Regional Transportation Concurrency System in Spokane County
A Feasibility Study

TECHNICAL MEMORANDUM # 6

Technical Aspects of a Regional Concurrency Review Process

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Spokane Regional Transportation Council

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EXECUTIVE SUMMARY

This memorandum outlines the planning tools that would be appropriate for use in a regional concurrency system. It also describes alternative methodological frameworks for evaluating a regional concurrency system. Lastly, it provides estimate of resources required for implementing a regional concurrency management system.

Planning Tools for a Regional Concurrency

This memorandum reviewed capacity analysis tools and travel demand models, as well as planning tools used in the current local and regional concurrency implementations in the Spokane Region. The review found that the Highway Capacity Manual (HCM) procedure has been the widely used traffic analysis tools for analyzing the level of service on small geographic scope (isolated location, segment, or corridor). Moreover, the software package that has been widely used for such deterministic LOS analysis is Synchro. The study recommends the HCM procedure and Synchro for the LOS analysis of intersections and small-scale corridors. At a regional scale, the four-step travel demand model is found to be the practical approach appropriate for the envisioned Spokane regional concurrency management system. There are three software packages (VISUM, TransCAD, Cube/Voyager) that are state-of-the-art tools for travel demand modeling and forecasting. Anyone of these tools is appropriate for modeling a regional concurrency system. VISUM is now the current modeling program used for the SRTC travel demand model. It is therefore recommended to continue to use VISUM as a tool for the envisioned regional transportation concurrency management system.

Methodological Frameworks for a Regional Concurrency

Existing methodology used by the SRTC in the current regional concurrency management system was reviewed. Alternative methodological frameworks were then discussed that includes potential regional concurrency structures, planning level and development review regional concurrency evaluation, level of service standards, and multimodal concurrency evaluation.

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Estimate of Resources for Implementing a Regional Concurrency

Estimate of resources required for implementing and monitoring of the regional concurrency management system include data, technical tools, and staff. Data include on-going regular and periodic collection of traffic counts, travel times, transportation improvement projects, pipeline projects, and comprehensive land use plans. Technical tools include acquiring license to the Synchro software. SRTC already has a license to the VISUM software. Staffing requirement includes staff to deal with the administration, data collection, modeling, and concurrency review of the regional concurrency management system.

SEPA and Concurrency

The interaction between a regional transportation concurrency management system (RTCMS) and SEPA will depend upon how the RTCMS is designed. The SEPA review is currently used to determine the impacts of a proposed development process. Currently, the SEPA process is used to mitigate impacts directly related to specific projects. The extent of SEPA analysis varies widely depending on the local government, the size of development, and to some extent the location of the development. SEPA seems to work best for large developments, but does not account well for the cumulative effects of a number of smaller developments. Consequently, the impact of development on regionally significant facilities is usually not mitigated. Nevertheless, a properly designed RTCMS would presumably use the SEPA process to determine impacts on these regional facilities and designate fees collected through the SEPA process to mitigate impacts on regional facilities. A well designed regional system would dovetail nicely with SEPA and create a more realistic and useable framework for SEPA mitigation.

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INTRODUCTION

The purpose of this Technical Memorandum # 6 is to outline the technical aspects of a concurrency review process, which is part of a feasibility analysis of a regional transportation concurrency management system in Spokane County, Washington. This memorandum examines the following specific issues concerning technical aspects of a concurrency review process for regional facilities:

- Planning tools, such as capacity analysis and travel demand models, most appropriate for concurrency review for regional facilities. Possible technical concerns associated with those planning tools.
- Alternative methodological frameworks used to evaluate regional concurrency.
- Estimate of resources required to implement a regional concurrency review process.

Subsequent sections discuss in detail each of the above issues.

A brief review of planning tools used for concurrency review in the Spokane Region is included to assist in the evaluation of resources that would be needed for a regional concurrency management system.

Review of Planning Tools Used for Concurrency Review in the Spokane Region

Jurisdictions within the Spokane Region generally use the Highway Capacity Manual (HCM) methodology for capacity analysis to determine the level of service at isolated intersections and at intersections within a corridor. The software Synchro has been used to aid in the analysis.

The Spokane Regional Transportation Regional Transportation Council (SRTC) has developed and maintained a regional travel demand model for its regional planning. The regional model has recently been updated using different application software called VISUM. VISUM is a state-of-the-art planning tool that offers a comprehensive, flexible software system for transportation planning, travel demand modeling and network data management.

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The current implementation of the SRTC regional travel demand model follows the conventional four-step procedure of trip generation, trip distribution, mode choice, and trip assignment. Review of travel demand models in subsequent sections provides more details of the four-step model approach.

The City of Spokane has utilized the SRTC regional travel demand model to evaluate planning level travel times as part of the City's two-tier concurrency structure. The regional model includes all arterials within the City and its Urban Growth Area (UGA), which provides a comprehensive tool for evaluating the major transportation facilities within the City.

Spokane County has also utilized the SRTC travel demand model to derive travel time forecasts for the concurrency management program[1]. The regional model is developed based on the Spokane County Comprehensive Plan land use assumptions. The concurrency management system measures the amount of time it takes to travel Eastbound, Westbound, Southbound and Northbound on major arterials, highways, and freeways in Spokane County.

TECHNICAL ASPECTS OF A CONCURRENCY REVIEW PROCESS

The Growth Management Act (GMA) requires that transportation improvements or strategies to accommodate development impacts need to be made concurrently with land development. "Concurrency" is defined by the GMA to mean that any needed improvements or strategies are in place at the time of development or that a financial commitment exists to complete the improvements or strategies within six years. If concurrency cannot be demonstrated, then local jurisdictions are required to enforce adopted ordinances, which prohibit development approval unless transportation improvements or strategies to accommodate the impacts of development are made concurrent with the development.

Local governments have many choices about how to apply concurrency within their plans, regulations, and permit systems. When a community establishes the level of service (LOS) it intends to provide, it also determines how the transportation network within its boundaries will be managed or expanded to maintain adopted LOS.

[1] Spokane County Performance Measurement Report, 2002

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Central to the implementation of concurrency is the concurrency review process, which is basically a determination to ensure there is adequate capacity available on the public road system to serve additional traffic that would be generated by a proposed land development. Figure 1 is a simplified illustration of performing the adequacy test. Each development application is reviewed to determine whether or not there is enough capacity at intersections or on arterial roads in the vicinity to accommodate the new traffic that will be generated by new development without having traffic congestion increase to unacceptable levels. Simply stated, if there is sufficient intersection and arterial capacity, the development is deemed concurrent and can proceed.

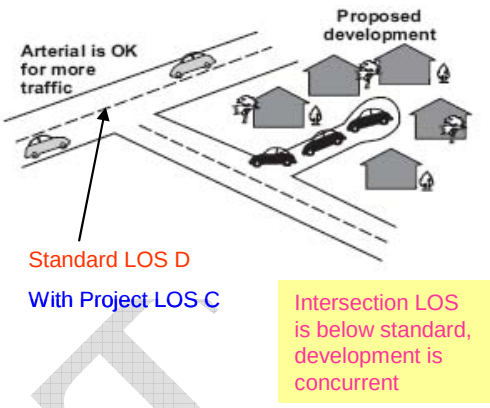

Figure 1 : Example of Adequacy Test

For the isolated scenario example in Figure 1, the technical analysis involve is quite straightforward. The amount of trips generated by new development is determined using standard trip generation methodology. The new trips are added to the existing plus background (i.e., traffic generated by approved but not yet built developments) traffic and the LOS of the intersection and the arterial roadway segment is calculated using standard traffic analysis procedure. The LOS with development is then compared to the LOS standard for the intersection and the LOS standard of the arterial segment. If the LOS with development is better than the adopted standard (e.g., $LOS_{development}$ C versus $LOS_{standard}$ D), then the development is deemed concurrent.

Levels of service is an alphabetical grading scale that measures the number of vehicles a road can accommodate over a certain period of time. The scale is similar to a school grading system, with A being highest and F being lowest. LOS A (least-congested) is the best level of service, while LOS F (most-congested) is the worst level of service. As traffic volumes increase to reach the capacity of the road, traffic congestion increases consequently reducing the average speed of vehicles which causes the LOS "grade" to fall. At LOS E, the volumes have reached capacity and cars are moving slowly, but they are still moving consistently. At LOS F, the traffic volumes have exceeded the capacity of the road, vehicles are moving in a "stop and go" manner resulting in very slow average speeds.

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On the surface, the concept of concurrency seems to be quite simple as Figure 1 illustrates. The test is often applied only within the scope of intersections immediately adjacent to a proposed site (Coie, 2003). The reality, however, is that traffic volumes adjust and spread over a wide road network requiring an expanded analysis. Figure 2 outlines the many dimensions to consider in calculating the level of service over an expanded road network, such as in a regional concurrency management system. The choice and combination of those dimensions affect the level of technical complexity involve in the concurrency review. The goals and objectives, cost, and system predictability and accuracy are main considerations in deciding what dimensions should be defined for the concurrency management system.

Performance Measure (V/C Ratio, Enhanced V/C, Travel Delay, Exception Areas/ Multimodal Districts, Regional Systems)
Level of Service Standard (By Facility, Location, Mode)
Modes to Measure (Automobile, Transit, Bicycle, Pedestrian)
Measurement Period (1-Hour or 2-Hour Peak, A.M. and P.M. Peak)
Location to Measure (Intersection, Segment, Corridor, Screenline)
Traffic Analysis Tools (Capacity Analysis and Travel Demand Models)

Figure 2: Dimensions of LOS Measurement

Technical Memorandum #3 describes five broad categories of transportation system performance to choose from: volume to capacity (v/c) ratio, enhanced v/c ratio, travel delay, exception areas/ multimodal districts, and regional systems. The choice of a performance measure is key in a concurrency system. The measurement system largely dictates the level of technical analysis required, including data and staffing requirements. A finding of the Puget Sound Regional Council study emphasized that the measurement system[2] can greatly affect what mitigation is required and what may be included in the capital facility plan. The choice of

[2] The Puget Sound Regional Council study emphasized that the choice of a measurement system is key in a concurrency system.

the measurement system is largely influenced by the desired goals and objectives of the concurrency system and the transportation and land use plans.

The adopted level of service standard can be defined by facility type, location, and mode. LOS standard by location can be set for intersections, roadway segments, corridors, screenlines, and area-wide. LOS standard may also include transit and non-motorized modes. How the LOS standard should be applied affect the complexity of analysis. Moreover, the inclusion of other modes, the number of time periods to monitor LOS compliance, and the location to monitor (intersection, corridor, area-wide) further increase the level of technical complexity.

The choice of planning tools must consider the required level of technical complexity involved in measuring the performance of the transportation system. The planning tools must also have the capability to evaluate various mitigation measures, including travel demand management and transportation system management strategies. Planning tools appropriate for analyzing regional concurrency management systems are described in subsequent sections.

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TRAFFIC ANALYSIS TOOLS

There are numerous analysis methodologies and tools that have been developed by public agencies, research organizations, and consultants. Traffic analysis tools can be grouped into the following categories[3]:

- Sketch-planning tools
- Travel demand models
- Analytical/ deterministic tools (HCM-based)
- Traffic signal optimization tools
- Macroscopic, mesoscopic, microscopic simulation models

For concurrency analysis, travel demand models and HCM-based analytical tools are the practical traffic analysis tools to determine level of service. Traffic signal optimization tools are also relevant for concurrency analysis when mitigation measures at signalized intersections are required. Sketch-planning and simulation tools are not practical for use in a concurrency system. Sketch-planning approaches use simplified analyses and highly aggregated data and therefore lack analytical robustness. Traffic simulation tools are data hungry, labor intensive, and usually have steep learning curves making simulation modeling impractical for use in a transportation concurrency[4].

HCM-based analytical methods for capacity analysis and travel demand models are discussed in more detail in the next sections along with application software options.

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[3] Traffic Analysis Toolbox Volume I: Traffic Analysis Tools Primer.
[4] California Department of Transportation: Guidelines for Applying Traffic Microsimulation Modeling Software.

CAPACITY ANALYSIS TOOLS

Analytical/Deterministic HCM-Based Procedure

Most analytical/ deterministic tools implement the procedures of the *Highway Capacity Manual* (HCM). HCM is a compilation of peer-reviewed procedures for computing the capacity and operational performance of various transportation facilities. HCM was first produced in 1950 and has undergone many major revisions since then. The current edition of HCM was produced in 2000 and currently published by the Transportation Research Board.

The primary purpose in applying the HCM procedure is to produce information that is useful in making a decision about a transportation facility or system in a limited geographic scope (isolated location, segment, corridor or small network). The various HCM procedures produce forecasts of one or more performance measures, one of which is tied to a level of service (LOS) grade A to F; LOS A being the best and LOS F being the worst.

The HCM procedures are closed-form, macroscopic, deterministic, and static analytical procedures that estimate capacity and performance measures to determine the level of service (e.g., density, speed, and delay). They are closed-form because they are not iterative. The practitioner inputs the data and the parameters and, after a sequence of analytical steps, the HCM procedures produce a single answer. They are macroscopic because the input and output deal with average performance during a 15-minute or a 1-hour analytical period. They are deterministic because any given set of inputs will always yield the same answer. Lastly, the HCM procedures are static because they predict average operating conditions over a fixed time period and do not deal with transitions in operations from one system state to another, such as would be addressed in a dynamic analysis.

HCM Strengths and Limitations

For many applications, HCM is the most widely used and accepted traffic analysis technique in the United States[5]. The HCM procedures are good for analyzing the performance of isolated facilities with relatively moderate congestion problems. These procedures are quick and reliable for predicting whether or not a facility will be operating above or below capacity,

[5] Beyond Speed: The Next Generation of Transportation Performance Measures, Performance Standards for Growth Management by Reid Ewing published in the 1996 American Psychological Association.

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and they have been well tested through significant field-validation efforts. However, the HCM procedures are generally limited in their ability to evaluate system effects.

Most of the HCM methods and models assume that the operation of one intersections or road segment is not adversely affected by conditions on the adjacent roadway. Long queues at one location that interfere with another location would violate this assumption. The HCM procedures are of limited value in analyzing queues and the effects of the queues.

There are also several gaps in the HCM procedures. HCM is a constantly evolving and expanding set of analytical tools and, consequently, there are still many real-world situations for which HCM does not yet have a recommended analytical procedure. Some of these identified gaps include the following:

- Multilane or two-lane rural roads where traffic signals or stop signs significantly impact capacity and/ or operations.
- Climbing lanes for trucks.
- Short through-lane is added or dropped at a signal.
- Two-way left-turn lanes.
- Roundabout of more than a single lane.
- Tight diamond interchanges.

For concurrency application, the HCM procedure is a valid planning analysis tool despite current limitations. There are strategies that can be employed to overcome some of the limitations. For example, in a highly congested location where long queues are experienced, micro-simulation analysis can be used to properly model the queuing situation.

Software

There is a wide array of analytical/ deterministic software tools currently available. These include tools for analyzing isolated intersection, arterial analysis, and network signal and timing analysis. Software tools considered most applicable for a concurrency analysis are listed in Table 1. Both Synchro and HCS are widely used. Synchro has added advantage for its signal coordination and microsimulation in SimTraffic. The most current version of Synchro has also

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an added 3-D capability providing better visualization tools. The Traffix methodology is embedded in the VISUM travel demand model program, thus enabling VISUM to properly account for delays at intersections. As mentioned earlier, VISUM is the current model platform used for the SRTC regional travel demand model.

Table 1: Appropriate Capacity Analysis Software Tools[6]

Synchro is a complete software package for modeling and optimizing traffic signal timings. It implements both the Intersection Capacity Utilization (ICU) 2003 method for determining intersection capacity, as well as the methods of the HCM, Chapters 15, 16, and 17; Urban Streets, Signalized Intersections, and Unsignalized Intersections, and reports both ICU and HCM results. Synchro is the preferred analysis tool for areas where surrounding intersection operations can influence each other, as it will consider the effects of the coded transportation network on each intersection. This software is also suggested for projects where traffic simulation will be desired, because the street network and operational parameters used can be directly transferred to the SimTraffic program or other simulation programs.
Traffix is a computer program that calculates level of service at signalized and unsignalized intersections based on the HCM or other available methods such as Circular 212 and SIGCAP. This program is frequently used for evaluating the impacts of proposed developments because it facilitates the process of trip distribution and assignment over a street network making it easier to test multiple development scenarios and different mitigation measures.
Highway Capacity Software (HCS) 2000 implements the procedures defined in the HCM for analyzing capacity and determining LOS for signalized intersections, unsignalized intersections, urban streets (arterials), freeways, weaving areas, ramp junctions, multi-lane highways, two-lane highways and transit. Intersection analysis is based on the methodologies presented in Chapters 16 and 17 of the HCM. While the HCS is a widely used tool, it can only accurately analyze intersections in an isolated environment, free from the effects of other intersections.

[6] Circular Number E-CO14: Traffic Analysis Software Tools published in September 2000.

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TRAVEL DEMAND MODELS

Travel demand models are utilized for larger geographic scope such as citywide, countywide, region wide, and statewide. They are sophisticated computer programs that analyze volumes of data on travel in a known year (the base year) and apply that information to a future year (the horizon year) to predict how much travel will occur, and where the trip making will be located. In this manner, predictions on the level of demand throughout a region can be made. Predicted demand can be used to evaluate the level of transportation performance, as well as determine the locations for roadway and non-roadway improvements. The output of the models is a key factor in shaping how transportation resources will be spent.

In the recent past, there have been several methodological and statistical advances in travel demand modeling. The purpose of this section is to provide a brief assessment of which methodology would be appropriate for the envisioned Spokane regional concurrency management system.

Four-Step vs. Activity Based Modeling

The conventional trip-based approach, exemplified in the four-step model in Figure 3, is a sequential application of the four model components (trip generation, trip distribution, modal split, and traffic assignment). Trip generation is concerned with predicting the number of trips produced by and attracted to each traffic analysis zone. Trip distribution model links the origin and destination ends of the trips generated by the trip generation model. Modal split models predict the proportion of trips by each mode between each origin and destination. Traffic assignment predicts the route/s used by the trips from a given destination using a particular mode.

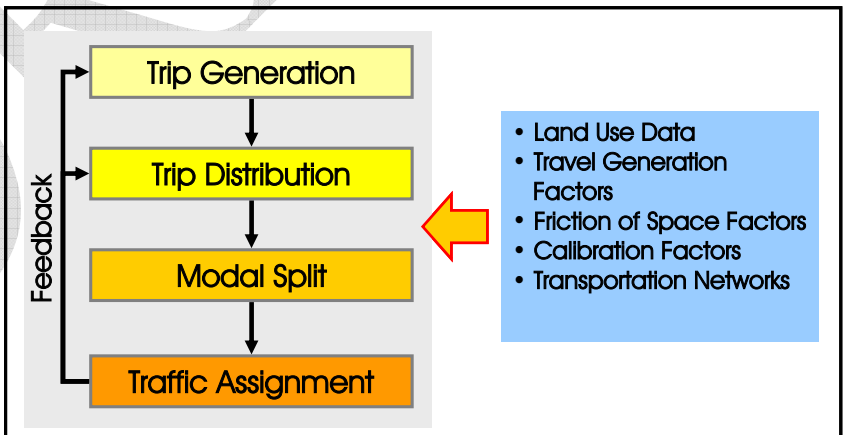

Figure 3: Four-Step Model Process

The inadequacies of the conventional transportation demand modeling process are well documented (McNally and Recker, 1987). The four-step model consists of sequential, independent steps in which the trip purposes are dealt with separately and there are no linkages among trips. Over the years, numerous incremental improvements have been made to the four-step process, introducing more linkages between purposes and trip segments and iterating through the steps to obtain equilibrium in the system.

Activity based travel demand models predict travel behavior as a derivative of activities. It relies on the following five paradigms: travel is a derived demand from the activity participation, focus on sequence of activities, activities are both planned and executed in the household context, activities are spread along a 24-hour period in a continuous manner rather than using a simple categorization of peak and off-peak events which are usually applied in trip-based models.

The major paradigm shift towards activity based modeling is contributing to the increasing interest in the adoption of tour based models. The use of tours as a basis for analysis allows one to better represent inter-dependency among trips, for example, mode choice is done at the level of the tour as opposed to the individual trip. These systems improve upon the trip-based method of sequential modeling of home based and non-home based trips in order to capture scheduling changes which can occur in response to changing conditions.

Despite major advances in data collection and application software, there are currently few cities that have moved towards the development and implementation of tour-based models that move away from the traditional four-step trip-based modeling approach. These include Portland, San Francisco County, New Hampshire, and Columbus, Ohio. Data, readily available application software, reliability and accuracy are some of the reasons that preclude the wider application of tour based models. In the recent past, there were no software packages that perform tour-based analysis as a standard option; the user must develop customized code and implement within the package. Presently, VISEM demand model within the PTV suite calculates travel demand based on homogeneous behavioral groups and on activity chains. The demand can be assigned using the VISUM model.

For the purpose of a regional concurrency system, the four-step model is the practical approach to use at this stage. Level of service and other transportation system performance

measures can be determined reasonably well within the four-step approach. Likewise, the level of technical complexity resulting from the many dimensions of LOS in a regional concurrency system is easily handled using the current state-of-the-art demand modeling software packages.

Demand Model Limitations and Countermeasures

Limitations

The conventional four-step travel demand model was designed to project future trips on the highway network based on a given land-use plan. As the models have evolved over time, transit, air quality and land-use have been incorporated by states and localities to varying degrees. However, generally the basic model framework is not designed to capture pedestrian or bicycle trips which tend to be short trips. Often these short non-motorized trips are treated as intrazonal trips, i.e., trips wholly inside the traffic analysis zones (TAZ) and therefore not assigned in the network. Moreover, a characteristic of the models regarding land-use plans is that they tend not to differentiate between land-use patterns suited to pedestrian trips and those which are not.

Recent research demonstrates that the walkability of an area is a critical factor in determining the level of pedestrian activity. Factors such as the existence of sidewalks, the safety of street/road crossings, the length of blocks, the connectivity of the street network, the land-use patterns as well as site design (setbacks), and the terrain all play a role in determining the suitability of an area for non-motorized trips. The absence of this capability results in outcomes that may understate the mode choice, trip distribution and traffic assignment.

Countermeasures

The issue of intrazonal trips can be addressed by defining smaller TAZ in areas with higher presence pedestrians and bicyclists such as in downtown areas, transit centers, shopping areas and regional centers, university and college campuses, and recreational areas.

State-of-the-art software packages have GIS capabilities. Sidewalks, bike lanes, and other bicyclist and pedestrian facilities should be coded in the model. Bicycle and pedestrian

level of service methodologies can be used to determine the level of service of these non-motorized trips.

Application Software Functionality

Application software appropriate for analyzing regional concurrency systems should have at the minimum the following functionality:

- Model auto, transit, trucks, bicycle, and pedestrians
- Model travel demand management and transportation system management strategies
- Multi-class assignment
- Account for intersection delays
- GIS and spatial analysis capabilities
- Good network editor
- Good matrix and link calculators
- Interface with other software
- Quality report generation
- Easy to use

Software

There are several travel demand model software packages available. The most widely used in recent times include TransCAD, VISUM, Cube/Voyager, and EMME/2. The use of EMME/2 in the United States has dropped compared to its use in the 1990's. VISUM has recently been introduced in North America from Europe. Its many recent enhancements that include the incorporation of some features from TModel have significantly increased its market share among North American users. TransCAD has been widely used due to its GIS-based modeling system with direct link to the Census data. Cube/Voyager has also made significant market share as it continues to enhance its modeling capabilities, particularly on freight modeling and pricing.

In 2003, the Research Center of the Florida Department of Transportation completed an evaluation of transportation models for the statewide model task force[7]. The Model Task Force blue ribbon panel evaluated four software packages: VISUM, EMME/2, Cube/Voyager, and

[7] Evaluation of Transportation Models for the Statewide Model Task Force

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TransCAD. The evaluation examined four broad themes: current and emerging issues, modeling directions, modeling software capabilities and functionality, and administrative and management aspects. Detailed issues were looked at for each theme. The evaluation also included a user survey. Interested reader should refer to the study report for details of the evaluation. The Model Task Force concluded all four software packages are state-of-the-art planning tools that have the desired capabilities for use as standard planning tool for Florida's MPOs and for FDOT's statewide model. TransCAD and Cube/Voyager emerged as the preferred top 2. Although TransCAD was finally endorsed by the task force, in 2006 the FDOT has switched to Cube/Voyager.

Table 2 lists three of the current most widely used software packages offering state-of-the-art capabilities. For regional concurrency systems, all three software packages in Table 2 have the desired functionality that more than meet the level of technical complexity needed to determine the level of service of regional transportation facilities for concurrency determination.

Important software functionality for regional concurrency systems is the capability to account for intersection delays. As mentioned earlier, VISUM has built in Traffix features enabling it to compute delays on specific traffic movements when analyzing the intersection using the HCM methodology. VISUM is already the current software package of the SRTC regional travel demand model. The Spokane Region has therefore the necessary tools in place for a regional concurrency system.

Table 2: Travel Demand Models Appropriate for Regional Concurrency Systems

VISUM is a comprehensive, flexible software system for transportation planning, travel demand modeling and network data management. VISUM is designed for multimodal analysis that allow users to integrate all relevant modes of transportation (SOV, HOV, truck, bus, train, pedestrians and bicyclists) into one consistent network model. Assignment procedures and 4-stage modeling routines meet the requirements of all the different modes. VISUM is PC-based using Microsoft Windows and offering open data and image exchange into the total Windows environment. Beyond conventional modeling, VISUM offers many specialized and advanced methods, such as activity based models, dynamic methods or advanced transit models. VISUM is fully integrated with the microscopic traffic simulator VISSIM.

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TransCAD is a Geographic Information System (GIS) designed specifically for use by transportation professionals to store, display, manage, and analyze transportation data. TransCAD combines GIS and transportation modeling capabilities in a single integrated platform. TransCAD can be used for all modes of transportation, at any scale or level of detail. It has applications for all types of transportation data and is ideal for building transportation information and design support systems. TransCAD provides: a powerful GIS engine with special extensions for transportation; mapping, visualization, and analysis tools designed for transportation applications; application modules for routing, travel demand forecasting, public transit, logistics, site location, and territory management. TransCAD runs on readily-available hardware under Microsoft Windows operating systems and embraces virtually all desktop computing standards.
CUBE / VOYAGER Cube is a complete travel forecasting family of software products that provides capabilities for the comprehensive planning of transportation systems. Cube functionality encompasses urban, regional, and long distance travel forecasting, freight forecasting, multimodal and microsimulation. Cube has direct use of ArcGIS. Cube's broad range of capabilities provides answers to all types of planning questions from evaluating new developments to testing new public transit alternatives to road pricing strategies. Cube Voyager is the Cube extension for personal travel forecasting offering advanced methodologies for the study of urban, regional and long distance multimodal systems.

METHODOLOGY FOR EVALUATING REGIONAL CONCURRENCY

This section of the memorandum describes alternative frameworks that could be used to evaluate a regional transportation concurrency management system (RTCMS). A review of the current regional concurrency management system in the Spokane Region is included to set the stage for discussing alternative frameworks.

Methodology Adopted in the Current Regional Concurrency System

The current implementation of the Spokane regional concurrency management system adopts the travel time performance measure. The rationale for using travel times and the resulting speeds is that travel times are relatively easy to understand by the public and elected officials. PM peak hour travel times are estimated using the regional travel demand model maintained by SRTC. The model travel times are validated using actual travel time data from

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an Automated Vehicle Identification (AVI) system. The observed travel time data include the time it takes a vehicle to travel along a road segment and the delays at intersections.

PM peak hour travel times in key corridors have been adopted as the regional LOS standard. SRTC is using estimates of travel times in regional corridors to evaluate the regional and local land use and transportation plans. The PM peak hour travel times for the model can be directly correlated to speeds and delays, consistent with LOS criteria in the Highway Capacity manual. This provides a solid technical basis for the evaluation method and program concept.

Thresholds of corridor travel time were developed using the following approaches:

- 2025 travel times
- Extrapolation of travel time from the base year (2000) by a growth factor
- Utilization of the highest modeled travel times between the base and 2025 forecasts
- Utilization of the lower modeled travel times of 2025 or factored growth from 2000

The SRTC travel demand model was utilized to provide the 2025 travel times and forecasts. The favored threshold approach was the 2025 forecast travel times with some provisions.

Alternative Methodological Frameworks

The methodological framework for the envisioned Spokane RTCMS would largely depend on the following: the goals and objectives of the RTCMS, its final structure, included transportation facilities, and the chosen measurement system.

Potential Regional Concurrency Structures

For the purpose of discussion in this memorandum, it is assumed that the SRTC would be the regional agency responsible for the implementation and monitoring of the envisioned Spokane RTCMS. In addition, the legal, political, socio-economic and other impacts related to a particular regional concurrency structure are not dealt with in this memorandum. The pros and cons of a particular concurrency structure will be discussed in the main study report. The purpose of presenting possible concurrency structures here is to aid in the discussion of alternative methodologies for regional concurrency evaluation.

Figure 4 outlines possible Spokane RTCMS structures. The assumption in all RTCMS structures is that SRTC will develop, maintain, and update the regional concurrency model. Under a single structure, it is further assumed that SRTC will conduct the concurrency analysis for the entire county and jurisdictions within the county. This implies that the RTCMS will have all the types of roadways in the regional travel demand model. The role of SRTC is simply to undertake the technical analysis of the concurrency review and make recommendations to the local jurisdictions of the outcome of the concurrency analysis. Local jurisdictions would make the concurrency determination. An option where SRTC has the full control over concurrency determination is not even contemplated as it would be certainly politically unacceptable to local jurisdictions to loss full control over land use decisions.

Under a two-tier structure, SRTC would be responsible for maintaining the RTCMS that only includes regional transportation facilities, i.e., all principal arterials and some minor arterials. Local jurisdictions would be responsible for maintaining their local concurrency. This two-tier structure is similar to the current practice in Spokane. The main difference of the two-tier structure in Figure 4 with the current practice is the conduct of development review by SRTC for proposed developments that would impact the regional transportation facilities. Under Option A, local jurisdictions would retain control over land use decisions. The role of SRTC under Option A is simply to carry out the technical analysis of the regional concurrency review. Under Option B, SRTC would have the authority to make the concurrency determination, which means that local jurisdictions would loss control over land use decisions that have regional impact.

Potential issues with a single structure could be the cost to update and maintain the level of detail for the entire Spokane County. For the two-tier structure, determining the area of influence (AOI) of developments to trigger regional concurrency determination could be a major issue. Another issue could be developers' perception regarding predictability of such two-tier structure.

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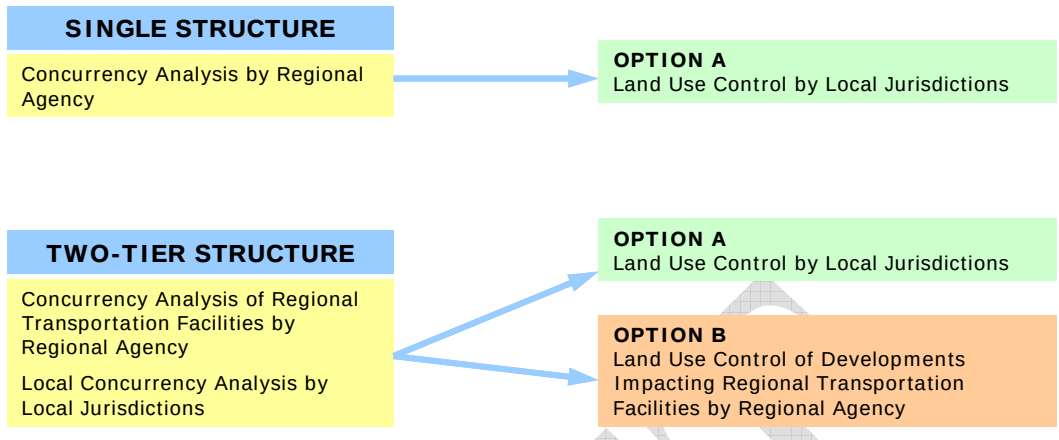

Figure 4: Potential Regional Concurrency Structures

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Planning Level and Development Review Regional Concurrency Evaluation

In the current implementation of the Spokane regional concurrency management system, SRTC only carries out a regional planning level analysis where the regional concurrency model is updated once a year to add development projects that were approved during the prior year. This planning level only analysis is what is required of the current regional concurrency management system where SRTC's role of in the concurrency is only to monitor the consistency of local plans to regional plans, but not to analyze and make concurrency determinations of individual proposed development.

The regional concurrency structures considered in Figure 4 would entail both a planning level RTCMS evaluation and a development review RTCMS evaluation. The planning level RTCMS would serve as a tool for developing and evaluating land use and transportation plans that would be used for prioritizing of capital improvement projects in the Six-Year Transportation Improvement Program (TIP).

Because SRTC would be involved in the concurrency analysis of individual proposed development that impact regional transportation facilities, it is necessary for SRTC to establish the development review process, which may include among others the development of a travel

model process to evaluate a six-year planning horizon instead of the long range 20 year forecast.

Level of Service Standards

The LOS standards should be qualified by rural and urban geography; lower LOS in the urban area than in the rural area. Tailoring of LOS should be defined which allow for lower LOS within downtown, urban and regional centers, and other locations where growth is encouraged. Lower LOS should also be allowed in areas with good transit compatibility. Likewise if non-motorized modes are to be encouraged, lower LOS should be considered.

Multimodal Concurrency Evaluation

In 2001 Glatting Jackson proposed three broad approaches to applying a multimodal transportation concurrency for Seminole County, Florida. These include (1) multi-mode LOS with an initial LOS point system, (2) performance criteria, and (3) multi-mode sector plan. The multimode LOS with an LOS point system would involve developing a LOS measure for each mode of travel (walking, transit, bicycling, along with vehicle traffic) and combining the scores into an overall LOS score. This approach takes the same notion of LOS and applies it to more modes of travel over greater areas. The performance criteria differ fundamentally from a LOS approach in that the goal is specified instead of the means of achieving the goal. Actions, e.g., frequency of bus service, that eventually produce more multimodal capacity are specified. In the multimodal sector plan all elements of multimodal adequacy are identified as a part of a detailed site-specific plan. Under this approach, an area plan would be developed showing, in graphic form, a conceptual plan for all of the model elements, including sidewalks, crosswalks, transit stops, bicycle lanes and paths, and other elements of the transportation system.

Glatting Jackson (2001) recommended a two-pronged approach to concurrency. First, a multimodal LOS point system is recommended to be used county-wide using the LOS measure developed by the Florida Department of Transportation, but with local weightings applying to the amount of priority given to each mode in different environments: rural areas, development corridors, mixed use centers, and neighborhoods. In areas where meeting the LOS standard can no longer be feasibly achieved, and that have been identified in the County comprehensive

plan for redevelopment, a multimodal sector plan was recommended to be developed to guide how the redevelopment should occur.

For the Spokane RTCMS, the above approaches could be considered if a multimodal consideration would be one of the goals and objectives of the RTCMS.

ESTIMATE OF RESOURCES REQUIRED FOR A SPOKANE RTCMS IMPLEMENTATION

Assumptions

For the purpose of estimating resources required to implement a regional transportation concurrency management system in the Spokane Region, the following assumptions are made with respect to the role and responsibilities of the regional agency charged with implementing the RTCMS:

- Assuming the two-tier structure discussed earlier (refer Figure 4), the regional agency will have the responsibility to make concurrency analysis of proposed development projects that have impact on regional transportation facilities. This assumption entails more resources required for the regional agency to carry out the regional concurrency review in contrast to current practice of regional concurrency review by the SRTC where concurrency determination of development projects are carried out by local jurisdictions.
- The regional agency will be responsible for developing guidance on interlocal agreements.
- The regional agency will be responsible for the development, operation, and maintenance of a robust regional travel demand model that will be used for concurrency determination and monitoring of the RTCMS.
- The regional agency will be responsible for on-going data collection (travel times, traffic counts, etc) for use in the monitoring and updating of the travel demand model.
- The regional agency will be the repository of data.

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- The regional agency will take the lead role in developing consistent methodology for determining level of service.

Required Resources

Data

The following are data required for implementing and monitoring a regional concurrency system:

- **Traffic counts** at key intersections and links throughout the region. Traffic count data collection will be an on-going activity. Initially, traffic counts will be used to calibrate the base year regional concurrency model. After implementation, on-going traffic count collection is needed for monitoring and updating the regional concurrency model. Such on-going traffic count location need not be done for the entire region; rather areas in the region can be identified where traffic counts may be done infrequently, for example once in every three years. This can be done in areas of the county with very low expected annual growth in traffic.
- **Speed and travel times** along key corridors. Extensive travel time measurement will be needed if the regional concurrency system uses travel times as performance measure. The SRTC has been undertaking travel time measurement using the Automated Vehicle Identification (AVI) system in its monitoring of the current regional concurrency system. More travel time data may need to be measured for key corridors in the envisioned Spokane Region concurrency management system. Moreover, on-going monitoring of travel times will be necessary.
- **Transportation facilities** that will be included in the regional concurrency system.
- **Transportation improvement projects** included in the Six Year Transportation Improvement Program.
- **Development projects** that have been approved, but have not been built yet (i.e., projects in the pipeline).
- **Comprehensive land use plans** from cities and county.

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Technical Tools

As discussed in the capacity analysis tools and travel demand models sections, HCM-based analytical/ deterministic methodology is recommended for capacity analysis with Synchro as the most appropriate application software to use. The SRTC has current Synchro license, including a license of VISSIM. The cost to purchase the software is no longer an issue.

Besides the SRTC, City of Spokane, City of Spokane Valley, Spokane County, and WSDOT have Synchro license. Spokane County has also a HCM license while WSDOT has also a VISSIM license.

At a regional-scale, the conventional four-step model process is recommended as the practical approach with the application software VISUM. The SRTC is already using VISUM for the regional travel demand model. The cost to purchase the software is no longer an issue.

The City of Spokane Valley, Spokane County, Spokane Transit Authority, and WSDOT have VISUM license. The City of Spokane is looking at acquiring a copy of VISUM.

Staffing Requirement

Table 3 outlines the staffing required to administer, implement, and continually monitor the RTCMS.

Activity	**Staff Requirement**
Administration	Staff responsible to receive, file, respond to questions and other administrative work involve with the implementation of the RTCMS. More than one staff may be required.
Data Collection	Staff responsible for periodic and regular collection of traffic counts and travel times. The number of staff required may depend on whether some of the data collection can be done by local jurisdictions or by subcontracting to consultants.

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Modeling	Staff responsible for running, maintaining, and updating the travel demand model and other capacity analysis tools. Staff will be responsible for carrying out planning level and development review concurrency analysis. More than one modeler or transportation planner with strong modeling skills would be required.
Concurrency Review	A Traffic Engineer may be required unless an agreement can be made with Traffic Engineers from cities and the county.

SEPA AND CONCURRENCY

This section of the memorandum provides a brief overview of the potential interaction between SEPA and concurrency processes in a regional concurrency management system. A more detailed analysis is not within the scope of this feasibility study.

The term "SEPA" stands for the State Environmental Policy Act. The purpose of SEPA is to encourage harmony between the citizenry and the environment, by evaluating the environmental impacts of a proposed project, and identifying methods to reduce the impacts. SEPA is designed to ensure that:

- Environmental values are considered during land use decisions;
- Adequate and timely environmental information is gathered and provided to decision makers; and
- Public involvement is included in the decision making process.

The SEPA Rules establish the requirements for conducting environmental review of a proposal. Information provided during the SEPA review process helps agency decision makers, applicants, and the public understand how a proposal will affect the environment. This information can be used to change a proposal to reduce likely impacts, or to condition or deny a proposal when adverse environmental impacts are identified.

The Regulatory Reform Act of 1995 addresses in state law the shift in emphasis from project review to primary reliance on plans and development regulations and the SEPA review

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of those documents. Under this Act, some communities have combined the GMA and the SEPA in their analyses. WAC 197-11-210 through 197-11-235 authorizes GMA counties/ cities to integrate the requirements of SEPA and the GMA to ensure that environmental analyses under SEPA can occur concurrently with and as an integral part of the planning and decision making under GMA.

The interaction between a regional transportation concurrency management system (RTCMS) and SEPA will depend upon how the RTCMS is designed. The SEPA review is currently used to determine the impacts of a proposed development process. Currently, the SEPA process is used to mitigate impacts directly related to specific projects. The extent of SEPA analysis varies widely depending on the local government, the size of development, and to some extent the location of the development. SEPA seems to work best for large developments, but does not account well for the cumulative effects of a number of smaller developments. Consequently, the impact of development on regionally significant facilities is usually not mitigated. Nevertheless, a properly designed RTCMS would presumably use the SEPA process to determine impacts on these regional facilities and designate fees collected through the SEPA process to mitigate impacts on regional facilities. A well designed regional system would dovetail nicely with SEPA and create a more realistic and useable framework for SEPA mitigation.

SUMMARY

This memorandum outlines the planning tools that would be appropriate for use in a regional concurrency system. It also describes alternative methodological frameworks for evaluating a regional concurrency system. Lastly, it provides estimate of resources required for implementing a regional concurrency management system.

This memorandum reviewed capacity analysis tools and travel demand models, as well as planning tools used in the current local and regional concurrency implementations in the Spokane Region. The review found that the Highway Capacity Manual (HCM) procedure has been the widely used traffic analysis tools for analyzing the level of service on small geographic scope (isolated location, segment, or corridor). Moreover, the software package that has been widely used for such deterministic LOS analysis is Synchro. The study recommends the HCM procedure and Synchro for the LOS analysis of intersections and small-scale corridors. At a

regional scale, the four-step travel demand model is found to be the practical approach appropriate for the envisioned Spokane regional concurrency management system. There are three software packages (VISUM, TransCAD, Cube/Voyager) that are state-of-the-art tools for travel demand modeling and forecasting. Anyone of these tools is appropriate for modeling a regional concurrency system. VISUM is now the current modeling program used for the SRTC travel demand model. It is therefore recommended to continue to use VISUM as a tool for the envisioned regional concurrency management system.

Existing methodology used by the SRTC in the current regional concurrency management system was reviewed. Alternative methodological frameworks were then discussed that includes potential regional concurrency structures, planning level and development review regional concurrency evaluation, level of service standards, and multimodal concurrency evaluation.

Estimate of resources required for implementing and monitoring of the regional concurrency management system include data, technical tools, and staff. Data include on-going regular and periodic collection of traffic counts, travel times, transportation improvement projects, pipeline projects, and comprehensive land use plans. Technical tools include acquiring license to the Synchro software. SRTC already has a license to the VISUM software. Staffing requirement includes staff to deal with the administration, data collection, modeling, and concurrency review of the regional concurrency management system.

It was suggested that the SEPA and concurrency processes should be combined in some fashion, so they are not two tandem processes. Some stakeholders thought that *("…. the outcome of SEPA and concurrency is pretty similar so why not combine them. The advantages of combining involve less of a timeframe impact and less of additional study.")*

Finally, the relationship between a regional transportation concurrency management system and SEPA is outlined. There are advantages of combining these two processes. A well designed regional concurrency system would dovetail nicely with SEPA and create a more realistic and useable framework for SEPA mitigation.

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