MONTANA
STATE UNIVERSITY

Transportation Master Plan

RPA

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ABBREVIATIONS / ACRONYMS

ASMSU	Associated Students of Montana State University
AWSC	All Way Stop Control
BMP	Bicycle Master Plan
CAP	Climate Action Plan
CPTMP	Comprehensive Parking and Transportation Master Plan
CSU	Colorado State University
FY	Fiscal Year
HRDC	Human Resources Development Council
LMP	Landscape Master Plan
LRCDP	Long Range Campus Development Plan
LOS	Level of Service
MAC	Montana Agricultural College
MCA	Montana Code Annotated
MDT	Montana Department of Transportation
MSC	Montana State College
MSU	Montana State University

NAH	Norm Asbjornson Hall
NMSU	New Mexico State University
PSBP	Parking Services Business Plan (FY 14-15)
RPA	Robert Peccia and Associates
SOV	Single Occupant Vehicle
SUB	Strand Union Building
TDM	Transportation Demand Management
TWSC	Two Way Stop Control
WSU	Washington State University
WSU	Weber State University
WTI	Western Transportation Institute

Transportation Master Plan

1.0. BACKGROUND

The Transportation Master Plan (TMP) for Montana State University (MSU) outlines a transportation strategy to provide mobility for students, faculty, staff, and visitors. The TMP will develop strategies for campus access while maintaining the quality of the campus environment and minimizing the financial risk to MSU. Working with the project oversight committee, Robert Peccia and Associates (RPA) analyzed parking and transportation functionality, programs, and investments over the ten-year planning horizon. The TMP addresses transportation facilities and operations on campus in a balanced way under the following principles:

The MSU campus is a major draw to the Bozeman community. This TMP looks to improve the overall transportation experience at MSU for students, faculty, staff and visitors.

- The TMP reviews the existing parking supply and utilization, and assesses future parking needs based on planned institutional growth, potential demand reductions through transportation demand management (TDM) programs, and potential loss of parking supply due to redevelopment.
- The TMP reviews and looks to improve the quality of multi-modal connections including walking and bicycling between campus destinations and relevant off-campus destinations.
- The TMP looks to reduce the number of vehicles, particularly single occupant vehicles, regularly travelling to and around the campus by establishing TDM policies and mode share targets in support of the overall transportation system and campus sustainability initiatives.

1.1. Campus History[1]

On February 16, 1893, the Agricultural College of the State of Montana was founded as the state's land-grant college. Renamed The Montana College of Agriculture and Mechanic Arts, the institution was popularly known as Montana Agricultural College, or MAC. By the 1920s, the institution's preferred name was Montana State College and so it remained until July 1, 1965, when, in recognition of the enormous advances in the College's commitment to scientific and humanistic research, the thirty-ninth legislative assembly of the state of Montana changed MSC's name to Montana State University.

Today, Montana State University Bozeman has a national and international reputation for its excellence in undergraduate and graduate education in the liberal arts and sciences, agriculture, architecture, education, engineering, health and human development, and nursing. It is routinely listed by U.S. News and World Report as one of America's "best buys" for undergraduate education and ranks among the leaders in the number of Goldwater Scholarship recipients. It is an institution committed to making history by better positioning today's students for meaningful lives in the globalizing economy of the 21st century.

Taylor Hall, the first building on campus, completed in 1894 *(attributed to Helena, Montana Architect Charles S. Haire)*.

[1] http://www.montana.edu/msuhistory/index.html; accesses 10/21/2015.

Understanding past planning efforts, and the visions, goals, and objectives presented through those efforts, are important to this planning process. After review of several past and on-going planning efforts on campus, a vision for this TMP is articulated as follows: to seek improved functionality, efficiency, compatibility, and form within MSU's transportation and parking system. To complement this vision, a number of specific goals have emerged as priorities to guide MSU's physical development over the next 10 years:

- Goal 1: Enhance mobility for MSU's employees, faculty, students, and visitors.
- Goal 2: Protect existing parking facility investments, and identify future parking needs based on projected demands.
- Goal 3: Improve multi-modal connectivity between the campus and off-campus destinations.
- Goal 4: Reduce the number of single occupant vehicles on and around campus.

A summary of past and on-going planning efforts on campus pertinent to transportation and parking is contained in the following section.

1.2. On-going and Past Planning Efforts

The following reports represent the most relevant planning efforts made by MSU over the previous decade.

1.2.1. Bicycle Master Plan 2015

The Bicycle Master Plan (BMP) was developed to improve bicycle mobility and encourage greater use at MSU. The planning effort began in November, 2014 and a final BMP report was issued in January 2017. The BMP is intended to guide the future development, design, education, and implementation of all bicycle activity on the MSU campus by providing attainable objectives for MSU over the coming years and methods of measuring performance in terms of completing those objectives.

This Bicycle Master Plan is firmly rooted in the reality that MSU has faced and will continue to face physical, social, and monetary challenges to maximizing bicycling as a mode of transportation. However, MSU bicycle leaders and advocates are confident that these challenges are not insurmountable and that with the guidance contained in the Master Plan and the enthusiasm of students, faculty and staff on campus, MSU can become a leader among Bicycle Friendly Universities and foster and practice inclusive, safe, and efficient bicycle ridership.

The vision statement of the Bicycle Master Plan outlines the bicycle policies, physical network, and supporting programs that MSU would like to see achieved. The vision statement for the Bicycle Master Plan is as follows:[2]

> *Montana State University will create a campus environment where bicycling is a safe, convenient, and comfortable transportation option for students, faculty, staff, and visitors. The University will be a leader in setting policy, developing programs, encouraging respectful riding, and improving infrastructure to encourage bicycling to, from, and within the MSU campus.*

Goals and objectives to support MSU's overall mission and help guide the implementation of future bicycle facilities and programs were established. Goals and objectives aid in directing resource allocation, program operation, and project prioritization. The goals and objectives developed for the Bicycle Master Plan are organized into five categories known as the Five E's, and have been identified by the League of American Bicyclists as the essential elements consistent in making a place great for bicycling. These goals and objectives are listed in **Table 1.1**.

Table 1.1: MSU Bicycle Plan Goals and Objectives

Goals	Objectives
Provide a safe, efficient, and well-connected network of bicycle facilities and accommodations on campus. **(Engineering)**	• Implement the recommended improvements for bicycle and pedestrian facilities on campus. These recommendations will be utilized for all University projects and programs within a year of bicycle master plan adoption. • Develop and install consistent campus bikeway signage (to increase awareness of bicyclists on campus). • Provide convenient, covered, and secure bicycle parking at focal points on campus, such as parking areas, residence halls, academic buildings, and other campus use areas. • Evaluate repositioning existing bicycle racks on an annual basis, or as needed, to promote most efficient use. • Address the top three major hazards and barriers to bicycling within two years of adoption of the plan. • Reduce the number of over-capacity bike racks.

[2] MSU Bicycle Master Plan, 2015, Alta Planning + Design.

Goals	Objectives
Implement comprehensive bicycle education programs targeted at students, faculty, and staff. **(Education)**	• Incorporate bicycling and bike culture (safety, programs, rules of the road) into new student and employee orientation programs in order to reach incoming students, faculty, and staff. • Develop education and outreach programs. • Educate MSU campus community regarding safe motor vehicle operation around bicycles. • Offer bicycle maintenance program. • Provide education on rack usage and locking. • Provide city - or campus - oriented bicycle map online and in hard copy form. • Coordinate with nearby agencies and groups on annual bicycle events such as “Bike/Walk to Work Day,” “Bike/Walk to School Day,” and bicycle safety courses. • Integrate bicycle education into appropriate curriculums.
Promote the use of bicycles as transportation for students, faculty, staff, and visitors. **(Encouragement)**	• Develop programs that encourage off-campus students, faculty, staff, and visitors to bike. Develop programs that encourage campus residents (students, faculty, and staff) to bike. • Implement a bicycle mentorship program. • Provide incentives and support facilities for individuals who commute by bicycle. • Promote bicycling at MSU sponsored events. • Increase the number of bikes available for rent on campus. • Promote recreational biking. • Enhance integration of bicycling with other modes of transportation for travel to and from campus. • Develop and promote online information sources for bicycle transportation and recreation.
Establish positive campus enforcement program for bicycling behavior and bicycle parking. **(Enforcement)**	• Review, revise, and enforce the “MSU Police Department Bicycle Regulations.” • Appoint a University Police point person to interact with campus cyclists and the Bicycle Task Force. • Increase enforcement of appropriate behavior among drivers, pedestrians, and cyclists on campus. • Establish a protocol for reporting of motorist, bicyclist, and pedestrian infractions. • Encourage and incentivize the proper use of bike parking. • Encourage registration of bicycles on campus. • Review and revise policy on abandoned bicycles. • Establish program(s) to positively reinforce good cycling practices (ex. handing out bike lights, gift certificates, bike locks, or similar incentives.

Goals	Objectives
Ensure implementation of the MSU Bicycle Master Plan and update on an annual basis. **(Evaluation and Planning)**	• Appoint a permanent full-time staff member as Bicycle Program Manager. • Create a sustainable, dedicated source of funding within the annual budget, for bicycle infrastructure and programs. • Establish a formal Bicycle Transportation Committee that makes recommendations to the Parking and Transportation Advisory Committee (PTAC). • Include Bicycle Master Plan in all campus planning, design, and construction activities. • Create a program to regularly conduct research on bicycle usage to more efficiently distribute resources. • Produce an annual report to track, review, and evaluate implementation of the plan and recommend updates. • Develop prioritization process for implementation of projects and programs recommended in the master plan. • Annual application to the League of American Bicyclists for evaluation to determine level of bicycle friendly University accomplishment.

1.2.2. Parking Services Business Plan (FY 14-15)

The Parking Services Business Plan is prepared every other year by the Police Department's Parking Services Unit. University system parking operations are required by state statute to function as independent, non-state funded, self-sustaining business entities.[3] All costs associated with the development, management, operations, and maintenance of the Parking Enterprise and parking facilities must be covered by revenue generated through user fees and enforcement fines.

The Business Plan articulates the "parking triangle" concept. The parking triangle concept suggest that the effective overall management of parking services requires a responsible balance of three competing interests: convenience, cost, and quantity. The more that services are skewed toward any one or two of these competing interests, the more glaring the deficiencies will become in the remaining interest(s). For example, providing significant quantities of convenient parking can only be achieved at a correspondingly significant cost (e.g., parking structures), or inexpensive parking can be located at an inconvenient distance from the center of campus (Fieldhouse Lot) at less cost to the user. MSU strives to maintain an appropriate balance among these competing interests which results in responsible parking services.

The Business Plan contains the mission statement described on the following page:

[3] Montana Code Annotated (MCA) Title 20, Chapter 25).

The mission of Montana State University-Bozeman Police Department's Parking Services Unit is to provide equitable and quality services and the best possible parking value to the University community. Our mission statement is met by providing

- pleasant and courteous service,
- safe and well-maintained parking facilities,
- enforcement that promotes voluntary compliance with parking regulations,
- efficient and service-oriented sales of parking permits,
- services to stranded motorists,
- parking for special events,
- bicycle parking,
- management of information resources pertaining to parking facilities and parking customers,
- security in and around the parking lots,
- investigation of motor vehicle accidents, and
- proactive planning for future parking needs.

Arising from the Business Plan are a series of overarching principles and goals to guide the Parking Services Unit. These are as follows:

1. It is the goal of the Parking Enterprise to provide safe and well-maintained parking for students, employees, and visitors, and to provide efficient and courteous customer service.
2. The Parking Enterprise should continue to provide parking information and motorist assistance to customers.
3. Effective management of the Parking Enterprise should include proactive participation in long-range planning for campus parking needs, effective parking demand management strategies within the campus boundaries, and consideration for interfacing with public transit as it expands in the community and the region.
4. The Parking Enterprise is required by statute to function as an independent, non-state funded, self-sustaining business entity. All costs associated with the development, management, operations, and maintenance of the Parking Enterprise and facilities must be covered by revenue generated through user fees and enforcement fines.
5. In addition to development, management, operations, and maintenance costs, user fees will also reflect pertinent considerations such as parking/traffic demand strategies, long-range campus development planning issues, alternative modes of transportation, public transit, ADA parking and accessibility requirements, peer/customer survey data, surrounding community issues, etc.

6. It is the goal of the Parking Enterprise to protect the significant investment in parking facilities through a planned program of regular maintenance, repair, resurfacing, and replacement.

As related to the campus master plan:

1. The main campus historic academic core is the anchor for academic, instructional, and student-oriented functions, and will not be displaced, abandoned, or relocated. This campus core will remain pedestrian-oriented with quality, landscaped open spaces and no major surface parking facilities.
2. The restrictive residents-only parking zones surrounding the campus will remain over the long term.
3. South 19th Avenue will continue to be a major community arterial and vehicular access route to campus.
4. South 11th Avenue routes city traffic through the main campus academic area and will continue to do so into the future.
5. Kagy Boulevard separates the Stadium/Museum properties from the main campus and will continue to do so into the future. Kagy is also likely to be widened to full traffic configuration by the year 2020 or before.
6. On-campus housing provides certain intrinsic characteristics that are not available to private-sector housing in the surrounding community. MSU will continue to provide about the same amount of housing for students over time.
7. MSU cannot afford to continue to provide an ever-increasing amount of parking near the campus core. With approximately only two potential users per available parking space (in comparison to our peer average of about three potential users per available parking space), MSU should employ demand management strategies to align parking inventory with peer institutions and to encourage evolving alternative modes of transportation
8. Public transit will continue to develop in the future and will serve a series of strategic destinations at MSU.
9. MSU will continue to encourage use of alternative modes of transportation, e.g., bicycling, public transit, carpooling, etc.
10. If future building projects displace existing parking facilities, the value of the investment in the parking assets must be considered in each building project in order to avoid imposing replacement costs on the parking enterprise customers inappropriately. Parking Services will recover the value of parking lost to the construction project.
11. Increased consolidation of parking lots into multi-story parking structures will best support future development as the campus becomes a more urban environment.
12. While actual planning outcomes may be seasoned by financial realities, planning outcomes will not be abandoned to financial expediencies alone.
13. Campus service drive areas are currently insufficient to accommodate the full range of service demands to include short term parking, service vehicle access, staging, deliveries, etc. Future planning and construction of service areas must consider and accommodate all uses.

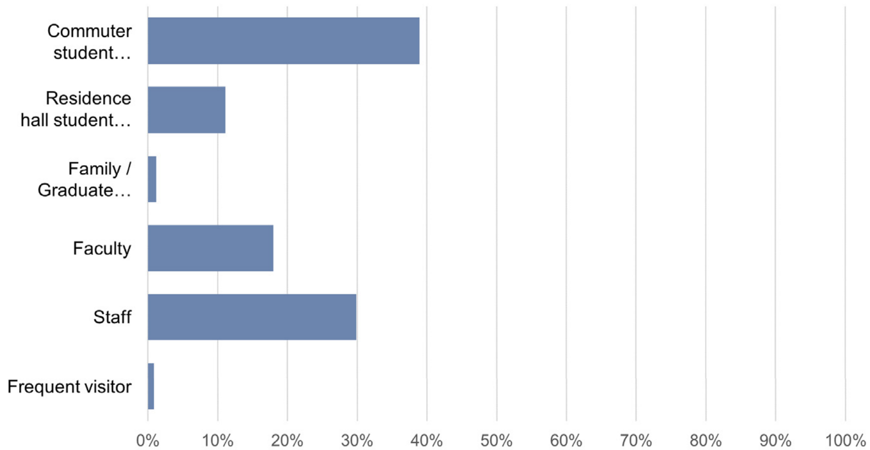
14. It is both desirable and achievable to connect MSU's circulation networks to those in the surrounding community, e.g., vehicular, bicycle, pedestrian trails, etc.
15. The University has chosen to use parking lots for staging construction materials. Parking Services will recover the costs lost to the enterprise from the loss of these parking spaces.

1.2.3. Parking Survey (2016)

The MSU Police Department's Parking Services Unit develops and administers a variety of surveys to gage perception and query proposal for parking on the MSU campus. In 2016, a comprehensive survey was developed that consisted of 27 questions geared towards gathering data on parking at MSU. The survey, although not statistically valid, does provide a snapshot on current conditions and thinking regarding parking items of concern. Four of the most pertinent survey questions and corresponding responses touch on where people live (Question 1), how far they commute (Question 3), how often they park on campus (Question 4), and what they would like to see occur if parking permit prices were raised an additional $10 over that which they cost now (Question 27). The results of the four questions are shown on the following pages.

Question 1:

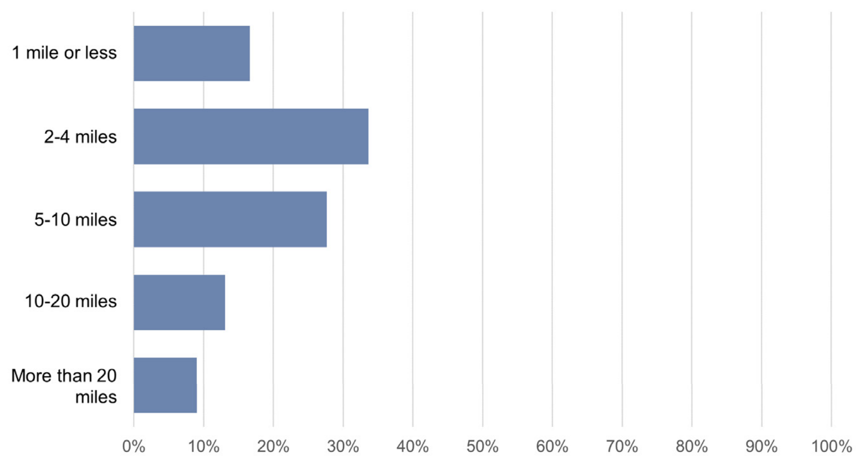
Are you:



Answer Choices	Responses	
Commuter student (live off campus)	38.93%	262
Residence Hall student	11.14%	75
Family / Graduate housing resident	1.19%	8
Faculty	17.98%	121
Staff	29.87%	201
Frequent visitor	0.89%	6
Total		673

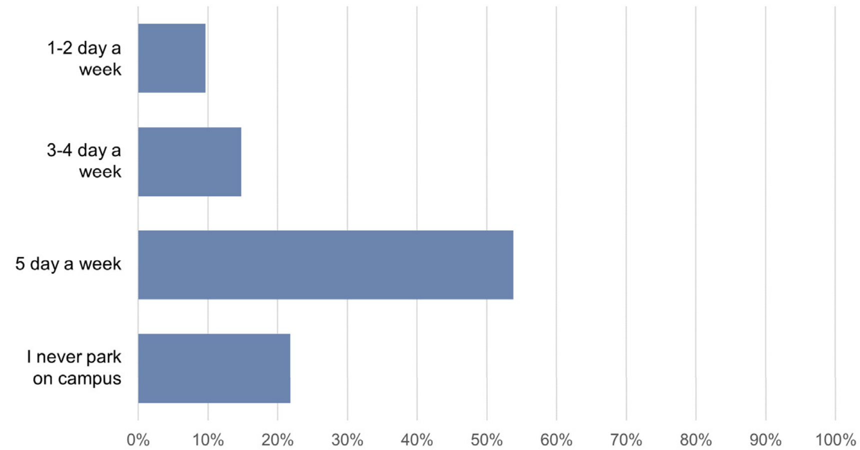
Question 3:

How Far do you live from campus?



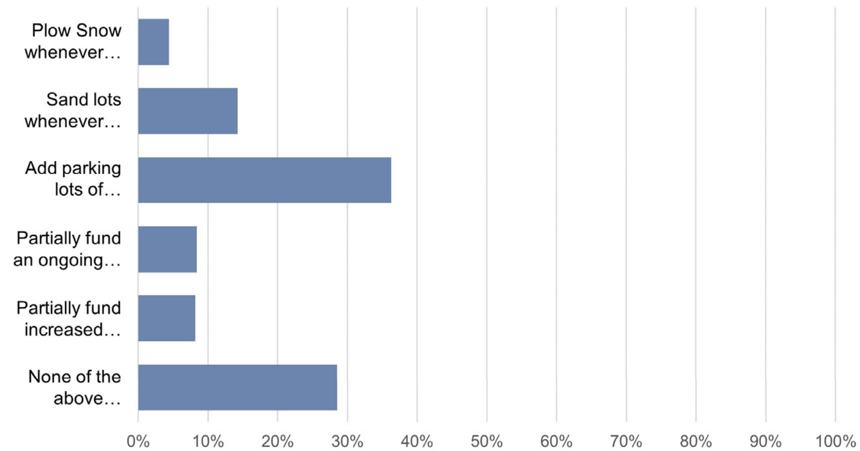
Answer Choices	Responses	
1 mile or less	16.64%	98
2-4 miles	33.62%	198
5-10 miles	27.67%	163
10-20 miles	13.07%	77
More than 20 miles	9.00%	53
Total		*589*

Question 4:
On average, how often do you park a motor vehicle on campus during the fall and spring semesters?



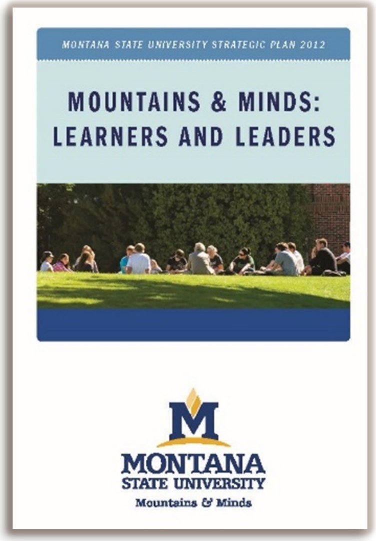
Answer Choices	Responses	
1-2 day a week	9.62%	64
3-4 days a week	14.74%	98
5 days a week	53.83%	358
I never park on campus	21.80%	145
Total		*665*

Question 27:
Parking services at MSU is self-funded; all expenses are funded through permit fees and citation fines. If Parking Services charged $10 more per permit per year, we could fund additional activities. Which one of the following is most important to you?



Answer Choices	Responses	
Plow snow whenever accumulations reach 1 inch (we currently plow when accumulation is 2 inches or more).	4.40%	21
Sand lots whenever a slippery surface forms and dispose of the sand at the end of winter. Lots would be plowed with same frequency as they are now.	14.26%	68
Add Parking lots of approximately 200 spaces every 4-5 years.	36.27%	173
Partially fund an ongoing program to improve bike lanes, bike parking, or otherwise incentivize bike ridership, which may decrease parking demand.	8.39%	40
Partially fund increased Streamline bus service frequency which may decrease parking demand.	8.18%	*39*
None of the above; keep my permit price the same.	28.51%	*136*
Total		*477*

1.2.4. Strategic Plan 2012



The MSU Strategic Plan was adopted in 2012 and is monitored on a yearly basis through development of progress reports and other means. The Strategic Plan sets overarching goals for MSU, and is intended to guide and inform those making strategic decisions. Implementation goals and strategies are crafted around six themes as follows:

- Learning
- Discovery
- Engagement
- Integration
- Access
- Stewardship

In terms of the Strategic Plans' influence on the TMP, the single biggest topic relates to foreseeable growth of campus in terms of student, faculty, and staff numbers. As the existing and projected conditions analysis is prepared, campus enrollment and employment feed directly into parking and transportation demand. Knowing how the campus population is intended to grow influences parking policy, transportation infrastructure, and demand management strategies for both. To that end, it isn't necessary to know specific locations of new or expanded building facilities, but overall growth rates for student, faculty, and staff will establish much needed information to understand the future demands within the TMP framework. Goals, objectives, and metrics relative to this growth are found most directly under the "Access" theme; those most applicable to this planning effort are described as:

"Access" Goal: Montana State University is committed to widening access to higher education and ensuring equality of opportunity for all.

Objective A.1: Educate more students while maintaining the quality of programs.

Metric A.1.1: By 2019, the number of Montana undergraduate students enrolled will surpass 9,900 (a 15 percent increase).

Metric A.1.2: By 2019, the number of new transfer enrollments will increase 15 percent to approximately 1,100.

Metric A.1.3: By 2019, the number of students enrolled in graduate programs will increase 20 percent to approximately 2,350.

Metric A.1.5: By 2019, the number of students enrolled in Gallatin College degree and certificate programs will double to 400.

Metric A.1.7: By 2019, the total student population will increase 15 percent to 16,000.

In general terms, the Strategic Plan recognizes a future growth rate of 15 percent over the horizon of the Plan (year 2019; Metric A.1.7). This growth rate must be revisited to assess whether it is desirable and achievable over the planning horizon of the TMP (10 years, or year 2025). A nice feature of each annual Progress Report is the presentation of headcounts for students, faculty, and staff. **Table 1.2** depicts these headcounts for the period of 2012-2014 (3 years)[4]. Additionally, this has been supplemented with Fall 2015 student enrollment numbers.

Table 1.2: Campus Population Data (2012 – 2015)

	2012	2013	2014	2015[5]
Undergraduate Headcount Enrollment	12,772	13,264	13,371	13,707
Graduate Headcount Enrollment	1,888	2,030	2,050	1,981
Student Enrollment (Sub-total)	14,660	15,294	15,421	15,688
Full-time Faculty	580	549	569	790
Part-time Faculty	337	375	391	432
Student to Faculty Ratio	17:1	19:1	19:1	N/A†
Full-time Employees, including Faculty	2,334	2,251	2,321	2,334
Part-time Employees, including Faculty	720	742	771	753
Total (Faculty, staff and students) *	17,714	18,287	18,513	19,997

** Total includes student enrollment and full- and part-time employees (including faculty); excluding graduate assistants*
† Fall 2015 student-to-faculty ratio not available online

[4] Strategic Plan Progress Reports (2013, 2014 and 2015); accessed on 10/21/2015; http://www.montana.edu/strategicplan/
[5] Fall 2015 student enrollment accessed on 01/22/2016; http://www.montana.edu/opa/facts/quick.html

1.2.5. Landscape Master Plan (February 2012)

The purpose of the MSU Landscape Master Plan (LMP) is to provide a framework for planning, design, development, and maintenance of the exterior spaces of the MSU campus that is fully grounded in physical realities, maintenance, and budgetary constraints.[6]

The LMP was developed as a companion plan of the Long Range Campus Development Plan (LRCDP), which MSU adopted in 2009. The open planning process of the LRCDP and collaborative culture continued with the planning and production of the LMP. The LMP serves as the framework for enhancing outdoor spaces of campus in alignment with the planning principles of the LRCDP.

The LMP strives to establish the synergy between land uses, site development and landscape enhancements, and the success of the university as a whole. Following the analysis of the programmatic needs of the university, assessment of the existing conditions, and aligning the plan with the LRCDP, a series of goals were established. These goals serve as a framework for the intentional improvement and orderly expansion of campus. The goals describe the larger philosophical ideals of the LMP while the recommendations offer definitive ways to achieve those goals. The overarching goals presented in the LMP are as noted below:

Goal 1: Uphold the university's mission.

Goal 2: Preserve and improve the campus image.

Goal 3: Uphold good stewardship of historic, natural, and fiscal resources.

Goal 4: Create a distinctive campus landscape character that acknowledges the university's land-grant heritage and dynamic future.

Goal 5: Develop the physical environment of the university with sensitivity, sustainable resource use, and long term viability.

Goal 6: Foster a positive relationship with the surrounding community.

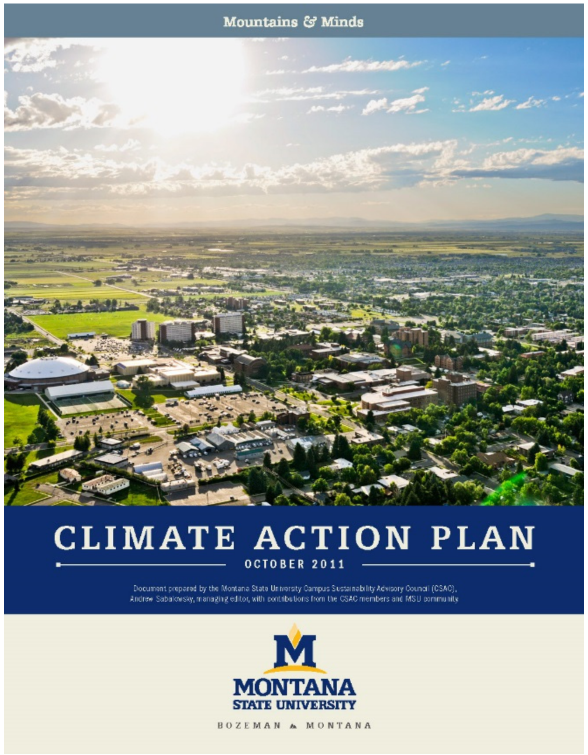
[6] MSU Landscape Master Plan (LMP), February 2012.

Both the LMP and LRCDP stress that a successful transportation network "is multi-modal, convenient, easily understood and interpreted, interconnected, and accessible." MSU has been working diligently to improve its transportation network in recent years.

The major improvements that have enhanced circulation included working with the city to provide upgraded paving and utility connections on the northeast end of campus and creating a Main Street to campus connection from the west. In addition, the pending wayfinding and signage plans will further delineate campus from the rest of the community and will add positively to the interpretation of the vehicular routes through campus.

Transportation and circulation on campus needs to be improved to provide efficient and safe vehicular and pedestrian routes that interconnect the districts and neighborhoods while providing access for all users. It must also be easy to locate and navigate to, especially for users with accessibility concerns.

1.2.6. Climate Action Control Plan (October 2011)



The Climate Action Plan (CAP) was prepared in October 2011 by the Montana State University Campus Sustainability Advisory Council to document its efforts to reduce campus greenhouse gas emissions and comply with the American College and University Presidents Climate Commitment. The document proposes campus-wide operational, curriculum, research, and civic engagement initiatives that integrate sustainability.

The CAP describes the results of a 2009 greenhouse gas emission baseline audit that found that transportation—including campus vehicle fleets, commuting, and air travel—comprise 38 percent of MSU's net emissions. Recommendations made to reduce commuter emissions included:

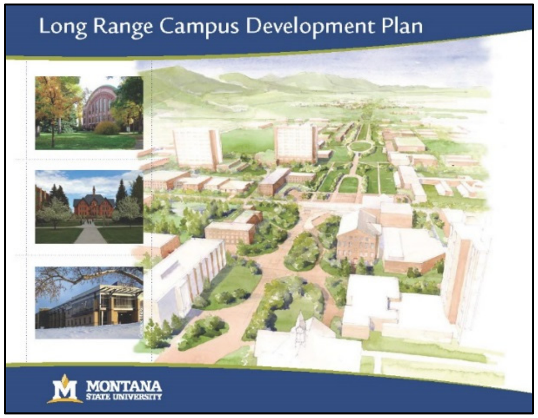
- Additional online courses,
- Increased parking fees,
- Subsidized public transportation passes,
- Priority parking for carpools,
- Restriction of student cars and parking to upperclassmen,
- Installation of more bike racks and bike paths,
- Education about impact of commuter choices on carbon emissions,
- Subsidized on-campus housing, and
- Conversion of parking lots to green space.

A detailed transportation report is included as Appendix 3 to the CAP and was prepared by the Western Transportation Institute. Recommendations applicable to the TMP planning effort include:

- Providing covered bike parking and bike lockers for commuters;
- Collaborating with the City of Bozeman to improve bicycle infrastructure;
- Implementing an education program, including safety and cold-weather training;
- Distributing maps and lights;
- Participating in bike to work events;
- Increasing bike to transit connections;
- Integrating bicycling into campus parking and transportation plans;
- Starting a bike share program; and
- Increasing safety by enforcement of speed limits.

The recommendations emphasize integrating campus improvements with the City of Bozeman's infrastructure updates and taking advantage of city-wide education and encouragement programs.

1.2.7. Long Range Campus Development Plan (December 2008)



The primary purpose of the long range campus planning effort was to establish a shared vision for the physical development of the campus environment that is comprehensive, creative, useful, and most importantly, inspiring.[7] Successful comprehensive planning recognizes attributes that create the area's unique sense of place and formulates guiding principles and goals to protect physical assets and accomplish the expectations of the university's mission.

The process of formalizing a long term shared vision fit into the emerging culture of planning at MSU. Individuals throughout the campus and local community were engaged in open-forum planning of the future campus. Throughout the participatory process, stakeholders transformed their sense of ownership into ideas that shaped stewardship of the final plan. Inclusive planning efforts that culminate in an adopted formal development plan ensures that the physical development of the campus will be guided by a set of wide-ranging principles that are aligned with the priority interests of

[7] MSU Long Range Campus Development Plan (LRCDP), December 2008.

academic, research, and service missions. The Plan helps guide campus growth and future decisions related to the physical environment of the campus.

MSU continuously changes, which necessitates renovation and adaptation of existing facilities as well as planning new facilities while maintaining the architectural character of the campus, embracing historic elements, and preparing for technological innovations and demands. It is a tool to achieve a successful balance between preservation and the need to accommodate growth and maintain the desirable quality of life on campus.

The Plan identifies potential building sites that promote rational build-out of the core campus while preserving critical open space. The building sites suggest building orientation for connectivity, as well as views and proximate parking. The Plan illustrates the alternatives the university has for future use of its land and facilities.

Planning principles, goals, and objectives were crafted as part of this planning effort. Appropriate to the TMP, goals and objectives were established for both circulation (**Table 1.3**) and parking (**Table 1.4**).

Table 1.3: "Circulation" Goals from LRCDP

Premise	Goals
The campus core is pedestrian-oriented.	Limit vehicle intrusion into the campus core and retain and protect the pedestrian-oriented circulation. Provide safe access choices for pedestrians as well as motorized and non-motorized vehicle use. Actively employ parking demand management techniques to encourage alternative modes of transportation. Provide service corridors and service access to all buildings.

Table 1.4: "Parking" Goals from LRCDP

Premise	Goals	Status
The university has the second-highest ratio of parking spaces among its peer institutions group. The university cannot continue to provide an ever-increasing amount of parking. The parking-space-per-FTE ratio will decline over the next 25 years.	Increase alternative modes of transportation using the University's FTEs and pertinent ratios. Plan, site, and construct parking facilities to accommodate future university needs, which include collaborative and enterprise zone uses. Continue to encourage bicycle use as part of traffic and parking demand management.	There has been a concerted effort to meet these goals. A Director of Sustainability position was created to further development of alternative transportation, and in 2015 MSU prepared its first ever Bicycle Master Plan. Parking expansion has occurred as needed with a new parking structure at the corner of South 7th Avenue and Grant Street, and development of new surface lots such as the Bison Lot and the East Fieldhouse Lot.
Public transit will develop significantly over the next 25 years.	Integrate public transit to serve a series of strategic university destinations serving all areas of the campus.	Minor progress has been made with service provided to MSU with transferring at the SUB south entrance. There is great potential for expanded transit and shuttling options as described in section 6.0 of this Plan.
Traffic travels along South 11th Avenue through the campus academic area. This situation will continue to present special challenges to the expansion of the campus pedestrian network west of South 11th Avenue.	Develop traffic calming measures to improve pedestrian safety.	This has not been achieved in that South 11th Avenue is a relatively traffic oriented roadway with little improvement for pedestrians other than signage and crosswalk marking. Traditional traffic calming (i.e. curb bulb-outs, raised intersections, etc.) will not be achievable without compromising bicycle movement unless the roadway prism is expanded.
Kagy Boulevard separates the Stadium and Museum of the Rockies properties from the core campus. Kagy Boulevard will likely be widened to its full traffic configuration in the next 25 years.	Use pedestrian corridors, continuous landscaping, and shared parking to integrate university facilities south of Kagy Boulevard into the campus fabric.	Modest progress has been made to link facilities south of Kagy Boulevard to the main campus in terms of pedestrian crossings with Rapid Rectangular Flashing Beacons (RRFBs) and signalization at South 11th Avenue. A major reconstruction project of Kagy Boulevard is the City's number one priority for its urban routes, but the project is underfunded and has been removed as a "committed" project in the foreseeable future.

Premise	Goals	Status
The arterial character of South 19th Avenue represents a significant challenge to the westward growth of the campus and connectivity between the east and west elements of the university's properties. Portions of South 19th Avenue will be widened to five lanes and will continue to carry an increasing amount of traffic over the next 25 years. This situation will continue to present special challenges and require unique solutions to accommodate the expanding campus pedestrian network west of South 19th Avenue.	Connect the University's circulation networks (vehicle, bicycle lanes, pedestrian trails, etc.) to similar networks within the surrounding community.	South 19th Avenue from College Street to south of Kagy Boulevard has been reconstructed to a five-lane principal arterial configuration. While there are traffic signals at two locations (Garfield Street and College Street), much work needs to be done to connect existing and future campus areas east and west of South 19th Avenue. The 2015 Bicycle Master Plan contains non-motorized recommendations to provide for active transportation across and along S. 19th Ave.
The intersection of South 19th Avenue and College Street is becoming more congested. Planned improvements of the intersection will relieve some congestion and accommodate a greater traffic volume. The intersection also will become increasingly important as a regional and local arrival point, or gateway, to the university.	Develop the South 19th Avenue and College Street intersection as a distinct campus gateway, creating a sense of arrival that is inviting, significant, and well defined.	Improvements have been made to the intersection as part of the College Street and the South 19th Avenue reconstruction projects. Some debate whether the intersection truly serves as a "distinct campus gateway" and there could be more work envisioned at the intersection in terms of aesthetics and wayfinding.
The university granted an easement to the City of Bozeman for underground city infrastructure along the future route of Fowler Avenue. It is highly probable that Fowler Avenue will be constructed through the university's property (agricultural land) in the next 25 years.	Coordinate with the City of Bozeman and Montana Department of Transportation on any infrastructure through university property to ensure that MSU's needs are met.	Both this Plan and the City's Transportation Master Plan envision a future north – south connection for Fowler Avenue.
Existing campus service drive areas are insufficient and must be improved.	Construct adequate service drive, loading and temporary parking areas for service access to existing and new campus facilities.	This is ongoing and facilities to access existing and new buildings on campus are always being evaluated.

Contained in the LRCDP was a future vision for campus expansion over a 25-year build-out program. The vision map included areas of new and/or expanded buildings, agricultural lands, open space and other teaching facilities. **Figure 1.1** shows the extended long-term vision shown in the LRCDP.

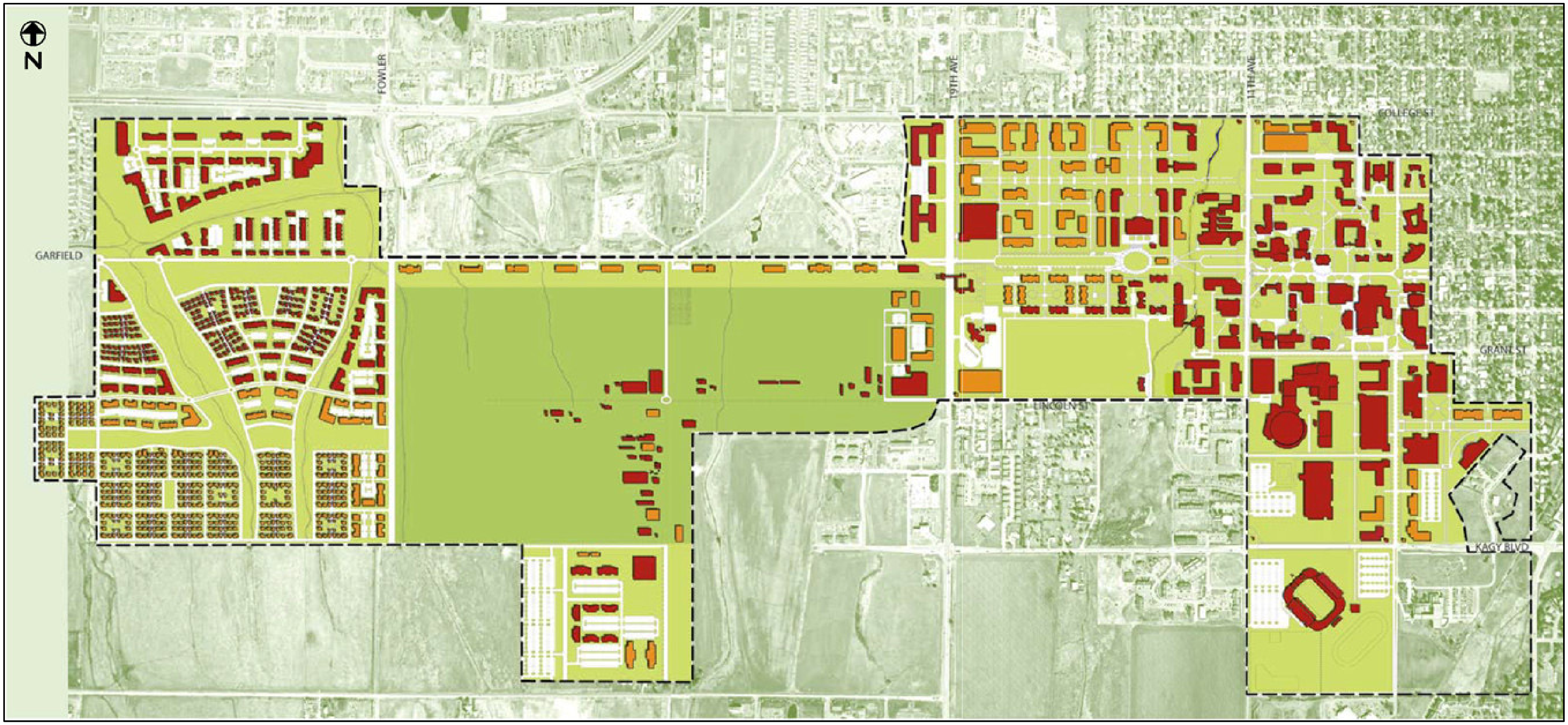


Figure 1.1: Long Term Vision from LRCDP

1.2.8. Goals for this Plan

Based on a review of prior, relevant planning efforts for MSU relative to transportation, parking, and mobility, the following **vision** has been developed:

> To seek improved functionality, efficiency, compatibility, and form within MSU's transportation and parking system.

Proposed **goals** have been crafted to complement this vision and should emerge as priorities to guide MSU's physical development over the 10 year planning horizon:

Goals

- Goal 1: Enhance mobility for MSU's employees, faculty, students, and visitors.
- Goal 2: Protect existing parking facility investments and identify future parking needs based on projected demands.
- Goal 3: Improve multi-modal connectivity between the campus and off-campus destinations.
- Goal 4: Reduce the number of single occupant vehicles on and around campus.

Objectives that have been identified to align with each transportation and parking goal are shown in **Table 1.5**.

Table 1.5: MSU Transportation & Parking Goals and Objectives

Goals	Objectives
Goal 1: Enhance mobility for MSU's employees, faculty, students, and visitors.	**Engineering** 1.1 Implement the recommended improvements for bicycle and pedestrian facilities on campus as identified in the MSU Bicycle Master Plan. **(BMP)** 1.2 Address top three major hazard and barriers to bicycling within two years. **(BMP)** 1.3 Limit vehicle intrusion into the campus core and retain and protect the pedestrian-oriented circulation. **(LRCDP)** 1.4 Provide safe access choices for pedestrians as well as motorized and non-motorized vehicle use. **(LRCDP)** 1.5 Provide service corridors and service access to all buildings. **(LRCDP)** 1.6 Construct adequate service drive, loading, and temporary parking areas for service access to existing and new campus facilities. **(LRCDP)** 1.7 The main campus historic academic core is the anchor for academic, instructional, and student-oriented functions and will not be displaced, abandoned, or relocated. This campus core will remain pedestrian-oriented with quality, landscaped open spaces and no major surface parking facilities. **(PSBP)** 1.8 Enhance integration of bicycling with other modes of transportation for travel to and from campus. **(BMP)** **Education** 1.9 Incorporate bicycling into the new student and employee orientation program in order to reach all incoming students, faculty, and staff. **(BMP)** 1.10 Integrate bicycle education into the curriculum. **(BMP)** **Encouragement** 1.11 MSU will continue to encourage use of alternative modes of transportation, e.g., bicycling, public transit, carpooling, etc. **(PSBP)** 1.12 Develop programs that encourage commuting students, faculty, staff, and visitors to bike. **(BMP)** 1.13 Develop programs that encourage campus residents (students, faculty, and staff) to bike. **(BMP)** 1.14 Promote bicycling at MSU sponsored events. **(BMP)** 1.15 Increase the number of bikes available for rent on campus. **(BMP)**

Goals	Objectives
	1.16 Promote recreational biking. **(BMP)** **<u>Enforcement</u>** 1.17 Review, revise, and enforce the "MSU Police Department Bicycle Regulations." **(BMP)** 1.18 Appoint a University Police point person to interact with campus cyclists and the Bicycle Task Force. **(BMP)** 1.19 Increase enforcement of appropriate behavior among drivers, pedestrians, and cyclists on campus. **(BMP)** 1.20 Establish a protocol for reporting of motorist, bicyclist, and pedestrian infractions. **(BMP)** 1.21 Encourage registration of bicycles on campus. **(BMP)** 1.22 Review and revise policy on abandoned bicycles. **(BMP)**
Goals 2: Protect existing parking facility investments and identify future parking needs and locations based on projected demands.	**<u>Engineering</u>** 2.1 Provide convenient, covered, and secure bicycle parking at focal points on campus, such as parking areas, residence halls, academic buildings, and other campus use areas. **(BMP)** 2.2 Reposition existing bicycle racks on an annual basis to promote most efficient use. **(BMP)** 2.3 Reduce the number of over-capacity bike racks. **(BMP)** 2.4 Plan, site, and construct parking facilities to accommodate future university needs, which include collaborative and enterprise zone uses. **(LRCDP)** 2.5 Provide safe and well-maintained parking for students, employees, and visitors and provide efficient and courteous customer service. **(PBP)** 2.6 Participate in long-range planning for campus parking needs, effective parking demand management strategies within the campus boundaries, and consideration for interfacing with public transit as it expands in the community and the region. **(PSBP)** 2.7 Protect the significant investment in parking facilities through a planned program of regular maintenance, repair, resurfacing, and replacement. **(PSBP)** 2.8 The restrictive residents-only parking zones surrounding the campus will remain over the long term. **(PSBP)** 2.9 Increased consolidation of parking lots into multi-story parking structures will best support future development as the campus becomes a more urban environment. **(PSBP)** 2.10 Campus service drive areas are currently insufficient to accommodate the full range of service demands, including short term parking, service vehicle access, staging, deliveries, etc. Future planning and construction of service areas must consider and accommodate all uses. **(PSBP)**
Goal 3: Improve multi-modal connectivity between the campus and off-campus destinations.	**<u>Engineering</u>** 3.1 Develop and install consistent campus bikeway signage to increase awareness of bicyclists on campus. **(BMP)** 3.2 Connect the University's circulation networks (vehicle, bicycle lanes, pedestrian trails, etc.) to similar networks within the surrounding community. **(LRCDP)** 3.3 Coordinate with the City of Bozeman and Montana Department of Transportation on any infrastructure through university property to ensure that MSU's needs are met. **(LRCDP)**
Goal 4: Reduce the number of single	**<u>Engineering</u>** 4.1 Actively employ parking demand management techniques to encourage alternative modes of transportation. **(LRCDP)** 4.2 Develop traffic calming measures to improve pedestrian safety. **(LRCDP)**

Goals	Objectives
occupant vehicles on and around campus.	4.3 Use pedestrian corridors, continuous landscaping, and shared parking to integrate university facilities south of Kagy Boulevard into the campus fabric. **(LRCDP)** 4.4 MSU cannot afford to continue to provide an ever-increasing amount of parking near the campus core. With approximately only two potential users per available parking space (in comparison to our peer average of about three potential users per available parking space), MSU should employ demand management strategies to align parking inventory with peer institutions and to encourage evolving alternative modes of transportation. **(PSBP)** **<u>Education</u>** 4.5 Develop education and outreach programs. **(BMP)** 4.6 Provide education on rack usage and locking. **(BMP)** 4.7 Provide city-or campus-oriented bicycle map online and in hard copy form. **(BMP)** 4.8 Coordinate with nearby agencies and groups on annual bicycle events such as "Bike/Walk to Work Day," "Bike/Walk to School Day," and bicycle safety courses. **(BMP)** 4.9 Integrate public transit to serve a series of strategic university destinations serving all areas of the campus. **(LRCDP)** 4.10 Develop and promote online information sources for bicycle transportation and recreation. **(BMP)** 4.11 Educate MSU affiliates regarding safe motor vehicle operation around bicycles. **(BMP)** **<u>Encouragement</u>** 4.12 Offer bicycle maintenance program through MSU Outdoor Recreation. **(BMP)** 4.13 Increase alternative modes of transportation using the University's FTEs and pertinent ratios. **(LRCDP)** 4.14 Continue to encourage bicycle use as part of traffic and parking demand management. **(LRCDP)** 4.15 Implement a bicycle mentorship program. **(BMP)** 4.16 Provide incentives and support facilities for individuals who commute by bicycle. **(BMP)** 4.17 Establish program(s) to positively reinforce good cycling practices by handing out bike lights, gift certificates, bike locks, or similar incentives. **(BMP)** 4.18 Encourage and incentivize the proper use of bike parking, to include bike locks to prevent theft. **(BMP)**

Note: Acronyms after the objective refer to the existing MSU planning document within it was found. In some cases wording has been modified to more effectively convey an objective statement. Refer to page ii - Abbreviations/Acronyms - for acronym key.

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2.0. CONTEXT

Since the founding of the Agricultural College of the State of Montana (later renamed to Montana College and later Montana State University) in 1893, Bozeman and MSU have influenced one another. From its rural beginnings, Bozeman has grown into a semi-urban city with a population of approximately 40,000 people. Similarly, MSU has grown from 46 students in 1893 to 15,688 students in 2015. As the nature of the greater Bozeman area has shifted from agricultural to a more diverse economy, so has the nature of MSU which offers a broad range of degree programs from engineering to fine arts and more. The transportation network of both Bozeman and MSU have grown and adapted based on the ever changing transportation demands of the area.

Situated on the southern end of Bozeman, MSU attracts traffic that uses multiple roadways to access to a variety of destinations on campus. **Figure 2.1** presents a map showing the major street network of Bozeman along with the location of the MSU campus. In addition to vehicular traffic, other travel modes are able to access campus via shared-use paths, sidewalks, on-street bike lanes, and transit. Transit service to MSU is provided by the Streamline bus system and is fare free for all users. Further in-depth discussion of the Streamline system can be found in **Section 3.2.5**.

The core area of MSU encompasses approximately 90 acres and is pedestrian centric in nature. Many of the on-campus parking lots are within a five to 10 minute walk of the core area. Campus is bisected by two main roadways, Grant Street and South 11th Avenue. A large portion of on-campus housing is located on the west side of South 11th Avenue, while the core of campus is primarily on the east side. Similarly, a large portion of on-campus parking is south of Grant Street and the core of campus is on the north side. As a result, the potential for pedestrian-vehicle conflicts is high on these two roadways. However, there are many opportunities to improve pedestrian accommodations on campus.

Vehicle traffic around campus is made up of commuters traveling to both the university and other non-university destinations. This combination of traffic results in congestion during peak hours. The interface between campus and the city presents many challenges to both city and MSU planners. As such, it is possible to establish mutually beneficial recommendations to alleviate traffic congestion.

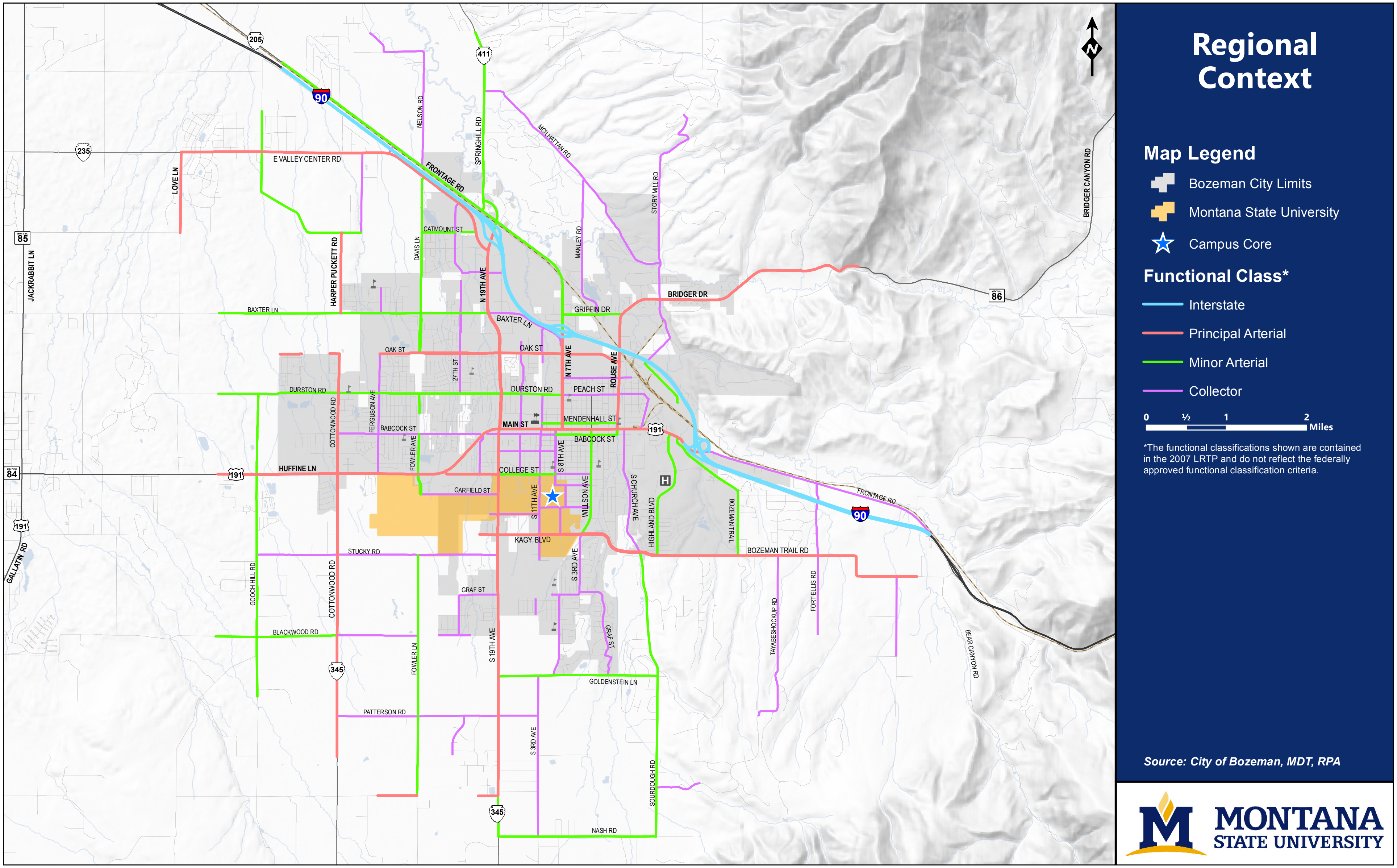


Figure 2.1: Regional Context

3.0. EXISTING CONDITIONS ASSESSMENT AND KEY FINDINGS

The existing conditions assessment summarizes important past research, data sources, and new data collected to use throughout the development of the TMP. Existing conditions have been reviewed in the following order:

- Parking,
- Transportation, and
- Transportation demand management.

3.1. Parking

This section of the existing conditions assessment looks at many aspects of campus parking including supply, utilization, permits, pricing strategy and finances, and loading facilities. The current parking ratio on an "enrolled student" basis is approximately 0.41 (i.e. 6,480 spaces divided by 15,688 students). This provision of parking is more generous than the University of Montana (parking ratio of 0.32). As the campus grows in student population, consideration will be given to whether the current parking ratio can be maintained, or if a lower ratio should be provided in conjunction with alternative travel mode strategies.

3.1.1. Parking Location

MSU maintains 25 separate permitted parking lots. Additional visitor, metered, and public parking areas are also available on the campus. **Table 3.1** contains a breakdown of parking permits, the eligibility for such permits, lots that may be used, and the total number of stalls available. As of September 30, 2015, 6,480 parking stalls were available for general use. This figure excludes family and graduate and service vehicle only stalls. **Figure 3.1** shows the locations of all parking areas and the parking reference designations (i.e. SB, E, F, R, etc.).

Table 3.1: Summary of Parking Spaces, by Type

Permit	Eligibility Requirement	Lots that may be used	Number of Stall Campus-wide	Percent of Inventory
SB	Commuting students, faculty, and staff	SB, E, F, FH	2,367	36.5%
E	Students living on-campus	E, F	2,146	33.1%
F	Students living on-campus, commuting students, faculty, and staff	F	1,268	19.6%
R*	Commuting students, faculty, and staff	SB, E, F, FH, R*	346	5.3%
ADA	State issued handicapped parking tag and an F parking permit	SB, E, F, FH	145	0.2%
Hourly	Hourly visitor parking lot		208	0.3%
		Total	**6,480**	**100%**

** Reserved (R) permits are issued for specific lots*

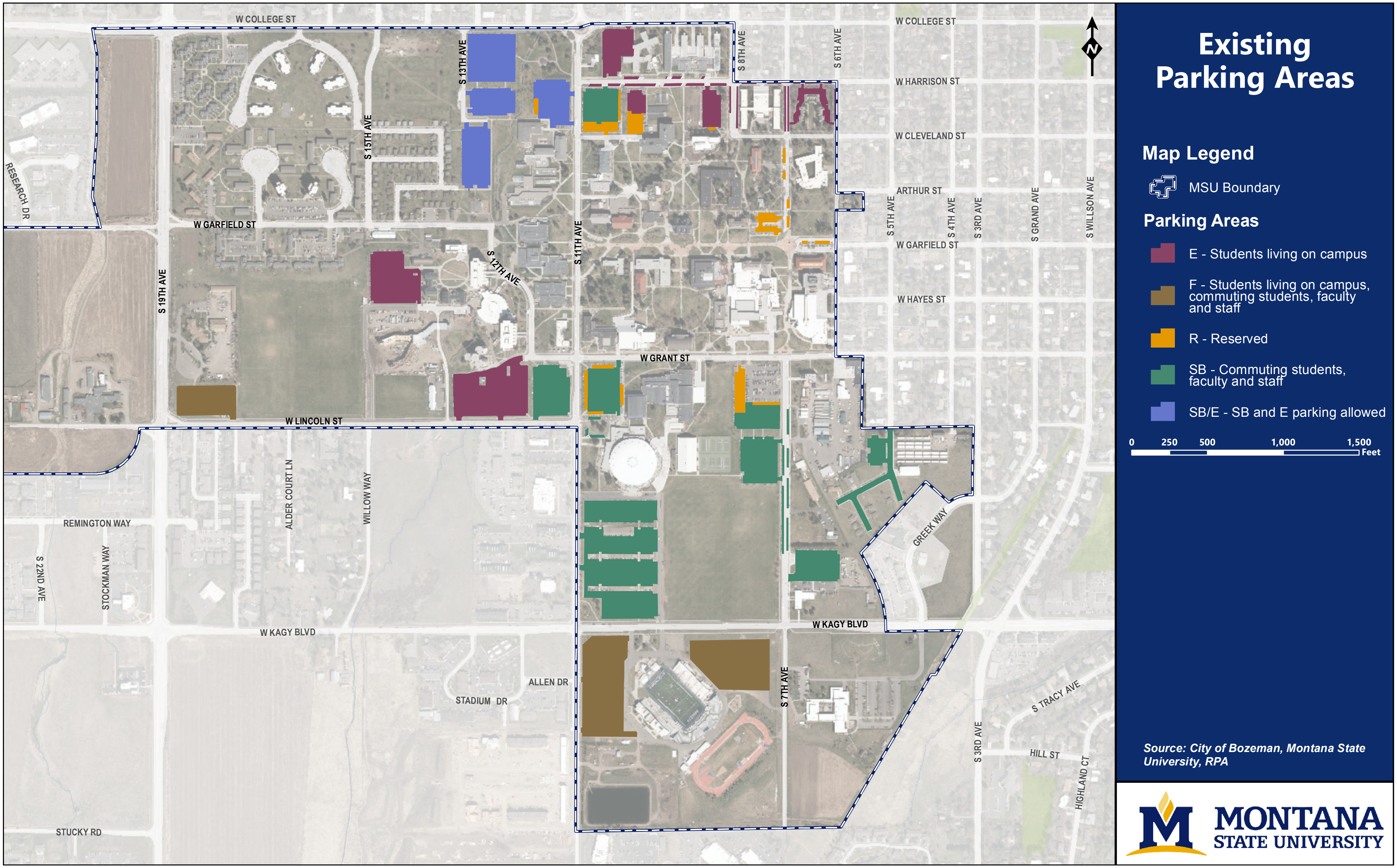


Figure 3.1: Campus Parking Locations and Designations

3.1.2. Parking Utilization

For purposes of the parking utilization analysis, the designated campus parking lots shown in **Figure 3.1** were identified as 29 discrete locations for ease of data collection. The 29 locations are reflected by permit type, include the 26 designated parking lots shown on **Figure 3.1**, and also include three on-street areas defined for their significance to the overall parking scheme. The 29 parking locations identified for purposes of the parking utilization study are shown in **Figure 3.2**. The parking utilization study was completed over two days in September, 2015; Tuesday, September 29 and Wednesday, September 30. Data was collected every hour between 8:00 AM and 5:00 PM.

Parking utilization rates were calculated for the average weekday as well as for the peak hour. **Table 3.2** shows the data that was collected and the computations involved. **Figure 3.3** shows the average parking utilization and **Figure 3.4** shows the peak parking utilization. The data suggests that a number of individual parking lots and on-street parking areas currently operate at or near capacity. In some cases, the occupancy data exceeds the parking supply value, resulting in utilization percentages greater than 100 percent, which may indicate that some motorcycles were counted or that some vehicles are parked illegally.

Parking utilization rates represent an average percent of available parking occupied between 8:00 am and 5:00 pm, or in the case of peak hour utilization the rate represents the percent of available parking occupied during the peak hour. Parking utilization greater than 90 percent is considered to be of concern as users have difficulty finding available spaces.

Analysis of the utilization data suggests that the perceptions of many students, faculty, and staff regarding the inadequacy of the parking may, in fact, be accurate. It is generally accepted in the parking industry that people typically perceive parking as full once about 90 percent of the spaces are occupied because they are then forced to search for an alternate location from their first choice.

Table 3.2: Parking Utilization Results, by Location

Location			Stalls	Observed Parking Utilization Rate										
				8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	Average	Peak
1	North Hedges	E	312	100%	99%	100%	100%	98%	99%	97%	93%	92%	**98%**	**100%**
2	Roskie	E	471	100%	100%	100%	100%	99%	99%	98%	96%	93%	**98%**	**100%**
3	South Hedges	SB	261	100%	100%	100%	100%	97%	99%	93%	84%	63%	**93%**	**100%**
4	South 12th Street	E/SB	244	90%	100%	100%	98%	98%	98%	93%	85%	76%	**93%**	**100%**
5	Deer Street	E/SB	166	95%	99%	99%	98%	94%	98%	92%	88%	58%	**91%**	**99%**
6	Greenhouse	E/SB	175	100%	100%	99%	100%	99%	100%	100%	97%	94%	**99%**	**100%**
		R-9	12	13%	38%	54%	71%	58%	63%	50%	21%	13%	**42%**	**71%**
7	West Linfield	SB	169	100%	100%	100%	99%	98%	100%	98%	95%	94%	**98%**	**100%**
		R-7	39	28%	59%	71%	76%	58%	62%	63%	59%	40%	**57%**	**76%**
8	Langford	E	137	100%	100%	100%	100%	100%	100%	99%	98%	98%	**99%**	**100%**
9	Lewis & Clark	E	91	99%	100%	100%	100%	100%	100%	100%	100%	99%	**100%**	**100%**
		R	4	38%	50%	38%	13%	38%	38%	50%	13%	13%	**32%**	**50%**
10	North Gatton	SB	136	100%	100%	100%	100%	98%	100%	100%	100%	99%	**100%**	**100%**
		R-5	76	36%	66%	77%	82%	74%	76%	81%	78%	72%	**71%**	**82%**
11	South Gatton	SB	253	100%	100%	100%	100%	96%	100%	100%	96%	88%	**98%**	**100%**
12	Faculty Court	SB	140	43%	55%	78%	86%	81%	79%	79%	73%	50%	**69%**	**86%**
13	Huffman	SB	167	19%	99%	100%	100%	98%	93%	98%	90%	70%	**85%**	**100%**
14	North Fieldhouse	SB	188	100%	100%	100%	100%	99%	99%	99%	93%	91%	**98%**	**100%**
		R-8	69	56%	70%	75%	80%	78%	78%	78%	66%	62%	**71%**	**80%**
15	South Fieldhouse	SB	990	45%	78%	92%	92%	87%	82%	74%	57%	40%	**72%**	**92%**
16	Hamilton	R-1/R-2	34	40%	50%	59%	56%	53%	56%	57%	53%	47%	**52%**	**59%**
17	Roberts	R-4	15	23%	53%	60%	60%	53%	53%	53%	37%	37%	**48%**	**60%**
18	Antelope	SB/E	325	41%	100%	98%	97%	91%	93%	85%	67%	53%	**81%**	**100%**
19	East Linfield	E	38	100%	100%	100%	100%	97%	99%	97%	93%	96%	**98%**	**100%**
		R-6	70	44%	69%	84%	86%	82%	83%	86%	83%	70%	**77%**	**86%**
20	West Stadium	F	516	13%	19%	20%	20%	20%	18%	17%	15%	11%	**17%**	**20%**
21	Lincoln	F	352	24%	29%	30%	32%	29%	30%	29%	27%	25%	**28%**	**32%**
22	Quads	E	75	100%	100%	100%	100%	99%	100%	99%	98%	99%	**99%**	**100%**
23	Harrison	E	77	100%	100%	100%	100%	100%	100%	99%	99%	98%	**100%**	**100%**
24	S. 7th Reserved	R-3	27	15%	46%	54%	50%	46%	50%	48%	43%	35%	**43%**	**54%**
26	Eighth Ave	E	21	100%	100%	100%	100%	98%	93%	100%	95%	98%	**98%**	**100%**
27	Seventh Ave N	E	14	100%	100%	100%	100%	100%	100%	100%	100%	96%	**100%**	**100%**
28	Seventh Ave S	SB	63	98%	100%	100%	100%	96%	97%	99%	93%	83%	**96%**	**100%**
29	East Stadium	F	400	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Combined Totals		SB	3,277	70%	91%	96%	96%	93%	92%	88%	78%	64%	**85%**	**96%**
		R	346	38%	62%	72%	75%	68%	70%	72%	65%	56%	**64%**	**75%**
		F	1,268	12%	15%	16%	17%	16%	16%	15%	14%	11%	**15%**	**17%**
		E	1,236	100%	100%	100%	100%	99%	99%	98%	96%	95%	**99%**	**100%**
		ADA	145	-	-	-	-	-	-	-	-	-	**-**	**-**
		Hourly	208	-	-	-	-	-	-	-	-	-	**-**	**-**
		All	**6,480**	**62%**	**76%**	**79%**	**79%**	**77%**	**76%**	**74%**	**67%**	**59%**	**72%**	**79%**

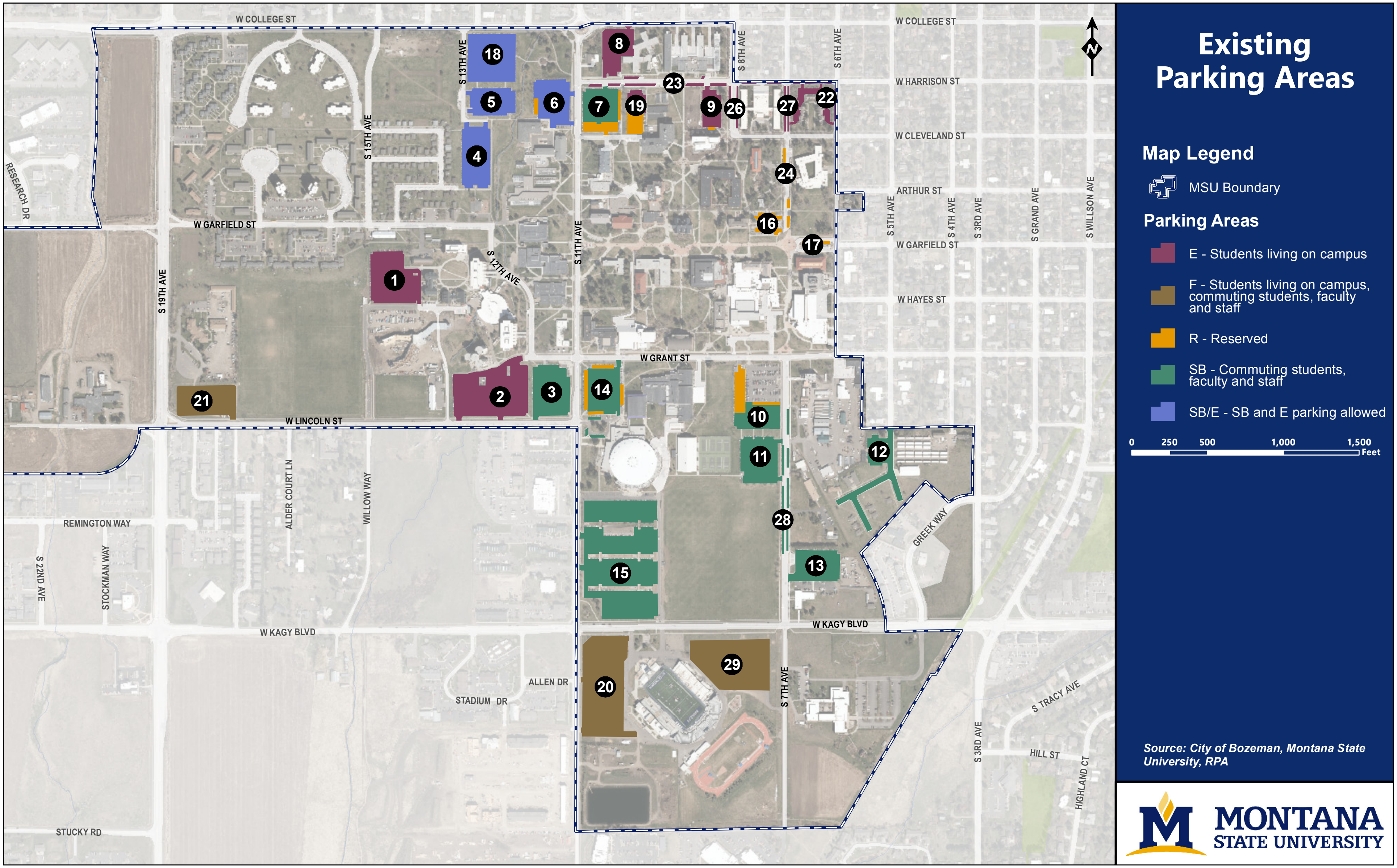


Figure 3.2: Campus Parking Areas Designated for Utilization Study

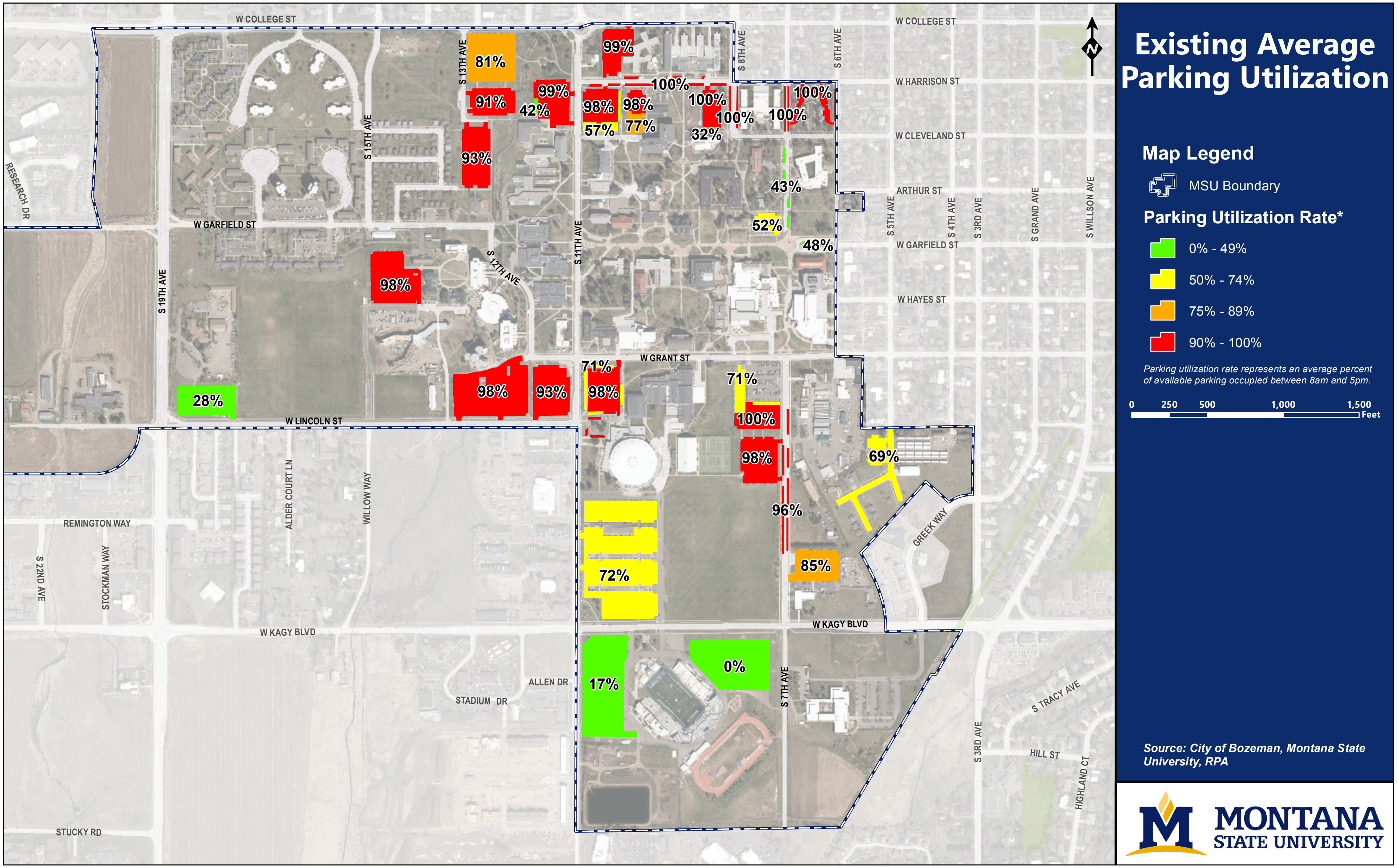


Figure 3.3: Average Parking Utilization, by Lot

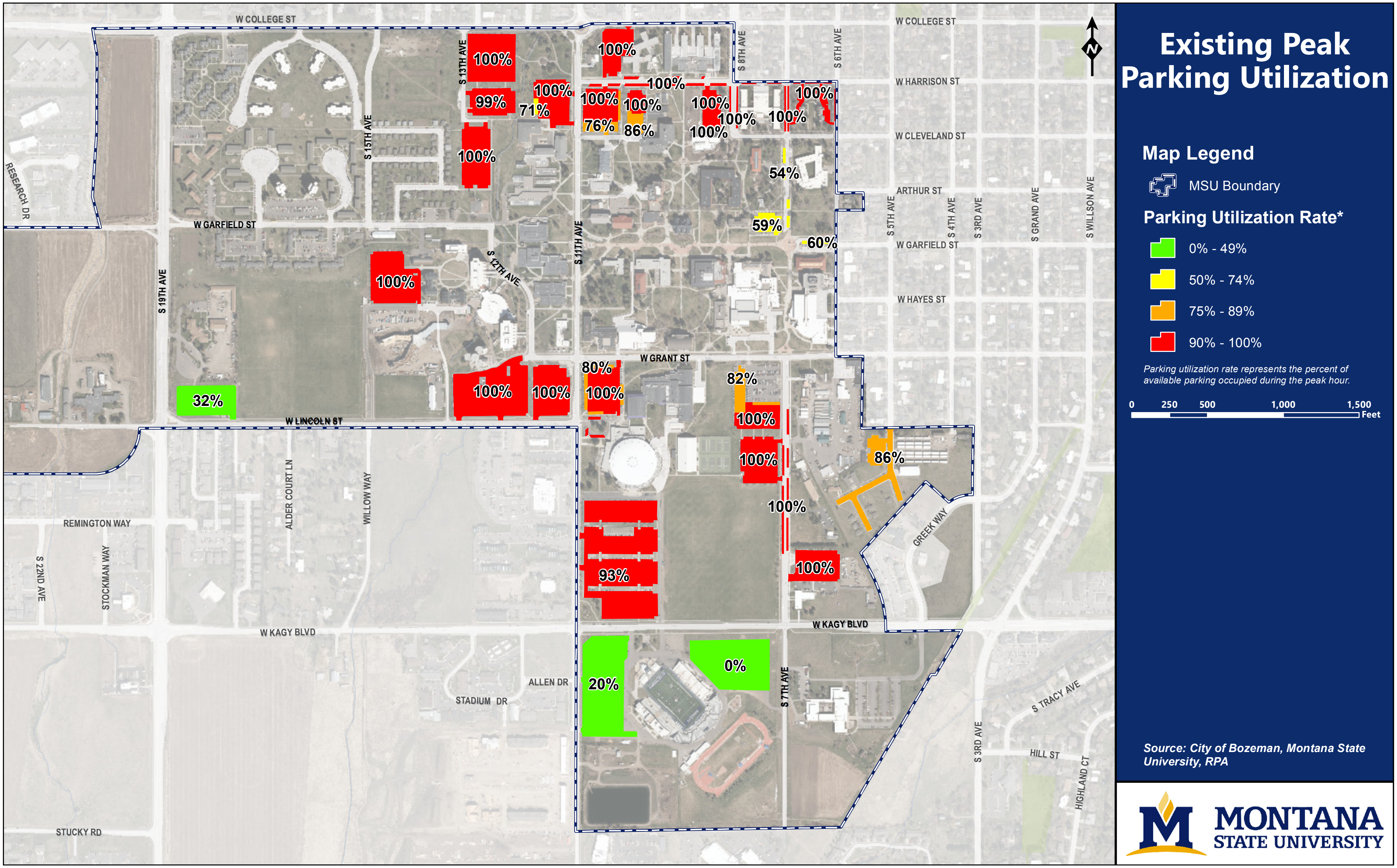


Figure 3.4: Peak Parking Utilization, by Lot

3.1.3. Parking Permits

Parking permits at MSU are available for students, faculty, and staff. Students living on campus are limited to an E pass for those living in the dorms or an FH pass for those living in family housing. Individuals commuting to campus have the option of purchasing an F, SB, or R pass. The F is the lowest cost parking option, however, the permit only allows parking in three lots that are far from the campus core. The SB permits have the most available parking options with many of the lots located near and within the campus core. R permits are the most expensive permit tier and are offered for specific locations with varying cost per lot. Parking that is available to R permits is very near to many campus buildings. Due to the limited number of R permits issued, parking is available most of the time. Visitor parking is available as both an hourly fee in a designated lot at near South 7th Avenue and Grant Street or as a single day hang tag that permits parking in any SB, F, or E lot. Permit prices are tabulated in **Table 3.3**.

Table 3.3: Annual and Semester Permit Prices by Permit Designation (FY17)

Permit Type	FY '17 Price	Permit Designation
S/B (Commuter)	**$185**	**SB**
Half Year	$120	SA/SB
Summer	$93	SB
Winter	$105	
E (Resident)	**$185**	**E**
Half Year	$120	EA/E
Summer	$93	E
F (Discount Commuter)	**$40**	**F**
Half Year	$30	F
Summer	$20	F
Upgrade to SB	$145	SB
Half Year Upgrade to SB	$90	SB
Summer Upgrade SB	$73	SB
G (Garage) *	**$475**	**G**
Summer	$52	FH
Upgrade to SB	$79	SB
Summer upgrade to SB	$41	SB
MC (Motorcycle)	**$70**	**MC**
With SB/E/F Pass	$10	MC
Summer	$33	MC
Delivery	**$111**	**DE**
Summer	$56	DE
Service	**$185**	**SV**
Summer	$93	SV

Permit Type	FY '17 Price	Permit Designation
Special Purpose (Horseshoe School, Potato Lab, Babysitting)	**$56**	**HS**
Town Pass SB	**$185**	**YS**
Half Year	$120	YS
Summer	$93	YS
Town Pass F	**$74**	**YF**
Summer	$37	YF
Daily Hang Tag	**$4**	**DA/SO**
R1	**$777**	**R1**
Half Year	$513	R1
Summer	$389	R1
R2-R4	**$570**	**R2-R4**
Half Year	$376	R2-R4
Summer	$285	R2-R4
R5-R10	**$475**	**R5-R10**
Half Year	$314	R5-R10
Summer	$238	R5-R10
Pay Lot Prices		
0-60 Minutes	$4	
Each additional hour	$2	
Maximum/Entry	$9	
Replacement Pass	**$22**	
Bike Registration	**Free**	

** Parking garage to open in early 2017.*

Special events parking is allowed on a case-by-case basis. If a special event requires parking accommodations, the event organizers are required to contact Parking Services to request parking. All requests are considered based on:

- Time of year and time of day, which dictate parking demands;
- Type of event and the importance of the event to the University;
- Size of the event and number of parking spaces required;
- Duration of the event; and
- Location and availability of alternate parking for displaced faculty, staff, and students; etc.

Fines are charged to violators/abusers of the parking system. The purpose of parking enforcement is to promote compliance with a set of parking regulations. Fines serve as a disincentive before the fact and as a punitive measure after the fact. That being said, fines are also the appropriate mechanism to recover the costs of enforcement. However, fines that are either insufficient to cover enforcement costs or that go uncollected are essentially levied against the legitimate users of the system. The fee schedule for parking related fines is presented in **Table 3.4**.

Table 3.4: Parking Violations and Fines

Description	FY '17 Cost	Description	FY '17 Cost
24-hr Reserved Stall	$60	Parked or Driving on Lawn	$30
Damaged Hang Tag	$30	Parking in Crosswalk	$30
Violation of Bicycle Regulations	$25	Parking in or Blocking Drive	$30
Blocking Trash Receptacles	$30	Parking/Driving on Sidewalk	$30
Expired Meter	$30	Posted No Parking	$45
Failure to Display Valid Permit	$30	Reserved 6am – 6pm	$60
Failure to Register	$60	See Officer Comment	$30
Fire Lane	$60	Service Drive	$30
Handicap Spaces*	$100	Service Vehicle Parking Only	$30
15 Minute Loading Zone	$30	Student Health Parking Only	$30
Not in Designated Area	$30	Special Permit Required	$30
Not in E Lot	$30	Parked in Tow Away Zone	$60
Over Line - 2 Spaces	$30	Towing Fee	$75
Overtime Parked	$30	Wrong Side Parked	$30
Parked in Yellow Zone	$45	Parking Privileges Revoked	$60

Use or possession of a lost, stolen, forged, altered, or counterfeit permit is a $175 fine and is subject to university tow.
** Per MCA 49-4-307*

City of Bozeman Parking Districts

The City of Bozeman restricts on-street parking in certain areas to residents only. The resident only parking area adjoining MSU (delineated with red in **Figure 3.5**) extends two to four blocks away from campus. The fine for parking in the district without a valid permit is $20 and enforced by City of Bozeman Parking enforcement officers. Currently, there is evidence of students parking beyond the restricted zone and walking to campus. The extent of this district may expand in the near future[8]. The last time the district was expanded, demand for parking on campus increased as students sought to park on campus rather than walk the additional distance to campus. MSU Parking Services Unit should continue to work closely with their City of Bozeman counterpart to fully evaluate potential impacts to campus parking demand should the City's university district parking area expand. Anecdotally, should an expansion occur it is reasonable to expect that more commuters will desire to park on campus, further exacerbating the parking utilization that is already at capacity in core campus areas.

In addition to parking on city streets, students have been found parking at businesses near MSU. When a complaint is received from a business, MSU advises the business to sign their parking lot to notify students that they are not allowed to use the lot. It is up to the business to take further action. MSU Police do not have the ability to cite students for parking illegally off campus. However, through memorandums of understanding, MSU Police have been given jurisdiction over some locations, such as on Willow Way.

[8] Personal Communication, Kurt Blunck, conversation with Tom Thorpe, City of Bozeman Parking Manager, October, 2016.

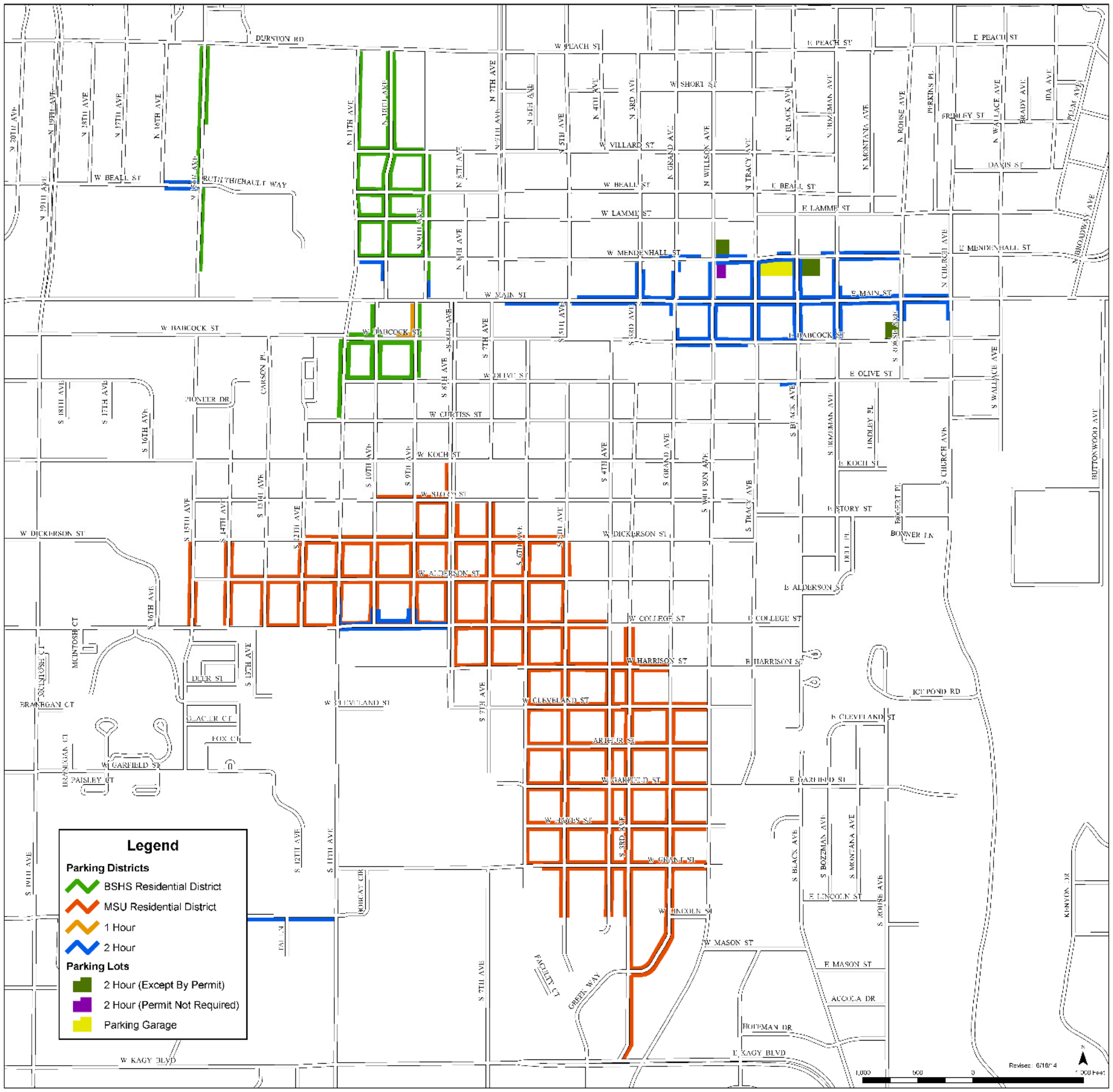


Figure 3.5: City of Bozeman Parking Districts

3.1.4. Parking Pricing Strategy and Finances

University system parking operations are required by state statute (MCA Title 20, Chapter 25) to function as independent, non-state funded self-sustaining business entities. All costs associated with the development, management, operations, and maintenance of the Parking Enterprise and parking facilities must be covered by revenue generated through user fees and enforcement fines.

Parking fees are charged to legitimate users as outlined in **Section 3.3**. The funds collected through user fees are tied to capital improvement reserves, maintenance of existing assets, planning activities, and purchased services (e.g. snow removal, cleaning, etc.). As such, fees are driven by maintenance, purchased services, and long-term capital improvement and replacement costs, not by personnel and operating costs. It is noted in the fiscal year (FY) 2014–2015 Parking Services Business Plan that demand for parking is influenced more by price than by enrollment. Therefore, parking fees can be used as one tool to manage parking demand.

Parking fines are charged to violators and abusers of the parking system as presented in **Section 3.3**. The purpose of parking enforcement is to promote compliance with a set of parking regulations. Fines should be priced in such a way as to cover the costs associated with enforcement, collections, appeals, and any punitive influence desired. As such, fines are heavily influenced by the operating and personnel costs associated with enforcement functions.

Table 3.5: Financial Overview

Account Description	FY '13	Projected FY '14 Total
Total Sales and Service	(11,774)	(15,000)
Total Investment Income	6,260	-
Other	(79)	
Total Transfers In	1,816,057	1,835,000
Total Revenue	**1,810464**	**1,820,000**
Total Salary	971,883	928,930
Total Benefits	364,221	412,779
Other	7,150	
Personnel Services Total	**1,343,255**	**1,341,709**
Contracted Services	201,399	94,900
Total Supplies	86,869	78,100
Total Communications	8,607	6,652
Total Travel	7,301	2,000
Total Rent	1,460	650
Total Maintenance	255,435	155,000
Total Other Expenses	26,065	32,262
Operations Total	**587,136**	**369,564**
Capital Equipment Replacement	71,484	-
Transfer to Huffman Lot	1,019	
Transfer to R&R	-	559,491
Total Expense	**2,002,893**	**2,270,764**
Income Less Expense	**(192,429)**	**(450,764)**
Ending Fund Balance	**573,505**	**122,741**

Financial prospectus balances, revenues, and expense projections are prepared on a biennial basis. Figures for FY 2013 and projected 2014 are presented in **Table 3.5**.

3.1.5. On-campus Loading Service Locations

A total of 49 service access locations are located around the MSU campus. Of these locations, 18 are accessed through a parking lot, six are accessed via a shared walkway, and the remaining 25 are accessed from an adjoining street. Many of these locations are utilized for delivery of goods, Facilities Services access, and/or trash removal. The service access locations presented in **Figure 3.6** were collected during a field visit in October, 2015.

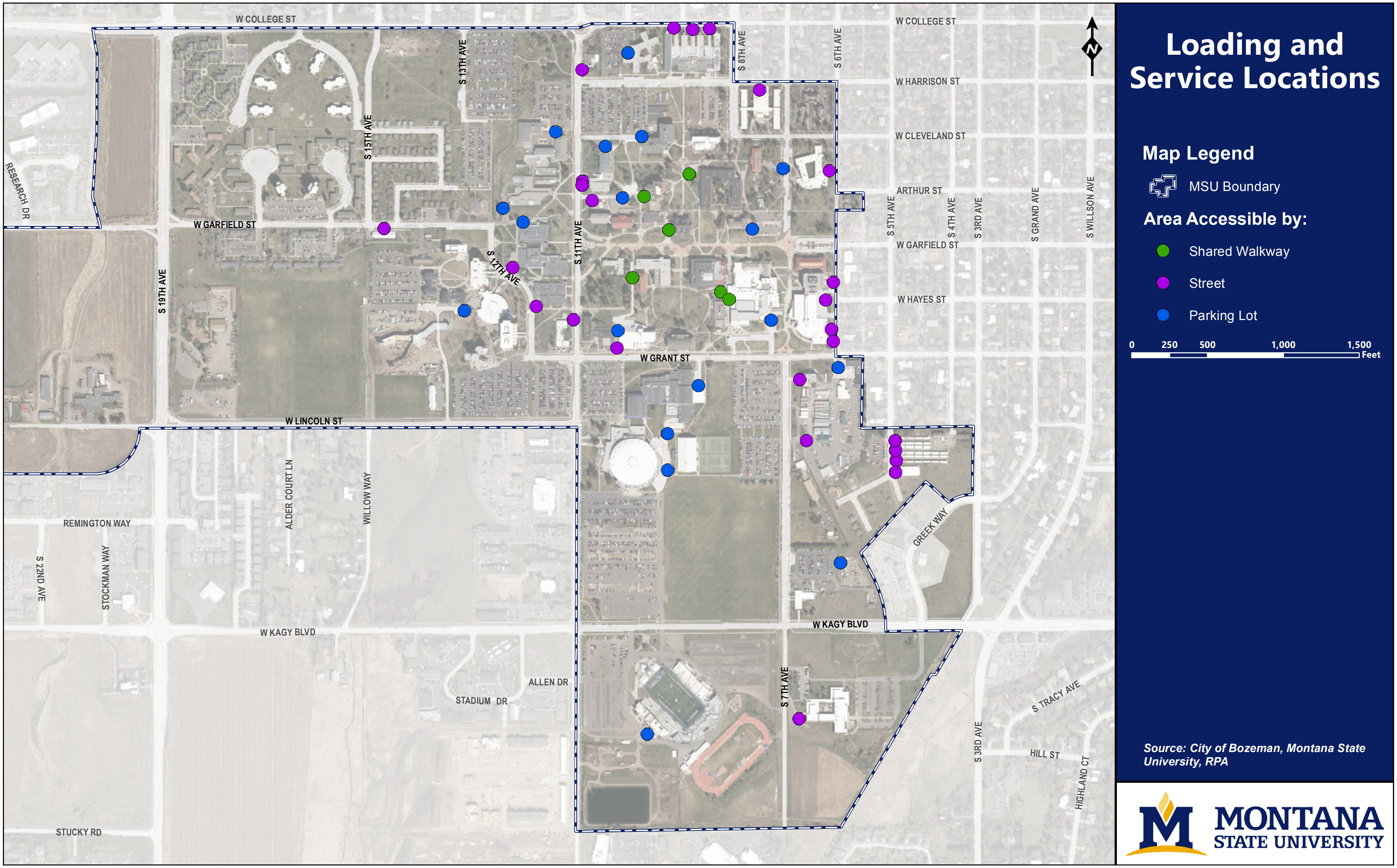


Figure 3.6: Loading and Service Locations

3.2. Transportation

The transportation needs of Bozeman are different from the needs of MSU. Intra-campus transportation is dominated by pedestrian and bicycle traffic. While walking, biking and transit make significant contributions to overall mode share, the majority of travel to campus is done in an automobile. The traffic operations of the surrounding roadways, therefore, impact the students, staff, and faculty of MSU when they are arriving or departing campus. As such, traffic congestion impacts both the general public of Bozeman and the MSU population.

3.2.1. Roadway Network

The roadway network in and around the core of MSU consists of South 11th Avenue, South 7th Avenue, South 8th Avenue, College Street, Grant Street, Lincoln Street, and Kagy Boulevard. These roadways intersect at seven locations. Intersection turning movement counts (TMCs) were performed at each intersection on October 21st, 2015. Data was collected for vehicle, pedestrian, and bicycle traffic during the AM and PM peak hours – commonly called rush hours. In addition to the TMCs, field observations were performed to qualitatively assess the traffic conditions on campus.

The TMC data was analyzed to determine the intersection Level of Service (LOS). LOS is a grading system that is based on the amount of unnecessary delay to vehicles that is incurred at an intersection. The scale ranges from "A" which is little to no delay, to "F" which is substantial delay. Roundabout controlled intersections use the same criteria as all-way stop controlled intersections. It should be noted that for signalized and all-way stop-controlled intersections, the LOS is an average of all intersection legs. It is possible, therefore, to have a leg of an intersection operating with a high amount of delay, but the average intersection delay could still be low. A LOS of "C" or better is considered acceptable operation. **Table 3.6** portrays a graphical representation of LOS.

The intersection LOS analysis results presented in **Figure 3.7** confirms the peak period traffic delay and congestion that were observed during the field visit. The intersection of South 7th Avenue and Kagy Boulevard was observed to perform poorly with traffic queues extending west towards South 11th Avenue. The LOS, as expected, was determined to be "F" for both the AM and PM peak periods. This poor LOS is due largely to the delay incurred by south and northbound vehicles attempting to make left turns. The other six intersections were found to be performing at satisfactory LOS's. Additional LOS information is provided in **Table 3.7**.

Table 3.6: Intersection LOS Descriptions

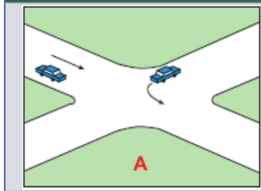
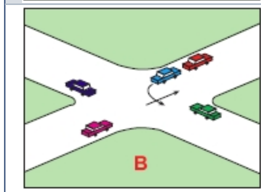
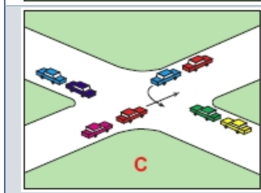
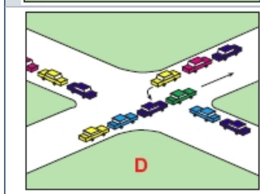
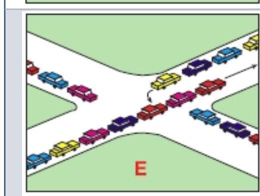
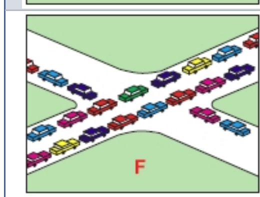
LOS	Description	Average Delay per Veh. (sec)	
		Signalized	Unsignalized
	Traffic moves freely, low volumes accompany the free flow condition. At signalized intersections, progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. At unsignalized intersections, nearly all drivers find freedom of operation with very little time spent waiting for an acceptable gap. Very seldom is there more than one vehicle in queue.	< 10	<10
	Traffic moves fairly freely, volumes are somewhat low. At signalized intersections, there is good progression and/or short cycle lengths. Vehicles generally clear on one green phase. At unsignalized intersections, some drivers begin to consider the average control delay an inconvenience, but acceptable gaps are still very easy to find. Occasionally there is more than one vehicle in queue.	10 to 20	10 to 15
	Traffic moves smoothly, volumes are beginning to increase. At signalized intersections, higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, although many still pass through the intersection without stopping. At unsignalized intersections, average control delay becomes noticeable to most drivers, even though acceptable gaps are found on a regular basis. It is not uncommon for an arriving driver to find a standing queue of at least one additional vehicle.	20 to 35	15 to 25
	Traffic approaching unstable flow, the influence of congestion becomes more noticeable. At signalized intersections, longer delays may result from some combination of unfavorable progression, long cycle length, or high volume/capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable. At unsignalized intersections, average control delay is long enough to be an irritation to most drivers. Acceptable gaps are hard to find because there is a standing queue of vehicles already waiting when the driver arrives	35 to 50	25 to 35
	Unstable traffic flow, volumes at or near capacity. At signalized intersections, the high delays generally indicate poor progression, long cycle lengths, and high volume/capacity ratios. Individual cycle failures are frequent occurrences. At unsignalized intersections, drivers find the length of the average control delay approaching intolerable levels. Acceptable gaps are hard to find because there is a standing queue of vehicle already waiting when the driver arrives.	50 to 80	35 to 50
	Saturation condition, volumes are over capacity. This is considered to be unacceptable to most drivers. This condition occurs with oversaturation. At signalized intersections, it may occur at high volume/capacity ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute to such high delay values. At unsignalized intersections, delays are high because acceptable gaps are hard to find. Acceptable gaps are hard to find because there is a standing queue of vehicles already waiting when the driver arrives.	> 80	> 50

Table 3.7: Existing LOS

	AM		PM	
	Delay	LOS	Delay	LOS
South 11th Ave & College St (Roundabout)	**8.3**	**A**	**14.8**	**B**
Northbound	6.1	A	23.5	C
Southbound	9.0	A	8.0	A
Eastbound	8.9	A	10.9	B
Westbound	7.8	A	10.3	B
South 11th Ave & Grant St (AWSC)	**10.6**	**B**	**15.8**	**C**
Northbound	10.5	B	17.5	C
Southbound	11.4	B	16.2	C
Eastbound	9.5	A	11.3	B
Westbound	10.2	B	14.5	B
South 11th Ave & Lincoln St (AWSC)	**11.2**	**B**	**14.4**	**B**
Northbound	10.5	B	15.8	C
Southbound	10.3	B	13.6	B
Eastbound	12.2	B	14.2	B
Westbound	8.8	A	11.9	B
South 11th Ave & Kagy Boulevard (Signalized)	**24.8**	**C**	**30.1**	**C**
Northbound	21.5	C	36.1	**D**
Southbound	23.2	C	39.3	**D**
Eastbound	16.6	B	30.6	C
Westbound	35.0	C	21.0	C
8th Ave & College St (AWSC)	**12.9**	**B**	**17.9**	**C**
Northbound	10.9	B	13.7	B
Southbound	11.7	B	12.3	B
Eastbound	12.7	B	23.7	C
Westbound	14.3	B	14.6	B
South 7th Ave & Grant St (AWSC)	**9.2**	**A**	**10.3**	**B**
Northbound	9.0	A	10.4	B
Eastbound	8.8	A	10.5	B
Westbound	9.8	A	9.9	A
South 7th Ave & Kagy Boulevard (TWSC)	**87.2**	**F**	**71.2**	**F**
Northbound	65.1	**F**	18.6	C
Southbound	23.5	C	32.4	**D**
Eastbound	2.4	A	0.5	A
Westbound	0.3	A	0.1	A

AWSC: All-way Stop Control
TWSC: Two-way Stop Control

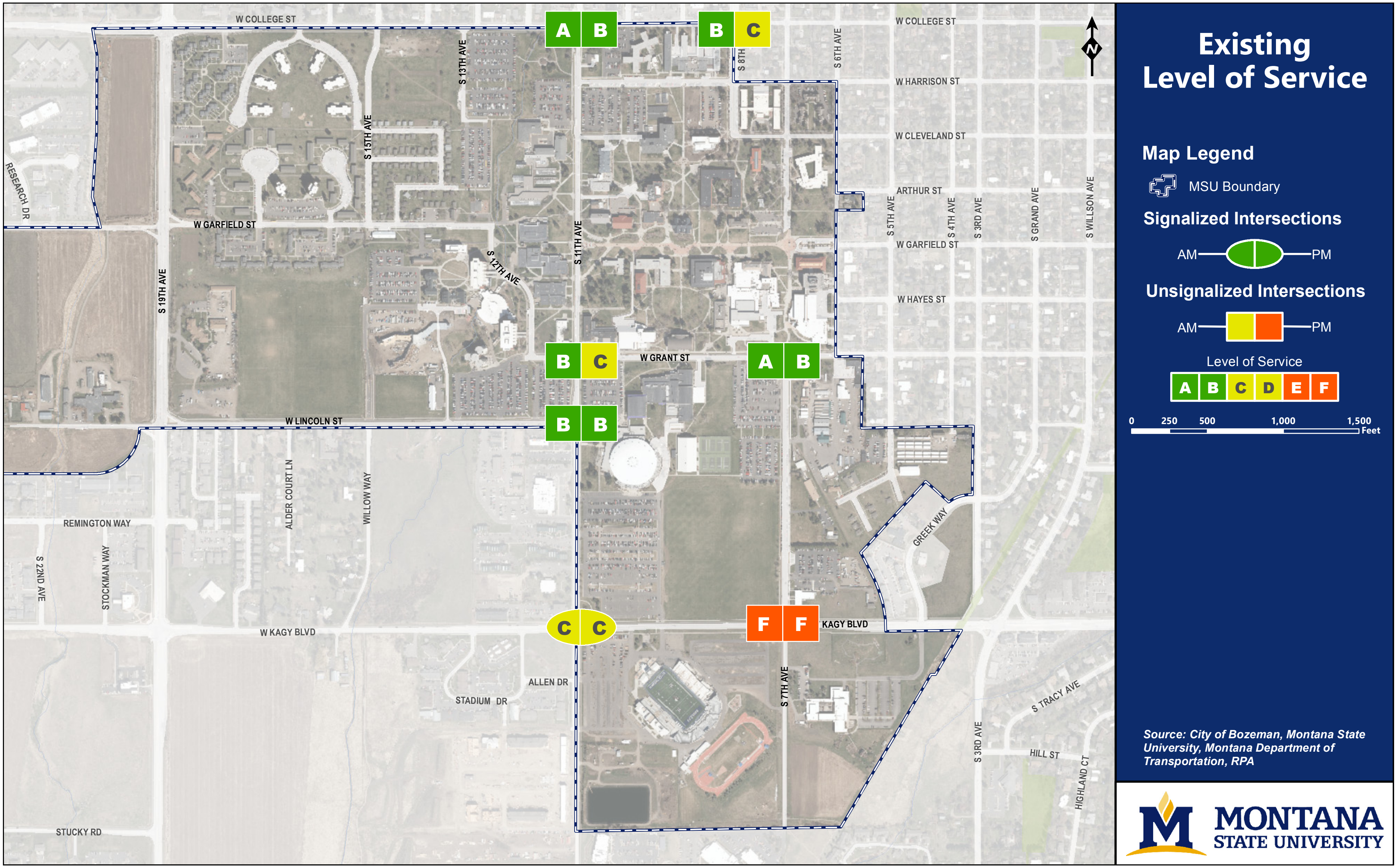


Figure 3.7: Intersection Level of Service

3.2.2. Travel Data and Patterns

Student enrollment for the fall semester of 2015 totaled 13,707 undergraduate and 1,981 graduate students for total of 15,688 students. Currently, MSU is capable of housing approximately 3,500 students on campus, leaving about 12,000 students living off-campus. In addition to the off-campus students, 3,087 individuals are employed by MSU. Combined, approximately 15,000 individuals need to travel to and from campus on a regular basis.

Vehicular access to the campus core is provided by the seven intersections reviewed in **Section 3.2.1**. The intersections with the largest volume of vehicles entering campus between 7:00 AM and 9:00 PM were found to be South 11th Avenue and College Street, where approximately 21.4 percent of traffic entered, and South 11th Avenue and Lincoln Street, where approximately 18.1 percent of traffic entered. Traffic entering campus from the south off of Kagy Boulevard on South 11th and South 7th Avenues accounted for 18.0 and 15.3 percent of entering traffic, respectively. **Figure 3.8** presents the volume and percentage of total volume entering campus between 7:00 AM and 9:00 AM for each of the seven main access points.

Vehicle accessibility within the core of campus is limited. Access to several buildings is restricted to loading and small parking areas. The drop-off area on the south side of the Strand Union Building (SUB) is frequently the location of pedestrian-vehicle conflicts as well as conflicts with service vehicles and the Streamline Bus. Other locations on campus with frequent pedestrian-vehicle conflicts include the Hamilton parking lot, and crosswalks along South 11th Avenue and Harrison Street. Further detail of the pedestrian network is presenting in **Section 3.2.4**.

Commuting students, faculty, and staff must travel to campus from the greater area. To determine the relative locations of commuters, parking permit data from 2014 were used to identify the address of SB parking permit holders within 2 to 3 miles of the campus. This information was used to generate the density map shown in **Figure 3.9**. It can be seen that various areas of Bozeman have a high density of students, faculty, or staff. Of note is the fact that 760 (9.5 percent of all reported commuter permits) permit holders reported living within one half mile of the campus core. A total of 1,414 (17.7 percent) of commuters reported living within one mile of campus. Within two miles of campus, 2,864 (35.9 percent) home addresses for permits were reported.

Again, **Figure 3.9** is intended to show area(s) within 2 to 3 miles of the MSU campus and is not intended to reflect all commuter residence locations. Numerous commuters to MSU live outside the area shown on **Figure 3.9**, hold commuter parking permits, and commute to and park on the MSU campus.

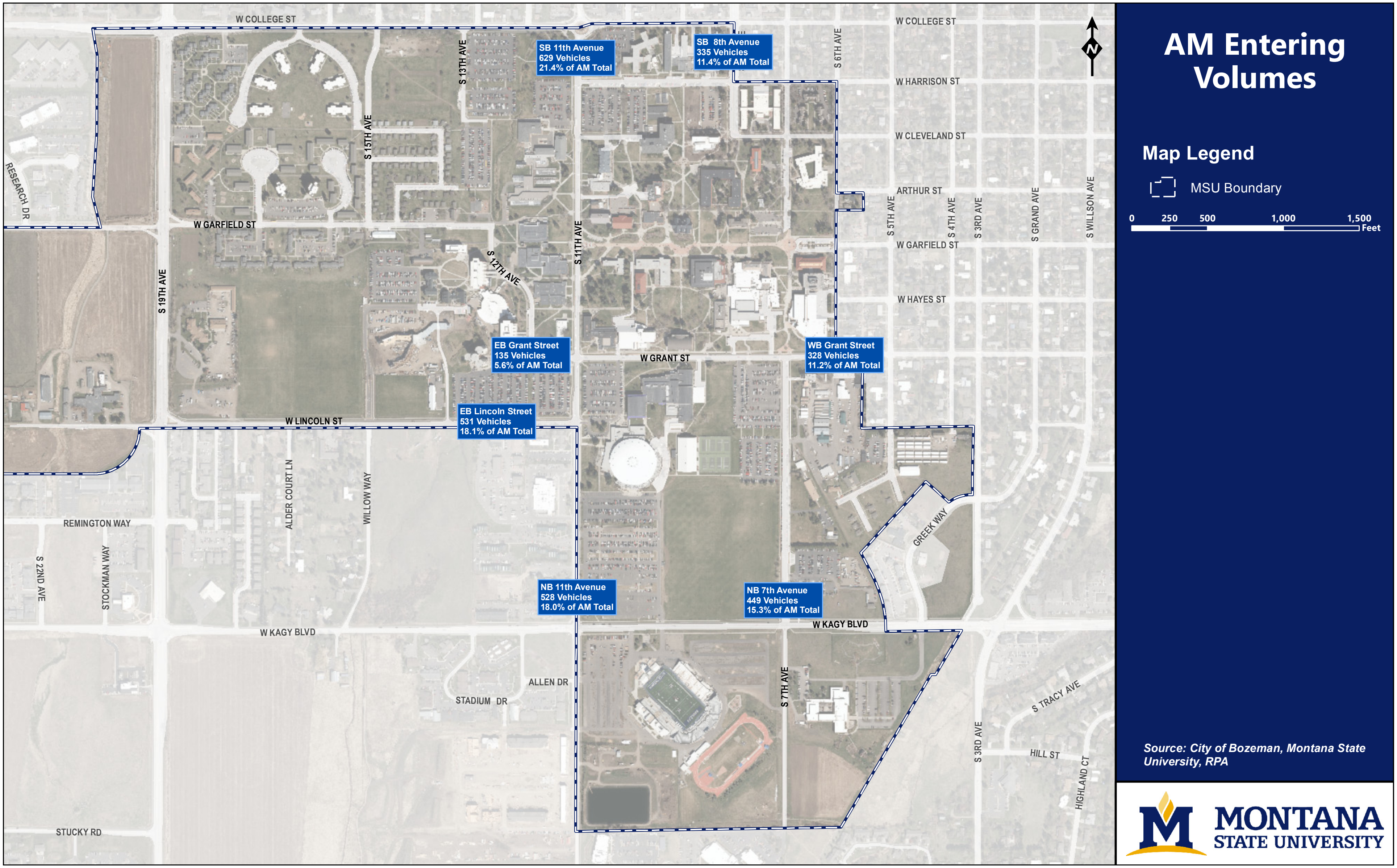


Figure 3.8: AM Entering Volumes

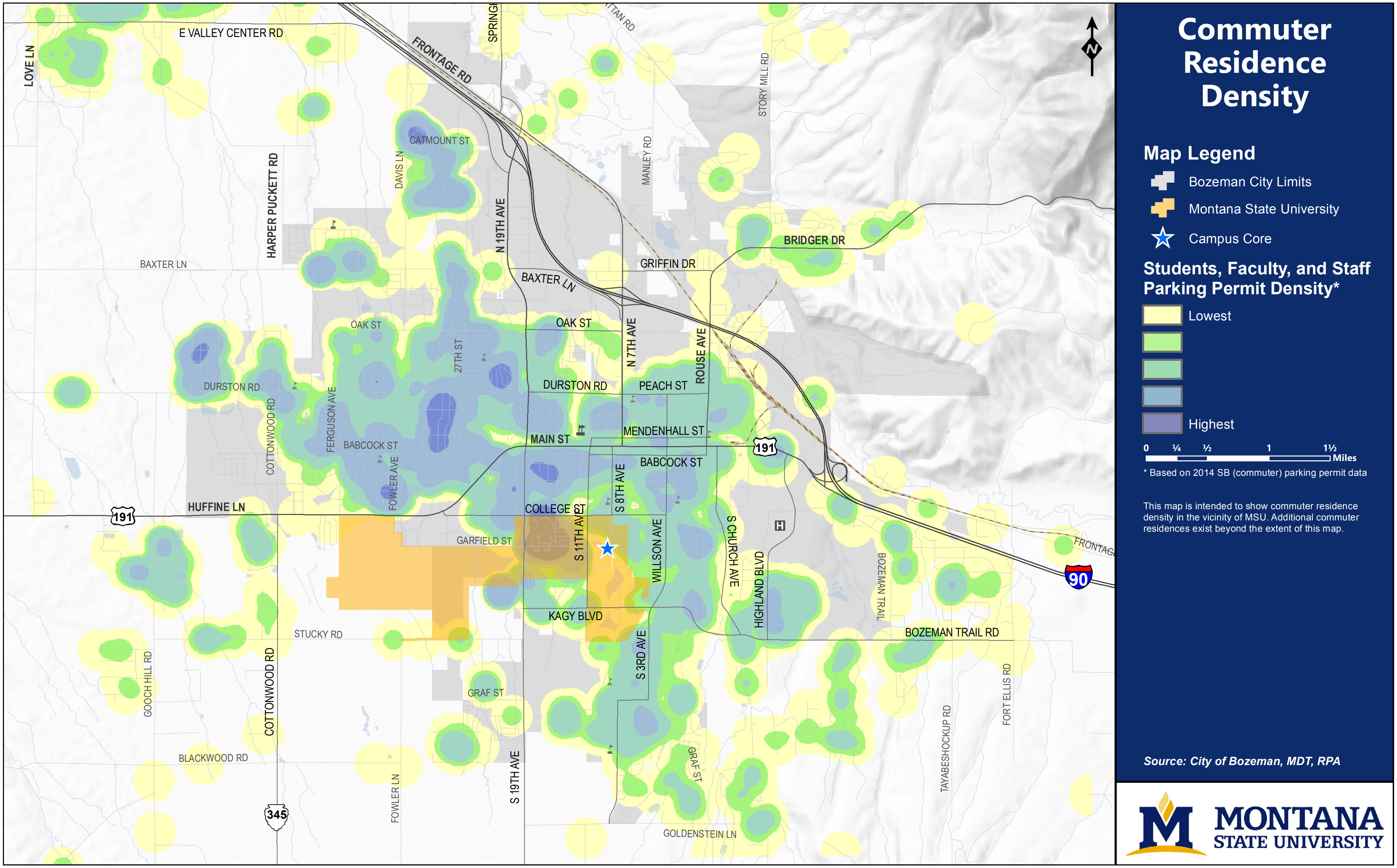


Figure 3.9: Commuter Residence Density

3.2.3. Bicycle Facilities

Bicycle facilities can be categorized as either on-street or off-street. On-street facilities consist of bike lanes or designated shared lanes. Bike lanes provide a striped lane with bicycle pavement markings for one-way travel on a street. New bike lanes frequently occur in conjunction with pavement resurfacing or roadway reconstruction. Grant Street, Kagy Boulevard, S. 8th Avenue, and S. South 11th Avenue all have bike lanes, although not all of these routes are consistently marked. No on-campus roads are designated as shared bike routes per se, but do function in that capacity. Grand Avenue and Koch Street are examples of streets that function as a designated bicycle route.

Bike Route Signage – Grand Avenue

Shared-use Path – College Street

Off-street facilities are often shared with pedestrian traffic. Examples of off-street facilities are shared use paths, sidewalks, and plazas. While many of these facilities are wide enough to accommodate multiple user types, some may be too narrow to safely accommodate bikes and pedestrians. Conflicts between bikes and pedestrians are rarely reported to the University Police Department, and it is difficult to document a substantial conflict history.

Existing bicycle facilities are presented in **Figure 3.10**.

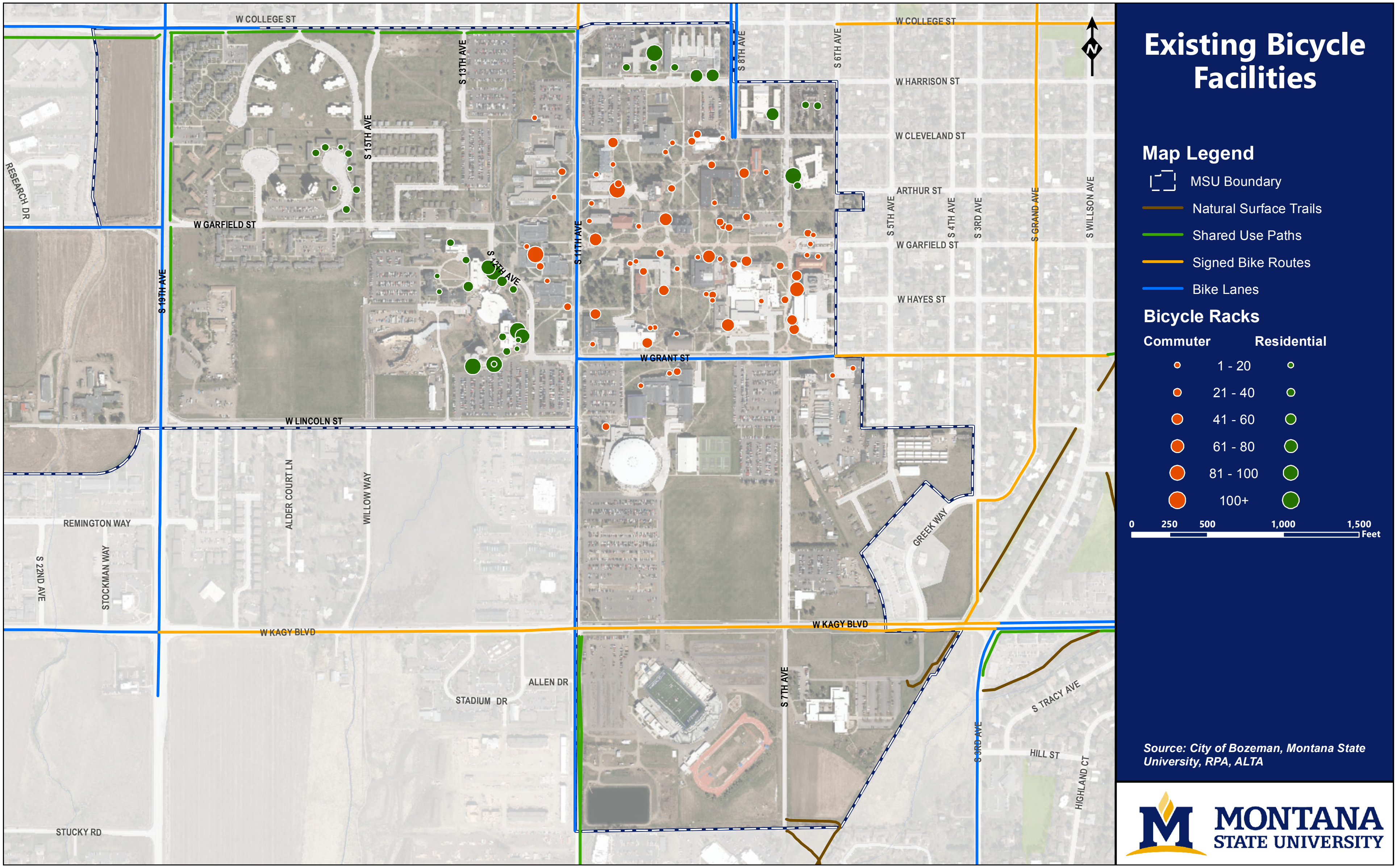


Figure 3.10: Existing Bicycle Facilities

Bicycle Level of Traffic Stress

Vehicular LOS has been a standard metric to evaluate transportation networks for decades. Transportation professionals have struggled over the years to develop a comparable means of evaluation for pedestrians and bicyclists. For these modes, it is the qualitative metrics, or how a street feels that may determine how it performs. One tool to analyze the level of traffic stress has been outlined in the Mineta Transportation Institute Report 11-19[9]. A level of traffic stress (LTS) for bicyclists is determined based on factors including posted speed limit, street width, and the presence and character of bicycles lanes. The combinations of these criteria separates the bicycle network into one of four scores:

LTS 1: Low-stress roadway suitable for all ages and abilities,

LTS 2: Roadway comfortably ridden by the mainstream adult population,

LTS 3: Roadway ridden by the "enthused and confident" cyclists, and

LTS 4: Roadway ridden by the "strong and fearless" cyclists.

In general, a separated bicycle facility would qualify as a low-stress (LTS 1) bikeway, while a roadway shared with motor vehicle traffic operating at high speed would receive a higher stress score. The results of the LTS analysis help identify existing areas with a high level of stress as well as focus areas for improvement. Local streets with low traffic and low volume can be quite comfortable to most bicyclists despite being a shared lane environment. The LTS analysis is specifically focused on the street environment. Adjacent shared-use offer a more comfortable facility type that is not reflected in the LTS score. The results of the LTS analysis are presented in **Figure 3.11**.

LTS provides an intuitive framework to describe the benefits of bicycling infrastructure and to demonstrate that some roadways may require more intervention than others to provide a truly comfortable experience. For example, the only time a standard bike lane is considered an LTS 1 facility is a six-foot wide facility on a roadway with a posted speed limit of 30 miles per hour or lower. The best LTS score achievable on a roadway with four or more travel lanes without installing a separated bike lane is LTS 3.

[9] Mineta Transportation Institute, Report 11-19, Low-stress Bicycling and Network Connectivity, May 2012
http://transweb.sjsu.edu/PDFs/research/1005-low-stress-bicycling-network-connectivity.pdf

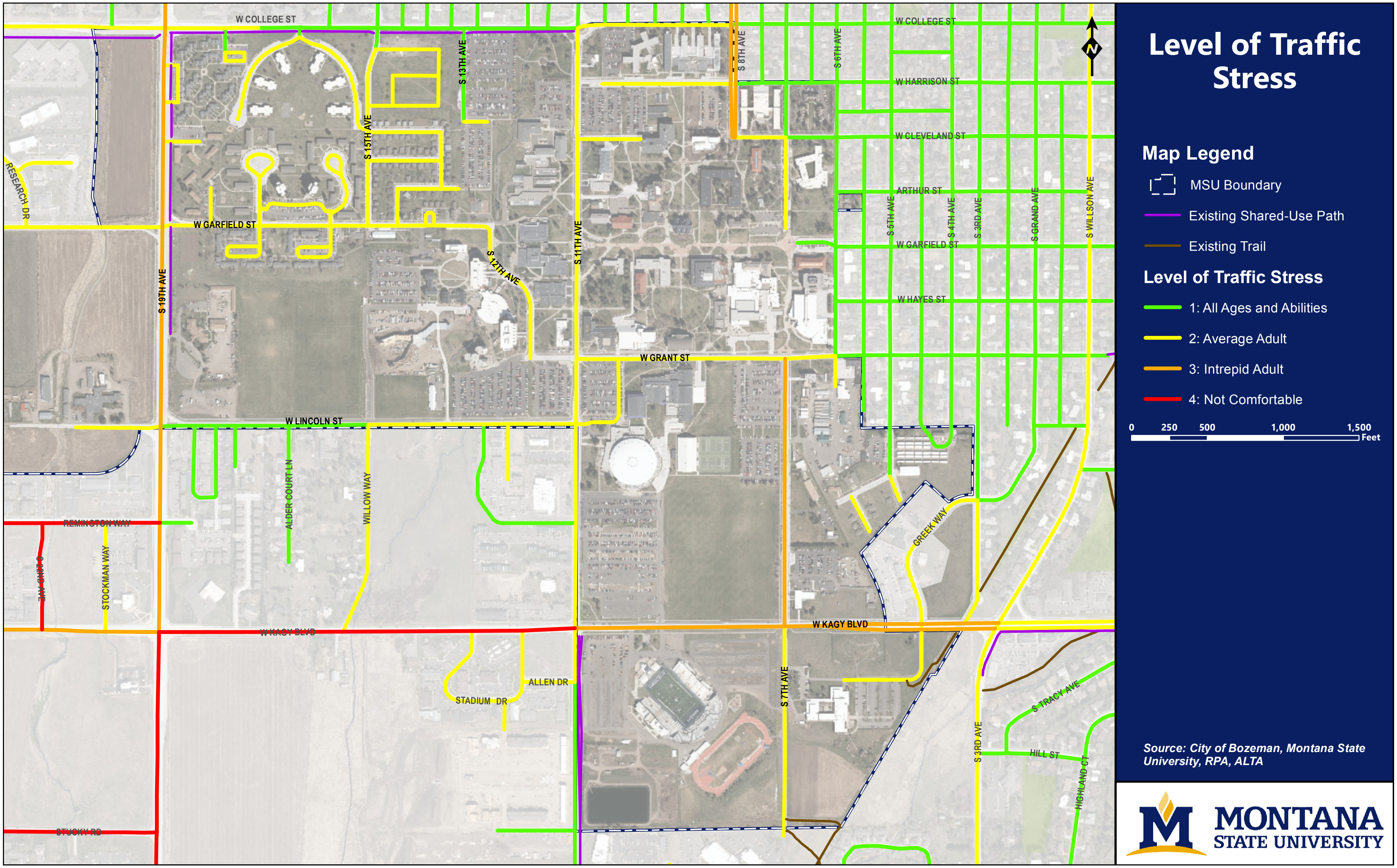


Figure 3.11: Bicycle Level of Traffic Stress

Bicycle Mode Share

Bicycle count data was collected at the same seven intersections as vehicular volume and for the same peak hour periods. Bike usage on off-street facilities or at numerous other potential campus access points was not determined as part of the data collection effort. Bicyclists accounted for an average of five percent of traffic during the AM peak hour and four percent during the PM peak hour. Mode share data is presented in **Figure 3.12**.

Collision and Safety Analysis

The University Police Department does not have the ability to maintain extensive and detailed crash statistics. However, due to the low frequency in which bike related accidents occur, this is not seen as a shortcoming. Anecdotally, an officer with the MSU Police Department stated that there are "a few" bicycle crashes per year. The most common location for bike crashes is the off-campus segments of South 11th Avenue. On-campus, there are a few crashes per year near the crosswalks at South 11th Avenue and Grant Street.

3.2.4. Pedestrian Facilities

Pedestrian facilities on campus serve to move individuals between parking lots, residence halls, off-campus locations, and between academic buildings. The most highly visible pedestrian facility is the Michael P. Malone Centennial Mall which runs from South 11th Avenue to approximately South 7th Avenue.

The pedestrian is the defining transportation modal element of any campus. Class schedules result in surge periods where pedestrians fill the pedestrian network to capacity followed by much lower demand. In general, bicycles and high volumes of pedestrians do not mix well. Many campuses nationwide have worked to provide separate space for bicyclists on high-volume bicycle routes.

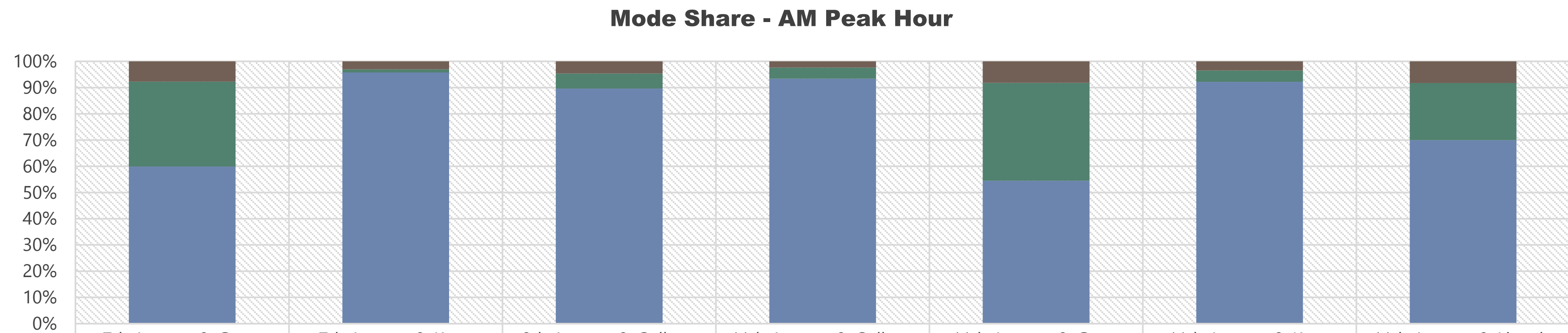
Personal safety is also of concern to all pedestrians, but particularly to women who walk at night. Safety can be broken down into two main components: 1) actual or statistical and 2) perceived. For transportation planners, perceived safety is just as important as actual safety; even if a place has had no reported incidents of crime, if users perceive it to be unsafe, they will prefer to drive rather than walk.

Design and materials should support the safety of pedestrians as they travel at the edge of the pedestrian core, or interact with other modes as they cross the core. A key example can be found in bollard placement where spacing prohibits vehicles from entering a space. Other items such as unified pathway treatments can help to define a space as pedestrian-dominant.

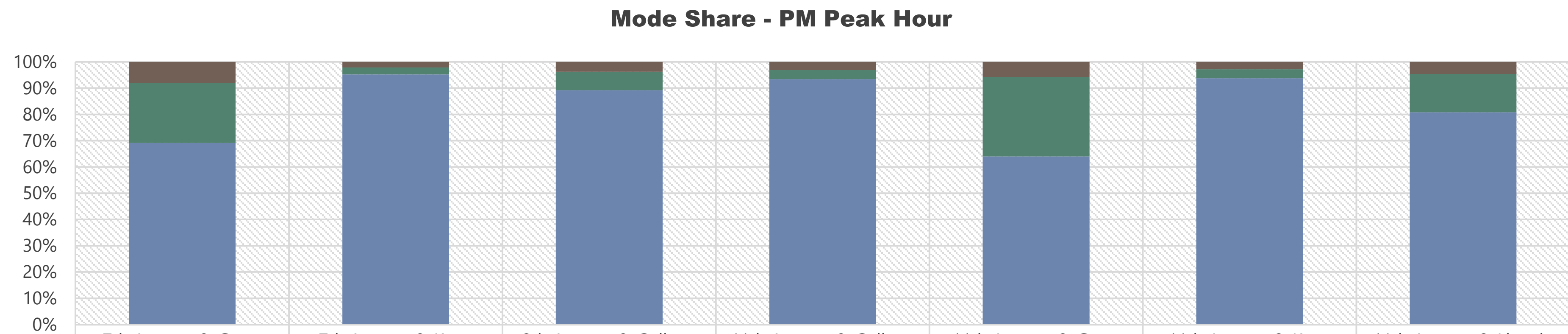
Another key concept to consider is the need to set aside sufficient circulation area for the volume of pedestrians entering or exiting a specific space. It is especially important that areas near doorways and at the edge of crowded pathways provide extra space to permit adequate circulation during crowd events, and where other modes such as bicycles, wheelchairs, or delivery carts may be present. An area approximately two feet from a building or curb edge is generally not used for circulation, and it should not be assumed that this space can always be applied to the effective circulation width of a pathway. Many campus walkways are relatively narrow to handle high pedestrian flows and create further issues if bicyclists are present.

Pedestrian Mode Share

Pedestrian count data was collected at the same seven intersections as vehicular volumes and for the same peak hour periods. Crosswalks exist at mid-block locations along South 11th Avenue, Kagy Boulevard, Grant Street, and Harrison Street. Pedestrian usage data, however, was not collected at these mid-block locations or along any non-intersection locations on campus. During the AM peak hour, 37 percent of individuals passing through the intersection of South 11th Avenue and Grant Street were pedestrians, assuming single occupancy vehicles. Similarly, pedestrians accounted for 30 percent of individuals passing through the intersection of South 11th Avenue and Grant Street during the PM peak hour. On average, 15 and 12 percent of traffic through the study intersections was pedestrian during the AM and PM peak hours, respectively. Mode share data is presented in **Figure 3.12**.



	7th Avenue & Grant Street	7th Avenue & Kagy Boulevard	8th Avenue & College Street	11th Avenue & College Street	11th Avenue & Grant Street	11th Avenue & Kagy Boulevard	11th Avenue & Lincoln Street
Bikes	8%	3%	5%	2%	8%	4%	8%
Peds	32%	1%	6%	4%	37%	4%	22%
Cars	60%	96%	90%	93%	54%	92%	70%



	7th Avenue & Grant Street	7th Avenue & Kagy Boulevard	8th Avenue & College Street	11th Avenue & College Street	11th Avenue & Grant Street	11th Avenue & Kagy Boulevard	11th Avenue & Lincoln Street
Bikes	8%	2%	4%	3%	6%	3%	5%
Peds	23%	3%	7%	3%	30%	3%	15%
Cars	69%	95%	89%	93%	64%	94%	81%

Figure 3.12: AM (top) and PM (bottom) Mode Share

Mode Share – Comparison to Other Communities

Providing an accurate picture of pedestrian and bicycle activity within any community is difficult. Data is typically not available or not comprehensive enough to form a complete picture of active transportation behavior. Count data for vehicles is, by comparison, more readily available. The City of Bozeman has collected annual bicyclist counts since 2011, allowing some understanding of local demand to be understood. Overall, Bozeman exhibits high levels of walking and bicycling for commute based trips by national standards. Bozeman is comparable to Missoula within the State of Montana. One useful comparison for the discussion of mode share at MSU itself is to compare the larger community of Bozeman against other peer cities chosen for similarities (i.e. Rocky Mountain West, college community, geography, etc.) using a five-year data set from the American Community Survey (2010-2014). Each of the cities depicted in **Figure 3.13** are college towns.

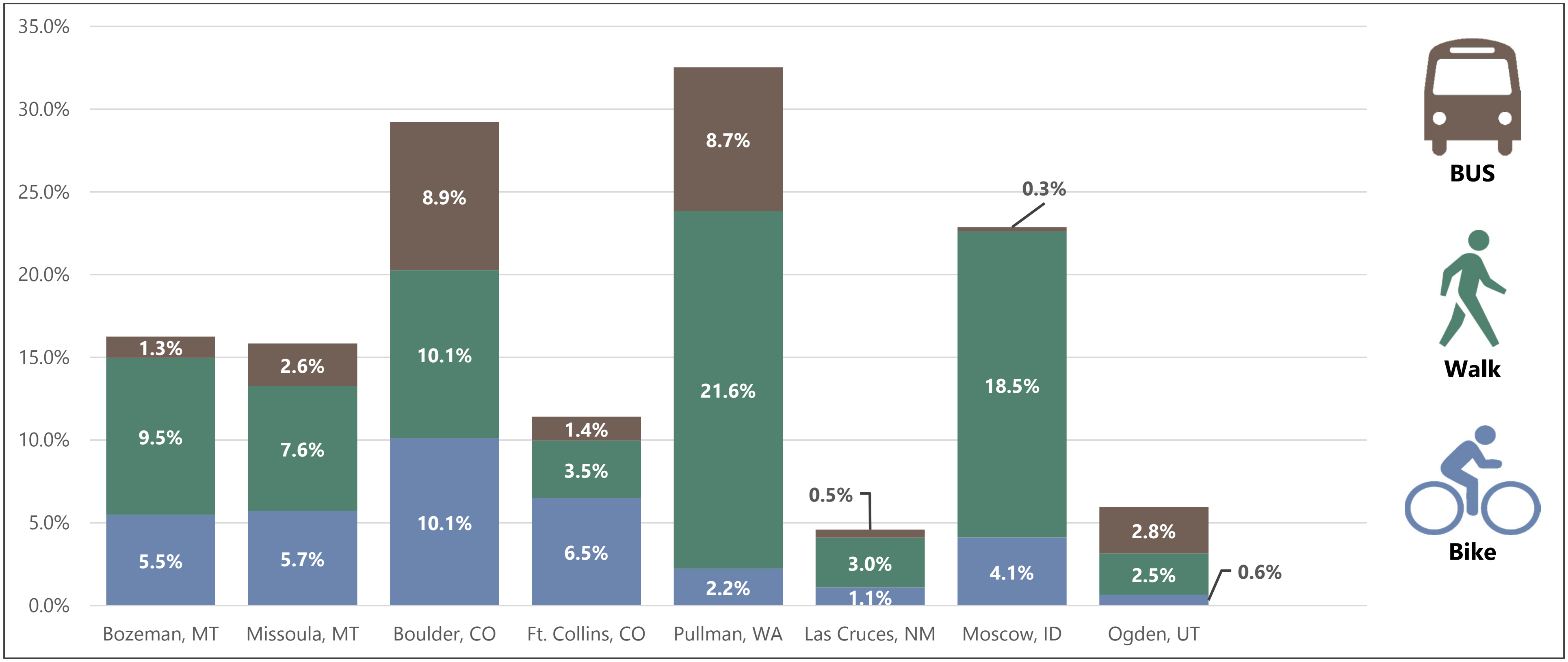


Figure 3.13: Peer Cities Commute Mode Share

Sidewalks and Pathways

Access to all buildings is provided by sidewalks and internal pathways throughout campus. However, many unpaved desire lines exist in multiple areas of campus, suggesting that the existing sidewalk network does not provide adequate access in these areas. Areas with desire lines include but are not limited to the Romney Oval, the Duck Pond area, between Montana and Hamilton Halls, along the north side of the Strand Union Building, between Hannon and Roberts Halls, and east of Linfield Hall. To address these informal pathways, several mitigation techniques have been used, including installing pavement, laying down organic and inorganic mulch, or using recycled concrete pieces for stepping stones. These measures have had mixed success.

Marked and unmarked crosswalks provide crossing along all major roadways in and around campus. The crosswalks such as those on Grant Street and others around the perimeter of the campus core have been constructed with colored and stamped concrete to increase visibility of the crossing for both pedestrians and vehicles. Five mid-block crossings are on Grant Street between South 11^{th} and South 7^{th} Avenues. Eight mid-block crosswalks are on South 11^{th} Avenue between Grant and Harrison Streets. These mid-block crosswalks connect with the sidewalk network to provide convenient crossing between academic buildings, residence halls, and parking lots. Marked crosswalks and desire lines are presented in **Figure 3.14**.

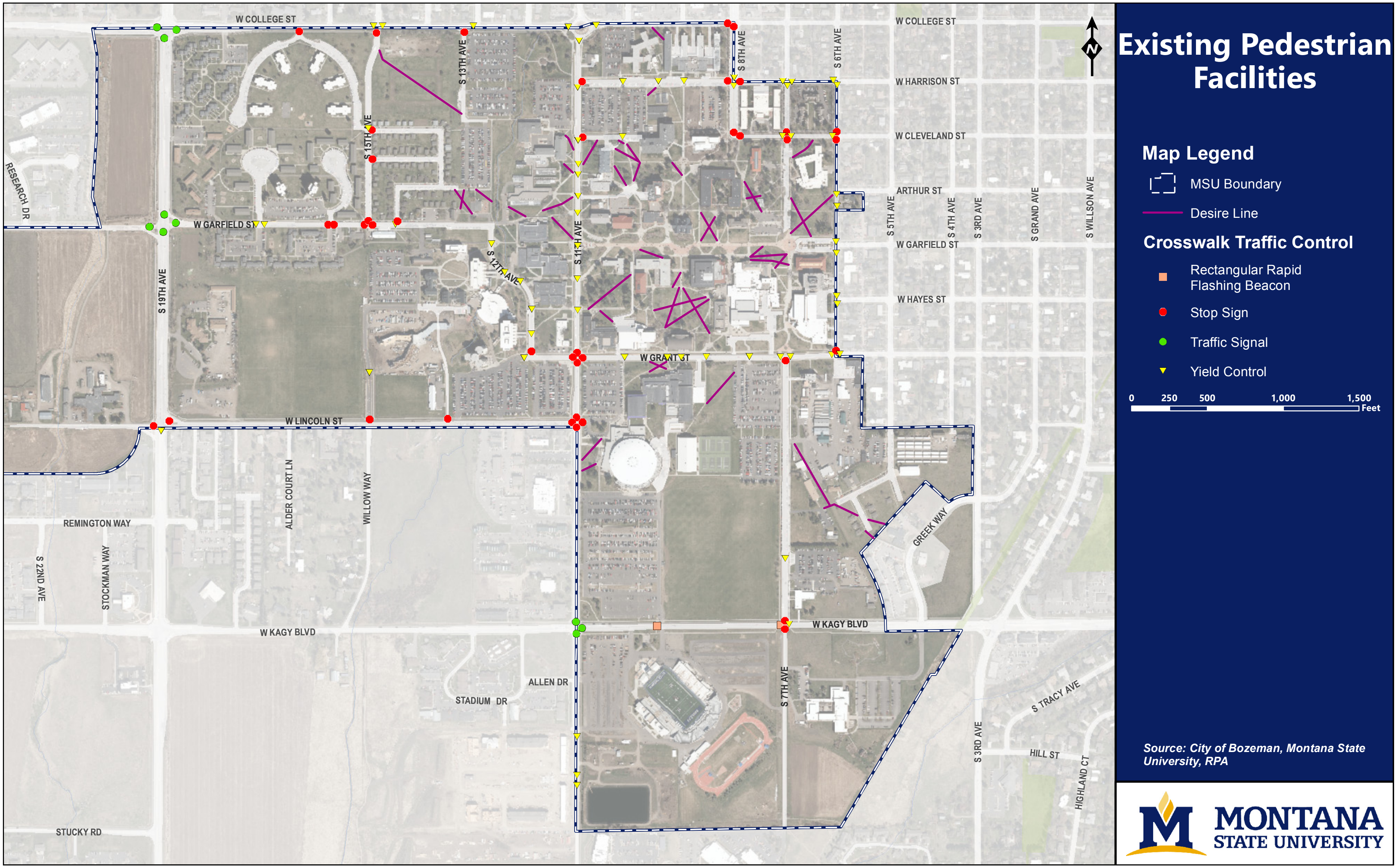


Figure 3.14: Existing Pedestrian Facilities

Connections to Off-Campus Locations

The surrounding neighborhoods make walking a viable mode of travel to and from campus. As such, pedestrian amenities are available in many areas off-campus. A shared used path along College Street from Huffine Lane to South 11th Avenue provides continuous access for pedestrians walking from residential areas to the north-west of campus. Additionally, improvements to crossing along Kagy Boulevard have made pedestrian crossings more visible–i.e. rectangular rapid flashing beacons at South 7th Avenue and mid-block near Bobcat Stadium.

3.2.5. Transit Facilities

Streamline Transportation, the Montana Transit Program of the Year for 2014, was recently honored as one of five urban transit systems throughout the nation to be awarded an Outstanding Public Service Award by the Federal Transit Administration. Streamline provides fixed route public transportation in Bozeman, Belgrade, and Livingston. Streamline began as a partnership between the Human Resource Development Council (HRDC) District IX, and the Associated Students of Montana State University (ASMSU). The partnership now includes the cities of Bozeman and Belgrade and the President's Office at Montana State University. Riders are overwhelmingly MSU students, faculty, and staff. This is both because universities tend to generate significant ridership, and because Streamline's service is MSU-centric, with routes and schedules designed to serve MSU students and employees.

Streamline Bus

Services provided by Streamline include:

- Daytime (Fixed Route)
- Latenight (Deviated Fixed Route)
- Bridger Bowl/Bohart Ranch (Deviated Fixed Route) (Seasonal)
- Saturday service (Fixed Route)
- Livingston Commuter (Fixed Route)
- Belgrade Commuter (Fixed Route)

Skyline is also relevant to MSU and the greater community and is a Big Sky area bus service that also provides the Link between Bozeman and Big Sky. The bus runs seven days a week, except during the off-season when it runs Monday through Friday.

Streamline Schedule(s)

Rides are fare free on all Streamline buses. Streamline daytime service runs 5 times per day to Belgrade with the Green Line from 6:35 am to 8:16 am; 12:10 pm to 1:15 pm; and from 5:15 pm to 7:00 pm. The Red Line, Yellow Line, and Blue Line in Bozeman run one hour routes between 6:30 am and 7:15 pm, Monday through Friday. In 2011 there were three additional daytime routes added to the Red, Yellow and Blue Lines on the half hour during peak times from 7:00 am and 9:30 am and between 4:00 and 6:30 in the afternoon during the MSU school year. In 2012 the Blue half hour route was suspended due to lack of use. Streamline also adds time to the routes when the Warming Center is open during the winter months. **Figure 3.15** depicts the current weekday daytime service routes.

In FY 2008, Streamline added a Latenight service that runs Thursday, Friday and Saturday nights between 7:45 pm and 2:47 am. Streamline encourages those who work late, like to shop in the evenings, or to take in a movie to make use of this service. The Latenight Downtown and Upstream buses runs Thursday, Friday, and Saturday. The Bozeman Police and DARE have both endorsed the use of the buses at night. **Figure 3.16** shows the current Latenight service routes.

There are three routes that run on Saturday during the day from 7:30 am and 6:15 pm. These three routes are shorted versions of the Blue, Red, and Yellow Lines. The Red Line route was added in January 2014 and has been very successful. **Figure 3.17** shows the current Saturday service routes.

A Livingston commuter service (**Figure 3.18**) started on October 13, 2008 with the morning run at 5:50 from Bozeman (Wal-Mart) to Livingston and departing Livingston at 6:35. The return run departs from MSU at 5:15 pm and returns to Bozeman at 6:45.

Lastly, a weekend Bridger Bowl and Bohart Ranch service runs during the ski season, approximately the second weekend of December through the first weekend of April. Bridger Bowl and Bohart Ranch service runs two buses on Saturday and Sunday from 8:00 am to 4:45 pm.

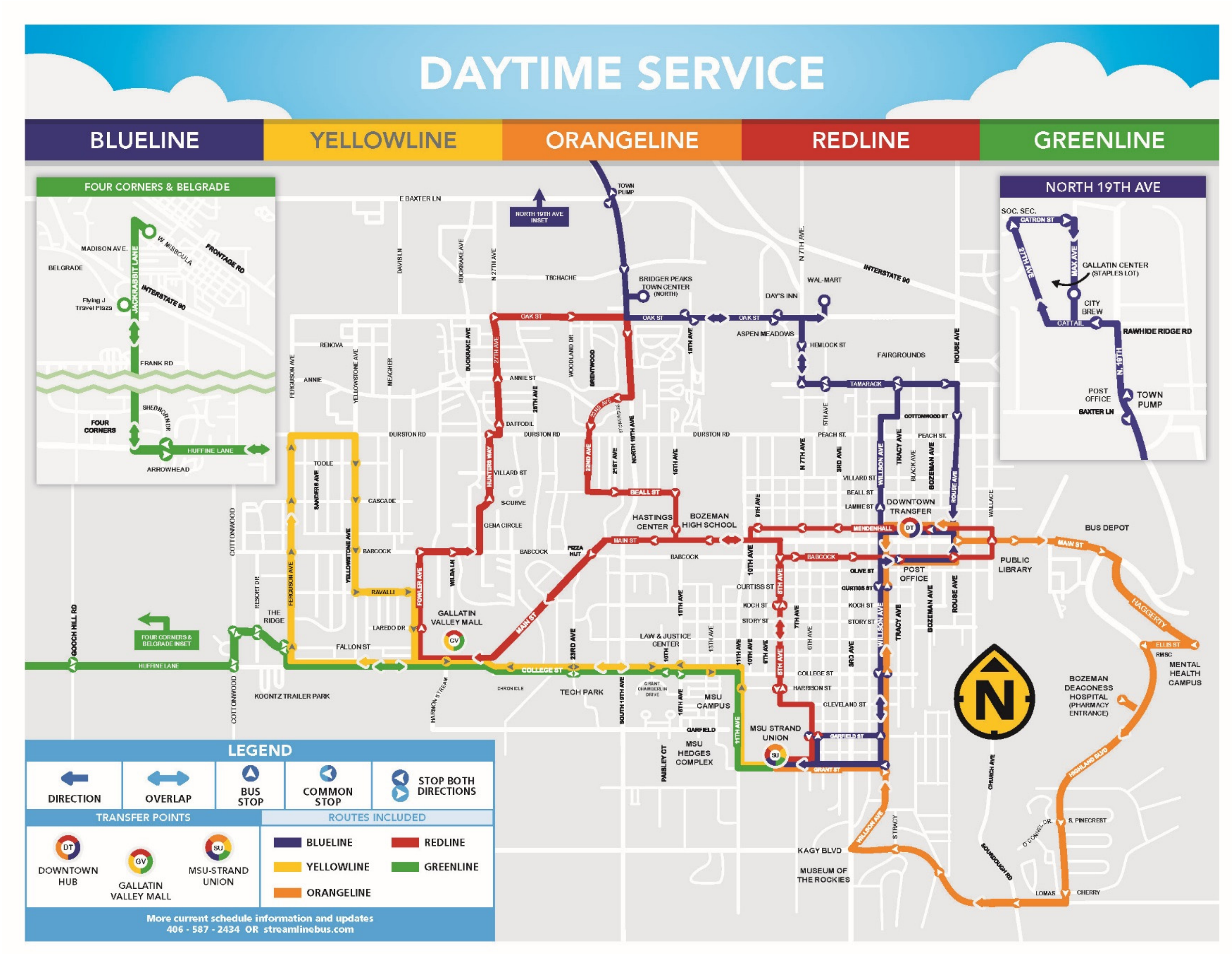


Figure 3.15: Weekday Daytime Service Routes (2015–2016)

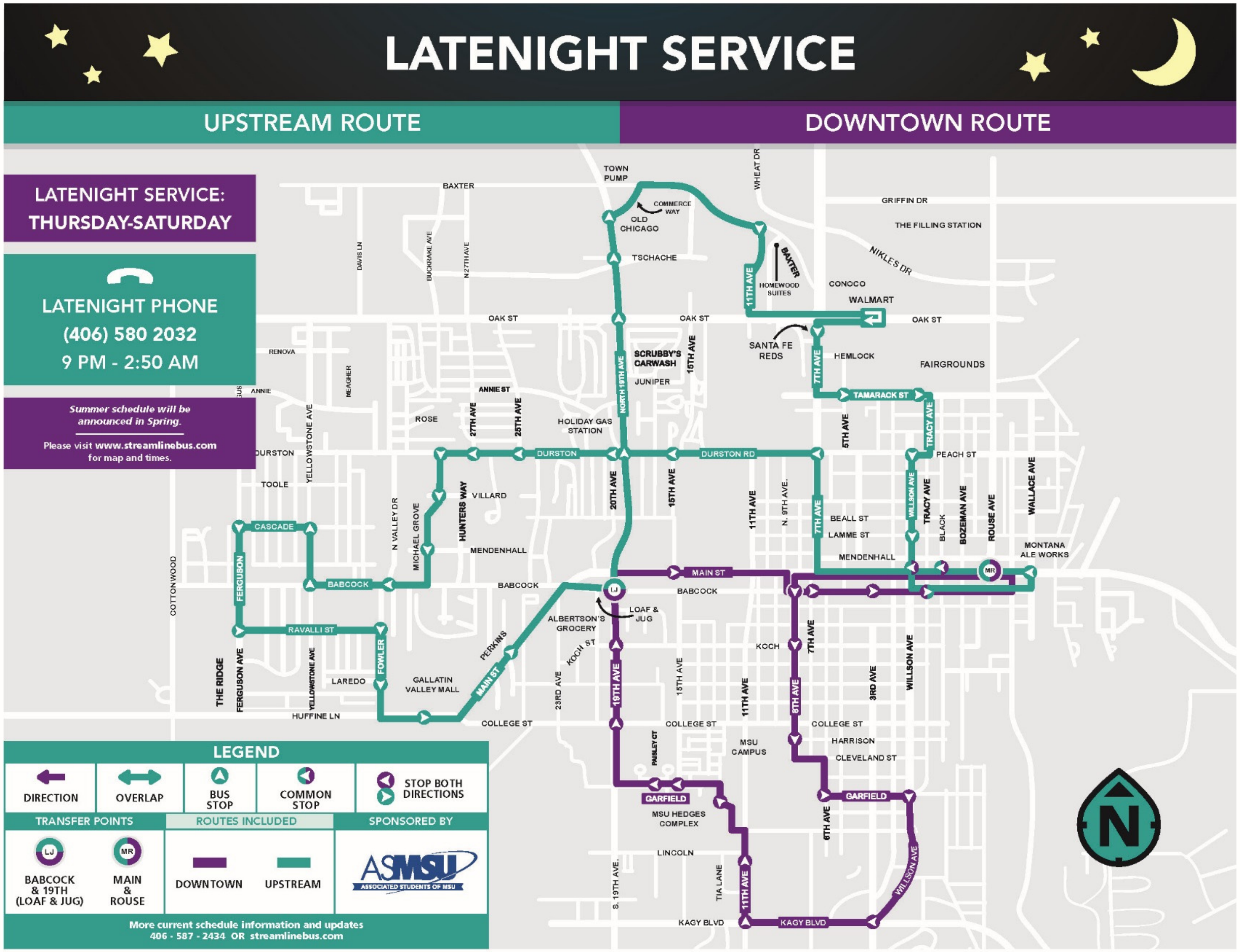


Figure 3.16: Weekday Latenight Service Routes (2015–2016)

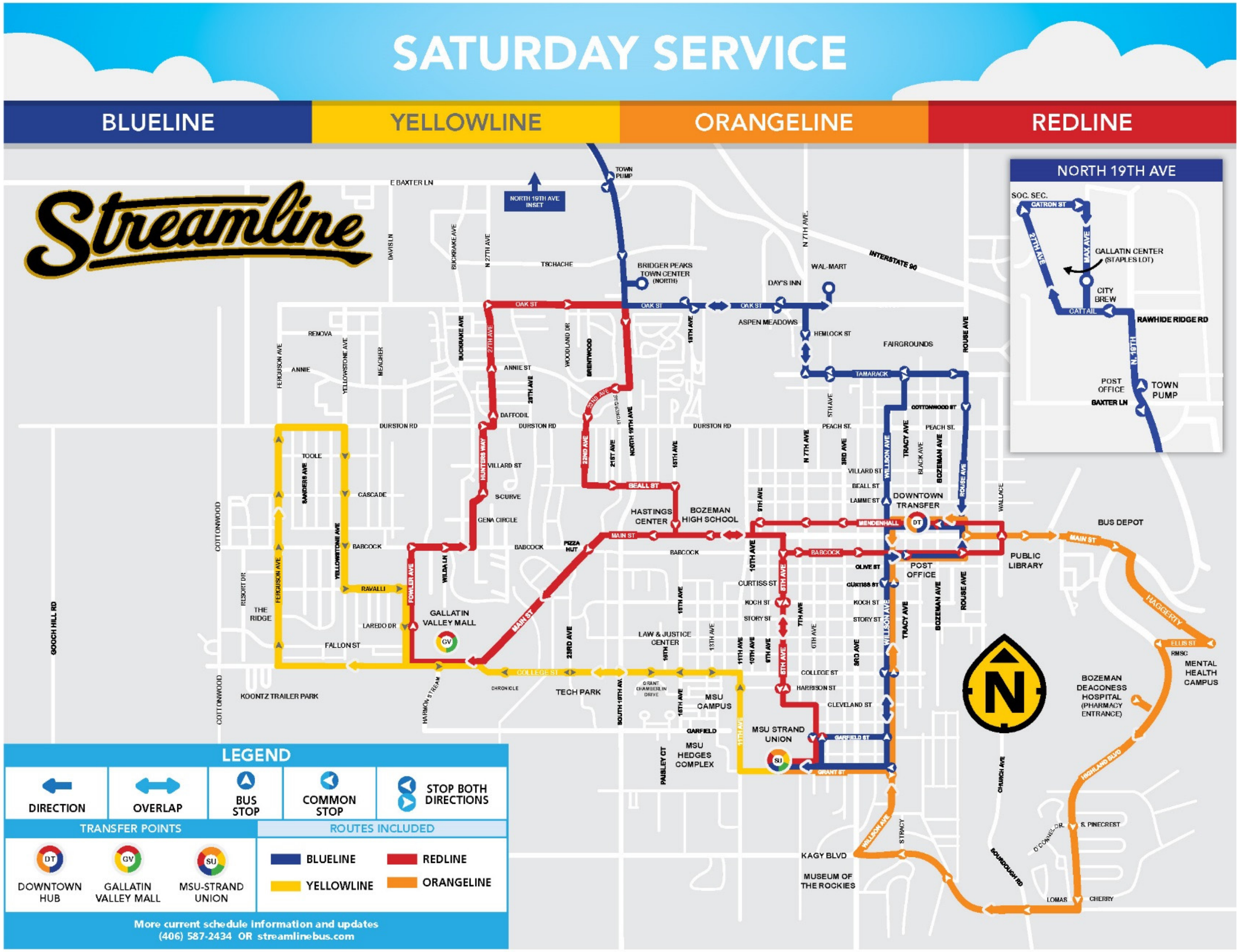


Figure 3.17: Saturday Service Routes (2015–2016)

LIVINGSTON MON-FRI | AM

STOPS	DEPARTURE	W
Wal-Mart Bozeman Depart	5:50 a	No
Printing for Less (Livingston)	6:25 a	No
Shopko (Livingston) Depart	6:30 a	No
Bozeman Deaconess (Pharmacy)	7:15 a	Yes
MSU SUB Arrive	7:15 a	No
MSU SUB Depart	7:20 a	No
Oak & 15th	7:30 a	Yes
Evergreen Business Park	7:35 a	Yes

LIVINGSTON MON-FRI | PM

STOPS	DEPARTURE	W
Evergreen Business Park	4:35 p	No
Oak & 15th	4:40 p	No
MSU SUB Arrive	5:10 p	No
MSU SUB Depart	5:15 p	No
Bozeman Deaconess (Pharmacy)	5:25 p	No
Shopko (Livingston) Arrive	6:05 p	Yes
Printing for Less (Livingston)	6:10 p	Yes
Wal-Mart (Bozeman) Arrive	6:45 p	No

HIGHLIGHTED ROWS = TRANSFER POINTS

BOZEMAN AREA MAP

LEGEND

- MORNING
- EVENING
- START OF ROUTE
- DROP-OFF ONLY See First Page
- SHARED STOP
- DIRECTION
- TRANSFER POINT MSU STRAND UNION

LIVINGSTON AREA MAP

Figure 3.18: Livingston Service Routes (2015–2016)

Streamline Ridership Trends

Ridership data is collected by the drivers when a passenger boards the bus. Monthly ridership data for all routes between fiscal year 2007 and 2015 was provided by Streamline. These data do not provide information for boardings and alightings at specific stops, rather the data is categorized as daytime, late night, Livingston, Bridger Bowl/Bohart Ranch, and Gardner/Mammoth. The Bridger Bowl/Bohart Ranch line runs on weekends during the ski season, approximately from early December to early April. The Gardner/Mammoth route was tested in fiscal year 2011, however, due to low ridership the route was canceled. Both the Bridger Bowl/Bohart Ranch and Gardner/Mammoth routes are not included in the following analysis. Furthermore, fiscal year 2010 was the first year to have weekday, Saturday, late night, and Livingston service, as such, the following analysis will include data from fiscal year 2010 to 2015.

Streamline ridership trends can be summarized on a year-to-year and a month-to-month basis. Data show that total ridership has increased year-to-year from 2010 until 2014. A slight decrease in ridership was seen in 2015. The average annual growth rate based on simple compound growth is 7.5 percent. **Figure 3.19** presents the total combined ridership for the weekday, Saturday, late night, and Livingston routes. Individually, the Saturday and late night categories showed increasing ridership in fiscal year 2015.

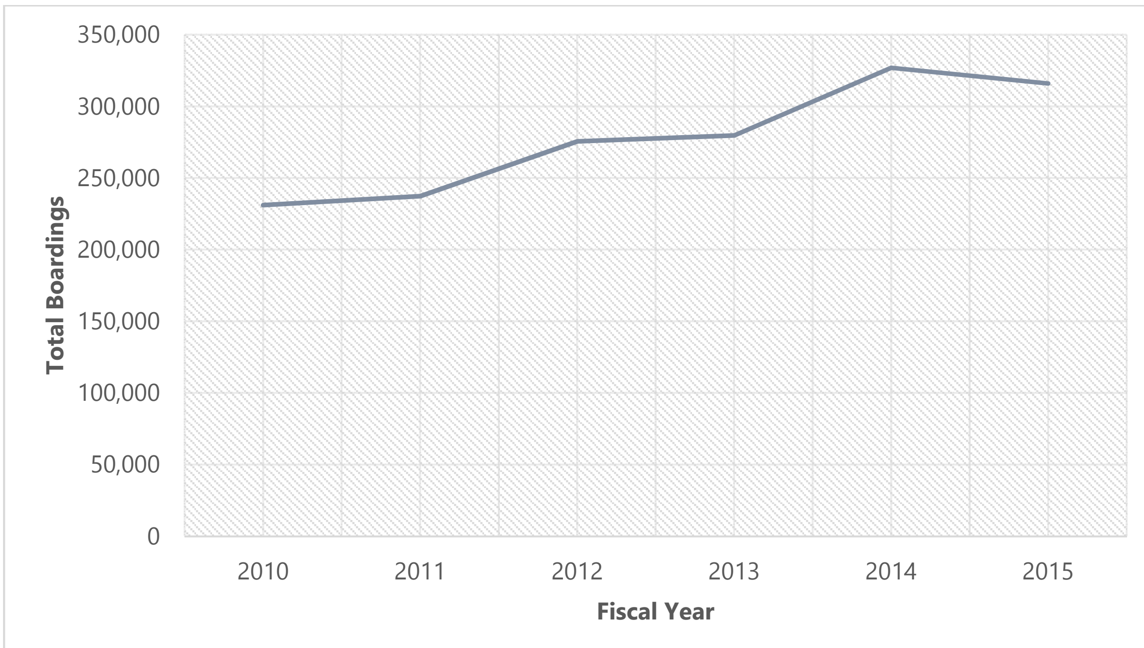


Figure 3.19: Streamline Ridership

On a month-by-month basis, a seasonal variation in ridership can be seen with winter months generally having greater ridership as compared to summer months. It can also be seen that ridership in December decreases as compared to November and January. This trend could be attributed to the holiday season and university students returning home for winter break. The daytime, Saturday, and Livingston categories show less seasonal variation, possible due to more non-university commuters. The late night category shows the greatest variation throughout the year with peaks in April and October and a low in July. Weather and availability of other transportation modes may also contribute seasonal variation of ridership. **Figure 3.20** shows the average percentage of boardings for each month.

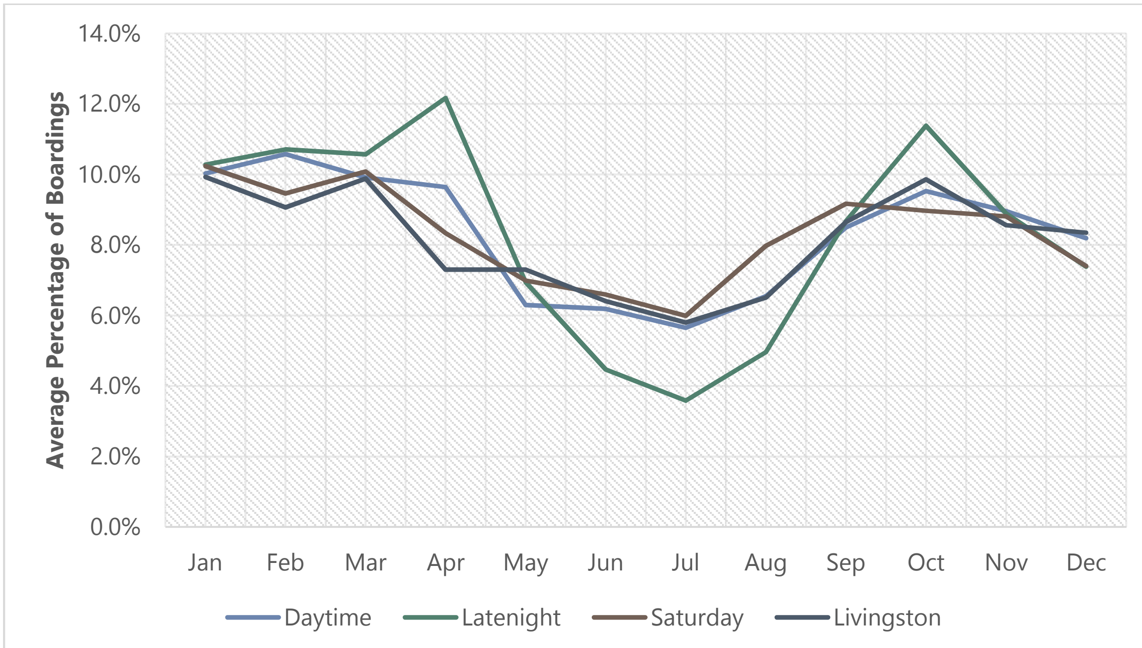


Figure 3.20: Monthly Boardings

3.3. Transportation Demand Management

Transport Demand Management (TDM) can be construed as a set of strategic initiatives geared at improving the efficiency of the transportation network, encouraging alternatives to the single occupant vehicle (SOV) trip and encouraging behavioral change. The ultimate goal is to reduce both traffic volumes and parking demand by changing transportation behavior. There are many manners in which transportation behavior can be affected; however as a general rule TDM aims to address increases in travel demand by:

1. Increasing the cost of auto use (particularly parking) and/or
2. Promoting and encouraging the use of non-automotive transportation modes (e.g. walking, bicycling, transit and carpooling).

Transportation is recognized as a major contributor to greenhouse gas (GHG) emissions, representing a significant opportunity and obligation to review and revise conventional transportation practices. In fact, the MSU Climate Action Plan (CAP) prepared in October 2011 by the Montana State University Campus Sustainability Advisory Council describes the results of a 2009 greenhouse gas emission baseline audit that found that transportation—including campus vehicle fleets, commuting, and air travel—comprise 38 percent of MSU's net emissions.

Moving forward, new developments and changes (such as the Stadium Apartments or NAH, for example) have the potential–or are expected to–impact current parking and transportation demands. As campus related facilities are developed–either on or off campus–it is worthy to address potential impacts in a proactive, sustainable manner. The alternative to TDM is providing additional parking and road capacity to cater to user demand. Furthermore, the benefits of active transportation are becoming increasingly well known. Health, environmental quality, social equity, and community safety all improve when people choose active transportation over driving.

3.3.1. Existing TDM Programs

The MSU Office of Sustainability is the campus leader in promoting time and resources to implement transportation related TDM strategies. Working collaboratively with other partners, MSU's Office of Sustainability strives to increase convenience and incentives for commuters using alternative transportation, not only to improve campus transportation overall but to achieve the goals for GHG emission reductions as contained in MSU's Climate Action Plan. MSU actively promotes the following campus-wide TDM strategies:

- **Carpool:** Carpooling is a great way to be sustainable and meet new people. The Western Transportation Institute (WTI) created a site called Ride Share MT in order to promote safe commuting across Montana.
- **City Transit:** Another way to get to campus is on the Streamline, which is very convenient and free. The Streamline also has bike racks on it, so if a user is only able to bike part of the way, Streamline can provide the remainder of the journey.
- **Biking:** MSU and bicycling advocates are very passionate about biking on campus, since Bozeman has so many trails and outdoor enthusiasts, the biking community and outreach in Bozeman is strong. Publications and resources include rules of the road guidance, the MSU Bike Task Force, bike to work/school and other events, bike maps, and bicycle repair resources.
- **Walking:** Many people choose to walk, scooter and skateboard to campus, primarily from origins within one mile of campus.

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4.0. PEER REVIEW

To put MSU's transportation and parking systems into perspective, several institutions were contacted to identify current practices, parking ratios, and TDM programs. The narrative herein provides an overview of institutional implementation of different categories of measures across a variety of peer universities. This information was gathered through brief interviews with university officials and through information available on the respective institutions' websites. Basic statistics for each institution are summarized in **Table 4.1** below and a more detailed description of each program is provided in this section.

Table 4.1: Comparison Institutions

	Montana State	Univ. of Montana	Univ. of Colorado	Colorado State	Washington State	New Mexico State	Univ. of Idaho	Weber State
			Boulder					
City Population	39,860	69,122	103,166	152,061	31,395	101,324	24,534	84,249
Students	15,688	13,358	30,000	27,217	19,756	15,829	10,474	25,955
Faculty/Staff	3,087	2,540	7,260	6,209	4,481	3,938	2,464	2,554
Land Use	Rural/Semi Urban	Urban	Urban	Urban	Rural/Semi-Urban	Urban	Rural/Semi Urban	Urban
Parking Spaces	6,480*	4,274	7,605	13,103	6,149	11,499	5,737	7,100
Parking Ratio (per Student)	0.41	0.32	0.25	0.48	0.31	0.73	0.55	0.27
Parking Ratio (per Student Faculty & Staff)	0.34	0.27	0.20	0.39	0.25	0.58	0.44	0.25

** NAH parking will result in 150 additional spaces*

Montana State University, Bozeman, MT
City Population: 39,860
Students: 15,688
Faculty and Staff: 3,087

Montana State University is located near the southern extents of Bozeman, Montana. The university has a rural/semi urban character. A total of 6,480 parking stalls are available for students, faculty, and staff. Parking permits range in cost from $72 to $765 annually depending upon the parking pass desired.

Bus service to campus is provided by the Streamline Bus system. Streamline is fare free for all users and largely funded through the Associated Students of Montana State University (ASMSU). Active transportation is emphasized by providing facilities for both bicycling and walking.

University of Montana, Missoula, MT
City Population: 69,122
Students: 13,358
Faculty and Staff: 2,540

The University of Montana is located in Missoula, Montana and has an urban character. Students and faculty share a total of 4,274 parking stalls. Parking permits range in cost from $225 to $600 depending upon the level of parking permit.

The Mountain Line transit system services the University of Montana campus as well as the City of Missoula. Recently, Mountain Line changed to a fare free model. In addition to the Mountain Line routes, the UDASH system provides University specific routes. Active transportation modes are encouraged through providing bike parking and other non-motorized amenities.

University of Colorado, Boulder, Colorado
City Population: 103,166
Students: 30,000
Faculty: 7,260

University of Colorado, Boulder is located in Boulder, Colorado and has an urban character. Students and faculty/staff share 7,260 parking stalls. Parking rates range from $262 to $396 per academic year depending upon the level of parking permit desired.

A student bus program is available to students and includes regional coverage and routes to Denver International Airport. For faculty and staff working at least 20 percent of full time, unlimited usage of Boulder County transit services is provided through the EcoPass program. In addition to transit service, EcoPass entitles university faculty and staff to a guaranteed ride home program free of charge. Ridematching is provided through Zimride. Additionally, reserved priority parking spaces are set aside for carpools in various parking lots. Biking and walking are encouraged through providing bike parking and other non-motorized amenities.

Colorado State University, Fort Collins, CO
City Population: 152,061
Students: 27,217
Faculty and Staff: 6,209

Colorado State University (CSU) is situated at the northern end of Fort Collins, Colorado. The urban character of CSU results in a finite amount of space for parking. As such, plans to replace surface parking with structured parking are in place. A total of 13,103 parking stalls are available on the CSU campus. The annual parking fee for a commuting student is $234, resident student permits cost $303. Some on-campus housing offer free parking.

Transfort–the public transit system in Fort Collins–has one of its three major transit centers located in the northeast corner of the CSU campus. Transfort is heavily subsidized by CSU students, faculty, and staff. Students are able to use their Ram card (student ID) to board any Transfort bus. Students are charged a yearly fee of $50 for unlimited access to the Transfort system. In order to emphasize active transportation modes, CSU's campus core is closed to motorized vehicles. Furthermore, "Dismount Zones"–areas that require bicyclist and skateboarders to dismount-on campus promote safe pedestrian areas. Other TDM strategies include preferential parking for carpool permit holders, vehicle rental options available to students and faculty, and various carpooling and ride sharing programs.

Washington State University, Pullman, WA
City Population: 31,395
Students: 19,756
Faculty and Staff: 4,481

Located in Pullman, Washington, Washington State University (WSU) has a rural/semi-urban character. A total of 6,149 parking stalls are available on the WSU campus. Parking permits are available at an annual fee ranging from $76.74 to $656.07 dependent upon which parking permit is purchased. Through a cooperative parking arrangement, select parking permits are valid for both WSU and UI campus parking at eligible lots.

Bus service to campus and destinations around Pullman are provided free of charge to students by Pullman Transit. The bus system runs Monday through Saturday during the academic year. Other transit services include a shuttle to the Spokane Airport and a vacation bus service from Pullman to Seattle during WSU break periods. For other on-demand transportation needs, WSU offers Zipcar rentals to students. Active transportation modes are promoted. A free park and ride commuter lot is located on the western side of the WSU campus.

New Mexico State University, Las Cruces, NM
City Population: 101,324
Students: 15,829
Faculty and Staff: 3,938

New Mexico State University (NMSU) is located in Las Cruces, NM near the intersection of I-25 and I-10. According to a 2011 Transportation and Parking Analysis, there is an inventory of 15,359 stalls available for students, faculty, and staff. Annual cost for parking permits range from $52.00 for commuter students to $105.50 for faculty and staff. Additionally, free parking is available on the periphery of campus with a free shuttle providing transportation to the campus core.

Transit services on and around campus are provided by the City of Las Cruces transit system, RoadRUNNER Transit. On campus routes are funded through a fee imposed on students as part of their tuition. Three lines provide service between parking and the campus core. NMSU students have the option to use the Crimson Cab program which gives students free cab service within the city limits of Las Cruces between 9:00 PM and 5:00 AM every day.

University of Idaho, Moscow, ID
City Population: 24,534
Students: 10,474
Faculty and Staff: 2,464

The UI campus is located in Moscow, Idaho and has a rural/semi-urban character. A supply of 5,737 parking stalls are available for students, faculty, and staff. Parking permits range in cost from $64 to $325 dependent upon the level of parking permit desired. Through a cooperative parking arrangement, select parking permits are valid for both WSU and UI campus parking at eligible lots.

Limited fixed-route transit is available in Moscow. The Vandal Access Shuttle provides transportation on campus only and gives priority to individuals with disabilities. Moscow Valley Transit provided two fixed routes within the City of Moscow. Active transportation modes are encouraged on campus through providing bike parking, non-motorized areas, and wayfinding signage. Other programs intended to decrease on-campus vehicles include ZipCar rentals and Zimride (a ride sharing program that requires a UI email address).

Weber State University, Ogden, Utah
City Population: 84,249
Students: 25,955
Faculty: 2,554

Weber State University is located in Ogden, Utah and has an urban character. While information on the total number of stalls on campus was unavailable, using aerial imagery it was found that approximately 7,100 stalls are available. Parking permits range in cost from $26 to $115 depending on permit type. "A" permits, which offer parking closer to academic buildings are available to seniors through a lottery drawing.

Shuttle service is provided between the Dee Events Center and the Stewart Library near the center of campus. Parking around the Dee Events Center is plentiful with about 2,000 stalls, however, a $26 parking permit is still required. The Utah Transit Authority operates various fixed route transit services near campus and the surrounding areas. Students may ride free of charge if a valid student ID is presented when boarding the bus. Active transportation modes are encouraged through providing bike parking and other non-motorized amenities.

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5.0. FUTURE CONDITIONS

The following subsections outline the future condition of traffic and parking on the MSU campus.

5.1. Student and Faculty/Staff Growth

A critical step in developing recommendations is to understand future demand for the parking and transportation system. Traditionally, historic traffic data would be used to establish an estimated growth rate of traffic. For this study, however, existing traffic data may be dominated by off-campus road users and, as such, may not be a good representation of overall demand during the planning horizon. Accordingly, historic student enrollment and faculty/staff counts have been used to generate possible annual average growth rates (AAGRs).

It was assumed that growth would occur in an exponential manner (similar to simple interest). Identifying a historic time period that is representative of future trends can be complicated by external variables. Historic data dating back to 1893 is available. The data from 1990 through 2015 was plotted and visual trends were identified. An increase in enrollment was noted in 2007. From this, three AAGRs were developed: 1995-2007 (low), 1990-2015 (moderate), and 2007-2015 (high). This information is presented in **Table 5.1** and graphically in **Figure 5.1**.

Faculty/staff growth was assessed in a similar fashion to student enrollment. Data is available from 1995 to current. The data was plotted and faculty/staff growth has happened at a consistent rate for the past 20 years. An AAGR of 1.76 percent per year was determined to be representative of historic growth. This information, as with student enrollment projections, is presented in **Table 5.1** and **Figure 5.1**.

Table 5.1: Projected Student and Faculty/Staff Growth

	Existing Count (2015)	AAGR	Projected Count (2025)
Students (Low Growth)	15,688	0.61%	16,672
Students (Moderate Growth)	15,688	1.50%	18,207
Students (High Growth)	15,688	3.59%	22,323
Faculty/Staff	3,087	1.76%	3,675
Combined (Low Growth)	18,775	-	20,347
Combined (Moderate Growth)	18,775	-	21,882
Combined (High Growth)	18,775		26,022

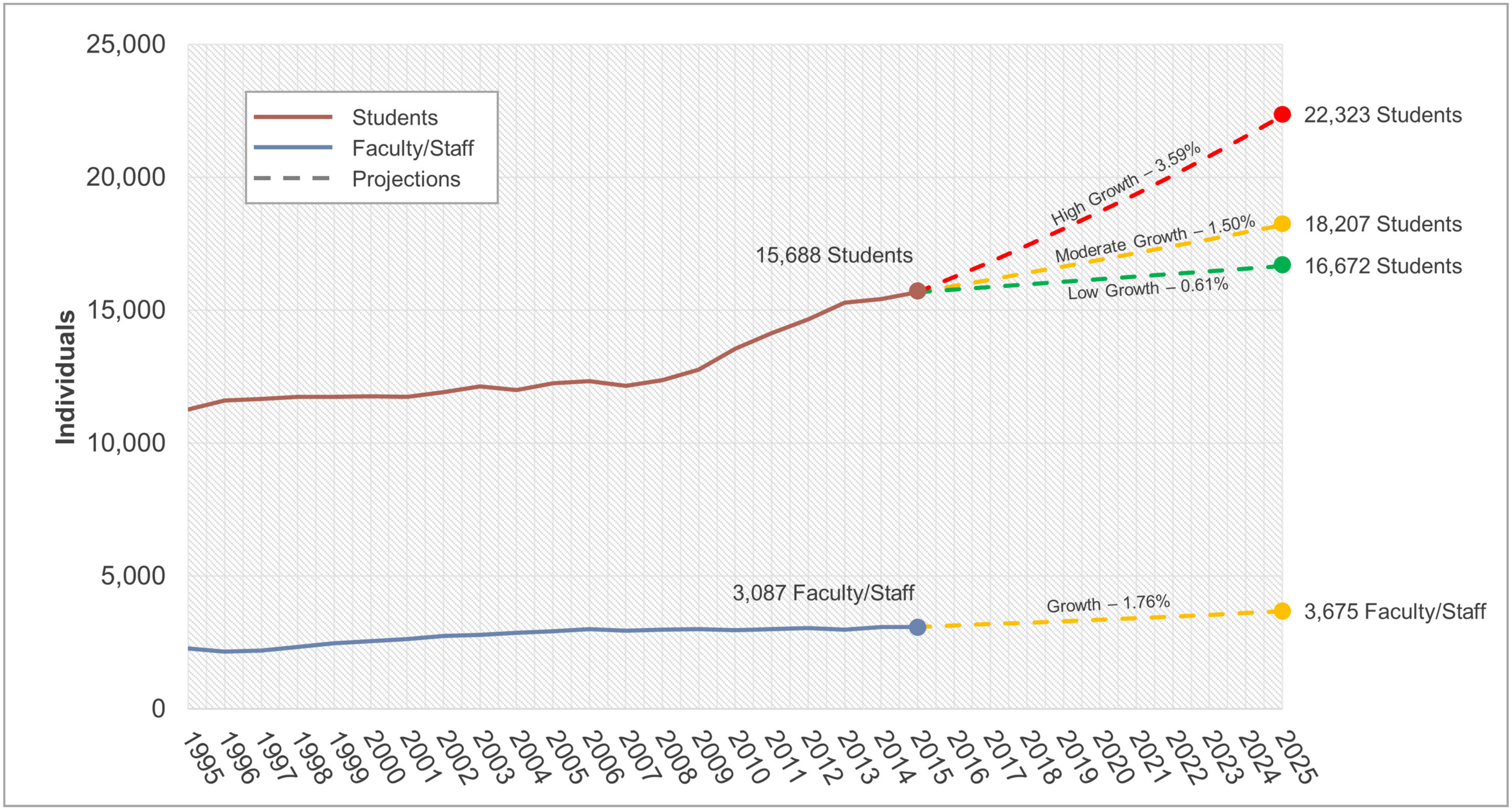


Figure 5.1: Projected Student and Faculty/Staff Growth

5.2. Projected Parking Inventory

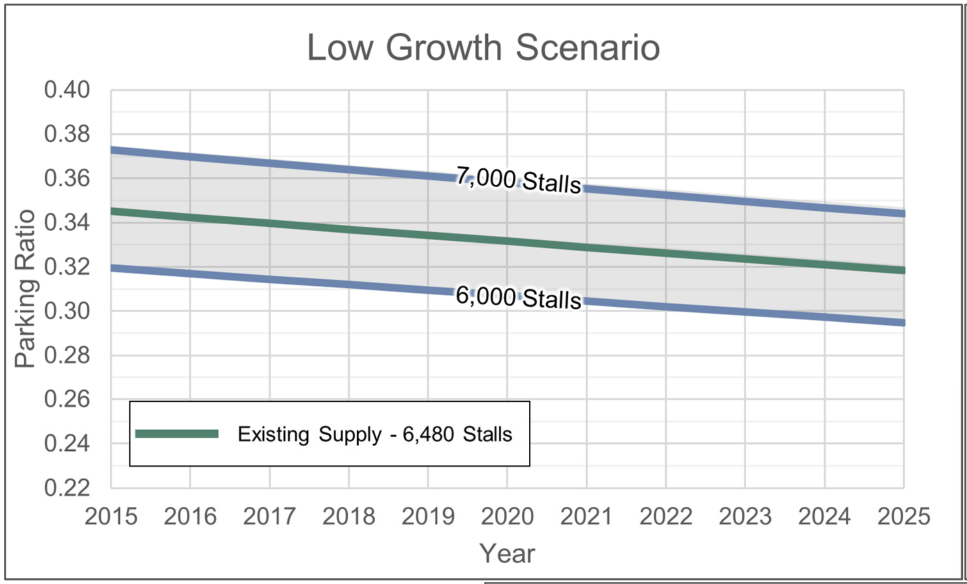
In an effort to project the amount of parking inventory needed to match the demand for parking, it is important to consider the following: desired parking ratio, acceptable average utilization and projected mode share. These three variables are not independent of one another. For example, if the parking ratio is allowed to decrease as the number of students and faculty/staff increases, the utilization of parking will increase. Alternately, if the percent of users opting to use active transportation modes increases the utilization of available stalls will decrease which could allow for the parking ratio to be reduced with little perceived ill effect. Therefore, it is necessary to address future parking inventory based on each of these three aspects.

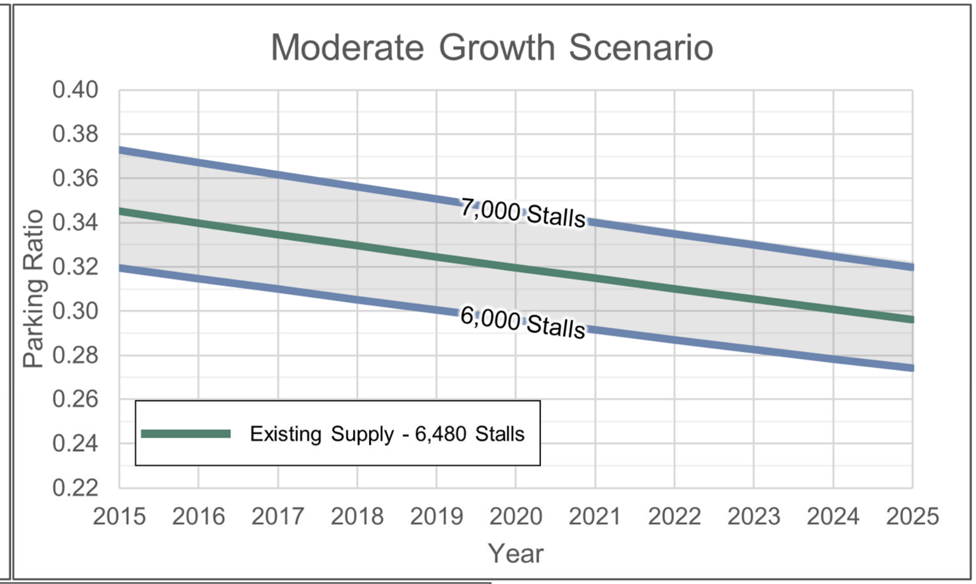
The parking ratio changes when either the number of users or stalls changes. Student and faculty/staff growth will change the number of users and result in a decreased parking ratio if no new parking is constructed. Construction on campus can affect the number of parking stalls if buildings are placed in locations that encroach on existing parking lots. Alternately, new parking lots or parking structures can be constructed, resulting in an increase in the number of available stalls. Parking ratio projections were made assuming that mode share remains consistent and user growth follows the trends presented in **Section 5.1**. **Table 5.2** presents the number of parking stalls that would need to be available if the current parking ratio of 0.34 were to be maintained. The graphs presented in **Figure 5.2** show the range of parking ratios in a given year based on the number of available parking stalls.

Table 5.2: Projected Parking Ratio and Inventory Needs

Growth Scenario	Projected Students and Faculty/Staff	Parking Ratio with Existing Parking Inventory	Parking Inventory Required to Maintain a Parking Ratio of 0.34
Low Growth	20,347	0.32	6,918
Moderate Growth	21,882	0.30	7,440
High Growth	22,323	0.29	7,590

Parking utilization is a function of parking supply and demand. Changes to supply are a result of construction or removal of parking stalls. Parking demand is a result of student and faculty/staff growth or changes to mode share. Under existing conditions, average parking utilization is 72 percent. If more parking stalls were constructed, the utilization would decrease. However, as the student population increases, so does parking utilization. If it were assumed that mode share will not change, parking utilization will be approximately 76, 82, and 97 percent in 2025 under the low, moderate, and high growth scenarios, respectively. However, if the supply of parking spaces were increased to 6,500 stalls, the parking utilization would be 74, 79, and 94 percent in 2025 under the low, moderated, and high growth scenarios, respectively. **Figure 5.3** presents the parking utilization based on the number of available stalls for both the low and moderate growth scenarios under the assumption that mode share will remain the same.





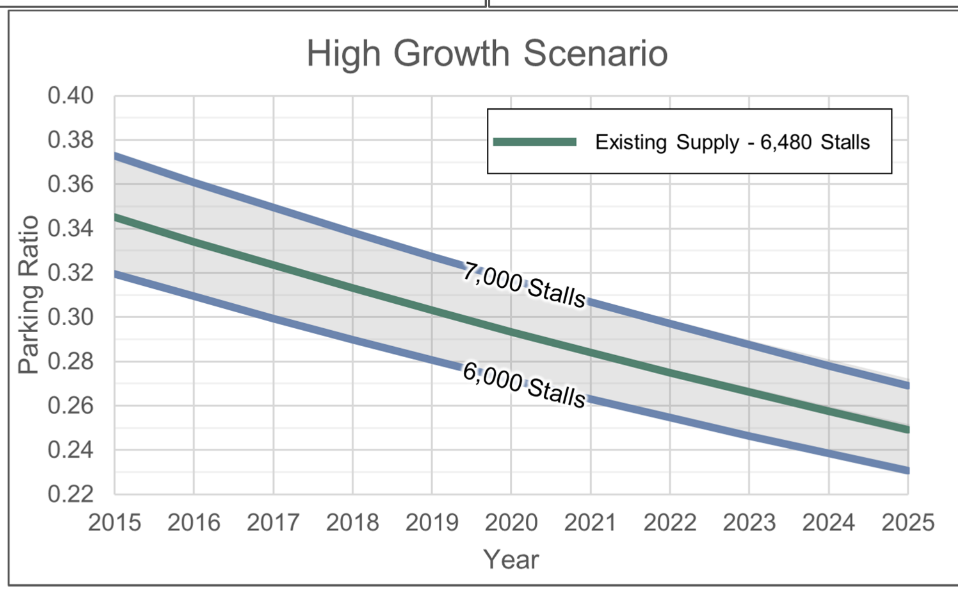


Figure 5.2: Projected Parking Ratio Based on Growth Scenario

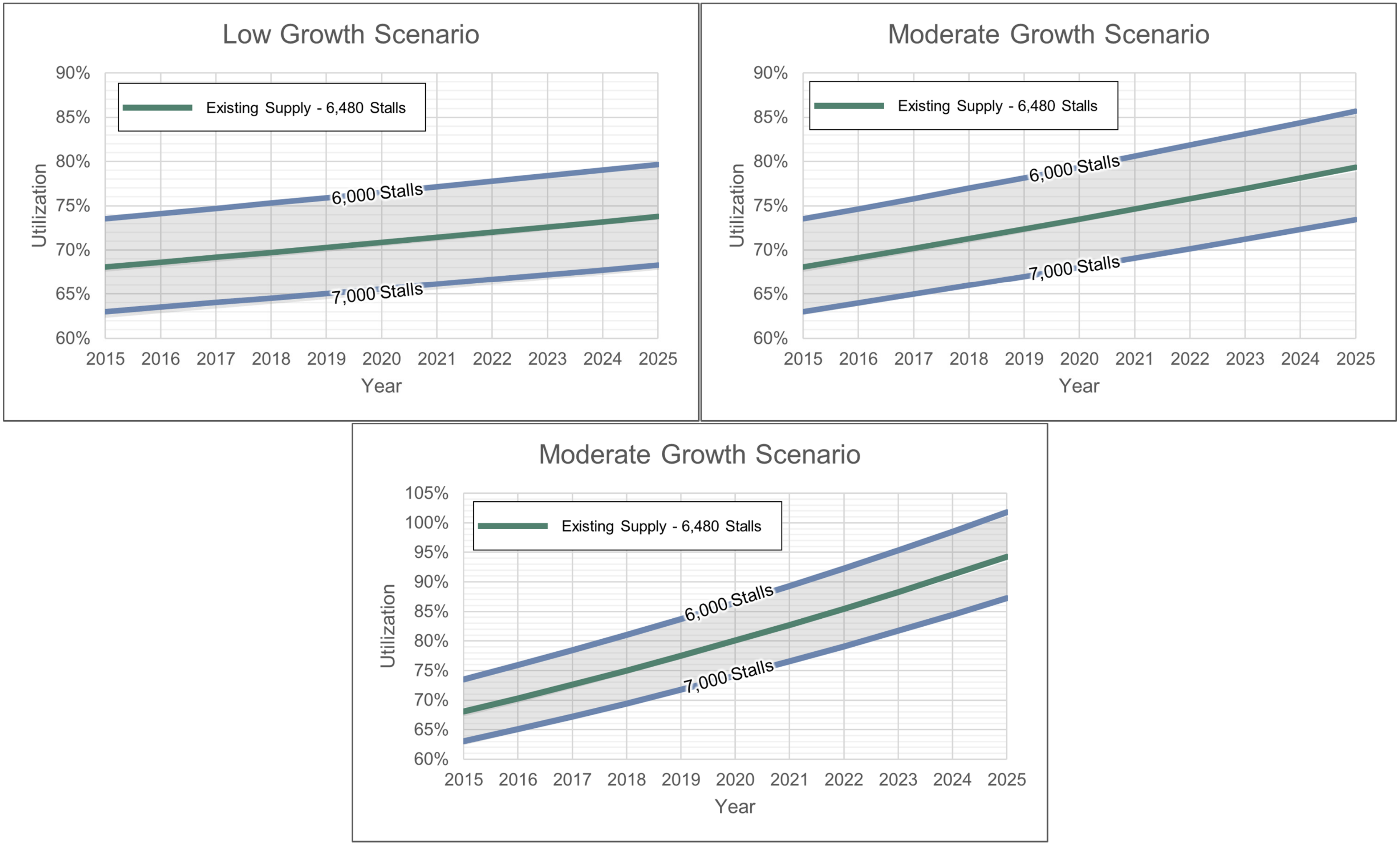


Figure 5.3: Projected Parking Utilization Based on Growth Scenario Assuming no Change to Mode Share

5.3. Projected LOS

Projections for intersection traffic volumes were made for the seven intersections analyzed previously in **Section 3.2.1**. These projections were based on the percent growth rates calculated from the Bozeman Transportation Master Plan's (TMPs) travel demand model between the years 2014 and 2040. The growth rate was determined for each intersection as a whole. Intersections that are scheduled for reconfiguration or reconstruction, as per the City's Capital Improvement Plan (CIP) or the Kagy Boulevard reconstruction project, were changed to reflect the future configuration of the intersection. Note that changes in travel patterns and volumes resulting from new road connections and revised intersection configurations make traffic volume predictions difficult, and in some cases may not represent the ultimate future volumes that may be realized at a given location. Because Kagy Boulevard was modeled as a 3-lane road as specified in the existing Greater Bozeman Area LRTP, true demand along the corridor is constrained forcing traffic to find other routes through and around MSU. Accordingly, computed future intersection level of service (LOS) may be conservative and represent a "worst-case" scenario.

The results of this analysis are tabulated in **Table 5.3**. A graphical representation of the projected LOS analysis is presented in **Figure 5.4**. Note that the projected LOS is for the year 2040 as that is the planning horizon for the Bozeman TMP and that which projections were readily available for using the travel demand model.

Table 5.3: Projected LOS (Year 2040)

	AM		PM	
	Delay	LOS	Delay	LOS
South 11th Ave & College St (Roundabout)	**11.1**	**B**	**85.9**	**F**
Northbound	7.4	A	198.5	F
Southbound	12.8	B	13.1	B
Eastbound	12.2	B	31.7	D
Westbound	10.1	B	17.7	C
South 11th Ave & Grant St (AWSC)	**22.3**	**C**	**234.6**	**F**
Northbound	22.0	C	340.6	F
Southbound	28.9	D	261.4	F
Eastbound	13.7	B	22.1	C
Westbound	16.5	C	128.3	F
South 11th Ave & Lincoln St (AWSC)	**30.1**	**D**	**103.2**	**F**
Northbound	17.3	C	151.2	F
Southbound	16.1	C	75.3	F
Eastbound	46.0	E	87.0	F
Westbound	11.2	B	25.0	C
South 11th Ave & Kagy Boulevard (Signal)	**34.6**	**C**	**239.1**	**F**
Northbound	45.6	D	160.4	F
Southbound	53.9	D	217.9	F
Eastbound	23.3	C	296.5	F
Westbound	42.2	D	182.0	F
8th Ave & College St (AWSC)	**20.3**	**C**	**99.1**	**F**
Northbound	13.6	B	25.7	D
Southbound	15.7	C	20.1	C
Eastbound	19.9	C	196.1	F
Westbound	25.6	D	39.2	E
South 7th Ave & Grant St (AWSC)	**26.2**	**D**	**123.1**	**F**
Northbound	15.7	C	126.6	F
Eastbound	22.4	C	169.6	F
Westbound	35.0	D	50.7	F
South 7th Ave & Kagy Boulevard (Signal)	**7.9**	**A**	**10.7**	**B**
Northbound	38.9	D	31.1	C
Southbound	42.1	D	35.5	D
Eastbound	6.5	A	7.9	A
Westbound	6.2	A	7.2	A

AWSC: All-way Stop Control

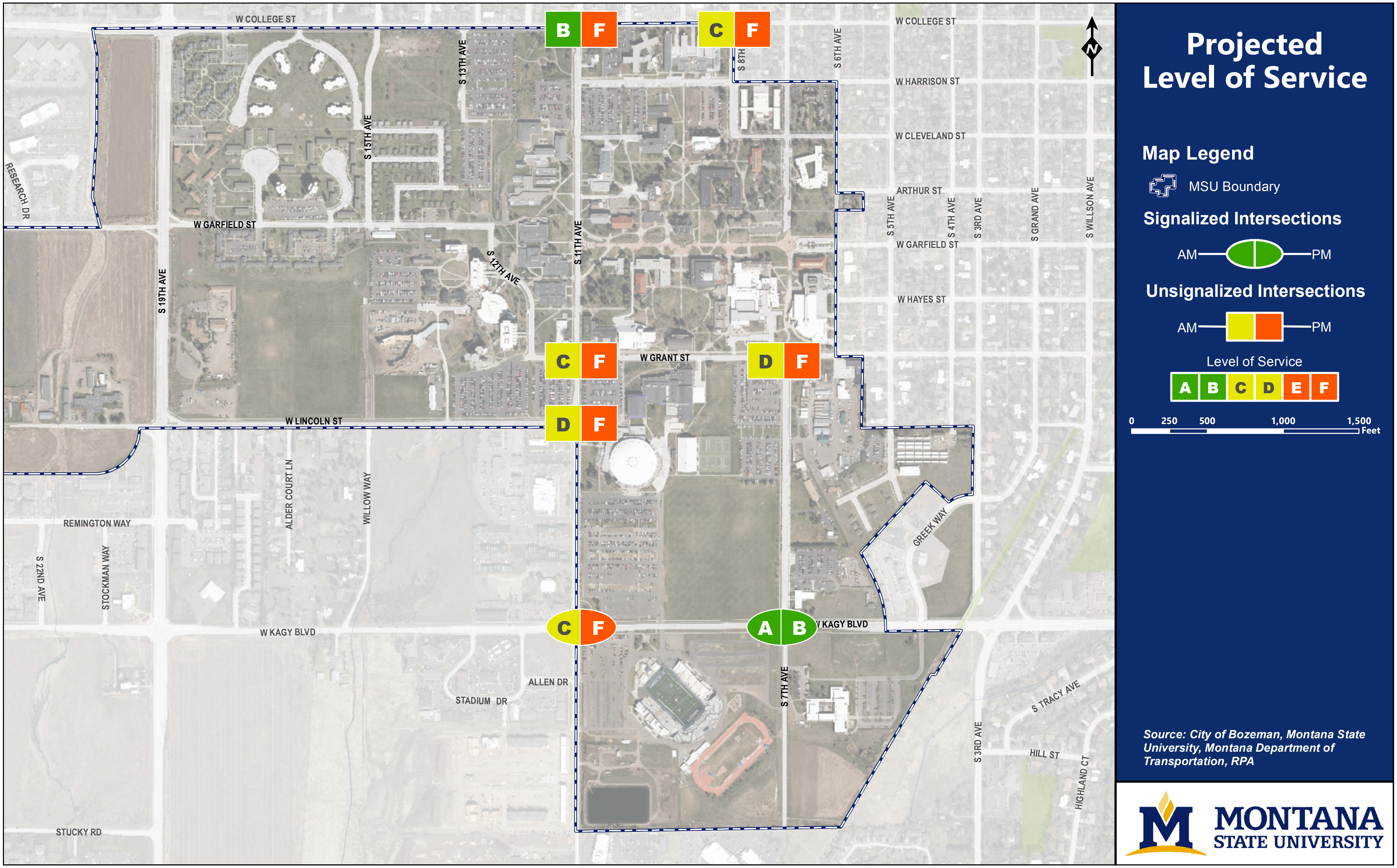


Figure 5.4: Projected Level of Service (Year 2040)

6.0. PLAN CONCEPTS

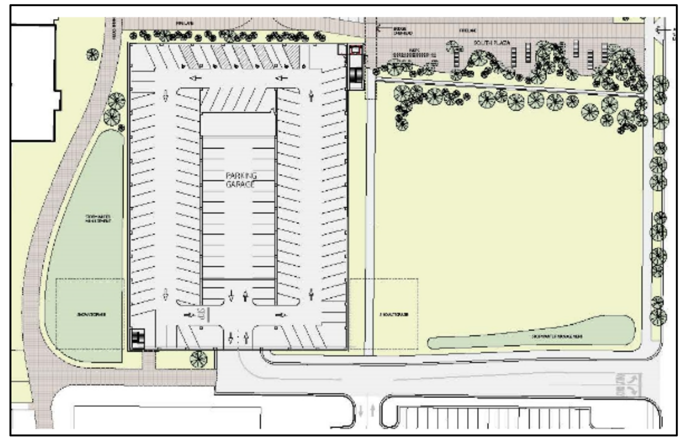
The following subsections present committed transportation and parking improvements along with concepts and recommendations based on the analyses presented in prior sections of this report.

6.1. Recent and Planned Transportation and Parking Improvements

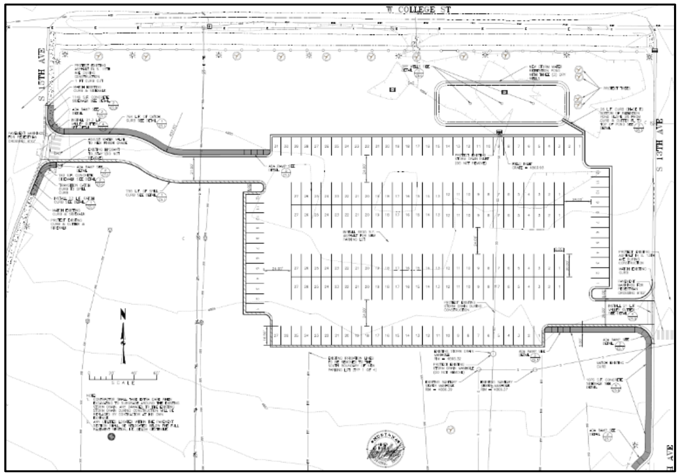
Recent and planned transportation and parking improvements represent those projects that were recently completed, or are likely to be constructed, in the near future.

6.1.1. South Campus Parking Structure

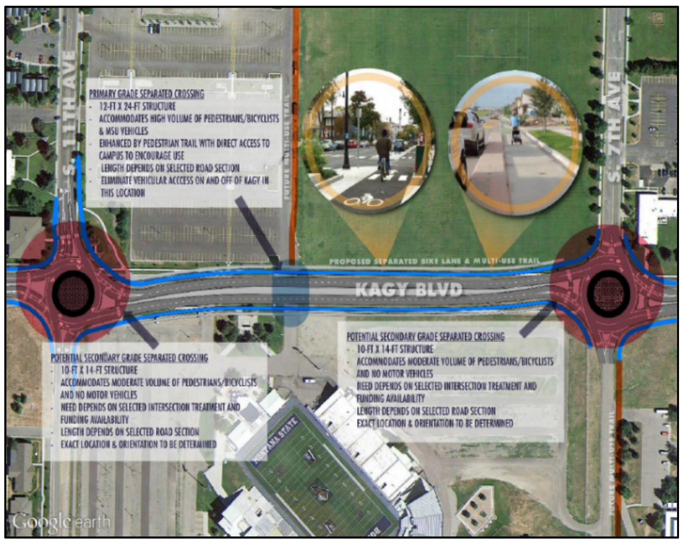
The parking structure is the first part of the South Campus Development, which also includes Norm Asbjornson Hall (NAH) and related elements. Construction on the parking structure and the NAH are staggered so as to have the least impact on parking over the entire South Campus Development construction process. The new parking structure was opened for parking in January 2017. The new parking structure has 550 parking spaces, which resulted in a net gain of 150 spaces over those lost due to the construction of the NAH and the parking structure itself. Note that these additional spaces have been included in the parking supply quantification depicted earlier in this document. Access to the parking structure is off of South 7th Avenue just south of the intersection with Grant Street.



The new parking structure is accessed from South 7th Avenue just south of Grant Street.



The new "Bison Lot" surface parking area resulted in 190 new spaces (*courtesy of TDH Engineering*).



Design concepts for the reconstruction of Kagy Boulevard have evaluated three-, four- and five-lane options (*courtesy of Sanderson-Stewart*).

6.1.2. Bison Parking Lot

The Bison Parking Lot was constructed in August, 2016 and is located west of South 13th Avenue and south of College Street. The new surface parking area includes 190 spaces with site lighting and storm water retention. An additional access to South 15th Avenue with lighting was also included. Much of the parking is a result of parking displaced due to the new dining hall project.

6.1.3. Kagy Boulevard Reconstruction

The City of Bozeman and the Montana Department of Transportation (MDT), in cooperation with MSU, the Museum of the Rockies and other stakeholders, initiated a project for the reconstruction of Kagy Boulevard from South 19th to Willson Avenues. The anticipated improvements include roadway widening, intersection improvements, landscaping, and the installation of lighting, storm drain and pedestrian and bicycle facilities along Kagy Boulevard from the intersection with South 19th Avenue to the intersection of Willson Avenue. Several options were presented to the public at a community meeting in April, 2016 and consisted of three-lane, four-lane and five-lane configurations with a variety of intersection treatments ranging from traffic signalization(s) to multi-lane roundabouts. Discussions of potential grade separation for bicyclists and pedestrians between South 11th and South 7th Avenues occurred to safely link the South Fieldhouse Lot to the campus path system. The preliminary configuration realizes a four-lane roadway section with multi-lane roundabouts at the intersections of Kagy Boulevard with South 11th, South 7th, and South 3rd (Willson) Avenues.

Unfortunately, the project is underfunded by approximately $6 Million and has led the city of Bozeman to pull it from their committed capital improvement project list. That is, the funding source to build the project is no longer available and it is not likely to occur before 2021. As an interim improvement, the city of Bozeman intends to improve Kagy Boulevard from approximately 500 feet west of South 11th Avenue to approximately 500 feet east of South 7th Avenue to a full three-lane cross section which includes a two-way left-turn lane (TWLTL).

6.2. Transportation Recommendations

The following recommendations are based on the analyses presented in prior sections of this document.

6.2.1. Vehicular Modes

Vehicular modes of travel in the context of this report include motorized private vehicles such as cars, trucks and motorcycles. **Figure 6.1** presents a map of the vehicular recommendations.

Intersection Improvements

Seven intersections were analyzed for safety and operations via a LOS analysis. These intersections are listed below and recommended improvements are described for each as appropriate.

INT-1: South 11th Avenue & College Street – This intersection is currently a single-lane roundabout and operates at a LOS A (AM peak hour) and B (PM peak hour) under current conditions. During the year 2040, the intersection is anticipated to deteriorate to an overall intersection LOS of B and F. The degradation to a LOS F in the PM peak hour is almost solely due to congestion on the northbound leg of South 11th Avenue as drivers look to find alternative routes to possible congestion on Kagy Boulevard as a three-lane roadway. As a stand-alone intersection, there are no improvements identified for consideration. The intersection is relatively new, and the potential degradation of the intersection out to the year 2040 caused by the northbound movement on South 11th Avenue can be mitigated by strengthening other travel routes west of South 11th Avenue in combination with introducing comprehensive transportation demand management strategies and providing active transportation facilities. **There are no recommendations proposed for this recently constructed intersection**.

INT-2: South 11th Avenue & Grant Street – This intersection operates under all-way stop-control (i.e. 4-way stop). Currently, the intersection operates at a LOS B (AM peak hour) and C (PM peak hour). The intersection has a very high share of pedestrians; in fact, traffic counts showed about 34 percent pedestrian mode share at the intersection. During the year 2040, the intersection is anticipated to deteriorate to an overall intersection LOS of C and F. The degradation to a LOS F in the PM peak hour is almost solely due to congestion on the southbound leg of South 11th Avenue as drivers look to find alternative routes to possible congestion on Kagy Boulevard as a three-lane roadway.

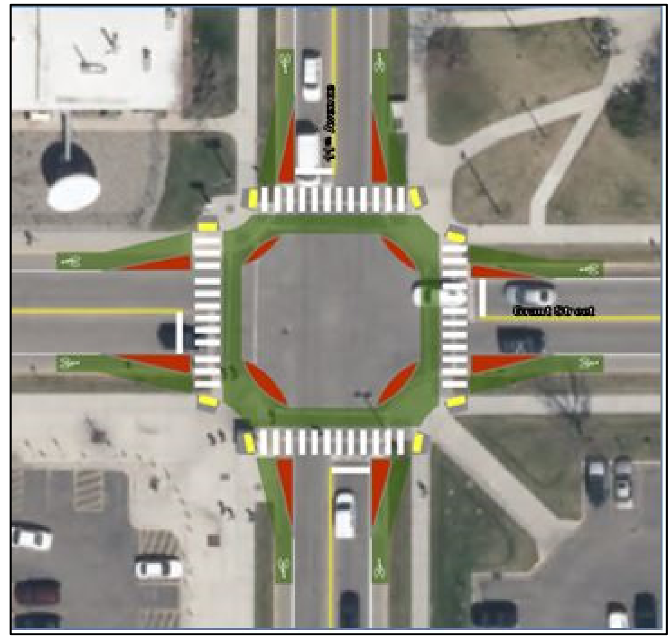
For this intersection, **two intersection configurations are recommended for consideration:** 1) an all-way stop controlled intersection with protected pedestrian and bicycle facilities, and 2) a compact urban roundabout.

An all-way stop controlled intersection with protected pedestrian and bicycle facilities could help to improve pedestrian and bicycle safety at this intersection. Protected pedestrian and bicycle facilities act to decrease the crossing width for pedestrians, similar to bulb outs.

Additionally, these facilities provide an off-street refuge for bicyclists while they wait to cross the intersection. On approach to the intersection, bicyclists would be diverted from on-street bike lanes to separated bike lanes at the intersection corners. More intrepid bicyclists still have the option to merge with vehicular traffic and proceed as a vehicle. Designated crossing areas are marked for pedestrians and bicyclists to ensure minimal conflict between the user groups. While vehicular LOS may remain low with this configuration, pedestrian and bicycle safety will be increased over a simple four-way stop controlled intersection.

Estimated Cost: $650,000

A compact urban roundabout at this location would help to ease traffic congestion. Roundabouts allow vehicles to travel smoothly through an intersection. During off-peak times, vehicles do not need to stop at the intersection. Pedestrian and bicycle users would utilize designated crosswalks with refuge areas between traffic lanes. The refuge areas allow pedestrians and bicyclist the ability to cross one lane of traffic at a time. Bicyclists entering the roundabout have the option of traveling through the roundabout as a vehicle or merging onto the sidewalk and proceeding as a pedestrian.



An example of an All-way, Stop-controlled intersection treatment at S. 11th Ave and Grant Street.

Estimated Cost: $2,000,000

INT-3: South 11th Avenue & Lincoln Street – The intersection of South 11th Avenue and Lincoln Street is a four-legged intersection, with the east leg serving as a parking lot access. The intersection currently operates at a LOS B (AM peak hour) and B (PM peak hour). The intersection is projected to degrade to a LOS D and F by the year 2040. The most troublesome movement contributing to the degradation is the through movement in the eastbound direction. Commuters use Lincoln Street as a direct access route to MSU from South 19th Avenue as it is the most direct route to the parking areas north and south of the Brick Breeden Fieldhouse.

For this intersection, **two intersection configurations are recommended for consideration:** 1) an all-way stop controlled intersection with protected pedestrian and bicycle facilities, and 2) a compact urban roundabout.

An all-way stop controlled intersection with protected pedestrian and bicycle facilities could help to improve pedestrian and bicycle safety at this intersection. Protected pedestrian and bicycle facilities act to decrease the crossing width for pedestrians, similar to bulb outs.

Additionally, these facilities provide an off-street refuge for bicyclists while they wait to cross the intersection. On approach to the intersection, bicyclists would be diverted from on-street bike lanes to separated bike lanes at the intersection corners. More intrepid bicyclists still have the option to merge with vehicular traffic and proceed as a vehicle. Designated crossing areas are marked for pedestrians and bicyclists to ensure minimal conflict between the user groups. While vehicular LOS may remain low with this configuration, pedestrian and bicycle safety will be increased over a simple four-way stop controlled intersection.

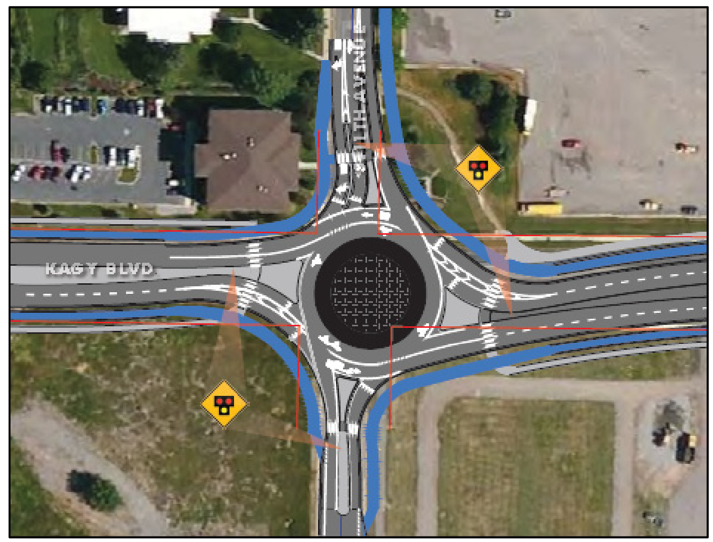
Estimated Cost: $650,000

A compact urban roundabout at this location would help to ease traffic congestion. Roundabouts allow vehicles to travel smoothly through an intersection. During off-peak times, vehicles do not need to stop at the intersection. Pedestrian and bicycle users would utilize designated crosswalks with refuge areas between traffic lanes. The refuge areas allow pedestrians and bicyclist the ability to cross one lane of traffic at a time. Bicyclists entering the roundabout have the option of traveling through the roundabout as a vehicle or merging onto the sidewalk and proceeding as a pedestrian.

Estimated Cost: $2,000,000

INT-4: South 11th Avenue & Kagy Boulevard – This intersection has recently been evaluated for operations, safety and improvements as part of the Kagy Boulevard Reconstruction Project. **For the intersection of South 11th Avenue and Kagy Boulevard, the recommendation being advanced is a multi-lane roundabout or enhanced traffic signalization to accommodate existing and future traffic volumes**. The multi-lane roundabout was previously recommended as part of the Kagy Boulevard reconstruction project that realizes the corridor as a four-lane road facility (i.e. two lanes in each direction). Currently, the intersection operates as a LOS C (AM peak hour) and C (PM peak hour) under traffic signal control. With no improvements, the intersection is expected to degrade out to the year 2040 to a LOS of C and F respectively. MSU seeks improvements at this location that will promote safe and secure bike/ped movements.

Estimated Cost: $2,850,000



Multi-lane roundabout concept at South 11th Avenue and Kagy Boulevard (*courtesy of Sanderson-Stewart*).

INT-5: South 8th Avenue & College Street – This intersection is currently a four legged all-way stop-controlled intersection that functions at LOS B (AM peak hour) and C (PM peak hour). The 2040 projected LOS is anticipated to degrade to a C and F without any improvements to the intersection. This degradation is caused almost solely due to the volumes and associated delay on the eastbound leg of College Street for those vehicles desiring to turn north on South 8th Avenue. Mitigation strategies for this potential condition could include restricting this movement (i.e. prohibiting the eastbound to northbound turn), or examine intersection control in the form of a single-lane roundabout or traffic signalization. **No recommendations are proposed at this time due to the uncertainties with realizing actual traffic volumes at this location and the operations only degrading for mainly one individual movement during one peak hour of the day**.

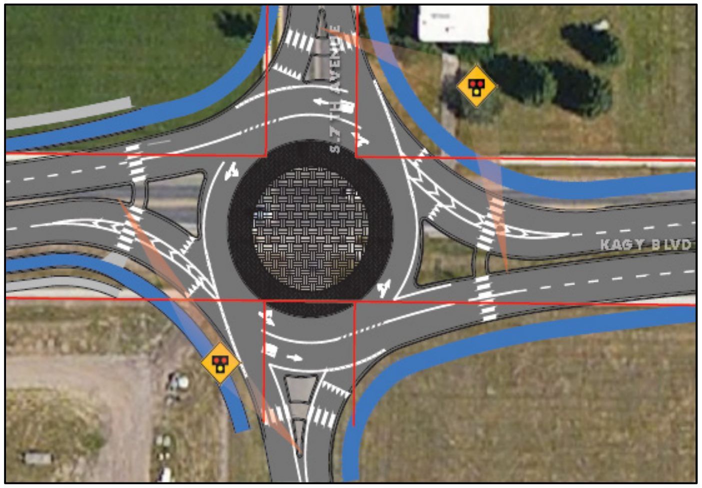
INT-6: South 7th Avenue & Grant Street – This intersection is currently a three-legged stop-controlled intersection that functions at a LOS A (AM peak hour) and B (PM peak hour). The 2040 projected LOS is anticipated to degrade to a D and F without any improvements to the intersection. This intersection realizes a fair amount of traffic destined for MSU from the east via Willson Avenue. The intersection is not a good candidate for traffic signalization.

For this intersection, **two intersection configurations are recommended for consideration:** 1) an all-way stop controlled intersection with protected pedestrian and bicycle facilities, and 2) a compact urban roundabout.

An all-way stop controlled intersection with protected pedestrian and bicycle facilities could help to improve pedestrian and bicycle safety at this intersection. Protected pedestrian and bicycle facilities act to decrease the crossing width for pedestrians, similar to bulb outs. Additionally, these facilities provide an off-street refuge for bicyclists while they wait to cross the intersection. On approach to the intersection, bicyclists would be diverted from on-street bike lanes to separated bike lanes at the intersection corners. More intrepid bicyclists still have the option to merge with vehicular traffic and proceed as a vehicle. Designated crossing areas are marked for pedestrians and bicyclists to ensure minimal conflict between the user groups. While vehicular LOS may remain low with this configuration, pedestrian and bicycle safety will be increased over a simple four-way stop controlled intersection.

Estimated Cost: $650,000

A compact urban roundabout at this location would help to ease traffic congestion. Roundabouts allow vehicles to travel smoothly through an intersection. During off-peak times, vehicles do not need to stop at the intersection. Pedestrian and bicycle users would utilize designated crosswalks with refuge areas between traffic lanes. The refuge areas allow pedestrians and bicyclist the ability to cross one lane of traffic at a time. Bicyclists entering the roundabout have the option of traveling through the roundabout as a vehicle or merging onto the sidewalk and proceeding as a pedestrian.



Multi-lane roundabout concept at South 7th Avenue and Kagy Boulevard (*courtesy of Sanderson-Stewart*).

Estimated Cost: $2,000,000

INT-7: South 7th Avenue & Kagy Boulevard (Roundabout or Traffic Signal) – **Similar to the intersection at South 11th Avenue, this intersection has been recommended for a multi-lane roundabout or traffic signalization in conjunction with improvements to Kagy Boulevard**. Currently, the intersection operates at a LOS F (AM peak hour) and F (PM peak hour) under two-way stop-control. The movements contributing to the LOS are the northbound and southbound left-turn movement which have to wait to turn on to Kagy Boulevard. Under year 2040 conditions and traffic signal control, the intersection is expected to operate as a LOS of A and B respectively. MSU seeks improvements at this location that will promote safe and secure bike/ped movements.

If the Kagy Boulevard reconstruction project cannot be funded (and thus implemented), this intersection is a **high priority for improvements** in the form of a stand-alone traffic signalization project with an eastbound left-turn lane for vehicles accessing South 11th Avenue.

Estimated Cost: $2,850,000

Roadway Improvements

South 11th Avenue is a vibrant, multi-use corridor that provides for important north-south travel through MSU.

RD-1: South 11th Avenue – This corridor effectively serves as the major internal north-south roadway through campus. It is the westerly border of the historic campus core, and realizes all travel uses at various times of the day. During high activity times, the sheer volume of pedestrians crossing across South 11th Avenue essentially acts as traffic calming to slow vehicles down, often times to a standstill. Bicyclists are also present throughout the corridor and mix with through traffic in the north-south direction in the bike lane, ride on the parallel sidewalks, and cross the road in pedestrian crossings. From Kagy Boulevard to College Street there are few "major" changes to be made to the roadway. It is not envisioned to reconstruct or widen the roadway anywhere along this segment. **It is recommended to formalize the roadway for all users by re-purposing the space to provide for buffered on-street bicycle lanes in each direction**. A "buffered" bicycle lane is a bicycle lane that includes a painted buffer space between the vehicle travel lane and the bicycle lane. In areas where width is limited, a minimum 6-foot bicycle lane should be provided. South of Grant Street and north of Kagy Boulevard, existing sidewalks on both sides of South 11th Avenue should be modified to 10- to 14-foot shared use paths.

Estimated Cost: $4,000 to $5,000

South of Kagy Boulevard, it is recommended that a three-lane roadway section with on-street bicycle lane be constructed as development occurs. Currently, a portion of this roadway typical section is realized south to the entrance to the Stadium View Apartments. Ultimately, it is envisioned that South 11th Avenue be extended to the theoretical extension of Graff Street to serve future development activities and regional connectivity. To that end, an appropriate roadway section includes one travel lane in each direction, a two-way center turn lane (i.e. left-turn lane at intersections), on-street bicycle lanes in each direction, and curb and gutter with adjacent sidewalk and/or paths. This is a viable roadway typical section that accommodates all user types and is that recommended in the current Bozeman TMP.

Estimated Cost: $1,600,000

RD-2: Grant Street – This roadway segment is a two-lane, undivided urban roadway which acts as a barrier between parking and activity south of the roadway and the campus core. It realizes a large amount of pedestrian and bicycle traffic and doesn't carry an inordinate amount of vehicular traffic compared to other roads in the vicinity. With the construction of the South Campus parking structure and the NAH the opportunity exists to reclaim Grant Street as a pedestrian and bicycle facility by closing Grant Street to regular automobile traffic between the east approach to the North Fieldhouse Lot and the west approach to the Strand Union Building.

Grant Street should be considered for closure to vehicular traffic between the east North Fieldhouse Lot access and the SUB westerly access.

It is recommended that MSU consider permanent closure of Grant Street to vehicular traffic between the east approach to the North Fieldhouse Lot and the west approach to the Strand Union Building. Such a closure would provide the benefit of a nearly continuous dedicated pedestrian and bicycle connection between the South Fieldhouse parking lot and the campus core. Removable bollards could be placed just west of the westerly access point to the SUB and also just east of the North Fieldhouse parking lot approach. Removable bollards would allow for building deliveries to loading/unloading ramps and also provide for emergency service response when needed. Also, bicycle lane signs and stencils should be added in both directions between South 8th and South 11th Avenues to reinforce the striped shoulder areas into formal bicycle lanes. Note that a comprehensive site-specific traffic impact study will need to be completed prior to implementing any project that would close Grant Street.

Estimated Cost: $35,000 (traffic study) // $90,000 (improvements)

There is little room for repurposing the area within the roadway prism of South 7th Avenue.

RD-3: South 7th Avenue – South 7th Avenue is essentially at its full use within the roadway prism; that is between two driving lanes and on-street parking on both sides of the street between Grant Street and Kagy Boulevard there is no room within the typical section for re-purposing. **However outside the actual roadway prism it is recommended to eventually re-purpose the concrete sidewalk running north and south to a shared use pathway on both sides of the route**. This will be desirable from a functionality perspective as more land use changes occur south of Kagy Boulevard and parking at the East Stadium lot becomes fully utilized. The shared use path should be between 10 and 14 feet in width. The east side would be the priority for development first, followed by the west side.

Estimated Cost: $153,000 to $162,000

RD-4: College Street – College Street was recently constructed to a three-lane principal arterial section between Main Street and South 19th Avenue. In the future, College Street will require further improvement east of South 19th Avenue to South 8th Avenue. This section is functionally classified as a minor arterial in the City of Bozeman's Major Street Network. **Accordingly, it is recommended to reconstruct College Street from the intersection of South 19th Avenue to South 11th Avenue to a three-lane urban "minor arterial" standard**. This includes one travel lane in each direction, center shared turn lane, bike lanes on each side, curb and gutter throughout, boulevard, and sidewalks. The roundabout at College Street and South 11th Avenue should remain as-is. In the short term, new marked pedestrian crosswalks with Rapid Rectangular Flashing Beacons (RRFBs) should be installed at the intersections of College Street with South 15th and South 13th Avenues as these are fairly high pedestrian crossing locations and will have new operational influences as a result of the ingress and egress points to the new Bison parking lot.

Estimated Cost: $1,100,000

Additionally, it is recommended to reconstruct College Street from the intersection of South 11th Avenue to South 8th Avenue to a two-lane urban "minor arterial" standard. This includes one travel lane in each direction, on-street parking, bike lanes on both sides, curb and gutter throughout, and sidewalks. The roundabout at College Street and South 11th Avenue should remain as is. Note that the MSU BMP suggests removing parking on the north side to realize a wider, protected bicycle lane.

Estimated Cost: $440,000

RD-5: Kagy Boulevard – As was previously noted, the City of Bozeman and MDT have contemplated major reconstruction of Kagy Boulevard from South 19th to Willson Avenues. Currently, that project is on hold due to inadequate funding and is likely to be unrealistic before 2021. A roadway configuration has not been decided as of the writing of this report. It is imperative that whatever lane configuration is chosen, **at least two grade separation crossings of Kagy Boulevard be included between South 11th and South 7th Avenues to better connect areas south of Kagy Boulevard to the main campus core**. On-street bicycle lanes and 10- to 14-foot shared use paths on both sides of Kagy Boulevard should be included in the project.

Estimated Cost: $14,000,000

Interim improvements for Kagy Boulevard between South 11th Avenue and 7th Avenue include expanding the typical section to include a shared center turn lane. This expansion would allow users to exit the traffic stream when waiting to make a left turn.

Estimated Cost: $500,000

RD-6: Lincoln Street – West Lincoln Street, between South 19th and South 11th Avenues, will eventually require reconstruction to keep pace with increasing demand and land use changes in the area. Currently, Lincoln Street receives traffic entering the MSU campus area from the western part of the community. **It is recommended to eventually reconstruct Lincoln Street to a three-lane urban "collector" standard**. This includes one travel lane in each direction, a center two-way, left-turn lane (TWLTL) as necessary, bike lanes on each side, parking on each side, curb and gutter throughout, boulevard, and sidewalk (on the south side) and a 10- to 14-foot shared use path on the north side. Additionally, a full movement traffic signal at the intersection of South 19th Avenue and Lincoln Street should be installed when warrants are met.

Estimated Cost: $1,500,000

RD-7: South 19th Avenue – There are no roadway improvements recommended on South 19th Avenue other than a full traffic signal at a future reconstructed Lincoln Street. However it is **recommended that a 10- to 14- foot shared use path be installed on the east side of South 19th Avenue between the Fish Wildlife and Parks driveway and Kagy Boulevard**. This will help to further active transportation along the facility and provide continuity with the existing path to the north and the future active transportation facilities on Kagy Boulevard.

Estimated Cost: $166,000 to $176,000

RD-8: Future Garfield Street Extension – Plan for the **extension of Garfield Street between Fowler and Ferguson Avenues to a two-lane urban "collector" standard**. This includes one travel lane in each direction, bike lanes on each side, curb and gutter throughout, boulevard, and sidewalks.

Estimated Cost: $1,100,000

RD-9: Future Kagy Boulevard Extension – Plan for the **extension of Kagy Boulevard between South 19th and Ferguson Avenues to a three-lane urban "principal arterial" standard**. This includes one travel lane in each direction, bike lanes on each side, curb and gutter throughout, boulevard, 10- to 14-foot shared use paths on both sides, and a two-way center turn lane/raised median as appropriate.

Estimated Cost: $4,500,000

RD-10: Future South 27th Avenue Extension – Plan for the **extension of South 27th Avenue between Garfield Street and Kagy Boulevard to a two-lane urban "collector" standard**. This includes one travel lane in each direction, bike lanes on each side, curb and gutter throughout, boulevard, and 10- to 14-foot shared use paths on both sides.

Estimated Cost: $2,200,000

RD-11: Future Fowler Avenue Extension – Plan for the **extension of Fowler Avenue between Garfield Street and Kagy Boulevard to a three-lane urban "minor arterial" standard**. This includes one travel lane in each direction, bike lanes on each side, curb and gutter throughout, boulevard, sidewalks, and a two-way center turn lane/raised median as appropriate.

Estimated Cost: $1,500,000

RD-12: Future Ferguson Avenue Extension – Plan for the **extension of Ferguson Avenue between Huffine Lane and Kagy Boulevard to a two-lane urban "collector" standard**. This includes one travel lane in each direction, bike lanes on each side, curb and gutter throughout, boulevard, and sidewalks.

Estimated Cost: $1,650,000

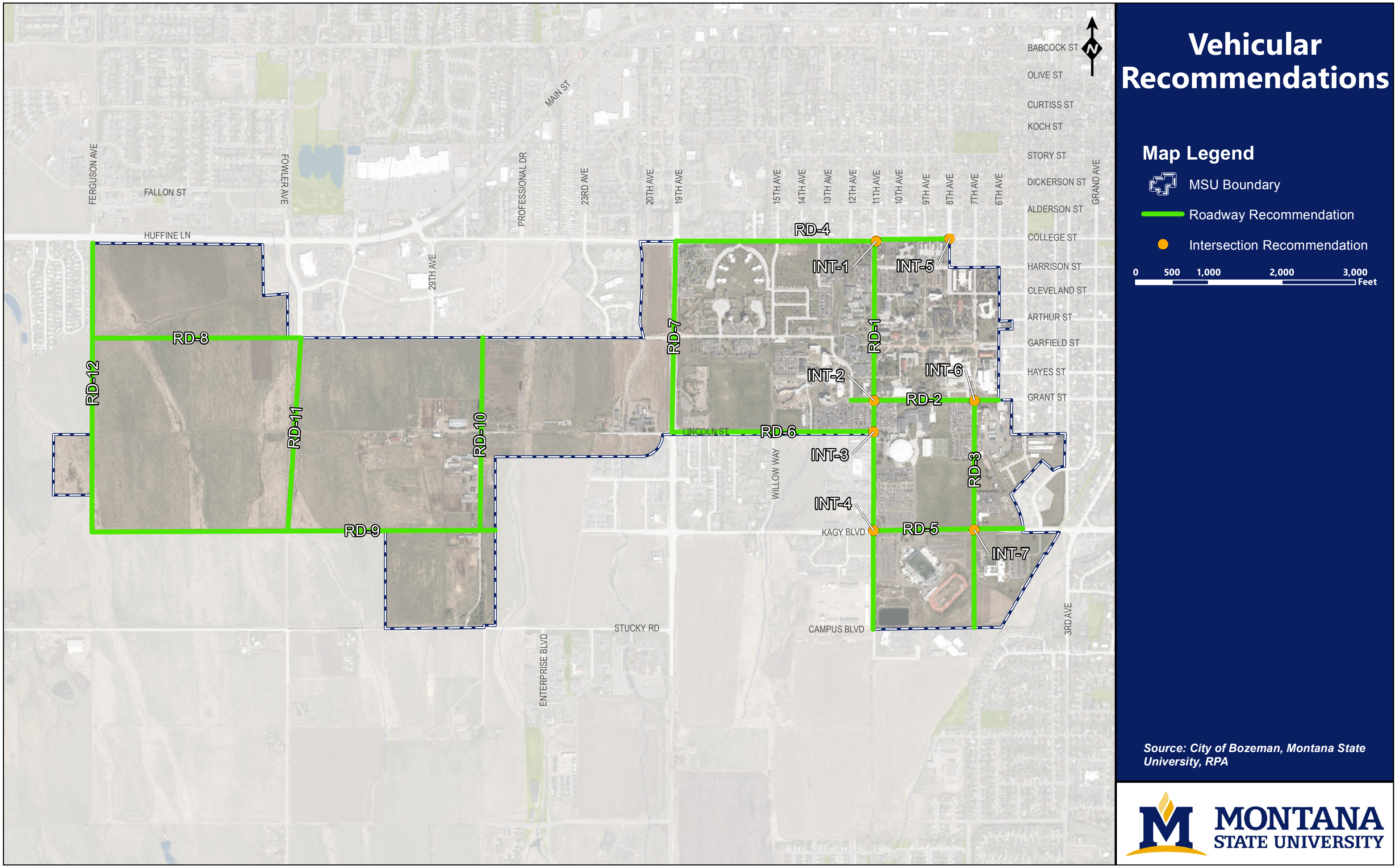


Figure 6.1: Vehicular Recommendations

6.2.2. Active Transportation Modes

MSU has identified a wide range of facilities, programs and enforcement measures to improve active transportation within and to campus. MSU is working to complete a Bicycle Master Plan which recommends strategic bicycle routes to both interact with the existing and planned City of Bozeman system and also to provide a high-quality user experience and enable access to key destinations on and around campus. Facility recommendations contained in the MSU Bicycle Master Plan include bikeways comprised primarily of the following classifications: shared-use paths, bike lanes, separated bike lanes, and shared lanes. Spot improvements are also included in the recommendations to enhance the linear bikeways. A key objective in the previous planning process was to provide bicyclists with key direct cross-campus bike paths, while reserving most of the existing system of campus pathways for local connections to buildings just as they are today. **Figure 6.2** maps the recommended improvements for the campus core.

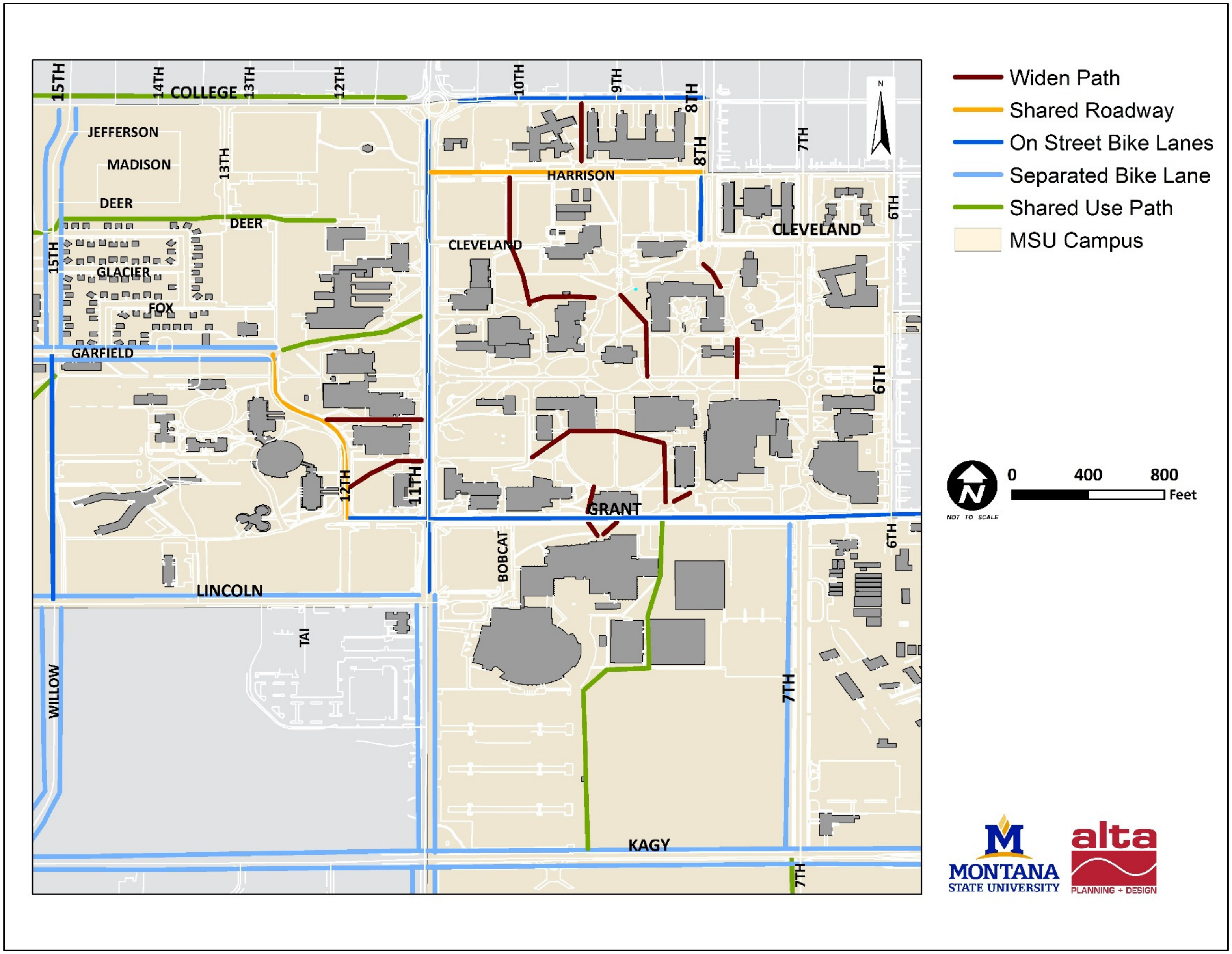


Figure 6.2: Recommended Bicycle Facilities (Campus Core)

6.3. Parking Concepts

The MSU Parking Services Business Plan is prepared every other year by the Police Department's Parking Services Unit and reinforces parking policies and goals. To supplement the successful policy and goals of the Parking Services Unit as they manage MSU parking infrastructure, the following policy guidelines are used and encouraged to be evaluated with every development or project proposal:

- Look for ways to manage parking demand through TDM and active commute modes to enhance campus sustainability.
- Use cost to inform decisions on new facilities.
- Locate new parking facilities to balance regional traffic impacts, on-campus traffic and parking, and maximize opportunities to share parking resources.
- Support campus sustainability initiatives by considering and incorporating pedestrian, bicycle, carpool, and transit amenities.
- Design facilities consistent with MSU goals and aesthetics.
- Incorporate technology to improve parking operations and access.

Analysis of the proposed parking development program identifies a subtle assumption that currently the proposed amount of planned parking going forward is designed to maintain the current ratio (0.34) of parking spaces to overall campus population. With the assumption that the university campus population will grow from the current 18,775 (students/faculty and staff) to approximately 20,347 (low growth), 21,882 (moderate growth), or 26,022 (high growth) by the year 2025, it is clear that there are two basic philosophies to consider in the campus parking program; 1) continue to build parking at the existing parking ratio of 0.34 as the campus population grows, or 2) utilize various TDM strategies to pull back the expansion of parking and thus target a lower parking ratio.

Option 1: Continue to Build Parking

MSU currently has 6,480 parking spaces, with a parking space to campus population ratio of 0.34. Extrapolation of this current ratio would suggest that if this ratio was maintained, MSU would need a parking supply of 6,918 spaces (low growth), 7,440 spaces (moderate growth), and 7590 (high growth) in 2025. This is an extra 438 spaces (low growth), 960 spaces (moderate growth), and 1,110 spaces (high growth) over the next ten years. Where to build new or expanded parking is dynamic and subject to the overall MSU capital building program. As the campus expands with new buildings for academics, housing and other facilities, open space areas within the campus core become compromised. Dialogue amongst MSU leaders must occur that weighs the advantages and disadvantages of constructing parking structures (i.e. vertical construction) against the status quo of constructing surface parking lots (i.e. horizontal construction). Many campuses across the nation find themselves in this very same dilemma – as new buildings get placed within historic campus cores, the amount of land available for parking continually shrinks. Further compounding this dilemma is the significant cost difference in constructing parking structures versus surface parking lots. Based on 2016 figures, the parking price per surface stall is approximately $2,500 (bid results for the Bison parking lot)[10]. To create a 200 space lot would cost approximately $500,000 in construction costs alone–not including land replacement costs. This does not account for the opportunity cost of other uses of this space, nor does it take into account environmental costs (e.g. loss of trees, habitat, storm water management, etc.). The cost of structured parking is even more, with a national average of approximately $18,000 per parking structure stall[11]. A 200 space parking structure would cost approximately $3.6 million (again, construction costs only).

Option 2: Utilize TDM Strategies

A policy that aggressively pursues a wide range of TDM strategies - including enhanced transit - combined with a reduction in parking supply that targets a lower parking space/student and staff ratio may be better aligned with the campus' overall master plan and sustainability goals. To fully achieve success with this parking management strategy, a robust investment in active transportation modes and TDM strategies would be required. The active transportation network has been articulated in the recently completed MSU Bicycle Master Plan and should be developed accordingly. TDM strategies that have the potential for success are contained in **Section 6.4**. Additionally, serious dialogue would be needed amongst MSU leaders as to what an appropriate target parking ratio should be.

6.4. TDM Strategies

Transportation Demand Management (TDM) is a priority for many universities concerned with energy and cost reductions, environmental impacts, and recruitment. A 2012 survey by the Princeton Review found that two thirds of prospective students surveyed were interested in information about a school's commitment to the environment and said it might impact their decision to apply or attend. MSU created a Director of Sustainability position in 2013. Transportation is a pivotal piece of this commitment that should be a focus as MSU grows.

TDM involves encouragement of transportation alternatives to driving alone in a vehicle. Single-occupant vehicles (SOV) are a burden on roadway congestion, the environment, parking, and other resources. TDM traditionally took the form of employer incentives to encourage commuters to consider commute-alternatives to SOV commutes during the peak hour and on peak-utilized routes. Preliminary goals were to reduce congestion and mitigate air quality concerns. As the TDM discussion matured, SOV trips are still discouraged, but TDM strategies are shifting to include non-commute trips. TDM is beginning to address land-use and how residential, retail, and work locations can play a large role with the number of miles an individual needs to travel, and the travel options available when trips are shorter.

Walking, biking and the infrastructure and land use that support these modes have long been major components of campus master planning. Student residences, campus buildings, and classrooms create a dense, mixed-use environment with little space left-over for

[10] Bison parking lot "high" bid received; June 16, 2016
[11] Carl Walker, Industry Insights, April 2014 (http://www.carlwalker.com/wp-content/uploads/2014/04/April-Newsletter-2014.pdf)

vehicle storage. Unlike standard morning and evening commute peaks, campus trips tend to be numerous and cover short distances, as students, staff, and faculty pass from one classroom or building to the next to fulfill daily course schedules.

Walking and biking are major modes for the campus community at MSU. Bozeman is a great place to be a pedestrian and/or a bicyclist, and active transportation and build-out of infrastructure for these modes is a fundamental goal of the Bozeman Transportation Master Plan (TMP). By 2025, the number of students who live very close to or on campus is likely to increase. MSU has recently built additional student housing on campus, and all signs point to increasing the student body during this time. It is likely that students who begin college living on campus will want to continue living close to campus, even as proximity is already an important factor for housing choice among MSU students.

It is clear that MSU is moving away from its roots as a commuter campus and into a new era of a complete campus community, which will have new and different transportation demands and needs. TDM will become a necessary discussion to ensure that the needs of future students, faculty, and staff are met. This section presents a range of TDM strategies and concepts for consideration by MSU officials. Ultimately, implementing specific TDM measures will be based on economic, logistical, and campus-cultural factors. The following rationale outlines the importance of TDM in the MSU campus community:

- Transportation is recognized as a major contributor (over eleven percent for faculty, student and staff commuting according to the October 2011 MSU Climate Action Plan) to gas emissions, representing a significant opportunity and obligation to review and revise our practices.
- New developments and changes (such as the NAH, the new Dining Hall, Yellowstone Hall, and potential movement of programs) are, or are expected to, impact current parking and transportation demands. We want to address these in a proactive, sustainable manner.
- The current use, or replacement of undeveloped land, for parking (the status quo) is not sustainable.
- The alternative to TDM is providing additional parking and road capacity to cater to user demand. One problem with this approach is its impact on the environment and the surrounding community. Encouraging car use through abundant parking puts more cars on the road, thus increasing emissions, traffic congestion and storm water run-off. Another problem is the cost to provide more parking.
- The benefits of active transportation are becoming increasingly well known. Health, environmental quality, social equity and community safety all improve when people choose active transportation over driving.

The potential TDM strategies contained on the following pages are identified in an effort to decrease the number of single vehicle trips in and around MSU campus. They are not listed in any particular order with respect to priority. MSU is embarking on a golden opportunity beginning in Fiscal Year (FY) 2017 with the commitment for financial participation for a newly created TDM initiative. This is the first initiative of its kind in the Greater Bozeman area, and is being funded by the Western Transportation Institute through a Federal grant, with match funds being provided by the city of Bozeman and Montana State University. It is anticipated that this initiative will initially be funded for three years, and will focus on reducing overall vehicle miles traveled through a number of TDM efforts, including an emphasis on walking, biking, carpooling, vanpooling and transit. Additional information on these and other TDM strategies is provided in the following section.

TDM-1: Improve Bike Parking/Storage - Construct sheltered bike racks at more locations on campus, including rental bike lockers at key locations on campus. Construct secure and/or covered bike parking at parking lots further than a 10-minute walk from the campus core. This strategy will promote the use of bicycles to access campus. Adding bike parking at distant parking lots will allow users to park and use a bike to access the campus core. Very few existing bicycle racks are protected from weather. Covered bike parking could promote the use of bikes, and having rental bike lockers may ease some users concerns about security.

TDM-2: Campus Specific Rideshare App or Carpool Pairing App - A rideshare program that is open to only university students, faculty and staff may be desirable. The program would allow for students who are already driving to campus to be paired with students that need a ride or would like to not drive. This could result in decreased traffic and reduced parking demand. Some students, faculty and staff at MSU commute from as far away as Livingston or Belgrade. Some of these students may have space for a passenger and may be willing to provide a ride to others along their route to campus.

TDM-3: Zip Cars or Car Sharing - Provide a small pool of vehicles that are available to students, faculty and staff that can be rented. This will promote alternate commute modes by eliminating the barrier of not being able to run errands during the day due to lack of quick transportation. MSU does not currently offer any car sharing programs, although there has been dialogue in the recent past about furthering such a program.

TDM-4: TDM Marketing Program - Market through flyers, signs, etc. the benefits of using other transportation modes, carpooling, schedule shifting, etc. Student and faculty/staff marketing may be different. This will increases awareness of transportation options, and help individuals understand their transportation options.

TDM-5: Guaranteed Ride Home Program (Faculty/Staff Only) - For faculty and staff that routinely use alternate transportation modes, create a system in which they can get a ride home if, for example, they miss the last bus, their bike breaks, or any other unforeseen issue arises. One mechanism would be to pay cab fare up to two times a month for individuals that walk/bike/ride the bus more than 75 percent of the time. This strategy would promote alternate transportation modes. With the limited hours of operation for Streamline, it is possible to miss the last bus of the evening and need a ride home. Additionally, weather can change unexpectedly, making it complicated to travel by active transportation modes.

TDM-6: Construct Distant Park-and-Ride Lot with Shuttle Service - A parking lot that is distant from campus but has a shuttle running at short headways between the lot and campus core may be a desirable strategy to remove traffic and parking demand from the campus core and nearby roadways. The campus core is currently accessible within a 10-minute walk from most parking lots (dependent on what building is being accessed). A parking lot west of South 19th Avenue would be beyond walking distance but a shuttle could traverse the one-mile to the campus core rather swiftly.

TDM-7: Incentivize Transit Use - This strategy would provide incentives for those who ride Streamline to campus. Possible options could include a "Transit Week" where users get free coffee if they ride the bus three days or transit users could be given parking day pass for every 10 days they use transit. Increased transit use could decrease the number of parking stalls required on campus.

TDM-8: Preferential Carpool Parking - Designate areas as carpool parking only. This would require at least two occupants for all vehicles parking in the lot. This would decrease the number of parking stalls needed and decrease traffic around campus. The SB Lot near the SUB would be a good candidate for this type of strategy, although enforcement would likely be complicated as identifying vehicles with more than one occupant would likely require a parking attendant.

TDM-9: Incentivize Freshman Not Having a Car - Create a program that incentivizes not having a car for freshman or on-campus residents. If no parking permit is purchased for an on-campus resident, some form of reward is given to the student, such as housing priority to those that don't have a car. This will decrease parking demand by on-campus residents. The E lots were full-to-capacity at all times during the data collection period. If resident students did not have cars, more E lot space could be designated for SB parking.

TDM-10: Establish Parking Price Tiers based on Distance from Campus to Student/Faculty/Staff's Residence - Make parking permits expensive for individuals that live within a given distance to campus. Decrease the permit price as distance becomes greater. Promotes alternate mode choice. Analysis of the home addresses of parking permit holders revealed that many commuter parking permits are issued for users that live within one-mile of the campus core.

TDM-11: Parking Pricing Based on Lot Distance to Campus Core - Charge more for parking closer to campus core. This promotes alternate mode choices and decreases traffic congestion immediately near the campus core. MSU already does this to some extent with the reserved pass designation, however more tiers could be developed to further incentivize the use of lots further from campus.

TDM-12: Signage/Wayfinding Kiosks at Parking Lots - Add additional campus maps on kiosks in heavily traveled pedestrian areas. Add signage that states the walking distance to major locations, i.e. Montana Hall, the fitness center, SUB, various buildings, or parking lots. This will raise the awareness of the distance between different areas of campus and may help people in their travel decisions. None of the parking lots have wayfinding for pedestrians after they exit their parked cars. Many of the parking lots route pedestrians through a limited number of locations and placement of kiosks would be along these routes.

TDM-13: Passenger Drop-off Locations - Build locations for vehicles to safely exit the traffic stream and drop-off passengers. Possible locations include along South 11th Avenue or College Street. People that receive rides to campus from others that may not be stopping at campus must be dropped-off. The front of the SUB is a good location, however it requires people to travel into the core of campus. This travel into the core of campus may increase traffic on Grant Street, South 7th Avenue and South 11th Avenue.

TDM-14: Improve Pedestrian Crossings on South 11th Avenue - Increase the visibility of crosswalks on South 11th Avenue by adding colored concrete similar to crosswalks on Grant Street. There are concerns related to pedestrian/vehicle interactions along South 11th Avenue. South 11th Avenue has many crosswalks that receive high volumes of pedestrian traffic, and little to no signage makes the crosswalks less visible. Installation of colored concrete crosswalks would increase visibility without creating sign clutter.

TDM-15: Make New Dorms Transit Oriented - New dorm construction could have a transit stop with shelter at or near the front door to promote the use of transit as an accessible transportation option. This would promote the use of transit. Currently, Streamline has stops that are within reasonable proximity of some dorms. With future dorms, designing transit access from the start may be able to save future construction costs.

TDM-16: Bike Share Programs – Bike share programs may be explored as a way to curb single occupancy vehicle trips of short distances to and from campus during the work day or for students living on campus who do not own their own bike and/or car. A bike share program may be most effective if it is developed as a joint venture between the University and the City of Bozeman.

TDM-17: Promote TDM through the Employee Wellness Program – The MSU system is fortunate to have a well-established wellness program for staff which promotes healthy living. Possible collaboration with the wellness program in regards to decreasing the use of single occupancy vehicles to access campus could, in turn, promote active transportation modes. As a part of the promotion, staff could be reimbursed for a certain percentage of non-vehicle trips made or be given a stipend to assist with purchase of bike parts and/or maintenance.

6.5 Other Policy Considerations

POLICY-1: Mode Share Target Adopt a mode share target consistent with that proposed in the Bozeman Transportation Master Plan (TMP).

The current Bozeman Transportation Master Plan (TMP) effort suggests adoption of a commuter mode share target as shown below. The MSU Bicycle Master Plan suggests bicycle mode share targets for commuters in five percent increments at 10, 15, 20 and 25 percent and portrays resultant changes to bicycle parking space requirements. MSU has a much higher mode share target for bicyclists as articulated in the Bicycle Master Plan. That Plan strives for a bicycle mode share of 20 percent, significantly higher than the City's proposed target for bicyclists of 11.5 percent. Within the overall Bozeman community, the Bozeman TMP recommends a commute mode share target of approximately 30 percent under the following modal break-out:

	City Mode Share	
Mode	**Existing (2015)**	**Proposed (2040)**
Bicycle	5.5%	11.5%
Walking	9.5%	12.0%
Transit	1.3%	6.5%
Target	**16.3%**	**30.0%**

Over a planning horizon that is to the year 2040, it is almost certain that the community-wide mode share target for bicycling and walking such as that presented above can be achieved with robust investment in active transportation infrastructure. This represents almost a doubling of the current commute mode share. What is lost in this narrative is that data available from the National Household Travel Survey (NHTS) provides mode share data aggregated at the national level for all trips and not just commute to work trips. NHTS indicates that for every one bike to work trip, there are another 1.6 utilitarian bike trips (shopping, personal trips, transporting others, medical or dental visits, meals, or other reasons), 0.5 bike to school trips, and 4.8 social or recreational trips. Overall bike to work trips represent only approximately 7.5 percent of all bike trips nationally. It should be noted that approximately 41 percent of bike trips counted by NHTS are return home trips, indicating many bicyclists perform part of their round trip by other means.

POLICY-2: Transportation Demand Management Review and implement TDM strategies to achieve successful changes in commuter and student mode choice behavior.

The TMP previously provided a range of potential TDM measures for consideration by MSU officials. MSU should not regard all of the measures in this TMP a comprehensive requirement to achieving successful changes in commuter mode choice behavior. MSU may choose to implement only a few or many specific TDM measures at any given time, as the decision will be based on economic, logistical, and campus-cultural factors. However, below is a list of guidelines developed to provide MSU with a set of policy principles for success, regardless of which specific TDM measures MSU may choose to implement on campus:

- **Provide transportation options that are competitive and convenient compared to single occupancy vehicle commuting.**

- Continue collaboration with Streamline and focus transit services within areas that generate dense campus populations and off-campus transit nodes.
- Improve the convenience of bicycle commuting through improved infrastructure and secure storage.

- **Direct incentives are the most effective way to encourage the use of alternative transportation and reduce driving.**
  - Support the use of Streamline by maintaining or providing fare-free use for the campus community.
  - Promote ridesharing by marketing ride-matching services, increasing permit discounts, and providing preferential parking.
- **Coordinate campus land use and parking management.**
  - Maintain the current parking ratios as growth occurs over the next ten years.
  - Prioritize future development and strategies to take advantage of existing under-utilized parking
  - Locate any new parking to serve zones of need and support future expansion, generally toward the campus periphery.
- **Apply consistent transportation demand management strategies throughout campus.**
  - Evaluate current transportation options and infrastructure on a regular basis.
  - Conduct periodic surveys to determine which transportation programs are working and generate ideas for new ones.
  - Integrate TDM evaluation and consideration with campus environmental and sustainability reviews and policies.
- **Institutionalize transportation options throughout campus by providing infrastructure and policies to support it.**
  - Construct physical infrastructure like bicycle lanes, bicycle storage, and others per the Bicycle Master Plan.
  - Maintain wide and continuous sidewalks and clearly lined or colored crosswalks.
- **Support and promote MSU as a major activity center in local, regional, and state plans.**
  - Continue to coordinate with local City of Bozeman government to ensure local and regional transportation systems provide expanded and innovative access to campus.
- **Communicate the benefits of alternative transportation to the campus community.**
  - Use the latest information technology, such as a dynamic website, to provide information to the MSU community on all transportation modes.
  - Solicit feedback from students and employees about TDM success, communication tools, and potential improvements.
- **Assess the viability of modified work or academic schedules to stagger arrival and departure times during the work day.**
  - Evaluate the possibility of establishing flexible or modified work schedules for MSU staff.
  - Evaluate the possibility of modifying academic schedules during the week to more effectively stagger arrival and departure times based on class start times.