RSG
the science of insight®

CITY OF BURLINGTON

TRANSPORTATION IMPACT FEE STUDY

40 Main Street, Suite 550
802.383.0118
Burlington, Vermont 05401
www.rsginc.com

May 2025

Prepared for:

The City of Burlington, Vermont

The preparation of this report has been financed in part through grant[s] from the Federal Highway Administration and Federal Transit Administration, U.S. Department of Transportation, under the State Planning and Research Program, Section 505 [or Metropolitan Planning Program, Section 104(f)] of Title 23, U.S. Code. The contents of this report do not necessarily reflect the official views or policy of the U.S. Department of Transportation.

CONTENTS

1.0 INTRODUCTION 1
1.1 LEGAL BACKGROUND 2
2.0 TRANSPORTATION PLANNING CONTEXT 3
2.1 OVERVIEW – COMP PLAN AND OTHER PIECES 3
2.2 IMPACT FEE BASIS 5
2.3 HOUSEHOLD GROWTH IN BURLINGTON 6
2.4 EMPLOYMENT TRENDS IN BURLINGTON 7
2.5 FORECAST GROWTH 9
2.6 CHITTENDEN COUNTY TRANSPORTATION MODEL 10
2.7 TRIP GENERATION FORECASTS 11
2.8 EXISTING CAPACITY 12
2.9 FUTURE NETWORK CAPACITY 13
2.10 CAPACITY CONSUMED BY LAND USE DEVELOPMENT 15
3.0 PROJECTS 19
3.1 PROJECT IDENTIFICATION 19
3.2 COSTS AND UTILIZATION OF PROJECTS 20
GRANT SUPPORT AND OTHER NONLOCAL SUPPORT 21
NEW GROWTH SHARE OF CAPACITY 21
4.0 BASE IMPACT FEE 22
4.1 BASE IMPACT FEE 22
4.2 CREDITS 24
INFRASTRUCTURE CREDITS 24
REVENUE CREDITS 24

APPENDIX A. CAPACITY OF INFRASTRUCTURE 26
APPENDIX B. TRANSPORTATION PROJECTS 29
APPENDIX C. TRIP GENERATION ESTIMATES 1

LIST OF FIGURES

FIGURE 1: IMPACT FEE PROCESS 1
FIGURE 2: CITY OF BURLINGTON RESIDENT POPULATION 3
FIGURE 3: NATIONAL AVERAGE HOUSEHOLD SIZE (1940–2016) 7
FIGURE 4: COMMUTE FLOWS (2021) 8
FIGURE 5: BURLINGTON TRAVEL MODE SHARES (EXISTING AND GOAL) 17
FIGURE 6: SUPPLY PROVIDED AT DIFFERENT DC RATIOS 18

LIST OF TABLES

TABLE 1: LEHD JOB INFLOW / OUTFLOW (2021) 7
TABLE 2: DISTRIBUTION OF EMPLOYMENT SECTORS IN BURLINGTON (2022) 8
TABLE 3: WORKERS IN BURLINGTON - OCCUPATIONS 9
TABLE 4: IMPACT FEE LAND USE FORECASTS 10
TABLE 5: LAND USE CHANGES ANTICIPATED IN BURLINGTON BY 2035 11
TABLE 6: EXISTING CAPACITY PER FACILITY TYPE PER USER 12
TABLE 7: TOTAL EXISTING CAPACITY BY USER 12
TABLE 8: EXISTING AND FUTURE CAPACITY BY 2035 14
TABLE 9: MULTIMODAL MILES OF TRAVEL DEMAND GROWTH 15
TABLE 10: IMPACT FEE PROJECT LIST 19
TABLE 11: BURLINGTON IMPACT FEE PROJECT LIST 20
TABLE 12: IMPACT FEE PROJECT CAPACITY IN PERSON MILES 21
TABLE 14: BASE IMPACT FEE 23

LIST OF ABBREVIATIONS

ACS	American Community Survey
AMI	Area median income
CCRPC	Chittenden County Regional Planning Commission
ITE	Institute of Transportation Engineers
LEHD	Longitudinal Employer-Household Dynamics
NHTS	National Household Travel Survey
TAZ	Traffic analysis zone
TDM	Transportation demand management

1.0 INTRODUCTION

This impact fee study report proposes how land use development in the form of additional transportation capacity in the city of Burlington can accommodate new users and the demand they generate on existing infrastructure. Impact fees are a type of land use regulation that local governments use to generate revenue to construct additional mobility capacity to address and mitigate this demand. The City of Burlington retained RSG to develop this needs study to identify a fair and equitable impact fee structure for its transportation investments.

Vermont statute authorizes municipalities to levy impact fees on new development. The purpose of these fees is to allocate the cost of new capital facilities to the development that will benefit from those facilities.[1] This can include fees to offset the costs of facilities built in the past with excess capacity for anticipated future development; it can also include facilities planned to be built to accommodate future development. The statute states that the costs of such infrastructure should only include the portion associated with new capacity to accommodate the future development's demand.

The methodology for the transportation impact fee follows a "needs-based" (also known as a "plan-based") approach. It does this by identifying the future transportation capacity necessary to mitigate the impacts of additional users generated by future land use development on the existing standards of service that users experience. Figure 1 outlines the impact fee development process.

FIGURE 1: IMPACT FEE PROCESS

Source: RSG

[1] 24 V.S.A. § 5200

This impact fee study report outlines the future growth anticipated in the city of Burlington. It then documents the basis for implementing a transportation impact fee, the purpose of which is to pay for additional capacity associated with the increased demand for transportation mobility while conforming to statutory requirements.

1.1 LEGAL BACKGROUND

The American Planning Association, which is a national organization dedicated to supporting local communities and planning processes, has developed standards for impact fees. These standards are as follows:[2]

- *The imposition of a fee must be rationally linked (the "rational nexus") to an impact created by a particular development and the demonstrated need for related capital improvements pursuant to a capital improvement plan and program.*
- *Some benefit must accrue to the development as a result of the payment of a fee.*
- *The amount of the fee must be a proportionate fair share of the costs of the improvements made necessary by the development and must not exceed the cost of the improvements.*
- *A fee cannot be imposed to address existing deficiencies except where they are exacerbated by new development.*
- *Funds received under such a program must be segregated from the general fund and used solely for the purposes for which the fee is established.*
- *The fees collected must be encumbered or expended within a reasonable timeframe to ensure that needed improvements are implemented. (This is six years in Vermont.)*
- *The fee assessed cannot exceed the cost of the improvements, and credits must be given for outside funding sources (such as federal and state grants, developer initiated improvements for impacts related to new development, etc.) and local tax payments which fund capital improvements, for example.*
- *The fee cannot be used to cover normal (day to day) operation and maintenance or personnel costs, but must be used for capital improvements, or under some linkage programs, affordable housing, job training, child care, transit operations, etc. This expectation has to define costs attributed to mitigating the impacts associated with additional land use development.*

Typical management activities:

- *The fee established for specific capital improvements should be reviewed at least every two years to determine whether an adjustment is required, and similarly the capital improvement plan and budget should be reviewed at least every 5 to 8 years.*
- *Provisions must be included in the ordinance to permit refunds for projects that are not constructed, since no benefit will have manifested.*

[2] American Planning Association. “APA Policy Guide on Impact Fees.” Available at: https://www.planning.org/policy/guides/adopted/impactfees.htm.

- *Impact fee payments are typically required to be made as a condition of approval of the development, either at the time the building or occupancy permit is issued.*

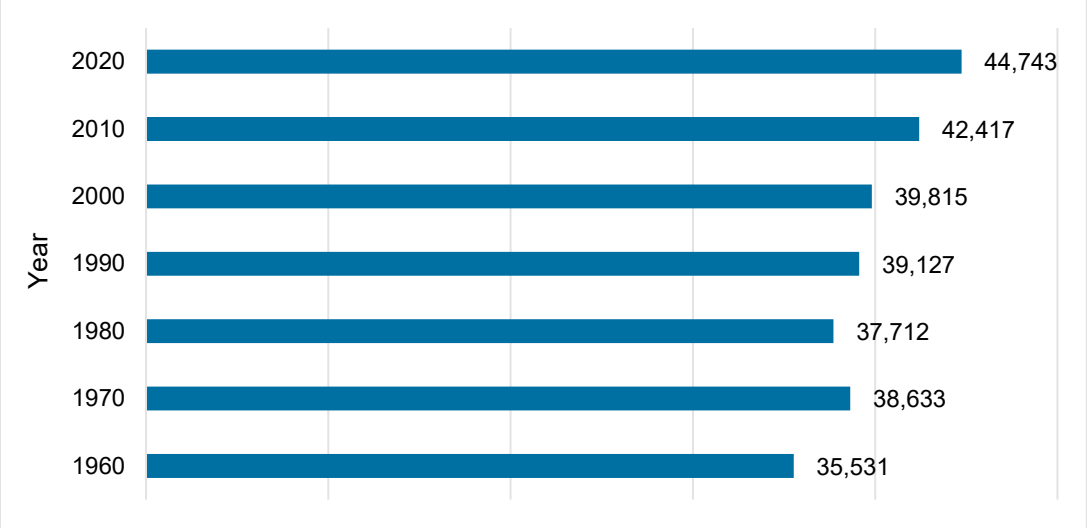
Vermont's impact fee statute does not preclude using funds for administrative duties associated with the management of the impact fee program. Nationally, it is common practice to collect and expend impact fees to cover time and expenses associated with the creation, management, and other administration of the impact fee program. These funds often cover the salary portion of the impact fee administrator, staff time in the preparation and review of impact fee studies, consultant or staff time preparing impact fee needs reports, and ordinance support.

2.0 TRANSPORTATION PLANNING CONTEXT

2.1 OVERVIEW – COMP PLAN AND OTHER PIECES

The city of Burlington is the cultural, recreation, and employment hub of Chittenden County. As the original shipping and rail hub, the city has had a tremendous influence on the trajectory of the other communities in Chittenden County. Burlington is large by Vermont standards, having some of the largest employers in the state, dense downtown, transit service, and other urban amenities. The city of Burlington is the most populous municipality in Chittenden County, with an estimated population of 44,646 as of 2022 people living within the 10.5 square miles. Burlington is approximately 27% of Chittenden County's population (168,320 in 2020).

FIGURE 2: CITY OF BURLINGTON RESIDENT POPULATION



The Comprehensive Plan specifies how Burlington is a connected city. This includes:

- People and place
- Economy and the natural environment

- Land use and development carefully coordinated with public services and natural environment considerations
- Robust transportation choices
- Recreation, services, and amenities close to where people live
- Internet and telecommunications
- Economic, social, and physical connections to our larger geographic region and beyond
- Connectivity to the world due quality telecom services, ease of travel, and professional and family connections of residents
- Opportunities for diverse cultures and backgrounds to connect
- Cohesion in decision-making and public administration
- Considering the long-term and wide-ranging impacts of decision-making

The city has used the Comprehensive Plan to inform a whole range of planning, land use, and development activities. It provides direction for maintaining and updating the city's zoning ordinance, has inspired underutilized properties to be revitalized, has led to the identification of priority lands for conservation, recommended the creation of new programs and funding mechanisms to address priority issues, and has even directed the creation of other plans and studies to investigate issues and areas of the city more thoroughly. Specifically, as it pertains to this study, the Comprehensive Plan acknowledges the role and value of impact fees as a land use regulation to offset and pay for additional capacity to meet the needs of new residents.

The Comprehensive Plan[3] summaries key transportation issues:

- The regional ECOS Plan identifies much of Burlington in a 'Metropolitan Planning Area,' and downtown Burlington as a 'Center Planning Area.' These designations are intended to promote these areas for the most intensive development within our region.
- As a major hub of jobs, services, and amenities in Chittenden County it will be important for Burlington to work with other municipalities and transportation service agencies in the region to implement transportation system improvements and locate new development in dense growth centers that will make these options more viable, reduce traffic congestion, and better manage available parking resources. It is imperative that these improvements are implemented in a way that balances the needs of our changing climate, demographics, and economic vitality.
- New mobility services, including e-bikes, e-scooters, eventually automated vehicles along with improved transit and train will improve accessibility throughout the city. These services have the potential to significantly reduce single occupant vehicle ownership and usage, traffic congestion, and the demand for parking. But they will bring about new challenges for and demands on our public rights-of-way and transportation

[3] City of Burlington 2019 planBTV Comprehensive Plan. https://www.burlingtonvt.gov/sites/default/files/u1476/planBTV_PDFs/planBTV_2019_full_adopted_03252019.pdf

infrastructure. It will be important to monitor these systems' impact on overall vehicle miles driven, greenhouse gas emissions, and traffic congestion.

- Coordinate land use, development, and innovative transportation solutions that strengthen multi-modal corridors which reduce traffic congestion and reliance on single-occupant vehicles, and provide access to a wide range of transportation services and options. This Action 17 includes several sub-actions outlined in the comprehensive plan.

The Plan sets out a vision for the future. Impact fees can supplement additional city funds to turn this vision into a reality. Impact fees are an important tool that the city can leverage by assessing fees on new land use development that would generate additional demands on the transportation system placing a burden on the existing facilities and would benefit from additional transportation capacity.

2.2 IMPACT FEE BASIS

It is expected that future land development generates additional users which increases the demand for travel that begins and/or ends within the city. Outside of the city, growth in population throughout the county and state generates additional demand for travel, although those trips begin and end outside of the city; and therefore, not directly associated with future development in Burlington. These trips are considered "through trips", although because of the design of the city streets and the shape of the city boundaries along with the land use pattern, there are few "through trips" in Burlington.

The transportation analysis in this impact fee study focuses on local traffic generated by anticipated future development. The basic unit of analysis is the Peak Hour Trip End, which is either the origin or the destination of a trip. Any given trip has two trip ends—an origin and a destination. Any trip that either begins or ends within the city is considered to be a local trip.

The PM peak hour is the "analysis hour" in which the fee is assessed on. The PM peak hour is the typical design hour[4] in the city of Burlington. It is noted that specific developments may generate a significant number of trips outside the design hour. Some uses (a religious institution, for example) may have different peak hours (and days) of traffic generation. Cumulatively however, the highest traffic volume at most locations in Burlington is during the PM peak design hour (the highest hour between 4-7pm).

Traffic impact fees are not assessed on trips that occur outside of the PM peak design hour. Limiting the period of assessment to the PM peak hour creates a consistent hour of analysis commonly used by traffic impact studies and practitioners. By assessing a fee during a particular hour of analysis the fee also acts as a transportation demand management (TDM) technique. This can encourage the development of land uses that generate travel demand outside of the peak hours to make more efficient use of the existing transportation infrastructure

[4] Design Hour in Vermont is defined as the 30th highest hour of volume during the year.

by using available capacity at other times of the day. This same principle goes for shifting modes. As congestion may increase for one mode of travel, some users will shift modes to utilize available capacity, reduce travel times and increase accessibility.

The impact fee is assessed on vehicle trips. Vehicle trips are typically the least efficient travel mode, both in terms of space per passenger it requires, the externalities from noise, air pollution, and congestion. The fee, which mitigates demand for travel by adding multimodal capacity, acts as an incentive to invite land uses that maximize nonvehicular trips and encourages any land development to reduce the number of vehicular trips. An impact fee on vehicle trips encourages a greater variety of land uses to maximize internal capture, use of TDM incentives, support transit services, as well as encourage land use patterns with greater intensity and connectivity in the urban centers to facilitate walking and biking.

2.3 HOUSEHOLD GROWTH IN BURLINGTON

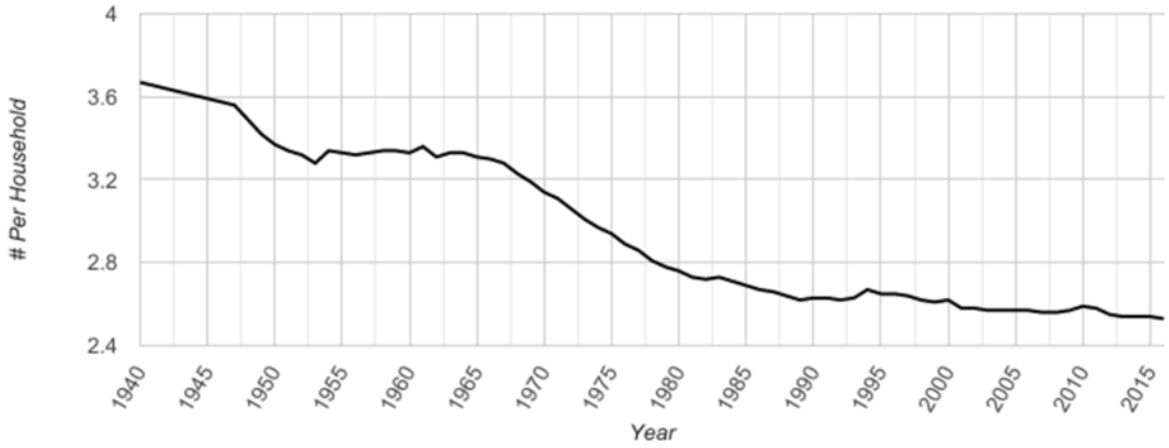
The US Census American Community Survey (ACS) estimates that as of 2022, there were 18,200 housing units in the city. This is an increase of over 1,800 housing units since the 2000 Census and over 1,300 more than the 2010 Census. The majority of the housing units are renter occupied (60%) with an average of 2.04 persons per household. The remaining 40% of households are owner occupied with 2.26 persons per household[5]. The citywide average is 2.45 persons per household (44,646 persons in 18,203 housing units). The discrepancy is due to the 5-year estimates from the ACS and the sampling between the unit types.

There have been attempts nationally to reduce the effect that transportation impact fees may have on housing costs, and especially, “affordable housing.” Changing the assessment on the square footage of the home or on the number of bedrooms provides a stronger relationship to the number of occupants and the quantity of travel consumed. The City has had a fee based on the square footage for some time, however, there isn’t sufficient data on the trips generated by square footage to retain that methodology. The city is able to respond to any local traffic generation estimates that might demonstrate affordable housing may have fewer (or greater) vehicle trips than traditional market rate units. Alternatively, Vermont statute provides wide latitude for the city to waive impact fees from affordable housing and other land uses that may further specific policy objectives.

The Burlington household sizes are consistent with national trends. Nationally, over the past half century the average size (number of persons) of the household has dropped from 3.67 persons per household in 1940 to 2.53 in 2016 as shown in Figure 3.

[5] 2022 American Community Survey 5-year estimates (DP04)

FIGURE 3: NATIONAL AVERAGE HOUSEHOLD SIZE (1940–2016)



source: U.S. Census Data

The number of occupants per household influences the number of housing units necessary to house the population and may also influence the degree to which any household may impact the needs for goods and services. Specifically, as it pertains to transportation, if there are fewer occupants, there may be a reduction in the degree of transportation capacity a household requires. The occupancy and size of a housing unit will be valuable to consider in the future, however, it is intended that any estimate of the transportation and traffic demand will be produced by using nationally available trip generation data like that provided by the Institute of Transportation Engineers (ITE).

2.4 EMPLOYMENT TRENDS IN BURLINGTON

Burlington is a major employment hub within Chittenden County. The Census Longitudinal Employer-Household Dynamics (LEHD) data estimates 32,592 jobs[6] are in Burlington with 24,927 (76.5%) of those being filled by those living outside of Burlington. Additionally, 9,740 residents of Burlington are employed outside of the city. The data is summarized in Table 1.

TABLE 1: LEHD JOB INFLOW / OUTFLOW (2021)

INFLOW/OUTFLOW JOB COUNTS (ALL JOBS)		
	2021	
	Count	Share
Employed in the Selection Area	32,592	100.00%
Employed in the Selection Area but Living Outside	24,927	76.50%
Employed and Living in the Selection Area	7,665	23.50%
Living in the Selection Area	17,405	100.00%
Living in the Selection Area but Employed Outside	9,740	56.00%
Living and Employed in the Selection Area	7,665	44.00%

Source: OnTheMap Census (2021 LEHD)

[6] The American Community Survey estimates jobs and employment differently than the dataset which was used by the CCRPC. There are some individuals with multiple jobs, 'gig' workers, and sole proprietorships which are not fully accounted for in the ACS data.

FIGURE 4: COMMUTE FLOWS (2021)

Source: OnTheMap Census

Table 2 shows the proportion of industries that are present in Burlington and the proportion of workers per industry. Note these are total jobs filled by either residents or non-residents.

TABLE 2: DISTRIBUTION OF EMPLOYMENT SECTORS IN BURLINGTON (2022)

INDUSTRY NAICS DESCRIPTION	% OF WORKERS IN BURLINGTON
Agriculture, forestry, fishing and hunting, and mining	0.3%
Construction	2.6%
Manufacturing	4.2%
Wholesale trade	1.1%
Retail trade	7.8%
Transportation and warehousing, and utilities	2.1%
Information	2.0%
Finance and insurance, and real estate and rental and leasing	6.4%
Professional, scientific, and management, and administrative and waste management services	11.1%
Educational services, and health care and social assistance	43.4%
Arts, entertainment, and recreation, and accommodation and food services	10.1%
Other services (except public administration)	3.5%
Public administration	5.2%
Armed forces	0.3%

Data source: ACS 2022 B08526 (5-year)

Table 3 shows the occupation of workers in Burlington. Note these are total jobs filled by either residents or non-residents.

TABLE 3: WORKERS IN BURLINGTON - OCCUPATIONS

CENSUS OCCUPATION	% OF WORKERS IN BURLINGTON
Management, business, science, and arts occupations	60.5%
Service occupations	16.4%
Sales and office occupations	14.5%
Natural resources, construction, and maintenance occupations	3.9%
Production, transportation, and material moving occupations	4.6%
Military specific occupations	0.1%

Data source: ACS 2022 B08524 (5-year)

2.5 FORECAST GROWTH

Several methods exist for developing impact fee studies. The Plan Based method is used in this update for the city of Burlington transportation impact fees. Plan based impact fee studies use an agreed vision of the future to identify the necessary capital investments to meet the future needs of residents and visitors. That agreed vision of the future starts with the development of a land use forecast for the number of new residents and jobs within the impact fee study area.

The city of Burlington and the regional metropolitan planning organization, Chittenden County Regional Planning Commission (CCRPC), have a high degree of influence in the nature of land use development in the study area. The specificity of zoning regulations along with a robust planning environment enables a confident projection of future land use conditions. The CCRPC conducts long-range planning for the communities within Chittenden County, including Burlington. Previous long-range plans have developed forecasts out to the year 2050 for each of the traffic analysis zones (TAZs) used in the regional travel demand model.

The land use forecast for the city's impact fee update starts by collecting previous long-range plans and builds upon those with more recent information.

The 2050 Metropolitan Transportation Plan (MTP) is the long-range plan developed by the CCRPC. The MTP published in 2018 included a significant effort to update previous demographic forecasts. The most recent MTP adopted in 2023 retains the land use forecasts completed in 2018.

In 2020, the Railyard Enterprise Project Environmental Assessment (EA) was started. Land use forecasts out to the year 2050 were revisited during the early phases of the study. Conversations between the consultant team and the city of Burlington planning department indicated that the CCRPC land use forecast for several of the TAZ's in the city of Burlington require revision to reflect changes in expected land development pattern in the city. The Railyard Enterprise Project EA used this project specific version of the land use forecasts in the development of the traffic flow forecasts used in the project impact evaluation. The majority of changes in land use reflect changes in zoning in the south end of the city as well as increased density in a handful of TAZs.

The land use forecasts from the Railyard Enterprise Project provided the base from which further revisions are made in this impact fee study to reflect anticipated land use changes in the city. The Planning Department provided RSG a summary of land use changes across several TAZs. The final land use forecast used in the development of the impact fees is shown in Table 4.

TABLE 4: IMPACT FEE LAND USE FORECASTS

	2020	2030	2050
Group Quarters	5,952	6,226	6,775
Households (exc. Group Quarters)	18,288	20,584	23,378
Total Households (inc. Group Quarters)	**24,240**	**26,810**	**30,153**
Total Jobs	**41,445**	**44,887**	**52,176**

It is noted that the number of total jobs here are different than the LEHD data or Census data. Each source includes different populations and sampling methods in the data. The travel model was calibrated using a combination of data producing a custom dataset on jobs and employment within the county that better reflects part-time employment, persons with more than one job, and self-employed persons who may not file payroll data.

2.6 CHITTENDEN COUNTY TRANSPORTATION MODEL

In 2015 the CCRPC initiated a significant update to the regional travel demand model that included population and employment projections for each municipality for five year increments out to 2050. The CCRPC forecasts were used to generate estimates of new traffic generation, vehicle miles traveled, and percentage of growth in traffic that is associated with changes in land use in Burlington as opposed to traffic growth simply passing through. The land use changes forecast in the model were agreed to by the city for use in this impact fee assessment. If at any point the land use development trajectory changes from that modeled, this impact fee study should be revisited.

The model is a traditional four-step trip based travel demand model. The four steps are iterated to achieve an optimized routing pattern with stable travel times. The steps are defined as follows:

- Trip Generation – estimates the number of person trips produced and attracted to each traffic analysis zone (TAZ). The land use inputs were established with each community by allocated future households and employees manually to the TAZs.
- Trip Distribution – connects person trips between TAZs.
- Mode Choice – splits person trips into single occupant vehicles, shared vehicle trips, transit trips, or walk/bike trips.
- Assignment – Selects the shortest route for each vehicle and transit trip traveling from one TAZ to another based on distance and travel time.

This study incorporated the anticipated land use changes to occur in Burlington by 2035. The land use changes included household growth and increases in specific sectors of the economy.

In total, an estimated 2,300 new households would be constructed, and 3,450 new jobs would be based in Burlington by 2035. Table 5 summaries the land use changes forecast by 2035.

TABLE 5: LAND USE CHANGES ANTICIPATED IN BURLINGTON BY 2035

2025–2035 LAND USE CHANGES	
Residential Growth	**Housing Units**
New households	2,300
Employment Growth	**Employees**
Accommodations	170
University & College	30
Commercial	1,010
Industrial	590
Institutional	390
Educational	120
Retail	1,140
Total Employment Growth	**3,450**

Source: CCRPC Land Use analysis by RSG[7]

2.7 TRIP GENERATION FORECASTS

The land use changes associated with the new housing units and commercial space were evaluated in the travel model in addition to all the other growth and changes in land uses within the county by 2035. The regional travel model accounts for growth in other communities within Chittenden County as well as estimated growth for trips that originate outside the county and for trips that may only pass through the county. The regional model produced estimates of the number of new travel demand associated with the land use changes summarized in Table 5.

Impact fees are assessed on the number of vehicle trips generated by a project often using the Institute of Transportation Engineers (ITE) Trip Generation manual. The number of vehicle trips expected to be generated by the land development is a function of several assumptions and trip generation adjustments such as the density of the project, site location (e.g., urban, suburban), proximity to transit, and mix of nearby uses. The travel model, using different approaches, also attempts to account for all these factors. Specifically, the factors: TDM and non-auto travel, internal capture (mix of complementary land uses within a travel analysis zone), and pass-by (trips that detour to a location en route to their primary destination). While the ITE Trip Generation manual 11th edition is starting to consider land use type in the vehicle trip generation rates, it is expected to be a vehicle-centric estimate of demand.

[7] The land use iteration used in the impact fee study reflect the changes in the land use that occurred during the I-89 Corridor Study and the Railyard Enterprise Scoping Study and subsequent NEPA Environmental Analysis.

Using both a ‘bottom up’ approach of estimating the trip generation based on ITE trip rates and a ‘top down’ approach using direct output from the travel model results in an estimate of 2,360 new vehicle trips generated by the forecast changes in land development. Appendix C has additional information on the trip generation estimate approaches.

2.8 EXISTING CAPACITY

Impact fees are based on the presumption and expectation that new users to the area will negatively affect the experience that existing users have. The concept is that existing users have a certain capacity or amount of supply available to them to use, which they have paid for through user fees, impact fees, or tax dollars. If new users are added to the system without adding additional capacity, then there is a reduction in the standard of service for those existing users.

Table 6 shows the derivation of the current transportation capacity (i.e., supply of infrastructure) per user. The hourly person miles of capacity for each facility type is from Appendix A.

TABLE 6: EXISTING CAPACITY PER FACILITY TYPE PER USER

Facility Type	Existing Miles [A]	Hourly Person Miles of Capacity (at LOS E) [B]	Users in Burlington [C]	Ratio Person Miles of Capacity to Users [D]
Standard bike lanes	25.1	13,952	65,466	0.213
Protected bike lanes	0.3	981	65,466	0.015
Road lanes	399.9	863,884	65,466	13.196
Shared use paths	6.5	5,788	65,466	0.088
Sidewalk - Less than 5 ft	81.5	17,837	65,466	0.272
Sidewalk - 5-10 ft	44.9	26,034	65,466	0.398
Sidewalk - Over 10 ft	2.2	3,223	65,466	0.049
Sidewalk - no description of width	0.6	392	65,466	0.006

The existing capacity per user defines the current standard which is enjoyed by the users of the city today. The capacity is compared by user group, population, employment, and users in Table 7.

TABLE 7: TOTAL EXISTING CAPACITY BY USER

Segment	Existing Market Segment Users in 2023 [A]	Existing Hourly Person Miles of Capacity (PMC) [B]	PMC / Market Segment [C]
Population	44,743	932,092	20.83
Employment	41,445	932,092	22.49
Users	65,466	932,092	**14.24**

The analysis of using person miles of capacity indicates that 14.3 hourly person miles of capacity exists in the city for every user. This capacity is the full extent of miles of capacity if every mode and facility type were to be utilized to its fullest extent, when demand equals the capacity of the system. This is not reasonable or logical (imagine if every road, sidewalk, bike lane was completely full of users). However, the availability of systemwide capacity does acknowledge that over the years the city has funded and constructed a diverse and extensive transportation system to meet the varied needs of the users. The approach used in this study accounts for *actual* demand relative to capacity (existing current utilization of available capacity is estimated to be around 46%).[8] This is based on a weighted average of demand on roadway links from the travel model and estimated demand for non-motorized links (e.g., sidewalks, paths, etc.).

2.9 FUTURE NETWORK CAPACITY

The City of Burlington is actively planning and constructing many transportation infrastructure projects to be open and functional by the year 2035. Approximately 20 miles of new facilities are expected, including roads, significant changes in the supply of bike lanes, both standard and protected, as well as shared use paths and sidewalks.

The city has conducted several studies over the past years identifying the types of projects and desired changes in the transportation system. These include the following studies used to identify future capacity in this study:

- North Avenue Corridor Study
- Colchester Avenue Scoping Study
- Colchester – Riverside Scoping Study
- BTV ONE (Old North End) Bikeway and Connectivity Study
- Pearl – Prospect – Colchester Scoping Study
- planBTV WalkBike Plan
- Queen City Park Bicycle Connections Scoping Study
- South End Project sequencing
- Winooski Avenue Transportation Study
- Burlington South End Multimodal Feasibility Study
- Railyard Enterprise Scoping Studies and NEPA study

Table 8 shows the existing and future lane miles by facility type anticipated by 2035.
Transportation Projects

Appendix Figure 4 includes the full list of future transportation capacity projects.

[8] See Appendix A, Figure 3

TABLE 8: EXISTING AND FUTURE CAPACITY BY 2035

Facility type	Existing miles [A]	Future miles [B]	Existing Person miles capacity	Future person miles capacity
Standard bike lanes	25.1	31.41	13,952	17,449
Protected bike lanes	0.3	4.51	981	13,142
Road lanes	399.9	400.68	863,884	865,467
Shared use paths	6.5	11.06	5,788	9,908
Sidewalk - Less than 5 ft	81.5	81.54	17,837	50,693*
Sidewalk - 5-10 ft	44.9	48.77	26,034	
Sidewalk - Over 10 ft	2.2	2.24	3,223	
Sidewalk - no description of width	0.6	0.58	392	
Total	**561.1**	**580.8**	**932,092**	**956,660**
Absolute Change	**-**	**19.7**		**24,568**
% Change in Total		**3.5%**		**2.6%**

**The future conditions replaced some facilities, added others, and to be conservative in estimating change in person miles capacity all replaced sidewalk was considered at the 5' width.*

Table 8 shows that the city is expected to increase hourly person capacity by 2.6% over the next 10 years across a variety of projects and facility types. The increase in capacity is in contrast to the 12% increase in population, 8% increase in employment, and an average of 11% increase in the daily Users in Burlington (see Table 8 above).

The increase in capacity appears to be inadequate (meaning the capacity isn't growing as fast as the growth in users) given the increase in the new number of users projected by the year 2035. However, this approach that compares the rate of growth of new users with the amount of capacity is referred to as the "ratio based" approach. Rather than this method, this impact fee study uses the Plan Based approach. The Plan Based approach considers a future vision for the system and appreciates a more nuanced and complex approach to what amount of capacity is actually warranted based on the increase in projected demand.

Plan Based Approach:
This approach is designed to reflect what the demand for transportation capacity is, what the system looks like, and how well does it operate. Based on an agreed vision for the future the new users would contribute impact fees based on the amount of that future capacity they will consume. The plan based approach is designed around a specific set of projects, a forecast level of demand, and a vision for the how the system works – while fairly allocating the cost burdens for realizing that vision. The plan based approach is used in the transportation impact fee calculation.

Standards (Consumption) Based Approach:
This approach bases the impact fee on the generalized cost for developing new transportation capacity in the city. Each land use development would then be assessed the cost to create the same amount of capacity that the users of that land use development would demand or consume. It often isn't based on a specific project list and would often expand capacity in a linear, marginal way, which may challenge changes in the way the service standard evolves over time. In the case of Burlington the shift towards funding a diverse multimodal transportation system requires a change in the ratios used to expand capacity. The linear, standards based is challenged to multimodal transportation capacity since some modes will be expanded less than other modes.

2.10 CAPACITY CONSUMED BY LAND USE DEVELOPMENT

The demand for transportation capacity given the growth in person trips per PM peak hour are also considered to derive the future estimate of demand. Table 9 shows the expected vehicle miles of travel consumed by growth and development and the non-vehicle person miles of travel. First, it accounts for vehicle trips and the share of new travel demand in vehicles. Second, the travel demand accounts for non-vehicular trips and the shorter average trip length. The overall growth in person miles of travel (PMT) associated with land use change in Burlington is the sum of vehicle and non-vehicle trips. The vehicle trips are expected to travel further, the full 1.8 mile trip length as estimated in the travel model, while the multimodal travel is a weighted average of walking, biking, and transit trip lengths.

TABLE 9: MULTIMODAL MILES OF TRAVEL DEMAND GROWTH

	Growth by 2035 PM Peak Hour
Growth in Vehicle Trips per PM Peak Hour [a]	2,200
Trip Length (miles) [b]	1.8
Vehicle Occupancy [c]	1.2
PM peak hour vehicular PMT consumed by new growth [d]	**4,752**
Growth in non-vehicle trips per PM Peak Hour [e]	1,000
Weighted Average Trip Length for non-vehicle trips (miles) [f]	0.75
PM peak hour person miles of travel consumed by new growth [g]	**750**
Total growth in PMT per PM Peak Hour [h]	**5,502**

The bottom row [h] of Table 9 shows the total person miles of travel demand (5,502) associated with the new land use development and growth by 2035. The results are derived using regional travel demand model data which estimates the vehicle trips and the trip length. The non-vehicle trips are derived through model data on person trips, land use changes, and expectations on pass-by, internal trip capture, travel demand management (walking, biking, transit), and working from home.

This table provides a more accurate description of how future demand in the year 2035 will use the available capacity. Some users will benefit from the improved walking and biking

infrastructure, while some roads will become increasingly utilized, while some facilities may have improved operations. The table suggests that rather than 24,568 new person miles of capacity (the difference in capacity in Table 8) scaled to population and employment growth during the PM peak hour the city will consume far less capacity, at 5,502 person miles of demand by the year 2035. The regional travel demand model is a helpful tool to help evaluate how travel behaviors will change as the city becomes more dense and diverse in land uses providing users travel alternatives to how they behave today.

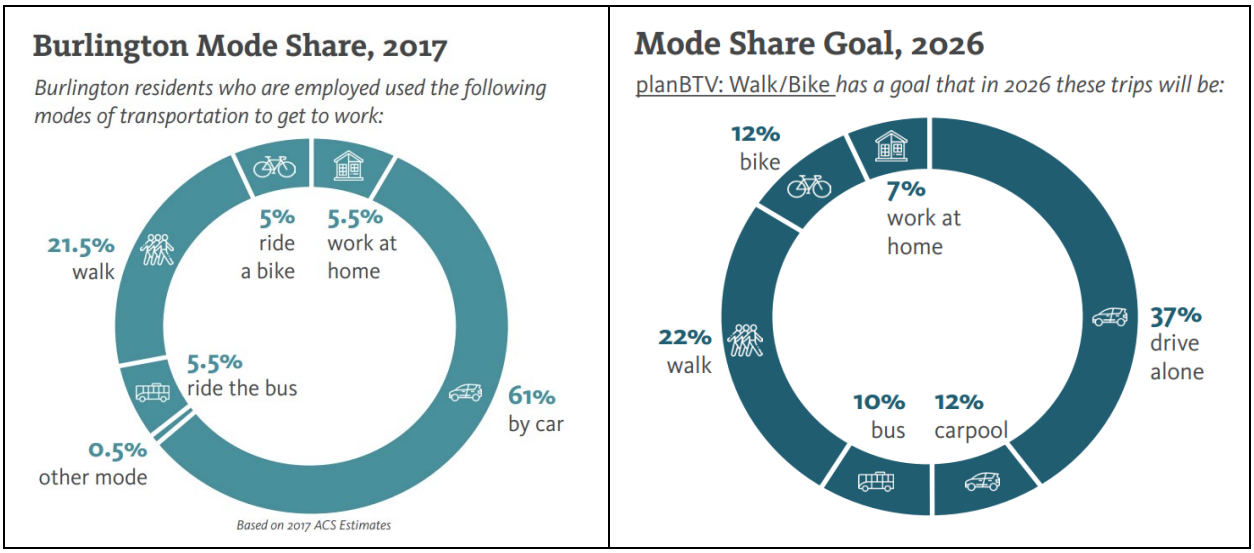
The service standard that users of the transportation system experience today is one gauge of the system performance. The existing demand to capacity (DC) is used to establish a DC weighted service standard across the citywide multimodal system.[9] The existing system has a weighted DC ratio across *all the facilities* in the city of 0.46.[10] If the city were to provide additional capacity at today's service standard it would require 11,928 person miles of hourly capacity added to the system (5,502 / 0.46).[11]

It is reasonable and expected that in the future the system should be *more heavily utilized*. This would increase demand and use for the active modal infrastructure and as vehicle congestion may increase, some users will shift to non-vehicle modes. If the city sets a future standard of service target at a *higher* utilization across the system, then the amount of capacity added to the system to accommodate the demand by the year 2035 can be **less**.

The higher utilization of the existing infrastructure is supported by the city's long-range planning efforts. The plan for building multimodal infrastructure and improved utilization of existing infrastructure aligns with the city's Comprehensive Plan and travel mode share goals. The mode share as of 2017 is shown in Figure 5 along with the mode share goal for the year 2026.

[9] Demand to capacity (DC) is equal to volume to capacity (VC) for facilities when the DC is less than 1.0. The systemwide DC ratio is weighted by the volume of the facility (more heavily trafficked roads contribute to the average more than less trafficked roads).
[10] Derived from the travel model for the highway modes and an estimated demand for all of the non-highway modes.
[11] The travel model for the PM peak period had a weighted average VC ratio of 0.50 for the roadway street segments. Appendix Figure 3 shows the existing VC ratios and the future standard of service.

FIGURE 5: BURLINGTON TRAVEL MODE SHARES (EXISTING AND GOAL)



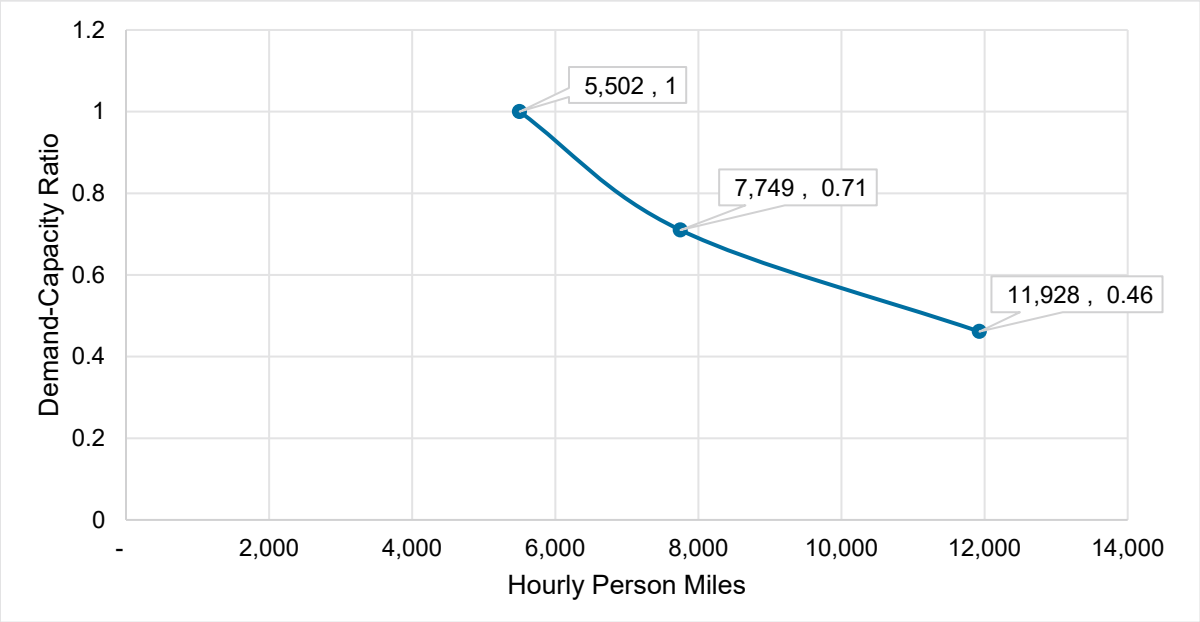
If the weighted DC ratio were to increase to a ratio of 0.71 (as opposed to 0.46 estimated today) then the expected travel demand of the land use development would require 7,749 in new person miles of hourly capacity. A DC of 0.71 is similar to a level of service (LOS) "C."[12] LOS is a common way to describe various ways the system is experienced by users (travel speed, average delay per vehicle, time waiting for a bus, experience walking or biking, etc.).

To put the DC ratios in perspective, imagine if the city expects that all new facilities would be fully utilized (DC =1), then the person miles of capacity *supplied* would equal those person miles *demanded* (5,502). Figure 6 visualizes the relationship between the supply provided and the demand (Table 9) using the DC ratio. Specifically:

- Supply equals demand at fully utilized capacity provided (DC ratio of 1.0) at 5,502 person miles
- Supply at the existing 0.46 DC ratio equals 11,928 person miles (lowest point)
- Supply at the service standard threshold of 0.71 DC equals 7,749 person miles (middle point)

[12] See Appendix Figure 2 for the Highway Capacity Manual summary of VC ratio and Level of Service.

FIGURE 6: SUPPLY PROVIDED AT DIFFERENT DC RATIOS



The amount of existing planned projects by the year 2035 is expected to add 24,569 new person miles of capacity during the PM peak hour (Table 8). However, the land use growth expected and modeled by the year 2034 suggests that 7,749 person miles of hourly capacity (at a LOS "C" DC ratio of 0.71) would be needed.

This suggests that the share of new capacity needed to serve the travel demands of new land use development and growth by the year 2035 is only 32% of the overall amount of new capacity being created (Equation 1).

EQUATION 1: LAND USE DEMAND ON NEW CAPACITY BY 2034

$$\frac{(7{,}749\ person\ miles\ of\ demand\ by\ 2035)}{(24{,}569\ person\ miles\ of\ capacity\ created\ by\ 2035)} = 32\%$$

This impact fee analysis reinforces the findings from other regional and local long range planning efforts that the transportation capacity to be constructed by 2035 is sufficient to accommodate the travel and transportation needs of city growth and land development beyond the year 2035.

3.0 PROJECTS

3.1 PROJECT IDENTIFICATION

This section summarizes the identification and selection of transportation projects that comprise the transportation impact fee. The projects have been developed over many years through the course of several transportation studies, plans, and community conversations. The many planning studies provide a myriad of possible transportation system investments that would be necessary to meet the mobility needs of future residents and employees.

These projects were identified by synthesizing numerous studies, reviewing the capital program, expected new infrastructure with land development, and prioritizing projects with various committees and other stakeholder groups.

The city has identified six priority projects that are eligible for impact fee funding. These are a subset of the projects included in the total transportation capacity shown in Table 8. The impact fee priority projects are those that widely benefit the city at large as well as provide important multimodal connections that support the city's mode shift goals. Several of the projects would create additional bicycling and pedestrian capacity by shifting curb lines, removing parking, with some reallocating road space away from vehicles toward walking and biking. The portion of the projects eligible for impact fee funding has been adjusted to account for replacing or removing capacity, as impact fee funds can only be used to build new capacity.

TABLE 10: IMPACT FEE PROJECT LIST

Project Name	Description
Union Street	Road Reconstruction (protected bike lanes to replace the existing bike lanes, moving curb, removing parking, narrowing lanes)
Battery Street	Road Reconstruction (Four to three-lane conversion, separated two-way bike facility on west side, improved sidewalks)
North Street	Road Reconstruction (on-street bike lanes, removing parking, narrowing lanes)
Pearl Street	Road Reconstruction (protected bike lanes, moving curb, removing parking, narrowing lanes)
Main Street (East)	Road Reconstruction (shared use path connectivity)
Colchester Ave	Road Reconstruction (Shared Use Path, improved sidewalk, transit pull outs, new signals)

The full list of projects considered for impact fee funding comes to $44.3 million dollars, as shown in Table 11. However, some projects are not fully eligible for 100% impact fee funding because some portions of the project are replacing existing transportation capacity or replacing non-transportation components (i.e., stormwater systems). The portion of the new capacity eligible for impact fee funding comes to $34.2 million dollars.

3.2 COSTS AND UTILIZATION OF PROJECTS

The cost of new projects is the cost of new capacity intended to meet the city's transportation needs into the future and be in alignment with the city's comprehensive plan. Projects that are eligible for impact fee funding must create new capacity and benefit the community and those paying impact fees. The projects themselves can be funded either fully or partially with impact fees. The costs of the projects must also be fairly attributed to growth and that the new users are not contributing or mitigating more than their level of impact on the system.

The total cost (col [A]) is discounted to account for the amount of new capacity being added, as well as whether the new capacity will be used by local Burlington land use or serve through traffic. The share of new capacity associated with a project to serve through traffic (users who need capacity but don't have an origin or destination in the city) requires non-impact fee funding to cover that share of the cost (col [E]). The remaining impact fee eligible capacity is then assessed to new users (col [G]).

The funding details for each impact fee project are shown in Table 11.

TABLE 11: BURLINGTON IMPACT FEE PROJECT LIST

Project	Total project cost [A]	Percent Eligible for Transportation Impact Fee (% new capacity, associated with new growth and new users) [B]	Local Users vs External Users (estimated %) [C]	Total cost (Impact fee eligible portion) [D=A*B]	Total cost (Non impact fee eligible) [E=A-D]	Estimated Grant and non-local funding available [F]	Local Share of Eligible Capacity [G=A-F]
Union Street	9.6 $/m	62%	100%	6.0 $/m	3.7 $/m	7.710 $/m	1.9 $/m
Battery Street	4.3 $/m	50%	100%	2.2 $/m	2.2 $/m	3.442 $/m	0.9 $/m
North Street	8.3 $/m	100%	100%	8.3 $/m	0.0 $/m	6.609 $/m	1.7 $/m
Pearl Street	6.5 $/m	100%	100%	6.5 $/m	0.0 $/m	5.177 $/m	1.3 $/m
Main Street (East)	8.7 $/m	90%	90%	7.8 $/m	0.9 $/m	6.939 $/m	1.7 $/m
Colchester Ave	7.0 $/m	50%	95%	3.5 $/m	3.5 $/m	5.600 $/m	1.4 $/m
Totals	**44.3 $/m**			**34.2 $/m**	**10.2 $/m**	**35.5 $/m**	**8.87 $/m**

The table shows the elements of each project including the total cost and the share of that project associated with growth as well as local land development. The columns include:

- Column [B] accounts for the share of the cost associated with new capacity
- Column [C] accounts for share of the project that serves local traffic (trips with an origin or an end in the city)
- Column [D] accounts for the cost of new capacity to be allocated among all trips consuming that capacity.
- Column [E] shows the cost of the project that is not able to use impact fee funds. Need to confirm that Column [F] exceeds Column [E]. Otherwise, other local funding would be needed.
- Column [G] shows the impact fee eligible capacity to be funded through local impact fees.

Grant Support and Other Nonlocal Support

The share of the projects eligible for impact fee funding was shown in Table 11, where $34.2 million of new capacity is eligible for impact fee funding, leaving around $10.2 million associated with non-impact fee eligible costs. Much of these projects are eligible for federal funding support using the traditional 80/20 cost sharing split. If the city is to rely on obtaining 80% of the project cost through grants and other federal support that would dramatically reduce the city's share of the cost for delivering the impact fee projects.

Table 11 shows the full cost of the projects and the estimated grant and non-local impact fee funding assigned to each project shown in Column [F]. The amount of non-local funding will be used to pay for the non-impact fee eligible capacity. Column [F] funds exceed the non-impact fee capacity costs. The Column [F] funds first are used to pay for the non-impact fee eligible capacity and then the balance is used to reduce the cost of the project associated with the impact fee.

The balance, shown in Column [G] is the remaining local impact fee eligible capacity that will be paid for by new land development.

New Growth Share of Capacity

The estimated capacity associated with the impact fee projects is shown in Table 12.

TABLE 12: IMPACT FEE PROJECT CAPACITY IN PERSON MILES

Project	Total Project Cost [A]	Total cost (Impact fee eligible portion) [C]	Additional Hourly Capacity [B]
Union Street	9.6 $/m	6.0 $/m	1,197
Battery Street	4.3 $/m	2.2 $/m	186
North Street	8.3 $/m	8.3 $/m	1,263
Pearl Street	6.5 $/m	6.5 $/m	2,596
Main Street (East)	8.7 $/m	7.8 $/m	1,188
Colchester Ave	7.0 $/m	3.5 $/m	3,517
Totals	**44.3 $/m**	**34.2 $/m**	**9,947**

Equation 1, above, indicates that 32% of the capacity added over the next 10 years would be consumed by the demand generated by the land use development over that same time period. Therefore, the cost of the impact fee projects can also be spread over a longer period, with only 32% of the costs imposed on land use growth and development over the next 10 years.

EQUATION 2: IMPACT FEE PORTION OF PROJECTS BY 2035

32% of capacity need attribute to growth by 2035	X	$34.16 million eligible project costs	=	$10.78 million

Because the capacity of the projects to be built over the next ten years will likely have available capacity to accommodate new years beyond 2035, the city would have the option to continue to

collect impact fees beyond the year 2035 as long as the demand to capacity across the system is below the 0.71 DC service standard (DC < 0.71) used in this study.

The impact fees can be designed in various ways to fairly assess growth to mitigate its impact on the system. The impact fee projects will add new capacity to the system, but the amount of new capacity cannot exceed the level of impact imposed by the new development (e.g., the level of service cannot be improved above existing levels using impact fees).

The analysis indicates that the list of impact fee eligible projects provide sufficient additional capacity (9,947 person miles of travel) to more than mitigate the demand that is anticipated with growth and land use development by 2035 (5,502 person miles of travel, see Table 9). It is estimated that the total capacity added to the city of Burlington's system over the next 10 years will provide nearly 25,000 person miles of capacity.[13] The total capacity is a mix of impact fee funded projects and non-impact fee funded projects.

The multimodal transportation system has existing spare capacity. As growth and development continue, the system will absorb that demand, however, additional capacity is still warranted because of the need to increase the diversity and variety of facility types to attain the desired mode share goals shifting trips away from vehicles, towards walking and biking. It is estimated that the land use growth would require 7,749 person miles of capacity if the new capacity is expected to have a DC ratio of 0.71. To contrast this, using the existing DC ratio (0.46), the new land use development would require nearly 12,000 person miles of capacity.

In summary, the land use changes will generate additional demand for travel in Burlington. The level of service, or utilization of the capacity, is expected to increase, even with the additional capacity. The land use changes and resulting users are not expected to use all of the capacity anticipated to be constructed over the next ten years, resulting in fees that can continue until the impact fee capacity is exhausted.

4.0 BASE IMPACT FEE

4.1 BASE IMPACT FEE

Base impact fees are the initial, unadjusted fees which are later discounted for credits and other incentives. The fee will be charged on the number of PM peak hour vehicle trips, consistent with other communities in Vermont and the Vermont Agency of Transportation's Statewide impact fee enabling legislation, per Act 145 of 2014-Transportation Impact Fees (10 VSA Sections 6101-6111).

Thirty-two percent (32%) of the new impact fee project capacity is needed to meet the needs of land use development by the year 2035. The impact fee costs allocated to land use growth and

[13] Twenty one projects are identified for implementation during the next ten years shown in Appendix B. Only a subset are eligible for impact fee funding.

development accounts for this 32% cost share. This is the base fee which would be the legally defensible maximum the city could assess to new land use development to pay for their contribution to the increased capacity in the transportation system by the year 2035.

The base impact fee is derived in Equation 3.

EQUATION 3: BASE IMPACT FEE

$$Base\ fee = \frac{Cost\ of\ new\ projects \times Growth\ Share\ of\ 2035\ Capacity}{Total\ Growth\ (new\ PM\ trips\ per\ hour)}$$

Table 13 shows the derivation of the base impact fee with the two different assumptions on the level of grant support to reduce the cost of the impact fee projects. The table shows the magnitude of the impact fee if the presumed federal grant share is not attained to offset the cost of the impact fee projects.

TABLE 13: BASE IMPACT FEE

Scenario	Cost of Impact Fee Capacity [A]	Growth Share of New Capacity by 2034 [b]	Total Growth (PM peak hour Veh Trips) by 2035 [C]	Base Impact Fee Per PM peak hour vehicle trip [D]
Six Projects with Zero Grant Support	~34.2 $/m	32%	2,200 [local growth] 160 [through traffic] 2,360 total veh trips	$4,632
Six Projects with 80% Grant support	~8.87 $/m	32%	2,200 [local growth] 160 [through traffic] 2,360 total veh trips	$1,203

The fee will be based on the **vehicle trips during the PM peak hour** as the unit of measure for the impact on the transportation system and its alignment with the goals identified in the city's comprehensive transportation plans, its consistency with Institute of Transportation Engineers (ITE) approach to traffic impact studies, and ability to be monitored and empirical derived for any specific land use. Impact fees are assessed on the primary vehicle trips generated by a land use change that increases trip generation from a previous use.

A trip generation study conducted as part of a traffic impact study or use of the Institute of Transportation Engineers Trip Generation Manual would determine the number of primary vehicle trips, which would account for the total trips and subtract pass-by trips. If the land use change replaces an existing use, the trips generated from the existing use shall be subtracted and only the difference in trips are assessed the fee. This applies to expansions, changes in land use types, and land use redevelopments.

The **plan based impact fee method** is used that accounts for a forecast land use and travel demand and specific list of transportation investments. The approach provides several benefits including its strong alignment with the state statutes of identifying investments in the capital program, the extensive work done in the city and the region to identify specific investments, and the ability to selectively decide which of the overall projects are best suited for impact fee

funding. The plan based approach is the most common in the northeast and in multimodal transportation impact fee studies in general.

The amount of new capacity being added to the system by the year 2035 is extensive. So much so that the projected increase in trips associated with the 12% increase in population, and 8% in jobs in the city is expected to consume only 32% of the new capacity, with an increasing degree of utilization relative to today. This expectation that the overall transportation capacity will be more heavily utilized in the future is common and is in agreement with impact principles that require that impact fees do not improve standards beyond what is experienced today. This is consistent with the city's comprehensive vision of improved walking, biking, and transit which has more demand using existing multimodal capacity as well as the new capacity.

4.2 CREDITS

Credits are adjustments to the base impact fee that a land use would be assessed. Typically, two credits are possible; infrastructure credit and revenue credits. The credits are applied after the base impact fee is calculated, as per equation:

Impact Fee = (Cost per PM Peak Hour Trip x New PM Peak Hour trips) – (Applicable Credits)

Infrastructure Credits

Any land use development that physically constructs any project identified in Table 10 is eligible for a reduction in impact fees, up to the total amount of the impact fee liability.

When the credit is in excess of the impact fee liability, the City Council has the authority to retain the balance of that credit and apply that balance to future land development projects carried forth by that same business or land development entity. The city ordinance determines how any credit may be used, as long as the credit does not exceed the cost of the project used to develop the impact fee, and the duration of time that the credit may be in effect before expiring.

The credit is also applicable even if the project was in satisfaction of a condition of the land use development permit imposed during the development review process. This reduces the perception of double payments and incentivizes development in areas identified for transportation infrastructure.

Revenue Credits

Revenue credits discount the base impact fee to reduce the chance that a land-use development in the city would be funding the same capital improvement through two different funds. This frequently occurs when the land use owner (e.g., developer) pays property taxes and a portion of which goes to fund the capital project that the impact fee contributed toward. In this case, it is necessary to offset the impact fee by a credit value to eliminate the double payment toward the same capacity. The credits equal the discounted present value of the stream of tax payments used for those expenditures.

The City of Burlington expects to obtain non-local funding support through federal funds that will pay for the portion of capacity not eligible for impact fee funding. Therefore, no revenue credits are necessary, as only the share of projects associated with new users will be assessed to new land use development.

APPENDIX A. CAPACITY OF INFRASTRUCTURE

The facility capacities are shown in the table below. The capacities are derived from several sources and represent hourly flows. However, this analysis attempts to reflect the situation that while the capacity of a facility such as a protected bike lane or a sidewalk may have a high point capacity, the trip lengths are relatively short and the collective benefit to the city is muted. Over time as trip lengths increase for bike trips the net capacity of the system can increase. However, at this time this approach using a conservative trip length estimate was used which reduced the capacity relative to the vehicle trip length modeled for the city. For example, the vehicle trip length is 1.8 miles. If a trip length on a bike lane is averaging 0.5 miles, it is 28% of the vehicle trip length. Thus, the capacity of bike lanes would be 28% of what is the hourly point capacity (28% x 2,000 = 556).

APPENDIX FIGURE 1: PERSON MILE CAPACITIES FOR FACILITY TYPES

Trip Length Accounting	Normalized to Vehicle Length	Facility	Existing VC Ratio (existing utilization of capacity)	Future Acceptable VC Ratio (future utilization of capacity)	Hourly Point capacity (LOS E)	Trip Length Adjusted Hourly Point capacity (LOS E)
0.5	28%	Bike lanes	0.25	0.6	2,000	556
0.75	42%	Protected Bike Lanes (2-way)	0.25	0.6	7,000	2,917
0.75	42%	SUP (10')	0.35	0.5	2,500	1,042
0.75	42%	SUP (8')	0.35	0.5	1,800	750
0.75	42%	SUP 12'	0.35	0.45	2,700	1,125
1.8	100%	Road lane (with 1.2 occupancy)	0.3	0.75	2,160	2,160
0.25	14%	Sidewalk 3'	0.4	0.65	1,350	188
0.25	14%	Sidewalk 4'	0.4	0.65	1,800	250
0.25	14%	Sidewalk 5'	0.4	0.65	2,200	306
0.25	14%	Sidewalk 6'	0.4	0.65	2,700	375
0.25	14%	Sidewalk 7'	0.35	0.6	3,150	438
0.35	19%	Sidewalk 8'	0.35	0.6	3,600	700
0.35	19%	Sidewalk 9'	0.35	0.6	4,050	788
0.35	19%	Sidewalk 10'	0.35	0.6	4,500	875
0.5	28%	Sidewalk 11'	0.35	0.6	4,950	1,375
0.5	28%	Sidewalk 12'	0.35	0.6	5,400	1,500

The Highway Capacity Manual (HCM) adopts the LOS approach.[14] Because of the simplicity, LOS has become extremely popular in practice.[15] The LOS can be determined by various traffic quantities, such as density, speed, volume to capacity ratio, and maximum service flow rate. The LOS of a roadway can be determined by the scale intervals of the volume to capacity ratio (V/C), as shown in Appendix Figure 2 below.[16]

APPENDIX FIGURE 2: HCM DELAY AND VC RATIO

LoS Class	Traffic State and Condition	V/C Ratio
A	Free flow	0–0.60
B	Stable flow with unaffected speed	0.61–0.70
C	Stable flow but speed is affected	0.71–0.80
D	High-density but the stable flow	0.81–0.90
E	Traffic volume near or at capacity level with low speed	0.91–1.00
F	Breakdown flow	>1.00

[14]. Manual, H.C. Transportation Research Board Special Report 209; Transportation Research Board: Washington, DC, USA, 1994.
[15] Wan, C.; Yang, Z.; Zhang, D.; Yan, X.; Fan, S. Resilience in transportation systems: A systematic review and future directions. Transp. Rev. 2018, 38, 479–498. [CrossRef] and Tang, J.; Heinimann, H.R. A resilience-oriented approach for quantitatively assessing recurrent spatial-temporal congestion on urban roads. PLoS ONE 2018, 13, e0190616.
[16] Afrin, Tanzina & Yodo, Nita. (2020). A Survey of Road Traffic Congestion Measures towards a Sustainable and Resilient Transportation System. Sustainability. 12. 4660. 10.3390/su12114660.

APPENDIX FIGURE 3: EXISTING AND FUTURE MILES AND VC RATIOS OF FACILITY TYPES

Type	Existing Miles	Existing person miles capacity (PMC)	Weighted Existing VC ratio	Future miles by 2034	Change in PMC (future – existing)	Future PMC	% increase in facility miles	Future VC ratios
Standard bike lanes	25.1	13,952	0.250	31.4	3,497	17,449	25.1%	0.600
Protected bike lanes	0.3	981	0.250	4.5	12,161	13,142	1240%	0.600
Road lanes	399.9	863,884	0.500	400.7	1,584	865,467	0.2%	0.750
Shared use paths	6.5	5,788	0.350	11.1	4,698	9,908	71.2%	0.483
Sidewalk - Less than 5 ft	81.5	17,837	0.400	81.5		17,837	0.0%	0.650
Sidewalk - 5-10 ft	44.9	26,034	0.370	48.8		28,291	8.7%	0.620
Sidewalk - Over 10 ft	2.2	3,223	0.350	2.2		3,223	0.0%	0.600
Sidewalk - NaN	0.6	392	0.373	0.6	2,630	392	0.0%	0.623
Total	561.1	932,092	0.46	580.8	24,569	955,711		0.71

APPENDIX B. TRANSPORTATION PROJECTS

APPENDIX FIGURE 4: TRANSPORTATION PROJECTS

Project ID	Project name	Impact fee project	Constructed or functional by 2034	Road miles	Road PMC	SUP miles	SUP PMC	Sidewalk miles	Sidewalk PMC	Protected Bike Lane Miles (length)	Protected Bike Lane PMC (2-way)	Bike lane miles	Bike lane PMC	Hourly capacity	Hourly capacity of new impact fee projects
101	Railyard Enterprise Project	0	1	0.7	1472.7	0.3	355.1	0.3	865.9				0.0	2,694	0
102	Intervale Side Path	0	1		0.0	0.4	269.9		0.0				0.0	270	0
103	Champlain Parkway Phase 1	0	1	1.4	3024.0	0.7	729.2		0.0				0.0	3,753	0
104	Champlain Parkway Phase 2	0	1		0.0	0.6	625.0		0.0				0.0	625	0
105	CityPlace Public Improvements (Pine St)	0	1	0.1	286.4		0.0		0.0				0.0	286	0
106	Great Streets Main Street	0	1		0.0		0.0	0.5	696.0	0.0	0.0	0.5	284.1	980	0
107	Winooski bridge & bike/ped	0	1		0.0	0.1	106.5		0.0				0.0	107	0
108	Queen City Park Rd SUP	0	1		0.0	1.5	1566.4		0.0				0.0	1,566	0
109	Lake Street/Penny Lane SUP	0	1		0.0	0.0	42.6		0.0				0.0	43	0
110	Queen City Park Rd Bridge	0	1		0.0		0.0		0.0				0.0	0	0
112	North Beach Bridge	0	1		0.0		0.0		0.0				0.0	0	0
113	Cobalt Controllers	0	1		0.0		0.0		0.0				0.0	0	0
114	Battery & College	0	1		0.0		0.0		0.0				0.0	0	0
115	Battery & King	0	1		0.0		0.0		0.0				0.0	0	0
116	Battery & Maple	0	1		0.0		0.0		0.0				0.0	0	0
117	Battery & Pearl	0	1		0.0		0.0		0.0				0.0	0	0
118	Main & Willard	0	1		0.0		0.0		0.0				0.0	0	0
119	General Inventory	0	1		0.0		0.0		0.0				0.0	0	0
120	Remove Wood poles	0	1		0.0		0.0		0.0				0.0	0	0
121	Upper Main Street	0	1		0.0		0.0		0.0				0.0	0	0
122	Annual Street & Sidewalk Paving	0	N/A		0.0		0.0		0.0				0.0	0	0
123	Union Street	1	1		0.0		0.0		0.0	0.7	1933.4	-1.3	-736.5	1,197	1,197

124	North Ave/Shore Road	0	1		0.0		0.0		0.0				0.0	0	0
125	North Ave/127	0	0		0.0		0.0		0.0				0.0	0	0
126	Curb & Bollards	0	N/A		0.0		0.0		0.0				0.0	0	0
127	MicroVision Cameras	0	1		0.0		0.0		0.0				0.0	0	0
128	FY2021 Install TPIs	0	1		0.0		0.0		0.0				0.0	0	0
129	FY2021 Install TPIs	0	1		0.0		0.0		0.0				0.0	0	0
130	FY2021 Install TPIs	0	1		0.0		0.0		0.0				0.0	0	0
131	ONE Greenway Hardscape	0	1		0.0		0.0		0.0				0.0	0	0
132	N Champlain Protected Bike Lanes & Manhattan Dr. Bike Lanes	0	1		0.0		0.0		0.0			0.5	274.0	274	0
133	Battery Street	1	1	-0.2	-532.2		0.0		0.0	0.2	718.7		0.0	186	186
134	Home/Shelburne Rd Intersection	0	1		0.0		0.0		0.0				0.0	0	0
135	NNE Sidewalks (new and gaps)	0	1		0.0		0.0	0.7	244.9				0.0	245	0
136	Pearl & Prospect Intersection	0	0		0.0		0.0		0.0				0.0	0	0
137	East Ave Traffic Calming	0	1		0.0		0.0		0.0				0.0	0	0
138	Plattsburg Ave	0	0		0.0		0.0	0.5	552.4				0.0	0	0
139	Various Locations	0	0		0.0		0.0		0.0				0.0	0	0
140	North Ave	0	1		0.0		0.0	3.3	1116.9			3.3	1823.5	2,940	0
141	North Street	1	1		0.0		0.0		0.0			2.3	1262.6	1,263	1,263
142	Pearl Street	1	1		0.0		0.0		0.0	0.9	2596.3		0.0	2,596	2,596
144	Main Street (East)	1	1		0.0		~~0.0~~		0.0	0.4	1187.7		0.0	1,188	1,188
145	Shelburne Street	0	1	-1.5	-3240.0		0.0		0.0	1.0	2916.7		0.0	-323	0
146	68 Sears Lane Roadways	0	0		0.0		0.0		0.0				0.0	0	0
147	CityPlace Public Improvements - St Paul St	0	1	0.3	572.7		0.0		0.0				0.0	573	0
148	Colchester/Barrett Intersection	0	0		0.0		0.0		0.0			0.1	52.6	0	0
149	Colchester Ave	1	1		0.0	1.0	1003.0	-1.0	-294.2	1.0	2808.4		0.0	3,517	3,517
150	Great Streets - Bank & Cherry	0	1		0.0		0.0		0.0				0.0	0	0
151	Plattsburg Ave Bike Lanes	0	1		0.0		0.0		0.0			1.1	589.2	589	0

APPENDIX C. TRIP GENERATION ESTIMATES

The CCRPC travel demand model was originally estimated the local vehicle trips for Burlington in the 2020 and 2030 mode years per the table below. Due to the way the long range growth projections were made, using a linear growth between today and 2050, any 10-year period has a similar level of growth and therefore, can appropriately be used to estimate the growth from 2025 to 2035 that is used in the impact fee study.

YEAR	PM PEAK MODEL TRIPS	DAILY MODEL TRIPS
2020	15,252	179,544
2030	16,479	194,831
Difference	**1,227**	**15,287**

The travel model may slightly underpredict the number of trips to be generated by the land use in any one community or network due to trip chaining as well as the trips and trips that start and end in the same TAZ may be discounted as internal capture, when in reality many of those trips are likely to be generated. The bottom-up approach (discussed below) suggests that internal capture and pass-by may be equivalent to around 900 vehicle trips. Adding the 900 to the 1,227 suggests the model could be as high as 2,200 new vehicle trips if the model unrealistically assumes no trip chaining and no internal capture.

A bottom-up approach is valid and important to compare to the modeling results, especially since the bottom-up approach using the ITE Trip Generation Manual will be used by engineers and planners representing any specific land development application. A manual adjustment process is required to take the preliminary ITE base trip generation estimates and account for site and land use characteristics which can reduce the number of vehicle trips. These adjustments include the intensity of the development, the TDM incentives, internal mixed-use capture of the site and immediate nearby sites, pass-by reductions, and working from home trip reductions. The extent to which these reductions and adjustments apply to Burlington varies by area within the city. The areas of the most intense land use change would warrant the highest degree of adjustment, and likewise, the areas of the least land use change are likely to see the least amount of adjustment. Additionally, the adjustments are not globally applied to all land uses equally. The sum of the factored trip generation in the two regions of the city of 2,360 new PM peak hour vehicle trips.

The result of the two approaches suggest that the 2,360 PM peak hour vehicle trips is a reasonable estimate after factoring up the travel model and factoring down the ITE Trip Generation estimates.

The following tables show the manual 'bottom up' adjustments to typical ITE Trip Generation rates for the different land use types based on the land use patterns surrounding those land uses. The majority of trips are anticipated in the areas with more intense growth.

AREAS OF MORE INTENSE GROWTH

GROWTH	UNIT CHANGE	RATE (TRIPS PER UNIT PER PM PEAK HOUR)	PM PEAK HR TRIPS	INTENSITY	TDM	INTERNAL CAPTURE	PASS-BY	WFH	PM PEAK HR TRIPS (NET ADJUSTMENTS)
HH	2168	0.5	1084.00	0%	15%	5%	0%	22%	629
Accommodations	164	0.800	131.20	5%	10%	5%	5%	5%	92
College & University	18	0.910	16.38	5%	15%	0%	0%	21%	10
Commercial	480	0.390	187.20	0%	20%	15%	8%	21%	67
Industrial	507	0.440	223.08	5%	10%	0%	0%	16%	154
Institutional	213	1.400	298.20	5%	15%	0%	0%	21%	176
K12	88	1.400	123.20	0%	10%	0%	0%	0%	111
Retail	941	1.500	1411.50	5%	20%	15%	32%	0%	395
Special Commercial	136	0.390	53.04	0%	20%	0%	32%	0%	25
Special Retail	58	1.250	72.50	0%	20%	0%	30%	0%	36
			3,600	3%	17%	8%	14%	11%	**1,695**

AREAS OF LESS INTENSE GROWTH

GROWTH	UNIT CHANGE	RATE (TRIPS PER UNIT PER PM PEAK HOUR)	PM PEAK HR TRIPS	INTENSITY	TDM	INTERNAL CAPTURE	PASS-BY	WFH	PM PEAK HR TRIPS (NET ADJUSTMENTS)
HH	126	0.75	94.50	0%	5%	5%	0%	18%	68
Accommodations	7	0.800	5.60	0%	4%	5%	0%	5%	5
College & University	8	0.910	7.28	0%	5%	0%	0%	20%	5
Commercial	338	0.390	131.82	0%	5%	5%	15%	20%	73
Industrial	86	0.440	37.84	0%	5%	0%	0%	15%	30
Institutional	172	1.400	240.80	0%	5%	0%	0%	20%	181
K12	28	1.400	39.20	0%	2%	0%	0%	0%	38
Retail	123	2.000	246.00	0%	3%	5%	15%	0%	189
Special Commercial	60	0.390	23.40	0%	3%	0%	15%	0%	19
Special Retail	15	2.000	30.00	0%	3%	0%	15%	0%	25
			856	0%	4%	3%	8%	12%	**633**