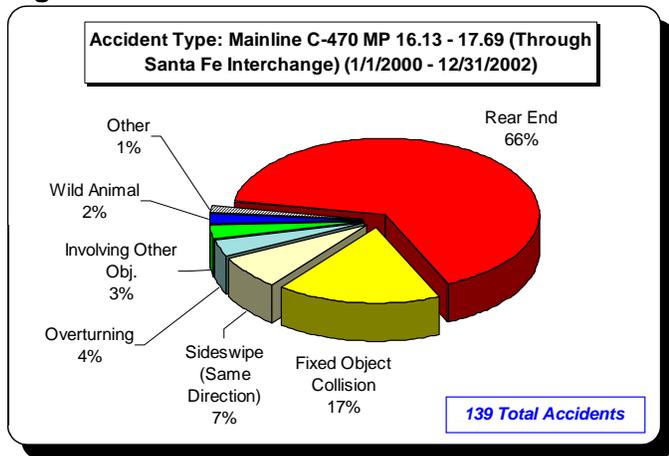
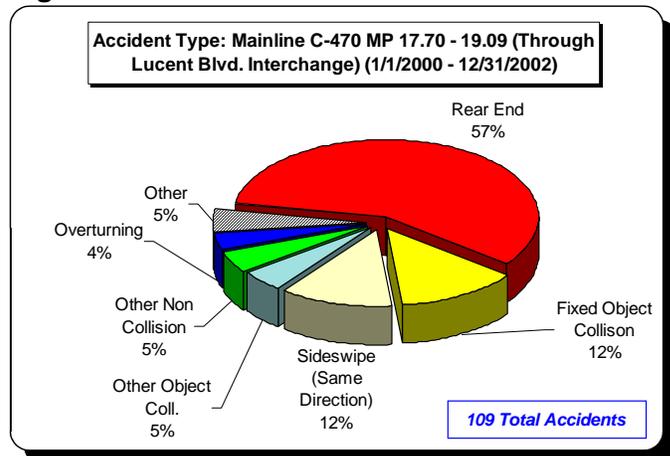


The following charts present the types of accidents making up the SPF points at locations 1 - 5 in the SPF graphs above (5 highest accident frequency locations). The charts depict only the accidents occurring on the mainline (non-ramp, non-cross rd. accidents) of C-470 to correspond to the SPF study.

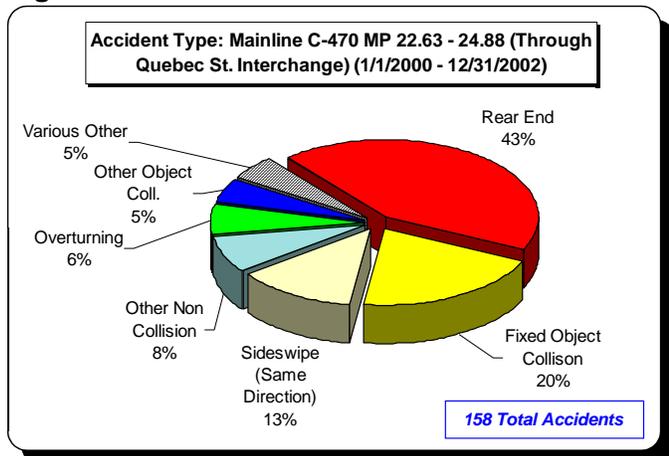
**Figure 7a**



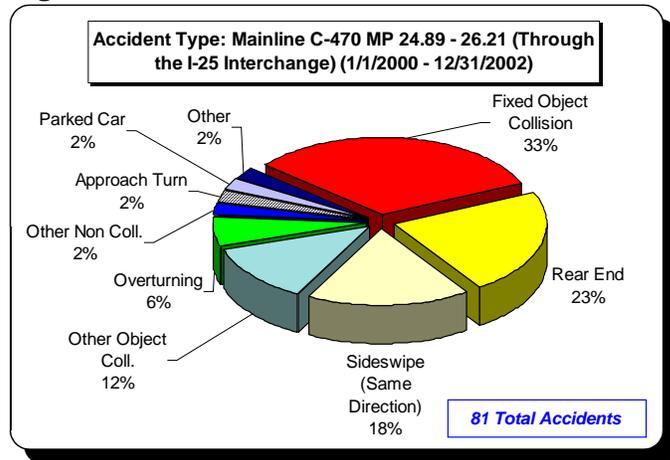
**Figure 7b**



**Figure 7c**



**Figure 7d**



**Figure 7e**

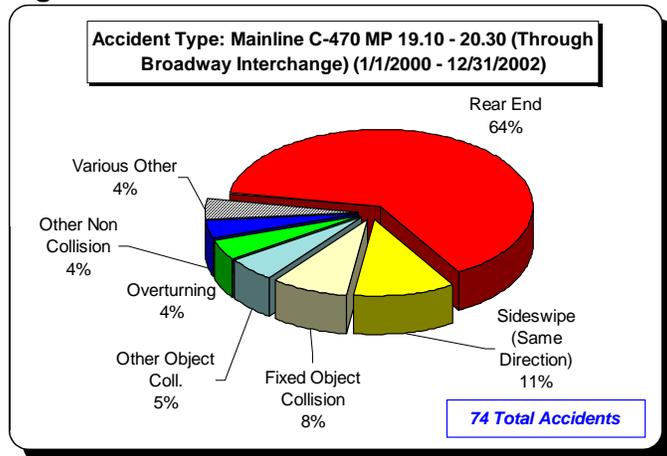


Figure 7a shows that rear-end collisions are the most common type of accident occurring on C-470 around the Santa Fe interchange area, accounting for over 60% of the total. Fixed object collisions (guardrail, median barrier, etc.) make up an additional 17% of the mainline crashes in this section. The rear-end collisions are commonly occurring during the morning and afternoon peak volume periods indicating that traffic congestion is a significant contributing factor.

The crash breakdown for the 1.4 mile segment of mainline 470 encompassing the Lucent Blvd. interchange is depicted in Figure 7b. Similar to the above segment surrounding the Santa Fe interchange, congestion-related rear-end collisions and crashes with various fixed objects account for nearly 70% of the overall total.

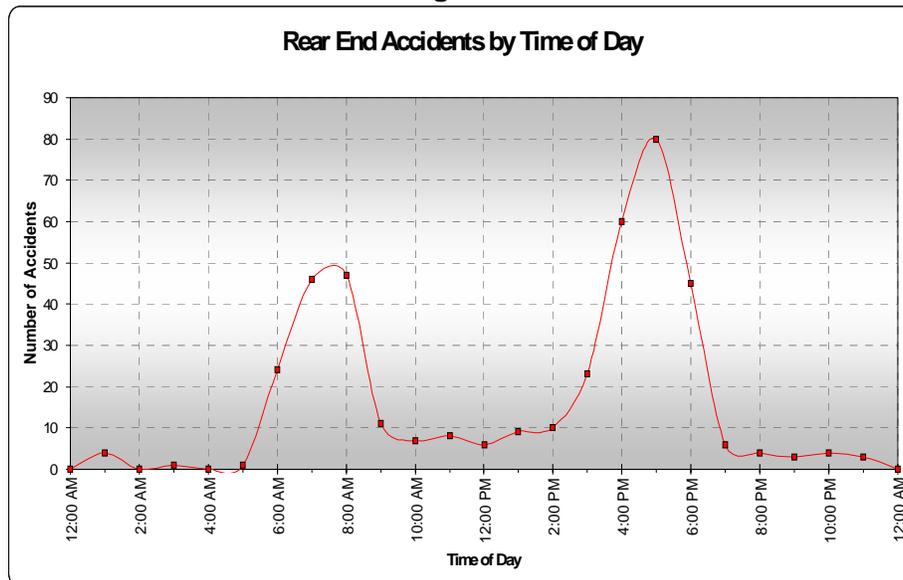
Figure 7c shows the crash breakdown for the segment surrounding Quebec St. In this segment, rear-end crashes prevail with an afternoon bias between 3 and 6:30 pm, again suggesting peak-hour congestion as a major contributing factor. A planned median cable rail project is slated for this segment by the Region. With evidence of median incursion and cross-over type loss of control incidents, this type of improvement is well justified.

In addition to the peak hour volume constraints, the accidents reported in the I-25 interchange zone, shown in Figure 7d also reflect intensified merging and weaving maneuvers associated with the I-25 and Yosemite ramps. In this segment, many collisions with fixed objects such as guardrail, median barrier and delineator posts are associated with loss of control during lane changes or other maneuvering during congested conditions.

Mainline C-470 accident history around the Broadway interchange continues to exhibit a congestion-related pattern with rear-end & same direction sideswipe crashes accounting for nearly 75% of the overall total. Again, most of these accidents are the direct result of one or more of the involved vehicles either unexpectedly slowing or actually stopping, due to congestion, on a high-speed freeway.

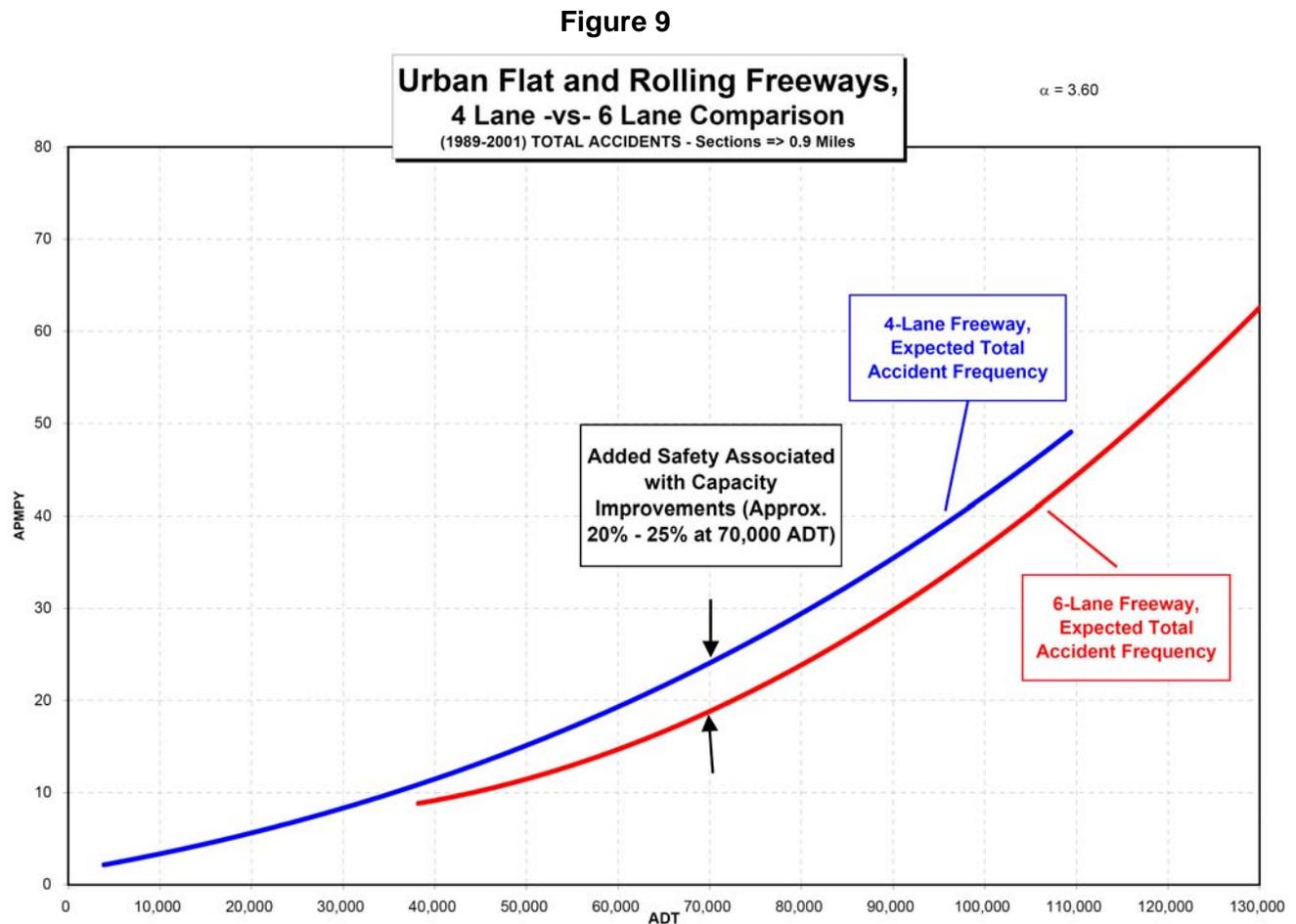
Across these 5 segments, rear end collisions account for an average of over 50% of the total accidents on C-470. Figure 8 shows how the incidence of rear end collisions varies with time of day, indicating that the frequency of these crashes escalates significantly during congested peak volume period traffic flows. In fact, 75% of the total rear end crashes occur between 6 am and 9 am and between 4 pm and 7 pm.

**Figure 8**



## Safety Benefit Through Capacity Improvement

Capacity improvement, in the form of additional traffic lanes, through this segment of C-470 is an alternative that would result in significant operational improvements. Generally, freeway facilities of 6 or more lanes are expected to have fewer accidents than 4 lane facilities carrying the same amount of traffic. This can possibly be explained by increased gap availability for weaving, merging and diverging. Increased capacity, therefore, also yields a safety dividend. Figure 9 depicts the safety dividend expected to accompany freeway capacity improvement. In this case, widening a facility from 4 lanes to 6 lanes.

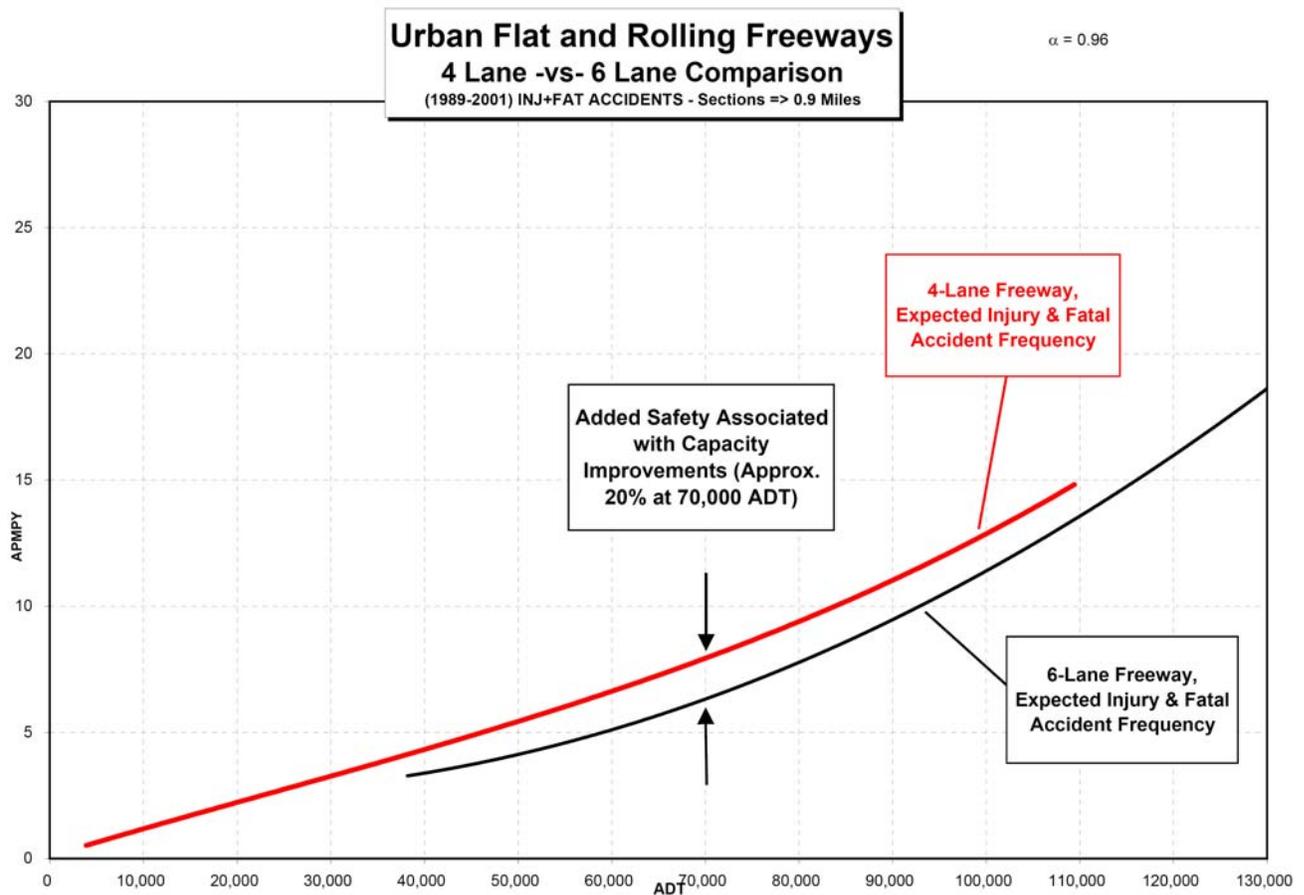


As shown above, in the urban freeway environment, widening from 4 to 6 lanes is expected to yield an overall reduction in collisions of up to 25% at an ADT of 70,000 vehicles per day. Considering a present mainline average crash frequency of 270 accidents per year, additional capacity could also mean a safety benefit of up to 68 prevented accidents per year. Again, this is in addition to the operational benefits attached to capacity improvements.

Figure 10 further indicates the safety dividend in severe accidents associated with widening. At an average ADT of 70,000, studies indicate that up to 20% of severe injury and fatal accidents

occurring on the present 4-lane configuration may be prevented. This segment of C-470 recorded 263 combined injury and fatal collisions during the 3-year study period. Widening to 6 lanes could therefore realize a reduction of up to 18 severe crashes annually at the present volume levels. Ultimately, widening to 8 lanes is anticipated in order to capture long term operational benefits. The safety gains accompanying major widening of this type is expected to exceed those attained in this 4-lane to 6-lane discussion.

Figure 10



Accident Pattern Analysis

We have further examined roadway segments for accident concentrations and patterns. The roadway within project limits was tested for the presence of patterns related to accident type, severity, direction of travel, road conditions, spatial distribution of accidents and time of day. Pattern recognition analysis was performed using diagnostic normative percentages for safety problems in an urban, 4 - lane freeway environment. These diagnostic norms are developed using the same data points as those graphed in the SPF analysis. The calculated norms are presented in table 1 (Statewide Avg. percentages for similar hways.) on the following page along with data on C-470 for the 3-year study period. Several accident types on C-470 exhibiting higher than expected frequency of occurrence have been identified. Evaluation of individual detected patterns for total number of collisions included and common accident characteristics further defines locations with genuine addressable problems.