MEMORANDUM

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DATE: **November 21, 2013**

TO: **Robin Lewis, P.E., City of Bend**

FROM: **Chris Maciejewski, P.E., PTOE**
Ray Delahanty, AICP
Kate Drennan

SUBJECT: **Existing Conditions – Bend Central District** P#

The City of Bend has taken great strides to begin implementation of their Central Area Plan, including a renewed focus on the Third Street Corridor, referred to in this project as the Bend Central District. Currently, the district is characterized by high traffic volumes, large surface parking lots and auto-oriented land uses, and a challenging pedestrian environment. The City of Bend envisions a district with a mix of uses and a safe and comfortable transportation system that provides strong pedestrian and bicycle connections to the Historic downtown core. One potential avenue for pursing this concept is a designating the area as a Multimodal Mixed-Use area (MMA).

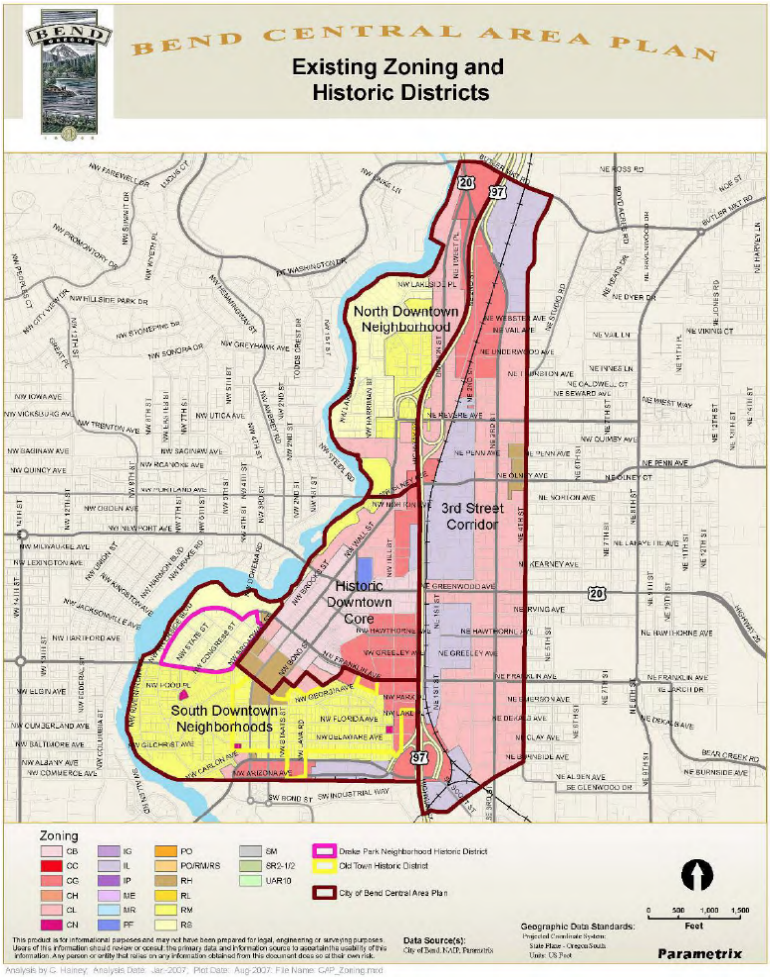


Figure 1: Study Area for the Bend Central Area Plan, including the 3rd Street Corridor (Bend Central District)

Multimodal Mixed-Use Areas

The MMA designation is applied by local governments to downtown or Main Street areas that exist within the urban growth boundary. Designation requires a local legislative land use action to amend the comprehensive plan, and involvement of the Department of Land Conservation and Development using the same procedures as any plan amendment. Coordination with ODOT is required if the MMA is located within a one-quarter mile of a ramp intersection or interchange. In these cases, operation and

safety effects must be considered and addressed if needed.

MMAs typically have a high density and a mix of uses, a robust multi-modal transportation network, and community leaders desiring to increase the intensity of uses through new development standards. By using an MMA designation, officials have considered and accepted the potential for increased congestion as a tradeoff for denser development and more multimodal-supportive network. Through use of the MMA, the local jurisdiction is not required to apply local or state mobility standards when evaluating a proposed plan or land use decisions for TPR compliance.

EXISITING TRANSPORTATION FACILITIES

Introduction

The Central District has hard edges on its west and south sides, where it is bounded by Highway 97 and the railroad. The study area has roadway classifications designated by the City of Bend in its Transportation System Plan, which include an expressway, minor arterial, principal arterial and local streets. Additionally, both U.S. Highway 97 and US Highway 20 are part of the National Highway System (NHS), ODOT-designated freight routes, and reduction review routes (RRR). These classifications carry specific requirements that must be considered for any proposed road design changes. In particular, for a reduction review route the Oregon Transportation Commission may not permanently reduce the "vehicle-carrying capacity" of an identified freight route, referring to the vertical and horizontal clearance needed for larger vehicles. An exception exists if a local government requests the reduction or safety or access considerations.

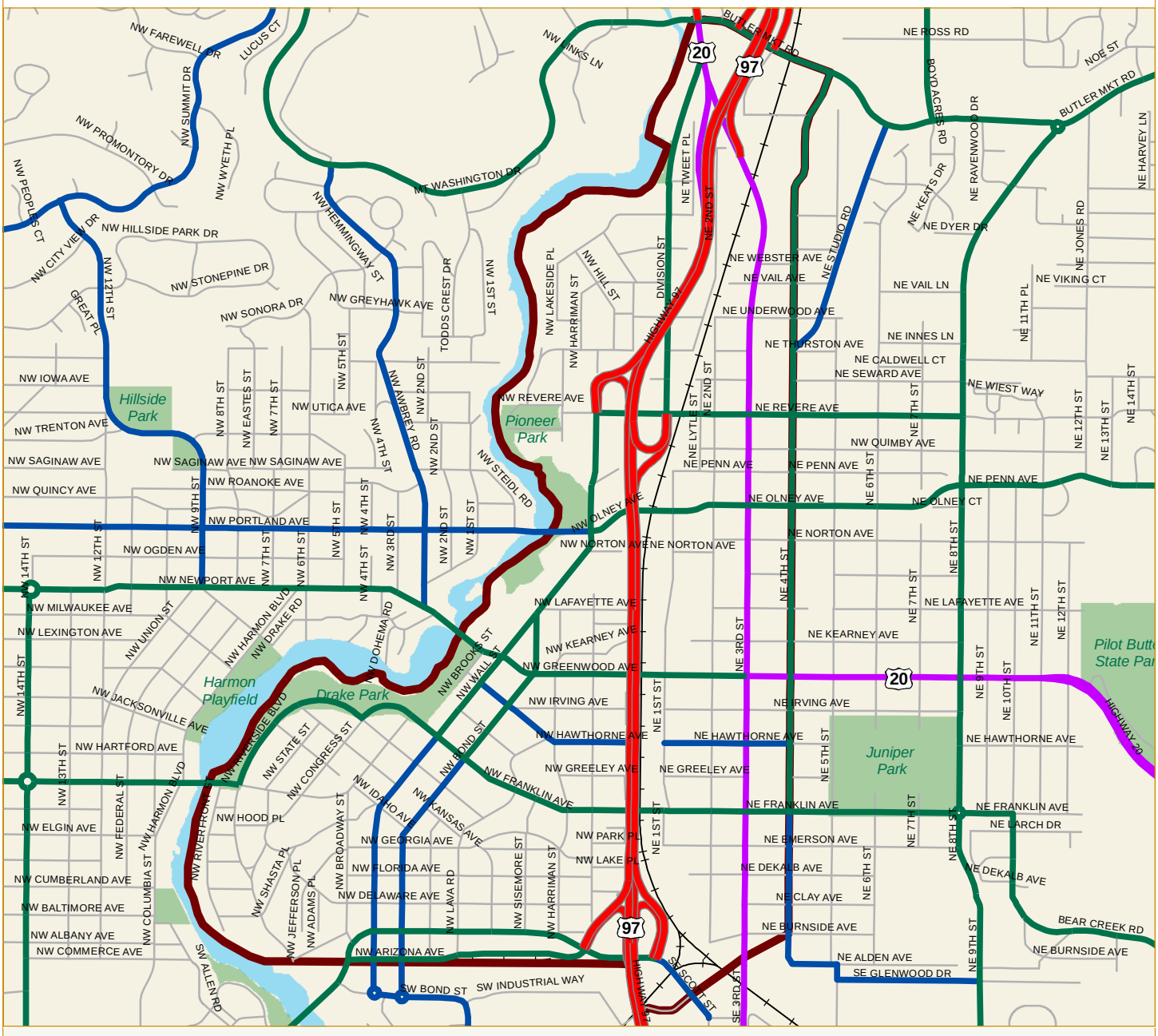
Though a prime route for intercity travel and freight movement, Highway 20 acts as an arterial though the Third Street Corridor, with a posted speed of 35 mph, while Highway 97 operates as an expressway with a posted speed of 45.

Table 1 Roadway Classification with Third Street Corridor Study Area

Classification	Definition
Expressway	Carry traffic through an urban area and connect major portions of a community to each other and to other neighboring communities; typically carry high traffic volumes and provide for higher travel speeds.
Principal Arterial	Carry traffic through an urban area and connect major elements of the area including central business districts, regional shopping centers and other major traffic generators. Principal arterials typically carry a high degree of through traffic. They frequently have some degree of access control, although direct access to major land use developments such as shopping centers may be allowed.
Minor Arterial	Carry traffic between principal arterials and lower classified streets or directly to commercial and industrial areas, with direct access to land use development generally permitted. Traffic control is commonly a mix of signalized intersections and stop sign control used on intersecting streets of lesser classification.
Major Collector	Often balance land access and traffic circulation within residential neighborhoods and commercial and industrial areas. They typically form the link between the arterial street system and lesser-classified streets that provide property access and local circulation.
Local Street	Provide direct access to adjacent property and to higher classified facilities. They offer the lowest degree of mobility and usually have no bus routes. They are not intended to carry through traffic but make up a significant percentage of total roadway mileage within a community.
Freight Route	Carry truck traffic through an urban area and connect major economic distribution centers to markets; typically carry high traffic volumes and provide for higher speeds.

BEND CENTRAL AREA PLAN

Roadway Functional Classifications



City of Bend Central Area
Expressway
Principal Arterial
Minor Arterial
Major Collector
Local Streets

0 500 1,000 1,500
Feet

Data Source(s):
City of Bend, NAIP, Parametrix

Geographic Data Standards:
Projected Coordinate System:
State Plane - Oregon South
Units: US Foot

Parametrix

Analysis by C. Hainey; Analysis Date: Jan-2007; Plot Date: Jan-2007: File Name: CAP_FunctionalClassifications.mxd

Existing System Characteristics

Throughout the study area, road width and speed vary. While sidewalks exist on at least one side of the street in all cases, there is no dedicated space for bicycles. The thoroughfares mostly prohibit on-street parking, while the local streets, particularly those running north-south, have street width that allows for parking on each side.

Arterials such as Revere, Olney, Greenwood, and Franklin Avenues connect to the historic downtown core via underpasses below the Bend Parkway. Greenwood and Franklin Avenues also feature narrow underpasses of the BNSF tracks, while Olney and Revere Avenues feature at-grade crossings. For all these connections except Olney Avenue, there is no dedicated space for cyclists, requiring either a shared lane or use of narrow separated sidewalks. It has also been noted that the undercrossings have issues with flooding during major storms.

Pavement Conditions

The City of Bend utilizes a Pavement Condition Index (PCI) that visually evaluates the surface conditions and assigns an index number. Scoring is based on characteristics such as the presence of potholes, cracking, weathering, asphalt bleeding, uneven pavement, and wheel rutting, etc. The condition and corresponding scoring range is summarized in Table 2 below.

Table 2: Definitions of Pavement Conditions Categories

Condition Category	PCI Range
Good	70-100
Satisfactory	50-69
Fair	25-49
Poor	< 25

Source: City of Bend Public Works Pavement Management Program Budget Options Report, October 2005

According the Bend Central Area Plan, the City has made an effort to devote resources to preserving or improving the pavement surfaces. While much of the central city is in Good condition, some facilities, most notably Greenwood Avenue, have been rated only Fair. Additionally, ODOT staff has indicated that the pavement condition along 3rd Street is Fair or better.

The City also assigns street classification based on measures of mobility or accessibility. Roads with higher speeds and fewer intersections have good mobility, and are typically classified as highways, expressways, and arterials. Roads with lower speeds, more frequent intersections or other street treatments support accessibility and are often classified as collectors or local streets. The table that follows identifies roadways, their classification and pavement condition.

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Table 3. Road Classifications in Study Area and Pavement Condition

Roadway	Classification	Jurisdiction	Pavement Condition/ Notes
U.S. 97/ Bend Parkway	Expressway	ODOT	P-F; Full access interchanges
NE 1st Street	Local Street	City of Bend	(no data)
NE 2nd Street	Local Street	City of Bend	(no data)
Hwy 20/ NE 3rd Street	Principal Arterial	ODOT	VG; Drainage issues along 3rd Street
NE 4th Street	Minor Arterial, south of Franklin: major collector	City of Bend	G
NE Revere Avenue	Minor Arterial	City of Bend	G
NE Olney Avenue	Minor Arterial	City of Bend	Connects West side of Bend with downtown, via a bridge across the Deschutes River
NW Greenwood Ave/ Hwy 20	Minor Arterial/ Principal Arterial	City of Bend	VP-F
NE Hawthorn Avenue	Major Collector	City of Bend	
NE Franklin Avenue	Minor Arterial	City of Bend	G

Data from Appendix A, Street Inventory, Bend Central Area Plan, 2007

While most of the pavement condition throughout the corridor is Good or better, it is worth noting that a key roadway in the study area, Greenwood Avenue is graded as having Very Poor condition between 3rd and 4th Street and only Fair condition as it continues between 4th and 8th Street. Also, the condition of NE 2nd Street should be assessed, as it was a key street in the CAP transportation alternatives, and may play a key role in this study's recommendations.

Table 4. Roadway Characteristics with Third Street Corridor

Roadway	No. of travel lanes	Speed	Bike Lanes	Sidewalks	Parking
U.S. 97	2 travel lanes each direction; center median	45 mph	Yes	--	--
NE 1st Street	1 travel lane each direction, unpainted	25 mph	None	Yes- one side	Via excess street space
NE 2nd Street	1 travel lane each direction, unpainted	25 mph	None	Yes- varies between one and two sides	Via excess street space
Hwy 20/NE 3rd Street.	2 travel lanes each direction, turn pockets	35 mph	None	Yes- both sides	None on-street
NE 4th Street	1 travel lane each direction, unpainted. Restricted to right turn only at Greenwood Ave.	25 mph	None	Yes- varies between one and two side	Via excess street space
NE Revere Avenue	2 travel lanes each direction, with left turn lanes	35 mph	None	Yes-both sides	None on street
NE Olney Avenue	1 travel lane each direction, with shared turn lane and pockets	25 mph	Wide shoulder	Yes- both sides	None on street
NW Greenwood Avenue/ Hwy 20	2 travel lanes each direction, with left turn lanes	35 mph	Shoulder on road. A separate and narrow walkway is provided on both sides of undercrossing structure	Yes- both sides	On street parking between Hwy 97 and NE 2nd St
NE Hawthorn Avenue	Non Striped, lane each direction		None	On one side	On street space for parking
NE Franklin Avenue	One travel lane each direction between parkway and 1st; east of NE 1st St, 2 travel lanes each direction with turn lanes		Painted shoulder for bikes east of NE 3rd St.	Yes- both sides	None on street

Access Management

As the City of Bend contemplates a different travel environment throughout the Third Street corridor, particularly through the potential use of an MMA, access to land parcels must be balanced with the ability to efficiently move through traffic and minimize pedestrian conflict. One tool for achieving this is access management, typically using infrastructure like median controls, driving spacing and consolidation, intersection spacing and so on to minimize turns.

State of Oregon

Along state highways, access is commonly controlled by ODOT through the purchase of access rights. New access to/from a state highway is provided consistent with the standards adopted in the Oregon Highway Plan (OHP) for each highway classification, its location within an urban or rural area, and its posted speed. These standards apply along US Highway 20, which bisects the study area, and the Bend Parkway, which forms the western edge of the district and provides key access points for regional through-travel.

As an Expressway in an urban area, the access spacing standard for the Bend Parkway is 2,640 feet. The following standards apply to the portions of 3rd Street and Greenwood Avenue that form US 20.[1] 3rd Street is posted at 35mph through the study area, and Greenwood Avenue is posted at 25 mph.

Table 5. Access Management Spacing Standards for US 20

Posted Speed	*Public and Private Approach Spacing*
> 55	1,320 feet
50	1,100 feet
40 & 45	800 feet
30 & 35	500 feet
< 25	350 feet

Source: OAR 734-051, Highway Approach Permitting, Access Control, and Access Management Standards.

City of Bend Access Management

The City of Bend has established access management standards and policies for their differing roadway classifications. Spacing requirements generally increase as posted speeds increase, with the maximum practical spacing and joint access with an adjoining property pursued wherever possible.

For arterial streets driveways should be spaced a minimum of 150 feet apart. Where medians are constructed on any arterial street, spacing between median openings should be at least 400 feet, unless studies have determined that left turn movements can be safely accommodated at closer distances. For principal arterials that provide longer-distance travel, the adopted standards are jointly administered by the City of Bend, Deschutes County, and ODOT. The policies generally encourage aim to limit left hand turns except at designated intersections through the use of physical median barriers. All other accesses would be limited to right-turn in, right turn out movements.

[1] See http://www.oregon.gov/ODOT/HWY/ACCESSMGT/docs/pdf/734-051_Perm_Rule.pdf

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Existing Traffic Volumes and Operations

Data on traffic volumes and operations is taken from analysis conducted as part of the 2007 Bend Central Area Plan. Traffic counts were taken during the peak travel hour period during a typical weekday, generally between 4:00 PM and 6:00 PM. They were collected during the month of January, and then adjusted by a seasonal factor of 1.4102 to reflect peak seasonal volumes. The 30th highest hourly volumes were developed using assumptions and methodologies published by the ODOT Transportation Planning Analysis Unit (TPAU) in its Analysis Procedures Manual.

Table 6. Volume Data for Intersections throughout Third Street Corridor

Intersection	EBR	EBT	EBL	WBR	WBT	WBL	NBR	NBT	NBL	SBR	SBT	SBL
Revere Avenue & Bend Pkwy SB Ramp	10	15	15	350	25	595	730	115	15	5	230	205
Revere Avenue & Bend Pkwy NB Ramp	440	365	160	125	510	50	585	285	120	315	5	140
Revere Avenue & 3rd Street	250	565	270	65	395	240	105	1365	135	70	815	80
Revere Avenue & 4th Street	140	350	275	120	345	25	45	245	80	280	185	170
Olney Avenue & 3rd Street	85	280	130	105	315	130	115	1460	95	25	1105	140
Olney Avenue & 4th Street	40	385	105	45	385	50	75	235	45	100	140	140
Greenwood Avenue & 3rd Street	135	775	310	295	585	300	295	960	150	110	745	325
Greenwood Avenue & 4th Street	25	1330	30	140	1055	70	130	5	0	155	0	0
Hawthorne Avenue & 3rd Street	45	5	15	55	5	0	35	1385	10	25	1220	35
Hawthorne Avenue & 4th Street	30	30	50	5	10	5	5	90	15	35	130	10
Franklin Avenue & 3rd Street	115	640	345	70	415	180	45	1035	175	125	1045	105
Franklin Avenue & 4th Street	45	660	70	15	470	25	45	25	25	145	15	15
Colorado Avenue & Bend Pkwy SB Ramp	0	0	0	65	400	5	930	205	10	345	0	9
Colorado Avenue & Bend Pkwy NB Ramp	0	230	795	475	230	0	0	0	0	240	0	15

Data from Bend Central Area Plan, Appendix E Seasonal Adjustments to Traffic Counts

Two measures were used to assess the performance of a intersections in the Bend Central Area: volume-to-capacity (v/c ratio), which estimates the proportion of available capacity that is being used, and average delay, which estimates how long the average vehicle must wait to get through an intersection. For this study, the modeling software Synchro was used to perform analysis consistent with 2000 Highway Capacity Manual methodology. Unlike traditional modeling software that often looks at intersection performance in isolation, Synchro displays the effects of traffic congestion on a corridor-wide basis that allows for assessment of impacts related to traffic queuing. State highway standards are noted below.

For the City of Bend, peak hour intersection operation must meet the following criteria to be rated acceptable:

Two-Way Stop Control

- Delay for individual lane groups less than or equal to 50 seconds, and
- Volume to capacity ratio for individual lane groups less than or equal to 1.0, and
- 95th percentile queuing less than or equal to storage length available.

All-Way Stop Control

- Delay for the intersection as a whole is less than or equal to 80 seconds

Roundabout

- Volume-to-capacity ratio for individual approaches less than or equal to 1.0.

Signalized Intersection

- Volume to capacity ratio for the intersection as a whole less than or equal to 1.0, and
- 95th percentile queuing less than or equal to storage length available
- Further details of relevant standards from City Code are presented below in Table 7.

Table 7 City of Bend Signalized Intersection Operating Standards

Intersection Status/Jurisdiction	Operating Standard
Built to TSP/Master Plan	v/c less than 1.0 for hour preceding and following Peak Hour
Not built to TSP/Master Plan; within Central Business/historic district	v/c less than 1.0 for hour preceding and following Peak Hour
Not built to TSP/Master Plan; outside Central Business/historic district	v/c less than 1.0 for Peak Hour

Source: Bend Development Code, Chapter 4.7, Transportation Analysis, Table 4.7.400a.

The Bend CAP assessed intersections throughout the larger Central Area, and included several intersections of interest to the current Central District planning process.

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Table 8. Signalized Intersection Operations (2007 PM Peak Hour)

Intersection	Overall V/C Ratio	Average Control Delay (sec./vehicle)	Exceeds City Standards	Exceeds State Standards
Revere Avenue/Parkway SB Ramps	0.69	17.1		No
Revere Avenue/Parkway NB Ramps	0.83	22.4		No
Revere Avenue/3rd Street	**1.05**	82.3		Yes
Olney Avenue/3rd Street	**1.04**	67.4		Yes
Greenwood Avenue/3rd Street	**1.23**	181.1		Yes
Franklin Avenue/3rd Street	0.99	80.7	Yes*	
Colorado Avenue/Parkway SB Ramp	0.67	18.6		No

Source: Bend Central Area Plan, 2007
Intersections not meeting targets shown in **bold**
*The Bend CAP notes that the Franklin Avenue/3rd Street intersection does not met the City standard even though the intersection v/c is below 1.0

The data above indicates that several intersections along 3rd Avenue currently exceed either the ODOT or City of Bend v/c standard. Signalized ramp terminals for the Bend Parkway currently meet standards, indicating that queuing back onto the mainline of the Parkway may not currently be an issue.

Table 9: Unsignalized Intersection Operations (2007 PM Peak Hour)

Intersection	Control Type	WORST MOVEMENT			OVERALL	
		Movement	V/C ratio	Average Delay (sec/veh)	V/C Ratio	Average Delay (sec/veh)
4th Street/Revere Avenue	AWSC	EBTR	> 1.0	> 80.0	0.93	**> 80.0**
4th Street/Olney Avenue	AWSC	WBTR	> 1.0	> 80.0	0.83	**> 80.0**
4th Street/Greenwood Avenue	TWSC	SBR	0.41	19.6	0.52	2.3
3rd Street/Hawthorne Avenue	TWSC	EB	0.32	29.2	0.57	1.3
4th Street/Hawthorne Avenue	TWSC	EB	0.18	11.7	0.28	4.1
4th Street/Franklin Avenue	TWSC	NB	**0.70**	**72.9**	0.45	7.7
Colorado Avenue/Parkway NB Ramps	TWSC	NBL	**> 1.0**	**> 80.0**	0.99	> 80.0

Source: Bend Central Area Plan, 2007
Intersections not meeting targets shown in **bold**

Analysis determined that two of the two-way stop controlled intersections and both of the all-way stop controlled intersections exceed the City of Bend and ODOT operational standards for worst movement. The 4th Street/Revere Avenue and 4th Street/Olney Avenue intersections may be near the point where they should be signalized. The stop-controlled intersection at Bend Parkway northbound and Colorado Avenue is also reaching the point where vehicles are experiencing high delays, particularly those attempting to make a southbound left from the off-ramp.

BICYCLE AND PEDESTRIAN FACILITIES

Currently the City of Bend has several types of bicycle and pedestrian facilities, including dedicated bicycle lanes, shared roadways, multi-use paths, and sidewalks. Most of Central Bend has sidewalks, with about 75% of the streets featuring a sidewalk on at least one of the street on an arterial or collector road. Pedestrians also have signal facilities at all signalized intersections. Current regulations require that any new street feature a sidewalk on both sides of the roadway.

Bend began construction bicycle facilities in the early 1980's, and now most of the arterial and collector streets feature either a bike lane, shared lane, or wide shoulder. Many off-street trails exist and serve a multitude of users, including cyclists, pedestrians, hikers, joggers, and strollers. For information on existing and proposed bicycle facilities, see the attached map from the Bend Central Area Plan.

Bicycle and Pedestrian Trip Types

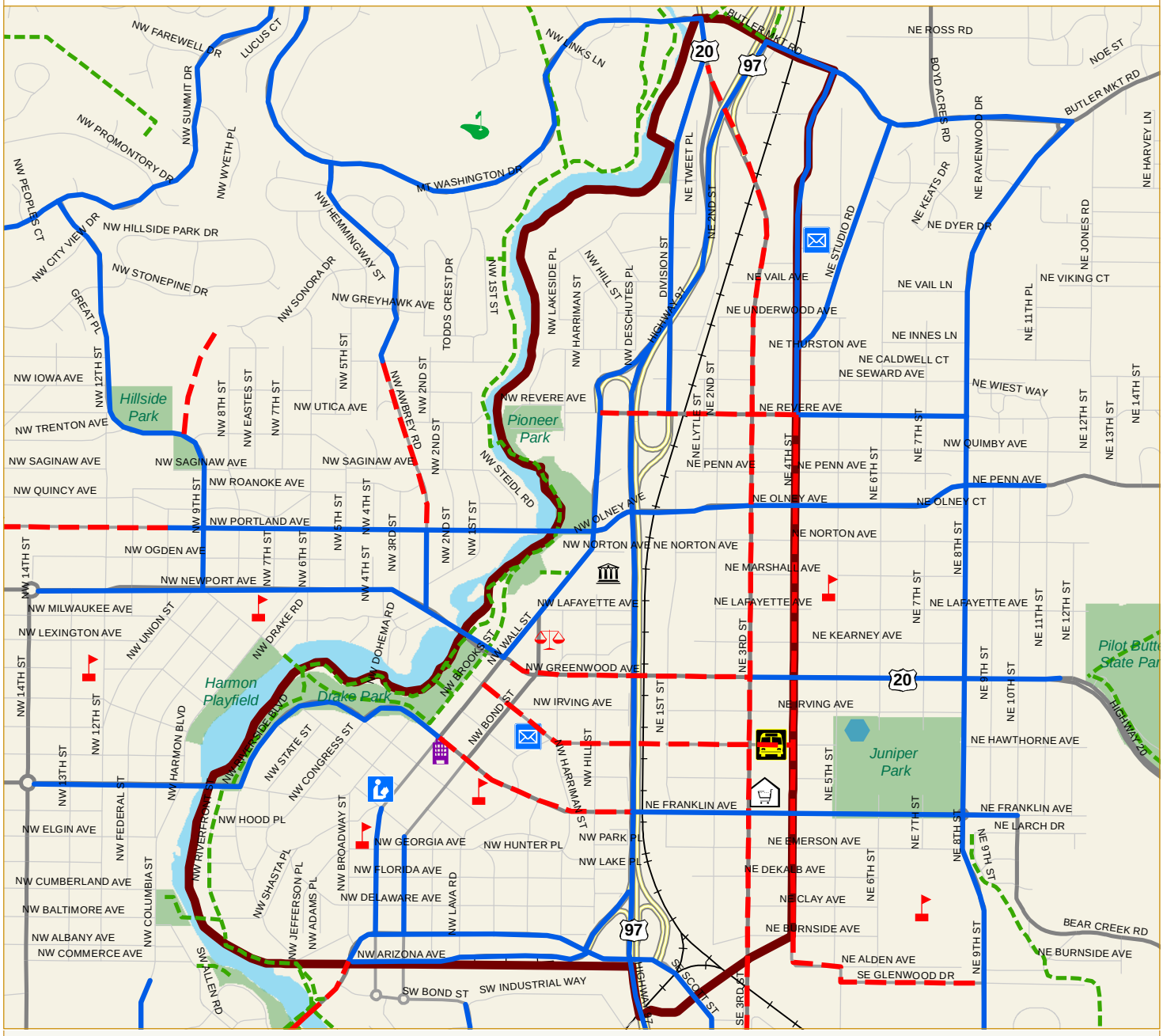
People walk or bike for a variety of reasons, resulting in trips that differ in purpose and value. These may include categories such as:

- Utilitarian trips – (within a mile) for shopping, services and errands
- Recreational trips – for aesthetic enjoyment and tourism
- Health and fitness – such as jogging or walking
- Access to transit – generally trips under ½ mile to bus stops or park and ride lots
- Commute trips – travel to work or school

For planning purposes, these trips require different considerations. A commute or utilitarian trip taker will likely gravitate toward the most direct route with safe facilities, while a recreation or fitness trip might desire a more scenic, uninterrupted path. While many destinations are attractive to both bicyclists and pedestrians, cyclists are generally willing to travel further to access them. The following map, found in the Bend Central Area Plan, depicts the sidewalk inventory in the central district of Bend.

BEND CENTRAL AREA PLAN

Existing Bike Lanes, Trails, and Trip Attractors



City of Bend Central Area
Existing Bike Lane
Proposed Bike Lane
Multi-Use Path

Aquatic Center
City Hall
County Offices

Courthouse
Golf Course
Library

Post Office
School
Shopping Center

Transit Center

0 500 1,000 1,500
Feet

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Data Source(s):
City of Bend, NAIP, Parametrix

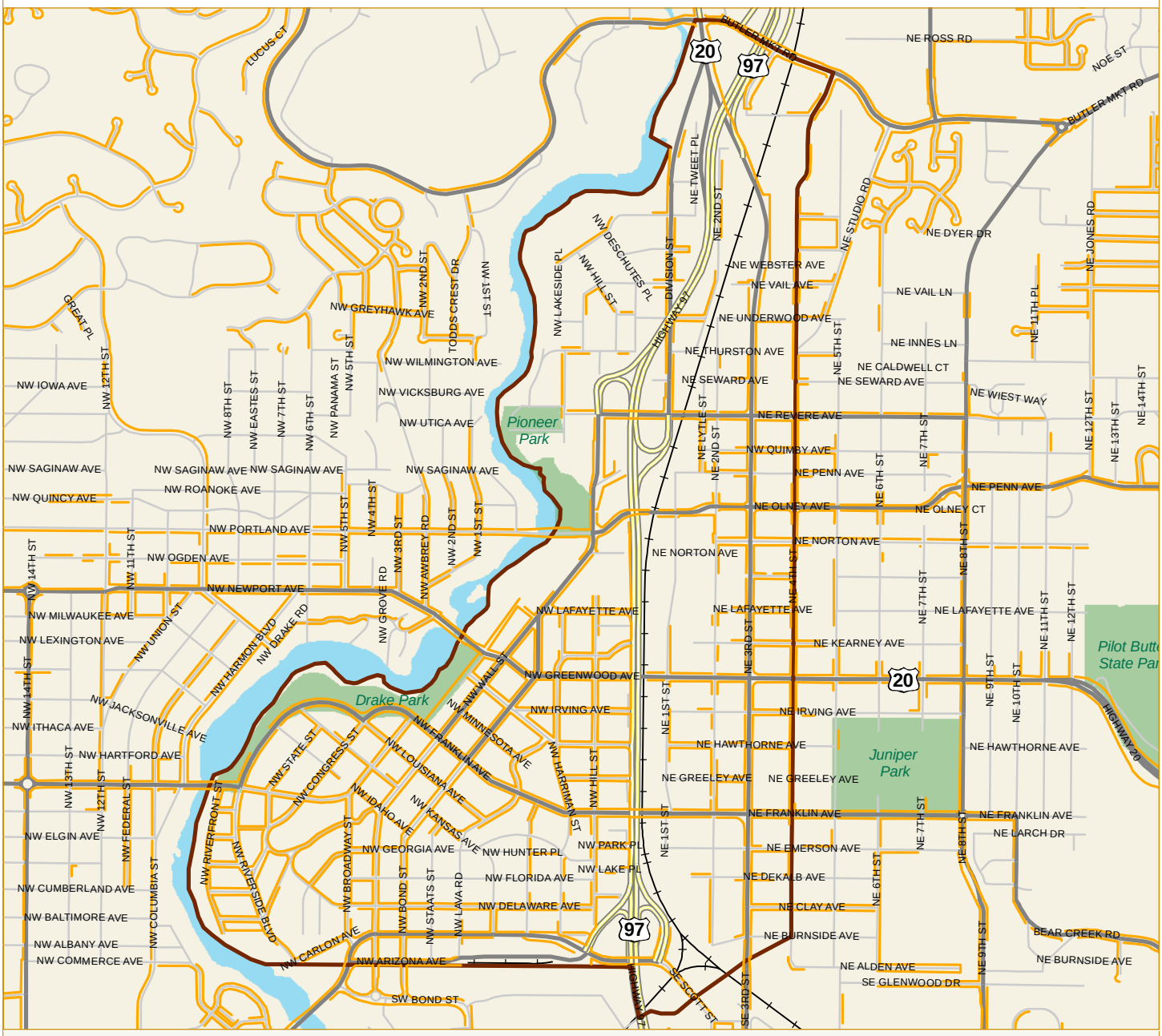
Geographic Data Standards:
Projected Coordinate System:
State Plane - Oregon South
Units: US Foot

Parametrix

Analysis by C. Hainey; Analysis Date: Jan-2007; Plot Date: Feb-2007: File Name: CAP_BikeLanesandAttractions.mxd

BEND CENTRAL AREA PLAN

Existing Sidewalks



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Analysis by C. Hainey; Analysis Date: Jan-2007; Plot Date: Feb-2007: File Name: CAP_Existing Sidewalks.mxd

Existing Conditions for the Third Street Corridor

While bicycle and pedestrian facilities do exist, there are still gaps in the system. Additionally, many existing facilities are unattractive and may be perceived as unsafe. In particular, there are few connections between downtown Bend and the Third Street Corridor. The Bend Parkway and adjacent railway tracks serve as a difficult barrier for non-auto users. The bicycle and pedestrian facilities to cross the parkway are typically dark, narrow underpasses. The paths are shared by bicyclists and pedestrians, and poor lighting and constrained site distances can lead to potential conflicts between the two users.

One of the primary connections between the Historic Downtown core and the Third Street corridor is Greenwood Ave. The road is wide, with heavy traffic volumes and high speeds making it an unfriendly pedestrian experience. Sidewalks are narrow and have frequent curb cuts introducing potential conflicts with turning vehicles. In a transit survey, 3rd Street was specifically identified as needing more frequent pedestrian crossings. Because buses are infrequent, riders often cross the five lane road mid-block to catch a bus, endangering themselves and drivers. Lastly, many sidewalks along the Third Street Corridor have poor pavement and other non-ADA compliance issues.

Vehicle speeds and frequent right turn conflicts at driveways are significant concerns for people riding bicycles as well. 3rd Street in particular is not marked with bike lanes, so people driving motor vehicles are not always alert to the possible presence of bicycles when making right turns.

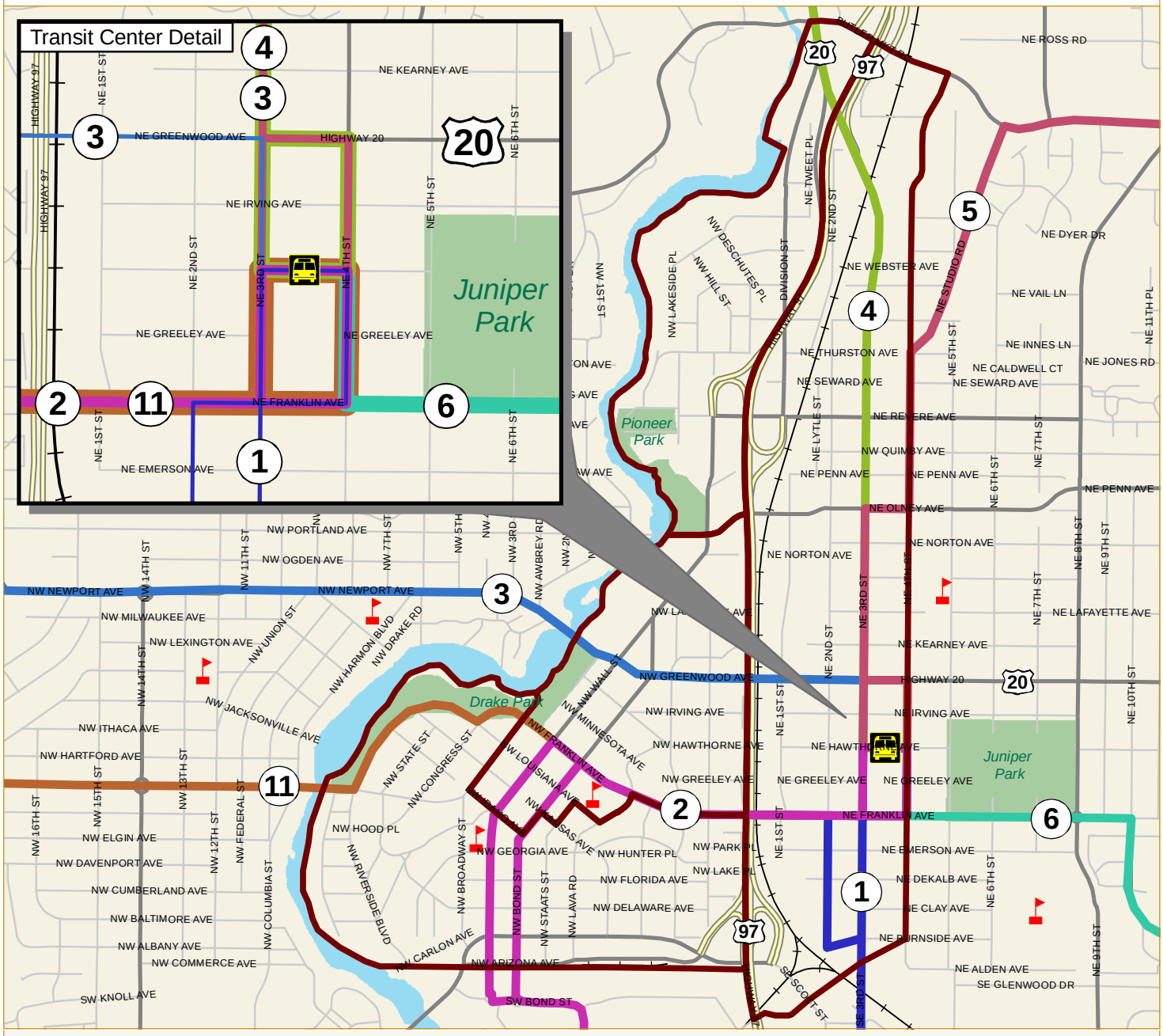
TRANSIT SYSTEM

Bend began offering a fixed bus route service, Cascade East Transit (CET), in 2006. Currently seven routes serve more than 180 stops, in a "hub and spoke" pattern from the primary Transit Center, Hawthorne Station. Service runs Monday- Friday from about 6:20 am to 6:15 pm every 30-40 minutes. Hours are slightly reduced on Saturdays, and there is no service on Sundays. The City also runs an on-demand transit service, regional bus routes to nearby Cities and seasonal shuttles to recreation destinations. Overall, about 24,000 residents, or 31% of the city's populations lives within a quarter-mile of a bus stop. About 60% of the population lives within a half mile of a stop.

Monthly ridership on the CET local fixed-route bus service has steadily grown over the past few years. Ridership grew from an average of about 28,000 riders per month in year 2009, to over 32,000 in year 2011. Many of these riders are transit dependent, with between 25 and 31% of month fixed-route riders consisting of senior citizens or persons with disabilities. Seasonal services, such as the "Ride the River" bus service has also contributed to the gains, attracting nearly 14,000 riders in 2011 and growing.

BEND CENTRAL AREA PLAN

Existing Transit



City of Bend Central Area

11 Galveston Ave.

1 South Third St.

6 Bear Creek Rd.

3 Newport Ave.

5 Wells Acres Rd.

2 Brookswood Blvd.

4 North Third St.

0 500 1,000 1,500

Feet

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Analysis by C. Hainey; Analysis Date: Jan-2007; Plot Date: Feb-2007: File Name: CAP_Existing_Transit.mxd

A survey conducted as part of the Bend MPO Public Transit Plan Existing Conditions Report, asked passengers how they typically access their bus stop. They were allowed to indicate multiple modes of travel. Results indicate that about 90% of passengers walk to the bus stop, reaching it in about 10 minutes or less. Another 8% walk 11 to 15 minutes, and a small number walk between 16 and 50 minutes to or from the bus. Bicycling is the second highest means of accessing bus stops, at 10%. Most cyclists, 55%, travel between one to three miles, while 35% travel under a mile. Lastly, 4% of passengers get a ride to the bus, while 2% drive.

Regional Plans

Bend Metropolitan Planning Organization (BMPO) recently undertook a study of existing conditions as an early element to instruct the creation of a Public Transit Plan (PTP). The partnership aims for the plan to be adopted and implemented as part of the BMPO Metropolitan Transportation Plan (MTP) and the City of Bend Transportation System Plan (TSP). Increased connectivity and multi-modal trip shares are a central goal of MMA's, including the Third Street Corridor.

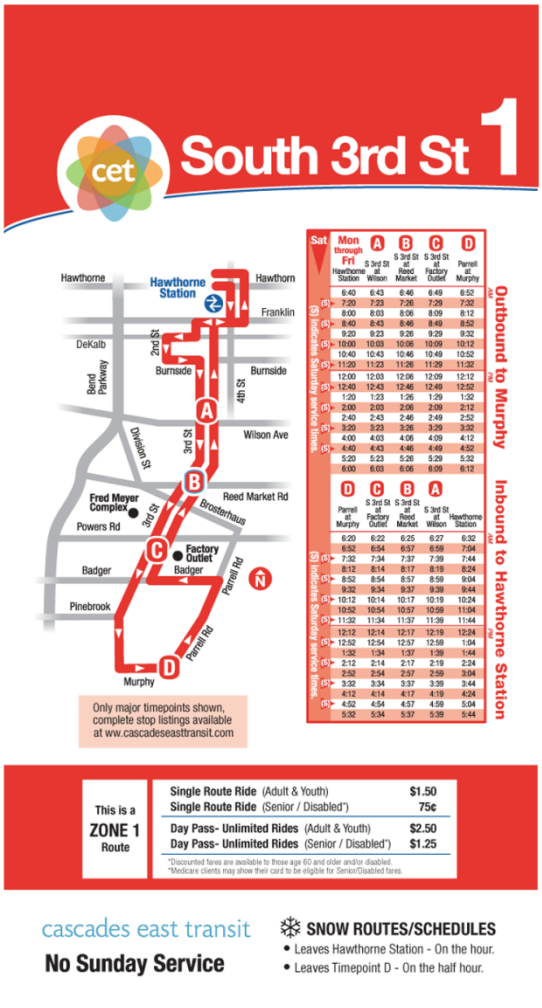
Regional efforts to increase transit usage include an initiative to reduce single occupant commute trips called Commute Options for Central Oregon. The incentive program provides gift cards to local businesses for every 45 round trip commutes using non-drive alone transportation modes. The Central Oregon Intergovernmental Council (COIC), which operates the CET, offers a group employee pass program to organizations with 10 or more employees which offers subsidized single and multi-zone passes.

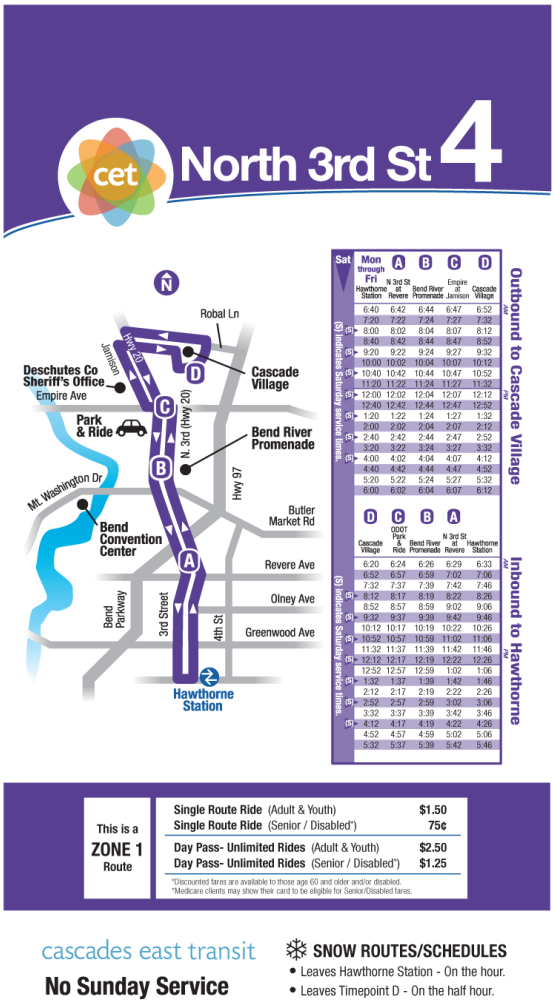
Surveys were conducted as part of the study, with a focus on identifying major barriers to transit usage amongst Bend Residents. Most cited convenience concerns and scheduling, rather than safety or cost issues. More frequent service and safer pedestrian facilities are top requests amongst respondents.

Third Street Corridor Conditions

The 3rd Street corridor is served by the 1 and 4 routes. The South Third street route (1) runs a loop from NE Hawthorne Ave to Murphy Road before heading north along Parrell Road to rejoin Third Street and return to Hawthorne Station, which serves as a transit center. The North 3rd Street route (4) runs from Hawthorne Station north to Cascade Village, and includes a stop at the ODOT Park & Ride near the intersection of N. 3rd St and Empire Ave. Both of these bus lines leave Hawthorne Station on the hour and between them cover nearly the entirety of the 3rd Street corridor.

On Route 1 or South Third Street, there are 22 stops, with the most heavily used stops near retail centers such as Wal-Mart, Goodwill, and Fred Meyer. On Route 4, destinations such as the Safeway, Cascade Village Shopping Center, Bend River Promenade, and a shelter called the Bethlehem Inn attract the most boardings and alightings. Rider surveys indicate, however, that service is desired at Boyd Acres to Brinson to accommodate a new industrial workforce. Overall, the most commonly cited concern amongst transit riders on the Third Street Corridor is pedestrian crossing or safety improvements.





Transit stop amenities vary from basic signage and schedule information on a sidewalk or along a gravel road, to a stop with seats or a shelter. Nearly all stops have ADA-accessible pads, with plans for more ADA-pads forthcoming. Within the CET system, the Third Street Corridor routes rank in the middle in terms of monthly productivity; measured as passengers per vehicle revenue hour. However they do have some of the strongest Saturday ridership within the system.

Cascade East Transit does offer Dial-A-Ride (DAR) service by reservation, to eligible riders who have been certified to have a disability that does not allow them to ride a fixed route. Alternatively, low-income seniors not living near a fixed route can use the service. The fleet consists of 4 vehicles that can carry eighteen passengers and two wheelchairs, and several older vehicles which can cay eight passengers and two wheelchairs.

The Third Street Corridor is also home to the City's primary Transit Center, Hawthorne Station. The station connects all of the seven local routes, as well as the community connector, or intercity bus roués. There are bathrooms, several covered shelter waiting areas as well as covered bike racks.

CRASH ANALYSIS

The City of Bend has undertaken significant recent work to determine the causes, types, and characteristics of crashes in the city, and how reductions to crashes can be achieved given limited resources. Bend undertook a Multimodal Traffic Safety Program[2] in 2012 to screen and evaluate the transportation system and look at countermeasures at locations with the potential to reduce crashes. For the current Bend Central District study, the latest five years of crash data (2008-2012) on the Bend Parkway and US 20 were reviewed to identify areas for improvement. Analysis and findings are summarized below.

City of Bend Multimodal Traffic Safety Program

Crash trends and countermeasures were identified in the city's 2012-2014 Program for the following study area intersections:

- **3rd Street/Franklin Avenue.** Crash trends indicate that red light running and right turn hooks involving bikes are issues at this intersection. Identified countermeasures include Dutch intersection treatments for bikes and updated signal timing and phasing.
- **1st Street/Greenwood Avenue.** Crash trends indicate northbound and eastbound angle crashes. The identified countermeasure is curb extensions on the south side of the intersection.
- **Revere Avenue/Division Street/Bend Parkway NB.** Crash trends include incidents involving permitted left turns, rear end crashes in the share left/through lane, and red light running. Countermeasures include protected-only phasing (and potentially new signal timing) and a road diet.

Central District Crash Analysis

Safety analysis for the Central District project involved two types of network screening identified in the 2010 AASHTO Highway Safety Manual: (1) critical crash rate and (2) excess proportion of specific crash types.

The **critical crash rate** method was used to better understand the existing safety performance of Bend Parkway segments within the project study area (MP 136.94 to MP 138.25). This method uses crash rates for each segment, with crash rates defined within a segment as number of crashes per million vehicle miles traveled (MVMT). This approach evaluates the crash history of a site while accounting for exposure. This helps to provide perspective given the number of vehicles that travel a given section of roadway. For example, three annual crashes when only three vehicles travel a portion of roadway may indicate a different finding than a location with three annual crashes with 3,000 vehicles traveling per day..

Use of the critical crash rate method, as opposed to crash rates alone, involves comparing crash rates of the study area segments to other segments with similar properties. These other segments are known as a reference population. This approach helps answer the question of whether the study sites behave in a manner that would be expected of other similar locations, or if they experience significantly more crashes than would be expected.

[2] City of Bend Multimodal Traffic Safety Program
(http://www.ci.bend.or.us/modules/showdocument.aspx?documentid=10378)

The reference population used for this study is comprised of additional segments of US 97 in Bend and Redmond.

The **excess proportion of specific crash types** method is used in this study to evaluate the proportion of specific crash types experienced at each study intersection along US 20 (3rd Street/Greenwood Avenue), and whether there is an overrepresentation of any of those crash types. This is done by comparing each study intersection to a reference population, which in this case is comprised of all study intersections along US 20 in Bend. Locations with proportions of crash types exceeding what is experienced at similar populations show an opportunity for improvement.

Bend Parkway (US 97)

To perform the critical crash rate analysis, the Bend Parkway was divided into three segments:

1. Revere Interchange (MP 136.94 to MP 137.32)
2. Revere – Colorado Segment (MP 137.33 to MP 138.02)
3. Colorado Interchange (MP 138.03 – MP 138.25)

Total crashes on the three segments are shown in Table 10.

Table 10: Total Crashes on Bend Parkway Segments

Segment	5 Year Crash Data[1]			
	Fatal	Injury	PDO	Total
Revere Interchange	0	16	23	39
Revere – Colorado Segment	0	15	13	28
Colorado Interchange	0	11	9	20

[1] ODOT Crash Data, January 1, 2008 – December 31, 2012

Crash rates were calculated for these segments based on the total crashes, segment length, and the most recent available traffic data. Results are shown in Table 11.

Table 11: Critical Crash Rate Performance of Bend Parkway Segments

Segment	Segment Length (mi)	5 Year Crash Total[1]	Annual Average Crashes[1]	2011 ADT[2]	Crash Rate[3]	Critical Rate[3]
Revere Interchange	0.38	39	7.8	37,400	1.50	1.92
Revere – Colorado Segment	0.69	28	5.6	37,933	0.59	1.61
Colorado Interchange	0.22	20	4	37,100	1.34	2.06

[1] ODOT Crash Data, January 1, 2008 – December 31, 2012
[2] 2011 ADT from ODOT Traffic Volume Tables
[3] Expressed as number of crashes per million vehicle miles traveled (MVMT)

Results of the critical crash rate analysis show that the three study segments all experience crash rates below their corresponding critical rate. This indicates that there is not an overrepresentation of crashes at these locations or potential for safety improvement through targeted mitigations.

Each year the Oregon DOT publishes a list of statewide average crash rates based on functional classification. The three study segments on the Bend Parkway are considered Urban Principal Arterials, with a corresponding statewide average rate of 2.56 for 2012. Therefore, the crash rates for the project study segments are below this statewide average, indicating that they are not recommended for further review.

2012 SPIS List

A review of the ODOT 2012 Top 10% SPIS List shows that there are no top 10 percent SPIS locations on US97 within the project area.

Review of Crash Trends

The US97 crash data was reviewed to determine whether any trends are present in the corridor. Overall, the following key observations are made:

- No fatal or Injury A collisions are recorded.
- No pedestrian or bicycle involved collisions are recorded.
- Rear-end collisions account for 48% of the collisions. There appears to be a cluster of these near Hawthorne Avenue.
- Turning movement collisions are the second most common at 20%. The majority of these take place at MP 137.2, which appears to be a driveway access.
- The majority of crashes occurred during daylight, clear/cloudy skies, and dry roadway surface conditions.

3rd Street/Greenwood Avenue (US 20)

The excess proportion of specific crash types methodology was used to evaluate the opportunity for safety improvement at study area intersections. These intersections include:

- 3rd Street/Greenwood Avenue
- 8th Street/Greenwood Avenue
- 3rdStreet/Olney Avenue
- 3rd Street/Revere Avenue

Identification of excess crash types depends on an assumption of the "limiting probability," or the likelihood that an excess of crashes of a certain type is not due to chance alone. Using a limiting probability of 70%, the crash history at three of the four study intersections indicates an excess proportion of specific crash types. These locations have a 70% or higher probability of experiencing an excess proportion of these specific crash types by the specified amount. Locations identified through this method are shown in the figure on the following page.

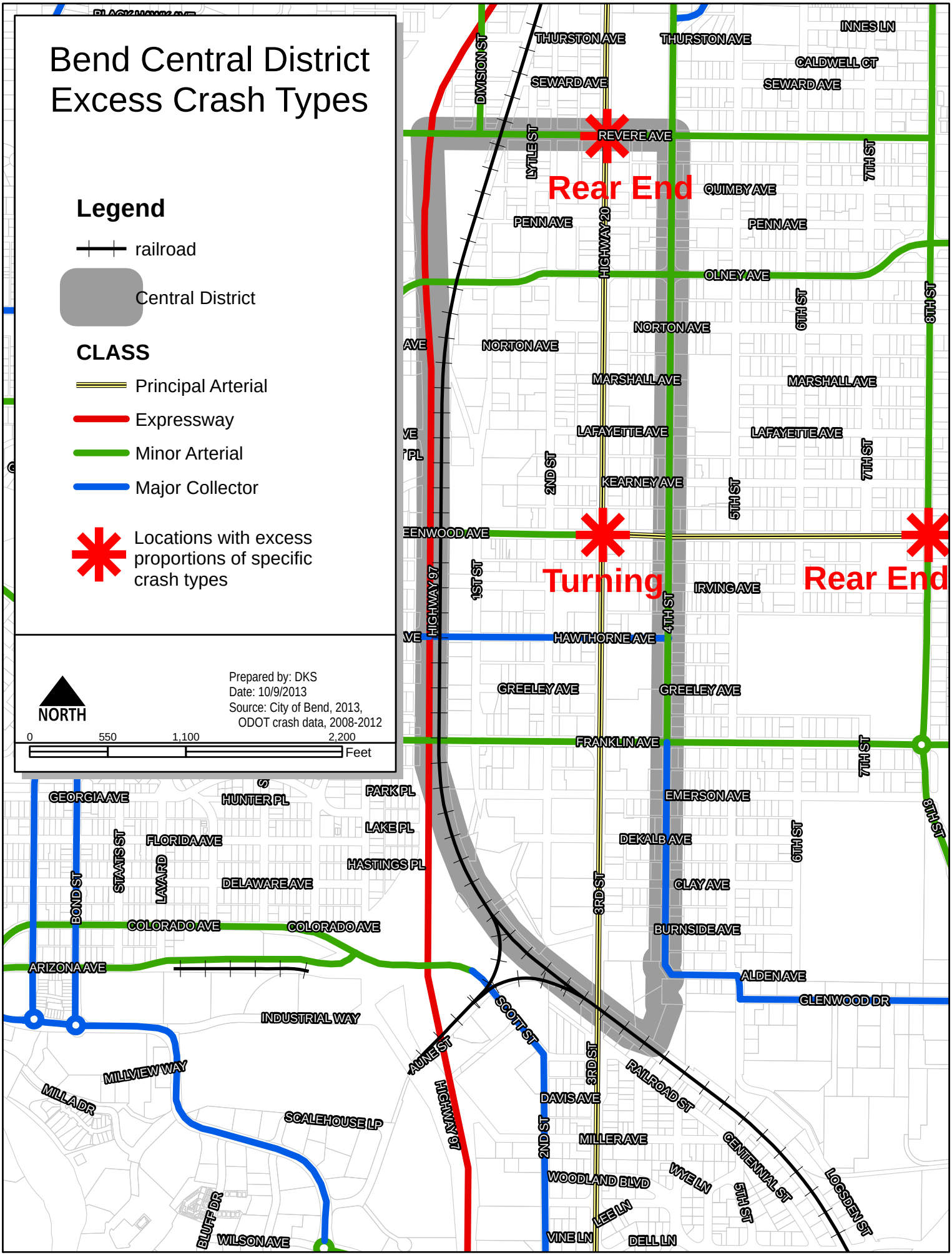

Bend Central District
Excess Crash Types
Legend
railroad
Central District
CLASS
Principal Arterial
Expressway
Minor Arterial
Major Collector
Locations with excess proportions of specific crash types
Rear End
Turning
Rear End
NORTH
0
550
1,100
2,200
Feet
Prepared by: DKS
Date: 10/9/2013
Source: City of Bend, 2013,
ODOT crash data, 2008-2012
THURSTON AVE
SEWARD AVE
REVERE AVE
QUIMBY AVE
PENN AVE
OLNEY AVE
NORTON AVE
MARSHALL AVE
LAFAYETTE AVE
KEARNEY AVE
GREELEY AVE
FRANKLIN AVE
IRVING AVE
HAWTHORNE AVE
EMERSON AVE
DEKALB AVE
CLAY AVE
BURNSIDE AVE
ALDEN AVE
GLENWOOD DR
DAVIS AVE
MILLER AVE
WOODLAND BLVD
VINE LN
LEE LN
DELL LN
WILSON AVE
COLORADO AVE
ARIZONA AVE
INDUSTRIAL WAY
MILLVIEW WAY
SCALEHOUSE LP
MILL A DR
BLUFF DR
DELAWARE AVE
HASTINGS PL
LAKE PL
PARK PL
HUNTER PL
FLORIDA AVE
GEORGIA AVE
DIVISION ST
LYTLE ST
HIGHWAY 20
HIGHWAY 97
1ST ST
2ND ST
3RD ST
4TH ST
5TH ST
6TH ST
7TH ST
8TH ST
BOND ST
STATE ST
LAVARD
SCOTT ST
AUNE ST
RAILROAD ST
CENTENNIAL ST
WYE LN
LOCSDEN ST
INNES LN
CALDWELL CT

Table 12: Excess Proportion Crash Performance of US 20 Intersections

Intersection	Crash Type	Excess Proportion Amount
3rd Street/Greenwood Avenue	Turning	9%
8th Street/Greenwood Avenue	Rear-End	7%
3rd Street/Revere Avenue	Rear-End	13%

Based on ODOT Crash Data, January 1, 2008 – December 31, 2012

Review of Crash Trends

The following trends are observed at the study intersections:

- No fatal collisions were reported
- Two Injury A collisions were reported:
  - One Injury A was a rear-end collision reported at Greenwood/8th
  - One Injury A collision was a turning collision at Greenwood/3rd involving a bicyclist.
- Four bicycle collisions were reported:
  - Two at Greenwood/8th (one Miscellaneous collision, one Turning collision)
  - One at Olney/3rd (angle collision)
  - One at Greenwood/3rd (Turning movement)
- One pedestrian collision was reported at 3rd/Greenwood

Contributing Factors and Potential Countermeasures

3rd Street/Greenwood Avenue. Patterns and causes for turning-type crashes at this intersection were unclear. All four approaches to this intersection contributed to at least one of the eight crashes of this type over the study period. The most often cited cause was not yielding right-of-way; other causes included reckless driving and disregarding traffic signals. One of the turning collisions involved a bicyclist.

- **Potential countermeasures:** Intersection treatments that make people on bikes more visible to motor vehicle drivers, such as Dutch bicycle treatments; signal phasing and timing adjustments; red light enforcement may deter drivers from disregarding the signal or operating recklessly.

8th Street/Greenwood Avenue. The rear-end collisions identified here occurred predominantly on the east leg of the intersection (50% of all rear-end collisions). The significant majority of all the rear-end crashes (14 out of 16) were caused by drivers following too close. Note that Greenwood Avenue westbound transitions from a facility with a limited access, "parkway" feel near Pilot Butte to an access-dense arterial as it nears 8th Street.

- **Potential countermeasures.** Warning signage or flashing lights in advance of the signal westbound may help drivers with maintaining adequate distance for stopping at the upcoming signal.

3rd Street/Revere Avenue. Rear-end collisions at this intersection occur primarily on the 3rd Street approaches, and the reason given for 13 of the 16 crashes is that drivers were following too close. Also, there are driveways in the functional area of the intersection.

- **Potential countermeasures.** There appears to be good visibility of this signal from the north and the south, so advance warning may not be effective. Driveway consolidation/removal near the intersection may help if crashes can be attributed to driveway movements