

6. Simulation Analysis

In order to fully assess the future traffic conditions with the addition of the project and all planned improvements within the project area, a simulation of the roadway network in the vicinity of the project area was created. The purpose of the simulation analysis is to evaluate the effect of adding new development, the proposed traffic signal at the El Camino Real/Cherry Street intersection, and the proposed changes to the Downtown San Carlos roadway network. This section presents the procedures used for the analysis and results of the analysis. Included is a discussion of the model coding process and the measures of effectiveness (MOE's) used to evaluate traffic conditions for each scenario analyzed.

Scope of Simulation Analysis

The City of San Carlos anticipates that development of the Samtrans property into residential and retail uses would greatly increase the demand for pedestrian crossings of El Camino Real. Therefore, in conjunction with the development of the project, the City would like to construct a series of roadway improvements. These improvements, referred to as the San Carlos Avenue improvements described in Chapter 5, in conjunction with the project sponsored traffic signal at the El Camino Real/Cherry Street intersection, would help make pedestrian circulation easier and safer in the vicinity of the project site. In order to evaluate the effects the proposed roadway changes would have on the roadway network, a simulation analysis was prepared. The simulation quantifies changes in traffic operations due to the proposed roadway network changes, and also produces animated graphics depicting the expected future traffic conditions in a comprehensive and realistic manner.

Intersections that would be directly affected by the proposed traffic signal at El Camino/Cherry and the San Carlos Avenue improvements were included in the simulation analysis. These intersections are:

- 8 Walnut Street and Holly Street (unsig)
- 9 Laurel Street and Holly Street (unsig)
- 10 El Camino Real and Holly Street
- 11 Old County Road and Holly Street
- 13 Walnut Street and San Carlos Avenue

- 14 Laurel Street and San Carlos Avenue
- 15 El Camino Real and San Carlos Avenue

Simulation analyses were conducted for the following scenarios:

Existing Conditions. The existing roadway network with existing traffic volumes (year 2007 and 2008 traffic counts) and existing signal timing and phasing were simulated using the Synchro/SimTraffic software. Results for the existing conditions simulations (AM and PM peak hour) were checked in the field to validate the accuracy of the simulation.

Project Conditions. Project conditions traffic volumes (existing plus approved and project trips) on the existing roadway network with the addition of the proposed traffic signal at the El Camino Real/Cherry Street intersection were simulated using the Synchro/SimTraffic software. Project conditions were compared to existing conditions in order to determine the effects of the project (and approved projects) and the proposed traffic signal at El Camino/Cherry on the roadway network.

Cumulative Conditions. Cumulative conditions traffic volumes (project conditions plus cumulative project trips) on the project conditions roadway network with the addition of the San Carlos Avenue improvements were simulated using the Synchro/SimTraffic software. Cumulative conditions were compared to existing conditions in order to determine the effects of the future development and the proposed roadway changes on the Downtown roadway network.

Analysis Procedures

The analysis was conducted using the Synchro 6 and SimTraffic software packages. Synchro 6 is used to model and optimize traffic signal timings, and employs the *2000 Highway Capacity Manual (2000 HCM)* methodology for level of service analyses at signalized and unsignalized intersections. SimTraffic is a microscopic traffic simulation software package that utilizes input and output data from Synchro 6 to simulate traffic operations on roadway networks.

A model representing the roadway network in the study area was created using the Synchro 6 software. The input and output data from Synchro 6 were used by SimTraffic to simulate the traffic operations of the roadway system under existing, project, and cumulative (with the project) conditions. Key measure of effectiveness (MOE) data were obtained from the simulation reports created by SimTraffic. The MOEs used for this analysis are discussed below.

Measures of Effectiveness

Measures of effectiveness (MOEs) are measurable parameters that best describe the quality of operation of a transportation system. Although there are various MOEs used to describe how the transportation system would operate under the various analysis scenarios, this analysis focused on the vehicle queue MOEs. This is described below:

95th Percentile Vehicle Queue Length – The 95th percentile vehicle queue length (measured in feet) is a probabilistic measure of the maximum queue length that could be expected during 95 percent of the signal cycles during the peak hours. For design purposes, this value is often used as the effective maximum storage length required for a particular turn movement at an intersection.

Vehicle queue length is a measure that relates to the physical capacity of the existing transportation network and intersection configurations to accommodate estimated maximum vehicle queues. If vehicle queue lengths become excessive, spill back to adjacent intersections could occur which could degrade traffic operations in the system.

Analysis Results

The results of the queue analysis for the intersections near the project site conducted under the various scenarios analyzed are described below.

Intersection Queuing

Part of the simulation analysis focused on vehicle queuing and traffic operations at the intersections that would be most affected by the proposed project and network changes. The queuing/operations analysis is based on vehicle queuing for turning movements on El Camino Real at Holly Street and San Carlos Avenue, and on Holly Street at Old County Road.

Vehicle queues for left and through movements at the El Camino/Holly Street and El Camino/San Carlos Avenue intersections were evaluated. In addition, the expected westbound queue length on Holly Street at Old County Road also was evaluated. The results of the analysis are summarized in Table 27 and discussed in more detail below.

The results of the analysis show that at the intersection of El Camino/Holly the northbound through traffic currently extends to the south intersection of El Camino/San Carlos during the PM peak hour. Under both project and cumulative conditions, the northbound through queue would continue to extend beyond the south intersection during both the AM and PM peak hours. Additionally, the southbound left-turn queue storage capacity is shown to be inadequate for the expected queue length under project and cumulative conditions. With implementation of the San Carlos Avenue improvements and the shift in eastbound traffic from San Carlos Avenue to Holly Street, the eastbound queue at El Camino/Holly would extend beyond the western intersection of Laurel/Holly under cumulative conditions.

The westbound through traffic on Holly Street at Old County Road is projected to extend beyond the east intersection of Industrial/Holly during the PM peak hour under both project and cumulative conditions. As the main gateway for the City of San Carlos to and from US 101, Holly Street serves a relatively large amount of traffic. The projected deficiency is due to the increase in future traffic for a movement that is currently reaching capacity.

At the intersection of El Camino/San Carlos, the maximum queue during the AM peak hour on the eastbound approach is shown to be longer than the existing queue storage capacity, causing it to extend back beyond the western intersection of Laurel/San Carlos. Under cumulative conditions, this capacity would be reduced by half with the elimination of one of the eastbound lanes, and although the volume is also projected to decrease by approximately half, this movement would continue to extend beyond the western intersection. The east leg of the intersection is shown to be inadequate to serve the existing queue. However, this leg would be eliminated with the development of the project.

The queue analysis shows extended queues for various movements under project and cumulative conditions. This is expected due to the projected increase in traffic as a result of future growth, including the proposed project, for movements that are currently at or close to be at capacity.

**Table 27
Intersection Queuing Summary**

| Turning Movement | Existing # of Lanes | Total Existing Storage (ft) ¹ | Existing | | Project | | Cumulative | | Existing w/ DT Improv | |
|---|------------------------|--|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
| | | | AM Peak Hour Queue Length (ft) | PM Peak Hour Queue Length (ft) | AM Peak Hour Queue Length (ft) | PM Peak Hour Queue Length (ft) | AM Peak Hour Queue Length (ft) | PM Peak Hour Queue Length (ft) | AM Peak Hour Queue Length (ft) | PM Peak Hour Queue Length (ft) |
| El Camino Real and Holly Street | | | | | | | | | | |
| NB through | 2 | 1100 | 1095 | 1235 | 1160 | 1220 | 1230 | 1325 | 595 | 1090 |
| SB through + TR | 2 | 2000 | 780 | 695 | 875 | 635 | 1015 | 500 | 615 | 600 |
| EB LT + TR | 2 | 560 | 495 | 300 | 505 | 330 | 775 | 770 | 735 | 780 |
| NB left-turn ² | 1 | 150 | 100 | 100 | 35 | 45 | ---- | ---- | ---- | ---- |
| SB left-turn | 2 | 425 | 330 | 220 | 430 | 380 | 525 | 225 | 310 | 215 |
| Old County Road and Holly Street | | | | | | | | | | |
| WB through | 1 | 1400 | 350 | 925 | 550 | 2930 | 675 | 2450 | 355 | 850 |
| El Camino Real and San Carlos Avenue | | | | | | | | | | |
| NB through + TR | 2 | 3900 | 415 | 465 | 380 | 1260 | 370 | 1875 | 260 | 515 |
| SB through | 2 | 1120 | 565 | 815 | 390 | 500 | 470 | 345 | 445 | 620 |
| EB L + LT | 2 ³ | 600 | 715 | 570 | 705 | 660 | 385 | 215 | 255 | 345 |
| WB through ⁴ | 1 | 25 | 30 | 85 | ---- | ---- | ---- | ---- | 20 | 85 |
| NB left-turn | 1 | 430 | 130 | 225 | 110 | 265 | 160 | 415 | 90 | 260 |
| SB left-turn | 1 | 200 | 65 | 65 | 10 | 35 | 10 | 40 | 50 | 95 |
| WB left-turn ⁴ | 1 | 25 | 25 | 35 | ---- | ---- | ---- | ---- | 20 | 40 |

Note: Reported queue lengths are 95th-percentile queue lengths rounded up to the nearest 5 feet.

Shade indicates inadequate storage capacity available.

- 1 Existing storage for through movements is the distance from the edge of the upstream signalized intersection to the stop bar of the subject intersection. Existing storage for turn lanes is the length of the turn pocket.
- 2 Movement/turn pocket would be eliminated under cumulative conditions.
- 3 One of the two lanes would be eliminated under cumulative conditions, reducing the total storage length by half.
- 4 Movement/turn pocket would be eliminated under project conditions.

For informational purposes only, a queue analysis of the existing traffic volumes under the proposed future roadway network (with the San Carlos Avenue improvements in place) was performed. This analysis showed that if the San Carlos Avenue improvements were to be implemented today, traffic conditions would slightly improve for some of the movements analyzed, such as the northbound through movement along El Camino Real. This is due to the reduced traffic on northbound El Camino Real as a result of the elimination of the northbound left-turn and one of the northbound right-turn lanes at El Camino/Holly. However, the eastbound movements at El Camino/Holly would extend beyond the western intersection, as projected under cumulative conditions, and the eastbound movement at El Camino/San Carlos also would continue to extend beyond the western intersection.

The simulation analysis provides a good tool to help understand and visualize traffic conditions on a future roadway network. However, it should also be noted that the results obtained from the simulation analysis are not absolute or final, but simply an illustration of potential traffic conditions under the given parameters. The results obtained from the simulation analysis, in conjunction with other results presented in this traffic study, should be used as a guideline for future planning. Overall, the simulation analysis shows that with carefully planned traffic signal timing and phasing, the proposed roadway network could accommodate the future traffic and pedestrian demand within the area.