TECH MEMO #5: ALTERNATIVES ANALYSIS AND FUNDING PROGRAM

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Project: Independence Transportation System Plan (TSP) Update

Subject: Tech Memo #5: Alternatives Analysis and Funding Program

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INTRODUCTION

This memorandum summarizes the alternatives analysis and funding program for the Independence Transportation System Plan (TSP) update. This memorandum includes information on projects that address identified deficiencies and needs in the City of Independence. The information provided in this memorandum will serve as the basis for alternatives solutions packages for the TSP update.

STREET SYSTEM

Streets serve a majority of trips within Independence across all travel modes. In addition to motor vehicles, pedestrians, bicyclists, and public transit riders use the street network to access local and regional destinations. This section identifies alternatives to address gaps and deficiencies in the street system as well as alternatives that will facilitate improvements to the pedestrian, bicycle, and public transit systems.

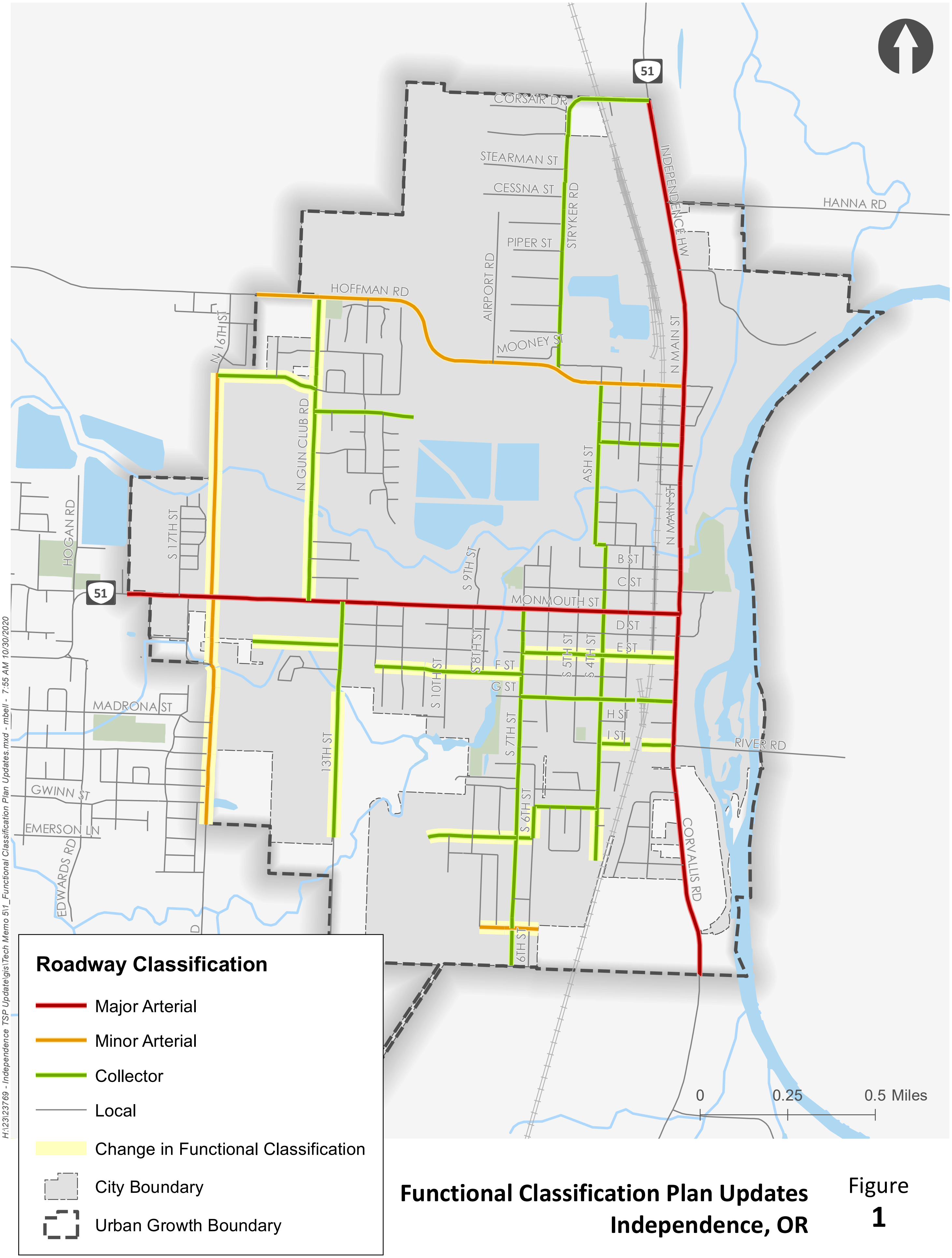
Functional Classification

Functional classification designations align the design of a roadway with its intended function, such as operating as a local freight route or offering a parallel route connection. A review of the existing Independence functional classification system indicates opportunities to better align with the roadway uses and to provide further arterial and collector connectivity within the built network. The functional classification opportunities are shown in Figure 1 and listed below.

- Re-designate 16th Street (north city limits to Talmadge Road) from a collector to a minor arterial.
- Re-designate 16th Street (Talmadge Road to south city limits) from a local street to a minor arterial.
- Re-designate Marigold Drive (16th Street to Gun Club Road) from a local street to a collector.
- Re-designate Gun Club Road from a minor arterial to a collector.
- Re-designate E Street (western end to 13th Street) from a local street to a collector.
- Re-designate Randall Way-F Street (12th Street to 7th Street) from a local street to a collector.
- Re-designate E Street (7th Street to OR 51-Main Street) from a local street to a collector.
- Re-designate 13th Street (F Street to the south City limits)from a local street to a collector.
- Re-designate I Street (4th Street to OR 51-Main Street) from a local street to a collector, assuming a rail crossing is feasible.
- Re-designate Chestnut Street (7th Street to western extents) from a local street to a collector.
- Re-designate Cedar Street/6th Street (7th Street to Spruce Avenue) from a local street to a collector.
- Re-designate 4th Street (Spruce Avenue to southern extents) from a local street to a collector.
- Re-designate Mountain Fir Avenue from a local street to a minor arterial.

Major Street Connectivity

A review of the existing arterial and collector system indicates a need for new major street connections within Independence. The future street system needs to balance the benefits of providing a well-connected grid system with the connectivity challenges in the city due railroads and Ash Creek running through the city and existing development.



Functional Classification Plan Updates
Independence, OR

Figure
1

Data Source: Polk County Data Portal, ODOT

In addition to new local streets discussed in a later section, there are opportunities to extend existing major streets and to provide new major street connections, as listed below and shown in Figure 2.

- Extend E Street west to Monmouth City Limits.
- Extend Randal Way west to 13th Street at F Street.
- Extend Chestnut Street southwest to the new east-west collector.
- Extend 4th Street south to the new east-west minor arterial.
- Construct a new east-west collector from 16th Street at Madrona Street to 13th Street.
- Construct a new east-west collector from 13th Street to G Street.
- Construct a new north-south collector from F Street at 8th street to the new east-west collector.
- Construct a new east-west collector from 16th Street at Gwinn to the new east-west minor arterial.
- Construct a new east-west minor arterial from 16th Street at Ash Creek Drive to Corvallis Road.

Intersection Operations

The intersection operations analysis summarized in *Tech Memo #4: Future (No-build) Conditions*, identifies six intersections that are projected to exceed their applicable mobility standards or targets within the planning horizon. The queuing analysis identifies one additional intersection where vehicle queues are projected to exceed the striped storage. This section summarizes the alternatives considered for implementation to address intersection operations and queueing deficiencies at the study intersections. *Attachment A contains the intersection operations analysis worksheets*..

Intersection Treatments

The intersection treatments considered include geometric changes and changes to existing lane configurations and traffic control.

Turn Lane

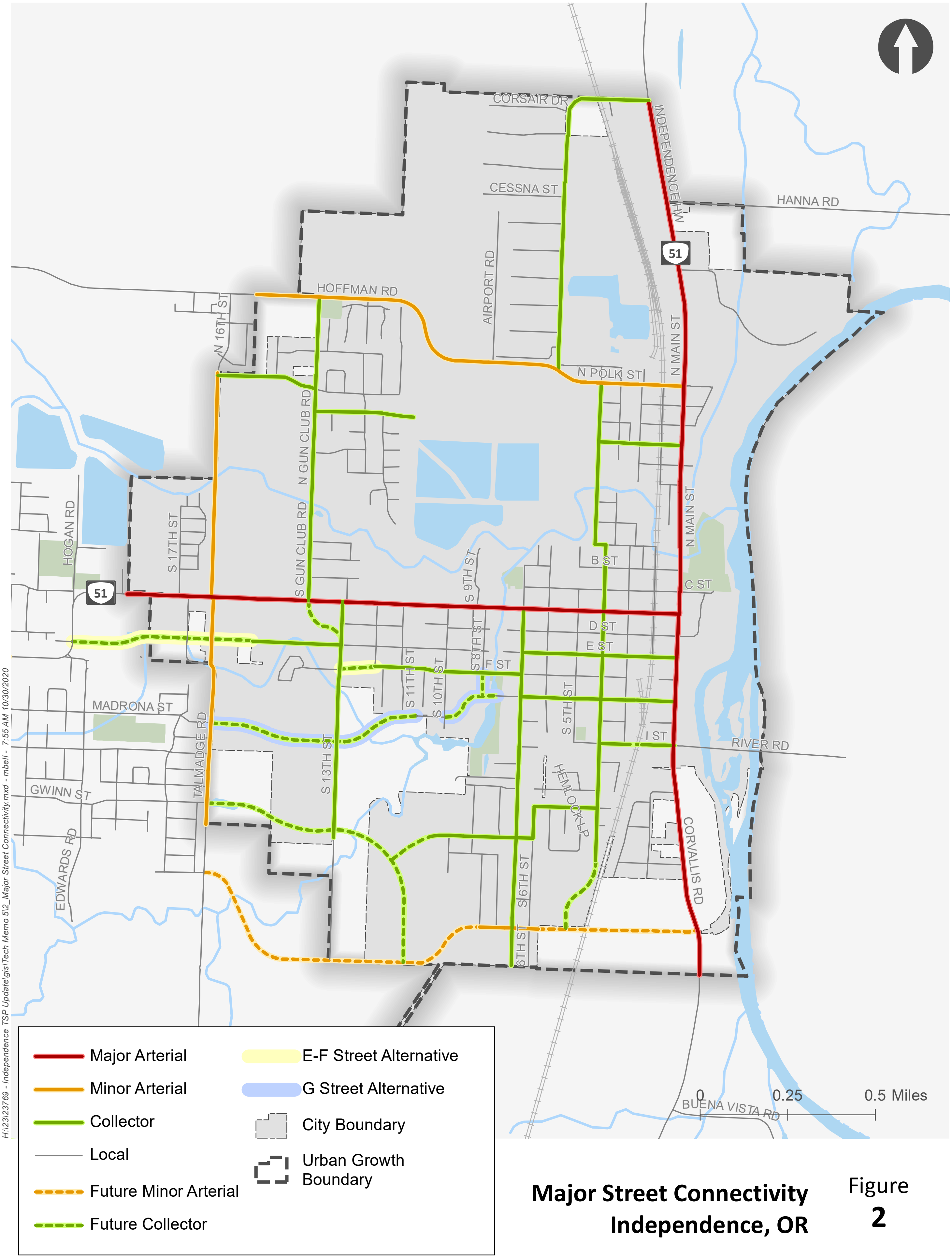
Separate left and right-turn lanes, as well as two-way left-turn lanes (TWLT), can provide significant increases in the capacity of intersections to accommodate turn movements. They can also provide a safety benefit by creating separation between slowed or stopped vehicles waiting to turn left and through vehicles. The design of turn lanes is largely determined based on a traffic study that identifies the need for the turn lane and the storage length needed to accommodate vehicle queues. Turn lanes are commonly used at intersections where the turning volumes warrant the need for separation.

Traffic Signal

Traffic signals allow opposing streams of traffic to proceed through an intersection in alternating patterns. When used, traffic signals can effectively manage high traffic volumes and provide dedicated times in which pedestrians and bicyclists can cross roadways. Because they continuously draw from a power source and must be periodically re-timed, signals typically have higher maintenance costs than other types of intersection control. Signals can also provide a safety benefit where signal warrants are met, however, they may result in an increase in rear-end crashes compared to other solutions. Signals have a significant range in costs depending on the number of approaches, how many through and turn lanes at each approach, and, if it is in an urban or rural area.

Signal Timing/Phasing Optimization

Signal timing/phasing optimization refers to updating signal timing/phasing plans to better match prevailing traffic conditions. Timing optimization can be applied to existing systems or may include



Major Street Connectivity
Independence, OR

Figure
2

Data Source: Polk County Data Portal, ODOT upgrading signal technology, such as signal communication infrastructure, signal controllers, or cabinets. Signal timing/phasing optimization can reduce travel times and be especially beneficial to improving travel time reliability. In high pedestrian or desired pedestrian areas, signal retiming/phasing optimization can facilitate pedestrian movements through intersections by increasing minimum green times to give pedestrians time to cross during each cycle. Signals can also facilitate bicycle movements with the inclusion of bicycle detectors.

Signal upgrades often come at a higher cost than signal timing/phasing optimization and usually require further coordination between jurisdictions. However, upgrading signals provides the opportunity to incorporate advanced signal systems to further improve the efficiency of a transportation network. Strategies include coordinated signal operations across jurisdictions, centralized control of traffic signals, adaptive or active signal control, and transit or freight signal priority. These advanced signal systems can reduce delay, travel time and the number of stops for transit, freight, and other vehicles. In addition, these systems may help reduce vehicle emissions and improve travel time reliability.

Roundabout

Roundabouts are circular intersections where entering vehicles yield to vehicles already in the circle. They are designed to slow vehicle speeds to 20 to 30 mph or less before they enter the intersection, which promotes a more comfortable environment for pedestrians, bicyclists, and other non-motorized users. Roundabouts have fewer conflict-points and have been shown to reduce the severity of crashes, as compared to signalized intersections. Roundabouts can be more costly to design and install when compared to other intersection control types, but they have a lower operating and maintenance cost than traffic signals. Topography must be carefully evaluated in considering a roundabout, given that slope characteristics at an intersection may render a roundabout infeasible.

Intersection Alternatives

OR 51/Polk Street

The eastbound approach to the intersection is forecast to operate at LOS F and above capacity (v/c>1.0). This is primarily due to high through traffic on OR 51-Main Street and increases in turning movements to/from Polk Street. The intersection is not forecast to meet preliminary signal warrants. Therefore, the following alternatives are being considered at the intersection:

- Install a left-turn lane (LTL) at the eastbound approach – the eastbound left would continue to operate at LOS F and above capacity (v/c>1.0).
- Reconfigure OR 51-Main Street to provide a center two-way left-turn (TWLT) lane at the northbound and southbound approaches – operations could be further enhanced by a left-turn lane on Polk Street.
- Install a single-lane roundabout – this alternative could require additional right-of-way.

Alternative	CM	V/C	Delay	LOS	Mobility Standard/Target	Meets Standard/Target
LTL	EBL	1.04	160.0	F	v/c ≤ 0.95	No
TWLT	EB	0.76	45.7	E	v/c ≤ 0.95	Yes
TWLT & LTL	EBL	0.54	36.6	E	v/c ≤ 0.95	Yes
Roundabout	SB	0.56	9.6	A	v/c ≤ 0.95	Yes

Main Street/Monmouth Street

All approaches to the intersection are forecast to operate at LOS F and above capacity (v/c>1.0). This is primarily due to increased traffic volumes throughout the City. The intersection is not forecast to meet preliminary signal warrants; however, a sensitivity analysis indicates that the intersection meets preliminary signal warrants with an additional two percent increase in traffic volumes on OR 51-Monouth Street. Therefore, the following alternatives are being considered at the intersection.

- Install a separate northbound left-turn lane (LTL) and a separate southbound right-turn lane (RTL) with 100ft of storage – operations could be further enhanced by a separate eastbound right-turn lane – each of these alternatives would require restricting on-street parking for up to two blocks.
- Install an actuated-uncoordinated traffic signal when warrants are met – operations could be further enhanced with an eastbound right, southbound right, or northbound left-turn lane with 100ft of storage – each of these alternatives would require restricting on-street parking for up to two blocks.
- Reconfigure OR 51-Monmouth Street as one-way eastbound from 4th Street OR 51-Main Street and reconfigure C Street to one-way westbound from 2nd Street to 4th Street – assumes five percent of traffic will use D Street to travel west.
- Reconfigure OR 51-Monmouth Street as one-way eastbound from 2nd Street OR 51-Main Street – assumes five percent of traffic will use D Street to travel west.
- Install southern corridor – this alternative is expected to improve operations relative to future no-build conditions but is not summarized below.

Alternative	CM	V/C	Delay	LOS	Mobility Standard/Target	Meets Standard/Target
NB LTL & SB RTL	EB	0.96	57.7	F	v/c ≤ 1.0	Yes
NB LTL, SB RTL, EB RTL	NBL	0.64	23.5	C	v/c ≤ 1.0	Yes
Traffic Signal	-	1.20	89.7	F	v/c ≤ 1.0	No
Traffic Signal & EBR	-	0.91	27.5	C	v/c ≤ 1.0	Yes
Traffic Signal & SBR	-	1.06	45.5	D	v/c ≤ 1.0	No
Traffic Signal & NBL	-	0.77	39.7	D	v/c ≤ 1.0	Yes
Couplet	NB	0.99	63.0	F	v/c ≤ 1.0	Yes
Square-about	NB	0.99	63.0	E	v/c ≤ 1.0	Yes

OR 51-Monmouth Street/4th Street

The northbound and southbound approaches to the intersection are forecast to operate at LOS F and above capacity (v/c>1.0). This is primarily due to high through traffic along OR 51-Monmouth Street and increases in traffic volumes to/from the south. The intersection is not forecast to meet preliminary signal warrants. Therefore, the following alternatives are being considered at the intersection.

- Install a TWLT lane on OR 51-Monmouth Street from the Ash Creek Bridge to 4th Street and taper to two lanes east of 4th Street – the northbound approach would continue to operate at LOS F and above capacity (v/c>1.0).
- Install a TWLT on OR 51-monmouth Street as indicated above and a separate left-turn lane at the northbound approach with 100 ft of storage – this alternative could require additional right-of-way – the northbound approach would continue to operate at LOS F and above capacity (v/c>1.0).

- Restrict the eastbound left, westbound right, northbound through, and southbound through movements for motorists. This could reduce the potential for cut-through traffic along 4th Street and improve circulation near Independence Elementary School – Bicyclists could still complete the restricted movements.
- Install southern corridor – this alternative is expected to improve operations relative to future no-build conditions but is not summarized below.

Alternative	CM	V/C	Delay	LOS	Mobility Standard/Target	Meets Standard/Target
TWLT	NB	1.28	264.5	F	v/c ≤ 1.0	No
TWLT & NB LTL	NB	1.05	248.3	F	v/c ≤ 1.0	No
Movement Restrictions	NB	0.93	161.9	F	v/c ≤ 1.0	Yes

OR 51-Monmouth Street/7th Street

The northbound approach to the intersection is forecast to operate at LOS F and above capacity (v/c>1.0). This is primarily due to high through traffic along OR 51-Monmouth Street and increases in traffic volumes to/from the south. The intersection is not forecast to meet preliminary signal warrants; however, a sensitivity analysis indicates that the intersection meets preliminary signal warrants with an additional two percent increase in traffic volumes on OR 51-Monouth Street. Therefore, the following alternatives are being considered at the intersection.

- Install a TWLT lane on OR 51-Monmouth Street from the Ash Creek Bridge to 4th Street and taper to two lanes east of 4th Street.
- Install a TWLT on OR 51-monmouth Street as indicated above and a separate northbound left-turn lane with 100 ft of storage – this alternative could require additional right-of-way.
- Install an actuated-uncoordinated traffic signal with separate eastbound and westbound left-turn lanes with 100 ft of storage when warrants are met.
- Install a single lane roundabout.
- Install southern corridor – this alternative is expected to improve operations relative to future no-build conditions but is not summarized below.

Alternative	CM	V/C	Delay	LOS	Mobility Standard/Target	Meets Standard/Target
TWLT	NB	0.80	57.1	F	v/c ≤ 0.95	Yes
TWLT & NB LTL	NBL	0.51	44.9	EF	v/c ≤ 0.95	Yes
Traffic Signal	NA	0.87	12.1	B	v/c ≤ 0.95	Yes
Roundabout	WB	0.76	15.4	C	v/c ≤ 0.95	Yes

Main Street/River Road

The westbound approach to the intersection is forecast to operate at LOS F and above capacity (v/c>1.0). This is primarily due to increased traffic volumes on the westbound and southbound approaches from vehicles entering and exiting the city. The intersection is not forecast to meet preliminary signal warrants. Therefore, the following alternatives are being considered at the intersection.

- Install a westbound left-turn lane (LTL) with 100 ft of storage – this alternative would require widening the bridge and is less viable with the southern corridor.

- Reconfigure the intersection with all-way stop-control (AWSC), install a westbound right-turn lane (RTL) with 100 ft of storage and a southbound left-turn lane (LTL) with 100 ft of storage – this alternative would require widening the bridge.
- Reconfigure the intersection with all-way stop-control (AWSC) as indicated above and allow the westbound right and southbound left/through/right to operate free – this alternative cannot be modeled in Synchro.
- Install a single-lane roundabout – this alternative could require additional right-of-way.

Alternative	CM	V/C	Delay	LOS	Mobility Standard/Target	Meets Standard/Target
WB LTL	WBL	0.66	65.4	F	v/c ≤ 0.80	Yes
RTL	WBL	0.72	72.4	F	v/c ≤ 0.80	Yes
AWSC, RTL, & LTL	WBR	0.79	30.4	D	v/c ≤ 0.80	Yes
Roundabout	WB	0.54	10.3	B	v/c ≤ 0.80	Yes

OR 51-Monmouth Street/Gun Club Road

The intersection is forecast to operate at LOS C and below capacity (v/c = 0.97); however, it is forecast to exceed its applicable mobility standard. This is primarily due to growth in through traffic along OR 51-Monmouth Street and traffic to/from Gun Club Road. The southbound left-turn queue is also forecast to exceed the striped storage available for the movement. Therefore, the following alternatives are being considered at the intersection:

- Optimize the signal timing/phasing to provide more green time to the southbound left-turn movement – this would impact other movements at the intersection, including those along OR 51-Monmouth Street.
- Extend the southbound left-turn storage – this would further impact the on-street bike lane on the west side of the road; however, the City could install a shared bike lane/right-turn lane to accommodate bicyclists.

ACCESS MANAGEMENT AND SPACING

The term "access management" is commonly used to describe the practice of managing the number, placement, and movements of intersections and driveways that provide access to adjacent land uses. Access management policies can be an important tool to improve transportation system efficiency by limiting the number of opportunities for turning movements on to or off of certain streets. In addition, well deployed access management strategies can help manage travel demand by improving travel conditions for pedestrian and bicycles. Eliminating the number of access points on roadways allows for continuous sidewalk and bicycle facilities and reduces the number of potential interruptions and conflict points between pedestrians, bicyclists, and cars. Access management is typically adopted as a policy in development guidelines. It can be extremely difficult to implement an access management program once properties have been developed along a corridor. Cooperation among and involvement of relevant government agencies, business owners, land developers and the public is necessary to establish an access management plan that benefits all roadway users and businesses.

Access Management Alternatives

The TSP should identify access management techniques and strategies that help to preserve transportation system investments and guard against deteriorations in safety and increased congestion. The City's approach to access management should balance the need for land use activities and property parcels to be served with appropriate access while preserving safe and efficient movement of traffic. Access management alternatives include:

- Update the city-wide access spacing standards to reflect conditions in the city;
- Defining a variance process for when the standard cannot be met, and;
- Establishing an approach for access consolidation over time to move in the direction of the standards at each opportunity.

Access Spacing Standards

As indicated in *Tech Memo 3B: Existing Conditions Analysis*, ODOT and the City have adopted access spacing standards for study area roadways. ODOT's access spacing standards are defined in Oregon Administrative Rule (OAR) 734 Division 51 and apply to access points along OR 51-Main Street and OR 51-Monmouth Street. The City's access spacing standards are defined in the current TSP. Table 1 summarizes the City's access spacing standards.

Table 1: City Access Spacing Standards

Functional Classification	Minimum Posted Speed	Minimum Spacing Between Driveways	Spacing Between Intersections
Major Arterial	35 – 50 MPH	250 feet	1,320 feet
Minor Arterial	35 – 50 MPH	250 feet	250 feet
Major Collector	25 – 40 MPH	100-150 feet	250 feet
Collector	25 – 40 MPH	100-150 feet	250 feet

As shown in Table 1, the City's access spacing standards are currently determined by functional classification and posted speed and apply to driveways and intersections. The standards could be updated to remove the major collector designation under functional classification and the minimum posted speed criteria – there are no major collectors in the city and many of the posted speeds are outside of the ranges shown). The standards could also be refined to reflect conditions in the City – most intersections are currently spaced at about 350-feet. Table 2 summarizes potential modifications to the City's access spacing standards.

Table 2: City Access Spacing Standards

Functional Classification	Minimum Intersection Spacing	Minimum Driveway Spacing
Major Arterial	350	175
Minor Arterial	350	175
Collector	350	100
Local Street	350	50

Access Spacing Variances

Access spacing variances may be provided to parcels whose highway/street frontage, topography, or location would otherwise preclude issuance of a conforming permit and would either have no reasonable access or cannot obtain reasonable alternate access to the public road system. In such a situation, a conditional access permit may be issued by ODOT or the City, as appropriate, for a connection to a property that cannot be accessed in a manner that is consistent with the spacing standards. The permit can carry a condition that the access may be closed at such time that reasonable access becomes available to a local public street. The approval condition might also require a given land owner to work in cooperation with adjacent land owners to provide either joint access points, front and rear cross-over easements, or a rear access upon future redevelopment.

The requirements for obtaining a deviation from ODOT's minimum spacing standards are documented in OAR 734-051-3050. For streets under the City's jurisdiction, the City may reduce the access spacing standards at the discretion of the City Engineer if the following conditions exist:

- Joint access driveways and cross access easements are provided consistent with the standards;
- The site plan incorporates a unified access and circulation system consistent with the standards;
- The property owner enters into an agreement with the City that pre-existing connections on the site will be closed and eliminated after construction of each side of the joint use driveway; and/or,
- The proposed access plan for redevelopment properties moves in the direction of the standards.

The City Engineer may modify or waive the access spacing standards for streets under the City's jurisdiction where the physical site characteristics or layout of abutting properties would make development of a unified or shared access and circulation system impractical, subject to the following considerations:

- Unless modified, application of the access standard will result in the degradation of operational and safety integrity of the transportation system.
- The granting of the variance shall meet the purpose and intent of these standards and shall not be considered until every feasible option for meeting access standards is explored.
- Applicants for variance from these standards must provide proof of unique or special conditions that make strict application of the standards impractical. Applicants shall include proof that:
  - Indirect or restricted access cannot be obtained;
  - No engineering or construction solutions can be applied to mitigate the condition; and,
  - No alternative access is available from a road with a lower functional classification than the primary roadway.

No variance shall be granted where such hardship is self-created. Consistency between access spacing requirements and exceptions in the TSP and the municipal code is an important regulatory solution to be addressed as part of this TSP update.

Access Consolidation

From an operational perspective, access management measures limit the number of redundant access points along roadways. This enhances roadway capacity, improves safety, and benefits circulation. Enforcement of the access spacing standards should be complemented with provision of alternative access points. Purchasing right-of-way and closing driveways without a parallel road system and/or other local access could seriously affect the viability of the impacted properties. Thus, if an access management approach is taken, alternative access should be developed to avoid "land-locking" a given property.

As part of every land use action, the City should evaluate the potential need for conditioning a given development proposal with the following items in order to maintain and/or improve traffic operations and safety along the arterial and collector roadways.

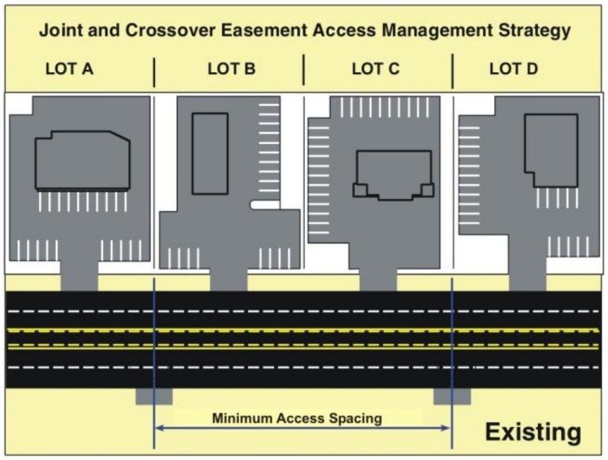
- Providing access only to the lower classification roadway when multiple roadways abut the site.
- Provision of crossover easements on all compatible parcels (considering topography, access, and land use) to facilitate future access between adjoining parcels.
- Issuance of conditional access permits to developments having proposed access points that do not meet the designated access spacing policy and/or can align with opposing driveways.
- Right-of-way dedications to facilitate the future planned roadway system in the vicinity of proposed developments.
- Half-street improvements (sidewalks, curb and gutter, bike lanes/paths, and/or travel lanes) along site frontages that do not have full build-out improvements in place at the time of development.

Exhibit 3 illustrates the application of cross-over easements and conditional access permits over time to achieve access management objectives. The individual steps are described in Table 3. As illustrated in the exhibit and supporting table, by using these guidelines, all driveways along the highways/streets can eventually move in the overall direction of the access spacing standards as development and redevelopment occur.

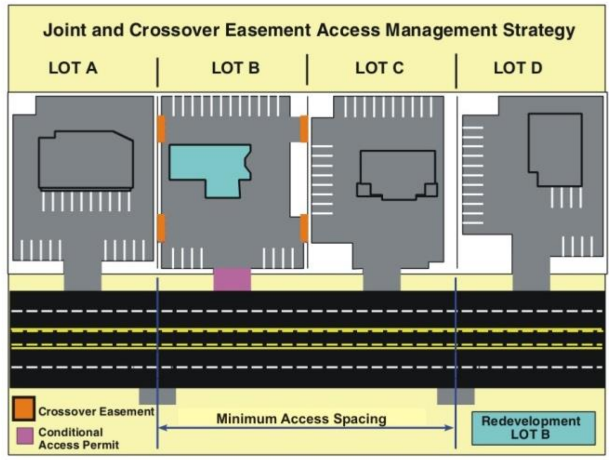
Table 3: Example of Crossover Easement/Indenture/Consolidation

Step	Process
1	EXISTING – Currently Lots A, B, C, and D have site-access driveways that neither meet the access spacing criteria of 500 feet nor align with driveways or access points on the opposite side of the highway. Under these conditions motorists are into situations of potential conflict (conflicting left turns) with opposing traffic. Additionally, the number of side-street (or site-access driveway) intersections decreases the operation and safety of the highway
2	REDEVELOPMENT OF LOT B – At the time that Lot B redevelops, the City would review the proposed site plan and make recommendations to ensure that the site could promote future crossover or consolidated access. Next, the City would issue conditional permits for the development to provide crossover easements with Lots A and C, and ODOT/City would grant a conditional access permit to the lot. After evaluating the land use action, ODOT/City would determine that LOT B does not have either alternative access, nor can an access point be aligned with an opposing access point, nor can the available lot frontage provide an access point that meets the access spacing criteria set forth for segment of highway.
3	REDEVELOPMENT OF LOT A – At the time Lot A redevelops, the City/ODOT would undertake the same review process as with the redevelopment of LOT B (see Step 2); however, under this scenario ODOT and the City would use the previously obtained cross-over easement at Lot B consolidate the access points of Lots A and B. ODOT/City would then relocate the conditional access of Lot B to align with the opposing access point and provide and efficient access to both Lots A and B. The consolidation of site-access driveways for Lots A and B will not only reduce the number of driveways accessing the highway, but will also eliminate the conflicting left-turn movements the highway by the alignment with the opposing access point.
4	REDEVELOPMENT OF LOT D – The redevelopment of Lot D will be handled in same manner as the redevelopment of Lot B (see Step 2)
5	REDEVELOPMENT OF LOT C – The redevelopment of Lot C will be reviewed once again to ensure that the site will accommodate crossover and/or consolidated access. Using the crossover agreements with Lots B and D, Lot C would share a consolidated access point with Lot D and will also have alternative frontage access the shared site-access driveway of Lots A and B. By using the crossover agreement and conditional access permit process, the City and ODOT will be able to eliminate another access point and provide the alignment with the opposing access points.
6	COMPLETE – After Lots A, B, C, and D redevelop over time, the number of access points will be reduced and aligned, and the remaining access points will meet the access spacing standard.

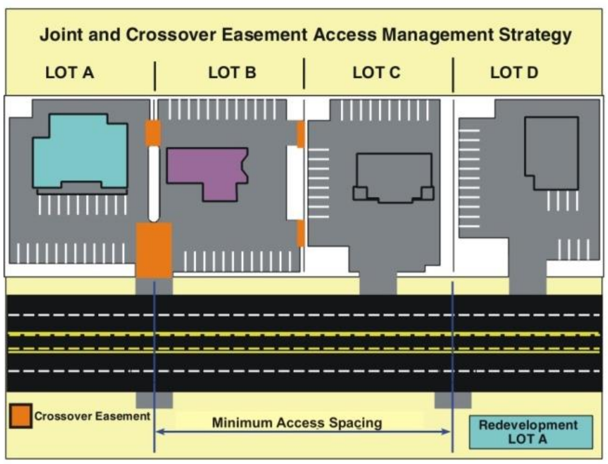
Exhibit 3: Cross Over Easement



Step 1



Step 2



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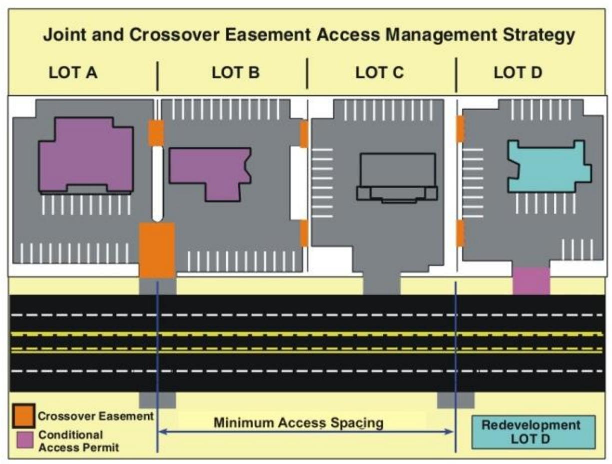

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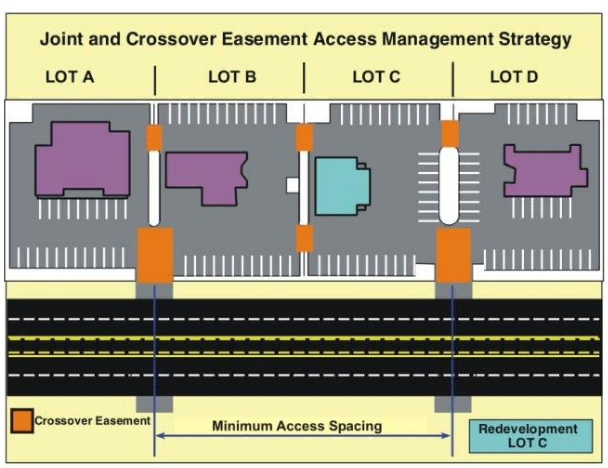
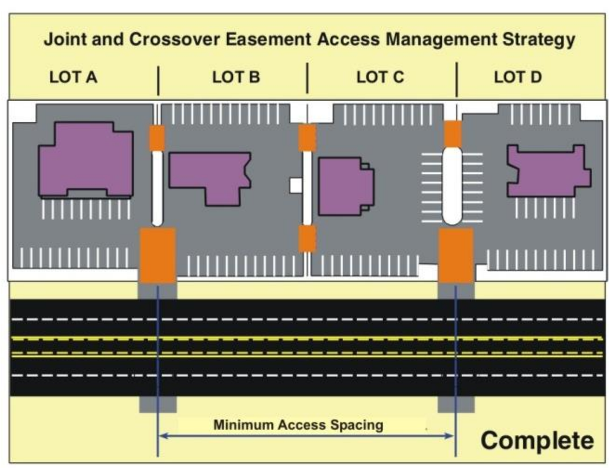


Step 5



Step 6

PEDESTRIAN CONNECTIVITY

This section provides an overview of pedestrian facilities that could be implemented within Independence to improve access and circulation for pedestrians. This section also identifies the pedestrian alternatives developed to address gaps and deficiencies in pedestrian connectivity along arterial and collector streets.

Pedestrian Facilities

Pedestrian facilities are the elements of the transportation system that enable people to walk and roll safely and efficiently between residential neighborhoods and schools, parks, retail/commercial centers, employment areas, and transit stops. These include facilities for pedestrian movement along roadways (e.g., sidewalks, shared-use paths, and trails) and for safe roadway crossings (e.g., crosswalks, flashing beacons, pedestrian refuge islands). Each facility plays an important role in developing a comprehensive pedestrian system.

Sidewalks

Sidewalks are the primary building block of the pedestrian system. They provide an important means of mobility for walkers as well as people with disabilities, families with strollers, and others who may not be able to travel on an unimproved surface. Sidewalks are usually 6-feet wide and constructed from concrete. They are also frequently separated from the roadway by planting strips, on-street parking, and/or on-street bike lanes or other bike facilities (see below). Sidewalks are widely used in urban and suburban areas. Ideally, sidewalks could be provided on both sides of the roadway; however, some areas with physical or right-of-way constraints may require that a sidewalk be located on only one side.

The City’s street design standards currently require 6-foot sidewalks on both sides of all arterial, collector, and local streets. The standards also require 6-foot planting strips on arterials, 5-foot planting strips on collectors, and encourages 4-foot planting strips on local streets. ODOT’s Highway Design Manual (HDM) also requires 6-foot sidewalks on both sides of all streets and 10-foot sidewalks in special transportation areas (STA), such as downtown Independence. The recently adopted Blueprint for Urban Design (BUD) provides additional guidance on how to determine the most appropriate sidewalk width and configuration that reflects the context of the area and the physical and operational characteristics of the roadway. When applied, these standards can provide comfortable pedestrian facilities for most pedestrians along City and ODOT roadways.

Crosswalks

Crosswalks enable people to safely cross streets, railroad tracks, and other transportation facilities. Planning for appropriate crosswalks requires the community to balance vehicular mobility needs with providing crossing locations along the desired routes of pedestrians. Enhanced crosswalk treatments include geometric features such as curb extensions and raised median islands with pedestrian refuges as well as signing and striping, flashing beacons, signals, countdown heads, and leading pedestrian intervals. Many of these treatments can be applied simultaneously to further alert drivers of the presence of pedestrians in the roadway. *Attachment B contains a description of several enhanced crosswalk treatments.*

ODOT provides guidance on the types of enhanced crosswalk treatments that can be applied along ODOT facilities. Additional guidance is available from the Federal Highway Administration (FHWA) and the National Cooperative Highway Research Program (NCHRP). The guidance generally considers the physical and operational characteristics of roadways at the crosswalk location, including number of lanes, traffic volumes, travel speeds, and (in some cases) pedestrian activity. With this information, the City or ODOT can determine the most appropriate treatment for a given crossing; however, this is not typically done as part of a TSP.

Shared-use Paths and Trails

Shared-use paths and trails are improved (i.e. paved) and unimproved (i.e. dirt and gravel) facilities that serve pedestrians and bicyclists. Shared-use paths and trails can be constructed adjacent to roadways where topography, right-of-way, or other issues preclude construction of sidewalks and bike facilities. A minimum width of 10 feet is recommended in areas with low levels of pedestrian/bicycle traffic (8-feet in constrained areas); 12 feet should be considered in areas with moderate to high levels of pedestrian/bicycle traffic. Shared-use paths and trails can be used to create long distance links within and between communities and provide regional connections. They play an integral role in recreation, commuting, and accessibility due to their appeal to users of all ages and skill levels.

Pedestrian Amenities

In addition to pedestrian facilities focused on throughput and movements, there are pedestrian amenities that can be provided to enhance the user experience. Street furniture, such as benches and garbage cans, can be provided in the public right-of-way in support of pedestrian and bike trips. In addition, amenities including street patios or parklets utilize space between the curbs that might have been previously used for another purpose such as parking.

Pedestrian Alternatives

The pedestrian alternatives summarized below are intended to enhance the existing pedestrian system as well as address gaps and deficiencies in pedestrian connectivity. Figure 3 illustrates the pedestrian gaps and deficiencies addressed by the alternatives described below.

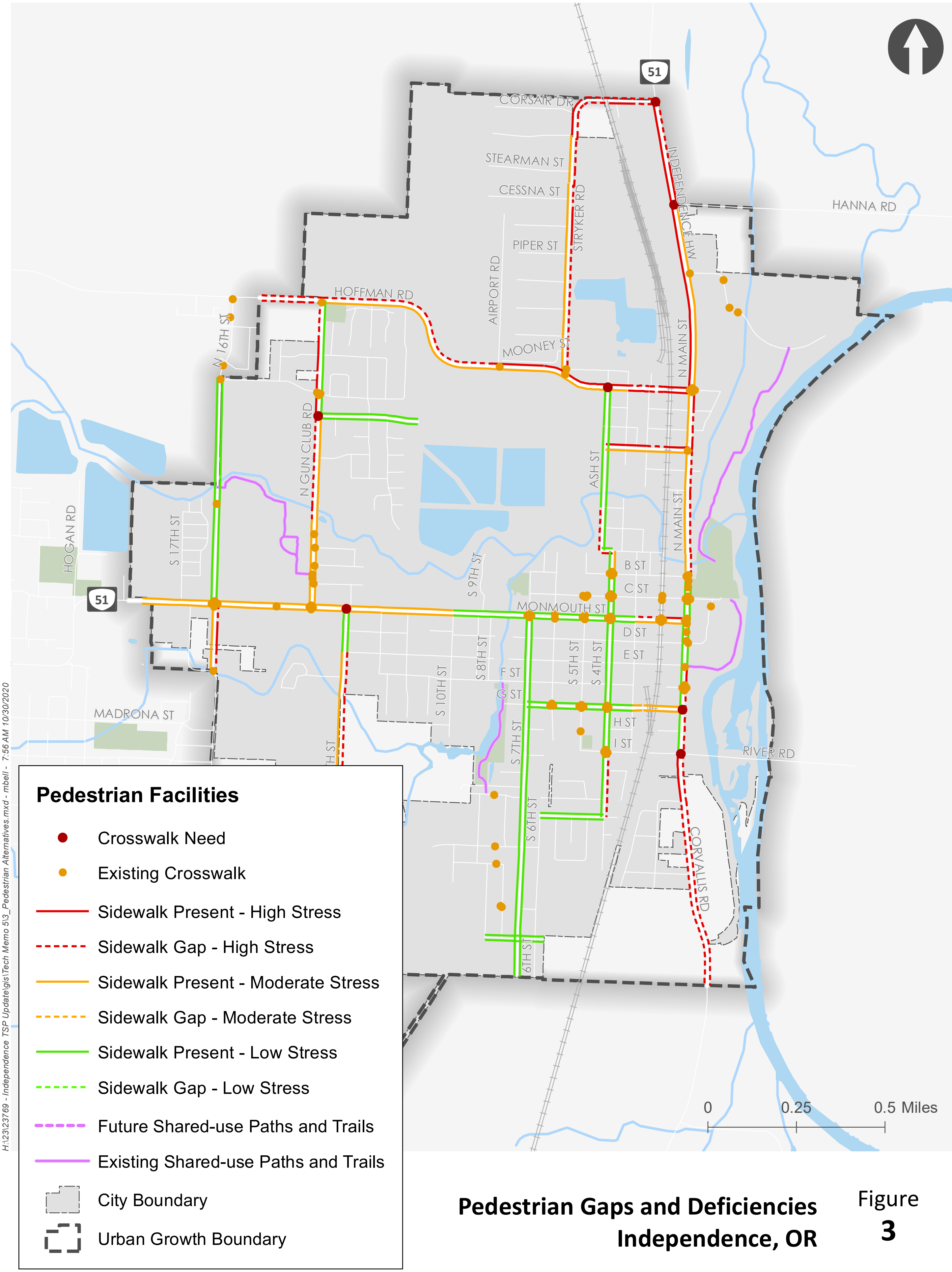
OR 51-Main Street

There are continuous sidewalks on the west side of OR 51-Main Street from Stryker Road to OR 51-Monmouth Street and gaps on the east side from Stryker Road to Hanna Road and from Polk Street to B Street. There are also several crosswalks at major intersections. The pedestrian level of traffic stress (PLTS) analysis indicates that the sidewalks north of B Street and the areas with sidewalk gaps may NOT be suitable for most pedestrians. This is primarily due to sidewalk gaps, lack of a buffer, limited street lighting, and relatively high travel speeds in some areas. Therefore, the alternatives include:

- Fill in the gaps on the east side of the roadway with new sidewalks
- Reconstruct the sidewalks following ODOT guidelines for low stress facilities
- Provide enhanced pedestrian crossing treatments at major crossing locations
- Consider opportunities for street patios, street furniture, and other amenities in the downtown area

OR 51-Monmouth Street

There are continuous sidewalks on both sides of OR 51-Monmouth Street from the west city limits to OR 51-Main Street, except for a gap on the north side from 3rd Street to 2nd Street. There are also several crosswalks at major intersections. The PLTS analysis indicates that the sidewalks from the west city limits to 10th Street and from 3rd Street to OR 51-Main Street, which includes the gap, may NOT be suitable for most pedestrians. This is primarily due to the lack of a buffer and relatively high travel speeds in some areas. Therefore, the alternatives include:



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Pedestrian Gaps and Deficiencies
Independence, OR

Figure
3

Data Source: Polk County Data Portal, ODOT

- Fill in the gap on the north side of the roadway with new sidewalks
- Reconstruct the sidewalks following ODOT guidelines for low stress facilities
  - Install 6-foot buffered sidewalks from the west city limits to 4th Street
  - Install 8-foot buffered sidewalks or 10-foot curb tight sidewalks from 4th Street to OR 51-Main Street
- Provide enhanced pedestrian crossing treatments at major crossing locations
- Consider opportunities for street patios, street furniture, and other amenities in the downtown area

Corvallis Road

There are continuous sidewalks on the west side of the roadway from OR 51-Monmouth Street to the south city limits and gaps on the east side from E Street to River Road and the south city limits. There are also several crosswalks at major intersections. The PLTS analysis indicates that the areas without sidewalks may NOT be suitable for most pedestrians. Therefore, the alternatives include:

- Fill in the gap on the east side of the roadway with new sidewalks
- Provide enhanced pedestrian crossing treatments at major crossing locations

Hoffman Road/Polk Street

There are continuous sidewalks on the south side of the roadway from the west city limits to OR 51-Main Street, except for a small gap from Log Cabin Street to Marsh Street, and there are several gaps on the north side of the roadway. There are also several crosswalks at major intersections. The PLTS analysis indicates that the existing sidewalks and the areas with sidewalk gaps may NOT be suitable for most pedestrians. Therefore, the alternatives include:

- Fill in the gaps on the north and south side of the roadway with new sidewalks
- Reconstruct the sidewalks consistent per City standards as part of future development/ redevelopment projects
- Provide enhanced pedestrian crossing treatments at major crossing locations, such as the north leg of the Stryker Road/Hoffman Road intersection

Gun Club Road

There are continuous sidewalks on the east side of the roadway from Hoffman Road to OR 51-Monmouth Street and gaps on the west side of the roadway from Picture Street to the high school property. There are also several crosswalks at major intersections, particularly adjacent to the high school. The PLTS analysis indicates that existing sidewalks and the areas with sidewalk gaps may NOT be suitable for most pedestrians. Therefore, the alternatives include:

- Fill in the gaps on west side of the roadway with new sidewalks
- Reconstruct the sidewalks consistent with City standards as part of future development/ redevelopment projects
- Provide enhanced pedestrian crossing treatments at major crossing locations

Stryker Road

There are gaps on both sides of the road from Hoffman Road to OR 51-Main Street. The PLTS analysis indicates that existing sidewalks and the areas with sidewalk gaps may NOT be suitable for most pedestrians. Therefore, the alternatives include:

- Fill in the gaps on both sides of the roadway with new sidewalks
- Reconstruct the sidewalks consistent with City standards as part of future development/ redevelopment projects
- Provide enhanced pedestrian crossing treatments across the rail line

Ash Street/4th Street

There are continuous sidewalks on both sides of the roadway from Polk Street to OR 51-Monmouth Street, except for a gap from Albert Street to A Street. There are also several crosswalks at major intersections. The PLTS analysis indicates that areas with sidewalk gaps may NOT be suitable for most pedestrians. Therefore, the alternatives include:

- Fill in the gaps on west side of the roadway with new sidewalks

16th Street

There are continuous sidewalks on the west side of the roadway from OR 51-Monmouth Street to the south city limits and gaps on the east side. The PLTS analysis indicates that the existing sidewalks and the areas with sidewalk gaps may NOT be suitable for most pedestrians. Therefore, the alternatives include:

- Fill in the gaps on the east side of the roadway with new sidewalks
- Reconstruct the sidewalks consistent with City standards as part of future development/ redevelopment projects

13th Street

There are continuous sidewalks on the west side of the roadway from OR 51-Monmouth Street to the south city limits and gaps on the east side of the roadway. The PLTS analysis indicates that the existing sidewalks and the areas with sidewalk gaps may NOT be suitable for most pedestrians. Therefore, the alternatives include:

- Fill in the gaps on the east side of the roadway with new sidewalks
- Reconstruct the sidewalks consistent with City standards as part of future development/ redevelopment projects

4th Street

There are continuous sidewalks on both sides of the roadway from OR 51-Monmouth Street to I Street and on the west side I street to the south terminus. There are also several crosswalks at major intersections. The PLTS analysis indicates that the areas with sidewalk gaps may NOT be suitable for most pedestrians. Therefore, the alternatives include:

- Fill in the gaps on the east side of the roadway with new sidewalks

Williams Street

There are continuous sidewalks on both sides of the roadway from Ash Street to OR 51-Main Street, except for a gap on the north side from Log Cabin Street to Marsh Street. The PLTS analysis indicates that the existing sidewalks and the areas with sidewalk gaps may NOT be suitable for most pedestrians. Therefore, the alternatives include:

- Fill in the gaps on the north side of the roadway with new sidewalks
- Reconstruct the sidewalks consistent with City standards as part of future development/ redevelopment projects

G Street

There are continuous sidewalks on both sides of the roadway from 7th Street to Corvallis Road. There are also several crosswalks at major intersections. The PLTS analysis indicates that some of the existing sidewalks may NOT be suitable for most pedestrians. Therefore, the alternatives include:

- Reconstruct the sidewalks consistent with City standards as part of future development/ redevelopment projects.

Shared-use Paths/Trails

The Independence Parks and Open Space Master Plan identifies the following shared-use path/trail connections. These connections were determined based on a comprehensive review of potential connections within the City.

- North South Connector Trail #1 – south of Hoffman Road to Wildfang Park.
- North South Connector Trail #2 – north from OR 51-Monmouth Street to Wildfang Park
- Ash Creek Trail Phase I – east/west trail connection from Riverview Park to Wildfang Park
- Mt. Fir North-South Trail – north/south trail from F Street to Mt. Fir Park and south across Becken Road – this connection may include some on-street segments
- Mt. Fir Connector Trail – east/west connection from Mt. Fir Street to Corvallis Road
- River Trail – north/south trail along Willamette Riverfront
- Going to the River Trail – east/west connection from Williams Street to Howard Court – this connection may include some on-street segments
- Central High School (HS) Connector Trail – north/south connection from Central High School to neighborhoods south of OR 51-Monmouth Street

The following shared-use path/trail connections were idented in the SW Independence Concept Plan:

- South Fork Trail – two north/south connections on the east/west sides of the South Fork Ash Creek
- Drainage Trail – an east/west connection from 13th Street to the South Fork Trails

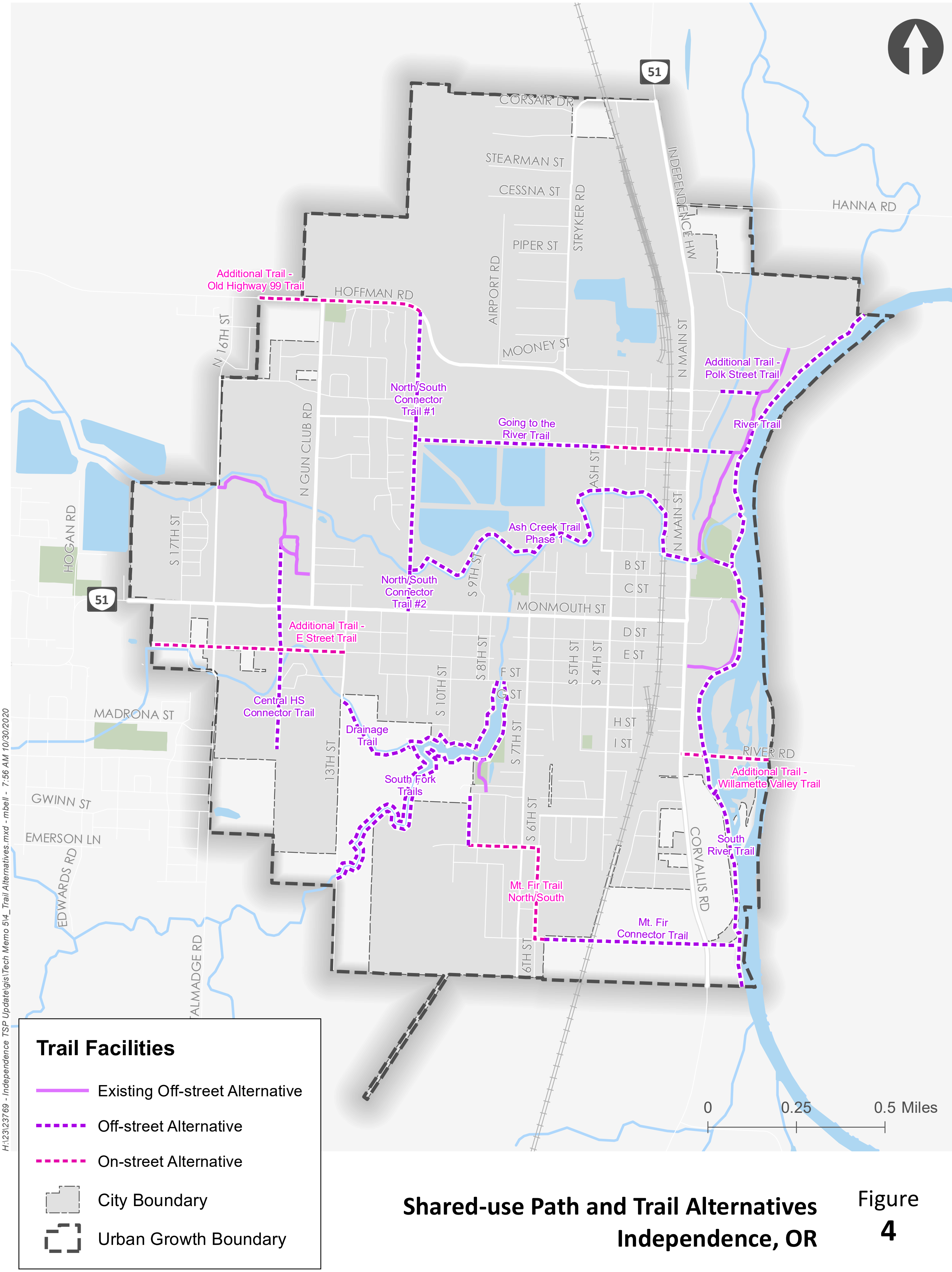
The following shared-use path/trail connections were identified throughout the planning process:

- Old Highway 99 Trail – an east/west connection to the existing shared-use path along OR 99 – this connection may include some on-street segments.
- Willamette Valley Trail – an east/west connection to the Willamette Valley Scenic Bikeway – this connection may include some on-street segments.
- Polk Street Trail – an east/west connection from the eastern terminus of Polk Street to the River Trail
- E Street Trail – an east/west connection from 13th Street at E Street to OR 51-Monmouth Street – this connection may include some on-street segments.

Figure 4 illustrates the location of the share-use path/trail connections.

BICYCLE CONNECTIVITY

This section provides an overview of bicycle facilities that could be implemented within Independence to improve access and circulation for bicyclists. This section also identifies the bicycle alternatives developed to address gaps and deficiencies in bicycle connectivity along arterial and collector streets.



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Shared-use Path and Trail Alternatives
Independence, OR

Figure
4

Data Source: Polk County Data Portal, ODOT

Bicycle Facilities

Bicycle facilities are the elements of the transportation system that enable people to travel safely and efficiently between residential neighborhoods and destinations in the city and the surrounding area by bike. These include facilities for bicycle movement along key roadways (e.g. shared lane pavement markings, on-street bike lanes, buffered bike lanes, and separated bike lanes) and facilities at key crossing locations (e.g., enhanced bike crossings). These also include end of trip facilities (e.g. bike parking, bike hubs, tune-up stations, changing rooms, and showers at worksites); however, most of these facilities are addressed through the development code. Each facility plays an important role in developing a comprehensive bicycle system.

Low-Traffic Bikeway

Low-traffic bikeways, also known as "bicycle boulevards," are streets with low vehicular volumes and speeds that can be optimized for bicycle travel by including treatments for traffic calming and traffic reduction, signage and pavement markings, and intersection crossing treatments. Bike boulevards are ideal on local streets that parallel larger, high traffic routes and provide connections to similar destinations.

Shared Lane Pavement Markings

Shared lane pavement markings (often called "sharrows") are used to indicate a shared space for cyclists and motorists and are typically centered in the roadway, or approximately four feet from the edge of the travel lane, and spaced approximately 50 to 250-feet apart depending on the traffic volumes and travel speeds. Sharrows are suitable on roadways with relatively low traffic volumes (<2,500 Average Daily Traffic [ADT]) and low travel speeds (<25 MPH); however, they may also be used to transition between discontinuous bicycle facilities along roadways with higher volumes and speeds.

On-Street Bike Lanes

On-street bike lanes provide a dedicated space for the exclusive use of cyclists on the roadway surface. They are usually 5 to 6-feet wide and include an 8-inch stripe along the roadway and bike symbols at intersections; they may also include a buffer as indicated below. On-street bike lanes are typically placed at the outer edge of the roadway surface but to the inside of right-turn lanes and/or on-street parking. On-street bike lanes can improve safety and security of cyclists and (if comprehensive) can provide direct connections between origins and destinations.

The City's street design standards currently require 6-foot bike lanes on both sides of arterial streets and define a two-phase process for implementing 6-foot bike lanes on collector streets:

- Collectors with < 2,000 ADT can accommodate on-street parking and shared use of road space by bicyclists and motor vehicles.
- For collectors with > 2,000 ADT, the City will study the need to eliminate on-street parking and provide bike lanes.

ODOT's HDM also requires 6-foot bike lanes on both sides of all state highways in urban areas; however, it provides exceptions in designated STAs, such as downtown Independence. The recently adopted BUD provides additional guidance on how to determine the most appropriate bicycle facility and configuration that reflects the context of the area and the physical and operational characteristics of the roadway. When applied, these standards can provide a comfortable environment for most bicyclists along City and ODOT roadways.

Buffered Bike Lanes

Buffered bike lanes are enhanced versions of conventional on-street bike lanes that include an additional striped buffer of typically 2-3 feet between the bike lane and the vehicle travel lane and/or between the bike lane and the vehicle parking lane. They are typically located along streets that require a higher level of separation to improve the comfort of bicycling.

Separated Bike Lanes

Separated bike lanes (often called "cycle tracks") are bike lanes that are physically separated from motor vehicle traffic by a vertical element such as a planter, flexible post, parked car, or a mountable curb. One-way separated bike lanes are typically found on each side of the street, like conventional bike lanes, while two-way separated bike lanes are typically found on one side of the street.

Bicycle Crossings

Bicycle crossings enable cyclists to travel safely through intersections and across streets, railroad tracks, and other transportation facilities. Planning for appropriate bicycle crossings requires the community to balance vehicular mobility needs with providing crossing locations along the desired routes of cyclists. Enhanced bicycle crossing treatments include pavement markings through conflict areas, bike boxes, two-stage left-turn bike boxes, bike only signals, and bicycle detection

Wayfinding Signs

Wayfinding signs are physical signs or travel lane markings located along roadways or at intersections that direct cyclists between destinations along low-stress and comfortable bicycle routes. Wayfinding signs help inexperienced and/or less confident cyclists overcome perceived barriers by identifying lower speed and lower volume routes that do not require a bicycle facility. They typically include distances and average walk/cycle times. Wayfinding signs are generally used along bicycle routes and shared-use paths.

Bicycle Parking

Bicycle parking is a vital component of a city's bicycle system and can be provided in a variety of sizes, shapes, and unique pieces of infrastructure that resemble the city's character. Bicycle parking can generally be categorized into two types: short-term and long-term.

- **Short-term bicycle parking** is designed to meet the needs of cyclists visiting businesses, institutions, and other destinations where visits typically last up to two hours. Short-term bicycle parking must be readily accessible, visible, and self-explanatory.
- **Long-term bicycle parking** places an emphasis on security and weather protection and is designed to meet the needs of cyclists who may leave their bicycle unattended for several hours or more. Long-term bicycle parking is typically located at residences or apartment buildings, workplaces, transit centers, and other routinely visited destinations.

Bike Corral

This treatment coverts vehicle parallel parking stalls into bicycle parking. These facilities can be installed on segments or near intersections. If installed near an intersection, it can be an effective alternative to vehicle parking which can cause sight distance hazards. Bike corrals are often designed to hold approximately 12-24 bikes and have been shown to have a positive impact on business.

Bike Sharing

Bicycle sharing has been growing rapidly in recent years along with the overall trend of micro mobility. Bike sharing in particular can be a key component in the public transit system while utilizing the bicycle infrastructure of the city. The strategic location of stations can highlight key destinations around the city and be an important asset to tourists and visitors seeking to experience the city without using a vehicle.

Bicycle Alternatives

The bicycle alternatives were developed to enhance the existing bicycle system as well as address gaps and deficiencies in bicycle connectivity. Figure 5 illustrates the bicycle gaps and deficiencies addressed by the alternatives described below.

OR 51-Main Street

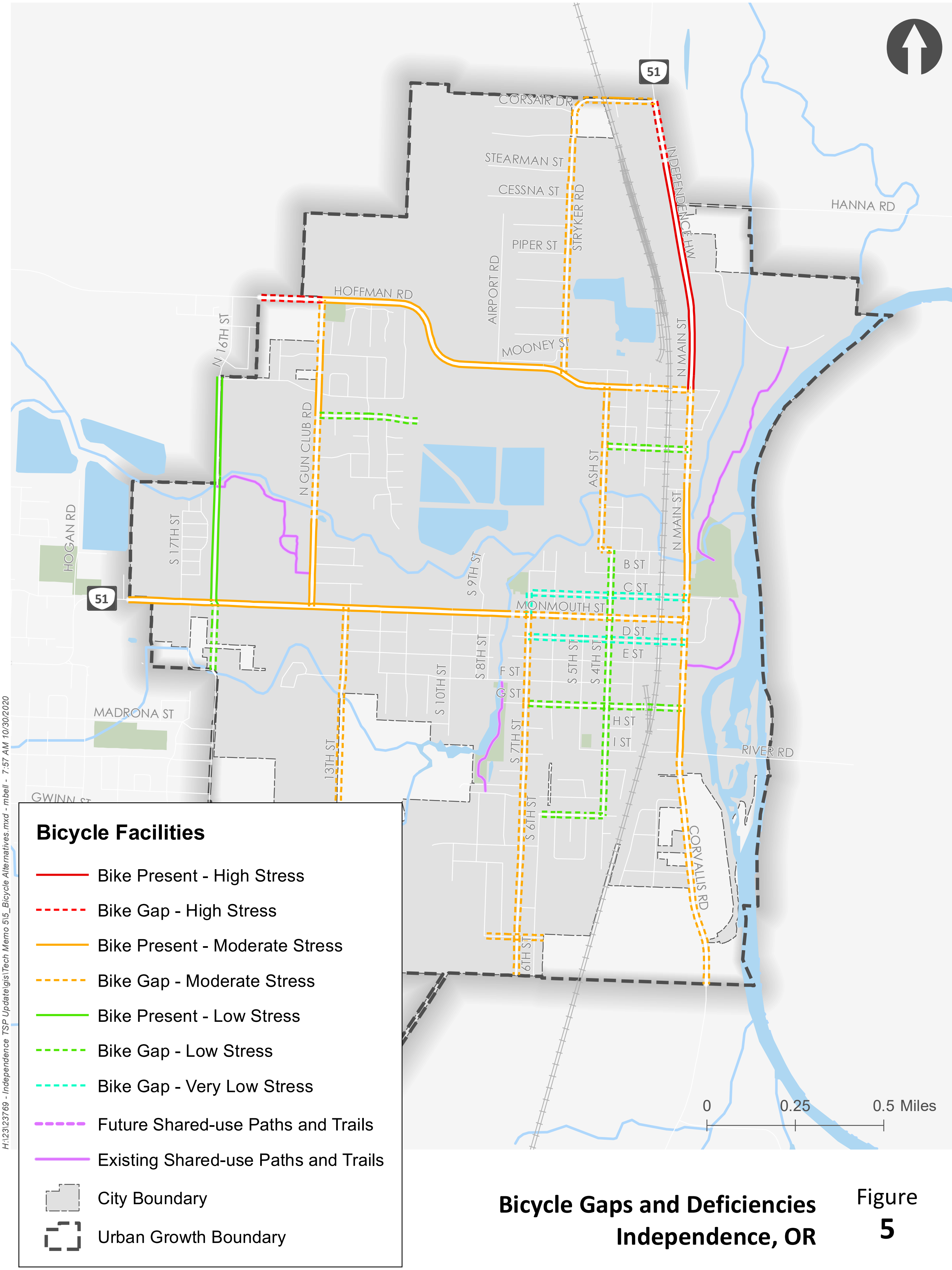
There are bike lanes on both sides of the OR 51-Main Street from Stryker Road to Polk Street and shoulder bikeways on both sides from Oak Street to B Street. The bicycle level of traffic stress (BLTS) analysis indicates that the segments with bike lanes, shoulder bikeways, and gaps located north of B Street may NOT be suitable for most bicyclists. This is primarily due to limited to no bicycle facilities and relatively high travel speeds in some areas. Therefore, the alternatives include:

- Install 6-foot bike lanes on both sides of the roadway from Stryker Road to B Street consistent with ODOT standards
- Install 7-foot buffered bike lanes on both sides of the roadway from Stryker Road to B Street (5-foot bike lane, 2-foot buffer) consistent with the BUD
- Install 6-foot separated bike lanes (cycle tracks) on both sides of the roadway from Stryker Road to B Street
- Install shared lane pavement markings (Sharrows) on both sides of the roadway from B Street to OR 51-Monmouth Street
- Install a bike corral on OR 51-Main Street near the OR 51-Main Street/OR 51-Monmouth Street Intersection

OR 51-Monmouth Street

There are bike lanes on both sides of the OR 51-Monmouth Street from the west City limits to the Ash Creek bridge and no bike lanes from the Ash Creek Bridge to OR 51-Main Street. The BLTS analysis indicates that the segments with and without bike lanes are suitable for most bicyclists. This is primarily due to relatively low travel speeds in areas with bike lanes and low travel speeds in areas without bike lanes. Despite the analysis results, anecdotal information indicates that the existing facilities are not comfortable for most bicyclists. Therefore, the alternatives include:

- Install 6-foot bike lanes on both sides of the roadway from the west city limits to 4th Street consistent with ODOT standards
- Install 7-foot buffered bike lanes on both sides of the roadway from the west city limits to 4th Street (5-foot bike lane, 2-foot buffer)
- Install 6-foot separated bike lanes (cycle tracks) on both sides of the roadway from the west city limits to 4th Street
- Install shared lane pavement markings (sharrows) on both sides of the roadway from 4th Street to OR 51-Main Street
- Install a bike corral on OR 51-Monmouth Street near the OR 51-Main Street/OR 51-Monmouth Street Intersection



Bicycle Gaps and Deficiencies
Independence, OR

Figure
5

Data Source: Polk County Data Portal, ODOT

Corvallis Road

There are shoulder bikeways on the east side of the road from E Street to G Street and on both sides of the roadway from G Street to River Road. The BLTS analysis indicates that the segments with and without shoulder bikeways located south of E Street are NOT suitable for most bicyclists. Therefore, the alternatives include:

- Install 6-foot bike lanes on both sides of the roadway from D Street to the south city limits consistent with City standards
- Install 7-foot buffered bike lanes on both sides of the roadway from D Street to the south city limits (5-foot bike lane, 2-foot buffer)
- Install 6-foot separated bike lanes (cycle tracks) on both sides of the roadway from D Street to the south city limits
- Install shared lane pavement markings (Sharrows) on both sides of the roadway from OR 51-Main Street to D Street
- Install a bike corral on OR 51-Main Street near the OR 51-Main Street/OR 51-Monmouth Street Intersection

Hoffman Road/Polk Street

There are bike lanes on both sides of the road from Gun Club Road to Ash Street and on the south side of the road from Ash Street to Walnut Street. The BLTS analysis indicates that the segments with and without bike lanes west of Stryker Road are NOT suitable for most bicyclists. This is primarily due to the relatively narrow lane width and posted travel speeds. Therefore, the alternatives include:

- Install 6-foot bike lanes on both sides of the roadway from the west city limits to OR 51-Main Street
- Install 7-foot buffered bike lanes on both sides of the roadway from the west city limits to OR 51-Main Street (5-foot bike lane, 2-foot buffer)
- Install 6-foot separated bike lanes (cycle tracks) on both sides of the road from the west city limits OR 51-Main Street

Gun Club Road

There are bike lanes on both sides of the road from OR 51-Monmouth Street to north of the high school property and gaps on both sides to Hoffman Road. The BLTS analysis indicates that the segments with and without bike lanes north of the high school property may NOT be suitable for most bicyclists. Therefore, the alternatives include:

- Fill in the gaps with 6-foot bike lanes on both sides of the roadway from north of the high school property to Hoffman Road

Stryker Road

There are shoulder bikeways on the east side of the road from Piper Street to Stearman Street and on the south side of the road east of the rail line. The BLTS analysis indicates that the segments with and without shoulder bikeways may NOT be suitable for most bicyclists. Therefore, the alternatives include:

- Install 6-foot bike lanes on both sides of the road from Polk Street to OR 51-Main Street

Ash Street/4th Street

There are no bike facilities on either side of the roads from Polk Street to OR 51-Monmouth Street. The BLTS analysis indicates that the roads may NOT be suitable for most bicyclists. Therefore, the alternatives include:

- Install 6-foot bike lanes on both sides of the roads from Polk Street to OR 51-Monmouth Street
    - This would likely require restricting on-street parking along the road and therefore should be considered when traffic volumes exceed 2,000 ADT per City standards

4th Street

There are no bike facilities on either side of the road from OR 51-Monmouth Street to Spruce Avenue. The BLTS analysis indicates that the road is suitable for most bicyclists. This is primarily due to relatively low traffic volumes and travel speeds. Therefore, the alternatives provided below are indented to improve wayfinding and plan for the long-term potential of the road:

- Install shared lane pavement markings (sharrows) from OR 51-Monmouth Street to Spruce Avenue
- Install 6-foot bike lanes on both sides of the road from OR 51-Monmouth Street to Spruce Avenue
    - This would likely require restricting on-street parking along the roads and therefore should be considered when traffic volumes exceed 2,000 ADT per City standards

13th Street/7th Street

There are no bike facilities on either side of the roads from OR 51-Monmouth Street to the south city limits. The BLTS analysis indicates that the roads may Not be suitable for most bicyclists. Therefore, the alternatives include:

- Install 6-foot bike lanes on both sides of the roads from OR 51-Monmouth Street to the south city limits
    - This would likely require restricting on-street parking along the roads and therefore should be considered when traffic volumes exceed 2,000 ADT per City standards

Picture Street/Williams Street/G Street/Spruce Avenue

There are no bike facilities on either side of the roads. The BLTS analysis indicates that the roads are suitable for most bicyclists. This is primarily due to relatively low traffic volumes and travel speeds. Therefore, the alternatives provided below are indented to improve wayfinding and plan for the long-term potential of the roads:

- Install shared lane pavement marking (sharrows) on both sides of the roads
- Install 6-foot bike lanes on both sides of the roads
    - This would likely require restricting on-street parking and therefore should be considered when traffic volumes exceed 2,000 ADT per City standards

C Street/D Street

C Street and D Street are local streets and are not required by City code to have on-street bike lanes. However, these streets could serve as parallel routes to OR 51-Monmouth Street and provide direct connections to the waterfront. Therefore, the alternatives include:

- Install low traffic bikeway (bicycle boulevard) treatments along both roadways
- Install shared lane pavement marking (sharrows) on both sides of the roads

River Road

River Road is owned and operated by Polk County and Marion County. However, the City has expressed an interested in providing a bicycle facility on River Road, primarily as a direct connection to the Valley Scenic Bikeway. Therefore, the alternatives include:

- Install 6-foot bike lanes on both sides of the road across the Willamette bridge – this would require widening the bridge or providing cantilevered bike paths on one or two sides of the bridge.
- Install actuated flashing beacons with "bikes on bridge" signs on both ends of the bridge.

TRANSIT

This section provides an overview of transit facilities and services that could be implemented within Independence to improve access and circulation by transit. This section also identifies the transit alternatives developed to address gaps and deficiencies in transit connectivity.

Transit Facilities and Services

Public transit provides important connections to destinations for people that do not drive or bike and can provide an additional option for all transportation system users for certain trips. Public transit can complement walking, bicycling, or driving trips: users can walk/roll to and from transit stops and their homes, shopping, or work places; people can drive to park-and-ride locations to access a bus; or people can bring their bicycles on transit vehicles and bicycle from a transit stop to their final destination.

Providing transit service in smaller cities is typically led by a local or regional transit agency. Cherriots provides fixed-route and demand-responsive transit service within Polk and Marion Counties, including multiple stops in Independence throughout the community.

Fixed-Route Service

Fixed-route service refers to transit service that runs on regular, scheduled routes, with designated transit stops. Fixed-route service is typically characterized by service frequency (the time between arrivals), service hours (the number of hours service is provided throughout the day), and service coverage (the amount of the population, households, and jobs served by transit).

Transit Stops

Transit stops are designated locations where residents can access local transit service. Transit stops are normally located at major intersections. The types of amenities provided at each transit stop (i.e. pole, bench, shelter, ridership information, trash receptacles) tend to reflect the level of usage.

- Pole and bus stop sign – All bus stops require a pole and bus stop sign to identify the bus stop location. Some transit agencies prefer the bus stop signs to be provided on a separate dedicated pole instead of on an existing utility pole, column, or other location.
- Bus stop shelters – Shelters are typically provided at stops with 50 or more boardings per day but may be considered at stops with fewer boardings per day if served by infrequent service (headways greater than 17 minutes) such as in Independence.
- Seating – Seating can be considered at any stop as long as it is accessible and as long as the safety and accessibility of the adjacent sidewalk or other facility are not compromised by seating placement.

- Trash receptacles – Trash cans can be considered at any stop; however, they are most commonly located at stops with shelters and/or seating. Trash cans will require pick-up by the city public works crews.
- Lighting – Lighting is an important amenity for bus stops as it provides visibility and increased security for transit users waiting, boarding, and aligning transit service.
- Bicycle parking, storage, and/or repair stations – As discussed above, public transit and bicycling can work together to support a single person trip. In addition to bicycle connections to bus stops, bicycle amenities located at bus stops further support multi-modal trips, allowing travelers to store their bicycles at one end of their trip or even repair their bicycle en route as needed.
- ADA accessibility – Bus stops should be accessible for users with all ranges of capabilities, including a concrete landing pad, adjacent parking restrictions, and ADA-compliant pedestrian ramps. Based on discussion with Cherriots staff, the concrete pad should be five feet by eight feet, with a slope of two percent or less to be in compliance.
- Real-time bus arrival reader boards -

Park-and-Rides

Park-and-rides provide parking for people who wish to transfer from their personal vehicle to public transportation or carpools/vanpools. Park-and-rides are frequently located near major intersections, at commercial centers, or on express and commuter bus routes. It is Oregon state policy to encourage the development and use of park-and-rides at appropriate urban and rural locations adjacent to or within the highway right-of-way. Park-and-rides can provide an efficient method to provide transit service to lower density areas such as Independence, connecting people to jobs, and providing an alternate mode to complete long-distance commutes.

Park-and-rides may be either shared-use, such as at a school or shopping center, or exclusive-use. Shared-use facilities are generally designated and maintained through agreements reached between the local public transit agency or rideshare program operator and the property owner. Shared-use lots can save the expense of building a new parking lot, increase the utilization of existing spaces, and avoid utilization of developable land for surface parking. In the case of shopping centers, the presence of a shared-use park-and-ride has frequently been shown to be mutually beneficial, as park-and-riders tend to patronize the businesses in the center.

Mobility Hubs

Mobility hubs focus on the connectivity of public transit to a variety of travel modes, supporting non-single-occupancy-vehicle trips and helping to connect people to the different modes they need. Although mobility hubs support a transit stop or station, all services and amenities do not need to be provided immediately adjacent to the stop as long as they are still within an easily accessible area. Shared mobility services such as bikeshare, carshare, e-scooters, and on-demand rideshare zones are all located within the hub, in addition to amenities such as transit waiting areas, pedestrian and bicycle facilities, bicycle parking, bicycle repair stations, and electric vehicle charging. Technology is also used to support a mobility hub with services such as real-time transit travel information and smart parking. Additional information on the mobility hubs is provided under the Emerging Technology section.

Real-Time Transit Information

Transit agencies or third-party sources can disseminate both schedule and system performance information to travelers through a variety of applications, such as in-vehicle, wayside, or in-terminal dynamic message signs, as well as the Internet or wireless devices. Coordination with regional or multimodal traveler information efforts can increase the availability of this transit schedule and system performance information. These systems enhance passenger convenience and may increase the attractiveness of transit to the public by encouraging travelers to consider transit as opposed to driving alone. They do require cooperation and integration between agencies for disseminating the information.

Transit Alternatives

This section summarizes the alternatives developed to address the gaps and deficiencies in the transit facilities and services provided in Independence. The alternatives are shown in Figure 6, as applicable.

New Routes & Existing Route Changes

Cherriots has developed a new service plan, which would replace the Polk County Flex Service. In fall 2020, Cherriots plans to adjust the Polk County Flex to become a deviated fixed route service called Cherriots Regional Route 45: Central Polk County. The service change was first considered by Cherriots in February 2019. Before initiating route planning, a survey was conducted in summer 2019, which showed that the public was in favor of a service redesign. Cherriots staff worked with the cities of Independence, Monmouth, and Dallas and in coordination with ODOT to determine a route and bus stop locations. The service will operate on a fixed route, including 50 stops within the three cities, but will also allow riders to call beforehand and request service at any location within the Route 45 service area. Service will be provided on weekdays from 7:00 a.m. to 5:00 p.m. with 2-hour headways.

In addition to the services provided by Cherriots, the cities of Independence and Monmouth are collaborating with other stakeholders to explore development of a local transit system. A Local Transit Feasibility Study is ongoing, focusing on a link between downtown Independence, downtown Monmouth, and Western Oregon University. This potential new link is likely to use OR 51-Monmouth Street, as a natural connector between the two cities, and will ideally use vehicles that look like the historic trolleys that used to serve this area in the 1800's. Per public comments, preferred vehicles would be electric or solar powered to limit emissions created by new services.

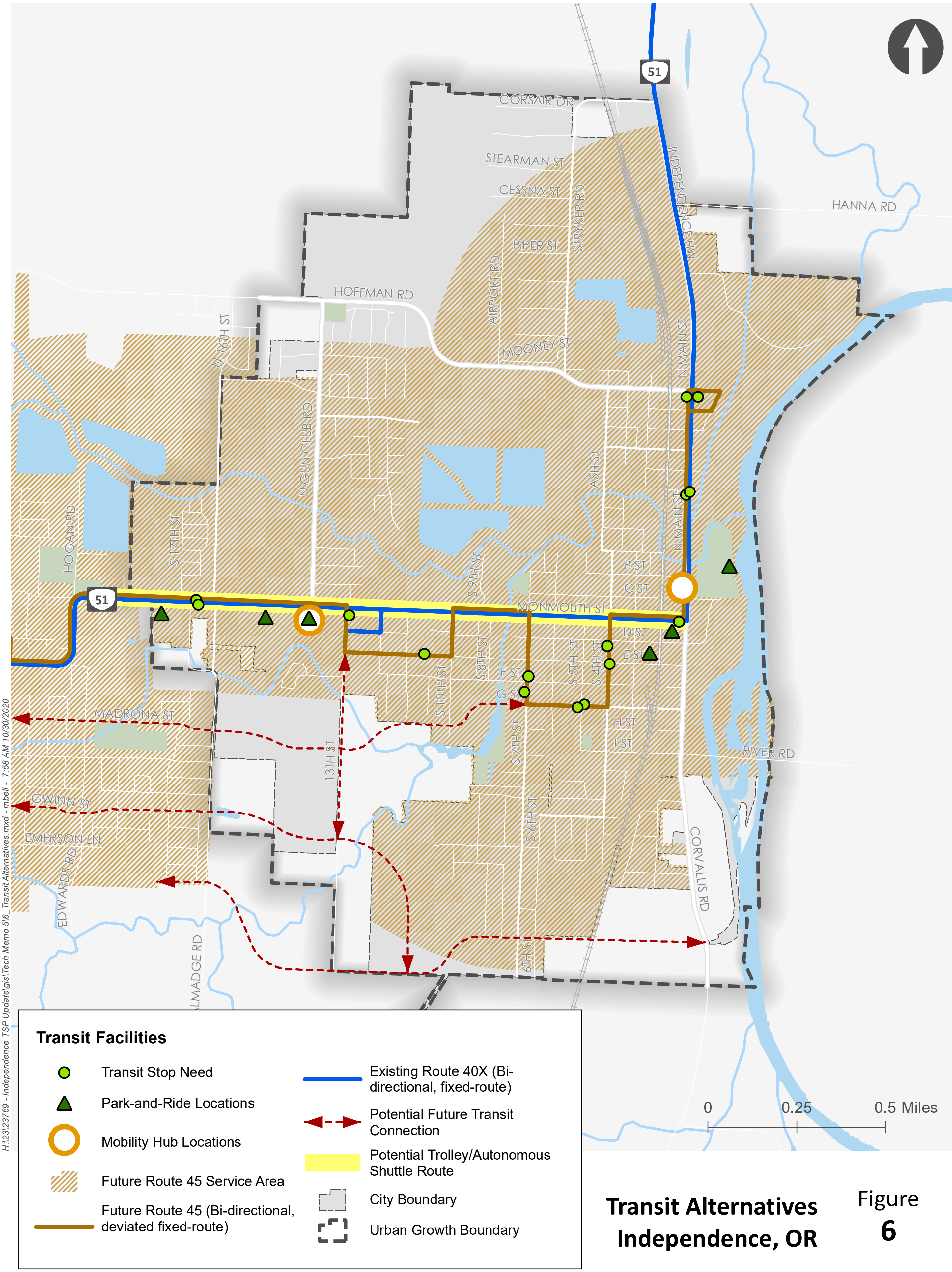
The City is also interested in operating an autonomous shuttle along OR 51-Monmouth Street. Additional information on autonomous shuttles is provided in the Emerging Technology section.

As these additional services are implemented and the street network is further connected in the southern area of the city, potential new transit routes (likely through a local route versus a regional route) should be studied. Based on the future streets discussed above, the following roadways may benefit from transit as development occurs:

- G Street and Madrona Street, if/when those street extensions are completed
- The Gwinn Street extension through southwest Independence
- 13th Street south to the southwest area, potential to connect to the other transit routes serving the city
- The new southern arterial, dependent on the developed land uses adjacent to the roadway

Service Frequency, Hours, & Coverage

Route 40X will stay in place as a regional express service when the Polk County Flex becomes Route 45 to serve local trips. Both routes operate between four and eight daily trips, depending on day of the week. After Route 45 is established and as Independence grows and changes, the frequency of trips for these routes should be verified and modified as appropriate.



Transit Alternatives
Independence, OR

Figure
6

Data Source: General Transit Feed Service

Based on public comment, there is a need for further weekend hours to support workers and travelers. For Route 40X, added Sunday service and extended Saturday service should be explored. For Route 45, monitoring and public outreach should be conducted once the service is in place to understand if weekend service is needed to support the community.

Although the existing Polk Flex Service area, and the service area for the future Route 45 replacement, provide coverage throughout the majority of the city, comments from the public show that these services are not fully understood. Several public comments listed *distance from transit routes* as an obstacle, while these services can pick up riders anywhere within the designated service area by request. The Route 45 service area will cover the majority of the city, as shown in Figure 6. Further marketing, outreach, and education are needed to those who live and work in Independence to provide a better understanding of the services available and how to request pick up and drop off within the service area. It is also important to note that inconsistent marketing for existing public transit facilities and service in Independence (i.e. continued references to the previous CARTS regional bus system) should be updated to further enhance awareness of services.

Transit Stops

Existing Transit Stop Improvements

The following identifies potential improvements at the five existing bus stops located in Independence. *Note: If pedestrian-scale lighting is preferred at the bus stops, all locations except Stop 1515 would require lighting installation.*

- Stop 1516: OR 51-Main Street/Polk Street (to Salem)
  - Provide bicycle parking, storage, and repair station
  - Provide ADA-compliant pedestrian ramps leading to the bus stop
- Stop 1517: Or 51-Main Street/Polk Street (to Dallas)
  - Concrete pad (Cherriots plans to upgrade this bus stop to be ADA-compliant in 2020)
  - Provide ADA-compliant pedestrian ramps leading to the bus stop
  - Provide bicycle parking, storage, and/or repair station
- Stop 1515: Library – OR 51-Monmouth Street/2nd Street (to Salem)
  - New "No Parking" zone
  - Provide bicycle storage and/or repair station (some bike parking already provided)
- Stop 1518: Library – OR 51-Monmouth Street/2nd Street (to Dallas)
  - No potential improvements based on existing conditions through August 2020
- Stop 1502: 13th Street/OR 51-Monmouth Street (bi-directional)
  - Install "No Parking" zone signage in addition to the yellow curb
  - Install lighting
  - Provide ADA-compliant pedestrian ramps leading to the bus stop
  - Street intersection (i.e. marked crossing with pedestrian refuge)
  - Provide bicycle parking, storage, and/or repair station
  - Real-time bus arrival reader board

New Transit Stops

As Cherriots implements Route 45, new bus stops will include a sign and pole. In addition, Cherriots is already working with local agencies to restrict parking at all new bus stop locations as part of stop installation. After Route 45 is in service long enough for ridership trends to be identified, evaluation of the need for shelters, seating, and/or trash cans should be completed.

The identified locations for the new bus stops were reviewed to identify modifications to support comfort and safety when service begins. These modifications are listed below.

- Install lighting. *Note: if pedestrian-scale lighting is preferred at the bus stops, all new stop locations would require lighting installation.*
    - 4th Street/E Street – to Dallas
    - 5th Street/G Street – both directions
    - 7th Street/F Street – both directions
    - E Street/11th Street – both directions
    - Monmouth Street/Talmadge Road – both directions
- Provide ADA-compliant pedestrian ramps leading to the bus stop
    - Main Street/Oak Street – both directions
    - 4th Street/E Street – both directions
    - 5th Street/G Street – both directions
    - 7th Street/F Street – both directions
    - E Street/11th Street – both directions
    - Monmouth Street/Talmadge Road – both directions
- Install an enhanced pedestrian crossing (i.e. marked crossing with pedestrian refuge)
    - Main Street/Oak Street – south leg of intersection

Potential Park-and-Ride Locations

Several potential shared-use park-and-ride locations were identified to support existing Route 40X and future Route 45. As discussed above, any of these locations would require agreements between the public transit agency or rideshare program operator and the property owner.

- Central Plaza (supporting Routes 40X and 45)
- Independence Library/Sterling Savings Bank (supporting Routes 40X and 45)
- Riverview Park (supporting Routes 40X and 45)
- Independence Cinema 8 (supporting Routes 40X and 45)
- First Baptist Church (supporting Routes 40X and 45)
- WinCo (supporting Route 45)

Potential Mobility Hub Locations

Two potential mobility hub locations were identified where a connected range of travel options may be beneficial to those traveling to, from, and within Independence.

- Central Plaza shopping center (supporting Routes 40X and 45)
- Downtown Independence, adjacent to Riverview Park (supporting Routes 40X and 45)

Pedestrian/Bicycle Connectivity

One of the most significant ways to increase ridership and accessibility of a transit route is to provide pedestrian bicycle connectivity to the service. Although there are pedestrian and bicycle facilities in the immediate vicinity of many existing and future transit stops, it is preferred for all stops to be supported by marked crosswalks and pedestrian and bicycle facilities both adjacent and connecting to these locations. Pedestrian and bicycle alternatives are further discussed in the previous sections, including those that would support transit and fill gaps in the surrounding network.

Other

In addition to the alternatives described above, the City can plan for transit-supportive land use patterns and support future transit viability by designing and building streets that will comfortably accommodate transit stops and include the right-of-way that could allow for transit stops to be located as close as possible to important destinations.

The 2007 TSP includes several policies in support of the public transit system:

- The City shall coordinate with governmental and private agencies in the planning and provision of public transportation services and shall ensure that a given level of service is adequate for the costs incurred
- The City will coordinate with willing private property owners to establish park-and-ride facilities for public transit and carpool users
- Transit routes and facilities shall be supported through appropriate measures such as bus stops, pullouts, optimum road geometrics, or parking restrictions (land use requirement)
- New retail, office and institutional developments should include transit routes and facilities and convenient pedestrian access to transit through walkways and connections (land use requirement)
- Allow existing developments to redevelop portions of parking areas for transit-oriented uses, such as carpool parking, park-and-ride parking, and public transit stations and platforms, where appropriate (City of Independence Development Code)

Additional policies in support of the public transit system based on information from Cherriots staff:

- Fares for local service, such as future planned Route 45, are recommended to be cheaper than a trip to Salem via private vehicle
- The City will consider transit stops for any new roadways built within the city, including consideration of planned future routes that are not yet in place
- The City will work with Cherriots and other partner agencies to provide real-time transit information for riders, especially as more routes and service types become available within the city. Coordination between agencies and providers to create a "one-stop-shop" for real-time transit information will allow users to seamlessly integrate the different services.

INTERMODAL ROUTE CONNECTIVITY

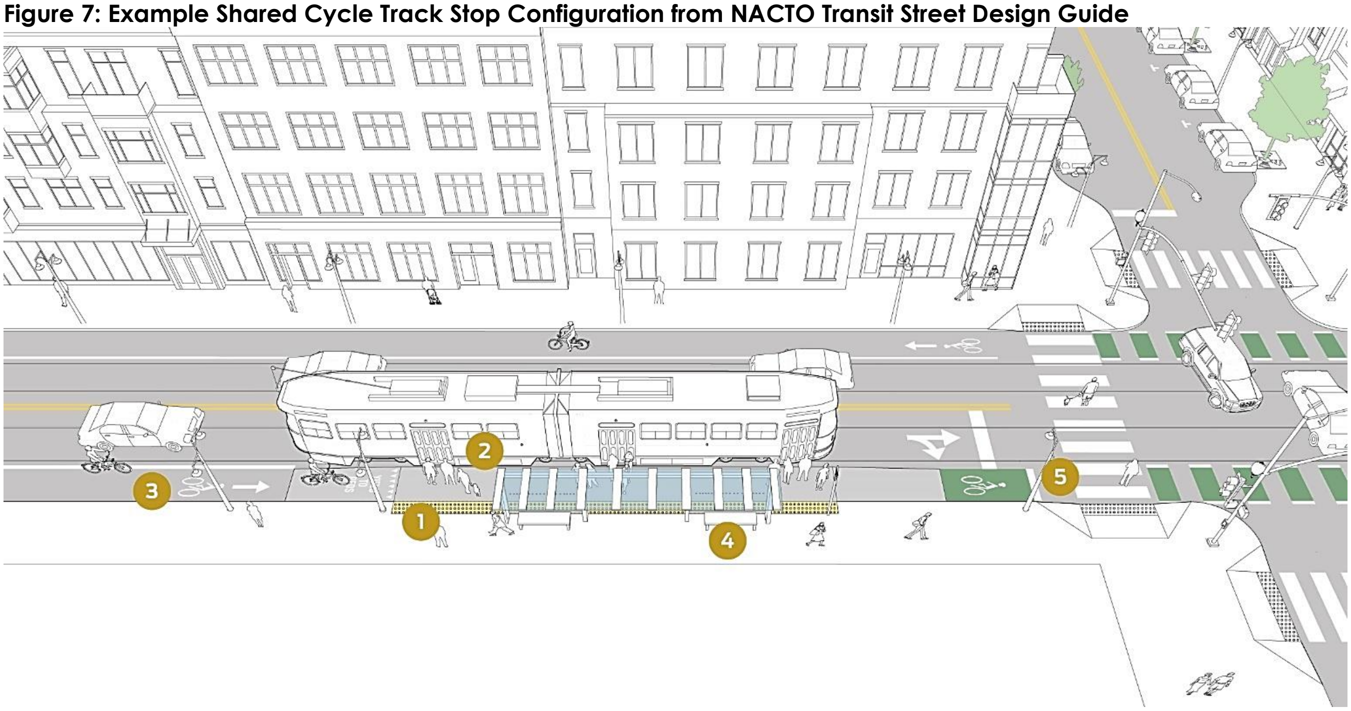
The future transit network was overlaid with existing bicycle and pedestrian facilities to understand intermodal route connectivity. Pedestrian facilities in Independence generally connect the arterial street network to bus stops. Bicycle facilities in Independence provide less connectivity to the transit system.

When considering roadways that need to support transit vehicles, bicycles, and private vehicles, there can be constrained right-of-way to accomplish the range of safety, connectivity, and mobility goals for a particular street. The National Association of City Transportation Officials (NACTO) Transit Street Design

Guide was reviewed for potential intermodal route connectivity solutions. Based on the existing street widths and classifications, future transit routes, and bicycle facility gaps in Independence, the following two solutions will be considered within the city.

- Shared lanes with a mix of transit vehicles, bicycles, and private vehicles. The following recommendations are provided in the NACTO Transit Street Design Guide:
  - This treatment is appropriate on roadways where bus volumes are moderate and/or where bus speeds are low
  - Along segments where buses and bicyclists are not expected to pass each other, shared lanes may be 10 to 11 feet
  - If passing is anticipated, shared lanes may be 13 feet wide
  - For roadways where there is adjacent parking, the combined width of the shared lane and parking lane is recommended to be 19 to 21 feet wide
- Shared cycle track stops. The following recommendations are provided in the NACTO Transit Street Design Guide:
  - This treatment is appropriate on higher classification roadways where there are in-lane stops and a bike lane or protected bike lane along the segment, such as OR 51 or G Street
  - Special consideration is needed for width of cycle track, placement of bicycle ramps, curbside activity restrictions, and proximity to turning traffic

Figure 7: Example Shared Cycle Track Stop Configuration from NACTO Transit Street Design Guide



1. Detectable warning strips and shark's teeth yield markings
2. Accessible waiting and boarding areas
3. Bike ramps that consider maintenance, visually impaired passengers, and curbside conflicts
4. Shelters that are transparent and open to the building side
5. Ensure bicyclists are visible for turning traffic and queue in front of transit vehicles

Source: NACTO Transit Street Design Guide (https://nacto.org/publication/transit-street-design-guide/stations-stops/stop-configurations/shared-cycle-track-stop/)

There are several gaps and areas for improvement for intermodal route connectivity in Independence, including:

- **OR 51-Main Street from Polk Street to OR 51-Monmouth Street** – This segment lacks designated bicycle facilities and continuous sidewalks on the east side of the roadway. The striped bike lanes north of this segment should be extended south to support bicycle access and connectivity. Although providing sidewalks on both sides of the street is preferred, a marked crossing at the future OR 51-Main Street/Oak Street bus stop location would provide connectivity to the continuous sidewalks on the west side of the roadway. Any marked crossings on OR 51 will require coordination with ODOT. Improvements to the existing bicycle/pedestrian facilities would provide further connectivity to transit. See the NACTO excerpt above for a potential configuration.
- **Polk Street from Walnut Street to OR 51-Main Street** – There are gaps in both the pedestrian and bicycle facilities in this segment. Filling these bicycle/pedestrian facility gaps would provide further connectivity to transit.
- **OR 51-Monmouth Street from OR 51-Main Street to 8th Street** – This segment is lacking designated bicycle facilities. In addition, there is a sidewalk gap on the north side of the roadway between 2nd Street and 3rd Street. Filling these bicycle/pedestrian facility gaps would provide further connectivity to transit. See the NACTO excerpt above for a potential configuration.
- **4th Street from OR 51-Monmouth to G Street** – This segment is lacking designated bicycle facilities. As a low-speed, low-volume collector street, a marked and signed shared roadway could be implemented to provide further connectivity to transit.
- **G Street from 4th Street to 7th Street** – This segment is lacking designated bicycle facilities. As a low-speed but higher-volume collector street, a designated bicycle facility such as a bike lane could be implemented to provide further connectivity to transit. See the NACTO excerpt above for a potential configuration.
- **7th Street from OR 51-Monmouth to G Street** – This segment is lacking designated bicycle facilities. As a low-speed, low-volume collector street, a marked and signed shared roadway could be implemented to provide further connectivity to transit.
- **10th Street from OR 51-Monmouth to E Street** – This segment is lacking designated bicycle facilities and has a pedestrian facility gap on the east side of the roadway. As a local street, a marked and signed shared roadway could be implemented to provide further connectivity to transit, in addition to filling the pedestrian facility gaps.
- **E Street from 10th Street to 13th Street** – This segment is lacking designated bicycle facilities and has a pedestrian facility gap on the north side of the roadway. As a local street, a marked and signed shared roadway could be implemented to provide further connectivity to transit, in addition to filling the pedestrian facility gaps.
- **13th Street from OR 51-Monmouth to E Street** – This segment is lacking designated bicycle facilities. As a low-speed, low-volume collector street, a marked and signed shared roadway could be implemented to provide further connectivity to transit.

FREIGHT

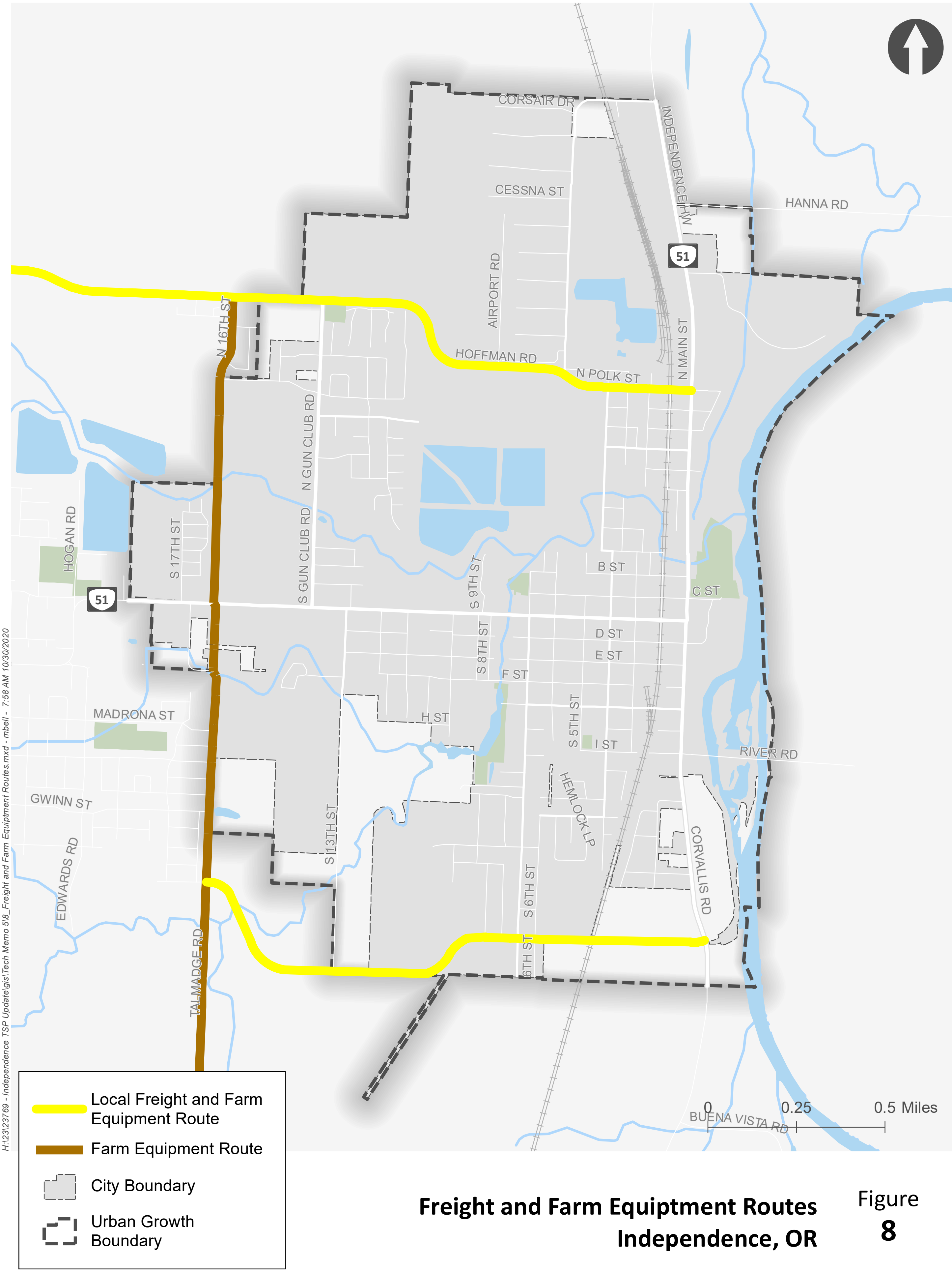
As indicated in *Technical Memorandum #3A: Existing Conditions Inventory*, there are no designated state or federal freight routes in Independence. The majority of freight activity occurs on Hoffman Road-Polk Street between the western UGB and OR 51-Main Street in support of the adjacent industrial land uses. In addition, passive measures, such as the curb extensions in place at the OR 51-Main Street/Monmouth Street intersection, make truck turning movements difficult, providing a disincentive for trucks to remain on OR 51 when traveling through Independence. However, commercial businesses within the downtown area generate freight traffic. Lastly, public comments expressed the difficulty of maneuvering large farm equipment throughout Independence to agricultural land uses north and south of the city. Therefore, the following alternatives were developed to address potential issues with freight and farm equipment traffic:

- Establish designated freight and farm equipment routes within the City that identify where large vehicles can and cannot travel.
    - These routes can include Hoffman Road-Polk Street, 16th Street, and the future southern arterial connection, as shown in Figure 8.
    - Gun Club road is not suggested as a local freight route unless the pedestrian and bicycle facilities are updated.
- Develop policies related to maintenance along designated freight and farm equipment routes to ensure the facilities do not become degraded over time.
- Develop policies related to pedestrian and bicycle facilities along designated freight and farm equipment routes to ensure greater separation of travel modes.
- Establish truck loading zones within the downtown area and develop policies related to the use of the truck loading zones.

RAIL

The rail line in Independence runs north-south along the entirety of the city. This introduces many intersecting locations with other modal networks in the city. Therefore, the following alternatives were developed to address potential issues with the rail network:

- Create a maintenance program to specifically address pavement condition on 2nd Street.
- Create a maintenance/improvement program to ensure ADA compliance of pedestrian crossings of the rail line.
- Create new pedestrian crossings where a pedestrian-only crossing would provide further connectivity between cul-de-sacs
    - Boat Landing Street
    - Picture Street
    - Grand Street
    - I Street
- Work with the rail operators to further reduce speed, and resulting noise, of trains passing through city limits.
    - Follow the Federal Railroad Administration's guidance for creating quiet zones, including installing of flashing lights and gates at each public crossing.
- Work with ODOT rail to determine the location of an at-grade or grade-separated rail crossing that would provide additional east-west connectivity of the roadway network.
    - Consideration can be given to removing a crossing to the north to ensure similar continued rail operations.



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Freight and Farm Equiptment Routes
Independence, OR

Figure
8

Data Source: Polk County Data Portal, ODOT

- Work with ODOT rail to consider a new at-grade rail crossing at I Street as part of treatments to the OR 51-Main Street/River Road intersection.
- Work with ODOT rail to consider potential compromised emergency response capabilities should a train become stalled on the tracks and block crossings. The fire and police stations are located west of the track, which gives them access to most of the city. However, trains can delay and/or cause detours for emergency vehicles trying to reach the eastern edge of town, including the downtown, waterfront park, residences and businesses.
- Consider passenger rail service.

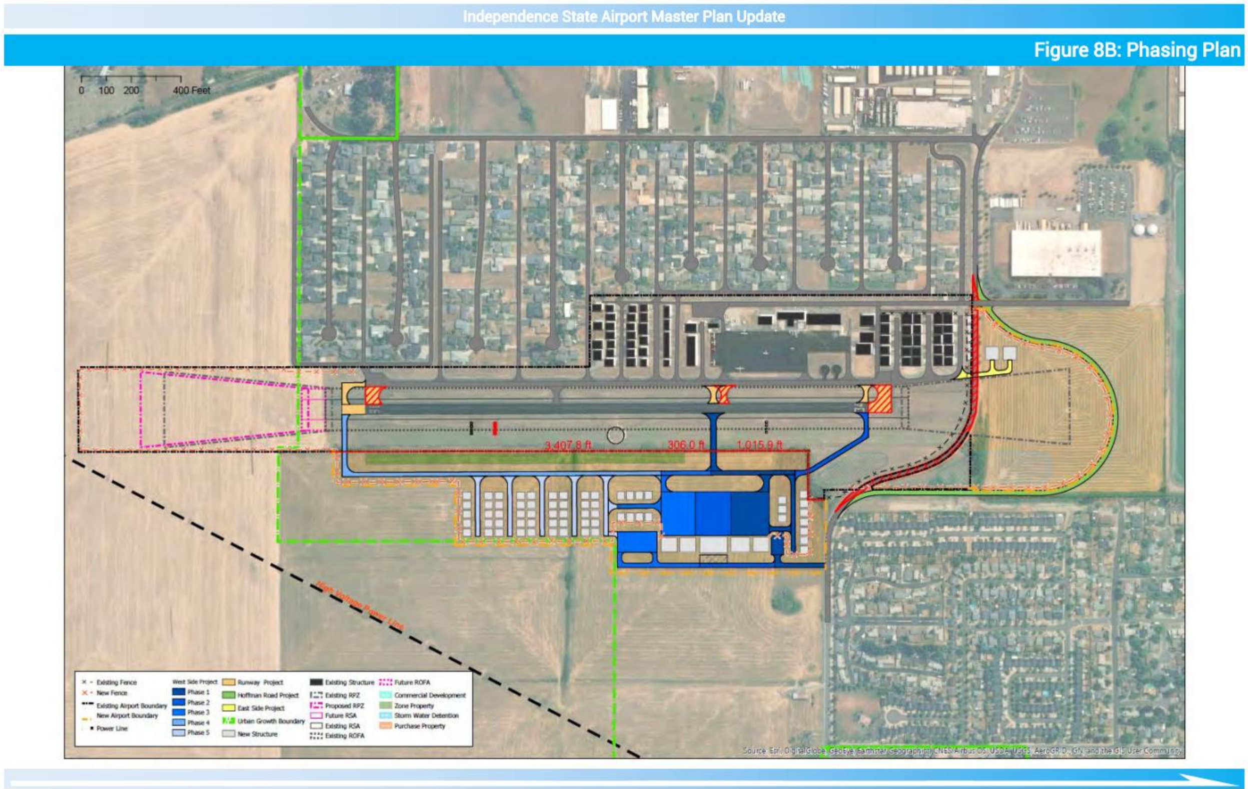
In addition, the 2007 TSP included several policies in support of the rail system:

- Improve safety by continuing to work with the W&P Railroad and the Rail Division of ODOT to identify crossing closures and safety improvements to existing crossings.
- Improve the trackage on 2nd Street to decrease pedestrian tripping and bicycling hazards, and vehicular and rail conflicts, between "B" and "E" Streets. Since its inception in 1993, W&P has encouraged Independence to consider a median strip on 2nd Street to separate train and vehicular traffic such as was done on 6th Street in Corvallis. The City will keep all design solutions to the existing railroad subgrade failure along 2nd Street open for discussion.
- Work with the railroad to identify, and evaluate the financial feasibility of, alternatives that would improve public safety, reduce roadway wear and tear, and reduce conflicts. (This policy is modified from its original content in the 2007 TSP)
- Reduce environmental degradation (noise impacts) and conflicts by requiring residential development adjacent to the railroad to use sound mitigation structures or planting buffers.
- Promote safe and efficient operation of the railroad and road system by allowing no new at-grade crossings by local roads and minimize the number of arterial and collector street at-grade crossings.
- Identify and evaluate the economic feasibility of various alternatives to provide for emergency access and response capabilities to the entire City. Some alternatives include building an overpass at an existing at-grade crossing or an unbuilt collector or arterial crossing or providing a satellite emergency response capability for the east side of Independence.

AIR

The Oregon Department of Aviation (ODA) updated the Independence State Airport Master Plan, with the final report published in March 2020. The master plan highlights a range of projects to support airport operations, presented in three phases. Phase 1 includes short-term elements slated to occur from 2019 to 2023. Phase 2 includes mid-term elements slated to occur from 2024 to 2028. Phase 3 includes long-term elements slated to occur from 2029 to 2038. As noted in the master plan, the project years provided are estimates and subject to change since implementation will be need-driven. Figure 9 shows the projects identified in the 2020 Independence State Airport Master Plan.

Figure 9: 2020 Independence State Airport Master Plan Project Map



Source: 2020 Independence State Airport Master Plan Update (https://indepndencemasterplan.files.wordpress.com/2020/04/2020-03-20-independence-airport-master-plan-web-1.pdf)

Implications for the Independence TSP Update

The majority of projects from the 2020 Independence State Airport Master Plan are outside of the City of Independence's right-of-way, but there is one long-term project listed that would greatly impact the city's transportations system: realignment of Hoffman Road and extension of Taxiway A. As noted in the master plan, "the City of Independence voiced concerns over rerouting Hoffman Road and increased noise that a larger airport configuration could bring." More specifically, Hoffman Road/Polk Street is one of the few east-west connections in the city and provides a local and regional freight connection. As noted in Section 4.3.13 of the 2020 Independence State Airport Master Plan, "it is recommended that ODA [Oregon Department of Aviation] and the City collaborate to develop an acceptable strategy to mitigate the incompatible land use of Hoffman Road within the Runway Protection Zone (RPZ)." In addition, the 2007 TSP included several policies in support of the air system:

- The City shall protect and maintain the Independence Airport site and coordinate with Polk County and the Oregon Department of Aviation in protection and maintenance efforts.
- The City, in cooperation with Polk County, shall maintain an airport overlay zoning which coincides with the future approach surfaces and FAR Part 77 surfaces. Airport overlay zoning should conform with Oregon Department of Aviation guidelines.
- City supports designating Runway 34 as the calm wind runway in order to minimize noise exposure on nearby residential areas south of the airport. The City also supports a review of airport operating procedures to ensure that appropriate noise abatement procedures and standard traffic pattern elevations and locations are being utilized at the airport.

SAFE ROUTES TO SCHOOL

Safe Routes to School (SRTS) plans make it safer for students to walk, bike, or take public transit to school. Safer routes encourage more walking and biking and provide convenient and accessible options to and from school and in surrounding neighborhoods. SRTS programs include six components known as the Six E's: evaluation, education, encouragement, engineering, enforcement, and equity. This section provides a summary of the Six E's and identifies alternatives to be considered by the City.

Safe Routes to School – Six E's

Education

The education component provides students and residents with information such as transportation options and the benefits of walking and biking to school. Education strategies for SRTS programs include identifying who needs to receive the information, what information needs to be shared, and how to convey the messages. Education components could include:

- Educational videos
- Structured skill practice training
- Lessons integrated into classroom subjects
- Media: radio, internet videos, newspaper articles, and television features

Encouragement

The encouragement component is most closely linked to the education component of a SRTS program. Encouragement strategies generate excitement and interest in walking and biking through events and activities. The encouragement component rewards participation and is used to increase the number of students who walk and bike to school. Encouragement strategies can be used to garner support for other SRTS components such as installing sidewalk. Encouragement components could include:

- Special events, such as international walk to school events
- Mileage clubs and contests
- Ongoing activities
    - Walking school bus or bicycle train
    - Park and walk
    - On-campus walking activities

Engineering

The engineering component of a SRTS program identifies design, implementation, operations and maintenance of physical improvements aimed at addressing specific needs which make walking and biking to school safer, more comfortable and convenient. An evaluation of the school environment is necessary to identify engineering problems and solutions. Engineering components could include:

- Pedestrian and bicycle facilities: sidewalks, crosswalks, bike lanes, bicycle racks, etc.
- Pedestrian and bicycle signage and signals equipment
- Enhanced crossing treatments: curb extensions, raised median islands, flashing beacons

Enforcement

Enforcement is included as part of a SRTS program to reinforce the objectives of the program and deter unsafe traffic behaviors and encourage all road users to obey traffic laws and share the road safely.

Enforcement strategies involve a network of community members who promote safe walking, biking and driving. Enforcement components could include:

- Identifying unsafe behaviors
  - Driver behaviors (e.g. speeding, failing to yield to pedestrians/bicyclists, running red lights, passing stopped school buses, parking in crosswalks, etc.)
  - Pedestrian and bicyclist behaviors (e.g. not following direction of crossing guards, crossing at undesirable locations, riding in traffic, no wearing bike helmet, etc.)
- Community enforcement (e.g. safety patrols, adult school crossing guards, neighborhood speed watch programs, etc.)
- Law enforcement methods (e.g. speed trailers, active speed monitors, traffic complaint hotlines, photo enforcement, etc.)

Evaluation

The evaluation component assesses which strategies and approaches are successful. Evaluation of SRTS programs ensure that initiatives support equitable outcomes, identify unintended consequences or opportunities to improve effectiveness and ensure there are adequate resources to implement all components of a SRTS program. Evaluation components could include:

- Data collection; surveys, observations
- Information sharing
- Walkability assessment
- Records of citations

Equity

Equity in a SRTS program ensures that program initiatives are benefiting all demographic groups. This component is especially important to ensuring safe, healthy, and fair opportunities for low-income students, students of color, students of all genders, students with disabilities and others. Incorporating equity efforts into all components of a SRTS could include:

- Assessing whether the recipient of education efforts reflect larger demographic patterns of the community
- Ensuring encouragement activities are available to low-income students and students of color
- Ensuring policy and physical improvements are implemented in low-income communities and communities of color
- Ensuring law enforcement officers build trust with communities and do not target students of color, low-income students, or other community residents
- Initiating efforts that decrease health disparities

Safe Routes to School Alternatives

The Monmouth-Independence Safe Routes to School Program is a collaboration between the cities of Independence and Monmouth, the Independence Police Department, the Independence Traffic Safety Commission and Central School District 13J. The purpose of the program is to integrate health, fitness, environmental awareness and safety into one collective program.

The Safe Routes to School Program uses a 4-tiered approach which focuses on engineering, encouragement, enforcement and education as means of enabling children to walk and bike to school. An increase in walkers and bikers and a decrease in automobile use benefits students through better health, personal enjoyment, better concentration in school and environmental exposure. The community benefits through cleaner air, increased social interaction and an overall safer environment.

As part of the program, the City of Independence is working to: hold encouragement activities; address school-related safety concerns through the traffic safety commission; integrate walking and biking safety education into the classroom; increase traffic enforcement around the schools and to construct a safe off-street route for pedestrian travel.

The City recently worked with each of the K-8 schools in the district to survey parents and students as a means of evaluating current modes of travel, parent concerns and to look at potential improvements. Data from the survey will be used to strategically improve roadways and other facilities around local schools.

Though the City of Independence has a plan they should consider implementing other elements of a SRTS plan, including:

- Develop an evaluation program that assesses which strategies and approaches are successful, ensures that initiatives support equitable outcomes, and identifies unintended consequences or opportunities.
- Develop an equity program that ensures that program initiatives are benefiting all demographic groups.
- Expand SRTS program to middle school and high school students.
- Continue to implement physical improvements to the transportation system aimed at addressing specific needs which make walking and biking to school safer, more comfortable and convenient.
    - Several alternatives are identified within the pedestrian and bicycle sections of this memorandum that could help the city further enhance the transportation system around school.

SAFETY

Traffic safety plays an important role in developing the most appropriate alternatives for a given gap or deficiency, particularly in areas where real or perceived safety risks may prevent people from using more active travel modes, such as walking, biking, and taking transit. The real or perceived safety risks may reflect the crash history of an area or the physical and/or operational characteristics of the roadways (winding curves, steep grades, high traffic volumes, high travel speeds, excessive heavy vehicles, etc.). Several methodologies have been developed to analyze and identify alternatives for addressing traffic safety within an area. Many of which are documented in the Highway Safety Manual (HSM) as well as several other resources developed by ODOT for addressing safety along roadway segments, at intersections, and for pedestrian and bicyclists.

Countermeasures

This section summarizes the countermeasures considered for implementation to address traffic safety along roadway segments, at intersections, and for pedestrians and bicyclists. Note: many of the countermeasures overlap, which illustrates how some countermeasures address multiple safety issues.

Roadway Segments

There are a variety of potential safety solutions that can be applied within Independence to address systemic crashes that occur along roadway segments, such as head-on collisions, sideswipes, and run off the road crashes as well as general speeding and other driver behaviors.

- Enhanced signs and pavement markings for curves (with and without flashing beacons)
- Tree/vegetation removal
- Street lighting
- Speed reduction treatments/traffic calming
- Enhanced enforcement
- Roadway reconfiguration

Intersections

There are a variety of potential safety solutions that can be applied within Independence to address systemic crashes that occur at intersections, such as angled crashes, turning movement crashes, rear-end crashes, and crashes that involve other travel modes (pedestrian, and bicycles).

- Enhanced signs and pavement markings (e.g. stop signs, warning signs, and/or beacons)
- Enhanced visibility of the intersection for entering vehicles (e.g. warning signs, street name signage on both sides of the road, and intersection lighting)
- Application of traffic control devices (signs, markings and signals)
- Signal improvements (e.g. signal timing, signal phasing)
- Left-turn phasing (e.g. permitted, protected, permitted-protected)
- Enhanced enforcement
- Pedestrian and bicycle improvements (see below)
- Intersection lighting
- Speed reduction treatments/traffic calming
- Roundabouts

Pedestrian and Bicycle

There are a variety of potential safety solutions that can be applied within Independence to address pedestrian and bicycle safety. The following provides a summary of the solutions by traffic control.

Signalized Intersections

Pedestrian Safety Solutions

- Street lighting
- Right-turn channelization
- Countdown pedestrian heads
- Leading pedestrian interval
- Left-turn phasing
- Vehicle turning movement restrictions
- Curb extensions (bulb-outs, neck downs)

Bicycle Safety Solutions

- Street lighting
- Bicycle signal
- Bicycle detection
- Pavement markings
- Right-turn channelization
- Leading bicycle interval
- Left-turn phasing
- Vehicle turning movement restrictions
- Protected intersection design
- Forward bicycle queueing area (bike box)

Unsignalized intersections

Pedestrian Safety Solutions

- Street lighting
- Enhanced crossing treatments
- Reduced curb radii
- Pedestrian refuge island or median
- Speed reduction treatments
- Vehicle turning movement restrictions
- Raised crosswalks

Bicycle Safety Solutions

- Street lighting
- Enhanced crossing treatments
- Reduced curb radii
- Skip Striping
- Supplemental signs and markings
- Bicycle boulevards
- Longitudinal bike stencil
- Speed reduction treatments
- Vehicle turning movement restrictions
- Strip bike lanes
- Raised crossings

Roadway segment – No traffic control

Pedestrian Safety Solutions

- Street lighting
- In-roadway warning lights
- Pedestrian-activated warning beacons
- Access management
- Sidewalks street lighting
- Enhanced mid-block crossing treatments
- Road reconfiguration
- Pedestrian refuge island or median

Bicycle Safety Solutions

- Access management
- Bicycle route signage
- Longitudinal bike stencil
- Separated bike lanes
- Dynamic warning signs
- Enhanced mid-block crossing treatments
- Street lighting
- Restrict on-street parking
- Road reconfiguration
- Refuge Island or median

Safety Alternatives

This section summarizes the alternatives developed to address traffic safety within Independence. The alternatives identified focus on safety issues identified from the crash data and perceived safety issues based on feedback from the PMT, advisory committees, and public comments.

OR 51/Stryker Road Intersection

There is an excess proportion of turning movement crashes that have occurred at this intersection and a high likelihood of future occurrence. In addition, the speed of southbound vehicles on OR 51-Main Street is a perceived safety issue. Potential alternatives include:

- Install advance intersection warning signs and/or flashing beacons as advance warning
- Install street name signage on both sides of the road – street name signs provide clarification on the location of local streets and reduce slowing or stopping near minor street connections
- Install southbound dynamic speed feedback sign after entering Independence
- Evaluate need for traffic control modification (i.e. all-way stop-control, traffic signal, roundabout)
- Provide traffic calming measures on OR 51-Main Street approaching the intersection

OR 51-Main Street/Deann Drive Intersection

Pedestrian crossings and speed are a perceived safety issues at this location, specifically for access to and from the A1 Market in the southeast corner. Potential alternatives include:

- Install advance intersection warning signs
- Install street name signage on both sides of the road
- Provide traffic calming measures on OR 51-Main Street approaching the intersection
- Install enhanced pedestrian crossing treatments

OR 51-Main Street/Polk Street Intersection

The concentration of all modes at this intersection (freight, private vehicles, pedestrians, transit) is a perceived safety issue at this location. Potential alternatives include:

- Install advance intersection warning signs and/or flashing beacons as advance warning
- Install street name signage on both sides of the road
- Evaluate need for traffic control modification (i.e. all-way stop-control, traffic signal, roundabout)
- Install additional lighting
- Provide traffic calming measures on OR 51-Main Street approaching the intersection

OR 51-Main Street/Grand Street Intersection

Visibility is a perceived safety issue at this location, specifically for access to and from the dog park to the east. Potential alternatives include:

- Install advance intersection warning signs
- Install street name signage on both sides of the road
- Install additional lighting
- Provide traffic calming measures on OR 51-Main Street approaching the intersection
- Conduct regular maintenance to trim vegetation to improve sight distance for vehicles turning from the east leg of Grand Street

OR 51-Main Street/OR 51-Monmouth Street Intersection

Pedestrian safety is a perceived issue at this location. Potential alternatives include:

- Evaluate need for traffic control modification (i.e. traffic signal)
- Install additional lighting to support the existing pedestrian-scale lighting
- Install enhanced pedestrian crossing treatments

OR 51-Monmouth Street/4th Street Intersection

There is an excess proportion of angle movement crashes that have occurred at this intersection and a high likelihood of future occurrence. Potential alternatives include:

- Evaluate need for traffic control modification (i.e. all-way stop-control, traffic signal, roundabout)
- Provide traffic calming measures on OR 51-Monmouth Street approaching the intersection

OR 51-Monmouth Street/7th Street Intersection

Lack of mainline traffic control is a perceived safety issue at this location. In addition, there is an excess proportion of rear-end crashes that have occurred at this intersection and a high likelihood of future occurrence. Potential alternatives include:

- Evaluate need for traffic control modification (i.e. all-way stop-control, traffic signal, roundabout)
- Provide traffic calming measures on OR 51-Monmouth Street approaching the intersection

Hoffman Road/Stryker Road

There is a perceived safety issues at the Hoffman Road/Stryker Road intersection where motorists disregard the right-turn only sign and turn left from Hoffman Road to Stryker Road. Potential alternatives include:

- Remove the right-turn only sign
- Reconfigure the intersection to reinforce the intent of the right-turn only sign
- Realign Hoffman Road at Stryker Road if/when redevelopment occurs
- Close Hoffman Road at Stryker Road – alternative access is provided to the east

Hoffman Road/Gun Club Road Intersection

There is an excess proportion of rear-end crashes that have occurred at this intersection and a high likelihood of future occurrence. In addition, the speed of vehicles on Hoffman Road is a perceived safety issue. Potential alternatives include:

- Install advance intersection warning signs and/or flashing beacons as advance warning
- Install street name signage on both sides of the road
- Install an eastbound dynamic speed feedback sign after entering Independence
- Evaluate need for traffic control modification (i.e. all-way stop-control, traffic signal, roundabout)
- Provide traffic calming measures on Hoffman Road approaching the intersection

Hoffman Road/16th Street Intersection

The speed of vehicles on Hoffman Road is a perceived safety issue. In addition, the eastbound approach was listed as a top 15 percent SPIS site per the most recent SPIS list (2017). Potential alternatives include:

- Install advance intersection warning signs and/or flashing beacons as advance warning
- Install street name signage on both sides of the road
- Evaluate need for traffic control modification (i.e. all-way stop-control, traffic signal, roundabout)
- Provide traffic calming measures on Hoffman Road approaching the intersection

Main Street/River Road Intersection

There is an excess proportion of rear-end crashes that have occurred at this intersection and a high likelihood of future occurrence. In addition, the speed of northbound vehicles on OR 51-Main Street is a perceived safety issue. Potential alternatives include:

- Install advance intersection warning signs and/or flashing beacons as advance warning
- Install dynamic advance warning signs and/or flashing beacons on the bridge
    - Dynamic warning signage could warn approaching drivers about queued vehicles or about cyclists sharing the road on the bridge
- Install street name signage on both sides of the road
- Install a northbound dynamic speed feedback sign after entering Independence
- Install a "Welcome to Independence" sign south of the intersection
- Evaluate need for traffic control modification (i.e. all-way stop-control, traffic signal, roundabout)
- Provide traffic calming measures on OR 51-Main Street approaching the intersection
- Conduct a speed study to evaluate ability to move the posted speed transition from 40 MPH to 30 MPH further south of the intersection (currently located approximate 250 feet south of the intersection)

OR 51-Main Street Segment (B Street to D Street – Downtown Area)

Pedestrian safety is a perceived issue at this location. Potential alternatives include:

- Install pedestrian crossing signage at all marked crosswalks
- Install bicycle facilities and/or shared roadway pavement markings
- Provide traffic calming measures on OR 51-Monmouth Street

OR 51-Monmouth Street Segment (Gun Club Road to Western City Limits)

This roadway segment exceeds the crash rate for similar facilities. Potential alternatives include:

- Install an eastbound dynamic speed feedback sign after entering Independence
- Install a "Welcome to Independence" sign for eastbound traffic
- Provide traffic calming measures on OR 51-Monmouth Street

Hoffman Road Segment (Airport Road to Western City Limits)

Speed is a perceived safety issue for this roadway segment. Potential alternatives include:

- Install dynamic speed feedback signage
- Provide traffic calming measures on Hoffman Road
- Reconfigure the roadway so that it feels more urban (i.e. narrower lanes travel lanes, bike lanes, plants street trees where there are gaps, etc.)

4th Street Segment (OR 51-Monmouth Street to Spruce Street)

This roadway segment exceeds the crash rate for similar facilities, and speed is a perceived safety issue. Potential alternatives include:

- Create new no parking zones on both sides of the street at intersections
- Install additional lighting at intersections
- Install bicycle facilities and/or shared roadway pavement markings
- Install street name signage on both sides of the road at intersections
- Provide traffic calming measures on 4th Street

6th Street Segment (OR 51-Monmouth Street to G Street)

Visibility is a perceived safety issue at this location, often due to parked vehicles. Potential alternatives include:

- Create new no parking zones on both sides of the street at intersections
- Install additional lighting at intersections

Stryker Road

Speed is a perceived safety issue for this roadway. Potential alternatives include:

- Install dynamic speed feedback signage
- Provide traffic calming measures on Stryker Road
- Enhanced signs and pavement markings for the roadway curve west of OR 51

Gun Club Road

Speed is a perceived safety issue for this roadway. Potential alternatives include:

- Install dynamic speed feedback signage
- Provide traffic calming measures on Gun Club Road

7th Street

Speed is a perceived safety issue for this roadway. Potential alternatives include:

- Install dynamic speed feedback signage
- Provide traffic calming measures on 7th Street

C Street

Speed is a perceived safety issue for this roadway. Potential alternatives include:

- Install dynamic speed feedback signage
- Provide traffic calming measures on C Street

Morning Glory Drive, Northgate Drive, and Marigold Drive

Speed is a perceived safety issue for this neighborhood. Potential alternatives include:

- Provide traffic calming measures on roadways

City-wide

In addition to the alternatives provided above to address location-specific safety issues, the following are potential city-wide alternatives to consider:

- Provide increased community education on sharing the road, both for drivers and bicyclists

- Review lighting and systemically provide additional lighting on arterial and collector street segments and at intersections throughout Independence
- Review sign reflectivity and visibility and systemically upgrade throughout Independence
- Install reflectorized back plates for all traffic signal heads
- Install green skip striping on arterial and collector roadways where bike lanes continue through major intersections
- Install enhanced pedestrian crossings on higher-speed and/or wider cross-section roadways (i.e. marked crossing with pedestrian refuge)

LOCAL STREET CONNECTIVITY AND EXTENSION PLAN

Most streets within Independence are classified as local streets. The local streets within downtown Independence and throughout most of the area south of Ash Creek were built on a grid system, while the local streets north of Ash Creek were built on a network of cul-de-sacs and stub streets, which limits the potential for future connections. These streets can be desirable to residents because they tend to have lower traffic volumes and travel speeds; however, cul-de-sacs and stub streets result in longer trip distances, increased reliance on arterials and collectors for local trips, and limited options for people to walk and bike to the places they want to go.

Incremental improvements to the street system can be planned carefully to provide route choices for motorists, cyclists, and pedestrians while accounting for potential neighborhood impacts. In addition, the quality of the transportation system can be improved by making connectivity improvements to the pedestrian and bicycle system separate from street connectivity, as discussed in the previous sections. The following summarizes the potential local street connection and extension opportunities within Independence.

Local Street Connections

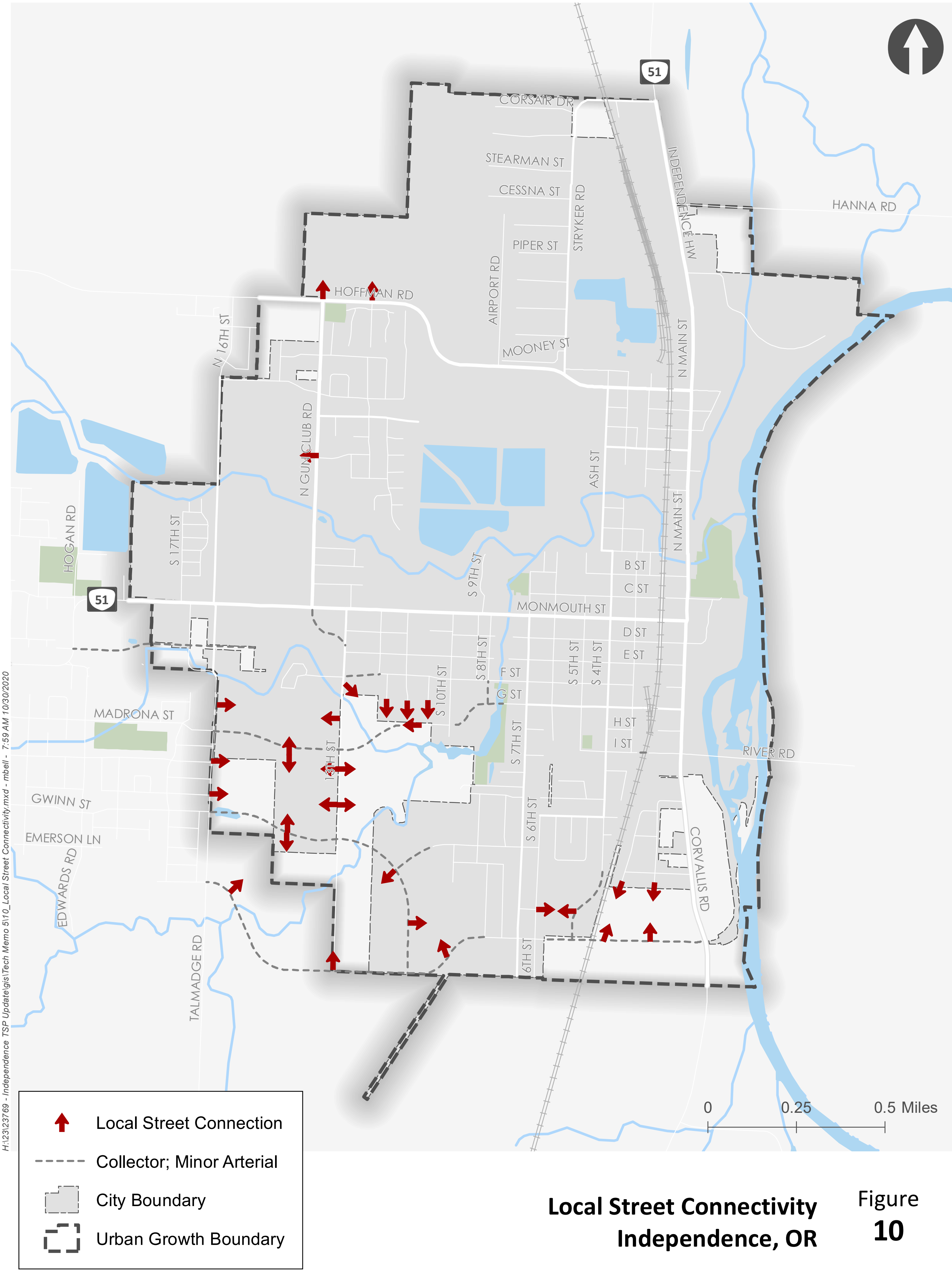
There are a number of areas within Independence that could experience future development or redevelopment, including in the southwest, south, and north parts of the City. Within these areas, there are opportunities for new local streets that could improve access and circulation for all travel modes. Figure 10 illustrates the location of the local street connections. The arrows shown in Figure 10 represent potential connections and the general direction for the placement of the connection. In each case, the specific alignments and design will be determined upon development review.

Street Extensions

In addition to new local streets, there are opportunities to extend existing streets as shown in Figure 10.

EMERGING TECHNOLOGIES

Transportation technologies are rapidly evolving, and cities are evaluating what steps they can take to be prepared. The challenge is that most emerging technologies are initiated by the private sector and can be difficult to predict. So how can cities use their money efficiently while also seeing the benefits of emerging technology? The following summarizes several steps the City can take to prepare for emerging technology.



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Local Street Connectivity
Independence, OR

Figure
10

Data Source: Polk County Data Portal, ODOT

Emerging Technologies

Transportation Technology Liaison

A transportation technology liaison is someone who facilitates connections between the city and private sector companies offering various forms of emerging technologies. The liaison could be a City employee, an employee of a public or private organization, or a private contractor. The liaison role could also be developed in coordination with City of Monmouth, Western Oregon University, and/or others (see stakeholder connection for more potential roles and responsibilities of the liaison).

Public Partnerships

Public partnerships are strategic partnerships with public entities in the region, state, or nation which can provide value to the City in the form of collaboration or other means depending on the partnership. The two primary public partnerships which may be most beneficial to the City are university partnerships and city partnerships.

- University partnership can be beneficial to the City by providing them with a direct connection to students and research programs. In addition, the partnership can create student interest and engagement with the City and encourage students to come to Independence after completing their studies.
- City partnership can be beneficial to the City by allowing them to pool resources and collaborate on emerging technologies and to support users in the region so that emerging technologies do not stop at the city limits.

Private Sector Incentives

Private sector incentives are incentives provided to private sector companies that focus on emerging technologies to encourage them to operate in the City. These incentives could include financial assistance to help with the start-up cost or other incentives that lower the bar for operating within the City.

Private Sector Policies

As emerging technologies are primarily initiated by private sector companies, cities need to find a way to effectively work with these companies if they want to be supported by the emerging technologies. The primary connecting point of cities and private sector companies is through policy. Currently, the prime example of this interaction can be found in cities with micro mobility services, such as e-scooters. However, as private sector companies advance autonomous vehicle fleets and other technologies, these policies could become instrumental in maintaining a healthy transportation network. For example, policies that prevent an autonomous vehicle from using a specific cut through route and prioritizing routes that utilize the City's arterial network.

Review Current Policies

In addition to crafting new policy to accommodate emerging technologies, the review of current policies can be an effective first step to prepare the city for emerging technologies. Cities preparing for emerging technologies should review their current policies through the lens of the future technology they plan to accommodate. If the policy hinders or prohibits the desired future technology, alterations should be considered for that policy. Specifically, a review of the development code can be effective to find and alter policies that could prevent future flexible use areas as many innovative technologies push the boundaries of traditional land uses.

Technology Incubators and Startup Labs

As a focus on creative problem solving has emerged and startup businesses have begun to gain popularity, Technology Incubators and Startup Labs have become an effective means to foster innovation and entrepreneurship. Technology Incubators (commonly referred to as Incubators) and Startup Labs provide infrastructure for new ideas and emerging businesses to grow.

Infrastructure

Investing in new infrastructure is often the first step cities take in preparing for emerging technologies. However, as emerging technologies are driven by the private sector, they can change rapidly and may not require major changes to the existing system to be effective. The following summarizes infrastructure improvements that could be useful to consider now in anticipation of the future transportation system.

- **EV Charging Stations** – Electric vehicle (EV) charging stations could be provided in many areas throughout the city to support the growing use of electric vehicles. EV charging stations could be a requirement of private development
- **Curb Management** – As the city develops, curb management will become more important to ensure an efficient use of the space. When an autonomous fleet becomes available to cities, parking in the quantity it is provided today will likely not be necessary. The City should begin to make plans for adaptive reuse of parking areas and find alternative uses for parking around the city, especially near mobility hubs. Considerations for pick-up drop-off zones at key destinations that are more likely to be used by mobility on demand, ride sharing, and taxi services.

Connect with Stakeholders about Emerging Technologies

When adopting emerging technologies into the transportation system, it is important to connect with stakeholders prior to adoption to ensure the service can be offered throughout the city and surrounding area. The transportation needs of the community are not contained within the UGB of the city nor are the needs contained to only streets owned and operated by the City. Key stakeholders for the City include local residents, the City of Monmouth, Polk County, and ODOT.

Mobility on Demand & Innovative Transit

Technology advances in ride hailing and other forms of transit (transportation with vehicles not owned by the user) have allowed for some innovative solutions to challenges that have been present in transportation systems for decades. These new transportation services are all in various phases of development and therefore some may not be practical at this time. A common service available now are services that offer mobility on demand such as Uber and Lyft. Mobility on demand is an effective way to offer a transportation alternative that is generally accepted among users around the world already. The addition of mobility on demand offers users a means to go directly from point A to point B without the need to park or return to a specific destination. Establishing these services in the area can also be used as an effective means to set up the city for a future autonomous shuttle service. Multiple mobility on demand service providers have programs developing autonomous technology. If a public-private relationship can be formed and Independence can be included in the service area, then this can open the door for an autonomous shuttle fleet that is funded/provided via private sector funding and through good policy practices these services can be regulated to function in the best interest of the city.

Mobility Hubs

Another major step Independence can take now is establishing mobility hubs within the city. Designating them early and building the infrastructure needed to support them is important to the success of the mobility hubs. As a first step in the formation of mobility hubs the City of Independence should identify one primary as well as one secondary mobility hub. The primary will be the priority for transportation infrastructure in the City of Independence and the secondary will be developed when funding already satisfies the needs of the primary. Due to the waterfront plan and recent development in the area, the downtown/waterfront area should be the primary mobility hub and a potential secondary hub could be located somewhere in the vicinity of the airport or somewhere in the developing southwest concept area.

Emerging Technology Alternatives

The following summarizes a list of discrete steps (primarily planning and policy related) that the City can take to be prepared for the emergence of new transportation technologies.

- Create a Transportation Technology Liaison Role: This role should be in conjunction with Monmouth and serve to carry out the listed tasks below.
- Connect with cities in the surrounding area (Salem and Monmouth), establish a service zone for any emerging technology coming to the area.
- Develop partnerships and programs with Western Oregon University to attract students.
- Review the development code and create avenues for flexible uses.
- Hold public outreach to determine which emerging technologies local residents are interested in.
- Meet with ODOT, City of Monmouth, Polk County and any other relevant jurisdictions in the surrounding area and discuss emerging technologies.
- Establish a primary and secondary mobility hub in the City.
- Consider adding EV charging requirement to development code.
- Invest in pick-up drop-off loops and adaptive reuse design for any parking structures/lots.
- Allow multiple ride-hailing services and micromobility services (E-scooters, bike share, etc.) to be established in Independence.

PARKING

Parking in downtown Independence is provided along both sides of most streets, including OR 51-Main Street and OR 51-Monmouth Street. Parking is also provided in several public and private off-street parking lots. There are currently no limitations or restrictions on the use of the on-street or off-street parking stalls, in terms of who can park there and for how long. The following summarizes potential alternatives considered to address parking in downtown Independence.

- Prepare a municipal parking management plan for downtown Independence. The plan should consider the following parking management strategies:
    - Truck loading zones, taxi zones, zones for rideshare vehicles (i.e. Uber, Lyft)
    - Time limits (2-hours, 30 minutes, 15 minute) in the marked stalls on OR 51
    - Disabled parking (location and design)
    - Parking enforcement policies and strategies

- Work with local business owners to establish parking areas for employees.
- Develop how to park resources and parking maps

FUNDING PROGRAMS

The following summarizes current and potential future funding sources for transportation improvements.

Current Transportation Funding Sources

State Revenue

The primary state revenue source is the state gas tax. State gas taxes are comprised of proceeds from excise taxes imposed by the state and federal government to generate revenue for transportation funding. The proceeds from these taxes are distributed to Oregon counties and cities in accordance with Oregon Revised Statute (ORS) 366.764, by county registered vehicle number, and ORS 366.805, by city population. The Oregon Constitution states that revenue from the state gas tax is to be used for the construction, reconstruction, improvement, maintenance, operation and use of public highways, roads, streets, and roadside rest areas.

Local Revenue

The primary local revenue source is from Transportation SDCs. Transportation SDCs are fees assessed on developments for impacts to the transportation infrastructure. All revenue is dedicated to transportation capital improvement projects designed to accommodate growth. The City can offer SDC credits to developers that provide public improvements beyond the required street frontage, including those that can be constructed by the private sector at a lower cost. For example, SDC credits might be given for providing off-site improvements, such as sidewalks and bike lanes that connect the site to nearby transit stops. Independence uses the revenue from SDCs on eligible projects that cannot be funded by other means.

Potential Transportation Funding Sources

Based on the current transportation funding sources identified above, Independence will likely need to identify additional funding sources that can be dedicated to transportation-related capital improvement projects over the next 20 years. The City will likely rely upon transportation improvements grants, partnerships with regional and state agencies, and other funding sources to help implement future transportation-related improvements. Table 4 summarizes the funding opportunities and identifies the intended use of the funds and any applicable project types. Attachment C contains detailed descriptions of the funding opportunities identified below.

Table 4: Funding Opportunities Summary

Funding Source	Intended Use
Federal Sources	
FAST Act	Road, bridge, bicycling, and pedestrian improvements
STBG	Preserve and improve surface transportation investments from a flexible funding source
TA Set-Aside	Smaller-scale transportation projects
CMAQ	Support programs that reduce emissions from transportation-related activities

HSIP	Reduce traffic fatalities and serious injuries on all public roads
BUILD	Road, rail, transit, and port projects that achieve national objectives and have significant local and regional impact
Recreational Trails	Develop and maintain recreational trails and trail-related facilities
NHPP	Projects that improve conditions along NHS Routes
State Sources	
STIP	Multi-modal projects on federal, state, and local facilities
State Highway Trust Fund	Bicycle and pedestrian infrastructure improvements
SWIP	Projects that enable people to move across or around the state highway system
SRTS	Projects that improve safety for children walking or biking to school
ARTS	Projects that address hotspot and systemic safety issues and concerns (roadway departure, intersection safety, and bicycle and pedestrian safety); part of STIP program and utilizes federal HSIP funds
OCP	Create and maintain connections through shared-use paths
HB 2017	Create a steady funding stream for statewide transportation improvements
MAT *Rules to be established in 2020**	Expected to support bicycle and pedestrian infrastructure improvements
Local Sources	
SDC	Increase capacity of transportation system to accommodate growth
TUF	Provide additional funding for transportation infrastructure
Local Fuel Tax	Adds a tax on top of gasoline costs that support street operation, maintenance, and preservation
Local Improvement Districts (LIDs)	Pools funds from property owners to make local transportation improvements
Economic Improvement Districts (EIDs)	Pools funds from area businesses to make improvements in the business district.
Urban Renewal/Tax Increment Financing	Raises revenue from increased property values in an area to fund localized improvements
Local Bond Measures	Asks voters for bond funding to finance a set list of infrastructure investments
Street Utility Fee/Road Maintenance Fee	Calculates trips generated for land uses and charges owners a fee relative to the number of trips

Southwest Independence Concept Area

The Southwest Independence Concept Area has special funding considerations because the transportation system does not currently extend into this area. Therefore, there are major investments that will need to be made as development occurs, specifically facilities that provide connectivity for vehicles, pedestrians, and bicyclists. In addition to the funding sources that will be available city-wide, funding sources that may be more specifically targeted to the Southwest Independence Concept Area include the following (all previously described above):

- Better Utilizing Investments to Leverage Development (BUILD) Grant
- Recreational Trails Program
- Statewide Transportation Improvement Program (STIP)

- Safe Routes to School Program (SRTS)
- Oregon Community Paths Program (OCP)
- House Bill (HB) 2017 Transportation Investments
- Multimodal Active Transportation Fund (MAT)
- System Development Charges (SDC)/Transportation Impact Fees
- Local Improvement Districts (LID)

The Southwest Independence Concept Plan also outlined the following mechanisms around cost-sharing approaches as this area develops:

- Require developers to provide for local streets, as well as water, wastewater and stormwater facilities required to serve proposed development, consistent with existing city Comprehensive Plan policies and code provisions.
- Generally, use the City's system development charges to pay for system-wide improvements associated with new growth, including growth and development in the planning area.
- The extent that some needed improvements are not currently included in the Capital Improvement Plans associated with those SDCs, the CIPs and SDC methodologies and/or fees may need to be updated to accurately reflect the cost of improvements needed in the Planning Area or elsewhere, including the following:
    - Collector and arterial roads in the Planning Area
- Use of rough proportionality requirements to ensure that developers construct or pay for their proportional share of new collector and arterial roads within the Planning Area to the extent that they are needed to serve development within that area.
- Consider use of development agreements to clarify responsibilities for funding and constructing new improvements, including cost-sharing among multiple property owners.
- Consider use of "late-comers" agreements to identify how property owners or developers may be reimbursed for a portion of the cost of a needed improvement if the improvement also will benefit other future development but must be constructed before that development occurs.
- Consider the establishment of a Local Improvement District (LID) so that a group of property owners can share in the cost of transportation infrastructure improvements or other types of public improvements such as installing water and sanitary sewer lines.

DEVELOPMENT CODE AMENDMENTS

Oregon Administrative Rule (OAR) 660, Division 12, also known as the Transportation Planning Rule (TPR), defines the necessary elements of a local TSP and how to implement Statewide Planning Goal 12 – Transportation. The overall purpose of the TPR is to provide and encourage a safe, convenient, and economic transportation system. The rule also implements provisions of other statewide planning goals related to transportation planning in order to plan and develop transportation facilities and services in close coordination with urban and rural development. The TPR directs TSPs to integrate comprehensive land use planning with transportation needs and to promote multi-modal systems that make it more convenient for people to walk, bicycle, use transit and drive less. The Independence TSP must be consistent with the TPR, which was amended most recently in 2010.

The TPR requires cities to prepare local TSPs that are consistent with the Oregon Transportation Plan (OTP); Technical Memorandum #1 (Plans and Policy Review) addresses the OTP and other background documents that will be referenced in updating the TSP. Attachment C contains a review of the City's Development Code for compliance with the TPR.. The table contained in Attachment C describes how city development requirements meet particular TPR sections. The table provides a list of recommended Development Code amendments, recommended modifications that may be necessary to implement the updated TSP or where local requirements could be strengthened to be more consistent with the TPR. To the extent necessary, suggested draft code language will be prepared at the implementation phase of the TSP update project that supports the policies and recommendations of the draft TSP.

TRANSPORTATION DEMAND MANAGEMENT

Transportation Demand Management (TDM) is a general term used to describe any action that removes single occupancy vehicle (SOV) trips from the roadway during peak time periods. As population and employment increase in the city, the number of trips will also increase. The ability to change travel behavior and provide alternative modes will help accommodate the growth in trips without the need for significant investments in new infrastructure. A major focus of TDM is on major employers; however, there are many things the City can do to support TDM implementation. The following summarizes TDM alternatives that can be applied by the City.

- Learn about TDM and the role it can play in achieving local planning objectives
- Encourage and require local businesses to implement TDM solutions
- Work to build partnerships with community organizations to support TDM implementation.
- Help create TDM programs to provide local TDM services
- Improve non-motorized transportation facilities, public transit services, and other transportation services
- Support carshare, ridesharing, bikeshare, e-scooters, and other micromobility services
- Apply more comprehensive transportation planning, including multimodal level of service indicators when evaluating transportation improvements
- Implement TDM strategies, such as commute trip reductions programs for employees, and special transportation management when sponsoring events that attract crowds.

TDM strategies help achieve many of the City's goals, including reduced traffic congestion, reduced parking demand, improved mobility for non-drivers, improved community livability, improved public fitness and health, and others.

ATTACHMENTS

A. Intersection Operations Analysis Worksheets
B. Enhanced Crossing Treatments
C. Development Code Review

Attachment A Intersection Operations Analysis Worksheets

Intersection	
Int Delay, s/veh	15.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	120	2	102	6	2	4	99	444	4	8	499	139
Future Vol, veh/h	120	2	102	6	2	4	99	444	4	8	499	139
Conflicting Peds, #/hr	0	0	9	9	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	-	-	-	100	-	-	200	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	6	0	2	0	0	0	1	5	0	0	2	3
Mvmt Flow	126	2	107	6	2	4	104	467	4	8	525	146

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1294	1293	607	1355	1364	469	671	0	0	471	0	0
Stage 1	614	614	-	677	677	-	-	-	-	-	-	-
Stage 2	680	679	-	678	687	-	-	-	-	-	-	-
Critical Hdwy	7.16	6.5	6.22	7.1	6.5	6.2	4.11	-	-	4.1	-	-
Critical Hdwy Stg 1	6.16	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.16	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.554	4	3.318	3.5	4	3.3	2.209	-	-	2.2	-	-
Pot Cap-1 Maneuver	137	164	496	128	149	598	924	-	-	1101	-	-
Stage 1	472	486	-	446	455	-	-	-	-	-	-	-
Stage 2	434	454	-	445	450	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 122	144	492	89	131	598	924	-	-	1101	-	-
Mov Cap-2 Maneuver	~ 122	144	-	89	131	-	-	-	-	-	-	-
Stage 1	419	483	-	396	404	-	-	-	-	-	-	-
Stage 2	380	403	-	341	447	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	92.7	34.6	1.7	0.1
HCM LOS	F	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	924	-	-	122	470	134	1101	-	-
HCM Lane V/C Ratio	0.113	-	-	1.035	0.233	0.094	0.008	-	-
HCM Control Delay (s)	9.4	-	-	160	15	34.6	8.3	-	-
HCM Lane LOS	A	-	-	F	C	D	A	-	-
HCM 95th %tile Q(veh)	0.4	-	-	7.2	0.9	0.3	0	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	120	2	102	6	2	4	99	444	4	8	499	139
Future Vol, veh/h	120	2	102	6	2	4	99	444	4	8	499	139
Conflicting Peds, #/hr	0	0	9	9	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	-	200	-	-
Veh in Median Storage, #	-	1	-	-	1	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	6	0	2	0	0	0	1	5	0	0	2	3
Mvmt Flow	126	2	107	6	2	4	104	467	4	8	525	146

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1294	1293	607	1355	1364	469	671	0	0	471	0	0
Stage 1	614	614	-	677	677	-	-	-	-	-	-	-
Stage 2	680	679	-	678	687	-	-	-	-	-	-	-
Critical Hdwy	7.16	6.5	6.22	7.1	6.5	6.2	4.11	-	-	4.1	-	-
Critical Hdwy Stg 1	6.16	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.16	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.554	4	3.318	3.5	4	3.3	2.209	-	-	2.2	-	-
Pot Cap-1 Maneuver	137	164	496	128	149	598	924	-	-	1101	-	-
Stage 1	472	486	-	446	455	-	-	-	-	-	-	-
Stage 2	434	454	-	445	450	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 123	144	492	90	131	598	924	-	-	1101	-	-
Mov Cap-2 Maneuver	236	263	-	173	229	-	-	-	-	-	-	-
Stage 1	419	483	-	396	404	-	-	-	-	-	-	-
Stage 2	380	403	-	341	447	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	45.7	20.9	1.7	0.1
HCM LOS	E	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	924	-	-	310	239	1101	-	-
HCM Lane V/C Ratio	0.113	-	-	0.761	0.053	0.008	-	-
HCM Control Delay (s)	9.4	-	-	45.7	20.9	8.3	-	-
HCM Lane LOS	A	-	-	E	C	A	-	-
HCM 95th %tile Q(veh)	0.4	-	-	5.8	0.2	0	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	120	2	102	6	2	4	99	444	4	8	499	139
Future Vol, veh/h	120	2	102	6	2	4	99	444	4	8	499	139
Conflicting Peds, #/hr	0	0	9	9	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	-	-	-	100	-	-	200	-	-
Veh in Median Storage, #	-	1	-	-	1	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	6	0	2	0	0	0	1	5	0	0	2	3
Mvmt Flow	126	2	107	6	2	4	104	467	4	8	525	146

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1294	1293	607	1355	1364	469	671	0	0	471	0	0
Stage 1	614	614	-	677	677	-	-	-	-	-	-	-
Stage 2	680	679	-	678	687	-	-	-	-	-	-	-
Critical Hdwy	7.16	6.5	6.22	7.1	6.5	6.2	4.11	-	-	4.1	-	-
Critical Hdwy Stg 1	6.16	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.16	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.554	4	3.318	3.5	4	3.3	2.209	-	-	2.2	-	-
Pot Cap-1 Maneuver	137	164	496	128	149	598	924	-	-	1101	-	-
Stage 1	472	486	-	446	455	-	-	-	-	-	-	-
Stage 2	434	454	-	445	450	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 123	144	492	90	131	598	924	-	-	1101	-	-
Mov Cap-2 Maneuver	236	263	-	173	229	-	-	-	-	-	-	-
Stage 1	419	483	-	396	404	-	-	-	-	-	-	-
Stage 2	380	403	-	341	447	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	26.4	20.9	1.7	0.1
HCM LOS	D	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	924	-	-	236	484	239	1101	-	-
HCM Lane V/C Ratio	0.113	-	-	0.535	0.226	0.053	0.008	-	-
HCM Control Delay (s)	9.4	-	-	36.6	14.6	20.9	8.3	-	-
HCM Lane LOS	A	-	-	E	B	C	A	-	-
HCM 95th %tile Q(veh)	0.4	-	-	2.9	0.9	0.2	0	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Intersection Delay, s/veh	9.1
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	235	12	575	679
Demand Flow Rate, veh/h	245	12	599	694
Vehicles Circulating, veh/h	549	729	144	113
Vehicles Exiting, veh/h	257	14	650	628
Ped Vol Crossing Leg, #/h	0	0	9	0
Ped Cap Adj	1.000	1.000	0.999	1.000
Approach Delay, s/veh	8.4	5.7	8.8	9.6
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	245	12	599	694
Cap Entry Lane, veh/h	788	656	1191	1230
Entry HV Adj Factor	0.959	1.000	0.959	0.979
Flow Entry, veh/h	235	12	575	679
Cap Entry, veh/h	756	656	1142	1204
V/C Ratio	0.311	0.018	0.503	0.564
Control Delay, s/veh	8.4	5.7	8.8	9.6
LOS	A	A	A	A
95th %tile Queue, veh	1	0	3	4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	120	2	102	6	2	4	99	444	4	8	499	139
Future Volume (veh/h)	120	2	102	6	2	4	99	444	4	8	499	139
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.97	0.98		0.97	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1668	1750	1723	1750	1750	1750	1736	1682	1750	1750	1723	1709
Adj Flow Rate, veh/h	126	2	107	6	2	4	104	467	4	8	525	146
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	6	0	2	0	0	0	1	5	0	0	2	3
Cap, veh/h	476	5	252	245	84	81	443	955	8	606	744	207
Arrive On Green	0.18	0.18	0.18	0.18	0.18	0.18	0.57	0.57	0.57	0.57	0.57	0.57
Sat Flow, veh/h	1337	27	1423	435	475	455	773	1665	14	937	1297	361
Grp Volume(v), veh/h	126	0	109	12	0	0	104	0	471	8	0	671
Grp Sat Flow(s),veh/h/ln	1337	0	1450	1365	0	0	773	0	1679	937	0	1658
Q Serve(g_s), s	0.2	0.0	2.1	0.0	0.0	0.0	3.6	0.0	5.3	0.2	0.0	9.3
Cycle Q Clear(g_c), s	2.4	0.0	2.1	2.1	0.0	0.0	12.9	0.0	5.3	5.5	0.0	9.3
Prop In Lane	1.00		0.98	0.50		0.33	1.00		0.01	1.00		0.22
Lane Grp Cap(c), veh/h	476	0	257	410	0	0	443	0	963	606	0	951
V/C Ratio(X)	0.26	0.00	0.42	0.03	0.00	0.00	0.23	0.00	0.49	0.01	0.00	0.71
Avail Cap(c_a), veh/h	989	0	813	946	0	0	819	0	1779	1061	0	1756
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.8	0.0	11.7	10.9	0.0	0.0	9.5	0.0	4.1	5.7	0.0	4.9
Incr Delay (d2), s/veh	0.3	0.0	1.1	0.0	0.0	0.0	0.3	0.0	0.4	0.0	0.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	0.6	0.1	0.0	0.0	0.4	0.0	0.5	0.0	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	12.1	0.0	12.8	11.0	0.0	0.0	9.8	0.0	4.4	5.7	0.0	5.9
LnGrp LOS	B	A	B	B	A	A	A	A	A	A	A	A
Approach Vol, veh/h		235			12			575			679	
Approach Delay, s/veh		12.5			11.0			5.4			5.9	
Approach LOS		B			B			A			A	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		22.4		9.7		22.4		9.7				
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0				
Max Green Setting (Gmax), s		34.0		18.0		34.0		18.0				
Max Q Clear Time (g_c+I1), s		14.9		4.4		11.3		4.1				
Green Ext Time (p_c), s		3.5		0.9		4.8		0.0				

Intersection Summary			
HCM 6th Ctrl Delay			6.8
HCM 6th LOS			A

Intersection	
Intersection Delay, s/veh	33
Intersection LOS	D

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	254	257	280	257	285	262
Future Vol, veh/h	254	257	280	257	285	262
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	3	1	0	4	4	2
Mvmt Flow	267	271	295	271	300	276
Number of Lanes	1	0	1	1	1	1

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	2	2
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	2	1	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	2	0	1
HCM Control Delay	57.7	22.6	20
HCM LOS	F	C	C

Lane	NBLn1	NBLn2	EBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	50%	0%	0%
Vol Thru, %	0%	100%	0%	100%	0%
Vol Right, %	0%	0%	50%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	280	257	511	285	262
LT Vol	280	0	254	0	0
Through Vol	0	257	0	285	0
RT Vol	0	0	257	0	262
Lane Flow Rate	295	271	538	300	276
Geometry Grp	7	7	2	7	7
Degree of Util (X)	0.658	0.57	0.975	0.636	0.526
Departure Headway (Hd)	8.032	7.585	6.527	7.628	6.868
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	451	476	559	474	524
Service Time	5.783	5.336	4.527	5.377	4.618
HCM Lane V/C Ratio	0.654	0.569	0.962	0.633	0.527
HCM Control Delay	25	20	57.7	22.8	17
HCM Lane LOS	C	C	F	C	C
HCM 95th-tile Q	4.6	3.5	13.4	4.4	3

Intersection	
Intersection Delay, s/veh	19.9
Intersection LOS	C

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	254	257	280	257	285	262
Future Vol, veh/h	254	257	280	257	285	262
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	3	1	0	4	4	2
Mvmt Flow	267	271	295	271	300	276
Number of Lanes	1	1	1	1	1	1

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	2	2
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	2	2	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	2	0	2
HCM Control Delay	19.5	21.3	19
HCM LOS	C	C	C

Lane	NBLn1	NBLn2	EBLn1	EBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	100%	0%	0%	0%
Vol Thru, %	0%	100%	0%	0%	100%	0%
Vol Right, %	0%	0%	0%	100%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	280	257	254	257	285	262
LT Vol	280	0	254	0	0	0
Through Vol	0	257	0	0	285	0
RT Vol	0	0	0	257	0	262
Lane Flow Rate	295	271	267	271	300	276
Geometry Grp	7	7	7	7	7	7
Degree of Util (X)	0.64	0.554	0.602	0.514	0.619	0.511
Departure Headway (Hd)	7.819	7.376	8.105	6.843	7.428	6.674
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	463	490	447	528	486	541
Service Time	5.555	5.111	5.836	4.574	5.163	4.408
HCM Lane V/C Ratio	0.637	0.553	0.597	0.513	0.617	0.51
HCM Control Delay	23.5	18.9	22.4	16.6	21.5	16.2
HCM Lane LOS	C	C	C	C	C	C
HCM 95th-tile Q	4.4	3.3	3.9	2.9	4.1	2.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	254	257	280	257	285	262
Future Volume (veh/h)	254	257	280	257	285	262
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	0.99	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1709	1736	1750	1695	1695	1723
Adj Flow Rate, veh/h	267	271	295	271	300	276
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	1	0	4	4	2
Cap, veh/h	202	205	309	244	524	482
Arrive On Green	0.27	0.27	0.64	0.64	0.64	0.64
Sat Flow, veh/h	756	767	386	379	813	748
Grp Volume(v), veh/h	539	0	566	0	0	576
Grp Sat Flow(s),veh/h/ln	1526	0	764	0	0	1561
Q Serve(g_s), s	24.0	0.0	39.3	0.0	0.0	18.7
Cycle Q Clear(g_c), s	24.0	0.0	58.0	0.0	0.0	18.7
Prop In Lane	0.50	0.50	0.52			0.48
Lane Grp Cap(c), veh/h	407	0	553	0	0	1006
V/C Ratio(X)	1.32	0.00	1.02	0.00	0.00	0.57
Avail Cap(c_a), veh/h	407	0	553	0	0	1006
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	33.0	0.0	26.5	0.0	0.0	9.0
Incr Delay (d2), s/veh	162.2	0.0	44.2	0.0	0.0	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	27.0	0.0	19.1	0.0	0.0	5.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	195.2	0.0	70.6	0.0	0.0	9.8
LnGrp LOS	F	A	F	A	A	A
Approach Vol, veh/h	539			566	576	
Approach Delay, s/veh	195.2			70.6	9.8	
Approach LOS	F			E	A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		62.0		28.0		62.0
Change Period (Y+Rc), s		4.0		4.0		4.0
Max Green Setting (Gmax), s		58.0		24.0		58.0
Max Q Clear Time (g_c+I1), s		60.0		26.0		20.7
Green Ext Time (p_c), s		0.0		0.0		5.0

Intersection Summary						
HCM 6th Ctrl Delay			89.7			
HCM 6th LOS			F			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	254	257	280	257	285	262
Future Volume (veh/h)	254	257	280	257	285	262
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1709	1736	1750	1695	1695	1723
Adj Flow Rate, veh/h	267	271	295	271	300	276
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	1	0	4	4	2
Cap, veh/h	335	302	363	299	569	523
Arrive On Green	0.21	0.21	0.70	0.70	0.70	0.70
Sat Flow, veh/h	1628	1471	427	428	813	748
Grp Volume(v), veh/h	267	271	566	0	0	576
Grp Sat Flow(s),veh/h/ln	1628	1471	854	0	0	1561
Q Serve(g_s), s	13.1	15.1	39.1	0.0	0.0	14.8
Cycle Q Clear(g_c), s	13.1	15.1	53.9	0.0	0.0	14.8
Prop In Lane	1.00	1.00	0.52			0.48
Lane Grp Cap(c), veh/h	335	302	662	0	0	1092
V/C Ratio(X)	0.80	0.90	0.85	0.00	0.00	0.53
Avail Cap(c_a), veh/h	348	314	728	0	0	1185
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	31.8	32.6	17.4	0.0	0.0	6.0
Incr Delay (d2), s/veh	12.0	25.9	9.1	0.0	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.2	7.5	11.0	0.0	0.0	4.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	43.8	58.5	26.5	0.0	0.0	6.4
LnGrp LOS	D	E	C	A	A	A
Approach Vol, veh/h	538			566	576	
Approach Delay, s/veh	51.2			26.5	6.4	
Approach LOS	D			C	A	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		63.0		21.3		63.0
Change Period (Y+Rc), s		4.0		4.0		4.0
Max Green Setting (Gmax), s		64.0		18.0		64.0
Max Q Clear Time (g_c+I1), s		55.9		17.1		16.8
Green Ext Time (p_c), s		3.0		0.2		5.1

Intersection Summary			
HCM 6th Ctrl Delay			27.5
HCM 6th LOS			C

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	254	257	280	257	285	262
Future Volume (veh/h)	254	257	280	257	285	262
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	0.99	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1709	1736	1750	1695	1695	1723
Adj Flow Rate, veh/h	267	271	295	271	300	276
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	1	0	4	4	2
Cap, veh/h	261	265	331	257	961	827
Arrive On Green	0.34	0.34	0.57	0.57	0.57	0.57
Sat Flow, veh/h	757	768	476	453	1695	1460
Grp Volume(v), veh/h	539	0	566	0	300	276
Grp Sat Flow(s),veh/h/ln	1528	0	929	0	1695	1460
Q Serve(g_s), s	31.0	0.0	42.6	0.0	8.4	9.1
Cycle Q Clear(g_c), s	31.0	0.0	51.0	0.0	8.4	9.1
Prop In Lane	0.50	0.50	0.52			1.00
Lane Grp Cap(c), veh/h	526	0	587	0	961	827
V/C Ratio(X)	1.02	0.00	0.96	0.00	0.31	0.33
Avail Cap(c_a), veh/h	526	0	587	0	961	827
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	29.5	0.0	24.7	0.0	10.3	10.4
Incr Delay (d2), s/veh	45.6	0.0	28.1	0.0	0.2	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	17.7	0.0	16.6	0.0	3.0	2.8
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	75.1	0.0	52.8	0.0	10.5	10.7
LnGrp LOS	F	A	D	A	B	B
Approach Vol, veh/h	539			566	576	
Approach Delay, s/veh	75.1			52.8	10.5	
Approach LOS	E			D	B	

Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		55.0		35.0		55.0
Change Period (Y+Rc), s		4.0		4.0		4.0
Max Green Setting (Gmax), s		51.0		31.0		51.0
Max Q Clear Time (g_c+I1), s		53.0		33.0		11.1
Green Ext Time (p_c), s		0.0		0.0		3.2

Intersection Summary						
HCM 6th Ctrl Delay			45.5			
HCM 6th LOS			D			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	254	257	280	257	285	262
Future Volume (veh/h)	254	257	280	257	285	262
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	0.99	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1709	1736	1750	1695	1695	1723
Adj Flow Rate, veh/h	267	271	295	271	300	276
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	1	0	4	4	2
Cap, veh/h	261	265	346	961	461	424
Arrive On Green	0.34	0.34	0.57	0.57	0.57	0.57
Sat Flow, veh/h	757	768	850	1695	813	748
Grp Volume(v), veh/h	539	0	295	271	0	576
Grp Sat Flow(s),veh/h/ln	1528	0	850	1695	0	1561
Q Serve(g_s), s	31.0	0.0	28.2	7.4	0.0	22.8
Cycle Q Clear(g_c), s	31.0	0.0	51.0	7.4	0.0	22.8
Prop In Lane	0.50	0.50	1.00			0.48
Lane Grp Cap(c), veh/h	526	0	346	961	0	884
V/C Ratio(X)	1.02	0.00	0.85	0.28	0.00	0.65
Avail Cap(c_a), veh/h	526	0	346	961	0	884
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	29.5	0.0	32.3	10.1	0.0	13.4
Incr Delay (d2), s/veh	45.6	0.0	18.0	0.2	0.0	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	17.7	0.0	8.3	2.7	0.0	7.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	75.1	0.0	50.3	10.2	0.0	15.1
LnGrp LOS	F	A	D	B	A	B
Approach Vol, veh/h	539			566	576	
Approach Delay, s/veh	75.1			31.1	15.1	
Approach LOS	E			C	B	
Timer - Assigned Phs		2		4		6
Phs Duration (G+Y+Rc), s		55.0		35.0		55.0
Change Period (Y+Rc), s		4.0		4.0		4.0
Max Green Setting (Gmax), s		51.0		31.0		51.0
Max Q Clear Time (g_c+I1), s		53.0		33.0		24.8
Green Ext Time (p_c), s		0.0		0.0		4.7
Intersection Summary						
HCM 6th Ctrl Delay			39.7			
HCM 6th LOS			D			

Intersection	
Intersection Delay, s/veh	49.5
Intersection LOS	E

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	254	257	0	523	285	0
Future Vol, veh/h	254	257	0	523	285	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	3	1	0	4	4	2
Mvmt Flow	267	271	0	551	300	0
Number of Lanes	1	0	0	1	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	1	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	1	0	1
HCM Control Delay	52.4	63	19.6
HCM LOS	F	F	C

Lane	NBLn1	EBLn1	SBLn1
Vol Left, %	0%	50%	0%
Vol Thru, %	100%	0%	100%
Vol Right, %	0%	50%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	523	511	285
LT Vol	0	254	0
Through Vol	523	0	285
RT Vol	0	257	0
Lane Flow Rate	551	538	300
Geometry Grp	1	1	1
Degree of Util (X)	0.996	0.953	0.584
Departure Headway (Hd)	6.51	6.378	7.008
Convergence, Y/N	Yes	Yes	Yes
Cap	556	570	513
Service Time	4.573	4.433	5.084
HCM Lane V/C Ratio	0.991	0.944	0.585
HCM Control Delay	63	52.4	19.6
HCM Lane LOS	F	F	C
HCM 95th-tile Q	14.2	12.6	3.7

Intersection	
Intersection Delay, s/veh	49.5
Intersection LOS	E

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	254	257	0	523	285	0
Future Vol, veh/h	254	257	0	523	285	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	3	1	0	4	4	2
Mvmt Flow	267	271	0	551	300	0
Number of Lanes	1	0	0	1	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	1	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	1	0	1
HCM Control Delay	52.4	63	19.6
HCM LOS	F	F	C

Lane	NBLn1	EBLn1	SBLn1
Vol Left, %	0%	50%	0%
Vol Thru, %	100%	0%	100%
Vol Right, %	0%	50%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	523	511	285
LT Vol	0	254	0
Through Vol	523	0	285
RT Vol	0	257	0
Lane Flow Rate	551	538	300
Geometry Grp	1	1	1
Degree of Util (X)	0.996	0.953	0.584
Departure Headway (Hd)	6.51	6.378	7.008
Convergence, Y/N	Yes	Yes	Yes
Cap	556	570	513
Service Time	4.573	4.433	5.084
HCM Lane V/C Ratio	0.991	0.944	0.585
HCM Control Delay	63	52.4	19.6
HCM Lane LOS	F	F	C
HCM 95th-tile Q	14.2	12.6	3.7

Intersection	
Int Delay, s/veh	24.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	140	525	52	15	588	41	59	39	20	21	49	170
Future Vol, veh/h	140	525	52	15	588	41	59	39	20	21	49	170
Conflicting Peds, #/hr	6	0	2	2	0	6	0	0	2	2	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	100	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	1	0	0	2	0	0	0	20	0	0	0
Mvmt Flow	147	553	55	16	619	43	62	41	21	22	52	179

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	668	0	0	610	0	0	1665	1577	585	1587	1583	647
Stage 1	-	-	-	-	-	-	877	877	-	679	679	-
Stage 2	-	-	-	-	-	-	788	700	-	908	904	-
Critical Hdwy	4.12	-	-	4.1	-	-	7.1	6.5	6.4	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.218	-	-	2.2	-	-	3.5	4	3.48	3.5	4	3.3
Pot Cap-1 Maneuver	922	-	-	979	-	-	78	111	479	88	110	475
Stage 1	-	-	-	-	-	-	346	369	-	445	454	-
Stage 2	-	-	-	-	-	-	387	444	-	332	358	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	917	-	-	977	-	-	~ 35	91	477	62	90	472
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 59	217	-	184	240	-
Stage 1	-	-	-	-	-	-	290	309	-	372	444	-
Stage 2	-	-	-	-	-	-	209	434	-	231	300	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.9	0.2	264.5	36.9
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	97	917	-	-	977	-	-	354
HCM Lane V/C Ratio	1.281	0.161	-	-	0.016	-	-	0.714
HCM Control Delay (s)	264.5	9.7	-	-	8.7	-	-	36.9
HCM Lane LOS	F	A	-	-	A	-	-	E
HCM 95th %tile Q(veh)	8.7	0.6	-	-	0	-	-	5.3

Notes

~: Volume exceeds capacity $: Delay exceeds 300s   +: Computation Not Defined   *: All major volume in platoon

Intersection	
Int Delay, s/veh	15.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	140	525	52	15	588	41	59	39	20	21	49	170
Future Vol, veh/h	140	525	52	15	588	41	59	39	20	21	49	170
Conflicting Peds, #/hr	6	0	2	2	0	6	0	0	2	2	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	100	-	-	100	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	1	0	0	2	0	0	0	20	0	0	0
Mvmt Flow	147	553	55	16	619	43	62	41	21	22	52	179

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	668	0	0	610	0	0	1665	1577	585	1587	1583	647
Stage 1	-	-	-	-	-	-	877	877	-	679	679	-
Stage 2	-	-	-	-	-	-	788	700	-	908	904	-
Critical Hdwy	4.12	-	-	4.1	-	-	7.1	6.5	6.4	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.218	-	-	2.2	-	-	3.5	4	3.48	3.5	4	3.3
Pot Cap-1 Maneuver	922	-	-	979	-	-	78	111	479	88	110	475
Stage 1	-	-	-	-	-	-	346	369	-	445	454	-
Stage 2	-	-	-	-	-	-	387	444	-	332	358	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	917	-	-	977	-	-	~ 35	91	477	62	90	472
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 59	217	-	184	240	-
Stage 1	-	-	-	-	-	-	290	309	-	372	444	-
Stage 2	-	-	-	-	-	-	209	434	-	231	300	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.9	0.2	135.5	36.9
HCM LOS			F	E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	59	266	917	-	-	977	-	-	354
HCM Lane V/C Ratio	1.053	0.233	0.161	-	-	0.016	-	-	0.714
HCM Control Delay (s)	248.3	22.6	9.7	-	-	8.7	-	-	36.9
HCM Lane LOS	F	C	A	-	-	A	-	-	E
HCM 95th %tile Q(veh)	5	0.9	0.6	-	-	0	-	-	5.3

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	11.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	595	52	15	608	0	59	0	20	21	0	170
Future Vol, veh/h	0	595	52	15	608	0	59	0	20	21	0	170
Conflicting Peds, #/hr	6	0	2	2	0	6	0	0	2	2	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	1	0	0	2	0	0	0	20	0	0	0
Mvmt Flow	0	626	55	16	640	0	62	0	21	22	0	179

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	646	0	0	683	0	0	1418	1334	658	1344	1361	646
Stage 1	-	-	-	-	-	-	656	656	-	678	678	-
Stage 2	-	-	-	-	-	-	762	678	-	666	683	-
Critical Hdwy	4.12	-	-	4.1	-	-	7.1	6.5	6.4	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.218	-	-	2.2	-	-	3.5	4	3.48	3.5	4	3.3
Pot Cap-1 Maneuver	939	-	-	919	-	-	116	155	434	130	150	475
Stage 1	-	-	-	-	-	-	458	465	-	445	455	-
Stage 2	-	-	-	-	-	-	400	455	-	452	452	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	934	-	-	917	-	-	70	150	432	120	145	472
Mov Cap-2 Maneuver	-	-	-	-	-	-	70	150	-	120	145	-
Stage 1	-	-	-	-	-	-	457	464	-	442	440	-
Stage 2	-	-	-	-	-	-	242	440	-	429	451	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.2	161.9	27.3
HCM LOS			F	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	89	934	-	-	917	-	-	357
HCM Lane V/C Ratio	0.934	-	-	-	0.017	-	-	0.563
HCM Control Delay (s)	161.9	0	-	-	9	0	-	27.3
HCM Lane LOS	F	A	-	-	A	A	-	D
HCM 95th %tile Q(veh)	5.2	0	-	-	0.1	-	-	3.3

Intersection												
Int Delay, s/veh	7.2											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	7	627	100	139	760	1	85	0	117	1	1	6
Future Vol, veh/h	7	627	100	139	760	1	85	0	117	1	1	6
Conflicting Peds, #/hr	4	0	12	12	0	4	0	0	2	2	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	100	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	7	660	105	146	800	1	89	0	123	1	1	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	805	0	0	777	0	0	1835	1836	727	1887	1888	805
Stage 1	-	-	-	-	-	-	739	739	-	1097	1097	-
Stage 2	-	-	-	-	-	-	1096	1097	-	790	791	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	828	-	-	848	-	-	~ 59	77	427	54	71	386
Stage 1	-	-	-	-	-	-	412	427	-	261	291	-
Stage 2	-	-	-	-	-	-	261	291	-	386	404	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	825	-	-	838	-	-	~ 49	62	421	33	57	385
Mov Cap-2 Maneuver	-	-	-	-	-	-	176	199	-	109	173	-
Stage 1	-	-	-	-	-	-	404	419	-	258	239	-
Stage 2	-	-	-	-	-	-	211	239	-	270	396	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	1.6	57.1	19.2
HCM LOS			F	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	265	825	-	-	838	-	-	262
HCM Lane V/C Ratio	0.802	0.009	-	-	0.175	-	-	0.032
HCM Control Delay (s)	57.1	9.4	-	-	10.2	-	-	19.2
HCM Lane LOS	F	A	-	-	B	-	-	C
HCM 95th %tile Q(veh)	6.2	0	-	-	0.6	-	-	0.1

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	7	627	100	139	760	1	85	0	117	1	1	6
Future Vol, veh/h	7	627	100	139	760	1	85	0	117	1	1	6
Conflicting Peds, #/hr	4	0	12	12	0	4	0	0	2	2	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	100	-	-	100	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	2	-	-	2	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	7	660	105	146	800	1	89	0	123	1	1	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	805	0	0	777	0	0	1835	1836	727	1887	1888	805
Stage 1	-	-	-	-	-	-	739	739	-	1097	1097	-
Stage 2	-	-	-	-	-	-	1096	1097	-	790	791	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	828	-	-	848	-	-	~ 59	77	427	54	71	386
Stage 1	-	-	-	-	-	-	412	427	-	261	291	-
Stage 2	-	-	-	-	-	-	261	291	-	386	404	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	825	-	-	838	-	-	~ 49	62	421	33	57	385
Mov Cap-2 Maneuver	-	-	-	-	-	-	176	199	-	109	173	-
Stage 1	-	-	-	-	-	-	404	419	-	258	239	-
Stage 2	-	-	-	-	-	-	211	239	-	270	396	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	1.6	28.7	19.2
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	176	421	825	-	-	838	-	-	262
HCM Lane V/C Ratio	0.508	0.293	0.009	-	-	0.175	-	-	0.032
HCM Control Delay (s)	44.9	17	9.4	-	-	10.2	-	-	19.2
HCM Lane LOS	E	C	A	-	-	B	-	-	C
HCM 95th %tile Q(veh)	2.5	1.2	0	-	-	0.6	-	-	0.1

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	7	627	100	139	760	1	85	0	117	1	1	6
Future Volume (veh/h)	7	627	100	139	760	1	85	0	117	1	1	6
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	0.99		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1750	1723	1750	1750	1736	1750	1750	1750	1750	1750	1750	1750
Adj Flow Rate, veh/h	7	660	105	146	800	1	89	0	123	1	1	6
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	0	2	0	0	1	0	0	0	0	0	0	0
Cap, veh/h	55	1020	161	190	898	1	167	16	152	71	56	208
Arrive On Green	0.71	0.71	0.71	0.71	0.71	0.71	0.18	0.00	0.18	0.18	0.18	0.18
Sat Flow, veh/h	4	1443	228	184	1270	2	526	91	853	72	315	1162
Grp Volume(v), veh/h	772	0	0	947	0	0	212	0	0	8	0	0
Grp Sat Flow(s),veh/h/ln	1674	0	0	1456	0	0	1470	0	0	1550	0	0
Q Serve(g_s), s	0.0	0.0	0.0	19.8	0.0	0.0	7.9	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	17.4	0.0	0.0	37.3	0.0	0.0	9.6	0.0	0.0	0.3	0.0	0.0
Prop In Lane	0.01		0.14	0.15		0.00	0.42		0.58	0.12		0.75
Lane Grp Cap(c), veh/h	1236	0	0	1088	0	0	336	0	0	335	0	0
V/C Ratio(X)	0.62	0.00	0.00	0.87	0.00	0.00	0.63	0.00	0.00	0.02	0.00	0.00
Avail Cap(c_a), veh/h	1581	0	0	1384	0	0	450	0	0	451	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	5.6	0.0	0.0	8.0	0.0	0.0	27.5	0.0	0.0	23.7	0.0	0.0
Incr Delay (d2), s/veh	0.5	0.0	0.0	5.1	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.5	0.0	0.0	9.1	0.0	0.0	3.5	0.0	0.0	0.1	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	6.1	0.0	0.0	13.1	0.0	0.0	29.5	0.0	0.0	23.7	0.0	0.0
LnGrp LOS	A	A	A	B	A	A	C	A	A	C	A	A
Approach Vol, veh/h		772			947			212			8	
Approach Delay, s/veh		6.1			13.1			29.5			23.7	
Approach LOS		A			B			C			C	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		16.5		53.4		16.5		53.4				
Change Period (Y+Rc), s		4.0		4.0		4.0		4.0				
Max Green Setting (Gmax), s		18.0		64.0		18.0		64.0				
Max Q Clear Time (g_c+I1), s		11.6		19.4		2.3		39.3				
Green Ext Time (p_c), s		0.6		7.6		0.0		10.2				

Intersection Summary			
HCM 6th Ctrl Delay			12.1
HCM 6th LOS			B

Intersection	
Intersection Delay, s/veh	13.4
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	772	947	212	8
Demand Flow Rate, veh/h	785	955	212	8
Vehicles Circulating, veh/h	148	96	681	1043
Vehicles Exiting, veh/h	903	797	252	8
Ped Vol Crossing Leg, #/h	0	2	12	4
Ped Cap Adj	1.000	1.000	0.998	1.000
Approach Delay, s/veh	12.2	15.4	9.1	7.8
Approach LOS	B	C	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	785	955	212	8
Cap Entry Lane, veh/h	1187	1251	689	476
Entry HV Adj Factor	0.983	0.992	1.000	1.000
Flow Entry, veh/h	772	947	212	8
Cap Entry, veh/h	1167	1240	688	476
V/C Ratio	0.662	0.764	0.308	0.017
Control Delay, s/veh	12.2	15.4	9.1	7.8
LOS	B	C	A	A
95th %tile Queue, veh	5	8	1	0

Intersection	
Int Delay, s/veh	12.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	3	1	97	9	419	6	246	94	262	252	16
Future Vol, veh/h	6	3	1	97	9	419	6	246	94	262	252	16
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	3	3	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	100	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	-2	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	2	0	4	4	2	3	0
Mvmt Flow	6	3	1	102	9	441	6	259	99	276	265	17

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1372	1199	274	1152	1158	312	282	0	0	361	0	0
Stage 1	826	826	-	324	324	-	-	-	-	-	-	-
Stage 2	546	373	-	828	834	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	6.7	6.1	6.02	4.1	-	-	4.12	-	-
Critical Hdwy Stg 1	6.1	5.5	-	5.7	5.1	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	5.7	5.1	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.318	2.2	-	-	2.218	-	-
Pot Cap-1 Maneuver	124	187	770	200	225	741	1292	-	-	1198	-	-
Stage 1	369	389	-	718	677	-	-	-	-	-	-	-
Stage 2	526	622	-	404	424	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	38	134	770	154	162	739	1292	-	-	1195	-	-
Mov Cap-2 Maneuver	38	134	-	154	162	-	-	-	-	-	-	-
Stage 1	367	282	-	712	671	-	-	-	-	-	-	-
Stage 2	208	616	-	290	308	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	85.3	28.1	0.1	4.4
HCM LOS	F	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1292	-	-	55	154	688	1195	-	-
HCM Lane V/C Ratio	0.005	-	-	0.191	0.663	0.655	0.231	-	-
HCM Control Delay (s)	7.8	0	-	85.3	65.4	19.6	8.9	0	-
HCM Lane LOS	A	A	-	F	F	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.6	3.7	4.9	0.9	-	-

Intersection	
Int Delay, s/veh	12.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	3	1	97	9	419	6	246	94	262	252	16
Future Vol, veh/h	6	3	1	97	9	419	6	246	94	262	252	16
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	3	3	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	100	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	-2	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	2	0	4	4	2	3	0
Mvmt Flow	6	3	1	102	9	441	6	259	99	276	265	17

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1372	1199	274	1152	1158	312	282	0	0	361	0	0
Stage 1	826	826	-	324	324	-	-	-	-	-	-	-
Stage 2	546	373	-	828	834	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	6.7	6.1	6.02	4.1	-	-	4.12	-	-
Critical Hdwy Stg 1	6.1	5.5	-	5.7	5.1	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	5.7	5.1	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.318	2.2	-	-	2.218	-	-
Pot Cap-1 Maneuver	124	187	770	200	225	741	1292	-	-	1198	-	-
Stage 1	369	389	-	718	677	-	-	-	-	-	-	-
Stage 2	526	622	-	404	424	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	38	134	770	154	162	739	1292	-	-	1195	-	-
Mov Cap-2 Maneuver	38	134	-	154	162	-	-	-	-	-	-	-
Stage 1	367	282	-	712	671	-	-	-	-	-	-	-
Stage 2	208	616	-	290	308	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	85.3	28	0.1	4.4
HCM LOS	F	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1292	-	-	55	155	739	1195	-	-
HCM Lane V/C Ratio	0.005	-	-	0.191	0.72	0.597	0.231	-	-
HCM Control Delay (s)	7.8	0	-	85.3	72.4	16.8	8.9	0	-
HCM Lane LOS	A	A	-	F	F	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.6	4.3	4	0.9	-	-

Intersection	
Intersection Delay, s/veh	23.6
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	3	1	97	9	419	6	246	94	262	252	16
Future Vol, veh/h	6	3	1	97	9	419	6	246	94	262	252	16
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	0	0	0	0	0	2	0	4	4	2	3	0
Mvmt Flow	6	3	1	102	9	441	6	259	99	276	265	17
Number of Lanes	0	1	0	0	1	1	0	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	2	1
HCM Control Delay	12.2	26.8	25.6	19.4
HCM LOS	B	D	D	C

Lane	NBLn1	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	2%	60%	92%	0%	100%	0%
Vol Thru, %	71%	30%	8%	0%	0%	94%
Vol Right, %	27%	10%	0%	100%	0%	6%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	346	10	106	419	262	268
LT Vol	6	6	97	0	262	0
Through Vol	246	3	9	0	0	252
RT Vol	94	1	0	419	0	16
Lane Flow Rate	364	11	112	441	276	282
Geometry Grp	6	6	7	7	7	7
Degree of Util (X)	0.711	0.026	0.239	0.8	0.583	0.555
Departure Headway (Hd)	7.028	8.869	7.712	6.526	7.616	7.078
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	517	403	468	556	474	511
Service Time	5.055	6.938	5.426	4.24	5.36	4.822
HCM Lane V/C Ratio	0.704	0.027	0.239	0.793	0.582	0.552
HCM Control Delay	25.6	12.2	12.8	30.4	20.5	18.3
HCM Lane LOS	D	B	B	D	C	C
HCM 95th-tile Q	5.6	0.1	0.9	7.7	3.7	3.3

Intersection	
Intersection Delay, s/veh	8.7
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	10	552	364	558
Demand Flow Rate, veh/h	10	561	378	572
Vehicles Circulating, veh/h	657	281	291	117
Vehicles Exiting, veh/h	32	388	376	725
Ped Vol Crossing Leg, #/h	0	3	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	5.2	10.3	7.6	8.0
Approach LOS	A	B	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	10	561	378	572
Cap Entry Lane, veh/h	706	1036	1026	1225
Entry HV Adj Factor	1.000	0.984	0.962	0.976
Flow Entry, veh/h	10	552	364	558
Cap Entry, veh/h	706	1019	987	1195
V/C Ratio	0.014	0.542	0.369	0.467
Control Delay, s/veh	5.2	10.3	7.6	8.0
LOS	A	B	A	A
95th %tile Queue, veh	0	3	2	3

Attachment B Enhanced Crossing Treatments

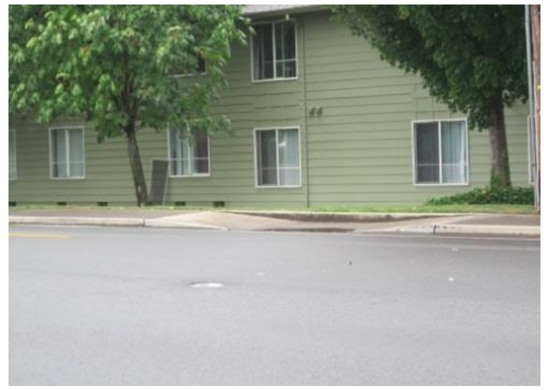
ENHANCED CROSSING TREATMENTS

Pedestrian Crossing Treatments

Pedestrian crossing facilities enable people to safely cross streets, railroad tracks, and other transportation facilities. Planning for appropriate pedestrian crossings requires the community to balance vehicular mobility needs with providing crossing locations that the desired routes of walkers. The following summarizes several enhanced pedestrian crossing treatments.

Unmarked Crosswalks

Under Oregon law, pedestrians have the right-of-way at all unsignalized intersections. On narrow, low-speed streets unmarked crosswalks are generally sufficient for pedestrians to cross the street safely, as the low-speed environment makes drivers more responsive to the presence of pedestrians. However, drivers are less likely to yield to pedestrians at unmarked crosswalks on high-speed and/or high-volume roadways, even when the pedestrian has stepped onto the roadway. In these situations, enhanced pedestrian crossing facilities are needed to remind drivers that they must yield when pedestrians are present.



Marked Crosswalks

Marked crosswalks are painted roadway markings that indicate the location of a crosswalk to motorists. Marked crosswalks can be accompanied by signs, curb extensions and/or median refuge islands, and may occur at intersections or at mid-block locations. Research has shown that marked crosswalks in certain situations do not improve pedestrian safety and can even make it worse. Recent research indicates that on multi-lane roadways (more than two lanes), marked crosswalks should not be installed without accompanying treatments, such as Rectangular Rapid Flash Beacons (RRFBs) or Pedestrian Hybrid beacons.

Rectangular Rapid Flashing Beacon (RRFB)

RRFBs are user-actuated amber lights that have an irregular flash pattern similar to emergency flashers on police vehicles. These supplemental warning lights are used at unsignalized intersections or mid-block crosswalks to improve safety for pedestrians using a crosswalk. RRFBs could be used at any unsignalized intersection or mid-block crossing where warrants require a higher level of crosswalk protection.

Pedestrian Hybrid Beacon

A Pedestrian Hybrid Beacon (sometimes called a HAWK) is a user-actuated signal that is unlit when not in use. It begins with a yellow light alerting drivers to slow, and then displays a solid red light requiring drivers to remain stopped while pedestrians cross the street. The beacon then shifts to flashing red lights to signal that motorists may proceed, after stopping, and after pedestrians have completed their crossing. A Pedestrian Hybrid Beacon can be used at mid-block crossings or, in some cases, at unsignalized intersections (the MUTCD suggests that the beacons be located at least 100-feet from an intersection). Pedestrian Hybrid Beacons could be used at any unsignalized intersection or mid-block crossing where warrants require a higher level of crosswalk protection.

Pedestrian Signal

Pedestrian Signals provide pedestrians with a signal-controlled crossing at a mid-block location or, in some cases at a previously stop-controlled intersection where pedestrian volumes warrant full signalization (the MUTCD no longer allows half signals at intersections). The signal remains green for the mainline traffic movements until actuated by a pushbutton to call a red signal for traffic. They are typically located at midblock crossings with high pedestrian or bicycle demand and/or high traffic volumes, such as where shared-use paths intersect with roadways.

Pedestrian Countdown Heads

Pedestrian Countdown heads inform pedestrians of the time remaining to cross the street with a countdown timer at the signalized crossing. The countdown should include enough time for a pedestrian to cross the full length of the street, or in rare cases, reach a refuge island. The current Manual on Uniform Traffic Control Devices (MUTCD) requires all new pedestrian signals, and any retrofitted signals to include pedestrian countdown heads.

Leading Pedestrian Interval (LPI)

Leading pedestrian intervals allow pedestrians to start crossing the street at a signalized intersections five to seven seconds before conflicting vehicles are given a green light and allowed to enter the intersection. They are most commonly used at signalized intersections where left- or right-turning vehicles interfere with pedestrian crossing movements. LPI could be applied at all existing or potential future traffic signals to improve crossing conditions for pedestrians.

Geometric Considerations

There are a number of geometric enhancements that can be considered at pedestrian crossings that may be implemented in conjunction with previously discuss treatments.

Curb Extensions

Curb extensions create additional space for pedestrians at crosswalks and allow pedestrians and vehicles to better see each other. Curb extensions are typically installed at intersections and midblock crossings located along roadways with on-street parking to help reduce crossing distances and the amount of exposure pedestrians have to vehicle traffic. Curb extensions can narrow the vehicle path, slow down traffic, and prohibit fast turns. Curb extensions could be applied along any street where on-street parking is allowed or where there is sufficient shoulder width so the curb extension does not conflict with on-street bike lanes.

Raised Median Island

Raised median islands provide a protected area in the middle of the roadway where pedestrians can stop while crossing the street. Raised median islands allow pedestrians to complete two-stage crossings if needed. Raised median islands can narrow the vehicle path and slow down traffic along the roadway. Raised median islands could be applied along any street where they would not interfere with turning movements at driveways and intersecting roadways.

Bicycle Crossing Treatments

Pavement Markings Through Intersections

Pavement markings can be extended through the intersection for bicyclists. Green paint can be used in “conflict zones” where vehicles and bicycles cross paths in intersections, at driveways, or at right-turn pockets. These pavement marking are typically used at signalized intersections to emphasize a connection in a larger bicycle network. They could be used at all signalized intersections and in other select “conflict zones”.

Bike Box

Bicycle boxes are designated spaces at signalized intersections, placed between a set-back stop bar and the pedestrian crosswalk, that allow bicyclists to queue in front of motor vehicles at red lights. Bike boxes are typically used at signalized intersections to facilitate turn movements as well as other movements for cyclists.

Two-Stage Left-Turn Bike Box

Two-stage left-turn bike boxes allow bicyclists to safely and comfortably make left-turns at multilane intersections from a right-side bicycle lane or cycle track. Bicyclists arriving on a green light travel into the intersection and pull out into the two-stage turn queue box away from through-moving bicycles and in front of cross street traffic, where they can wait to proceed through on the side-street green signal. Two-stage left-turn bike boxes can be applied at signalized intersections to improve bicycle crossing conditions.

Bike only signal

Bicycle-only signals can be used at intersections to provide a separate signal phase that is dedicated to bicyclists. At this stage, the MUTCD does not allow bicycle signal to operation concurrent with permissive vehicle phases.

Bicycle Detection

Many traffic signals along are actuated, meaning that green indication is given to a movement when a vehicle is detected. However, actuating a signal as a cyclist can be difficult. Bicycle detection allows cyclists to actuate the traffic signal from the bicycle lane with a detector that is calibrated to recognize a bicycle. Pavement markings could be added to show cyclists where to stand to actuate a signal. Bicycle detection is typically applied at signalized intersections that accommodate bicycles and can be used at all of the signalized intersection to improve bicycle crossing conditions.

Attachment C Funding Programs

FUNDING PROGRAMS

Federal Sources

Fixing America's Surface Transportation Act (FAST Act)

Fixing America's Surface Transportation Act (FAST Act) funds surface transportation programs, including, but not limited to, federal-aid highways. The FAST Act is the first long-term surface transportation authorization enacted in a decade that provides long-term funding certainty for surface transportation. The FAST Act establishes and funds new programs to support critical transportation projects to ease congestion and facilitate the movement of freight on the interstate system and other major roads. The FAST Act is not a direct funding source; however, it funds programs at the federal and state levels that are direct funding sources for multimodal transportation improvements. More information on the Fast Act is available at: https://www.fhwa.dot.gov/fastact/.

Surface Transportation Block Grant Program (STBG)

The Surface Transportation Block Grant Program (STBG) provides flexible funding that may be used by States and localities for projects to preserve and improve the conditions and performance on any Federal-aid highway, bridge and tunnel projects on any public road, pedestrian and bicycle infrastructure, and transit capital projects, including intercity bus terminals. Projects must be identified in the Statewide Transportation Improvement Program (STIP)/Transportation Improvement Program (TIP) and be consistent with the Long-Range Statewide Transportation Plan and the Metropolitan Transportation Plan(s). More information on the STBG Program is available at: https://www.fhwa.dot.gov/specialfunding/stp/160307.cfm#c.

Transportation Alternatives Program (TA Set-Aside)

The FAST Act replaced the former Transportation Alternatives Program (TA Set-Aside) with a set-aside of funds under the STBG Program. For administrative purposes, the FHWA refers to these funds as the TA Set-Aside. The TA Set-Aside authorizes funding for programs and projects defined as transportation alternatives, including on- and off-road pedestrian and bicycle facilities, infrastructure projects for improving non-driver access to public transportation and enhanced mobility, community improvement activities such as historic preservation and vegetation management, and environmental mitigation related to stormwater and habitat connectivity; recreational trail projects; safe routes to school projects; and projects for planning, designing, or constructing boulevards and other roadways largely in the right-of-way of former divided highways. Oregon administers TA Set-Aside funds, giving grants to local governments, as part of the STIP Enhance funds (see below). Grants require a small local match (20%) and vary from $250,000 to $1.4 million. More information on the TA Set-Aside is available at: https://www.fhwa.dot.gov/environment/transportation_alternatives/.

Congestion Mitigation and Air Quality Program (CMAQ)

The Congestion Mitigation and Air Quality program (CMAQ) provides a flexible funding source to State and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act. Funding is available to reduce congestion and improve air quality for areas that do not meet the National Ambient Air Quality Standards for ozone, carbon monoxide, or particulate matter (nonattainment areas) and for former nonattainment areas that are now in compliance (maintenance areas). Funds may be used for a transportation project or program that is likely to contribute to the attainment or maintenance of a national ambient air quality standard, with a high level of effectiveness in reducing air pollution, and that is included in the metropolitan planning organization's (MPO's) current transportation plan and transportation improvement program (TIP) or the current state transportation improvement program (STIP) in areas without an MPO. More information on the CMAQ Program is available at: https://www.fhwa.dot.gov/fastact/factsheets/cmaqfs.cfm.

Highway Safety Improvement Program (HSIP)

The Highway Safety Improvement Program (HSIP) is a core federal-aid program with the purpose of achieving a significant reduction in traffic fatalities and serious injuries on all public roads, including non-state-owned public roads and roads on tribal lands. The HSIP requires a data-driven, strategic approach to improving highway safety on all public roads that focuses on performance. Applications must focus on a strategy, activity or project consistent with a State Strategic Highway Safety Plan, and correct or improve a hazardous road location or feature, or address a highway safety problem, including automated enforcement in school zones. Infrastructure and non-infrastructure projects are eligible. Projects require a small local match (10%) and are administered through the STIP (See below). More information on the HSIP Program is available at: https://safety.fhwa.dot.gov/hsip/.

Better Utilizing Investments to Leverage Development (BUILD)

The Better Utilizing Investments to Leverage Development, or BUILD Transportation Discretionary Grants program, provides funding for road, rail, transit and port projects that promise to achieve national objectives. Previously known as Transportation Investment Generating Economic Recovery, or TIGER Discretionary Grants, Congress has dedicated nearly $7.9 billion for eleven rounds of National Infrastructure Investments to fund projects that have a significant local or regional impact.

The eligibility requirements of BUILD allow project sponsors at the State and local levels to obtain funding for multi-modal, multi-jurisdictional projects that are more difficult to support through traditional DOT programs. BUILD can provide capital funding directly to any public entity, including municipalities, counties, port authorities, tribal governments, MPOs, or others in contrast to traditional Federal programs which provide funding to very specific groups of applicants (mostly State DOTs and transit agencies). This flexibility allows BUILD and our traditional partners at the State and local levels to work directly with a host of entities that own, operate, and maintain much of our transportation infrastructure, but otherwise cannot turn to the Federal government for support.

The BUILD discretionary grant program is a very competitive pot of funds; a small percentage of funded projects have been bike/pedestrian related. Applications must highlight project benefits to safety, economic competitiveness, state of good repair, livability and environmental sustainability goals. More information on the BUILD discretionary grant program is available at: https://www.transportation.gov/BUILDgrants.

Recreational Trails Program

The Recreational Trails Program (RTP) provides funds to the States to develop and maintain recreational trails and trail-related facilities for both nonmotorized and motorized recreational trail uses. The RTP is an assistance program of the Federal Highway Administration (FHWA). Federal transportation funds benefit recreation including hiking, bicycling, in-line skating, equestrian use, cross-country skiing, snowmobiling, off-road motorcycling, all-terrain vehicle riding, four-wheel driving, or using other off-road motorized vehicles. The RTP is a set-aside under the TA Set-Aside for both motorized and non-motorized trail projects. ODOT currently sends Oregon's RTP funds to the Oregon Parks and Recreation Department for administration. More information on the RTP is available at: https://www.fhwa.dot.gov/environment/recreational_trails/.

State Sources

Statewide Transportation Improvement Program (STIP)

The Statewide Transportation Improvement Program (STIP) is ODOT's four-year capital improvement program for state and federally funded projects. The STIP includes projects on federal, state, city, and county transportation systems, multimodal projects (highway, passenger rail, freight, public transit, bicycle and pedestrian), and projects in the National Parks, National Forests, and Indian tribal lands. STIP project lists are developed through the coordinated efforts of ODOT, federal and local governments, Area Commissions on Transportation, tribal governments, and the public.

The STIP is divided into five major categories: **Fix-it** programs funds projects that fix or preserve the state's transportation system, including bridges, pavement, culverts, traffic signals, and others. The **Enhance** program funds projects that enhance or expand the transportation system - Area Commissions on Transportation recommend high-priority investments from state and local transportation plans in many of the Enhance programs. **Safety** programs reduce deaths and injuries on Oregon's roads. This includes the ARTS program (See below), which selects projects through a data-driven process to ensure resources have maximum impact on improving the safety of Oregon's state highways and local roads. **Non-highway** programs fund bicycle and pedestrian projects and public transportation**. Local government** programs direct funding to local governments so they can fund priority projects.

Project proposals for the STIP can be made to the state via regional offices; however, projects must be in a local adopted Transportation System Plan. More information on the STIP is available at: http://www.oregon.gov/ODOT/TD/STIP/Pages/default.aspx.

State Highway Trust Fund/Bicycle Bill

When roads are constructed or reconstructed, Oregon law requires walkways and bikeways be provided. Additionally, all agencies receiving State Highway Funds are required to spend at least 1% of those funds on bicycle and/or pedestrian infrastructure improvements (ORS 366.514). Currently, cities and counties receive 20% and 30% of the state's highway trust funds, respectively, which can be used for walking and biking projects along roads.

Sidewalk Improvement Program (SWIP)

The sidewalk improvement program (SWIP) builds pedestrian and bicycle facilities on state and local roads that help people moving across or around the state system. Projects should address needs identified in the region's Active Transportation Needs Inventory (ATNI) or other Oregon Bicycle and Pedestrian Plan (OBPP) priorities. All project phases are eligible for SWIP funding, but emphasis is on construction activities, per ORS 366.514. Funds may be used for standalone projects or as add-on to another project, if all region Active Transportation Leverage funds have already been allocated. More information on SWIP funds is available at:
https://www.oregon.gov/odot/programs/pages/bikeped.aspx.

Safe Routes to School Program (SRTS)

ODOT's Safe Routes to School (SRTS) program is focused on providing grants to make it safer for children to walk and bike to school, providing opportunity through investments in infrastructure and non-infrastructure. ODOT's grant funding for infrastructure programs help create and improve safe walking and biking routes to school, while its grant funding for non-infrastructure programs help raise awareness by focusing on education and outreach. Non-motorized transportation projects related to getting children to school safely, such as closing gaps in the sidewalk and bicycle networks, are eligible for infrastructure program funding. More information on ODOT's SRTS program is available at: https://www.oregon.gov/ODOT/Programs/Pages/SRTS.aspx.

All Roads Transportation Safety (ARTS)

The All Roads Transportation Safety (ARTS) program (formerly known as the Jurisdictionally Blind Safety Program) is intended to address safety needs on all public roads in Oregon. By working collaboratively with local jurisdictions, ODOT expects to increase awareness of safety on all roads, promote best practices for infrastructure safety, compliment behavioral safety efforts and focus limited resources to reduce fatal and serious injury crashes in the state of Oregon. The program is data driven to achieve the greatest benefits in crash reduction, including addressing hotspots. A portion is dedicated to a few proven low-cost measures to implement widely, where there is evidence that they would be most useful. Local agencies can submit applications for bicycle and pedestrian projects. More information on the ARTS program is available at: https://www.oregon.gov/ODOT/Engineering/Pages/ARTS.aspx.

Oregon Community Paths Program (OCP)

The Oregon Community Paths (OCP) program is a new grant program dedicated to helping communities create and maintain connections through shared-use paths. ODOT uses money from the state Multimodal Action Transportation Fund (See below) and the federal TA Set-aside (See above) to fund this program. The OCP program funds grants for project development, construction, reconstruction, major resurfacing or other improvements of shared-use paths that improve access and safety for people walking and bicycling. The OCP may also fund on-road improvements, such as enhanced crossing infrastructure that support a path although the focus of the program is on projects outside of the road right-of-way. Projects must improve a critical link, regional path or path crossing of a roadway. More information on the OCP program is available at: https://www.oregon.gov/ODOT/Programs/Pages/OCP.aspx.

House Bill (HB) 2017 Transportation Investments

In August 2017, Governor Kate Brown signed an eight-year transportation tax increase to raise roughly $5 billion for roads, bridges, mass transit, electric vehicles, and other transit options. House Bill (HB) 2017 affects drivers, bicyclists and payroll employees by increasing the gas tax, weight-mile tax, and other transportation-related fees such as excise tax on the sale of bicycles, new vehicles, and instituting a statewide payroll tax for transit equivalent to 1/10th of 1 percent of wages, deducted by employer from payment to employee. Though this funding source is one that can be used to finance multitude of project types, some cities have indicated that additional funds received from HB 2017 will be primarily allocated to maintenance of existing transportation facilities and operations. More information on HB 2017 is available at: http://www.oregon.gov/ODOT/Documents/HB2017-FAQ.pdf.

Multimodal Active Transportation Fund (MAT)

In 2019, the Oregon Legislature passed House Bill 2592 to clarify and amend House Bill 2017. The legislation establishes the Multimodal Active Transportation (MAT) Fund for bicycle and pedestrian projects, consisting of 7% of the Connect Oregon Fund plus revenues from Oregon's bicycle excise tax. The MAT is a separate grant program from Connect Oregon and requires a new set of administrative rules. With the separation of bicycle/pedestrian projects into the Multimodal Active Transportation fund, new rules for this fund are also anticipated to be established in 2020.

Local Sources

System Development Charges/Transportation Impact Fees

SDCs are one-time fees imposed on new developments (and some redevelopments) to help off-set the cost of new transportation infrastructure (and the expansion of existing transportation infrastructure) needed to accommodate traffic generated by the development. A city or county can offer SDC credits to developers that provide public improvements beyond the required frontage improvements, including those that can be constructed by the private sector at a lower cost. For example, an SDC credit might be given to a developer for providing improvements along both sides of an adjacent facility, for extending frontage improvements beyond the site frontage, or treatments at or connecting to nearby transit stops. SDCs are already a major transportation funding source for the City of Independence.

Transportation Utility Fees (TUF)

Transportation Utility Fees (also known as Street Utility, Road User, or Street Maintenance Fees) are monthly fees collected from residences and businesses via their water/sewer bills. Fees are assessed based on the expected number of trips for each land use. Funds are usually used for road maintenance and sidewalks but can cover capital improvements. At least nineteen Oregon cities currently have TUFs. Funds generated by these fees can add up; for example, roughly half of Medford's Public Works operations budget comes from a street utility fee. More information is available from the League of Oregon Cities in their 2008 report:
https://www.orcities.org/application/files/3015/7481/0598/TUFReport2011.pdf.

Local Fuel Tax

While every state collects an excise tax on fuel, Oregon is one of only nine states that permits cities and counties to impose a local fuel tax to pay for street operation, maintenance, and preservation activities. The taxes are paid to the cities and counties monthly by distributors of fuel. Voters would need to pass the tax, and the process for presenting such a tax to voters would need to be consistent with Oregon State law as well as the laws of the local jurisdiction. There are currently 27 cities and two counties in Oregon that have a local fuel tax. The taxes range from $0.01 to $0.10 per gallon. More information is available at:
https://www.oregon.gov/ODOT/FTG/Pages/Current%20Fuel%20Tax%20Rates.aspx?wp9904=p:2&wp4401=l:100#g_2d60aa8d_2408_4664_bd10_d745b56f361d.

Local Improvement Districts (LID)

Local Improvement Districts (LID) are most often used to construct projects such as streets, sidewalks, or bikeways. Through the LID process, the costs of local improvements are generally spread out among a group of property owners within a specified area. The cost can be allocated based on property frontage or other methods such as trip generation. The cost of LID projects are borne primarily by property owners, moderate administrative costs must be factored in, and the public involvement process must still be followed. If the cost of the local improvement is not 100 percent funded by property owners, the City/County is required to contribute the remaining unfunded portion of the improvement.

Economic Improvement Districts (EID)

Transportation improvements can often be included as part of larger efforts aimed at business improvement and retail district beautification. Economic Improvement Districts (EID) collect assessments or fees on businesses to fund improvements that benefit businesses and improve customer access within the district. Adoption of a mutually agreed upon ordinance establishing guidelines and setting necessary assessments or fees to be collected from property owners is essential to ensuring a successful EID.

Urban Renewal District/Tax Increment Financing

Urban Renewal Districts are separate taxing districts created to remove blight within a district. Each Urban Renewal Plan has identified actions that will remove the blight within the District. Those actions are funded by debt financing (e.g., bonds) using the incremental tax revenue generated from improvements on private property that increase the tax assessable value of that property that then create additional property tax revenue. The additional tax revenue (i.e., tax increment) is then directed to the Urban Renewal District to be used for blight removal. This public finance method is referred to as Tax Increment Financing (TIF) and is limited to Urban Renewal in the State.

Local Bond Measures

Local bond measures, or levies, are usually initiated by voter-approved general obligation bonds for specific projects. Bond measures are typically limited by time, based on the debt load of the local government or the project under focus. Funding from bond measures can be used for right-of-way acquisition, engineering, design, and construction of transportation facilities. Transportation-specific bond measures have passed in other communities throughout Oregon. Though this funding source is one that can be used to finance a multitude of project types, it must be noted that the accompanying administrative costs are high and voter approval must be gained. In addition, local bonds for transportation improvements will compete with local bonds for other public needs, such as fire and rescue, parks and recreation, schools, libraries, etc.

Street Utility Fees/Road Maintenance Fee

The fee is based a flat fee charged to each property, on the number of trips a particular land use generates, or some combination of both and is usually collected through a regular utility bill. For the communities in Oregon that have adopted this approach, it provides a stable source of revenue to pay for street maintenance allowing for safe and efficient movement of people, goods, and services.

Attachment D Development Code Review

MEMORANDUM

Independence Regulatory Review

Independence Transportation System Plan Update

DATE	July 30, 2020
TO	Project Management Team
FROM	Matt Hastie and Clinton "CJ" Doxsee, Angelo Planning Group
CC	FILE

INTRODUCTION

This memorandum presents a review of the City of Independence's Development Code (Code) for compliance with the State of Oregon's Transportation Planning Rule (TPR), OAR 660 Division 12. The memorandum provides the intent, purpose, and requirements for the TPR, followed by a comprehensive review in the subsequent table. This memorandum also includes a cursory review of the City's transportation system development charges as they relate to the Code, as well as an overview sidewalk standards found in the Code and other City documents.

Regulatory Review

The purpose of the TPR is *"…to implement Statewide Planning Goal 12 (Transportation) and promote the development of safe, convenient and economic transportation systems that are designed to reduce reliance on the automobile so that the air pollution, traffic and other livability problems faced by urban areas in other parts of the country might be avoided."* The TPR also establishes requirements for coordination among affected levels of government for preparation, adoption, refinement, implementation, and amendment of transportation system plans.

Specifically, the TPR requires all local jurisdictions with a population greater than 2,500 to prepare, adopt and implement a Transportation System Plan (TSP). Section -0045 of the TPR addresses implementation of the Transportation System Plan. The table below identifies each applicable element required by 660-012-0045,[1] the existing City development code standards which address the requirement, and the preliminary conclusion of whether or not the City's existing standards

[1] Note, TPR Sections -0045(4) and (5) do not apply Independence due the size of the City and it being located outside of an MPO.

appear to be deficient in meeting the TPR requirements. This information will be used as the basis for amendments to the City's TSP and development code.

TPR Section -0060 (Plan and Land Use Regulation Amendments) addresses amendments to plans and land use regulations. It specifies measures to be taken to ensure that allowed land uses are consistent with the identified function and capacity of existing and planned transportation facilities. Section -0060 establishes criteria for identifying the significant effects of plan or land use regulation amendments on transportation facilities, actions to be taken when a significant effect would occur, identification of planned facilities, and coordination with transportation facility providers.

In summary, the TPR requires that local governments revise their land use regulations to implement the Transportation System Plan in the following manner:

- Amend land use regulations to reflect and implement the Transportation System Plan.
- Clearly identify which transportation facilities, services, and improvements are allowed outright, and which will be conditionally permitted or permitted through other procedures.
- Adopt land use or subdivision ordinance measures, consistent with applicable federal and state requirements, to protect transportation facilities, corridors, and sites for their identified functions, to include the following topics:
    - access management and control;
    - protection of public use airports;
    - coordinated review of land use decisions potentially affecting transportation facilities;
    - conditions to minimize development impacts to transportation facilities;
    - regulations to provide notice to public agencies providing transportation facilities and services of land use applications that potentially affect transportation facilities; and
    - regulations assuring that amendments to land use applications, densities, and design standards are consistent with the Transportation System Plan.
- Adopt land use or subdivision regulations for urban areas and rural communities to provide safe and convenient pedestrian and bicycle circulation and bicycle parking, and to ensure that new development provides on-site streets and accessways that provide reasonably direct routes for pedestrian and bicycle travel.
- Establish street standards that minimize pavement width and total right-of-way.

The following assessment of TPR compliance is based on the Independence Development Code. Table 1 lists TPR implementation requirements, an assessment of existing City code and regulatory provisions that meet the requirements, and recommendations for changes to the Code that will likely be needed to fully implement the a new TSP and bring the City regulations in compliance with the TPR. Recommended changes to local regulatory documents are intended to provide guidance to project staff during the update of the TSP. In particular, modifications to the Code will be drafted during the planning process and become implementation recommendations for inclusion in the draft TSP.

Transportation System Development Charges

City staff expressed interest in reviewing the Development Code for potential conflicts with the City's transportation system development charge (SDC) and other transportation improvement requirements.[2] The City wants to ensure that it does not require developers to pay twice for the same improvements through a combination of SDCs and off-site transportation improvements identified as part of the development review and Transportation Impact Analysis requirements.

An SDC is a one-time fee imposed on new development to provide equitable funding for growth and development. The SDC fees are used by the City on capital improvements to expand the capacity of infrastructure or public services such as transportation, stormwater, or similar utilities. In particular, fees from transportation SDCs are designated for upgrades to the transportation system and include, but are not limited to, streets, sidewalks, bike lanes and paths, street lights, traffic signs and signals, street trees, public transportation, vehicle parking, and bridges.

The imposition of SDCs in Independence are authorized in the City's Municipal Code under Article VII – Utility System Development Charges. SDCs are collected at the time of increased usage of a capital improvement, during issuance of a development or building permit, or when a new connection to the system is made.

Section 34-442 of the Article outlines the methodology for SDC fees and charges, stating the methodologies used to establish SDCs to be adopted by Council resolution.[3] The section requires the adopted methodology must include provisions for credits against the improvement fee for the construction of any qualified public improvement.[4]

Section 34-448 establishes provisions for providing SDC credits, which are summarized below.

- Credits for uses that were existing at the time of the ordinance adoption.
- Credits for qualified public improvements associated with a development, but only for the portion not located or wholly contiguous to the property.
- Credits for a capital improvement constructed as part of a development that reduces demand on existing improvements or the need for future improvements, or that would otherwise be constructed at the City's expense.

With one exception, the City's Code does not explicitly refer to the use of SDCs. However, the Code allows the City to impose conditions of approval for development subject to quasi-judicial or legislative approval that may potentially require a developer to construct capital improvements to

[2] The City currently imposes SDCs to fund improvements for transportation, water, sewer, and storm drains. This review is focused on transportation SDCs only, as they relate to the Development Code.

[3] Information on the methodology adopted by Council resolution was not available at the time of this review.

[4] Qualified public improvements are defined in Section 34-438 as a capital improvement that is required as a condition of approval, in a CIP as identified in Section 34-445, and not located on or adjacent to land that is subject to residential development approval.

mitigate identified potential impacts associated the new development. Provisions in the Code that allow the City to impose such conditions include Section 11.15 (General Administrative Provisions) and Section Subchapter 71 (Conditional Uses). Section 11.15(E) establishes procedures for quasi-judicial actions (Type II and Type III land use actions) that include applying conditions of approval. The section provides limitations and direction on applying conditions of approval to land use actions. Uses subject to Conditional Use permits and the associated provisions in Subchapter 71 (Conditional Uses) are subject to conditions of approval.

The requirements for a traffic impact analysis (TIA) are provided in Sections 80.30.05 (Site Design Review) and 90.60.35 (Subdivisions). Like an SDC, a TIA is typically required when new development is anticipated to have impacts on the transportation system. TIAs are required to identify impacts and corresponding mitigation measure associated with demand from the new development. Neither section specifically applies the use SDCs as part of the provisions, however the identified mitigation measure may be used to establish conditions of approval that require a developer to construct the improvement.

Based on our review of these requirements, we believe that the City's SDC credit provisions should be sufficient to avoid requiring developers to pay for the same improvements twice. Any improvements identified as part of set of conditions of approval as a result of a development application and TIA should fall under the categories of "qualified (off-site) public improvements" or "capital improvement constructed as part of a development that reduces demand on existing improvements or the need for future improvements." To the extent that these same improvements are included in the City's SDC Capital Improvement Plan, the developer would receive corresponding credits to their SDCs. This process should be outlined in some sort of administrative document but would not typically be described in the City's Development Code.

Table 1: Independence Development Code Regulatory Review	
OAR 660-12-0045	
(1) Each local government shall amend its land use regulations to implement the TSP.	
(a) The following transportation facilities, services and improvements need not be subject to land use regulations except as necessary to implement the TSP and, under ordinary circumstances do not have a significant impact on land use: (A) Operation, maintenance, and repair of existing transportation facilities identified in the TSP, such as road, bicycle, pedestrian, port, airport and rail facilities, and major regional pipelines and terminals; (B) Dedication of right-of-way, authorization of construction and the construction of facilities and improvements, where the improvements are consistent with clear and objective dimensional standards; (C) Uses permitted outright under ORS 215.213(1)(j)–(m) and 215.283(1)(h)–(k), consistent with the provisions of OAR 660-012-0065; and (D) Changes in the frequency of transit, rail and airport services.	The IDC does not list the transportation facilities, services, and improvements in -0045(1)(a) as uses that are permitted outright, subject to standards. Independence does not have zones for exclusive farm use, therefore -0045(1)(a)(C) does not apply. **Recommendation:** Use authorized in individual zones of the IDC should be updated to include “Rights-of-way, easements and improvements for streets, water, sanitary sewer, gas, oil, electric and communication lines, stormwater facilities, and pump stations” as a use that is permitted outright, subject to the general development standards of the IDC.
(b) To the extent, if any, that a transportation facility, service or improvement concerns the application of a comprehensive plan provision or land use regulation, it may be allowed without further land use review if it is permitted outright or if it is subject to standards that do not require interpretation or the exercise of factual, policy or legal judgment;	See recommendation to -0045(1)(a) above.
(c) In the event that a transportation facility, service or improvement is determined to have a significant impact on land use or to concern the application of a comprehensive plan or land use regulation and to be subject to standards that require interpretation or the exercise of factual, policy or legal judgment, the local government shall provide a review and approval process that is consistent with OAR 660-012-0050. To facilitate implementation of the TSP, each local government shall amend its land use regulations to provide for consolidated review of land use decisions required to permit a transportation project.	Applications of more than one quasi-judicial land use action may be combined and reviewed concurrently (IDC 11.15(E)(7)). The IDC does not include provisions that would allow consolidation of land use reviews/actions beside quasi-judicial review, such as ministerial review (Type I) or legislative review (Type IV). Provisions in Section 11.15(C) require the City to provide notice to affected public agencies such as ODOT, the County, City of Monmouth, or similar agencies, what the City’s actions may impact them. Provisions in Section 11.15(D) specify that notice of Ministerial Actions (Type I) will be sent to interested agencies. Notice requirements for quasi-judicial public hearings (Type II or Type III) and legislative public hearings (Type IV) are subject to the requirements in Section 11.25. The provisions specify requirements for the time and location of notices. **Recommendation:** The IDC Administrative Provisions should be updated to allow all development permits and land use actions processed under the City’s administrative procedures to be consolidated for a single development project.

Table 1: Independence Development Code Regulatory Review	
(2) Local governments shall adopt land use or subdivision ordinance regulations, consistent with applicable federal and state requirements, to protect transportation facilities, corridors and sites for their identified functions. Such regulations shall include:	
(a) Access control measures, for example, driveway and public road spacing, median control and signal spacing standards, which are consistent with the functional classification of roads and consistent with limiting development on rural lands to rural uses and densities;	Access management spacing standards for private and public approaches on District Highways as well as access management requirements for City streets are regulated under Section 90.90.10(V). Access management spacing standards for District Highways are regulated according to the posted speed limit. Access spacing management standards for City streets are regulated according to the street's functional classification. The width, length, and shape of blocks are regulated under Section 90.90.15. The provisions generally limit the size of blocks to 600 feet (or 1,600 foot perimeter). Exceptions are allowed when average block sizes are proposed, adjacency to arterial streets, or for topographic conditions. **Recommendation:** Current regulations are compliant with TPR provisions. No amendments are recommended.
(b) Standards to protect future operation of roads, transitways and major transit corridors;	Requirements for traffic impact analyses are provided in Section 90.60.35. The requirements include provisions for County/ODOT coordination, threshold requirements, transportation assessment letter alternative, analysis scope and contents requirements, and provisions for conditions of approval. Additional threshold requirements for when a traffic impact analysis is required as part of Site Design Review are provided in Section 80.30.05(F). The thresholds are triggered for development permits or land use applications that generate a net increase of 200 or more vehicles trips per day or are likely to increase the V/C ratio, or decrease the safety of a State transportation facility. **Recommendation:** Current regulations are compliant with TPR provisions. No amendments are recommended.
(c) Measures to protect public use airports by controlling land uses within airport noise corridors and imaginary surfaces, and by limiting physical hazards to air navigation;	The City regulates development in areas surrounding the airport through the Airport Development District (ADD) in Subchapters 76 and 77 and Airport Safety & Compatibility Overlay (ASCO) in 78. The City also has a unique residential airpark (RSA) zone that regulates residential development adjacent and connected to the airport. These provisions are provided in Subchapter 48 – Residential Single-Family Airpark Overlay (RSA) Zone. The provisions restrict or limit development that negatively affects the approach zone and the airport in any way. **Recommendation:** Current regulations are compliant with TPR provisions. No amendments are recommended.
(d) A process for coordinated review of future land use decisions affecting transportation facilities, corridors or sites;	See response to -0045(1)(c).

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(e) A process to apply conditions to development proposals in order to minimize impacts and protect transportation facilities, corridors or sites;	Requirements for traffic impact analyses are provided in Section 90.60.35. The requirements include provisions for conditions of approval. Section 11.15(E) establishes procedures for quasi-judicial actions (Type II and Type III land use actions) that include applying conditions of approval. The section provides limitations and direction on applying conditions of approval to land use actions. Uses subject to Conditional Use permits and the associated provisions in Subchapter 71 (Conditional Uses) are subject to conditions of approval. **Recommendation:** Current regulations are compliant with TPR provisions. No amendments are recommended.
(f) Regulations to provide notice to public agencies providing transportation facilities and services, MPOs, and ODOT of: (A) Land use applications that require public hearings; (B) Subdivision and partition applications; (C) Other applications which affect private access to roads; and (D) Other applications within airport noise corridors and imaginary surfaces which affect airport operations; and	See response to -0045(1)(c).
(g) Regulations assuring that amendments to land use designations, densities, and design standards are consistent with the functions, capacities and performance standards of facilities identified in the TSP.	Section 10.030 and 10.040 addresses amendments to the zoning map and development code, respectively. Section 11.02 specifies the level of review for specific land use actions. Zone changes and Comprehensive Plan Map amendments are subject to Type III actions while amendments to the Comprehensive Plan or zoning code are subject to Type IV action. Subchapter 12 includes provisions for zone changes and plan amendments. It specifies procedural requirements and approval standards. **Recommendation:** Current regulations are compliant with TPR provisions. No amendments are recommended.
(3) Local governments shall adopt land use or subdivision regulations for urban areas and rural communities as set forth below. The purposes of this section are to provide for safe and convenient pedestrian, bicycle and vehicular circulation consistent with access management standards and the function of affected streets, to ensure that new development provides on-site streets and accessways that provide reasonably direct routes for pedestrian and bicycle travel in areas where pedestrian and bicycle travel is likely if connections are provided, and which avoids wherever possible levels of automobile traffic which might interfere with or discourage pedestrian or bicycle travel.	
(a) Bicycle parking facilities as part of new multi-family residential developments of four units or more, new retail, office and institutional developments, and all transit transfer stations and park-and-ride lots;	Section 73.25 includes requirements for bicycle parking. The requirements specify minimum bicycle parking requirements for public or industrial parking lots with 10 or more vehicle parking spaces, for businesses in the MUPC zone, and for residential development with four or more dwellings or more

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	than 12 residents. The Section also includes design standards that that specify shelter, surface, and rack requirements. **Recommendation:** Current regulations are compliant with TPR provisions. No amendments are recommended.
(b) On-site facilities shall be provided which accommodate safe and convenient pedestrian and bicycle access from within new subdivisions, multi-family developments, planned developments, shopping centers, and commercial districts to adjacent residential areas and transit stops, and to neighborhood activity centers within one-half mile of the development. Single-family residential developments shall generally include streets and accessways. Pedestrian circulation through parking lots should generally be provided in the form of accessways. (A) "Neighborhood activity centers" includes, but is not limited to, existing or planned schools, parks, shopping areas, transit stops or employment centers; (B) Bikeways shall be required along arterials and major collectors. Sidewalks shall be required along arterials, collectors and most local streets in urban areas, except that sidewalks are not required along controlled access roadways, such as freeways; (C) Cul-de-sacs and other dead-end streets may be used as part of a development plan, consistent with the purposes set forth in this section; (D) Local governments shall establish their own standards or criteria for providing streets and accessways consistent with the purposes of this section. Such measures may include but are not limited to: standards for spacing of streets or accessways; and standards for excessive out-of-direction travel; (E) Streets and accessways need not be required where one or more of the following conditions exist: (i) Physical or topographic conditions make a street or accessway connection impracticable. Such conditions include but are not limited to freeways, railroads, steep slopes, wetlands or other bodies of water where a connection could not reasonably be provided; (ii) Buildings or other existing development on adjacent lands physically preclude a connection now or in the future considering the potential for redevelopment; or (iii) Where streets or accessways would violate provisions of leases, easements, covenants, restrictions or other agreements existing as of May 1, 1995, which preclude a required street or accessway connection.	**On-site circulation, connections and parking lots:** Section 19.005 provides residential design standards that specify building orientation and connectivity requirements to promote pedestrian circulation. Section 33.030(B) and 33.040(H) provide development standards for the MUPC and Downtown Riverfront Zone respectively. They specify the design and requirements for internal pedestrian connections in parking lots with more than 10 spaces. Similarly, each section requires pedestrian connections between the building and the sidewalk. The section also specifies maximum pedestrian lighting requirements. **Bikeways and sidewalks:** Subdivision requirements in Subchapter 90 include street design standards that specify sidewalk and bike lanes requirements by street classification. Bike lanes are required for all arterials and for collectors that exceed 2,000 ADT. Sidewalks are required on all street classifications. **Cul-de-sacs:** Subdivision requirements in Subchapter 90 restrict the use of cul-de-sacs to circumstances with a demonstrated need. Circumstances are defined to include slopes, wetlands/water bodies, or existing development. Cul-de-sacs are limited in length and the number of single-family dwellings they serve. **Street and accessway layout:** The width, length, and shape of blocks are regulated under Section 90.90.15. The provisions generally limit the size of blocks to 600 feet (or 1,600 foot perimeter). Exceptions are allowed when average block sizes are proposed, adjacency to arterial streets, or for topographic conditions. Public accessways may be required to connect cul-de-sacs, connect unusually long blocks, or to provide public paths according to adopted plans or to provide connections to schools, parks, or other public areas. **Recommendation:** The City's standards generally are consistent with the TPR provisions. However, the City should consider strengthening connectivity and circulation standards to include multifamily development and planned unit developments.

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(c) Where off-site road improvements are otherwise required as a condition of development approval, they shall include facilities accommodating convenient pedestrian and bicycle travel, including bicycle ways along arterials and major collectors; *[Note: Subsection (d) defines safe and convenient]*	See response to Section -0045(2)(e).
(e) Internal pedestrian circulation within new office parks and commercial developments shall be provided through clustering of buildings, construction of accessways, walkways and similar techniques.	Section 33.030(B) and 33.040(H) provide development standards for the MUPC and Downtown Riverfront Zone respectively. They require pedestrian connections between the building and the sidewalk, but do not specify standards or guidelines for clustering buildings and making pedestrian connections between other on-site buildings. **Recommendation:** The City should consider strengthening connectivity and circulation standards to encourage on-site pedestrian connections between buildings and to cluster buildings where feasible.
(4) To support transit in urban areas containing a population greater than 25,000, where the area is already served by a public transit system or where a determination has been made that a public transit system is feasible, local governments shall adopt land use and subdivision regulations as provided in (a)–(g) below:	The City of Independence had an estimated population of 9,326 in the year 2017 and does not exceed the threshold for this provision.
(6) In developing a bicycle and pedestrian circulation plan as required by OAR 660-012-0020(2)(d), local governments shall identify improvements to facilitate bicycle and pedestrian trips to meet local travel needs in developed areas. Appropriate improvements should provide for more direct, convenient and safer bicycle or pedestrian travel within and between residential areas and neighborhood activity centers (i.e., schools, shopping, transit stops). Specific measures include, for example, constructing walkways between cul-de-sacs and adjacent roads, providing walkways between buildings, and providing direct access between adjacent uses.	The TSP update will make recommendations to the bicycle and pedestrian plan that are consistent with TPR -0020. This TPR requirements is currently addressed in the following areas: - Walkways between cul-de-sacs and adjacent roads – See response and recommendations in Section -0045(3)(b). - Walkways between buildings – See response and recommendations related to accessways in Section -0045(3)(b). - Access between adjacent uses – See response and recommendations related to accessways in Section -0045(3)(b). **Recommendation:** This requirement will be addressed by the TSP update planning process and can be met by requiring improvements in developing areas consistent with adopted code provisions. In identifying pedestrian and bicycle improvements for inclusion in the TSP, the City should review recommendations in the City's Parks, Open Space and Trails Master Plan, which focused in part on improving pedestrian pathway and other connections between residential areas and activity centers.
(7) Local governments shall establish standards for local streets and accessways that minimize pavement width and total right-of-way consistent with the operational needs of the facility. The intent of this requirement is that local governments consider and reduce excessive standards for local streets and accessways in order to reduce the cost of construction, provide for more efficient use of urban land, provide for emergency vehicle access	Street standards are located in Section 90.90.10. Local streets are required to have a 52- foot right-of-way with 28-feet pavement width. The standard local street width is consistent with the recommended widths illustrated in the Transportation Growth Management Neighborhood Street Design Guidelines (listed below).

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while discouraging inappropriate traffic volumes and speeds, and which accommodate convenient pedestrian and bicycle circulation. Not withstanding section (1) or (3) of this rule, local street standards adopted to meet this requirement need not be adopted as land use regulations.	*Pavement ROW* *No On-Street Parking 20' 42-48'* *Parking on One Side 24' 47-52'* *Parking on Two Sides 28' 52-56'* **Recommendation:** Current regulations are compliant with TPR provisions. No amendments are recommended.
OAR 660-12-0060	
Amendments to functional plans, acknowledged comprehensive plans, and land use regulations that significantly affect an existing or planned transportation facility shall assure that allowed land uses are consistent with the identified function, capacity, and performance standards of the facility.	Section 10.030 and 10.040 addresses amendments to the zoning map and development code respectively. Section 11.02 specifies the level of review for specific land use actions. Zone changes and Comprehensive Plan Map amendments are subject to Type III actions while amendments to the Comprehensive Plan or zoning code are subject to Type IV action. Subchapter 12 includes provisions for zone changes and plan amendments. It specifies procedural requirements and approval standards. The approval standards for zone changes and plan amendments include requirements for the change to be consistent the Comprehensive Plan and the Transportation System Plan. **Recommendation:** Current regulations are compliant with TPR provisions. No amendments are recommended.