# Vermillion

## Area Multimodal Transportation Plan

# Report

August 2012

URS

Snyder & Associates

Area Transportation Plan Vermillion

City of Vermillion
Clay County
South Dakota Department of Transportation

# VERMILLION AREA TRANSPORTATION PLAN

## Final Report

**August 2012**

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# GLOSSARY OF TRANSPORTATION PLAN TERMS

**Americans With Disabilities Act (ADA) -** Federal civil rights legislation for disabled persons passed in 1990; calls on public transit systems to make their services more fully accessible as well as to underwrite a parallel network of paratransit service.

**Arterial Street** – A major thoroughfare used primarily for through traffic rather than for access to adjacent land, that is characterized by high vehicular capacity and continuity of movement.

**Average Daily Traffic (ADT)** – The total amount of traffic observed, counted or estimated during a 24-hour period.

**Capacity** – The maximum sustainable vehicle flow rate that can be expected to traverse a roadway segment/intersection during a specific time period given roadway, geometric, traffic, environmental, and control conditions, usually expressed in vehicles per day (vpd) or vehicles per hour (vph).

**Carpool –** A ridesharing arrangement where individuals share a ride via private automobile. The vehicles are typically owned by one of the participants, and the ridesharing arrangement can be relatively informal and organized by the individuals involved, or organized/matched by an employer or government agency.

**Collector Street** – A street that offers circulation within neighborhoods and subareas, provides a connection between neighborhoods and commercial areas and between local streets and arterial streets. Functionally, collectors serve low-to-moderate traffic volumes, and balance land access and mobility, with some favor land access over mobility.

**Delay** – The amount of time traffic spends not moving due to a traffic signal being red, or being unable to pass through an unsignalized intersection.

**Development Scenario** – A likely future growth scenario used as an input to the travel forecasts for the Plan. The development concept for the 2032 Vermillion Plan is representation of where new houses and jobs are anticipated to be built/located between today and 2032.

**Expansion Project –** An improvement that adds capacity to or reconfigures the transportation system. Expansion projects included added through lanes, turn lanes, new trails, new transit service, new or reconfigured interchange or other new roadway treatments that improve traffic flow/safety. These are the types of projects that are included in the Transportation Plan.

**FHWA** - Federal Highway Administration (See U.S. DOT).

**Freeways –** Highways that service longer-distance trips, connecting regions together. These facilities are typically higher speed, higher traffic volume roadways that limit access to interchanges only, with no direct land access.

**FTA** – Federal Transit Administration (See U.S. DOT).

**Illustrative Projects –** Those projects that are included in the final Transportation Plan list for illustrative purposes, but do not have identified funding source during the planning horizon (2032).

**Level of Service (LOS)** – A qualitative measure of intersection or road segment operating condition. A grading scale of A through F is used to characterize traffic operating conditions. The scale is based on the ability of an intersection or street segment to accommodate the amount of traffic using it, and can be used for both existing and projected conditions. The scale ranges from "A" which indicates little, if any, vehicle delay, to "F" which indicates significant vehicle delay and traffic congestion.

**Local Street** – A street within a neighborhood or subarea that's primary function is to provide property access; speeds and traffic volumes are typically low.

**Maintenance/Rehabilitation Project –** A category of transportation improvement focused solely on maintaining the current network/system. These projects include resurfacing, bridge replacement and reconstruction of the pavement. These types of projects are typically not included in a Long Range Transportation Plan.

**Multimodal** – The concept of incorporating private passenger vehicles, transit, and non-motorized (bicycles and pedestrians) transportation features into the planning process.

**South Dakota Department of Transportation (SDDOT)** – The department charged with providing and maintaining the state's transportation system.

**On-Street Bicycle Route –** A designated roadway corridor shared by bicyclists and motorists. The route can involve either striped and signed bike lanes, which are designated for bicycle use only, or can be signed routes with no designated bike lanes where bicycles and automobiles share the same travel lane.

**Peak Hour** – The hour of greatest traffic flow at an intersection or on a road segment during a day. Typically, it is broken down into AM and PM peak hours.

**Ridesharing** – A form of transportation, other than public transit, in which more than one person shares the use of the vehicle, such as a van or car, to make a trip. Also known as "carpooling" or "vanpooling."

**Single-Occupant Vehicle (SOV)** – A vehicle with one occupant, the driver, who is sometimes referred to as a "drive alone."

**Transportation Demand Management (TDM)** – Usually low-cost programs developed to reduce the levels or patterns of transportation demand in order to use the transportation system more efficiently, such as programs to promote telecommuting, flextime and ridesharing.

**Transportation System Management (TSM)** – Projects designed to increase the efficiency of the existing transportation system through minor, localized improvements such as focused intersection and signalization improvements.

**United States Department of Transportation (U.S. DOT)** – The Federal cabinet-level agency with responsibility for highways, mass transit, aviation and ports; headed by the secretary of transportation. The DOT includes the Federal Highway Administration and the Federal Transit Administration, among others.

**Vanpool** – A ridesharing arrangement where individual share a common commute via van. Vanpools are typically most effective for longer commutes and usually use a rented or leased vehicle supplied by an employer or government/quasi-government agency. Operating costs are typically divided among members, sometimes with employer or government subsidy.

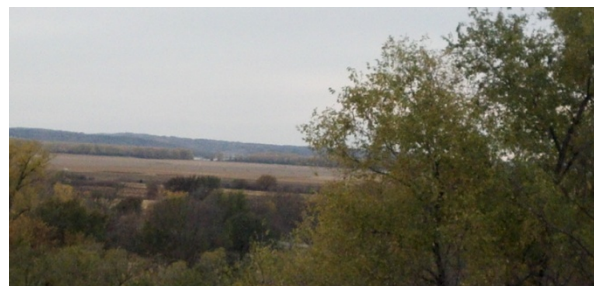
**Volume to Capacity (V/C) Ratio** – The resultant of dividing the counted or estimated traffic volume in a corridor or at an intersection by the facility's estimated capacity.

# PLAN INTRODUCTION

## BACKGROUND

The Vermillion Area Transportation Plan intends to lay out a vision and set the direction for how people and goods move throughout the community over the next 20 years. The transportation planning process has been a collaborative effort between the City of Vermillion, Clay County, the South Dakota Department of Transportation (SDDOT) and the Federal Highway Administration (FHWA). The Plan study team has worked with the Vermillion community to identify the expectations and goals of citizens, system stakeholders and local officials for their multi-modal transportation system. The Transportation Plan addresses the study area displayed in **Figure 1**.

The Vermillion multi-modal system includes travel by private automobile, transit, bicycle and on foot. The goal of the Plan has been to collect as broad a range of input from local stakeholders as possible. The Transportation Plan has incorporated this public input along with technical analyses to identify the needs, desires and vision of the community for its transportation system for the next 20 years.



*Vermillion and Missouri River Valley from Vermillion*

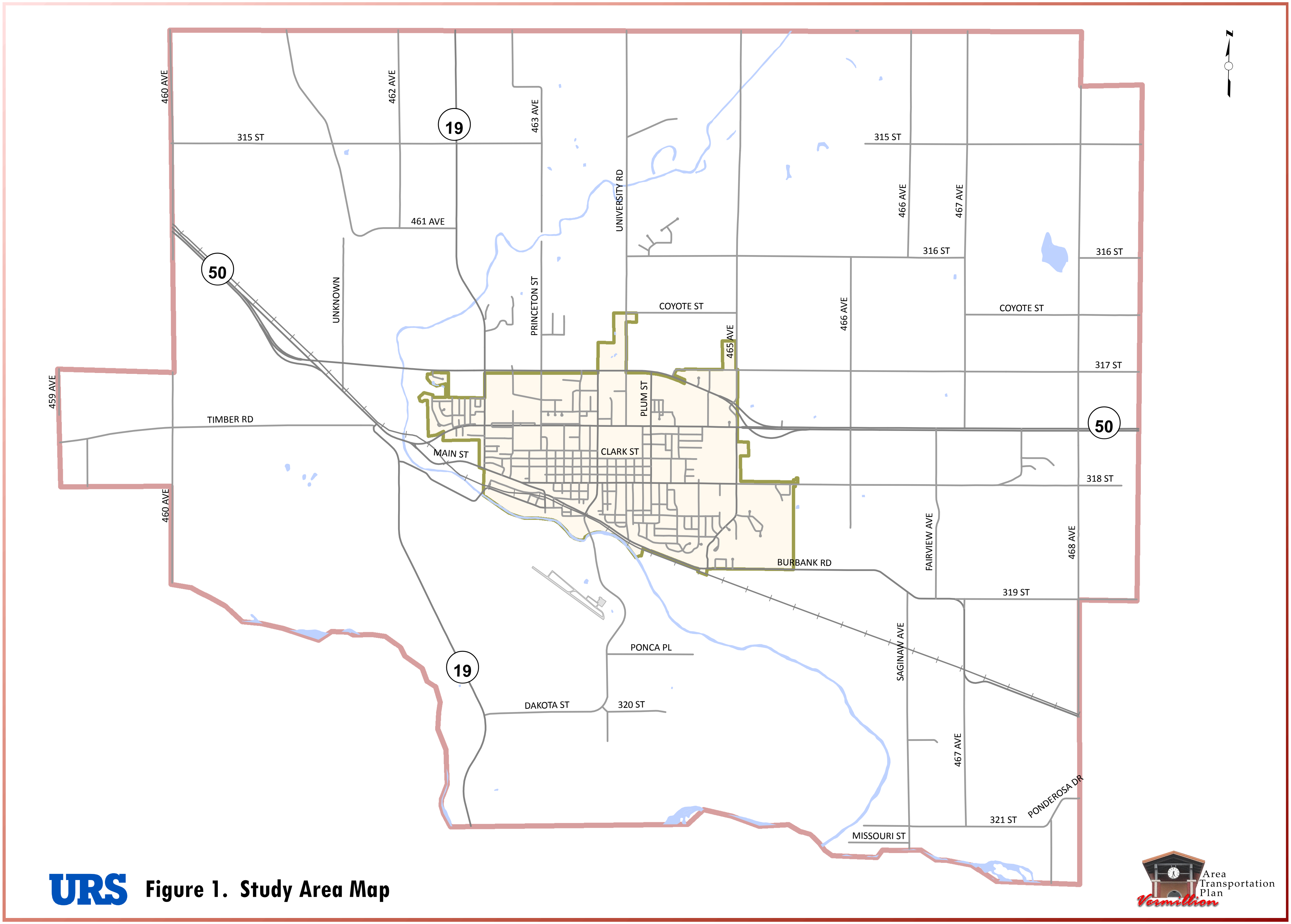
The Transportation Plan report provides the Vermillion area a blueprint for achieving its vision for the transportation system through a series of recommended projects, programs and policies.

## COMMUNITY INVOLVEMENT

The Vermillion Area Master Transportation Plan is founded on the consent of the community. In order for the Plan to be implemented, it is necessary that it support and reflect the community's expectations for its transportation system.

An early, varied and far-reaching involvement approach was used in the Plan to garner public input. In addition to **two public meetings/open houses**, additional elements were included in the involvement portion of the Plan including:

- Forming a **Stakeholders Committee** with representatives from a diverse cross-section of neighborhoods, organizations and entities including residents from across the area, the transit provider, bicyclists, business interests, university representation, hospitals, and freight representation. The Stakeholders Committee was asked to be a sounding board at key update milestones to help the technical study team create a Plan that reflects the community.
- The **Plan Update Website**, *vermilliontransportation.blogspot.com*, was a timely source of information for the public and Plan stakeholders throughout the course of the update, providing meeting notices, presentations from past meetings, opportunities for easy feedback to the study team, up-to-date study documentation and reports.




URS Figure 1. Study Area Map

Area Transportation Plan Vermillion

- An **on-line Transportation Plan survey,** was conducted to get additional feedback from those not participating in the stakeholders committee and public meetings. The survey was located at: *surveymonkey.com/s/vermillion_transportation_survey*, and was advertised at the public and stakeholders meetings. A link to the survey was provided from the study website. The non-scientific survey was conducted to get some feedback on where citizens live and work, mode of travel and their impressions / opinions of the Vermillion transportation system.

A summary of the public involvement effort is provided in **Appendix A**.

## Report Outline

The 2012 Vermillion Area Transportation Plan includes discussion of the following topics:

- **Goals, Objectives and Standards** that reflect input from a broad range of perspectives and guided Plan development.
- **Existing Transportation System Conditions**, including technical analyses of current roadway, non-motorized and transit conditions.
- **Future Land Development and Future Travel Demands** through 2032.
- **Multimodal Alternatives Analysis**, a summary of the various projects and programs evaluated to address the long-term needs of the community.
- **Transportation Funding Evaluation**, which provides projections of anticipated future transportation system funding.
- **Recommended Transportation Plan** includes the list of recommended modal transportation project lists.

# TRANSPORTATION SYSTEM GOALS AND OBJECTIVES

Development of the goals and objectives is a critical initial step in the Transportation Plan because they define the general course of Plan development. They provide direction for the study team as we evaluate how the system currently performs, and establishes the framework for how we look at potential enhancements to the Vermillion multimodal system.

Goals and objectives are connected concepts: *Goals* are far-reaching, generalized statements of intent or vision for the Plan, while *objectives* are more-focused statements of specific approaches, measures or procedures related to attaining the established goals. The remainder of this section provides a set of preliminary goals and objectives for the Study Advisory Team to consider and revise for use in the Vermillion Area Transportation Plan.

**Goal #1: Provide an efficient multimodal transportation system that effectively moves people and goods.**

- Evaluate whether or not the current functional classification of streets is appropriate based on their current and/or future role in the transportation network.
- Identify improvements to the arterial and collector street network needed to accommodate current and projected traffic.
- Evaluate current Major Street Plan (See Comprehensive Plan) for consistency with development and transportation system objectives.
- Identify sidewalk, trail and on-street improvements that would enhance bicycle and pedestrian connectivity across Vermillion.
- The bicycle and pedestrian system should connect activity centers including, but not limited to, University of South Dakota (USD) campus to downtown; west side retail to USD campus; outlying residential subdivisions to the city center.
- Identify the appropriate portions of the 2000 – 2020 Comprehensive Plan recommended bike routes to integrate into the Transportation Plan.
- Identify actions that would improve the efficiency of Vermillion Public Transit.
- Enhance wayfinding and gateways to the university.

**Goal #2: Provide a safe and secure transportation system.**

- Identify high crash locations and evaluate appropriate actions to improving safety.
- Review locations of automobile – pedestrian conflicts and evaluate potential safety improvements.
- Incorporate state and local emergency response and security plans into the Transportation Plan.
- Identify, prevent, manage, or respond to threats (natural and human) to the motorized and non-motorized transportation system and its users.

**Goal #3: Maintain the existing transportation system.**

- Prepare a plan for preserving, maintaining and improving the existing multimodal transportation system.
- Before building new roadway corridors, promote improvement of an existing multimodal corridor whenever it is appropriate and supports development plans.
- Identify and reserve/protect planned future transportation corridors.
- Promote a corridor access management approach that balances the needs of land access with corridor safety and mobility

**Goal #4: Manage the transportation system's impact on the social and natural environment.**

- Maintain or reduce current per-capita levels of vehicle miles traveled and vehicle hours traveled.
- Engage citizens in all stages of the transportation planning process.
- Coordinate Transportation Plan actions with the appropriate state and federal agencies responsible for natural resources, environmental protection and historic preservation.
- Address the impacts to neighborhood character and quality of life when considering transportation investments.
- Limit future negative transportation system impacts by coordinating land development planning and transportation planning. Promote multimodal transportation improvement concepts that are complementary to and compatible with adjacent uses/activities, building types and setbacks and sensitive natural and social features of the region.

**Goal #5: Provide a transportation system that supports and enhances the area's economy and supports the Comprehensive Plan.**

- Coordinate area economic development activities and plans with the Transportation Plan.
- Develop a Transportation Plan that supports the Comprehensive Plan, including preservation of agricultural uses on the urban fringe and development within the City Limits.
- Promote transportation system improvements that support compact, contiguous urban development and support preservation of agricultural uses beyond the urban growth boundary.
- Assess parking issues and needs from the perspectives of the user and property owner, taking into account that different uses have different requirements regarding desirable walk distance, number of spaces, etc.
- Create, enhance and maintain multimodal connections to major business, the university and other institutional and tourist destinations.
- Implement transportation projects/programs that enhance resident, worker, student and visitor quality of life.
- Maintain truck routes to preserve the flow of goods and services to/from Vermillion.
- Provide adequate parking to support key activity centers.

- Involve development community, planning staff and University Planner on the Plan Stakeholders Committee.

## Measures of Effectiveness

Measures of effectiveness were established as benchmarks that allowed the study team to screen how various ideas, concepts and alternatives performed against the study objectives documented above. There were several different measures of effectiveness that were applied throughout the study. Different measures of effectiveness were used according to the modal system being evaluated.

Table 1 below provides a summary of some of the measures of effectiveness that were used for the motorized and non-motorized modes:

**Table 1. Measures of Effectiveness by Travel Mode**

| Travel Mode | Measures of Effectiveness Used |
|---|---|
| Roadway / Vehicular Travel | Level of service<br>Peak period delay<br>Peak period queuing<br>Route / travel Length<br>Corridor Function (Access vs. Mobility)<br>Parking capacity / utilization |
| On-Street Bike Routes | Route connectivity<br>Peak hour vehicle traffic<br>Street width<br>Grade |
| Pedestrian System | Route connectivity<br>Route / travel length<br>Pedestrian delays<br>Pedestrian crashes |
| Transit System | Bus system capacity / utilization<br>Hours of operation |

## Federal Livability Initiative

The livability initiative is a partnership between the U.S. Department of Transportation (DOT), Department of Housing and Urban Development (HUD), and Environmental Protection Agency (EPA). The multi-disciplinary livability initiative is guided by six livability principles:

- **Provide more transportation choices**. Develop safe, reliable and economical transportation choices to decrease household transportation costs, reduce our nations' dependence on foreign oil, improve air quality, reduce greenhouse gas emissions and promote public health.

- **Promote equitable, affordable housing**. Expand location- and energy-efficient housing choices for people of all ages, incomes, races and ethnicities to increase mobility and lower the combined cost of housing and transportation.
- **Enhance economic competitiveness**. Improve economic competitiveness through reliable and timely access to employment centers, educational opportunities, services and other basic needs by workers as well as expanded business access to markets.
- **Support existing communities**. Target federal funding toward existing communities - through such strategies as transit oriented, mixed-use development and land recycling - to increase community revitalization, improve the efficiency of public works investments, and safeguard rural landscapes.
- **Coordinate policies and leverage investment**. Align federal policies and funding to remove barriers to collaboration, leverage funding and increase the accountability and effectiveness of all levels of government to plan for future growth, including making smart energy choices such as locally generated renewable energy.
- **Value communities and neighborhoods**. Enhance the unique characteristics of all communities by investing in healthy, safe and walkable neighborhoods - rural, urban or suburban. [1]

More discussion of how the livability initiative is address in the Plan is provided in the "Recommended System Plan" chapter.

[1] US DOT. *Livability in Transportation Guidebook - FHWA-HEP-10-028 Planning Approaches that Promote Livability*. 2010

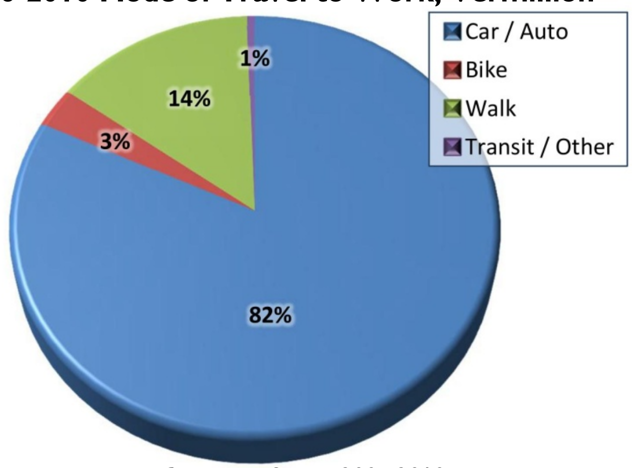
# EXISTING TRANSPORTATION SYSTEM

## Overview

To gain a more complete understanding of what actions, policies, and improvements might be desired by the community and warranted for inclusion in the Plan, it is first important to consider the state of the current system. Current transportation system performance and issues are the underpinnings of future (2022 and 2032) transportation system improvements. The current transportation system is composed of the following major elements:

- Motorized travel on streets and roadways
- Non-motorized system via streets, trails and sidewalks.
- Transit system.
- Intercity bus transportation.
- Freight transportation.
- Land access to air transportation facilities.

**2006-2010 Mode of Travel to Work, Vermillion**




*Source: American Community Survey, 2006-2010*

## Current Multimodal Issues

One of the first activities during Plan development was to work with the general community, study stakeholders and the Study Advisory Team to document current or emerging transportation system issues. Issues were collected from workshops, citizen feedback from public and stakeholders meetings and the study website. A summary of the issues collected from stakeholders, study advisory team and the public through the Vermillion Area Plan involvement efforts is provided in **Figure 2**.

## Motorized Travel on Streets and Roadways

The street and highway system is the primary backbone of the Vermillion transportation system. Between 2006 and 2010, 82 percent of work trips in Vermillion were made by automobile[2] on the street and highway network. The network provides connections within the city, connections to other cities and regions and connections between various modes of travel within the area. This section provides an overview of the various components of the street and highway network.

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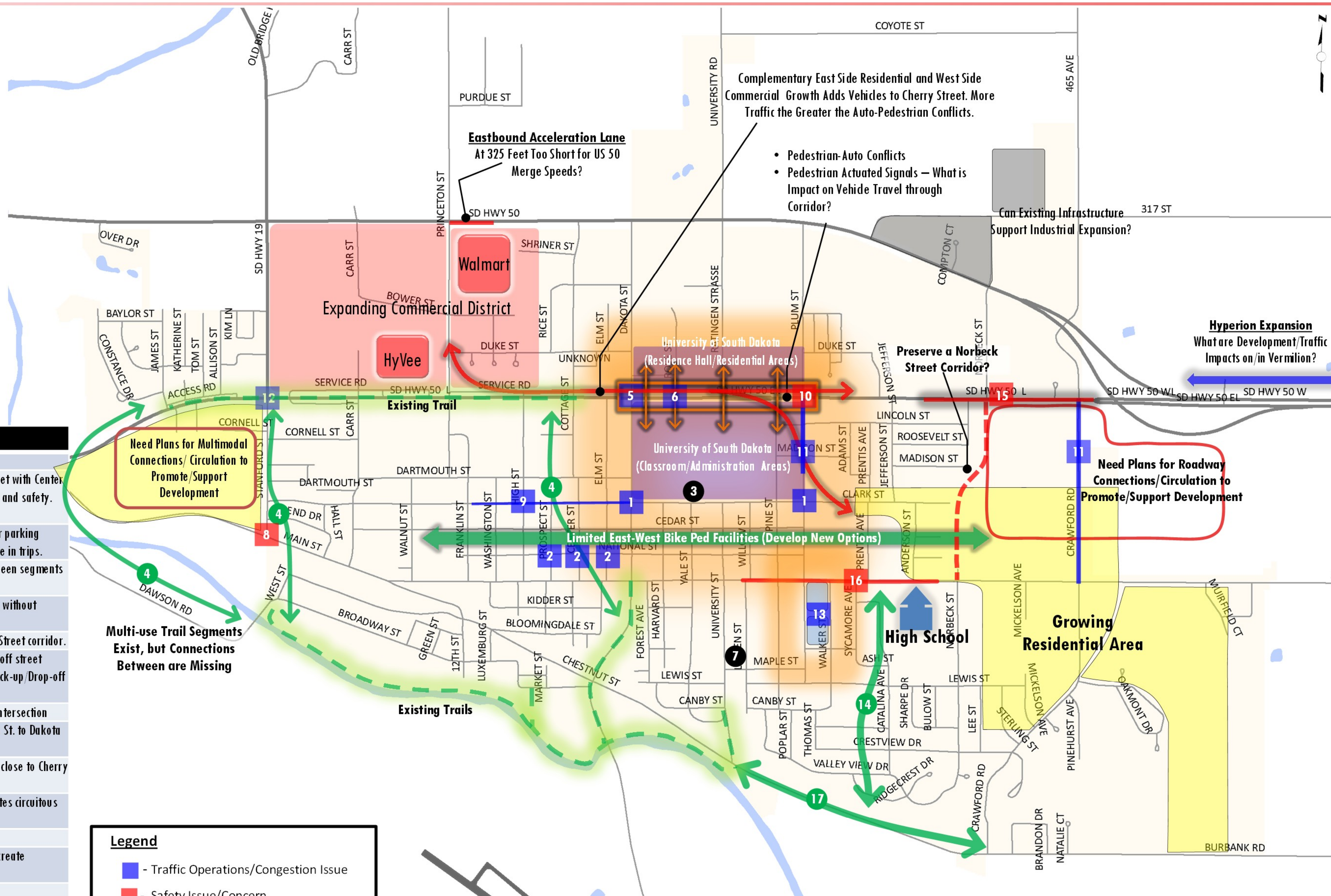
[2] U.S. Census Bureau, *American Community Survey*, 2006 to 2010 5-Year Estimates for City of Vermillion.




| Number | Description |
|---|---|
| 1 | Intersection congested during peak period. |
| 2 | Offset approaches on north side and south side of Main Street with Center street, Prospect Street ad Elm Street negatively impact flow and safety. Look at correction options. |
| 3 | Expansion of the National Music Museum – Need to consider parking requirements (off-street) (autos and tour buses) and increase in trips. |
| 4 | Nice segments of multi-use trail exist, but connectivity between segments is lacking. |
| 5 | Turning radii not large enough to allow trucks to make lefts without encroaching on cross route stopped vehicles. |
| 6 | Fixed time signal – creates inefficient flow through Cherry Street corridor. |
| 7 | Jolley School – on-street parking issues. Approximately 30 off street spaces for approximately 40 staff and over 300 students. Pick-up/Drop-off on street. |
| 8 | Safety – sight distance issues when cars park too close to intersection |
| 9 | Clark Street – South side sidewalk is discontinuous Franklin St. to Dakota St. |
| 10 | Assess to north side parking lot and commercial uses – too close to Cherry St. Creates safety and operations issues. |
| 11 | Truck restrictions along new section of Crawford Road, creates circuitous trips and/or neighborhood cut-through trips. |
| 12 | Intersection congestion is growing. |
| 13 | Hospital – On-street parking Stop controlled intersections, create congestion issues. Parking shortage? |
| 14 | Lacking north-south bike connections/facilities. |
| 15 | Along 5-Lane section, need to improve pedestrian crossing safety. |
| 16 | Before and after school – Mixing of school and hospital traffic causes congestion and safety concerns. Pedestrian and auto conflicts on Main Street |
| 17 | Extend multi-use trail to the east. |

**Legend**

- Traffic Operations/Congestion Issue
- Safety Issue/Concern
- Land Use Issue/Concern
- Trail Continuity/Connectivity
- On-street Parking Issue

URS **Figure 2. Summary of Locally Identified Transportation System Issues**

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## Major Street Plan


Downtown Vermillion Traffic

Roadway classification through a major street Plan is an approach to categorizing roadways according to the level of traffic service that they are intended to provide for local use. A roadway classification system for Vermillion area roadways has been developed that includes the following categories:

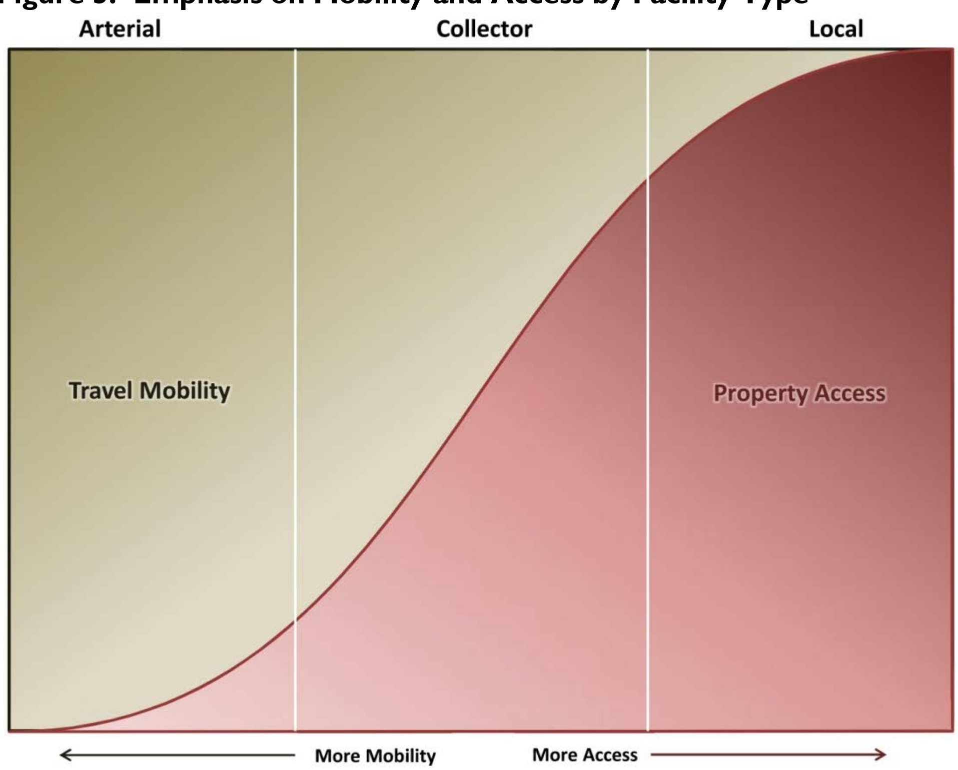
- Arterial
- Local
- Collector

The roadway classifications developed for the major street plan are related to, but should not be confused with, the FHWA functional classification system. Roadway classifications define the roadway's general role in performing two primary functions:

- Providing access to adjacent properties
- Providing travel mobility from one part of the region to another.

These two functions are in competition, as an increase in property access (more driveways) tends to degrade the level of mobility in a corridor. The relative level of mobility and access performed by the various facility types is illustrated in **Figure 3**.

**Figure 3. Emphasis on Mobility and Access by Facility Type**

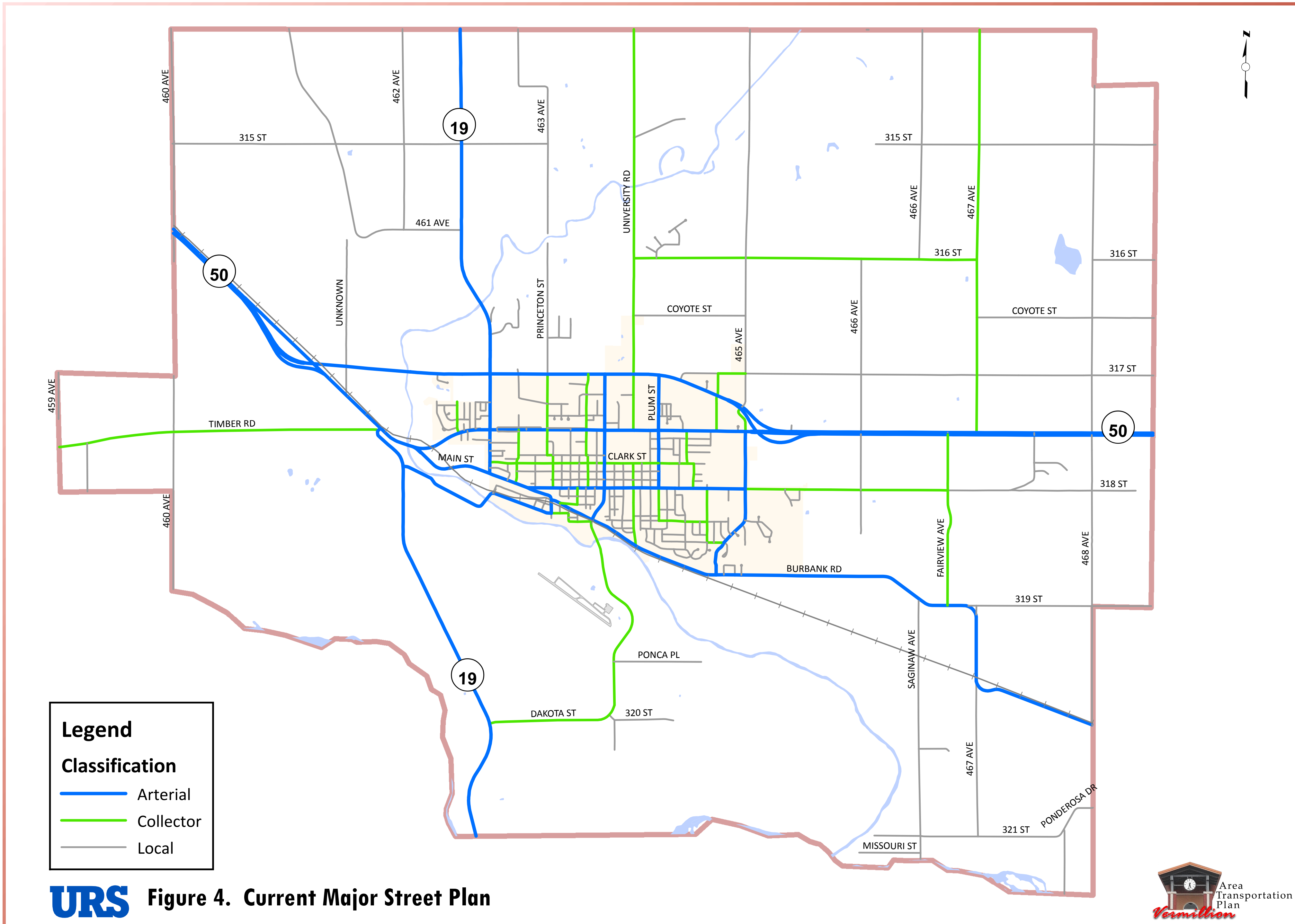


The general characteristics of the various classes are described in **Table 2**; providing an overview of the role each type plays in the roadway network. Highways and arterials favor travel mobility and limit property access, while collectors and local streets favor property access and limit travel mobility.

The current roadway classification network for Vermillion is provided in **Figure 4**. The proposed classification network used the *Vermillion Comprehensive Plan's* Major Street Plan (Map 5) as a starting point, and then adjusted the classifications to fit with guidance provided by SDDOT and FHWA. The recommended roadway classification designations are illustrated in Table 2.

**Table 2. General Description of Vermillion Roadway Classifications**

| Facility Type | General Role | Mobility / Access Balance | Typical Spacing |
|---|---|---|---|
| Arterial | Connects Vermillion with other regions. Also connects activity centers, subareas, and neighborhoods within Vermillion. | Emphasis is on traffic mobility, with some limited land access. | Urban arterial spacing is typically 0.5 to 1 mile or more apart. Rural minor arterials are typically several miles apart. |
| Collector | Urban collectors offer circulation within subareas and provide connectivity between arterials and neighborhoods / commercial areas. Rural collectors connect small towns, farms and rural residential areas within the county to the arterial system. | Balanced, but favors land access over mobility. | Urban collector spacing can range from a few hundred feet to ½ mile. Rural collectors are typically at least 1 mile apart. |
| Local | Streets that offer direct property access. | Primarily provides property access. Mobility is low due to reduced speeds. | Varies according to parcel size. Local streets / roads provide sufficient density to support direct access to individual parcels. |




## Legend

### Classification

- Arterial
- Collector
- Local

URS **Figure 4. Current Major Street Plan**

## Traffic Operations

The roadway system has a finite vehicle-carrying capacity, and the traffic that a given roadway segment or intersection can accommodate is defined as its capacity. As traffic volumes increase and approach the capacity of a segment or intersection, travel delays increase. Traffic volumes are a key determinant in evaluating how the roadway system is performing. As traffic volumes approach intersection / segment capacity, conflicts between vehicles for space will lead to travel delay. Average daily traffic (ADT) volume counts are available from the SDDOT for 2009-2011, and are illustrated in **Figure 5.**


*Traffic at Main St / Plum St*

Another key element that affects traffic flow and capacity is the number of travel lanes at an intersection, and how that intersection is controlled (whether by stop sign, traffic signal, roundabout, etc.)

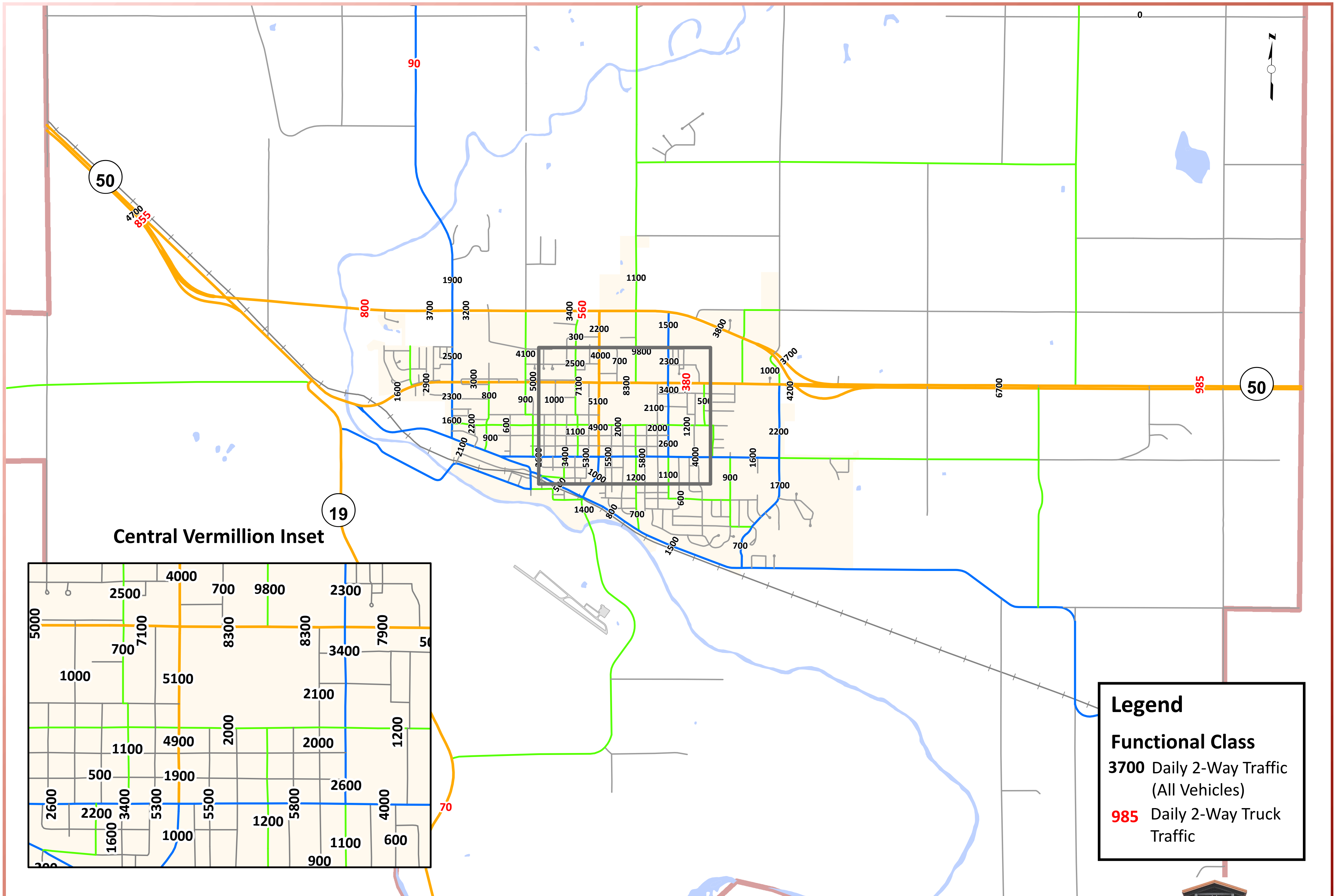
**Table 3** provides the intersections where traffic operations were evaluated and the type of traffic control utilized at each.

### *Traffic Operations Approach*

The data used for this analysis were provided by the City of Vermillion and collected by the consultant. The data included:

- Lane configuration observed from our field visits and from review of available aerial photography.
- Intersection control details, observed from field visits and confirmed by City staff.
- Intersection turning movement counts, collected by the City and consultant. Three of the intersections were also based on counts previously completed by SDDOT staff.

The existing traffic conditions evaluation utilized the procedures and methodologies contained in the *2000 Highway Capacity Manual* (HCM). These procedures and methodologies were facilitated using the Synchro program for both signalized and unsignalized intersections.




URS **Figure 5. Existing (2009 - 2011) Average Daily Traffic Volumes**

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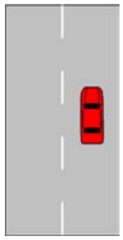
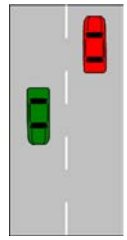
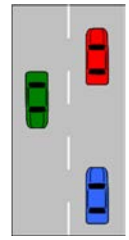
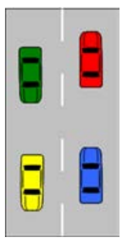
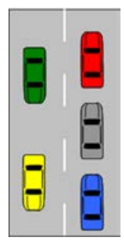
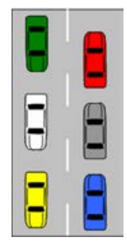
**Table 3. Evaluated Vermillion Intersections and Traffic Control**

| Intersection | Traffic Control[1] | Intersection | Traffic Control[1] |
|---|---|---|---|
| SD Hwy 50 & Stanford St | Stop - North/South | Clark St & Harvard St | Stop - South |
| SD Hwy 50 & Princeton St | Stop - North/South | Clark St & Yale St | Stop - South |
| SD Hwy 50 & University St | Stop - North/South | Clark St & University St | Stop - South |
| Cherry St & Stanford St | Stop - North/South | Clark St & Willow St | Stop - South |
| Cherry St & Princeton St | Signal - Loop North/South | Clark St & Pine St | Stop - All |
| Cherry St & Cottage St | Signal - Loop North/South | Clark St & Plum St | Stop - All |
| Cherry St & Dakota St | Signal - Loop North/South | Clark St & Jefferson St | Stop - South |
| Cherry St & Rose St | Signal - Loop North/South[2] | Main St & University St | Signal - Loop North/South |
| Cherry St & University St | Signal - Loop N | Main St & Norbeck St | Stop - North/South |
| Cherry St & Plum St | Signal - Loop North/South | Main St & Dakota St | Signal - Timed |
| Chestnut St & Dakota St | Stop - East/West | Main St & Stanford St | Stop - North |
| Chestnut St & University St | Stop - West | Main St & Plum St | Stop - All |
| Chestnut St & Crawford Rd | Stop - North | Main St & Walker St | Stop – South |
| Dakota St & Dartmouth St | Stop - West | Main St & Sycamore Ave | Stop – South |
| Pine St & Lincoln St | Stop - East | Main St & Center St | Signal - Timed |
| Pine St & Madison St | Stop - East | Main St & Crawford St | Stop - All |
| Clark St & Dakota St | Stop - All | | |

1: Stop sign controlled or traffic signal controlled. For stop signs, directions that stop are also indicated. Signalized intersections also indicate the type of signalization implemented. For signals with loop detectors, legs with loops are indicated by direction.
2: Loop detection was added in 2012.

Observations of traffic volumes provide an understanding of the general nature of traffic, but are insufficient to indicate either the ability of the street network to carry additional traffic or the quality of service presently provided by the street system. For this reason, the concept of level of service (LOS) has been developed to correlate numerical traffic volume data to subjective descriptions of traffic performance at intersections. LOS categories range from A (best) to F (worst) as shown in **Figure 6** for both signalized and stop controlled intersections. At signalized intersections, LOS is based on the weighted average of all approach delays. For unsignalized intersections, the LOS is based on the worst (or "critical") minor street movement delay.

**Figure 6. Level of Service Definitions for Intersections and Illustration**

| | LOS A | LOS B | LOS C |
|---|---|---|---|
| **Illustration** |  |  |  |
| **Delay Per Vehicle** | *Signalized*: < 10 Seconds<br>*Unsignalized*: <10 Seconds | *Signalized*: 10 to 20 seconds<br>*Unsignalized*: 10 to 15 seconds | *Signalized*: 20 to 35 seconds<br>*Unsignalized*: 15 to 25 seconds |
| **Description** | *Free Flow, Insignificant Delays.* Very little, if any, delay incurred. Corridor travel speed is within 10% of the free-flow operating speed (travel speed without any outside influences controlling any one drivers decision as how fast to drive). | *Stable Operation, Minimal Delays.* Described as reasonably unimpeded operations. A driver's ability to maneuver within the traffic stream is only minimally restricted by other vehicles. Operating speeds are within approximately 30 percent of the free-flow speed. | *Stable Operation, Acceptable Delays.* Operations with the corridor are stable, but maneuvering between lanes or turns may be restricted. Not all vehicles during every signal cycle clear the intersection (cycle failures). |
| | **LOS D** | **LOS E** | **LOS F** |
| **Illustration** |  |  |  |
| **Delay Per Vehicle** | *Signalized*: 35 to 55 Seconds<br>*Unsignalized*: 25 to 35 Seconds | *Signalized*: 55 to 80 seconds<br>*Unsignalized*: 35 to 50 seconds | *Signalized*: >80 seconds<br>*Unsignalized*: >50 seconds |
| **Description** | *Restricted Flow, Regular Delays.* Limits of stable flow. Slight changes in vehicle flow results in substantial increases in delay. Typical operating speeds are 40 percent of the free-flow speed. Queues may develop, but dissipate rapidly without excessive delays. | *Maximum Capacity, Extended Delays.* Volumes at or near the finite capacity. Vehicles may wait through several signal cycles. Long queues form upstream from intersection. Typical operating speeds in the corridor are less than 35 percent of the free-flow speed. | *Forced Flow, Excessive Delays.* Represents jammed conditions. Intersection operates below capacity with low volumes. Queues may block upstream intersections. |

Source: *Highway Capacity Manual (HCM 2010)*, Transportation Research Board and URS Corporation.

### *Traffic Operations Findings*

The results of the signalized and unsignalized intersection capacity analyses for the AM and PM peak periods are summarized in **Table 4**. The traffic operations during the worst peak hour are also displayed in **Figure 7.**

How LOS is calculated / presented depends on the type of intersection control that is present at each intersection. Table 3 documents the intersection control types. The levels of service presented in Table 4 and Figure 7 are represented differently for intersections with 4-way stop control and traffic signal controlled intersections compared to 2-way stop controlled intersections:

- At 4-way stop controlled and traffic signal controlled intersections, the delay and LOS are presented based on the average delay for all approaches.
- At 2-way stop controlled intersections, delay and LOS are presented based on the amount of delay for the poorest operating approach. For instance, the Highway 50 / Stanford Street intersection is 2-way stop controlled for the north and south legs, with free-flowing traffic on the east and west legs. The intersection is reported as LOS C for 2011, because delays for traffic on the north leg average 19 seconds during the PM peak hour. It should be noted that while this 2-way stop controlled intersection is reported as LOS C, the majority of traffic passing through the intersection is on the east and west legs has no delay because these legs are not controlled.

The Study Advisory Team has tentatively set a locally preferred threshold for acceptable level of service as Level of Service C. The acceptable threshold for Vermillion was a local decision that incorporated:

- Resident perception of acceptable congestion / delay.
- Funding available for improvements that result in the street system meeting the goal.
- The level of adjacent impacts (including right-of-way, environmental and social impacts) associated with providing the capacity required to meet the desired LOS goal.

This generally fits with feedback received from local residents and stakeholders to this point. Congestion is not considered to be a large concern for local residents (see survey results section, including Figure 18). As shown in Table 3 and Figure 7, all intersections within the Vermillion area currently operate at LOS C or better. For these reasons, LOS D was the starting point for defining undesirable traffic operations. Locations where levels of service do not meet this threshold for current conditions, and for forecasted 2022 and 2032 conditions, will be evaluated for potential improvements that address the deficiency.

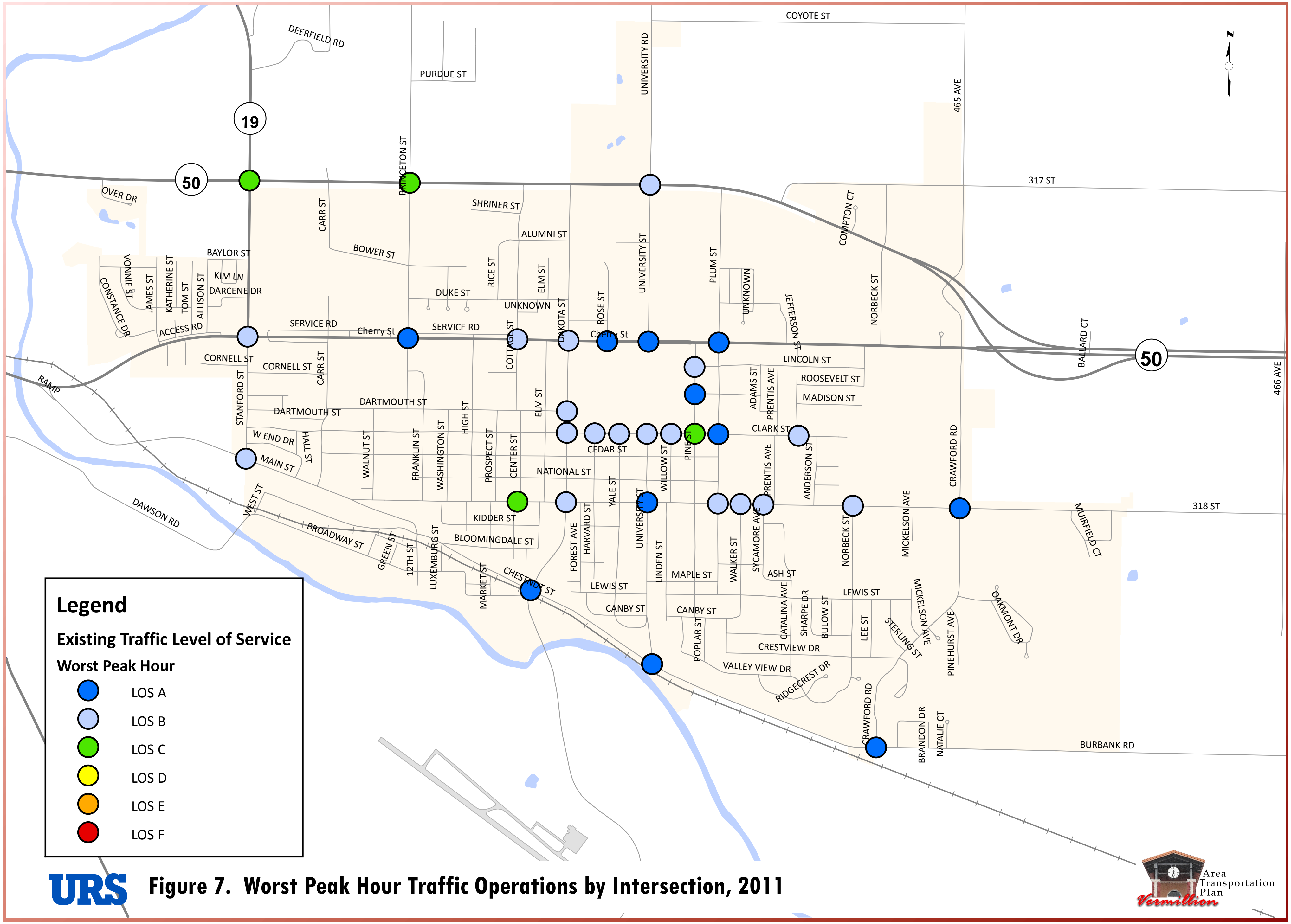



**Figure 7. Worst Peak Hour Traffic Operations by Intersection, 2011**

**Table 4. Existing Levels of Service and Delay by Intersection**

| Intersection | 2011 AM Peak | | 2011 PM Peak | |
|---|---|---|---|---|
| | LOS (Vehicle delay, sec) | Unsignalized Critical Approach | LOS (Vehicle delay, sec) | Unsignalized Critical Approach |
| SD Hwy 50 & Stanford St | B (13) | SB | C (18) | SB |
| SD Hwy 50 & Princeton St | B (15) | SB | C (19) | SB |
| SD Hwy 50 & University St | B (13) | SB | B (15) | NB |
| Cherry St & Stanford St | B (11) | SB | B (12) | NB |
| Cherry St & Princeton St | A (8) | | A (8) | |
| Cherry St & Cottage St | A (7) | | B (11) | |
| Cherry St & Dakota St | A (9) | | B (11) | |
| Cherry St & Rose St | A (6) | | A (7) | |
| Cherry St & University St | A (8) | | A (8) | |
| Cherry St & Plum St | A (8) | | A (8) | |
| Chestnut St & Dakota St | A (10) | WB | A (10) | EB |
| Chestnut St & University St | A (9) | EB | A (9) | EB |
| Chestnut St & Crawford Rd | A (9) | SB | A (9) | SB |
| Dakota St & Dartmouth St | B (11) | EB | B (12) | EB |
| Pine St & Lincoln St | B (10) | WB | A (10) | WB |
| Pine St & Madison St | A (10) | WB | A (10) | WB |
| Clark St & Dakota St | B (12) | NB | B (15) | SB |
| Clark St & Harvard St | B (12) | NB | B (12) | SB |
| Clark St & Yale St | B (12) | NB | B (11) | SB |
| Clark St & University St | B (13) | NB | B (12) | NB |
| Clark St & Willow St | B (10) | NB | B (10) | NB |
| Clark St & Pine St | A (9) | WB | C (22) | EB |
| Clark St & Plum St | A (9) | NB | A (9) | NB |
| Clark St & Jefferson St | B (10) | SB | A (10) | SB |
| Main St & Stanford St | A (9) | SB | B (10) | SB |
| Main St & Center St | C (24) | | C (25) | |
| Main St & Dakota St | B (11) | | B (11) | |
| Main St & University St | A (9) | | A (7) | |
| Main St & Plum St | B (10) | WB | A (10) | EB |
| Main St & Walker St | B (12) | NB | B (12) | NB |
| Main St & Sycamore Ave | B (11) | NB | B (13) | NB |
| Main St & Norbeck St | B (10) | NB | B (11) | NB |
| Main St & Crawford St | A (8) | NB | A (8) | SB |

## Traffic Safety Assessment

Analysis of Vermillion study area traffic safety was based on evaluation of the crash / accident records available from the SDDOT for the years 2008, 2009 and 2010. In the study area, the crash dataset was evaluated for intersection-based crashes. Crashes that occurred within 100 feet of an intersection were summarized together in a geographic information system (GIS) to get a picture of the three-year crash history at each intersection in the Vermillion area. All of the Vermillion area reported 2008 to 2010 crashes were also evaluated for clusters that happened along segments (not necessarily at an intersection) and for locations where the most severe injuries occurred.

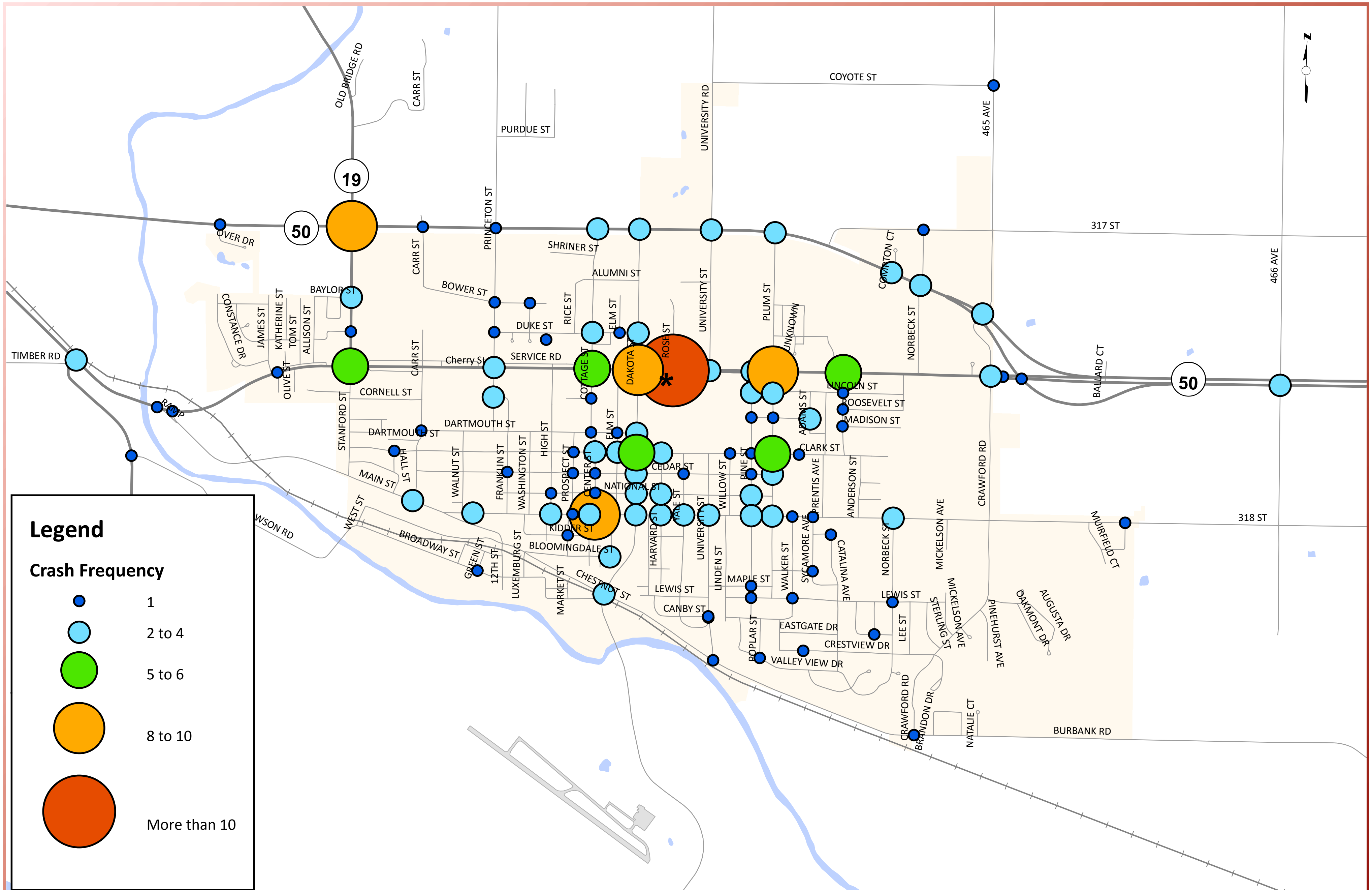
The crash assessment approach screened all of the study area intersections to find those locations with the highest number of crashes between 2008 and 2010. There were 10 intersections in the Vermillion area with 5 or more crashes during the studied three-year periods. Due to the relatively low number of total crashes across the study area, crash rates were not estimated for this evaluation. Lower volume, lower crash study areas can have crash rates that vary significantly with the addition or absence of a single crash. Thus, a crash frequency evaluation was applied but crash rates were not. The intersections with the highest frequency of crashes between 2008 and 2010 are identified in **Figure 8**.

As shown in Figure 6, the intersections with the highest number of crashes for the years 2008, 2009 and 2010 were:

- Cherry St & Rose St (14 crashes)
- Cherry St & Dakota St (10 crashes)
- Cherry St & Plum St (8 crashes)
- Main St & Center St (8 crashes)
- Highway 50 & Stanford St (8 crashes)
- Clark St & Dakota St (6 crashes)
- Cherry St & Stanford St (5 crashes)
- Cherry St & Cottage St (5 crashes)
- Cherry St & Jefferson St (5 crashes)
- Clark St & Plum St (5 crashes)

A second level of crash evaluation was completed for locations with the highest number of crashes, to analyze both the type and severity of crashes. Additionally, locations of the most severe crashes were evaluated across the study area.

Cherry Street / Rose Street had the following numbers of crashes by year: two (2) crashes in 2008, three (3) crashes in 2009, and nine (9) crashes in 2010. A new traffic signal was placed at the intersection of Cherry and Rose in 2010, and all nine crashes that year happened after signal installation. One possible explanation for the spike in crashes at this intersection in 2010 was that drivers were not paying attention to the change in signal control and were not expecting to stop. To evaluate whether drivers had become more accustomed to the traffic signal at Cherry and Rose Street intersection in 2011, SDDOT provided the most recent crash data available for 2011 at the intersection: January through November, 2011. For the most recent 11 months of data, there were two (2) crashes, which was a large reduction from 2010. Neither of the two 2011 crashes appeared to be intersection related: one was attributed to driving too fast in winter weather and the other was a sideswipe due to the driver swerving.




# Figure 8. Crash Frequency by Intersection, 2008 through 2010

* Note: The majority of the Cherry St - Rose St crashes occurred within a few months of 2010 after the signal was installed. The number of crashes at Cherry - Rose by year: 2008 - 2 crashes, 2009 - 3 crashes, 2010 - 9 crashes (all after signal installation), 2011 - 2 crashes.

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### *Crash Type*

**Table 5** summarizes the types of crashes by percentage occurring at each of the 10 most frequent crash locations.

**Table 5. Crash Type at Ten Highest Frequency Intersections**

| Intersection | Total Crashes[1] | Percentage Crash Type by Intersection | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Rear-End | Single Car | Angle | Animal | Head-On | Sideswipe, Same Direction | Sideswipe, Opposite Direction |
| Cherry St & Rose St | 14 | 71% | 7% | 21% | 0% | 0% | 0% | 0% |
| Cherry St & Dakota St | 10 | 20% | 0% | 60% | 0% | 10% | 10% | 0% |
| Cherry St & Plum St | 8 | 38% | 0% | 63% | 0% | 0% | 0% | 0% |
| Highway 50 & Stanford St | 8 | 13% | 25% | 50% | 13% | 0% | 0% | 0% |
| Main St & Center St | 8 | 63% | 25% | 13% | 0% | 0% | 0% | 0% |
| Clark St & Dakota St | 6 | 17% | 0% | 83% | 0% | 0% | 0% | 0% |
| Cherry St & Cottage St | 5 | 20% | 0% | 60% | 0% | 0% | 20% | 0% |
| Cherry St & Jefferson St | 5 | 40% | 40% | 20% | 0% | 0% | 0% | 0% |
| Cherry St & Stanford St | 5 | 20% | 0% | 80% | 0% | 0% | 0% | 0% |
| Clark St & Plum St | 5 | 0% | 40% | 60% | 0% | 0% | 0% | 0% |
| Top 10 Intersections | 74 | 35% | 12% | 49% | 1% | 1% | 3% | 0% |
| All Vermillion Area Crashes | 371 | 20% | 30% | 33% | 14% | 1% | 2% | 1% |

1: During 3-year period: 2008 to 2010.

Based on the data summarized and presented in Table 5, two types of crashes are most prevalent:

- **Angle Crashes**: Angle crashes were the most prevalent type of crash at the top 10 most frequent intersections, representing 49 percent of the recorded crash types at these 10 intersections. Angle crashes were also the most prevalent type of crash throughout the study area as a whole, representing 33 percent of all recorded crash types in the Vermillion area between 2008 and 2010. Angle crashes can be caused by several factors including failure to yield, lack of protected turns leading to aggressive driving and sight-distance issues at intersections.
- **Rear End Crashes**: Rear end crashes were the second most prevalent crash type recorded at the top 10 most frequent intersections, representing 35 percent of recorded crash types. Several factors can cause rear-end crashes, including stop-and-go travel conditions during congestion, or signals that are out of coordination with adjacent signals which can sometimes violate driver expectations.

### *Crash Severity*

**Table 6** summarizes the injury severity of crashes by percentage occurring at each of the 10 most frequent crash locations.

**Table 6. Crash Severity at Ten Highest Frequency Intersections**

| Intersection | Total Crashes[1] | Percentage Crash Severity by Intersection | | | |
|---|---|---|---|---|---|
| | | Fatal injury | Injury[2] | Possible[3] | No injury |
| Cherry St and Rose St | 14 | 0% | 0% | 29% | 71% |
| Cherry St and Dakota St | 10 | 0% | 0% | 0% | 100% |
| Cherry St and Plum St | 8 | 0% | 25% | 0% | 75% |
| Highway 50 and Stanford St | 8 | 0% | 50% | 13% | 38% |
| Main St and Center St | 8 | 0% | 13% | 0% | 88% |
| Clark St and Dakota St | 6 | 0% | 0% | 0% | 100% |
| Cherry St and Cottage St | 5 | 0% | 0% | 20% | 80% |
| Cherry St and Jefferson St | 5 | 0% | 20% | 0% | 80% |
| Cherry St and Stanford St | 5 | 0% | 20% | 20% | 60% |
| Clark St and Plum St | 5 | 0% | 0% | 0% | 100% |
| Top 10 Intersections | 74 | 0% | 12% | 9% | 78% |
| All Vermillion Area Crashes | 371 | < 1% | 21% | 10% | 69% |

1 During 3-year period: 2008 to 2010.

2 Injuries were classified as either incapacitating or non-incapacitating. None of the injuries for the Top 10 intersections were classified as incapacitating while 3 percent of all study area crashes had incapacitating injuries.

3 Possible injuries are defined as those claimed by someone involved in the crash, but not visibly evident to crash observers (limping, nausea, complain of pain, momentary unconsciousness).

To determine if there were locations with more frequent incidence of crashes that were classified as either incapacitating injury or resulted in a fatality, maps of the locations with the most severe injury crashes were developed for the years 2008 to 2010. During that period, there were 10 crashes involving an incapacitating injury and one (1) fatal crash. The locations of the 11 most severe crashes are shown in **Figure 9**.

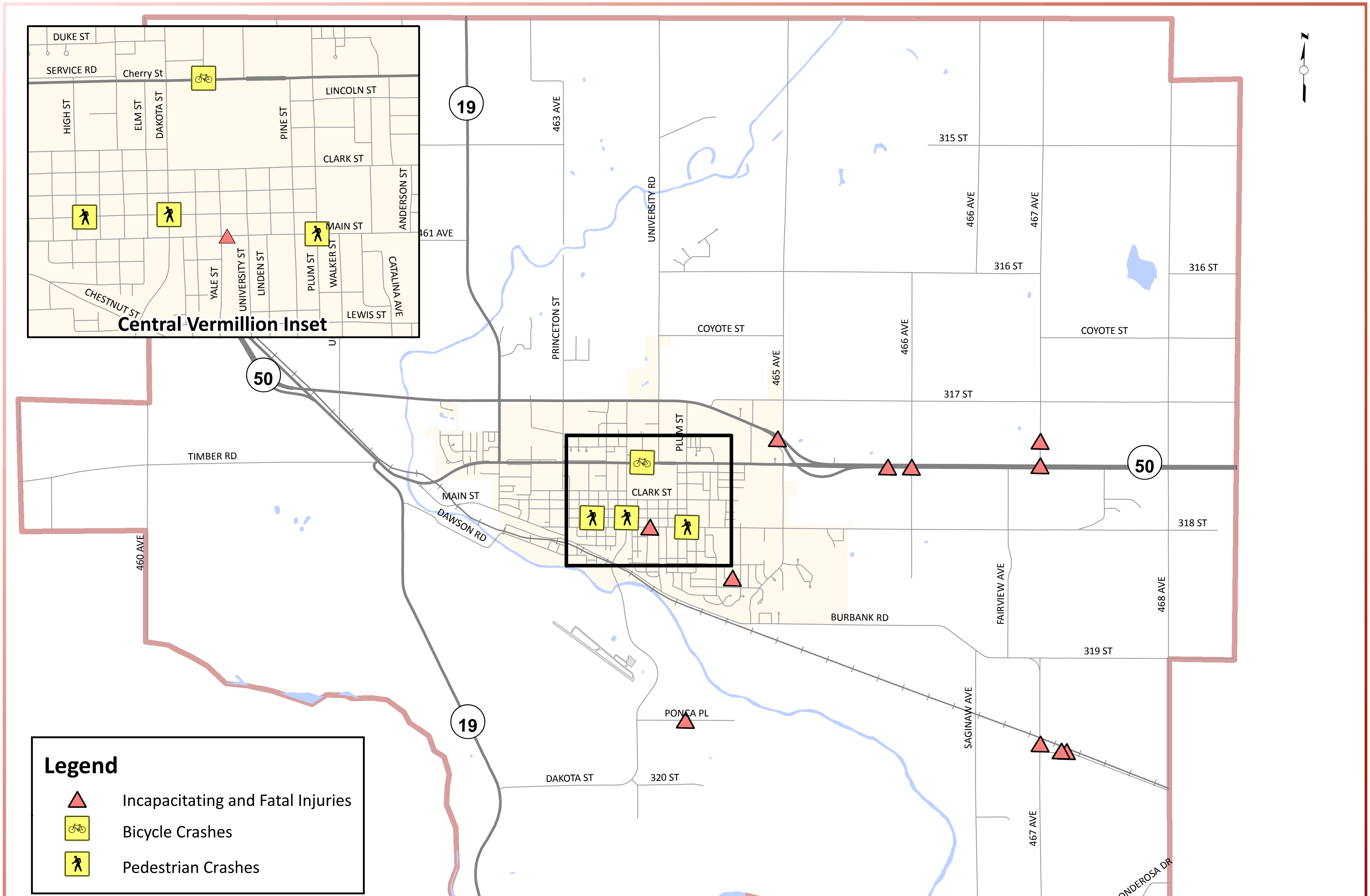


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**Figure 9. Locations of Incapacitating / Fatal Injury Crashes and Bicycle and Pedestrian Crashes, 2008 through 2010**

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The following bullets summarize the most severe injury crashes between 2008 and 2010:

- Three (3) of the 11 most severe injury crashes happened within ¼ mile of each other on Burbank Road, southeast of Vermillion. This short segment of Burbank Road has a curve where the roadway changes from a southeast-to-northwest orientation to a north-south orientation at the BNSF railroad crossing. All three crashes were single-vehicle rollover crashes with dry pavement conditions.
- Two (2) severe injury crashes happened within ¼ mile of the 467th Avenue / Highway 50 intersection. The crash north of the intersection was a single-vehicle rollover crash involving a semi-truck. The crash at the intersection was an angle crash involving two vehicles.

*Westbound Advanced Warning Sign on Burbank Road*

- Two (2) severe injury crashes happened within ¼ mile of the 466th Avenue / Highway 50 intersection. One of these crashes was incapacitating, one was fatal. Both crashes were recorded as angle crashes between two vehicles, one crash record indicating cell phone use as a contributing factor.
- The four (4) remaining crashes were at different urban and rural locations across the study area, and were all single-vehicle crashes. Alcohol was listed as a contributing factor in two of the four crashes, and snow was listed in the road surface conditions for one of the other crashes.

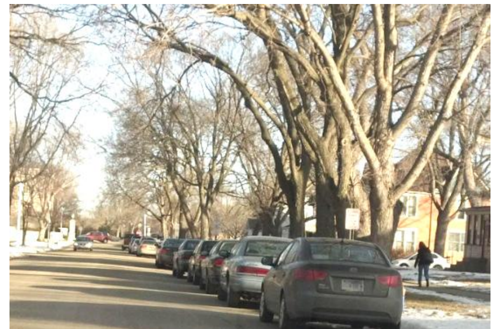
### *Crashes Involving Pedestrians and Bicyclists*

The multimodal nature of the Vermillion Area Transportation Plan recognizes that the roadway system needs to accommodate all modes of travel, not just motor vehicles. The crash database was reviewed to gain understanding of non-motorized users' safety when using / crossing the roadway system. Three (3) pedestrian crashes and one (1) bicycle crash were reported between 2008 and 2010, and are illustrated in **Figure 9.** The non-motorized crashes are summarized in the following bullets:

- Three non-motorized crashes were listed as "possible" injuries (see definition in note 2 of Table 6), one was "non-incapacitating".
- Two of the pedestrian crashes were reported as the driver failing to yield. The third pedestrian-involved crash did not occur at an intersection (on National Street) and the report did not highlight any contributing factors.
- The bicycle crash at Cherry Street / Rose Street was reported as driver vision obstructed.
- During the early public involvement efforts of the Plan, pedestrian activity / crossing of Cherry Street adjacent to the University of South Dakota (USD) campus and pedestrian conflicts with vehicular traffic were listed as an issue area that the study team needed to monitor. Between 2008 and 2010, there were no recorded pedestrian-involved crashes on Cherry Street.

## Parking On / Adjacent to USD Campus

The availability of parking in portions of the study area has been identified as an issue by residents and stakeholders. Specifically, high on-street parking utilization in the neighborhoods adjacent to the USD campus south of Cherry St has been cited as an issue. When classes are in session, several blocks of on-street parking within residential neighborhoods are at or near full utilization, typically between 9AM and 4 PM during the week. Based on input from the public meeting and input from stakeholders, the evaluation of on-street parking focuses on the current demands and utilization of on-street parking in the neighborhood south of the USD campus.


On-Street Parking South of USD

Parking is available to students, faculty, staff and visitors in off-street lots on campus, and is available on public streets adjacent to campus. The remainder of this section describes current parking conditions on-street adjacent to campus and in on-campus lots.

### *On-Street Parking Adjacent to Campus*

The streets south of campus are relatively narrow streets and parking is allowed on one-side of most streets in the neighborhood.

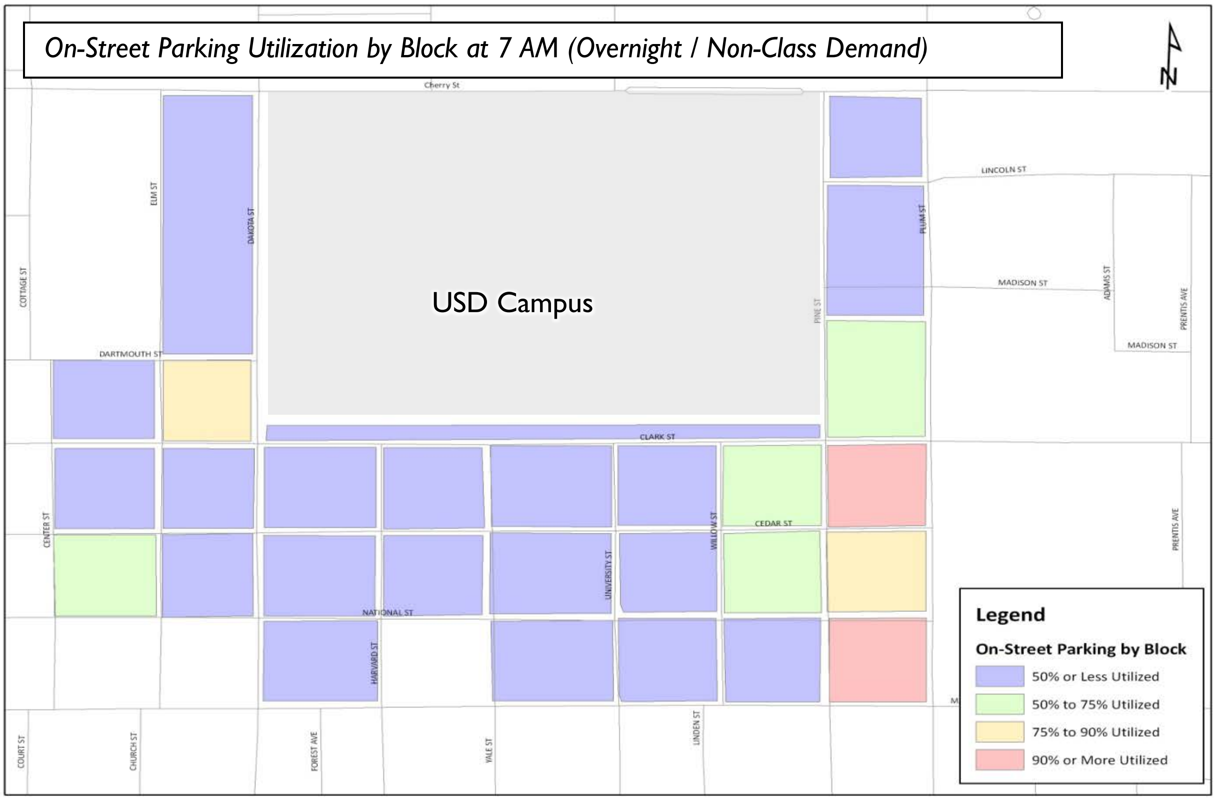
To evaluate the level of on-street parking demand south of the USD campus, data were collected in March 2011 and January 2012, reflecting the level of on-street parking before and during classes. **Figure 10** compares the level of on-street parking utilized before classes (at 7:00 AM) and during classes (at 10:00 AM). The 7:00 AM count was assumed to be a reasonable reflection of the overnight, on-street parking demand by neighborhood residents. The 10:00 AM count represented peak conditions combining the demand by residents and a typical level of university demand (i.e., peak parking demand conditions).

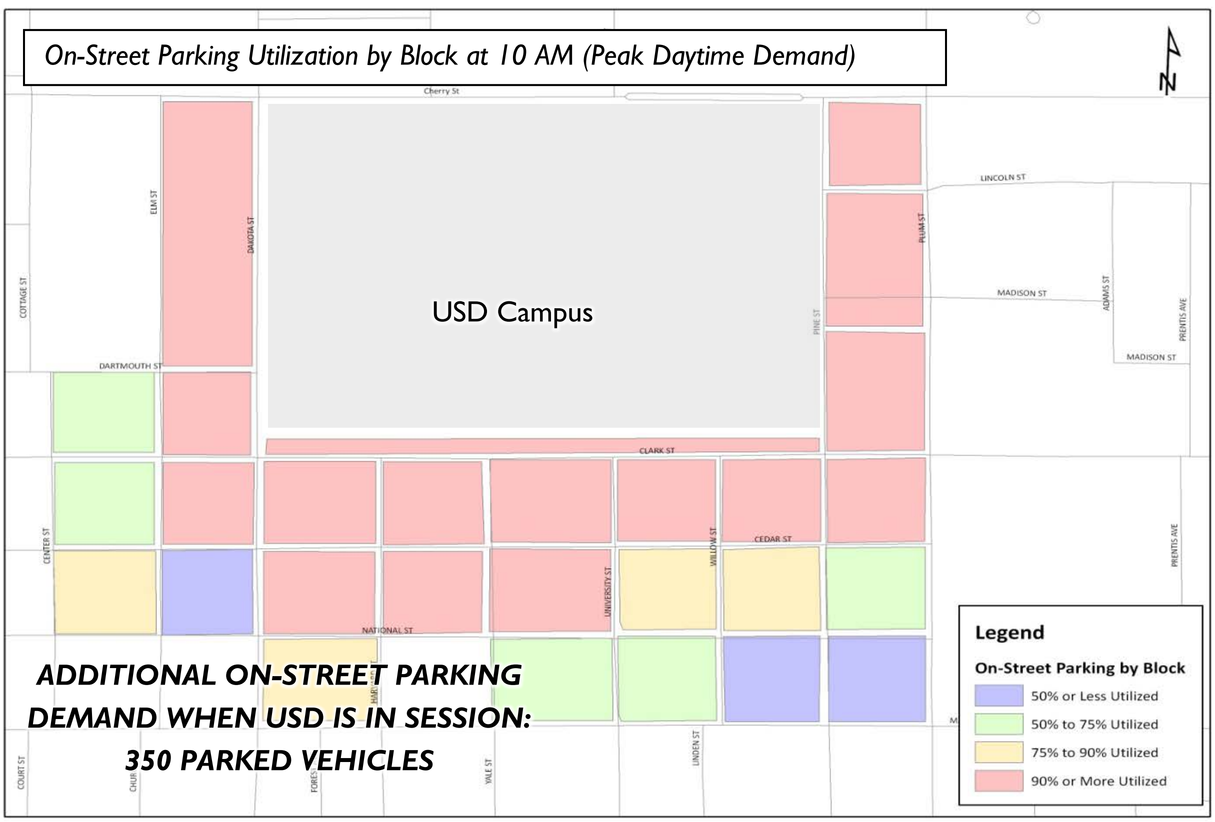
As shown in Figure 10, when class is not in session on-street parking demand is typically below 50 percent utilized for most neighborhood blocks, except for those blocks on the east side near Plum and Pine Streets, which are adjacent to higher-density housing. When school is in session, on-street parking is at least 75 percent full for the majority of blocks between Clark Street and Main Street.

Typically, the "effective capacity" for on-street parking is defined as a block that is 85 to 90 percent utilized. This is because when only 10 to 15 percent of on-street parking spots are available it becomes more difficult, time consuming and ultimately frustrating for drivers to find a parking space to use. Given the high demands in the neighborhood, 90 percent utilized is a reasonable level to define effective capacity in Figure 10. More than half of the blocks illustrated in Figure 10 are at or over effective capacity when class is in session. The portion at effective capacity is much higher for the blocks immediately adjacent to campus between National Street and Clark Street.

**USD On-Street Demand**: Based on our observations of peak and off-peak parking adjacent to south campus, it is estimated that current USD-related demand for on-street parking in neighborhoods adjacent to south campus is 350 vehicles.

**Figure 10. On-Street Parking Utilization in Neighborhood South of USD**



### *Campus Parking Lots*

The levels of parking in the neighborhood cannot be fully evaluated without first understanding parking availability and usage in campus lots. On campus parking data from March 2012 were provided by USD and evaluated by the study team. The data were provided by four different time periods over the course of the day, and broken down by permit type by lot.

On-campus parking is limited to designated and permitted surface lots for faculty, staff and students and metered visitor parking spaces. All faculty, staff, and students must pay for on-campus parking. This can be done through the purchase and display of annual or temporary parking permits or payment at meters. There are three general types of parking on campus:

- **Commuter Parking**: Faculty, staff, and students who commute to campus can purchase an "A" parking permit.
- **Campus Resident Parking**: Students who live in University housing on campus can purchase a "B" parking permit.
- **Visitor Parking**: Designated visitor parking lots are provided for campus visitors.

There are several surfaces lots on campus, but there are no parking structures / parking garages. **Figure 11** illustrates the location and type of on-campus parking lots at USD. Figure 11 also shows the general location and number of USD-related (non-neighborhood resident) on-street parking demand in relation to the available on-campus parking. As shown, the southwest and south-central parts of campus experience the highest USD-related demand for on-street parking when classes are in session.

To provide a complete illustration of parking demand in and around the campus, **Figure 12** documents:

- Peak on-campus parking lot utilization during classes.
- Peak on-street parking utilization by block during classes.
- Estimated 5-minute walk radii for all academic building areas. This illustrates the proximity of the available parking to the academic buildings on campus.

As shown in Figure 12, those on-campus lots in proximity to more of the academic building areas have the highest parking utilization. The summary of the observations of on-campus parking lot utilization are provided in the following bullets:

- Campus lots south of Cherry Streets currently have approximately 1,100 permit parking spots. On-campus lots south of Cherry are currently at "effective capacity" - over 85 percent of spots are in use when class is in session.
- Campus lots north of Cherry Street currently have approximately 2,600 permit parking spots. The on-campus lots north of Cherry have excess capacity, with approximately 50 percent of spots are in use when class is in session.
- The DakotaDome parking lots, on the edge of the 5-minute walk radius, have typical peak parking utilizations less than 25 percent.

**Figure 11. General Number and Location of USD-related On-Street Parking Demand in Adjacent Neighborhood**

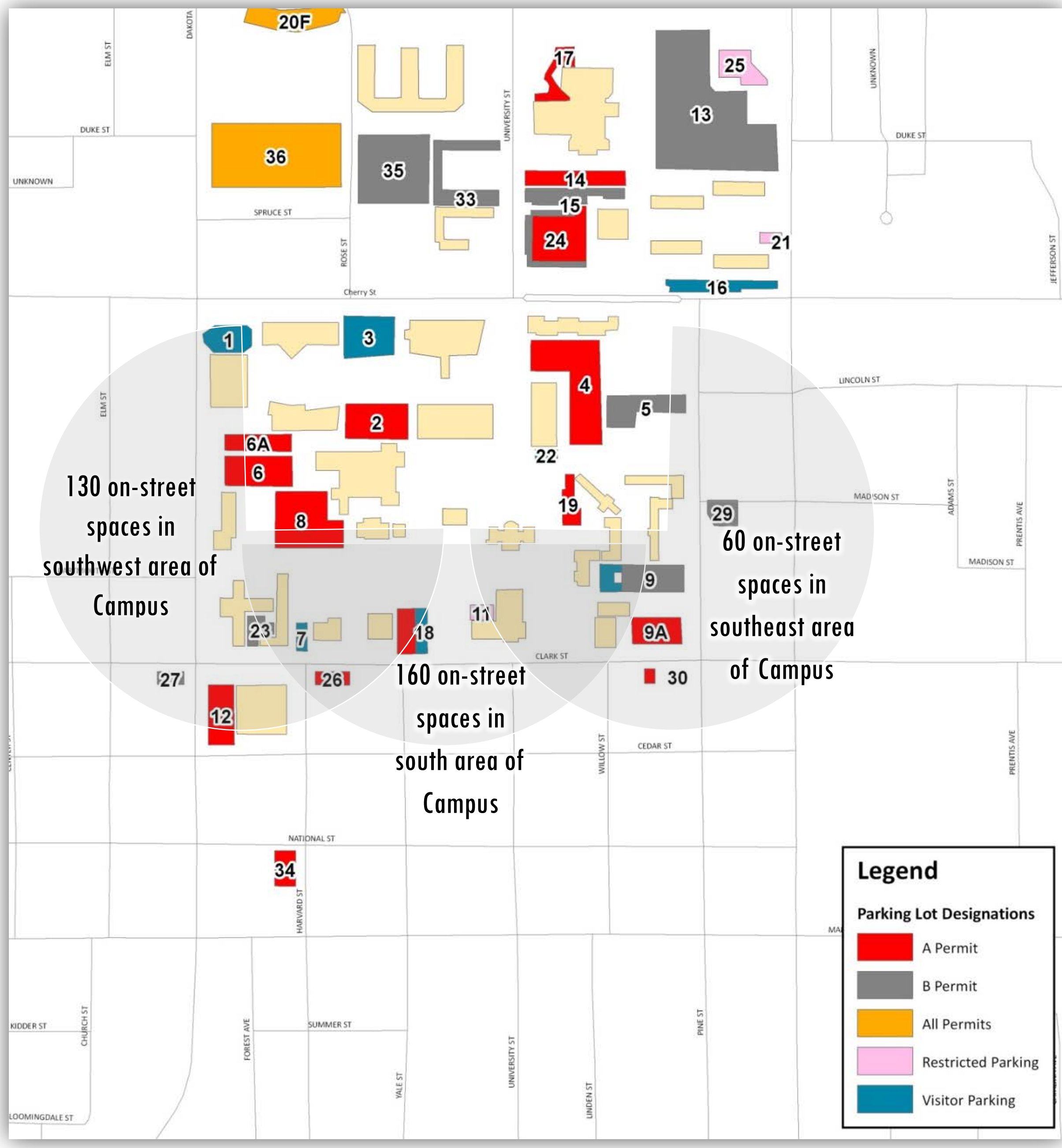
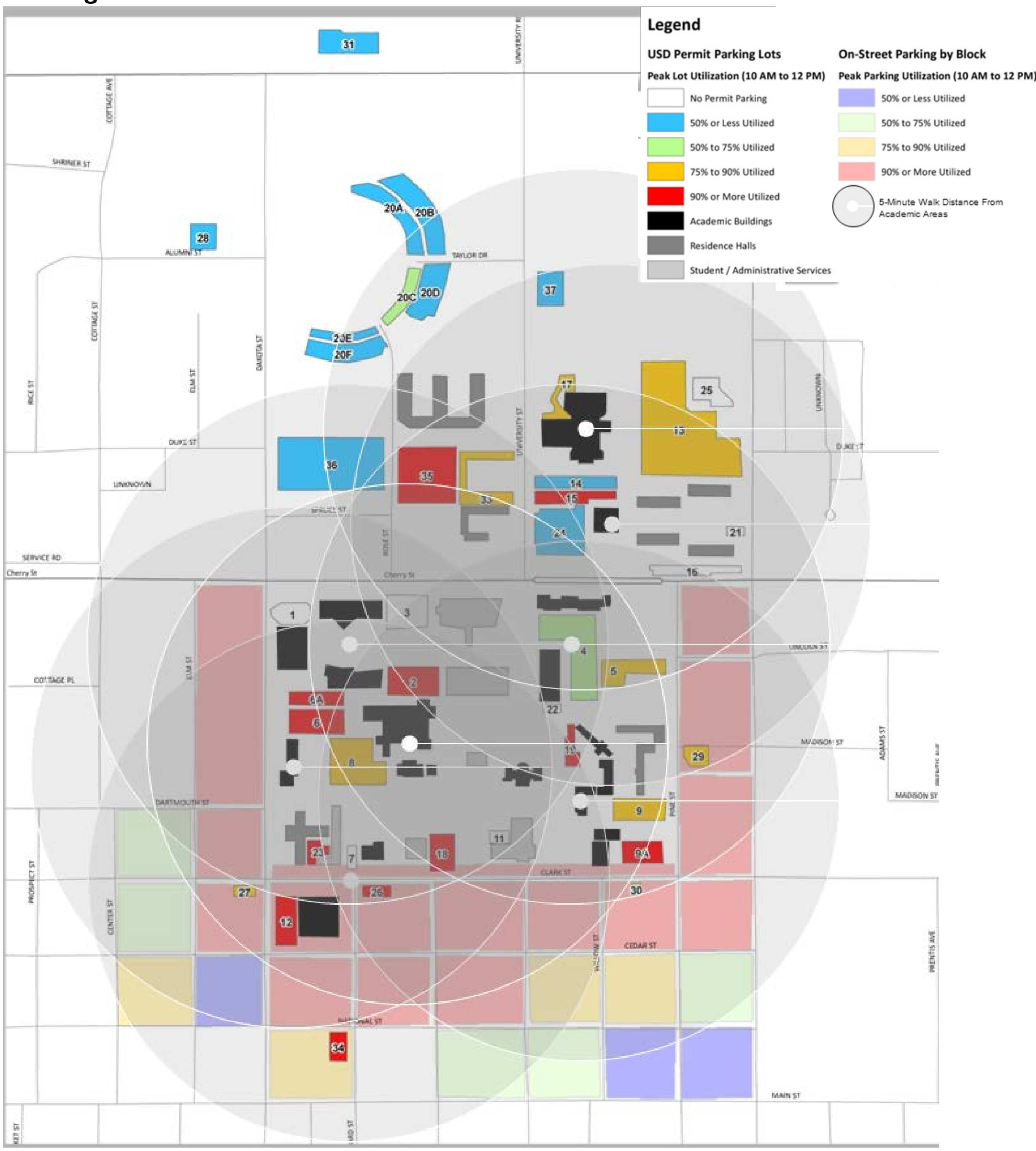


**Figure 12. Campus Parking Utilization and 5-minute Walk Radii to Academic Buildings**



## NON-MOTORIZED SYSTEM

Walking and biking, or "non-motorized travel", are relatively popular means of traveling across the Vermillion area. As indicated by the 2006-2010 American Community Survey data shown on the chart on page 8, walking and biking accounted for a combined 17 percent of Vermillion commute trips. Work trips are only a portion of the walking and biking trips in the area. Thus, walking and biking should be viewed as an essential element of the Vermillion multimodal system.


Pathway and Parked Bikes at USD

In most portions of the urbanized Vermillion area, pedestrian access is accommodated via sidewalks and cross-walks. **Figure 13** illustrates the current multi-use trail system in Vermillion and shows the streets and highways within the urban portions of the study area where neither trails nor sidewalks are provided. There are just over three (3) miles of multi-use trails currently available for bicyclists and pedestrians in Vermillion. Those corridors not shown in yellow in Figure 13 have a sidewalk on at least one side of the street for pedestrians. As indicated in Figure 13, some corridors in commercial and industrial areas and on the fringes of the study area do not provide pedestrian accommodations.

There is currently no on-street bicycle network identified for the Vermillion area. However, much of the current street network within the established urban area is conducive to bicycling due to several factors:

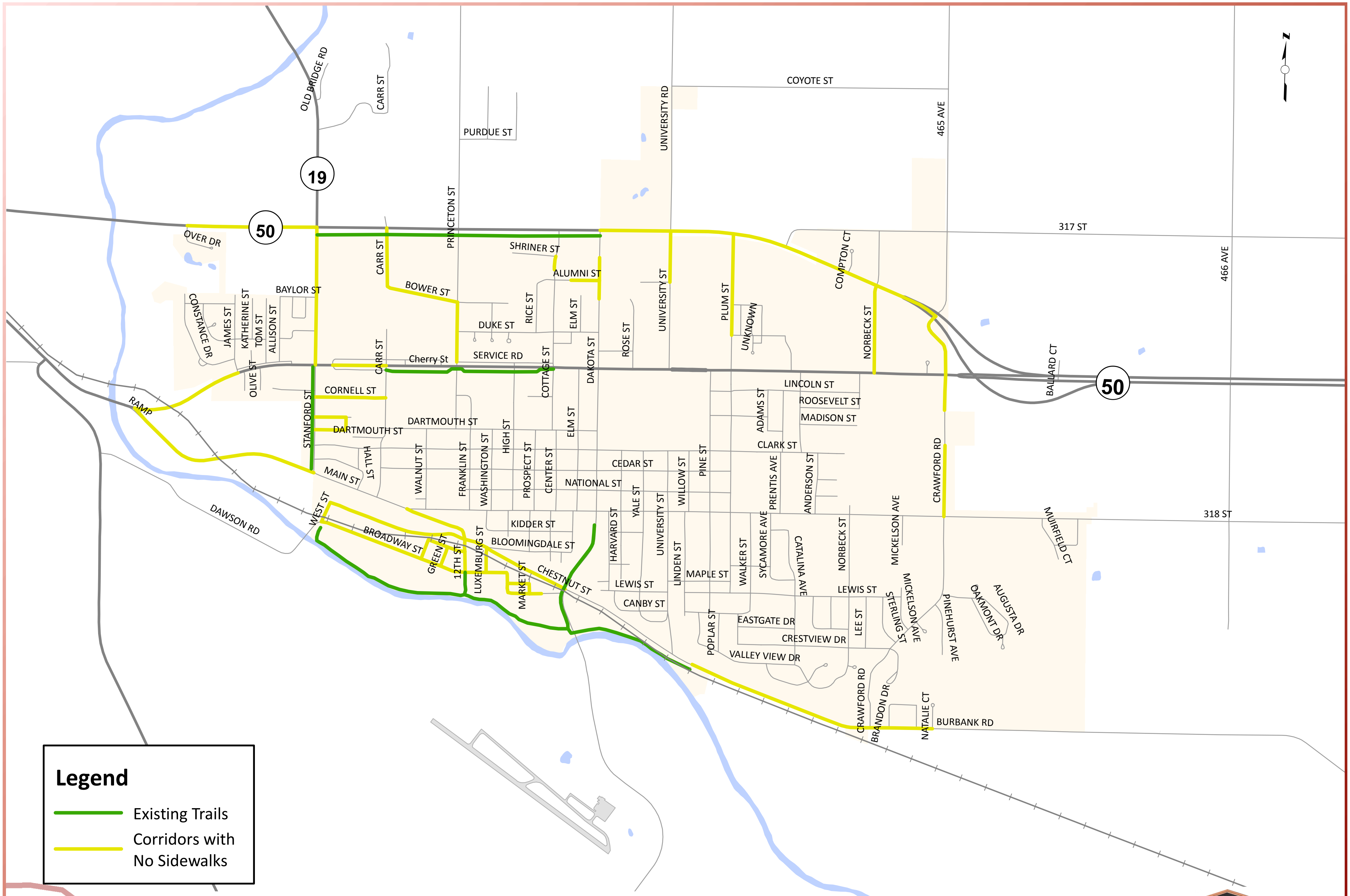
- Continuous street corridors that provide direct routes.
- Relatively low vehicular traffic volumes.
- Low vehicular travel speeds.
- Relatively flat / low grade corridors north of the ridge.

Bicycling / walking safety and connectivity have been identified as an issue throughout study development.

### Cherry Street Pedestrian Crossings at USD Campus

One of the issues identified by the public was conflicts between pedestrians and automobiles along Cherry Street adjacent to the USD campus. Cherry Street is a state highway (South Dakota Highway 50 Loop) and a relatively busy arterial street that bisects the USD campus. Many of the USD residence halls and recreational uses are north of Cherry Street and many of the USD academic buildings and student service uses are south of Cherry Street. This leads to significant demand for students, faculty and staff to cross Cherry Street. Much of the travel between campuses happens on foot at three primary pedestrian crossings:

- Rose Court / Cherry Street intersection
- University Street / Cherry Street intersection
- The east campus signalized pedestrian crossing between University Street and Pine Street.

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# Figure 13. Current Trails and Locations of Sidewalk System Gaps

* Note: The Stanford Street trail segment between Main St and Cherry Street was underconstruction in July 2012.

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The vehicle traffic operations analysis in the corridor did not indicate significant traffic delays. Traffic operations along Cherry Street are all LOS A or B (as shown in Figure 7), with LOS D or worse being considered deficient in Vermillion. However, vehicle traffic operations do not provide a complete picture of the multimodal nature of the Cherry Street corridor. The review of crash records indicated one bicycle – vehicle crash at the Cherry Street / Rose Court intersection between 2008 and 2010. There were no recorded pedestrian –vehicle crashes during that period.

To further evaluate the interaction between pedestrians and cars in the corridor, the study team conducted field observations of pedestrian and vehicular activity when USD classes were in session on Monday, April 16, 2012 between 8:00 AM and 3:00 PM. The following data were collected by 15-minute time interval:

- Number of pedestrian crossings that occurred when allowed by pedestrian walk indication.
- Number of pedestrian crossings that occurred when not allowed by pedestrian walk indication ("Do not walk" signal).
- Number of pedestrian signal "activations" (when pedestrians pushed the button to cross the street).
- Number of pedestrians that crossed the street outside of a designated pedestrian crossing.
- Number of vehicles queued during each red light when pedestrians were crossing Cherry Street.

Based on the field data collection and analysis, the following bulletpoints summarize the Cherry Street pedestrian crossing observations at the USD campus:

- The busiest interval for pedestrians to cross Cherry Street was consistently the 15-minutes before a class period began. The study team observed 65 percent of the hourly pedestrian crossings during the 15-minutes before a class period started.
- The highest hour of pedestrian crossings was from 11:45 AM to 12:45 PM, when nearly 650 pedestrians crossed Cherry Street at the three primary crossings (Rose Court, Dakota Street and the east campus pedestrian signal).
- The busiest crossing of the three was the east campus signalized pedestrian crossing, with approximately 380 crossings at this location alone during a peak hour.
- Approximately 66 percent of pedestrians crossed Cherry Street when allowed by the pedestrian walk indication. Pedestrians violated the "Do Not Walk" signal 34 percent of the time. Based on the field observations, pedestrians who violated the "Do Not Walk" signal typically did it when vehicular traffic was low and there was reduced potential for vehicle – pedestrian conflicts in the street.
- It is estimated that less than one (1) percent of all pedestrian crossings occurred outside of a designated cross-walk. Based on this observation, the cross-walks appear to be properly located.
- The maximum number of vehicles the study team observed queued at the any of the traffic signals during pedestrian crossings was 10. The average number of queued vehicles during a pedestrian activation was three (3) to five (5) vehicles.

- An evaluation of pedestrian level of service, based on the HCM methodology of evaluating pedestrian crossing time and available crossing space per pedestrian, indicated that the Cherry Street pedestrian crossings provide LOS A and LOS B operations.

## TRANSIT SYSTEM

### Transit System Overview

Regional transit service provides an important mode of travel in the Vermillion area. As the long-term cost of gasoline is forecasted to increase, transit service provides reliable, affordable transportation to residents of Vermillion. Transit services in the area are provided by Vermillion Public Transit (VPT). VPT is operated and administered by SESDAC, Vermillion's community-based service agency.

The Vermillion Public Transit service is an on-demand / dial-a-ride service open to general the public. Reservations are not required. The hours of operation are:

- Monday through Friday, 8AM to 10 PM.
- Saturdays 9 AM to 7 PM.
- Sundays 9 AM to 2 PM. The system has six (6) vehicles and operates three (3) during peak hours, which run Monday through Friday, 8 AM to 5 PM. Two (2) buses run from 5PM to 6PM weekdays on and Sundays. One (1) bus runs from 6PM to 10 PM weekdays and on Saturdays. Vermillion Public Transit operates a Safe Ride program for USD on Thursday, Friday and Saturday nights from 10 PM to 3 AM. All vehicles are wheelchair accessible. The buses for use around Vermillion are all 18-passenger buses.

Vermillion Public Transit Vehicle

In addition to trips in and around the Vermillion Area, Vermillion Public Transit also offers coordinated van trips during the week to Sioux Falls for medical purposes, including regularly scheduled trips for repeat users. A similar service to Yankton is starting in the near future.

Vermillion Public Transit is the ticketing agent for Jefferson Lines intercity bus service to / from Vermillion.

### Transit Operating Statistics

Reviewing the operating statistics for Vermillion Public Transit helps us gain an understanding of the role that public transit plays in Vermillion. Vermillion Public Transit provided operating data for 2010. In 2010, Vermillion Public Transit provided almost 50,000 trips to Vermillion area residents. The remainder of this section provides summaries of how these trips were broken down by:

- Trip purpose (work, shopping, medical, recreation, school).
- Ride type (agency or funding source).

- Trip length.
- Trip time of day.

**Figure 14** provides a distribution breakdown for the purpose of trips made on Vermillion Public Transit in 2010. As shown, the majority of the transit trips were for work (57%), followed by shopping (26%), and medical (8%) trips.

**Figure 14. Trip Purpose Distribution of Vermillion Transit Trips, 2010**

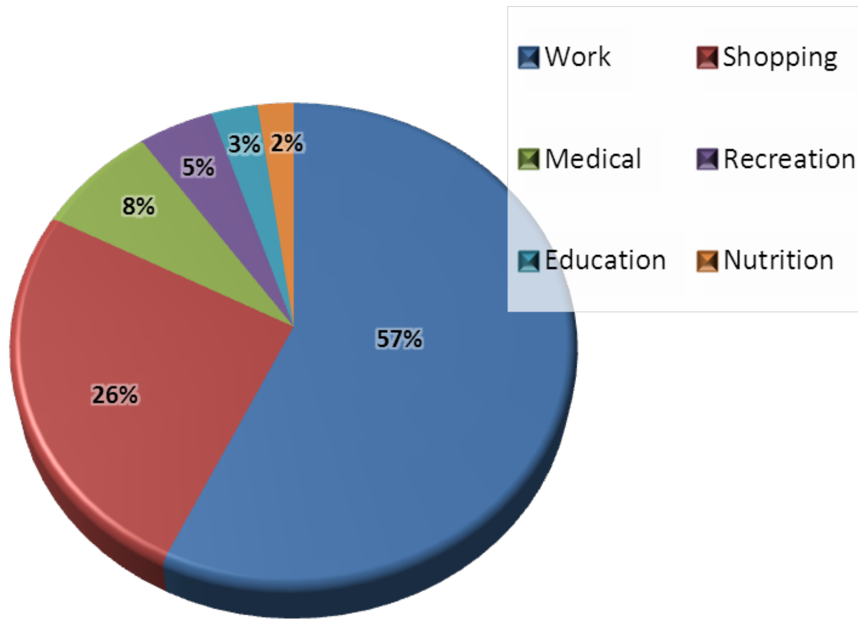



**Figure 15** provides a breakdown for the type of ride (agency / funding source) on Vermillion Public Transit in 2010. As shown, 64 percent of the transit trips were in support of SESDAC programs, and 29 percent of trips were paid trips (15% ticketed rides, 14% prepaid pass rides).

**Figure 15. Ride Type Distribution of Vermillion Transit Trips, 2010**

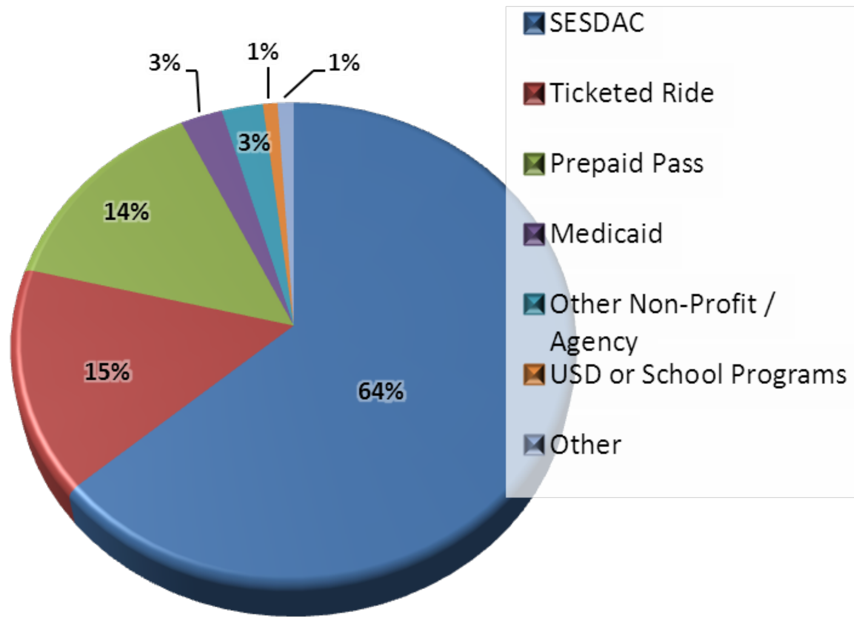
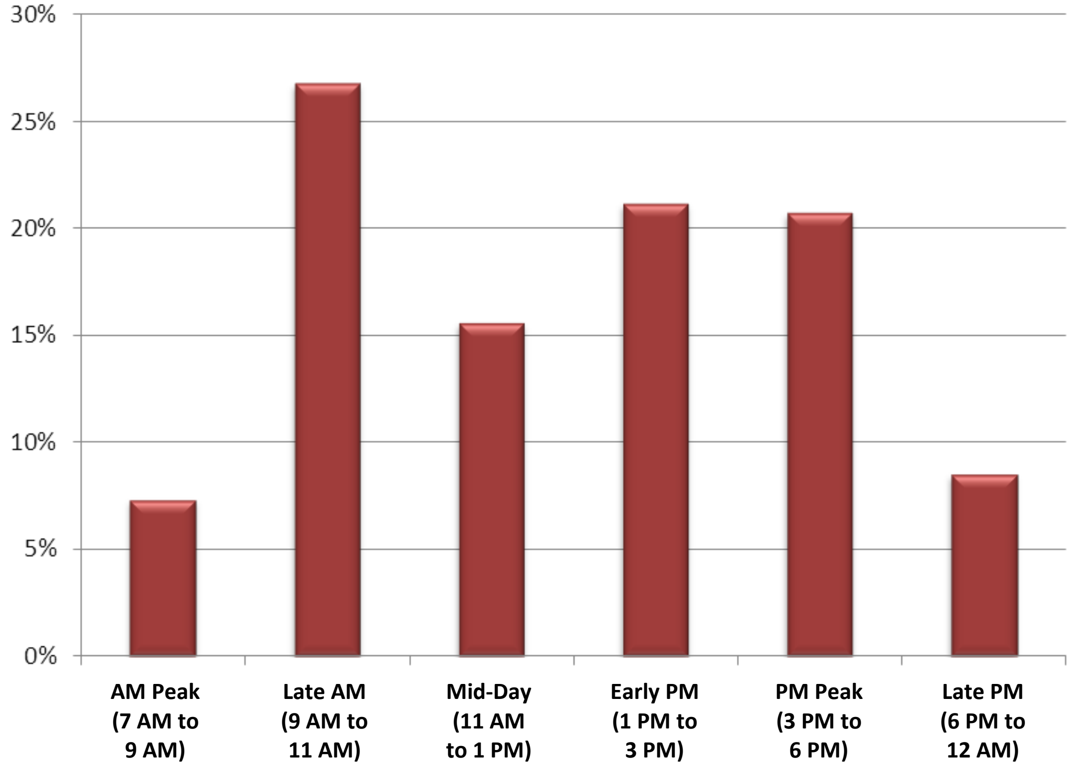



**Figure 16** provides a distribution of when trips happened over the course of a typical day in 2010. As illustrated in Figure 16, late morning and early afternoon trips are the most frequent time of day for transit trips. This is noteworthy, as the identified vehicular traffic peaks for most intersections in Vermillion happened earlier in the morning and later in the afternoon than for transit.

**Figure 16. Percentage of Transit Rides Provided by Time of Day, 2010**




## INTERCITY BUS TRANSPORTATION

Intercity bus transportation provides connectivity between Vermillion and other cities. The role of intercity bus transportation in Vermillion is to provide residents a cost-effective mode for intercity travel, and to provide shorter inter-city trips that are not efficiently served by air from Sioux Falls or Sioux City.


Intercity bus service is provided by Jefferson Lines, with 3 buses arriving and departing daily. Routes are oriented north and south along the I-29 corridor, with connections to the I-90 corridor in Sioux Falls. Jefferson Lines operates lines across the Midwest and connects to the larger Greyhound national intercity bus system.

## FREIGHT

The effectiveness and efficiency of freight transportation is a prominent factor in the cost to produce and purchase goods and service. From the production perspective, manufacturers consider reliability and speed when making transportation decisions. If shipments of materials do not arrive on time, or in a predictable manner, production is impacted, which affects total company costs by lowering productivity. From a community's perspective, freight movement creates both economic benefits and secondary impacts for residents and travelers in a community; a good freight system is crucial to maintaining the high quality of life that we expect through product delivery and movement, at the same time travelers and residents do not want to contend with heavy commercial vehicles on the roadways or adjacent to their homes. Thus, planning for both of these ideas is critical in both the Comprehensive Plan and the area Transportation Plan is required to reduce the potential for conflicts.

## Existing Truck Routes

The community is naturally sensitive to conflicts created by mixing heavy commercial vehicle traffic with local vehicle traffic and non-motorized traffic. Addressing this issue is not intended to portray truck traffic as a negative element in the community, it simply recognizes that mixing a range of activities in a single corridor (freight movement, recreational biking, commuter traffic, shopping traffic, commuter biking, pedestrians, etc.) has the potential to create conflicts. In addition, the city, county and state have responsibility for managing the level of conflict that is inherent in the system.

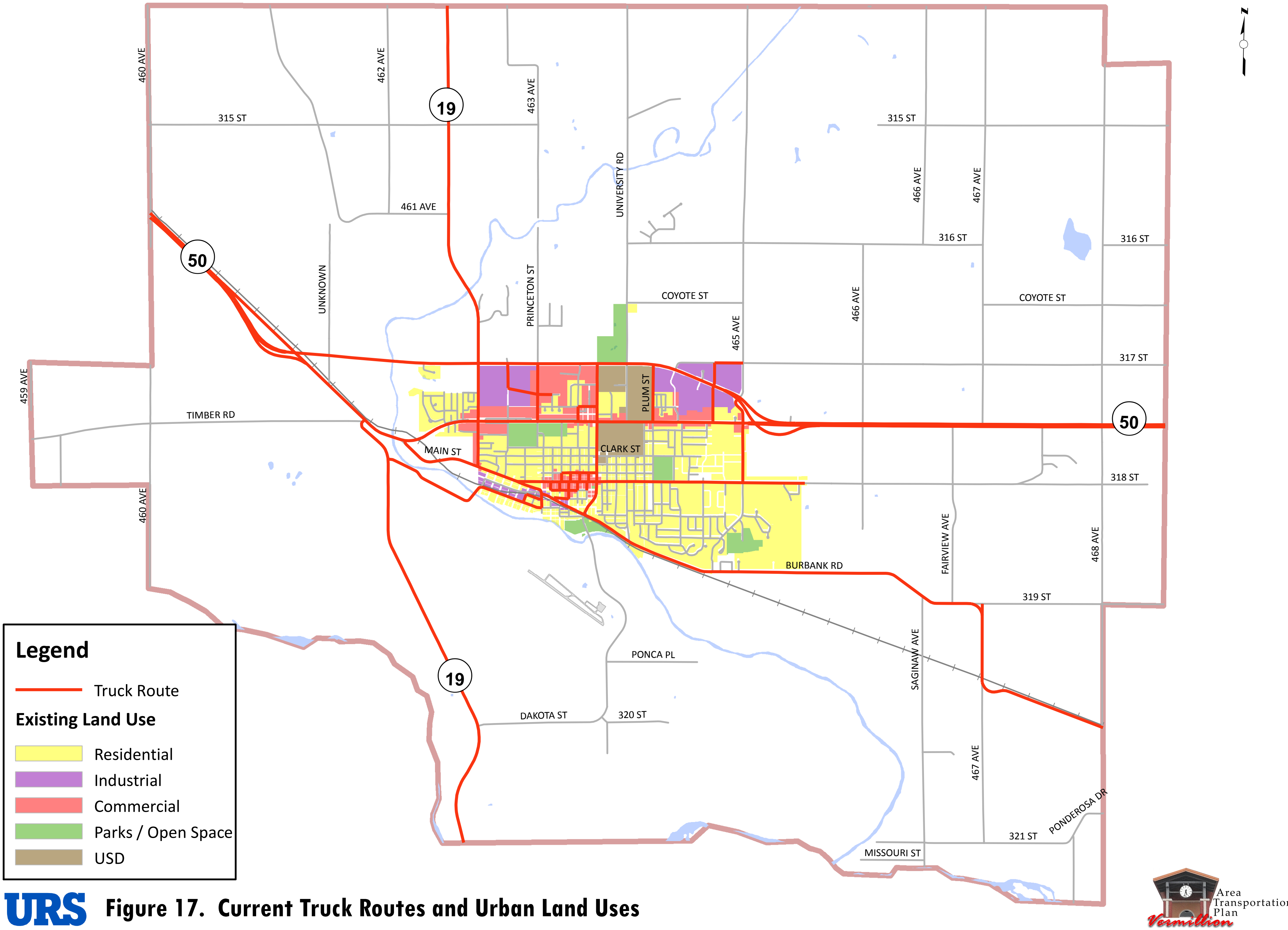
One means of managing the potential for conflict is through an established community truck route system. Similar to how roadway functional classification addresses and prioritizes the conflict between land access and mobility, truck routes prioritize how freight movement and people movement interface. Unlike the roadway classification prioritization where access and mobility each are provided almost complete prioritization in selected classifications, the movement of people is always afforded the priority in all corridors and heavy commercial vehicles are either allowed or restricted in corridors. In corridors designated as truck routes, freight movement can be provided a higher corridor priority through the following:

- Pavement that is designed for heavier loads.
- Separating non-motorized travel from auto/truck travel through setback sidewalks, separated multi-use trails, signalized pedestrian crossing, etc. Non-motorized travel is not prohibited, but rather vehicles (both autos and trucks) tend to be separated from bicyclists and pedestrians.

Vermillion's designated truck routes are illustrated in **Figure 17**.

### *Assessment of the Existing Truck Route System*

While it is desirable to have industrial areas served by truck routes, all else being equal it is undesirable to locate trucks in close proximity to residential properties. There is a potential conflict that may arise from the potential mixing of pedestrian / bicycle activities with heavy commercial vehicles on truck routes. Where residential areas have direct driveway access to truck routes, there is increased potential for these conflicts. Thus, deficiencies in the system would be observed in residential areas with driveway access onto a truck route.




URS Figure 17. Current Truck Routes and Urban Land Uses

Corridors in the urban area that have direct residential access to a truck route include:

- Dakota Street south of Cherry Street.
- Cherry Street east of Norbeck Street.
- Main Street east and west of Downtown.
- Burbank Road east of University Street.
- 12th Street between Broadway Street and Chestnut St.
- Broadway Street west of 12th Street.

## Rail Freight

Rail freight in Vermillion is provided by the Burlington Northern Santa Fe Railroad. Vermillion is located on the Sioux City to Aberdeen branch line. According to the Federal Railroad Administration Crossing database, the BNSF branch line through Vermillion carries two (2) through freight trains a day. This branch line through Vermillion is a single track with at-grade roadway crossings at:

- Burbank Road.
- Saginaw Avenue.
- Dakota Street.
- Luxembourg Street.
- 12th Street.
- West Street.
- 461st Avenue.
- 460th Avenue.

BNSF Building in Vermillion

Of these at-grade crossings, Dakota Street has the most vehicular traffic: approximately 1,400 vehicles per day. Grade separated roadway crossings with the BNSF branch line include:

- Main Street.
- Cherry Street.
- Highway 50.

In our review of the traffic crash data from SDDOT, no train-auto crashes were recorded between 2008 and 2010.

## Air Service

Air service in Vermillion is provided by Harold Davidson Field. The airport is owned by the City of Vermillion, and provides general aviation operations via a single runway: Runway 12/30. The 2001 *Airport Layout Plan* identifies a future runway (4/22) that crosses the existing runway.

There are 26 aircraft based at the airport. General aviation operations accounted for an average of 20 aircraft operations per day in 2010-2011. No commercial services other than occasional air taxi operations are offered in Vermillion (source: *www.airnav.com/airport/KVMR*). Commercial service is available in nearby Sioux City and Sioux Falls.

Air service has received limited attention as an issue from the public and stakeholders during Plan development.

## Event Traffic and Pedestrian Observations

Vermillion is home to the Dakota Dome and the University of South Dakota, and hosts several major events over the course of the year. One element that this study has examined is how traffic and pedestrian flow operates during these large events. The objective of this study task was to identify locations of travel conflicts. To get an understanding of how major events affect Vermillion travel, two different events were observed:

- Dakota Days / USD Homecoming (October 8, 2011)
- High School Football Championships (November 10-12, 2011)

### Dakota Days Observations

Observations were conducted on Saturday, October 8, 2011 during the parade and the tailgating and football game at the Dakota Dome. The parade started at 10:00 AM and football kickoff was at 4:00 PM. During observations of this event, particular attention was paid to vehicular circulation and flow into and around the Dakota Dome, and pedestrian patterns and conflicts associated between the downtown area and the Dakota Dome area.

Traffic conditions after the 2011 Dakota Days game were likely one of the most congested in recent years, as it was a closely contested game until the end of the game. Unlike past years the majority of the crowd stayed the entire game. Observations of traffic flow during Dakota Days included:

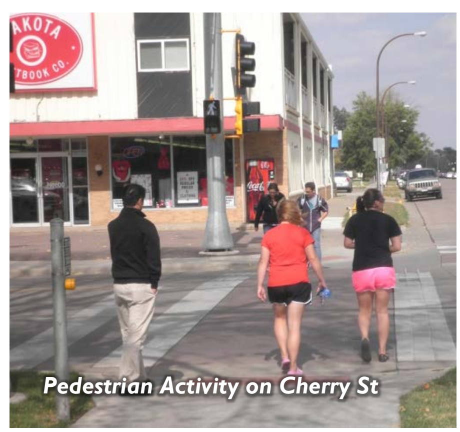
- When the parade ended at approximately 10:30 AM, there was an increase in traffic volumes on Cherry Street and Dakota Street.
  - The levels of delay or queuing along Cherry Street did not seem to worsen significantly.
  - Queues along southbound Dakota Street north of Cherry Street increased, but were only typically four or five vehicles deep. Delays were limited as all vehicles were cleared during green phase
- By 2:30 PM, most of the tailgating south of the stadium had begun and traffic volumes were down dramatically and there were no queues or delay on Dakota Street, Cherry Street or Highway 50. There was no observed queuing for traffic entering tailgating area either north of the dome for general parking or south of the dome for the Coyote Nation parking. Even with parking money collectors located at the entry point, queues for entering vehicles were limited.
- By kickoff at 4:00 PM, nearly all tailgaters went into game. There was very little vehicle or pedestrian traffic observed during the game.
- The game was over at 6:50 PM. For the first 30 minutes after the game, until about 7:20 PM, the majority of pedestrians and vehicles were leaving the game. During this time:

  - At the intersections of Dakota Street / Highway 50 and University Street / Highway 50, there were typically 10 to12 vehicles in a northbound queue. Queues moved relatively quickly as vehicles were able to pull up, find acceptable gaps in Highway 50 traffic to turn either west or east on to Highway 50 with limited delay.
  - At the intersection of Dakota Street / Cherry Street, there was typically 10 vehicles queued to proceed southbound. The majority of observed southbound traffic was turning left to go east on Cherry Street and approximately only half of the queue was able to clear during each green phase. Most of the southbound left-turn delay was due to pedestrians crossing the east approach of the intersection.

- Between 7:20 PM and 7:40 PM (30 to 50 minutes after the game):
  - Queues on Dakota Street and University Street / Highway 50 were reduced to about 2 or 3 vehicles.
  - Cherry Street was still busy during this time, with reduced queues at the pedestrian crossing, but it was still causing backups to University Street.
  - Southbound queues at the Dakota Street / Cherry Street intersection were down to about 4 to 5 vehicles at this time.
- By 7:40 PM (50 minutes after the end of the game), traffic was back to more “normal” levels seen during non-event times.
- The mid-block pedestrian crossing signal between University and Pine is not coordinated with the signals on Cheery Street. Much of the Cherry Street vehicle congestion between Dakota Street to Plum Street after the event would have been relieved if the Cherry Street intersection signals were coordinated with the pedestrian signal. This also likely caused some of the southbound left-turn delays at Dakota Street / Cherry Street during the post-game peak.

Observations of pedestrian and related parking activity associated to Dakota Days were as follows:

- The majority of tailgaters arrived on site by walking north along Dakota Street.
- A large portion of the tailgaters also either parked on University Street or in adjoining parking lots and walked to tailgating.
- Both Dakota Street and University Street had vehicles parked on street all the way up to Highway 50.
- Alumni Street and Duke Street had vehicles parked from Dakota Street to Cottage Avenue.
- Cottage Avenue had vehicles parked for about halfway from Duke Street to Shriner Street.
- There were less than 10 vehicles parked in the grass over flow parking west of Dakota Street near the Dome.
- Pedestrians on Dakota Street and University Street north of the Dome were forced to walk in the



*Pedestrian Activity on Cherry St*

through lanes of Dakota Street as there are no sidewalks on either side of the street. This essentially made each a one lane road during peak pedestrian times.

In general, vehicular and pedestrian flows were somewhat disrupted before and after the game, but delays are not excessive. All queues diminished relatively quickly and no incidents of excess queues or delay were observed pre- or post- game. On the Friday before and on the Saturday of Dakota Days, the signals on Cheery Street seemed to have slipped out of coordination.

## South Dakota High School Football Championship Observations

The South Dakota High School Football Championships were held between Thursday, November 10 and Saturday, November 12, 2011 at the Dakota Dome. To observe what the study team believes were the "worst" conditions related to this event, we observed traffic and pedestrian conditions during the two games held on Thursday, November 10. The Thursday session was chosen because it had two games that involved Class 11A and 11B teams, and all four schools were from within 90 minutes' drive of Vermillion. This allowed the study team to observe the ebb and flow in between games and how that would mix with afternoon peak hour traffic in Vermillion. The remainder of this section provides our observations associated with each High School football game at the Dome.

Game 1 – Class 11A: Dell Rapids vs. West Central : 2:30 PM

- The attendance was estimated 6,000 to 7,000.
- The arrival pattern of vehicles for the game was relatively steady, with no real delay or operational problems as vehicles arrived and parked.
- Prior to the game (at noon on Thursday), very little parking was utilized around the Dome area.
- During the game, parking utilization on-site was higher than during the Dakota Days game. Dakota Avenue and University Street were lined with on-street parking on both sides of the street, and the overflow parking west of the stadium was highly utilized.
- No vehicles utilized the Dakota Days "tailgate area" south of the dome.
- No pedestrians were observed coming from the south as with the Dakota Days game.
- The game was over at 4:45, and nearly all vehicles stayed for the entire game. After the game:
    - Between 5:00 and 5:15 was the peak time for vehicles leaving the Dome area. As traffic left, it mixed with typical daily peak hour traffic on Highway 50.
    - Queuing for northbound Dakota Avenue and University Street traffic at the Highway 50 intersections was at similar levels to Dakota Days. Typically at least 4 to 6 vehicles queued, but the queues kept moving with limited delays.
    - Dakota Avenue / Cherry Street had similar queuing as observed during Dakota Days as well. Typically 10 to 12 southbound vehicles were queued and 6 to 8 northbound vehicles were queued during the peak 15 minutes. Eastbound traffic queued back through the intersection due to mid-block pedestrian signalized crossing.
    - By 5:45 all of the vehicle queues had diminished were back to pre-game/ pre-PM peak levels. All parked vehicles around the stadium were gone by 6:00.

In the future if traffic volumes associated with this game are more of an issue, it would make sense to adjust the game time to avoid mixing the normal daily traffic peak coinciding with the dismissal of game traffic.

<u>Game 2 – Class 11B: Tri-Valley vs. McCook Central/Montrose: 7:30 PM</u>

- Game attendance was not announced, but parking for Game 2 was similar to Game 1.
- As with Game 1, the arrival pattern of vehicles for the game was relatively steady, with no real delay or operational problems as vehicles arrived and parked.
- Similar to Game 1, Game 2 parking utilization in and around the Dome area appeared be higher than for the Dakota Days game. The amount of parked cars and locations of parked cars were nearly identical to Game 1.
- No pedestrians were observed coming from the south – all activity appeared to be originating from parked cars near the Dome.
- The game was over at 9:55 PM. All vehicles stayed to the end of the game.
- By 10:10, the exiting traffic was very heavy. Traffic on Highway 50 and Cherry Street was very low. Based on observations, well over 95 percent of the traffic was from the football game.
- There were no observed queues at the Dakota Avenue and University Street intersections with Highway 50. There were also no queues observed on Cherry Street or Dakota Avenue.
- 10:20 PM, 25 minutes after the game, nearly all of the traffic had left and traffic levels returned to normal, light levels.

In general, the High School Football Championship traffic was more vehicle-oriented than Dakota Days, as nearly all attendees arrived on site in automobiles and parked as close to the stadium as possible. The most significant operations issues seen were due to the afternoon game traffic mixing with typical PM peak hour traffic. Adjusting the afternoon game time so that it dismissed prior to the afternoon peak would address some of the observed operations issues associated with that game.

## Community Survey

An on-line survey was conducted to get additional feedback from those not participating in the stakeholders committee and public meetings. The survey was located at:

*www.surveymonkey.com/s/vermillion_transportation_survey*


Dartmouth Street, Vermillion

The survey was advertised in the public meeting announcements in the newspaper, was promoted at the public meetings and stakeholders meetings and via the Transportation Study website (vermilliontransportation.blogspot.com). The on-line survey asked a series of questions asking for how citizens traveled in Vermillion and looking for feedback and impressions of the transportation system. The on-line survey was run from October through December of 2011. A total of 49 unique respondents were received from Vermillion area residents during the period. The study team recognizes that this is not a statistically-significant sampling of the entire Vermillion area, but rather provides us with an additional means of gathering input from additional Vermillion citizens. The rest of this section summarizes survey responses by topic.

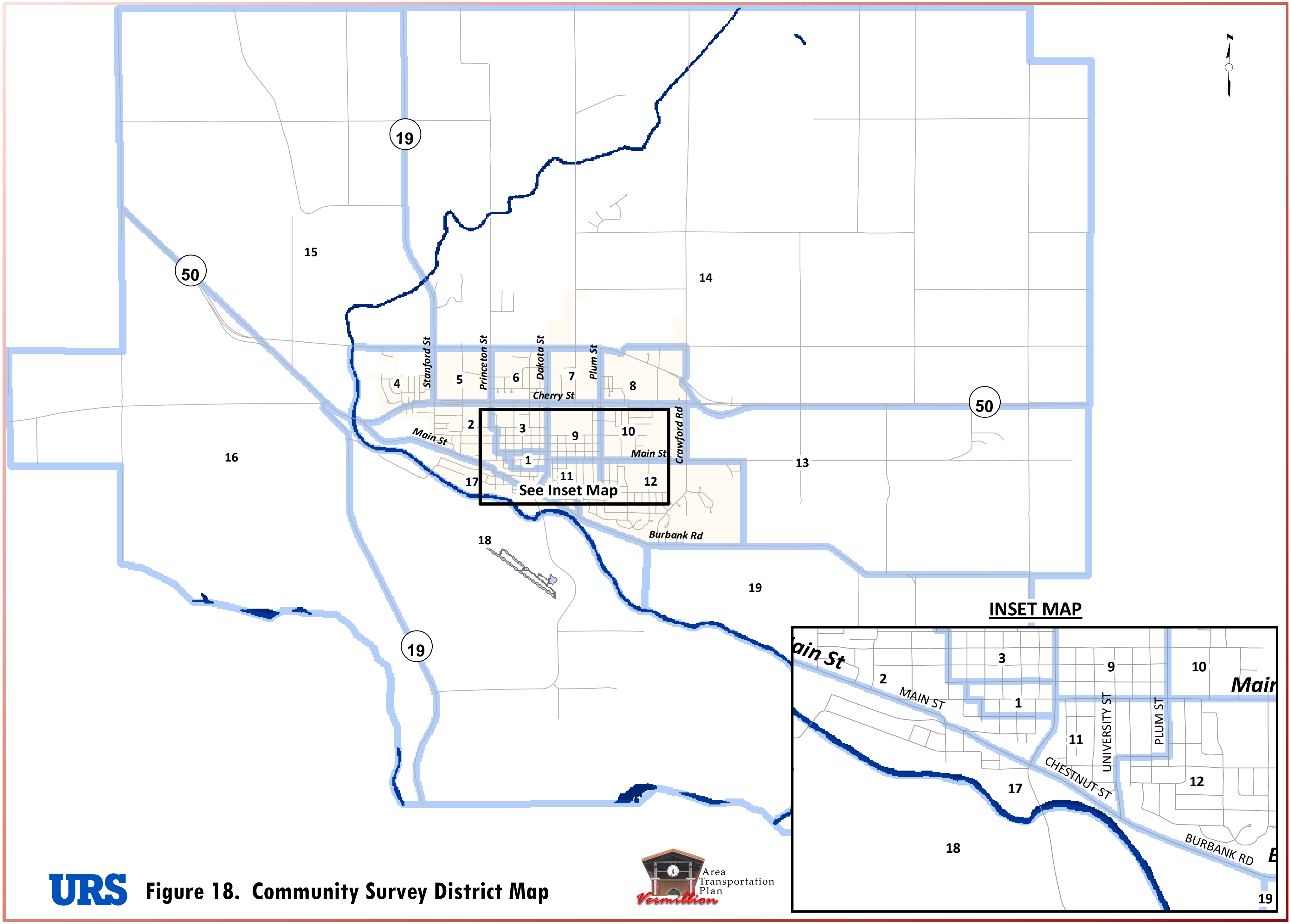
### Where Citizens Live and Work

A map was provided to survey respondents, which divided the study area into 19 districts and asked in which district they lived, and which district they worked. The community survey district map is shown in **Figure 18.** Based on the responses to the live and work question, the three most frequent districts for respondents to live in were:

- District 11: 11 responses (24%).
- District 12: 11 responses (24%).
- District 4: 6 responses (13%).
- District 14: 4 responses (9%).

Two respondents lived outside of the study area. The most frequent districts for respondents to work in were:

- District 9 (USD campus): 15 responses (33%).
- District 1 (Downtown): 11 responses (24%).
- Outside of Study Area: 5 (11%).
- Five different districts (Districts 3, 6, 8, 10 and 11) were the workplaces of two (2) respondents each.

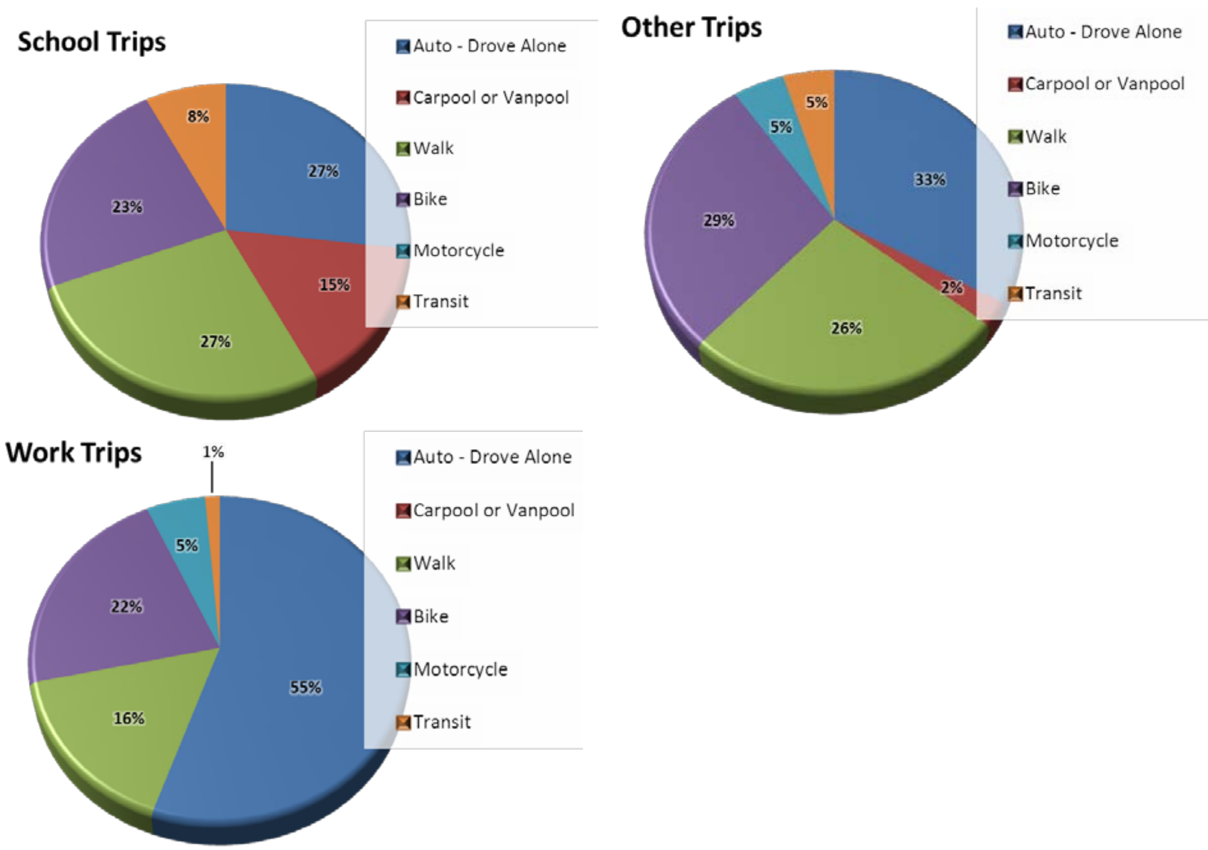



URS Figure 18. Community Survey District Map

## Mode of Travel by Trip Purpose

Respondents were asked what mode of travel they or other family members normally use to get to/from work, school and other trip purposes. **Figure 19** shows the responses of survey respondents by trip purpose.

**Figure 19. Respondents' Mode of Travel by Trip Purpose**

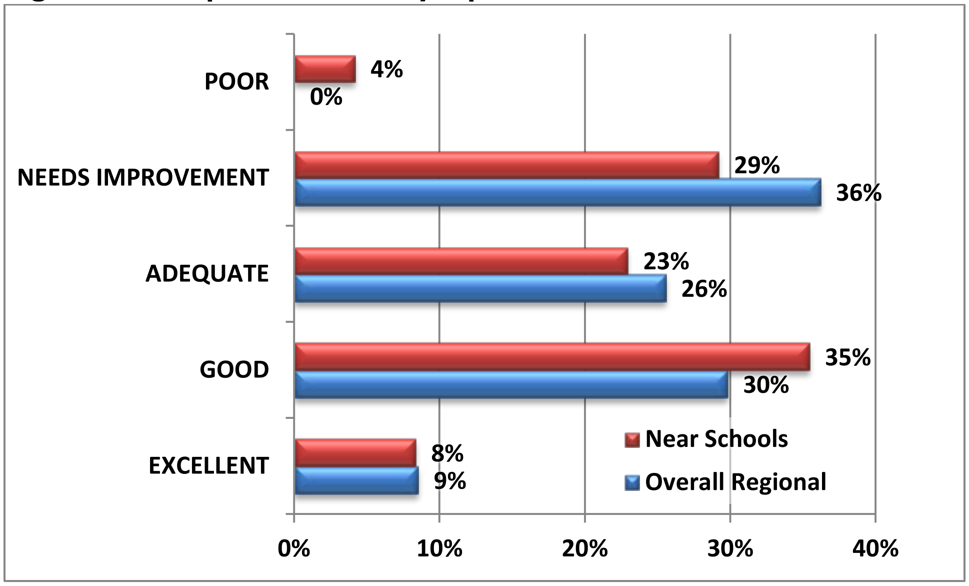



As shown in the charts, driving an automobile alone was the most frequent means of respondents' travel to work, school and "other" trips. However, the respondents' reported use of automobiles for work travel is lower than the 2006-2010 Census reported commute mode share for all of Vermillion residents (82%), illustrated on page 1. Based on these responses and the available commute data from the Census, it appears that walking and biking system users are somewhat more represented in our non-scientific sample than the Vermillion population as a whole.

## Safety Opinions

Respondents were asked to rate the safety of the overall system and near schools. **Figure 20** summarizes their responses.

**Figure 20. Respondents' Safety Opinions**




As shown in Figure 20, the majority of respondents characterized system safety as good or adequate. No respondents stated that safety in the region was poor, while 9 percent rated it excellent. Near schools, 4 percent rated current safety poor and 8 percent rated safety as excellent.

## Congestion / Ease of Travel Opinions

Respondents were asked about their overall concern about Vermillion-area traffic congestion and their ease of travel to three different major destinations. As shown in **Figure 21** and **Figure 22**, most respondents felt that traffic congestion was either not a problem or just a minor problem, and most felt that access to major destinations was either easy or moderately easy.

**Figure 21. Respondents' Overall Concern with Traffic Congestion**

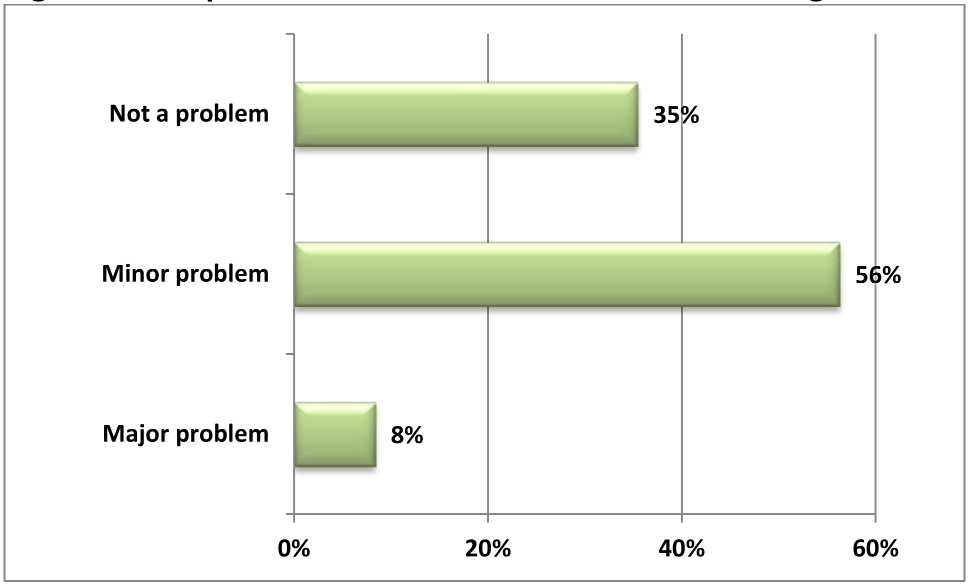
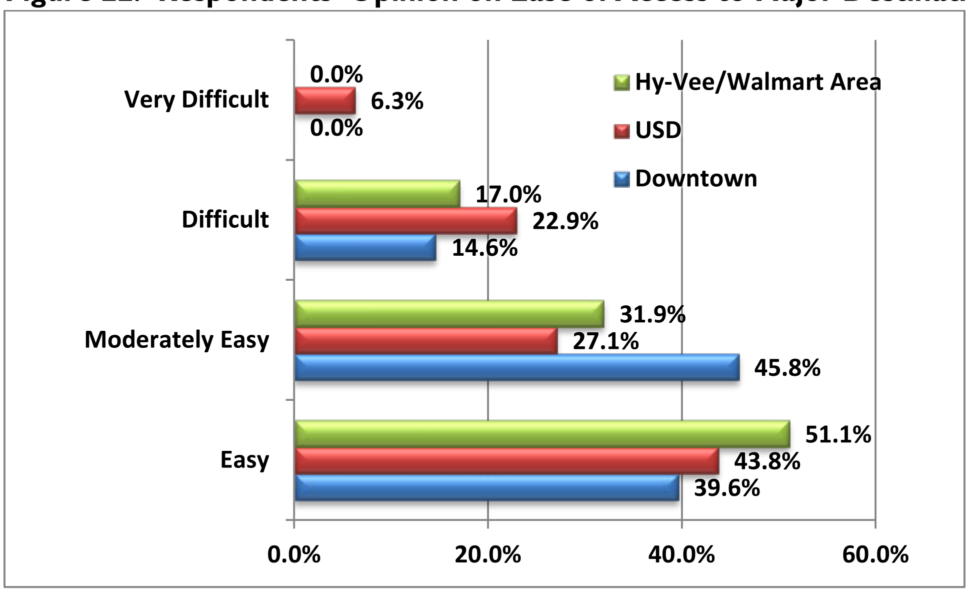


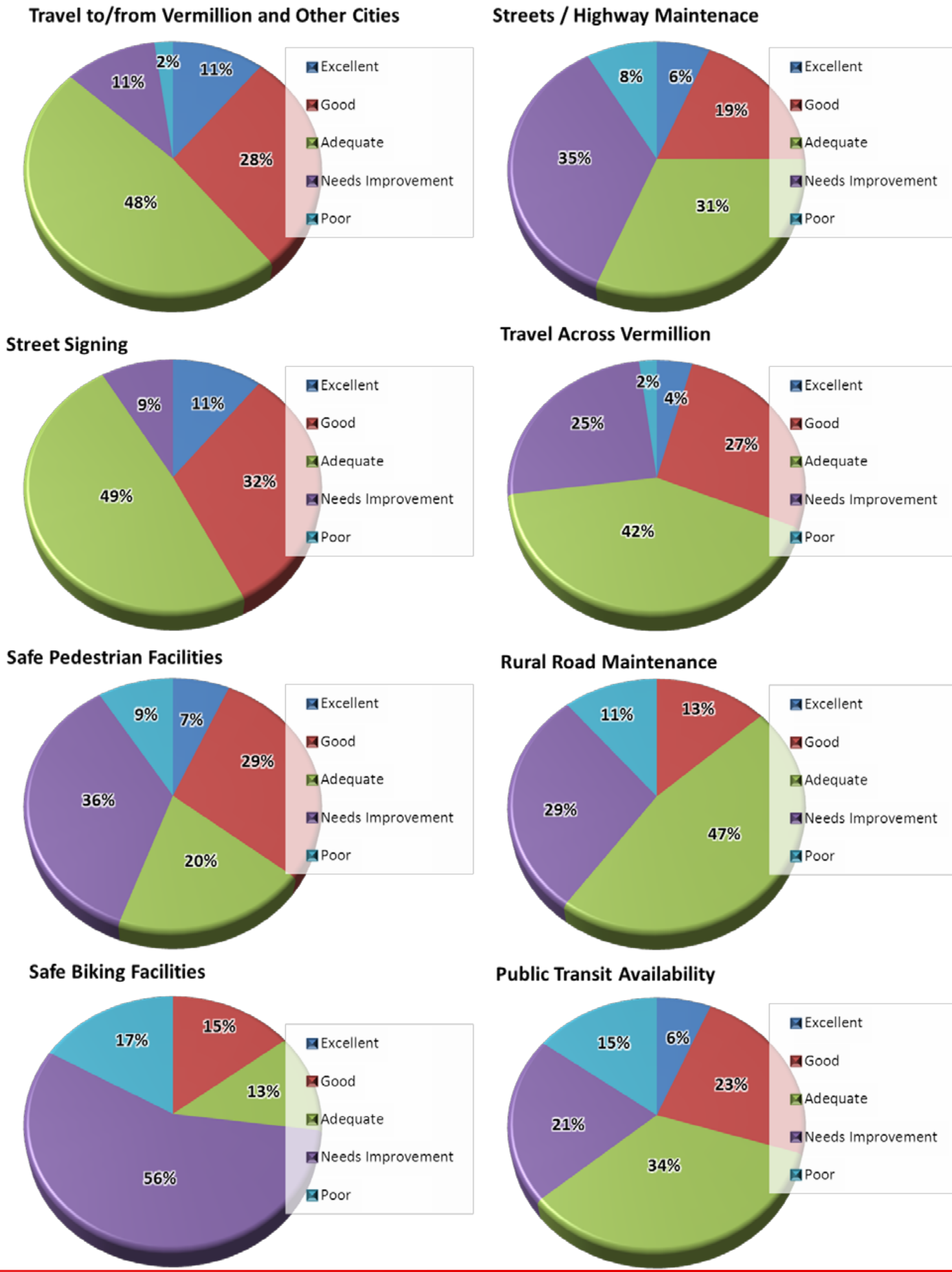

**Figure 22. Respondents' Opinion on Ease of Access to Major Destinations**



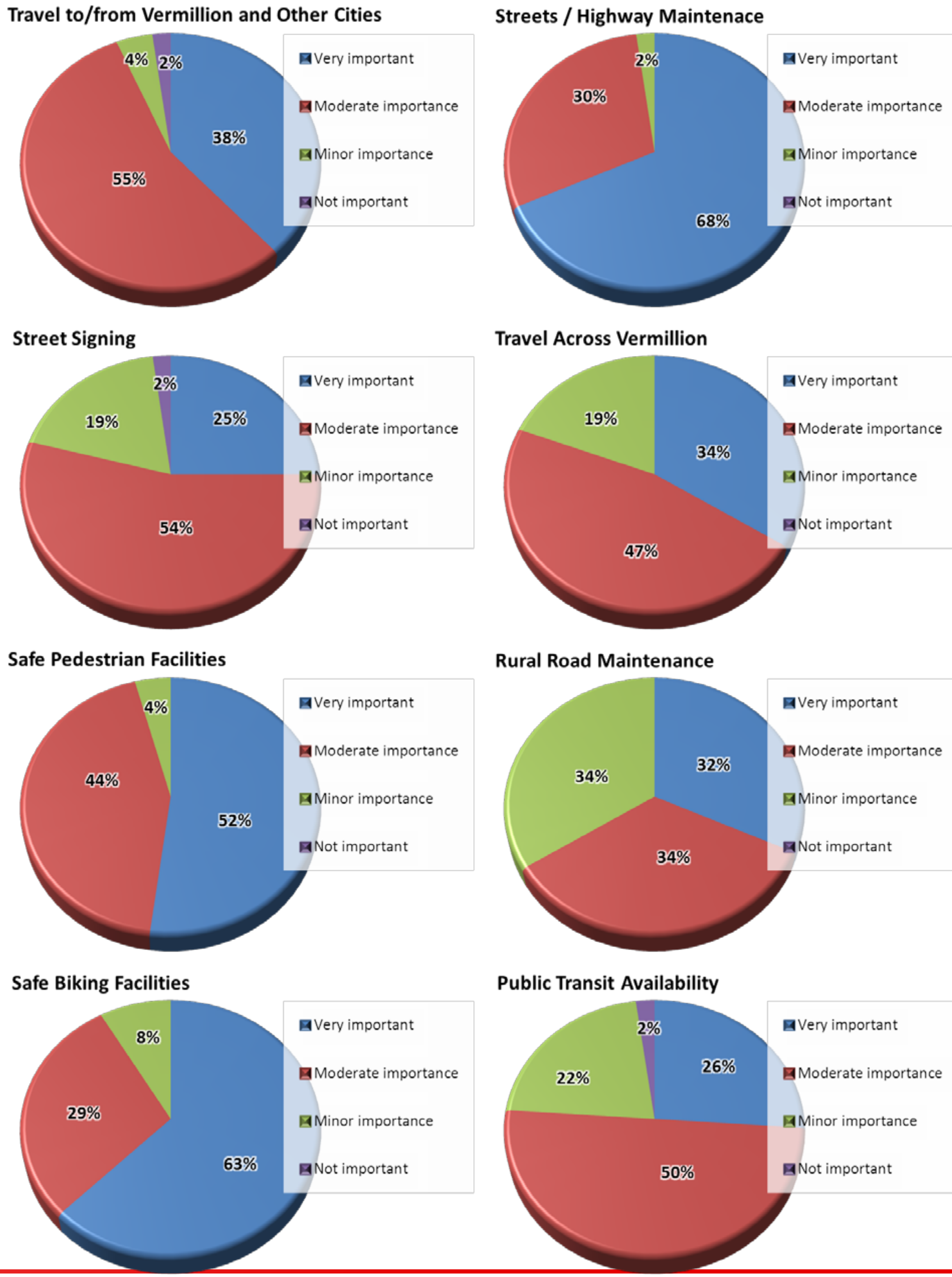

## System Satisfaction and Component Importance

Respondents were asked to rate their satisfaction with various components of the Vermillion transportation system, and to rate their opinion of the importance of various components of the system. **Figure 23** reflects respondents' satisfaction with the system components. **Figure 24** reflects respondents' opinion of the importance of the various transportation system components.

**Figure 23. Respondents' Satisfaction with Various System Components**



## Figure 24. Respondents' Opinion on the Importance of Various System Components



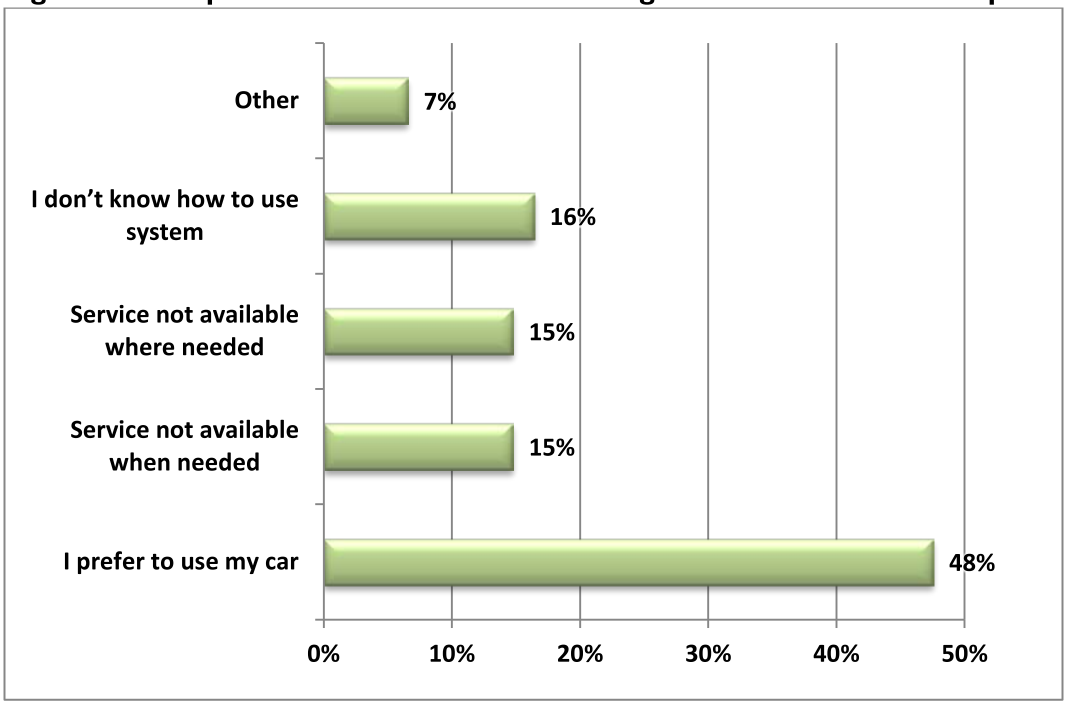
## Transit System Opinions

Respondents were asked about their usage of the transit system and reasons why they did or did not use the system. Of the 48 respondents who answered the question:

- 31 percent had used the Vermillion public transit system before.
- 69 percent had not used the Vermillion public transit system before.

For those respondents who had not used Vermillion Public Transit before, **Figure 25** illustrates the reasons provided for not using the service.

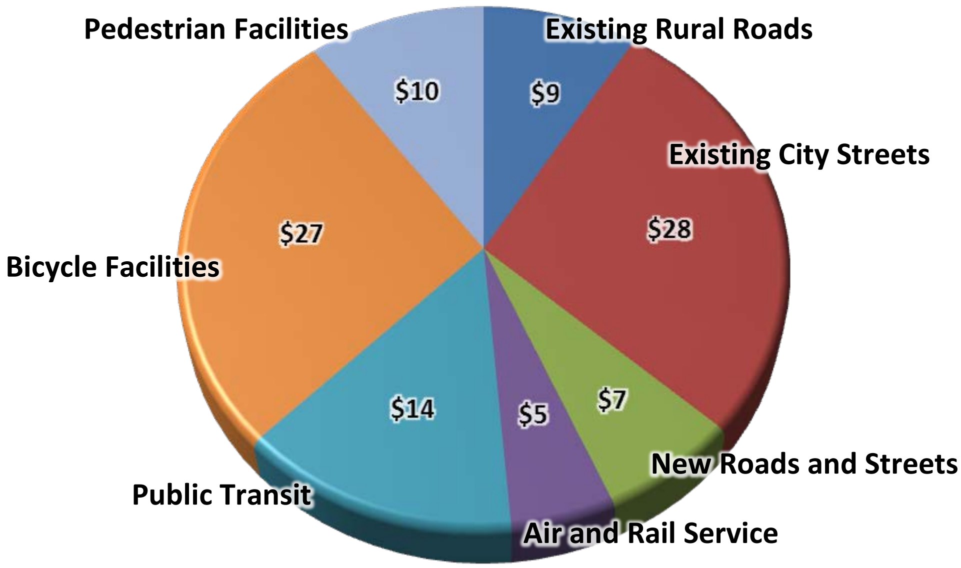
**Figure 25. Respondents' Reasons for Not Using Vermillion Public Transportation**




## Funding Priorities Opinion

Respondents were asked if they had $100 to allocate to transportation projects for the area, how they would allocate their funding to each transportation improvement type. **Figure 26** represents the average respondent's allocation of that $100 of transportation funds.

**Figure 26. Average Respondent's Allocation of $100 in Transportation Funds**



# FUTURE VERMILLION AREA DEVELOPMENT SCENARIO AND TRAFFIC

## FUTURE DEVELOPMENT SCENARIO

In an effort to anticipate the future transportation system needs of the Vermillion area, future levels of development (e.g., new housing, new shopping, new employers) and future locations of development were projected to 2032. The connection between land use / land development and demand on the transportation system is well recognized and goes both ways. Land development influences the transportation system by producing additional demands for the system. Transportation planning / transportation system investments affect accessibility levels, which influence land development patterns. Communities shape how their land develops (where development occurs, what types of development occur and the density of development) based on its transportation investment decisions. These investment decisions include where to build transportation infrastructure and the modes (roadway, transit, bicycle, and/or walking) in which it invests.

For the Transportation Plan preparation, land development plans are expressed as population, households and employment levels reflective of 2012 (base year) and the 2032 planning horizon. The Transportation Plan worked through a process with stakeholders and the study advisory team to develop a future growth scenario that was believed to represent a likely future development outcome. There are two main sub-tasks involved in developing the future growth scenario:

- The **control total** step, in which the forecasts of how much total Vermillion area growth there will be by 2032. In the control total step, the future growth scenario was initiated by projecting:
  - The amount of household change by 2032.
  - The amount of employment change by 2032.
- The land development **allocation** step, in which forecasts of the locations of the new jobs and houses will be added between today and 2032. In the allocation step, the future growth scenario was updated to reflect:
  - The location of new household growth areas.
  - The location of new jobs, divided into commercial and industrial growth areas.

The future growth scenario developed for the Transportation Plan was based on a process that:

- Used the *City of Vermillion Comprehensive Plan* (2011) as a guide. The land use growth areas identified in the Plan and the rate of population and employment growth were considered.
- Reviewed additional sources of data / projections as input to the control total forecasting. These additional data sources included:
  - Trend Extrapolation based on US Census Data, 1970 to 2010.
  - Trend Extrapolation based on South Dakota Department of Labor employment data, 1990 to 2010.

  - Woods and Poole Economics, Inc., 2011.
  - South Dakota Rural Life and Census Data Center.
- Presented the control total options to the Study Advisory team for their consideration / selection.
- Identified the amount of land required to accommodate the selected control total.
- Worked with the Study Advisory Team to identify which growth areas would be most likely to develop.
- Presented the future development scenario to the stakeholders and public for their comment / feedback.

More detail related to the development of control total development is provided in the memorandum *Vermillion Population, Household and Employment Projection Overview*, provided in **Appendix B**.

**Figure 27** shows the amount of population and employment growth forecasted for the Vermillion area through 2032. As shown in Figure 27, it is forecasted that:

- Study area population will increase by 1,800 people through 2032.
- Study area employment will increase by 2,580 jobs through 2032.

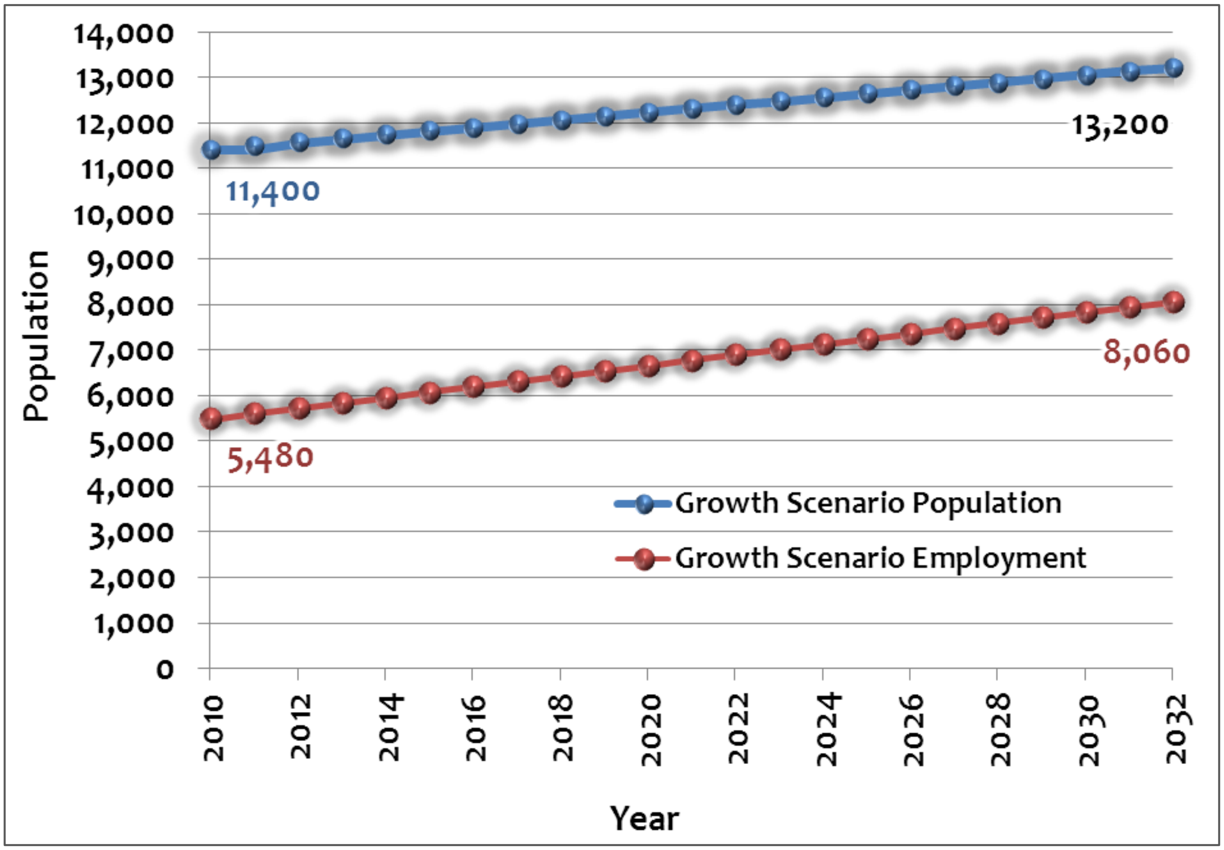
The required amount of developable land to accommodate the level of growth documented in Figure 27 was determined through evaluating development densities documented in the Comprehensive Plan, and through reviewing as-built densities of existing developments in Vermillion. Based on that review, it was determined that the required amount of land for each land use type through 2032 was:

- 100 acres of industrial land.
- 160 acres of commercial land.
- 280 acres of residential land.

Potential growth areas were identified in the *City of Vermillion Comprehensive Plan* (2011) and used as a starting point for identifying the anticipated 2012 to 2032 Transportation Plan growth areas that would make up the 2032 Vermillion Development Scenario. The potential growth areas identified in the Comprehensive Plan represented an amount of land much greater than is expected to be developed by 2032. Thus, the study team worked with the Study Advisory Team to identify and prioritize those growth areas that were believed to be most likely to develop by 2032. Growth areas were identified until the required development acres for industrial, commercial and residential land were met.

The 2032 Vermillion Development Scenario is illustrated as in **Figure 28**.

**Figure 27. Forecasted Growth in Population and Employment through 2032**



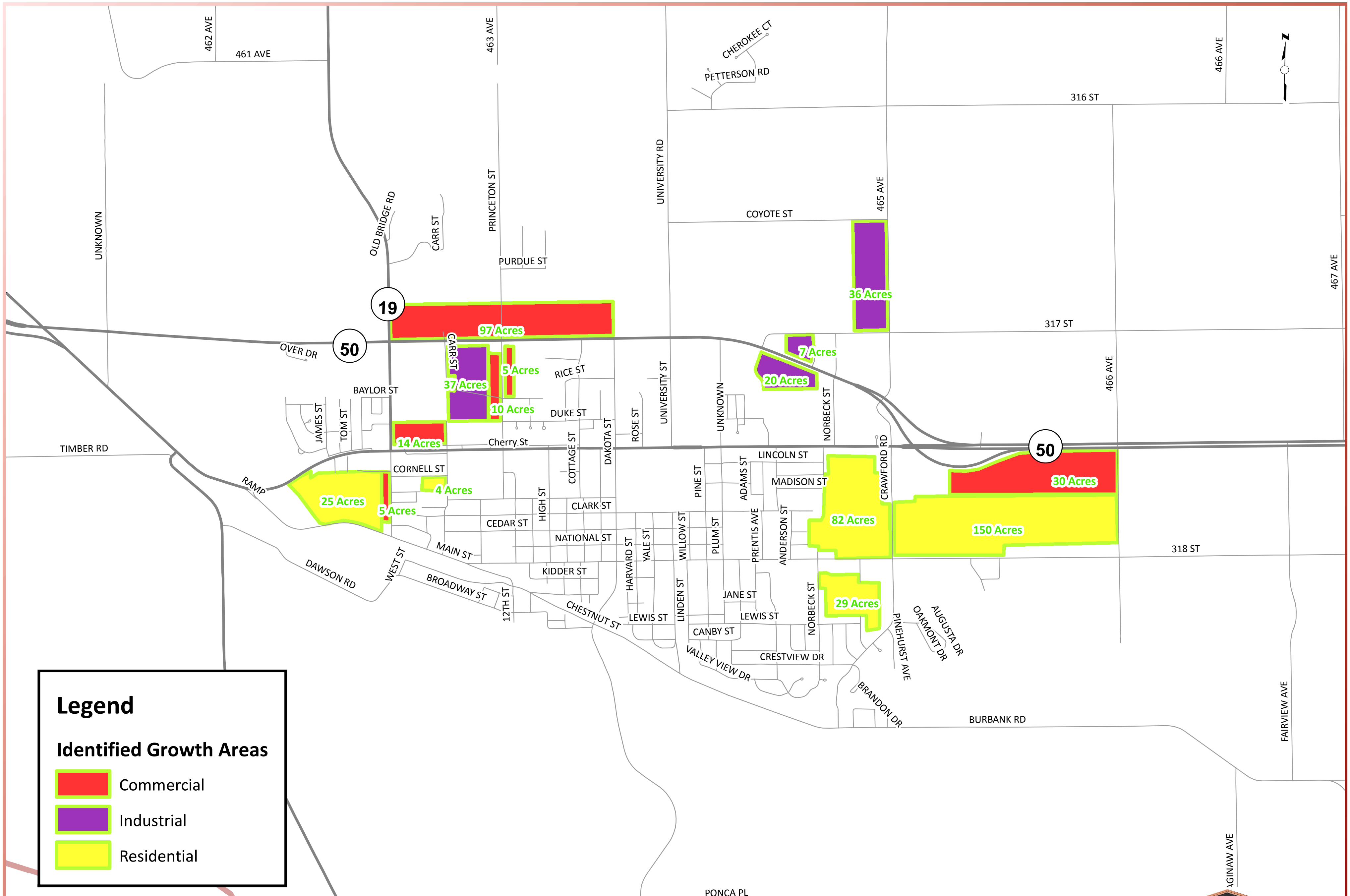



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**Figure 28. Development Scenario Future Growth Areas**

Vermillion Area Transportation Plan

# Future Travel

## Traffic Forecasts

The original proposed approach to developing traffic forecasts for the Vermillion Transportation Plan was to evaluate available historical traffic volumes and develop trend-based traffic growth rates by area type. However, the historical traffic volume data that were available (1998 to 2010) for Vermillion had some holes with missing years and some changes in counting methodology which led to uneven and sometimes declining traffic trends. Declining traffic trends are contrary to what should be expected in Vermillion, based on three factors:

- The drivers of traffic volume change, population, employment and USD enrollment grew during the period for which historical data were available:
    - The Census population data for 2000 and 2010 indicate an 8 percent growth in population for Vermillion during the 2000s.
    - Employment estimates from the state indicate a 4 percent growth in employment levels between 1998 and 2010.
    - Data from the South Dakota Board of Regents indicates enrollment at USD grew by 39 percent between 1998 and 2010.
- Over the period, Census data indicate that the mode of travel to work remained constant. Automobile trips were the mode of travel for 82 percent of all work trips in both 2000 and 2010.
- Over the same 1998 to 2010 period, vehicle miles traveled (VMT) in the United States grew by nearly 20 percent. This means that the average US community over that period saw a 1.5 percent annual traffic growth rate.

As a result of the uncertainty over the past historical trend of traffic volume change in Vermillion, the study team established a set of reasonable traffic growth factors by corridor type that represent typical traffic volume growth rates for communities with moderate growth rates. The traffic growth rates used in Vermillion were based on experience in other communities forecasted to have low-to-moderate amounts of residential and commercial growth over 20 years, and were representative of reasonable rates of growth for South Dakota based on feedback from the SDDOT. The assumed traffic growth assumptions by corridor growth type were:

- **Urban developed corridors**: assume a 0.5% per year rate of traffic growth. By 2032, this would be 12% total traffic growth over 2010 traffic levels. This rate of growth reflects a moderate level of traffic growth in mature portions of a growing community. Rural corridors not adjacent to growth areas were assumed to have the same growth rate.
- **Developing residential arterial and collector corridors**: assume a 2.5% per year rate of traffic growth. By 2032, this would be a 72% total traffic growth over 2010 traffic levels. This rate of growth reflects a typical level of traffic growth in growing suburban residential corridors.
- **Developing commercial arterial and collector corridors**: assume a 3% per year rate of traffic growth. By 2032, this would be a 92% total traffic growth over 2010 traffic levels. This rate of growth reflects a typical level of traffic growth in growing suburban commercial corridors.

- **Developing industrial arterial and collector corridors**: assume a 1.5% per year rate of traffic growth. By 2032, this would be a 39% total traffic growth over 2010 traffic levels. This rate of growth reflects a typical level of traffic growth in growing industrial corridors.
- **Development transition corridors**: for all three developing corridor types, "transition" segments of the corridor represent the interface between a *developing* corridor and a *developed* corridor. The assumed growth rate on transition segments is the average of the *developing* corridor and the *developed* corridor.

**Figure 29** shows forecasted corridor growth types in relation to the Vermillion Development Scenario.

Based on the growth rates identified in Figure 29, daily traffic forecasts for 2032 were developed. In addition to the defined growth rates by segment identified Figure 29, the forecasts have applied some smoothing of the volumes to make reasonable transitions between higher-growth links and lower growth links. Daily 2032 traffic forecasts are shown in **Figure 30**, along with current daily traffic volumes for reference.

## Future Traffic Operations

The traffic operations analysis approach was the same as the approach used for the existing conditions. Growth factors, based on the forecasted growth in daily traffic illustrated in Figure 30, were applied to the 2011 traffic volume counts to determine 2022 and 2032 peak hour traffic volumes for analysis[3]. As with the existing conditions, the future AM and PM peak hour intersection analyses were conducted using the Synchro software program. Traffic operations were analyzed at key study area intersections for forecasted 2032 traffic levels. The 2032 traffic operations results are shown in **Figure 31**, reflecting the worst peak hour of travel.

As with the existing conditions evaluation, a future traffic operations deficiency is defined as LOS D or worse. **Table 7** documents the worst peak hour of delay for existing conditions, the 2022 scenario, and the 2032 scenario, assuming no changes in intersection control treatment between today and 2032. Table 7 also documents the current intersection control for each intersection.

[3] At all of the analyzed study area intersections, 20 year traffic growth was assumed to be linear between 2012 and 2032. 2022 volume growth was half of 2032 traffic growth.

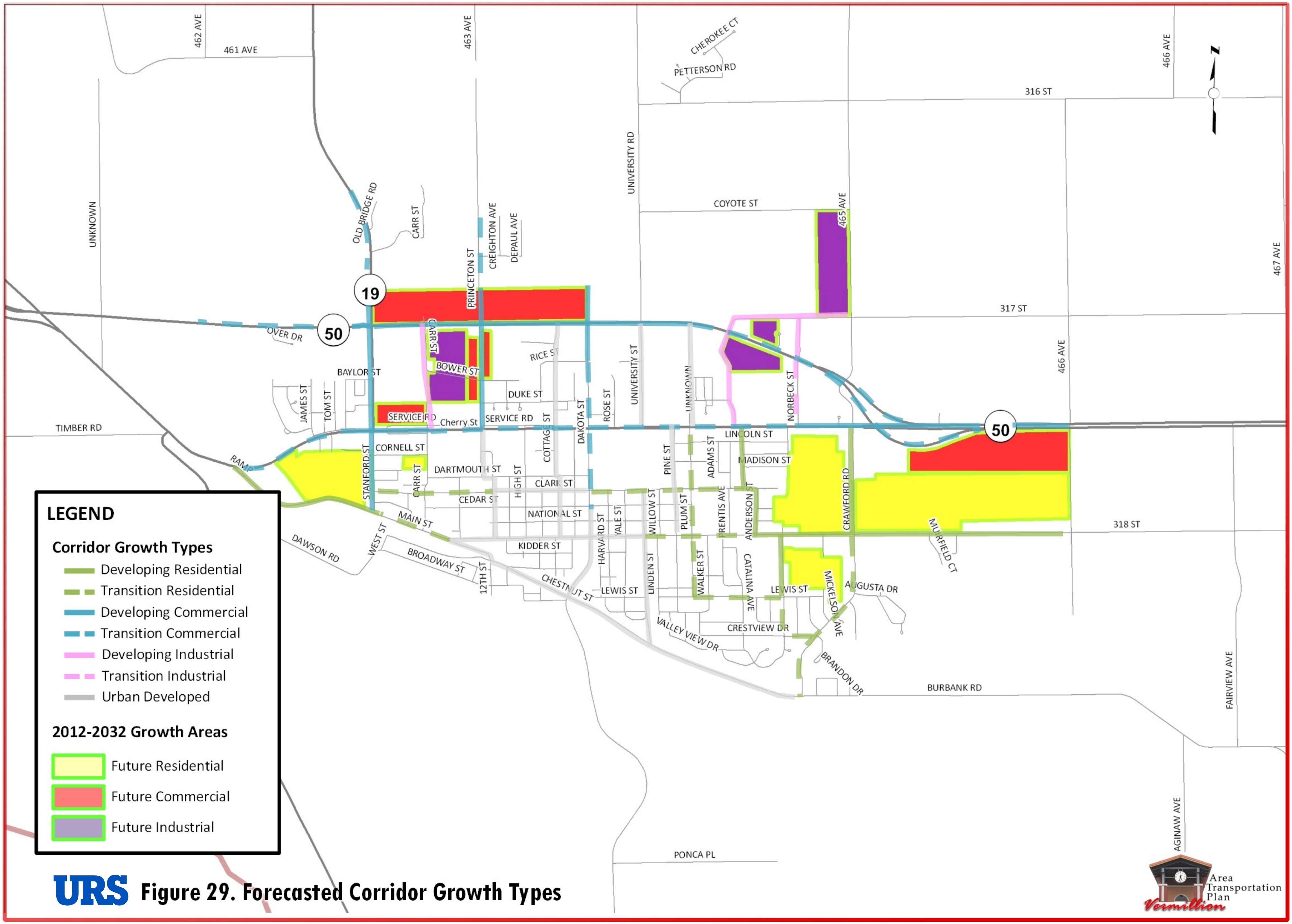


**Figure 29. Forecasted Corridor Growth Types**

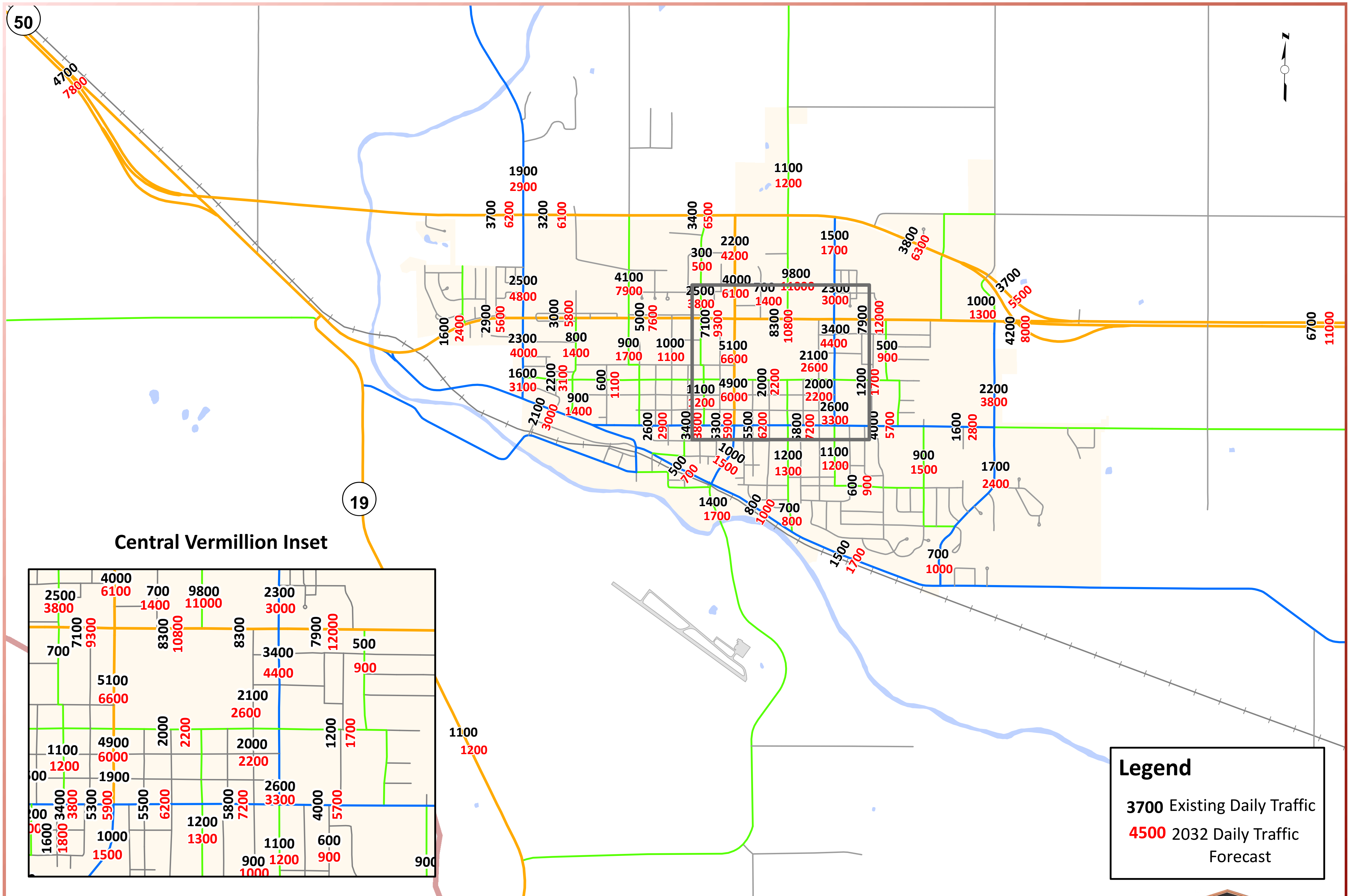


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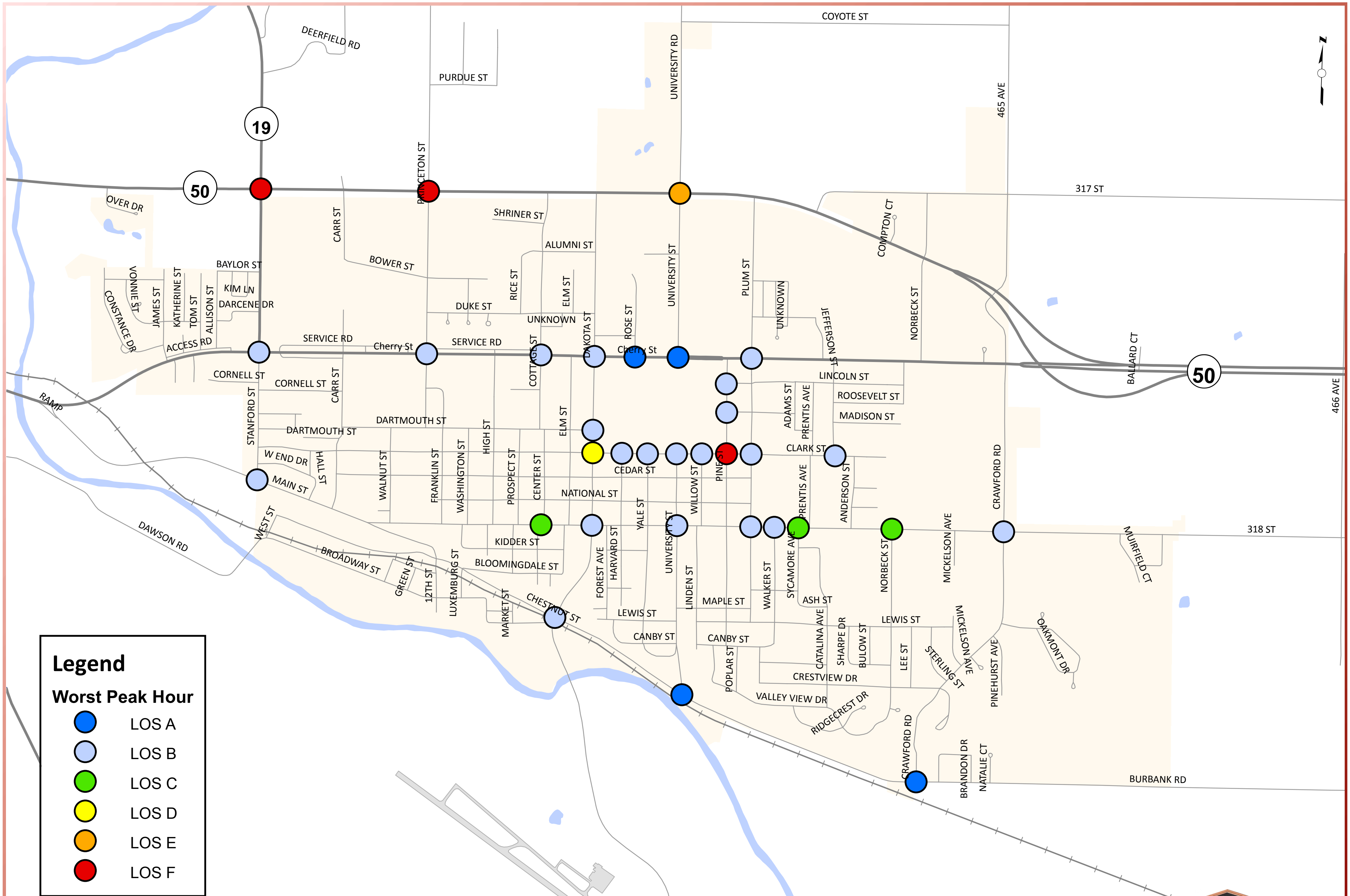
Figure 30. Future 2032 Daily Traffic Forecasts and Existing (2009-2011) Daily Traffic Volumes




## Legend

**Worst Peak Hour**

- LOS A
- LOS B
- LOS C
- LOS D
- LOS E
- LOS F

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**Figure 31. Forecasted Worst Peak Hour Traffic Operations by Intersection, 2032**

Area Transportation Plan Vermillion

**Table 7. Existing and Forecasted Levels of Service, Worst Peak Hour of Delay**

| Intersection | Worst Peak Hour LOS by Year | | |
|---|---|---|---|
| | 2011 LOS | 2022 LOS | 2032 LOS |
| SD Hwy 50 & Stanford St | C | E | F |
| SD Hwy 50 & Princeton St | C | F | F |
| SD Hwy 50 & University St | B | C | E |
| Cherry St & Stanford St | B | C | C |
| Cherry St & Princeton St | A | B | B |
| Cherry St & Cottage St | B | B | B |
| Cherry St & Dakota St | B | B | B |
| Cherry St & Rose St[2] | A | A | A |
| Cherry St & University St | A | A | A |
| Cherry St & Plum St | A | B | B |
| Chestnut St & Dakota St | A | B | B |
| Chestnut St & University St | A | A | A |
| Chestnut St & Crawford Rd | A | A | A |
| Dakota St & Dartmouth St | B | B | B |
| Pine St & Lincoln St | B | B | B |
| Pine St & Madison St | A | B | B |
| Clark St & Dakota St | B | C | D |
| Clark St & Harvard St | B | B | B |
| Clark St & Yale St | B | B | B |
| Clark St & University St | B | B | B |
| Clark St & Willow St | B | B | B |
| Clark St & Pine St | C | D | F |
| Clark St & Plum St | A | A | B |
| Clark St & Jefferson St | B | B | B |
| Main St & Stanford St | B | B | B |
| Main St & Center St | C | C | C |
| Main St & Dakota St | B | B | B |
| Main St & University St | A | A | A |
| Main St & Plum St | B | B | B |
| Main St & Walker St | B | B | B |
| Main St & Sycamore Ave | B | C | C |
| Main St & Norbeck St | B | C | C |
| Main St & Crawford St | A | B | B |

1: Stop sign controlled or traffic signal controlled. For stop signs, directions that stop are also indicated. Signalized intersections also indicate the type of signalization implemented. For signals with loop detectors, legs with loops are indicated by direction.
2: Loop detection was added in 2012.

As noted in the *Existing Transportation System* chapter, LOS is calculated and presented differently depending on the type of intersection control that is present at each intersection. At 4-way stop controlled and traffic signal controlled intersections, the delay and LOS are presented based on the average delay for all approaches. At 2-way stop controlled intersections, delay and LOS are presented based on the amount of delay for the poorest operating approach.

As shown in Figure 31 and Table 7, several intersections are forecasted to operate at LOS D or worse by 2032 without improvements (no added lanes, no changes to intersection control, etc.) Those intersections are:

- SD Hwy 50 & Stanford Street.
- SD Hwy 50 & Princeton Street.
- SD Hwy 50 & University Street.
- Clark Street & Dakota Street.
- Clark Street & Pine Street.

Note that none of the intersections forecasted to operate at LOS D or worse are currently signalized intersections; they are all 2-way or 4-way stop controlled.

# TRANSPORTATION SYSTEM ALTERNATIVES

The first several tasks in the Vermillion Area Transportation Plan were structured to identify what items the Plan should address, consistent with the vision the community had established for its Transportation System in the Goals and Objectives portion of the study. Different approaches were employed to arrive at a list of issues / deficiencies that are anticipated to arise over the next 20 years. These approaches have included:

- Collecting transportation system issues and Plan direction from the public, stakeholders and the study advisory team.
- Evaluation of current traffic operations.
- Reviewing recent crash history.
- Forecasting future traffic conditions.

This chapter describes the identified issue areas and describes the possible alternatives for addressing each issue. Many of the identified issue areas had multiple alternatives considered and assessed. For some of the issues, the alternatives presented are not necessary stand-alone alternatives. Many of the alternatives can be used in combination with each other to create a comprehensive set of concepts to address a single issue.

## ALTERNATIVES ANALYSIS APPROACH

The alternatives analysis conducted as part of the Transportation Plan incorporated both quantitative and qualitative approaches to assessing the range of potential transportation improvement concepts. While it may be desirable to develop the Plan recommendations through purely quantitative methods, there are a broad range of factors to evaluate when reviewing transportation improvements and not all of them can be measured on a consistent basis. Furthermore, there are an equally broad range of perspectives and preferences across the Vermillion community. The priorities of the community are quite diverse in terms of what individuals / groups want done (build new roadway corridors, add on-street bike routes, add more parking, etc.), and there is no truly mathematical way of balancing conflicting priorities. For these reasons, qualitative assessment based on community input was brought into the process.

The alternatives analysis process was set up so that:

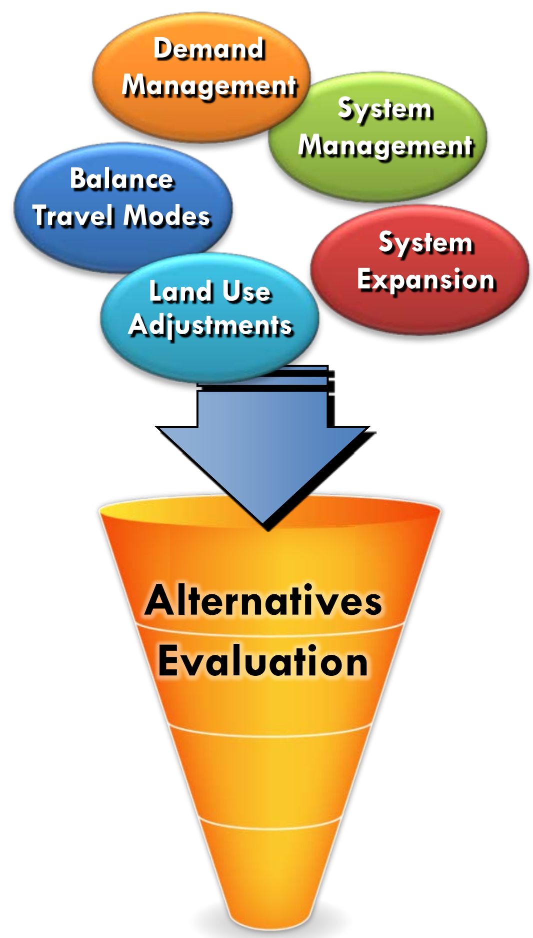
- An assessment of each issue area and a list of potential alternatives were provided to the Study Advisory Team, the public and the Stakeholders Committee for their feedback and additions.
- Based on that feedback, some alternatives were carried forward for additional discussion and analysis, some alternatives were modified, new alternatives were added and some alternatives were discarded from further consideration.
- The remaining alternatives were discussed with Study Advisory Team members in a workshop on May 29, 2012, and the recommended list of Plan improvements was selected.

The alternatives were evaluated based on the goals, objectives and evaluation criteria established earlier in the study. Within that framework, each alternative is evaluated from the "SEE" approach. Through the SEE methodology, all potential transportation alternatives are assessed from the three following "perspectives":

- **S**ocial: What are the impacts to adjacent land uses (residents and businesses) and cultural impacts? Can the community support the alternatives? What are the economic impacts?
- **E**ngineering: Does the alternative provide the desired capacity and / or safety benefits? Does it fit with local or state design guidelines?
- **E**nvironmental: What are the impacts to the natural environment? How does the alternative affect fuel consumption, air quality or traffic noise?

The SEE methodology ties into the Vermillion area's vision for its transportation system, which is to provide a system that:

- Supports mobility and economic development.
- Provides for an efficient transportation service, measured in terms of modal capacity, speed, convenience and safety.
- Provides for interconnectivity and use of all travel modes.
- Balances transportation service with the neighborhood and environmental impacts associated with construction.
- Fits with local land use policies.
- Reflects the values of the community.
- Has the support of the community.
- Is financially feasible.




The outline below provides an illustration of how the study team went through the alternatives evaluation approach that includes:

- **What is the issue?**
    - *What are the potential types of solutions?*

Listed below is a summary of potential solutions to observed issue types.

- **Issue Type: Intersection Capacity / Safety**.
    - *System Management Solutions:*
        - Add turn-lanes at intersection.
        - Change the current intersection control, such as replace a stop sign with a signal, change signal timing, etc.
        - Provide advanced warning for safety.

- Remove problem driveways, access points or streets.
  - *Expansion Solutions*:
    - Add more through lanes to streets.
    - Add new streets to share load.
  - *Demand Management Solutions:*
    - Encourage carpooling / ridesharing.
    - Work with employers to adjust shift change times to avoid peak hour of travel.
  - *Balance Travel Modes Solutions:*
    - Increase transit service in area.
    - Increase share using bikes or walking.
  - *Land Use Adjustment Solutions*:
    - Reduce intensity of land uses to reduce trip generation.
    - Shift development to areas with more capacity to handle growth.

- **Issue Type: Limited Bicycle / Pedestrian Access**
  - *System Management Solutions*:
    - Restripe existing roadway and add signage to provide bike lanes.
    - Remove on-street parking to provide area for bikes.
    - Add pedestrian amenities to corridor (improved crossings, intersection bump-outs, street furniture, etc.).
  - *Expansion Solutions*:
    - Widen roadway to allow for on-street bike lanes.
    - Build new off-street trails.

- **Issue Type: Pedestrian – Vehicle Conflicts**
  - *System Management Solutions*:
    - Adjust signal timing to limit vehicle-pedestrian conflicts.
    - Provide additional signing to reduce conflicts.
  - *Expansion Solutions*:
    - Add sidewalks/trails.
    - Provide grade-separated pedestrian crossing to eliminate conflicts.
    - Build more sidewalks in corridor to reduce conflicts.
  - *Demand Management Solutions:*
    - Encourage carpooling / ridesharing to reduce vehicular demand that plays a part in conflicts.
  - *Land Use Adjustment Solutions*:
    - Promote mixed use development for locations not divided by major roadways, which results in less demand by pedestrians to cross major streets.

## Identified Issue Areas for Alternatives Analysis

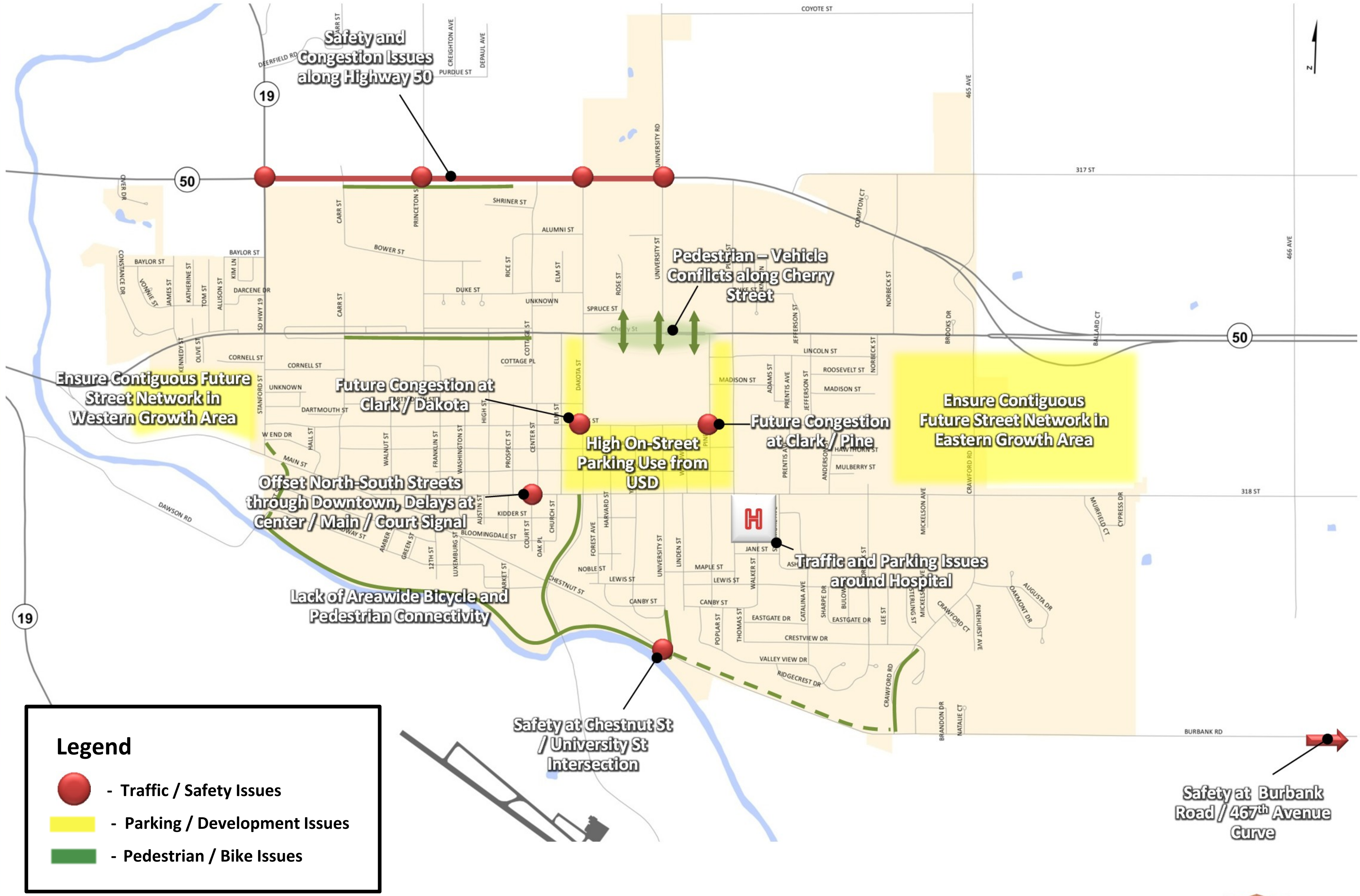
The following sub-sections provide a discussion of the issue areas identified for the alternatives analysis. The issue areas for which alternatives were reviewed are illustrated in **Figure 32**.

### Future Congestion / Safety along SD 50 between University Street and Stanford Street

SD 50 at University Street

**Issue:** These intersections are currently two-way stop controlled for northbound and southbound traffic. Highway 50 is a 5-lane roadway, with two-through lanes in each direction and a center turn lane, classified as a Principal Arterial on the state highway system. Highway 50 provides a link between I-29 and southeast South Dakota communities including Yankton, Wagner, Tyndall and Vermillion. Any alternatives developed to address cross-street access and safety need to recognize that through traffic in the Highway 50 corridor is important to regional mobility. Specific issue items in this corridor include:

- Current delays for stop-controlled cross-street traffic, during the peak hour have increased to level of service (LOS) "C" at Princeton and Stanford Streets. Stanford Street is also a state highway, designated South Dakota Highway 19 (SD 19). By 2032, the stop-controlled side-street approaches at both of these intersections are forecasted to operate at LOS "F".
- The 2008-2010 crash history indicates that the Stanford / SD 50 intersection is one of the most frequent crash intersections in Vermillion. This corridor is adjacent to a future Commercial growth area, and is forecasted to experience significant traffic increases by 2032. Without changes to current intersection control, the northbound and southbound Stanford/SD 19 and Princeton intersections will operate at LOS "F" and safety issues will likely persist.
- The intersection of University Street / SD 50 is forecasted to operate at LOS "E" by 2032 for the stop controlled traffic on University St.
- The current pavement width in the corridor ranges between 55 feet and 65 feet. In several locations the left-turn lanes on Highway 50 are relatively narrow at only seven or eight feet wide. In the public meetings, the lack of a buffer for left-turning traffic provided by the relatively narrow turn lanes was cited as a safety concern.




URS **Figure 32. Identified Issue Areas with Alternatives**

Vermillion Area Transportation Plan

- A traffic signal may be warranted at Dakota Street / SD 50 by 2032 as commercial land north of the highway develops. In the workshop with the study advisory team, the commercial land north of Highway 50 was viewed as the second tier of land to develop after infill commercial land adjacent to Princeton Street, Cherry Street and Stanford Streets had been developed. Based on feedback received during Plan development, the commercial land north of Highway 50 is most likely to develop around the middle of the planning horizon, near 2022.

## On-Street Parking Conflicts between University of South Dakota (USD) and Neighborhood Residents near South Campus

**Issue:** When USD classes are in session, on-street parking in the residential neighborhood adjacent to south Campus increases from use by students, faculty and staff. The USD campus south of Cherry Street has approximately 1,100 permit parking spots. When class is in session, most of the USD lots south of Cherry Street are at "effective capacity" – 90 percent or higher utilized. Based on field data collection and study team analysis, it is estimated that 350 USD students and staff park on the streets in the neighborhoods adjacent to south Campus at peak times when classes are in session. During peak periods, on-street parking for most of the blocks within two to three blocks of south campus is 90 percent or higher utilized. This limits the ability of residents in the neighborhood to use on-street parking in front of their homes when class is in session.

On-Street Parking South of USD

This conflict arises from two different elements: parking cost / availability on the USD campus and the proximity of free on-street parking in the neighborhood near campus. Only through managing both on-campus and off-campus parking supply can a reasonable alternative likely be developed for this issue.

## Travel Delays and Safety at Main Street / Center Street / Court Street Offset Intersection

The offset intersection of Main Street / Center Street / Court Street has a traffic signal that operates in three-phases: the first phase is a green light for eastbound and westbound traffic on Main Street, the second phase is a green light for northbound traffic on Court Street and the third phase is a green light for southbound traffic on Center Street. Each signal phase has a minimum green time that accommodates pedestrian crossing time and oftentimes the minimum green time for pedestrian is longer than required to serve vehicles on an intersection approach. With three-phase signal operations, motorists experience more stop time at red lights than they typically would with a two-phase signal. As a result, stop delay for

Center St – Main St – Court St

vehicles at the intersection is higher than at other Vermillion signalized intersections.

Current and forecasted future traffic operations are for LOS "C" at this intersection. As noted in the "Existing Conditions" chapter, this intersection had one of the higher crash frequencies in the Vermillion area, with eight (8) crashes between 2008 and 2010, the majority of which did not involve injuries. Traffic operations are forecasted to remain at LOS "C" through 2032. Through the public involvement process, the community has expressed a desire for the Plan to investigate options to reduce the delays at this intersection.

## Pedestrian - Auto Conflicts along Cherry Street (SD 50 L) at USD Campus

**Issue:** Cherry Street/South Dakota Highway 50 Loop is an arterial street that bisects the USD campus. Many of the University uses north of Cherry Street are residence halls and recreation / sports buildings while uses south of Cherry are academic, administrative and food service buildings. This creates significant demand for pedestrian crossings of Cherry Street, which also carries a significant amount of vehicular traffic (8,300 vehicles per day). At USD, there are three significant pedestrian crossing locations that each have 100 or more pedestrian crossings per hour when classes are in session:


*Pedestrians at Cherry Street*

- Rose Court.
- University Street.
- Pedestrian Crossing south of North Complex residence halls.

During the peak hour of pedestrian activity there are approximately 650 crossings of Cherry Street at the USD campus during the peak hour. Nearly 65 percent of these crossings are concentrated in the 15 minutes prior to the scheduled start of a class period. The analyses completed during the Plan do not indicate deficient pedestrian or vehicle traffic operations in the corridor, nor is there a documented pedestrian crash history in the corridor. There is a desire for the Transportation Plan to address ways to better accommodate both pedestrians and vehicles in this corridor.

## Lack of Area-Wide Bicycle and Pedestrian Connectivity

**Issue:** Vermillion currently has the key components in place to provide a robust bicycle and pedestrian system: a relatively complete sidewalk system within established parts of urban Vermillion and existing trails along portions of Highway 50, Cherry Street and the Vermillion River south of town. However, there are significant gaps to making this an area-wide contiguous system, particularly for bicycle travel. There is a well-developed grid street system with relatively low traffic volumes that would provide a

*Bicycle Warning Sign on Stanford Street* good on-street bike system. These bikeable streets and walkable neighborhoods provide significant non-motorized opportunities for Vermillion, and the preliminary alternatives provided for non-motorized travel take advantage of these characteristics.

## Hospital Parking / Circulation / Conflicts with High School Traffic

**Issue:** Members of the public identified periods of congestion adjacent to the Hospital as an issue. Hospital circulation / parking operations mixing with traffic from the High School were the general issues identified at this location. Much of this issue is focused on the Plum Street – Main Street intersection, which is currently a 4-way stop controlled intersection. This intersection is currently estimated to operate at LOS "B" during the peak hour. In the future, delays are expected to increase slightly but remain at LOS "B" through 2032. In discussions with Hospital staff, they indicated that their afternoon shift change is typically a gradual change, where up to 75 employees leave intermittently between 2:00 and 3:00 PM. This does not overlap with Vermillion High School's dismissal, which occurs between 3:23 and 3:29 PM on weekdays. Hospital staff indicated that there were no defined plans for future expansion of facilities or operations at the hospital.

In our observations of hospital parking, we noted that the parking lots and on-street parking along Plum Street adjacent to the main entrance were highly utilized (near capacity). Parking along Main Street on north side of Hospital was also highly utilized by both employees and visitors. Lots along Walker Street and Jane Street had many available parking spots. Additionally, on-street parking along Walker Street east of Hospital was little utilized. Several handicapped spots near entrance were available during our observations. In summary, parking near the main hospital entrance was highly utilized, but parking within a block of the main entrance was available.

*Sanford Vermillion Hospital from Main Street*

## Ensure Contiguous Networks in Future Eastern and Western Growth Areas

**Issue:** There are several locations in Vermillion where offset intersections and discontinuous streets have historically been built. It was stressed by members of the public that the Plan should identify corridors for future growth areas to ensure that an orderly, contiguous travel network is provided into the future.

In the residential growth areas identified as part of the Vermillion Development Scenario, it will be important to provide a contiguous collector road system that extends existing collector roadways into growth areas when practical. Examples of existing roadways that could extend as collectors into future growth areas include Clark Street on the east and west sides and Norbeck Street on the east side. Extending the existing Vermillion grid system will enhance system connectivity, which shortens travel distances, increases route options and balances travel across the network.


***Illustration of Street Grid Patterns / Continuities and Discontinuities in Eastern Vermillion***

## Future Congestion at Clark Street / Dakota Street

**Issue:** The Clark Street / Dakota Street intersection is currently a 4-way stop controlled intersection with left-turn lanes and shared through / right-turn lanes on the northbound and southbound approaches. Based on the forecasted traffic growth at the intersection, it is projected to operate at LOS "D" in the PM peak by 2032.

## Future Congestion at Clark Street / Pine Street

**Issue:** The Clark Street / Pine Street intersection is currently a 4-way stop controlled intersection with single-lane approaches. The intersection is directly adjacent to the USD campus and is highly influenced by travel demand and parking demand oriented to / from campus. Based on the forecasted traffic growth at the intersection, it is projected to operate at LOS "F" in the PM peak by 2032.

## Safety at Burbank Road Curve east of the 467th Avenue / Railroad Crossing

**Issue:** This short segment of Burbank Road has a curve where the roadway changes from a southeast-to-northwest orientation to a north-south orientation at the BNSF railroad crossing. The crash database for 2008 to 2010 included three crashes near here that were single-vehicle rollover crashes with dry pavement conditions.

***Burbank Rd Curve East of 467th Ave***

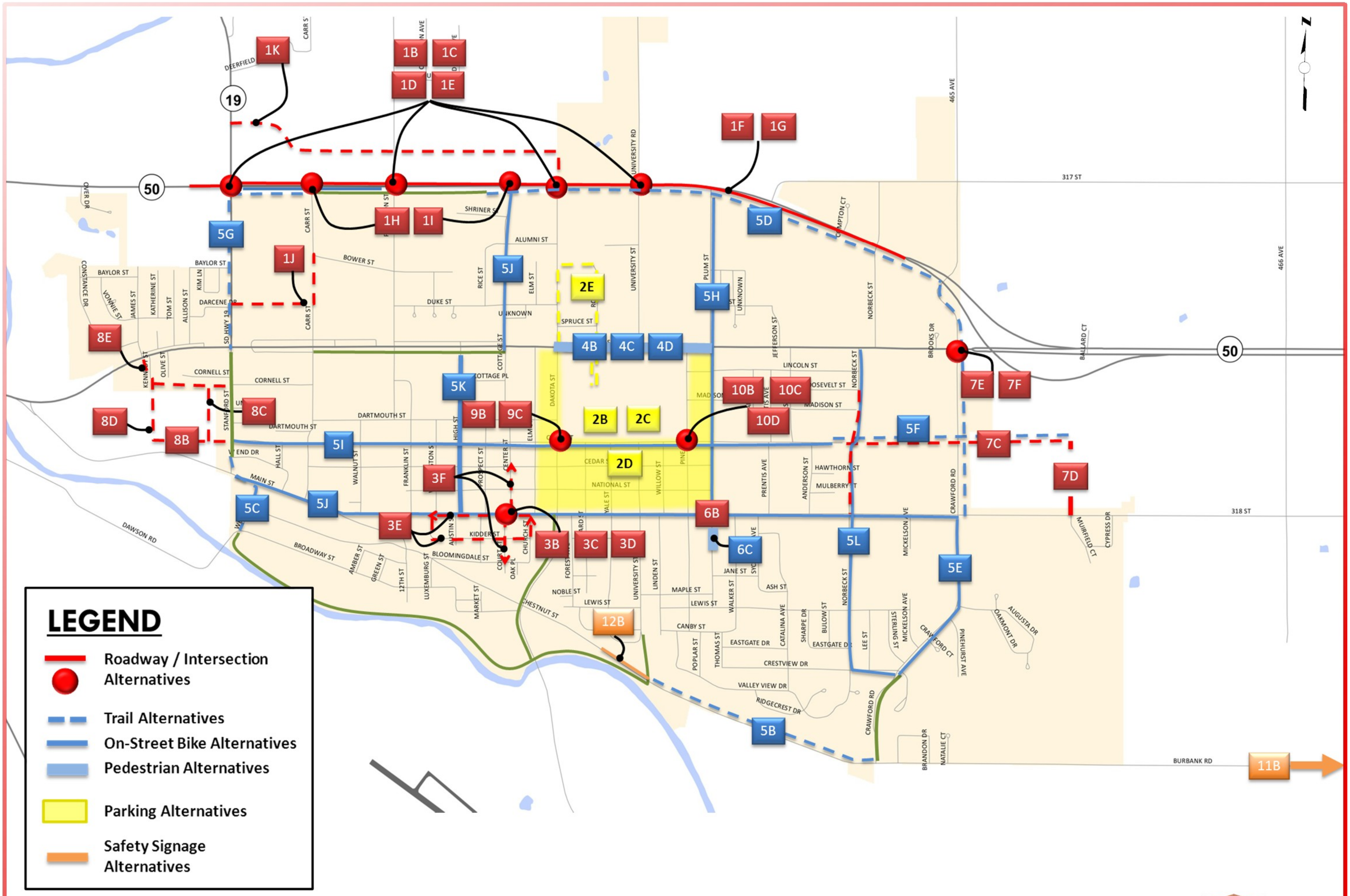
## Safety along Chestnut Road at Burbank Road / University Intersection

**Issue:** City staff have reported two speed-related crashes have occurred for eastbound vehicles traveling eastbound on Chestnut Road since the start of 2011. Chestnut Road forms a T-intersection with Burbank Road / University Street that is stop-controlled for eastbound Chestnut Road. The vehicles that crashed were traveling at a high rate of speed through the intersection and crashed into the residential property east of the intersection.


To address this issue, the City has recently added more speed limit signs on Chestnut Road, added red flags to the Stop Ahead signs and added reflective tape to the intersection approaches. These are relatively recent additions, and it is not certain what effect these improvements might have had on safety at the intersection.

## Alternatives Considered

Alternatives were developed for each of the identified issue areas documented above. Those alternatives are documented in the **Appendix C table** and illustrated in **Figure 33**. The Appendix C Table provides an overview of each alternative considered from the SEE perspective, providing the social, engineering and environmental pros and cons of each. The Appendix C table also provides a planning level cost estimates of the alternatives that were considered. The cost estimates are based on simple unit-cost calculations from other projects around the region, based on input from SDDOT. The costs do not include any contingency costs.




URS Figure 33. Transportation System Improvements Included in the Alternatives Analysis

Area Transportation Plan Vermillion

# TRANSPORTATION SYSTEM FUNDING EVALUATION

The approach used in preparing the financial plan is consistent with the FHWA urban policy of providing cost estimates in the anticipated year of expenditure and a revenue structure that provides a reasonable assurance that there will be sufficient financial resources available to complete the project as planned.

Two key guiding principles of the financial plan are:

- Costs of future transportation projects are described in terms of year of expenditure dollars, which take into account a reasonable rate of inflation between the current year (2012) and the period in which the concept is expected to be implemented.
- Funding estimates based on historic allocations in the Vermillion area from federal and state programs less funds from discretionary funding programs (earmarks).

**_TITLE 23 USC_ SECTION 134 – METROPOLITAN TRANSPORTATION PLANNING**

A transportation plan under this section shall be in a form that the Secretary determines to be appropriate and shall contain, at a minimum, the following:
…indicates resources from public and private sources that are reasonably expected to be made available to carry out the plan, and recommends any additional financing strategies for needed projects and programs.

Observations from other urban areas provide the following assumptions for the Vermillion area:

- **Project Cost Inflation**: FHWA, up until approximately 2009, compiled and published transportation project construction cost indices. That practice, however, has been suspended. Based on data and guidance provided by SDDOT, it is assumed that project cost inflation will be two (2) percent per year through 2032.
- **Funding Escalation**: Historically, past transportation legislation (including SAFETEA-LU) provided for the assumption that transportation funding levels to states and localities increase over time. The recently passed MAP-21 legislation does not have increased funding levels; in fact, the state of South Dakota is expecting some decrease in funding under the new bill. To address the short-term and long-term uncertainties over funding levels, the plan will assume that funding levels will be steady between 2012 and 2032 (no increase in annual funding).

A key result of these assumptions is that the local and state burden for funding transportation improvements increases or the cumulative buying power of an urban area decreases each year as inflation is outpacing increases in federal funding.

## ROADWAY FUNDING

Cumulative funding from local, state and federal sources available for projects included in the Transportation Plan were developed through the following steps:

1. Identify from the Vermillion Capital Improvement Plan the amount of local funding that on average is allocated to expansion and rehabilitation projects consistent with those included in the Transportation Plan.

2. Identify from the State Transportation Improvement Program the annual federal and state funds allocated to the Vermillion area.
3. Separate the state and federal funds into the categories of existing infrastructure maintenance and system expansion/major rehabilitation. The Transportation Plan actively addressed individual system expansion and major rehabilitation projects, while addressing maintenance in a lump sum. In this step the lump sum (percentage of the total allocation) typically directed to maintenance is removed from availability for projects included in the recommended improvement list of the Transportation Plan.

The city provided an estimate of the annual funding level for transportation expansion and major rehabilitation projects. The estimate of $250,000 per year is based on a review of expenditures for the last five to 10 years.

Over the last 22 years (1990 through 2012) over $35 million in state and federal funds have been allocated to projects in the Vermillion area. Included in the state and federal funding projects was replacement of the SD 50 bridges on the east side of town. The $15.2 million (funded in 2000) for the bridge project was removed from the analysis because there are few other locations in town where the bridge replacement program funds can be used.

**Table 8** displays the distribution of remaining funding allocations into the categories of transportation enhancements, system maintenance and expansion projects. Only the transportation enhancements and expansion funds are actively considered in the funding analysis. For the Vermillion area the resulting assumption is that approximately $473,000 will be available for Transportation Plan covered projects.

**Expansion Projects**

Focused on improving traffic flow or safety through:

- Adding through lanes or turn lanes.
- New streets/roads.
- Upgrading to an intersection roundabout.
- New / Improved Interchanges on the interstate.

**Maintenance/Operations Projects**

Are solely focused on maintaining the current network:

- Resurfacing and reconstructing streets (no new lanes)
- Bridge replacement.
- Maintaining buses.
- Operating daily transit service
- Trail maintenance.

**Table 8. Estimated Historical Annual Roadway Funds by Use**

| | Funding By Improvement Category | | |
|---|---|---|---|
| **Expenditure** | **Transportation Enhancement** | **Maintenance** | **Expansion** |
| Over Period from 1990 - 2012 | $114,200 | $9,872,000 | $10,397,000 |
| Annual Equivalent | $5,200 | $448,700 | $472,600 |

*Sources:* City of Vermillion and South Dakota Department of Transportation

## Non-Motorized System Funding

The funding estimates for trails and other pedestrian/bicycle improvements reflect only the federal and state transportation enhancement (TE) programs. Local funds likely make up a significant portion of the expenditures for enhancement projects.

## Transit Funding

Demand-responsive transit budgets for the period from 2007 through 2011 were used as the source of information for developing the planning period funding estimate. A summary of the annual and period funding sources are displayed in **Table 9**.

**Table 9. Transit Service Annual Expenditures**

| Funding Source | Budget Year | | | | | 5-Year Average |
|---|---|---|---|---|---|---|
| | **2007** | **2008** | **2009** | **2010** | **2011** | |
| Federal[1] | $139,825 | $161,523 | $152,304 | $173,752 | $177,018 | $160,884 |
| State[2] | $23,376 | $25,181 | $23,376 | $39,037 | $23,376 | $26,869 |
| Local | $72,513 | $88,947 | $75,828 | $93,220 | $94,405 | $84,983 |
| Fares | $25,233 | $21,872 | $21,887 | $32,124 | $27,954 | $25,814 |
| Total | $260,946 | $297,523 | $273,395 | $338,134 | $322,753 | $298,550 |

*1: Federal includes Section 5311 funding and Title III-B funding.*
*2: State funding fluctuates as a small amount of discretionary money is provided when ridership grows from one year to the next.*
*Source:* Vermillion Public Transit

## Planning Period (2012 – 2032) Modal Funding Estimates

Estimates of the total funding for the planning period were developed using the average annual historical expenditure estimate. Based on the funding levels included in the recently passed MAP-21 transportation legislation, it was assumed that there would be no increase in funding through the planning period. Listed below are the estimated funds available through 2032 for projects included in the recommended improvement plan:

- Roadway Projects: $9,924,600 (represents funds from federal and state sources).
- Transit Projects and Operations: $5,971,000.
- Transportation Enhancement Projects: $109,200 (represents funds from federal and state sources).
- Intermodal Funds: $5,250,000 (represents local transportation funds that are not specifically directed to any particular mode).

## Year of Expenditure Cost Estimates

To address the uncertainties and relatively inexact science of determining the exact future year for project implementation, the approach that employed for the 2032 Transportation Plan is to place projects into one of two general time periods: short and long-range. For the purposes of the year of expenditure assessment, the mid-point year in each period is assumed as the expenditure year for the period. Mid-points of the implementation periods are:

- *Short-term*: Ranges from 2012 to 2022, with a midpoint year of 2017 (5 years beyond 2012).
- *Long-term*: Ranges from 2023 to 2032, with a midpoint 15 years (2027) beyond 2012.

Application of the annual two percent growth in construction costs would result in the following *cost* inflation factors for projects assigned to the implementation periods:

- *Short-term*: 10.4 percent cost increase over 2012 costs.
- *Long-term*: 34.6 percent cost increase over 2012 costs.

## Year of Expenditure Impact on Modal Alternatives Costs

### Roadway Improvements

The year of expenditure funding estimates for the Vermillion area are documented in **Table 10**.

### Transit Service

The transit system costs over the planning period are documented below:

- *Capital Costs:* The current Vermillion Public Transit fleet is six (6) light duty vehicles. Five (5) of the vehicles are 18-passenger buses with an estimated six year life span. One (1) vehicle is a transit van with an estimated five year life span. Thus, over the 20 year planning period the entire fleet is predicted turnover is:
  - *Buses*: 16 vehicle replacements over the course of the next 20 years.
  - *Vans*: 4 vehicle replacements over the course of the next 20 years.

  In 2012 dollars, Vermillion Public Transit's average capital cost for vehicle replacement is estimated at $48,700 per year[4]. Over the planning horizon, total capital cost for vehicle replacement is estimated at $1,250,000 in year-of-expenditure dollars (at a 2% cost increase per year).
- *Operating Costs:* The costs for the planning period are based on similar average cost per trip as the current system. Based on the data provided in Table 9, the average annual total budget for the transit system is $298,550. With an estimated average capital cost of $48,700, it is assumed that the remaining $249,850 per year (in 2012 dollars) represent system operating costs.

  The transit system currently provides approximately 49,350 trips annually, at a current operating cost of approximately $5.06 per trip. Removing the amount of system costs collected in fares, typically $25,814 over the recent past, the current operating subsidizes (operating costs minus direct fare collection) are $4.54 per trip.

The cost estimates for the planning short- and long-term horizons are based on the same cost growth rates documented for the roadway analysis. It should be noted that the data used to develop the two percent per year cost growth projection are not based on transit operations or capital cost data, but are based on transportation construction cost data. However, it is believed that this rate of growth represents a sufficiently conservative cost growth assumption for application to the transit cost evaluation.

### Non-motorized System Improvements

Vermillion has many pieces of a strong non-motorized system in place and has opportunities to build on the existing system to create more complete bicycle and pedestrian network.
Figure 38 (in the next chapter) shows the recommended non-motorized system improvements, including new trails and new on-street bike routes. Based on the anticipated trail project phasing, it is estimated that the total costs for trails is over $1,100,000 in Year of Expenditure

[4] Vehicle replacement costs based on typical data for 2012 vehicles: $50,000 for ADA accessible 18-passenger bus and $35,000 for ADA accessible vans.

(YOE) dollars. The forecasted amount is considerably higher than the anticipated Transportation Enhancement funds, however, local transportation dollars can also be tapped for enhancement projects. Project costs in excess of the very conservative state/federal source estimate of $109,200 would need to come from the roadway expansion funding totals shown in Table 10.

**Conclusions Recommended Projects and Year of Expenditure**

Based on historical funding levels, it is reasonable to assume that the $15,284,000 in YOE project costs for expansion and rehabilitation projects could be included within the program funding capacity for the Vermillion area.

**Table 10. Projected Future Annual Roadway Funds by Use**

| Year | Transportation Enhancement | Roadway Expansion/Rehabilitation Federal/State Funds | Roadway Expansion/Rehabilitation Local Funds |
|---|---|---|---|
| 2012 | $5,200 | $472,600 | $250,000 |
| 2013 | $5,200 | $472,600 | $250,000 |
| 2014 | $5,200 | $472,600 | $250,000 |
| 2015 | $5,200 | $472,600 | $250,000 |
| 2016 | $5,200 | $472,600 | $250,000 |
| 2017 | $5,200 | $472,600 | $250,000 |
| 2018 | $5,200 | $472,600 | $250,000 |
| 2019 | $5,200 | $472,600 | $250,000 |
| 2020 | $5,200 | $472,600 | $250,000 |
| 2021 | $5,200 | $472,600 | $250,000 |
| 2022 | $5,200 | $472,600 | $250,000 |
| Short-Term Period Funding Availability | $57,200 | $5,198,600 | $2,750,000 |
| 2023 | $5,200 | $472,600 | $250,000 |
| 2024 | $5,200 | $472,600 | $250,000 |
| 2025 | $5,200 | $472,600 | $250,000 |
| 2026 | $5,200 | $472,600 | $250,000 |
| 2027 | $5,200 | $472,600 | $250,000 |
| 2028 | $5,200 | $472,600 | $250,000 |
| 2029 | $5,200 | $472,600 | $250,000 |
| 2030 | $5,200 | $472,600 | $250,000 |
| 2031 | $5,200 | $472,600 | $250,000 |
| 2032 | $5,200 | $472,600 | $250,000 |
| Long-term Period Funding Availability | $57,200 | $5,198,600 | $2,750,000 |
| TOTALS | $109,200 | $9,924,600 | $5,250,000 |

Note: Federal and state sources for maintenance projects over period - $9.42 million.

# RECOMMENDED SYSTEM PLAN

In order to be a reasonable and implementable Plan, the Vermillion Area Transportation Plan requires balancing the area's multimodal system improvement projects with the transportation funding that can reasonably be anticipated from public and private sources. The Transportation Plan has been developed to address the area's future travel needs with the expected federal, state, and local funding available through the 2032 planning period. The Plan was developed through review of numerous multimodal alternatives and evaluating their relative effectiveness in meeting the community's transportation system goals and objectives and the ability to fund the included programs and projects.

Alternate project and program lists were presented to the public, the Stakeholders and Study Advisory Committees to gauge the level of local support for plans that address varying levels of investment in the roadway, non-motorized and transit systems. Based on input received from each of the stakeholder groups and the technical analysis of the system plans, a multimodal improvement program for the region was developed. Elements of the system plan include:

- **Roadway system improvements** that address safety, congestion/serviceability, and connectivity/accessibility goals.
- **Non-motorized system investments** that plan for an expanded trail network and establish an on-street bicycle route system.
- **Transit system options** that were considered to improve mobility and parking system usage in and around the USD campus.
- A **future major street plan** that provides the blueprint for maintaining the efficient movement of people and goods while provided needed access to businesses and residences.
- **Areas for continued study** covering issues that require longer-term coordination than is associated with the Transportation Plan.

The projects included on the recommended plan lists and recommended programs represent those projects categorized as system improvement, reconstruction and expansion. Operations and maintenance of the roadway, transit and non-motorized elements of the current system are not specified as line items in any of the system improvement lists. To address the need to maintain the current system, and recognize that maintenance activities will continue to be a major part of transportation investments into the future, funding for operations and maintenance has been separated from the projects included in this section.

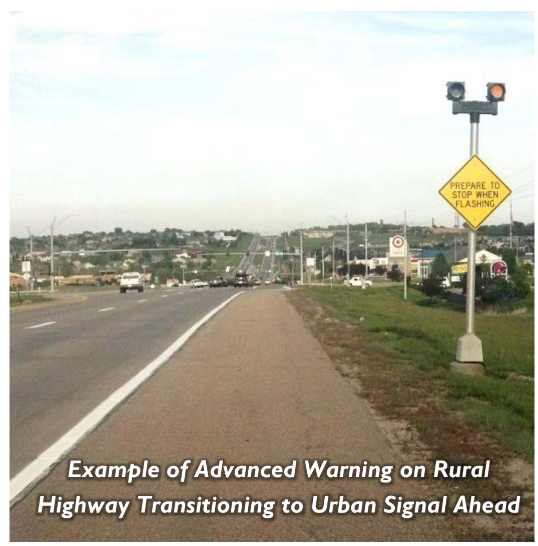
## Proposed Roadway System Plan Projects

The <u>proposed</u> plan projects are those that meet the study goals and objectives, were evaluated by the public, stakeholders and study advisory team and deemed good ideas for Vermillion, but did not necessarily fit within the anticipated 20-year regional funding capacity. The elements of the proposed street and roadway system are provided by issue area below. The elements are provided in this section based on identified need / desire from a planning perspective. The elements presented in this section are not necessarily part of the fundable plan, which is described later in the chapter.

## Proposals for Highway 50 Congestion and Safety Improvements

To address the safety and future congestion issues along South Dakota Highway 50, the following projects are proposed.

- Short Term (2012 to 2022): Three projects are included in the short-term for this issue area:
    - *Alternative 1G:* **Minor Widening of Highway 50** to provide a wide enough pavement cross-section for 12-foot wide center turn lanes while maintaining at least 12-foot wide travel lanes. Between Stanford Street (SD 19) and the Cherry Street (SD 50 Loop) ramps, this will require approximately five (5) feet of additional pavement.
    - An additional project related to the short term development of the industrial land south of Highway 50 would be *Alternative 1J:* **Extend Duke Street and Carr Street** to provide circulation to industrial / commercial area between Stanford - Princeton south of SD 50.
    - As commercial land adjacent to Highway 50 starts developing later in the short-term period, it is anticipated that portions of *Alternative 1K*: **Construct a commercial backage road north of future commercial development area** should be constructed. The remaining portions of the commercial backage road north of SD 50 will be built in the long term period.
- Long Term (2022 to 2032): As commercial land adjacent to Highway 50 starts developing, traffic demand in the corridor and on the side streets will grow in the 2022 to 2032 time period. At this point, the following projects are proposed:
    - *Alternative 1B:* **Signalize the intersections** of Stanford Street / SD 50, Princeton Street / SD 50, Dakota Street / SD 50 and University Street / SD 50 as signal warrants are met. If warrants are met and signals are installed, the SD 50 signal system should include active advanced detection / warning signs and flashing beacons. Advanced warning / flashing signage will be an important safety feature for signals in the corridor as motorists are transitioning from a rural, high-speed facility. An overview of the signal warrant evaluation is provided in the next section of this chapter. More discussion of **traffic signal warrants** is provided later in **Appendix D**.




*Example of Advanced Warning on Rural Highway Transitioning to Urban Signal Ahead*

    - *Alternative 1H:* **Eliminate SD 50 left-turns to / from Carr Street and Cottage Street**. This is a complementary project that would occur when the adjacent arterial intersections are signalized. Simple channelization and median treatments to prevent left-turns at Carr Street and Cottage Street will improve access control along SD 50, improving future safety and minimizing collector-related delays. This project will emphasize the role of SD 50 has a regional corridor that serves traffic through Vermillion, while still providing access to Vermillion's major cross-streets.

- As commercial development finishes in the Long Term, the last portions of *Alternative 1K:* **Construct a commercial backage road north of future commercial development area** will be built**.** This project would provide a collector circulation enhancements for development adjacent to SD 50 to enhance circulation in the development areas, and to support access management along SD 50 is (north of SD 50).

The combined proposals for the Highway 50 corridor are illustrated in **Figure 34**.

## Proposal for On-Street Parking Conflicts between USD and Neighborhood Residents

The **No Action** option, *Alternative 2A*, is the recommendation that the City would like to have included in the Transportation Plan. Selection of the "No Action" recommendation is not an indication that there is not an on-street parking issue in the neighborhoods adjacent to USD. The City and USD representatives on the study advisory team believed that some of the alternatives that address both on-street parking restrictions in the neighborhood and parking supply / policy on campus could be effective options to address the issues. Selection of the "No Action" option reflects that further coordination between the City and the University must be completed before any comprehensive solution can be implemented.

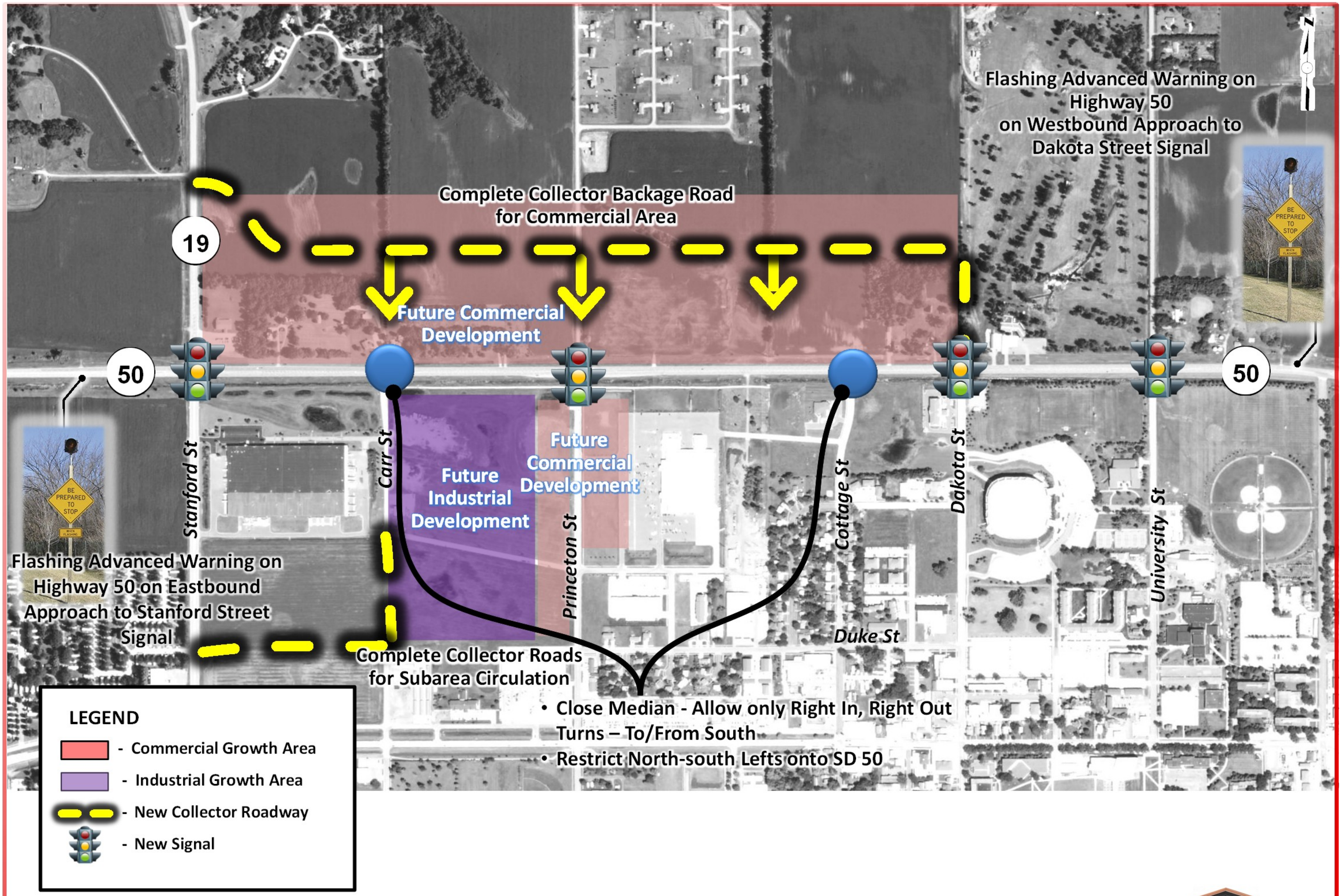
The study advisory team, including the City and University, recognize that a "one-sided" solution is not possible to address the on-street parking issues near USD:

- As a standalone policy, neighborhood parking restrictions will not provide sufficient USD-related parking in close proximity to south campus.
- Adding more on-campus permit (paid) parking south of Cherry Street, or encouraging more expanded use of on-campus permit parking north of Cherry Street, will not likely work on its own as free on-street neighborhood parking is currently available within a short walk of campus.

The most significant investment, from a cost standpoint, would need to come for the University to address the on-campus supply side of the solution. University representatives indicated that the construction of more on-campus parking south of Cherry Street is expected within the next 10 years. However, the timing and number of parking stalls cannot be confirmed at this time. Thus, the extent to which the addition of on-campus parking would address the excess demand for south campus parking is unknown at this time.

Conversely, on-street parking restrictions (whether through a parking permit program or through time-of-day parking elimination) would be a relatively low-cost, self-funded program. However, either of the two neighborhood parking programs would, to differing extents, affect the ability of a large number of neighborhood residents and their visitors to park in front of their homes. For this reason, some additional public and City Council engagement is needed prior to committing to inclusion of such programs. Therefore, the following alternatives are included as options for **continued discussions** between the City and University:

- *Alternative 2B*: Add More Off-Street Parking to South Campus.
- *Alternative 2D*: Incorporate On-Street Parking Permit System for Residents.
- *Alternative 2E*: Eliminate On-Street Parking in USD-Area Neighborhoods While Classes are in Session.




URS Figure 34. Proposed South Dakota 50 Improvements

*Alternative 2F*, **a shuttle bus between Dakota Dome parking lots and south campus** destinations, is also included as a project to continue evaluating in the future (not proposed) as development and parking on-campus evolve. The service could be provided by either Vermillion Public Transit or by the University. This project on its own will likely provide little relief to the neighborhood parking issues, and also little shuttle ridership, without some restrictions on neighborhood parking and a better idea of the long-term parking supply on south campus. Therefore, the shuttle bus concept will be maintained as an illustrative project only, with no identified funding source or implementation timeframe during the 2012 to 2032 Plan horizon.


*Parking on Clark Street During Classes*

**Proposals for Travel Delays and Safety at Main Street / Center Street / Court Street Offset Intersection**

The **No Action** option, *Alternative 3A*, is the recommendation for inclusion in the Transportation Plan. Converting the intersection to 2-way stop or 4-way stop would improve the travel delays experienced at the intersection, but these intersection control changes would likely negatively affect safety at the intersection. The City has indicated that additional study at a later date is desired for the following alternatives:

- *Alternative 3B*: **Remove traffic signal and add median along Main Street to eliminate left-turns on all approaches**.
- *Alternative 3E*: **Convert Main Street to one-way operation through downtown, pair with Kidder St**.
- *Alternative 3F*: **Convert Court Street and Center Street to one-ways oriented away from Main Street**.

## Proposal for Pedestrian - Auto Conflicts along Cherry Street at USD Campus

The **No Action** option, *Alternative 4A*, is the recommendation for inclusion in the Transportation Plan. Traffic and pedestrian operations in the corridor are forecasted to operate at acceptable levels through the planning horizon, and there is no information to indicate a pedestrian safety issue in the corridor.

## Proposal for Hospital Parking / Circulation / Conflicts with High School Traffic

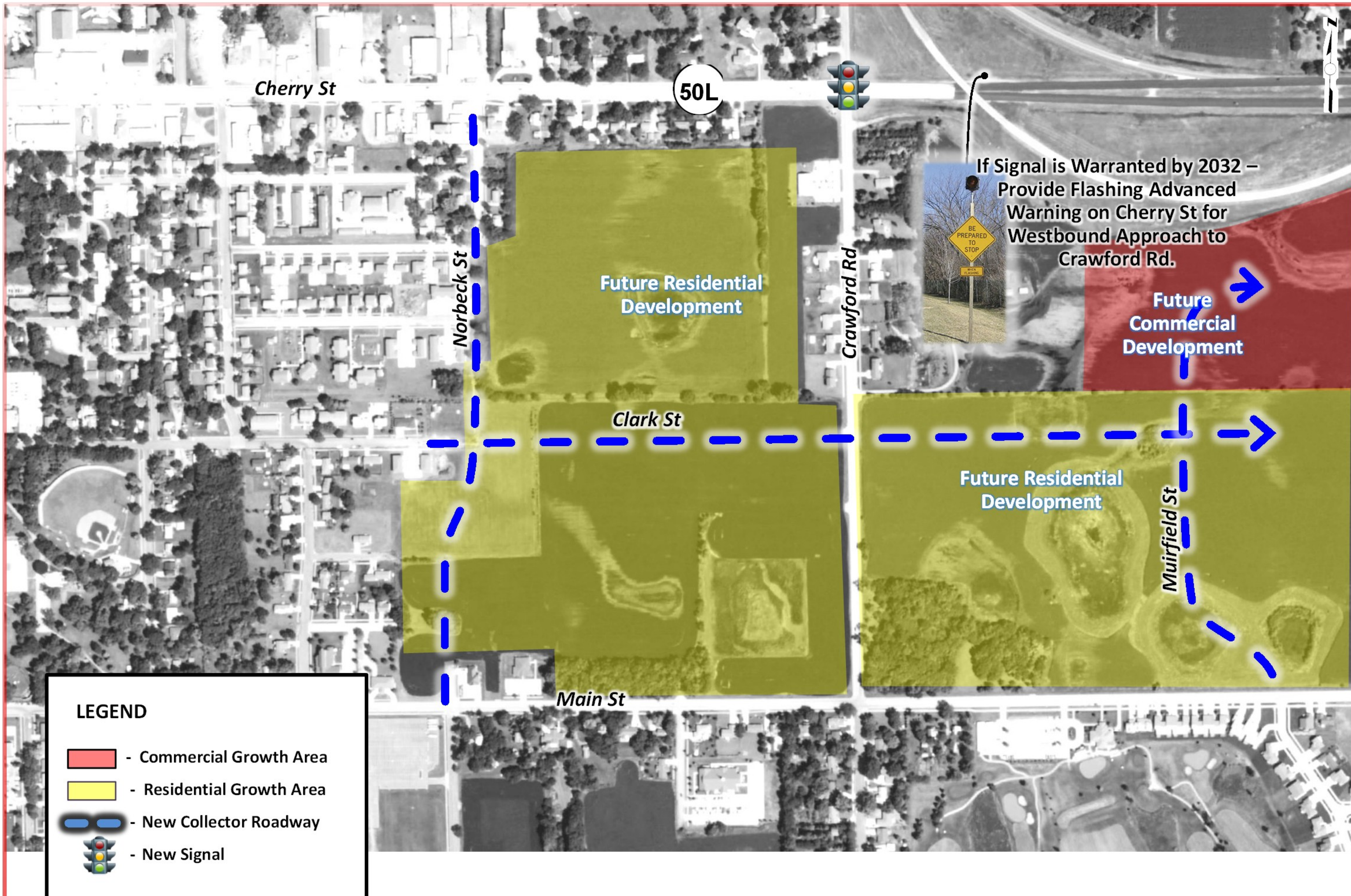
The **No Action** option, *Alternative 6A*, is the recommendation for inclusion in the Transportation Plan. The traffic analysis, parking observations and interviews with Hospital staff did not provide a clear cut deficiency to be addressed.

## Proposals for Contiguous Street Networks in Eastern Growth Area

To address the desire for contiguous street network development in the Eastern Growth Area, the following projects are proposed:

- Short term (2012 to 2022): The residential growth area west of Crawford is anticipated to be the first residential area to develop, so collector roads to support development are proposed for the 2012 to 2022 period. The following projects are included in the short term project list:
    - *Alternative 7B*: **Build Norbeck Street as a continuous corridor from Main Street to Cherry Street**. This will provide a north-south collector through the future neighborhood, and connects to existing Norbeck Street north of Cherry and south of Main.
    - *Alternative 7C (west)*: **Extend Clark Street from its current terminus at approximately Anderson Street to Crawford Road**. This roadway will provide an east-west collector through the future neighborhood, and connects to the existing Clark street west of the neighborhood.
- Long term (2022 to 2032): The residential growth area east of Crawford is anticipated to develop later in the planning horizon, so collector roads to support development are proposed for after 2022. The following projects are included in the long term proposal list:
    - *Alternative 7C (east)*: **Extend Clark Street east of Crawford Road into the future residential area**. This roadway will continue the east-west collector connecting to the existing and short-term (2012 to 2022) improvements to Clark Street.
    - *Alternative 7D*: **Create North-South Collector to connect with Main Street / Muirfield Court intersection**. This intersection will provide north-south collector access to Main Street.
    - *Alternative 7E*: **Install traffic signal at the Crawford Road - Cherry Street intersection** by 2032. The planning-level analysis indicates that the intersection will require a traffic signal, but a signal warrant analysis will need to be conducted and met before it can be installed.

The proposed improvements for the Eastern Growth Area are shown in **Figure 35**.




URS **Figure 35. Proposed Eastern Growth Area Improvements**

Area Transportation Plan Vermillion

## Proposals for Contiguous Street Networks in Western Growth Area

The Western Growth Area is projected to develop between 2022 and 2032. To address the desire for contiguous street network development in the Western Growth Area, the following projects are proposed for the Long Term (2022-2032):

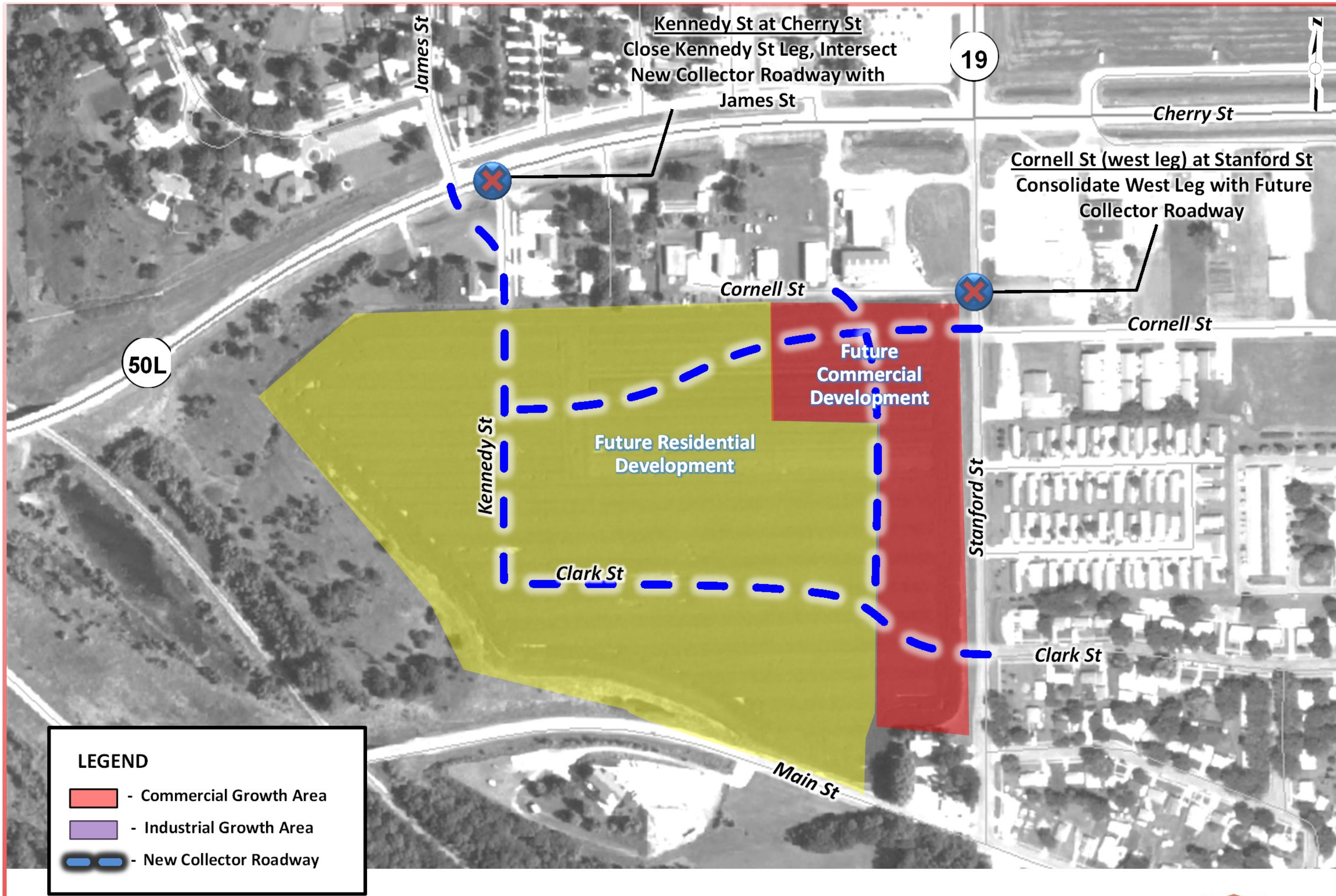
- *Alternative 8B*: **Extend Clark Street into residential growth areas west of Stanford Street**. As land is readied for development west of Stanford St, this project will ensure that the Clark Street alignment is maintained to allow for continuous collector corridor on both sides of Stanford Street.
- *Alternative 8C*: **Provide backage road to future commercial development west of Stanford Street**. A commercial development area is anticipated to develop west of Stanford between Cherry Street and Main Street. The backage road will provide circulation and access to the commercial developments along Stanford.
- *Alternative 8D*: **Create North-South collector to connect with Cherry Street**. In the growth area, Clark Street will transition into a north-south collector at about Kennedy Street to tie into Cherry Street on the north edge of the growth area.
- *Alternative 8E*: **Realign Kennedy Street to intersect with the James Street - Cherry Street intersection**. To improve access control along Cherry Street, the future north-south collector for the Western Growth Area should be aligned with the existing James Street intersection. James Street is designated as the collector for the neighborhood north of Cherry Street. The intersection would likely operate as 2-way stop controlled. This project would likely require the acquisition of a residential property south of Cherry Street.
- *Alternative 8F*: **Add Northbound left turn lane at Stanford Street - Cherry Street intersection**. The intersection will operate at LOS "B" in 2032, but the northbound approach would operate at LOS "C". The 2012 widening project on Stanford will provide sufficient pavement width to restripe and sign northbound approach with no other costs or construction. While this intersection is not deficient, this improvement will add slightly more capacity for northbound traffic with little cost or impact.

The proposed improvements for the Western Growth Area are shown in **Figure 36**.

## Proposals for Future Congestion at Clark Street and Dakota Street

The intersection of Clark Street and Dakota Street is currently a four-way stop controlled intersection, with left-turn lanes provided on the Dakota Street legs (north and south). The intersection currently operates at LOS B, but is forecasted to operate at LOS D by 2032. The intersection is on the edge of the USD campus, and the peak hour traffic is highly impacted by USD-generated traffic.

The proposed project to address the LOS D operations in 2032 is *Alternative 9B*: **add a traffic signal** at the intersection during the 2022 to 2032 time frame. As with other proposed signal additions, a signal warrant analysis will need to be conducted and met before a signal can be installed at this location.




URS Figure 36. Western Growth Area Proposed Improvements

## Proposals for Future Congestion at Clark Street and Pine Street

The intersection of Clark Street and Dakota Street is currently a four-way stop controlled intersection. The intersection is directly adjacent to the USD campus, and traffic patterns through the intersection are highly influenced by USD schedules and activities. A very high percentage of daily traffic occurs during the hour after classes dismiss. If these characteristics change in the future, it is possible that no changes to intersection treatment will be warranted at Clark and Pine. Based on traffic counts received by the study team, this intersection currently operates at LOS C and is forecasted to operate at LOS F by 2032.

As this intersection is highly dependent on USD-generated traffic, a tiered approach to this issue area is proposed:

- First, traffic volumes should be monitored at the intersection. There is no immediate need for an improvement, but the intersection should be counted during the peak periods and evaluated every couple of years. When the peak period traffic volumes are collected, the volumes should be summarized to see if total traffic entering the intersection during the peak hour approach approximately 900 entering vehicles. At this point, based on current traffic patterns, delays for the average vehicle will approach 25 seconds of delay (LOS D).
- In the Short-Term (2012-2022), if volumes approach or exceed the approximate 900 entering vehicles and average vehicle delays of 25 seconds or more are observed, it is proposed that *Alternative 10B*: **Add left-turn lanes on all approaches** be implemented. This project would require removing on-street parking adjacent to intersection and restriping the approaches to provide a separate left-turn lane and a shared through/right turn lane.
- In the Long-Term (2022-2032), if volumes continue to grow and maintain their currently high peak-hour characteristics, the added left-turn lanes will only provide LOS D by 2032. If total traffic volumes entering the intersection during the peak hour approach approximately 1050 entering vehicles, delays at the four-way stop (with left-turn lanes) are forecasted to exceed the "accepted" LOS C and operate at LOS D. It is proposed that a detailed traffic study be completed at this future time to determine if additional improvements are warranted. If volumes at the intersection reach the point where the short-term improvements are in place and the operations analysis finds delays for the average vehicle are at 25 seconds of delay (LOS D), *Alternative 10D*: **Convert the Clark Street – Pine Street intersection to a single lane roundabout** is proposed. The proposed design would be a compact urban roundabout with an approximate 80 to 90 foot travelway diameter (100 to 110 foot roundabout diameter including sidewalks). If needed in the future, this roundabout would provide LOS A in 2032 and if properly designed should accommodate single-unit trucks (not semis). Clark Street and Pine Street are not truck routes, so this design should provide sufficient capacity and should have at most very minor right-of-way impacts (at most about a 5 foot arc on the intersection corners).

## Proposal for Safety at Burbank Road Curve east of the 467th Avenue / Railroad Crossing

As noted in the safety and alternatives discussion, the Burbank Road curve east of the 467th Avenue / BNSF Railroad crossing has had three injury crashes in three years. The proposed project at this location is *Alternative 11B:* **Improve Advanced Warning Signing by Adding Chevron Signs on Curve**. If crashes persist after the chevron signs are added to the roadway curve, the County could consider implementing flashing warning signs on the approaches to the curve.

## Proposal for Safety on Chestnut Road at Burbank Road / University Street Intersection

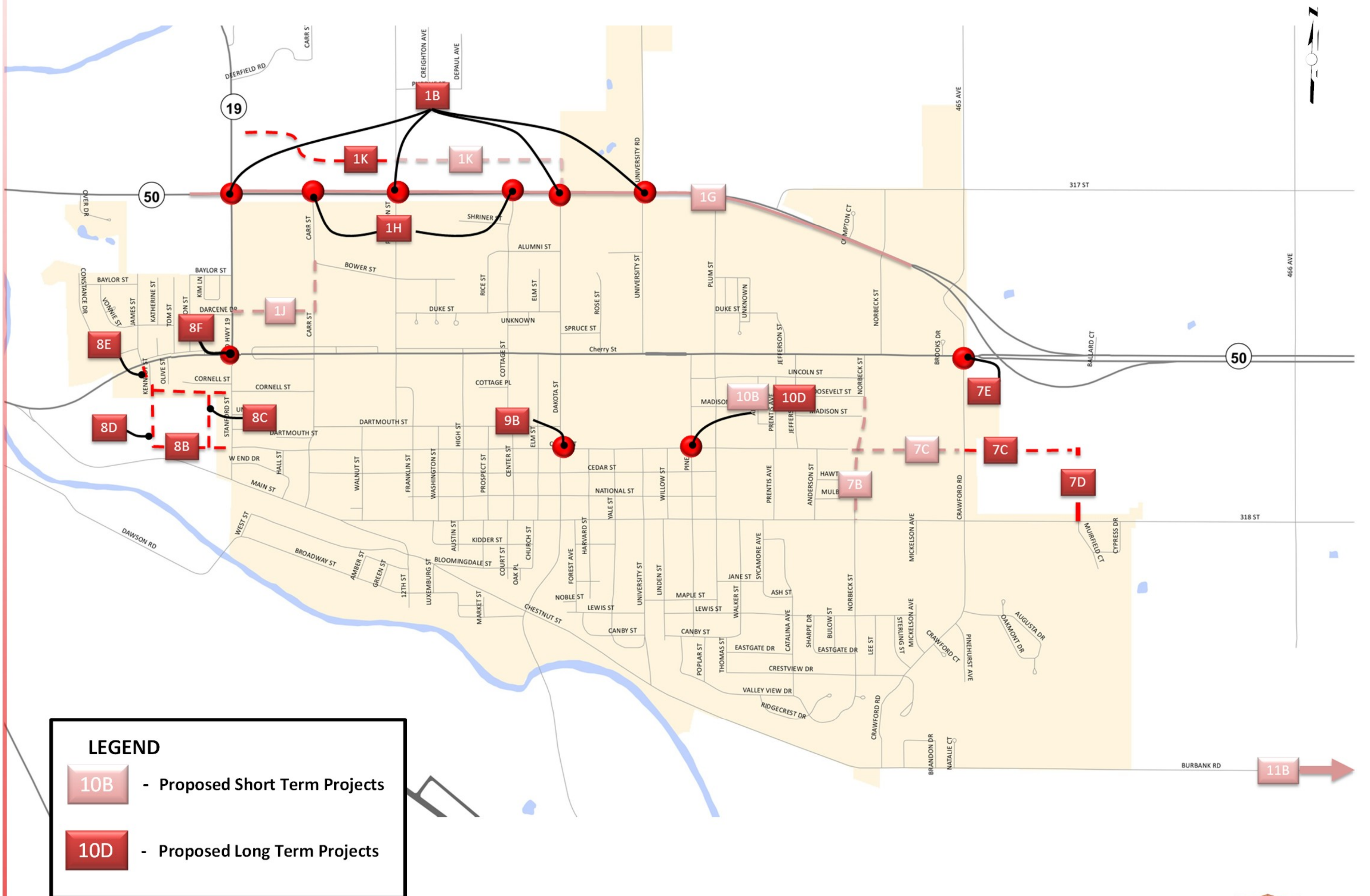
As noted in the alternatives discussion, there have been two recent speed-related crashes on Chestnut Road on the west leg of the Chestnut Road / Burbank Road / University Street intersection. The City has recently added more speed limit signs on Chestnut Road, added red flags to the Stop Ahead signs and added reflective tape to the intersection approaches. These are relatively recent additions, and it is not certain what effect these improvements might have had on safety along Chestnut Road. The preference of the City is to evaluate how well the recent signing / flagging / striping additions perform before making any other changes in this corridor. So, the Plan will reflect *Alternative 12A*: **No Action**. An illustrative project for this corridor is *Alternative 12B:* **Add advanced warning signing and add rumble strips**, which the City might consider in the future if crashes persist at the intersection.

The proposed roadway system plan projects are illustrated in **Figure 37**.

## PROPOSED BICYCLE AND PEDESTRIAN SYSTEM PLAN

Some of the objectives of the Transportation Plan are to enhance the overall connectivity of the bicycle and pedestrian network in Vermillion. While pedestrian and bicycle travel are often considered to be primarily a recreational amenity, the Transportation Plan treats non-motorized travel from the perspective of meeting the transportation needs of the community. The recreational, fitness and environmental benefits of walking or biking may attract more people to making more walking and biking trips, but there needs to be a viable non-motorized network in place to facilitate non-motorized travel. Three main types of walking and biking projects are being carried forward as proposals:

- Expansion of the existing multimodal trail system.
- On-street bike routes.
- Sidewalk improvements.




**URS** Figure 37. Proposed Roadway System Plan Projects

Area Transportation Plan Vermillion

The on-street bicycle facilities were only proposed in corridors that are not anticipated to require widening or removal of on-street parking to accommodate bike facilities. The following trail projects are included in the proposed Plan:

- *Alternative 5B*, **Extend Riverfront Trail east to Crawford Rd**.
- *Alternative 5C*, **Provide new off-street connections to Vermillion River Trail on west side of city**.
- *Alternative 5D*, **Provide new off-street trail along SD 50 between Princeton St and Crawford Rd**.
- *Alternative 5E*, **Extend Crawford Rd Trail North To SD 50. On-Street through Existing Built Residential - Off-street In Other Areas**.
- *Alternative 5F*, **Provide Clark Street Trail as roadway improvements are made when neighborhoods are developed**.
- *Alternative 5G*, **Provide Stanford Street trail between Cherry Street and SD 50**.

On-street bicycle routes have been identified in working with local bicyclists, stakeholders and the City. Lower-traffic volume, continuous street routes were favored in this evaluation. The on-street routes would be designated shared-use streets for both motor vehicles and bicyclists. On-street bicycle routes are proposed in the following projects:

- *Alternative 5H*, **Plum St from Main Street to SD 50**.
- *Alternative 5I*, **Clark St from Stanford Street to Plum Street**.
- *Alternative 5K*, **High Street / Cottage Street corridor from SD 50 to Main Street**.
- *Alternative 5L*, **Norbeck Street / Crestview Street corridor from Cherry Street to Crawford Road**.

Sidewalk additions are proposed as part of *Alternative 5M* in the following corridors where they are not currently located:

- North Princeton Street.
- North Stanford Street.
- Streets adjacent to north USD campus, including Dakota Street, University Street, and Plum Street.

The proposed bicycle and pedestrian projects should all be implemented in the Short Term (2012 to 2022) as they are part of an identified current need for the area.

The proposed bicycle and pedestrian system projects are illustrated in **Figure 38**.

## Proposed Project Year of Expenditure Costs

A summary of the Proposed Roadway and Bicycle and Pedestrian (Non-Motorized) System Plan is provided in **Table 11**.


URS **Figure 38. Proposed Bicycle And Pedestrian System Projects**

Vermillion Area Transportation Plan

**Table 11. Proposed Roadway and Non-Motorized System Plan and Costs**

| Project ID | Project Description | Cost Estimate (2012 $)[1] | Implementation Term (Year of Expenditure) | Year of Expenditure / Mid-Point Year Cost Estimate |
|---|---|---|---|---|
| *Alternative 1G* | Highway 50 widening to consistent 66 foot width | $750,000 | Short Term (2017) | $830,000 |
| *Alternative 1J* | Extend Duke St and Carr St Collectors south of SD 50. | $1,600,000 | Short Term (2017) | $1,770,000 |
| *Alternative 1K (first half)* | Commercial backage road north of Future SD 50 Commercial Development. | $2,500,000 | Short Term (2017) | $2,760,000 |
| *Alternative 5B* | Extend Riverfront Trail east to Crawford | $200,000 | Short Term (2017) | $220,000 |
| *Alternative 5C* | Trail connection to Vermillion River Trail on West Side of City. | $25,000 | Short Term (2017) | $30,000 |
| *Alternative 5D* | SD 50 trail between Dakota St and Crawford Rd. | $360,000 | Short Term (2017) | $400,000 |
| *Alternative 5F* | Clark St Trail as new east neighborhoods are developed. | $200,000 | Short Term (2017) | $220,000 |
| *Alternative 5G* | Stanford St trail from Cherry to SD 50. | $125,000 | Short Term (2017) | $140,000 |
| *Alternative 5E* | Crawford Rd On-Street Routes | $50,000 | Short Term (2017) | $60,000 |
| *Alternative 5H* | Plum St from Main St to SD 50 On-Street Routes | | | |
| *Alternative 5I* | Clark St from Stanford St to Plum St On-Street Routes | | | |
| *Alternative 5K* | High St / Cottage St corridor from SD 50 to Main St On-Street Routes | | | |
| *Alternative 5L* | Norbeck St / Crestview St corridor from Cherry St to Crawford Rd On-Street Routes | | | |
| *Alternative 5M* | Add sidewalks in areas without service and pedestrian demand.<br>- North Dakota St.<br>- North University St<br>- North Plum St. | $90,000 | Short Term (2017) | $100,000 |
| *Alternative 7B* | Build Norbeck St as a continuous corridor from Main St to Cherry St. | $1,400,000 | Short Term (2017) | $1,550,000 |
| *Alternative 7C (west)* | Extend Clark St from its current terminus to Crawford Rd. | $1,500,000 | Short Term (2017) | $1,660,000 |
| *Alternative 8C* | Provide backage road to future commercial development west of Stanford. | $750,000 | Short Term (2017) | $830,000 |
| *Alternative 10B* | Pine / Clark: Add left-turn lanes. | $2,000 | Short Term (2017) | $2,000 |
| *Alternative 11B* | Improve advanced warning signing by adding Chevron signs on curve near rail crossing. | $2,000 | Short Term (2017) | $2,000 |
| **Short-Term Summary** | | **$9,554,000** | | **$10,574,000** |

1: Cost estimates do not include potential right-of-way costs.

**Table 11. Proposed Roadway and Non-Motorized System Plan and Costs (continued)**

| Project ID | Project Description | Cost Estimate (2012 $)[1] | Implementation Term (Year of Expenditure) | Year of Expenditure / Mid-Point Year Cost Estimate |
|---|---|---|---|---|
| Alternative 1B | Signalize SD 50 intersections and provide advanced warning flashers. | $850,000 | Long Term (2027) | $1,140,000 |
| Alternative 1H | Eliminate left turns at Carr St and Cottage St to / from SD 50. | $50,000 | Long Term (2027) | $70,000 |
| Alternative 1K (last half of support roadways) | Construct a commercial backage road north of future SD 50 commercial development. | $2,500,000 | Long Term (2027) | $3,360,000 |
| Alternative 7C (east) | Extend Clark St from Crawford Rd (future intersection) into Long Term growth area east of Crawford. | $1,500,000 | Long Term (2027) | $2,020,000 |
| Alternative 7D | North-South Collector to connect with Main St / Muirfield Ct intersection. | $1,000,000 | Long Term (2027) | $1,350,000 |
| Alternative 7E | Install traffic signal at Crawford Rd - Cherry St by 2032. | $200,000 | Long Term (2027) | $270,000 |
| Alternative 8B | Extend Clark St into residential growth areas west of Stanford St. | $1,000,000 | Long Term (2027) | $1,350,000 |
| Alternative 8D | Create North-South collector to connect with Cherry St. | $800,000 | Long Term (2027) | $1,080,000 |
| Alternative 8E | Realign Kennedy St so that it intersects with the James St - Cherry St intersection. Make intersection 2-way stop controlled. | $100,000 | Long Term (2027) | $130,000 |
| Alternative 8F | Add Northbound left turn lane at Stanford St - Cherry St intersection. | $2,000 | Long Term (2027) | $3,000 |
| Alternative 9B | Install traffic signal at Dakota St / Clark St intersection by 2032. | $200,000 | Long Term (2027) | $270,000 |
| Alternative 10D | Convert intersection to single lane roundabout by 2032. | $250,000 | Long Term (2027) | $340,000 |
| **Long-Term Summary** | | **$8,452,000** | | **$11,383,000** |

1: Cost estimates do not include potential right-of-way costs.

As shown in Table 11:

- Short Term project costs are estimated at $9,550,000 in 2012 dollars and at $10,574,000 in Year of Expenditure (2017) dollars.
- Long Term project costs are estimated at $8,450,000 in 2012 dollars and at $11,383,000 in Year of Expenditure (2027) dollars.

## FUNDABLE SYSTEM PLAN

The estimated total combined Year of Expenditure cost for all of the proposed roadway system and non-motorized system costs is $21,957,000. As identified in the *Transportation System Funding Evaluation* chapter, funding levels in terms of year of expenditure are only $15,284,000. Thus, there is a funding shortfall of approximately $6,673,000 between proposed Plan projects and anticipated funding through 2032. There are two potential approaches to addressing this funding short-fall:

- **Identifying alternative revenue sources to make up the shortfall**. A large portion of the proposed roadway costs are due to new collectors proposed to support future development in growth areas. If funding partnerships can be formed that allow developers to pay a portion of the roadway systems needed to support future development, then potentially some / all of the proposed roadway projects could be included on the recommended list. Although the City has the policies in place to allow developer-funded projects, based on past experience these arrangements should not be expected for the foreseeable future.
- **Cutting some proposed projects from the ultimate funded, recommended Transportation Plan**. If additional funding is not a feasible near term solution, the option of cutting projects is the most reasonable approach to get funding and Plan costs in line.

As documented in the Funding Evaluation Chapter, one requirement of this Plan is to provide a Transportation Plan that is fundable. In order to provide a Transportation Plan with balanced revenues and costs, two proposed projects will be included as illustrative, but will not be a part of the funded Transportation Plan. Those proposed projects that will be included as illustrative / non-funded projects in the recommended plan are:

- *Alternative 1K*: **Construct a commercial backage road north of future SD 50 commercial development**. Eliminating this project lowers total transportation system year of expenditure costs by $6,120,000 ($5,000,000 in 2012 dollars).
- *Alternative 8C*: **Provide backage road to future commercial development west of Stanford Street.** Eliminating this project lowers total transportation system year of expenditure costs by $830,000 ($750,000 in 2012 dollars).

**Table 12** reflects the fundable, recommended roadway and non-motorized system plan projects and their costs.

## Table 12. Recommended Roadway and Non-Motorized System Plan and Costs

| Project ID | Project Description | Cost Estimate (2012 $)[1] | Implementation Term (Year of Expenditure) | Year of Expenditure / Mid-Point Year Cost Estimate |
|---|---|---|---|---|
| *Alternative 1G* | Highway 50 widening to consistent 66 foot width. | $750,000 | Short Term (2017) | $830,000 |
| *Alternative 1J* | Extend Duke St and Carr St Collectors south of SD 50. | $1,600,000 | Short Term (2017) | $1,770,000 |
| *Alternative 5B* | Extend Riverfront Trail east to Crawford. | $200,000 | Short Term (2017) | $220,000 |
| *Alternative 5C* | Trail connection to Vermillion River Trail on West Side of City. | $25,000 | Short Term (2017) | $30,000 |
| *Alternative 5D* | SD 50 trail between Dakota St and Crawford Rd. | $360,000 | Short Term (2017) | $400,000 |
| *Alternative 5F* | Clark St Trail as new east neighborhoods are developed. | $200,000 | Short Term (2017) | $220,000 |
| *Alternative 5G* | Stanford St trail from Cherry to SD 50. | $125,000 | Short Term (2017) | $140,000 |
| *Alternative 5E* | Crawford Rd On-Street Routes | $50,000 | Short Term (2017) | $60,000 |
| *Alternative 5H* | Plum St from Main St to SD 50 On-Street Routes. | | | |
| *Alternative 5I* | Clark St from Stanford St to Plum St On-Street Routes. | | | |
| *Alternative 5K* | High St / Cottage St corridor from SD 50 to Main St On-Street Routes. | | | |
| *Alternative 5L* | Norbeck St / Crestview St corridor from Cherry St to Crawford Rd On-Street Routes. | | | |
| *Alternative 5M* | Add sidewalks in areas without service and pedestrian demand.<br>- North Dakota St.<br>- North University St<br>- North Plum St. | $90,000 | Short Term (2017) | $100,000 |
| *Alternative 7B* | Build Norbeck St as a continuous corridor from Main St to Cherry St. | $1,400,000 | Short Term (2017) | $1,550,000 |
| *Alternative 7C (west)* | Extend Clark St from its current terminus to Crawford Rd. | $1,500,000 | Short Term (2017) | $1,660,000 |
| *Alternative 10B* | Pine / Clark: Add left-turn lanes. | $2,000 | Short Term (2017) | $2,000 |
| *Alternative 11B* | Improve advanced warning signing by adding Chevron signs on curve near rail crossing. | $2,000 | Short Term (2017) | $2,000 |
| **Short-Term Summary** | | $6,304,000 | | $6,984,000 |

1: Cost estimates do not include potential right-of-way costs.

## Table 12. Recommended Roadway and Non-Motorized System Plan and Costs (continued)

| Project ID | Project Description | Cost Estimate (2012 $)[1] | Implementation Term (Year of Expenditure) | Year of Expenditure / Mid-Point Year Cost Estimate |
|---|---|---|---|---|
| Alternative 1B | Signalize SD 50 intersections and provide advanced warning flashers. | $850,000 | Long Term (2027) | $1,140,000 |
| Alternative 1H | Eliminate left turns at Carr St and Cottage St to / from SD 50. | $50,000 | Long Term (2027) | $70,000 |
| Alternative 7C (east) | Extend Clark St from Crawford Rd (future intersection) into Long Term growth area east of Crawford. | $1,500,000 | Long Term (2027) | $2,020,000 |
| Alternative 7D | North-South Collector to connect with Main St / Muirfield Ct intersection. | $1,000,000 | Long Term (2027) | $1,350,000 |
| Alternative 7E | Install traffic signal at Crawford Rd - Cherry St by 2032. | $200,000 | Long Term (2027) | $270,000 |
| Alternative 8B | Extend Clark St into residential growth areas west of Stanford St. | $1,000,000 | Long Term (2027) | $1,350,000 |
| Alternative 8D | Create North-South collector to connect with Cherry St. | $800,000 | Long Term (2027) | $1,080,000 |
| Alternative 8E | Realign Kennedy St so that it intersects with the James St - Cherry St intersection. Make intersection 2-way stop controlled. | $100,000 | Long Term (2027) | $130,000 |
| Alternative 8F | Add Northbound left turn lane at Stanford St - Cherry St intersection. | $2,000 | Long Term (2027) | $3,000 |
| Alternative 9B | Install traffic signal at Dakota St / Clark St intersection by 2032. | $200,000 | Long Term (2027) | $270,000 |
| Alternative 10D | Convert intersection to single lane roundabout by 2032. | $250,000 | Long Term (2027) | $340,000 |
| **Long-Term Summary** | | **$5,952,000** | | **$8,023,000** |
| | | | | |
| Alternative 1K | Construct a commercial backage road north of future SD 50 commercial development. | $5,000,000 | Illustrative | - |
| Alternative 8C | Provide backage road to future commercial development west of Stanford. | $750,000 | Illustrative | - |
| **Illustrative Summary** | | **$5,750,000** | | |

1: Cost estimates do not include potential right-of-way costs.

## Future Major Street Plan

Based on the roadway projects that are included in the proposed street and roadway list, a future major street plan is provided in **Figure 39**. As shown in Figure 39, there are no major arterial additions to the Vermillion street network by 2032. The existing arterial system should provide sufficient connectivity and overall capacity through the planning horizon. The additions to the system are collector roadways, which will be added to provide a connection between the arterial system and future commercial and residential growth areas. The two proposed collector projects that were recommend from the final, recommended (fundable) plan project list are shown as "illustrative" roadways in Figure 39.

## Plan Consistency with Goals, Objectives and Livability Guidance

### Consistency with Goals and Objectives

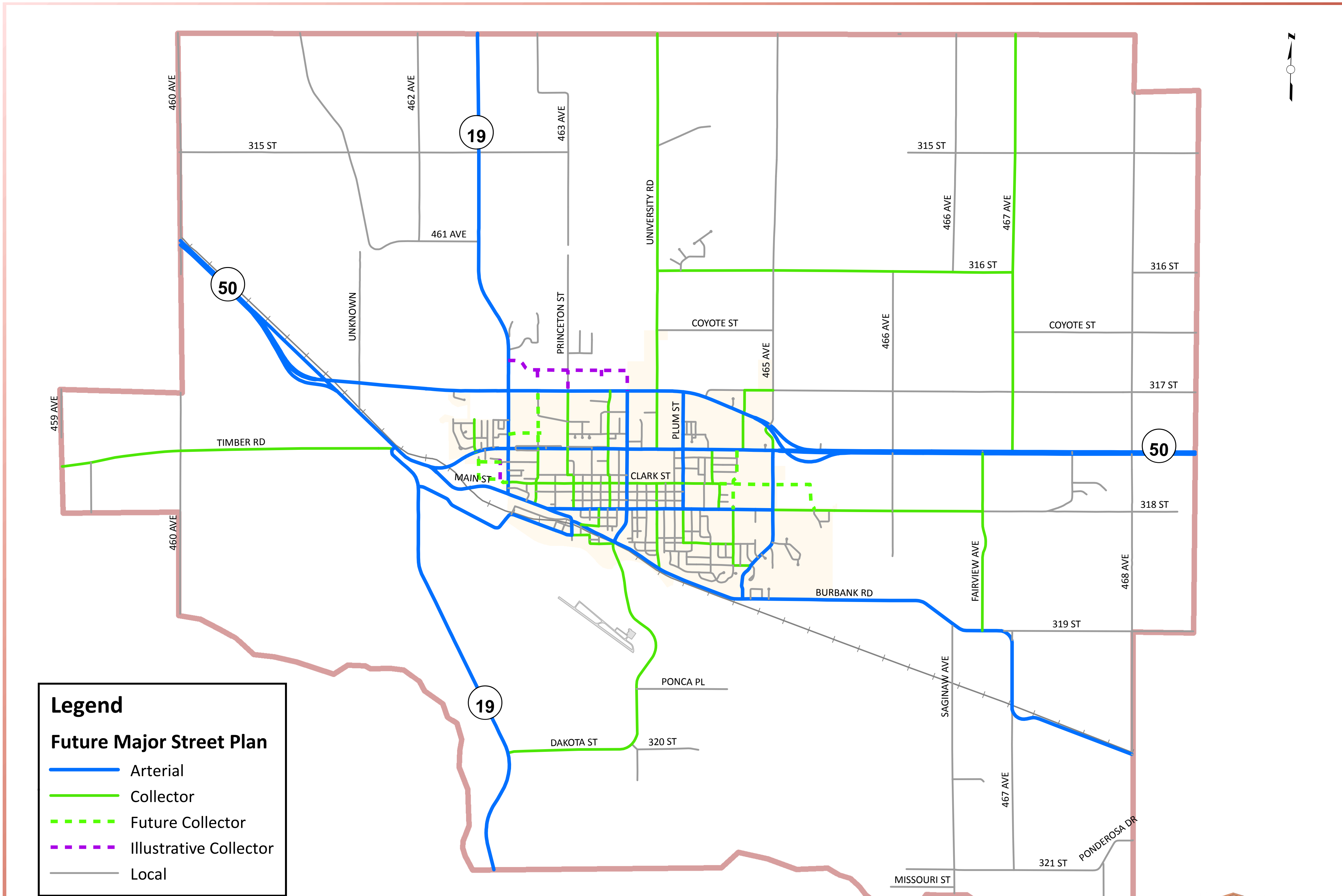
The goals and objectives established in the early stages of the study formed, in part, the criteria by which options for the transportation system were developed and evaluated. **Table 13** provides a summary of how Plan activities addressed each of the goals and objectives. While all of the recommended projects were developed and evaluated based on the Plan goals and objectives, some more directly reflect one or more of the goals than others. **Table 14** provides a summary of which Plan goals each recommended project directly addressed.

### Consistency with Livability Guidance

As noted in the Transportation System Goals and Objectives Chapter, the Federal Livability Initiative provides principles that apply to transportation plans such as this. Much of the livability guidance is consistent with the Vermillion transportation system vision established by the community. For each of the identified livability principles, the plan has actively supported the guidance in the following ways:

***Provide more transportation choices***
The Transportation Plan provides several recommendations that are considered new transportation choices, particularly the inclusion of several projects that together would constitute a more complete bike and pedestrian system. The on-street bicycle routes and multi-use trails included in the fundable plan expand the range non-automobile travel in options Vermillion, consistent with the overall intent of the Livability Initiative.

***Promote equitable, affordable housing***
The Transportation Plan does not directly address housing quality, mix, or pricing. Promoting system improvements that address safety, congestion, extension of the system into development areas, as well as considering maintenance of the existing system, the Plan has laid the foundation for providing enhanced accessibility across all income segments of the community.




**URS** Figure 39. Future Major Street Plan

Vermillion Area Transportation Plan

**Table 13. Transportation Plan Goals and Objectives and How Each Was Addressed by Plan Activities**

| **Goals** / Objectives **to be Addressed** | **Transportation Plan Activities that Address Each Objective** |
|---|---|
| **Goal #1: Provide an efficient multimodal transportation system that effectively moves people and goods.** | |
| Evaluate whether or not the current functional classification of streets is appropriate based on their current and/or future role in the transportation network. | Issues identification and alternatives analysis phases reviewed how streets operate in the existing condition and future conditions. Recommendations were made to change the role of some streets to address new development areas. |
| Identify improvements to the arterial and collector street network needed to accommodate current and projected traffic. | Alternatives were identified to address current and future operations and safety deficiencies. Recommendations that address these needs are included in the Plan. |
| Evaluate current Major Street Plan (See Comprehensive Plan) for consistency with development and transportation system objectives. | The Major Street Plan included in the 2000-2020 Comprehensive Plan was used as a starting point for developing an updated Current Major Street Plan (Figure 4), consistent with providing a continuous system that balances the needs of land access and mobility. |
| Identify sidewalk, trail and on-street improvements that would enhance bicycle and pedestrian connectivity across Vermillion. | Alternatives were identified to enhance the Vermillion bicycle and pedestrian network and provide a more complete / interconnected non-motorized network (shown in Figure 38). Recommendations that address these needs were included in the Plan. |
| The bicycle - pedestrian system should connect activity centers including, but not limited to University of South Dakota (USD) campus to downtown, west side retail to USD campus, outlying residential areas to the city center. | The bicycle and pedestrian system recommendations provide access to major recreational and activity centers throughout Vermillion, including USD, downtown, the 4 major city parks and the riverfront trail, Cherry Street retail destinations, and the outlying residential and employment areas of the city. |
| Identify the appropriate portions of the 2000 – 2020 Comprehensive Plan recommended bike routes to integrate into the Transportation Plan. | Bike routes from the Comprehensive Plan were included in the non-motorized alternatives considered and are part of the recommended system. |
| Identify actions that would improve the efficiency of Vermillion Public Transit. | The current transit system is demand-response. Alternatives were considered that would provide fixed route transit service in the community (Alternative 2F), but no recommendations relating to the Transit system were identified in the plan. This service might be incorporated at a later date if on-street parking issues near USD campus are addressed. The plan does identify current and future costs for transit operations and vehicle replacement. |
| Enhance wayfinding and gateways to the university. | Alternatives were considered that would enhance university gateways, particularly along Cherry Street. At this time, none of these gateway enhancements are anticipated to be implemented by the University. |

## Table 13. Transportation Plan Goals and Objectives and How Each Was Addressed (continued)

| **Goals** / Objectives **to be Addressed** | **Transportation Plan Activities that Address Each Objective** |
|---|---|
| **Goal #2: Provide a safe and secure transportation system.** | |
| Identify high crash locations and evaluate appropriate actions to improving safety. | The Plan identified the highest crash intersections and other high crash locations. Alternatives were developed to address these locations. |
| Review locations of automobile – pedestrian conflicts and evaluate potential safety improvements. | The Plan reviewed pedestrian safety data and focused on the Cherry Street Corridor near USD for locations where potential safety improvements were considered. Based on input from the study advisory team, none of the Cherry Street pedestrian crossing options were recommended. |
| Incorporate state and local emergency response and security plans into the Transportation Plan. | The South Dakota Strategic Highway Safety Plan (SHSP) was reviewed and considered as alternatives were developed. One emphasis area in the SHSP was addressing "Run off road crashes and head on collisions". The safety analysis looked at these types of crashes - Alternatives 10B and 11B address run off road crashes. Emergency responders at the hospital were consulted regarding alternatives (Alternative 6A-6C) being considered around the hospital area. |
| Identify, prevent, manage, or respond to threats (natural and human) to the motorized and non-motorized transportation system and its users. | From a Transportation Planning perspective, no imminent threats to the multimodal system were identified during the issues identification / analysis phases of the study. |
| **Goal #3: Maintain the existing transportation system.** | |
| Prepare a plan for preserving, maintaining and improving the existing multimodal transportation system. | The Plan was developed so that sufficient resources were set aside for maintenance projects through the planning horizon. The majority of the recommended plan projects were improvements to the existing system, and were not new facilities / programs. |
| Before building new roadway corridors, promote improvement of an existing multimodal corridor whenever it is appropriate and supports development plans. | The majority of the recommended plan projects were improvements to the existing system, and were not new facilities. |
| Identify and reserve/protect planned future transportation corridors. | Many of the alternatives and recommendations focused on identifying future corridors to support development. The City has already reserved right-of-way for some of these corridors. |
| Promote a corridor access management approach that balances the needs of land access with corridor safety and mobility | The future major street plan (Figure 39) provides a system that meets both the land access and mobility needs of the Vermillion area. |

**Table 13. Transportation Plan Goals and Objectives and How Each Was Addressed (continued)**

| **Goals** / Objectives **to be Addressed** | **Transportation Plan Activities that Address Each Objective** |
|---|---|
| **Goal #4: Manage the transportation system's impact on the social and natural environment.** | |
| Maintain or reduce current per-capita levels of vehicle miles traveled and vehicle hours traveled. | To limit vehicle miles of travel (VMT) and vehicle hours of travel (VHT) growth, average trip lengths need to be maintained into the future and locations of travel delay need to be addressed. One step to addressing this objective was that the development concept that first identified areas of infill and contiguous development. New arterials on the fringe of the developed area can often lead to increased VMT, and none of these were recommended. |
| Engage citizens in all stages of the transportation planning process. | Public meetings were held at critical milestones during the study, and a stakeholders committee made up of citizens met throughout the study. To provide additional, continuous opportunity for citizen engagement, a study website was maintained through the key input stages of the study. A web-based survey was also maintained for the first few months of the study to gather public input on the study. |
| Coordinate Transportation Plan actions with the appropriate state and federal agencies responsible for natural resources, environmental protection and historic preservation. | The range of alternatives identified were all within existing corridors or within currently developed areas and there were no projects that had any substantial environmental impacts. Thus, no opportunities for agency coordination were identified during the alternatives analysis phase of the Plan. |
| Address the impacts to neighborhood character and quality of life when considering transportation investments. | One of the primary alternative screening measures was the impact to surrounding uses / neighborhoods. Alternatives were screened to determine if private property would need to be acquired, if the alternative would affect neighborhood quality, and how it might affect neighborhood amenities such as on-street parking, walkability, access to corridors, etc. |
| Limit future negative transportation system impacts by coordinating land development planning and transportation planning. Promote multimodal transportation improvement concepts that are complementary to and compatible with adjacent uses/activities, building types and setbacks and sensitive natural and social features of the region. | A land development concept was developed for this plan, based on the previous work of the Comprehensive Plan. The Plan built off of the development concept and evaluated the anticipated future transportation systems impacts of development. The evaluation went both ways, as the alternatives analysis considered the effects on adjacent land uses and the natural environment for all transportation options considered in the Plan. |
| **Goal #5: Provide a transportation system that supports and enhances the area's economy and supports the Comprehensive Plan.** | |
| Coordinate area economic development activities and plans with the Transportation Plan. | The land development concept reflected latest information on where commercial and industrial land would develop. Transportation alternatives and recommendations were established to support development and provide access to these areas of anticipated future business areas. |

**Table 13. Transportation Plan Goals and Objectives and How Each Was Addressed (continued)**

| | |
|---|---|
| **Goal #5: Provide a transportation system that supports and enhances the area's economy and supports the Comprehensive Plan (continued).** | |
| Develop a Transportation Plan that supports the Comprehensive Plan, including preservation of agricultural uses on the urban fringe and development within the City Limits. | The Plan land development concept was based on the previous work completed in the Comprehensive Plan. The development concept first identified areas of infill for the first tier of development, and then areas contiguous to the existing city limits. None of the areas identified for development through 2032 were more than 3/4 of a mile from the current city limits. Thus, the vast majority of agricultural uses in the Study Area were preserved for the Plan's development concept. |
| Promote transportation system improvements that support compact, contiguous urban development and support preservation of agricultural uses beyond the urban growth boundary. | In addition to the development concept efforts cited above, most of the multimodal infrastructure investments recommended for this plan were for the existing system. Thus, improvements to the system focused on already-developed parts of the study area. |
| Assess parking issues and needs from the perspectives of the user and property owner, taking into account that different uses have different requirements regarding desirable walk distance, number of spaces, etc. | These factors focused the evaluation criteria used for the analyses and alternatives developed to address the on-street parking conflicts in the neighborhood adjacent to the USD campus. |
| Create, enhance and maintain multimodal connections to major business, the university and other institutional and tourist destinations. | Many of the alternatives and recommendations focused on maintaining these connections. Specifically, alternatives to improve side street access / congestion along SD 50, sidewalk improvements near the DakotaDome and alternatives that address future congestion at intersections adjacent to the USD campus / National Music Museum address this objective. |
| Implement transportation projects/programs that enhance resident, worker, student and visitor quality of life. | Quality of life is reflected in how the alternatives analysis was conducted. Social and physical environment factors and input from the public and stakeholders were considered as a part of the evaluation criteria. Furthermore, the Plan provides expanded transportation options for the residents of Vermillion. |
| Maintain truck routes to preserve the flow of goods and services to/from Vermillion. | Several of the recommendations were focused on truck routes in Vermillion, including balancing access to businesses that generate truck trips along Highway, while maintaining continued mobility for regional traffic (including trucks) along Highway 50. No recommendations were made to change the current where truck routes were located in the study area. |
| Provide adequate parking to support key activity centers. | The alternatives analysis included parking observations and analyses at several key locations, including USD campus, the Dakota Dome during events, on-street parking adjacent to the USD campus, and at the Hospital. These analyses developed alternatives where an issue was identified - focused mainly on the neighborhoods surrounding USD. |
| Involve development community, planning staff and University Planner on the Plan Stakeholders Committee. | City staff invited representatives of all three groups to various input opportunities, and input was received on development plan and alternatives analysis from each of the constituencies. |

**Table 14. Goals Directly Addressed by Each Recommended Project**

| Project ID | Project Description | Goal #1: Provide an efficient multimodal transportation system. | Goal #2: Provide a safe and secure transportation system. | Goal #3: Maintain the existing transportation system. | Goal #4: Manage the impacts on the social and natural environment. | Goal #5: Support the economy and the Comprehensive Plan. |
|---|---|---|---|---|---|---|
| Alternative 1G | Highway 50 widening to consistent 66 foot width. | √ | √ | √ | | √ |
| Alternative 1J | Extend Duke St and Carr St Collectors south of SD 50. | √ | | | √ | √ |
| Alternative 5B | Extend Riverfront Trail east to Crawford. | √ | √ | | √ | |
| Alternative 5C | Trail connection to Vermillion River Trail on West Side of City. | √ | | | √ | |
| Alternative 5D | SD 50 trail between Dakota St and Crawford Rd. | √ | √ | | √ | |
| Alternative 5F | Clark St Trail as new east neighborhoods are developed. | √ | √ | | √ | √ |
| Alternative 5G | Stanford St trail from Cherry to SD 50. | √ | √ | | √ | √ |
| Alternative 5E | Crawford Rd On-Street Routes. | √ | √ | √ | √ | √ |
| Alternative 5H | Plum St from Main St to SD 50 On-Street Routes. | √ | √ | √ | √ | √ |
| Alternative 5I | Clark St from Stanford St to Plum St On-Street Routes. | √ | √ | √ | √ | √ |
| Alternative 5K | High St / Cottage St corridor from SD 50 to Main St On-Street Routes. | √ | √ | √ | √ | √ |
| Alternative 5L | Norbeck St / Crestview St corridor from Cherry St to Crawford Rd On-Street Routes. | √ | √ | √ | √ | √ |
| Alternative 5M | Add sidewalks in areas without service and pedestrian demand. | √ | √ | | √ | √ |

**Table 14. Goals Directly Addressed by Each Recommended Project (continued)**

| Project ID | Project Description | Goal #1: Provide an efficient multimodal transportation system. | Goal #2: Provide a safe and secure transportation system. | Goal #3: Maintain the existing transportation system. | Goal #4: Manage the impacts on the social and natural environment. | Goal #5: Support the economy and the Comprehensive Plan. |
|---|---|---|---|---|---|---|
| Alternative 7B | Build Norbeck St as a continuous corridor from Main St to Cherry St. | √ | √ | | | √ |
| Alternative 7C (west) | Extend Clark St from its current terminus to Crawford Rd. | √ | √ | √ | | |
| Alternative 10B | Pine / Clark: Add left-turn lanes. | √ | √ | √ | √ | |
| Alternative 11B | Improve advanced warning signing by adding Chevron signs on Burbank Rd curve near rail crossing. | | √ | √ | | |
| | | | | | | |
| Alternative 1B | Signalize SD 50 intersections and provide advanced warning flashers. | √ | √ | √ | √ | √ |
| Alternative 1H | Eliminate left turns at Carr St and Cottage St. | √ | √ | | | |
| Alternative 7C (east) | Extend Clark St from Crawford Rd (future intersection) into Long Term growth area east of Crawford. | √ | | | | √ |
| Alternative 7D | North-South Collector to connect with Main St / Muirfield Ct intersection. | √ | | | | √ |
| Alternative 7E | Install traffic signal at Crawford Rd - Cherry St by 2032. | √ | √ | √ | √ | |
| Alternative 8B | Extend Clark St into residential growth areas west of Stanford St. | √ | | | | √ |

**Table 14. Goals Directly Addressed by Each Recommended Project (continued)**

| Project ID | Project Description | Goal #1: Provide an efficient multimodal transportation system. | Goal #2: Provide a safe and secure transportation system. | Goal #3: Maintain the existing transportation system. | Goal #4: Manage the impacts on the social and natural environment. | Goal #5: Support the economy and the Comprehensive Plan. |
|---|---|---|---|---|---|---|
| Alternative 8D | Create North-South collector to connect with Cherry St. | √ | | | | √ |
| Alternative 8E | Realign Kennedy St to intersect with James St - Cherry St intersection. Make it 2-way stop controlled. | √ | √ | | | |
| Alternative 8F | Add Northbound left turn lane at Stanford St - Cherry St intersection. | √ | √ | √ | | |
| Alternative 9B | Convert intersection to traffic signal controlled. | √ | √ | √ | √ | |
| Alternative 10D | Convert intersection to single lane roundabout. | √ | √ | √ | √ | |

***Enhance economic competitiveness***

The Transportation Plan enhances economic competitiveness by maintaining the existing system, while addressing emerging system needs to maintain a continuous, safe and efficient system. Recommendations include improved access to major regional facilities like South Dakota Highway 50, while promoting enhanced traffic operations along those facilities to minimize delays. Furthermore, many of the provided recommendations enhance economic competitiveness by increasing community access to future business developments.

***Support existing communities***

The Transportation Plan supports the existing portions of the Vermillion community by targeting recommended investments throughout currently developed parts of the city. Furthermore, the Plan provides recommended multimodal corridors that focus the automobile, walking and biking connections for new development areas into existing portions of the community.

***Coordinate policies and leverage investment***

The Transportation Plan was completed to reflect the community development vision established in its Comprehensive Plan. The transportation plan provides a fundable implementation plan for transportation investments that support land use decisions included in the Comprehensive Plan. Additional efforts provided in the Transportation Plan include recommendations for continued cooperation between the City and University, to coordinate investments and policies adjacent to campus that would provide a comprehensive solution to the on-street parking issues between Cherry Street and Main Street near USD, while providing supporting mobility alternatives to supplement any parking changes.

***Value communities and neighborhoods***

As alternatives were considered for potential inclusion in the Transportation Plan, how well a project or policy “fit” with its surrounding environment was a critical performance measure. Alternatives were screened to determine if private property would need to be acquired, if the alternative would affect neighborhood quality, and how it might affect neighborhood amenities (on-street parking availability, ability to accommodate all modes, walkability, etc.). Community residents were also included on the Stakeholders Committee that provided input on the screening of transportation alternatives.