Attachment

Planning Commission Agenda Report

Meeting Date: March 22, 2018

Department: Development Services

INITIATED BY: David Rogers, P.E., T.E., Traffic Engineering Manager

SUBMITTED BY: Gayle Ackerman, AICP, Director of Development Services

REVIEWED BY : Niki Wetzel, AICP, Planning Manager

SUBJECT: DISCUSSION OF ANNUAL COLLISION REVIEW (Continued from February 22, 2018)

RECOMMENDED ACTION(S):

1. Review and discuss the findings and conclusions; and
2. Make recommendations to the City Council as appopriate

EXECUTIVE SUMMARY:

It is considered good engineering practice to periodically review traffic collision patterns and trends for intersections with higher collision totals. As part of the FY16/17 budget, the City Council allocated funding to purchase a traffic collision data management system. The system uses the information from the Orange County Sherriff's Department and allows the City to track and analyze traffic collision patterns and trends. Staff recently completed the implementation of the system and is now presenting the results of the City's first Annual Traffic Collision Review. The findings are that the overall collision totals, pattern and trends are generally within expected limits, and, therefore, only minor mitigations are being recommended at this time.

BACKGROUND:

In 2015, the Citizen Traffic Advisory Group's (CTAG) presented their recommendations to the City Council. One of the recommendations was to have the City conduct an annual review of traffic collision patterns and trends. In addition, the CTAG recommended that the City acquire a software system to help review and analyze the collision data. As part of the FY16-17 budget, the City Council allocated funding for this system. Staff recently completed the data correction and implementation process and finalized the analysis for the City's first Annual Collision Review.

DISCUSSION:

For a city like Lake Forest, the vast majority of traffic collisions occur at intersections. Therefore, reviewing the top 20-25 intersections with the highest collision totals is appropriate to determine if patterns or trends exist (Attachment 1). By reviewing collision patterns and trends, the City can identify any potential issues and can consider mitigations where conditions suggest the need for remedial steps.

The City's new collision analysis software allows staff to update data on a regular basis and to perform various types of analysis for collisions. The data comes from the State Wide Integrated Traffic Reporting System (SWITRS) run by the California Highway Patrol (CHP). This system aggregates all the traffic collision report data for the entire state and provides it to the local agencies for their use. For Lake Forest, the data comes from the collision reports prepared by the Orange County Sheriff's Department (OCSD) and from the CHP.

When reviewing traffic collisions it is important to understand some basic information.

- Collisions will always occur as long as humans are in primary control of vehicles. Therefore, it is unrealistic to believe that all collisions can be prevented. According to the National Highway Traffic Safety Administration (NHTSA) about 94% of all collisions are caused by driver error; 2% are caused by vehicle issues; 2% are caused by the environment, and only about 2% are for unknown reasons (see Attachment 2). Of the 94% caused by driver error, recognition error (which included driver's inattention, internal and external distractions, and inadequate surveillance) was the most frequently assigned reason (41%). Decision error (such as driving too fast for conditions, too fast for the curve, false assumption of others' actions, illegal maneuver, and misjudgment of gap or others' speed) accounted for about 33%.

- Collision totals and rates should be judged against established statistical standards, and more comprehensive reviews should be considered only when collision totals and rates exceed these standards.

- Individual collision types and numbers can vary significantly from intersection to intersection, but can still be considered within typical ranges/limits.

- Due to the random nature of collisions, small clusters of collisions can occur over a short period of time. These clusters do not, in and of themselves, justify remedial action unless there are additional supporting circumstances.

- A pattern or trend would generally involve situations where there is group of similar collisions and evidence suggests that the at-fault drivers are all traveling in the same direction. For example, there may be several right angle collisions at a signalized intersection, but only if a significant number are caused by drivers running the red in the same direction would this be considered a pattern or trend.

Common Collisions at Different Intersection Types

The frequency of various collision types is often associated with the type of control at an intersection. For a signalized intersection, the most common collision types are usually rear end and right angle/broadside collisions. For an intersection with only stop controls on the minor street, right angle/broadside collisions are usually the most common because all turns are permissive.

Comparison Data

To Other Agencies

To provide perspective, it is worthwhile to review information that might provide comparisons between similar sized cities. The California Office of Traffic Safety (OTS) reviews injury and fatal collision information by jurisdiction in the State and then provides this comparison data to the agencies. The most recently available data from the OTS is for calendar year 2015 (Attachment 3). The information suggests that the City of Lake Forest has some of the lowest injury and fatality totals in the State, when compared to other agencies with a similar population (Group C: 50,000 -100,000). The attached information from 2015 shows that the overall composite for Lake Forest is 86/105 (where 105/105 is the lowest or best). This rating is similar to the South County cities of Laguna Niguel (95/105), Mission Viejo (87/105) and significantly better than San Clemente (43/105). The composite rating for the years 2011-2014 for Lake Forest are similar to the 2015 rating (2011 – 94/101, 2012 – 99/102, 2013 – 84/103, 2014 – 102/105). The consistent ranking for Lake Forest over this 5 year period suggests that the combination of engineering (well-designed roadways and appropriate traffic controls), education, and enforcement (through the OCSD) are effective in minimizing the number of injuries and fatalities.

To Other Intersections

Collison patterns or trends based on collision totals may suggest a need for further review or study. A collision pattern or trend is generally defined as 5 or more similar collisions occurring within a 12 month period. As noted above, a pattern or trend would generally involve situations where there is group of similar collisions and evidence suggests that the at-fault drivers are all traveling in the same direction. For example, there may be several right angle collisions at a signalized intersection, but only if a significant number are caused by drivers running the red in the same direction would this be considered a pattern or trend.

The initial list of study locations is based on collision totals for the study period. This is an effective way to compare intersections. However, staff has also included a review of the collision rate for each of the intersections. The collision rate is calculated using the collision total and the total traffic volume in the intersection over the study period. Taking into account the total volume provides another tool to compare intersection collision information. The combination of collision frequency (collisions per year) and vehicle exposure (traffic volumes) results in a collision rate. Collision rates are expressed as "collisions per Million Entering Vehicles" (MEV) for intersections.

Collision rate thresholds that would suggest the need for additional review vary by intersection type. Based on staff's experience, a rate higher than 1.12 for signalized intersections; higher than 1.38 for two way stop intersections (where the major/through street does not stop); and higher than 0.76 for one way stop intersections (t-intersections) would normally suggest a need for a more in depth review. Although a collision rate may occasionally exceed a threshold, it does not mean there is an issue at the location. An intersection can exceed the threshold, but the collisions may simply be random with no discernable pattern or trend.

Mitigations

Occasionally, a pattern or trend may suggest a need to review possible mitigations or improvements. Some of the more common ones include:

- Improving Sight Distance – This could include methods such as modifying landscaping near an intersection or restriping to move vehicles into a better location to view oncoming traffic.
- Improving Signage/Striping – This could include intersection warning signs or "SIGNAL AHEAD" painted legends.
- Improving Signal Visibility – This could include adding traffic signal heads to provide more opportunities for drivers to see the red/yellow/green indications or trimming trees that may be partially obscuring a signal head.

- Changes to Traffic Signal Timing – This could include increasing the yellow clearance interval or increasing the all-red (where all drivers see a red for 1-2 seconds) between every change in movement.

Individual Intersection Findings

Using the most current calendar year for which data is available (2016), staff developed a list of the top 50 locations with at least 2 collisions. The collision totals ranged from a high of 9 to a low of 2. Of the 50, only 16 locations had 4 or more collisions. Since a pattern or trend is usually defined as 5 or more of the same collision type in a 12 month period, staff limited this review to the top 16. Since this is the first Annual Traffic Collision Review, staff also included a review of data for the same intersections for calendar year 2015 for comparison.

Rank	Location	2016 Count	2015 Count	Int. Volume	2016 Rate	2015 Rate
1	Lake Forest/Rockfield	9	7	59,600	0.41	0.32
2	El Toro/Bridger/I-5 NB Ramp	8	5	61,500	0.36	0.22
3	El Toro/Rockfield	7	3	64,900	0.30	0.13
4	El Toro/Muirlands	6	6	61,900	0.27	0.27
5	El Toro/Raymond	6	1	45,400	0.36	0.06
6	Lake Forest/Trabuco	6	7	54,950	0.30	0.35
7	Bake/Trabuco	6	3	56,200	0.29	0.15
8	Lake Forest/Serrano	5	2	37,750	0.36	0.15
9	El Toro/Jeronimo	5	7	54,500	0.25	0.35
10	Lake Forest/Toledo	5	2	38,900	0.35	0.14
11	Lake Forest/Portola	4	5	36,150	0.30	0.38
12	Jeronimo/Lake Forest	4	6	44,800	0.24	0.37
13	Bake/Portola	4	5	33,950	0.32	0.40
14	Muirlands/Dylan	4	1	26,300	0.42	0.10
15	El Toro/Trabuco	4	6	58,200	0.19	0.28
16	Rockfield/Orchard	4	1	19,400	0.56	0.14

A review of the information above and the individual collision diagrams (Attachment 4) suggests that there are no unusual patterns or trends at 15 of the 16 study locations. Staff did find a pattern at the intersection of Lake Forest/Rockfield that warranted additional review.

Lake Forest/Rockfield

This signalized intersection of two major roadways is located near the 5 freeway and a major commercial center is located on the northwest corner. The traffic

signal provides fully protected left turn phasing in all four directions. For 2016, a review of the base collision diagram indicated that there were 4 collisions involving westbound left turning vehicles and eastbound through vehicles. In addition, there was a head on collision involving an eastbound vehicle and a westbound vehicle that may have been coded incorrectly (it potentially involved a left turning vehicle). This many similar collisions suggested a potential pattern or trend, and, therefore, staff completed a more in depth review.

The more in depth review for this intersection found that for the 4 collisions involving left turning vehicles, 2 were caused by the left turning drivers, 1 was caused by the through driver, and 1 was of unknown cause (due to a lack of an independent witness). None of the 4 involved drivers under the influence. There was insufficient detail on the one head on collision to determine if it actually involved a left turning vehicle or not.

Staff also reviewed the available data for 2015 and the first half of 2017 to see if there were additional collisions involving westbound left turns. For all of 2015, there was one, and it was caused by the left turning driver. For the first half of 2017, there were no collisions involving westbound left turning vehicles. Therefore, over a 2.5 year period, there were only 5 similar collisions (an average of 2 per year) with 3 caused by westbound left turning drivers. Since 5 similar collisions in a 12 month period is considered an unusual pattern, this collision history suggests that the collision totals and types simply fall into a normal pattern. As noted above, because collisions are random events, it is not unusual to have a cluster of similar collisions in a short period of time. Therefore it is always appropriate to see if the collisions are truly part of a cluster or are part of a long term trend.

In staff's experience about 90% of collisions at signalized intersections with fully protected left turn phasing that involve a left turning vehicle and an opposing through vehicle are usually caused by the through driver running the red. However, in this case, 3 of the 5 over the 2.5 year period were caused by the left turning drivers. Although this does not technically constitute a traditional pattern or trend, it is a higher percentage than you would normally expect.

When attempting to address issues related to red light running, one of the methods that can be considered is a minor change to the traffic signal timing. The vast majority of red light violations occur within less than half a second of the signal going red and are usually caused by an error in judgment (as opposed to an intentional act of running the red). To counter this condition, most agencies (including Lake Forest) now use an "all-red" timing at the end of each movement. What this means is that when a signal is changing from one movement to a conflicting movement, all the conflicting movements will see red for a short time

(usually about one second). This allows drivers who make a minor error in judgement to have just a bit more time to clear the intersection. At this time, the westbound left turn has four seconds of yellow (the minimum is three) and one second of all-red (considered the minimum).

Recommendation:

- Based on the overall conditions, staff is recommending an increase in the all-red from 1 to 1.5 seconds for the westbound left turn (2 seconds is considered the maximum). This would result in 0.5 seconds less green time for the movement, but would provide a small additional amount of clearance time (yellow plus all red). For uniformity this may require that the eastbound left also have the same all-red timing.

Review of Other Locations from the List of 50

Based on experience, intersection type or other unique factors, staff reviewed a select group of locations (from the remainder of the original list of 50 locations) to see if there were any anomalies. Staff concluded that there were none, with the exception of the intersection of El Toro Road/Santiago Canyon Road/Live Oak Canyon.

El Toro/Santiago Canyon Road/Live Oak Canyon Road

This t-intersection is included in this review based on staff's knowledge of a pattern of collisions. According to our work order repair logs and other information, four westbound Live Oak Canyon drivers in the last four years have failed to stop when the road "t's" into El Toro/Santiago Canyon and have struck the guard rail and signage on the westside of El Toro/Santiago. There is a stop sign for Live Oak located in a curbed median and a stop ahead sign and a "STOP AHEAD" pavement legend on Live Oak approaching El Toro/Santiago Canyon.

Location	2016 Count	2015 Count	Int. Volume	2016 Rate	2015 Rate
El Toro/Santiago/Live Oak	3	2	11,500	0.71	0.48

Although the collision totals and rates do not exceed the normal thresholds, the intersection type, location, and pattern suggests that some remedial steps may be justified. The County of Orange, which is responsible for all of Live Oak Canyon Road except for the last 100 feet or so before it terminates into El Toro/Santiago, is currently preparing plans for a traffic safety improvement project on Live Oak. The City is working with the County to improve the advance

warning signing and legends as part of the project. During the field review in support of this project, staff determined that additional improvements could be beneficial. Because Live Oak curves just slightly to the right as you get to El Toro/Santiago, the stop sign is somewhat less visible on the approach. The "stop ahead" sign located about 400 feet from the intersection and "STOP AHEAD" legends located about 100 feet from the intersection do provide advanced warning but do not, in and of themselves, improve visibility of the actual stop sign.

Recommendation:

Due to the rural nature of the roadways in this area (where drivers encounter fewer controls), the curvature of Live Oak right as you get to El Toro/Santiago, and the collision history, staff is recommending the following:

- The installation of a larger stop sign with higher intensity reflective sheeting. This will provide better "target value" for drivers in both the day and night.
- The installation of a solar powered red flashing beacon on top of the stop sign post . This will provide enhanced warning of the upcoming stop.
- The installation of an additional "stop ahead" sign adjacent to the "STOP AHEAD" legends. This sign will provide secondary warning for this unique condition. The sign will also have the higher intensity reflective sheeting.

Special Study Locations

Although not required as part of a traditional collision review, staff has determined that it would be appropriate to include additional intersections in the review. These intersections can include those that may have special conditions or have been included as part of other special studies. The six intersections in the list are included in the upcoming Traffic Signal Master Plan (TSMP) Study. These intersections are being evaluated for the possible installation of traffic signals. However, since the locations are only planned to be studied once every two to three years as part of the TSMP, staff concluded that it would be appropriate to continue to monitor the locations annually to determine if there are any changes to the conditions between the updates to the TSMP.

A. Lake Forest/Overlake

This four way intersection is located between Muirlands and Jeronimo and serves as one of two access points to the community south of Lake Forest. It was included in the TSMP based on sight distance constraints for Overlake and traffic

volumes that can sometimes reduce the number of available gaps to make turns off the side street.

B. Bake/Baffin Bay

This four way intersection is located east of Commercentre and provides access to the City's dog park and to a commercial/industrial area. This intersection was included in the TSMP based on sight distance constraints for the commercial/industrial area approach and traffic volumes that can sometimes limit the number of available gaps in traffic to make turns off the side street approaches.

C. Muirlands/Entrados

This four way intersection is located south of Ridge Route and was included in the TSMP due to a recent collision between a school bus and vehicle. Sight distance exceeds the minimum required and gaps in traffic are usually sufficient during all hours of the day. There have been some other collisions that resulted in property damage.

D. Rancho Parkway South/Sunflower

This t-intersection was included in the TSMP due to concerns about the pedestrian crossings across Rancho Parkway between the multifamily developments and Baker Ranch Community Park. The City installed some pedestrian crossing warning signs on Rancho Parkway South and has suggested that pedestrians use the signalized intersection of Alton/Rancho Parkway South (about 1,000 feet away) to cross the street.

E. Lake Forest/Old Trabuco Road

This four way intersection in located just east of Trabuco and was included following a separate study of this intersection. The primary concern was related to delays leaving the adjacent church after services. The City installed some additional signing and striping to guide and organize traffic and agreed to study this location as part of the TSMP.

F. Rockfield/Dune Mear

This t-intersection was included in the TSMP because it has an uncontrolled school crosswalk across the major street. This is the only location in the City with this condition. Currently, there is a crossing guard assigned to this location and

there are pedestrian activated rectangular rapid flashing beacons to warn drivers of pedestrian activity.

Letter	Location	2016 Count	2015 Count	Int. Volume	2016 Rate	2015 Rate
A	Lake Forest/Overlake	2	1	32,650	0.17	0.08
B	Bake/Baffin Bay	0	0	27,850	0.00	0.00
C	Muirlands/Entrados	3	2	22,000	0.37	0.25
D	Rancho Pkwy South/Sunflower	0	0	6,100	0.00	0.00
E	Lake Forest/Old Trabuco	0	0	26,100	0.00	0.00
F	Rockfield/Dune Mear	0	0	18,000	0.00	0.00

Based on the overall information, there are no unusual patterns or trends at these special study locations, and, therefore, staff is not recommending any changes at this time. Additional information on these intersections will be presented as part of the TSMP report that is scheduled to come before the PTC in March.

Summary of Recommendations

Lake Forest/Rockfield

- Based on the overall conditions, staff is recommending an increase in the all-red from 1 to 1.5 seconds for the westbound left turn (2 seconds is considered the maximum). This would result in 0.5 seconds less green time for the movement, but would provide a small additional amount of clearance time (yellow plus all red). For uniformity, this may require that the eastbound left also have the same all-red timing.

El Toro/Santiago Canyon/Live Oak Canyon

Due to the rural nature of the roadways in this area (where drivers encounter fewer controls), the curvature of Live Oak right as you get to El Toro/Santiago and the collision history, staff is recommending the following:

- The installation of a larger stop sign with higher intensity reflective sheeting. This will provide better target value for the drivers in both the day and night.
- The installation of a solar powered red flashing beacon on top of the stop sign post. This will provide enhanced warning of the upcoming stop.
- The installation of an additional “stop ahead” sign adjacent to the “STOP AHEAD” legends. This sign will provide secondary advance warning for

this unique condition. The sign will also have the higher intensity reflective sheeting

Other Intersections (including Special Study Locations)

Based on the overall information, there are no unusual patterns or trends at 15 of the 16 original study locations or any of the six special study locations and therefore staff is not recommending any changes to these locations at this time.

FISCAL IMPACT

The estimated cost to complete the minor traffic signal timing modification, install the flashing beacon and install the signing is $2,500. There is sufficient funding in the Fiscal Year 2017-2018 budget to accommodate these expenditures.

ATTACHMENTS:

1. Location Study Map
2. NHTSA information
3. OTS information
4. Collision diagrams

Attachment 1

The City of Lake Forest
Annual Collision Review Study Locations

Department of Public Works
February 12, 2018

Bake/Portola
Lake Forest/Portola
Rancho Pkwy South/Sunflower
Bake/Baffin Bay
Bake/Trabuco
Lake Forest/Trabuco
Lake Forest/Old Trabuco
Lake Forest/Serrano
Jeronimo/Lake Forest
Lake Forest/Toledo
Lake Forest/Overlake
El Toro/Trabuco
Lake Forest/Rockfield
Muirlands/Dylan
El Toro/Jeronimo
Muirlands/Entrados
El Toro/Muirlands
Rockfield/Dune Mear
El Toro/Raymond
El Toro/Rockfield
Rockfield/Orchard
El Toro/Bridger/I-5 NB Ramp
El Toro/Santiago/Live Oak

Legend

- Special Study Location
- List Study Location
- Additional Study Location

0 0.35 0.7
Miles

Path: C:\Users\sshin\Desktop\2018-02-12\Annual Collision Review Study Locations\Annual Collision Review Study Locations extent.mxd

Attachment 2

U.S. Department of Transportation
National Highway Traffic Safety Administration

TRAFFIC SAFETY FACTS
Crash • Stats

NHTSA
www.nhtsa.gov

DOT HS 812 115 | A Brief Statistical Summary | February 2015

Critical Reasons for Crashes Investigated in the National Motor Vehicle Crash Causation Survey

Summary

The National Motor Vehicle Crash Causation Survey (NMVCCS), conducted from 2005 to 2007, was aimed at collecting on-scene information about the events and associated factors leading up to crashes involving light vehicles. Several facets of crash occurrence were investigated during data collection, namely the pre-crash movement, critical pre-crash event, critical reason, and the associated factors. A weighted sample of 5,470 crashes was investigated over a period of two and a half years, which represents an estimated 2,189,000 crashes nationwide. About 4,031,000 vehicles, 3,945,000 drivers, and 1,982,000 passengers were estimated to have been involved in these crashes. The critical reason, which is the last event in the crash causal chain, was assigned to the driver in 94 percent (±2.2%)[†] of the crashes. In about 2 percent (±0.7%) of the crashes, the critical reason was assigned to a vehicle component's failure or degradation, and in 2 percent (±1.3%) of crashes, it was attributed to the environment (slick roads, weather, etc.). Among an estimated 2,046,000 drivers who were assigned critical reasons, recognition errors accounted for about 41 percent (±2.1%), decision errors 33 percent (±3.7%), and performance errors 11 percent (±2.7%) of the crashes.

Introduction

Databases such as the National Automotive Sampling System (NASS) Crashworthiness Data System (CDS) do not provide information on pre-crash scenarios and the reason underlying the critical pre-crash events. In 2005, the National Highway Traffic Safety Administration (NHTSA) was authorized under Section 2003(c) of the Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users (SAFETEA-LU) to conduct a national survey to collect on-scene data pertaining to events and associated factors that possibly contributed to crash occurrence. NHTSA's National Center for Statistics and Analysis (NCSA) conducted NMVCCS from July 3, 2005, to December 31, 2007. Crashes were investigated at the crash scene to collect driver, vehicle, and environment-related information pertaining to crash occurrence, with a focus on driver's role. The targeted information was captured mainly through four data elements: (i) movement prior to critical pre-crash event (i.e., the movement of the vehicle immediately before the occurrence of the critical event); (ii) critical pre-crash event (i.e., the circumstance that led to vehicle's first impact); (iii) critical reason for the critical pre-crash event (i.e., the immediate reason for the critical event, which is often the last failure in the causal chain of events leading up to the crash); and (iv) the crash-associated factors (i.e., the factors that are likely to add to the probability of crash occurrence). This was done with reference to the crash envelope that comprises of a sequence of events, referring to the above data elements, which eventually led to the crash.

This Crash•Stats presents some statistics related to one of the four data elements, namely "critical reason for the critical pre-crash event." The data obtained through the sample of 5,470 NMVCCS crashes and the weights associated with them were used to obtain national estimates of frequencies and percentages along with their 95-percent confidence limits, as presented in the following sections.

Critical Reasons for the Critical Pre-Crash Event

The critical reason is the immediate reason for the critical pre-crash event and is often the last failure in the causal chain of events leading up to the crash. Although the critical reason is an important part of the description of events leading up to the crash, it is not intended to be interpreted as the cause of the crash nor as the assignment of the fault to the driver, vehicle, or environment.

A critical reason can be assigned to a driver, vehicle, or environment. Normally, one critical reason was assigned per crash, based upon NMVCCS researcher's crash assessment. The critical reason was assigned to the driver in an estimated 94 percent (±2.2%) of the crashes (Table 1). In addition, the critical reason was assigned to the vehicle in an estimated 2 percent (±0.7%) and to the environment in about 2 percent (±1.3%) of the crashes.

Table 1. Driver-, Vehicle-, and Environment-Related Critical Reasons

Critical Reason Attributed to	Estimated	
	Number	Percentage* ± 95% conf. limits
Drivers	2,046,000	94% ±2.2%
Vehicles	44,000	2% ±0.7%
Environment	52,000	2% ±1.3%
Unknown Critical Reasons	47,000	2% ±1.4%
Total	2,189,000	100%

*Percentages are based on unrounded estimated frequencies
(Data Source: NMVCCS 2005–2007)

The critical reasons related statistics are presented in detail in Table 2 for drivers, Table 3 for vehicles, and Table 4 for environment.

Critical reason attributed to drivers

The critical reason was assigned to drivers in an estimated 2,046,000 crashes that comprise 94 percent of the NMVCCS crashes at the national level. However, in none of these cases was the assignment intended to blame the driver for causing the crash. The driver-

[†] 95% conf. limits: $\pm t_{\alpha/2;\,\text{deg. freedom}} \times$ Std. Dev. ($\alpha = 0.05$, t-value = 2.179)

related critical reasons are broadly classified into recognition errors, decision errors, performance errors, and non-performance errors. Statistics in Table 2 show that the recognition error, which included driver's inattention, internal and external distractions, and inadequate surveillance, was the most (41% ±2.2%) frequently assigned critical reason. Decision error such as driving too fast for conditions, too fast for the curve, false assumption of others' actions, illegal maneuver and misjudgment of gap or others' speed accounted for about 33 percent (±3.7%) of the crashes. In about 11 percent (±2.7%) of the crashes, the critical reason was performance error such as overcompensation, poor directional control, etc. Sleep was the most common critical reason among non-performance errors that accounted for 7 percent (±1.0%) of the crashes. Other driver errors were recorded as critical reasons for about 8 percent (±1.9%) of the drivers.

Table 2. Driver-Related Critical Reasons

Critical Reason	Estimated (Based on 94% of the NMVCCS crashes)	
	Number	Percentage* ± 95% conf. limits
Recognition Error	845,000	41% ±2.2%
Decision Error	684,000	33% ±3.7%
Performance Error	210,000	11% ±2.7%
Non-Performance Error (sleep, etc.)	145,000	7% ±1.0%
Other	162,000	8% ±1.9%
Total	2,046,000	100%

*Percentages are based on unrounded estimated frequencies
(Data Source: NMVCCS 2005–2007)

Critical reason attributed to vehicles

The critical reason was assigned to vehicles in an estimated 44,000 crashes comprising about 2 percent of the NMVCCS crashes, though none of these reasons implied a vehicle causing the crash. There were no detailed inspections of vehicles during the NMVCCS on-scene crash investigation; the vehicle-related critical reasons were mainly inferred through external visual inspection of the vehicle components. This resulted in only mostly external, easily visible factors (tires, brakes, steering column, etc.) that were cited as the few vehicle-related critical reasons. The related statistics may not, therefore, be representative of the role of other internal vehicle related problems that might have led to the crash. Of the small percentage (2%) of the crashes in which the critical reason was assigned to the vehicle, the tire problem accounted for about 35 percent (±11.4%) of the crashes. Brake related problems as critical reasons accounted for about 22 percent (±15.4%) of such crashes. Steering/suspension/transmission/engine-related problems were assigned as critical reasons in 3 percent (±3.3%) of such crashes. Other vehicle-related problems coded as critical reasons were assigned in about 40 percent (±24.0%) percent of such crashes.

Table 3. Vehicle Related Critical Reasons

Critical Reason	Estimated (Based on 2% of the NMVCCS crashes)	
	Number	Percentage* ± 95% conf. limits
Tires /wheels-related	15,000	35% ± 11.4%
Brakes-related	10,000	22% ± 15.4%
Steering/suspension/transmission/ engine-related	2,000	3% ± 3.3%
Other/unknown vehicle-related problems	17,000	40% ± 24.0%
Total	44,000	100%

*Percentages are based on unrounded estimated frequencies
(Data Source: NMVCCS 2005–2007)

Critical reason attributed to environment

The critical reason was assigned to about 2 percent of the estimated 2,189,000 NMVCCS crashes. However, none of these is suggestive of the cause of the crash. Table 4 presents statistics related to crashes in which the critical reason was attributed to roadway and atmospheric conditions. In about 50 percent (±14.5%) of the 52,000 crashes the critical reason was attributed to slick roads. Glare as a critical reason accounted for about 17 percent (±16.7%) of the environment-related crashes, and view obstruction was assigned in 11 percent (±7.2%) of the crashes. Signs and signals accounted for 3 percent (±2.5%) of such crashes. In addition, in 52,000 of the crashes with a critical reason attributed to the environment, the weather condition (fog/rain/snow) was cited in 4 percent (±2.9%) of the crashes.

Table 4. Environment-Related Critical Reasons

Critical Reason	Estimated (Based on 2% of the NMVCCS crashes)	
	Number	Percentage* ± 95% conf. limits
Slick roads (ice, loose debris, etc.)	26,000	50% ±14.5%
Glare	9,000	17% ±16.7%
View obstructions	6,000	11% ±7.2%
Other highway-related condition	5,000	9% (0, 9.9)††%
Fog/rain/snow	2,000	4% ±2.9%
Other weather-related condition	2,000	4% (0.0, 9.1)††%
Signs/signals	1,000	3% ± 2.5%
Road design	1,000	1% (0, 3.3)††%
Total	52,000	100%

*Percentages are based on unrounded estimated frequencies
††Conf. limits with lower limit 0
(Data Source: NMVCCS 2005–2007)

Suggested APA Format Citation for This Document:

Singh, S. (2015, February). Critical reasons for crashes investigated in the National Motor Vehicle Crash Causation Survey. (Traffic Safety Facts Crash•Stats. Report No. DOT HS 812 115). Washington, DC: National Highway Traffic Safety Administration.

U.S. Department of Transportation
National Highway Traffic Safety Administration

This Crash•Stats was prepared by Santokh Singh, senior mathematical statistician, Bowhead Systems Management, Inc., working under contract with the Mathematical Analysis Division of the National Center for Statistics and Analysis, NHTSA. For questions regarding the information presented in this document, please contact NCSAWEB@dot.gov.

Attachment 3

CALIFORNIA OFFICE OF TRAFFIC SAFETY (/default.asp)

2015 OTS RANKINGS

Agency	Year	County	Group	Population (Avg)	DVMT
Lake Forest	2015	ORANGE COUNTY	C	83,376	872,819

TYPE OF COLLISION	VICTIMS KILLED & INJURED	OTS RANKING
Total Fatal and Injury	317	86/105
Alcohol Involved	34	77/105
Had Been Drinking Driver < 21	4	9/105
Had Been Drinking Driver 21 - 34	11	78/105
Motorcycles	29	42/105
Pedestrians	11	93/105
Pedestrians < 15	3	54/105
Pedestrians 65+	1	88/105
Bicyclists	14	82/105
Bicyclists < 15	1	85/105
Composite	148	75/105

TYPE OF COLLISION	FATAL & INJURY COLLISIONS	OTS RANKING
Speed Related	52	91/105
Nighttime (9:00pm - 2:59am)	31	75/105
Hit and Run	16	82/105

TYPE OF ARRESTS	ARRESTS	OTS RANKING*
DUI Arrests	165	50/105

Contact Us

Address: 2208 Kausen Drive, Suite 300, Elk Grove, CA 95758

Public Information Inquiries: (916) 509-3030 | Fax (916) 509-3055

Email: ContactOTS@ots.ca.gov (mailto:ContactOTS@ots.ca.gov)

Follow Us

Attachment 4

LAKE FOREST DR & ROCKFIELD BL
2016

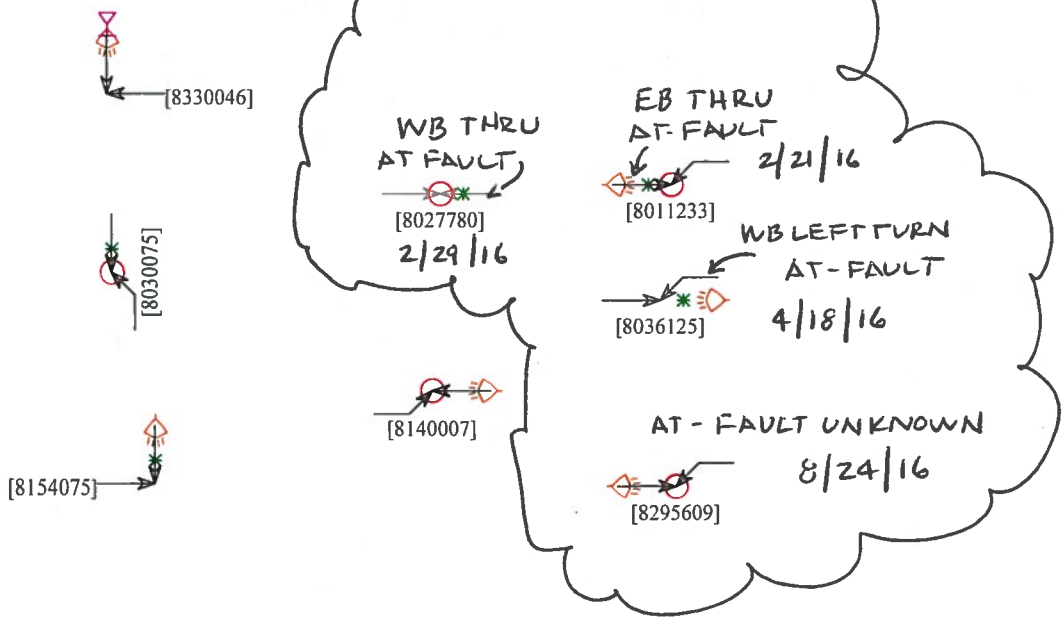
9 Crashes

Distance LTE 200

POTENTIAL PATTERN

2016

1



NOT IN INTERSECTION

[8134643]

(0) crashes could not be placed in this schematic

- Straight
- Stopped
- Unknown
- Backing
- Overtaking
- Sideswipe
- Parked
- Erratic
- Out of control
- Right turn
- Left turn
- U-turn
- Pedestrian
- Bicycle
- Injury
- Fatality
- Nighttime
- DUI

Fixed objects:

- General
- Signal
- Tree
- Pole
- Curb
- Animal

- 3rd vehicle
- Extra data

LAKE FOREST DR & ROCKFIELD BL

2016

10 Crashes

2016

Distance LTE 200

Collisiondate	Collisiontime	Dayofweek	Collisionseverity	Distance	Typeofcollision	Atfault_One	Atfault_Two	Atfault_Three
1/27/2016	12:50 pm	Wednesday	Injury (Complaint of Pain)	0	Broadside	Yes	No	No
12/25/2016	2:10 am	Sunday	PDO	0	Head-On	No	No	
2/21/2016	9:18 pm	Sunday	Injury (Complaint of Pain)	0	Broadside	Yes	No	
2/22/2016	7:48 am	Monday	Injury (Complaint of Pain)	0	Broadside	No	Yes	
2/29/2016	1:30 pm	Monday	Injury (Other Visible)	0	Not Stated	Yes	No	
4/18/2016	10:50 pm	Monday	PDO	0	Not Stated	Yes	No	
8/10/2016	1:05 am	Wednesday	PDO	0	Broadside	Yes	No	
8/12/2016	2:50 pm	Friday	Injury (Complaint of Pain)	107	Rear End	No	Yes	
8/24/2016	11:28 pm	Wednesday	Injury (Complaint of Pain)	0	Broadside	No	No	
9/5/2016	8:55 pm	Monday	Injury (Severe)	0	Broadside	No	No	

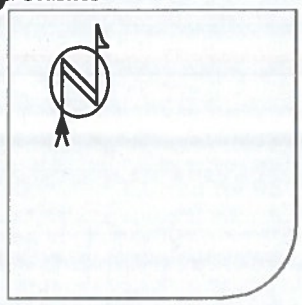
1

LAKE FOREST DR & ROCKFIELD BL

2015

7 Crashes

Distance LTE 200



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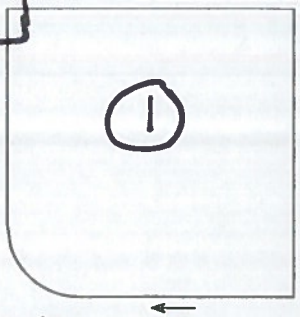
2015



WB LEFT TURN
AT FAULT
12/26/15

[7184888]

[6842062]

[6947282]

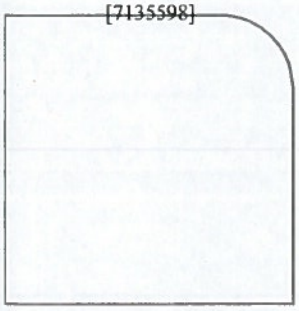
[7049106]

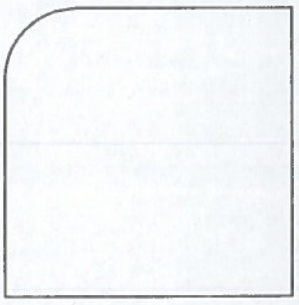
[6972158]

ONLY 1 ADDITIONAL COLLISION INVOLVING W/B LEFT

[7135598]

[7102352]





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- Bicycle
- Injury
- Fatality
- Nighttime
- DUI

Fixed objects:

- General
- Signal
- Tree
- Pole
- Curb
- Animal

- 3rd vehicle
- Extra data

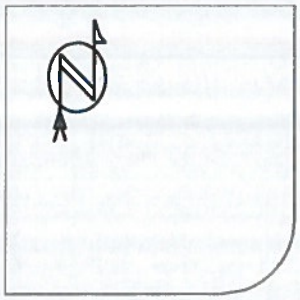
LAKE FOREST DR & ROCKFIELD BL (1)

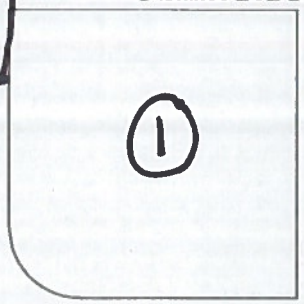
1/1/2017 - 6/30/2017

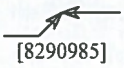
5 Crashes

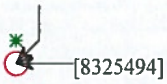
Distance LTE 200

1ST 6 MONTHS OF 2017









NO ADDITIONAL COLLISIONS INVOLVING W/B LEFT

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- Nighttime
- DUI

Fixed objects:

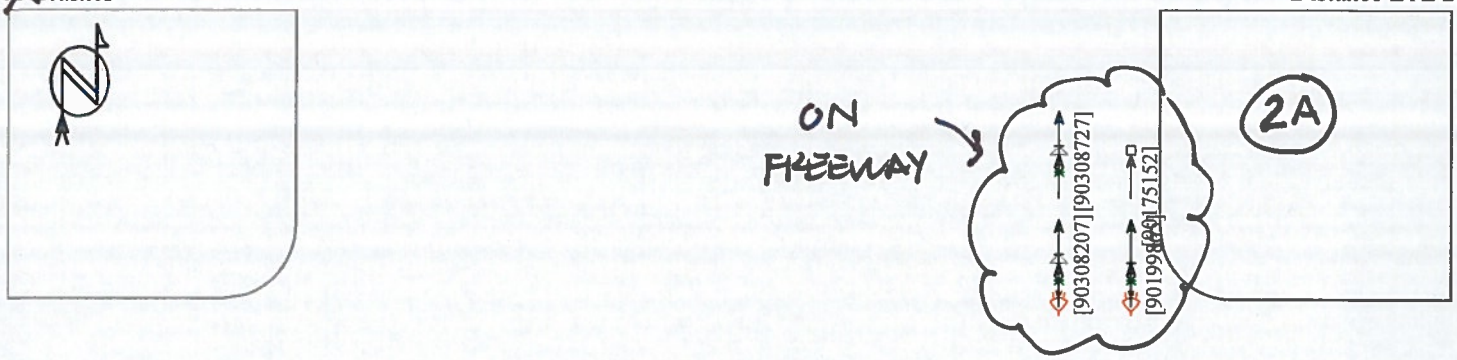
- General
- Signal
- Tree
- Pole
- Curb
- Animal

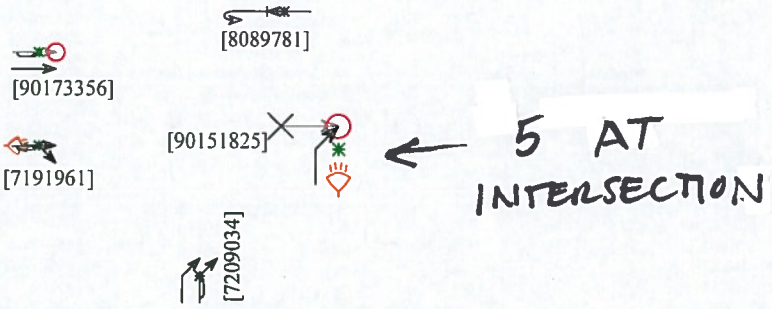
- 3rd vehicle
- Extra data

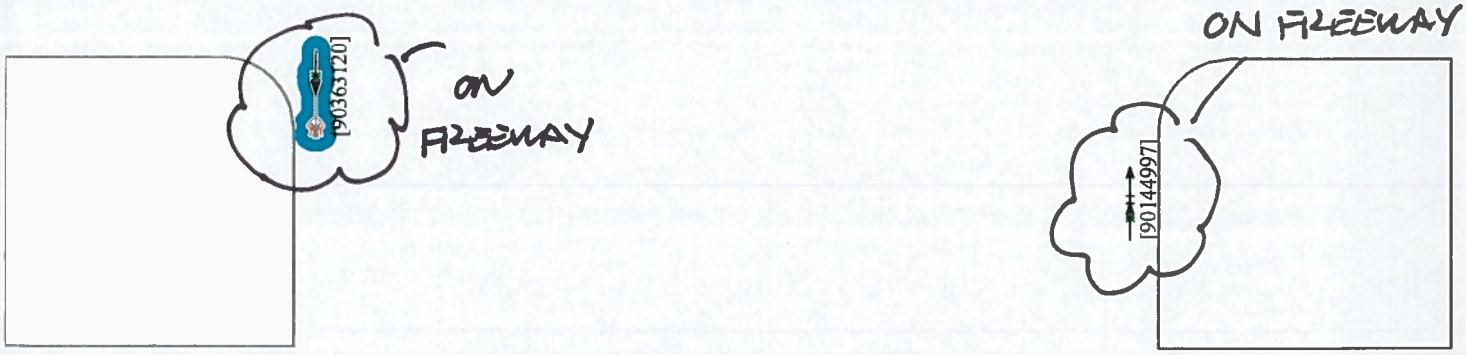
EL TORO RD & I-5 N/B
2016

5 Crashes

Distance LTE 200







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- Fatality
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- DUI

Fixed objects:

- General
- Signal
- Tree
- Pole
- Curb
- Animal

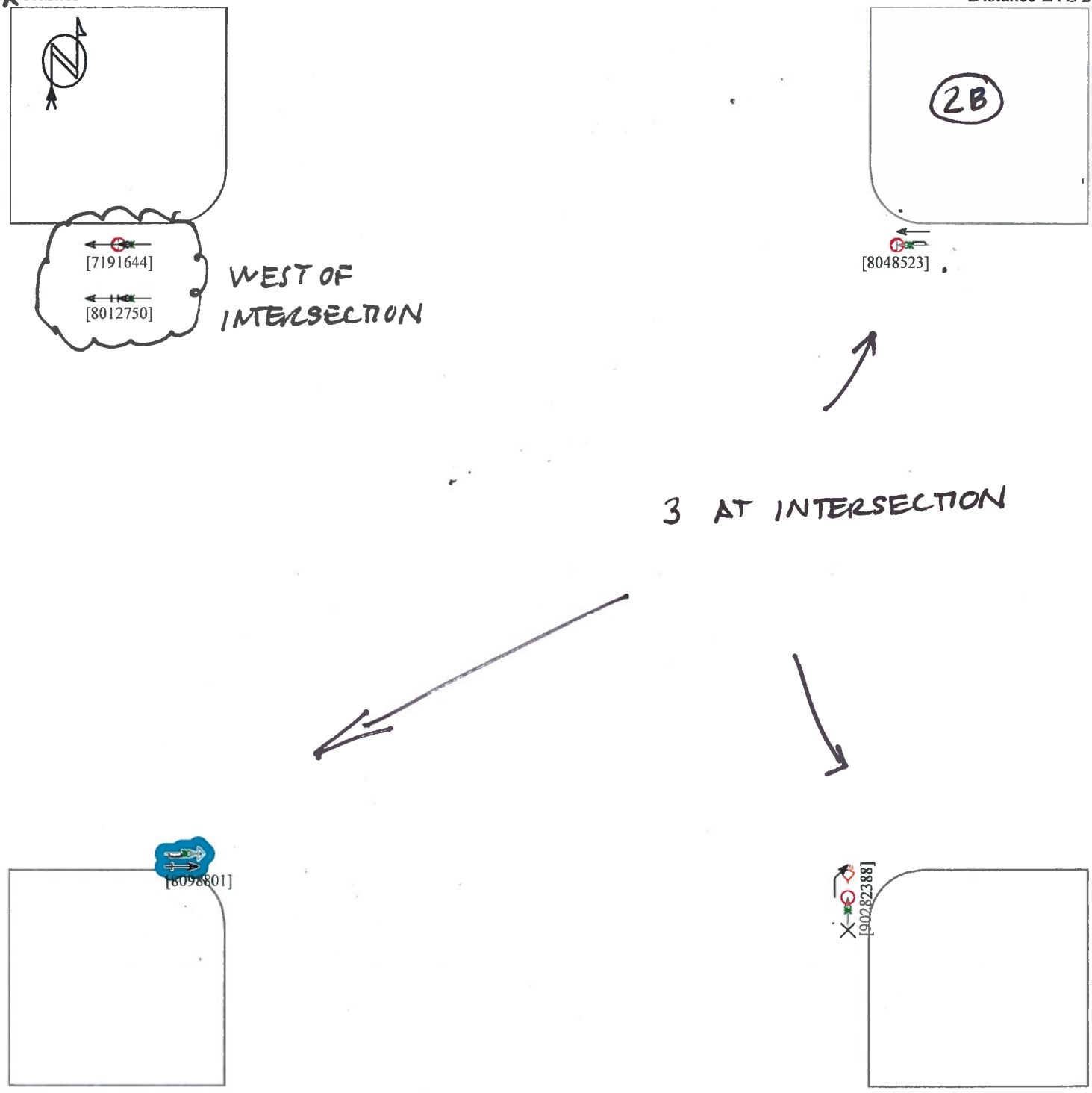
- 3rd vehicle
- Extra data

Pd' Programming, Inc. 2/2/2018

EL TORO RD & BRIDGER RD
2016

3 Crashes

Distance LTE 200



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- DUI

Fixed objects:

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- Tree
- Pole
- Curb
- Animal

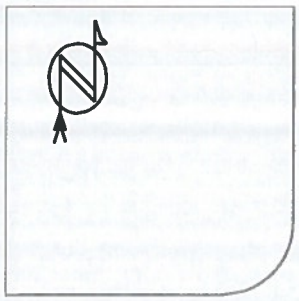
- 3rd vehicle
- Extra data

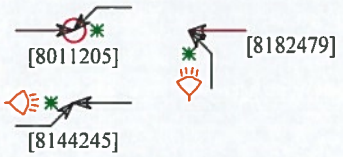
EL TORO RD & ROCKFIELD BL

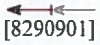
2016

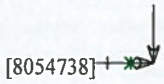
7 Crashes

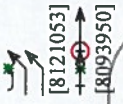
Distance LTE 200

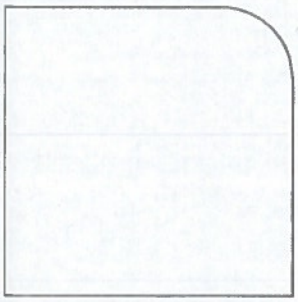


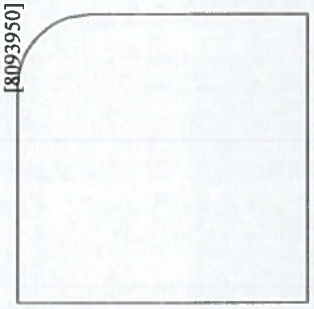












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- Nighttime
- DUI

Fixed objects:

- General
- Signal
- Tree
- Pole
- Curb
- Animal

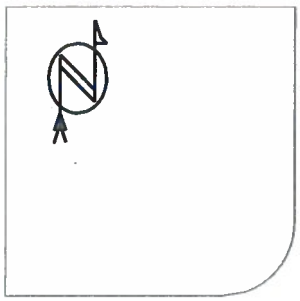
- 3rd vehicle
- Extra data

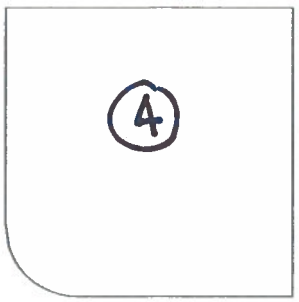
Pd' Programming, Inc. 2/2/2018

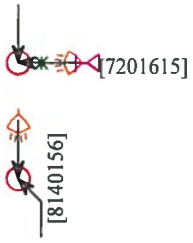
EL TORO RD & MUIRLANDS BL
2016

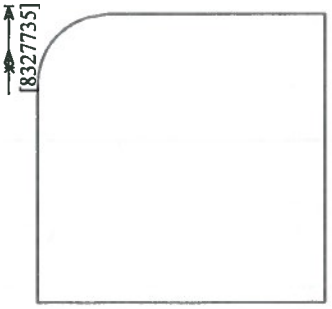
7 Crashes

Distance LTE 200









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- Nighttime
- DUI

Fixed objects:

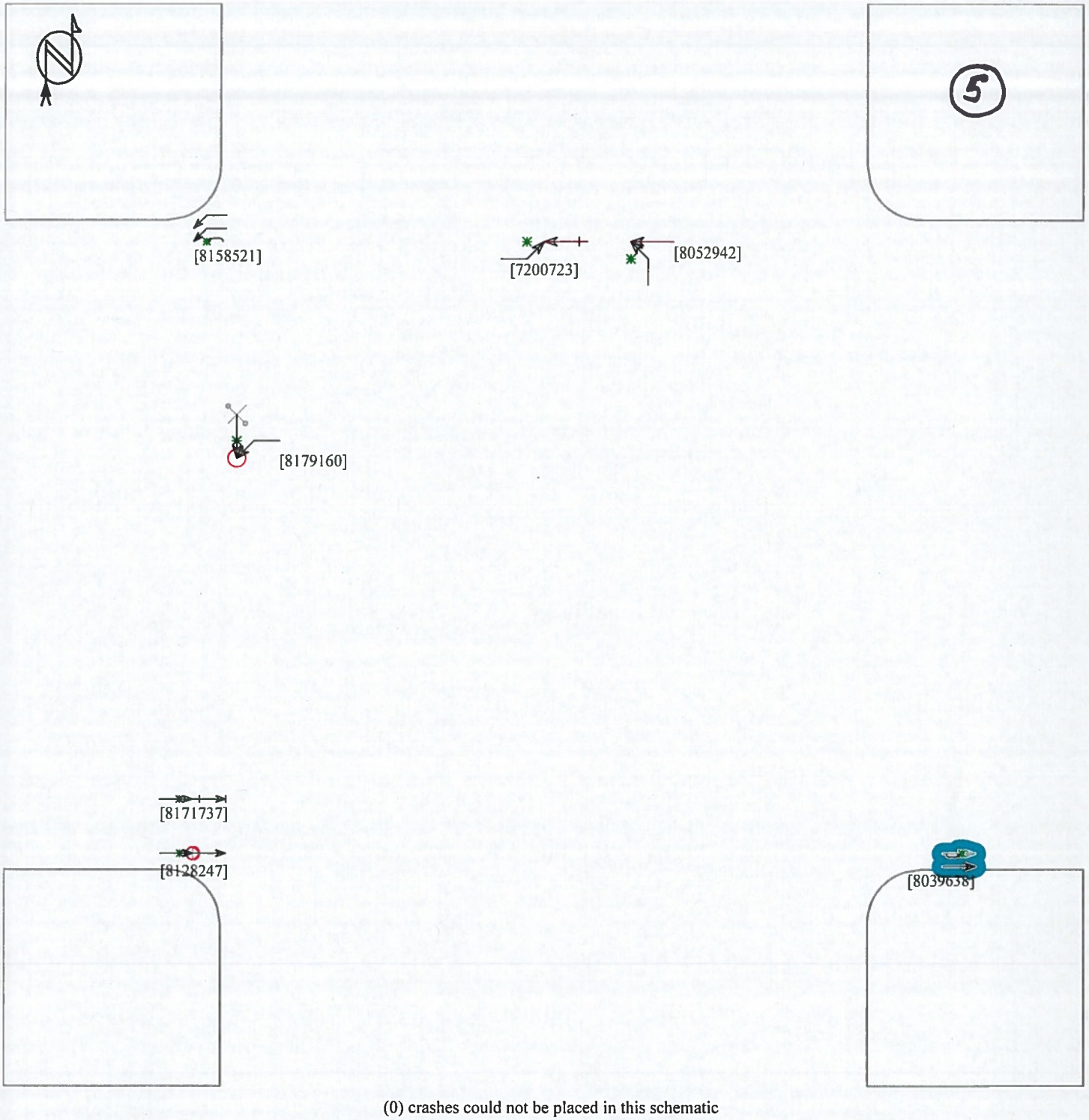
- General
- Signal
- Tree
- Pole
- Curb
- Animal

- 3rd vehicle
- Extra data

EL TORO RD & RAYMOND WY
2016

7 Crashes

Distance LTE 200



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Fixed objects:

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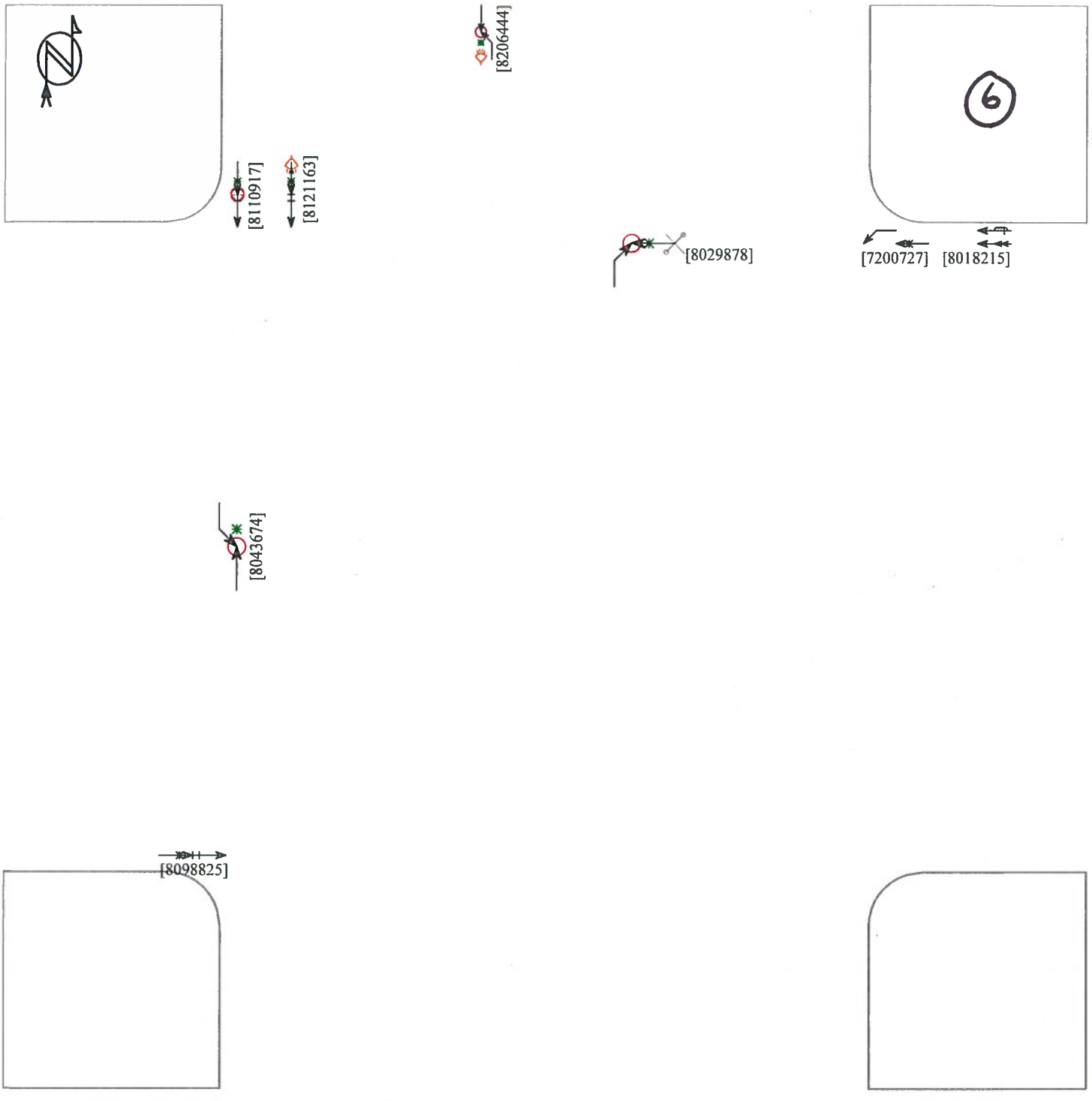
- Tree
- Pole
- Curb
- Animal

- 3rd vehicle
- Extra data

LAKE FOREST DR & TRABUCO RD
2016

8 Crashes

Clear



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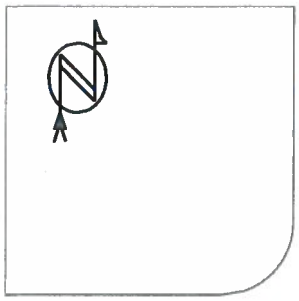
- Extra data

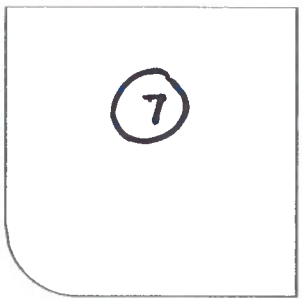
Pd' Programming, Inc. 2/2/2018

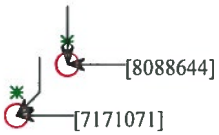
BAKE PKWY & TRABUCO RD
2016

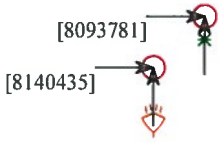
6 Crashes

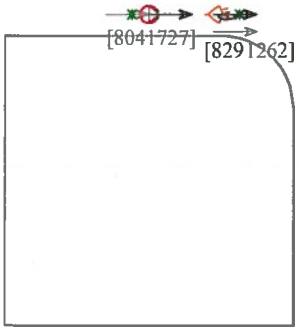
Distance LTE 200

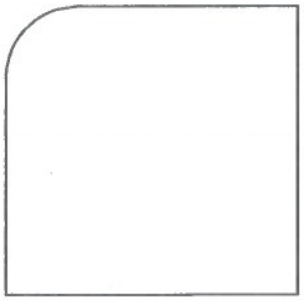












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- Pedestrian
- Bicycle
- Injury
- Fatality
- Nighttime
- DUI

Fixed objects:

- General
- Signal
- Tree
- Pole
- Curb
- Animal

- 3rd vehicle
- Extra data

BAKE PKWY & TRABUCO RD
2016

6 Crashes

Distance LTE 200

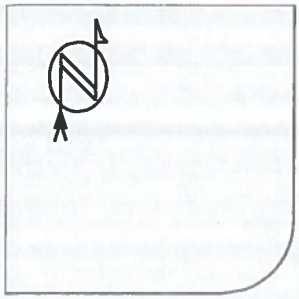
Collisiondate	Collisiontime	Dayofweek	Collisionseverity	Distance	Typeofcollision	Atfault_One	Atfault_Two	Atfault_Three
1/8/2016	11:20 am	Friday	Injury (Complaint of Pain)	20	Broadside	Yes	No	
11/22/2016	7:50 pm	Tuesday	PDO	50	Sideswipe	No	Yes	
5/2/2016	11:58 am	Monday	Injury (Complaint of Pain)	155	Broadside	Yes	No	No
6/28/2016	6:41 pm	Tuesday	Injury (Other Visible)	0	Broadside	No	Yes	
7/11/2016	12:30 pm	Monday	Injury (Complaint of Pain)	0	Broadside	Yes	No	
9/4/2016	11:23 pm	Sunday	Injury (Other Visible)	0	Broadside	No	No	

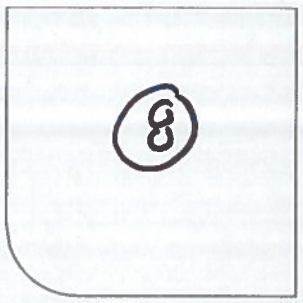
7

LAKE FOREST DR & SERRANO RD
2016

5 Crashes

Distance LTE 200





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[8140447]

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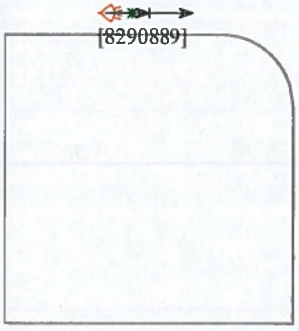
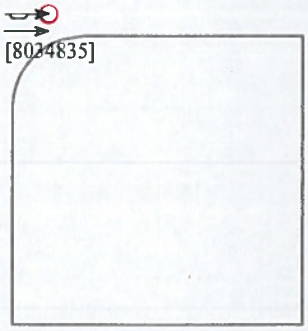


[8024835]



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- Fatality
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Fixed objects:

- General
- Signal
- Tree
- Pole
- Curb
- Animal

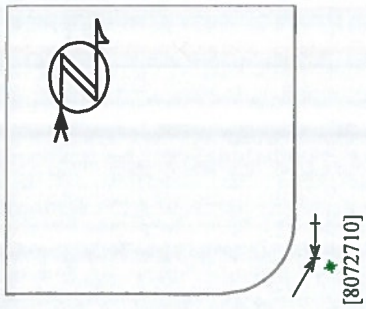
- 3rd vehicle
- Extra data

Pd' Programming, Inc. 2/2/2018

EL TORO RD & JERONIMO RD
2016

5 Crashes

Distance LTE 200



(0) crashes could not be placed in this schematic

- Straight
- Stopped
- Unknown
- Backing
- Overtaking
- Sideswipe
- Parked
- Erratic
- Out of control
- Right turn
- Left turn
- U-turn
- Pedestrian
- Bicycle
- Injury
- Fatality
- Nighttime
- DUI

Fixed objects:

- General
- Signal
- Tree
- Pole
- Curb
- Animal

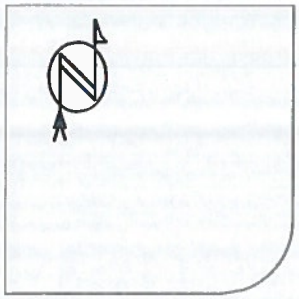
- 3rd vehicle
- Extra data

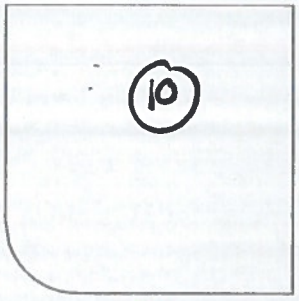
Pd' Programming, Inc. 2/2/2018

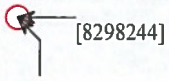
LAKE FOREST BL & TOLEDO WY
2016

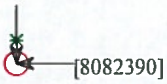
5 Crashes

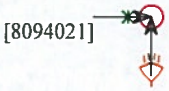
Distance LTE 200

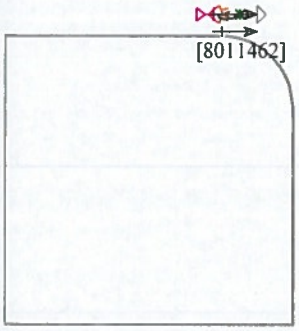


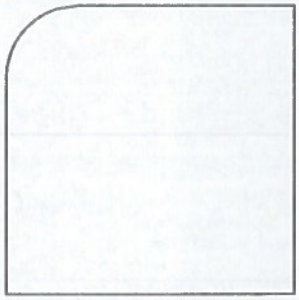












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- Pedestrian
- Bicycle
- Injury
- Fatality
- Nighttime
- DUI

Fixed objects:

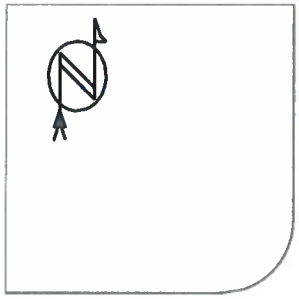
- General
- Signal
- Tree
- Pole
- Curb
- Animal

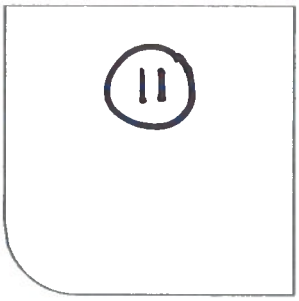
- 3rd vehicle
- Extra data

LAKE FOREST BL & PORTOLA PKWY
2016

4 Crashes

Distance LTE 200





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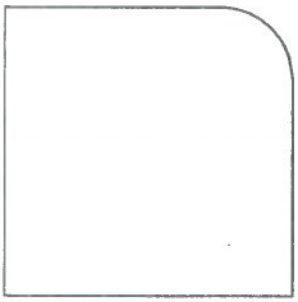

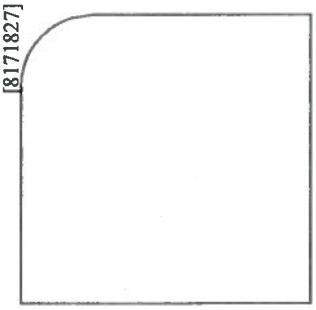

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Fixed objects:

- General
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- Pole
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- Animal

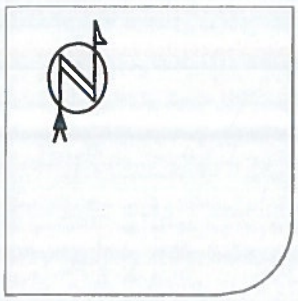
- 3rd vehicle
- Extra data

Pd' Programming, Inc. 2/2/2018

JERONIMO RD & LAKE FOREST DR
2016

4 Crashes

Distance LTE 200



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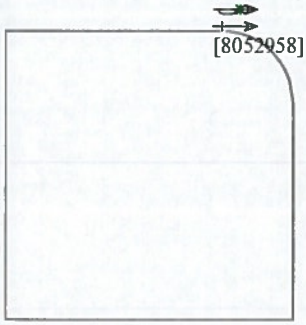

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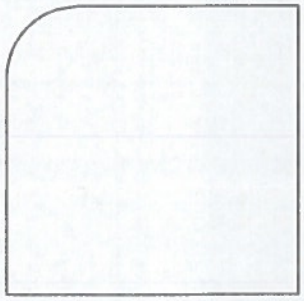

(0) crashes could not be placed in this schematic

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Fixed objects:

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- Pole
- Curb
- Animal

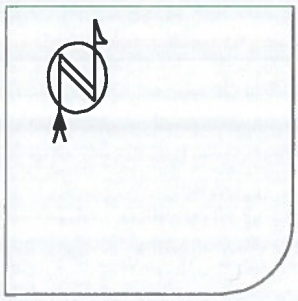
- 3rd vehicle
- Extra data

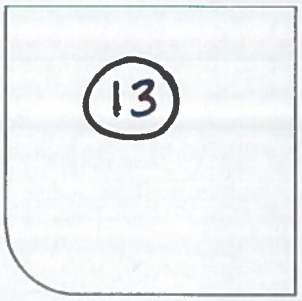
Pd' Programming, Inc. 2/2/2018

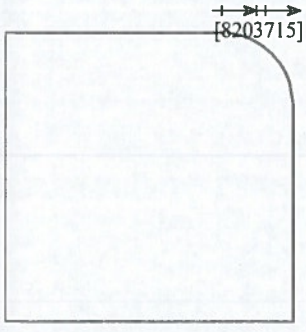
BAKE PKWY & PORTOLA PKWY
2016

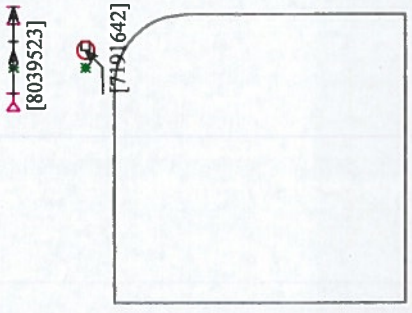
4 Crashes

Distance LTE 200









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Fixed objects:

- General
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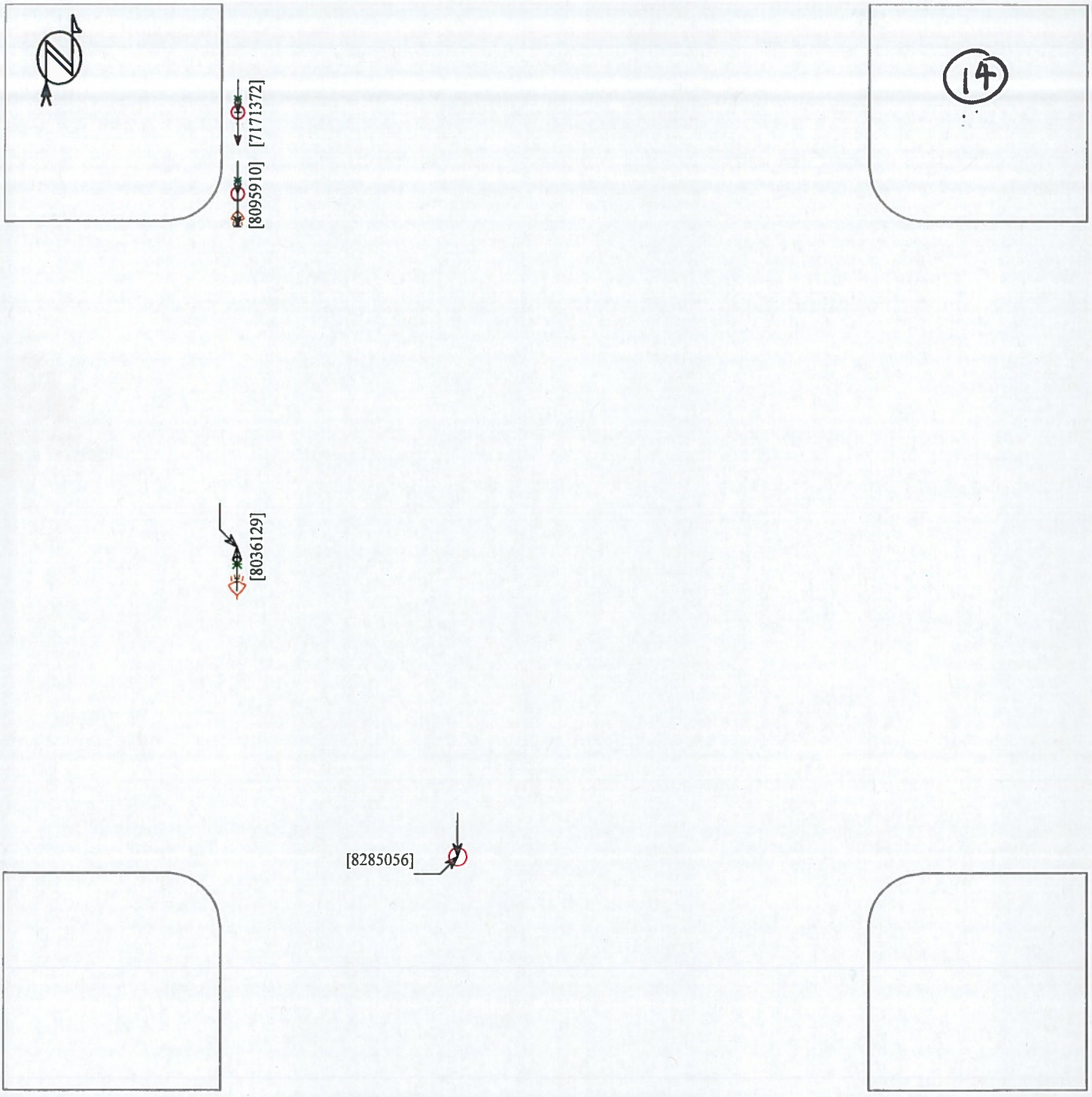
- Tree
- Pole
- Curb
- Animal

- 3rd vehicle
- Extra data

DYLAN AV & MUIRLANDS BL
2016

4 Crashes

Distance LTE 200



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Fixed objects:

- General
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- Pole
- Curb
- Animal

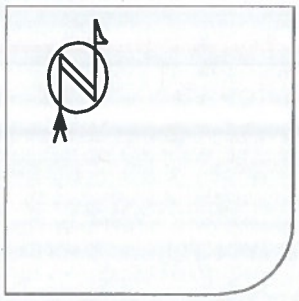
- 3rd vehicle
- Extra data

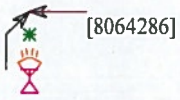
Pd' Programming, Inc. 2/5/2018

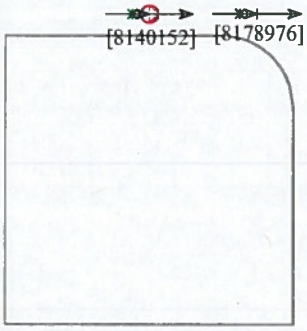
EL TORO RD & TRABUCO RD
2016

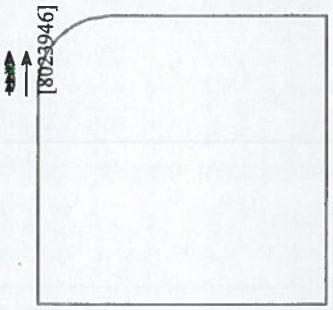
4 Crashes

Distance LTE 200









(0) crashes could not be placed in this schematic

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Fixed objects:

- General
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- Pole
- Curb
- Animal

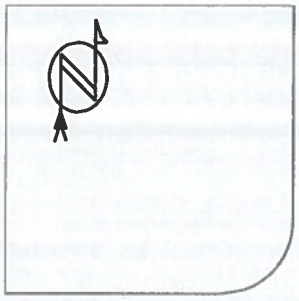
- 3rd vehicle
- Extra data

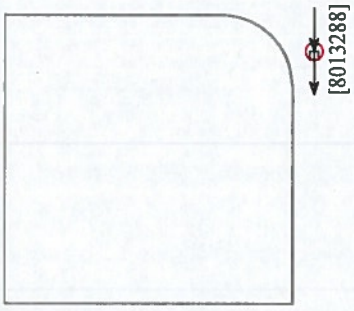
Pd' Programming, Inc. 2/5/2018

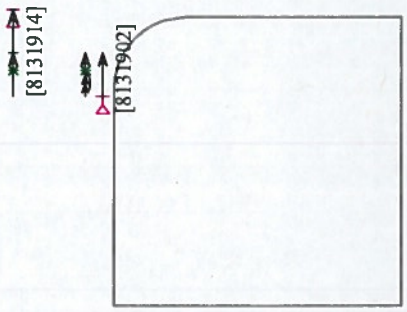
ORCHARD LN & ROCKFIELD BL
2016

4 Crashes

Distance LTE 200







(0) crashes could not be placed in this schematic

- Straight
- Stopped
- Unknown
- Backing
- Overtaking
- Sideswipe
- Parked
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- Bicycle
- Injury
- Fatality
- Nighttime
- DUI

Fixed objects:

- General
- Signal
- Tree
- Pole
- Curb
- Animal

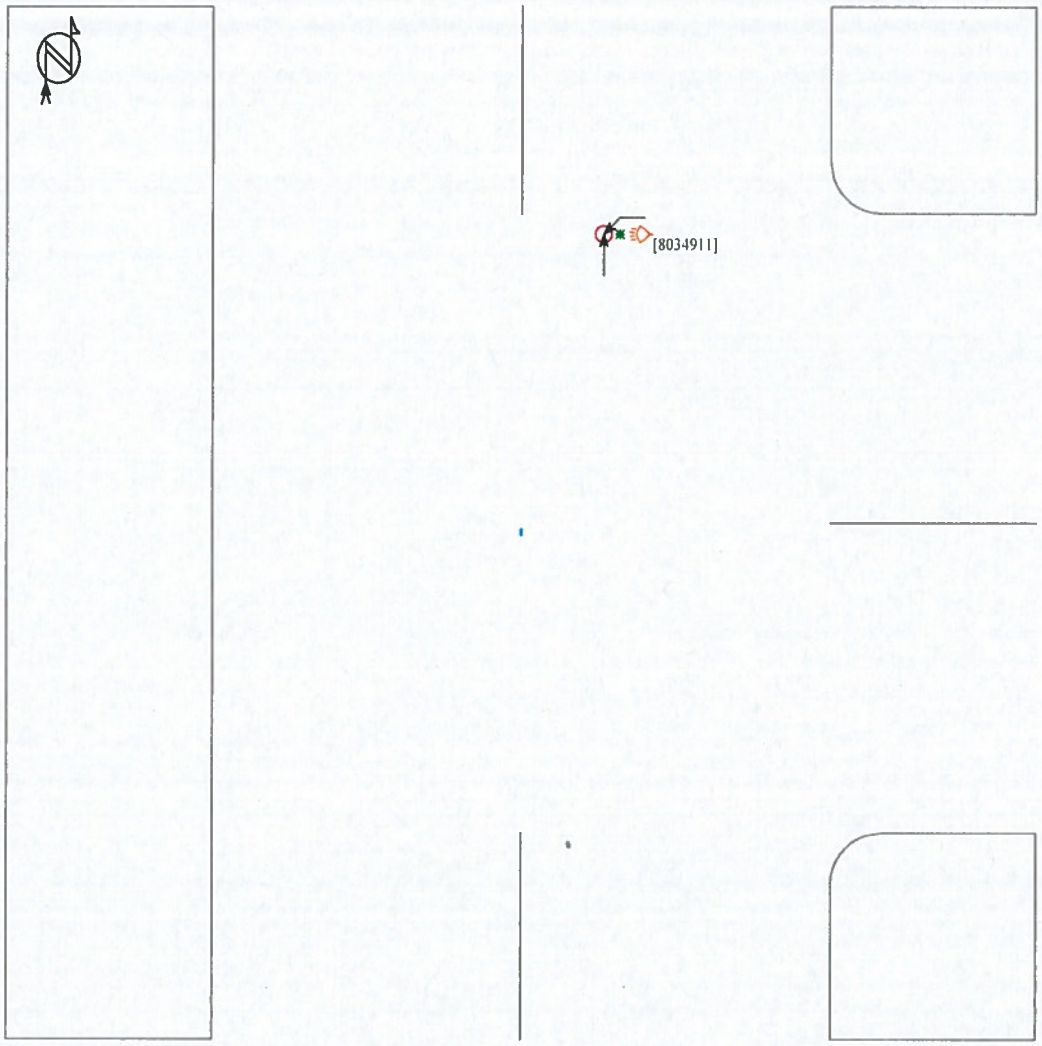
- 3rd vehicle
- Extra data

Pd' Programming, Inc. 2/5/2018

EL TORO RD & LIVE OAK CANYON RD
2016

2 Crashes

Distance LTE 200



(1) crashes could not be placed in this schematic

- Straight
- Stopped
- Unknown
- Backing
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- Sideswipe
- Parked
- Erratic
- Out of control
- Right turn
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- DUI

Fixed objects:

- General
- Signal
- Tree
- Pole
- Curb
- Animal

- 3rd vehicle
- Extra data

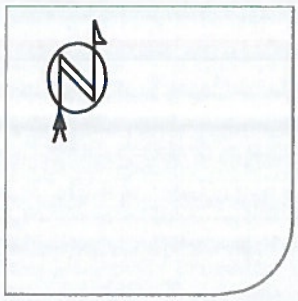
Pd' Programming, Inc. 2/8/2018

SANTIAGO CANYON RD & LIVE OAK CANYON RD (1)

2016

1 Crashes

Distance LTE 200



[8108217]

(0) crashes could not be placed in this schematic

- Straight
- Stopped
- Unknown
- Backing
- Overtaking
- Sideswipe
- Parked
- Erratic
- Out of control
- Right turn
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- Bicycle
- Injury
- Fatality
- Nighttime
- DUI

Fixed objects:

- General
- Signal
- Tree
- Pole
- Curb
- Animal

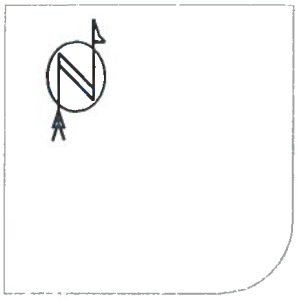
- 3rd vehicle
- Extra data

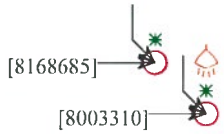
Pd' Programming, Inc. 2/8/2018

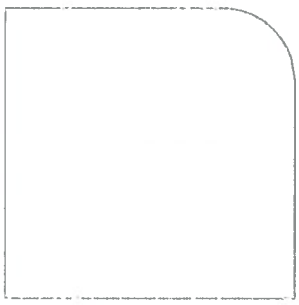
LAKE FOREST DR & OVERLAKE (1)
2016

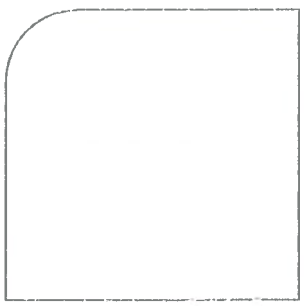
2 Crashes

Distance LTE 200









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- Nighttime
- DUI

Fixed objects:

- General
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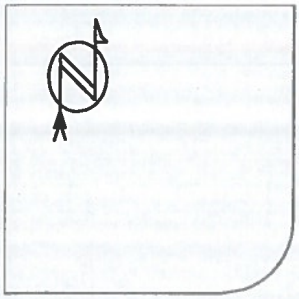
- Tree
- Pole
- Curb
- Animal

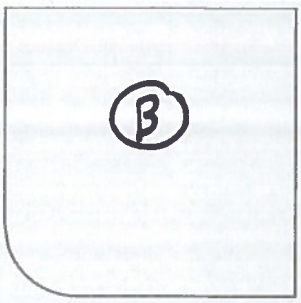
- 3rd vehicle
- Extra data

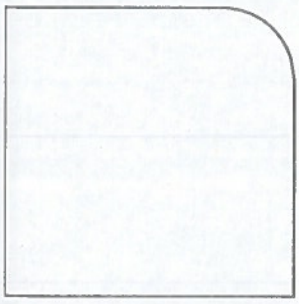
BAKE PKWY & BAFFIN BAY DR
2016

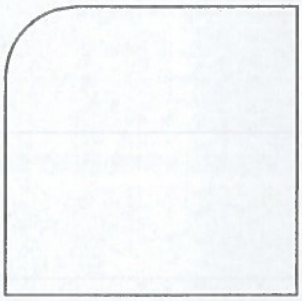
0 Crashes

Distance LTE 200









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Fixed objects:

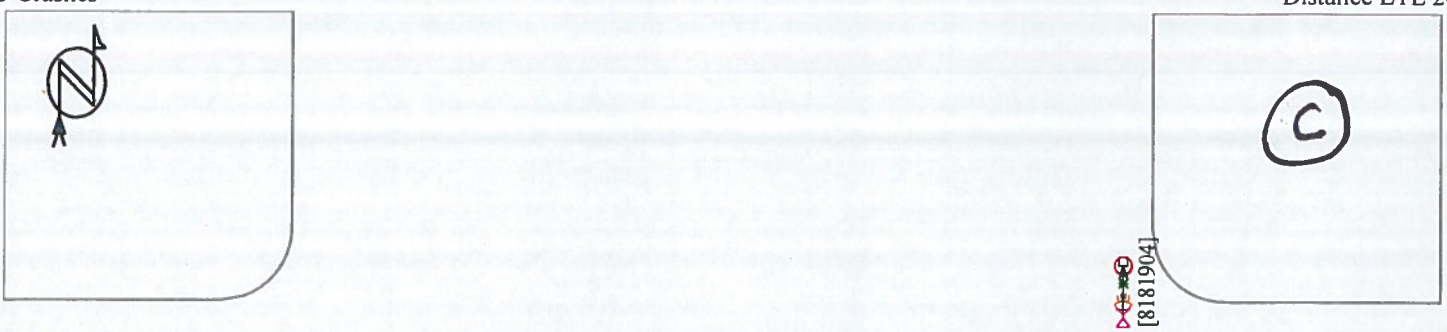
- General
- Signal
- Tree
- Pole
- Curb
- Animal

- 3rd vehicle
- Extra data

MUIRLANDS BL & ENTRADOS DR
2016

3 Crashes

Distance LTE 200



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Fixed objects:

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- 3rd vehicle
- Extra data

Pd' Programming, Inc. 2/8/2018

(D)

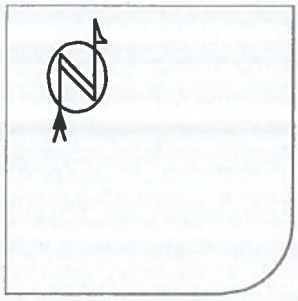
Special Study Location D – Rancho Parkway South/Sunflower

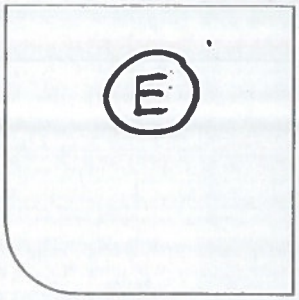
No collisions have ever been reported in the database at Sunflower, so a collision diagram cannot be created.

LAKE FOREST DR & OLD TRABUCO RD
2016

0 Crashes

Distance LTE 200





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Fixed objects:

- General
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- 3rd vehicle
- Extra data

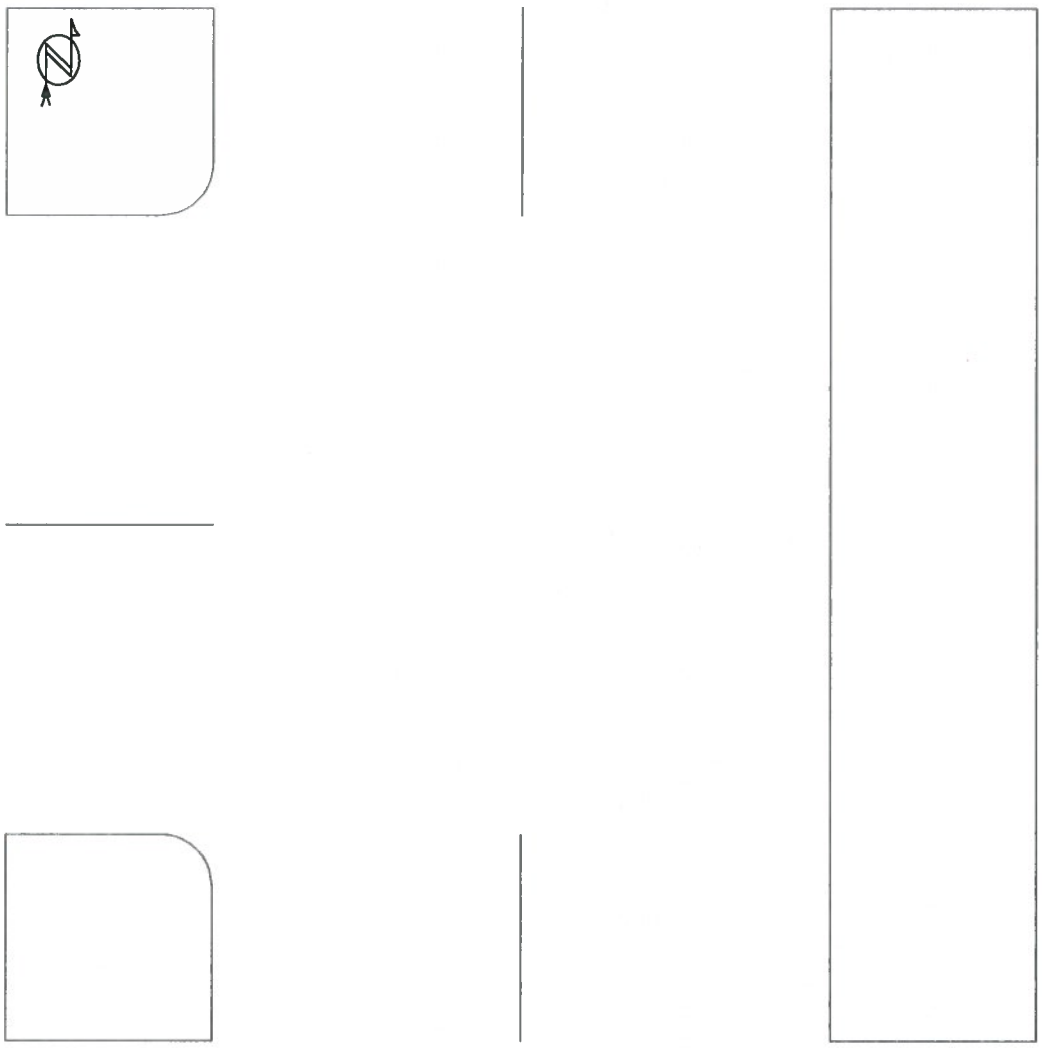
Pd' Programming, Inc. 2/8/2018

ROCKFIELD BL & DUNE MEAR RD
2016

0 Crashes

Distance LTE 200

F



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