APPENDIX I:
Levels of Service

The Washington State Growth Management Act (GMA) requires cities and counties to adopt level of service (LOS) standards for arterials and transit routes. LOS is defined as "qualitative measures describing operational conditions within a traffic stream, and their perception by motorists and/or passengers." It can be described in terms of volume over capacity, travel times, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. The standards are used to identify acceptable levels of congestion on roadways. The two most common methods used are arterial and intersection Levels of Service. Both methods use the letter identification of A through F, which denotes from best to worst.

Arterial Level of Service for Motor Vehicles

The arterial LOS is for uninterrupted flow conditions (such as on freeways and long sections of roadways between stop signs or signalized intersections). Whatcom County, and most of the local jurisdictions within the County, uses this method for determining a roadway's LOS during the pm peak traffic hour. It is quantified by determining the ratio of vehicle volume to capacity (v/c) of a roadway.

The following definitions apply (Highway Capacity Manual, 2000 Edition):

Level of Service A describes primarily free flow operations at average travel speeds, usually about 90 percent of the free-flow speed for the arterial classification. Vehicles are seldom impeded in their ability to maneuver in the traffic stream. Delay at signalized intersections is minimal.

Level of Service B represents reasonably unimpeded operations at average travel speeds, usually about 70 percent of the free-flow speed for the arterial classification. The ability to maneuver in the traffic stream is only slightly restricted and delays are not bothersome.

Level of Service C represents stable operations; however, ability to maneuver and change lanes in midblock locations may be restricted than in LOS B, and longer queues, adverse signal coordination, or both may contribute to lower average travel speeds of about 50 percent of the average free-flow speed for the arterial classification.

Level of Service D borders on a range in which small increases in flow may cause substantial increases in approach delay and hence decreases in arterial speed. LOS D may do to adverse signal progression, inappropriate signal timing, high volumes or some combination of these. Average travel speeds are about 40 percent of free-flow speed.

Level of Service E is characterized by significant delays and average speed of one third of the free-flow speed or less. Such operations are caused by some combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections and inappropriate signal timing.

Level of Service F characterizes arterial flow at extremely low speed from less than one-third to one-quarter of the free-flow speed. Intersection congestion is likely at critical signalized locations with long delays and extensive queuing.

The transportation policy for Whatcom County is established at the LOS of C (i.e., vehicle traffic counts at 70% to 80% of capacity) for all roads that are not within cities or urban growth areas. This

results in a v/c ratio of .75 during p.m. peak hours. The policy for some of the cities and urban growth areas is LOS D (i.e., vehicle traffic counts at 80% to 90% of capacity). Due to size, population, large employers, and commuter traffic, Bellingham has a LOS of E (i.e., vehicle traffic counts at 90% to 100% of capacity) for its streets. There are also 14 arterial streets and intersections that are already beyond capacity at p.m. peak hour but have severe constraints for improvement. These unique streets and intersections have a LOS of F. Some additional arterial streets and intersections identified in the Bellingham Comprehensive Plan Transportation Element are forecast to reach LOS F by 2022.

Intersection Level of Service for Motor Vehicles

A different method of determining the accepted LOS is used for intersections. This takes into account a greater number of variables than the arterial method. The Cities of Lynden, Ferndale, and Bellingham have adopted intersection LOS method.

The City of Bellingham has adopted automobile LOS "E" for both arterials segments and intersections. Intersection LOS is not part of Bellingham's concurrency calculations, but is reviewed via traffic studies required by SEPA.

Following are criteria used in the intersection method (Institute of Transportation Engineers, 2nd Edition):

Level of Service A Describes operations with very low control delay, up to 10 seconds. This LOS occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.

Level of Service B Describes operation with control delay greater than 10 and up to 20 seconds. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.

Level of Service C Describes operations with control delay greater than 20 and up to 35 seconds. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

Level of Service D Describes operations with control delay greater than 35 and up to 55 seconds. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

Level of Service E Describes operations with control delay greater than 55 and up to 80 seconds. This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent occurrences.

Level of Service F Describes operations with control delay in excess of 80 seconds. This level, considered to be unacceptable to most drivers, often occurs with over saturation, that is, v/c with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

Bicycling Level of Service

Engineering standards for roadway capacity for motor vehicles are based on systematic vehicle counts. Roadway widths, speed limits, and design of intersections are components in calculation of Level of Service, but these measurements are appropriate for motor vehicles

and are less appropriate measurements for cycling. A similar measurement and evaluation system for cycling transportation could offer a basis for decisions about when and where to construct changes to the walking and bicycling transportation network.

Level of Service standards for bicycling have been developed to offer a measure by which facilities could be ranked and construction priorities could be established. Level of Service for bicyclists measure different characteristics than capacity and speed. Bicyclists may be well served by a low traffic shared roadway lane in a downtown location but may benefit from a wide shoulder in a higher speed area. Planners, engineers and policy makers can make more efficient investment decisions when measurements become available through a cycling-specific Level of Service calculation.

Walking Level of Service

The 2011 update of the federal Highway Capacity Manual includes a Multi-modal Level of Service rating system that similarly rates facilities for quality of the walking environment. Existing infrastructure can be evaluated based on the presence or absence of these features. Planning and Complete Streets policies can prioritize locations for improvement based on target standards.

Level of Service for State Highways

The Whatcom Council of Governments sets LOS standards for state highways of regional significance which are also referred to as non-highways of statewide significance (SR 11, 542, 544, 547, and 548). The Whatcom Council of Governments set LOS during the peak hour for urban roads at D and for rural roads at C. WSDOT, in consultation with local governments, sets LOS standards for highways of statewide significance (I-5, SR 9, SR 20, SR 539, SR 543, and SR 546).

Transit Level of Service

The WTA strategic plan establishes standards for transit service in the region. Regional and local jurisdictions may refer to WTA strategic plan rather than defining their own LOS standards for transit services.

City of Lynden's Level of Service

As part of the City's 1994 Comprehensive Plan, LOS C was adopted by the City for weekday peak hour traffic on roadways within the City limits. A standard of LOS D was adopted for intersections with the two state highways (Guide Meridian and Badger Road) within the City.

City of Ferndale's Level of Service

The City of Ferndale established intersection LOS, as follows:

- **Traffic Signals, Roundabouts, and All-Way Stop Controlled Intersections** – LOS C or better based on overall average delay per vehicle.
- **Unsignalized Two-Way Stop Controlled Intersections** – LOS D or better for worst traffic movement.

The City of Ferndale generally utilizes an intersection Level of Service for automobiles, except along four primary corridors within the City: Main Street/Axton Road, Slater Road, Grandview Road, and Vista Drive. Along these corridors, the average weekday pm peak hour travel speeds are determined and compared against the posted speed limit. LOS C has been adopted throughout the City. For areas measured by corridor travel time, this LOS equates to approximately 50% of the posted speed limit, although sub-segments within the corridor may be allowed to fall to approximately 40% of the speed limit, provided that the overall average maintains an LOS C.

Whatcom County Level of Service

The Whatcom County Comprehensive Plan sets an LOS of 0.75 weekday peak hour volume/capacity on collectors and arterials outside urban growth areas, except for designated primary routes, for which an LOS of 0.90 is established. For County collectors and arterials within urban growth areas, the LOS is set at 0.90. The LOS standard can be reduced for a development in urban growth areas if the development provides non-motorized facilities or access to a transit stop within one quarter mile. The County also sets an LOS standard for the Lummi Island ferry: 513 passenger trips annually per capita Lummi Island population.

Bellingham's LOS and Multimodal Transportation Concurrency Program

From June 2007 to January 2009, Bellingham Public Works transportation planners worked to fundamentally change Bellingham's level of service (LOS) standards from auto-centric to multimodal to further support Urban Villages and infill land use policies in the Land Use Element and multimodal transportation policies in the Transportation Element of the Bellingham Comprehensive Plan. BMC 13.70 now measures the availability and adequacy of facilities and service for the four major modes of mobility; pedestrian, bicycle, public transit, and motorized vehicles, throughout Bellingham's transportation network. In recognition of its innovative approach and contribution to furthering the goals of the Washington's Growth Management Act, Bellingham's Multimodal Transportation Concurrency Program received the American Planning Association/Planning Association of Washington Award for Transportation Planning in Washington State in November 2009.

Bellingham's Comprehensive Plan Transportation Element adopts the following LOS:

TP-11 Establish Level of Service (LOS) standards for a range of multimodal transportation modes to identify deficiencies and need for improvements.

Bellingham's adopted LOS standard is "**Person Trips Available by Concurrency Service Area**" based on arterial and transit capacity for motorized modes and on the degree of network completeness for pedestrian and bicycle modes, as listed below. The individual thresholds for each transportation mode available in each Concurrency Service Area are listed in Table 1 of BMC 13.70 Multimodal Transportation Concurrency requirements.

Motorized Transportation Modes

- **Arterial Streets:** Peak Hour LOS Person Trips Available (PTA) during weekday p.m. peak hour based on data collected at designated Concurrency Measurement Points for each Concurrency Service Area;
- **Transit:** Determine seated capacity, measure ridership, and equate to person trips available via public transit service during weekday p.m. peak hour based on data collected at designated Concurrency Measurement Points for each Concurrency Service Area;

Non-motorized Transportation Modes

- **Bicycle:** Credit person trips according to degree of bicycle network completeness for designated system facilities/ routes for each Concurrency Service Area;
- **Pedestrian:** Credit person trips according to degree of pedestrian network completeness for designated system facilities/routes for each Concurrency Service Area; and

- **Trails:** Credit person trips according to degree of bicycle and pedestrian network completeness, where trails serve a clear transportation function for a Concurrency Service Area.

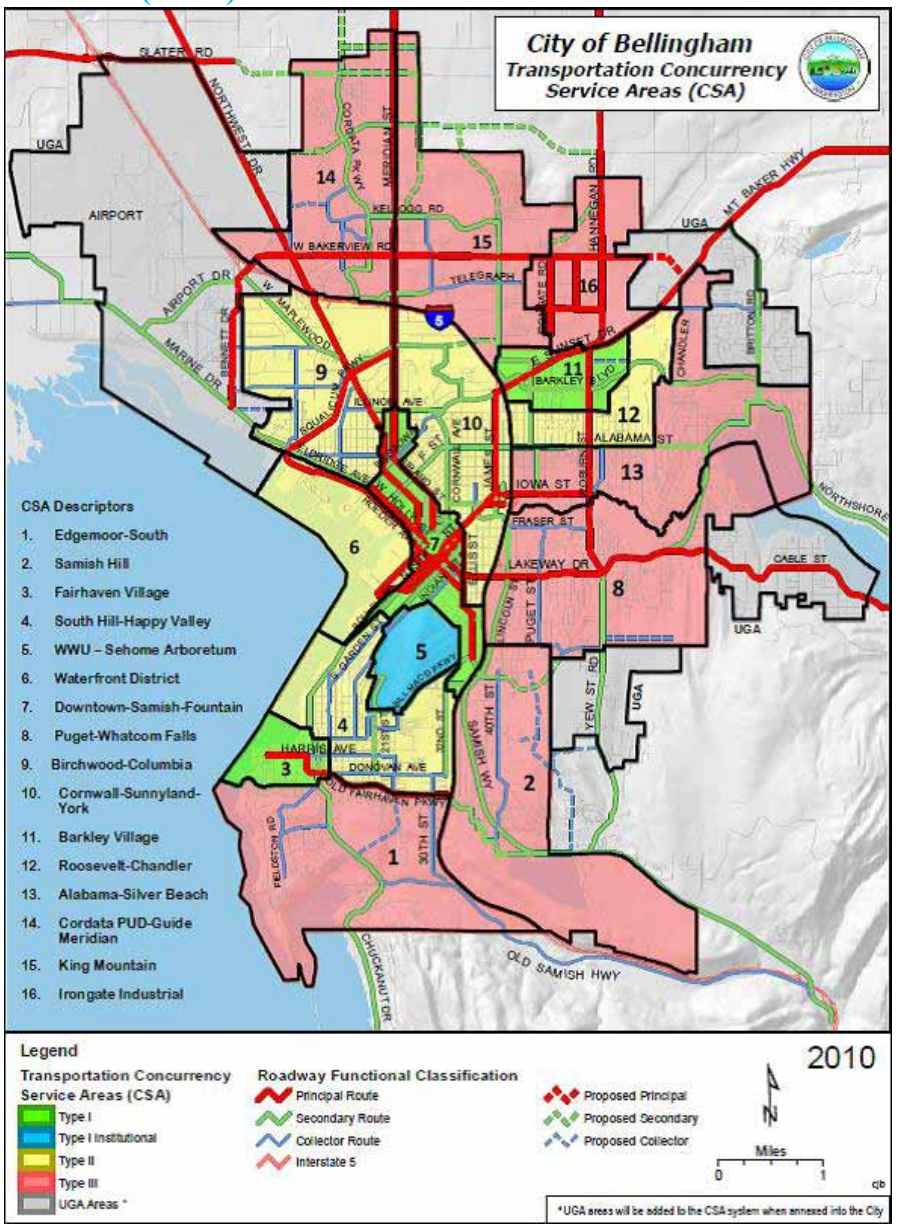
Bellingham is divided into 16 Concurrency Service Areas (CSA) classified into Types 1, 2, or 3 according to location, land use environment, and availability of multimodal transportation modes.

The intent of BMC 13.70 Multimodal Transportation Concurrency is to further implement the multimodal transportation policies of the Transportation Element and the infill land use strategies of the Land Use Element. Consistent with Washington's Growth Management Act and the Bellingham Comprehensive Plan, the Multimodal Transportation Concurrency methodology promotes infill development where the greatest degree of multimodal transportation facilities are already available or have funding secured for construction.

Concurrency Service Area (CSA) Classifications

Type 1 CSA *(Green)* are Urban Villages with adopted Master Plans (Downtown, Old Town, Samish, and Barkley) or active planning processes leading toward the adoption of a Master Plan (Fountain). Type 1 CSA are characterized by a high percentage of pedestrian and bicycle facilities, high frequency transit service, and higher density land uses with a good mix of services. WWU (CSA #5) is an exception and is classified as "Type 1 Institutional" due to the extremely high transit service and ridership, campus parking limitations, and the adopted WWU Institutional Master Plan. The combination of land use characteristics and availability of transportation alternatives in Type 1 CSAs generally creates a lower degree of reliance on the private automobile for transportation mobility.

Figure 19. Bellingham's 16 Concurrency Service Areas (CSA)



Type 1A CSA *(Blue)* are areas that have very similar transportation characteristics to Type 1 CSA's (Green), but have different land use characteristics in that they are primarily "Institutional Uses" and/or have "Institutional Master Plans (IMP)." Western Washington University (WWU-CSA 5) is the only Type 1A CSA at present, but the Saint Joseph's Hospital campus area, the Whatcom Community College campus area, and the Bellingham Technical College (BTC) campus area are all potential future Type 1A (Blue) CSA's.

Type 2 CSA *(Yellow)* are essentially transition areas between Urban Villages and outlying suburban areas. With the exception of the Roosevelt-Chandler CSA #12, Type 2 CSAs are located west and south of Interstate 5. Type 2 CSA are generally characterized by grid pattern residential streets, a moderate percentage of pedestrian and bicycle facilities, some high frequency transit service, and moderate density land uses that are primarily residential with a smaller degree of mixed uses and neighborhood commercial services. The combination of land use characteristics and availability of transportation alternatives in Type 2 CSAs generally creates a moderate degree of reliance on the private automobile for transportation mobility.

Type 3 CSA *(Red)* are located furthest from the urban core at the outer edges of Bellingham and, with the exception of Edgemoor-South CSA #1, are primarily located east and north of Interstate 5. Type 3 CSA are characterized by a low percentage of pedestrian and bicycle facilities, moderate to low transit service availability, moderate to low density land use with a small to non-existent degree of mixed uses. The combination of land use characteristics and availability of transportation alternatives in Type 3 CSAs generally creates a higher degree of reliance on the private automobile for transportation mobility.

In order to promote infill development where adequate multimodal transportation facilities already exist, higher emphasis and Person Trip Availability is awarded to Type 1 CSAs, moderate emphasis and Person Trip Availability is awarded to Type 2 CSAs, and lower emphasis and Person Trip Availability is awarded to Type 3 CSAs. This is done through weighting factors called "Policy Dials" adopted in BMC 13.70 Table below.

Table 27: Multimodal transportation policy dials applied to land use environments

	Transportation Concurrency Service Areas		
Mode	Type 1	Type 2	Type 3
Motorized			
Auto			
Mode weight factor	0.7	0.8	0.9
Transit			
Mode weight factor	1	1	0.8
Non-Motorized			
Pedestrian Percent threshold for minimum system complete	50%	50%	50%
Person trip credit for 1% greater than minimum threshold	20	20	20
Mode weight factor	1	0.9	0.8
Bicycle Percent threshold for minimum system complete	50%	50%	50%
Person trip credit for 1% greater than threshold	20	20	20
Mode weight factor	1	0.9	0.8
Multi-Use Trails Person trip credit for 1% greater than threshold	10	10	10
Mode weight factor	1	0.9	0.8

Source: City of Bellingham

Calculations to establish the number Person Trips Available for each CSA are made as follows:

Motorized Vehicle Person Trips Available

The City regularly collects vehicle traffic counts at designated Concurrency Measurement Points on arterials streets serving Concurrency Service Areas (CSA). Vehicle traffic volumes are converted to person trips using local and national data for average car occupancy rates. Motorized vehicle person trips are then used as one variable to calculate total Person Trips Available within each Concurrency Service Area (CSA). Adjustments are made based on the directional use of the corridor.

Transit Person Trips Available

Transit trips are determined by counting seated capacity available on WTA buses, measurements of ridership on selected routes at Concurrency Measuring Points, and conversion to Person Trips Available within Concurrency Service Areas (CSA). Transit person trips are used as one variable to calculate total Person Trips Available within Concurrency Service Areas (CSA). The City works with WTA to determine seated capacity on transit routes, regularly collect transit ridership statistics, and to calculate the number of transit person trips available in each Concurrency Service Areas (CSA) within the City. Adjustments are made based on the ability of the off-peak transit service to actually serve travel demands during the PM peak hour. For example, each WTA high-frequency transit "GO Line" (15-minute headways) can provide the seated capacity equivalent of up to 320 person trips per hour (40-seat bus x 4 runs per hour in each direction).

Non-Motorized Bicycle and Pedestrian Person Trips Available

Sidewalks, bicycle lanes, and, in some cases, off-street multi-use trails also provide person trips in the multimodal transportation network. Pedestrian and bicycle trips are determined by measuring the degree of completeness of selected pedestrian and bicycle routes serving Concurrency Service Areas (CSA), and converting this to credits for Person Trips Available. The City works directly with the Bicycle and Pedestrian Advisory Committee (BPAC) to determine the degree of completeness of selected pedestrian and bicycle routes serving Concurrency Service Areas (CSA). Pedestrian and bicycle person trip credits are used as one variable to calculate total Person Trips Available within Concurrency Service Areas (CSA). The City awards 20 person trip credits for every 1% of bicycle or pedestrian facility completed above 50%. As an example, assume that the existing inventory shows 45,000 linear feet of select bicycle facilities serving Concurrency Service Areas (CSA) "X". Assume that an additional 27,000 linear feet of planned bicycle facilities have been adopted in the Transportation Element and/or fully funded within the 6-Year TIP. This equates to 72,000 linear feet of "planned" bicycle network for the CSA "X". The 72,000 planned network divided by the 45,000 existing inventory results in a 62.5% complete network, which is 12.5% above the minimum 50% threshold for awarding person trip credit. At 20 credits for every 1% above 50%, this would convert to 250 bicycle person trips available for CSA "X". The more complete the bicycle network is, the more person trip credits are available.

Figure 20. Calculation of person trips available and used within each CSA