Staff Report – Transportation Element

To: Burlington Planning Commission

From: Brad Johnson, Community Development Director _____

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Subject: Comprehensive Plan Update – Transportation Element, Technical Report

DRAFT

Summary

Burlington's comprehensive plan must include a transportation element (RCW 36.70A.070). The transportation element shows how the city's future transportation needs will be met. This report summarizes what the Growth Management Act (GMA) requires with respect to transportation, describes transportation planning techniques, and addresses the crucial connection between transportation and land use. A list of recommended changes is also provided at the end of the report.

Over the next 20 years the city will experience significant growth, including 1,448 dwelling and 3,516 jobs. Fiscal constraints coupled with fundamental shifts in development patterns, housing characteristics, and economic conditions will require that the city reimagine its transportation system. While more detailed recommendations are presented later in this report, the most significant points can be summarized as follows:

- **Coordinate land use and transportation.** The transportation system must be consistent with, and support, the types of growth described in the land use element. Over the next 20 Burlington's population and employment base will experience significant growth, and most of this growth will be accommodated through infill and redevelopment. A large percentage of future growth will be directed to the Burlington Boulevard corridor and the City's downtown. The City should build invest in transportation improvements that facilitate the type of development it wants to see.

- **Build a better connected transportation system.** Traditionally cities were developed with an orderly grid of streets with frequent intersections and short blocks. Later transportation systems became more hierarchical with less frequent intersections, wide streets, and numerous dead-ends. As a result large volumes of traffic were routed to a

small number of arterial streets increasing travel distances and causing traffic problems. Today the City suffers from a lack of continuous routes in many places. As a result the city's transportation system lacks redundancy and travel distances are much greater than they need to be, even between points that are geographically close to one another. These deficiencies increase emergency response times and make it difficult for people to get around.

- **Make it possible for more people to get where they're going without a car.** While most of city' residents get where they're going by car, many others including children, seniors, people with disabilities, and those who cannot afford to drive do not. Often, a lack of convenient routes, or suitable sidewalks means that people are forced to drive even when making short trips. Finally, as the percentage of growth occurring in, or near, commercial areas increases, the demand for sidewalks, bike lanes, paths, and other similar improvements will increase.

- **Transportation choices must be financially sustainable.** For Burlington residents, transportation is costs often represent the second largest household expense after housing. At the same time the amount of revenue available to the city to expand the transportation system has been declining. In order to minimize monthly household expenses and ensure scare public resources are used efficiently the city should focus on maintaining existing facilities and upgrading existing structurally deficient roads. Investments in new capacity should focus on improving connections.

Planning Requirements

The transportation element must show how the transportation infrastructure and services needed to support projected growth and development will be provided. Importantly, the transportation element must be consistent with, and implement the land use element (RCW 36.70A.070 (6)). The transportation element must include an inventory of existing transportation system components, a projection of future demand, and a list of improvements needed to support future population and employment growth. Importantly, the City's transportation element must be consistent with state and regional plans.

The City is required to identify "level of service standards" (LOS) for arterials and transit routes. The purpose of identifying level of services standards is to evaluate the performance of transportation facilities and systematically analyze the need for future improvements. If transportation system components fall below adopted LOS standards, improvements must be identified that will bring the system into compliance. Essentially, LOS standards are used describe how well a community expects their transportation system to function and represent an opportunity to balance cost and performance considerations. Importantly, the GMA only requires that the City adopt level of services standards. It does not however, specify the level of service that must be provided.

In addition to identifying the improvements needed to support future growth, the transportation element must also show how the improvements will be paid for. Specifically, the GMA requires the City pay for the required improvements. If the funding available is insufficient to meet future needs, the City must either identify new sources of funding or reassess the land use element to minimize transportation impacts. The City may also mitigate traffic impacts by using "transportation demand management techniques" to reduce traffic and travel, or to shift travel from expensive modes (such as single occupant cars) to lower cost modes (such as walking). This means there's no free lunch when it comes to transportation planning.

The most important GMA requirements related to transportation can be summarized as follows:

- The City's transportation plan must be consistent with, and support, the land use element
- An inventory of existing transportation facilities and services must be provided
- A forecast of future transportation demand, based on the growth projection included in the land use element, must be prepared
- By comparing the existing inventory to the projected future travel, the City must prepare a list of projects needed to support planned growth, and identify the funding sources that will be used to pay for them.
- The transportation element must be consistent with the plans adopted by neighboring jurisdictions, regional planning agencies, and the State of Washington
- The City's six year transportation improvement plan (TIP) must be based on, and fully consistent with, the transportation element of the comprehensive plan

Transportation Planning Principles

Approaches to transportation planning tend to fall into one of two categories. As will be shown, neither approach has produced satisfactory results. On one end of the spectrum, seemingly obvious solutions are applied to isolated problems without giving much thought to the big picture (addressing a congested spot by adding an additional lane for example). By ignoring important underlying concepts and broad considerations this approach frequently results in unintended consequences. Often the "solutions" simply create more problems or move problems somewhere else. For example widening a road in one spot may simply move the congestion to the next intersection.

At the other end of the spectrum are techniques that rely heavily on complex computer programs and sophisticated mathematical models. These techniques often hide flawed or poorly supported assumptions behind a veil of mathematical complexity. This approach often produces results that, while exceedingly detailed and precise, are inaccurate or misleading nonetheless. While mathematical models can be extremely helpful, the quality of the model outputs is tied directly to the quality of the inputs. Faulty assumptions simply lead to faulty results.

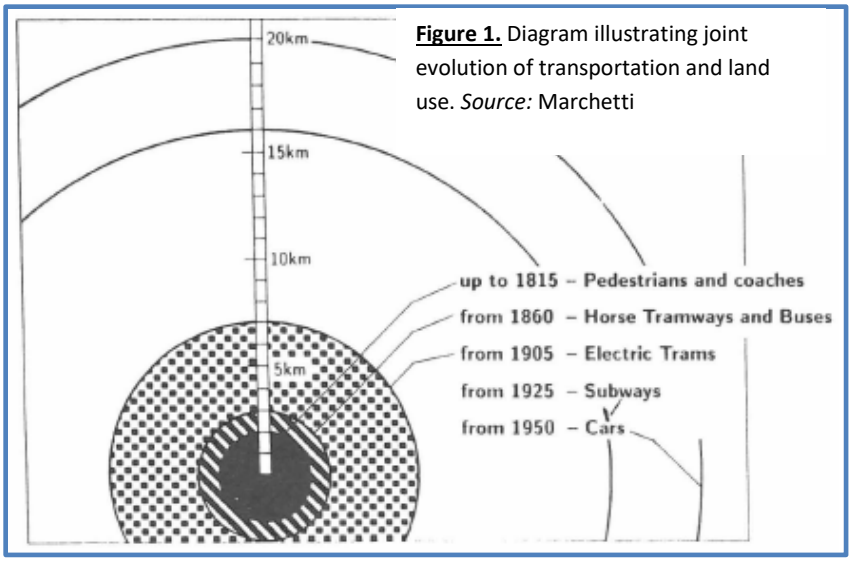


Figure 1. Diagram illustrating joint evolution of transportation and land use. *Source:* Marchetti

The pitfalls associated with the two approaches described above can be avoided with a better understanding of how transportation systems work and how transportation relates to development. The recommendations in this report draw a direct connection between how a city is developed and how its transportation system functions. Two important concepts guide this relationship, the "constant travel time theory" and "induced demand".

The first concept, known as the constant travel time theory", argues that throughout history, regardless of the dominate mode of transportation, or available technology, people tend to spend about an hour a day traveling (Marchetti). When transportation modes are slow, people simply travel shorter distances and, in the absence of constraints, the intensity with which land is used and developed increases. With the introduction of transportation improvements that allow travel speeds to increase, the distance people travel each day also increase. Essentially, people use the time they save from transportation improvements to travel further (Fleischer & Tir). The constant travel time theory explains why cities have gradually become more spread out as transportation has become faster. As figure 1 illustrates, early cities were limited by the distance a person could reasonably walk. Then, as travel speeds increased the distances people could travel grew allowing cities to become more spread out.

The second concept, which is closely related to the first, is known as "induced demand". Because travel time savings result in longer trips, or more travel, reducing travel times by speeding up traffic creates a self-defeating cycle. All things being equal, widening roads rarely relieves congestion (Duranton, Gilles & Turner, Matthew). Instead wider roads simply enable greater travel distances and lead to more dispersed development patterns. While somewhat counter intuitive, transportation problems can often be addressed more cost effectively by changing the way land is used and developed.

Transportation and the Growth of Cities

Two terms are frequently when discussing land use and transportation; mobility and accessibility. While similar, and related, these terms differ in important ways. While mobility is nothing more than a simple measure of travel speed, accessibility describes how easy it is for people can get where they're going (Zhang, Zu, & Li, 2009; Litman, 2019). At first glance these terms may seem to be the same. Most people assume, not unreasonably, that moving faster

will allow them to get where they want to go more quickly. However, by focusing exclusively on speed, this assumption ignores the important role of proximity (how close things are to one another).

Accessibility is frequently measured in terms of the number of jobs or businesses that can be reached within a given amount of time and tends to be highest in central areas and lowest in remote or peripheral locations (Ewing, Bartholomew, Winkelman, Walters & Chen, 2007). As a result, the most accessible locations tend to be those with the greatest concentration of jobs, housing, and services. However, in such places travel speeds tends to be slow (Levine, Grengs, Qinggyun, & Shen, 2012).

Whether they realize it or not, most people intuitively understand this relationship. For example, a freeway running through an empty desert will allow for very high travel speeds, but this does not mean that living in the middle of an empty desert is convenient since things are separated by great distances. Alternatively, while it may be impossible to travel quickly through the center of a large city, like New York, this does not mean that such places are inconvenient since a large number of jobs, services, dwellings, and stores are concentrated in a small area. The purpose of this example is not to suggest that everyone solve their transportation problems by becoming more like New York, but rather to illustrate the two way relationship between land use and transportation and to show that increasing travel speeds does not necessarily make it easier to get around.

Given the importance of accessibility, the relationship between land use and transportation is both circular and self-reinforcing. Because centrally located areas tend to be the most accessible, they also tend to be the most highly valued. All other factors being equal, land will be most expensive near the center of cities and employment centers and gradually decrease in value as the distance to the center increases (Kivell, 1993). This concept is known as the “land use gradient” and is a factor in all land markets to varying degrees. Essentially, the land use gradient is an economic measure of the relative accessibility of land.

In an otherwise unrestricted market, developers respond to expensive land by using it more efficiently and developing at higher levels of intensity. All things being equal, the most accessible locations will have the greatest development potential (Hansen, 1959). More intensive development invariably leads to more traffic congestion, making long distance travel increasingly difficult and time consuming. However, increasing the intensity of development also improves accessibility (Olds, 2014). As a result, proximity and accessibility become even more important, causing land values to increase still further, thereby perpetuating the cycle until the costs imposed by congestion begin to outweigh the access benefits of higher density development (Zhang, Zu, & Li, 2009). Despite the effects of congestion, the accessibility improvements associated with density increases are ten times greater than the congestion effects. (Levine, Grengs, Qinggyun & Shen, 2012).

No city however, can be described as an unrestricted market. Instead, zoning and development regulations influence the development process described above. In most places zoning

regulations tend to limit development intensities near the center of the city and rigidly separate commercial and residential areas. Overall, these restrictions tend to reduce proximity and accessibility.

Transportation and land use are closely related. The most important elements of this relationship can be summarized as follows:

- Places where lots of things are close together have high levels of accessibility and slow travel speeds. Accessibility is better measure of how efficient a city is than travel speeds.
- Transportation improvements that increase travel speeds result in longer travel distances and more dispersed development patterns.
- Limiting development intensities or rigidly separating different land uses has a negative effect on accessibility
- Increasing development intensities and permitting a greater mix of land uses increases congestion but also improves accessibility. Importantly the accessibility improvements significantly outweigh the congestion impacts.

Designing a Better Transportation System

Changing the way land is used and developed can affect how far people travel, the way they travel, and how easily they're able to reach their destination. Broadly speaking, land use changes that reduce travel distances, make it possible to make more trips without a car, or make it easier to use public transit can be referred to as "demand management techniques". In many cases demand management represents a more efficient and cost effective way of addressing transportation needs than simply adding road capacity (Couture, Duanton & Turner, 2016). Studies have repeatedly shown that that a number of land-use and urban design factors, such as street connectivity, mixed land uses, density, and the availability of transit service all affect transportation demand (Ewing & Cervero, 2017).

As will be shown in this section, the cumulative effect of incrementally increasing street connectivity, providing more opportunities for mixed use development, and increasing residential densities in areas with a good access to jobs and transit service, can significantly reduce the demand for road capacity (Nelson, 2017; Arizona Department of Transportation Research Center, 2012).

Cities in the United State were historically developed with a dense grid of streets intersecting and regular intervals. By maximizing the number of intersections, property developers were able to provide access to maximize the number of accessible lots and leasable street frontage. However, following World War II this system began to change. In the 1950's engineers and city planners began to promote the use of disconnected, hierarchical street systems (Marshal & Garrick, 2009). Instead of an orderly grid of equally sized streets, these new street layouts relied on a system of local streets terminating in dead-ends which feed into increasingly larger collectors and arterials.

While intended to reduce accidents and minimize "through traffic" in residential areas the evidence supporting the use of hierarchical street systems has always been scant. While hierarchical networks devote less land to streets (Rifaat, Tay, & De Barros, 2012) they are also less reliable, carry less traffic, discourage walking, and significantly increase distances people must travel (Cortright, 2017). In recent decades mounting evidence has shown that far from improving traffic conditions, disconnected street networks actually force people to travel longer distances and cause traffic congestion on arterials (Marshal & Garrick, 2009). Simply put, disconnected street networks concentrate too much traffic on a small number of streets and force people to travel longer than necessary.

One measure of a transportation system's efficiency is "circuity". Circuity essentially measures how direct real world trips are by comparing straight-line distances to street distances. The closer the two measures are to one another, the less circuitous, and more efficient, the transportation system is. Importantly, traditional street grids, especially those with closely spaced intersections, are considerably less circuitous than modern hierarchical street networks (Boeing, 2018). In addition to shorter travel distances, traditional street grids also reduce traffic congestion by balancing traffic across multiple streets and providing a more robust and redundant street network (Commerce, 2007). Also, because gridded street patterns offer multiples ways of reaching a destination they are considerably more reliable, and less prone to disruption, than modern street networks (Rifaat, Tay, & De Barros, 2012; Cortright, 2017).

Ultimately making it easier for people get around isn't just about street networks. Mixed use development has been shown to shorten trip lengths, improve access, and is associated with higher levels of pedestrian activity (Cervero & Duncan, 2006; Pivo, Hess & Thatte, 1995). Importantly, households in mixed use areas travel significantly less than those in single use areas (Arizona Department of Transportation Research Center, 2012). This isn't just about commuting to work, non-work trips, such as shopping, entertainment, and personal business, account for 70 – 80 percent of all household travel and non-work travel also represents the fastest growing segment of transportation demand (Arizona Department of Transportation Research Center, 2012). On a basic level, mixing land uses, such as stores and apartments, is about shortening the distance between where people live and where they need to go.

Changing the way a cities street network is designed and the way land use is regulated can significantly improve transportation outcomes. Specifically:

- A transportation system comprised of a dense network of interconnected streets with intersections at regular intervals is more efficient than a hierarchical system with widely spaced streets and frequent dead ends.
- Allowing a greater mix of land uses and higher development intensities reduces travel distances and make it easier for people to get around.
- The majority of travel is not work related. By focusing on non-work travel significant transportation improvements can be realized.

Forecasting Future Needs

A city's comprehensive plan must describe how well the system is expected to perform (commonly referred to as "level of service") and include a list of improvements necessary to achieve this level of performance. Typically these requirements are addressed by producing a transportation demand forecast and comparing the forecast results to the capacity of existing services and facilities. While a useful tool for identifying future transportation needs, traditional transportation forecasting models suffer from a number of fundamental problems. This section explains how common transportation models work, describes their shortcomings, and explains how model outputs can be adjusted or supplemented to improve the utility of transportation planning work.

Identifying future transportation needs typically involves a five step process. First levels of service are established. Next the condition of existing services and facilities are evaluated and a forecast of future traffic, or travel, volumes is produced. By comparing this forecast to current levels of service standards, deficiencies can be identified. Finally, a list of improvements necessary to address the deficiencies is compiled. While seemingly simple, the details of the process are considerably more complex.

Transportation models begin with an estimate of population and employment growth. In Washington, population forecasts are produced for each county by the Office of Financial Management (OFM). These forecasts are then used by local government to develop individual population and employment forecasts. Local governments then estimate the amount of development that will result from the projected population and employment growth. Each new development is assumed to "generate" a certain number of vehicle trips each day.

To assess the amount, and location, of future traffic, the city is typically divided into a number of small geographic areas called "transportation analysis zones" (TAZs). TAZs vary in size depending on the density of population or jobs they contain. The city's projected development, and the associated vehicle trips are then assigned to each TAZ. Finally, a mathematical model is used estimate the amount of travel that will occur between each TAZ. By comparing existing traffic volumes and the anticipated growth in the trips to the capacity of existing facilities, cities can identity where future improvements will be needed.

While a helpful tool for estimating future vehicle traffic, traditional transportation modeling suffers from some crucial defects. Notably many transportation models are based on flawed assumptions and inaccurate data. By focusing only on traffic, transportation models ignore other forms of transportation. Also, by using level of service standards that are based on delay and slowdowns, transportation models can produce perverse outcomes that are contrary to GMA planning goals.

Like all models, the quality of transportation demand forecasts depend on the quality and validity of the assumptions and data on which they are based. Because transportation demand forecasts are predicated on assumptions about how many trips each new land use will

generate, trip generation rates are critical model input. Most models use trip generation rates provided by Institute of Transportation Engineers (ITE). However, ITE trip generation rates have been shown to be inaccurate. In fact, studies have shown that the ITE may overestimate trip generation rates by 53 percent. It has also been shown that ITE trip generation rates are based on faulty methods, statistically invalid samples sizes, and information sources that cannot be verified or peer reviewed (Millard-Ball, 2015).

Another significant problem is that most, but not all, transportation models fail to account for the relationship between land use and transportation. For example, transportation models commonly treat each new household or job the same regardless of where it is located. A home near the edge of town is expected to generate the same transportation impact as one built near the center of the city. However, all things are not equal. In fact, traffic impacts vary widely depending on location and development type. Households in more accessible areas make fewer trips by car and travel fewer miles when they do (Krizek, 2003; Larco, 2013; Arizona Department of Transportation Research Center, 2012).

Although traffic forecasting models have their shortcomings, they remain a useful starting point for gauging future travel conditions provided steps are taken to account for their inherent weaknesses, such as:

- In centrally located areas where a mix of commercial and high density residential uses are expected, lower trip generation rates and VMT estimates should be used.
- Transportation plans should separately account for non-motorized transportation and transit needs.
- Design standards should be adopted for streets and intersections that identify a “fully improved condition”, such as a maximum number of lanes, beyond which demand management techniques or parallel connections should be used to address deficiencies.
- Instead of continually rerunning forecast models, other important level of service indicators, such as per capita VMT, non-motorized transportation use, transit ridership, and average commute times, should be monitored.

Bicycle and Pedestrian Travel

Walking is one of the simplest and cheapest ways to get around. For local governments, the cost of accommodating pedestrians and bicyclists is significantly lower than the cost of building new roads or expanding transit systems. For households, more walking or bicycling means less money spent on gas, insurance, and cars. There are other benefits too. Lack of physical activity has been linked to numerous health problems including diabetes, high blood pressure, and heart disease (Commerce, 1998). Increasing the number of trips people make by walking or bicycling has been shown to improve both physical and mental health (California Air Resources Board, 2016). These factors suggest that while planning for non-motorized transportation is required by law, it is not without good reason.

Planning for non-motorized transportation is neither fundamentally complex, nor particularly expensive. In fact, simple common sense measures can significantly impact the number of trips made on foot or by bike. These measures include a combination of land use, urban design, and infrastructure factors. First, in order for walking or bicycling to be viable options, it must be physically possible for a person to make the trip, meaning a sidewalk, path, or other reasonably safe route is available, and their intended destination is close by. Second, there needs to be destination nearby that are worth walking to, such as schools, parks, stores, and services. Finally, while some people are forced to walk or ride a bike due to age, income, or disability, for many others it is a choice. For such people walking or riding must be safe comfortable and pleasant (Stampe, 2018; Arizona Department of Transportation Research Center, 2012).

In areas with busy streets sidewalks, bicycle lanes, paths, and improved pedestrian crossings are essential in order for people to get where they're going. As previously discussed, the directness, or circuity, of available routes is a measure of a transportation system's relative efficiency (Boeing, 2018; Rifaat, Tay, & De Barros2012). This concept is particularly relevant to non-motorized transportation planning since pedestrians and bicyclists are much more sensitive to small changes in travel distance than drivers. Generally speaking, pedestrians can be expected to travel up to one-half mile (Commerce, 2007). Riding a bicycle expands this range to three miles (PSRC, 2015). By providing a connected grid of streets with short blocks and frequent crossings the number of trips made on foot or by bicycle can be significantly increased (Berrigan, Pickle, & Dill, 2010 and Commerce, 2005).

So what sort of changes can be made to accommodate pedestrians and bicyclists? Research has shown that non-motorized travel can be increased by limiting block lengths to 200 – 600 feet in residential areas (Oregon Department of Transportation) and 1,000 feet in commercial areas (Commerce, 2005). Other physical impediments to pedestrian and bicycle travel, such as dead end streets and cul-de-sacs should be prohibited or removed (ODOT). It has also been shown that households that live within one-quarter mile of bicycle lane ride more frequently than those who don't (Krizek & Johnson 2006), suggesting that creating a grid of bicycle lanes and dedicated paths at intervals of one-half mile, would bring most of the City's residents within this range.

The way land is used and developed also influences how people travel. While it may seem obvious, it's worth stating that people aren't inclined to walk unless there's somewhere nearby worth walking to. When surveyed, people identify parks, stores and restaurants, transit service, and schools as the places they'd most like to walk to. Changing land use policies and regulations to allow higher residential densities and a wider range of uses allows more people to live near, and walk to, these popular destinations. Even small changes in residential densities and the mix of allowed uses can increase walking and biking (Pivo, Hess & Thatte, 1995).

In fact people who live in areas with higher residential densities and a mix of commercial and residential uses drive 40 percent less than those who don't (Ewing, Bartholomew, Winkelman, Walters & Chen, 2007) and also walk or ride bikes much more frequently (Arizona Department of Transportation Research Center, 2012). Studies in Washington have documented significant

reductions in driving, and corresponding increases in non-motorized travel, when employment densities reach 20 employees per acre and residential densities exceed 13 dwellings per acre (Lawrence & Pivo). Importantly, these relationships are causal and not the product of mere correlation or self-selection (Boarnet, Raphel, & Williams 2017).

The vast majority of travel is unrelated to commuting and instead involves non-work trips. One significant source of non-work travel involves parents dropping their kids off at school (US Department of Transportation, 2007). Over the past 50 years the catchment area, or area served by local schools, has increased in size. Unsurprisingly, over the same time the number of students walking to school has also steadily decreased. While some parents drive their kids to school because it's convenient, or because of bad weather, more commonly they do so because of a lack of safe, convenient routes bicycling or walking routes (Schlossberg, Greene, Phillips, Johnson & Parker, 2006).

Aside from physical improvements such sidewalks, bike lanes, and crosswalks, distance is a crucial factor in determining the number of students who walk to school. A study of middle school students in Oregon showed that 52 percent of students who lived within one mile of their school walked or bicycled. For students who lived up to 1.5 miles from school, 36 percent walked or bicycled. However, the percentage of students who walked or bicycled declined to 4 percent when the distance between their home and school exceeded 1.5 miles (Schlossberg, Greene, Phillips, Johnson & Parker, 2006). These are significant numbers and demonstrate that students will walk or ride to school when it is safe and convenient. The numbers also suggest that significant travel efficiencies can be realized by increasing residential densities near schools and by providing adequate infrastructure.

Burlington Boulevard has one of the densest concentrations of shopping, services, and high density housing in Skagit County. Over the next 20 years the number of people living, and working, along the Burlington Boulevard corridor is expected to increase significantly. These factors are particularly relevant to non-motorized transportation. Although people don't commonly associated commercial strips with pedestrian activity, commercial strips are frequently bordered by areas of higher density housing, making short trips to stores and services possible. In fact studies have shown that people who live near commercial strips make a large number of trips on foot or by bike. One study of commercial strips located in places as diverse as Oregon and Georgia, showed people living near strips made a third of their trips on foot or by bike (Larco, 2013), suggesting the City could increase pedestrian and bicycle trips by directing growth to the Burlington Boulevard corridor.

In addition to land use changes, that encourage the construction of places for people to walk to, and physical changes, that make walking and bicycling trips possible, it's also necessary to consider factors that make non-motorized trips safe and enjoyable. These factors are sometimes classified as qualitative, rather than quantitative, and are nearly as important as physical improvements and land use changes. Whether because of age, disability, or income, a certain percentage of the population will always have few alternatives to walking. As a result, increasing the number of non-motorized trips necessarily involves convincing those who could

drive that walking or riding are bike are better options. For those who might otherwise drive, safety, comfort, and enjoyment important considerations (Litman, 2017).

Subtle urban design changes can have a tremendous impact on people's perception of safety and comfort. For example, generally people do not like walking along busy arterials because they feel dangerously close to traffic (Larco, 2013); however, this perception can be mitigated with wider sidewalks, street trees, and on-street parking. It is also important to provide a visually interesting environment in which to walk. This can be accomplished by providing high quality landscaping, locating buildings near the sidewalk ensuring that parking areas are not located between the building entrance and the street, and limiting the width and frequency of driveway curb cuts (PSRC, 2015; Mukhija & Shoup, 2006; Commerce, 1998). In residential areas traffic calming measures such as traffic circles and narrow travel lanes can also be effective (Commerce, 2005).

The most important pedestrian and bicycle planning concepts are summarized below:

- Provide continuous sidewalks
- Small blocks and frequent intersections reduce travel distances and make it easier to get around without a car
- Land use policies and regulations can influence the number of trips made on foot or by bike. Allowing higher residential densities in areas that are close to shops, services, parks, and schools will result in more pedestrian and bicycle trips.
- A significant amount of vehicle traffic is created when people feel it is unsafe or impractical for their children to walk to school. Connecting schools to surrounding residential areas with sidewalks and bike lanes can reduce unnecessary vehicle trips
- Pedestrians are heavily influenced by the perception of safety and comfort. Urban design changes such as street trees, wider sidewalks, and the presence of on-street parking can significantly increase pedestrian travel.
- Commercial corridors, such as Burlington Boulevard, have been shown to generate surprising amounts of pedestrian travel.

Public Transportation

Transit is not generally regarded as a viable mode of transportation in small towns or rural areas. However, in cities with a large concentrated employment base, compact geography, and convenient access to other regional destinations, it represents a cost effective and efficient way of moving large numbers of people. A functional public transportation system also serves important economic functions by lowering monthly household expenses and providing access to jobs and services (Godavarthy, Mattson & Ndembe, 2014). As this section will show, Burlington has the necessary characteristics to support public transportation service, and by making targeted investments and smart decisions about future growth, the number of people who use public transit can be increased while simultaneously reducing the per-capita cost of providing transit service (PSRC, 2015).

Transit ridership is influenced by a variety of factors, including development patterns, street connectivity, and the speed and reliability of transit vehicles (King County METRO, 2012). In terms transit operations, frequency, average routes speed, and service hours are all important (Commerce, 2012). Because the City has little control over these operational characteristics, land use factors are also important. The Puget Sound Regional Council (PSRC) has identified four land use conditions that are necessary to support a viable public transportation system, including a critical mass of patrons (dense concentration of intensive commercial and residential development), all day travel demand resulting from a concentration of activities such as stores restaurants, services and entertainment, convenient pedestrian access to transit stops, and regional connections (PSRC, 2015).

The Burlington Boulevard corridor addresses all of these conditions. It is served by a reasonably frequent transit route, with connections to regional service in both Mount Vernon and Burlington. It contains a regionally significant concentration of employment, stores, restaurants, and services and much of the City's future multifamily housing is projected to be located along this strip. Finally, the corridor is approximately one-half mile wide, meaning all of the development on either side of the Boulevard is within walking distance of transit service. Surveys of residents in areas with similar characteristics similar to Burlington Boulevard indicate they drive less (Boarnet, Raphel, Bostic & Williams, 2017) and use transit frequently (Larco, 2013).

The most important planning concepts related to transit service are summarized below:

- Transit service plays a crucial economic role by allowing those who are unable, or who cannot afford, to drive to get to work or go shopping.
- Since much of Burlington's planned growth will occur within walking distance of Burlington Boulevard, a major bus route, there is significant potential for ridership growth.
- Transit ridership can be supported by increasing residential and employment densities near transit routes and by providing convenient pedestrian connections between residential areas, businesses, and bus routes.
- Frequency, hours of operation and average route speeds are all important operational characteristics that affect transit ridership. Focusing resources on a small number of high quality routes is the best way to improve ridership.

Public Health and Safety

The characteristics of a city's transportation system can have profound impacts on the health and safety of its residents and visitors. Motor vehicles accidents and pedestrian collisions are a leading cause of death for Americans (Ewing, Schieber & Zegeer, 2003). Conventional transportation planning has been linked to a host of physical and mental ailments associated with sedentary lifestyles (Lawrence, Sallis, Conway, Chapman, Saelens & Bachman, 2006). Finally, motorized transportation is a significant source of air pollution which can affect

people's health (California Air Resources Board, 2016). Fortunately, by making smart planning decisions and changing the way the City's transportation system is used and developed many of these negative impacts can be minimized.

Motor vehicle deaths are the number one cause of death for Americans under 34 years of age and a significant risk for all age groups. The most vulnerable road users are pedestrians. Despite that fact that pedestrian trips account for only 5 percent of all trips, pedestrian deaths represent 12 percent of all traffic fatalities (Ewing, Schieber & Zegeer, 2003). This represents a pressing public safety issue, particularly for those who are unable to drive, including the young, the poor, the elderly, and the disabled. A large percentage of traffic deaths can be attributed to street designs that encourage excessive speeds and inadequately protect vulnerable road users, such as pedestrians and cyclists.

Paradoxically, reducing traffic fatalities may not necessarily involve a corresponding reduction in traffic accidents. Cities with the lowest fatality rates are not those with the lowest accident rates, but rather those with the fewest *severe* accidents (Marshal & Garrick, 2009). The key determinant in the severity of accidents appears to be speed. While a pedestrian struck by a vehicle traveling at 40 miles per hour has an 85 percent chance of being killed, a pedestrian struck by a vehicle traveling at 20 miles per hour has only a five percent chance of being killed (Ewing, Schieber & Zegeer, 2003). Accordingly, reducing deaths necessarily entails reducing vehicle speeds and providing safe infrastructure for pedestrians and cyclists.

Development patterns and street design can have a significant impact on vehicle speeds and accident rates (Ewing, Schieber & Zegeer, 2003). Areas with well-connected streets and frequent intersections are not only more efficient, they are also safer. As the frequency of intersections increase the rate of fatal accidents declines (Marshal & Garrick, 2009). By creating a more traditional grid system with frequent intersections, adding bike lanes and improved sidewalks, and constructing traffic calming improvements the City can significantly enhance the safety of its transportation system.

More than 30 percent of Americans are obese and fewer than half have a healthy body weight. One of the leading contributors to obesity and related illnesses, such as diabetes, heart disease, high blood pressure, and osteoporosis is a lack of daily exercise (Commerce, 2007; 2005; Frank, Sallis, Conway, Chapman, Saelens & Bachman, 2006). Health experts recommend that adults engage in at least 30 minutes of moderate physical activity (such as walking) each day, yet only 5 percent of adults meet this recommendation (Berrigan, Pickle, & Dill, 2010). The connection between physical activity and transportation is not difficult to grasp. A larger share of the population could easily incorporate the recommend physical activity into their daily lives if they simply spent 15 minutes each day walking to and from a store, restaurant, or bus stop each day. Unfortunately, the design of many modern cities makes such casual physical activity difficult.

Fortunately, there are a number of simple land use and urban design strategies that can improve public health by allowing people to incorporate physical activity into their daily lives (Commerce, 2007). Specifically, people who live in neighborhoods with characterized by higher

residential densities, well-connected streets, and nearby commercial activities drive less, walk or bicycle more, and have lower rates of obesity than those who live in areas with more suburban patterns of development (Frank, Sallis, Conway, Chapman, Saelens & Bachman, 2006; Larco, 2013). Aside from reducing obesity, populations that live in walkable neighborhoods suffer from lower rates of hypertension, diabetes, stroke, heart disease, and cancer. Importantly, these health benefits are not due to self-selection and have been shown to be independent of other health factors such as age, sex, diet, or smoking (Institute of Cardiovascular and Medical Sciences, University of Glasgow, 2017).

Transportation also impacts public health by contributing to air pollution. Motorized transportation is responsible for more than 50 percent of air pollution in urban areas (CDC) and represents the single largest source of greenhouse gas emissions in Washington State (Olds, 2014). Pollution from transportation sources includes fine particulate matter, ground level ozone, carbon monoxide, nitrogen dioxide, and methane. These forms of pollution are responsible a variety of repertory ailments and other illnesses including cancer (World Health Organization and Union of Concerned Scientists, 2014). Because cities lack direct control over vehicle emissions, the only viable method of minimizing air quality impacts is through strategies that reduce the number of miles traveled by car and by promoting active transportation and transit use (CDC).

Important planning concepts related to public health and safety:

- Many common health problems can be attributed to a lack of physical activity. Transportation planning that allows people to incorporate more walking or bicycling into their daily routines can significantly improve public health.
- Motor vehicle accidents are the leading cause of death for Americans under 34 and a significant risk for all age groups. Pedestrians account for disproportionate percentage of traffic deaths, and many of these deaths can be attributed to street designs that encourage excessive speed or fail to protect vulnerable road users
- Development patterns have a significant impact on vehicle speeds and accident rates. Areas with a network of streets with frequent intersections have lower accident rates and less serous collisions.

Parking

Although parking is often considered a separate issue it is an important component of the transportation system. Parking affects the way people get around and can influence how cities look and function (The Economist, 2017). Parking can also affect the cost of housing and the feasibility of development. Parking policies and regulations must be carefully crafted to avoid unintended consequences and ensure consistency with broader land use, housing, and transportation goals.

Typically parking is provided either privately, in parking lots associated with individual developments, or publicly, in the form of shared lots and on-street parking. While private

developments would undoubtedly provide some parking in an otherwise unregulated market, most private parking is provided in response to regulatory requirements. Alternatively, public parking is generally provided by local governments as a way to manage excess right-of-way or to accomplish specific economic development goals, such improving access to a downtown business district.

How parking is provided also affects how it is used. With few exceptions private parking is restricted to a single use, or user. As a result private parking is frequently underutilized during much of the day. For example, office parking lots generally full during daytime hours but empty at night. Alternatively, restaurants and apartment buildings have little demand for parking during the day, but have the greatest need for parking on nights and weekends. As a result private parking is frequently oversupplied due to inefficiencies in the way it is managed. These inefficiencies can be traced back to local regulations which require each development, or business, to provide parking in a stand-alone fashion.

Parking requirements can impact the intensity, cost, and feasibility of development. The availability of parking also affects the number of pedestrian, bicycle, and transit trips (Commerce, 2007). For example, studies have shown that the number of miles people must travel by car increases as the amount of available parking increases (Pivo, Hess & Thatte, 1995; Salon, 2014). In addition to quantity, the way parking areas are designed also impacts these relationships. For example, large single use parking lots located in front of buildings increase the distance between buildings and the street, effectively increasing trip lengths and discouraging waking, even between neighboring businesses, thereby creating a need for still more parking. Alternatively, parking lots that are small, dispersed, and located behind buildings are more efficient and increase foot traffic by encouraging people to visit multiple destinations from a single parking space (Mukhija & Shoup 2006).

Except in older cities and traditional downtowns most parking is provided privately in response to government regulations that require new development to provide free on-site parking. However, as with most things, this “free” parking is not really free, but rather paid for by property owners or developers who pass the cost on to their customers and renters (Millard-Ball, 2015). Excessive parking requirements can also affect the financial feasibility of development projects, reducing the supply of affordable housing (Gabbe, 2017).

Parking requirements might work well if they were closely related to demand. In practice however, parking requirements generally exceed the actual demand for parking (The Economist, 2017). While some might imagine parking requirements are established using a rigorous technical process; in actuality, the methods used to set minimum parking requirements have been shown to unscientific and highly inaccurate (Shoup, 1999; Weinberger & Karlin-Resnick, 2014). Most commonly parking standards are simply copied from other jurisdictions; thereby overlooking local conditions, repeating errors, and making it possible to analyze or verify the methods used to establish the original requirements.

In those instances where parking requirements aren't copied from other jurisdictions, they are typically established using a manual published by the ITE. However, far from being a reliable source of accurate information, it has been demonstrated that the estimates in the ITE manual are based on poor quality data, overly broad assumptions, and statistically invalid methods. Notably, most of the parking estimates in the ITE manual are based on surveys with extremely small sample sizes. For example, over 50 percent of the entries in the ITE manual are based sample sizes of 4 or less, and remarkably, 22 percent are based on a single sample (Shoup, 1999). Obviously, such small sample sizes are inadequate for developing a national database and are prone to serious errors. In fact, studies have shown that parking requirements often exceed demand by a margin of 45 -65 percent (Weinberger & Karlin-Resnick, 2014).

So what's the problem with excessive parking requirements? In many situations parking in unquestionably a necessity, but it is also expensive to construct and consumes valuable land. A single parking space, together with its share of the required access and circulation space typically requires 300 – 400 square feet, about the same amount of space required for a cubicle in an office building or nearly as much as a small apartment. Simply put, parking spaces requires almost as much space as the uses they serve (Litman, 2017).

Ideally, private parking requirements should be set at a level that more accurately reflects the demand for parking, taking into consideration factors such as vehicle ownership rates, proximity to transit, and the diversity of surrounding land uses. Parking requirements should also be crafted to achieve the City's broader land use, transportation, and economic development goals (Willson & Roberts, 2011). Public parking, such as on-street spaces, should be managed to maximize the value of a scarce resource and valuable public resource. Turn-over should be encouraged to benefit short term customer parking and discourage long term parking.

Important planning concepts related to parking:

- Parking is an important component of a city's transportation system and influences how cities look and function and also affects how people get around.
- Parking requirements are frequently based on flawed, incomplete, or inaccurate information.
- Excessive or overly rigid parking requirements can increase the cost of housing and make development infeasible
- The way parking lots are designed and located can influence how people get around. Parking lots that are small, dispersed, shared with multiple businesses, and located alongside or behind buildings make it easier to travel between businesses in the same area on foot.
- Free parking is not actually free, instead the cost is paid by consumers and renters.

Economic Development & Financial Implications

Transportation decisions have important economic and financial implications for households, businesses, and municipalities. Through effective long range planning, a city's transportation system can improve business conditions, make it easier and less expensive for residents and visitors to get around, and maximize the value of tax dollar investments. Unfortunately the reverse is also true. Short sighted decision making can create an inflexible transportation system that's unable to adapt to changing business needs and development trends, saddle local governments with untenable financial obligations, and make transportation expensive and inconvenient.

Though frequently overlooked, transportation costs are a significant household expense. In fact, after housing, transportation constitutes the second largest monthly expense for American households. Household transportation expenses are directly impacted by urban design factors and land use factors. All things being equal, households that live in areas with a large concentration of jobs, shopping opportunities, and services will have lower transportation costs than those who don't (Stampe, 2018). In order to minimize household transportation costs, it's important to ensure transportation planning decisions incorporate land use and housing considerations.

Transportation costs vary by location. Though it may seem obvious, to a large extent transportation costs are driven by the number of cars a household must own and how many miles each member of the household must drive each day. The American Automobile Association (AAA) reports that it costs between $625 - $851 per month to own and operate a car (Godavarthy, Mattson & Ndembe, 2014), and studies have shown the average American household spends 18 percent of its income on transportation (Couture, Duanton, & Turner 2016). For purposes of comparison, this is a significant portion of what a one bedroom apartment costs in Burlington. While some people choose to travel long distances each day, others do not. Instead many are forced into long commutes by a lack of housing options or local job opportunities.

Unemployment levels, income, and financial mobility are tied to job access. Research has shown that people who live closer to areas of concentrated employment find employment more easily and are less likely to be unemployed (Kneebone, & Holmes, 2015). Studies have also tied upward financial mobility to job access. In places where jobs are highly concentrated, people find it easier to locate suitable employment, travel shorter distances to work, and are more likely to be able to get to work without a car. The reverse is also true, low employment densities result in longer commutes and fewer employment options. In such areas, few, if any jobs, will be accessible to person without a car. This relationship is particularly significant for low income households because they own fewer cars and are less able to afford the cost of driving. By permitting a dense concentration of housing and by creating a transportation system that addresses the needs of those who are unable to drive, cities can reduce unemployment and foster upward financial mobility.

Constructing and maintaining transportation infrastructure and funding public transportation are significant expenses for local governments. Expenses can be minimized and transportation services can be provided more efficiently by ensuring land use and transportation plans are coordinated, prioritizing maintenance, and by focusing on simple low cost solutions.

Transportation costs include both direct costs paid by drivers and transit riders, such as gas, insurance, registration taxes, tolls, and fares, and indirect costs which are shared equally by all tax payers whether they drive or not. Indirect costs include things that are widely recognized, like general fund expenditures financed by sales and property taxes, and less well acknowledged things, such as the financial and economic impacts of accidents, congestion, and pollution. Because so many transportation costs are indirect, and because transportation funding comes from many sources, the total cost of providing transportation services is difficult to determine. Also, since roads and parking are often provided without a direct cost, they tend to appear cheaper than they really are (Olson, Berkaw, Charland, Patton & Bilmes, 2019). Making smart transportation planning decisions requires a complete analysis of costs and benefits.

One way of minimizing transportation costs is by ensuring land use and transportation plans are coordinated. Ideally a city's land use plan should be crafted in a way that makes getting around convenient and cost effective. Generally, transportation infrastructure can be provided more efficiently in areas with higher population and employment densities. While the relative effectiveness of land use strategies vary, scenario planning exercises have shown significant cost savings and efficiencies can be realized by changing the way land is used and developed (Sweeney, 2013; Nelson, 2017), with some studies showing that more compact development patterns are 12 – 15 percent more cost effective than alternative development scenarios (TRB 1998).

Another frequently overlooked aspect of transportation planning is the cost of maintenance. While it's easy to focus on the more obvious costs and benefits associated with new projects, each new project creates an ongoing need for repair and maintenance. Deferring or ignoring maintenance requirements compounds these expenses because when roads and other transportation infrastructure deteriorate beyond are certain point they must be replaced or reconstructed (Transportation for America, 2019). Optimum paving and maintenance schedules can be determined using a "life cycle cost analysis". Generally the objective of these studies is to determine the minimum level of periodic repair and maintenance required to avoid costly reconstruction work (Babashamsi, Yusoff, Ceylan, Nor & Jenatabadi, 2016). When considering new transportation projects, ongoing maintenance costs should also be considered and periodic maintenance schedules should be established for existing infrastructure using a lowest life cycle cost analysis.

With the rise of internet shopping and changing demographic and economic conditions, shopping has become more of an activity and less of a necessity. Because of this shift, consumers have increasingly come to value short trips and high quality amenities (Buliung & Hernandez, 2009). Increasingly, many experts believe that small scale retailers will outperform

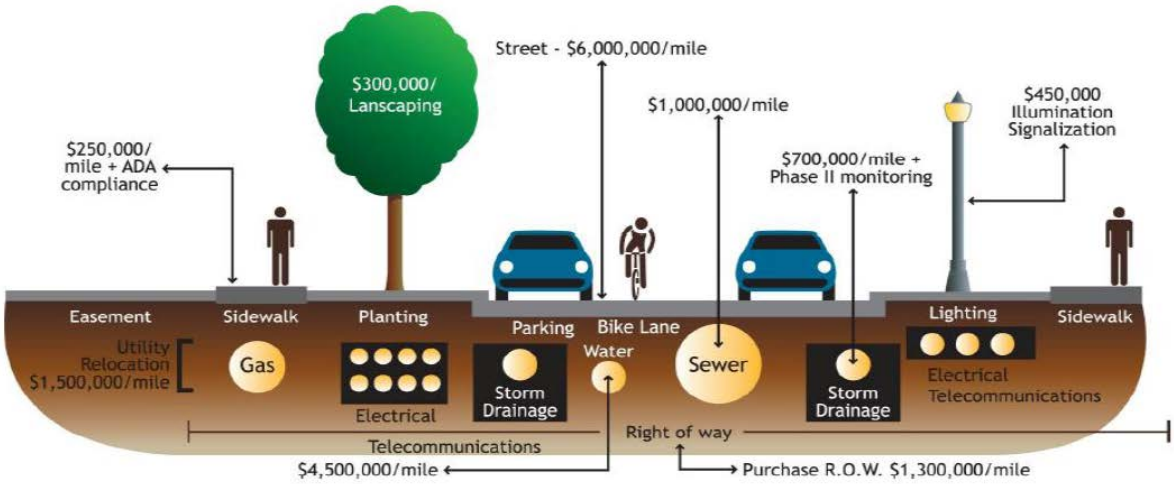
large scale big-box stores because of they provide a more personalized experience and flexible product assortment than large format retailers and traditional shopping centers (Gray, 2017). To remain economically relevant cities must change their transportation plans to adapt to these trends.

Small scale retail businesses are dependent on casual shoppers and foot traffic. They also require street networks, buildings, and parcel configurations that can be easily adapted to accommodate different uses. Importantly, these types of businesses are most successful when they are surrounded by a dense concentration of complementary businesses and connected together by a network of streets and sidewalks that allow shoppers a number of shops, restaurants, and other businesses in the same trip (Cortright, 2018). Economic development experts suggest that aging commercial strips, such as Burlington Boulevard, can be improved by providing pedestrian amenities, such as wider sidewalks that can be used for outdoor dining, and breaking up large parcels with new streets and smaller blocks (EPA).

Important financial and economic considerations:

- Building new roads to serve low density uses in peripheral areas is not cost effective.
- Ongoing repair and maintenance costs are frequently overlooked when new transportation projects are being considered.
- Transportation investments generate larger returns when they are focused on improving access rather than increasing capacity. Capacity investments have been shown to have little economic value and seldom result in long term transportation improvements.
- Online shopping has fundamentally changed the nature of retail development. Retail developments are now smaller and more focused on providing an experience for shoppers. Small blocks, frequent intersections, flexible parking arrangements, and high quality pedestrian amenities are needed to adapt to changing market conditions.

Figure 2. The cost of common transportation improvements. *Source.* WSDOT



Current Conditions and Future Needs

Burlington's compact geography, small population, and balance of jobs and housing means it is generally easy place to get around. Residents have short commutes and shops and services close at hand. Despite these advantages, the City faces many of the same transportation issues as other communities. The future poses additional challenges. Much of the infrastructure built over the past two decades is aging and needs to be repaired or upgraded, but little funding exists for this work. At the same time evolving economic and demographic conditions will result in new challenges and different needs. Over the next 20 years population and employment densities are expected to increase significantly, the bulk to the City's growth will shift from peripheral areas to existing developed areas. These changes will require a more balanced and interconnected transportation system.

The average commute time for a Burlington resident is approximately 19 minutes, which is less than average for Washington as a whole (27 minutes) and other nearby cities. While average commute times are useful for illustrating general traffic conditions and commuting patterns, only 28 percent of household travel is associated with commuting (AASHTO, 2013). Accordingly, by focusing solely on commute time and travel modes important trends can be masked with respect to the 72 percent of travel that is not work related.

Table 1. Average Commute Times

	Burlington	Mount Vernon	Sedro Wooley	Anacortes	Ferndale	Bellingham	Washington
2010	22.9	22.8	25.7	21.8	21.8	17.4	25.4
2012	22.5	22.8	23.4	21.8	21.3	17.6	25.5
2014	20.7	23.2	21.8	22.2	19.8	17.6	25.9
2016	19.2	23.9	23.9	22	19.9	17.9	26.7
Change	-3.7%	+1.1%	-1.8%	+0.2%	-1.9%	+0.5%	+1.3%

**Source: American Community Survey/US Census Bureau – All times in minutes*

While most of Burlington's residents and worker commute by car, a significant and growing number, 7.8 percent, use transit or commute by walking or riding a bike. This is slightly lower than the average for Washington State, which is 10.7 percent, but higher than other surrounding cities. Only Bellingham has a higher percentage of commuters who use alternative forms of transportation. Notably, Burlington is the only city in the area to record a net increase in alternative transportation since 2010.

Table 2. Alternative Transportation Use

	Burlington	Mount Vernon	Sedro Wooley	Anacortes	Ferndale	Bellingham	Washington
2010	3%	5.3%	1.4%	7.9%	3.8%	17.2%	9.9%
2012	2.7%	5.7%	1.8%	8.8%	5.4%	18%	10.1%
2014	5.7%	6%	0.6%	7.4%	3.1%	16.7%	10.3%
2016	7.8%	4%	1.3%	7.5%	2.4%	17.1%	10.7%
Change	+4.8%	-0.5%	-0.1%	-0.4%	-1.4%	-0.1%	+0.8%

**Source: American Community Survey/US Census Bureau – "Alternative Transportation" includes walking, biking, and transit*

The numbers presented above have been used because they were the only available data source unique to Burlington; however, caution should be exercised when interpreting these numbers for three reasons. First, the information was obtained from the US Census Bureau's American Community Survey (ACS) program. ACS data is based on statistical sampling. Because of Burlington's small population size, it represents a comparably small, and less reliable, sample group. Second, this data covers a narrow timespan of only six years, making it difficult to gauge long term trends. Finally, this data only addresses work related travel. Non-work related travel now accounts for the majority of household travel. In order to address these deficiencies, over the next 20 years the City should seek more accurate sources of information and continually monitor changes in travel behavior.

Land Use Assumptions

While over the next 20 years the City's rate of growth is not expected to change dramatically, the form, and location, of development are expected to change. Between 2015 and 2036 the City's population is expected to grow by 3,808 people and 3,516 jobs will be added to the economy. Most, if not all, of this growth will occur within the City's existing municipal boundaries through infill and redevelopment. The land use element calls for directing the bulk of this growth to three "primary growth areas" centered along the Burlington Boulevard and Fairhaven Avenue corridors.

Future development will not only shift from peripheral areas to centrally located areas, but the form of development will also change. Importantly the percentage of the City's housing stock comprised of higher density attached housing, such as duplexes, townhomes, and apartments is projected to increase from 48 percent to 60 percent. The nature of commercial development is also expected to change. In the past job growth was associated with large format, "big box", retailers resulting in relatively low employment densities. Future job growth is expected to be

comprised of larger share of office, health care, food service, and smaller specialty retailers, all of which tend to have higher employment densities.

From a regional perspective, it is assumed that residentially growth will be largely confined to existing City's and urban growth areas. Skagit County's long range plan for the region is predicated on directing 80 percent of future growth to cities and urban growth areas (Skagit County, 2016) and the location and size of these urban growth areas is expected to remain relatively constant.

Streets and Sidewalks

The City's primary transportation system is comprised of a network of streets and sidewalks. This network includes approximately 47.8 miles of street within the City's municipal boundaries. An additional 8 miles of streets are located in the unincorporated urban growth area. This total includes approximately 4.6 mile of state highway, 35 miles of city streets, and 8.2 miles of private streets and roads. The City's streets are classified into four groups depending on their characteristics and intended purposes. These groups include:

- Major arterials
- Secondary arterials
- Collector arterials
- Local access streets (including private roads)

Currently only 36 percent of the City's street network consists of streets with fully improved right-of-way, including curbs, gutters, sidewalks on both sides, and storm-water infrastructure. Approximately one third of Burlington's streets have only limited improvements and 32 percent have no curbs, sidewalks, or formal storm-water infrastructure. There are no streets in the unincorporated UGA that are improved to urban standards; however, Lafayette Road is currently being improved from Monroe Street to the Skagit County Housing Authority's property at Farmview Lane.

In order to provide adequate pedestrian access, improve safety, and properly manage storm-water the City's substandard streets should be gradually over the next 20 years. While some projects will be completed in conjunction with private development, projects near schools, parks, and high density housing should be prioritized.

Table 3. Existing Road and Sidewalk Conditions

	Municipal Boundaries	Unincorporated UGA
Fully Improved	17.38 miles (36%)	0.0 miles
Limited Improvements	14.9 miles (31%)	1.36 miles (16%)
Pavement Only	15.27 miles (32%)	6.54 miles (79%)
Unimproved (dirt or gravel)	0.20 miles (1%)	0.38 miles (5%)
Total:	**47.75 miles**	**8.28 miles**

Burlington's historic downtown area has the highest level of connectivity in the City and is characterized by a uniform pattern of small blocks measuring 330' X 220'. The level of street connectivity in the Commercial Core and Northern Gateway growth areas varies dramatically. Importantly Burlington Boulevard is the only continuous corridor in this area making transportation in the most intensively developed portion of the City prone to disruption. Also, the Burlington Northern right-of-way is a significant barrier to east-west travel, resulting in poor connectivity between the residential areas east of the rail line and the commercial areas along Burlington Boulevard. The outlying areas of the City and the unincorporated UGA have the lowest levels of connectivity.

A separate, yet related, connectivity issue concerns the distance people must walk along high volume, higher speed arterials before reaching a signalized, or controlled intersection where they can cross safety. Commercial strips, such as Burlington Boulevard, have the potential to generate comparatively large volumes of pedestrian traffic, particularly with the addition of mixed use or high density residential development (Larco, 2013). Unfortunately, because of the distance between safe crossing and higher vehicle speeds, streets such as Burlington Boulevard, also associated with more serious pedestrian injuries and deaths (Marshal & Garrick, 2009; Ewing, Schieber, & Zegeer, 2003).

Burlington has two principle arterials where higher vehicle speeds are permitted, Burlington Boulevard and Highway 20/Avon Avenue. However, Highway 20 is controlled by the State and does not contain the same concentration of commercial, mixed use, and higher density residential uses and Burlington Boulevard. In order to both facilitate pedestrian traffic and minimize safety risks, the distance between crossings should not exceed 1,000 feet and should ideally be closer to 600 feet (Litman, 2017).

Currently there are 12 controlled intersections along Burlington Boulevard with an average spacing of 977 feet. However, as shown below there are three street segments where the spacing exceeds 1,000 feet and five segments where the intersection spacing is less than 1,000 feet but more than 600 feet. There are three segments of Burlington Boulevard where the gap between intersections is less than 600 feet. In order to accommodate the City's anticipated growth in pedestrian traffic and constrain the growth in vehicle travel, additional signalized intersections should be added along Burlington Boulevard, beginning with the street segments where the largest gaps exist. The City should consider establishing a minimum level of service for intersection spacing of 1,000 feet and a more ambitious goal of 600 feet.

While the City's transportation system functions relatively well, limited areas of heavy traffic exist. Currently level of service (LOS) "C" is used for all City streets, except Burlington Boulevard, where LOS D is used. LOS "C" is not commonly used in urban areas and maintaining LOS "C" would be prohibitively expensive. Accordingly, this report is based on a citywide LOS standard of "D". State Highways are managed by the Washington State Department of Transportation and are subject to a LOS standard of "D". The City is required to assess traffic conditions on State Highways but is not responsible for ensuring that LOS standards are maintained.

There are four intersections that do not meet current LOS standards, three of which are located along Highway 20 and are controlled by the Washington State Department of Transportation (WSDOT). The intersection of South Spruce Street and Rio Vista Avenue is controlled by the City an currently operates a LOS "D". This plan envisions lowering the LOS standard city-wide from "C" to "D", which will eliminate this deficiency. Traffic forecasting conducted by Transportation Solutions Incorporated (TSI) shows that over the next 20 years traffic conditions will steadily worsen. By 2036 a total of nine intersections in the City will fall below LOS D, six of which are managed by WSDOT. The remaining three are the City's responsibility and changes must be made to ensure an acceptable level of service.

Table 4. Burlington Boulevard Intersection Spacing

Status	Distance	Street Segment
Meets Goal	579 feet	Rio Vista – Sharon
Meets Goal	592 feet	Pump Drive – Cascade Place
Meets Goal	587 feet	Costco Drive – George Hopper
Acceptable	903 feet	I-5 - Kirkby
Acceptable	849 feet	Kirkby – Avon
Acceptable	830 feet	Avon – Fairhaven
Acceptable	901 feet	Gilkey – Pump Drive
Acceptable	950 feet	Cascade Place – Pease Road
Poor	1,300 feet	Fairhaven – Rio Vista
Poor	1,850 feet	Sharon – Gilkey
Poor	1,215 feet	Pease Road – Costco Drive
Poor	1,166 feet	George Hopper – Market Place Drive
Average Distance:	***977 feet***	

Table 5. Local Arterial Intersection Conditions

Location	2016 Level of Service	2036 Level of Service	Status
George Hopper Rd & Bouslog Rd	C	D	Pass
Spruce Street & Rio Vista Ave	D	D	Pass
Anacortes St & Rio Vista Ave	B	D	Pass
Whitmarsh Rd & Pease Rd	C	D	Pass
Skagit St & Fairhaven Ave	B	D	Pass
Burlington Blvd & George Hopper Rd	C	E	Fail (2036)
Burlington Blvd & Pease Rd	D	E	Fail (2036)
Spruce St & Greenleaf Ave	C	F	Fail (2036)

**Citywide level of service standard "D" - Source Transportation Solutions Inc. (TSI), 2017*

Table 6. WSDOT Intersection Conditions

Location	2016 Level of Service	2036 Level of Service	Status
SR-20 & Spruce St	D	E	Fail (2036)
SR-20 & Avon Ave	E	F	Fail (2016)
SR-20 & Skagit St	F	F	Fail (2016)
SR-20 & Section St	F	F	Fail (2016)
SR-20 & Cherry St	D	F	Fail (2036)
SR-20 & Regent St	C	E	Fail (2036)

**WSDOT level of service standard "D" – Source Transportation Solutions Inc. (TSI), 2017*

Bicycle and Pedestrian Facilities

Currently the transportation element of the City's comprehensive plan does not address pedestrian and bicycle facilities and the City does not have a formally adopted non-motorized transportation plan. While several non-motorized transportation maps were produced for previous transportation element updates, most recently in 2010, these maps suffer from a number of shortcomings which must be addressed in order to plan effectively for non-motorized transportation; specifically:

- Information should be provided on the location, extent, or condition of sidewalks
- Maps should specify what, specifically is proposed by differentiating between different bike lanes, multi-use paths, etc.
- Non-motorized transportation improvements should create a complete circulation system, provide safe routes to schools, and create logical connections between parks, high density housing, and commercial services

While only partially complete the City's non-motorized transportation system includes a number of important routes. A paved multi-use path parallels the Old Highway 99/Burlington Boulevard corridor and extends from the Burlington Edison High School to the municipal boundary at Gear Road. This path connects the Burlington Edison High School to the Chuckanut Transit Station and may ultimately connect to regional path along State Route 20. The Tami Wilson Trail provides the only non-motorized crossing of I-5. It begins near the Cascade mall and follows Gages Slough a short distance before terminating at Steven Road. Another important non-motorized route is the SR-20 path which begins in Lions Park near Anacortes Street and extends past the municipal boundary, ending at District Line Road.

A significant share of the City's future growth will be accommodate by increasing residential densities in, or near, commercial areas, particularly along Burlington Boulevard. While this pattern of growth has been shown to reduce the demand for automobile travel (Pivo, Hess & Thatte, 1995), studies have also shown this is only possible when adequate infrastructure is present (Stampe, 2018). In order to achieve the objectives outlined in the land use element of the comprehensive plan, it will be necessary to make a greater investment in the City's non-motorized infrastructure, including sidewalks, multi-use paths, and bike lanes.

The non-motorized transportation provisions in the transportation element should focus on improving conditions in areas that are likely to experience the highest demand, or have the greatest impact on the number of trips made on foot or by bike. It has been consistently demonstrated that areas, such as the Burlington Boulevard corridor, with a mix of intensive commercial and residential development, generate the highest volumes of non-motorized trips (ODOT; TRAC, 1995; Lawrence & Pivo; Ewing, Bartholomew, Winkelman, Walters & Chen, 2007; DOE, 2008; Salon, 2014; Litman 2017). Therefore, the provision of pedestrian and bicycle amenities should be prioritized along, or near these corridors. Schools and parks have also been shown to create a high demand for non-motorized transportation (Schlossberg, Greene,

Phillips, Johnson & Parker, 2006; Commerce, 2007; Larco, 2013) and attention should be given to improving connections between these facilities.

Table 7. Non-Motorized Facilities

Name/Location	Type	Length	Comments
Highway 99/ North Burlington Boulevard Path	Multi-Use Path	1.07 miles	• Paved surface • Connects to transit station and high school
Burlington Edison High School Trail	Multi-Use Path	0.7 miles	• Connects to Hwy 99/Burlington Blvd Path • Owned by School District
Tammi Wilson/Gages Slough	Multi-Use Path	0.4 miles	• Paved surface • Crosses I-5
SR-20 Trail	Multi-Use Path	0.83/1.7 miles (city/total)	• Paved surface • Extends from Anacortes Street past City limits to District Line Road • Connects to Dike Trail
Dike Trail	Multi-Use Path	1.5/2.69 miles (city/total)	• Gravel Surface • Connects to Skagit River park • Owned by Dike District
Lucille Umbarger Path	Multi-Use Path	0.58 miles	• Gravel/grass surface • Mixed ownership • Connects school, Rotary Park, Skagit River Boat Launch, and Dike Trail
Sharon Street Path	Multi-Use Path	0.05 miles/254 feet	• Gravel surface • Unopened right-of-way • Connects to Anacortes Street • Provide route to School
Section Street Bike Lane	Bike Lane	0.25 miles	• Connects to Rio Vista Bike Lane
Rio Vista Bike Lane	Bike Lane	0.25 miles	• Connects to Section Street Bike Lane
Garrett Road Bike Lane	Bike Lane	0.20 miles	

Transit Service

The Skagit Area Transit (SKAT) operates 19 bus routes, including six local routes, three commuter routes, and six primarily rural routes. Four routes originate in, or pass through, the City of Burlington, including route 80X which provides express commuter service from Bellingham to Mount Vernon, route 208 which connects Burlington and Mount Vernon and provides service along the Burlington Boulevard/Riverside Drive corridor, and routes serving the Anacortes and Sedro Woolley. Chuckanut Station, which includes a park and ride facility is a major hub for transit service in the City and provides convenient access to downtown Burlington and the Burlington Edison High School. SKAT route 208, which serves the Burlington

Boulevard corridor, is the most productive bus route in county and accounts for nearly 24 percent of SKAT's total ridership (SKAT, 2018).

Daily transit use is quite low in Skagit County but 8.3 percent of County residents report using transit occasionally (Whatcom Council of Governments & SCOG, 2009). Generally, households that have low incomes or limited access to cars use transit most frequently (PSRC, 2015); however, the case of Skagit County, more than half of transit users have access to a car, suggesting that many SKAT users are riders by choice, a positive indication of good quality transit service. Still, when surveyed SKAT users identified a number of improvements which might encourage greater levels of ridership including, more frequent service, better bus stops and shelters, and extending service hours later into the evening (SKAT, 2018).

Table 8. Existing Transit Service

Route	Hours	Frequency	Serves
80X	6:45 AM – 7:20 PM (weekday) 8:00 AM – 6:00 PM (weekends)	Hourly (weekdays) two hours (weekends)	Bellingham - Mount Vernon
208	6:20 AM – 8:15 PM (weekday) 8:15 AM – 5:45 PM (weekends)	30 minutes (weekdays/weekends)	Burlington – Mount Vernon
513	7:10 AM – 7:10 PM	Three hours (weekdays only)	Burlington - Anacortes
300	7:15 AM – 8:15 PM (weekdays) 8:15 AM – 5:15 PM (weekends)	Hourly (weekdays/weekends)	Burlington – Sedro Woolley

Other Transportation Services and Facilities

Two rail lines pass through the City of Burlington, including the BNSF mainline and a spur between Sedro Woolley and Anacortes. Currently BNSF provides freight service to a number of Burlington businesses and the Washington State Department of Transportation (WSDOT) operates the Amtrak Cascades service between Eugene Oregon and Vancouver BC. While convenient access to rail service is an important asset. The presence of the rail lines, and numerous at grade crossing pose significant safety risks and create traffic problems. The BNSF bridge across the Skagit River is also aging and in need for replacement for safety, flood control, and capacity reasons.

Other regional transportation options include ferry service and privately operated bus lines. Bellair Airporter bus line provides service between Bellingham and the SeaTac Airport with a stop in Burlington. WSDOT provides ferry Service between Anacortes, the San Juan Islands and Sydney BC and Skagit County operates a ferry between Anacortes and Guemes Island.

Recommended Changes and Improvements

This section includes recommended changes intended to meet the City's current and future transportation needs. These recommendations are also intended to ensure a high level of coordination between the Transportation Element and the other sections of the comprehensive plan. The recommended changes include both capital projects, and revisions to the City's comprehensive plan policies and development regulations. In some cases, the recommended changes should be implemented immediately, while other projects are less essential and may be deferred until they are needed and resources become available.

Comprehensive Plan Changes

The following changes should be incorporated into the Comprehensive Plan:

- Require that all arterial intersections perform at Level of Service (LOS) "D" or better
- Adopt "build-out" standards for each arterial street in the City. These standards would prevent perverse outcomes from the application of LOS standards and avoid the possibility of the City investing money in projects beyond the point of diminishing returns. Build-out standard would essentially define a completed state for each arterials street section. Once the completed state was reached, LOS requirement would be addressed through general network improvements, demand management, or investments in alternative transportation.
- Establish maximum intersection and pedestrian crossing standards for major arterials such as Burlington Boulevard.
- Establish minimum street connectivity goals, and develop a GIS model for evaluating circuity and monitoring changes over time.
- Adopt policies to encourage Skagit Transit to prioritize investment in their most productive routes and the routes with the greatest potential for ridership growth. Specifically the City should insist that SKAT maintain peak hour headways of 30 minutes or better and off peak headways of one hour or better along Burlington Boulevard. The City should also insist that regional intercity routes maintain all day service with peak hour headways of one hour or better. The City should strongly discourage the use of scare resources to serve areas outside of Urban Growth Areas.
- Include policies specifying that the Planning Commission review and approve annual revisions to the Transportation Improvement Plan (TIP), and that all capital spending decision be consistent with the TIP and comprehensive plan.

Development Regulations

- Adopt detailed street standards and requirements that specify when they apply
- Develop and adopt maximum block size and street connectivity requirements for subdivisions and site plan reviews

- Revised development regulations to clearly specify that sidewalks are required along all road segments
- Recognize that development will impact the transportation system differently depending on where it occurs by adopting a tiered impact fee schedule. A tiered impact fee schedule would create a financial incentive for development in centrally located areas and a disincentive for development in expensive outlying areas
- Conduct a review of completed developments to determine parking occupancy rates. Parking requirements should then be adjusted to reflect actual occupancy rates, as well as other factors that influence parking demand locally.
- Require that new developments provide connections to all surrounding streets and undeveloped parcels
- Require that new public projects that generate large volumes of pedestrian traffic, such as schools, parks, and transit centers, contribute to the city's non-motorized transportation plan.

Streets and Sidewalks

The City's most pressing transportation needs are unrelated to roadway capacity. Instead the City's street system suffers from low levels of circuity, inadequate intersection controls, and substandard street segments. Investments will be required to enhance the connectivity of the street system, fix failing intersections, and upgrade substandard streets. Map 1 shows the location of major street and intersection improvements that should be constructed over the next 20 years.

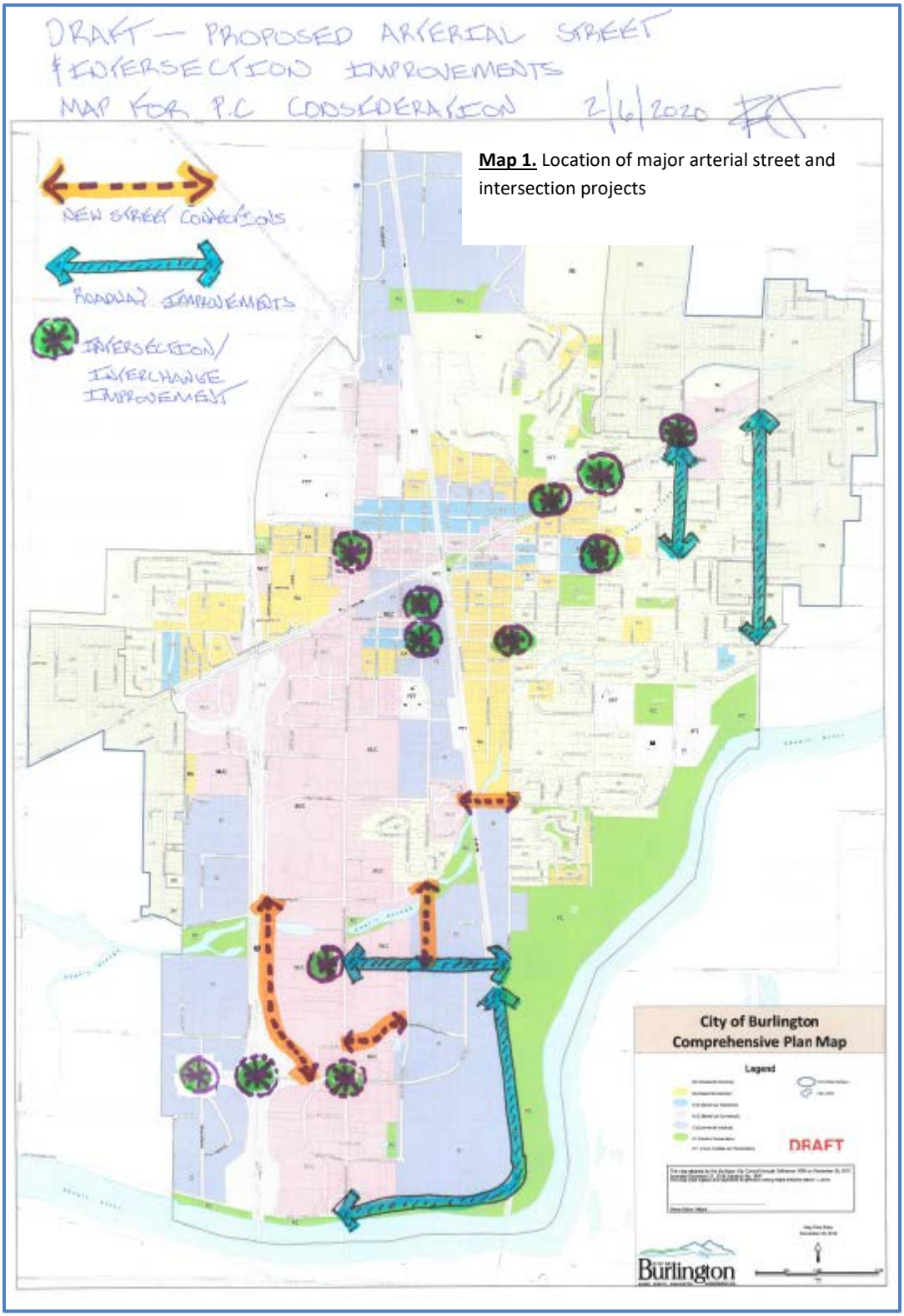
Table 9. Local Arterial Intersection Improvements

Location of Deficiency	2036 LOS Without Changes	Proposed Changes	2036 With Changes
Burlington Blvd & George Hopper Rd	E	Interchange Improvements	D
		Signal Timing Improvements	
Burlington Blvd & Pease Rd	E	Gilkey Railroad Overpass	C
		McCorquedale Road Extension to Costco Drive	
		Signal Timing Improvements	
Spruce St & Greenleaf Ave	E	Install Signal or Roundabout	A

**Citywide level of service standard "D" - Source Transportation Solutions Inc. (TSI), 2017*

The following street and sidewalk improvements should be made:

- Reduce block lengths along Burlington Boulevard to 1,000 feet or less by constructing at least four new signalized intersections.
- Prevent the City's arterial intersections from falling below LOS E by making the improvements identified in the table above.
- Create a new east-west route by constructing a new grade separated railroad crossing
- Create a new north-south route by extending Spruce Street over Gages Slough.
- Improve connectivity and balance traffic flows by extending East McCorquedale Road to Costco Drive.
- Incrementally upgrade substandard streets.

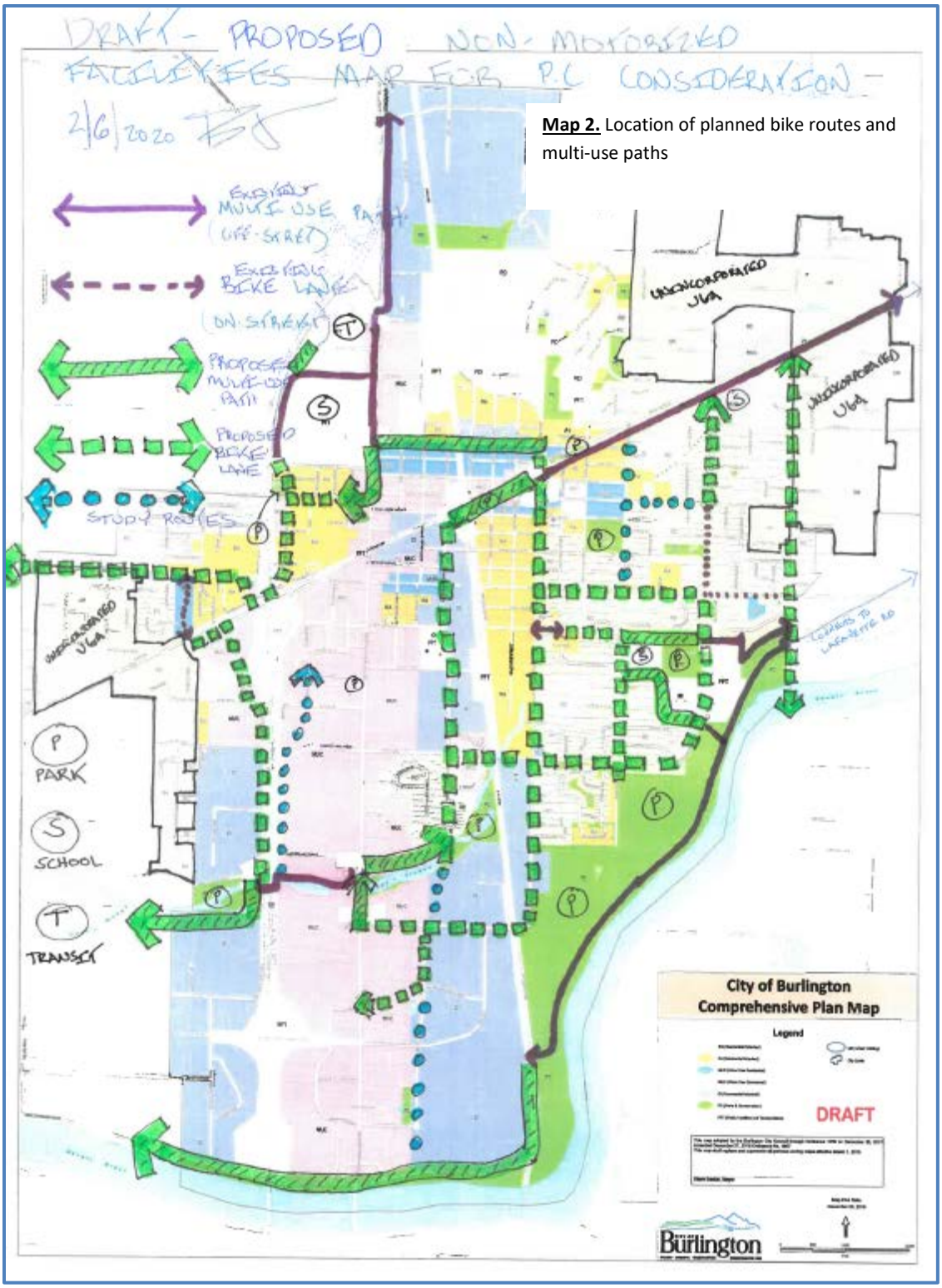


Map 1. Location of major arterial street and intersection projects

Bicycle and Pedestrian Facilities

As illustrated on map 2 existing bike lane and trails segments should be connected together. In particular, should be given to connecting parks and schools. Also, connections should be provided between residential areas and the commercial core. Ultimately the City should strive to create a fully connected network of bike lanes and multi-use paths located at quarter-mile intervals. Bike lanes should be constructed incrementally in conjunction with repaving/restriping projects. Multi-use paths should crate overlapping park and transportation benefits. In order to accommodate the changing nature of retail business, the city should create high quality pedestrian amenities, such as wider sidewalks, planting strips, lighting, and streetscape improvements, along Burlington Boulevard and Fairhaven Avenue. These improvements should be constructed incrementally in conjunction with development.

- Reduce block lengths and increasing the number of intersections
- Eliminate dead end streets a cul-de-sacs
- Provide clear and direct pedestrian paths within, and between, developments
- Increase residential densities and the mix of allowable land uses along commercial strips such as Burlington Boulevard
- Connect parks together and provide connections between parks and schools, residential areas and public services
- Allow increased residential densities within one mile of schools and connect schools to surrounding residential areas with marked crossing, improved sidewalks, dedicated paths and bike lanes
- Create a network of bike lanes at one-half mile intervals so most of the City's residents and commercial areas area within one-quarter mile of a bike lane
- Enhance pedestrian comfort and safety with landscaping, pedestrian scaled lighting and signage, and by providing a buffer between traffic and pedestrians with street trees or on-street parking



Map 2. Location of planned bike routes and multi-use paths

Map 3. Location of streets with enhanced pedestrian amenities

Transit Service

Transit service in the City of Burlington is provided by Skagit Area Transit (SKAT). While the City has little direct control over SKAT's operations, the City can take actions to improve the efficiency and effectiveness of transit service, by concentrating development near bus routes, providing continuous sidewalks between residential areas and arterial bus routes, and by ensuring that uses that generate significant demand for transit service are located near transit routes and provided with good quality pedestrian access improvements.

- Direct the majority of the City's future commercial and residential growth to the Burlington Boulevard corridor
- Provide high quality pedestrian amenities along the Boulevard
- Encourage SKAT to prioritize investments in high volume corridors and regional express service
- Establish levels of service for transit based on frequency, headways, average route speed, service hours and the number of residents and employees within walking distance of a transit route

Other Transportation Services and Facilities

Replacing the rail bridge over the Skagit River has been identified as a priority. This project would have multiple benefits, including increased rail capacity, improved safety, and reducing flood risks by increasing the amount of water that can pass between the bridge abutments. The City should actively encourage the State of Washington and BNSF to prioritize this project and, if possible, incorporate a pedestrian bicycle crossing into the final design.

<u>Conclusion</u>

The changes recommend in this report are intended to accommodate the City's changing transportation needs over the next 20 years. The overall objective of these changes is to better coordinate land use and transportation, build a more connected transportation system, make it easier for residents and visitor to get around without a car, and to ensure the City's transportation system in financially sustainable. The changes should be incorporated into the City's comprehensive plan and steps should be taken to ensure all subsequent Capital Improvement Plans and Transportation Improvement Plans are consistent with these recommendations.

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