DRAFT

2016 Transportation Development Impact Fee Study

Prepared for:

City of Boulder, Colorado

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TischlerBise
FISCAL | ECONOMIC | PLANNING

4701 Sangamore Road, Suite S240
Bethesda, MD
301.320.6900

www.tischlerbise.com

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EXECUTIVE SUMMARY

As part of the 2016 transportation work scope, TischlerBise will prepare three products for the City of Boulder. This document focuses on the capital cost of transportation improvements needed to accommodate new development assuming more rigorous Development Impact Fee (DIF) legal requirements. A second work product will provide a Development Excise Tax (DET) study for a broader set of growth-related transportation improvements. The third work product will focus on operational costs and on-going maintenance of Boulder's multimodal transportation system.

As a revenue raising mechanism, an excise tax has less restrictive legal constraints than an impact fee. The latter is a form of land use regulation, imposed under the City's police power, for the purpose of health, safety, and welfare. In Colorado, local governments must establish an impact fee at a level no greater than necessary to defray projected impacts caused by, and directly related to, proposed development. Also, impact fees may only be used for capital facilities, excluding replacement of infrastructure and correcting existing deficiencies [see CRS 29-20-104.5].

This report assumes compliance with Colorado's impact fee enabling legislation and applicable legal precedents. The proposed 2016 Transportation DIF schedule is proportionate and reasonably related to the growth cost of capital facilities needed to serve new development [see CRS 29-20-104.5 (1) and (2)]. Specific costs have been identified using local data and current dollars. With input from City staff, TischlerBise determined demand indicators for transportation capacity and calculated proportionate share factors to allocate costs by type of development. Transportation DIF methodologies also identify the extent to which new development is entitled to various types of credits to avoid potential double payment of growth-related capital improvements.

CURRENT TRANSPORTATION DET

The City of Boulder currently collects a Development Excise Tax (DET), with a portion of the funds used for transportation capital improvements. In 1998, voters approved a maximum consolidated DET schedule that was significantly less than the proposed transportation DET schedule supported by a study completed in 1996. Boulder's DET is a one-time revenue imposed on new construction. As shown in Figure 1, the City of Boulder currently collects a Transportation DET of $2.48 per square foot of nonresidential floor area and a Transportation DET for each additional dwelling (approximately $2,227 per detached and $1,650 per attached unit). Applying these rates to the projected increase in development within Boulder over the next ten years (see Land Use Assumptions by TischlerBise) would yield approximately $11.5 million in Transportation DET revenue, with residential units contributing 43% of the ten year total and 57% from nonresidential development.

Figure 1: Transportation DET Rates Currently Collected

Tax Name	Nonresidential	Residential	
	Per Square Foot	*Per Detached Dwelling Unit*	*Per Attached Dwelling Unit or Mobile Home*
Development Excise Tax			
Park Land	N/A	$1,144.84	$795.98
Transportation	$2.48	$2,226.93	$1,650.29
Total	$2.48	$3,371.77	$2,446.27
Housing Excise Tax	$0.51	$0.23 per square foot	$0.23 per square foot

The right column in Figure 2 indicates the maximum consolidated DET amounts approved by voters in 1998. Nonresidential development is currently paying the maximum rate, but residential development could pay up to $5,630 per detached dwelling and $3,624 per attached dwelling. One option to consider is increasing the transportation DET for residential units to the maximum, voter-approved rates.

Figure 2: Maximum Voter-Approved DET Rates

TYPE OF DEVELOPMENT	CURRENT	PROPOSED 1999	PROPOSED MAXIMUM (LIMITED BY CPI)
NEW AND ANNEXING DETACHED DWELLING UNIT	3,667.05	4,331.06	5,630.38
NEW AND ANNEXING ATTACHED DWELLING UNIT	2,369.03	2,787.77	3,624.10
NEW, ANNEXING AND EXPANDED NON-RESIDENTIAL DEVELOPMENT	1.45 PER SQUARE FOOT	1.91 PER SQUARE FOOT	2.48 PER SQUARE FOOT

General Impact Fee Methods

In contrast to project-level improvements, impact fees fund the growth cost of infrastructure that will benefit multiple development projects, or the entire jurisdiction (referred to as system improvements). There are three general methods for calculating one-time development charges for public facilities needed to accommodate new development. The choice of a particular method depends primarily on the timing of infrastructure construction (past, concurrent, or future) and service characteristics of the facility type being addressed. Each method has advantages and disadvantages in a particular situation, and can be used simultaneously for different cost components.

Reduced to its simplest terms, the process of calculating infrastructure costs for new development involves two main steps: (1) determining the cost of development-related capital improvements and (2)

allocating those costs equitably to various types of development. In practice, though, impact fee calculations can become quite complicated because of the many variables involved in defining the relationship between development and the need for facilities within the designated service area. The following paragraphs discuss three basic methods and how those methods can be applied in Boulder.

Cost Recovery (past improvements)

The rationale for recoupment, often called cost recovery, is that new development is paying for its share of the useful life and remaining capacity of facilities already built, or land already purchased, from which new growth will benefit. This methodology is often used for utility systems that must provide adequate capacity before new development can take place.

Incremental Expansion (concurrent improvements)

The incremental expansion method documents current level-of-service (LOS) standards for each type of public facility, using both quantitative and qualitative measures. This approach ensures that there are no existing infrastructure deficiencies or surplus capacity in infrastructure. New development is only paying its proportionate share for growth-related infrastructure. Revenue will be used to expand or provide additional facilities, as needed, to accommodate new development. An incremental expansion cost method is best suited for public facilities that will be expanded in regular increment to keep pace with development.

Plan-Based (future improvements)

The plan-based method allocates costs for a specified set of improvements to a specified amount of development. Improvements are typically identified in a capital improvements plan and development potential is identified by land use assumptions. There are two options for determining the cost per service unit: 1) total cost of a public facility can be divided by total service units (average cost), or 2) the growth-share of the public facility cost can be divided by the net increase in service units over the planning timeframe (marginal cost).

Credits

Regardless of the methodology, a consideration of "credits" is integral to legally defensible impact fee studies. There are two types of "credits" with specific characteristics, both of which should be addressed in studies and ordinances.

- First, a revenue credit might be necessary if there is a double payment situation and other revenues are contributing to the capital costs of infrastructure to be funded by DIF revenue. This type of credit is integrated into the DIF calculation, thus reducing the gross amount. In contrast to some studies that only provide general costs, with credits at the back-end of the analysis, Boulder's 2016 transportation DIF update uses growth shares to provide an up-front reduction in total costs. Also, the 2016 update provides DIF revenue projections to verify that new development will fully fund the growth share of future infrastructure costs (i.e., only DIF revenue will pay for growth costs).
- Second, a site-specific credit or developer reimbursement might be necessary for dedication of land or construction of system improvements to be funded by DIF revenue. This type of credit is addressed in the administration and implementation of the impact fee program.

CONCLUSIONS

After evaluating the 1996 DET study, that emphasized moving vehicles and allocated costs accordingly, TischlerBise concluded the current Transportation DET rate schedule is not proportionate by type of development and does not comply with Colorado's impact fee enabling legislation. It is not possible to simply update the 20-year old DET methodology with current data and comply with more rigorous impact fee standards that were enacted in 2001. Because local government must quantify reasonable impacts caused by, and directly related to, proposed development [see CRS 29-20-104.5 (1) and (2)], the 2016 transportation study yields lower charges on new development. Proposed dollar amounts shown in Figure 4 are expected to yield approximately $9.9 million over the next ten years, which will cover the growth cost of planned transportation enhancements. In comparison, the current Transportation DET rate schedule would yield approximately $11.5 million over the next ten years. Also, the current Transportation DET rate schedule would obtain approximately 43% of future revenue from residential development and 57% from nonresidential development. In contrast, the proposed 2016 DIF methodology expects to obtain approximately 52% of future Transportation DIF revenue from residential development and 48% from nonresidential development. TischlerBise also finds the current Transportation DET rate schedule to be inconsistent with best practices to ensure impact fees are proportionate to the need for capital facilities. For residential development, TischlerBise recommends switching from the current Transportation DET approach, based on two housing types, to a fee schedule based on dwelling size (measured by square feet of finished living space). To be proportionate, transportation impact fees should also differentiate by type of nonresidential development as shown in Figure 4. For ease of administration and comparison, the transportation DIF schedule is consistent with Boulder's 2016 DIF study for all other types of infrastructure.

PROPOSED 2016 TRANSPORTATION DEVELOPMENT IMPACT FEE

Figure 3 summarizes the methods and cost components used in Boulder's 2016 Transportation DIF study. Both the DIF and DET studies share the same types of improvements and cost allocation methods. The key difference between the two is the magnitude of cost, with the DET based on a more extensive set of growth-related transportation improvements.

Figure 3: Proposed Transportation DIF Methods and Cost Components

Type of Improvements	*Cost Allocation*	*Service Area*	*Plan-Based Method (future)*
Walk / Bike / Transit	Functional Population and Jobs	Citywide	Sidewalks, Multi-Use Paths, Bike Lanes and Bus Stops/Pullouts
Streets	Vehicle Miles of Travel	Citywide	Arterial/Collector Capacity and Intersection Improvements

Figure 4 shows the proposed 2016 Transportation DIF schedule, along with current Transportation DET rates. For residential development, updated amounts are based on square feet of finished living space. Garages, porches and patios are excluded from the DIF assessment.

For nonresidential development, DIF rates are stated per square foot of floor area, except for "Nursing Home / Assisted Living" (per bed) and "Lodging" (per room). The proposed DIF schedule for nonresidential development is designed to provide a reasonable DIF amount for general types of development. For unique developments, the City may allow or require an independent assessment.

The proposed total DIF is a combination of two cost components and different cost allocation methods. The cost of "Bus Bike Walk" capital improvements was allocated to the increase in population and jobs within Boulder. The cost of street improvements was allocated to the projected increase in vehicle miles of travel. Details regarding both cost allocation methods are provided in the middle section of this report.

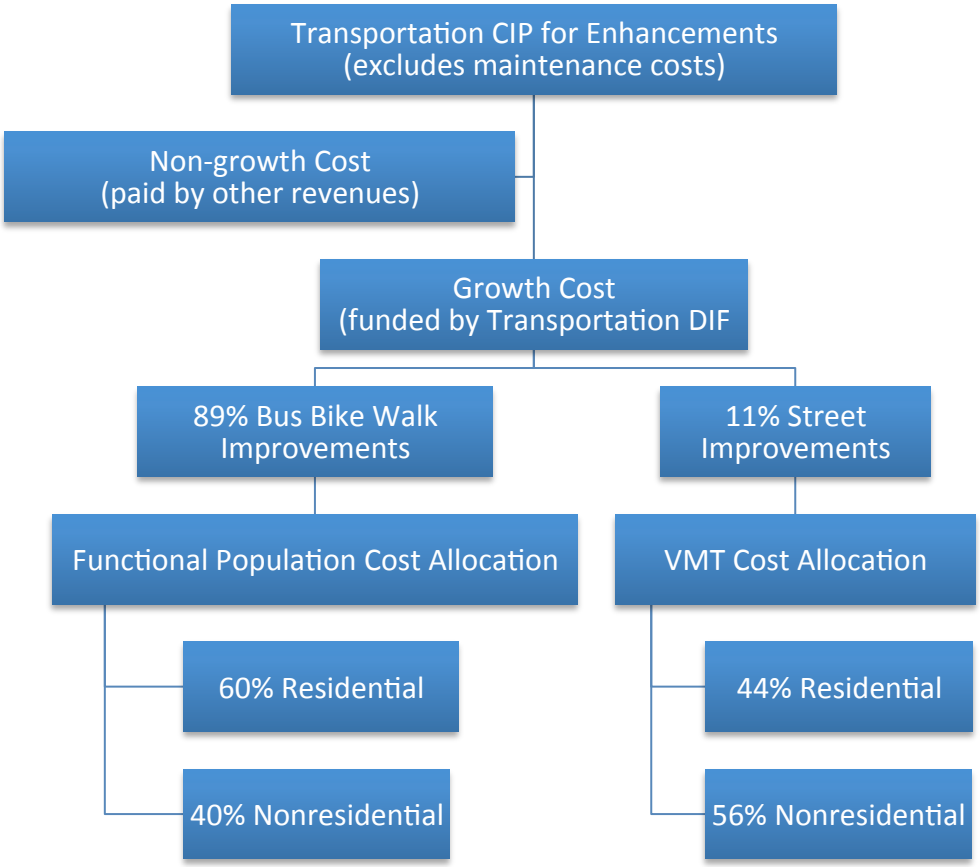
Figure 4: Proposed 2016 Transportation DIF Schedule

2016 Transportation DIF	*Development Unit*	*Bus Bike Walk*	*Streets*	*Proposed Transportation DIF*	*Current Transportation DET*	*Increase/ Decrease*	*Percent Change*
Residential (by square feet of finished living space)							
800 or less	Dwelling Unit	$875	$97	$972	$1,650	-$678	-41%
801 to 1200	Dwelling Unit	$1,346	$153	$1,499	$1,650	-$151	-9%
1201 to 1600	Dwelling Unit	$1,638	$188	$1,826	$1,939	-$113	-6%
1601 to 2200	Dwelling Unit	$1,885	$217	$2,102	$2,227	-$125	-6%
2201 or more	Dwelling Unit	$2,117	$245	$2,362	$2,227	$135	6%
Nonresidential							
Retail / Restaurant	Square Foot	$1.35	$0.54	$1.89	$2.48	-$0.59	-24%
Office	Square Foot	$1.94	$0.22	$2.16	$2.48	-$0.32	-13%
Light Industrial	Square Foot	$1.25	$0.14	$1.39	$2.48	-$1.09	-44%
Warehousing	Square Foot	$0.50	$0.07	$0.57	$2.48	-$1.91	-77%
Institutional	Square Foot	$0.44	$0.19	$0.63	$2.48	-$1.85	-75%
Hospital	Square Foot	$1.58	$0.27	$1.85	$2.48	-$0.63	-25%
Nursing Home / Assisted Living	Bed	$453	$55	$508			
Lodging	Room	$307	$165	$472			

MULTIMODAL TRANSPORTATION DIF

The 2016 Transportation DIF study uses a plan-based methodology that includes improvements for all modes of travel. Figure T1 provides an overview of the methodology. This study documents the general cost allocation between residential and nonresidential development, including detailed calculations used to derive specific DIF amounts by dwelling size and type of nonresidential development. From the universe of all projects in Boulder's Capital Improvement Plan (CIP), which is based on the Transportation Master Plan (TMP), staff and consultants identified transportation improvements needed to accommodate new development over ten years. This study refers to these projects as "enhancements" to differentiate them from "maintenance" projects that are not eligible for impact fee funding. Also, each project was evaluated to quantify the reasonable impacts caused by, and directly related to, proposed development, as required by Colorado's impact fee enabling legislation. These "growth costs" will be funded by DIF revenue, with non-growth costs funded by other revenues. Staff determined that 89% of enhancement projects are for Bus Bike Walk facilities (primarily moving people), with the remaining 11% for street improvements (i.e. primarily moving vehicles). The growth cost of Bus Bike Walk improvements was allocated to residential and non-residential development based on functional population (described further below). The growth cost of street improvements was allocated according to estimated Vehicle Miles of Travel (VMT) for general types of development.

Figure T1: DIF Calculation Flow Chart



Growth Share of Future Transportation Enhancements

The 9.9% growth share is based on the projected average annual increase in person trips to and from Boulder from 2010 to 2035 (illustrated by Figure 3-22 in Boulder's State of the System Report). Because internal-external travel is most evident during morning and afternoon peak hours, it is a key factor in our perception of traffic congestion. Figure T2 provides a reasonable means of quantifying the impact of growth on transportation facilities.

Figure T2: Person Trips To and From Boulder

Communities	2010	2035	Change	%Change
Broomfield	28,130	39,254	11,124	39.5%
Denver	13,643	14,416	773	5.7%
DIA	2,962	4,139	1,176	39.7%
ERIE	11,993	24,546	12,554	104.7%
Lafayette	18,613	21,564	2,950	15.9%
Longmont	40,976	47,774	6,798	16.6%
Lyons	1,892	1,968	77	4.0%
Louisville	25,799	26,214	415	1.6%
Superior	9,988	12,073	2,085	20.9%
TOTAL	153,995	191,947		
		0.99%	<= Average Annual Growth Rate	
		9.9%	**<= Percent Increase Over Ten Years**	

Data source
H:\Projects - Open\A-E\BOULDER Transit Master Plan 2012.777\05 Background\Travel Demand Model\Person_Trips

Capital Improvements Plan for Transportation Facilities

As shown in Figure T3, the ten-year growth cost of planned enhancement projects is approximately $10.58 million. For most transportation projects listed below, the growth share to be funded by DIF revenue is 9.9% of the local cost, which is the total project cost less any grant funding. The 9.9% growth share is based on the projected increase in person trips to and from Boulder from 2010 to 2035, as discussed above.

Given the fact that Boulder is not expanding geographically (i.e. no significant additional transportation infrastructure on the periphery), the improvements listed below are primarily enhancements to existing facilities. Thus existing and new development will equally benefit from all projects except those with a 100% growth share. The four line items that are 100% attributable to new development are for development coordination, TIP scoping/prioritization and corridor studies. To account for grant funds, four line items in the table below have growth cost ranging from 16.1% to 49.5% of the local cost. These percentages were derived after applying the 9.9% growth allocation factor to the total project cost.

The list of improvements in Figure T3 excludes three projects proposed by staff but not recommended by TischlerBise due to the requirement in Colorado's enabling legislation that fees must be limited to impacts caused by, and directly related to proposed development. Boulder's current practice is to derive citywide fees and limit fee expenditures to projects that will benefit all new development. To avoid the need for multiple service areas and fee schedules, the following projects in the University Hill area were excluded: 1) street improvements for events in the commercial district, and 2) lighting within the residential area. The final project excluded was for pedestrian access and lighting improvements to Chautauqua Park, which could possibly be funded using park impact fees.

Figure T3: Growth Cost of Transportation Enhancements

				Enhancement Cost Due To Growth		
CIP#	*Project Location*	*Description*	*Ten-Year Cost (less grants)*	*FY16-25 Walk/Bike/Transit*	*FY16-25 Streets*	*Growth Share of Local Cost*
310TR052OG	Citywide Funds 2800 & 2810	TIP local match & TMP implementation	$18,363,000	$1,642,800	$182,500	9.9%
310TR003OC	Citywide	Major capital reconstruction and enhancements	$4,800,000	$436,900	$39,700	9.9%
310TR773OC	Citywide	Pedestrian facilities repair/replacement/ADA and enhancements	$3,774,000	$375,500	$0	9.9%
310TR153NG	30th St & Colorado*	Local share of bike/ped underpass (total cost = $7,500,000)	$3,150,000	$588,500	$149,600	23.4%
310TR156NC	Boulder Creek & Aprapahoe (15th to Broadway)	Reconstruction and multimodal improvements	$2,500,000	$248,300	$0	9.9%
3102ABCK03	Boulder Creek - Arapahoe & 13th	Underpass	$2,365,000	$234,100	$0	9.9%
310TR152NG	Broadway - Violet to Hwy 36*	Local share of reconstruction & multimodal improvements (total cost = $7,050,000)	$1,825,000	$661,000	$34,800	38.1%
310TR692OC	Citywide	Bikeway facilities enhancements	$1,350,000	$133,700	$0	9.9%
3102ABCK01	Boulder Creek	Path lighting	$979,680	$97,000	$0	9.9%
310TR743NC	28th St - Valmont to Iris	Multimodal improvements	$860,000	$76,900	$8,500	9.9%
3102ABCK02	Boulder Creek	Path improvements	$770,000	$76,200	$0	9.9%
310TR112OC	Citywide	Pedestrian facilities enhancements	$750,000	$74,300	$0	9.9%
310TR692OC	Citywide	Tributary greenways	$585,000	$57,900	$0	9.9%
310BJ002NC	Bluff & 30th St	Traffic signal	$532,000	$10,500	$42,100	9.9%
310TD019NC	28th St - Baseline to Iris	Complete street elements; turn lanes; widen bridge	$470,000	$42,000	$4,700	9.9%
310TDOO4OC	Citywide Funds 2810 & 3500	Development coordination	$450,000	$337,500	$112,500	100.0%
310TR157NG	Citywide	Bldr Co/City Joint TIP Scoping & Prioritization	$289,000	$289,000	$0	100.0%
310TD021OC	Citywide	Intersection improvements	$200,000	$4,000	$15,800	9.9%
310TR479OC	30th & Colorado	Transportation Corridor Study	$200,000	$150,000	$50,000	100.0%
310TR154NG	19th - Norwood to Upland*	Local share of reconstruction & walk/bike improvements (total cost = $257,000)	$157,000	$16,800	$8,400	16.1%
310TR480NC	East Arapahoe	Transportation Corridor Study	$100,000	$75,000	$25,000	100.0%
310TR151NG	Boulder Slough - 30th St to Pearl*	Local share of multiuse path (total cost = $480,000)	$96,000	$47,500	$0	49.5%
	Citywide	Additional improvements in Years 7-10	$29,710,500	$3,783,600	$449,100	14.2%
		Ten-Year Total =>	$74,276,180	$9,459,000	$1,122,700	14.2%
				89%	11%	
			$10,581,700	<= Ten Year Total to be funded by DIF		
			$63,694,480	<= Total to be funded by other revenues		

** Projects with grant funding; enhancem*
cost growth share is approximately 5.9% of total cost

COST ALLOCATION FOR BUS BIKE WALK FACILITIES

The demand for Bus Bike Walk facilities is a function of both residential and nonresidential development. As shown in Figure T4, functional population is similar to what the U.S. Census Bureau calls "daytime population" by accounting for people living and working in a jurisdiction. In addition to the Boulder-specific data, TischlerBise has relied on extensive public and private sector input to establish reasonable "weighting factors" to account for time spent at either residential or nonresidential development. These weighting factors are shown below with grey shading.

The functional population analysis starts with 2015 estimates of jobs and population in Boulder (see yellow highlighting), as documented in the Land Use Assumptions. According to the 2013 TMP State of the System report (see page 3-13), approximately 10% of Boulder jobs are self-employed persons. The remaining 90% of jobs require "journey-to-work" travel. The 2014 Boulder Valley Employee Survey indicates Boulder residents held 38% of these jobs, with persons living outside of Boulder holding the remaining 62% of journey-to-work jobs. The functional population analysis assumes all workers spend ten hours per weekday (annualized average) at nonresidential locations.

Residents who work in Boulder are assigned 10 hours to nonresidential development (discussed above) and 14 hours to residential development. Residents who work outside Boulder are assigned 14 hours to residential development. Jobs held by non-residents are assigned 10 hours to nonresidential development. Residents who don't work are assigned 20 hours per day to residential development and four hours per day to nonresidential development (annualized averages) to account for time spent shopping, eating out, and other social/recreational activities.

Based on Boulder's 2015 functional population analysis, the cost allocation for residential development is 60%, while nonresidential development accounts for 40% of the demand for Bus Bike Walk infrastructure.

Figure T4: Functional Population

Boulder Functional Population Analysis

		Service Units in 2015			Demand Hours/Day	Person Hours
Nonresidential						
	Jobs Located in City*		98,510			
	10% Self-employed	9,851			10	98,510
	Jobs Requiring Journey-To-Work	88,659				
	Jobs Held By Residents** 38%	33,690			10	336,900
	Jobs Held By Non-residents** 62%		54,969	<= 56% of jobs	10	549,690
	Non-working Residents	51,054			4	204,216
				Nonresidential Subtotal		1,189,316
				Nonresidential Share =>		**40%**
Residential						
	Population* 104,808					
	Non-working Residents	51,054			20	1,021,080
	Resident Workers	53,754				
81%	Residents Working in City (includes self-employed)***		43,541	<= 44% of jobs	14	609,574
19%	Residents Working Outside City***	10,213			14	142,982
				Residential Subtotal		1,773,636
				Residential Share =>		**60%**
				TOTAL		2,962,952

** Boulder Land Use Assumptions, TischlerBise 01/27/16.*
*** Percentages from 2014 Boulder Valley Employee Survey, Table 36, Question 32.*
**** Percentages from 2014 Boulder Community Household Survey, Table 112, Question 24.*

Based on the cost of planned transportation enhancements (see Figure T3) Bus Bike Walk improvements account for 89% of growth costs, or approximately $9.46 million over the next ten years. As shown in Figure T5, 60% of this amount, divided by the projected increase in Boulder's population over the next ten years, yields a capital cost of $748 per additional resident. The Bus Bike Walk component of the 2016 DIF for transportation improvements is equal to the cost per person multiplied by the average number of persons per dwelling, by size range (i.e. square feet of finished living space). For example, an apartment building with small units (800 or less square feet) would have to pay $748 per person multiplied by an average of 1.17 persons per dwelling, or $875 per dwelling unit (rounded). The DIF for nonresidential development is equal to the capital cost per additional job, multiplied by the average number of jobs per development unit, for each type of development.

Figure T5: Bus Bike Walk Improvements Allocated to Population & Jobs

Ten Year Growth Cost of Bus Bike Walk Improvements =>	$9,459,000

Cost Range and Allocation per Service Unit

	Proportionate Share Based on Functional Population	*2015 to 2025 Increase*	*Cost per Additional Service Unit*
Boulder Population	60%	7,580	$748
Boulder Jobs	40%	7,013	$539

	2015	*2025*
Population	104,808	112,388
Jobs	98,510	105,523
Ten Year Increase in Population plus Jobs		**7.2%**

Residential

Square Feet of Living Space	*Development Unit*	*Persons per Housing Unit*	*Proposed Bus Bike Walk Component*
800 or less	Dwelling Unit	1.17	$875
801 to 1200	Dwelling Unit	1.80	$1,346
1201 to 1600	Dwelling Unit	2.19	$1,638
1601 to 2200	Dwelling Unit	2.52	$1,885
2201 or more	Dwelling Unit	2.83	$2,117

Nonresidential

Type	*Development Unit*	*Jobs per Development Unit*	*Proposed Bus Bike Walk Component*
Retail / Restaurant	Sq Ft of Floor Area	0.00251	$1.35
Office	Sq Ft of Floor Area	0.00359	$1.94
Light Industrial	Sq Ft of Floor Area	0.00231	$1.25
Warehousing	Sq Ft of Floor Area	0.00092	$0.50
Institutional	Sq Ft of Floor Area	0.00081	$0.44
Hospital	Sq Ft of Floor Area	0.00294	$1.58
Nursing Home / Assisted Living	Bed	0.84	$453
Lodging	Room	0.57	$307

VEHICLE MILES OF TRAVEL

Figure T3 above indicates street improvements to provide additional vehicular capacity account for 11% of the growth cost, or $1.12 million over the next ten years. The streets component of the Transportation DIF is derived from custom trip generation rates (see Appendix A), trip rate adjustment factors, and the capital cost per Vehicle Mile of Travel (VMT). The latter is a function of average trip length, trip-length weighting factor by type of development, and the growth cost of transportation improvements. Each component is described below.

VMT is a measurement unit equal to one vehicle traveling one mile. In the aggregate, VMT is the product of vehicle trips multiplied by the average trip length[1]. The average trip length of 3.8 miles within Boulder is from the 2012 Modal Shift Report, as derived from a survey of residents (i.e. household travel diaries).

Vehicular Trip Generation Rates

Boulder's 2016 Transportation DIF study is based on Average Weekday Vehicle Trip Ends (AWVTE). For residential development, trip rates are customized using demographic data for Boulder, as documented in Appendix A. For nonresidential development, trip generation rates are from the reference book Trip Generation published by the Institute of Transportation Engineers (ITE 9th Edition 2012). A vehicle trip end represents a vehicle either entering or exiting a development (as if a traffic counter were placed across a driveway). To calculate transportation development fees, trip generation rates require an adjustment factor to avoid double counting each trip at both the origin and destination points. Therefore, the basic trip adjustment factor is 50%. As discussed further below, the DIF methodology includes additional adjustments to make the fees proportionate to the infrastructure demand for particular types of development.

Adjustments for Commuting Patterns and Pass-By Trips

Residential development has a slightly larger trip adjustment factor of 52% to account for commuters leaving Boulder for work. According to the Boulder Valley 2012 Modal Shift report (see Figure 46), work or work commute trips by single and multiple occupancy vehicles accounted for 15.9% of production trips (i.e., all out-bound trips, which are 50% of all trip ends). Also, Table 112 (Question 24) in the 2014 Boulder Community Survey indicates that 19% of resident workers traveled outside Boulder for work. In combination, these factors (0.159 x 0.50 x 0.19 = 0.02) support the additional 2% allocation of trips to residential development.

For commercial development, the trip adjustment factor is less than 50% because retail development and some services, like schools and daycare facilities, attract vehicles as they pass by on arterial and collector roads. For example, when someone stops at a convenience store on the way home from work, the convenience store is not the primary destination. For the average shopping center, ITE indicates that 34% of the vehicles that enter are passing by on their way to some other primary destination. The remaining 66% of attraction trips have the commercial site as their primary destination. Because attraction trips are half of all trips, the trip adjustment factor is 66% multiplied by 50%, or approximately 33% of the trip ends.

Trip Length Weighting Factor by Type of Land Use

The transportation DIF methodology includes a percentage adjustment, or weighting factor, to account for trip length variation by type of land use. As shown in Figure T6, trips associated with residential development are approximately 113% of the average trip length. The residential trip length adjustment factor includes data on work commute, driving passengers, social/recreational purposes and other

[1] Typical VMT calculations for development-specific traffic studies, along with most transportation models of an entire urban area, are derived from traffic counts on particular road segments multiplied by the length of that road segment. For the purpose of the DIF study, VMT calculations are based on attraction (inbound) trips to development located in the service area, with trip length limited to the road network considered to be system improvements (arterials and collectors). This refinement eliminates pass-through or external- external trips, and travel on roads that are not system improvements (e.g. state highways).

work/business travel. Conversely, shopping and eating trips associated with commercial development are roughly 68% of the average trip length while other nonresidential development typically accounts for trips that are 72% of the average for all trips.

Figure T6: Average Trip Length by Trip Purpose in Boulder

Type of Development	*Trip Purpose*	*Miles Percent*	*Miles*	*Trips Percent*	*Trips*	*Miles Per Trip*	*Weighting Factor*
1-Residential	Work Commute	14.9%	2,719	9.2%	444	6.1	
1-Residential	Drive a Passenger	6.6%	1,205	4.8%	232	5.2	
1-Residential	Change Mode & Other	2.9%	529	2.5%	121	4.4	
1-Residential	Social/Recreational	15.0%	2,738	13.4%	647	4.2	
1-Residential	Go Home	35.4%	6,461	34.7%	1,676	3.9	
1-Residential	Other Work/Business	3.7%	675	4.6%	222	3.0	
1-Residential Total			**14,327**		**3,342**	**4.3**	**1.13**
2-Retail/Restaurant	Shopping	8.4%	1,533	11.1%	536	2.9	
2-Retail/Restaurant	Eat a Meal	4.0%	730	7.1%	343	2.1	
2-Retail/Restaurant Total			**2,263**		**879**	**2.6**	**0.68**
3-Other Nonresidential	Personal Business	5.7%	1,040	6.3%	304	3.4	
3-Other Nonresidential	School	3.4%	621	6.3%	304	2.0	
3-Other Nonresidential Total			**1,661**		**609**	**2.7**	**0.72**
TOTAL		100.0%	18,251	100.0%	4,830	3.8	

Data Source: Figures 44 and 45, Modal Shift in Boulder Valley, 2012.

Development Prototypes and Projected VMT

The relationship between the amount of development within Boulder and Vehicle Miles of Travel (VMT) is documented in Figure T7. At the top are data on existing and projected development units. The lower portion of the table indicates the cost allocation for street improvements. VMT per development unit is equal to AWVTE x Trip Adjustment Factor x Mode Share for Single and Multiple Occupancy Vehicles (SOV & MOV) x Trip Length Weighting Factor x Average Trip Length. Based on projected development in Boulder over the next ten years, residential development should pay for approximately 44% of the growth cost of street improvements, with the remaining 56% funded by nonresidential development.

Figure T7: Projected VMT Increase to Development within Boulder

Development Type (1)	*2015 Development Units (1)*	*2025 Development Units (1)*	*Additional Development Units*
Single Unit Dwellings	24,242	24,806	564
Multiple Unit Dwellings	21,498	23,752	2,254
Industrial Sq Ft	13,576,996	14,547,603	970,607
Retail Sq Ft	8,565,611	9,174,939	609,328
Office & Other Services Sq Ft	14,848,416	15,904,789	1,056,373
Housing Unit Total	45,740	48,558	2,818
Nonres KSF Total	36,991,023	39,627,331	2,636,308

(1) Land Use Assumptions, TischlerBise 2016.
(2) Residential trip rates adjusted to Boulder demographics; nonresidential trip rates are national averages (ITE 2012).
(3) Residential includes commuting pattern adjustment; Retail includes pass-by adjustment.
(4) Residential mode share from Figure 1, 2012 Modal Shift; nonresidential mode share from Table 2 (primary mode) 2014 Employee Survey.
(5) Derived from Figures 44+45, Modal Shift, 2012..
(6) Figure 19, 2012 Modal Shift

Streets Cost Allocation Based on Vehicle Miles of Travel

Development Type	*Avg Wkdy Veh Trip Ends per Dev Unit (2)*	*Trip Adjustment Factors (3)*	*SOV+MOV Mode Share (4)*	*Trip Length Weighting Factor (5)*	*Vehicle Miles of Travel per Dev Unit*	*Ten Year VMT Increase*	*Proportionate Share by Type of Dev*
Single Unit Dwellings	8.17	52%	55.5%	113%	10.12	5,710	10.27%
Multiple Unit Dwellings	6.63	52%	55.5%	113%	8.22	18,519	33.31%
Industrial (per KSF)	3.56	50%	73.2%	72%	3.56	3,460	6.22%
Retail (per KSF)	42.70	33%	73.2%	68%	26.65	16,240	29.21%
Office & Other Services (per KSF)	11.03	50%	73.2%	72%	11.05	11,668	20.99%
				Average Trip Length in miles (6) =>	3.80	55,598	100.00%
				Ten Year Growth Cost of Street Improvements =>		$1,122,700	
				Cost per Additional VMT =>		$20.19	

Cost Allocation for Street Improvements

Input variables for the streets portion of Boulder's 2016 Transportation DIF schedule are shown in Figure T8. Inbound VMT by type of development, multiplied by the capacity cost per VMT, yields the DIF amount. For example, Lodging generates 8.18 VMT per room, multiplied by the capital cost of $20.19 per VMT, yields a DIF charge of $165 per room (rounded) for street improvements.

The text below from Trip Generation (ITE 2012) supports the consultant's recommendation to use ITE 820 Shopping Center as a reasonable proxy for all commercial development (i.e. retail and restaurants). The shopping center trip generation rates are based on 302 studies with an r-squared value of 0.79. The latter is a goodness-of-fit indicator with values ranging from 0 to 1. Higher values indicate the independent variable (floor area) provides a better prediction of the dependent variable (average

weekday vehicle trip ends). If the r-squared value is less than 0.50, ITE does not publish the value because factors other than floor area provide a better prediction of trip rates.

> *"A shopping center is an integrated group of commercial establishments. Shopping centers, including neighborhood, community, regional, and super regional centers, were surveyed for this land use. Some of these centers contained non-merchandising facilities, such as office buildings, movie theaters, restaurants, post offices, banks, and health clubs. Many shopping centers, in addition to the integrated unit of shops in one building or enclosed around a mall, include out parcels (peripheral buildings or pads located on the perimeter of the center adjacent to the streets and major access points). These buildings are typically drive-in banks, retail stores, restaurants, or small offices. Although the data herein do not indicate which of the centers studied include peripheral buildings, it can be assumed that some of the data show their effect."*

Figure T8: Cost of Street Improvements Allocated by VMT

Residential DIF for Streets

Square Feet of Living Space	*Development Unit*	*AWVTE per Dev Unit (2)*	*Trip Adjustment Factors (3)*	*SOV+MOV Mode Share (4)*	*Trip Length Weighting Factor (5)*	*VMT per Dev Unit*	*Proposed Streets Component*
800 or less	Dwelling Unit	3.94	51%	55.5%	113%	4.79	$97
801 to 1200	Dwelling Unit	6.23	51%	55.5%	113%	7.57	$153
1201 to 1600	Dwelling Unit	7.65	51%	55.5%	113%	9.30	$188
1601 to 2200	Dwelling Unit	8.85	51%	55.5%	113%	10.76	$217
2201 or more	Dwelling Unit	9.99	51%	55.5%	113%	12.14	$245

Nonresidential DIF for Streets

Type	*Development Unit*	*AWVTE per Development Unit (2)*	*Trip Adjustment Factors (3)*	*SOV+MOV Mode Share (4)*	*Trip Length Weighting Factor (5)*	*VMT per Dev Unit*	*Proposed Streets Component*
Retail / Restaurant	Sq Ft	0.04270	33%	73.2%	68%	0.02665	$0.54
Office	Sq Ft	0.01103	50%	73.2%	72%	0.01105	$0.22
Light Industrial	Sq Ft	0.00697	50%	73.2%	72%	0.00698	$0.14
Warehousing	Sq Ft	0.00356	50%	73.2%	72%	0.00356	$0.07
Institutional	Sq Ft	0.01403	33%	73.2%	72%	0.00927	$0.19
Hospital	Sq Ft	0.01322	50%	73.2%	72%	0.01324	$0.27
Nursing Home / Assisted Living	Bed	2.74	50%	73.2%	72%	2.74	$55
Lodging	Room	8.17	50%	73.2%	72%	8.18	$165

Revenue Credit Evaluation

A credit for other revenues is only necessary if there is potential double payment for system improvements. In Boulder, sales and gas tax revenue will be used for maintenance of existing facilities, correcting existing deficiencies, and for capital projects that are not DIF system improvements. As shown below in the Figure T9, cumulative DIF revenue over the next ten years approximates the growth cost of system improvements. There is no potential double payment from other revenues if Boulder's elected officials make a legislative policy decision to use Transportation DIF revenue to fund the growth cost of system improvements.

Funding Strategy for Transportation Improvements

The revenue projection shown in Figure T9 assumes implementation of the proposed 2016 Transportation DIF schedule and the development projections described in the land use assumptions. To the extent the rate of development either accelerates or slows down, there will be a corresponding change in DIF revenue and the timing of capital improvements. Based on the proposed 2016 methodology, residential development will pay approximately 52% of the growth cost for transportation system improvement, with nonresidential development covering the remaining 48%.

Figure T9: Projected Transportation DIF Revenue

		Residential	*Light Industrial*	*Retail*	*Office & Other Services*
		$1,826	$1.39	$1.89	$2.16
	Year	per housing unit	per 1000 Sq Ft	per 1000 Sq Ft	per 1000 Sq Ft
		Housing Units	*Square Feet*	*Square Feet*	*Square Feet*
Base	2015	45,740	13,576,996	8,565,611	14,848,416
Year 1	2016	46,012	13,670,663	8,624,414	14,950,360
Year 2	2017	46,288	13,765,405	8,683,890	15,053,473
Year 3	2018	46,566	13,860,809	8,743,783	15,157,308
Year 4	2019	46,846	13,956,881	8,804,095	15,261,869
Year 5	2020	47,127	14,053,626	8,864,830	15,367,162
Year 6	2021	47,409	14,151,048	8,925,989	15,473,193
Year 7	2022	47,694	14,249,152	8,987,577	15,579,965
Year 8	2023	47,980	14,347,942	9,049,596	15,687,486
Year 9	2024	48,268	14,447,424	9,112,049	15,795,758
Year 10	2025	48,557	14,547,603	9,174,939	15,904,789
Ten Year Increase		2,817	970,607	609,328	1,056,373
Projected Revenue =>		$5,145,000	$1,349,000	$1,152,000	$2,282,000
Total Projected Transportation DIF Revenue (rounded) =>					$9,928,000
Res Share =>		52%		Nonres Share =>	48%

APPENDIX A: LAND USE ASSUMPTIONS RELATED TO TRANSPORTATION

Most of the demographic data for Boulder's 2016 transportation studies may be found in memo dated January 27, 2016 regarding "Draft 3 Land Use Assumptions for Impact Fee/Excise Tax Studies." This Appendix contains additional information specific to the transportation analysis, such as customized vehicle trip generation rates for the City of Boulder.

CUSTOM TRIP GENERATION RATES BY DWELLING SIZE

As an alternative to simply using national average trip generation rates for residential development, as published by the Institute of Transportation Engineers (ITE), TischlerBise derived custom trip rates using local demographic data. Key inputs needed for the analysis (i.e. average number of persons and vehicles available per housing units) are available from American Community Survey (ACS) data for Colorado Public Use Microdata Area 803, which is essentially the City of Boulder.

City of Boulder Control Totals

The 2010 census did not obtain detailed information using a "long-form" questionnaire. Instead, the U.S. Census Bureau has switched to a continuous monthly mailing of surveys, known as the American Community Survey (ACS), which is limited by sample-size constraints. For example, data on detached housing units are now combined with attached single units (commonly known as townhouses). Part of the rationale for deriving development related transportation taxes/fees by bedroom range, as discussed further below, is to address this ACS data limitation. Because townhouses generally have fewer bedrooms and less living space than detached units, fees by dwelling size ensure proportionality and facilitate construction of affordable units.

According to the U.S. Census Bureau, a household is a housing unit that is occupied by year-round residents. Development fees often use per capita standards and persons per housing unit, or persons per household, to derive proportionate-share fee amounts. TischlerBise recommends that fees for residential development in Boulder be imposed according to the number of year-round residents per housing unit. Figure A1 indicates the average number of year-round residents per housing unit in Boulder. In 2013, the control total for the City of Boulder is 2.14 persons per dwelling (i.e. weighted average for all types of housing).

Figure A1: Year-Round Persons per Unit by Type of Housing

2013 Summary by Two House Types

Units in Structure	*Persons*	*House-holds*	*Persons per Household*	*Housing Units*	***Persons per Housing Unit***	*Housing Mix*	*Vacancy Rate*
Single Unit*	57,742	22,479	2.57	23,284	2.48	53%	3%
All Other	36,747	19,828	1.85	20,767	1.77	47%	5%
Subtotal	94,489	42,307	2.23	44,051	**2.14**		4%
Group Quarters	8,674						
TOTAL	103,163						

** Single unit includes detached and attached (e.g. townhouse).*

Source: Tables B25024, B25032, B25033, and B26001.

2013 American Community Survey 1-Year Estimates, U.S. Census Bureau.

Trip generation rates are also dependent upon the average number of vehicles available per dwelling. Figure A2 indicates vehicles available per housing unit in the City of Boulder. For the purpose of customizing vehicle trip generation rates, the control total for Boulder is an average of 1.55 vehicles available per housing unit.

Figure A2: Vehicles Available per Housing Unit

		Households (2)		
Tenure	*Vehicles Available (1)*	*Single Unit Detached or Attached*	*All Other*	*Total*
Owner-occupied	35,644	16,469	3,657	20,126
Renter-occupied	32,522	6,010	16,171	22,181
Total	68,166	22,479	19,828	42,307

Units per Structure	*Vehicles Available*	*Housing Units (3)*	*Vehicles per Housing Unit*
Single Detached or Attached	37,979	23,284	1.63
All Other	30,187	20,767	1.45
Total	68,166	44,051	**1.55**

(1) Vehicles available by tenure from Table B25046, American Community Survey, 2013.

(2) Households by tenure and units in structure from Table B25032, ACS, 2013.

(3) Housing units from Table B25024, American Community Survey, 2013.

Customized Trip Rates by Dwelling Size and Type

Custom tabulations of demographic data by bedroom range can be created from individual survey responses provided by the U.S. Census Bureau, in files known as Public Use Micro-data Samples (PUMS). Because PUMS files are available for areas of roughly 100,000 persons, the City of Boulder approximates Colorado Public Use Micro-data Area (PUMA) 803. At the top of Figure A3, in the cells with yellow shading, are the 2013 survey results for Boulder (latest available). Unadjusted survey results derived from PUMS data (i.e. persons per dwelling and vehicles available per dwelling), were adjusted to match control totals for the City of Boulder, as documented above in Figures A1 and A2.

The middle section of Figure A3 provides nation-wide data from the Institute of Transportation Engineers (ITE). AWVTE is the acronym for Average Weekday Vehicle Trip Ends, which measures vehicles coming and going from a development. Dividing trip ends per household by trip ends per person yields an average of 2.01 persons per occupied apartment and 3.73 persons per occupied single dwelling, based on ITE's national survey. Applying Boulder's current housing mix of 47% apartments and 53% single-unit dwellings yields a weighted average of 2.92 persons per household. In comparison to the national data, Boulder only has an average of 2.14 persons per housing unit.

Dividing trip ends per household by trip ends per vehicle available yields an average of 1.30 vehicles available per occupied apartment and 1.58 vehicles available per occupied single dwelling, based on ITE's national survey. Applying Boulder's current housing mix of 47% apartments and 53% single-unit dwellings yields a weighted average of 1.45 vehicles available per household. In comparison to the national data, Boulder has more vehicles available, with an average of 1.55 per housing unit.

Rather than rely on one methodology, the recommended trip generation rates shown in the bottom section of Figure A3 (see Boulder AWVTE per Housing Unit in bold numbers), are an average of trip rates based on persons and vehicles available, for all types of housing units by bedroom range. In the City of Boulder, each housing unit is expected to yield an average of 7.45 Average Weekday Vehicle Trip Ends (AWVTE), compared to the national average of 8.17 trip ends per household.

Figure A3: Persons and AWVTE by Bedroom Range and House Type

City of Boulder 2013 Data

Bedroom Range	*Persons (1)*	*Vehicles Available (1)*	*Housing Units (1)*	*Boulder Hsg Mix*	*Unadjusted Persons/HU*	***Adjusted Persons/HU (2)***	*Unadjusted VehAvl/HU*	*Adjusted VehAvl/HU (2)*
0-1	114	89	89	19%	1.28	**1.31**	1.00	0.95
2	220	162	121	25%	1.82	**1.86**	1.34	1.27
3	296	236	134	28%	2.21	**2.26**	1.76	1.66
4+	372	300	135	28%	2.76	**2.83**	2.22	2.10
Total	1,002	787	479		2.09	2.14	1.64	1.55

National Averages According to ITE

ITE Code	*AWVTE per Person*	*AWVTE per Vehicle Available*	*AWVTE per Household*	*Boulder Hsg Mix*	*Persons per Household*	*Veh Avl per Household*
220 Apt	3.31	5.10	6.65	47%	2.01	1.30
210 SFD	2.55	6.02	9.52	53%	3.73	1.58
Wgtd Avg	2.91	5.59	8.17		2.92	1.45

Recommended AWVTE per Dwelling Unit by Bedroom Range

Bedroom Range	*AWVTE per Housing Unit Based on Persons (3)*	*AWVTE per Housing Unit Based on Vehicles Available (4)*	***Boulder AWVTE per Housing Unit (5)***
0-1	3.81	5.31	**4.56**
2	5.41	7.10	**6.26**
3	6.58	9.28	**7.93**
4+	8.24	11.74	**9.99**
Total	6.23	8.66	7.45

(1) American Community Survey, Public Use Microdata Sample for CO PUMA 803 (2013 One-Year unweighted data).
(2) Adjusted multipliers are scaled to make the average PUMS values match control totals based on American Community Survey 2013 1-year data for the City of Boulder.
(3) Adjusted persons per housing unit multiplied by national weighted average trip rate per person.
(4) Adjusted vehicles available per housing unit multiplied by national weighted average trip rate per vehicle available.
(5) Average of trip rates based on persons and vehicles available per housing unit.

AWVTE per Dwelling by House Type

ITE Code	*AWVTE per Housing Unit Based on Persons (3)*	*AWVTE per Housing Unit Based on Vehicles Available (4)*	*Boulder AWVTE per Housing Unit (5)*	*Boulder Persons/HU*	*Boulder VehAvl/HU*
All Other	5.15	8.11	6.63	1.77	1.45
210 SFD	7.22	9.11	8.17	2.48	1.63
All Types	6.23	8.66	7.45	2.14	1.55

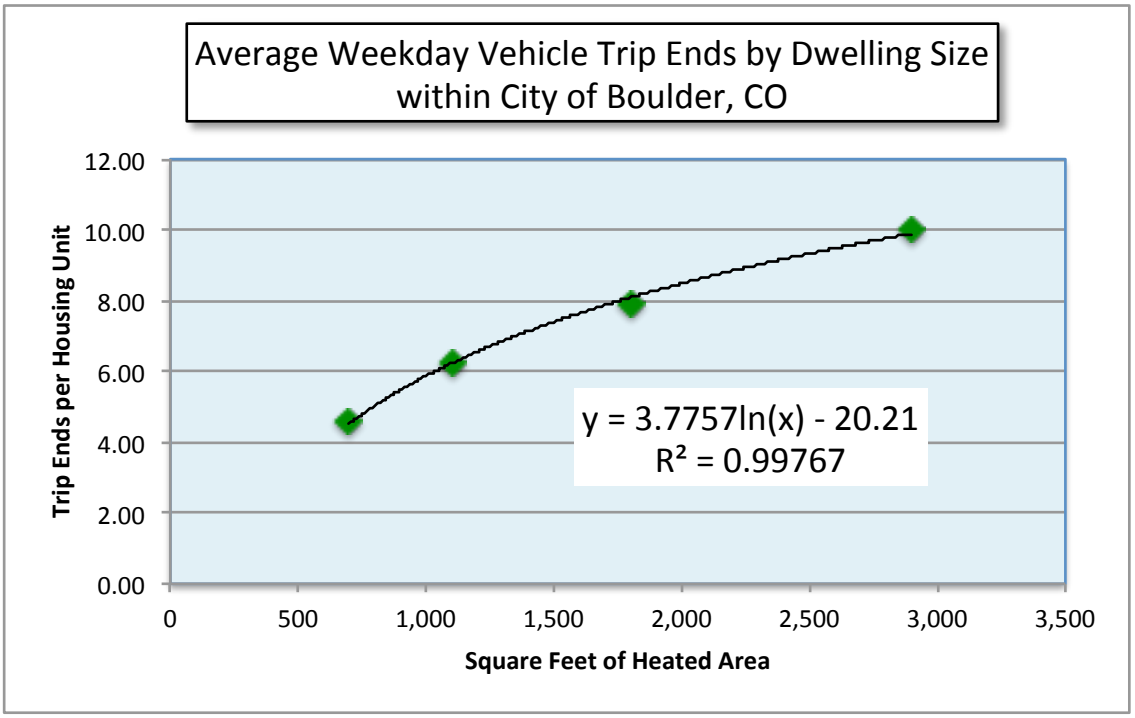
Trip Generation by Dwelling Size

To derive AWVTE by dwelling size, TischlerBise matched trip generation rates and average floor area, by bedroom range, as shown in Figure A4. The logarithmic trend line formula, derived from the four actual averages in Boulder, is used to derive estimated trip ends by dwelling size, across five size thresholds. TischlerBise does not recommend average fees for all house sizes because it makes small units less affordable and essentially subsidizes larger units.

Apartment units will generally be in the three smallest size thresholds, with one-bedroom units being 800 square feet or less, two-bedroom units ranging from 801 to 1200 square feet, and a few three-bedroom apartments being at least 1201 square feet.

Single-unit dwellings (both detached and attached) will have floor areas that correspond to the three largest size thresholds. Smaller units will likely have 1201 to 1600 square feet of living space. The most common single-unit dwelling will have three bedrooms and likely range from 1601 to 2200 square feet. All units with 2201 or more square feet of living space are assumed to generate a maximum 9.99 AWVTE per dwelling.

Figure A4: Vehicle Trips by Dwelling Size

Average dwelling size by bedroom range is from Property Assessor parcel database. Average weekday vehicle trip ends are calibrated to 2013 1-Year ACS PUMS data for CO PUMA 803 (City of Boulder).

Actual Averages per Hsg Unit			*Fitted-Curve Values*	
Bedrooms	*Square Feet*	*Trip Ends*	*Sq Ft Range*	*Trip Ends*
0-1	700	4.56	800 or less	3.94
2	1,100	6.26	801 to 1200	6.23
3	1,800	7.93	1201 to 1600	7.65
4+	2,900	9.99	1601 to 2200	8.85
			2201 or more	9.99