The University of New Mexico

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Institute for Social Research

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Specifics & Findings

In this brief: Our review of the Red Light Camera system in Albuquerque, NM focused on determining the traffic safety impact measured by changes in crashes and the cost of crashes.

The full report titled *City of Albuquerque Red Light Camera Study Final Report*, can be found at: cabq.gov/redlight/

Main Findings

- The primary finding of a moderate net cost benefit supports the continued use of RLCs in Albuquerque. The moderate net cost benefit primarily derives from the reduction in the number of injury crashes relative to the increase in Property Damage Only crashes.
- The finding that this benefit varies by Red Light Camera intersection suggests a more targeted approach to the use of RLC systems. This is further supported by the finding that the mix of injury and Property Damage Only crashes also varies considerably by intersection.
- The reduction of red light running citations and speeding citations provides evidence and parallels the findings of other studies that RLC programs reduce the number and rate of red light running violations. Our study was not intended to address this issue and so the findings presented in this report are only preliminary.

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Report in Brief: City of Albuquerque Red Light Camera Study

The goal of this study is to report on the traffic safety impact of the Red Light Camera (RLC) system in Albuquerque, N.M. Traffic safety is generally measured by changes in crashes, the type and severity of crashes, and changes in the cost of crashes at RLC intersections.

The City of Albuquerque has 20 RLC intersections with 40 monitored approaches total. All intersections have 2 cameras (approaches) with the exception of Eubank and Montgomery, which has one monitored approach, and Coors and Montano which has 3 monitored approaches. All 40 approaches record both red light running violations and speeding violations. The program officially began in May 2005 and the last RLC intersection was added in April 2007. In an agreement with the New Mexico Department of Transportation (NMDOT) in April 2010 three RLC systems were shut off and since May 2010 the City has 17 operational RLC systems.

The 20 intersections were chosen because they were 20 of the most dangerous intersections in New Mexico as measured by traffic crashes and fatalities. All 20 intersections appear on a list of the top 50 crash intersections in 2001-2003 and 19 of the 20 intersections appear on the 2003-2005 most dangerous intersection list.

This study defines an intersection crash as a crash, which according to the information maintained in the statewide traffic crash database, occurred in the intersection or was intersection related. The database contains information on every crash that occurs in New Mexico with property damage over $500 and that occurs on public property.

Alcohol involved crashes were removed because they would have occurred regardless of the existence of the RLC system.

This report includes a brief literature review, a short methodology section, a brief description of the RLC system in Albuquerque, and an analysis of study crash and cost data.

Literature Review

In 2008 there were approximately 7,400 fatal crashes at intersections or that were intersection related (NHTSA, 2008). Approximately 2,600 of these fatal crashes were at signalized intersections. In addition, there were approximately 720,000 injury related crashes and approximately 1,550,000 property damage only crashes. Approximately 45 percent of all crashes are intersection-related (NHTSA, 2008). According to the Insurance Institute for Highway Safety, in 2008, 762 people were fatally injured and an estimated 137,000 people were injured in red light running crashes (www.iihs.org). A red light violation occurs when a vehicle enters an intersection some time after the signal light has turned red. Vehicles inadvertently in an intersection when the signal changes to red (i.e. waiting to turn left) are not red light runners. A nationwide study of fatal crashes at traffic signals in 1999 and 2000 estimated that 20 percent of drivers fail to obey traffic signals (http://www.iihs.org/research/qanda/rlr.html).

Several studies have shown that RLC programs reduce the number and rate of red light running violations (Retting et al., 1999). In short periods after RLC programs are implemented, violation rates drop dramatically. Some programs have seen reductions in violations of between 20 percent and 83 percent as drivers become accustomed to the presence of the cameras and are educated by the signs and public information campaigns that usually accompany RLC programs. In Greensboro, NC the violation rate declined by roughly 35 percent within several months. Some have suggested that reductions in violations translate into reduced crashes and improvements in safety.

Generally studies indicate that red light cameras are effective at reducing both red light violations and associated crashes. However, there is a broad range of methods that have been used to examine the effects of red light cameras with varying results (Retting, Ferguson, and Hakkert, 2003).

A meta-analysis of RLC literature found that most studies "are tainted by methodological difficulties that raise questions about any conclusions from them". One of the most important difficulties with RLC studies is the failure to account for what is known as "regression to the mean", which can exaggerate positive effects of RLC enforcement. Additionally, many studies do not account for the possibility of "spill-over effects," or the expected effect of RLCs on intersections other than the ones that are actually treated resulting from jurisdiction-wide publicity and the general public's lack of knowledge of where RLCs are installed (Federal Highway Administration, 2005).

In past studies RLC systems have been shown to not only reduce the severities of accidents, but to reduce the overall costs of accidents in intersections where they are installed as well (Council et al., 2005; Washington and Shin, 2005). The most severe and costly accidents at intersections are right-angle crashes (Washington and

Methodology

This study uses four methods to study the effectiveness of RLCs. These four methods are common in the traffic safety literature (Ozbay et al., 2009). Our study uses these four methods with some slight modifications. In the second and third method we calculate crashes per million entering vehicles (MEV). These methods are:

A simple before and after study. This method focuses on the comparison of the frequency and rate of crashes by total and type of crash (rear-end and right-angle) for a period of time before the installation of RLCs and for a similar period of time after the installation of RLCs.

Before and after study with a correction for traffic flow. This method adjusts the impact of RLC safety from the before to after study periods by correcting for traffic volumes. Traffic volume is an important factor that is influential on travel safety.

Before and after study using comparison intersections. This study uses comparison intersections in order to consider the effects of unrecognized factors. Comparison intersections are defined as intersections that are similar in crash rates, traffic volume, and geographic characteristics.

Before and after study with Empirical Bayes (EB) method. This method has been designed to adjust for the regression to the mean (RTM) problem, which is a serious problem associated with before and after traffic safety studies. Regression to the mean is a problem because intersections are chosen for RLCs because they are thought to have a relatively high rate of crashes.

A cost analysis that translates the estimated changes in the frequency of crashes to a dollar impact is also conducted.

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- Because of the variation in the change in traffic safety at RLC intersections an assessment of current RLC intersections focused on a review of the specific engineering countermeasures recommended by the Federal Highway Administration to reduce red light running should be considered.
- The evidence of a general deterrent spillover effect that was found in the comparison intersections is important and deserves further study.
- As changes are made to the current RLC system it would be useful to study how these changes impact traffic safety at RLC intersections and traffic safety generally in Albuquerque.
- In our review of yellow light interval timings at both RLC and comparison intersections we found very few differences with the stated city time. We also found these yellow light interval times met national standards.
- RLC intersections have the highest crash rates among all Albuquerque intersections.

Target Audience:

Mayor's Office, City of Albuquerque; Albuquerque City Council; Albuquerque citizens; other local and state government policymakers; law enforcement agencies; and traffic safety researchers.

Table 1. Albuquerque Intersection Crashes 2000-2008						
Variable	**Citywide Crashes**		**Comparison Crashes**		**RLC Crashes**	
Intersection Count	~600		38		20	
Crash Count	44,474		7,174		6,331	
Average Crashes per Intersection	65.60		188.79		316.55	
	Count	Percent	Count	Percent	Count	Percent
Fatal	39	0.1	6	0.1	2	0.03
Injury	16,229	36.5	2,498	34.8	2,067	32.6
PDO	28,206	63.4	4,670	65.1	4,262	67.3
Angle	20,656	46.4	2,747	38.3	1,720	27.2
Rear-end	23,818	53.6	4,427	61.7	4,611	72.8

Shin, 2005). At intersections where RLCs are installed, studies have revealed the number of angle and left turn crashes decrease, and the number of rear-end collisions increase. Rear-end crashes have been shown to be less severe and less costly than angle crashes (Council et al., 2005).

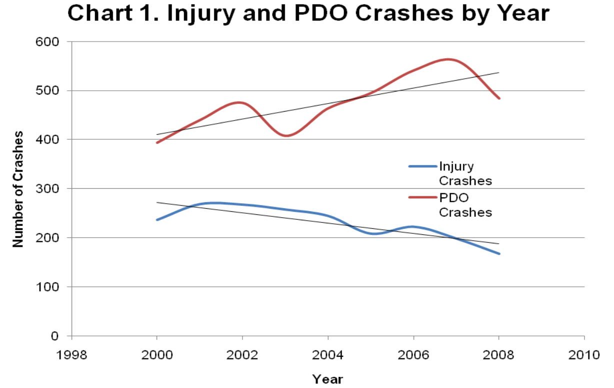
Albuquerque Crashes

Between January 2000 and December 2008 there was 44,474 crashes at signalized intersections in Albuquerque, 7,174 crashes at the 38 comparison intersections, and 6,331 crashes at the 20 RLC intersections.

Chart 1 displays the number of RLC injury and PDO crashes by year. Both the number and percent of angle crashes and injury crashes decreased from January 2000 through December 2008 while the number and percent of rear-end and property damage only crashes increased.

Table 2 reports the findings from the Empirical Bayesian (EB) analysis that determines the safety impact of the RLC system. This analysis compares crashes that did occur at RLC intersections (the actual crashes) and the crashes that would have occurred had no camera been installed (the predicted crashes generated by the EB analysis).

Chart 1. Injury and PDO Crashes by Year



For a safety improvement to exist the number of crashes expected (EB expected) must exceed the actual number of crashes (actual crash count) that occurred in the after time period. There was a change of +3.5% in the number of actual crashes compared to the expected, a 18.2% decrease in the number of actual injury crashes, and an increase of 13.2% in the number of actual PDO crashes. The index of effectiveness included in the last column notes the RLC system improved safety overall for all crashes, injury crashes, and PDO crashes.

The count of expected to actual crashes at the comparison intersections decreased 9.9% for all crashes, decreased 29% for injury crashes and increased 0.3% for PDO crashes. Because separate analyses were completed for total crashes, injury crashes, and PDO crashes the sum of the injury crashes and PDO crashes do not equal the total crashes.

Table 2. Empirical Bayes Safety Impact						
Crashes	**Pre-Period Crash Count**	**EB Post-Period Crash Count Expected**	**Actual Post-Period Crash Count**	**Percent Change In Crash Fre-quency**	**Crash Differ-ence**	**Index of Effective-ness**
RLC Intersections						
Total	1,740	1,707	1,769	+3.5%	+62	0.98
Injury	579	561	459	-18.2%	-102	0.94
PDO	1,161	1,142	1,308	+13.2%	+166	0.97
Comparison Intersections						
Total	1,954	1,984	1,787	-9.9%	-59	0.94
Injury	681	699	496	-29.0%	-203	0.88
PDO	1,269	1,286	1,290	+0.3%	+4	0.93

As indicated in Table 3 there was a cost savings of $2,652,000 based on a predicted reduction of 102 injury crashes through December 2008 and an increase of $398,400 based on a predicted increase of 166 PDO crashes. The RLC system experienced a moderate aggregate crash cost benefit of $2,253,600 ($2,652,000 - $398,400) from the activation of the first RLC system in October 2004 through December 2008.

This cost estimate varies by RLC intersection. Two intersections experienced no increase or decrease in crash costs, 6 intersections experienced increases in injury crash costs, and 12 intersections had decreases in injury crash costs. Twelve intersections experienced increased PDO crash costs and 8 intersections experienced decreased PDO

Table 3. Estimated Costs

Severity	EB Estimated After Crashes	Actual After Crashes	Change	Cost per Crash	Calculated Cost
Injury (K+A+B+C)	561	459	-102	$26,000	$2,652,000
Possible Injury (O)	1,142	1,308	+166	$2,400	-$389,400

crash costs. Ten intersections that experienced at least a moderate cost reduction per year (~$50,000) we considered to have increased or improved traffic safety. Four intersections that experienced at least a moderate cost increase per year (~$50,000) we considered to have a reduction in traffic safety. The remaining six intersections are those that experienced either small annual reductions or increases in cost and we considered these to be relatively flat with either small increases or reductions in safety. Three of the four intersections (Coors and Montano, Coors and Paseo del Norte, and Jefferson and Paseo del Norte) that had at least moderate annual increases in cost were deactivated in May 2010.

Conclusion

In the Empirical Bayesian analysis certain RLC intersections were shown to be associated with beneficial effects and some RLC intersections were shown to be associated with a reduction in safety. This is similar to what has been found in other studies (Garber et al, 2005) and this finding was supported by the findings in the other three methods. An overall moderate cost benefit was found based on the decrease in injury crashes relative to the increase in PDO crashes and the cost associated with each. We also found differences by RLC intersection with some intersections experiencing increases and some intersections experiencing reductions. We believe the method used to measure the cost benefit produces a conservative estimate

The findings in this study have policy implications for the use of RLCs in Albuquerque at signalized intersections and suggest several courses of action. First, the primary finding of a moderate net cost benefit supports the continued use of RLCs in Albuquerque. Second, the finding that this benefit varies by intersection suggests a more targeted approach to the use of RLC systems. This is further supported by the finding that the mix of injury and PDO crashes also varies considerably by intersection. Third, the reduction of red light running citations and speeding citations provides evidence and parallels the findings of other studies that RLC programs reduce the number and rate of red light running violations. Fourth, because of the variation in the change in traffic safety at RLC intersections an assessment of current RLC intersections to reduce red light running should be considered. Fifth, the evidence of a general deterrent spillover effect that was found in the comparison intersections is important and deserves further study.

As noted by Washington and Shinn (2007) RLC systems are not a complete remedy to address red light running problems that include crashes at intersections. RLC systems are one of several possible countermeasures that can be utilized to address crash problems at intersections.

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