Road Safety Assessment (RSA)

SR 126 – Santa Paula to Fillmore
Ventura Co., California
July 2014

Making Your Roads Safer

BACKGROUND/ INTRODUCTION

In July 2014, a Road Safety Assessment (RSA) was conducted on a portion of California State Route 126 (SR 126) in Ventura County, approximately 50 miles north of Los Angeles. The study area (**Figure 1**) extends from Hallock Drive in Santa Paula to E Street in Fillmore, a distance of about 7 miles.

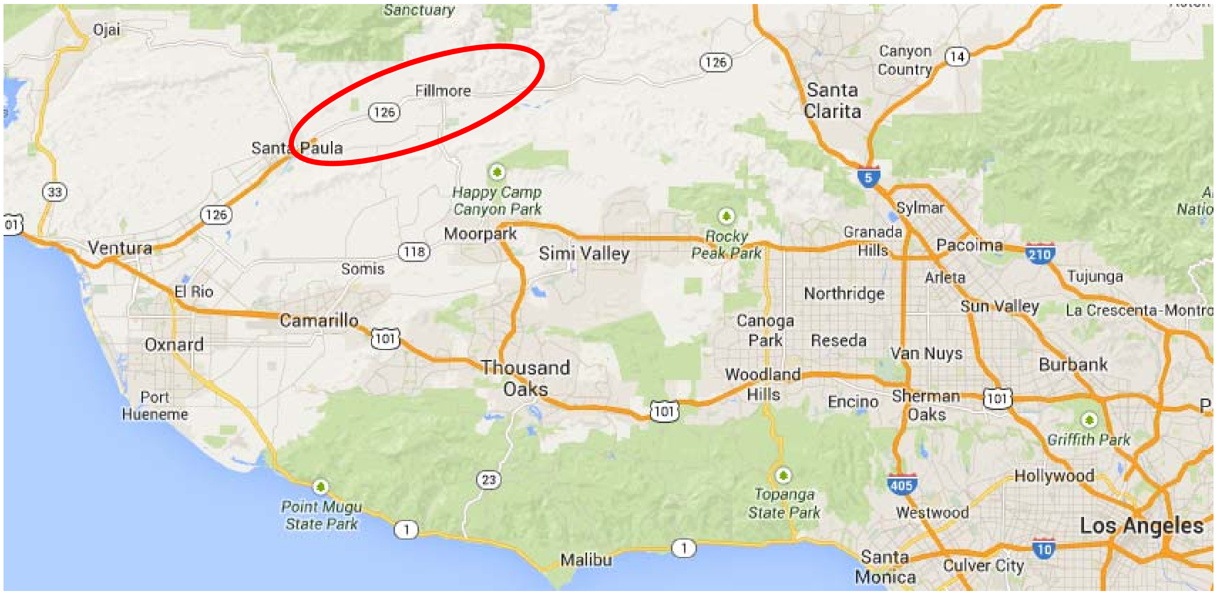


Figure 1: Corridor Study Location

Study Corridor

SR 126 is a five-lane conventional highway with two 12-foot lanes in each direction, 8-foot to 10-foot outside shoulders, and a 12-foot flush paved median, which is striped for left-turn channelization at public road intersections and as a two-way left turn lane (TWLTL) to serve private driveways.

The curvilinear roadway roughly follows the Santa Clara River to the south and has no appreciable grades. The Fillmore and Western Railway also parallels the route on the south side, crossing SR 126 at grade near the east and west ends of the corridor.

Hallock Drive, a signalized intersection at the west end of the study area marks the eastern terminus of the freeway portion of SR126. Several other major (unsignalized) intersections including Toland Road, Sycamore Road, Kenny Grove Park/Old Telegraph Road, and “E” Street cross Route 126 within the study area. The remaining roadways, most of them named and signed, are private roadways.

There are two existing 2-lane roads crossing under the mainline that allow traffic from both directions to reverse their course. The first is just east of Sycamore Road, while the second is further east about half a mile west of Old Telegraph Road.

Traffic demand generated along this corridor comes mainly from three primary uses: agriculture, residential, and the through traffic traveling between I-5 and the Pacific Coast, crossing through the cities of Santa Paula and Fillmore. State Route 126 is also a designated bike route.

Residential uses are a combination of single-family lots, large agricultural ranches, and yet to be constructed tracts such as Limonera East. Other land uses include a landfill, a one-room schoolhouse, retail stores, oil production, and possibly other less visible uses.

The average 2011 and 2012 AADT for this segment of Route 126 was approximately 33,000 vehicles with 10-15% truck traffic and an approximate peak hourly demand of 1300 vehicles per hour per lane (vphpl). The AADT and truck counts are both expected to increase since new proposed developments at Newhall Ranch (21,000 dwelling units) and, possibly at Limoneira East (up to 1500 dwelling units) are expected to be built in the future.

The posted speed limit within the study area is 55 mph (except for a short segment near E Street in Fillmore).

RSA Purpose

Prior to undertaking a planned project to install concrete median barrier throughout a significant portion of the corridor, the California Department of Transportation (Caltrans) requested that the Federal Highway Administration (FHWA) conduct an RSA to independently evaluate the safety of the corridor. The FHWA California Division Office requested the assistance of the FHWA Resource Center Safety and Design Technical Services Team, a team that responds to requests from across the country and the world to evaluate and recommend safety and design elements for all types of roadways.

The purpose of this RSA was to identify safety issues that may be contributing to the reported crashes along the corridor and to identify potential measures to mitigate these issues. Another goal of the RSA was to identify safety issues that have not yet resulted in crashes and suggest proactive improvements to address these issues.

FHWA defines an RSA as a “formal safety performance evaluation of an existing or future road or intersection by an independent, multidisciplinary team.” RSAs conducted by a team that is independent of the design and operations of the facility are able to address safety through a thorough review of roadway, traffic, environmental, and human factors conditions.

(More detailed information on RSAs, including best practices, case studies and guidelines, can be found by visiting FHWA's RSA website here: http://safety.fhwa.dot.gov/rsa)

RSA Team Role and Responsibilities

The RSA team was comprised of the following individuals whose collective experience and expertise includes geometric design, traffic safety and law enforcement:

Craig Allred	FHWA Resource Center
Keith Harrison, PE	FHWA Resource Center
Josué Yambó	FHWA California Division
Brian Frazer, PE	Caltrans Headquarters
Son Dao, PE	Caltrans District 7

The RSA Team was ably assisted by the following individuals and organizations who generously offered their time and effort in support of the RSA:

Caltrans District 7
Caltrans Maintenance - Fillmore
California Highway Patrol - Ventura
City of Fillmore
City of Santa Paula
Community Stakeholders

The RSA Team conducted several field reviews from Monday, July 28 through Wednesday July 30, observing the road conditions and traffic operations during weekday morning and afternoon peak periods and again during nighttime conditions. (Time constraints prevented weekend and seasonal observations.)

The corridor was driven in both directions, enabling detailed observations of the roadway, roadside and other road users. Where appropriate, the Team made periodic stops to explore specific locations on foot. A series of still photos and video footage were recorded to help supplement written notes.

Immediately preceding the site visit, a public stakeholder "Kickoff" meeting was held on Monday, July 28 at Fillmore City Hall to familiarize the RSA Team with stakeholders' thoughts, ideas, issues and concerns about the SR 126 corridor. (A public presentation of preliminary findings was also held at the conclusion of the RSA effort on Friday, August 1 at the Community Center in Santa Paula)

As a preliminary result of the field investigation stage of the RSA effort, a number of potential areas for safety improvements were identified. Some of these were location-specific; some involved systemic improvements throughout the corridor; many shared a common "theme".

To thoroughly capture these themes and to more broadly address overarching safety issues, they have been incorporated into one or more topics, discussed later: *Farm Driveway Access, Railroad Grade Crossings*, *Lane Departure Crashes*, *Intersections*, *Santa Clara Elementary School,* and *Speed Management.*

Although Caltrans' proposed project to install median barrier in this corridor had been prompted by a history of cross-median crashes, this RSA was undertaken with no pre-conceived notion about the relative degree of safety in the present context. It should also be understood that this RSA made no attempt to judge the appropriateness of any safety improvements incorporated in any past project or in any other way seek to "validate" any facet of other proposals.

The RSA Team's role was limited to conducting a purely technical study to identify safety issues and possible countermeasures. The team did not evaluate the cost, feasibility, or environmental impact of any of these suggested improvements, as that was beyond the scope of the RSA.

Information Sources

Caltrans supplied the RSA Team with Traffic Accident Surveillance and Analysis System (TASAS) crash data covering a span of 6 years, from April 2006 through March 2012. More recent crash data was not available, as there is typically a substantial time lag in migrating data from the Statewide Integrated Traffic Record System (SWITRS) into TASAS.
To help fill the gap, the Team was provided supplemental crash data and analysis by the California Highway Patrol (CHP). The Team also accessed the web-based Transportation Injury Mapping System (TIMS) to further analyze crash patterns for Fatal and Injury crashes.

Additional background source documentation provided by Caltrans included traffic volume counts, area maps, environmental documents, plan sets and project reports.
These were not reviewed prior to conducting the actual assessment, but proved helpful in analyzing the crash data and identifying appropriate mitigation treatments.

On several occasions, where the written documentation may have lacked necessary detail or otherwise needed clarification, Team members contacted Caltrans technical staff with those questions. Several local government officials and concerned citizens were also very helpful to the Team in understanding the issues and challenges.

CRASH ANALYSIS

Methodology

The RSA Team reviewed several Caltrans reports that identified crash trends, contributing factors, and potential countermeasures in support of scoping project improvements meant to improve safety in the SR 126 corridor.

Some additional crash analysis was conducted independently by the RSA Team to better understand the corridor crash history and to supplement those Caltrans reports.

[NOTE: *While every reasonable attempt has been made to minimize the possibility of errors, the accuracy and validity of the RSA Team's computational analysis cannot be guaranteed. Caltrans should not base any program or project decisions on this analysis without taking steps to confirm the accuracy and validity of these calculations and conclusions*].

Crash History and Crash Potential

One of the hallmarks of the RSA process is that the Team does not rely on historical crash data alone. Equally important is the capability to identify characteristics of the facility that may potentially lead to *future* crashes.

Identifying "hot spots" (locations where crashes are concentrated) by examining crash history is an important step in diagnosing the cause of crashes and in identifying targeted countermeasures. However, other locations that may have similar characteristics (the outside of a curve, for example) should be considered for mitigation as well.

Unfortunately, crashes are random events. That is, we cannot reliably predict where a driver may commit an error, a vehicle may experience a mechanical failure, or a deer may cross the road. We can, however, apply proactive countermeasures that can reduce the likelihood of a crash as well as the severity of its outcome.

Indications and Trends

Crash Location

Tying crash occurrence to location can help pinpoint roadway characteristics that may either lead to driver error and/or may increase the risk of crashing when errors do occur. Knowing the location of "hot spots" is also useful in identifying spot improvements.

There are as many as 100 "access points" (mostly private roads/driveways) that "intersect" SR 126. However, typically, only crashes occurring within 250 feet of a public road would be coded as "Intersection" crashes. Therefore, since public road intersections in the study area are few and far between, it’s not surprising that these locations accounted for only 31 of more than 300 crashes along the corridor.

Crash Severity

While fatal crashes are undeniably catastrophic, focusing on fatal crashes alone can sometimes distort the safety performance of a facility. Since injury crashes are many fold more frequent than fatal crashes, considering both Fatal and Injury (“F&I”) crashes as a proportion of Total crashes may better describe crash trends and help target effective countermeasures.

Of 320 Total crashes that occurred April 2006 through March 2012, there were 9 Fatal crashes and 111 Injury crashes. These 120 F&I crashes represent 38% of all crashes.

Exploring further some of the characteristics of these F&I crashes helps provide insights as to possible contributing factors which, in turn, can help strategize countermeasures that can reduce crashes of all severities.

Looking first at Fatal crashes only [Figure F1], we see that of the 9 crashes, 6 were Head-On or Broadside and 5 crashes were attributed to “Improper Turns”.

Looking next at the 18 Fatal (Level 1) or *Severe* (Level 2) Injury crashes [Figure F2], we see that there were more “Hit Object” crashes than Head-On or Broadside and that most (12) crashes were, again, attributed to Improper Turns”.

Figure F3 shows how the 120 F&I crashes are dispersed throughout the corridor. The numbered “balloons” show the approximate center of a cluster of crashes. Although the scale of the map does not allow for a high level of precision in plotting crash locations, the larger clusters are near intersections and/or curves, as would logically be expected.

Analyzing the Type of Collision [Figure F4] for these same 120 crashes, we see that Rear End crashes now account for more crashes than either Hit Object, Head-On or Broadside. Since Figure F3 adds 102 Severity level 3 and 4 crashes to the more severe crashes depicted in Figure F2, many more less-severe Rear-End crashes appear. Note however, that “Unsafe Speed” is cited as Primary Collision Factor in just 4 fewer collisions than “Improper Turn”.

Exploring those two PCFs a bit more closely, we clearly see the connection between “Unsafe Speed” and Rear-End Crashes [Figure F5]. Likewise, we see a clear linkage between “Improper Turn” and “Hit Object” [Figure F6].

Time of Crash

The times of crash occurrence trends were largely inconclusive.
“Month”, “Day of Week” and “Hour of Day” data mostly reflect crash patterns that are quite typical for a facility like this.

The Months with the highest number of crashes were July (36), September (35), January (32) and December (31).

The Days with the highest number of crashes were Wednesday (58) and Thursday/Friday/Saturday (51 each).

The Hourly grouping with the most recorded crashes was the late afternoon 2PM – 6PM (91).
The comparable morning commute period peak was 5AM – 9AM (62).
Interestingly, the mid-day period 10AM – 2PM had slightly more crashes (65) than early morning.

Summer months and/or months with several major holidays, commute hours and weekends each tend to have higher traffic volumes which, in turn, often translate into higher crash frequencies. The somewhat unusual mid-day peak crash count may simply be a reflection of farm-related activities that take place throughout the day, not just during the traditional "commute" periods.

"Environmental" Factors

Although we cannot control the weather, or when the sun rises and sets, knowing the extent that those "environmental" factors may have played in previous crashes can help identify appropriate countermeasures.

Only 22 of 320 crashes occurred under Rainy or Foggy conditions.
However, even modest amounts of precipitation can affect vehicle response and tire traction. 38 (12%) of total crashes occurred when the pavement was Wet/Snowy/Icy/Slippery. (Although flooding was cited as a concern by several stakeholders, including Caltrans Maintenance staff, there were no crashes during the 6 year period attributed to Flooding).

110 crashes occurred under "Dark" conditions; another 10 at Dusk or Dawn. These 120 crashes represent nearly 40% of all crashes. More important, three quarters (89) of these occurred in locations that were unlit by street lights.

In such locations, a vehicle's headlights may not adequately illuminate the path ahead for turning onto a crossroad or steering through a curve. Recognizing a pedestrian walking along the road or beginning to cross can also be more difficult, particularly if the pedestrian is wearing dark, non-reflective clothing.

Human Factors

To better understand <u>why</u> crashes are occurring, it's particularly important to review the actions of drivers and other road users, i.e. the "human" factors. Toward that end, an examination of the Primary Collision Factor (PCF) and other related statistics is enlightening.

Speeding

116 (36%) of 320 crashes were in some way attributed to Speeding as the PCF.

It is important to understand that "Speeding" does not always indicate that a driver has exceeded the posted speed limit. In many cases, the driver may have been going "too fast for conditions". In fact, 44 (38%) of these 116 crashes were coded as "Rear-End" crashes where the driver was likely operating well below the posted speed limit, yet could not slow enough to avoid running into a slowed or stopped vehicle in his path. Nevertheless, that still leaves 72 crashes where excessive speed may have played a role.

The significance of speed in the severity of crashes is well known.
The adage "Speed Kills" is not just hyperbole. As speed increases, the risk of occupant injury increases dramatically. Higher speeds also reduce the time a driver has to recognize and respond to signs and markings, roadway cues, changes in alignment and other road users.

Improper Turn

The next most frequently cited PCF was "Improper Turn".
91 crashes (28%) were coded as such.

Here again, the terminology can sometimes be misleading.

Improper Turn often means someone abruptly turned in front of someone at a driveway or intersection. But, this can just as easily mean that the driver simply failed to negotiate a curve (and perhaps ran off the road or crossed over the centerline). There were, in fact, some rear-end crashes coded as improper turn. In fact, the crash data shows that only 5 of these crashes occurred "At Intersection"; 30 were coded as "Ran Off Road" or "Cross Centerline". Improper Turn may be symptomatic of conflicting or confusing signs and markings or incompatible roadway geometry.

Influence of Alcohol

Alcohol consumption was the next highest cited PCF (excluding the "Other" category).

While only 20 (6%) of all crashes were coded as "Influence - Alcohol" as the Primary contributing factor, that statistic can tend to understate the presence of impaired operation.

For example, a police officer might have cited "Speeding" as the Primary factor even though the driver may have seemed to be impaired, but could not be proven. For example, an "Other" Associated Factor (OAF) code of "Had Been Drinking – Impairment Unknown" was entered for 5 crashes; and "Not Known" for 34 others.

In addition, it is worth noting that 3 other crashes involved a driver "Under Drug Influence" and 10 more crashes involved drivers who were suffering from "Fatigue".

While it may seem that we can only throw up our hands and think that we can't do anything to combat Impaired driving, that's not really true. On a broad scale, public awareness and educational campaigns have begun to make a difference. At the local level, increased enforcement, such as periodic DUI checkpoints can be a deterrent.

While those strategies are intended to influence driver behavior, engineering measures that accommodate driver behavior should not be overlooked. For example, providing a more "forgiving" roadside might allow impaired drivers an opportunity to at least partially recover control of their vehicles and could also allow "innocent" drivers to take evasive action to avoid a crash.

Bicycle Safety

Although the RSA Team observed few bicyclists during any of the weekday and weeknight site visits, SR 126 is a designated Bike Route. That said, there is clearly a concern for ensuring the continued safe usage of SR 126 by bicyclists.

Historical crash data shows no significant safety issues. Only 2 crashes involving bicyclists occurred.

Pedestrian Safety

Pedestrian safety is a growing national concern, especially in view of policy changes at the Federal and State levels that emphasize "Complete Streets" and espouse the importance of walkability.

The land use context of the study area does not presently generate much pedestrian activity. Residences are few and far between. Team members observed very few pedestrians during our drive-throughs.

Fortunately, only 2 pedestrian-involved crashes took place in the corridor.

Nevertheless, future expansion of the school site and planned high-density residential development near Santa Paula may tend to increase pedestrian activity. Should those land use changes materialize, pedestrian accommodation will take on a much higher priority.

Type of Collision

Identifying the type of collision helps to correlate driver's actions with specific crash outcomes

"Hit Object" crashes account for 117 (36%) of all crashes. Excluding "Other Vehicles", in all but a handful of cases, the objects hit were outside of the traveled way. Among "Objects Struck – Primary", 33 crashes were "Overturn"; 28 crashes involved Trees; an additional 46 were Guardrail or Fence. 31 (26%) of these crashes resulted in injuries.

A related crash statistic, "Movement Preceding Collision", shows that 49 crashes were coded as Ran Off Road (ROR). This statistic actually understates the ROR phenomenon. Whether or not the "Movement Preceding Collision" was coded as ROR, 174 crashes resulted in vehicles leaving the roadway and traveling beyond the shoulder before striking an object. (36 of these were encroachments to the left i.e., the vehicle crossed the centerline, the opposing lane and the opposite shoulder).

SAFETY ISSUES AND COUNTERMEASURES

The findings described below may sometimes be common to more than one issue. Similarly, some of the suggested countermeasures can often address one or several issues.

No attempt has been made to organize them in any particular way. Their order of presentation should not be interpreted as any indication of their relative importance, degree of urgency, nor sense of priority.

Some of these suggested countermeasures may be accomplished in the near term, at modest cost, and with minimal social, economic or environmental impacts. Others may take more time, more dollars and result in far more substantial impacts.

While these factors are important considerations in any deliberations that may lead to future project proposals for the corridor, they are beyond the scope of this RSA.

- *Farm Driveway Access*
- *Railroad Grade Crossings*
- *Lane Departure Crashes*
- *Intersections*
- *Santa Clara Elementary School*
- *Speed Management*

Farm Driveway Access

Findings

While SR 126 serves both local commute traffic between Santa Paula and Fillmore and regional commercial and recreational traffic from I-5 to the Pacific Coast, the adjacent land use is primarily agricultural. Santa Paula River Valley is a protected agricultural reserve. Therefore, farm trucks/equipment will be part of this community for years to come.

The presence of specialized trucks and other farm equipment introduces somewhat unusual circumstances owing to their performance characteristics. These vehicles tend to accelerate more slowly and make wide, sweeping turns.

Where this becomes particularly problematic is when they must turn into or out of one of the many narrow access roads (driveways) serving farm property. Vehicles turning left off of SR 126 must wait in the two-way left turn lane (TWLTL) for a gap in oncoming high-speed traffic and then execute the turn quickly enough to clear two lanes of traffic. This maneuver is made more difficult by the narrow throat width of the driveway apron and the rough, unpaved farm road surface.

Left turns onto SR 126 can be equally daunting for much the same reason.

Because of the narrow driveway openings, often bracketed closely by a run of metal beam guardrail (MBGR) on each side, right turns from SR 126 are especially difficult. Most farm vehicles cannot execute the turn from the right (slow) lane. Instead, they must turn from the left (fast) lane. In fact, the driver of the Team's 7- passenger van was not able to turn right from the right lane without pulling partially into the driveway, backing up and straightening out the turn.

The Team learned that a local custom was to stop in the TWLTL, wait for a gap in through traffic approaching the right side of the vehicle, then turn "blindly" across two parallel lanes of traffic. The driver must rely entirely on RH mirror to identify suitable gaps and then begin the turn from a stopped condition. If a barrier were present, even if offset to one side of the median, the right-turning vehicle would encroach into the high-speed (left) lane, further exacerbating this scenario.

Any resulting crash would likely be very severe, owing to high speed and high impact angle.

We heard from a number of stakeholders representing agricultural interests that safely accommodating farm vehicles was important and any proposed safety improvements not adversely impact their mobility and access. For example, one local farmer expressed concern that installation of a median barrier (limiting access points to a select few locations) could increase out of direction travel and lead to added fuel consumption and pollutants.

Recommendations

- Redesign driveway/side road openings to accommodate right turns by large vehicles from right lane
- Consider consolidation of access points
- Investigate alternative access from parallel and back roads
- Investigate if any of the open ditches could be at least partially enclosed, reducing the need for MBGR to shield these channels.

Railroad Grade Crossings

Findings

The Fillmore and Western Railroad operates a tourist train between Fillmore and Santa Paula and its tracks cross SR 126 in two locations – just east of Hallock Drive and just west of Sespe Creek Bridge. The trains were most recently being operated only on weekends. At the time of the RSA, the railroad operations had been suspended due to non-renewal of the railroad company's operating permit/lease.

Each grade crossing is equipped with active warning, train-actuated signals and gates, shielded with guardrail and impact attenuators. These all appeared to be in a good state of repair. However, these devices, especially the median crash attenuators, are not very conspicuous at night.

The crossing surface is in relatively good condition. However, the eastbound pavement section approaching to the Sespe Creek crossing has a very pronounced bump.

The Sespe Creek crossing approaches include a widened shoulder (pull-out area) meant to enable those vehicles (certain trucks and buses) legally required to stop at the crossing to not impede following traffic. This targeted widening was absent from the Hallock crossing, causing non-exempt vehicles to have to stop in an active travel lane. Several rear-end crashes here may have been caused, in part, by drivers not expecting a vehicle to be stopping or slowing when signals and gates have not been activated by an approaching train.

On the far (east) side of Sespe Creek crossing, a short length of wide shoulder area serves as an acceleration lane for vehicles that have used the pull-out. The Team observed some trucks were not able to achieve mainline speed before having to merge abruptly back into the outside travel lane. The resulting speed differential can sometimes lead to rear-end crashes.

Recommendations

- The future viability of the Fillmore and Western Railroad is in question. Should the railroad permanently cease operations, the crossings could be removed and the active equipment and barrier could be eliminated
- The crossing near Hallock Drive should be widened in both directions to provide for a pull-out area and acceleration lane.
- The Sespe Creek crossing may benefit from a longer acceleration lane than currently exists.
- Additional delineation, such as reflective sheeting should be installed to enhance the conspicuity of the grade crossing equipment, particularly the impact attenuators.
- Advanced signage advising drivers to watch for slowed traffic ahead should be considered, particularly westbound approaching the Hallock Drive rail crossing.

Lane Departure Crashes

NOTE: For purposes of this report, the term "Lane Departure" Crash is meant to encompass both Run-Off-Road (ROR) crashes and Cross-Median crashes.

Findings

In the course of reviewing the original police reports for numerous crashes, the Team concluded that many "drift-off" crashes resulted in collisions with roadside objects or overturned. Some of these vehicles subsequently returned to roadway and were then involved in sideswipe, broadside or head-on crashes. (As noted previously, crash reports often code these as "Improper Turn")

In 2011, Caltrans conducted a Median Barrier Study that examined 23 cross-median crashes that occurred from 2006 through 2010.

Recognizing that Caltrans had independently identified cross-median crashes as a safety concern, the team examined the corridor for any conditions that might significantly increase the likelihood of such a crash occurring.

While any roadway that accommodates two-way traffic has some inherent risk for vehicles to encroach into the opposing travel lanes, the SR 126 corridor did not suggest a significant risk above what would be expected for a facility with similar characteristics.

The team also examined historical crash data from TASAS and reviewed the actual police reports for all crashes to attempt to tease out any trends.

There were no significant concentrations of such crashes within the corridor.

Nonetheless, when cross-median crashes do occur, they often result in higher-severity outcomes. In that context, Caltrans use of and responsiveness to their Multilane Cross Median Collision Monitoring Program is a commendable practice.

In particular, it should be acknowledged that even before Caltrans monitoring program investigative study was triggered, Caltrans was aware of the crossover crashes that had occurred and proceeded with interim safety enhancements by installing edgeline and centerline rumble strips throughout the corridor.

We were not able to objectively gauge the effectiveness of those improvements, as most of the crash data reviewed pre-dated their installation (completed December 2011). However, Caltrans staff reported that their preliminary analysis suggests these improvements are indeed reducing the number of reported cross-median crashes.

Those results are encouraging and are consistent with national data that show rumble strips to be a particularly effective countermeasure.

NCHRP Report 641 documents milled shoulder and edge rumble strips to provide statistically significant reductions in single-vehicle run-off-road injury crashes: 10 to 24 percent on rural freeways, and 26 to 46 percent on two-lane rural roads. Reductions were also shown on other types of roadways. Studies of milled freeway shoulder rumble strips in Michigan and New York documented drift-off-road crash reductions of 38 and 79 percent.

Recommendations

- Continue to monitor and evaluate effectiveness of rumble strips
- Consider median barrier in selected locations with a somewhat higher potential for median encroachments, such as horizontal curves
- If concrete median barrier is contemplated, need to consider potential for periodic flooding (especially debris blockage)
- Caltrans maintenance staff expressed concern that concrete barrier would further constrict their work area and heighten their exposure to high speed traffic. There is also potential for impeding emergency response, or law enforcement activities
- Enhanced signing and marking (delineators, chevrons, raised pavement markers)
- Reevaluate guardrail placement and crashworthiness
- Regrade gravel backing of shoulders and retrofit with beveled “Safety Edge”
- Consider enclosing drainage (eliminate v-ditch) and reduce need for guardrail, especially near driveways
- Reevaluate quality of roadside (presence of fixed objects, traversability of slopes)

Intersection Related Crashes

Findings

This particular topic serves well to illustrate one distinct advantage of an RSA – the ability to identify, proactively, potential safety issues that might not otherwise have been raised by relying on crash history alone.

As mentioned in the earlier discussion of crash data at intersections, there is not a significant concentration of rear end or broadside crashes.

One plausible explanation for this was offered by a local stakeholder and confirmed by Team member observations: To avoid having to wait for a suitable gap in high volume, high speed traffic on the mainline, many local drivers choose to turn right onto SR 126, proceed a short distance, enter the TWLTL and subsequently execute a U-turn from the opposite shoulder.

In fact, one such maneuver was made by the driver of a tractor-trailer rig who gave up waiting for a gap to turn left (east) from Toland Rd., repositioned his truck and turned right (west) onto SR 126. Nearly 20 minutes later, he drove eastbound through the intersection.
(This echoes concerns voiced by local farmers about out of direction travel).

Planned development (near Hallock, in particular) may increase traffic volumes at certain intersections which may lead to higher crash frequency

Recommendations

- Advance signing - notice of slowed or stopped traffic, particularly on the approaches to Hallock Drive, where the intersection is offset left of the tangent sightline
- Evaluate Street name sign placement and size
- Consider alternative intersection configurations e.g. Roundabouts, to facilitate turns and reduce speeds
- Roundabout most appropriate at School/Toland (Facilitate ingress and egress to dump; calm traffic/manage speeds; separate school related traffic movements)
- Jughandles without traffic control still present challenges (finding gaps in oncoming high speed traffic)
- Michigan left (or similar) still has issue of speed differential (low speed trucks merging)

Santa Clara Elementary School

Findings

On the south side of SR 126, just to the west of Toland Rd., is the historic Santa Clara School. Established in 1879, and in continuous active use ever since, it now serves about 60 students (Grades K through 8) from the local community. While there are no imminent plans for expanding school facilities, potential population growth may later boost school enrollment and increase related vehicle trips.

Since school was on summer break at the time of the RSA, the team spoke with a representative of the school and learned that virtually all pupils are transported to school by private auto.

Typically, parents drop off their children around 8 AM and then return to pick them up at the end of the school day – Noon for Kindergarten; 3 PM for the older kids. To minimize queuing and delays, the school has sent letters to parents with suggested procedures to make their drop-off and pickup go smoothly.

Although crash data does not show a significant issue at the intersection with Toland Rd., there exists a high volume of large trucks destined to the municipal dump. Even with the current time-of-day restrictions in place to minimize the number of trucks in the area at the start and end of the school day, existing conditions have high potential for severe or fatal crashes likely influenced by proximity of the school.

There exists a worn, marked crosswalk leading from the west corner of Toland Rd. to the east corner of the school property. In practice, the crosswalk is very seldom used. The sidewalk leading from the school to the crosswalk is almost hidden from view and partially overgrown with weeds and shrubs.

A cantilever sign support with flashing beacons has been installed just west (upstream) of the school, facing eastbound traffic. Two diagonal shape caution signs are mounted side by side. The left, slightly larger sign, cautions oncoming traffic to beware of slow trucks turning left. The right sign advises of the presence of the pedestrian crosswalk. Viewed side by side, the higher priority message seems to be watch for slow trucks rather than school zone activity.

There is also a great deal of additional sign clutter that further detracts from the conspicuity of the school sign. That is a particular concern because the view of the school itself is obscured in both directions by mature trees that block sight lines of approaching drivers on SR 126.

Although the installation of guardrail has helped better shield and delineate the school drop-off area, vulnerable users (children) still must enter and exit vehicles very close to high volume, high speed traffic.

The presence of the adjacent intersection with Toland Rd not only increases potential turning conflicts but also serves as a distraction, in that a drivers' mental focus may be on conflicting vehicular movements at that intersection rather than activity in the school parking lot.

Recommendations

Remove obsolete lane drop marking adjacent to guardrail

Consider realigning the Toland Rd intersection with the school driveway so as to remove the existing offset

Enhance the conspicuity of the existing marked pedestrian crosswalk

Speed Management

Findings

The crash statistics clearly indicate that "Speeding" was most often cited as the PCF in SR126 crashes. While "Speeding" can sometimes mask other factors, excessive speed is a legitimate concern.

Of equal concern is the issue of speed differential. Slow moving trucks or farm machinery entering and exiting the roadway may lead to unsafe lane changes or panic stops by drivers approaching at higher speed, resulting in rear-end or sideswipe crashes.

In May 2008, the speed limit was reduced from 60 mph to 55 mph.
In 2012, Caltrans installed a series of speed-feedback signs as part of the same safety enhancement project that installed rumble strips.

The perceived effectiveness of those signs as judged by local stakeholders varied widely. Regardless, the long-term effectiveness of feedback signs almost certainly will diminish over time without a sustained, high visibility enforcement effort.

High speeds also reduce available gaps for traffic turning into or out of side roads and intersections.

Speed by itself may aggravate the severity of crashes, but if speed limits are reasonable and credible, they can enhance safety. Proper speed limits need engineering studies, compatible designs, strong enforcement, adjudication and public support to succeed.

Recommendations

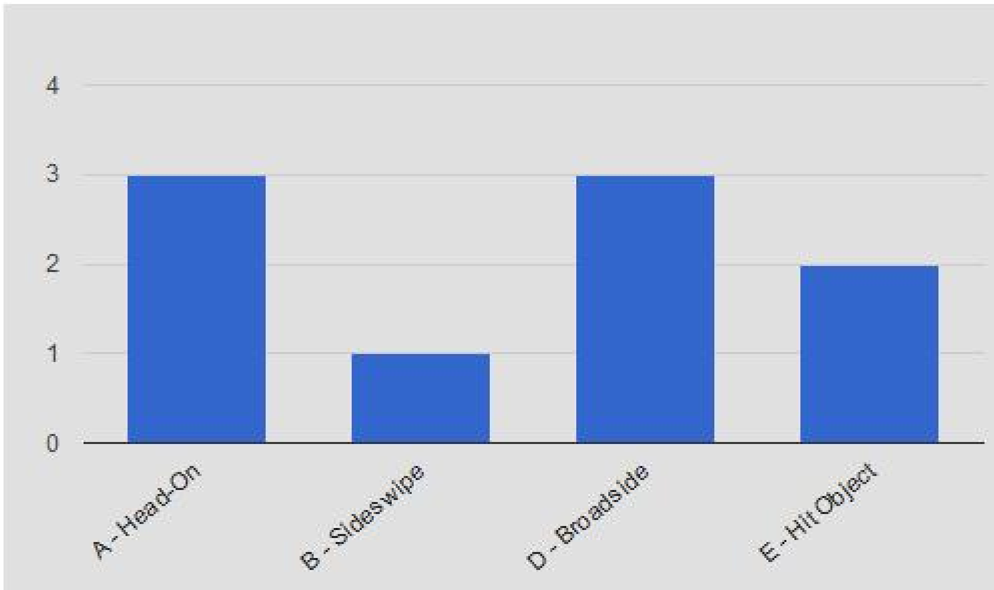
- Consider alternative intersection configurations discussed in "*Intersections*"
- Roundabouts at Old Telegraph Rd. (east end), Hallock Dr. (west end) and Toland Rd. and/or Sycamore Rd/Hail Rd in the middle. Hallock Dr. is especially important to slow traffic coming off of the freeway section.
- Explore promising traffic calming strategies such as innovative pavement markings (optical effect)
- Targeted enforcement (perhaps augmented by California Office of Traffic Safety Grant money)

Crash Data

Figure F1
Fatal Crashes

9 collisions in chosen extent.

Injury Severity | Collision Type | Primary Collision Factor | Involved With



9 collisions in chosen extent.

Injury Severity | Collision Type | Primary Collision Factor | Involved With

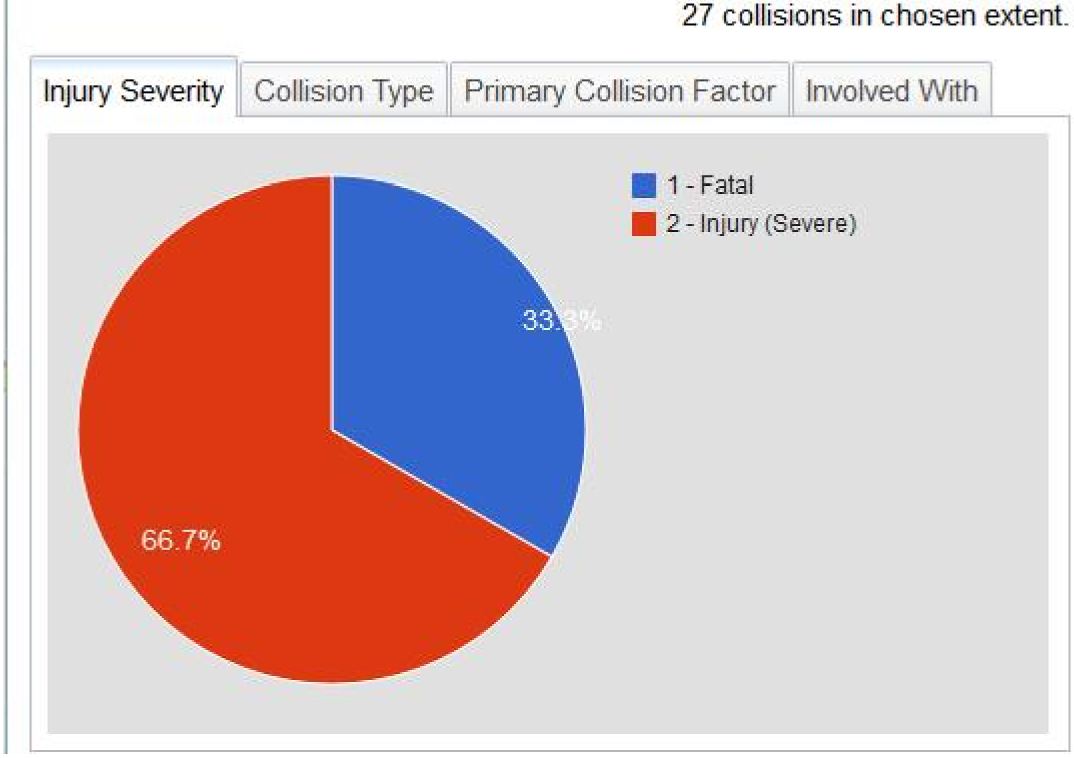
Primary Collision Factor	Collisions	Percentage
08 - Improper Turning	5	55.6%
03 - Unsafe Speed	1	11.1%
05 - Wrong Side of Road	1	11.1%
07 - Unsafe Lane Change	1	11.1%
09 - Automobile Right of Way	1	11.1%

9 collisions in chosen extent.

Injury Severity | Collision Type | Primary Collision Factor | Involved With

Motor Vehicle Involved With	Collisions	Percentage
C - Other Motor Vehicle	7	77.8%
I - Fixed Object	2	22.2%

Figure F2:
Fatal and Severe Crashes



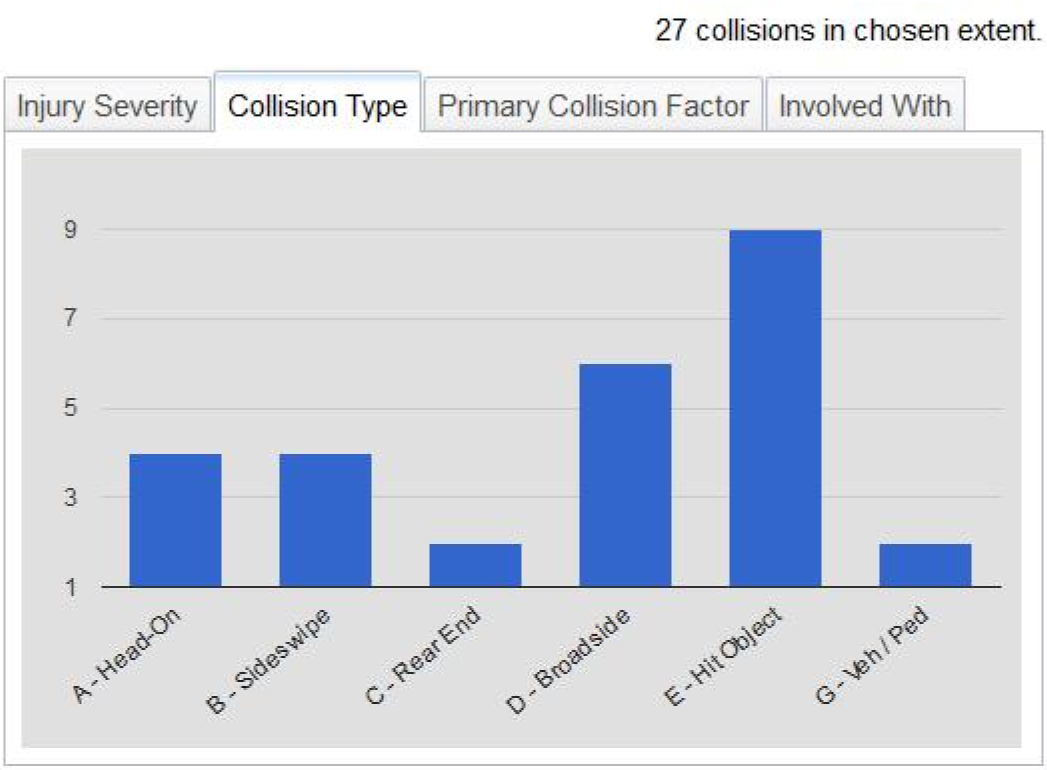


Figure F2:
Fatal and Severe Crashes

27 collisions in chosen extent.

Injury Severity | Collision Type | Primary Collision Factor | Involved With

Primary Collision Factor	Collisions	Percentage
08 - Improper Turning	12	44.4%
01 - Driving or Bicycling Under the Influence of Alcohol or Drug	4	14.8%
03 - Unsafe Speed	3	11.1%
09 - Automobile Right of Way	3	11.1%
05 - Wrong Side of Road	2	7.4%
07 - Unsafe Lane Change	1	3.7%
11 - Pedestrian Violation	1	3.7%
18 - Other Than Driver (or Pedestrian)	1	3.7%

27 collisions in chosen extent.

Injury Severity | Collision Type | Primary Collision Factor | Involved With

Motor Vehicle Involved With	Collisions	Percentage
C - Other Motor Vehicle	16	59.3%
I - Fixed Object	9	33.3%
B - Pedestrian	2	7.4%

Figure F3:
Distribution of F&I Crashes

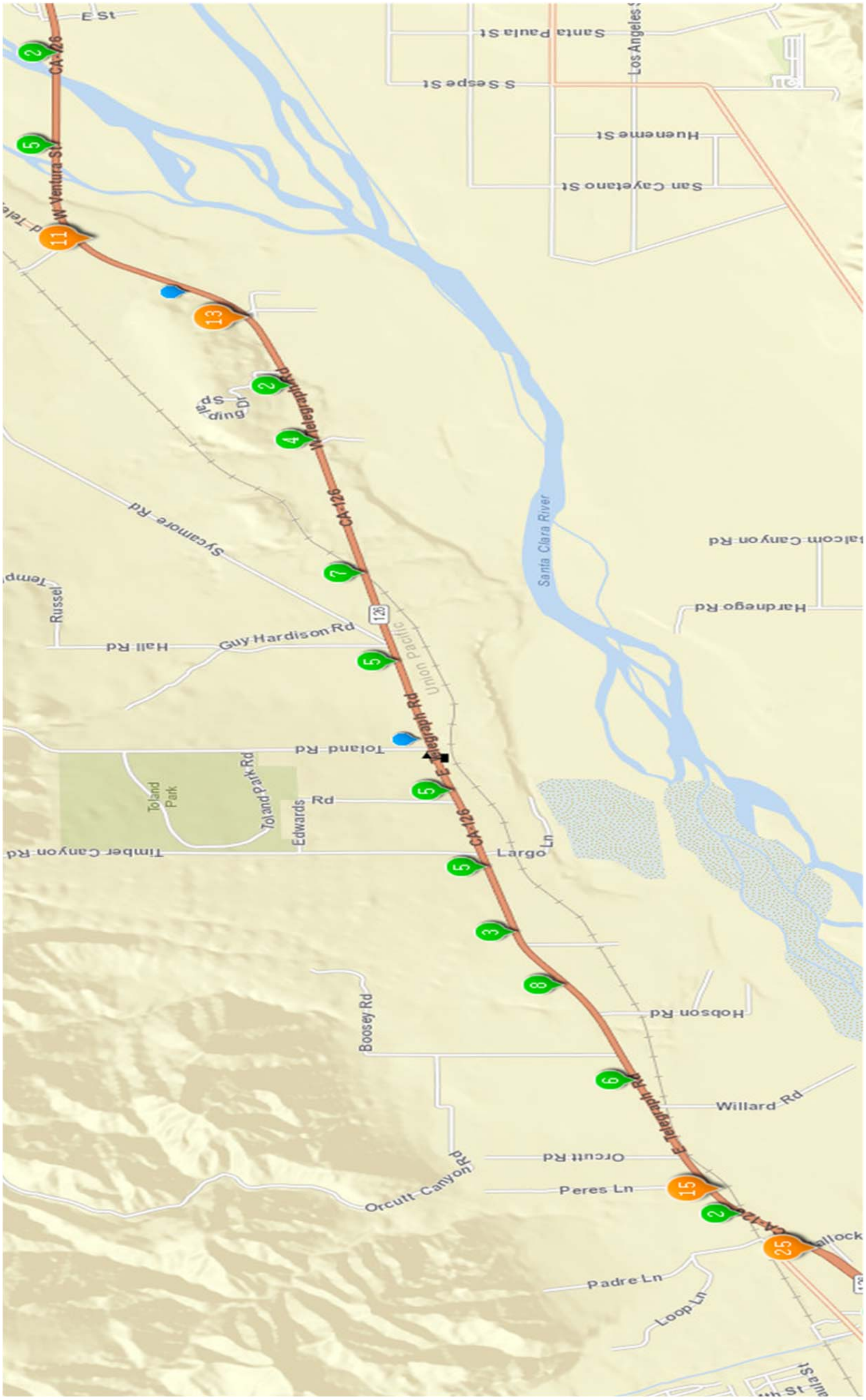
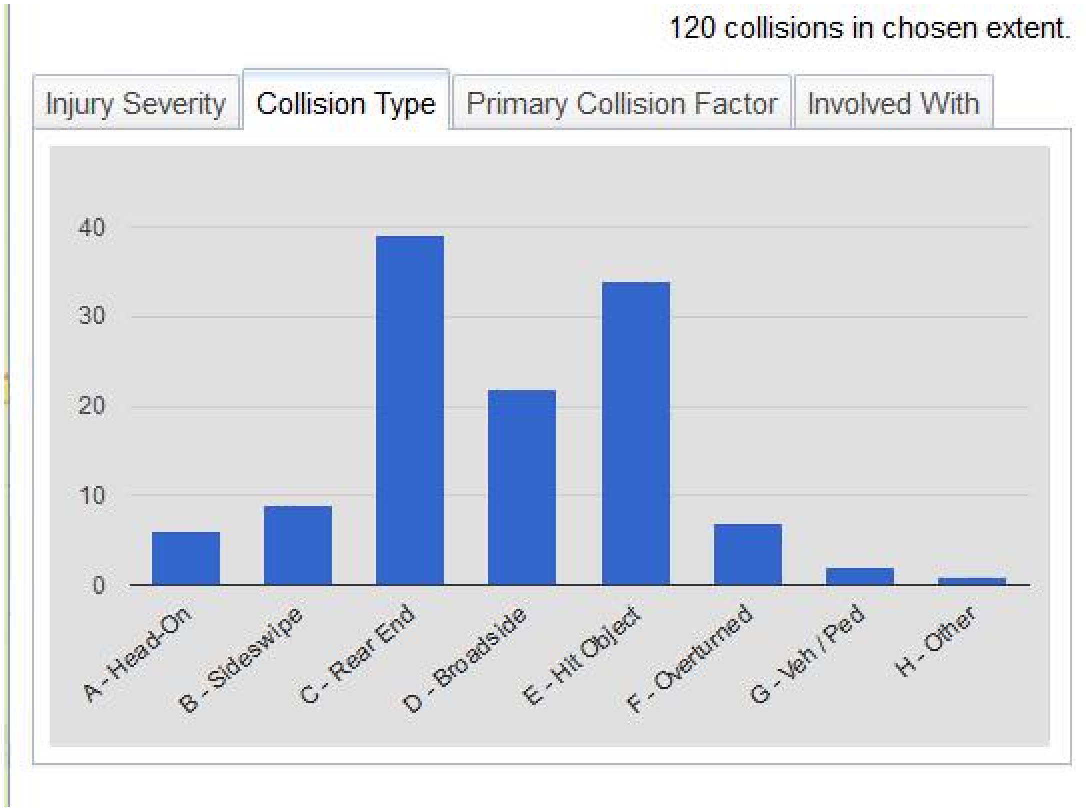


Figure F4
Type of Collision



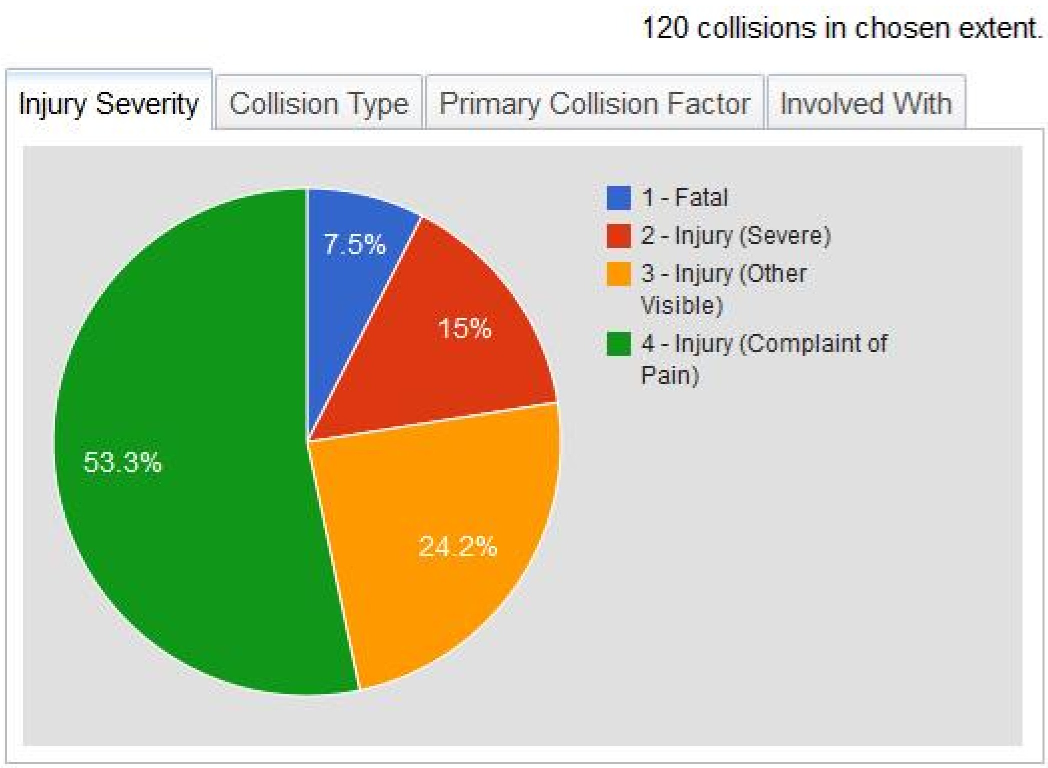


Figure F4
Type of Collision

120 collisions in chosen extent.

Injury Severity | Collision Type | Primary Collision Factor | Involved With

Primary Collision Factor	Collisions	Percentage
08 - Improper Turning	42	35%
03 - Unsafe Speed	38	31.7%
09 - Automobile Right of Way	13	10.8%
01 - Driving or Bicycling Under the Influence of Alcohol or Drug	10	8.3%
05 - Wrong Side of Road	3	2.5%
07 - Unsafe Lane Change	3	2.5%
21 - Unsafe Starting or Backing	3	2.5%
12 - Traffic Signals and Signs	2	1.7%

120 collisions in chosen extent.

Injury Severity | Collision Type | Primary Collision Factor | Involved With

Motor Vehicle Involved With	Collisions	Percentage
C - Other Motor Vehicle	76	63.3%
I - Fixed Object	33	27.5%
A - Non-Collision	7	5.8%
B - Pedestrian	2	1.7%
G - Bicycle	1	0.8%
J - Other Object	1	0.8%

Figure F5
PCF: Unsafe Speed

38 collisions in chosen extent.

Injury Severity | Collision Type | Primary Collision Factor | Involved With

Primary Collision Factor	Collisions	Percentage
03 - Unsafe Speed	38	100%

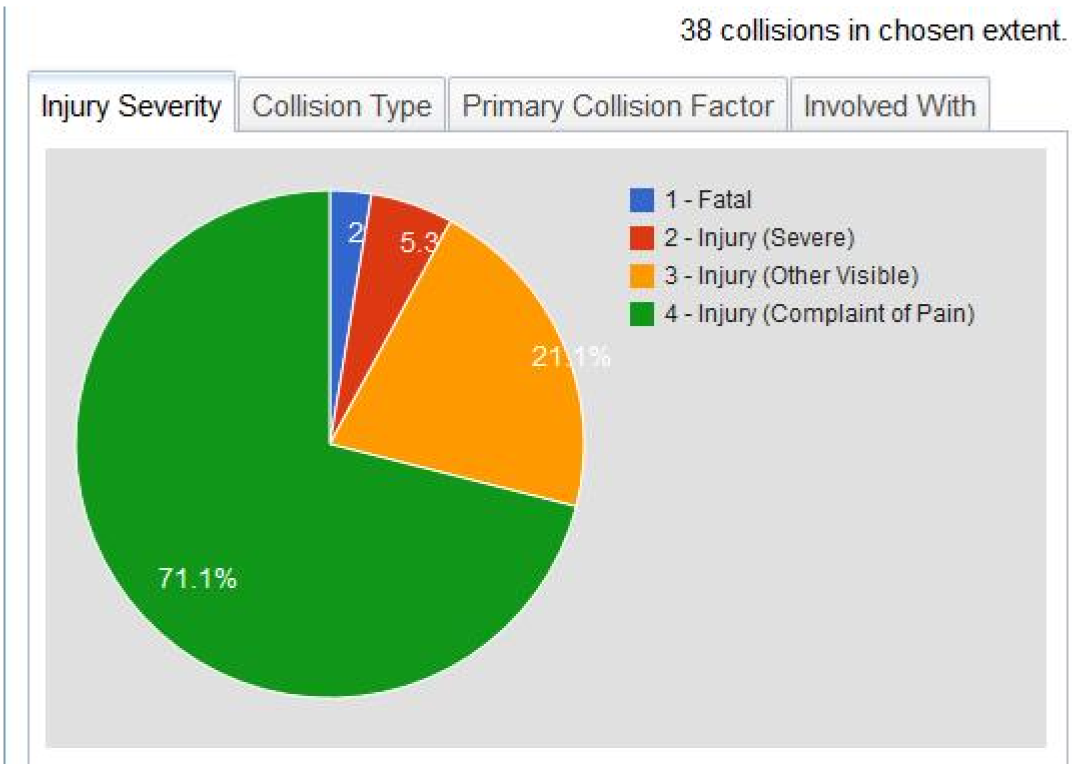
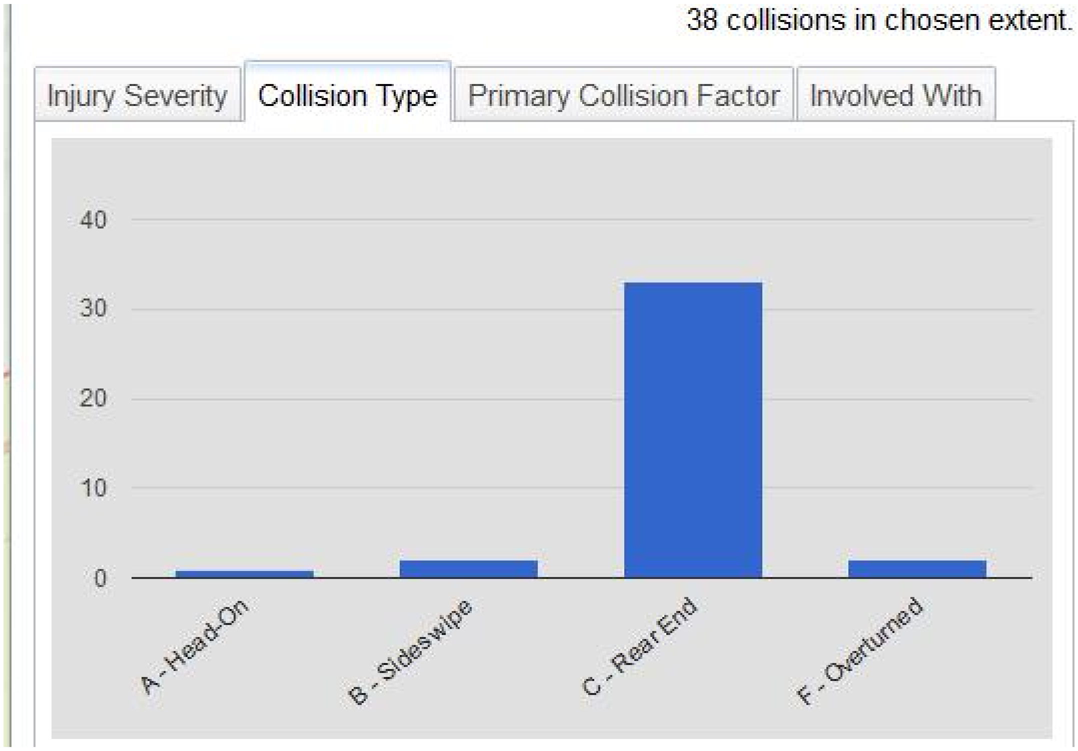


Figure F5
PCF: Unsafe Speed



38 collisions in chosen extent.

Injury Severity | Collision Type | Primary Collision Factor | Involved With

Motor Vehicle Involved With	Collisions	Percentage
C - Other Motor Vehicle	36	94.7%
A - Non-Collision	2	5.3%

Figure F6
PCF: Improper Turn

42 collisions in chosen extent.

Injury Severity | Collision Type | Primary Collision Factor | Involved With

Primary Collision Factor	Collisions	Percentage
08 - Improper Turning	42	100%

42 collisions in chosen extent.

Injury Severity | Collision Type | Primary Collision Factor | Involved With

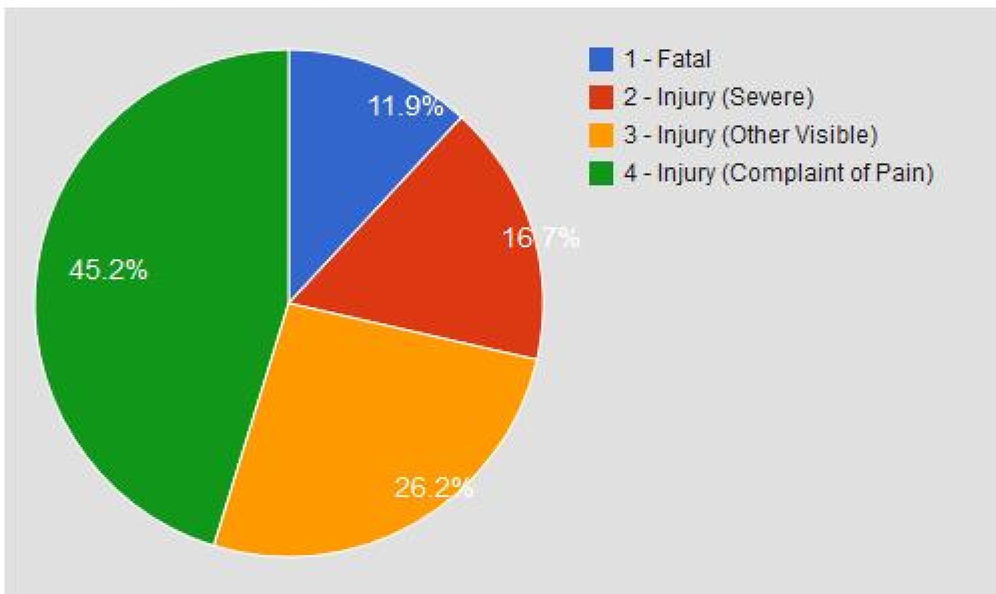
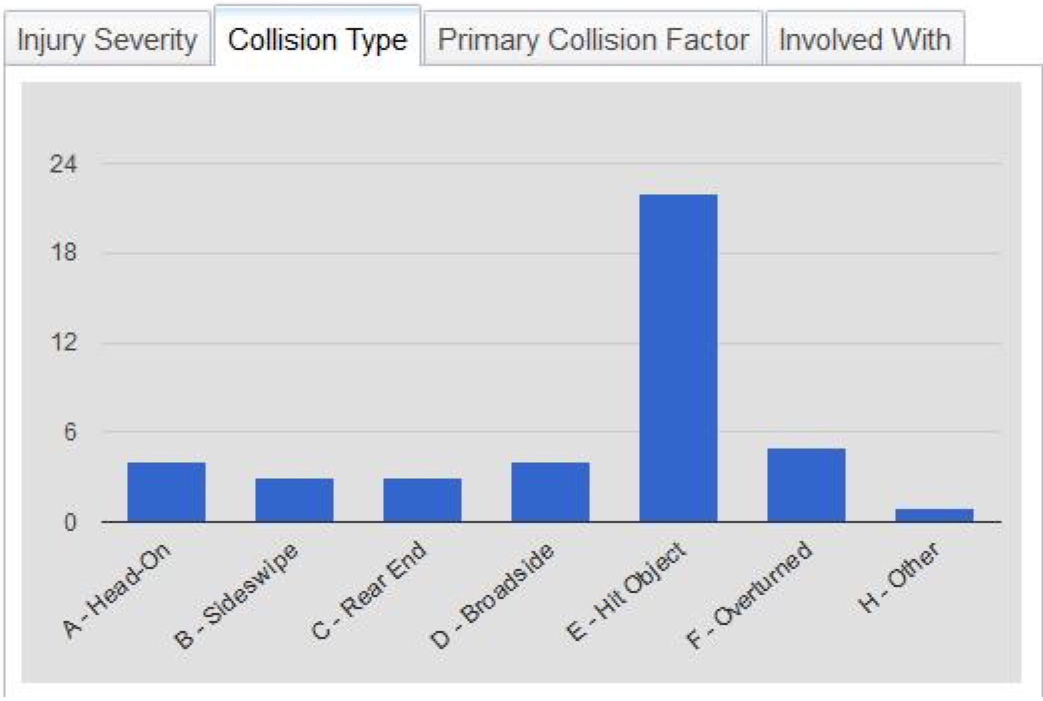


Figure F6
PCF: Improper Turn

42 collisions in chosen extent.



42 collisions in chosen extent.

Injury Severity | Collision Type | Primary Collision Factor | Involved With

Motor Vehicle Involved With	Collisions	Percentage
I - Fixed Object	22	52.4%
C - Other Motor Vehicle	14	33.3%
A - Non-Collision	5	11.9%
G - Bicycle	1	2.4%

Primary Collision Factor (PCF)

PCF	Number	Percentage
Speeding	116	36.3%
Improper Turn	91	28.4%
Other	56	17.5%
Alcohol	20	6.3%
Fail to Yield	17	5.3%
Not Driver	15	4.7%
Unknown	3	0.9%
Too Close	1	0.3%
Improper Driving	1	0.3%
Asleep	0	0.0%
TOTAL	320	

Type of Collision

Type	Number	Percentage
Head-On	8	2.5%
Sideswipe	40	12.5%
Rear End	107	33.4%
Broadside	33	10.3%
Hit Object	117	36.6%
Overturn	9	2.8%
Pedestrian	2	0.6%
Other	4	1.3%
TOTALS	320	

Movement Preceding Collision

Movement	Number
Stopped	68
Straight	216
ROR	49
Right Turn	10
Left Turn	12
U Turn	3
Backing	1
Slowing, Stopping	39
Passing	8
Lane Change	23
Parking	0
Enter from Shoulder	6
Other Unsafe trun	33
Cross into Opp Lane	11
Parked	3
Merging	0
Wrong Way	0
Other Unsafe turn	29
Not Stated	0

Location of Collision

Location	Number
Beyond Left Stripe	63
Beyond Left Shoulder	36
Left Shoulder	0
Left Lane	134
Interior Lanes	4
Right lane	131
Right Shoulder	12
Beyond Right Shoulder	138
Gore	2
Other	18
HOV Lane	0
HOV Buffer	0
Not Stated	0

Farm Driveway Access

Farm Driveway Access

Farm Driveway Access

Combining and closing closely spaced driveways, as seen here, could reduce the number of access points (traffic conflict points) as well as eliminate a guardrail end treatment

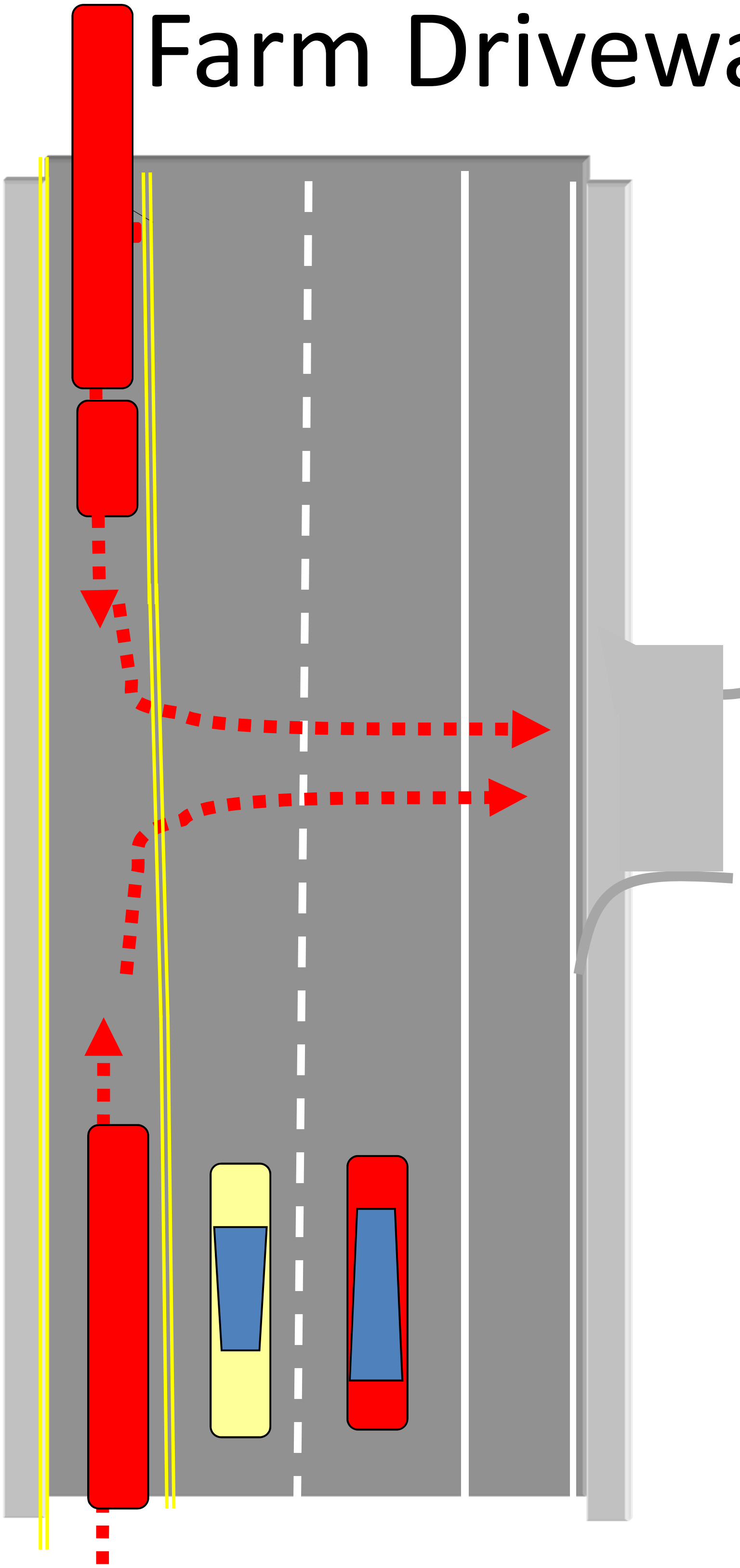
Farm Driveway Access

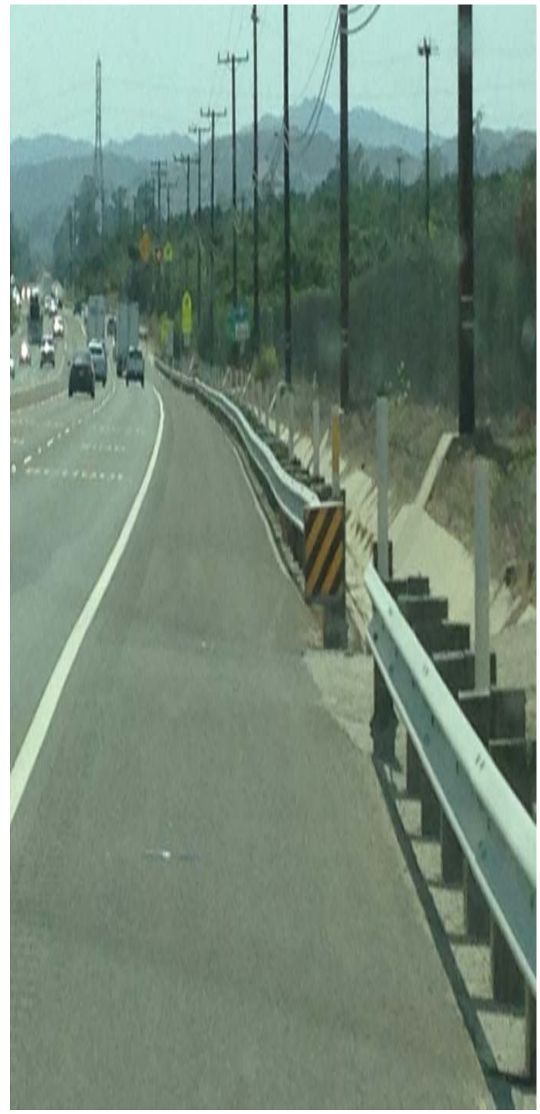
Narrow driveway aprons make turns difficult, even for small vehicles

Farm Driveway Access

Narrow driveway aprons make turns difficult, even for small vehicles

Farm Driveway Access





Operators of large trucks and trailers are challenged by narrow driveways (farm roads).

Railroad Grade Crossings

Railroad Grade Crossings

Sespe Rd RR Crossing, looking west. Note the marked pullout area for vehicles legally required to stop.

Railroad Grade Crossings

Sespe Rd RR Crossing, looking west. A tanker has used the designated pullout area to stop outside of the active travel lane.

Railroad Grade Crossings

Hallock Drive RR Crossing, looking west. Note the absence of a marked pullout area for vehicles legally required to stop.

Lane Departure Crashes

Lane Departure Crashes

Placing chevrons along the outside of a curve and installing luminaires would enhance the driver's ability to track the curve as well as see and react to conflicting turns into and out of the side road.

Intersections

Intersections

Drivers approaching Hallock Drive on the eastern end of the freeway section of SR 126 see a service station directly ahead of them. The signalized intersection is offset to the left and may not be readily detected at night or if a large truck blocks the driver's view.

Intersections

Rather than wait for a gap in eastbound traffic, this farm vehicle driver chose to turn right (west) and still had to wait for an eastbound car turning left to “shield” his turn

Intersections

Owing to the high volume, high speed approach traffic on SR 126, very few drivers were observed to wait for a gap in traffic to execute a left turn as this driver did.

Santa Clara School

Santa Clara School

The cantilever sign here seems to emphasize being vigilant for slow trucks more so than for pedestrians.
Note also the sign clutter (directional sign and speed enforcement sign) and the tree line obscuring the driver's view of the school.

Santa Clara School

Even as the driver is almost over the stenciled “XING” marking (bottom photo), the crosswalk that it refers to is almost invisible until the driver is almost upon it (top photo).

Santa Clara School

The outer lane marked with a skip line may encourage drivers to pull out to discharge children on the traffic side of the MBGR or might entice impatient drivers to bypass slow drivers in the through lanes.

Santa Clara School

Because of the desire to locate the south end of the crosswalk near the northeast corner of the school, the crosswalk bisects the eastbound left turn lane (seen here partially blocked by one of the many trucks destined for the disposal area off Toland Rd.).

Santa Clara School

View of sidewalk on south side of SR 126, looking back from near the marked crosswalk. The overgrown vegetation and post-mounted cabinet do not provide a pedestrian-friendly environment.

Speed Management

Speed Management

Speed feedback signs erected a few years ago have had mixed results and rely on a sustained enforcement effort to encourage compliance.