



Analysis of Signalized Intersection Crashes

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Outline

- ∅ An overview of signalized intersections and accidents
- ∅ Purpose of the study
- ∅ Methodology
- ∅ Crash prediction analysis
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An overview of signalized intersections and accidents

- Signalized intersections are where most of the accidents happen because of the varying speeds, change of direction and many others.
- Among different factors considered for the cause of accidents at a signalized intersection like the AADT, speed, type of left turn control, pedestrian crossings etc., FHWA the most number of accidents at a signalized intersection are due to left turn .

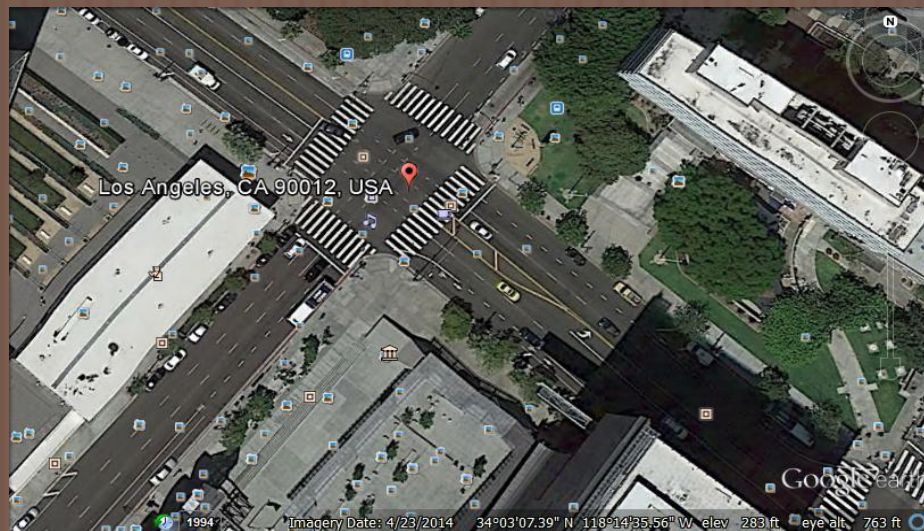
General Pictures of Traffic Signals



(a) Protected/Permissive Mode (b) Protected Only

Purpose of the study

- To weigh the various factors on a common scale and tell which could have more influence in a left turn collision.
- To set up the correlation of various factors on the left turning collisions.



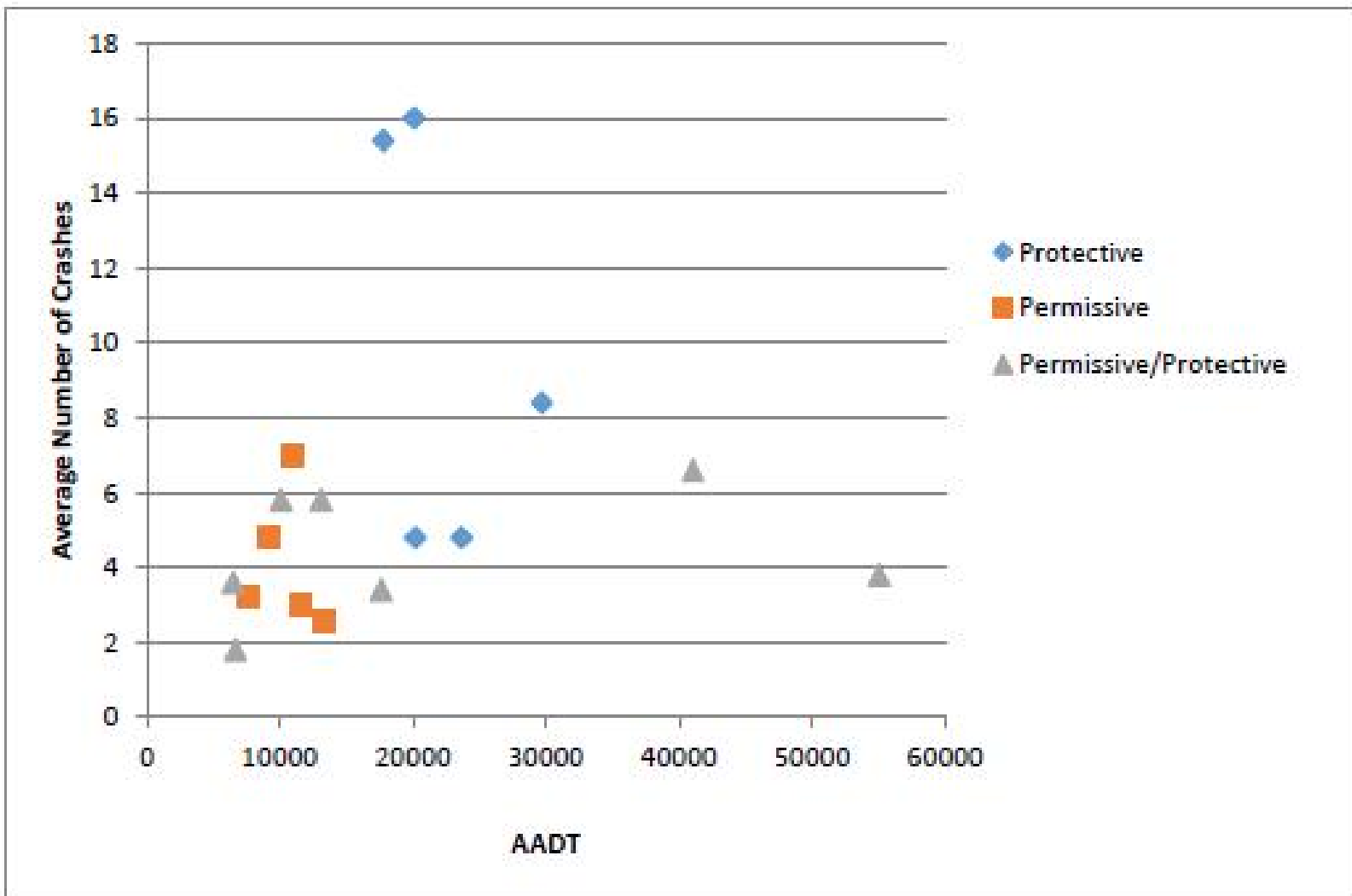
Methodology

- Study has been conducted on 17 signalized intersections in the cities of Long Beach and Los Angeles in California.
- Data collected include AADT, number of accidents, speed range and other factors from the Public works of city.
- A linear regression model is developed to study the effect of various factors on the left turning accidents at these intersections.
- Finally, a detailed analysis is made to ultimately give some solutions for the left turning collisions and also some basis for future research so as to reduce the left turning collisions.

Intersection information

O Z	Intersecti on	Street Direction	Speed Limit (mph)	No. of Lane (EB)	No. of Lane (WB)	Intersecti on	Street Direction	Speed Limit (mph)	No. of Lane (NB)	No. of Lane (SB)	Type of Signal		AAD T	Averag e Accide nts
											NB/SB	EB/WB		
1	1 st St	E/ W	30	3	3	Main St	N/ S	30	4	-	Protected	-	2367 1	4.8
2	108 th St	E/ W	30	2	2	Main St	N/ S	30	3	2	Permissive	Permissive	1159 6	3
3	104 th St	E/ W	30	1	1	Main St	N/ S	30	2	2	Permissive	Permissive	1331 0	2.6
4	Colden Ave	E/ W	30	1	1	Main St	N/ S	30	2	2	Permissive	Permissive	9142	4.8
5	120 th St	E/ W	30	2	2	Main St	N/ S	30	3	2	Permissive	Permissive	7631	3.2
6	Center Dr	E/ W	35	4	4	Seplulved a Blvd	N/ S	35	4	3	Protected/perm issive	Protected	5504 9	3.8
7	Venice Blvd	E/ W	35	2	2	Seplulved a Blvd	N/ S	35	4	4	Protected/perm issive	Protected	4105 1	6.6
8	Westches ter Pkwy	E/ W	35	2	3	Seplulved a blvd	N/ S	35	3	3	Protected/perm issive	Protected/perm issive	1761 8	3.4
9	Bellflowe r Blvd	E/ W	40	4	4	Atherton St	N/ S	40	3	3	Protected	Protected	2020 0	4.8
10	Palo Verde Ave	E/ W	35	3	2	Atherton St	N/ S	40	3	3	Permissive	Protected/perm issive	1010 0	5.8
11	Anaheim St	E/ W		3	3	Long Beach Blvd	N/ S		3	3	Left turn prohibited	Protected	2010 0	16
12	Pacific Coast Hwy	E/ W		3	3	Long Beach Blvd	N/ S		3	3	Protected	Protected	1780 0	15.4
13	Willow St	E/ W		3	3	Long Beach Blvd	N/ S		3	3	Protected	Protected	2970 0	8.4
14	10 th St	E/ W		2	2	Long Beach Blvd	N/ S		2	2	Permissive	Protected	1090 0	7
15	7 th St	E/ W		-	3	Long Beach Blvd	N/ S		2	2	Permissive	Protected	1310 0	5.8
16	Hill St	E/ W		2	2	Long Beach Blvd	N/ S		2	2	Permissive	Protected	6500	3.6
17	Burnett St	E/ W		2	2	Long Beach Blvd	N/ S		3	3	Permissive	Protected	6700	1.8

AADT vs. Average Number of Intersection Crashes



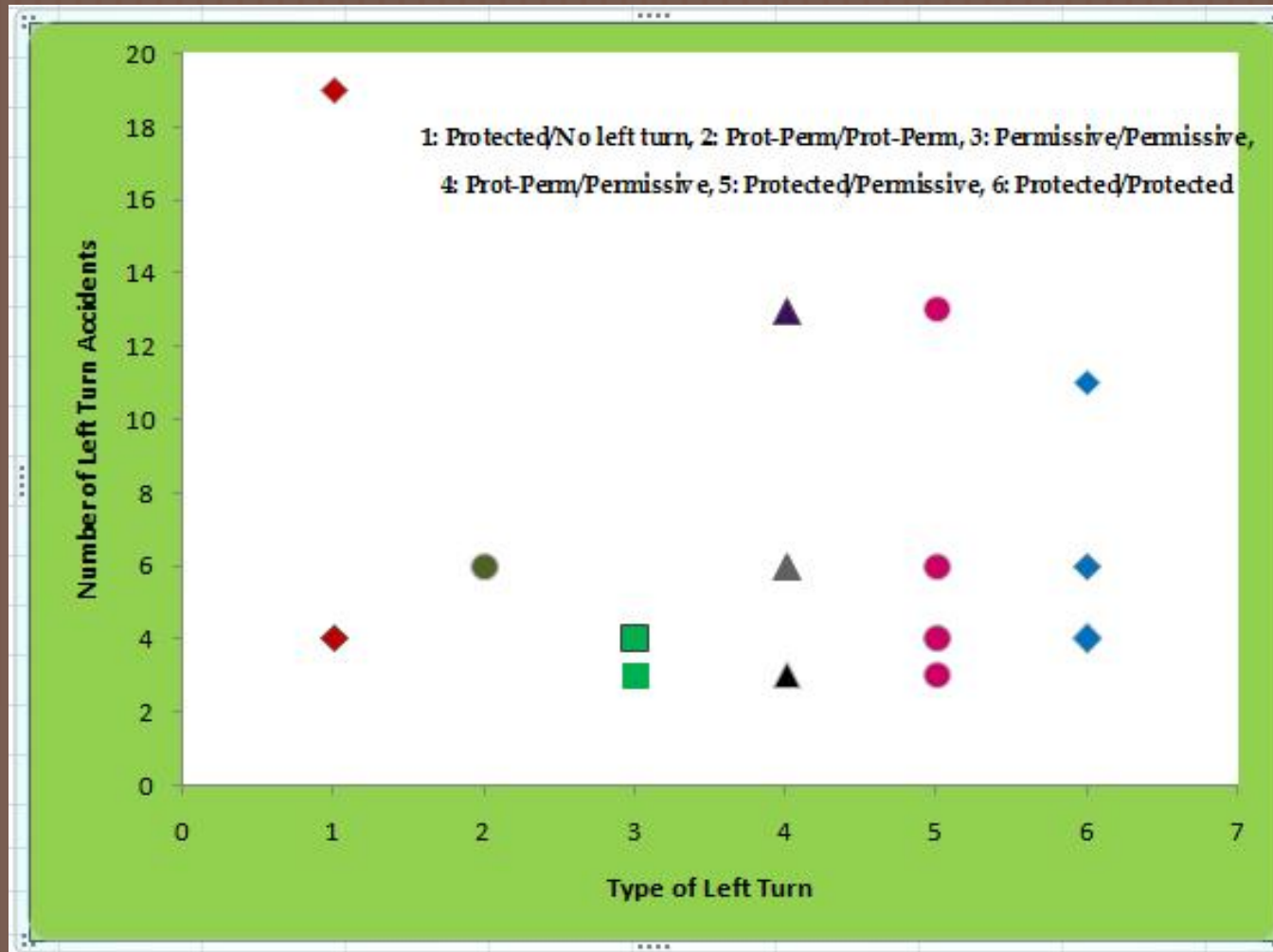
Linear Regression of Average Number of Accidents with AADT

Regression Model	Values
R	0.138158
R Square	0.019088
Std. Error of the Estimate	4.148667
Coefficient of Regression	5.135814
p-value	0.011346

Total left turn related accidents only with the types of signal

Intersection	Type of Signal	Total Left Turn Accident
1 st St-Main St	Protected/No Left Turn	4
108th St-Main St	Permissive/Permissive	3
104th St-Main St	Permissive/Permissive	3
Colden Ave-Main St	Permissive/Permissive	4
120 th St- Main St	Permissive/Permissive	3
Center Dr- Sepulveda Blvd	Prot-Perm/Permissive	3
Venice Blvd- Sepulveda Blvd	Prot-Perm/Permissive	6
Westchester Pkwy- Sepulveda Blvd	Prot-Perm/Prot-Perm	6
Bellflower Blvd- Atherton St	Protected/Protected	6
Palo Verde Ave-Atherton St	Prot-Perm/Perm	13
Anaheim St- Long Beach Blvd	Protected/No Left Turn	19
Pacific Coast Hwy- Long Beach Blvd	Protected/Protected	11
Willow St- Long Beach Blvd	Protected/Protected	4
10 th St- Long Beach Blvd	Permissive/Protected	13
7 th St- Long Beach Blvd	Permissive/Protected	6
Hill St-Long Beach Blvd	Permissive/Protected	4
Burnett St- Long Beach Blvd	Permissive/Protected	3

Intersections with Left turn accidents only Vs Types of left turn



Linear Regression of Average Number of Accidents

Variables	Linear Regression Coefficients	p-value	R Square	Std. Error of the Estimate
AADT	1.515	0.469121		
LANE	-4.64	0.071		
MEDN	1.573	0.13181	0.65675	3
PEDN	-2.51	0.37954		
LT SIGNAL	6.572	0.02837		
SPEED	0.3425	0.1742		

Crash Prediction Analysis

q A regression analysis is performed using the average accident data for five years.

q Independent variables used are AADT, travel speed, average number of lanes, presence of medians, pedestrian crossings, types of left turn control.

q By introducing dummy variable where 0 represents protected control and 1 represents permissive or combination of protective-permissive control, the type of left turn signal control is evaluated.

Crash Prediction Analysis (Cont.)

The resulting relationship is as follows:

$$\text{Acc} = 1.52 \ln(\text{AADT}) - 4.64L + 1.57\text{MDN} - 2.51\text{PED} + 6.57\text{LT SGNAL} + 0.34\text{SPD} - 5.81$$

Where,

Acc= average number of crashes;

AADT=annual average daily traffic;

L=total number of lanes at the intersection;

MDN=total number of medians at the intersection;

PED= total number of pedestrians at the intersection;

LT SGNAL=type of left turn signal control;

SPD= travel speed

Conclusion

- q Due to a very small sample size of 17 intersections from two different cities, some limitations are observed .
- q Data on each road changes were collected for five to six years.
- q Performing regression analysis at 10% significance level brought some correlation between the AADT and average no of accidents.



Conclusion (cont.)

- The analysis shows that traffic accidents and those factors (variables) have a relationship that could be useful for traffic engineers and the planners.
- Further studies may be needed to suggest different types of signals at the intersections.

Acknowledgements

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