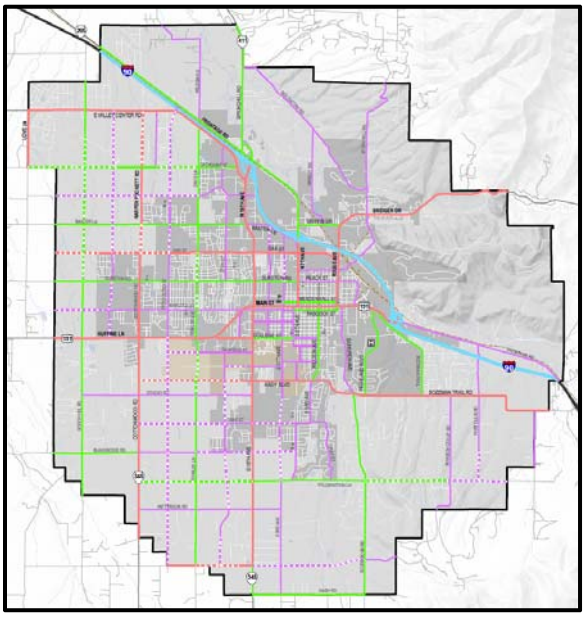
City of Bozeman Transportation Impact Fee Update Study

DRAFT REPORT

May 30, 2018



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City of Bozeman
Transportation Impact Fee Update Study
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I. Executive Summary

The most recent technical study for the City of Bozeman's transportation impact fees was completed in 2012. The City retained Tindale Oliver to prepare an update study to reflect changes to cost, credit, and demand components since the last technical study. Additionally, this update study transitions the roadway impact fee into a multi-modal impact fee, providing additional flexibility to fund capital infrastructure for stand-alone transit, bicycle, and pedestrian facilities, in addition to roads. It should be noted that figures included in this study represent the technically defensible level of impact fees that the City could charge; however, the City may choose to discount fees as a policy decision.

An impact fee is a one-time capital charge levied against new development to fund infrastructure capacity consumed by new growth. Impact fee revenue can only be used for capacity expansion projects and not for expenses related to replacement, maintenance, or operations.

The methodology used to update City's impact fee program is a consumption-based impact fee methodology, which has also been used to calculate the City's adopted impact fees. A consumption-based impact fee charges new development based upon the burden placed on services from each land use (demand). A consumption-based impact fee is intended to charge new growth the proportionate share of the cost of providing additional infrastructure available for use by new growth. In addition, consistent with the requirements of the Montana enabling legislation, a credit is subtracted from the total cost to account for the value of future non-impact fee revenue contributions (taxes, user fees, etc.) of the new development toward the construction of capacity expansion projects when non-impact fee funding is used to build capital facilities.

Consistent with the City's adopted impact fee methodology, the primary steps involved in the update of the transportation impact fee included the following:

- Review of the travel demand characteristics of land uses
- Review of recent cost data related to transportation capacity expansion
- Review of funding sources used for transportation capacity expansion projects
- Calculation of the updated multi-modal transportation impact fee

Table ES-1 provides a summary of the calculated fees.

Table ES-1
Summary of Multi-Modal Transportation Impact Fee Rates

ITE LUC	Land Use	Unit	Net Impact Fee	Net IF w/5% Admin
	RESIDENTIAL:			
n/a	Residential: 1,400 sf or less	du	$3,895	**$4,090**
	Residential: 1,401 to 1,600 sf	du	$4,021	**$4,222**
	Residential: 1,601 to 1,800 sf	du	$4,148	**$4,355**
	Residential: 1,801 to 2,000 sf	du	$4,240	**$4,452**
	Residential: 2,001 to 2,200 sf	du	$4,339	**$4,556**
	Residential: 2,201 to 2,400 sf	du	$4,416	**$4,637**
	Residential: 2,401 to 2,600 sf	du	$4,504	**$4,729**
	Residential: 2,601 to 2,800 sf	du	$4,581	**$4,810**
	Residential: 2,801 to 3,000 sf	du	$4,634	**$4,866**
	Residential: 3,001 sf or more	du	$4,656	**$4,889**
n/a	Group Quarters	person	$1,583	**$1,662**
254	Assisted Living	bed	$472	**$496**
	LODGING:			
320	Lodging	room	$916	**$962**
	INSTITUTIONS:			
520	Elementary School (Private)	1,000 sf (gfa)	$4,418	**$4,639**
530	Secondary School (Private)	1,000 sf (gfa)	$3,580	**$3,759**
550	University/College	student	$691	**$726**
565	Day Care Center	student	$397	**$417**
610	Hospital	1,000 sf (gfa)	$4,209	**$4,419**
	OFFICE:			
710	Office	1,000 sf (gfa)	$2,359	**$2,477**
760	Research & Development Center	1,000 sf (gfa)	$3,551	**$3,729**
	RETAIL:			
820	Retail/Restaurant	1,000 sf (gla)	$6,878	**$7,222**
	INDUSTRIAL:			
110	Light Industrial	1,000 sf (gfa)	$1,195	**$1,255**
140	Manufacturing	1,000 sf (gfa)	$942	**$989**
150	Warehouse	1,000 sf (gfa)	$421	**$442**
151	Mini-Warehouse	1,000 sf (gfa)	$217	**$228**

Source: Appendix D, Table D-1

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II. Introduction

The City of Bozeman's transportation impact fee was most recently updated in 2012 and has been indexed annually to keep up with inflation. The City's Street Impact Fee Ordinance (Bozeman Municipal Code (BMC), Chapter 3.24.050 – Street Impact Fees) was adopted in 1996. The impact fee ordinance was imposed to assist the City in providing adequate transportation facilities needed to accommodate the roadway capacity consumed by new development. The primary purpose of the roadway system is to provide mobility with the additional role of ensuring public safety by providing access for fire and ambulance response vehicles. In addition, the roadway system provides the transportation capacity needed to serve new development. The City of Bozeman has retained Tindale Oliver to prepare an update study to reflect changes to the cost, credit and demand components since 2012.

In addition, the City is interested in converting the current roadway-based transportation impact fee to a multi-modal fee. A multi-modal fee shares the same basic principles as a roadway impact fee except that it provides additional flexibility to fund capital infrastructure for transit facilities as well as stand-alone bicycle and pedestrian facilities, in addition to roads. The City's current fee structure allows for bike/ped improvements, but only when they accompany a roadway capacity expansion improvement. A multi-modal fee expands funding flexibility to add sidewalks and bicycle lanes to existing roads as well as construct transit amenities, and reflects new development's impact on the entire transportation system (excluding rail and interstate facilities).

Methodology

The methodology used for the multi-modal transportation impact fee study follows a consumption-based impact fee approach in which new development is charged based upon the proportion of person-miles of travel (PMT) that each unit of new development is expected to consume of a lane-mile of the transportation network. The multi-modal impact fee incorporates the entire network of transportation within the city, including city, county and state roads, as well and transit, bicycle, and pedestrian facilities, but excludes limited access facilities and rail, which require large scale investments and are not typically funded with impact fees. The fee is assessed on all new development within the City limits and revenues are restricted to be used for capacity expansion improvements inside the City.

Examples of capacity expansion projects that are eligible to be funded with impact fee revenues include new roadway construction, road lane addition, intersection improvements, addition of sidewalks and bicycle lanes to existing roadways, construction of transit amenities, among others. As long as these facilities are located on classified collector and arterial roadways (not on local, neighborhood roads), impact fee revenues can be used to fund these types of capacity expansion projects. In the case of roadways and intersections, the level of service standards included in the City's Transportation Master Plan are based on Highway Capacity Manual. As outlined in the Manual, capacities incorporated into levels of service (LOS) standards are based on properly functioning intersections. The Manual defines LOS standards of A through F for both roadways and intersections. In other words, intersection movements are an integral part of roadway capacity and it is not possible to achieve a given LOS without the intersections operating at least at the same level or better. Finally, intersections that function efficiently result in higher capacity per lane mile, which in turn reduces the impact fee. If the intersections do not operate as they should, the achieved capacity decreases, which in turn increases the fee. As such, intersection improvements are an integral part of achieving additional capacity and are eligible to be funded completely with impact fee revenues.

Included in this document is the necessary support material used in the calculation of the transportation impact fee. The general equation used to compute the impact fee for a given land use is:

[Demand x Cost] – Credit = Fee

The "demand" for travel placed on a transportation system is expressed in units of Vehicle-Miles of Travel (VMT) (daily vehicle-trip generation rate x the trip length x the percent new trips [of total trips]) for each land use contained in the impact fee schedule. Trip generation represents the average daily rates since new development consumes trips on a daily basis. The VMT is converted to PMT using the person-trip factor.

The "cost" of building new capacity typically is expressed in units of dollars per person-mile of transportation capacity. Under the consumption-based approach, impact fee calculations are based on the marginal cost of adding capacity and do not include cost associated with improving existing deficiencies.

The "credit" is an estimate of future non-impact fee revenues generated by new development that are allocated to provide roadway capacity expansion. The impact fee is considered to be an "up front" payment for a portion of the cost of building a person-mile of capacity that is

reasonably related to the amount of capacity consumed by each unit of land use contained in the impact fee schedule, that is not paid for by future tax revenues generated by the new development activity. These credits are required under the supporting case law for the calculation of impact fees where a new development activity must be reasonably assured that they are not paying, or being charged, twice for the same level of service. The input variables used in the fee equation are as follows:

Demand Variables:

- Trip generation rate
- Trip length
- Percent new trips
- Vehicle-trips to person-trips factor

Cost Variables:

- Transportation cost per person-mile
- Transportation capacity per person-mile

Credit Variables:

- Equivalent gas tax credit (pennies)
- Present worth
- Fuel efficiency
- Effective days per year

Legal Compliance Overview

Section 7-6-1602 MCA established the requirements in state law for documentation for the development of an impact fee. That statute leaves to the judgement of each community where each piece of information is organized. Table 1 lists each element and shows where in the City of Bozeman documentation of facility planning and fee calculation the required item is provided. The listed section(s) is a primary, but not exclusive, location where the subject is discussed. Collectively, the facility plan, design standards and specifications policy, fee study, capital improvement program, unified development ordinance, and impact fee ordinance satisfy the required documentation. All reference documents are available through the City offices.

Table 1
Compliance with Montana State Statute, Section 7-6-1602 MCA

Section Reference	Documentation Item	Document(s)	Page or Section
(1)	For each public facility for which an impact fee is imposed, the governmental entity must prepare and approve a service area report	Transportation Impact Fee Study, 2018	N/A
(2)	The service area report is a written analysis that must:		
(2)(a)	describe existing conditions of the facility;	Bozeman Transportation Master Plan, 2017	Chapter 2, Section 2.3 & Appendix G
(2)(b)	establish level-of-service standards;	Bozeman Code of Ordinances	Chapter 38, Sec. 38.24.060
(2)(c)	forecast future additional needs for service for a defined period of time;	Bozeman Transportation Master Plan, 2017	Chapter 3, Section 3.2
(2)(d)	identify capital improvements necessary to meet future needs for service;	Bozeman Transportation Master Plan, 2017	Chapter 4 & Appendix H
(2)(e)	identify those capital improvements needed for continued operation and maintenance of the facility;	Bozeman Transportation Master Plan, 2017	Chapter 4 & Appendices H & I
(2)(f)	make a determination as to whether one service area or more than one service area is necessary to establish a correlation between impact fees and benefits;	Transportation Impact Fee Study, 2018	Section VII (Impact Fee Benefit Districts)
(2)(g)	make a determination as to whether one service area or more than one service area for transportation facilities is needed to establish a correlation between impact fees and benefits;	Transportation Impact Fee Study, 2018	Section VII (Impact Fee Benefit Districts)
(2)(h)	establish the methodology and time period over which the governmental entity will assign the proportionate share of capital costs for expansion of the facility to provide service to new development within each service area;	Bozeman Transportation Master Plan, 2017	Chapters 4 & 6
		FY 2018 Capital Improvements Program	Road Impact Fee CIP
(2)(i)	establish the methodology that the governmental entity will use to exclude operations and maintenance costs and correction of existing deficiencies from the impact fee;	Transportation Impact Fee Study, 2018	Section III (Cost Component), Appendix B
(2)(j)	establish the amount of the impact fee that will be imposed for each unit of increased service demand; and	Transportation Impact Fee Study, 2018	Section V (Fee Calculation), Appendix D
(2)(k)	have a component of the budget of the governmental entity that: (i) schedules construction of public facility capital improvements to serve projected growth; (ii) projects costs of the capital improvements; (iii) allocates collected impact fees for construction of the capital improvements; and (iv) covers at least a 5-year period and is reviewed and updated at least every 5 years	FY 2018 Capital Improvements Program	Arterial & Collector District Fund, Pg. 17 General Fund, Pg. 85 Street and Curb Reconstructions, Pg. 227 Street Impact Fee, Pg. 249 Street Maintenance District, Pg. 299
(3)	The service area report is a written analysis that must contain documentation of sources and methodology used for purposes of subsection (2) and must document how each impact fee meets the requirements of subsection (7)	Transportation Impact Fee Study, 2018	Each subsection of the report includes sources for reference and addresses various components of subsection (7) (see below)

Table 1 (continued)
Compliance with Montana State Statute, Section 7-6-1602 MCA

Section Reference	Documentation Item	Document(s)	Page or Section
(4)	The service area report that supports adoption and calculation of an impact fee must be available to the public upon request	Transportation Impact Fee Study, 2018	The impact fee technical report will be adopted through a public hearing process and all documents will be made available by the City of Bozeman
(5)	The amount of each impact fee imposed must be based upon the actual cost of public facility expansion or improvements or reasonable estimates of the cost to be incurred by the governmental entity as a result of new development. The calculation of each impact fee must be in accordance with generally accepted accounting principles	Transportation Impact Fee Study, 2018	Section III (Cost Component), Appendix B
(6)	The ordinance or resolution adopting the impact fee must include a time schedule for periodically updating the documentation required under subsection (2)	Bozeman Code of Ordinances	Chapter 2, Sec. 2.06.1700, K, 1
(7)	An impact fee must meet the following requirements: (a) The amount of the impact fee must be reasonably related to and reasonably attributable to the development's share of the cost if infrastructure improvements made necessary by the new development	Transportation Impact Fee Study, 2018	Section II (Demand Component), Section III (Cost Component), Section IV (Credit Component), Section V (Fee Calculation), Appendices A-D
	(b) The impact fees imposed may not exceed a proportionate share of the costs incurred or to be incurred by the governmental entity in accommodating the development. The following factors must be considered in determining a proportionate share of public facilities capital improvement costs; (i) the need for public facilities capital improvements required to serve new development; and	Bozeman Transportation Master Plan, 2017	Chapters 4 & 6
		FY 2018 Capital Improvements Program	Road Impact Fee CIP
	(ii) consideration of payments for system improvements reasonably anticipated to be made by or as a result of development in the form of user fees, debt service payments, taxes, and other available sources of funding the system improvements	Transportation Impact Fee Study, 2018	Section IV (Credit Component), Appendix C
	(c) Costs for correction of existing deficiencies in a public facility may not be included in the impact fee	Transportation Impact Fee Study, 2018	Section I (Introduction)
	(d) New development may not be held to a higher level of service than existing users unless there is a mechanism in place for the existing users to make improvements to the existing system to match the higher level of service	Transportation Impact Fee Study, 2018	Section I (Introduction)
	(e) Impact fees may not include expenses for operations and maintenance of the facility	Transportation Impact Fee Study, 2018	Section III (Cost Component), Appendix B

III. Demand Component

Travel Demand

The amount of transportation system consumed by a unit of new land development is calculated using the following variables and is a measure of the person-miles of new travel a unit of development places on the existing transportation system:

- Number of daily trips generated;
- Average length of those trips; and
- Proportion of travel that is new travel, rather than travel that is already on the transportation system.

The trip characteristics variables were primarily obtained from two sources: (1) similar studies conducted locally in Bozeman and outside of Bozeman (Trip Characteristics Database) and (2) the Institute of Transportation Engineers' (ITE) Trip Generation reference report (10th Edition). The Trip Characteristics Studies Database is included in Appendix A. This database was used to determine trip length, percent new trips, and the trip generation rate for several land uses.

Conversion of Vehicle-Trips to Person-Trips

In the case of the multi-modal approach, it is necessary to estimate travel in units of person-miles. Vehicle-trips were converted to person-trips by applying a vehicle-trip to person-trip conversion factor of 1.30, which accounts for the average number of persons occupying a car. This value was derived from vehicle occupancy trend data in the 2009 National Household Travel Survey (NHTS).

Interstate Adjustment Factor

This variable was used to recognize that interstate highway improvements are funded by the State (specifically, the Montana Department of Transportation) using earmarked State and Federal funds. The calculated multi-modal fees do not charge for the travel on these facilities and similarly, the impact fee calculations do not account for cost of or future revenues that will be spent on these facilities. Typically, impact fees are not used to pay for interstate

improvements and, therefore, the associated demand, cost, and credit are eliminated from the impact fee calculation.

The interstate adjustment factor was calculated using the projected 2040 VMT provided in the Bozeman Transportation Model. The projected VMT values were summarized based on the jurisdiction of each roadway segment, resulting in a **19.9 percent** adjustment factor calculated for travel on I-90. By applying this factor to the total VMT for each land use, the reduced VMT is then representative of only the roadways which can be funded by transportation impact fees. Appendix A, Table A-1 provides further detail on this calculation.

Local Trip Length Adjustment Factor

Tindale Oliver conducted local trip characteristics studies in Bozeman in 2008 for residential, office, and retail land uses. Results of these studies are presented in Appendix A. Based on these local studies, trip length adjustment factors were applied to remaining residential and non-residential land uses that were not studied, to reflect the local travel characteristics. These adjustment factors were applied to trip length data from the trip characteristics database (included in Appendix A).

Single Family trip length reduction factor of **53%** was applied to the following land uses:

- Group quarters
- Assisted living
- Lodging
- University/college
- Hospital

Office trip length reduction factor of **43%** was applied to the following land uses:

- Elementary school
- Secondary school
- Day care center
- Research & development center
- Light industrial
- Manufacturing
- Warehouse
- Mini-warehouse

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Trip Exchange District (TED) Discount Factor

Downtown TED:

Bozeman has identified the downtown core as a "trip exchange district" meaning that this area has different travel characteristics than the rest of the city. The downtown TED corresponds with lower consumption of transportation capacity per unit of development due to the following factors:

- Shared and consolidated parking.
- High degree of pedestrian and bicycle access to and throughout the TED.
- Public transit availability.
- Extensive trip capture between businesses. Person will make a single vehicle trip and visit multiple establishments.

Currently, Bozeman reduces impact fees for new development within the downtown TED by **29 percent**.

The downtown TED reduction factor was reviewed and compared to the internal capture ranges from several recent research studies on mixed-use development internal trip capture due to the mix of uses and design characteristics of these types of developments. Table 2 presents a summary of the findings.

As shown in Table 2, the range of internal capture reductions range from 0 to 62 percent. The current reduction factor of 29 percent falls within the range of the research studies results.

The Downtown TED boundary is presented in Map 1.

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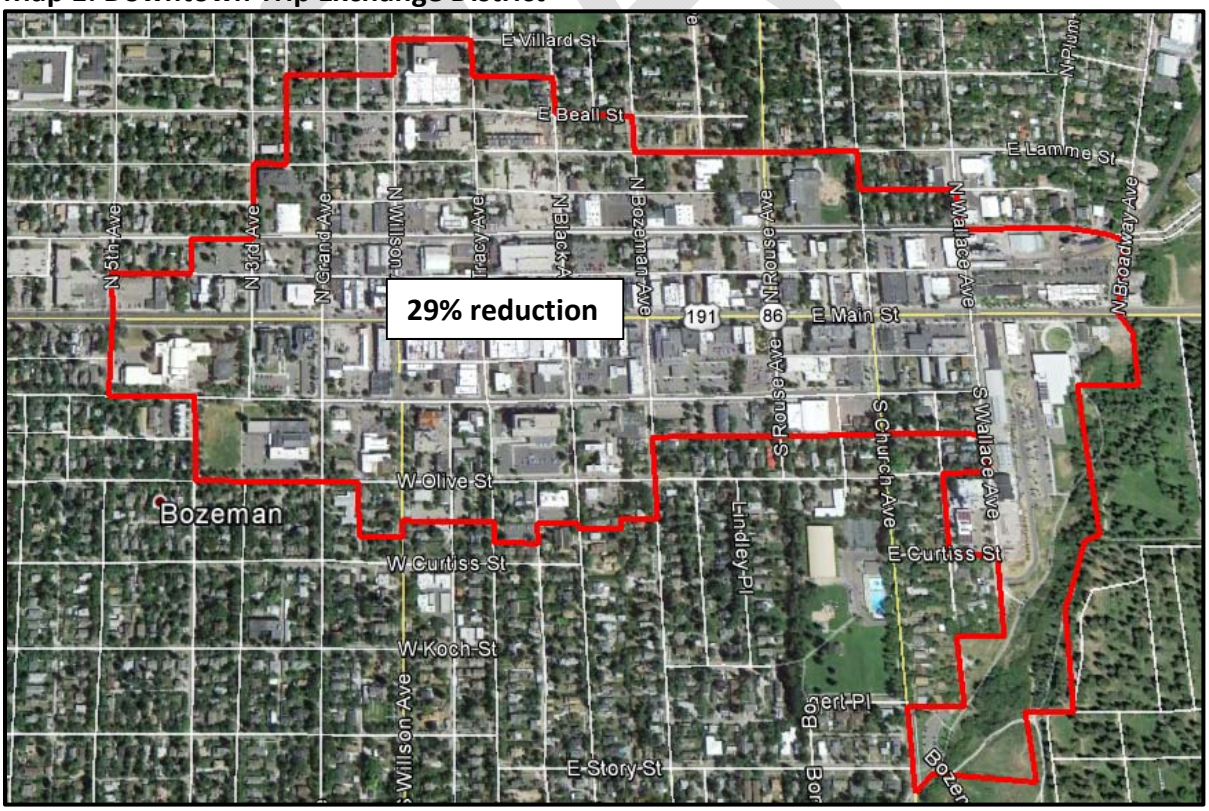
Table 2
Estimated Cost per Lane Mile for City and State Roadway Projects

Source	Reference	Range of Internal Capture
Research Studies		
ITE 2nd Edition	Institute of Transportation Engineers Handbook, 2nd Ed.	5-25%
NCHRP 684/ITE 3rd Edition	National Cooperative Highway Research Program	28-41%
EPX MXD Model v4.0	EPA, Fehr & Peers	8-28%
ITE 1998 surveys (origins)	NCHRP 684, PDF pg 19	0-53%
ITE 1998 surveys (destinations)	NCHRP 684, PDF pg 19	0-37%
Districtwide TGR Study, FDOT, District IV, March 1995	NCHRP 684, PDF pg 20	28-41%
FDOT Trip Characteristics Study of MXDs, FDOT, District IV, March 1993	NCHRP 684, PDF pg 21 (Table 8)	7-62%
Trip Generation for MXDs, Technical Committee Report, Colorado-Wyoming Section, ITE, January 1986	NCHRP 684, PDF pg 23	25%
Brandermill PUD Traffic Generation Study, Technical Report, JHK & Associates, Alexandria, Virginia, June 1984	NCHRP 684, PDF pg 23	45-55%
Kittelson & Associates, Crocker Center, Mizner Park, Galleria	NCHRP 684, PDF pg 25	38-41%
Mehara and Keller	NCHRP 684, PDF pg 25	0-40%
Local Government Practices		
Transportation Impact Analyses (ITE Method)	NCHRP 684, PDF pg 11	5-25%

Map 1: Downtown Trip Exchange District



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University TED:

In 2014/2015, the City of Bozeman recognized an additional TED district encompassing the Montana State University (MSU) campus and some peripheral private development land. The University TED boundary is presented in Map 2. A detailed transportation study[1] was conducted to assess internal capture and travel characteristics within this sub-area. This study concluded that, similar to the downtown TED, the University TED benefits from high trip capture and above average non-vehicle travel. The following reduction factors were determined for certain land uses:

- Non-Housing, private/near campus = **25%**
- Housing, private/near campus = **35%**
- Group Quarters, private/near campus = **59%**

- Non-Housing, MSU on campus = **31% office, 46% academic**
- Housing, MSU on campus = **44%**
- Group Quarters, MSU on campus = **62%**

Similar to the adopted downtown reduction factor, the University TED factors fall within the range of the mixed-use/internal capture observed in the research studies presented in Table 2.

[1] University Trip Exchange District Study, Western Transportation Institute, College of Engineering, MSU, October 2014

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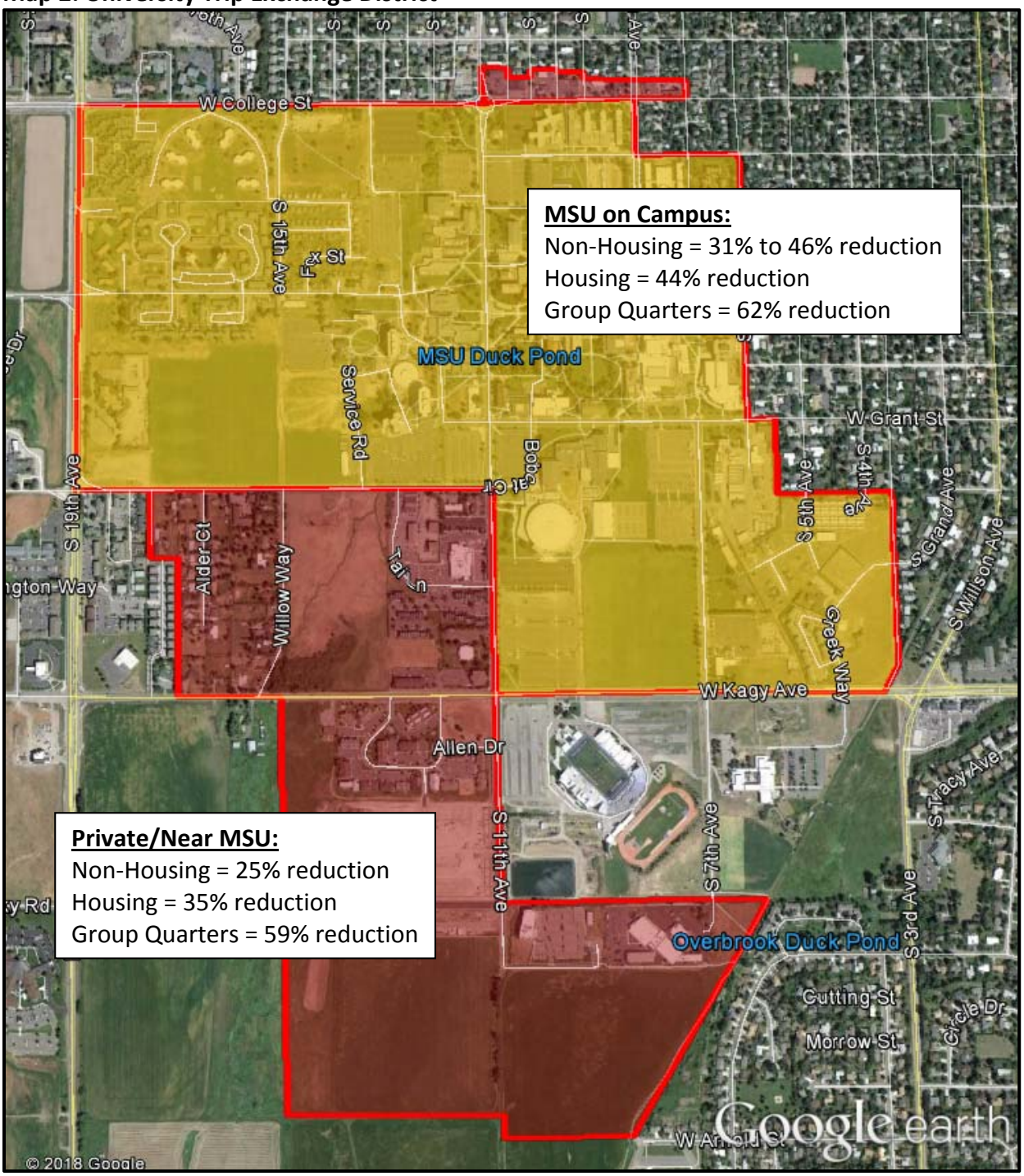
Map 2: University Trip Exchange District



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IV. Cost Component

This section examines the construction costs of transportation capacity-expansion improvements within the City of Bozeman.

City Roadway Cost

This section examines the right-of-way (ROW), construction, and other cost components associated with city roads with respect to capacity-expansion improvements in Bozeman. For this purpose, recent bid data and cost estimates for future improvements were reviewed to provide supporting cost data for city roadway improvements. The cost for each roadway capacity project was separated into two phases: ROW and construction.

Right-of-Way

The ROW cost reflects the total cost of the acquisitions along a corridor that were necessary to have sufficient cross-section width to widen an existing road or, in the case of new construction, to build a new road. Based on discussions with City staff, a 10 percent ROW-to-construction factor was determined for impact fee purposes. This factor reflects that most ROW is acquired through annexations or is readily available, but accounts for the occasional acquisitions that the City is forced to purchase for critical improvements.

Construction

The construction cost for city roads was based on a review of projected improvements in the City's Transportation Master Plan. The TMP project list totaled over 31 lane miles of committed and recommended city road improvements, averaging $2.8 million per lane mile. These improvements include associated intersection improvements that would accompany the roadway expansion and improve capacity. As mentioned previously, LOS values used in the Transportation Master Plan are determined by using the methods defined in the Highway Capacity Manual. The Highway Capacity Manual states that a roadway corridor's LOS, which is measured by free flow travel speeds and delay, is contingent upon the performance of the boundary intersections. Without the associated intersection improvements, the benefit from an improved roadway segment will be severely limited. Additionally, the capacity of certain corridors can be improved by solely improving the boundary intersections.

Based on this review, a city road construction cost of **$2.8 million** per lane mile was used in the multi-modal transportation impact fee calculation. Additional detail is provided in Appendix B.

State Roadway Cost

This section examines the right-of-way (ROW), construction, and other cost components associated with state roads with respect to capacity-expansion improvements in Bozeman. For this purpose, cost estimates for future state roadway improvements was reviewed. The cost for each roadway capacity project was separated into two phases: ROW and construction.

Right-of-Way

The ROW cost factor for state roads was assumed to be the same as the factor for city roads (10 percent of construction).

Construction

A review of the City's Transportation Master Plan identified over 27 lane miles of committed and recommended state road improvements, averaging approximately $3.2 million per lane mile. These improvements include associated intersection improvements that would accompany the roadway expansion and improve capacity.

Based on this review, a state road construction cost of **$3.2 million** per lane mile was used in the multi-modal transportation impact fee calculation. Additional detail is provided in Appendix B.

Summary of Costs (Blended Cost Analysis)

The weighted average cost per lane mile for city and state roads is presented in Table 3. The cost figures shown include both the construction cost and the ROW cost, as discussed previously. The resulting weighted average cost of approximately **$3.3 million** per lane mile was utilized as the cost input in the calculation of the multi-modal transportation impact fee schedule. The weighted average cost per lane mile includes city and state roads and is based on weighting the lane miles of roadway improvements in the Bozeman Transportation Master Plan.

Table 3
Estimated Cost per Lane Mile for City and State Roadway Projects

Cost Phase	Cost per Lane Mile		
	City Roads	State Roads	City & State Roads[4]
Right-of-Way[1]	$280,000	$320,000	$298,000
Construction[2]	$2,800,000	$3,200,000	$2,980,000
Total Cost	**$3,080,000**	**$3,520,000**	**$3,278,000**
Lane Mile Distribution[3]	55%	45%	100%

1) ROW is estimated at 10% of construction costs
2) Source: Appendix B, Table B-1, includes construction, design, construction administration, utilities and contingency, rounded to nearest $100,000
3) Source: Appendix B, Table B-1
4) Lane mile distribution (Item 3) multiplied by the ROW & construction phase costs by jurisdiction to develop a weighted average cost per lane mile

Person-Miles of Capacity Added per Lane Mile (Roadways)

An additional component on the impact fee equation is the capacity added per lane mile (also known as the maximum service volume added per lane mile) of roadway construction. To calculate the vehicle-miles of capacity (VMC) per lane mile of future roadways, an analysis of the Bozeman Transportation Master Plan was conducted to review future planned improvements within the City of Bozeman. As shown in Table 4, the VMC was then converted to person-miles of capacity (PMC) using the person-trip factor (1.30 persons per vehicle) previously discussed.

Table 4
Weighted Average Capacity Added per Lane Mile

Source	Lane Mile Added[1]	Vehicle-Miles of Capacity Added[1]	VMC Added per Lane Mile[2]	Vehicle-Trip to Person-Trip Factor[4]	Weighted Average PMC Added per Lane Mile[5]
City Roads	32.97	260,040	7,887	1.30	10,253
State Roads	27.11	214,125	7,898	1.30	10,267
Total	**60.08**	**474,165**			
Weighted Average VMC Added per Lane Mile[3]			**7,900**	**1.30**	**10,270**

1) Source: Appendix B, Table B-2
2) Vehicle-miles of capacity added divided by lane miles added
3) Total vehicle-miles of capacity added divided by the total lane miles added, rounded to the nearest 100.
4) Source: National Household Travel Survey
5) VMC added per lane mile (Item 3) multiplied by the person-trip factor (Item 4)

Cost per Person-Mile of Capacity Added (Roadways)

The transportation cost per unit of development is assessed based on the cost per person-mile of capacity (PMC). As shown in Tables 3 and 4, the cost and capacity for roadways in the City of Bozeman have been calculated based on typical roadway improvements. As shown in Table 5, the cost per PMC for travel within the City is $319.

The cost per PMC figure is used in the transportation impact fee calculation to determine the total multi-modal cost per unit of development based on the person-miles of travel consumed. For each person-mile of travel that is added to the transportation system, approximately $319 of transportation capacity is consumed.

Table 5
Cost per Person-Mile of Capacity Added

Source	Cost per Lane Mile[1]	Average PMC Added per Lane Mile[2]	Cost per PMC[3]
City Roads	$3,080,000	10,253	$300.40
State Roads	$3,520,000	10,267	$342.85
Weighted Average	**$3,278,000**	**10,270**	**$319.18**

1) Source: Table 3
2) Source: Table 4
3) Average PMC added per lane mile (Item 2) divided by cost per lane mile (Item 1)

Bicycle and Pedestrian Facility Costs

Bicycle and pedestrian facilities provide for relatively small quantities of the total vehicle-miles of travel due to the difference in the average distance traveled by a car trip versus pedestrian/bicycle trips. Because of their relatively small role in the urban travel scheme, they do not have a significant effect on evaluating the costs of providing for mobility. However, bike and pedestrian facilities are important and provide a source of travel for those who cannot drive or cannot afford to drive, and they are a standard part of an urban street design. Their costs are included in the standard roadway cross-sections for which costs are estimated for safety and mobility reasons. Thus, the costs of these facilities on major roads are included in the multi-modal transportation fee. The multi-modal fee provides funding for only those bike and pedestrian facilities associated with roadways on the classified road system (excluding local/neighborhood roads), and allows for facilities to be added to existing classified roadways or included in the construction of a new classified roadway or lane addition improvement.

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Transit Capital Cost per Person-Mile of Travel

A model for transit service and cost was developed to establish both the capital cost per person-mile of capacity and the system operating characteristics in terms of system coverage, hours of service, and headways. The model developed for Bozeman was based on information from the Streamline Bus System. Components of the transit capital cost include:

- Vehicle acquisition tied to new routes
- Bus stops, shelters, and benches
- Cost of road network used by transit vehicles

Transit capital costs are computed as the cost of capital features needed to expand the transit system, as follows:

Transit Capital Cost = Bus Infrastructure Cost + Road Capacity Cost

Taking into account the infrastructure costs and the decline in potential vehicle-capacity that comes with adding transit, it was determined that the difference between constructing a lane mile of roadway (for cars only) versus constructing a roadway with transit is not significant.

The roadway with transit cost per PMC is less than three (3) percent higher per lane mile than the cost to simply construct a road without transit amenities. Therefore, for the multimodal transportation impact fee calculation, the cost per PMC of approximately $319 is representative of the cost to provide transportation capacity for all modes of travel. Additional information regarding the transit capital cost calculation is included in Appendix B, Table B-4.

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V. Credit Component

Capital Improvement Credit

The present value of the portion of non-impact fee funding generated by new development over a 25-year period that is expected to be expended on capacity expansion projects was credited against the cost of the system consumed by travel associated with new development. In order to provide a connection to the demand component that is measured in terms of travel, non-impact fee dollars are converted to a gas tax equivalency.

City

As shown in Table 6, the City of Bozeman spends approximately $1.9 million per year (or the equivalent of 3.8 pennies of fuel tax revenue) on transportation capacity-expansion projects funded with non-impact fee revenues. Additional detail is provided in Appendix C, Table C-2.

County

As indicated in the FY 2018 Gallatin County budget, all non-impact fee transportation revenues are allocated to maintenance expenditures, therefore, no capital improvement credit is included in the multi-modal transportation impact fee calculation.

State

As shown in Table 6, State expenditures in Bozeman were reviewed, indicating expenditures of approximately $1.1 million per year (2.3 equivalent pennies of fuel tax revenue) was given for the capacity-expansion portion attributable to state transportation improvements. This review included several years of historical expenditures, including only those improvements located inside the city limits and tied to a capacity-expansion improvement. Additional detail is provided in Appendix C, Table C-3.

Table 6
Equivalent Pennies of Capital Improvement Credit

Credit	Average Annual Expenditures	Value per Penny[3]	Equivalent Pennies per Gallon[4]
City Revenues[1]	$1,899,953	$501,545	$0.038
State Revenues[2]	$1,129,481	$501,545	$0.023
Total	**$3,029,434**		**$0.061**

1) Source: Appendix C, Table C-2
2) Source: Appendix C, Table C-3
3) Source: Appendix C, Table C-1
4) Average annual expenditures divided by value per penny (Item 3), divided by 100

Present Worth Variables

Facility Life

The facility life used in the impact fee analysis is 25 years, which represents the reasonable life of a roadway.

Interest Rate

This is the discount rate at which gasoline tax revenues might be bonded. It is used to compute the present value of the gasoline taxes generated by new development. The discount rate of 3.0 percent was used in the multi-modal transportation impact fee calculation based on information obtained from the City of Bozeman.

Fuel Efficiency

The fuel efficiency (i.e., the average miles traveled per gallon of fuel consumed) of the fleet of motor vehicles was estimated using the quantity of gasoline consumed by travel associated with a particular land use.

Appendix C, Table C-6 documents the calculation of the fuel efficiency value based on the following equation, where "VMT" is vehicle-miles of travel and "MPG" is fuel efficiency in terms of miles per gallon.

$$FuelEfficiency = \sum VMT_{RoadwayType} \div \sum \left(\frac{VMT_{VehicleType}}{MPG_{VehicleType}} \right)_{RoadwayType}$$

The methodology uses non-interstate VMT and average fuel efficiency data for passenger vehicles (i.e., passenger cars and other 2-axle, 4-tire vehicles, such as vans, pickups, and SUVs) and large trucks (i.e., single-unit, 2-axle, 6-tire or more trucks and combination trucks) to calculate the total gallons of fuel used by each of these vehicle types.

The combined total VMT for the vehicle types is then divided by the combined total gallons of fuel consumed to calculate, in effect, a "weighted" fuel efficiency value that appropriately accounts for the existing fleet mix of traffic on non-interstate roadways. The VMT and average fuel efficiency data were obtained from the most recent *Highway Statistics 2016* (Federal Highway Administration). Based on the calculation completed in Appendix C, Table C-6, the fuel efficiency rate to be used in the updated multi-modal transportation impact fee equation is 18.74 miles per gallon.

Effective Days per Year

An effective 365 days per year of operation was assumed for all land uses in the calculated fee. However, this will not be the case since some land uses operate only on weekdays (e.g., office buildings) and/or only seasonally (e.g., schools). The use of 365 days per year, therefore, over-estimates actual consumption and provides a conservative estimate, ensuring that gasoline taxes are adequately credited against the fee.

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VI. Calculated Multi-Modal Transportation Impact Fee

The multi-modal transportation impact fee calculations for each land use are included in Appendix D, which includes the major land use categories and the calculated impact fees for the individual land uses contained in each of the major categories. For each land use, Appendix D illustrates the following:

- Demand component variables (trip rate, trip length, percent new trips, and person-trip factor)
- Total multi-modal cost
- Annual gas tax credit
- Present value of the gas tax credit
- Net multi-modal transportation impact fee

It should be noted that the net multimodal transportation impact fee illustrated in Appendix D is not necessarily a recommended fee, but instead represents a technically documented multi-modal transportation impact fee per unit of land use that could be charged in the City of Bozeman.

For clarification purposes, it may be useful to walk through the calculation of a multi-modal fee for one of the land use categories. In the following example, the net multi-modal impact fee rate is calculated for the Residential (1,801-2,000 sq ft) land use (ITE LUC 210) using information from the calculated multi-modal fee schedule included in Appendix D, Table D-1. For each land use category, the following equations are utilized to calculate the net multi-modal fee:

Net Multi-Modal Fee = Total Multi-Modal Cost – Gas Tax Credit

Where:

Total Multi-Modal Cost = ([Trip Rate x Assessable Trip Length x % New Trips] / 2) x (1 – Interstate Adjustment Factor) x (Person-Trip Factor) * (Cost per Person-Mile of Capacity)

Gas Tax Credit = Present Value (Annual Gas Tax), given a 3.0% interest rate & a 25-year facility life

Annual Gas Tax = ([Trip Rate x Total Trip Length x % New Trips] / 2) x (Effective Days per Year x $/Gallon to Capital) / Fuel Efficiency

Each of the inputs has been discussed previously in this document; however, for purposes of this example, brief definitions for each input are provided in the following paragraphs, along with the actual inputs used in the calculation of the fee for the residential (1,801-2,000 sq ft) land use category:

- *Trip Rate* = the average daily trip generation rate, in vehicle-trips/day (8.31)
- *Assessable Trip Length* = the actual average trip length for the category, in vehicle-miles (3.31)
- *Total Trip Length* = the assessable trip length plus an adjustment factor of half a mile, which is added to the trip length to account for the fact that gas taxes are collected for travel on all roads, including local roads (3.31 + 0.50 = 3.81)
- *% New Trips* = adjustment factor to account for the trips that are already on the roadway (100%)
- *Divide by 2* = the total daily miles of travel generated by a particular (i.e., rate * length * % new trips) is divided by two to prevent the double-counting of travel generated among land use codes since every trip has an origin and a destination
- *Person-Trip Factor* = Converts vehicle-miles of travel to person-miles of travel (1.30)
- *Interstate Adjustment Factor* = discount factor to account for the travel demand occurring on interstate highways (19.9%)
- *Cost per Person-Mile of Capacity* = unit of person-miles of capacity consumed per unit of development ($319.18)
- *Effective Days per Year* = 365 days
- *$/Gallon to Capital* = the amount of gas tax revenue per gallon of fuel that is used for capital improvements, in $/gallon ($0.061)
- *Fuel Efficiency* = average fuel efficiency of vehicles, in vehicle-miles/gallon (18.74)
- *Present Value* = calculation of the present value of a uniform series of cash flows, gas tax payments in this case, given an interest rate, “I”, and a number of periods, “n;” for 3.0% interest and a 25-year facility life, the uniform series present worth factor is 17.4131

Multi-Modal Transportation Impact Fee Calculation

Using these inputs, a net multi-modal impact fee can be calculated for the residential (1,801-2,000 sq ft) land use category:

Total Multi-Modal Cost = ([8.31 * 3.31 * 1.0] /2) * (1 – 0.199) * 1.30 * ($319.18) = $4,571
Annual Gas Tax = ([8.31 * 3.81 * 1.0] /2) * 365 * ($0.061 /18.74) = $19
Revenue Credit = $19 * 17.4131 = $331
Net Multi-Modal Transportation Impact Fee = $4,571 - $331 = $4,240
MMTIF with 5% Administrative Fee = $4,240 * (1.05) = **$4,452**

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VII. Impact Fee Revenue Projections

Between 2006 and 2017, the City has generated approximately $2.5 million per year in transportation impact fee revenue projections, reaching over $4 million per year in 2015 and 2016, as shown in Table 7. Since 2012, the annual transportation impact fee collections averaged $3.2 million. The City's Transportation Master Plan estimates approximately $2.9 million per year for planning purposes.

Table 7
Historical Transportation Impact Fee Revenues

Year	Amount[1]
2006	$2,572,050
2007	$2,669,701
2008	$1,727,093
2009	$1,011,530
2010	$1,003,127
2011	$1,422,660
2012	$2,495,120
2013	$2,991,069
2014	$3,266,441
2015	$4,298,647
2016	$4,006,149
2017	$2,067,064
Total	$29,530,652
Avg. 2006-2017	**$2,460,888**
Avg. 2012-2017	**$3,187,415**
TMP Planning[2]	**$2,900,000**

1) Source: City of Bozeman
2) Source: 2017 Bozeman Transportation Master Plan, Pg. 151

Revenue projections for the multi-modal transportation impact fee are based on a review of recent permitting activity and estimated growth levels for the City of Bozeman. Using the calculated MMTIF rates presented in this report, the City is likely to generate an average of **$3.5 million to $5.0 million** per year through 2040, or a total of **$80 million to $115 million** over the next 23 years. These figures are in 2018 dollars without any indexing or fee adjustments.

Finally, it should be noted that for impact fee purposes, revenue projections serve only as an overall guideline in planning future infrastructure needs. In their simplest form, impact fees charge each unit of new growth for the net cost (total cost less credits) of infrastructure needed to serve that unit of growth. Theoretically, if the growth rates remain high, the City will have more impact fee revenues to fund growth related projects sooner rather than later. If growth rates slow down, less revenue will be generated and the timing and need for future infrastructure improvements will be later rather than sooner.

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VIII. Impact Fee Benefit Districts

Impact fee benefit districts are boundaries that dictate where the impact fee revenues can be spent to ensure that the fee payers receive the associated benefit. These differ from fee districts, which dictate the impact fee rate that is charged. Fee districts are based on technical data to justify different fee rates. In Bozeman, an example would be the lower rates calculated for the trip exchange district (TED).

Benefit district boundaries typically follow geographical man-made or natural barriers to transportation. In the case of most counties, there are multiple benefit districts due to larger geographic areas. In the case of most cities, due to the relatively small geographical footprint, the entire city is considered as a single benefit district, which is also the case for Bozeman. As such, impact fees collected from new development may be spent on transportation capacity expansion improvements anywhere within the city limits.

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Appendix A
Demand Component

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Appendix A: Demand Component

This appendix presents the detailed calculations for the demand component of the City of Bozeman's transportation impact fee study.

Interstate Adjustment Factor

Table A-1 presents the portion of VMT occurring on Interstate 90, which represents the interstate adjustment factor used in the calculation of the multi-modal impact fee. This variable is based on the roadway inventory and projected 2040 VMT in the City of Bozeman's Transportation Model. The interstate adjustment factor is used to reduce the PMT that the multi-modal fee charges for each land use.

Table A-1
Interstate Adjustment Factor

Roadway	2040 VMT	Distribution
I-90[1]	251,459	**19.9%**
State Roads	453,042	35.9%
County Roads	28,923	2.3%
City Roads	528,175	41.9%
Total	**1,261,599**	**-**

1) Interstate adjustment factor for the Bozeman MMTIF
Source: Bozeman Transportation Model

Trip Characteristics Database

The Trip Characteristics Database includes over 200 studies on 40 different residential and non-residential land uses collected over the last 25 years. Data from these studies include trip generation, trip length, and percent new trips for each land use. This information has been used in the development of impact fees and the creation of land use plan category trip characteristics for communities throughout the U.S.

Tindale Oliver estimates trip generation rates for land uses in a roadway impact fee schedule using data from studies in the Trip Characteristics Studies (TCS) Database and the Institute of Transportation Engineers' (ITE) *Trip Generation* reference report (10th edition). In instances, when both ITE *Trip Generation* reference report (10th edition) and TCS trip generation rate (TGR) data are available for a particular land use, the data is typically blended to increase the sample

size and provide a more valid estimate of the average number of trips generated per unit of development.

The trip generation rate for each respective land use is calculated using machine counts that record daily traffic into and out of the site studied. The traffic count hoses are set at entrances to residential subdivisions for the residential land uses and at all access points for non-residential land uses.

The trip length information is obtained through origin-destination surveys that ask respondents where they came from prior to arriving at the site and where they intended to go after leaving the site. The results of these surveys were used to estimate average trip length by land use.

The percent new trip variable is based on assigning each trip collected through the origin-destination survey process a trip type (primary, secondary, diverted, and captured). The percent new trip variable is then calculated as 1 minus the percentage of trips that are captured.

Square Footage Definitions:

For residential land uses, the fees are assessed on a per unit basic, but are tiered by size. The related square footage (SF) excludes unfinished attics, carports, attached garaged, porches that are not protected from the weather (such as screened porches) and mobile home hitches. Both finished and unfinished basements are included.

For non-residential land uses, two types of square footage are used based on the data available from the ITE. The following paragraphs provide a definition of each type and the calculated fee schedule shown in Table D-1 indicates the appropriate type of square footage for each non-residential land use.

- Gross Floor Area (GFA): the sum of the area of each floor level of a building (expressed in square feet), including cellars, basements, mezzanines, penthouses, corridors, lobbies, stores, and offices, that are within the principal outside faces of exterior walls, not including architectural setbacks or projections. Included are all areas that have floor surfaces with clear standing head room (6 ft. 6 in. minimum) regardless of their use. With the exception of buildings containing enclosed malls or atriums, GFA is equal to gross leasable area and gross rentable area. Occupied gross floor area refers to GFA within the facility which is currently being utilized. If a ground-level area, or part thereof, within the

principal outside faces of the exterior walls is not enclosed, this floor area is considered part of the overall GFA of the building. However, unroofed areas and unenclosed roofed-over spaces, except those contained within the principal outside faces of exterior walls, would be excluded from the area calculations. For the purpose of trip generation calculation, the floor area of all parking garages within the building should not be included in the GFA of the entire building. The majority of land uses in the Trip Generation Manual use GFA as an independent variable.

- Gross Leasable Area (GLA): the total floor area designed for tenant occupancy and exclusive use, including and basements, mezzanines, or upper floors, expressed in square feet and measured from the centerline of joint partitions and from outside wall faces. For the purpose of trip generation calculation, the floor area of all parking garages within the building should not be included within the GLA of the entire building. GLA is the area for which tenants pay rent; it is the area that produces income for the property owner. Occupied gross leasable area refers to GLA within the facility which is currently in use. Leased space that is not in productive use is not considered occupied. In the retail business, GLA lends itself readily to measurement and comparison and it has been adopted by the shopping center industry as its standard for statistical comparison. Accordingly, GLA is used in the Trip Generation Manual for shopping centers. For specialty retail, strip centers, discount stores and freestanding retail facilities, GLA usually equals GFA.

Land Use 151: Mini-Warehouse

Location	Size (1,000 sf)	Date	Total # Interviews	# Trip Length Interviews	Trip Gen Rate	Time Period	Trip Length	Percent New Trips	VMT	Source
Orange Co, FL	89.6	2006	-	-	1.23	-	-	-	-	Orange County
Orange Co, FL	84.7	2006	-	-	1.39	-	-	-	-	Orange County
Orange Co, FL	93.0	2006	-	-	1.51	-	-	-	-	Orange County
Orange Co, FL	107.0	2007	-	-	1.45	-	-	-	-	Orange County
Orange Co, FL	77.0	2009	-	-	2.18	-	-	-	-	Tindale Oliver
Orange Co, FL	93.7	2012	-	-	1.15	-	-	-	-	Tindale Oliver
Total Size	545.0	5								
ITE	780.0	15								
Blended total	1,325.0									

Average Trip Length:	**n/a**
Weighted Average Trip Length:	**n/a**
Weighted Percent New Trip Average:	-
Weighted Average Trip Generation Rate:	1.47
ITE Average Trip Generation Rate:	1.51
Blend of FL Studies and ITE Average Trip Generation Rate:	**1.49**

Land Use 210: Single-Family Detached Housing (Bozeman)

Location	Size / Units	Date	Total # Interviews	# Trip Length Interviews	Trip Gen Rate	Time Period	Trip Length	Percent New Trips	VMT	Source
Bozeman, MT	41	Dec-06	180	180	9.32	-	4.53	n/a	42.22	Tindale Oliver
Bozeman, MT	105	Dec-06	249	249	-	-	1.59	n/a	-	Tindale Oliver
Bozeman, MT	142	Dec-06	819	819	9.69	-	3.23	n/a	31.30	Tindale Oliver
ITE	41,976	159								
Total (all):	288									
Total (excluding #2):	183									

Average Trip Length:	**3.12**
Weighted Average Trip Length*:	**3.52**
Weighted Average Trip Generation Rate:	**9.61**
ITE Average Trip Generation Rate:	9.44
Blend of Local Studies and ITE Average Trip Generation Rate:	9.44

Note: 2nd study excluded from summary statistics

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Land Use 230 (ITE 9th Edition): Residential Condominium/Townhouse (Bozeman)

Location	Size / Units	Date	Total # Interviews	# Trip Length Interviews	Trip Gen Rate	Time Period	Trip Length	Percent New Trips	VMT	Source
Bozeman, MT	57	Jan-07	95	95	5.74	-	3.58	N/A	20.55	Tindale Oliver
Bozeman, MT	63	Dec-06	200	200	7.70	-	2.67	N/A	20.56	Tindale Oliver
Total Size	120	2				Average Trip Length:	3.13			
ITE	10,024	56				Weighted Average Trip Length:	3.10			
Blended total	10,144									

Weighted Average Trip Generation Rate:	**6.77**
ITE Average Trip Generation Rate (9th Edition):	5.81
Blend of Local Studies and ITE Average Trip Generation Rate:	5.82

Residential Combined (Bozeman)

Location	Size / Units	Date	Total # Interviews	# Trip Length Interviews	Trip Gen Rate	Time Period	Trip Length	Percent New Trips	VMT	Source
Bozeman, MT	41	Dec-06	180	180	9.32	-	4.53	n/a	42.22	Tindale Oliver
Bozeman, MT	105	Dec-06	249	249	-	-	1.59	n/a	-	Tindale Oliver
Bozeman, MT	142	Dec-06	819	819	9.69	-	3.23	n/a	31.30	Tindale Oliver
Bozeman, MT	57	Jan-07	95	95	5.74	-	3.58	N/A	20.55	Tindale Oliver
Bozeman, MT	63	Dec-06	200	200	7.70	-	2.67	N/A	20.56	Tindale Oliver
ITE	41,976	159				Average Trip Length:	3.12			
Total (all):	408					Weighted Average Trip Length:	3.36			
Total (excluding #2):	303									

Weighted Average Trip Generation Rate:	**8.48**
Average Trip Generation Rate:	8.11
Average Trip Generation Rate of Single/Multi-Family*:	**8.19**
Average Trip Length of Single/Multi-Family*:	**3.31**

*Average of Single/Multi-Family reflects historical permitting distribution within the City

Land Use 210: Single Family - Detached (Florida)

Location	Size / Units	Date	Total # Interviews	# Trip Length Interviews	Trip Gen Rate	Time Period	Trip Length	Percent New Trips	VMT	Source
Sarasota Co, FL	76	Jun-93	70	70	10.03	-	6.00	-	60.18	Sarasota County
Sarasota Co, FL	79	Jun-93	86	86	9.77	-	4.40	-	42.99	Sarasota County
Sarasota Co, FL	135	Jun-93	75	75	8.05	-	5.90	-	47.50	Sarasota County
Sarasota Co, FL	152	Jun-93	63	63	8.55	-	7.30	-	62.42	Sarasota County
Sarasota Co, FL	193	Jun-93	123	123	6.85	-	4.60	-	31.51	Sarasota County
Sarasota Co, FL	97	Jun-93	33	33	13.20	-	3.00	-	39.60	Sarasota County
Sarasota Co, FL	282	Jun-93	146	146	6.61	-	8.40	-	55.52	Sarasota County
Sarasota Co, FL	393	Jun-93	207	207	7.76	-	5.40	-	41.90	Sarasota County
Hernando Co, FL	76	May-96	148	148	10.01	9a-6p	4.85	-	48.55	Tindale Oliver
Hernando Co, FL	128	May-96	205	205	8.17	9a-6p	6.03	-	49.27	Tindale Oliver
Hernando Co, FL	232	May-96	182	182	7.24	9a-6p	5.04	-	36.49	Tindale Oliver
Hernando Co, FL	301	May-96	264	264	8.93	9a-6p	3.28	-	29.29	Tindale Oliver
Charlotte Co, FL	135	Oct-97	230	-	5.30	9a-5p	7.90	-	41.87	Tindale Oliver
Charlotte Co, FL	142	Oct-97	245	-	5.20	9a-5p	4.10	-	21.32	Tindale Oliver
Charlotte Co, FL	150	Oct-97	160	-	5.00	9a-5p	10.80	-	54.00	Tindale Oliver
Charlotte Co, FL	215	Oct-97	158	-	7.60	9a-5p	4.60	-	34.96	Tindale Oliver
Charlotte Co, FL	257	Oct-97	225	-	7.60	9a-5p	7.40	-	56.24	Tindale Oliver
Charlotte Co, FL	345	Oct-97	161	-	7.00	9a-5p	6.60	-	46.20	Tindale Oliver
Charlotte Co, FL	368	Oct-97	152	-	6.60	9a-5p	5.70	-	37.62	Tindale Oliver
Charlotte Co, FL	383	Oct-97	516	-	8.40	9a-5p	5.00	-	42.00	Tindale Oliver
Charlotte Co, FL	441	Oct-97	195	-	8.20	9a-5p	4.70	-	38.54	Tindale Oliver
Charlotte Co, FL	1,169	Oct-97	348	-	6.10	9a-5p	8.00	-	48.80	Tindale Oliver
Collier Co, FL	90	Dec-99	91	-	12.80	8a-6p	11.40	-	145.92	Tindale Oliver
Collier Co, FL	400	Dec-99	389	-	7.80	8a-6p	6.40	-	49.92	Tindale Oliver
Lake Co, FL	49	Apr-02	170	-	6.70	7a-6p	10.20	-	68.34	Tindale Oliver
Lake Co, FL	52	Apr-02	212	-	10.00	7a-6p	7.60	-	76.00	Tindale Oliver
Lake Co, FL	126	Apr-02	217	-	8.50	7a-6p	8.30	-	70.55	Tindale Oliver
Pasco Co, FL	55	Apr-02	133	-	6.80	8a-6p	8.12	-	55.22	Tindale Oliver
Pasco Co, FL	60	Apr-02	106	-	7.73	8a-6p	8.75	-	67.64	Tindale Oliver
Pasco Co, FL	70	Apr-02	188	-	7.80	8a-6p	6.03	-	47.03	Tindale Oliver
Pasco Co, FL	74	Apr-02	188	-	8.18	8a-6p	5.95	-	48.67	Tindale Oliver
Pasco Co, FL	189	Apr-02	261	-	7.46	8a-6p	8.99	-	67.07	Tindale Oliver
Marion Co, FL	102	Apr-02	167	-	8.02	7a-6p	5.10	-	40.90	Kimley-Horn & Associates
Marion Co, FL	105	Apr-02	169	-	7.23	7a-6p	7.22	-	52.20	Kimley-Horn & Associates
Marion Co, FL	124	Apr-02	170	-	6.04	7a-6p	7.29	-	44.03	Kimley-Horn & Associates
Marion Co, FL	132	Apr-02	171	-	7.87	7a-6p	7.00	-	55.09	Kimley-Horn & Associates
Marion Co, FL	133	Apr-02	209	-	8.04	7a-6p	4.92	-	39.56	Kimley-Horn & Associates
Citrus Co, FL	111	Oct-03	273	-	8.66	7a-6p	7.70	-	66.68	Tindale Oliver
Citrus Co, FL	231	Oct-03	155	-	5.71	7a-6p	4.82	-	27.52	Tindale Oliver
Citrus Co, FL	306	Oct-03	146	-	8.40	7a-6p	3.94	-	33.10	Tindale Oliver
Citrus Co, FL	364	Oct-03	345	-	7.20	7a-6p	9.14	-	65.81	Tindale Oliver
Citrus Co, FL	374	Oct-03	248	-	12.30	7a-6p	6.88	-	84.62	Tindale Oliver
Lake Co, FL	42	Dec-06	122	-	11.26	-	5.56	-	62.61	Tindale Oliver
Lake Co, FL	51	Dec-06	346	-	18.22	-	9.46	-	172.36	Tindale Oliver
Lake Co, FL	59	Dec-06	144	-	12.07	-	10.79	-	130.24	Tindale Oliver
Lake Co, FL	90	Dec-06	194	-	9.12	-	5.78	-	52.71	Tindale Oliver
Lake Co, FL	239	Dec-06	385	-	7.58	-	8.93	-	67.69	Tindale Oliver
Hernando Co, FL	232	Apr-07	516	-	8.02	7a-6p	8.16	-	65.44	Tindale Oliver
Hernando Co, FL	95	Apr-07	256	-	8.08	7a-6p	5.88	-	47.51	Tindale Oliver
Hernando Co, FL	90	Apr-07	338	-	7.13	7a-6p	5.86	-	41.78	Tindale Oliver
Hernando Co, FL	58	Apr-07	153	-	6.16	7a-6p	8.39	-	51.68	Tindale Oliver
Collier Co, FL	74	Mar-08	503	-	12.81	7a-6p	3.05	-	39.07	Tindale Oliver
Collier Co, FL	97	Mar-08	512	-	8.78	7a-6p	11.29	-	99.13	Tindale Oliver
Collier Co, FL	315	Mar-08	1,347	-	6.97	7a-6p	6.55	-	45.65	Tindale Oliver
Collier Co, FL	42	Mar-08	314	-	9.55	7a-6p	10.98	-	104.86	Tindale Oliver
Total Size	10,380	55	13,130			Average Trip Length:	6.79			
						Weighted Average Trip Length:	6.62			
						Bozeman Adjusted Trip Length (=53%):	3.52			

Weighted Average Trip Generation Rate:	7.81
ITE Average Trip Generation Rate:	9.44

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Land Use 253: Congregate Care Facility

Location	Size / Units	Date	Total # Interviews	# Trip Length Interviews	Trip Gen Rate	Time Period	Trip Length	Percent New Trips	VMT	Source
Pinellas Park, FL	72	Aug-89	25	19	3.50	9am-5pm	2.20	79.0	7.70	Tindale Oliver
Palm Harbor, FL	200	Oct-89	58	40	-	9am-5pm	3.40	69.0	-	Tindale Oliver
Total Size	272	2	83				Average Trip Length:	2.80		
ITE	388	2					Weighted Average Trip Length:	3.08		
Blended total	660						Bozeman Adjusted Trip Length (≈53%):	1.63		
							Weighted Percent New Trip Average:	71.6		

Land Use 320: Motel

Location	Size (Rooms)	Date	Total # Interviews	# Trip Length Interviews	Trip Gen Rate	Time Period	Trip Length	Percent New Trips	VMT	Source
Pinellas Co, FL	48	Oct-89	46	24	-	10a-2p	2.80	65.0	-	Tindale Oliver
Pinellas Co, FL	54	Oct-89	32	22	-	12p-7p	3.80	69.0	-	Tindale Oliver
Pinellas Co, FL	120	Oct-89	26	22	-	2p-7p	5.20	84.6	-	Tindale Oliver
Total Size	222	3	104				Average Trip Length:	3.93		
ITE	654	6					Weighted Average Trip Length:	4.34		
							Bozeman Adjusted Trip Length (≈53%):	2.30		
							Weighted Percent New Trip Average:	76.6		
								ITE Average Trip Generation Rate:		3.35

Land Use 565: Day Care Center

Location	Size (1,000 sf)	Date	Total # Interviews	# Trip Length Interviews	Trip Gen Rate	Time Period	Trip Length	Percent New Trips	VMT	Source
Pinellas Co, FL	5.6	Aug-89	94	66	66.99	7a-6p	1.90	70.0	89.10	Tindale Oliver
Pinellas Co, FL	10.0	Sep-89	179	134	66.99	7a-6p	2.10	75.0	105.51	Tindale Oliver
Tampa, FL	-	Mar-86	28	25	-	-	2.60	89.0	-	Kimley-Horn & Associates
Total Size	15.6		301				Average Trip Length:	2.20		
							Weighted Average Trip Length:	2.03		
							Bozeman Adjusted Trip Length (≈43%):	0.87		
							Weighted Percent New Trip Average:	73.2		
								ITE Average Trip Generation Rate - per student:		4.09

Land Use 710: General Office Building (Bozeman)

Location	Size (1,000 sf)	Date	Total # Interviews	# Trip Length Interviews	Trip Gen Rate	Time Period	Trip Length	Percent New Trips	VMT	Source
Bozeman, MT	39.0	Dec-06	107	107	-	-	1.64	77.0	-	Tindale Oliver
Bozeman, MT	48.3	Dec-06	153	153	21.37	-	2.83	69.0	41.73	Tindale Oliver
Bozeman, MT	61.2	Dec-06	268	268	28.92	-	1.74	72.0	36.23	Tindale Oliver
Total Size	109.5	3					Average Trip Length:	2.29		
							Weighted Average Trip Length:	2.22		
Note: 1st study excluded from summary statistics							Weighted Percent New Trip Average:	70.7		
								ITE Average Trip Generation Rate:		9.74

Land Use 770: Business Park

Location	Size (1,000 sf)	Date	Total # Interviews	# Trip Length Interviews	Trip Gen Rate	Time Period	Trip Length	Percent New Trips	VMT	Source
Collier Co, FL	14.1	May-99	-	55	33.48	8a-6p	3.60	72.7	87.62	Tindale Oliver
Collier Co, FL	66.0	May-99	-	43	11.53	8a-6p	5.70	79.0	51.92	Tindale Oliver
Collier Co, FL	211.1	May-99	-	284	17.91	8a-6p	5.40	93.0	89.94	Tindale Oliver
Total Size	291.2	3					Average Trip Length:	4.90		
							Weighted Average Trip Length:	5.38		
							Bozeman Adjusted Trip Length (≈43%):	2.31		
							Weighted Percent New Trip Average:	88.8		

Land Use 820: Shopping Center/Retail (Bozeman)

Location	Size (1,000 sf)	Date	Total # Interviews	# Trip Length Interviews	Trip Gen Rate	Time Period	Trip Length	Percent New Trips	VMT	Source
Bozeman, MT	104.3	Dec-06	359	359	46.96	-	3.35	49.0	77.08	Tindale Oliver
Bozeman, MT	159.9	Dec-06	502	502	56.49	-	1.56	54.0	47.59	Tindale Oliver
Bozeman, MT	35.9	Dec-06	329	329	69.30	-	1.39	74.0	71.28	Tindale Oliver
Total Size	300.1	3					Average Trip Length:	2.10		
							Weighted Average Trip Length:	2.16		
							Weighted Percent New Trip Average:	54.7		
								ITE Average Trip Generation Rate:		37.75

Residential Trip Generation Rate Tiering

As part of this study, the residential trip generation rate tiering was included to reflect a multi-tier analysis to ensure equity by the size of a home. To facilitate this, an analysis was completed on the comparative relationship between housing size and household travel behavior. This analysis utilized data from the 2009 National Household Travel Survey (NHTS) and the 2015

American Housing Survey (AHS) to examine overall trip-making characteristics of households in the United States.

Table A-2 presents that trip characteristics being utilized in the proposed multimodal transportation impact fee schedule for the residential land use. These variables are based on five local trip characteristics studies conducted in Bozeman (details on page A-2 and A-3). The data for single and multi-family developments was averaged to reflect the 50/50 split in single and multi-family permitting that the City has experienced in recent years. The 2009 NHTS database was used to assess average annual household vehicle miles of travel (VMT) for various annual household income levels. In addition, the 2015 AHS database was used to compare median annual family/household incomes with housing unit size. It is important to recognize that the use of the income variable in each of these databases is completed simply to provide a convenient linking mechanism between household VMT from the NHTS and housing unit size from the AHS.

Table A-2
Calculated Single Family Trip Characteristics

Calculated Values Excluding Tiering	Trip Rate	Assessable Trip Length	Daily VMT
Single/Multi-Family	8.19	3.31	27.11

Source: Local trip characteristics studies included in this Appendix

The results of the NHTS and AHS analyses are included in Tables A-3 and A-4. First, the data shown in Table A-3 presents that average income in the U.S. for families/households living in various housing tiers.

Table A-3
Annual Income by Housing Size

2015 AHS Average Income Data by Housing Size (Single Family, detached)	Annual Income[1]
Less than 500 sf	$28,633
500 to 749 sf	$35,633
750 to 999 sf	$41,065
1,000 to 1,499 sf	$53,059
1,500 to 1,999 sf	$66,193
2,000 to 2,499 sf	$75,787
2,500 to 2,999 sf	$85,483
3,000 to 3,999 sf	$87,131
4,000 sf or more	$91,528
Average of All Houses	$57,146

Source: American Housing Survey for the United State in 2015
1) Weighted average of annual income for each tier

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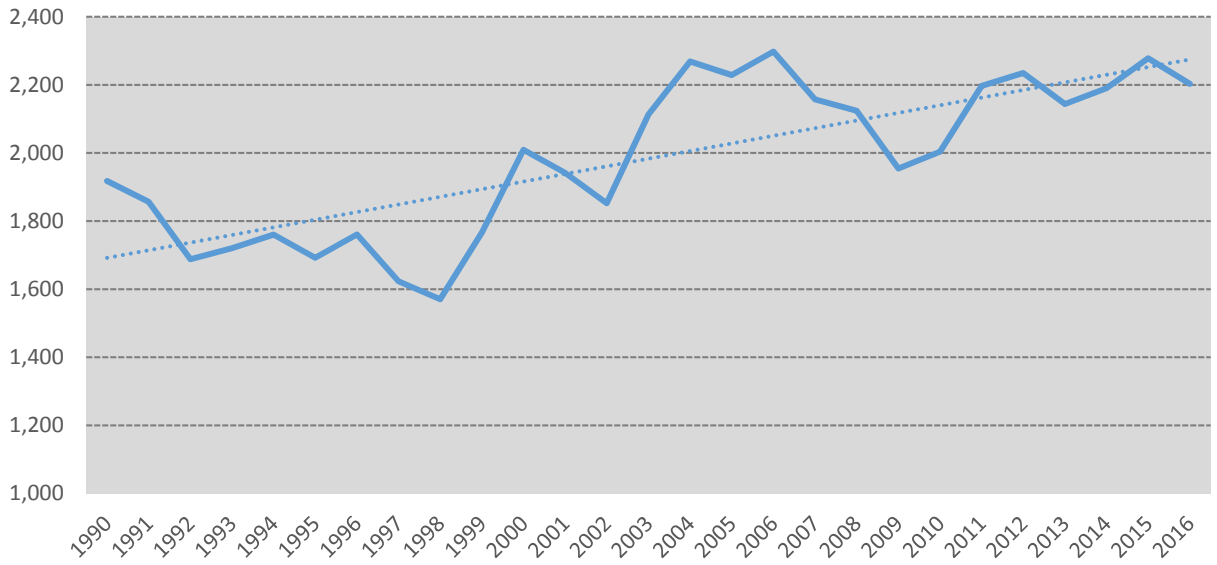
To calculate a corresponding trip rate for the new tiers, it was necessary to rely on comparative ratios. As an example, consider the $66,193 annual income category. First, it was determined that the average annual household VMT for this income level is 25,352 miles. This figure was then compared to the overall average annual VMT per household in the U.S. and normalized to the average of $57,146 (23,482 miles) category to derive a ratio of 1.080, as shown in Table A-4. Next, the normalized ratio was applied to the daily VMT for the average residential housing unit size of 1,500 to 1,999 square feet. This range is estimated to correspond with the average household size of typical construction in Bozeman. As shown in Figure A-1, the average size of single family homes has been increasing in recent years, typically averaging over 2,000 sq ft. However, since this land use category is representative of all residential development, the average trip generation rate of 8.19 (as shown in Table A-2) was tied to the 1,500-1,999 sq ft tier. This reflects that multi-family units are typically smaller (approximately 60% of single family) and have been accounting for half of the cities recent permitting.

Figure A-1
Single Family Home Size Trend in Bozeman



Source: Gallatin County Property Appraiser

Table A-4
NHTS Annual VMT by Income Category

2009 NHTS Travel Data by Annual HH Income	Annual VMT/HH	Days	Daily VMT	Ratio to Mean	Normalized to 1.080
Average of $28,633	14,890	365	40.79	0.634	0.587
Average of $35,633	17,454	365	47.82	0.743	0.688
Average of $41,065	18,591	365	50.93	0.792	0.733
Average of $53,059	22,501	365	61.65	0.958	0.887
Total (All Homes)	**23,482**	**365**	**64.33**	**1.000**	0.926
Average of $66,193	25,352	365	69.46	1.080	**1.000**
Average of $75,787	27,790	365	76.14	1.184	1.096
Average of $85,483	29,025	365	79.52	1.236	1.144
Average of $87,131	29,210	365	80.03	1.244	1.152
Average of $91,528	30,229	365	82.82	1.287	1.192

Source: 2009 National Household Travel Survey Database, Federal Highway Administration

Table A-5 presents the resulting trip generation rates calculated for each tier.

Table A-5
Estimated TGR by Income Category

Estimation of Trip Rate by Tier	Trip Rate(1)	Assessable Trip Length(2)	Daily VMT(3)	Ratio to Mean(4)
Single Family (Detached)				
Less than 500 sf	**4.81**	3.31	15.91	0.587
500 to 749 sf	**5.63**	3.31	18.65	0.688
750 to 999 sf	**6.00**	3.31	19.87	0.733
1,000 to 1,499 sf	**7.27**	3.31	24.05	0.887
1,500 to 1,999 sf	**8.19**	3.31	27.11	1.000
2,000 to 2,499 sf	**8.98**	3.31	29.71	1.096
2,500 to 2,999 sf	**9.37**	3.31	31.01	1.144
3,000 to 3,999 sf	**9.44**	3.31	31.23	1.152
4,000 sf or more	**9.76**	3.31	32.31	1.192

1) The average TGR of 8.19 (Table A-2) multiplied by the ratio to the mean (Item 4)
2) Source: Table A-2
3) Trip Rate (Item 1) multiplied by the assessable trip length (Item 2)
4) Source: Table A-4

While Table A-5 presents a tiering analysis, the tiers that are presented in the AHS do not align with the tiers that are used to assess the City's transportation impact fee. Therefore, the data points established in Table A-5 were placed on a scatterplot and a line of best fit equation was determined. Using this equation, the TGR for the Bozeman tier criteria were calculated.

Table A-6

TGR Inputs for Best-Fit Line

Tier	Trip Rate[1]
Less than 500 sf	4.81
500 to 749 sf	5.63
750 to 999 sf	6.00
1,000 to 1,499 sf	7.27
1,500 to 1,999 sf	8.19
2,000 to 2,499 sf	8.98
2,500 to 2,999 sf	9.37
3,000 to 3,999 sf	9.44
4,000 sf or more	9.76

1) Source: Table A-5. Data points plotted at the mid-point of each square footage tier

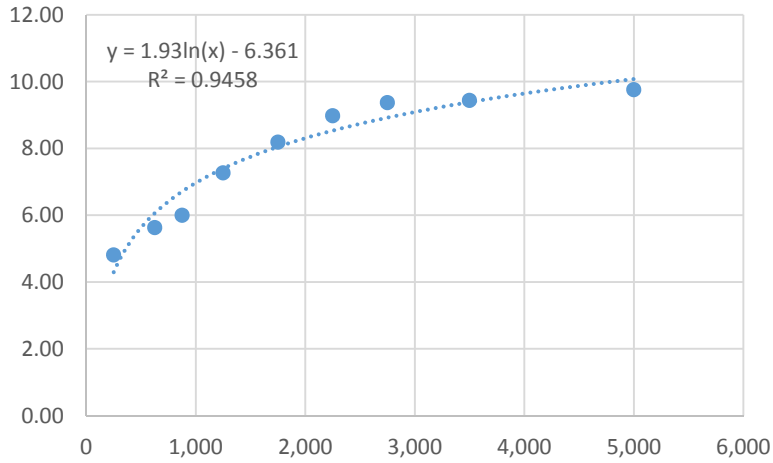


Table A-7 presents the trip generation rates used in the transportation impact fee calculation. These were calculated by using the line of best fit from Table A-6 and the square footage tiers from the cities current impact fee schedule (mid-point of square footage of each tier used in calculation).

Table A-7
Tiered Residential Trip Generation Rates

Tier	Trip Rate[1]
Residential: 1,400 sf or less	7.62
Residential: 1,401 to 1,600 sf	7.88
Residential: 1,601 to 1,800 sf	8.11
Residential: 1,801 to 2,000 sf	8.31
Residential: 2,001 to 2,200 sf	8.49
Residential: 2,201 to 2,400 sf	8.66
Residential: 2,401 to 2,600 sf	8.82
Residential: 2,601 to 2,800 sf	8.96
Residential: 2,800 to 3,000 sf	9.09
Residential: 3,001 sf or more	9.13

1) TGR for each square footage tier calculating using the max square footage of each tier and the line of best fit previously presented

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Appendix B
Cost Component

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Appendix B: Cost Component

This appendix presents the detailed calculations for the cost component of the multi-modal transportation impact fee. Supporting data and estimates are provided for all cost variables, including:

- Right-of-Way
- Construction
- Roadway Capacity
- Transit Capital Costs

Right-of-Way

The ROW cost reflects the total cost of the acquisitions along a corridor that was necessary to have sufficient cross-section width to widen an existing road or, in the case of new construction, build a new road.

City Roadways

For impact fee purposes, the ROW cost for city roads was estimated as a percentage of the construction cost per lane mile. This factor was developed through discussions with City staff regarding recent and planned acquisitions. For many improvements, the City is able to acquire ROW inexpensively through annexations or the land is readily available. However, in certain cases, large tracts must be purchased for critical improvements. Through these discussions, it was estimated that ROW costs are, on average, equivalent to 10 percent of the construction cost of a capacity-expansion improvement.

State Roadways

The ROW factor for state roads was assumed to be the same as the factor determined for city roads.

Construction

The construction cost estimates that follow include construction, design, construction administration, utilities, and contingency cost elements for capacity expansion.

City Roadways

As shown in Table B-1, the Transportation Master Plan's committed and recommended improvement list was reviewed to determine a cost per lane mile for city roadway improvements. As show, for city roads, the estimated construction cost is approximately **$2.8 million per lane mile**.

State Roadways

Similar to city roads, the construction cost for state roads was determined through a review of the TMP's committed and recommended list of improvements. As shown in Table B-1, for state roads, the estimated construction cost is approximately **$3.2 million per lane mile**.

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Table B-1
Bozeman Transportation Master Plan – Committed and Recommended Improvements

TMP ID	Jurisdiction	Title	Description	Improvement	Length	Existing Lanes	Future Lanes	Lanes Added	Lane Miles Added	Cost	Cost per Lane Mile
Committed MSN Improvements (FY 2018-2022)											
CMSN-1	State	Griffin Dr from N. 7th Ave to Rouse Rd	Reconstruct 3-Lane Urban Arterial	State, 2 to 3	0.74	2	3	1	0.74	$5,000,000	$6,756,757
CMSN-2	City	Cottonwood Rd from Babcock St to Durston Rd	Widen to 5-Lane Urban Arterial	City, 2 to 5	0.50	2	5	3	1.50	$2,555,883	$1,703,922
CMSN-5	City	Durston Rd from Ferguson Rd to Fowler Ave	Complete to a 3-Lane Urban Arterial	City, 2 to 3	0.50	2	3	1	0.50	$1,514,842	$3,029,684
CMSN-7	City	S. 11th Ave from Kagy Blvd to Graf St Ext.	Complete to a 2-Lane Urban Collector	City, 2 to 3	0.76	2	3	1	0.76	$1,600,000	$2,105,263
CMSN-9	City	W. Babcock St from S. 11th Ave to S. 19th St	Upgrade to a 3-Lane Urban Collector	City, 2 to 3	0.52	2	3	1	0.52	$1,500,000	$2,884,615
CMSN-10	State	Oak St from Rouse Ave thru Cannery District	Improve and add turn lane	State, 2 to 3	0.24	2	3	1	0.24	$266,000	$1,108,333
CMSN-11	State	Rouse Ave from E Main St to Oak St	Reconstruct 3-Lane Urban Principal Arterial	State, 2 to 3	0.84	2	3	1	0.84	$9,185,756	$10,935,424
CTSM-2	City	Ferguson Ave and Durston Rd	Traffic Signal or Roundabout Installation	Intersection	-	-	-	-	-	$2,256,220	-
CTSM-3	City	Oak St and Davis Lane	Roundabout Installation	Intersection	-	-	-	-	-	$1,761,508	-
CTSM-4	City	Oak St and Ferguson Ave	Traffic Signal or Roundabout Installation	Intersection	-	-	-	-	-	$1,345,331	-
CTSM-5	City	S. 3rd Ave and Graf St	Traffic Signal or Roundabout Installation	Intersection	-	-	-	-	-	$1,000,000	-
CTSM-6	City	Cottonwood Rd and Babcock St	Traffic Signal Installation	Intersection	-	-	-	-	-	$1,435,336	-
CTSM-9	State	Bozeman Signal Safety	Signal upgrades	Intersection	-	-	-	-	-	$1,635,776	-
CTSM-10	State	Cottonwood Rd & Stucky Rd	Roundabout Installation	Intersection	-	-	-	-	-	$3,158,260	-
CTSM-11	City	Highland Blvd and Main St	Intersection Improvement	Intersection	-	-	-	-	-	$150,000	-
CTSM-12	City	Baxter Ln and Davis St	Intersection Improvement	Intersection	-	-	-	-	-	$2,500,000	-
CTSM-14	City	Kagy Blvd (S. 19th Ave to Wilson Ave)	Intersection Improvement	Intersection	-	-	-	-	-	$500,000	-
Recommended MSN Improvements											
MSN-1	State	Kagy Blvd from Wilson Ave to Highland Blvd	Reconstruct to a 4-Lane Urban Principal Arterial	State, 2 to 4	1.05	2	4	2	2.10	$6,000,000	$2,857,143
MSN-2	State	Oak St from N. 7th Ave to west edge of Cannery District	Reconstruct to a 3-Lane Urban Principal Arterial	State, 2 to 3	0.49	2	3	1	0.49	$1,950,000	$3,979,592
MSN-3	City	N. 11th Ave from Durston Rd to Oak St	Construct to a 2-Lane Urban Collector	City, 0 to 2	0.51	0	2	2	1.02	$1,120,000	$1,098,039
MSN-4	City	N. 15th Ave from Patrick St to Baxter Ln	Construct to a 3-Lane Urban Collector	City, 0 to 3	0.32	0	3	3	0.96	$705,000	$734,375
MSN-5	State	N. 19th Ave from Interstate 90 to Springhill Rd	Reconstruct to a 5-Lane Urban Principal Arterial	State, 3 to 5	0.47	3	5	2	0.94	$2,500,000	$2,659,574
MSN-6	State	Springhill Rd from Frontage Rd to Sypes Canyon Rd	Reconstruct to a 3-Lane Rural Minor Arterial	State, 2 to 5	1.50	2	3	1	1.50	$2,850,000	$1,900,000
MSN-7	City	N. 27th Ave from Baxter Ln to Valley Center Rd	Construct to a 3-Lane Urban Collector	City, 2 to 3	1.41	2	3	1	1.41	$4,200,000	$2,978,723
MSN-8	State	Kagy Blvd from Wilson Ave to S. 19th Ave	Reconstruct to a 4-Lane Urban Principal Arterial	State, 2 to 4	1.04	2	4	2	2.08	$8,000,000	$3,846,154
MSN-9	State	Oak St from N. 27th Ave to N. 19th Ave	Reconstruct to a 5-Lane Urban Principal Arterial	State, 2 to 5	0.50	2	5	3	1.50	$2,100,000	$1,400,000
MSN-10	City	Cattail St from Davis Ln to Harper Puckett Rd	Construct to a 3-Lane Urban Collector	City, 0 to 3	1.00	0	3	3	3.00	$3,000,000	$1,000,000
MSN-11	City	Davis Ln from Baxter Ln to Valley Center Rd	Reconstruct to a 5-Lane Urban Minor Arterial	City, 2 to 5	1.71	2	5	3	5.13	$8,500,000	$1,656,920
MSN-12	City	Cottonwood Rd from Oak St to Cattail St	Construct to a 5-Lane Urban Principal Arterial	City, 0 to 5	1.00	0	5	5	5.00	$5,000,000	$1,000,000
MSN-13	City	Fowler Ave Connection from Huffine Ln to Oak St	Reconstruct to a 5-Lane Urban Minor Arterial	City, 2 to 5	1.51	2	5	3	4.53	$7,500,000	$1,655,629
MSN-15	City	Cottonwood Rd from Durston Rd to Oak St	Construct to a 5-Lane Urban Principal Arterial	City, 2 to 5	0.50	2	5	3	1.50	$2,500,000	$1,666,667
MSN-17	State	College St from S. 11th Ave to S. 19th Ave	Reconstruct to a 3-Lane Urban Minor Arterial	State, 2 to 3	0.52	2	3	1	0.52	$1,100,000	$2,115,385
MSN-18	City	Oak St from Cottonwood Rd to Flanders Mill	Reconstruct to a 5-Lane Urban Principal Arterial	City, 0 to 5	0.26	0	5	5	1.30	$1,550,000	$1,192,308
MSN-21	City	S. 3rd Ave from Graf St to Kagy Blvd	Reconstruct to a 3-Lane Urban Collector	City, 2 to 3	0.72	2	3	1	0.72	$2,100,000	$2,916,667
MSN-22	State	Highland Blvd from Main St to Kagy Blvd	Reconstruct to a 5-Lane Urban Principal Arterial	State, 2 to 5	1.63	2	5	3	4.89	$10,000,000	$2,044,990
MSN-26	State	Cottonwood Rd from Loyal Dr to Graf St	Reconstruct to a 5-Lane Urban Principal Arterial	State, 2 to 5	1.09	2	5	3	3.27	$5,500,000	$1,681,957

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Table B-1 (continued)
Bozeman Transportation Master Plan – Committed and Recommended Improvements

TMP ID	Jurisdiction	Title	Description	Improvement	Length	Existing Lanes	Future Lanes	Lanes Added	Lane Miles Added	Cost	Cost per Lane Mile
Recommended MSN Improvements											
MSN-29	State	Valley Center Rd from Valley Center Spur Rd to N. 27th Ave	Reconstruct to a 3-Lane Urban Principal Arterial	State, 2 to 3	1.07	2	3	1	1.07	$3,510,000	$3,280,374
MSN-34	City	Cattail St from N. 19th Ave to N. 27th Ave	Construct to a 3-Lane Urban Collector	City, 2 to 3	0.32	2	3	1	0.32	$960,000	$3,000,000
MSN-36	City	Manley Rd from Griffin Dr to Gallatin Park Dr North	Reconstruct to an Urban Collector	City, 2 to 3	0.63	2	3	1	0.63	$1,950,000	$3,095,238
MSN-37	City	W. Lincoln St from N. 19th Ave to S. 11th Ave	Reconstruct to a 3-Lane Urban Collector	City, 2 to 3	0.52	2	3	1	0.52	$1,500,000	$2,884,615
MSN-38	City	Oak St from Flanders Mill to Ryunson Way	Reconstruct to a 5-Lane Urban Principal Arterial	City, 0 to 5	0.21	0	5	5	1.05	$1,500,000	$1,428,571
MSN-39	City	Baxter Ln from Ferguson Ave to Harper Puckett Rd	Complete to a 3-Lane Urban Minor Arterial	City, 2 to 3	0.50	2	3	1	0.50	$1,500,000	$3,000,000
MSN-40	City	Baxter Ln from N. 19th Ave to Davis Ln	Complete to a 3-Lane Urban Minor Arterial	City, 2 to 3	0.85	2	3	1	0.85	$1,500,000	$1,764,706
MSN-41	State	Baxter Ln from N. 7th Ave to N. 19th Ave	Complete to a 3-Lane Urban Collector	State, 2 to 3	1.08	2	3	1	1.08	$1,500,000	$1,388,889
MSN-43	State	Oak St from N. 15th Ave to N. 19th Ave	Complete to a 5-Lane Urban Principal Arterial	State, 3 to 5	0.27	3	5	2	0.54	$765,000	$1,416,667
MSN-44	City	N. 27th Ave from Oak St to Tschache Ln	Complete to a 5-Lane Urban Collector	City, 2 to 5	0.25	2	5	3	0.75	$350,000	$466,667
MSN-46	State	S. 19th Ave from Kagy Blvd to Goldenstein Ln	Reconstruct to a 5-Lane Principal Arterial Standard	State, 2 to 5	1.77	2	5	3	5.31	$9,000,000	$1,694,915
MSN-47	City	Durston Rd from Cottonwood Rd to Ferguson Ave	Reconstruct to a 3-Lane Urban Minor Arterial	City, 2 to 3	0.50	2	3	1	0.50	$2,500,000	$5,000,000
TSM-2	City	N. 27th Ave and Oak St	Traffic Signal or Roundabout Installation	Intersection	-	-	-	-	-	$650,000	-
TSM-3	City	Baxter Ln and Cottonwood Rd	Traffic Signal or Roundabout Installation	Intersection	-	-	-	-	-	$2,500,000	-
TSM-4	City	Oak St and Cottonwood Rd	Traffic Signal or Roundabout Installation	Intersection	-	-	-	-	-	$2,750,000	-
TSM-5	City	Durston Rd and Flanders Mill Rd	Roundabout Installation	Intersection	-	-	-	-	-	$2,000,000	-
TSM-6	City	Bridger Dr and Story Mill Rd	Traffic Signal or Roundabout Installation	Intersection	-	-	-	-	-	$1,000,000	-
TSM-7	City	Fowler Ave and Babcock St	Intersection Improvement	Intersection	-	-	-	-	-	$2,000,000	-
TSM-9	City	Fowler Ave and Durston Rd	Intersection Improvement	Intersection	-	-	-	-	-	$2,000,000	-
TSM-10	City	Davis Ln and Cattail St	Traffic Signal or Roundabout Installation	Intersection	-	-	-	-	-	$2,000,000	-
TSM-11	City	Davis Ln and Catamount St	Traffic Signal or Roundabout Installation	Intersection	-	-	-	-	-	$2,000,000	-
TSM-13	City	N. 27th Ave and Tschache Ln	Traffic Signal Installation	Intersection	-	-	-	-	-	$2,000,000	-
TSM-14	City	Davis Lane and Valley Center Rd	Traffic Signal Installation	Intersection	-	-	-	-	-	$2,000,000	-
TSM-15	City	N. 27th Ave and Valley Center Rd	Traffic Signal Installation	Intersection	-	-	-	-	-	$2,000,000	-
TSM-16	State	Oak St and N. 19th Ave	Intersection Improvement	Intersection	-	-	-	-	-	$530,000	-
TSM-17	City	Oak St and N. 11th Ave	Traffic Signal Installation	Intersection	-	-	-	-	-	$1,150,000	-
TSM-18	State	N. 7th Ave and Griffin Dr	Intersection Improvement	Intersection	-	-	-	-	-	$2,350,000	-
TSM-19	State	Oak St and N. 7th Ave	Intersection Improvement	Intersection	-	-	-	-	-	$750,000	-
TSM-23	State	Highland Blvd and Ellis St	Traffic Signal or Roundabout Installation	Intersection	-	-	-	-	-	$2,000,000	-
TSM-24	State	Highland Blvd and Kagy Blvd	Traffic Signal or Roundabout Installation	Intersection	-	-	-	-	-	$2,850,000	-
TSM-25	State	Kagy Blvd and S. Church Ave/Sourdough Rd (Opt. 1)	Traffic Signal or Roundabout Installation	Intersection	-	-	-	-	-	$2,850,000	-
TSM-27	City	Huffine Ln and Fowler Ave	Signal Turn-Phase Evaluation	Intersection	-	-	-	-	-	$150,000	-
TSM-29	State	Oak St and Stoneridge Dr	Modify Intersection Approach	Intersection	-	-	-	-	-	$70,000	-
TSM-39	City	Lincoln St and S. 11th Ave	Roundabout Installation	Intersection	-	-	-	-	-	$2,000,000	-
Total									**60.08**		
City Roads Only					Lane Mile Distribution:			**55%**	32.97	$92,254,120	**$2,798,123**
State Roads Only					Lane Mile Distribution:			**45%**	27.11	$85,420,792	**$3,150,896**

Source: 2017 Bozeman Transportation Master Plan, Chapter 4; additional information provided by city staff

Roadway Capacity

As shown in Table B-2, the average capacity per lane-mile was based on the projects in the Bozeman Transportation Master Plan's committed and recommended projects lists. The listing of projects reflects the mix of improvements that will yield the vehicle-miles of capacity (VMC) that will be built in the City of Bozeman. The initial and future capacity values are based on the planning level estimates provided in the Bozeman Transportation Master Plan, Table 2.7, with an adjustment of 25 percent, based on discussions with City staff. This adjustment reflects that future improvements are designed to account for such factors as limiting direct access points to a facility, provided adequate roadway geometrics, and improving sight distance. The resulting weighted average capacity per lane mile of approximately 7,900 was used in the multi-modal transportation impact fee calculation.

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Table B-2
City of Bozeman Transportation Master Plan, Committed and Recommended Improvements

TMP ID	Jurisdiction	Title	Description	Improvement	Length	Existing Lanes	Future Lanes	Lanes Added	Lane Miles Added	Initial Capacity	Future Capacity	Added Capacity	VMC Added	VMC Added per Lane Mile
Table 4.1: Committed MSN Improvements (FY 2018-2022)														
CMSN-1	State	Griffin Dr from N. 7th Ave to Rouse Rd	Reconstruct 3-Lane Urban Arterial	State, 2 to 3	0.74	2	3	1	0.74	15,000	22,500	7,500	5,550	7,500
CMSN-2	City	Cottonwood Rd from Babcock St to Durston Rd	Widen to 5-Lane Urban Arterial	City, 2 to 5	0.50	2	5	3	1.50	15,000	40,000	25,000	12,500	8,333
CMSN-5	City	Durston Rd from Ferguson Rd to Fowler Ave	Complete to a 3-Lane Urban Arterial	City, 2 to 3	0.50	2	3	1	0.50	15,000	22,500	7,500	3,750	7,500
CMSN-7	City	S. 11th Ave from Kagy Blvd to Graf St Ext.	Complete to a 2-Lane Urban Collector	City, 2 to 3	0.76	2	3	1	0.76	12,000	18,000	6,000	4,560	6,000
CMSN-9	City	W. Babcock St from S. 11th Ave to S. 19th St	Upgrade to a 3-Lane Urban Collector	City, 2 to 3	0.52	2	3	1	0.52	15,000	22,500	7,500	3,900	7,500
CMSN-10	State	Oak St from Rouse Ave thru Cannery District	Improve and add turn lane	State, 2 to 3	0.24	2	3	1	0.24	15,000	22,500	7,500	1,800	7,500
CMSN-11	State	Rouse Ave from E Main St to Oak St	Reconstruct 3-Lane Urban Principal Arterial	State, 2 to 3	0.84	2	3	1	0.84	15,000	22,500	7,500	6,300	7,500
Table 4.2: Recommended MSN Improvements														
MSN-1	State	Kagy Blvd from Wilson Ave to Highland Blvd	Reconstruct to a 4-Lane Urban Principal Arterial	State, 2 to 4	1.05	2	4	2	2.10	15,000	30,000	15,000	15,750	7,500
MSN-2	State	Oak St from N. 7th Ave to west edge of Cannery District	Reconstruct to a 3-Lane Urban Principal Arterial	State, 2 to 3	0.49	2	3	1	0.49	15,000	22,500	7,500	3,675	7,500
MSN-3	City	N. 11th Ave from Durston Rd to Oak St	Construct to a 2-Lane Urban Collector	City, 0 to 2	0.51	0	2	2	1.02	0	15,000	15,000	7,650	7,500
MSN-4	City	N. 15th Ave from Patrick St to Baxter Ln	Construct to a 3-Lane Urban Collector	City, 0 to 3	0.32	0	3	3	0.96	0	22,500	22,500	7,200	7,500
MSN-5	State	N. 19th Ave from Interstate 90 to Springhill Rd	Reconstruct to a 5-Lane Urban Principal Arterial	State, 3 to 5	0.47	3	5	2	0.94	30,000	40,000	10,000	4,700	5,000
MSN-6	State	Springhill Rd from Frontage Rd to Sypes Canyon Rd	Reconstruct to a 3-Lane Rural Minor Arterial	State, 2 to 5	1.50	2	3	1	1.50	15,000	22,500	7,500	11,250	7,500
MSN-7	City	N. 27th Ave from Baxter Ln to Valley Center Rd	Construct to a 3-Lane Urban Collector	City, 2 to 3	1.41	2	3	1	1.41	15,000	22,500	7,500	10,575	7,500
MSN-8	State	Kagy Blvd from Wilson Ave to S. 19th Ave	Reconstruct to a 4-Lane Urban Principal Arterial	State, 2 to 4	1.04	2	4	2	2.08	15,000	30,000	15,000	15,600	7,500
MSN-9	State	Oak St from N. 27th Ave to N. 19th Ave	Reconstruct to a 5-Lane Urban Principal Arterial	State, 2 to 5	0.50	2	5	3	1.50	15,000	40,000	25,000	12,500	8,333
MSN-10	City	Cattail St from Davis Ln to Harper Puckett Rd	Construct to a 3-Lane Urban Collector	City, 0 to 3	1.00	0	3	3	3.00	0	22,500	22,500	22,500	7,500
MSN-11	City	Davis Ln from Baxter Ln to Valley Center Rd	Reconstruct to a 5-Lane Urban Minor Arterial	City, 2 to 5	1.71	2	5	3	5.13	15,000	40,000	25,000	42,750	8,333
MSN-12	City	Cottonwood Rd from Oak St to Cattail St	Construct to a 5-Lane Urban Principal Arterial	City, 0 to 5	1.00	0	5	5	5.00	0	40,000	40,000	40,000	8,000
MSN-13	City	Fowler Ave Connection from Huffine Ln to Oak St	Reconstruct to a 5-Lane Urban Minor Arterial	City, 2 to 5	1.51	2	5	3	4.53	15,000	40,000	25,000	37,750	8,333
MSN-15	City	Cottonwood Rd from Durston Rd to Oak St	Construct to a 5-Lane Urban Principal Arterial	City, 2 to 5	0.50	2	5	3	1.50	15,000	40,000	25,000	12,500	8,333
MSN-17	State	College St from S. 11th Ave to S. 19th Ave	Reconstruct to a 3-Lane Urban Minor Arterial	State, 2 to 3	0.52	2	3	1	0.52	15,000	22,500	7,500	3,900	7,500
MSN-18	City	Oak St from Cottonwood Rd to Flanders Mill	Reconstruct to a 5-Lane Urban Principal Arterial	City, 0 to 5	0.26	0	5	5	1.30	0	40,000	40,000	10,400	8,000
MSN-21	City	S. 3rd Ave from Graf St to Kagy Blvd	Reconstruct to a 3-Lane Urban Collector	City, 2 to 3	0.72	2	3	1	0.72	15,000	22,500	7,500	5,400	7,500
MSN-22	State	Highland Blvd from Main St to Kagy Blvd	Reconstruct to a 5-Lane Urban Principal Arterial	State, 2 to 5	1.63	2	5	3	4.89	15,000	40,000	25,000	40,750	8,333
MSN-26	State	Cottonwood Rd from Loyal Dr to Graf St	Reconstruct to a 5-Lane Urban Principal Arterial	State, 2 to 5	1.09	2	5	3	3.27	15,000	40,000	25,000	27,250	8,333
MSN-29	State	Valley Center Rd from Valley Center Spur Rd to N. 27th Ave	Reconstruct to a 3-Lane Urban Principal Arterial	State, 2 to 3	1.07	2	3	1	1.07	15,000	22,500	7,500	8,025	7,500
MSN-34	City	Cattail St from N. 19th Ave to N. 27th Ave	Construct to a 3-Lane Urban Collector	City, 2 to 3	0.32	2	3	1	0.32	15,000	22,500	7,500	2,400	7,500
MSN-36	City	Manley Rd from Griffin Dr to Gallatin Park Dr North	Reconstruct to an Urban Collector	City, 2 to 3	0.63	2	3	1	0.63	12,000	18,000	6,000	3,780	6,000
MSN-37	City	W. Lincoln St from N. 19th Ave to S. 11th Ave	Reconstruct to a 3-Lane Urban Collector	City, 2 to 3	0.52	2	3	1	0.52	15,000	22,500	7,500	3,900	7,500
MSN-38	City	Oak St from Flanders Mill to Ryunson Way	Reconstruct to a 5-Lane Urban Principal Arterial	City, 0 to 5	0.21	0	5	5	1.05	0	40,000	40,000	8,400	8,000
MSN-39	City	Baxter Ln from Ferguson Ave to Harper Puckett Rd	Complete to a 3-Lane Urban Minor Arterial	City, 2 to 3	0.50	2	3	1	0.50	15,000	22,500	7,500	3,750	7,500
MSN-40	City	Baxter Ln from N. 19th Ave to Davis Ln	Complete to a 3-Lane Urban Minor Arterial	City, 2 to 3	0.85	2	3	1	0.85	15,000	22,500	7,500	6,375	7,500
MSN-41	State	Baxter Ln from N. 7th Ave to N. 19th Ave	Complete to a 3-Lane Urban Collector	State, 2 to 3	1.08	2	3	1	1.08	15,000	22,500	7,500	8,100	7,500
MSN-43	State	Oak St from N. 15th Ave to N. 19th Ave	Complete to a 5-Lane Urban Principal Arterial	State, 3 to 5	0.27	3	5	2	0.54	22,500	40,000	17,500	4,725	8,750
MSN-44	City	N. 27th Ave from Oak St to Tschache Ln	Complete to a 5-Lane Urban Collector	City, 2 to 5	0.25	2	5	3	0.75	15,000	40,000	25,000	6,250	8,333
MSN-46	State	S. 19th Ave from Kagy Blvd to Goldenstein Ln	Reconstruct to a 5-Lane Principal Arterial Standard	State, 2 to 5	1.77	2	5	3	5.31	15,000	40,000	25,000	44,250	8,333
MSN-47	City	Durston Rd from Cottonwood Rd to Ferguson Ave	Reconstruct to a 3-Lane Urban Minor Arterial	City, 2 to 3	0.50	2	3	1	0.50	15,000	22,500	7,500	3,750	7,500
Total									**60.08**				**474,165**	**7,892**

Source: City of Bozeman 2017 Transportation Master Plan, Chapter 4; includes additional detail provided by city staff

Transit Capital Costs

To convert the roadway impact fee into a multi-modal fee, the marginal cost of adding transit infrastructure is considered. This section details the difference in cost per person-mile of capacity between expanding a roadway without transit amenities versus expanding a roadway with transit amenities. This calculation also accounts for the change in roadway PMC that occurs when a bus is on the road.

Table B-3 calculates the person-miles of capacity added for each new transit vehicle on the road. This calculation adjusts for the fact that buses have a significantly higher person-capacity than passenger vehicles. This table also identifies transit capital cost variables that will be used to calculate the added capital cost of constructing/expanding a roadway with transit facilities.

Table B-4 combines the roadway VMC and the transit PMC to calculate the marginal change in cost per PMC. First, the roadway characteristics, including cost and capacity, were used to calculate the roadway cost per VMC for a generic 8-mile roadway segment. Then, an adjustment factor was applied to recognize that incorporating transit along a segment of roadway decreases the vehicle-capacity as the bus makes intermittent stops and interrupts the free-flowing traffic. As shown in Table B-4, the bus blockage adjustment factor is much higher for a 2-lane roadway than for a 4-lane roadway. On a 2-lane road, all cars get caught behind the bus during a stop, while on a 4-lane roadway, there is an unobstructed travel lane that cars can use to pass-by or maneuver around the slower transit vehicle. This adjusted VMC was then converted to PMC using the vehicle-miles to person-miles adjustment factor previously discussed in this report. The additional person-capacity from the buses was added to the adjusted roadway PMC. The person-miles of capacity that a transit system would add to the stretch of roadway (Table B-4) mitigates the decrease in vehicle-miles of capacity due to the bus blockage adjustments.

Next, the capital cost of transit infrastructure was added to the capital cost of the roadway expansion for both new road construction (0 to 2 lanes) and lane addition (2 to 4 lanes). With the transit infrastructure included, the updated cost per PMC was calculated, which now reflects the total cost of building a new road with transit, or expanding a roadway and adding transit amenities. When compared to the cost per PMC for simply building/expanding a roadway without transit, the added cost of transit is between one (1) percent and four (4) percent.

As a final step, the increased costs were then weighted by the lane mile distribution of new road construction and lane addition improvements in the Bozeman Transportation Master Plan. As

shown, the plan calls for a higher number of lane addition improvements in the future. When the marginal cost of transit is included and weighted by this ratio, the resulting percent change is approximately 2.1 percent. Essentially, at a less than three percent cost difference, adding transit does not have a significant effect on the cost per person-mile of capacity for new road construction and lane addition improvements.

As it is currently structured, the transit model detailed in Tables B-3 and B-4 assumes that transit-miles and road-miles will be added to the system at the same rate. If the City adds more transit-miles, this would increase the bus traffic on existing roads, adding more stops, higher stop frequency, and creating additional bus blockage. As a result, the capital cost per person-mile for a roadway with transit would increase in relation to the ratio of added transit-miles vs. roadway-miles. For example, if the transit-mile investment was double that of roadway construction/expansion, the 2.0 percent change calculated in Table B-4 would increase to approximately 4.0 percent. The annual construction figures for transit-miles and road-miles should be tracked by the City and adjusted for in subsequent multi-modal fee update studies.

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Table B-3

Multi-Modal Cost per Person-Mile of Capacity

Input	Local Transit	Source:
Transit Person-Miles of Capacity Calculation		
Vehicle Capacity[1]	30	1) Source: City staff
Number of Vehicles (25% fleet margin)[2]	1	2) Cycle time (Item 9) divided by headway time (Item 6) increased by 25 percent to accommodate the required fleet margin
Service Span (hours)[3]	12	3) Source: Assumption based on current Streamline Routes
Cycles/Hour (aka Peak Vehicles)[4]	1.00	4) Headway time (Item 6) divided by 60
Cycles per Day[5]	12	5) Service span (Item 3) multiplied by the cycles/hour (Item 4)
Headway Time (minutes)[6]	60	6) Source: Assumption based on current Streamline routes
Speed (mph)[7]	13	7) Source: Integrated National Transit Database Analysis System (INTDAS). 6-yr average
Round Trip Length (miles)[8]	8.0	8) Source: Average trip length of current Streamline routes
Cycle Time (minutes)[9]	37	9) Round trip length (Item 8) divided by speed (Item 7) multiplied by 60
Total Person-Miles of Capacity[10]	2,880	10) Vehicle capacity (Item 1) multiplied by the cycles per day (Item 5) multiplied by the round trip length (Item 8)
Load Factor/System Capacity[11]	40%	11) Source: Optimistic assumption based on future goals (current load factor = 33%)
Adjusted Person-Miles of Capacity[12]	**1,152**	12) Total person-miles of capacity (Item 10) multiplied by the load factor (Item 11)
Capital Cost Variables		
Stops per Mile (w/o Shelter)[13]	4	13) Source: Model assumes 4 bench stops per mile
Shelters per Mile[14]	1	14) Source: Model assumes 1 shelter stop per mile
Vehicle Cost[15]	$200,000	15) Source: City staff
Simple Bus Stop[16]	$25	16) Source: City staff, includes signage
Sheltered Bus Stop[17]	$8,000	17) Source: City staff, includes signage, bench, shelter

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Table B-4

Multi-Modal Transportation Impact Fee: Transit Component Model

Item	New Road Construction		Lane Addtions	
	Roadway	Transit	Roadway	Transit
Roadway Characteristics:				
Roadway Cost per Mile[1]	$6,556,000		$6,556,000	
Roadway Segment Length (miles)[2]	8.0		8.0	
Roadway Segment Cost[3]	$52,448,000	**PMC**	$52,448,000	**PMC**
Average Capacity Added (per mile)[4]	20,540	26,702	20,540	26,702
VMC/PMC Added (entire segment)[5]	164,320	213,616	164,320	213,616
Roadway Cost per VMC/PMC[6]	$319.18	**$245.52**	$319.18	**$245.52**
Transit Capacity:				
Adjustment for Bus Blockage[7]	3.2%	-	1.6%	-
VMC/PMC Added (transit deduction)[8]	5,258	6,835	2,629	3,418
VMC/PMC Added (less transit deduction)[9]	159,062	206,781	161,691	210,198
PMC Added (transit addition ONLY)[10]		1,152		1,152
Net PMC Added (transit effect included)[11]		207,933		211,350
Road/Transit Cost per PMC (Road Capital)[12]		$252.24		$248.16
Transit Infrastructure:				
Buses Needed[13]	1	$200,000	1	$200,000
Stops per mile (both sides of street)[14]	4	$1,600	4	$1,600
Shelters per mile (both sides of street)[15]	1	$128,000	1	$128,000
Total infrastructure[16]		$329,600		$329,600
Multi-Modal Cost per PMC:				
Road/Transit Cost per PMC[17]		**$253.82**		**$249.72**
Percent Change[18]		**3.38%**		**1.71%**
Weighted Multi-Modal Cost per PMC:				
Lane Mile Distribution[19]		20%		80%
Weighted Roadway Cost per PMC[20]		$49.10		$196.42
Weighted Road/Transit Cost per PMC[21]		$50.76		$199.77
Weighted Average Multi-Modal Cost per PMC:				
Weighted Average Roadway Cost per PMC (new road construction and lane additions)[22]				$245.52
Weighted Average Road/Transit Cost per PMC (new road construction and lane additions)[23]				$250.53
Percent Change[24]				**2.04%**

Source:

1) Source: Table 3, adjusted to cost "per mile"
2) Source: Average length of BCT route
3) Roadway cost per mile (Item 1) multiplied by the roadway segment length (Item 2)
4) Source: Table 4, adjusted to capacity "per mile"
5) Roadway segment length (Item 2) multiplied by the average capacity added (Item 4) for both VMC and PMC
6) Roadway segment cost (Item 3) divided by the VMC/PMC added (Item 5) individually
7) Source: 2010 Highway Capacity Manual, Equation 18-9
8) VMC added (Item 5) multiplied by the adjustment for bus blockage (Item 7). For PMC, multiply the VMC by 1.40 persons per vehicle
9) VMC/PMC added (entire segment) (Item 5) less the VMC/PMC added (transit deduction) (Item 8) for VMC and PMC individually
10) Source: Table B-4, Adjusted Person-Miles of Capacity (Item 12)
11) PMC added (less transit deduction) (Item 9) plus the PMC added (transit addition ONLY) (Item 10)
12) Road segment cost (Item 3) divided by the net PMC added (transit effect included) (Item 11)
13) Number of vehicles (see Table B-4, Item 2) multiplied by the vehicle cost (see Table B-4, Item 15)
14) Stops per mile (3) multiplied by the roadway segment length (Item 2) multiplied by the cost per stop (Table B-4, Item 16)
15) Shelters per mile (1) multiplied by the roadway segment length (Item 2) multiplied by the cost per shelter (Table B-4, Item 17)
16) Sum of buses needed (Item 13), stops needed (Item 14), and shelters needed (Item 15)
17) Sum of the roadway segment cost (Item 3) and the total transit infrastructure cost (Item 16) divided by the net PMC added (Item 11)
18) Percent difference between the road/transit cost per PMC (Item 17) and the Roadway cost per PMC (Item 6)
19) Source: Estimate based on mix of Committed and Recommended Master Plan improvements
20) Roadway cost per PMC (Item 6) multiplied by the lane mile distribution (Item 19)
21) Road/Transit cost per PMC (Item 17) multiplied by the lane mile distribution (Item 19)
22) Sum of the weighted roadway cost per PMC (Item 20) for new road construction and lane additions
23) Sum of the weighted road/transit cost per PMC (Item 21) for new road construction and lane additions
24) Percent difference between the weighted average road/transit cost per PMC (Item 23) and the weighted average roadway cost per PMC (Item 22)

Appendix C
Credit Component

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Appendix C: Credit Component

The methodology used to calculate the fuel tax distribution per penny of gas tax is based on the following process summarized below and presented in Table C-1. Since the impact fee is based on consumption of capacity on all roads, the revenue credit considers capital investment on city, county, and state roadways.

- Estimating the value per penny using the Highway State Special Revenue Fund;
- Dividing the fuel tax revenue by 31.5 pennies;
- Calculating the value per penny of gas tax;
- Estimating the fuel tax distribution in Gallatin County based on the value per penny, per person, multiplied by the 2017 population estimate; and
- The use of Gallatin County data reflects a regional approach to the capital improvement credit which accounts for traffic entering and exiting the city, but do not necessarily remain in the city during the entire trip.

Table C-1
MDOT Fuel Tax Distribution per Penny

Item	Figure
Highway State Special Revenue Fund(1)	$165,000,000
State Fuel Tax Rate (Pennies)(1)	31.5
Value per Penny - State of Montana(2)	$5,238,095
Montana Population Estimate_2016(3)	1,023,391
Value per Penny per Person(4)	$5.12
Gallatin County Population Estimate_2016(3)	97,958
Value per Penny - Gallatin County(5)	**$501,545**

1) Source: Montana Department of Transportation
2) Highway State Special Revenue Fund divided by 31.5 pennies
3) American Community Survey 5-yr population estimate
4) Value per penny for Montana (Item 2) divided by the Montana population estimate
5) Value per penny per person (Item 4) multiplied by the Gallatin County population estimate

City Capital Improvement Credit

A review of the City of Bozeman's 5-year planned expenditures shows that transportation projects are primarily being funded by a combination of impact fees and arterial & collector

special assessment revenues. The FY 2018-2022 Capital Improvements Program indicates that city fuel tax revenues will be transferred to the Street Maintenance District fund and dedicated to maintenance projects and equipment. As shown in Table C-2, a total "gas tax equivalent" revenue credit of 3.8 pennies was given for transportation capacity-expansion projects funded with non-impact fee revenues.

Table C-2
City of Bozeman Fuel Tax Equivalent Pennies

Source	Cost of Projects	Number of Years	Revenue from 1 Penny(2)	Equivalent Pennies(3)
Projected CIP Expenditures (FY 2018-2022)(1)	$9,499,766	5	$501,545	**$0.038**

1) Source: Table C-4
2) Source: Table C-1
3) Cost of projects divided by number of years divided by revenue from 1 penny (Item 2) and multiplied by 0.01

County Capital Improvement Credit

A review of the Gallatin County FY 2018 budget indicated that road impact fees appear to be the only revenue source earmarked for capacity enhancements. However, recent changes in the collection of impact fees and the completion of several large projects have nearly exhausted the existing fund balance. The budget indicates that the portion of the state fuel tax distributed to the County is used to purchase materials and contracts for road maintenance. Therefore, the multi-modal transportation impact fee calculations do not include a County credit due to all non-impact fee revenue sources being spent on non-capacity improvements.

State Capital Improvement Credit

A review of historical state expenditures was conducted to calculate a credit for capacity improvements funded by the Montana Department of Transportation. The projects identified, as shown in Table C-5, include roadway, bicycle, and pedestrian improvements located within the City of Bozeman. As shown in Table C-3, a total "gas tax equivalent" revenue credit of 2.3 pennies was given for MDT-funded transportation capacity-expansion improvements.

Table C-3
State of Montana Fuel Tax Equivalent Pennies

Source	Cost of Projects	Number of Years	Revenue from 1 Penny[2]	Equivalent Pennies[3]
Historical Expenditures (2000-2017)[1]	$19,201,181	17	$501,545	**$0.023**

1) Source: Table C-5
2) Source: Table C-1
3) Cost of projects divided by number of years divided by revenue from 1 penny (Item 2) and multiplied by 0.01

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Table C-4
City of Bozeman FY 2018-2022 Capital Improvement Program

Proj.	Project Name	Description	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	Total
SIF036	Cottonwood (Babcock to Durston)	Complete 5-lane expansion	$1,278,000	$0	$0	$0	$0	$1,278,000
SIF039	Ferguson & Durston (Intersection)	Install roundabout	$451,244	$0	$0	$0	$0	$451,244
SIF046	Oak (New Holland to Ferguson)	Complete 5-lane expansion	$600,000	$0	$0	$0	$0	$600,000
SIF061	Oak & Ferguson (Intersection)	Signal Installation	$269,066	$0	$0	$0	$0	$269,066
SIF062	Durston (Fowler to Ferguson)	Complete 3-lane expansion	$0	$757,421	$0	$0	$0	$757,421
SIF074	Oak & Davis (Intersection)	Install roundabout	$352,302	$0	$0	$0	$0	$352,302
SIF076	Fowler Connection (Huffine to Oak)	New Road Construction	$0	$0	$0	$500,000	$0	$500,000
SIF080	Ferguson (Baxter to Oak)	New Road Construction	$666,666	$0	$0	$0	$0	$666,666
SIF104	Cottonwood & Babcock (Intersection)	Signal Installation	$287,067	$0	$0	$0	$0	$287,067
SIF108	S 3rd and Graf	Signal Installation	$0	$200,000	$0	$0	$0	$200,000
SIF109	Oak (Rouse through Cannery District)	Add Turn Lane	$0	$133,000	$0	$0	$0	$133,000
SIF110	Manley & Griffin (Intersection)	Intersection Improvement	$0	$0	$400,000	$0	$0	$400,000
SIF112	Highland & Main (Intersection)	Intersection Improvement	$30,000	$0	$0	$0	$0	$30,000
SIF113	Griffin (7th to Rouse)	Intersection Improvement	$0	$0	$2,000,000	$0	$0	$2,000,000
SIF117	Story Mill (Griffin to Bridger)	Lane Addition	$0	$0	$0	$225,000	$0	$225,000
SIF118	Babcock (11th Ave to 19th Ave)	Lane Addition	$0	$0	$0	$0	$750,000	$750,000
SIF121	Baxter & Davis (Intersection)	Install roundabout	$0	$0	$500,000	$0	$0	$500,000
SIF125	College (11th to 19th)	Lane Addition	$0	$0	$0	$100,000	$0	$100,000
Total			**$3,934,345**	**$1,090,421**	**$2,900,000**	**$825,000**	**$750,000**	**$9,499,766**
Average Annual Expenditures (over 5 years)								**$1,899,953**

Source: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics 2016, Section V, Table VM-1

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Table C-5
Montana Department of Transportation – Recent Capacity Expenditures in Bozeman

Cont. ID	Proj. #	Project Name	Award Date	Amount
03900	04490002000	NORTH 7TH AVENUE & GRIFFIN DRIVE	8/31/2000	$67,220
04900	04319006000	SIGNAL - NORTH 19TH & BAXTER	9/28/2000	$462,392
05603	04179037000	19TH & MAIN	4/5/2004	$2,266,446
16404	05094003000	HIGHLAND - KAGY TO MAIN	4/29/2004	$1,488,080
02708	4952012000	BABCOCK TO KAGY	9/8/2008	$8,586,776
	4918009000	S 19TH & COLLEGE		
	4713011000	SIGNAL-19TH & KOCH		
03B11	7412003000	BAXTER LN - N 7TH TO N 19TH	11/29/2011	$197,994
04614	7426003000	COLLEGE - MAIN TO S 19TH	6/24/2014	$5,780,777
22915	8689036000	DURSTON ROAD SIDEWALK	10/6/2015	$65,875
07616	8688039000	ELEM SCHOOL BIKE PED	6/28/2016	$285,620
Total (2000-2016)				**$19,201,181**
Average Annual Expenditures (over 17 years)				**$1,129,481**

Source: Montana Department of Transportation and City of Bozeman

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Table C-6
Average Motor Vehicle Fuel Efficiency – Excluding Interstate Travel

Travel Vehicle Miles of Travel (VMT) @			
	22.0	6.4	
Other Arterial Rural	317,691,000,000	45,164,000,000	362,855,000,000
Other Rural	302,483,000,000	27,939,000,000	330,422,000,000
Other Urban	1,553,636,000,000	93,910,000,000	1,647,546,000,000
Total	***2,173,810,000,000***	***167,013,000,000***	***2,340,823,000,000***

Percent VMT	
@ 22.0 mpg	@ 6.4 mpg
88%	12%
92%	8%
94%	6%
93%	**7%**

Fuel Consumed			
	Gallons @ 22.0 mpg	Gallons @ 6.4 mpg	
Other Arterial Rural	14,440,500,000	7,056,875,000	21,497,375,000
Other Rural	13,749,227,273	4,365,468,750	18,114,696,023
Other Urban	70,619,818,182	14,673,437,500	85,293,255,682
Total	***98,809,545,455***	***26,095,781,250***	***124,905,326,705***

Total Mileage and Fuel	
2,340,823	**miles (millions)**
124,905	**gallons (millions)**
18.74	**mpg**

Source: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics 2016, Section V, Table VM-1
Annual Vehicle Distance Traveled in Miles and Related Data – 2016 by Highway Category and Vehicle Type
https://www.fhwa.dot.gov/policyinformation/statistics.cfm

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Table C-7
Annual Vehicle Distance Travelled in Miles and Related Data – 2016[1]
By Highway Category and Vehicle Type

Published December 2017 — TABLE VM-1

YEAR	ITEM	LIGHT DUTY VEHICLES SHORT WB[2]	MOTOR-CYCLES	BUSES	LIGHT DUTY VEHICLES LONG WB[2]	SINGLE-UNIT TRUCKS[3]	COMBINATION TRUCKS	SUBTOTALS: ALL LIGHT VEHICLES[2]	SUBTOTALS: SINGLE-UNIT 2-AXLE 6-TIRE OR MORE AND COMBINATION TRUCKS	ALL MOTOR VEHICLES
	Motor-Vehicle Travel: (millions of vehicle-miles)									
2016	Interstate Rural	139,460	1,095	1,740	44,086	9,905	50,430	**183,546**	**60,335**	246,716
2016	Other Arterial Rural	226,036	2,633	2,116	91,655	16,371	28,794	**317,691**	**45,164**	367,605
2016	Other Rural	212,457	2,856	1,946	90,026	15,563	12,375	**302,483**	**27,939**	335,224
2016	All Rural	577,954	6,583	5,802	225,768	41,839	91,599	803,721	133,439	949,545
2016	Interstate Urban	392,838	2,939	2,542	99,523	18,555	41,991	**492,361**	**60,546**	558,388
2016	Other Urban	1,220,973	10,923	8,006	332,663	52,944	40,966	**1,553,636**	**93,910**	1,666,475
2016	All Urban	1,613,810	13,862	10,548	432,186	71,499	82,958	2,045,997	154,456	2,224,863
2016	Total Rural and Urban[5]	2,191,764	20,445	16,350	657,954	113,338	174,557	2,849,718	287,895	3,174,408
2016	Number of motor vehicles registered[2]	192,774,508	8,679,380	976,161	54,870,473	8,746,518	2,752,043	247,644,981	11,498,561	268,799,083
2016	Average miles traveled per vehicle	11,370	2,356	16,749	11,991	12,958	63,428	11,507	25,037	11,810
2016	Person-miles of travel[4] (millions)	3,045,205	22,022	346,610	878,994	113,338	174,557	3,924,199	287,895	4,580,725
2016	Fuel consumed (thousand gallons)	91,487,810	465,802	2,225,795	37,818,755	15,338,479	29,554,641	129,306,565	44,893,120	176,891,283
2016	Average fuel consumption per vehicle (gallons)	475	54	2,280	689	1,754	10,739	522	3,904	658
2016	Average miles traveled per gallon of fuel consumed	24.0	43.9	7.3	17.4	7.4	5.9	**22.0**	**6.4**	17.9

(1) The FHWA estimates national trends by using State reported Highway Performance and Monitoring System (HPMS) data, fuel consumption data (MF-21 and MF-27), vehicle registration data (MV-1, MV-9, and MV-10), other data such as the R.L. Polk vehicle data, and a host of modeling techniques. Starting with the 2009 VM-1, an enhanced methodology was used to provide timely indicators on both travel and travel behavior changes.
(2) Light Duty Vehicles Short WB - passenger cars, light trucks, vans and sport utility vehicles with a wheelbase (WM) equal to or less than 121 inches. Light Duty Vehicles Long WB - large passenger cars, vans, pickup trucks, and sport/utility vehicles with wheelbases (WB) larger than 121 inches. All Light Duty Vehicles - passenger cars, light trucks, vans and sport utility vehicles regardless of
(3) Single-Unit - single frame trucks that have 2-Axles and at least 6 tires or a gross vehicle weight rating exceeding 10,000 lbs.
(4) Vehicle occupancy is estimated by the FHWA from the 2009 National Household Travel Survey (NHTS); For single unit truck and heavy trucks, 1 motor vehicle mile travelled = 1 person-mile traveled.
(5) VMT data are based on the latest HPMS data available; it may not match previous published results.

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Appendix D
Multi-Modal Transportation Impact Fee Schedule

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Appendix D: MMTIF Fee Schedule

This appendix presents the detailed fee calculations for each land use in the City of Bozeman's multi-modal transportation impact fee schedule.

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Table D-1
Multi-Modal Transportation Impact Fee Schedule

$$ per Gallon to Capital:	$0.061	Unit Cost per Lane Mile:	$3,278,000	Interstate Adjustment Factor:	19.9%
Facility Life (Years):	25	Average VMC per Lane Mile:	10,270	Cost per PMC:	$319.18
Interest Rate:	3.00%	Fuel Efficiency:	18.74 mpg	Person-Trip Factor:	1.30
		Effective Days per Year:	365		

ITE LUC	Land Use	Unit	Trip Rate	Trip Rate Source	Assessable Trip Length	Total Trip Length	Trip Length Source	Percent New Trips	% New Trips Source	Net VMT(1)	Person-Trip Factor	Net PMT(2)	Total Impact Cost	Annual Cap. Imp. Credit	Cap. Imp. Credit	Net Impact Fee	Net IF w/5% Admin(3)
	RESIDENTIAL:																
n/a	Residential: 1,400 sf or less	du	7.62	Local Studies Tiered, App. A	3.31	3.81	Local Studies	100%	n/a	10.10	1.30	13.13	$4,191	$17	$296	**$3,895**	**$4,090**
	Residential: 1,401 to 1,600 sf	du	7.88	Local Studies Tiered, App. A	3.31	3.81	Local Studies	100%	n/a	10.45	1.30	13.59	$4,334	$18	$313	**$4,021**	**$4,222**
	Residential: 1,601 to 1,800 sf	du	8.11	Local Studies Tiered, App. A	3.31	3.81	Local Studies	100%	n/a	10.75	1.30	13.98	$4,461	$18	$313	**$4,148**	**$4,355**
	Residential: 1,801 to 2,000 sf	du	8.31	Local Studies Tiered, App. A	3.31	3.81	Local Studies	100%	n/a	11.02	1.30	14.33	$4,571	$19	$331	**$4,240**	**$4,452**
	Residential: 2,001 to 2,200 sf	du	8.49	Local Studies Tiered, App. A	3.31	3.81	Local Studies	100%	n/a	11.25	1.30	14.63	$4,670	$19	$331	**$4,339**	**$4,556**
	Residential: 2,201 to 2,400 sf	du	8.66	Local Studies Tiered, App. A	3.31	3.81	Local Studies	100%	n/a	11.48	1.30	14.92	$4,764	$20	$348	**$4,416**	**$4,637**
	Residential: 2,401 to 2,600 sf	du	8.82	Local Studies Tiered, App. A	3.31	3.81	Local Studies	100%	n/a	11.69	1.30	15.20	$4,852	$20	$348	**$4,504**	**$4,729**
	Residential: 2,601 to 2,800 sf	du	8.96	Local Studies Tiered, App. A	3.31	3.81	Local Studies	100%	n/a	11.88	1.30	15.44	$4,929	$20	$348	**$4,581**	**$4,810**
	Residential: 2,801 to 3,000 sf	du	9.09	Local Studies Tiered, App. A	3.31	3.81	Local Studies	100%	n/a	12.05	1.30	15.67	$5,000	$21	$366	**$4,634**	**$4,866**
	Residential: 3,001 sf or more	du	9.13	Local Studies Tiered, App. A	3.31	3.81	Local Studies	100%	n/a	12.10	1.30	15.73	$5,022	$21	$366	**$4,656**	**$4,889**
n/a	Group Quarters	person	3.10	2012 Study	3.31	3.81	Same as LUC 210	100%	n/a	4.11	1.30	5.34	$1,705	$7	$122	**$1,583**	**$1,662**
254	Assisted Living	bed	2.60	ITE 10th Edition	1.63	2.13	Same as LUC 253 (Appendix A)	72%	Same as LUC 253 (Appendix A)	1.22	1.30	1.59	$507	$2	$35	**$472**	**$496**
	LODGING:																
320	Lodging	room	3.35	ITE 10th Edition	2.30	2.80	FL Studies	77%	FL Studies	2.38	1.30	3.09	$986	$4	$70	**$916**	**$962**
	INSTITUTIONS:																
520	Elementary School (Private)	1,000 sf (gfa)	19.52	ITE 10th Edition	1.85	2.35	FL Studies (Pinellas County)	80%	FL Studies (Pinellas County)	11.57	1.30	15.04	$4,801	$22	$383	**$4,418**	**$4,639**
530	Secondary School (Private)	1,000 sf (gfa)	14.07	ITE 10th Edition	1.85	2.35	FL Studies (Pinellas County)	90%	FL Studies (Pinellas County)	9.38	1.30	12.19	$3,893	$18	$313	**$3,580**	**$3,759**
550	University/College	student	1.50	ITE Regression Analysis	3.31	3.81	Same as LUC 210	90%	FL Studies (Pinellas County)	1.79	1.30	2.33	$743	$3	$52	**$691**	**$726**
565	Day Care Center	student	4.09	ITE 10th Edition	0.87	1.37	FL Studies	73%	FL Studies	1.04	1.30	1.35	$432	$2	$35	**$397**	**$417**
610	Hospital	1,000 sf (gfa)	10.72	ITE 10th Edition	3.31	3.81	Same as LUC 210	77%	FL Studies (Pinellas County)	10.94	1.30	14.22	$4,540	$19	$331	**$4,209**	**$4,419**

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Table D-1 (continued)
Multi-Modal Transportation Impact Fee Schedule

ITE LUC	Land Use	Unit	Trip Rate	Trip Rate Source	Assessable Trip Length	Total Trip Length	Trip Length Source	Percent New Trips	% New Trips Source	Net VMT[1]	Person-Trip Factor	Net PMT[2]	Total Impact Cost	Annual Cap. Imp. Credit	Cap. Imp. Credit	Net Impact Fee	Net IF w/5% Admin[3]
	OFFICE:																
710	Office	1,000 sf (gfa)	9.74	ITE 10th Edition	2.22	2.72	Local Studies	71%	Local Studies	6.15	1.30	8.00	$2,551	$11	$192	**$2,359**	**$2,477**
760	Research & Development Center	1,000 sf (gfa)	11.26	ITE 10th Edition	2.31	2.81	Same as LUC 770 (Appendix A)	89%	Same as LUC 770 (Appendix A)	9.27	1.30	12.05	$3,847	$17	$296	**$3,551**	**$3,729**
	RETAIL:																
820	Retail/Restaurant	1,000 sf (gla)	37.75	ITE 10th Edition	2.16	2.66	Local Studies	55%	Local Studies	17.96	1.30	23.35	$7,453	$33	$575	**$6,878**	**$7,222**
	INDUSTRIAL:																
110	Light Industrial	1,000 sf (gfa)	4.96	ITE 10th Edition	2.22	2.72	Same as LUC 710	71%	Same as LUC 710	3.13	1.30	4.07	$1,299	$6	$104	**$1,195**	**$1,255**
140	Manufacturing	1,000 sf (gfa)	3.93	ITE 10th Edition	2.22	2.72	Same as LUC 710	71%	Same as LUC 710	2.48	1.30	3.22	$1,029	$5	$87	**$942**	**$989**
150	Warehouse	1,000 sf (gfa)	1.74	ITE 10th Edition	2.22	2.72	Same as LUC 710	71%	Same as LUC 710	1.10	1.30	1.43	$456	$2	$35	**$421**	**$442**
151	Mini-Warehouse	1,000 sf (gfa)	1.49	Blend ITE 10th & FL Studies	1.33	1.83	FL Studies (Pinellas County)	71%	Same as LUC 710	0.56	1.30	0.73	$234	$1	$17	**$217**	**$228**

1) Net VMT is calculated as ((Trip Generation Rate * Trip Length * % New Trips)*(1-Interstate Adjustment Factor)/2). This reflects the unit of vehicle-miles of capacity consumed per unit of development and is multiplied by the cost per vehicle
2) Net VMT multiplied by the person-trip factor
3) Net Impact Fee with the 5% administrative fee applied

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