

TRAFFIC STUDY FUTURE LEVEL OF SERVICE ANALYSES

SYNCHRO MODEL CALIBRATION

The following is a checklist to be used by consultants in the preparation of SYNCHRO models submitted to Snohomish County for the purpose of documenting a development's future level of service impacts. A future level of service analysis is required for any critical arterial unit impacted by three or more directional peak hour trips from a development generating 50 or more peak hour trips. Your future level of service analysis will generally consist of three scenarios: existing conditions, baseline (with pipeline) conditions, and future (with development) conditions. Scenarios depicting the impacts of proposed mitigation measures or recommended changes to the existing conditions should be included only when necessary and then in addition to the three basis scenarios described.

Scenario #1: Existing Conditions

Network Geometry : All link distances in SYNCHRO the map should match the true distances for each link of the arterial unit as shown in the County travel time study sheets. Overriding SYNCHRO link distances to match true distances is not appropriate. Curved links may be shown as curves or straight, but the SYNCHRO network should not include "dummy" intersections used to model a curved link by a series of straight segments.

Lane Geometry : Show the number of lanes that are present in the field (including HOV lanes, if applicable). Dedicated turn lanes must have a storage length assigned unless the lane truly is a drop lane extending to the previous intersection. Merges may be modeled by including a "dummy" intersection.

Running Time Settings : Adjust the link speeds in SYNCHRO to match existing running times for each link as shown on travel time sheets from Snohomish County (or other approved travel time data). Running time for each segment is the travel time without signal delays for that segment. The link speeds for each segment and for each direction may not be the same. The calibrated travel time in "Link Settings" depends only on link speed and link distance without delays.

Volumes : The volumes to be included in this scenario are the existing intersection turning movement volumes for each intersection. Intersection turning movement volumes are available from Snohomish County (or WSDOT for state intersections). If recent (less than one year old) intersection turning movement counts are not available, the applicant will need to conduct new counts. Peak hour factors should match field-measured peak hour factors for each leg of each intersection.

Signal Settings: Match signal timing data furnished by Snohomish County Traffic Operations (or WSDOT if for a state signal). Set input parameters in the SYNCHRO model to match timing sheets with special attention given to phasing – permissive, protected, protected-permissive, or split – and lead/lag. Match green, yellow and red times and pedestrian timing. Time of day functions such as Max II settings and

coordination plans as well as other signal parameters should be adhered to. The following are some guidelines for interpreting the signal timing sheets:

1. For actuated uncoordinated signals, check the time of day functions to determine whether the signal operates at Max I or Max II for a given peak hour.
2. Minimum initial in SYNCHRO is minimum green in signal timing sheets.
3. Vehicle extension in SYNCHRO is passage in State signal timing sheets.
4. Based on HCM 2000, total lost time in SYNCHRO is sum of yellow plus all red times. (This may be adjusted for calibration purposes.)
5. Time before reduce = 10 X (maximum gap - vehicle extension).
6. Time to reduce = 10 X (vehicle extension - minimum gap).
7. For an uncoordinated signal, the Max I or Max II times that show in signal timing sheets are maximum green time only. Maximum splits in SYNCHRO are the sum of maximum green plus yellow plus all red.
8. For coordinated signal networks, check to see which coordination plan is in effect for each peak hour. The maximum split for each phase is determined from the force-offs for the appropriate timing plan. Network offsets may be optimized.
9. When optimization is necessary and coordination is involved in the analysis, it should be noted that the SYNCHRO default setting for the sync point is the beginning of mainline green. For Snohomish County traffic signals, the sync point should occur at the end of green/beginning of yellow for coordinated phases. Sync points are settable in the "Timing Window".

Calibration of Delay Settings : In order to modify SYNCHRO to match existing field-measured signal delay, default values can be adjusted for factors used in the SYNCHRO percentile delay method. The first factors to be adjusted are total lost time and saturation flow rate. Other settings that can be adjusted include lane utilization factor, turning factors, width, grade, area type, busses and parking. Note that the overridden values will show in "red", and these factors will apply for baseline and future conditions.

Check: "Travel Time" in "Link Settings" will be the "Running Time" in the SYNCHRO report. "Travel Time" in SYNCHRO report is a total of "Running Time" and "Signal Delay". Check to see that the overall travel time in SYNCHRO report matches the travel time measured in the field. Calibrated model shall not exceed actual travel speed by more than 1.0 mph.

Scenario #2: Baseline Conditions

Input Volumes: The volumes to be used in this scenario are the existing intersection turning movement counts **plus** the pipeline database volumes for each intersection. Pipeline volumes are available from Snohomish County, and must be no older than allowed by DPW rules.

Update Network : Check the Six-Year Network to see if any impacted arterial units are to be impacted by **funded** future projects. (Developer-proposed modifications to the system should be included as a "Mitigation" scenario.) If the arterial unit will be

impacted by a funded future project, the Network and Lane Geometry in the SYNCHRO map should match the proposed geometry. New signals may be shown with optimized signal timing, unless the County has a preliminary timing plan available. Otherwise, all signal timing and delay settings are to remain unchanged from the existing conditions.

Exception: If the pipeline volumes exceed 30% of existing counts for any leg of an intersection, the peak hour factor for that leg may be increased for the Baseline Condition up to 0.92 for the AM peak hour and 0.95 for the PM peak hour. Field-measured peak hour factors above these thresholds need not be reduced.

Scenario #3: Future Conditions

Input Volumes : The volumes to be used in this scenario are the existing intersection turning movement counts **plus** the pipeline database volumes **plus** the project intersection turning movements for each intersection.

Other Parameters: All other parameters (signal timing, delay settings, geometry) shall remain the same as the Baseline Conditions.

Exception: If the project volumes exceed 30% of existing counts for any leg of an intersection, the peak hour factor for that leg may be increased for the Future Condition up to 0.92 for the AM peak hour and 0.95 for the PM peak hour. Field-measured peak hour factors above these thresholds need not be reduced

Additional Scenarios

If a future level of service analysis indicates that an arterial unit's level of service is forecast to fall below adopted standards, a developer may propose an additional scenario to demonstrate how an acceptable level of service could be obtained. Either of the following scenarios could be included:

Modification to Existing Signal Timing: (Does not include modifications to geometry.) A developer may propose, for County staff consideration, a modification to an existing County signal timing plan to demonstrate that an acceptable arterial level of service is achievable with existing geometry. County staff cannot consider modifications to signal timing for State signals. DPW may deem the development concurrent if the proposed signal modifications are reasonable. (Calibrated delay settings apply.)

Mitigation: (Capacity improvements that may include new geometry with or without signal modifications.) A developer may propose, for County staff consideration, capacity improvements to an existing County arterial unit (with or without signal modifications) to demonstrate that an acceptable arterial level of service is achievable. County staff cannot consider modifications to State intersections. DPW may deem a development conditionally concurrent if the proposed capacity improvements are deemed to provide the acceptable level of service, and the developer offers to construct the capacity improvements. (Delay settings may be set to default values.)