Contiguous HOV Lane Safety:
A Before and After Comparison of Accident Rates

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Abstract

Recent research studies have investigated increases in accident rates related to high occupancy vehicle (HOV) freeway lanes. Accidents were found to be concentrated at ingress/egress locations for barrier- or buffer-separated HOV lanes. However, in Northern California, HOV lanes on freeways are contiguous. That is, the HOV lane is immediately adjacent to the other lanes of traffic so that entering and exiting the HOV lane occurs at the driver's discretion along its entire length. Given the different operational characteristics, changes to accident rates with the addition of contiguous HOV lanes may be different than those reported for barrier- or buffer-separated HOV lanes.

To determine the changes to accident rates with the addition of a contiguous HOV lane, accident data from before and after the construction of HOV lanes were compared for two freeway corridors in the Sacramento area. The accident review included categorizing by collision location (shoulder, left lane, etc.); collision type (sideswipe, rear end, etc.); and movement preceding collision (proceeding straight, changing lanes, etc.). Additionally, changes in daily volumes and congestion level for before and after conditions were reviewed.

For the study corridors, the before and after comparison did not show a relationship between the accident rate and the addition of contiguous HOV lanes. Changes in accident rates appeared to be related to the level of congestion, particularly at downstream bottlenecks, rather than HOV lane operations. Relatively few accidents occurred in the HOV lane during after conditions, and the number of accidents that occurred while changing lanes did not increase.

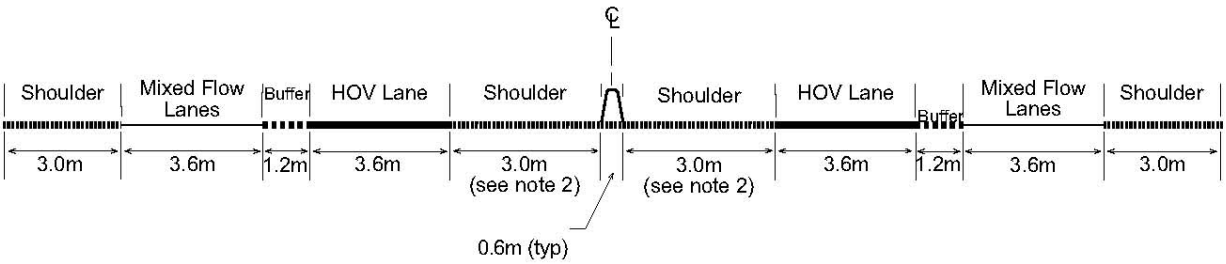
Background

Recent research studies in other states have investigated increased accident rates related to high-occupancy vehicle (HOV) freeway lanes (Cothron et al, 2004). Accidents were found to be concentrated at ingress/egress locations for barrier- or buffer-separated HOV lanes. As a result, the studies recommended design changes for these locations to provide additional weaving areas.

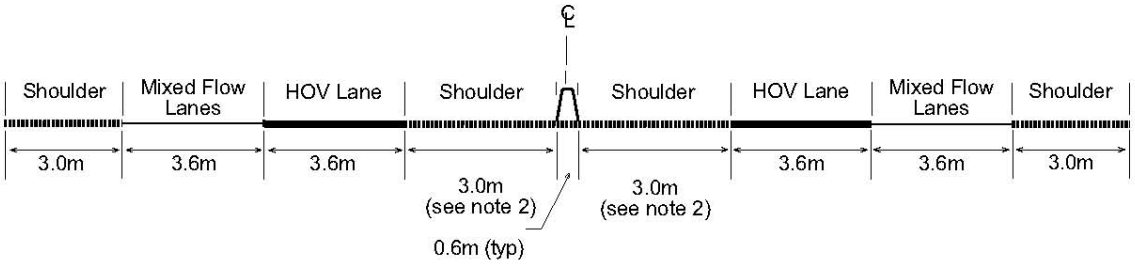
Figure 1 shows the typical cross-section for buffer-separated and contiguous HOV facilities. Buffer (and barrier) separated HOV facilities generally provide motorists with a better level of service than contiguous lanes. This includes higher driver comfort, additional maneuvering room, and a lessening of congestion impacts from the adjoining mixed-flow lanes. Contiguous HOV

FIGURE 1
TYPICAL CROSS SECTIONS
BUFFER-SEPARATED AND CONTIGUOUS
HOV FACILITIES

NOT TO SCALE



BUFFER-SEPARATED HOV FACILITY



CONTIGUOUS HOV FACILITY

Note: 1.5 m = 5 ft
3.0 m = 10 ft

Source: Caltrans

facilities are normally used in areas with short duration, high volume peak commute periods.

Barrier or buffer separated HOV lanes have designated ingress and egress points and a physical barrier or painted buffer that prevents lane changing between the HOV lane and the adjacent mixed-flow lane. The majority of the separated HOV lanes are restricted to HOV use all day. In contrast, entrance and exit to contiguous HOV lanes occur at the driver's discretion along the entire length. Also, the HOV restriction for two or more occupants occurs only during the peak commute periods. At all other times, all vehicles other than commercial trucks may use the lane.

Professor Edward Sullivan of the California Polytechnic University at San Luis Obispo conducted an extensive safety review of California HOV lanes in 1992. Using California Department of Transportation (Caltrans) Traffic Accident Surveillance and Analysis System (TASAS) accident data, he reviewed San Francisco Bay Area freeways with contiguous HOV Lanes and found "no clear, systematic differences in lane locations, collision types or other factor which would support hypotheses of differences in accidents due to the presence of the contiguous HOV lanes" (Sullivan et al, 1992).

The authors have reviewed accident data before and after HOV lanes were constructed in the Sacramento area to determine if the addition of HOV lanes affects accident rates.

Study Corridor Selection

HOV lanes in the Sacramento area are contiguous freeway lanes, unlike the barrier or buffer separated HOV lanes in southern California. Figure 2 and Table 1 show the HOV lane system in the Sacramento metropolitan area. The HOV lanes on State Route 99 (SR-99) were constructed first and were later extended south to Elk Grove and north onto State Route 51 (SR-51). Then, the U. S. Highway 50 (US-50) HOV lanes between Rancho Cordova and El Dorado Hills were built in 2002. Most recently, HOV lanes on Interstate 80 (I-80) between Citrus Heights and Sacramento were completed in 2004.

TABLE 1 – SACRAMENTO HOV LANE CONSTRUCTION HISTORY			
Route	**Length**	**Date**	**Limits**
US-50	11.5 miles	March 2002	Sunrise Blvd to Prairie City Rd (Westbound)
		July 2002	Sunrise Blvd to Prairie City Rd (Eastbound)
		November 2002	Prairie City Rd to El Dorado Hills Blvd
SR-51	1.5 miles	September 1999	US-50 to E St (Southbound)/N St (Northbound)
I-80	9.6 miles	October 2003	Madison Ave to Riverside Ave (Eastbound)
		July 2004	Longview Dr to Madison Ave (Eastbound)
			Longview Dr to Riverside Ave (Westbound)
SR-99	12.1 miles	November 1990	Mack Rd to MLK Jr Blvd
		October 1998	Elk Grove Blvd to Mack Rd
		September 1999	MLK Jr Blvd to US-50
Source: Caltrans District 3			

Of the three existing HOV lanes, the SR-51/SR-99 corridor is unique because it has reduced median shoulder widths and reduced lane widths between Martin Luther King Jr. Boulevard and US-50. Both the US-50 and I-80 HOV lanes have standard median shoulders and lane widths. This study evaluates the accident data only for the US-50 and I-80 HOV lanes.

Collision data was provided for differing periods because the HOV lanes were recently constructed. For US-50, the before period is 36 months, and the after period is 20 months. The before data includes the two-year construction period prior to opening. The accident data for the I-80 HOV lanes, which were constructed most recently, has only 12 months of after period data. Therefore, only one year of before data was reviewed for the I-80 corridor, although this year-long period does not include the construction period.

US-50 HOV Lanes

Corridor Description

In the Sacramento metropolitan area, US-50 has HOV lanes for about 11.5 miles from Sunrise Boulevard in Sacramento County to El Dorado Hills Boulevard in El Dorado County. US-50 serves primarily as a commuter route between job centers in Sacramento and Rancho Cordova and residential areas in Folsom and western El Dorado County. The freeway is also an important regional highway for

recreational traffic between the Central Valley and the San Francisco Bay area to the Reno/Lake Tahoe area.

Following are descriptions of the freeway lane configurations before and after the HOV lane construction.

- Before – Four lanes (two in each direction) east of Hazel Avenue and six lanes (three in each direction) west of Hazel Avenue
- After – Six lanes (two mixed-flow lanes and one HOV lane in each direction) east of Folsom Boulevard and eight lanes (three mixed-flow lanes and one HOV lane in each direction west of Folsom Boulevard

The HOV lane (in both directions) is restricted to vehicles with two or more passengers on weekdays (Monday through Friday) between the hours of 6 to 10 AM and 3 to 7 PM.

As shown in Table 2, congestion more than doubled on US-50 in the study area between 2002 and 2004. Residential growth in nearby communities is reflected in the increase in average daily volume on US-50 (from 79,600 vehicles per day in 2002 to 83,000 vehicles per day in 2004). Even with the construction of the HOV lanes, the level of traffic congestion increased by almost three times between 2002 and 2004.

TABLE 2 – US-50 CONGESTION DELAY

Year	AM (WB)	PM (EB)	Total
2002	47,000	80,000	127,000
2004	139,000	236,000	375,000

Note: Congestion delay is reported in vehicle-hours per year
Source: Caltrans District 3, 2003 & 2005

Accident Data

Table 3 lists the TASAS summary data for before and after the HOV lanes were constructed on US-50. Under both before and after conditions, both the fatality plus injury and total accident rates were greater than the average accident rate. However, the total accident rate increased after the HOV lanes were built.

TABLE 3 – US-50 ACCIDENT SUMMARY							
Conditions	**Number of Accidents**	**Actual Accident Rate**			**Average Accident Rate**		
		Fatality	**F+I[1]**	**Total**	**Fatality**	**F+I[1]**	**Total**
Before Conditions Mar 1999 through Feb 2002 (36 mos.)	612	0.006	**0.23**	**0.61**	0.006	0.20	0.59
After Conditions Nov 2002 through Jun 2004 (20 mos.)	431	0.003	**0.26**	**0.74**	0.007	0.21	0.61

Notes: Bold and underline font indicate an actual accident rate higher than the statewide average for similar locations.

1. The accident rate is accidents per million vehicle-miles.
2. F+I – the rate of fatalities and injuries per million vehicle-miles.

Source: Caltrans District 3, 2006

Table 4 compares the percentage of accidents for before and after the HOV lanes by type of collision. The number of sideswipe and rear-end collisions increased for the after period, and the number of hit object and other accidents decreased. Again, the increase in congestion may explain the increase in the number of accidents.

TABLE 4 – US-50 ACCIDENTS BY TYPE OF COLLISION				
Conditions	**Sideswipe**	**Rear End**	**Hit Object**	**Other[1]**
Before Conditions Mar 1999 through Feb 2002 (36 mos.)	10% (61)	52% (321)	28% (172)	10% (58)
After Conditions Nov 2002 through Jun 2004 (20 mos.)	11% (48)	60% (257)	23% (100)	6% (26)

Note: 1. The other accident types include head on, broadside, overturn, pedestrian, and other accident types.

Source: Caltrans District 3, 2006

Table 5 classifies accidents according to the movement preceding the collision. For this measure, the percentages sum to more than 100 percent because more than one vehicle is involved in most collisions. Only the “stopped” movement shows an increase for the after conditions, which likely reflects the observed increase in rear-end collisions from Table 4.

TABLE 5 – US-50 ACCIDENTS BY VEHICLE MOVEMENT PRECEDING COLLISION				
Conditions	**Stopped**	**Proceeding Straight**	**Slowing or Stopping**	**Changing Lane**
Before Conditions Mar 1999 through Feb 2002 (36 mos.)	27% (164)	73% (448)	26% (157)	12% (71)
After Conditions Nov 2002 through Jun 2004 (20 mos.)	33% (140)	74% (320)	26% (112)	13% (55)
Note: The percentages add to greater than 100% because the movements of all vehicles involved in the accident are included. Source: Caltrans District 3, 2006				

Table 6 lists the percentage of accidents by collision location – that is, the freeway lane where the collision occurred. Under after conditions, three percent of all collisions occurred in the HOV lane. The number of collisions in the left and right lanes went down and the number in the interior lanes went up. However, these changes are more likely due to the increase in interior lanes with the construction of the HOV lane, which is the third freeway lane for the majority of the corridor.

TABLE 6 – US-50 ACCIDENTS BY COLLISION LOCATION				
Conditions	**HOV Lane**	**Left Lane**	**Interior Lanes**	**Right Lane**
Before Conditions Mar 1999 through Feb 2002 (36 mos.)	n/a	41% (248)	11% (69)	24% (148)
After Conditions Nov 2002 through Jun 2004 (20 mos.)	3% (13)	28% (120)	38% (165)	17% (74)
Note: The length of freeway section with interior lanes is much greater for after conditions. Source: Caltrans District 3, 2006				

A review of the TASAS accident records showed that two of the 13 accidents associated with the HOV lane occurred outside the HOV lane operation hours, and one began as a hit object on the right side of the roadway. Of the remaining 10 accidents, seven occurred in the eastbound direction and three in the westbound direction. All except one of the eastbound accidents occurred during the PM peak period, which reflects the peak commute direction and observed congestion. In the westbound direction, two accidents occurred during the AM peak period and one during the PM peak period. All but one of the HOV lane

accidents occurred in the freeway section with two mixed-flow lanes and one HOV lane.

I-80 HOV Lanes

Corridor Description

I-80 has HOV lanes for about 9.6 miles in northeastern Sacramento County from Longview Drive to Riverside Avenue. I-80 connects the City of Sacramento with the City of Roseville and southern Placer County, passing through the City of Citrus Heights. It is the major commercial and commuter route between the two counties and is a commercial and recreation route between the San Francisco Bay area and the Reno/Lake Tahoe area.

Following are descriptions of the freeway lane configurations before and after the HOV lane construction.

- Before – Six lanes (three in each direction) with auxiliary lanes between Longview Drive and SR-51, 10 lanes (five in each direction) between SR-51 and Madison Avenue, eight lanes (four in each direction from Madison Avenue to Riverside Avenue with auxiliary lanes between Madison Avenue and Greenback Lane only, transitioning to six lanes (three in each direction) east of Riverside Avenue

- After – HOV lanes (one in each direction) were added along the corridor, a lane was added to the eastbound connector ramp to SR-51, and the capacity of the interchanges at Madison Avenue and Greenback Lane was increased.

The HOV lane (in both directions) is restricted to vehicles with two or more passengers on weekdays (Monday through Friday) between the hours of 6 to 10 AM and 3 to 7 PM.

Increased residential and commercial development in south Placer County has translated into increased traffic volume on I-80. The average daily volume of 90,800 vehicles per day in 2001 grew to 96,300 vehicles per day in 2004, an increase of six percent over three years. Table 7 presents the observed congestion delay in the eastbound and westbound directions of I-80 in the study area.

TABLE 7 – I-80 CONGESTION DELAY					
Year	Westbound		Eastbound		Total
	AM	PM	AM	PM	
2001	649,000	0	14,000	82,000	891,000
2004	233,000	0	70,500	256,000	559,000

Note: Congestion delay is reported in vehicle-hours per year.
Source: Caltrans District 3, 2002 & 2005

In the westbound direction, annual delay has dropped from 649,000 vehicle-hours in 2001 to 233,000 vehicle-hours in 2004, even though the volume has increased. The construction of the HOV lanes, the Business 80 westbound connector widening, and the interchange reconstruction projects at Madison Avenue and Elkhorn Boulevard/Greenback Lane have increased the capacity of the corridor and reduced congestion delay. In the opposite direction, the bottleneck was beyond the project limits of the HOV lanes, so the capacity constraint at the Placer County line remained. With the increase in volumes, annual delay has increased from 82,000 vehicle-hours in 2001 to 256,000 vehicle-hours in 2004.

Accident Data: Westbound

Table 8 shows the accident rate on westbound I-80 for before and after conditions. For the one-year before period in 2001, the fatality and total accident rates exceeded the statewide average. For the one-year after period in 2004-2005, the fatality plus injury accident rate exceeded the statewide average, but the total accident rate was lower. Although the total number of accidents is higher for after conditions (255 versus 250), the average daily volume increased from 90,800 to 96,300 so that the rate in accidents per million vehicle-miles is lower.

TABLE 8 – WESTBOUND I-80 ACCIDENT SUMMARY							
Conditions	**Number of Accidents**	**Actual Accident Rate**			**Average Accident Rate**		
		Fatality	**F+I[1]**	**Total**	**Fatality**	**F+I[1]**	**Total**
Before Conditions Jan 2001 through Dec 2001 (12 mos.)	250	**0.007**	0.25	**0.93**	0.005	0.29	0.89
After Conditions Jul 2004 through Jun 2005 (12 mos.)	255	0.003	**0.33**	0.89	0.006	0.30	0.92

Notes: Bold and underline font indicate an actual accident rate higher than the statewide average for similar locations.

1. The accident rate is accidents per million vehicle-miles.
2. F+I – the rate of fatalities and injuries per million vehicle-miles.

Source: Caltrans District 3, 2006

Table 9 shows the percentage of accidents in the westbound direction according to the type of collision. Compared to before conditions, the percentage of rear-end collisions increased slightly for after conditions.

TABLE 9 – WESTBOUND I-80 ACCIDENTS BY TYPE OF COLLISION				
Conditions	**Sideswipe**	**Rear End**	**Hit Object**	**Other[1]**
Before Conditions Jan 2001 through Dec 2001 (12 mos.)	16% (23)	78% (114)	3% (5)	3% (4)
After Conditions Jul 2004 through Jun 2005 (12 mos.)	14% (22)	80% (126)	4% (7)	2% (3)

Note: 1. The other accident type includes head on, broadside, overturn, and pedestrian accident types.

Source: Caltrans District 3, 2006

Table 10 classifies accidents according to the movement preceding the collision. The percentage of “slowing or stopping” movement increased and the “changing lane” movement decreased for the after conditions. This result reflects congested conditions in the corridor. The addition of an HOV lane might lead to an increase in accidents due to HOVs changing lanes quickly to enter or exit the HOV lane; however, the data show a decrease in accidents with vehicles that are changing lanes.

TABLE 10 – WESTBOUND I-80 ACCIDENTS BY VEHICLE MOVEMENT PRECEDING COLLISION

Conditions	Stopped	Proceeding Straight	Slowing or Stopping	Changing Lane
Before Conditions Jan 2001 through Dec 2001 (12 mos.)	43% (62)	86% (125)	32% (46)	23% (33)
After Conditions Jul 2004 through Jun 2005 (12 mos.)	42% (67)	87% (137)	38% (60)	18% (29)

Note: The percentages add to greater than 100% because the movements of all vehicles involved in the accident are included.

Source: Caltrans District 3, 2006

Table 11 shows the percentage of accidents in the westbound direction according to the collision location during the AM and PM peak periods. No accidents were reported in the HOV lane for after conditions. However, the percentage of left lane collisions increased from 18 to 27 percent with a corresponding reduction in interior lanes and right lane collisions.

TABLE 11 – WESTBOUND I-80 ACCIDENTS BY COLLISION LOCATION DURING PEAK PERIODS

Conditions	HOV Lane	Left Lane	Interior Lanes	Right Lane	Other[1]
Before Conditions Jan 2001 through Dec 2001 (12 mos.)	n/a	18% (26)	57% (83)	29% (42)	5% (8)
After Conditions Jul 2004 through Jun 2005 (12 mos.)	0% (0)	27% (42)	53% (84)	23% (37)	6% (9)

Note: The peak periods are weekdays 6 to 10 AM and 3 to 7 PM.

1. The other collision location includes right shoulder, left shoulder, beyond right shoulder, beyond left shoulder, and other locations.

Source: Caltrans District 3, 2006

A review of the “Left Lane” accident data revealed that the predominating movements prior to the collisions involved vehicles stopped, slowing or stopping, and proceeding straight, which is typical of freeway congestion. Four accidents were attributed to lane changing to or from the left lane, and the predominant type of collision was rear end.

Accident Data: Eastbound

Table 12 shows the accident rate on eastbound I-80 for before and after conditions. For the one-year before period in 2001, the fatality accident rate exceeded the statewide average. For both the before and after conditions, the fatality accident rate exceeded the statewide average. The overall accident rate was lower than the statewide average for both before and after conditions; however, the overall accident rate increase for the after conditions.

TABLE 12 – EASTBOUND I-80 ACCIDENT SUMMARY

Conditions	Number of Accidents	Actual Accident Rate			Average Accident Rate		
		Fatality	F+I[1]	Total	Fatality	F+I[1]	Total
Before Conditions Jan 2001 through Dec 2001 (12 mos.)	197	**0.011**	0.26	0.73	0.005	0.29	0.89
After Conditions Jul 2004 through Jun 2005 (12 mos.)	222	**0.010**	0.29	0.78	0.006	0.30	0.92

Notes: Bold and underline font indicate an actual accident rate higher than the statewide average for similar locations.

1. The accident rate is accidents per million vehicle-miles.
2. F+I – the rate of fatalities and injuries per million vehicle-miles.

Source: Caltrans District 3, 2006

Reflecting the commuting patterns, the number of PM peak period accidents is greater in the eastbound direction. Under before conditions, accidents in the eastbound direction cluster around the exits to Madison Avenue, Greenback Lane, and Antelope Road. For after conditions, the eastbound direction shows an increase in PM peak period accidents between Antelope Road and Riverside Avenue, which reflects the end of the HOV lane and the associated freeway lane drop.

Table 13 shows the percentage of accidents in the eastbound direction according to the type of collision. Compared to before conditions, the percentage of rear-end collisions increased slightly for after conditions, and the overall percentage of rear-end accidents remained high. As expected, the locations with high numbers of rear-end collisions correspond to the congested locations during the AM and PM peak periods.

TABLE 13 – EASTBOUND I-80 ACCIDENTS BY TYPE OF COLLISION				
Conditions	**Sideswipe**	**Rear End**	**Hit Object**	**Other[1]**
Before Conditions Jan 2001 through Dec 2001 (12 mos.)	12% (12)	78% (80)	7% (7)	3% (3)
After Conditions Jul 2004 through Jun 2005 (12 mos.)	12% (17)	80% (110)	4% (6)	4% (5)

Note: 1. The other accident type includes head on, broadside, over turn, pedestrian accident types.

Source: Caltrans District 3, 2006

Table 14 classifies accidents according to the movement preceding the collision. The percentage of "slowing or stopping" movement increased and the "stopped" and "changing lane" movements decreased for the after conditions.

TABLE 14 – EASTBOUND I-80 ACCIDENTS BY VEHICLE MOVEMENT PRECEDING COLLISION				
Conditions	**Stopped**	**Proceeding Straight**	**Slowing or Stopping**	**Changing Lane**
Before Conditions Jan 2001 through Dec 2001 (12 mos.)	44% (45)	88% (90)	31% (32)	17% (17)
After Conditions Jul 2004 through Jun 2005 (12 mos.)	41% (57)	88% (122)	36% (50)	15% (21)

Note: The percentages add to greater than 100% because the movements of all vehicles involved in the accident are included.

Source: Caltrans District 3, 2006

Table 15 shows the percentage of accidents in the eastbound direction according to the collision location during the AM and PM peak periods. Nine accidents were reported in the HOV lane for after conditions. The percentage of "Left Lane" collisions increased from 23 to 43 percent with a corresponding reduction in interior lanes and right lane collisions.

TABLE 15 – EASTBOUND I-80 ACCIDENTS BY COLLISION LOCATION DURING PEAK PERIODS

Conditions	HOV Lane	Left Lane	Interior Lanes	Right Lane	Other[1]
Before Conditions Jan 2001 through Dec 2001 (12 mos.)	n/a	23% (23)	37% (38)	35% (36)	8% (8)
After Conditions Jul 2004 through Jun 2005 (12 mos.)	6% (9)	43% (59)	38% (52)	14% (20)	4% (6)
After Conditions During Off-Peak[2] Jul 2004 through Jun 2005 (12 mos.)	7% (3)	17% (8)	45% (21)	15% (7)	15% (7)

Notes: Peak periods are weekdays from 6 to 10 AM and 3 to 7 PM.

1. The other collision location includes right shoulder, left shoulder, beyond right shoulder, beyond left shoulder, and other locations.
2. The off-peak period includes the following times when HOV lane use is not restricted: weekdays 7 PM to 6 AM & 10 AM to 3 PM, and all day Saturday and Sunday.

Source: Caltrans District 3, 2006

Of the nine "HOV Lane" collisions, two were reported to have lane changing as the movement preceding the collision. One was alcohol related with both vehicles proceeding straight. The remaining six were rear-end collisions with drivers proceeding straight under slowing or stopping conditions. Of the 59 "Left Lane" collisions for after conditions, only three were coded as changing lanes as the movement preceding the collision, which may indicate changing lanes from or to the HOV lane.

Conclusions

For the study corridors, a comparison of before and after data does not show a consistent pattern relating the accident rate and the addition of contiguous HOV lanes.

- On US-50, the accident rate increased from 0.61 to 0.74 accidents per million vehicle-miles.
- On I-80, the overall accident rate remained the same, about 0.83 accidents per million vehicle-miles. In the westbound direction, the accident rate decreased, and in the eastbound direction the accident rate increased.

Instead, the overall accident rate was related to the observed level of congestion. Congestion has increased on both US-50 and eastbound I-80 and decreased on westbound I-80, which corresponds to the changes in accident rates.

The introduction of an HOV lane might lead to more lane changing accidents since HOVs must change lanes to reach the median HOV lane; however, the accident data did not show a substantial increase in the number of "Changing Lanes" collisions.

- For US-50, the number of changing lanes collisions increased by one percent (from 12 to 13 percent).
- For I-80, the number of such accidents decreased overall and in each direction – five percent in the westbound direction (from 23 to 18 percent) and two percent in the westbound direction (from 17 to 15 percent).

With regard to collision factors, the accident data provided does not demonstrate an increased safety problem with the HOV lanes.

- On US-50, only ten collisions occurred in the HOV lanes during peak periods (when the HOV lane was operating), or about three percent of all collisions in over a 20-month period.
- In the westbound direction of I-80, no accidents occurred in the HOV lane.
- In the eastbound direction, nine accidents occurred in the HOV lane (six percent of all peak-period eastbound accidents).

Although "Left Lane" collisions increased for both US-50 and I-80, few of these accidents had "Changing Lanes" as the vehicle movement preceding the collision, which indicates that the HOV lane was not a factor in this increase.

Although the HOV lane operations do not appear to increase accident rates, the limits of the HOV lane do affect congestion, which indirectly affects accident rates. The accident data shows an increase in accidents for the freeway section within one mile of the HOV lane end between before and after conditions. For example, on eastbound US-50 during the PM peak period, the average number of accidents in the one-mile section increased from about 2 to 12 per year. The other locations (westbound US-50 and eastbound and westbound I-80) showed about a three-fold increase in accidents. This result is not surprising since the HOV lane generally relieves an upstream bottleneck along a corridor, which typically has an even higher accident rate. However, consideration should be given to the design and location of the HOV lane termination so that the accident rate can be minimized.

Accident rates are sensitive to traffic congestion whether a freeway has a contiguous HOV lane or not. Furthermore, review of the accidents on I-80 and US-50 found no clear differences in collision types, movement preceding collision, or other factors that would support the contention that contiguous HOV lanes affect traffic safety.

As more accident data become available for freeways with contiguous HOV lanes, further review can be conducted. This review could include a comparison of speeds between the HOV lane and the mixed-flow lanes. Field observations appear to show that HOV lane drivers reduce their speed when the mixed-flow lanes have slower speeds due to congestion. As a result, the speed differential between the free-flow HOV lane and the congested adjacent mixed-flow lane may not be as large as commonly assumed. The lower speed differential may be reflected in the relatively low number of HOV-lane-related collisions in the accident data.

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Disclaimer

The statements and conclusions of this report are those of the authors and not necessarily those of the State of California or the California Department of Transportation (Caltrans).

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End Notes

Figure 1: Caltrans “High-Occupancy Vehicle Guidelines,” August 2003, page 3-6.

Figure 2: Fehr and Peers Transportation Consultants