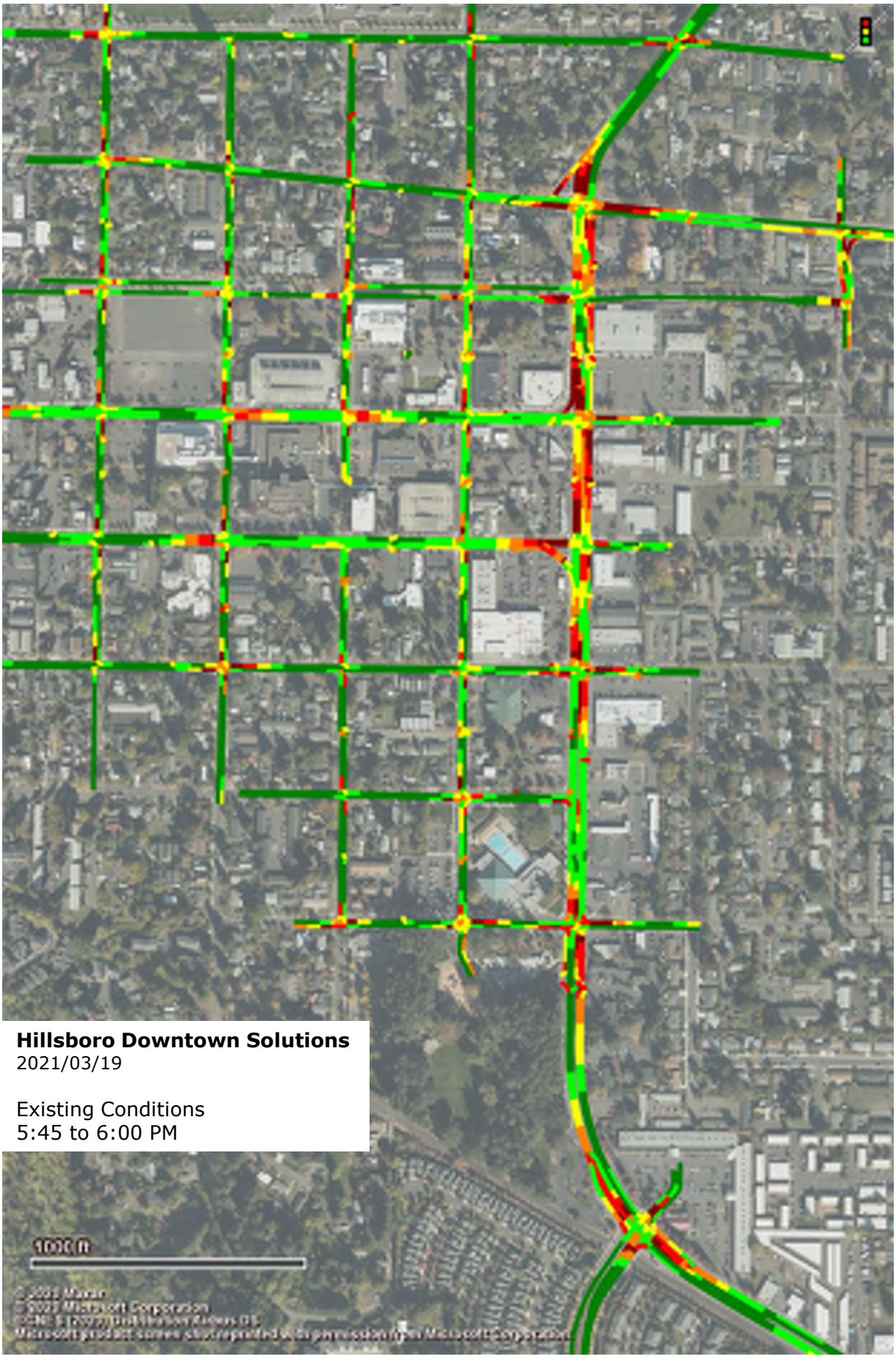
Hillsboro Downtown Solutions
2021/03/19

Existing Conditions
5:15 to 5:30 PM



Hillsboro Downtown Solutions
2021/03/19

Existing Conditions
5:30 to 5:45 PM



Hillsboro Downtown Solutions
2021/03/19

Existing Conditions
5:45 to 6:00 PM

Appendix E
Hillsboro Parking Code and Zoning Data

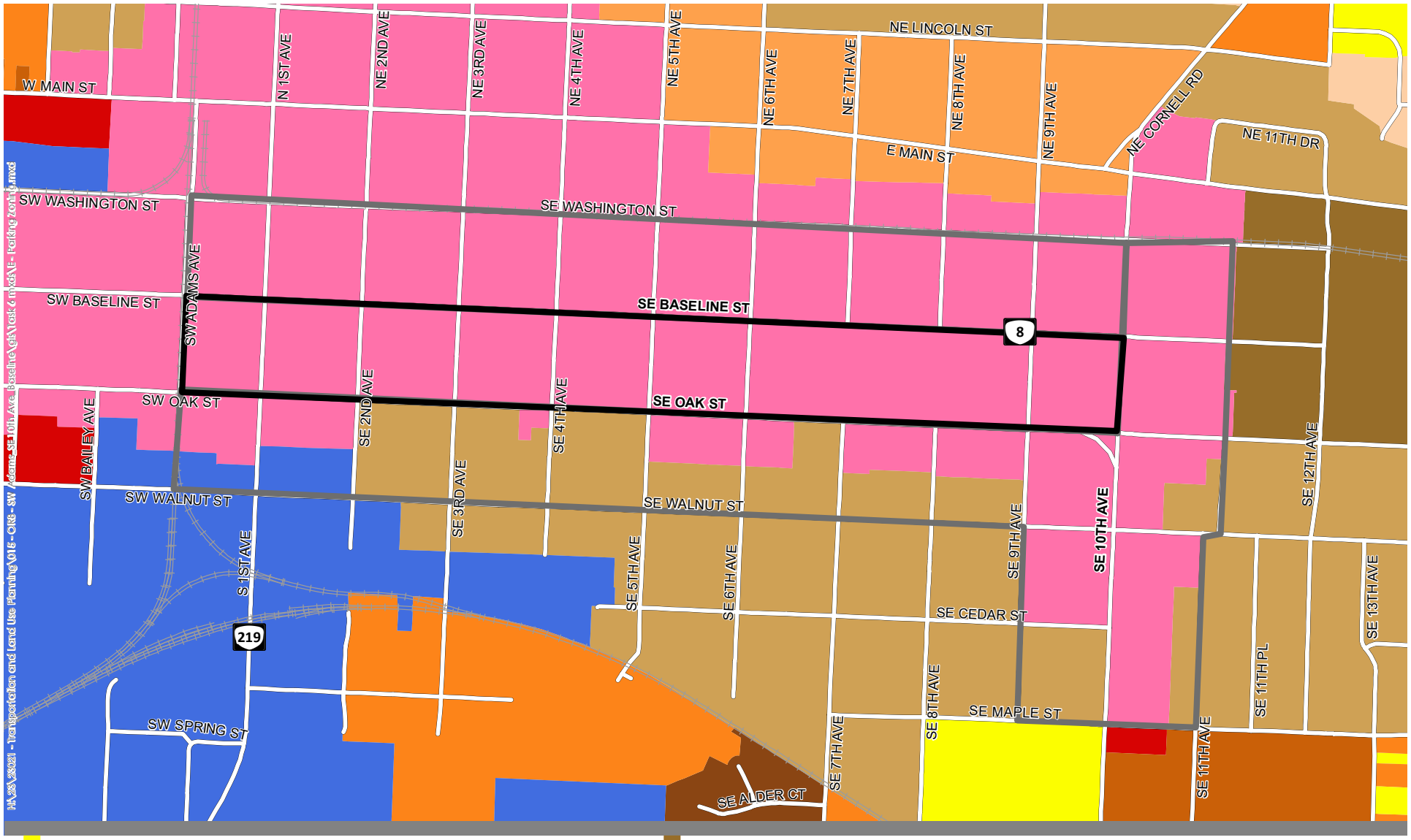
Table 15 shows the required parking spaces for commercial uses within Zone A of parking maximums development and design standards.

Table 15: Required Vehicle Parking Spaces for Commercial Uses (per 1,000 square feet of Net Floor Area unless otherwise specified)

Use Type	Minimum	Maximum (Zone A)
Commercial Lodging		
All uses	0.5/room	1/room
Commercial Recreation		
Indoor facilities	3	5
Court sports	2/court	5/court
Outdoor facilities (with bleachers)	1/4 ft. of bench length	None
Outdoor facilities (without bleachers)	20/field	40/field
Durable Goods Sales		
All uses	2	3
Eating and Drinking Establishments		
Fast food	5	10
Casual dining	6	12
Fine dining	8	15
Educational Services		
All uses (parking calculated per FTE student or employee)	0.15	0.30
Office		
General office	2	4
Medical office	4	5
Customer Service Communications Center	4.1	6.75
Retail Products and Services		
Minor Assembly Facilities	2	5
All other uses	4	5
Self-Service Storage		
All uses	1/5000 sq. ft. up to 20,000 sq. ft.; 1/20,000 sq. ft. thereafter	1/4000 sq. ft. up to 20,000 sq. ft.; 1/20,000 sq. ft. thereafter
Vehicle Service and Repair		
All types	3	4

Source: City of Hillsboro, Oregon Municipal Code 12.50.320

Zoning from the Hillsboro Comprehensive Plan (2018) is provided in Figure E.1. A majority of the influence area is Zoned Station Community Commercial. As described in the Comprehensive Plan Policies section above, the policy for this zoning is to reduce off-street parking requirements in this area.



Single Family Residential (SFR-7)
Station Community Residential - Low Density (SCR-LD)
Station Community Residential - Downtown Neighborhood Conservation (SCR-DNC)
Multi-Family Residential (MFR-1)
Multi-Family Residential (MFR-2)
Multi-Family Residential (MFR-3)
Station Community Residential - Medium Densit (SCR-MD)
Station Community Residential - High Density (SCR-HD)
Industrial - General (I-G)
Commercial - General (C-G)
Station Community Commercial - Downtown (SCC-DT)
Influence Area
Project Area

0 500 Feet

Figure E.1

Comprehensive Plan Zoning
Hillsboro, Oregon

KITTELSON & ASSOCIATES