V. LEVEL OF SERVICE STANDARDS

The National Transportation Research Board's Highway Capacity Manual contains specific methodologies to measure level of service for various transportation facilities. Most counties and cities in Washington employ LOS methodologies from this manual. Skagit County and most of the incorporated jurisdictions within the County employ HCM-based LOS methodology.

Once a level of service methodology is in place, a level of service standard can be set. A level of service standard is usually a congestion level measured by the LOS methodology, above which a road is considered to no longer function adequately in the manner to which it was designed. Once the LOS standard is exceeded on a road, the road is considered to be "in need" and improvements should be made.

A. LEGAL REQUIREMENTS FOR LOS

1. LOS for County Facilities

Under RCW 36.70AO70, the GMA requires that the Transportation Element of the Comprehensive Plan contain *"Level of service standards for all arterials and transit routes to serve as a gauge to judge performance of the system. These standards should be regionally coordinated."* The GMA goes on to state that *"local jurisdictions must adopt and enforce ordinances which prohibit development approval if the development causes the level of service on a transportation facility to decline below the standard adopted in the transportation element of the comprehensive plan, unless transportation improvements or strategies to accommodate the impacts of development are made concurrent with the development."* This is the much discussed "concurrency" requirement of the GMA

Since public supported transit has only very recently been established in parts of the unincorporated area of Skagit County, no level of service standards have yet been considered. In fact SKAT is not currently planning on establishing level of service standards for its urban routes. The primary consideration in the rural areas is if the ridership justifies the service. Therefore, the focus of the level of service standards and analysis here is on the County road system. Some additional discussion of service levels will be made with respect to the Guemes Island Ferry. However, formal level of service standards have never been considered for the ferry system.

2. LOS for State Facilities

State transportation facilities, particularly the state highways and the state ferries are, in many respects, the most important transportation facilities in Skagit County. They carry all the through county traffic as well as a substantial amount of traffic between major urban centers in the County. Because of this, the level of service that is provided on these state facilities has important implications for the successful functioning of the overall transportation system in the region.

In Skagit County, as in other areas, the Regional Transportation Planning Organization (RTPO) has taken the lead in helping determining the appropriate LOS standards for State highways in the region. In fact, the RTPOs have a specific legal responsibility for this from RCW 47.80.030 which states *"Each regional transportation planning organization shall develop a regional transportation plan that (a) ...(c) Establishes level of service standards for all state highways and ferry routes. These regionally established level of service standards for state highways and state ferries shall be developed jointly with the department of transportation to encourage consistency across jurisdiction.* " In 1998, HB 1487 required that the State establish the service level standards on state highways of statewide significance. In Skagit County, Highways of Statewide Significance (HSS) include I-5 and SR-20.

In 1996, the Skagit-Island RTPO, with input from various members including cities, the County and WSDOT, made a formal decision on the LOS standards for state highways. This decision was for LOS C to be the standard for all rural highways and LOS D the standard for all urban highways, with SR-20 through Anacortes designated as C. All designations are based on the Highway Capacity Manual LOS methodologies. This designation is documented in the Regional Transportation Plan. The County encourages the RTPO, in conjunction with San Juan County, to participate in the establishment of service level standards for the state ferry system serving Skagit County.

The background behind the drafting of the GMA indicates that the legislative intent was to include state facilities within the scope of the Act. However, the 1990 Act was unclear about how specific state facilities would be treated in local comprehensive plans, how LOS standards would be set, and how concurrency requirements would be applied to state facilities. As a result of the continuing concerns for

state system capacity, the 1998 Legislative Session approved SHB 1487 that requires the State classify the state routes of statewide significance. Other state routes will be classified by the state in coordination with regional planning organizations.

In particular, SHB 1487 requires the transportation commission to identify transportation facilities of statewide significance and submit a list of such facilities for adoption by the 1999 legislature. In 1999, level of service standards for those facilities were established by WSDOT. This statewide significance system shall include at a minimum interstate highways and other statewide principal arterials that are needed to connect major communities across the state and support the state's economy. The counties and cities will then make appropriate changes in their local transportation plans. The transportation commission selected I-5 and SR 20 as two statewide significant highways in Skagit County. They kept the level of service standards at LOS C in rural areas and LOS D in urban areas.

Skagit County fully supports the decisions by the RTPO on state highway LOS standards. Based on these standards, the traffic analysis that went into the Regional Transportation Plan clearly shows there will be significant highway improvement needs on the state highway system over the next few years. It is highly important that the State provide the financial resources for WSDOT to make these needed improvements in a timely fashion. Without such improvements, state highway congestion will increasingly spill over onto County roads in certain areas, undermining the County's efforts to provide residents with a reasonable level of service on the County road system.

B. PRIORITY PROGRAMMING FOR ROADS

The primary analytical method for evaluating and prioritizing transportation improvement projects in Skagit County prior to the implementation of GMA requirements has been the use of the Priority Array. WAC 136-14-020 states *"Priority programming techniques shall be applied in the ranking of all potential projects on the arterial* (functionally classified) *road system of each county. ...Priority programming will not be required, but is' recommended, for the local access road system.* " WAC 136- 14-030 goes on to state *"Items to be included in the* (priority programming) *technique for roads shall include, but not be limited to the following:*

(1) *Traffic Volume;*
(2) *Roadway condition;*
(3) *Geometrics;*

(4) *Matters of significant local importance."*

Finally, WAC 136-14-040 states:

> *"The resulting priority array ...shall be consulted together with the bridge priorities by the legislative authority and county engineer during the preparation of the proposed six year program."*

The Skagit County Priority Array, developed in the Engineering Division of the Public Works Department, is a computerized spreadsheet which contains information on all the road segments in the County road system. This information includes pavement condition, road geometrics, traffic level and accident rates. The priority calculation combines and weights these various factors to come to a project priority numeric rating.

Under GMA, Skagit County is required to use level of service standards in the prioritization of transportation projects. The general focus of LOS project programming is on traffic problems and the alleviation of congestion. This is different from the traditional focus of the County's Priority Array which is on safety and the physical characteristics of the roadway. Because of the two legal requirements, Skagit County now uses both an LOS methodology and a Priority Array methodology for road project programming. Beyond the legal requirements, the use of these two types of methodologies provides a more balanced approach and will hopefully result in the most beneficial projects rising to the top of the funding lists.

C. TRANSPORTATION IMPROVEMENT PROGRAMS

The major impact of level of service standards produced through the GMA planning efforts should be on the transportation improvement programs developed in Skagit County. Three such programs are discussed below.

1. GMA Transportation Financial Plan

The passage of the Growth Management Act has added a long-range transportation project planning requirement for Skagit and other counties throughout the State of Washington. Specifically, the GMA (RCW 36.70A.070) requires that the Transportation Element of the Comprehensive Plan show transportation facility and service needs, and include a *"multi-year financing plan based on the needs ...which shall serve as the basis for the six- year street, road, or transit*

program." These needs are based on level of service considerations and are presented later in Chapter VI. The Financial Plan is based on a 20-year horizon and is presented in Chapters IX. The Financial Plan and other aspects of the Transportation Element now directly impact the content of the County's Six Year Transportation Improvement Program and the Annual Transportation Program as discussed below.

2. Six Year Transportation Improvement Program

Each year Skagit County is required to produce a Six Year Transportation Improvement Program (Six Year TIP) which identifies those road, bridge, and ferry projects the County plans to work on over the next six years. This can be thought of as the County's medium range planning program for transportation facilities. In developing the Six Year TIP prior to 1995, the County Public Works Department has used the above-mentioned Priority Array as the main analytical tool to help identify those projects that should be included.

Three aspects of the Transportation Element have a direct bearing on transportation project programming and funding through the Six Year Transportation Improvement Program. These are: 1) transportation policies; 2) existing and future transportation needs (based on LOS); and, 3) the transportation financial plan. The transportation policies are used to give general direction for transportation improvement investments. Along with the County's Priority Array which prioritizes road projects primarily on physical deficiencies, the transportation needs (or LOS deficiencies) are used to select potential projects. The transportation financial plan is used to produce a financially feasible six-year plan. Thus, the Transportation Element is a major tool for use in transportation investment decisions by Skagit County officials.

3. Annual Program

During the County's budget process, the Annual Program for the next year's transportation engineering and construction is compiled and adopted by the Board of County Commissioners. This is the County's short-range transportation improvement program. The projects included are a combination of the first year of the Six Year TIP, projects that were not completed in the previous year, and projects on the Six Year TIP that may have changed priority. Typically, the Engineering Division of the Public Works Department will begin

working on a project in the year it is first included on the Annual Program and complete the work the following year.

It is in the project design phase of the Annual Program that various site specific issues and potential environmental impacts are considered. Often these issues relate to the project's impact on surface water drainage, on wetlands, and on adjacent property owners.

D. DEFINING LEVEL OF SERVICE STANDARDS

1. Highway Capacity Manual

The most widely used method to determine LOS for the GMA is the Highway Capacity Manual (HCM). This provides a good basis for coordinating among adjacent jurisdictions as required in the GMA. All agencies adjacent to Skagit County use the HCM to determine Level of Service (LOS) in their respective jurisdictions. It provides a consistent system of techniques for the evaluation of the quality of service on highway and street facilities. While different service measures are used for different types of facilities, The LOS rating categories are always A through F. In general, LOS A indicates free flow with no delays or mobility restrictions, while LOS F signifies severe congestion caused by more traffic than the facility has the capacity to serve (V/C > 1).

The Transportation Research Board's (TRB's) HCM 2000 provides a collection of state-of-the-art techniques for estimating the capacity and determining the level of service for transportation facilities, including intersections and roadways as well as facilities for transit, bicycles and pedestrians. For more than 50 years, the HCM has fulfilled this goal, earning a unique place in the esteem of the transportation community. Developed and revised under the direction of the TRB Committee on Highway Capacity and Quality of Service, this newest edition, HCM 2000, presents the best available techniques for determining capacity and level of service for transportation facilities at the start of the new millennium.

The HCM 2000 represents a significant revision and expansion of the material provided in previous editions. The manual has grown from 15 to 31 chapters. These chapters are divided into five parts:

I. Overview
II. Concepts
III. Methodologies

IV. Corridor and Areawide Analyses, and
V. Simulation and Other Models

Parts I and III contain information that corresponds to the contents of previous editions. Part II provided concepts and estimated default values for use in planning level analytical work. Part IV presents computational techniques and general analysis guidelines for corridor and areawide analyses. Part V offers background and information on alternative models that may be appropriate for system wide or more complex analysis.

The HCM provides methods for computational analysis that can be long and drawn out with a series of complex formulas. It does not provide or endorse software to perform the calculations. Several private companies have developed software to streamline the process. Users can just input variables to these programs and get reports summarizing the results. Users of the software should have training in the methodology of the HCM before using software to assure variables are in the correct format.

The Transportation Research Board adopted an updated Highway Capacity Manual (HCM) in December 2000. The updated HCM included many refinements including changes to the Two-Lane Highways section that applies to most roads in unincorporated Skagit County. Although formulas calculating LOS are based on the ratio of traffic volumes to facility capacity, the HCM converts the output to terms better understood by laymen. For example, the LOS of Two-Lane Highways is output in *percent time spent following* and is calibrated on a scale from A to F. LOS A may mean free flowing traffic with less than 40% time spent following. LOS C is also free flowing traffic with less than 70% time spent following. LOS E is traffic volumes nearing capacity and is approaching 100% time spent following. LOS F is traffic volumes exceeding capacity that is also 100% time spent following but also signifies traffic congestion including stopped vehicles waiting their turn to pass through the facility.

As mentioned above, different service measures are often used for different types of facilities. Volume over capacity (v/c) is a standard measure that is used for many different facilities. Examples of measures often used for different facility types are the following:

- Freeway Segment: cars per mile per lane (or v/c)
- Multilane Highways: cars per mile per lane (or v/c)

- Two-Lane Highways: percent time spent following or average travel speed
- Signalized Intersections: average control delay
- Unsignalized Intersections: reserve capacity
- Arterials: average travel speed

For rural county roads, the measures used for two-lane roads are percent time spent following or average travel speed. (A methodology for evaluating the LOS at specific intersections can be used as well.) The focus of the percent time spent following method is on restrictions in free flow travel caused by traffic level and restrictions in passing.

Saturation of traffic from low levels of service often impacts side street traffic and turning traffic requiring traffic signals to provide orders. Traffic signals in turn have a direct impact on road capacity in proportion to the percentage of time red indications are displayed on a facility. Typically signalized intersections will have lower levels of service than a free flow roadway with the same traffic volumes. Monitoring potential signalized intersections is also necessary to determine the functionality of a facility.

2. Categories of Traffic Flow

Facilities are classified in two categories of flow: uninterrupted and interrupted. Uninterrupted-flow facilities have no fixed elements such as traffic signals that are external to the traffic stream and might interrupt the traffic flow. Traffic flow conditions result from the interaction among vehicles in the traffic stream and between vehicles and the geometric and environmental characteristics of the roadway.

Interrupted-flow facilities have controlled and uncontrolled access points that can interrupt the traffic flow. These access points include traffic signals, stop signs, yield signs and other types of control that stop traffic periodically (or slow it significantly) irrespective of the amount of traffic.

Uninterrupted and interrupted flows describe the type of facility, not the quality of the traffic flow at any given time. A freeway experiencing extreme congestion, for example, is still an uninterrupted-flow facility because the causes of congestion are internal. Highways can operate under uninterrupted flow in long segments between points of fixed interruption. On two lane highways it is often necessary to examine points of fixed interruption as well as uninterrupted-flow segments. Skagit County will monitor road segments as uninterrupted flow and intersections as interrupted flow.

3. Road Segments

Skagit County will perform an annual analysis on all applicable road segments as identified in the County Road Log. The first step will be screening by inputting updated traffic volumes and screening out all road segments with traffic volumes too low to register a level of service equal to the level established by the Board of Commissioners as acceptable. The process will also be applied after applying growth rates to the traffic volumes to also analyze the LOS in 2015.

4. Intersections

Intersection LOS will be calculated using Traffic Signal Warrants in conjunction with LOS methods. The analysis will use real time data which focuses on turn movements and volumes of the entire intersection. This type of analysis can be made on any intersection in the County Road System.

E. LEVEL OF SERVICE INDICATORS FOR GUEMES ISLAND FERRY

Vehicle Carrying Capacity

The level of service (LOS) for the Guemes Island Ferry system is closely tied to its vehicle carrying capacity because vehicle traffic has a greater impact on the ferry system than walk-on passenger traffic. Simply put, the M/V Guemes can carry far more walk-on passengers than vehicles. In transportation planning, LOS is often measured by volume divided by capacity, the V/C ratio, and by the level of congestion. Measuring the V/C ratio is valuable in examining the overall carrying capacity of the system. As the V/C ratio approaches 100%, the overall system level of service is reduced. Examining the level of congestion on the Guemes Island Ferry system is more complex, but gives a better indication of LOS during peak demand for ferry service. The V/C ratio calculations and examination of system congestion will focus on the vehicle carrying capacity of the M/V Guemes.

The 1991 Guemes Island Ferry Capital Facilities Plan calculated a level of service indicator for the M/V Guemes by examining volume over capacity. The vehicle carrying capacity of the M/V Guemes in 1990 was 136,708 annually. The total number of vehicle crossings for 1990 (71,574) was divided by the number of scheduled ferry crossings (6214) in 1990, which resulted in an average of 11.5 vehicles per scheduled ferry crossing The 11.5 vehicles per scheduled ferry

crossing was divided by the 22 vehicle capacity of the M/V Guemes, which resulted in a volume-to-capacity (V/C) of 52%.

Due to an increase in the number of scheduled ferry crossings, the vehicle carrying capacity of the M/V Guemes in 2000 was increased to 143,000 annually. The total number of vehicle crossings for 2000 (106,410) was divided by the number of scheduled ferry crossings (6,500) in 2000, which resulted in an average of 16.4 vehicles per scheduled ferry crossing. The 16.4 vehicles per scheduled ferry crossing was divided by the 22 vehicle capacity of the M/V Guemes, which resulted in a volume-to-capacity (V/C) of 74%. This represents a V/C increase of 22% from 1990 to 2000, which is very significant.

If the number of scheduled ferry crossings remains the same, the vehicle carrying capacity of the M/V Guemes will remain the same, and the V/C ratio will continue to approach 100%. Linear regression analysis projections indicate that the current vehicle carrying capacity (143,000) will be exceeded in the year 2010 if the existing ferry schedule is not altered. If ferry crossings are added to the schedule, the M/V Guemes has far more capacity than is needed during the planning period. For a detailed discussion of additional vehicle capacity available in the existing ferry schedule, see Chapter VII. Transportation System and Demand Management.