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DRAFT MEMORANDUM #6

DATE: June 4, 2018

TO: Benton County TSP Project Management Team and Stakeholders

FROM: John Bosket, PE | DKS Associates
Rachel Vogt | DKS Associates

SUBJECT: Task 4.5 Transportation Standards
Benton County Transportation System Plan Update

This document provides an overview of the transportation system standards recommended for adoption as part of the Transportation System Plan (TSP) update for Benton County. Included is a detail of the roadway functional classification system, typical designs for roadways and shared use paths, special route designations, access spacing and mobility standards, and guidance for Traffic Impact Analysis requirements. Together, these standards will help ensure future transportation facilities are designed appropriately and that all facilities are managed to serve their intended purpose.

FUNCTIONAL CLASSIFICATION

Traditionally, roadways are classified based on the type of vehicular travel they are intended to serve (local versus through traffic). In Benton County, the functional classification provides an organizational mechanism for developing roadway design standards, establishing traffic speeds, controlling access, designing intersections, and allocating funds for maintenance and improvements.

Functional Class Hierarchy

Roadways with higher intended usage generally limit access to adjacent property in favor of more efficient motor vehicle traffic movement (i.e., mobility). Local roadways with lower intended usage have more driveway access and intersections, and generally accommodate shorter trips to nearby destinations.

Benton County's functional classification system categorizes all public roadways to provide for a context-sensitive network that balances local access and regional connectivity, while recognizing the unique needs of timber and agricultural areas. Higher classified roadways prioritize safe and efficient through movement, while lower classified roads are

designed to provide access to the adjacent land uses. The 2001 Benton County TSP applies the following functional classification system:

- **Principal Arterials** connect communities, provide through movement, and are primarily state highways. Access is limited and controlled, and parking is generally prohibited. Higher auto traffic volumes and speeds make principal and minor arterials uncomfortable for people walking and biking. There is a greater need to separate people walking and biking from auto traffic on arterials compared to other functional classifications. Within Benton County, all state highways are principal arterials.
- **Minor Arterials** connect areas of principal traffic generation to principal arterials, provide through movement, and distribute traffic to collector and local roadways. Access and parking are controlled.
- **Major Collectors** carry local traffic between neighborhoods, or between neighborhoods and arterials, and provide access to minor collectors and community services. Access and parking are controlled. There is still a need to separate people walking and biking from auto traffic on major and minor collectors, but the degree of separation required to create a comfortable environment is often smaller compared to arterials.
- **Minor Collectors** serve internal traffic within areas having a single land use pattern, and serve minor traffic generators such as schools or neighborhood shopping or community centers. They should form a continuous network in urban areas. Access and parking are allowed.
- **Resource Collectors** connect timber and agricultural areas with the arterial system. Their design standards take the characteristics of resource-oriented traffic into account.
- **Local Roads** provide on-street parking and direct access to abutting property. Their design discourages through traffic. Dead-end street lengths are minimized. People biking can share the road with auto traffic, but separation from traffic is still needed for pedestrians.

The proposed changes to the functional classification of County roads are shown in Table 1 and are consistent with modifications proposed as part of ongoing updates to the Corvallis TSP and Philomath TSP as well as the existing Albany TSP. Figure 1 and the following sub-area figures shows the resulting functional classifications of all County roads and State highways with these changes in place (a supporting table is included in the appendix).

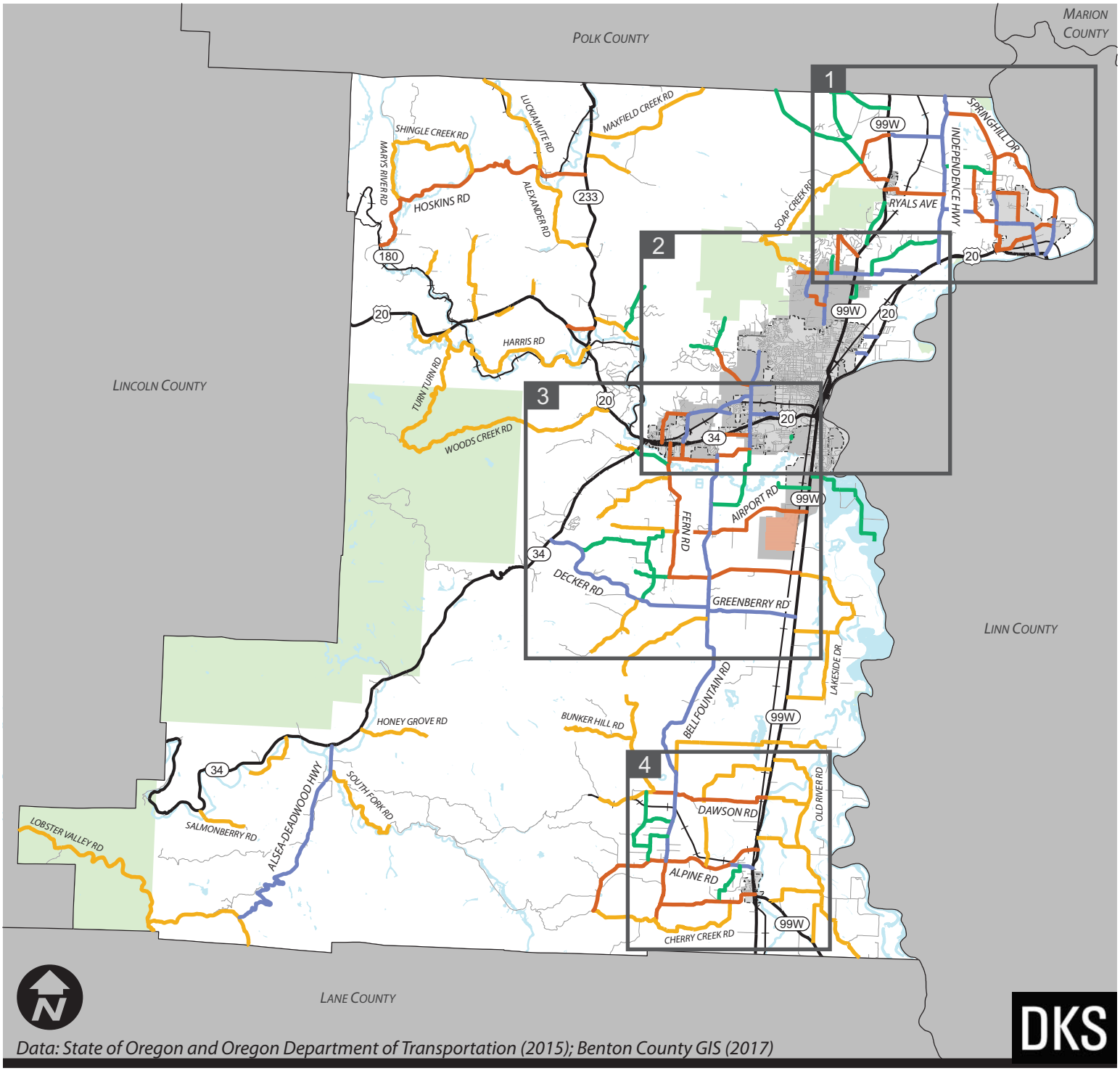
Table 1: Proposed Roadway Functional Classification Changes

Roadway	From	To	Functional Classification		Reason for Change
			Existing	*Proposed*	
19th Street	US 20/Highway 34	West Hills Road	Major Collector	Minor Arterial	Consistency with Philomath TSP
53rd Street	US 20/Highway 34	Plymouth Drive	Major Collector	Minor Arterial	Consistency with Corvallis TSP
53rd Street	Plymouth Drive	Bellfountain Road	Resource Collector	Minor Collector	Consistency with Corvallis TSP
9th Street	US 20/Highway 34	West Hills Road	Minor Collector	Major Collector	Consistency with Philomath TSP
Airport Road	Highway 99	Bellfountain Road	Minor Arterial	Major Collector	Consistent with current and future activity
Airport Road	Fern Road	End	Minor Arterial	Resource Collector	Consistent with current and future activity
Alpine Road	Bellfountain Road	Alpine Cut-off	Minor Arterial	Major Collector	Low Traffic Volumes
Blakeskey Creek Road	Cardwell Hill Drive	End	None[1]	Minor Collector	Consistent with current and future activity
Brooklane Drive	Chinitimini Avenue	Hawkeye Avenue	None[1]	Minor Collector	Consistency with Corvallis TSP
Circle Boulevard	Corvallis City Limits	US 20	None[1]	Minor Arterial	Consistency with Corvallis TSP
Conifer Boulevard	Corvallis City Limits	US 20	None[1]	Minor Arterial	Consistency with Corvallis TSP
County Club Drive	US 20/Highway 34	53rd Street	Minor Collector	Major Collector	Consistency with Corvallis TSP
Crescent Valley Drive	Lewisburg Avenue	Jackson Creek Drive	Major Collector	Minor Arterial	Consistency with Corvallis TSP
Crescent Valley Drive	South of Raider Way	Highland Drive	Minor Collector	Major Collector	Consistency with Corvallis TSP
Elliott Circle	Granger Avenue	End	None	Minor Collector	Consistency with Corvallis TSP
Gibson Hill Road	Scenic Drive	North Albany Road	Major Collector	Minor Arterial	Consistency with Albany TSP

Roadway	From	To	Functional Classification		Reason for Change
			Existing	*Proposed*	
Harrison Boulevard	53rd/Walnut Boulevard	Corvallis City Limits	None[1]	Minor Arterial	Consistency with Corvallis TSP
Herbert Avenue	Highway 99	End	None	Minor Collector	Consistency with Corvallis TSP
Kiger Island Drive	City UGB	End	Resource Collector	Minor Collector	Consistency with Corvallis TSP
Lewisburg Avenue	Huntington Drive	Crescent Valley Drive	Minor Arterial	Major Collector	Consistency with Corvallis TSP
Orchard Street	Coon Road	Highway 99W	None[1]	Major Collector	Consistent with current and future activity
Quarry Road	North Albany Road	Springhill Drive	None[1]	Major Collector	Consistency with Albany TSP
Sulphur Springs Road	Lewisburg Avenue	City UGB	Resource Collector	Major Collector	Consistency with Corvallis TSP
Vineyard Drive	Lewisburg Avenue	End	Local	Minor Collector	Consistency with Corvallis TSP
West Hills Road	9th Street	19th Street	Minor Arterial	Major Collector	Consistency with Philomath TSP
West Hills Road[2]	Reservoir Avenue	Western Boulevard	Major Collector	Minor Arterial	Consistency with Corvallis TSP

[1]Roadways were not previously listed in the 2001 TSP.

[2]Excluding the portion of West Hills Road that is within City Limits.



Data: State of Oregon and Oregon Department of Transportation (2015); Benton County GIS (2017)

FIGURE 1: PROPOSED ROADWAY FUNCTIONAL CLASSIFICATION

BENTON COUNTY
TRANSPORTATION SYSTEM PLAN

Legend

- Principal Arterial
- Minor Arterial
- Major Collector
- Minor Collector
- Resource Collector
- Local Roadway
- Railroad
- River
- Park
- Airport
- Urban Growth Boundary
- City Limits

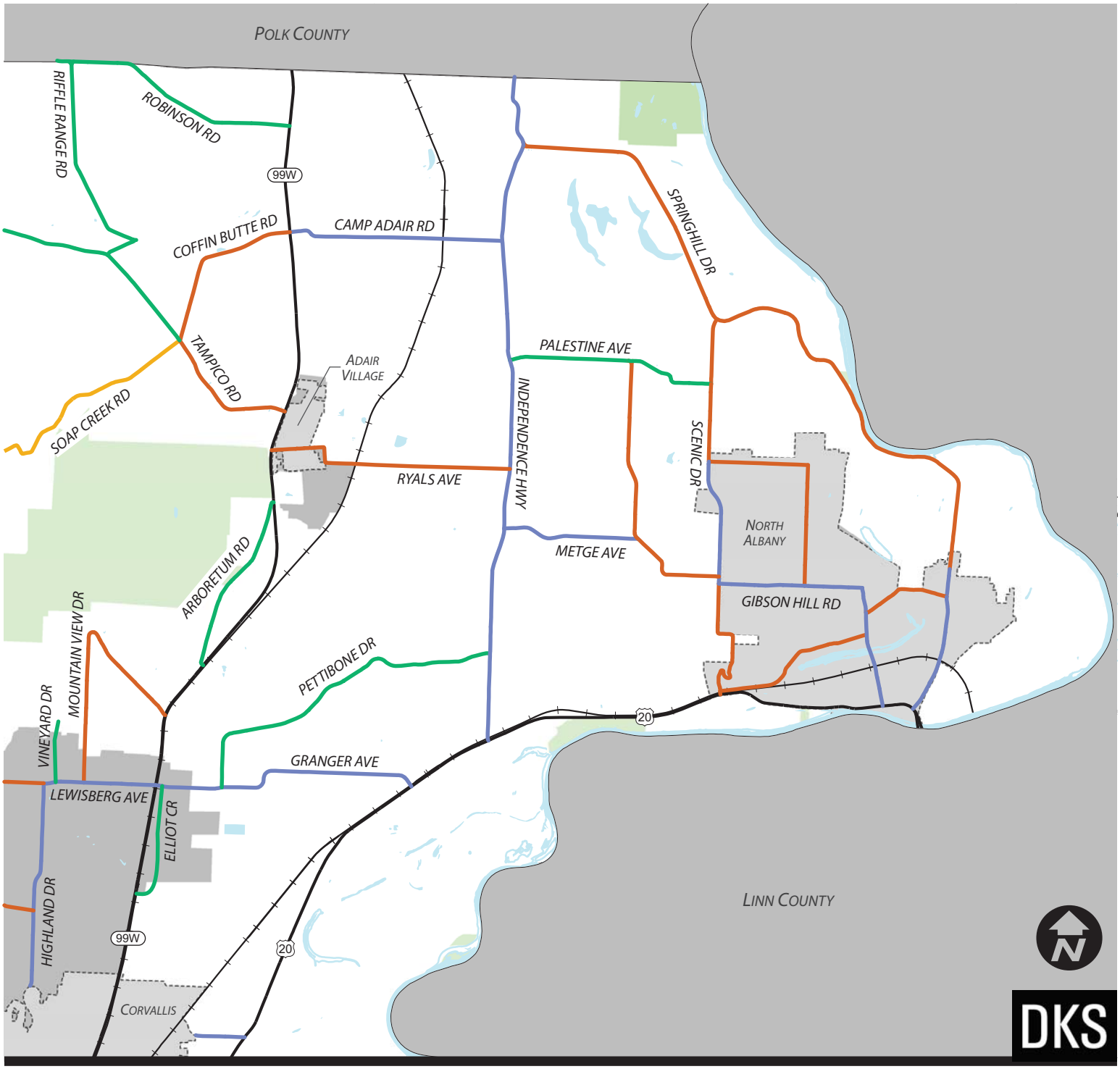
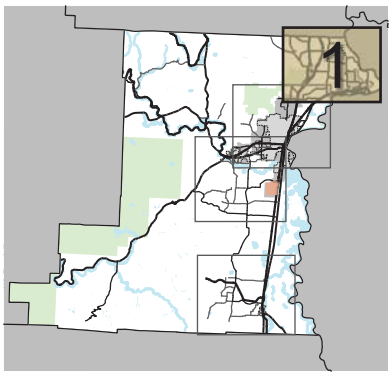


FIGURE 2: PROPOSED ROADWAY FUNCTIONAL CLASSIFICATION - SUBAREA 1

BENTON COUNTY
TRANSPORTATION SYSTEM PLAN

Legend

- Principal Arterial
- Minor Arterial
- Major Collector
- Minor Collector
- Resource Collector
- Local Roadway
- Railroad
- River
- Park
- Airport
- Urban Growth Boundary
- City Limits



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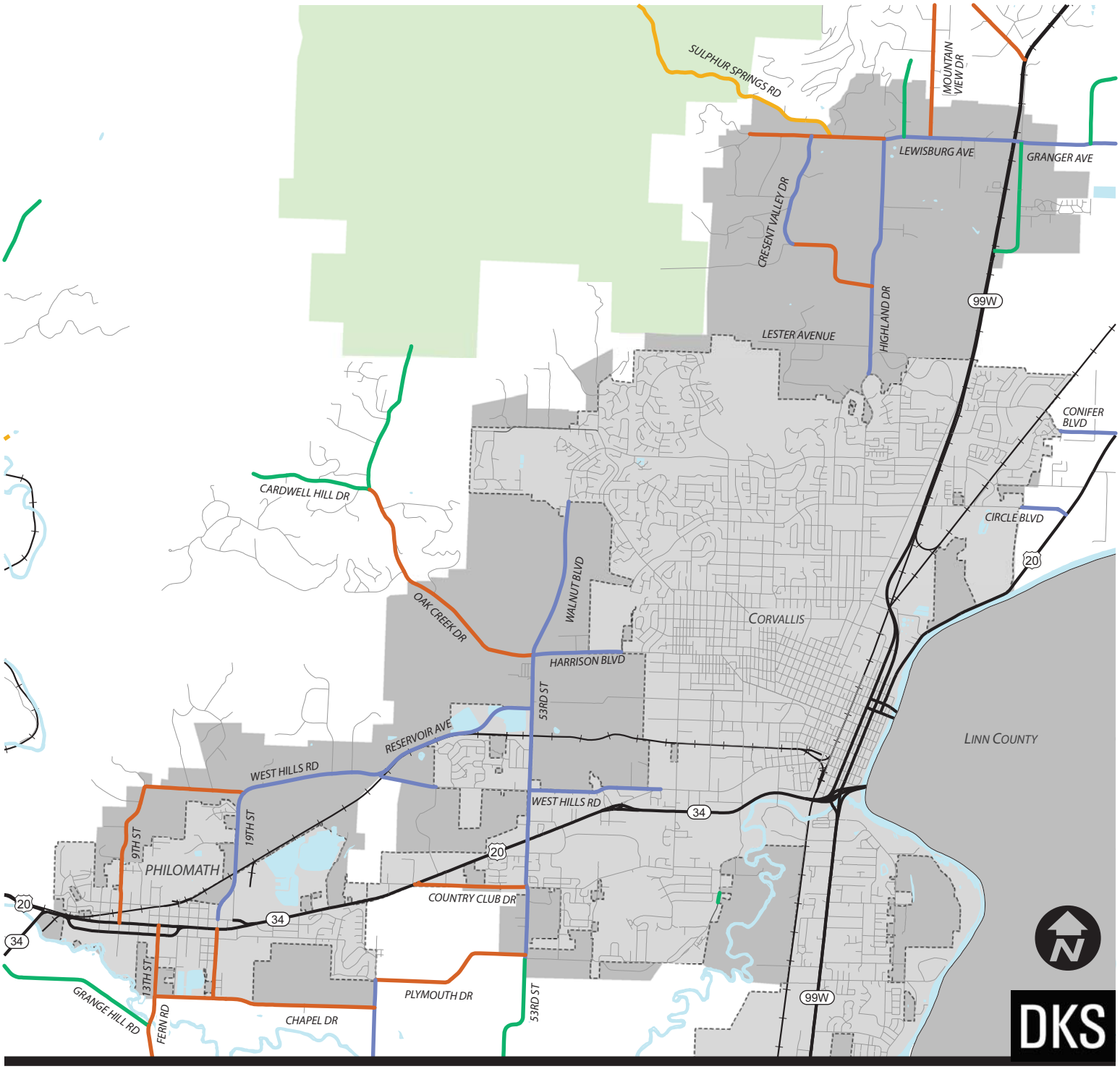


FIGURE 3: PROPOSED ROADWAY FUNCTIONAL CLASSIFICATION - SUBAREA 2

BENTON COUNTY
TRANSPORTATION SYSTEM PLAN

Legend

- Principal Arterial
- Minor Arterial
- Major Collector
- Minor Collector
- Resource Collector
- Local Roadway
- Railroad
- River
- Park
- Airport
- Urban Growth Boundary
- City Limits

Data: State of Oregon and Oregon Department of Transportation (2015); Benton County GIS (2017)

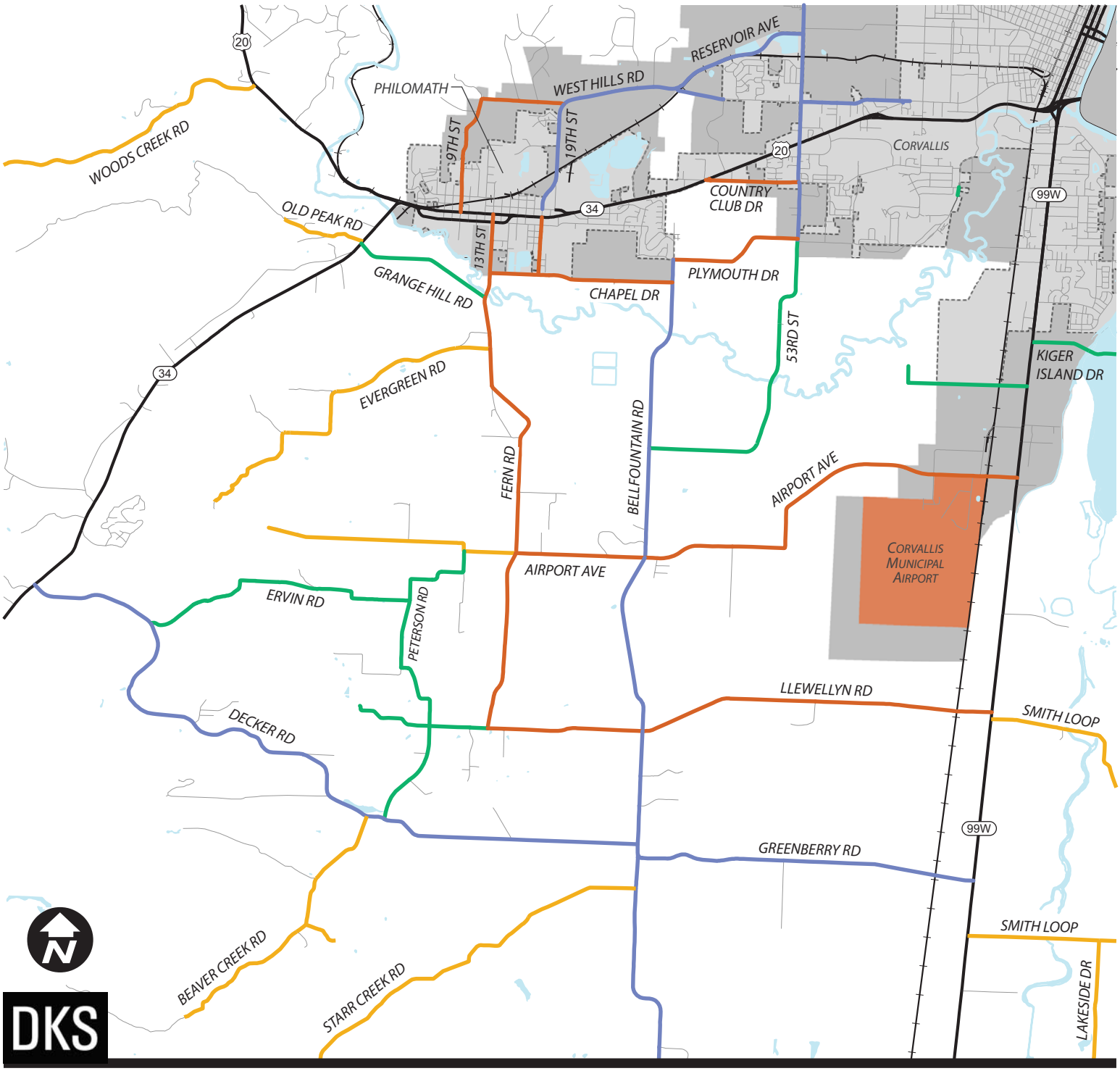
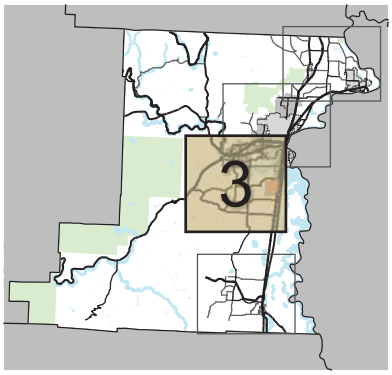


Figure 4: Proposed Roadway Functional Classification - Subarea 3

Benton County
Transportation System Plan

Legend

- Principal Arterial
- Minor Arterial
- Major Collector
- Minor Collector
- Resource Collector
- Local Roadway
- Railroad
- River
- Park
- Airport
- Urban Growth Boundary
- City Limits



Data: State of Oregon and Oregon Department of Transportation (2015); Benton County GIS (2017)

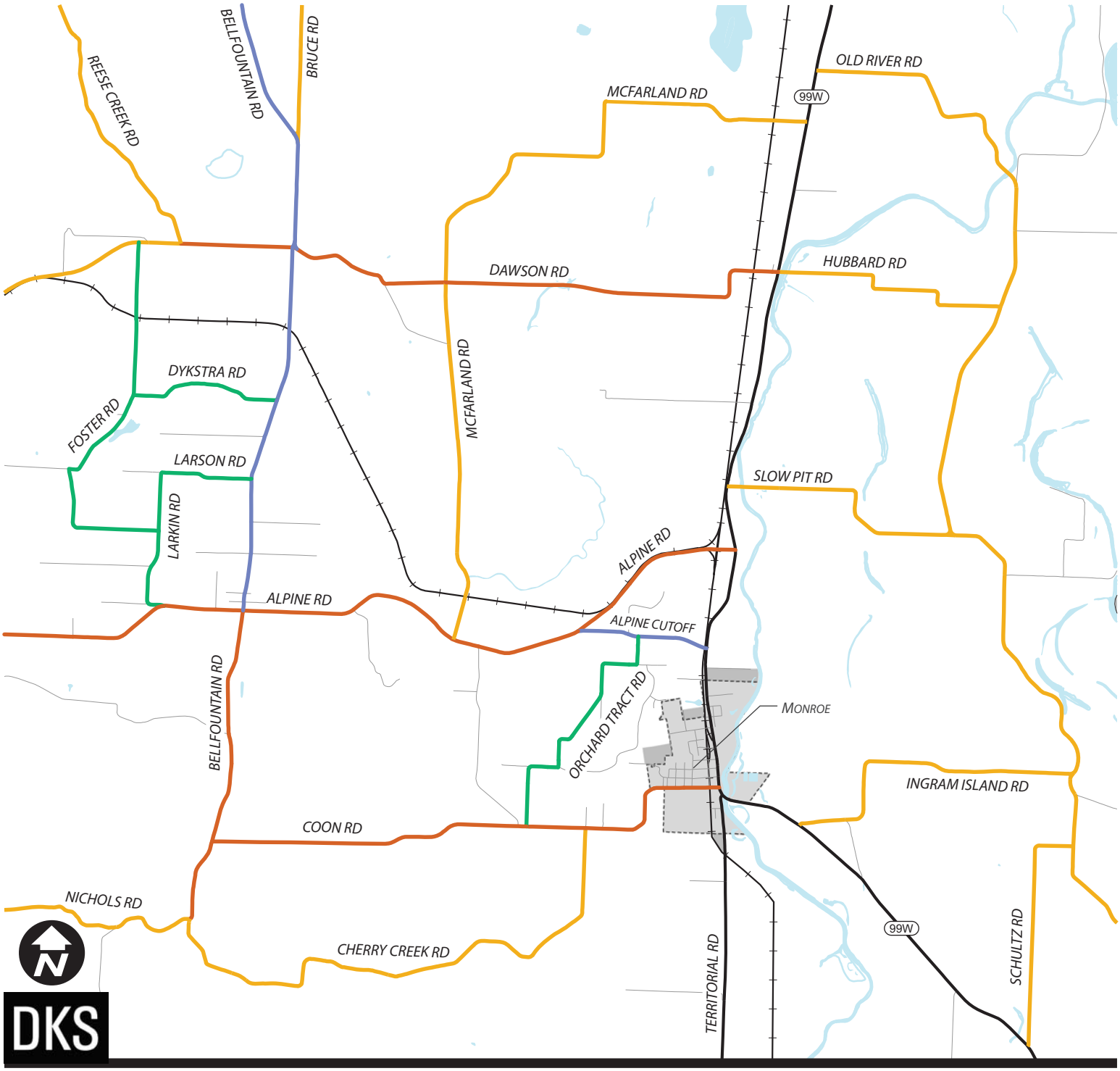
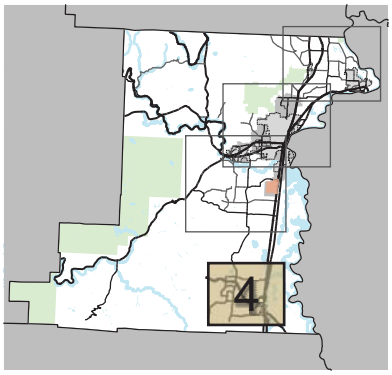


FIGURE 5: PROPOSED ROADWAY FUNCTIONAL CLASSIFICATION - SUBAREA 4

BENTON COUNTY
TRANSPORTATION SYSTEM PLAN

Legend

- Principal Arterial
- Minor Arterial
- Major Collector
- Minor Collector
- Resource Collector
- Local Roadway
- Railroad
- River
- Park
- Airport
- Urban Growth Boundary
- City Limits



Data: State of Oregon and Oregon Department of Transportation (2015); Benton County GIS (2017)

FREIGHT ROUTES

Roadways that are designated as freight routes are recognized as being appropriate and commonly traveled corridors for freight vehicles. Decisions affecting maintenance, operation, or construction on a designated freight route must address potential impacts on the safe and efficient movement of truck traffic. However, the intent is not to compromise the safety of other street users to accommodate truck traffic, especially in areas where many conflicts may be present. In such areas, the operational objectives of the street should prioritize safe travel for vulnerable users (e.g., people walking and biking) while continuing to accommodate passage by truck traffic.

The City of Corvallis does not currently define designated freight routes; however, it is considering designating Airport Avenue as a freight route as part of the ongoing Corvallis TSP update.[1] The City of Philomath is currently considering designating West Hills Road (Reservoir Avenue to 19th Street), 19th Street (West Hills Road to Main Street), Industrial Way (including the proposed extension), 13th Street, Chapel Drive, and Bellfountain Road (in City limits) as freight routes as part of the ongoing Philomath TSP update.[2]

The County has designated an Over Width Vehicle Route along Decker Road and Greenberry Road, however, there are no currently designated freight routes on County facilities. For this TSP update, it is recommended that the following corridors be designated as County freight routes once improvements have been made to support freight traffic:

- Coffin Butte Road (Soap Creek Road to OR 99W)
- Camp Adair Road
- Independence Highway (County border to US 20)
- Decker Road
- Greenberry Road
- Llewellyn Road
- 13th-Fern-Llewellyn
- Bellfountain Road (Greenberry Road to Plymouth Drive)
- Alpine Road (instead of Dawson)

ODOT has classified Corvallis-Newport Highway (US 20/OR 34), Pacific Highway West (OR 99W), and Corvallis-Lebanon Highway (OR 34) as freight routes and reduction review routes.[3] US 20 between Corvallis and Albany has also been designated as a reduction review route. Federal freight routes generally require 12-

[1] Technical Memorandum #16: Corvallis Transportation Plan Updated Task 6.1 Transportation Standards, October 27, 2017.
[2] Technical Memorandum #9: Philomath Transportation Plan Updated Task 7.1 Transportation Standards and Solutions, January 15, 2018.
[3] Technical Memorandum #4: Benton County Transportation Plan Update Task 2.2 Existing Transportation System Conditions and Deficiencies, November 6, 2017.

foot travel lanes. Reduction review routes are highways that require review of any proposed changes to determine if there will be a reduction of vehicle-carrying capacity.

A map of the proposed County freight routes and existing State/Federal freight routes and reduction review routes is provided in Figure 6.

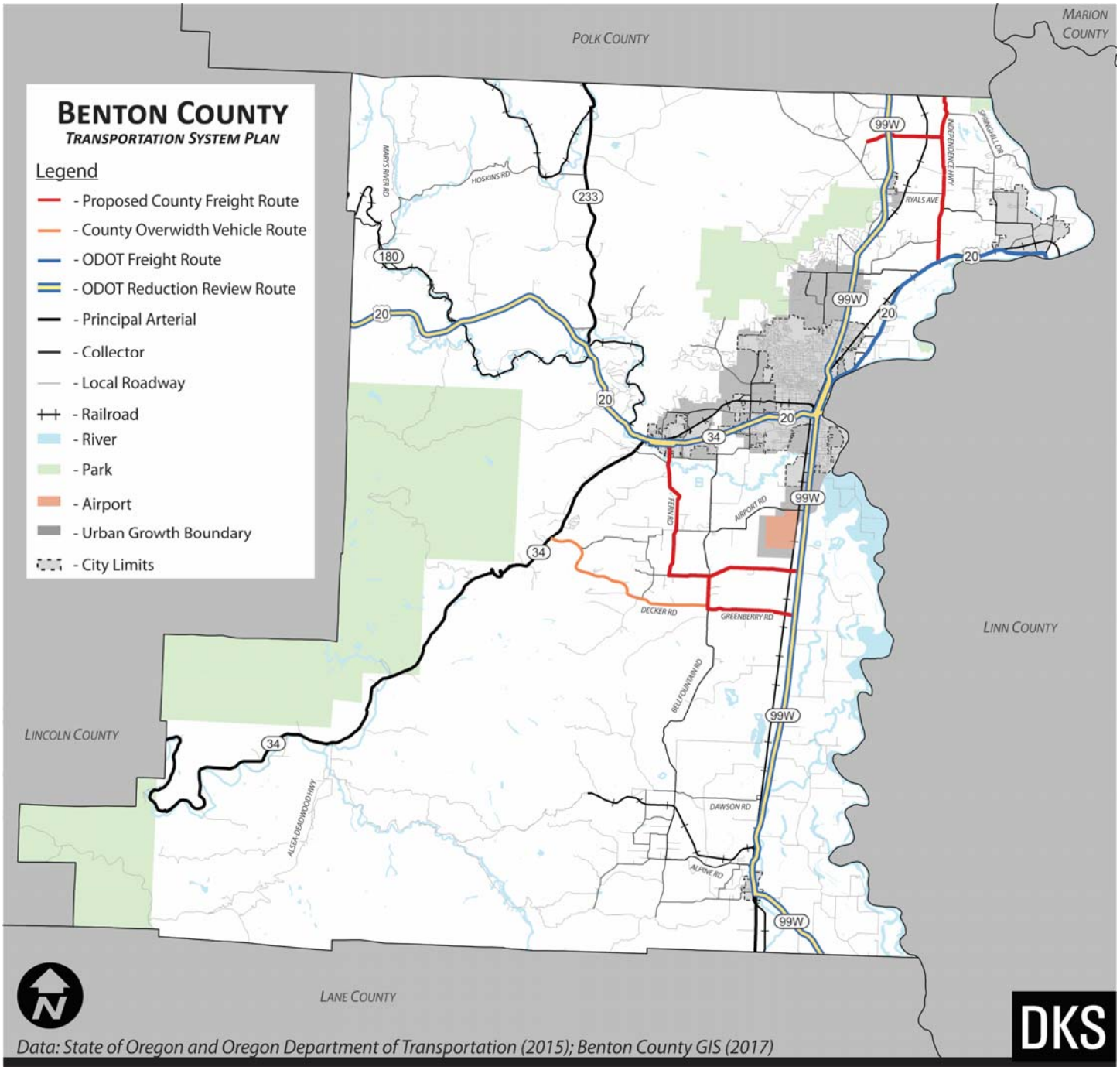


Figure 6: Proposed County Freight Routes

STREET CONNECTIVITY IN URBAN AREAS

Local street connectivity is required by the state Transportation Planning Rule (OAR 660-012). Providing adequate connectivity can reduce the need for wider roads, traffic signals, and turn lanes. Increased connectivity can reduce overall vehicle miles traveled (VMT), balance the traffic load on major facilities, encourage citizens to seek out other travel modes, and reduce emergency vehicle response times. While improvement to local street connectivity is easier to implement in newly developed areas, retrofitting existing areas to provide greater connectivity should also be attempted.

The design and construction of connector roadways should evaluate whether neighborhood traffic management strategies are necessary to protect existing neighborhoods from potential traffic impacts caused by extending stub end streets. In addition, to establish appropriate expectations, the County should require the installation of signs indicating the potential for future connectivity when development constructs stub streets.

The County's existing street connectivity is limited primarily by natural features such as hills and wetlands, railroads, large industrial developments, and by undeveloped areas for future development or annexation. In rural areas of the County, street connectivity is less of a concern due to low population density. The primary purpose of street connectivity standards is for areas outside of a city but inside the urban growth boundary (UGB). The cities within Benton County have adopted connectivity requirements that dictate features such as maximum block lengths, block perimeters, and cul-de-sac lengths. Inside UGBs, Benton County will apply the connectivity requirements of the applicable City. Because this TSP update effort will include special elements for Adair Village and Monroe, their current connectivity requirements with any suggested changes are shown below.

City of Adair Village

The Adair Village Land Use Development Code regulates proposed development to ensure good transportation system connectivity is provided.[4] Table 2 on the following page highlights key requirements and some proposed changes to consider.

[4] Adair Village Land Use Development Code Article 5, City of Adair Village, Amended March 2013.

Table 2: Adair Village Proposed Changes to Connectivity Requirements

Existing Requirement	Proposed Change
A block shall have an average block size of approximately 400 feet. No block shall be more than 1,200 feet in length between street corner lines unless approved by the City.	*No change*
There are no block length or perimeter maximums placed on specific land use (i.e. residential, commercial, or industrial) zones.	*No change*
Cul-de-sac streets should have a maximum length of 500 feet but may be longer where unusual circumstances exist. A cul-de-sac shall terminate with a circular turn-around with a minimum right-of-way of 50 feet.	*Cul-de-sacs should be discouraged, however, when they are unavoidable they may not exceed 500 feet in length. The City may approve longer cul-de-sac lengths, not to exceed 900 feet, where site-specific conditions such as environmental or topographical constraints, existing roads, development patterns, or compliance with other City standards preclude street extension and through-circulation. A cul-de-sac shall terminate with a circular turn-around with a minimum right-of-way of 50 feet.*
Developments adjoining existing or proposed bikeways shall include provisions for connection and extension of such bikeways through dedication of easements or rights-of-way. The City may include bikeway improvements as conditions of approval for developments that will benefit from bikeways. Where possible, bikeways should be separated from other modes of travel, including pedestrian ways. Minimum width for bikeway shall be 5 feet per travel lane.	*No change*

City of Monroe

The Monroe Code of Ordinances regulates proposed development in residential and commercial zones to ensure good transportation system connectivity is provided.[5] Table 3 on the following page highlights key requirements and some proposed changes to consider.

[5] Monroe Code of Ordinances Title 15, City of Monroe, 2002.

Table 3: Monroe Proposed Changes to Connectivity Requirements

Existing Requirement	Proposed Change
In residential and commercial zones, block lengths shall not exceed 500 feet and block perimeters 1,200 feet except where topography, natural features, or existing development creates conditions requiring longer blocks.	*No change*
Cul-de-sacs – no existing requirement	*Cul-de-sacs should be discouraged, however, when they are unavoidable they may not exceed 500 feet in length. The City may approve longer cul-de-sac lengths, not to exceed 900 feet, where site-specific conditions such as environmental or topographical constraints, existing roads, development patterns, or compliance with other City standards preclude street extension and through-circulation. A cul-de-sac shall terminate with a circular turn-around with a minimum right-of-way of 50 feet.*
Pedestrian and Bicycle Access – no existing requirement	Consider adding to Ordinance Sections 152.030(K)(3) and 152.031 (G) – Streets and alleys: *Pedestrian and Bicycle Access. New partitions and subdivisions shall provide safe bicycle and pedestrian connections to adjacent existing and planned residential areas, transit stops, and activity centers. Non-motorized connectivity can be provided through sidewalks, shared-use paths, and striped and/or signed bicycle facilities on local roadways.* *New definition:* *Activity center. Uses or buildings that are open to the public, have a civic or community function, and/or attract visitors. Uses include public parks, public buildings (e.g., post office, library, city offices, schools), elder care facilities, and shopping centers.*

TYPICAL ROADWAY CROSS-SECTION STANDARDS

On each roadway cross-section, there are facilities that accommodate bicycles and pedestrians. The following sections detail the roadway bicycle and pedestrian facilities that are a part of each roadway cross-section. The TSP update is recommending that County roadways within an UGB include walking and biking facilities consistent with the roadway design standards from the respective city's TSP.

Roadway Bicycle and Pedestrian Facilities

The basic design treatments used to accommodate bicycle travel include shared roadways, shoulder bikeways, bike lane, and pedestrian facilities. The previous TSP referenced a previous version of the Oregon Bicycle and Pedestrian Plan, Section II.1 as the standards to follow for bicycle and pedestrian facilities, except where the Benton County Development Code calls for a higher standard. The Oregon Bicycle and Pedestrian Plan has been recently updated.

The TSP update recommends using the following types of shared-use facilities for the appropriate situation. These facilities are based on the most recent definitions and standards of the Oregon Bicycle and Pedestrian Plan.[6]

- **Shared Roadway:** On a shared roadway, bicyclists and motorists share the same travel lane. A motorist will usually have to cross over into the adjacent travel lane to pass a bicyclist. Shared roadways are common on neighborhood streets and on rural roads and highways. The treatments that enhance shared roadways for bicyclists include a wide outside lane and bicycle boulevards.
- **Shoulder Bikeway:** Paved roadway shoulders on rural roadways provide an area for bicycling, with few conflicts with faster moving motor vehicle traffic. Most rural bicycle travel on the state highway system is accommodated on shoulder bikeways.
- **Bike Lane:** A portion of the roadway designated for use by bicyclists. Bike lanes are appropriate on urban arterials and major collectors. They may be appropriate in rural areas where bicycle travel and demand is substantial. Bike lanes must always be well marked to call attention to their use by bicyclists. Types of bike lanes include protected and buffered bike lanes.
- **Pedestrian Facilities:** Sidewalks, shared-use paths, and shoulder bikeways where no sidewalks exist all serve as pedestrian facilities. In addition, pedestrian may use trails that are not suited to or forbidden to bicyclists.

Table 4 on the following page presents the typical cross-section standards for County roadways outside of UGBs. Within UGBs, it is recommended that County roads be subject to the respective City's roadway design standards. The recommended cross-section standards are generally consistent with the current roadway design standards, with the exception that they are defined based on functional classification instead of average daily traffic (ADT).

The TSP update does not modify the design standards for state highways, which represent all principal arterials within the county. These roadways are subject to the design criteria in the state's Highway Design Manual.[7] Following Table 4, Figure 7 through Figure 13 include typical cross-section standards for County roadways outside of UGBs.

[6] Oregon Bicycle and Pedestrian Plan, ODOT, 1995, adopted May 19, 2016.
[7] Highway Design Manual, ODOT, 2012. https://www.oregon.gov/ODOT/HWY/ENGSERVICES/Pages/hwy_manuals.aspx.

Table 4: Typical Cross-section Standards

	Secondary Local	Residential Local	Residential Local HSO[1]	Primary Local	Minor Collector Standard	Major Collector Standard	Arterial Standard
Functional Classification	Local	Local	Local	Local	Minor Collector	Major Collector	Minor Arterial
Projected ADT	< 20	< 200	< 200	< 700	< 1000	< 2000	< 1000
Projected DHV	<10/Hour	<30/Hour	<30/Hour	<100/Hour	<100/Hour	<300/Hour	>300/Hour
Min ROW	50'	50'	50'	50'	60'	60'	80'
Surface Width	16'	20'	18'	22'	24'	32'	36'-72'
Lane Widths	8'	10'	9'	10'	10'	11'	12'
Surface Material	Gravel	Gravel	Asphalt, Concrete, Oil Mat	Asphalt, Concrete, Oil Mat	Asphalt, Concrete	Asphalt, Concrete	Asphalt, Concrete
Example Structure	10" CAB	10" CAB	3" AC, 12" Aggregate	3" AC, 12" Aggregate	4" AC over 10" CAB	4" AC over 12" CAB	6" AC over 15" CAB
Crushed Base Equivalent	10"	10"	18"	18"	18"	20"	27"
Shoulder	NA	NA	1' Gravel	1 Paved + 1' Gravel	2' Paved + 2' Gravel	2' gravel	2' gravel
Max Grade	15% Paved	15% Paved	15% Paved	0.15	0.12	0.1	0.08
Bike Lanes	None	None	None	None	If in TSP or Bike Plans	5' Bike Lane	6' Bike Lane
Min Curve Radius	150'	200'	200'	250'	500'	760'	800'
Design Speed	20 mph	20 mph	25 mph	30mph	45 mph	45 mph	50 mph

[1] HSO = Hard Surface Option

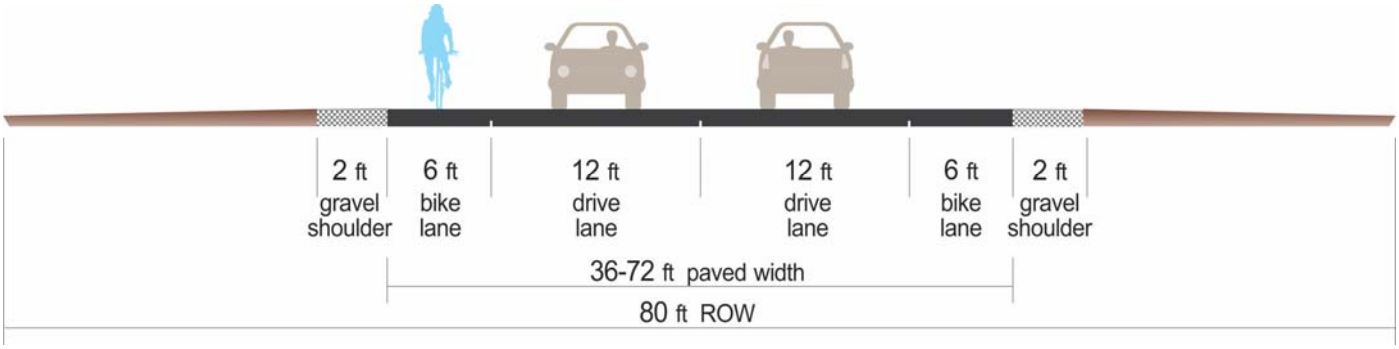


Figure 7: Arterial Standard Cross-Section

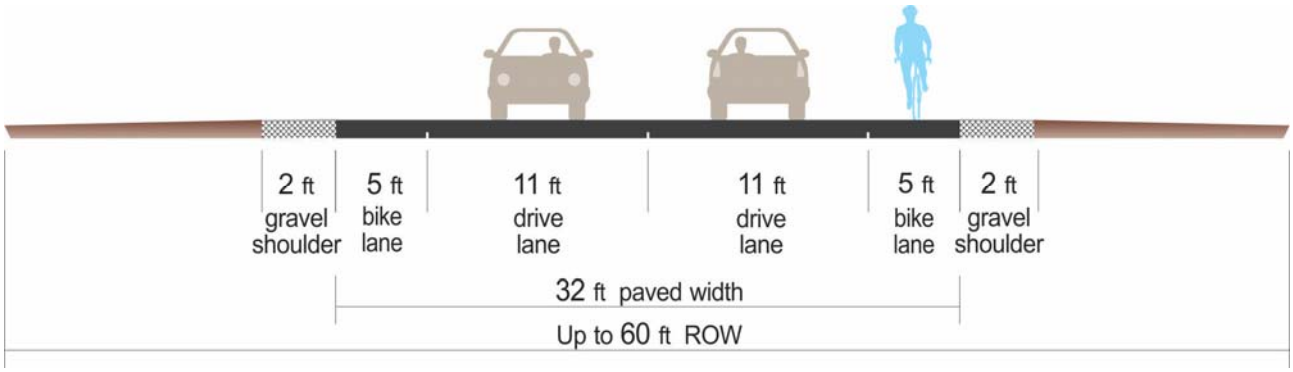


Figure 8: Major Collector Standard Cross-Section

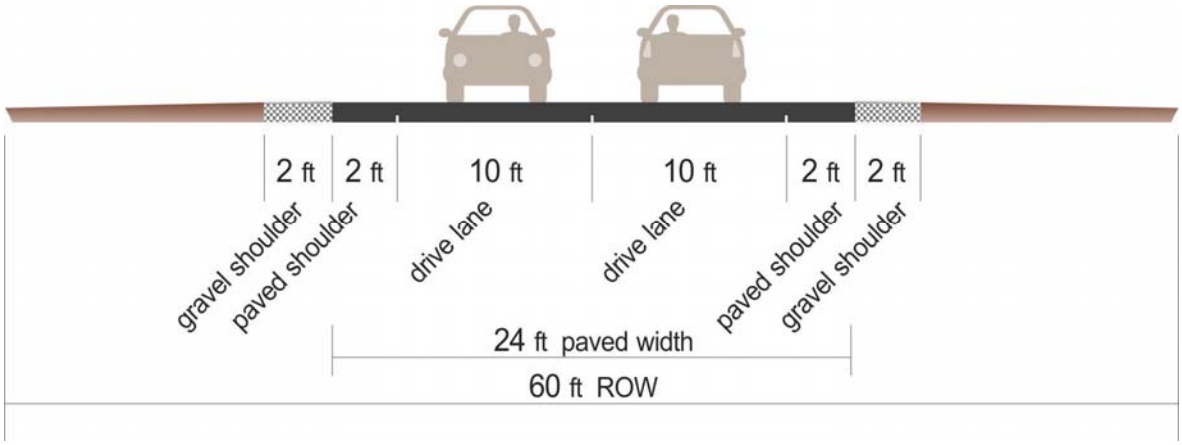


Figure 9: Minor Collector Standard Cross-Section

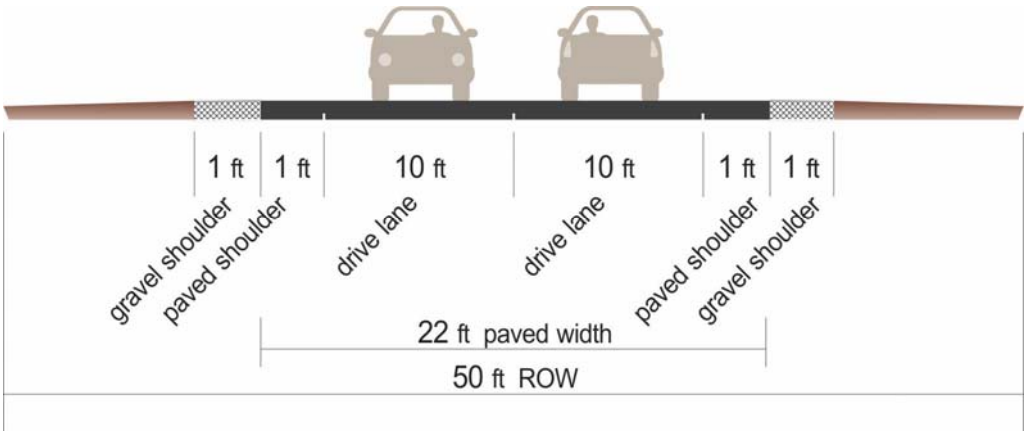


Figure 10: Primary Local Cross-Section

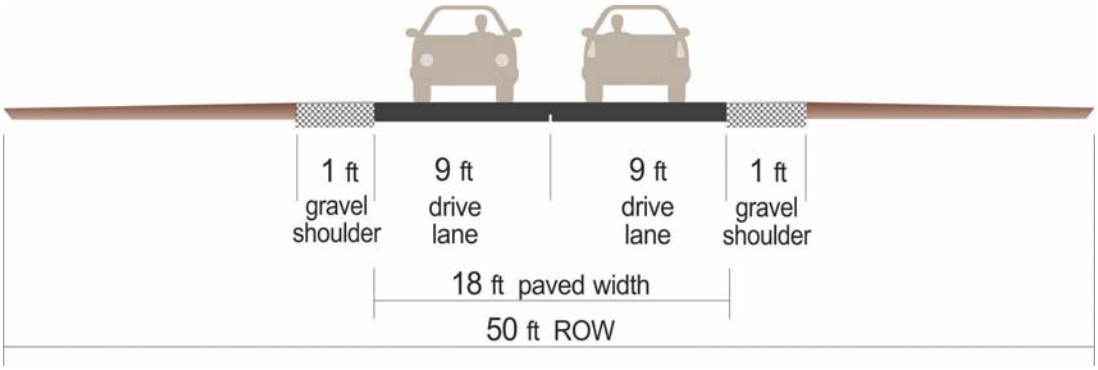


Figure 11: Residential Local HSO Cross-Section

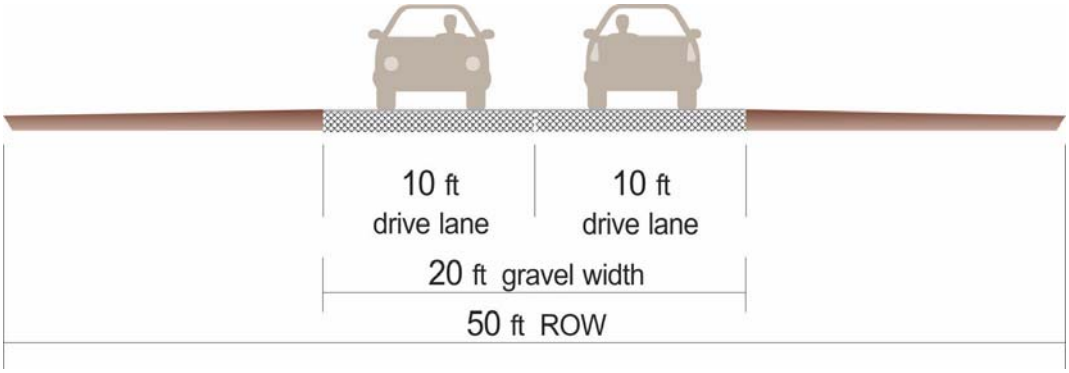


Figure 12: Residential Local Road Cross-Section

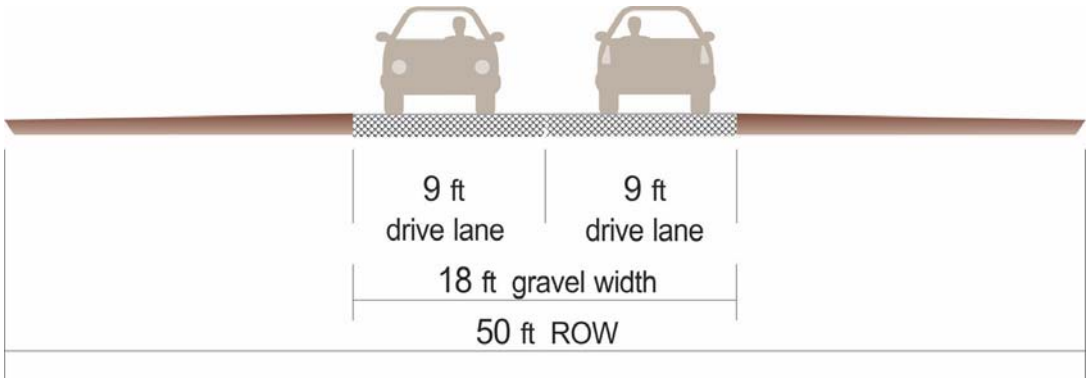


Figure 13: Secondary Local Road Cross-Section

Shared-use Path

A shared-use facility separated from motor vehicle traffic by an open space or barrier, either within the road right-of-way or within an easement. These are typically used by pedestrians, joggers, skaters, and bicyclists as two-way facilities. Shared-use paths are appropriate in corridors not well served by the street system (if there are few intersecting roadways) to create short cuts that link destination and origin points, and as elements of a community trail plan. Shared use facilities may sometimes be the preferred option over shoulder bikeways.

Shared-use paths provide off-roadway facilities for walking and biking travel. Depending on their location, they can serve both recreational and transportation needs. Shared-use path designs vary in surface types and widths. Hard surfaces are generally better for bicycle travel. Widths need to provide ample space for both walking and biking and should be able to accommodate maintenance vehicles.

The TSP update recommends that a paved shared-use path should be 12 feet wide in areas with significant walking or biking demand; otherwise, it should be 10 feet wide (see Figure 14). The Public Works Director may reduce the width of the typical paved shared-use path to a minimum of eight feet in constrained areas (e.g., steep, environmentally sensitive, historic, or previously developed areas).

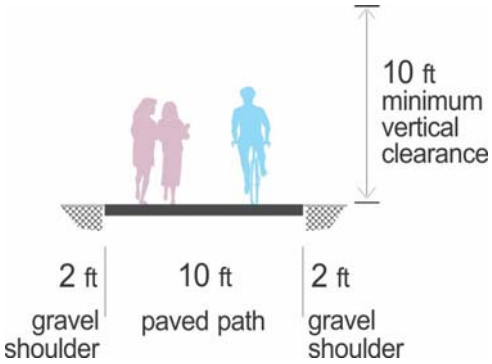


Figure 14: Paved Shared-Use Path

Enhanced Pedestrian Crossing Treatment Guidelines

Enhanced pedestrian crossing treatments are intended to make it easier and safer to cross a road for non-motorized travelers, especially those where high traffic volumes and speeds create a barrier-effect. Treatment alternatives that should be considered depending on the context of the crossing location include median refuge islands, curb extensions, improved street lighting, and several types of signalized enhancements. These treatments may be used in combination. For example, the median refuge island and street lighting could be stand-alone improvements or combined with a pedestrian traffic signal enhancement.

Roadways with high traffic volumes and/or speeds in areas with nearby transit stops, residential uses, schools, parks, shopping and employment destinations often require enhanced street crossings. The County should consider adding enhanced pedestrian crossing treatments to increase protection where warranted by the combination of pedestrian demand volumes and cross traffic speeds and volumes. Appendix A of National Cooperative Highway Research Program (NCHRP) Report 562, *Improving Pedestrian Safety at Unsignalized Crossings,* includes a procedure for treatment selection, with input variables including:

- Vehicle speed on the major street
- Pedestrian crossing distance
- Peak hour pedestrian volume
- Peak hour vehicle volume
- Local parameters such as motorist compliance, pedestrian walking speed, and pedestrian start-up and clearance time

NCHRP Report 562 includes worksheets for inputting the variables above and identifying the appropriate treatment type. Potential locations along County facilities where mid-block pedestrian and bicycle access ways should be considered are within an urban community area where blocks are longer than 500 feet and spacing is no more than 330 feet. In rural community areas, potential locations for improvements should be determined as the need arises and individual studies should be conducted to determine the appropriate treatment. Enhanced pedestrian crossing at state highways are required to be reviewed and approved by ODOT.

ACCESS SPACING STANDARDS

Access management is a broad set of techniques that balance the need to provide for efficient, safe, and timely travel with the ability to allow access to individual destinations. Appropriate access management standards and techniques can reduce congestion and accident rates, and may lessen the need for construction of additional roadway capacity. The spacing of street and driveway (i.e., accesses) intersections on a roadway is a key element of access management.

The current access standards are presented in Appendix B of the 2001 Benton County TSP. These standards reference the access management standards presented by ODOT that are limited to statewide, regional, and district highways. In the County, there are arterials and collectors that would benefit from access management strategies but as they are not considered a statewide, regional, or district highway there is no clear standard. This TSP update recommends replacing Appendix B with the following.

Minimum public roadway intersection and private access spacing standards for County-owned roadways outside of an UGB are identified in Table 5 on the following page**.** New roadways or redeveloping properties must comply with these standards to the extent practical, as determined by County staff. As the opportunity arises through redevelopment, roadways not complying with these standards could improve with strategies such as shared access points, access restrictions (median or channelization islands), or closure of unnecessary access points, as feasible.

Table 5: Minimum Roadway and Access Spacing Standards

Posted Speed or Travel Speed*	Minor Arterial	Major Collector	Minor Collector	Resource Collector	Local Roadway
≥ 50 mph	475 feet	475 feet	325 feet	100 feet	100 feet
40 & 45 mph	400 feet	400 feet	325 feet	100 feet	100 feet
30 & 35 mph	275 feet	275 feet	220 feet	100 feet	100 feet
≤ 25 mph	200 feet	200 feet	150 feet	100 feet	100 feet

*County staff shall determine the travel speed for roadways without a posted speed. An applicant for access may submit a speed study completed by an Oregon certified engineer or other professional with appropriate expertise, to be considered and approved by the County, if there is disagreement with the County speed determination.

The TSP update is recommending that County roadways within an UGB adopt roadway and access spacing standards consistent with the standards from the respective City. Access spacing standards for state highways are determined by ODOT and are defined in the Oregon Highway Plan, OAR 734-051, and ODOT's Highway Design Manual.

MOBILITY STANDARDS

The adoption of mobility standards for roadways and intersections in Benton County is recommended as part of the TSP update to provide a metric for assessing the impacts of new development on the existing transportation system and for identifying where capacity improvements may be needed. They are the basis for requiring improvements needed to sustain the transportation system as growth and development occur. Two methods to gauge intersection operations include volume-to-capacity (v/c) ratios and level of service (LOS).

- **Volume-to-capacity (v/c) ratio:** A v/c ratio is a decimal representation (between 0.00 and 1.00) of the proportion of capacity that is being used at a turn movement, approach leg, or intersection. The ratio is the peak hour traffic volume divided by the hourly capacity of a given intersection or movement. A lower ratio indicates smooth operations and minimal delays. A ratio approaching 1.00 indicates increased congestion and reduced performance.
- **Level of service (LOS):** LOS is a "report card" rating (A through F) based on the average delay experienced by vehicles at the intersection. LOS A, B, and C indicate conditions where traffic moves without significant delays over periods of peak hour travel demand. LOS D and E are progressively worse operating conditions. LOS F represents conditions where average vehicle delay is excessive and demand exceeds capacity, typically resulting in long queues and delays.

All roadways and intersections under the jurisdiction of ODOT must operate at the required mobility targets presented in the 1999 Oregon Highway Plan.[8] All roadways and intersections owned by Benton County must

[8] Oregon Highway Plan, ODOT, 1999, Last amended March 2018.

operate at or below the following recommended mobility targets. Consistent with Benton County Comprehensive plan policy, traffic capacity analysis will be changed from level of service (LOS) to volume/capacity (v/c) ratio.[9] A local agency may choose to apply their adopted mobility targets to county owned roadways in an UGB, given that they do not allow for a lesser degree of mobility.

Signalized, All-way Stop, or Roundabout Controlled Intersections: The intersection must operate with a volume to capacity (v/c) ratio not higher than 0.85 during the highest one-hour period on an average weekday (typically, but not always the evening peak period between 4 p.m. and 6 p.m. during the spring or fall).

Two-way Stop and Yield Controlled Intersections: All intersection approaches serving more than 20 vehicles during the highest one-hour period on an average weekday (typically, but not always the evening peak period between 4 p.m. and 6 p.m. during the spring or fall) shall operate with a v/c ratio not higher than 0.90. Mobility targets do not apply to approaches at intersections serving 20 vehicles or fewer during the peak hour.

TRAFFIC IMPACT ANALYSIS GUIDELINES

The County Traffic Impact Analysis (TIA) requirements implement Sections 660-012-0045(2)(b) and -0045(2)(e) of the State Transportation Planning Rule (TPR). These sections require the County to adopt mobility standards and a process to apply conditions to land use proposals to minimize the impacts on and protect transportation facilities.

The County's development review process is designed to help achieve its goal of managing growth in an efficient, responsible, and sustainable manner. A development application is required to submit full and accurate information upon which the County can base decisions. A developer-submitted transportation study prepared by a professional engineer qualified in the traffic engineering field is a critical tool used by the County to assess the expected transportation system impacts associated with a proposed development and the long-term viability of the transportation system.

The previous County TSP did not have any TIA requirements.[10] As part of this TSP update, the following triggers to require an applicant to submit a Traffic Impact Analysis (TIA) are recommended. A TIA may be required to be submitted to the County with a land use application at the request of the County Engineer or if the proposal is expected to involve one or more of the following:[11]

- Projected increase in trip generation of 50 or more trips outside an urban growth boundary, or 100 or more trips inside an urban growth boundary during either the AM or PM weekday peak hour.

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[9] Benton County Comprehensive Plan, 12.1.17, Benton County, 2007.
[10] Policy 12.1.12(a) of the adopted Benton County Comprehensive Plan (incorporated by reference into the Benton County Development Code as Chapter 50) requires a " traffic analysis that identifies adverse impacts to transportation flow caused by development and demonstrates how adverse impacts will be mitigated" in order to mitigate the traffic impacts of development.
[11] Note that Appendix A of Technical Memorandum #2, Plan Assessment, Goals, and Objectives, includes a recommendation that clear and objective standard be added to BCC Chapter 99 specifying when development proposals are required to conduct and submit a traffic impact study.

- Potential impact to roadways where congestion or safety problems have been previously identified.
- Changes in zoning designation.
- An increase in use of adjacent roadways by vehicles exceeding 26,000 pounds gross vehicle weight.
- The location of an existing or proposed access driveway does not meet minimum spacing or sight distance requirements, or is located where vehicles entering or leaving the property are restricted, or such vehicles are likely to queue or hesitate at an approach or access connection, thereby creating a safety hazard.
- Potential impacts to roadways identified as bicycle routes and safe routes to school.
- A TIA is required by ODOT pursuant with OAR 734-051.

Appendix

Functional Classification Table

County Road	From	To	Functional Classification
N 19th Street	US 20/Highway 34	West Hills Road	Minor Arterial
53rd Street	US 20/Highway 34	Country Club Drive	Minor Arterial
Alpine Cutoff Road	Highway 99	Alpine Road	Minor Arterial
Alpine Road	Bellfountain Road	Alpine Cutoff	Minor Arterial
Bellfountain Road	Plymouth Drive	Alpine Road	Minor Arterial
Camp Adair Road			Minor Arterial
Decker Road			Minor Arterial
Greenberry Road			Minor Arterial
NE Circle Boulevard			Minor Arterial
NE Conifer Boulevard			Minor Arterial
NE Granger Avenue			Minor Arterial
North Albany Road NW			Minor Arterial
NW Crescent Valley Drive	Jackson Creek Drive	Lewisburg Avenue	Minor Arterial
NW Highland Drive			Minor Arterial
NW Independence Hwy			Minor Arterial
NW Lewisburg Avenue			Minor Arterial
NW Metge Avenue			Minor Arterial
NW Walnut Boulevard			Minor Arterial
Scenic Drive NW	Valley View Drive	Gibson Hill Drive	Minor Arterial
Springhill Drive	U.S. 20	North of Nebergall Loop	Minor Arterial
SW 53rd Street	Country Club Drive	Plymouth Drive	Minor Arterial
SW Reservoir Avenue			Minor Arterial
SW West Hills Road	9th	Resevoir	Minor Arterial
Alpine Road	Nichols Road	Bellfountain Road	Major Collector
Alpine Road	Apline Cutoff	Highway 99	Major Collector
Bellfountain Road	Alpine Road	Cherry Creek Road	Major Collector
Chapel Drive			Major Collector
Coffin Butte Road			Major Collector
Coon Road			Major Collector
Crocker Lane NW			Major Collector
Dawson Road	Highway 99	Foster Road	Major Collector
Fern Road			Major Collector
Gibson Hill Road NW			Major Collector
Hoskins Road			Major Collector
Llewellyn Road	Fern Road	Highway 99W	Major Collector
Marys River Road	Highway 180	Hoskins Road	Major Collector
NE Arnold Avenue			Major Collector
NW Crescent Valley Drive	Jackson Creek Drive	Highland Drive	Major Collector
NW Crocker Lane			Major Collector
NW Mountain View Drive			Major Collector
NW Oak Creek Drive	Walnut Blvd/53rd Street	Cardwell Hill Drive	Major Collector
NW Ryals Avenue			Major Collector
NW Scenic Drive	Springhill Drive	North of Valley View Drive	Major Collector
Orchard Street			Major Collector
Priest Road			Major Collector
Quarry Road NW			Major Collector
S 13th Street			Major Collector
S 19th Street	US 20/Highway 34	End	Major Collector
Scenic Drive NW	Gibson Hill Drive	U.S. 20	Major Collector
Soap Creek Road	Highway 99	Tampico Road	Major Collector
Springhill Drive	Independence Highway	North of Nebergall Loop	Major Collector
SW Airport Avenue	Highway 99	Bellfountain Road	Major Collector
SW Airport Avenue	Fern Road	West End	Major Collector
SW Airport Avenue	Bellfountain Road	Fern Road	Major Collector
SW Plymouth Drive			Major Collector
SW West Hills Road	Resevoir	City Limits	Major Collector
Tampico Road	Soap Creek Road	Highway 99W	Major Collector
Valley View Drive NW			Major Collector
W Thornton Lake Drive NW			Major Collector
Blakesley Creek Road			Minor Collector

Dykstra Road			Minor Collector
Elliot Circle			Minor Collector
Ervin Road			Minor Collector
Foster Road			Minor Collector
Grange Hall Road			Minor Collector
Larkin Road			Minor Collector
Larson Road			Minor Collector
Llewellyn Road	Fern Road	West End	Minor Collector
N 9th Street			Minor Collector
NE Pettibone Drive			Minor Collector
NW Arboretum Road			Minor Collector
NW Cardwell Hill Drive	NW Oak Creek Drive	End	Minor Collector
NW Oak Creek Drive	Cardwell Hill Drive	End	Minor Collector
NW Palestine Avenue			Minor Collector
Orchard Tract Road			Minor Collector
Peterson Road			Minor Collector
Rifle Range Road			Minor Collector
Robison Road			Minor Collector
SW Brooklane Drive			Minor Collector
SW Country Club Drive			Minor Collector
Tampico Road	Soap Creek Road	West End	Minor Collector
Vineyard Drive			Minor Collector
Alexander Road			Resource Collector
Beaver Creek Road			Resource Collector
Blodgett Road			Resource Collector
Bruce Road			Resource Collector
Bunker Hill Road			Resource Collector
Cherry Creek Road			Resource Collector
Davis Road			Resource Collector
Dawson Road	Foster Road	S Fork Road	Resource Collector
Devitt Road			Resource Collector
Eureka Road			Resource Collector
Evergreen Road			Resource Collector
Harris Road			Resource Collector
Hayden Road			Resource Collector
Hazel Glen Road			Resource Collector
Hells Canyon Road			Resource Collector
Honeygrove Road			Resource Collector
Horton Road			Resource Collector
Hubbard Road			Resource Collector
Lakeside Drive			Resource Collector
Lilly Hill Road			Resource Collector
Lobster Valley Road			Resource Collector
Luckiamute Road			Resource Collector
Marys River Road	Hoskins Road	Shingle Creek Road	Resource Collector
Maxfield Creek Road			Resource Collector
Mc Farland Road			Resource Collector
Nichols Road			Resource Collector
Norton Creek Road			Resource Collector
NW Cardwell Hill Drive	Kings Valley Highway	End	Resource Collector
NW Harrison Boulevard			Resource Collector
Old Peak Road			Resource Collector
Old River Road			Resource Collector
Preacher Creek Road			Resource Collector
Price Creek Road			Resource Collector
Reese Creek Road			Resource Collector
Salmonberry Road			Resource Collector
Saxton Road			Resource Collector
Schultz Road			Resource Collector
SE Kiger Island Drive			Resource Collector
Shingle Creek Road			Resource Collector
Smith Loop			Resource Collector

Soap Creek Road	Tampico Road	Sulpher Springs Road	Resource Collector
South Fork Road			Resource Collector
Starr Creek Road			Resource Collector
Stow Pit Road			Resource Collector
Sulphur Springs Road			Resource Collector
SW 53rd Street	Plymouth Drive	Bellfountain Road	Resource Collector
Tum Tum Road			Resource Collector
W Ingram Island Road			Resource Collector
Wiles Road			Resource Collector
Woods Creek Road			Resource Collector