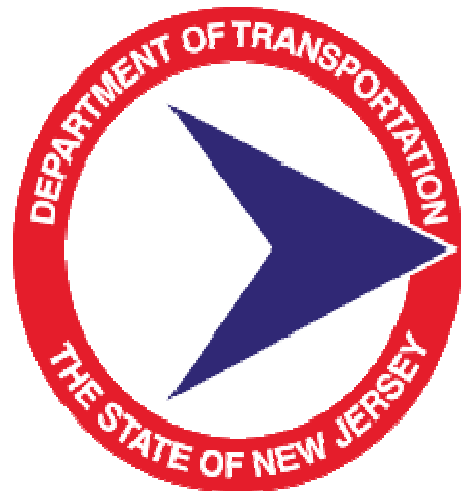


# **REPORT ON RED-LIGHT TRAFFIC CONTROL SIGNAL MONITORING SYSTEMS Second Annual Report**

Prepared by the New Jersey  
Department of Transportation

November 2012



## **Executive Summary**

Public Law 2007, Chapter 348 (P.L. 2007, c.348), signed into law on January 13, 2008, requires the New Jersey Department of Transportation (Department) to establish a five-year pilot program to determine the effectiveness of the installation and utilization of traffic control signal monitoring systems in New Jersey. The pilot program officially began December 16, 2009, the date the first monitoring system was activated. This second annual report and its associated technical appendix describes the pilot program and analyzes the safety data for all authorized monitoring systems where violations have been issued for at least one year for the time period ending December 31, 2011.

A traffic control signal monitoring system, also known as a Red Light Running (RLR) system, is an integrated device utilizing one or more cameras and sensors that work in conjunction with a traffic control signal to produce images of vehicles that disregard a red signal or “run a red light.” These images are transmitted to law enforcement officials who review both still photos and video produced by the system to determine if a violation has in fact occurred.

As per P.L. 2007, c.348, the Department’s goal is to establish RLR systems at locations where previous engineering, enforcement and educational efforts have not been effective in decreasing traffic violations or crashes attributed to running red lights. Through this report and those that will follow for years three (3) through five (5), the Department will determine the effectiveness of these systems by analyzing the citation data for month-by-month and annual trend line patterns. The crash data will be analyzed for patterns in the number of crashes that are attributable to running red lights, as well as the severity and associated costs of those crashes.

As of May 1, 2012, there were eighty-three (83) intersections in twenty-five (25) municipalities authorized for program participation. Based on the established reporting parameters, monitoring systems at two (2) RLR locations in Newark now have two (2) years of data for study analysis. Additionally, twenty-four (24) intersections within nine (9) municipalities in six (6) counties have been recording violations for at least one (1) full year.

For the two locations with two (2) years of data, when the Pre-Camera year crash data is compared to Year 2 crash data, right-angle crashes are down 86%, same-direction crashes are down 42%, total crashes are down 57%, and estimated severity costs have been reduced by \$268,900. Crash severity cost is the overall cost attributable to running red lights, which include such things as vehicle damage, property damage, emergency response, and medical care.

Regarding the citations issued, comparing month one of operation with month 24, citations are down 85%. Generally, there is noted a consistency in month-to-month issuance of citations while there is still an overall downward trend in the number of citations issued. More importantly, all monthly Year 2 data points at both intersections are lower than the corresponding Year 1 data points. While there is no expectation that

citations will drop to zero, there is an expectation that driver behavior will change with RLR, and these locations appear to be fulfilling these expectations.

Combining all RLR locations and comparing the Pre-Camera installation 12-month time period versus the Year 1 installation 12-month time period, the data indicate that total crashes are up 0.9%, however, more severe right-angle crashes are down 15%, while same-direction (rear-end) crashes are up 20%. Crash severity cost increased by an estimated \$1,172,800. The number of citations issued statewide in Year 1 decreased by 50% when comparing the citations issued in the first month of operation versus those issued in month twelve.

**Recommendation**

***The data from the two sites having two full years of operation shows a reduction in all types of crashes, however, the data are still too limited to draw any definitive conclusions about the pilot program at this time. The Department therefore recommends continued data collection and monitoring of RLR program intersections.***

## **Introduction**

As communities across the nation seek to address crashes and reduce both injuries and fatalities, they are increasingly looking for tools to supplement traditional enforcement resources. One of the safety tools over 550 communities, including those in New York and Pennsylvania, have employed is a Traffic Control Signal Monitoring System, better known as a Red Light Running (RLR) system. The first such system was installed in New York City in 1991. An RLR system is an integrated device using multiple cameras and vehicle sensors, which work in conjunction with a traffic control signal, to produce still pictures and video images of vehicles that disregard a red signal or “run a red light.”

P.L. 2007, c.348 (N.J.S.A. 39:4-8.12 et al.) signed into law on January 13, 2008, requires the Department to establish a five-year pilot program to determine the effectiveness of the utilization of RLR systems in New Jersey and to administer all aspects of this program. The statute outlines the application requirements and mandates municipal governing bodies to establish the installation and use of RLR systems via ordinance. The statute also requires these municipalities to conduct periodic RLR equipment inspections and lays out annual reporting requirements for municipalities and the Department.

## **Authorization Process**

Municipalities desiring to participate in the pilot program must submit an application to the Department. Applications are available on the Department’s website at: [www.state.nj.us/transportation/refdata/rlr/](http://www.state.nj.us/transportation/refdata/rlr/). At locations authorized for program participation, the affected municipalities are required to submit an ordinance establishing the monitoring system.

Upon receiving an application the Department extracts the crash, citation and volume data which is analyzed by staff within the Department’s Division of Highway and Traffic Design, producing an overall intersection safety score. The applications are then ranked. The municipality will generally receive a response within forty-five (45) days of application submission. While the program is currently at full participation, new applications continue to be submitted, scored and ranked. See *Technical Appendix for Report on Red-Light Traffic Control Signal Monitoring Systems Second Annual Report* available at the following website:

<http://www.state.nj.us/transportation/publicat/lmreports/> for more detailed information.

## **Program Participants**

Since inception, a total of sixty-two (62) municipalities have submitted two-hundred twenty-seven (227) RLR applications to the Department. The Department has capped participation at twenty-five (25) municipalities. The following is a list of the authorized participants as of May 1, 2012, along with the dates of their authorizations:

Brick Township (Ocean) 6/1/09
Cherry Hill Township (Camden) 3/16/09
Deptford Township (Gloucester) 3/16/09
East Brunswick Township (Middlesex) 11/21/08
East Windsor Township (Mercer) 6/20/11
Edison Township (Middlesex) 1/29/09
Englewood Cliffs Borough (Bergen) 1/11/11
Glassboro Borough (Gloucester) 3/16/09
Gloucester Township (Camden) 3/16/09
Jersey City (Hudson) 8/2/10
Lawrence Township (Mercer) 1/29/09
Linden City (Union) 1/29/09
Monroe Township (Gloucester) 3/16/09
Newark City (Essex) 11/21/08
New Brunswick City (Middlesex) 1/29/09
Palisades Park Borough (Bergen) 9/13/10
Piscataway Township (Middlesex) 12/1/08
Pohatcong Township (Warren) 9/13/10
Rahway City (Union) 9/13/10
Roselle Park Borough (Union) 12/1/08
Springfield Township (Union) 5/2/11
Stratford Borough (Camden) 3/16/09
Union Township (Union) 5/2/11
Wayne Township (Passaic) 1/29/09
Woodbridge Township (Middlesex) 3/16/09

There has been one revision to the list of authorized municipalities included in the 2011 report. South Brunswick Township, which had received authorization to participate on March 16, 2009, could not garner the council majority needed to pass a Township ordinance in support of program participation. As such, South Brunswick's authorization was rescinded on June 20, 2011, and replaced by East Windsor Township. East Windsor had, at that time, the highest safety score of the municipalities with pending applications, making it the next priority location for an RLR system.

Although the number of program participants is capped, the number of intersections within those participating municipalities has expanded since June 1, 2011, from fifty-nine (59) to eighty-three (83), representing a 41% increase. Program location additions are determined by the safety score generated from the application's data. If the safety score is equal to or greater than the established safety standard, the new application from that municipality will be authorized to participate within the program as well.

### **Yellow Change Interval**

Considering its effect on data collection and program viability, a discussion of the methodology of determining the yellow change interval at signals is appropriate. In New Jersey, yellow change intervals are determined by nationally accepted standards. The Department's guiding principle is the 2009 edition of the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), as amended and supplemented. Section 4D.26 of the MUTCD states: *The duration of the yellow change interval shall be determined using engineering practices.* The MUTCD is adopted in New Jersey through existing motor vehicle law, specifically Title 39 of the Revised Statutes. The accepted engineering practice to determine yellow change intervals is from the Institute of Transportation Engineers' 1994 report, "Determining Vehicle Signal Change and Clearance Intervals". For more detailed information, see *Technical Appendix for Report on Red-Light Traffic Control Signal Monitoring Systems Second Annual Report* available at the following website <http://www.state.nj.us/transportation/publicat/lmreports/>.

New Jersey continues to follow nationally accepted standards and does not accept practices such as reduction of yellow intervals at any signalized intersection. Municipalities are required to conduct six-month operational inspections regarding the RLR cameras and related equipment, pursuant to N.J.S.A. 39:4-8.14(e). Should any RLR-authorized municipality reduce yellow change intervals and the Department becomes aware of such actions, program authorization will be rescinded immediately.

### **Overall Data Analysis**

As per N.J.S.A. 39:4-8.17, authorized municipalities must submit reports every twelve (12) months, detailing increases or decreases in crashes or citations. The Department is focused on two (2) types of crashes: right-angle and same-direction (rear-end). The reason for this focus is that a right-angle crash is the only crash type determined to be directly attributed to red light running. Additionally, national reports of RLR programs have generally shown a slight to moderate rise in same-direction crashes due to sudden stops by motorists knowing of the presence of RLR cameras.

### **Crash Severity and Cost**

National studies that focus exclusively on raw numbers and associated percentage changes are missing the critical factor of crash severity. For example, at a location where right-angle crashes decreased by two (2) but same-direction crashes increased by three (3), it might be concluded that RLR was ineffective, as the total number of crashes increased. However, in general, right-angle crashes tend to be much more severe when compared to other crash types. As a result, crashes must be analyzed not only numerically but also by severity.

One way to measure crash severity is to estimate and compare the monetary cost of crashes. Costs considered include, but are not limited to, vehicle damage and repair, damage to property, emergency response, medical care, and even funeral costs. The

U.S. Department of Transportation and the Federal Highway Administration outlined in a January 2010 report “Highway Safety Improvement Program Manual – The Focus is Results” that the National Safety Council developed a scale of five (5) categories of injuries: fatality, disabling injury, evident injury, possible injury, and property damage only (no injury). Table 1 shows these categories and associated costs.

**Table 1: Crash Severity Costs**

<b>Severity</b>	
<b>K = Fatality</b>	\$4,008,900
<b>A = Disabling Injury</b>	\$216,000
<b>B = Evident Injury</b>	\$79,000
<b>C = Possible Injury</b>	\$44,900
<b>O = Property Damage Only</b>	\$7,400

### **Citation Data**

There can be no true comparison of citations issued by a police enforcement presence versus an RLR system. The Department expects that the presence of RLR would reduce the number of automated citations issued, certainly year-to-year if not month-to-month, indicating that motorist behavior is changing. The specific violation associated with RLR is N.J.S.A. 39:4-81, failure to observe the instructions of a traffic control signal.

### **Year 2 Analysis**

Out of the twenty-four (24) locations with at least one full year of RLR operation, two (2) of those intersections, Broad Street & Market Street and Broad Street & Raymond Boulevard, both in Newark City, now have been operational for two (2) full years. As discussed within the 2011 RLR Report, when compared to the Pre-Camera installation year of 2009, the Year 1 (2010) data revealed that total crashes were down 45%, right-angle crashes were down 57%, and same-direction crashes were down 50%. Additionally, crash severity costs were reduced by an estimated \$149,000, and both locations experienced a decreasing trend line regarding the number of citations issued.

At Broad Street & Market Street, when comparing Year 1 to Year 2 crash data, right-angle crashes were reduced by 50%, same-direction crashes were down 50% and total crashes decreased by 29%. Regarding estimated severity values, right-angle crash costs were down by \$44,900 and same-direction crash costs were reduced by \$97,200, resulting in a net public benefit of \$142,100. For Broad Street & Raymond Boulevard, right-angle crashes were down 100% (1 to 0), while same-direction crashes increased numerically from zero (0) to four (4). Total crashes remained constant, with five (5) occurring in each year. Regarding estimated severity costs, right-angle crash costs were reduced by \$44,900, but same-direction crash costs increased by \$67,100, resulting in a net public cost of \$22,200. Overall, right-angle crashes experienced at

these two locations were down 67%, same-direction crashes went up by 17%, and total crashes decreased by 23%, with the intersections experiencing a net Year 2 severity cost benefit of \$119,900.

The Year 1/Year 2 (2011) RLR operational crash comparison is detailed within Table 2; the severity cost comparison is detailed within Table 3.

**Table 2: Year 1 and Year 2 Count of Crash Types per Intersection**

**Year 1 Camera Installation**

Intersection	Municipality	County	Right Angle Crashes	Same Direction Crashes	Total (incl. non-RLR)
Broad St. and Market St.	Newark City	Essex	2	6	21
Broad St. and Raymond Blvd.	Newark City	Essex	1	0	5

**Year 2 Camera Installation**

Intersection	Municipality	County	Right Angle Crashes	Same Direction Crashes	Total (incl. non-RLR)
Broad St. and Market St.	Newark City	Essex	1	3	15
Broad St. and Raymond Blvd.	Newark City	Essex	0	4	5

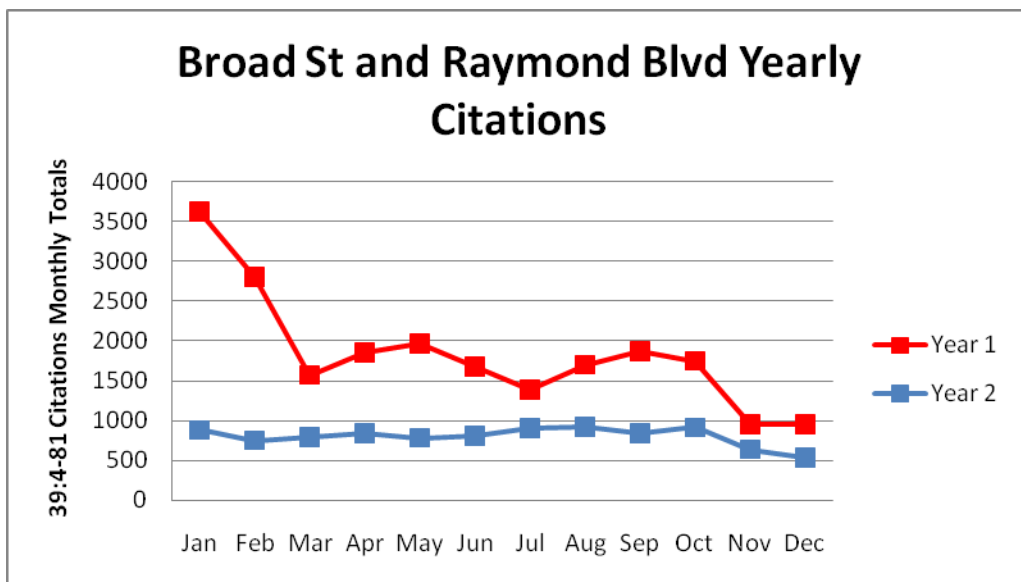
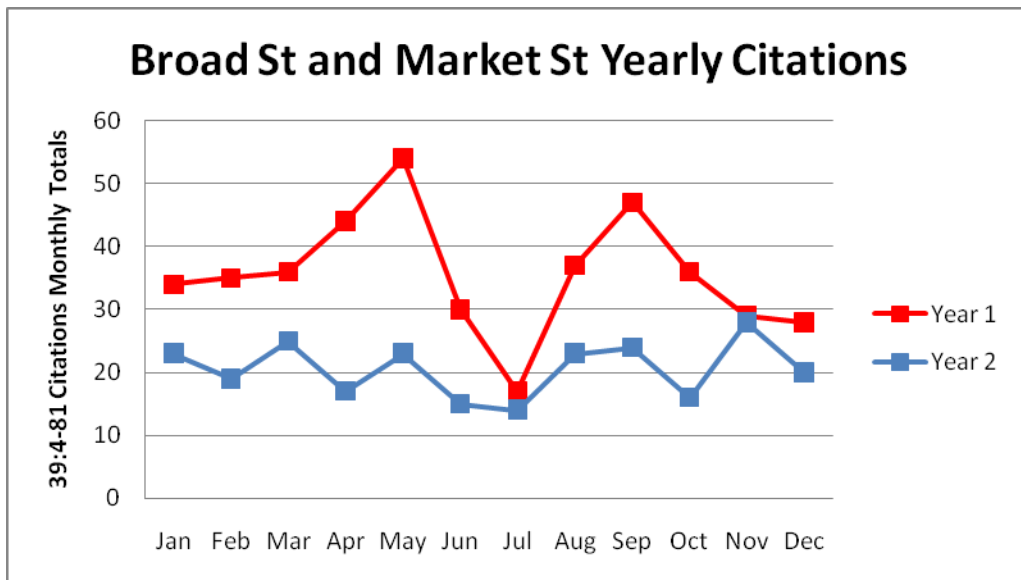
**Table 3: Year-to-Year Cost/Benefit Analysis Summary**

Intersection	Municipality	County	Year 1 to Year 2		Net Benefit [Loss]
			Right Angle	Same Direction	
Broad St. and Market St.	Newark City	Essex	\$44,900	\$97,200	\$142,100
Broad St. and Raymond Blvd.	Newark City	Essex	\$44,900	(\$67,100)	(\$22,200)

Comparing the number of automated citations issued in January 2011 with those issued in December 2011, Broad Street & Market Street saw a decrease of 13%, and Broad Street & Raymond Boulevard saw a decrease of 39%. For both intersections combined, a total of 910 citations were issued in January, compared to 558 issued in December, a total decrease of 39%. Citation comparisons are detailed in Chart 1.



**Chart 1: Year 1 and Year 2 Count of Citations per Intersection**



When comparing the Pre-Camera year crash data to Year 2, at Broad & Market, right-angle crashes remained unchanged (1 to 1), same-direction crashes were reduced by 50% (6 to 3), total crash experience was reduced by 46% (28 to 15), and estimated total crash costs were reduced by \$97,200. For Broad & Raymond, right-angle crashes were reduced by 100% (6 to 0), same-direction crashes were reduced by 33% (6 to 4), total crashes were reduced by 74% (19 to 5) and crash costs were reduced by \$171,700. Overall, right-angle crashes are down 86%, same-direction crashes are down 42%, total crashes are down 57%, and estimated severity costs have been reduced by \$268,900.

As for citations issued, at Broad & Market, comparing month 1 of operation with month 24, citations are down 41%. For Broad & Raymond, citations are down 85%. Combined, a total of 3,652 citations were issued in January 2010, compared to 558 issued in December 2011, a total decrease of 85%.

Two interesting notes can be found in Chart 1. First, there is a general consistency of month-to-month issuance of citations while still maintaining an overall downward trend line. Both locations indicate a leveling pattern, which suggests that drivers are modifying their behavior due to the presence of RLR cameras. Second, and more importantly, all monthly Year 2 data points at both intersections are lower than the corresponding Year 1 data points. While there is no expectation that citations will drop to zero, there is an expectation that driver behavior will change with RLR, and these locations appear to be fulfilling these expectations.

These values and trends are encouraging, however, as was concluded within the 2011 Report, two points of data within a program of statewide focus are much too limited to allow any meaningful conclusions to be drawn. While a downward trend has been observed, it is anticipated that the 2013 Report will be able to draw more concrete programmatic conclusions at these two intersections when three (3) years of data is analyzed.

### **Statewide – Year 1 Analysis**

For calendar year 2011, twenty-four (24) locations statewide have had RLR systems in operation where citations have been issued for at least one full year. Using the data submitted within the various municipal reports, the Pre-Camera year was compared to Year 1. In other words, for all twenty-four (24) locations, the first twelve (12) months of operation under the issuance of RLR citations are being examined against the previous twelve (12) months of operation prior to the activation of RLR. These twelve (12)-month periods vary for each location, depending upon the month and year that RLR was activated. Table 4 provides a summary of that analysis. See *Technical Appendix for Report on Red-Light Traffic Control Signal Monitoring Systems Second Annual Report* at the following website <http://www.state.nj.us/transportation/publicat/lmreports/> for more detailed information on crash data, severity costs, and citations issued at these locations.

**Table 4: Pre- and Post-Year Count of Crash Types per Intersection**

#### **Statewide - RLR Intersections**

<b>Crashes</b>	<b>Right Angle</b>	<b>Same Direction</b>	<b>Other</b>	<b><u>Total</u></b>
<b>Pre-Camera</b>	60	286	231	577
<b>Year 1</b>	51	343	188	582

#### **Statewide - Reference Intersections**

<b>Crashes</b>	<b>Right Angle</b>	<b>Same Direction</b>	<b>Other</b>	<b><u>Total</u></b>
<b>Pre-Camera</b>	23	79	47	149

<b>Year 1</b>	23	81	47	151
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Comparing the crash data at the twenty-four (24) RLR locations, total crashes increased by 0.9%. For the focus RLR crash types, right-angle crashes decreased by 15%, while same-direction crashes increased by 20%.

As per P.L. 2007, c.348, each municipality must designate a control location or “reference intersection”. The purpose of this requirement is to provide as much of a direct crash comparison between intersections with and without RLR cameras as possible. With nine (9) municipalities encompassing the twenty-four (24) RLR intersections analyzed within this Report, there are nine (9) reference intersections. At these locations, total crashes increased by 1.3%. For the focus crash types, right-angle crashes remained unchanged and same-direction crashes increased by 2.5%.

The Department compared crash severity data for the Pre-Camera year conditions to the Year 1 conditions for all twenty-four (24) RLR locations, as well as for the nine (9) municipal reference intersections. Table 5 provides a summary of the statewide RLR crashes by severity type, while Table 6 provides a summary of the statewide cost/benefit analysis.

**Table 5: RLR Crashes by Severity Type**

**Statewide - RLR Locations**

**Right Angle Crashes**

<b>Severity</b>	<b>K</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>O</b>	<b><u>Total</u></b>
<b>Pre-Camera</b>	0	0	1	20	39	60
<b>Year 1</b>	0	0	5	26	20	51

**Same Direction Crashes**

<b>Severity</b>	<b>K</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>O</b>	<b><u>Total</u></b>
<b>Pre-Camera</b>	0	1	1	72	212	286
<b>Year 1</b>	0	0	4	80	259	343

**Statewide - Reference Intersections**

**Right Angle Crashes**

<b>Severity</b>	<b>K</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>O</b>	<b><u>Total</u></b>
<b>Pre-Camera</b>	0	0	3	3	17	23
<b>Year 1</b>	0	0	1	4	18	23

**Same Direction Crashes**

<b>Severity</b>	<b>K</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>O</b>	<b><u>Total</u></b>
<b>Pre-Camera</b>	0	0	0	11	68	79
<b>Year 1</b>	0	0	2	18	61	81

**Table 6: Year-to-Year Cost/Benefit Analysis Summary**

<b>Statewide - Benefit/(Loss)</b>			
<b>Benefit/(Loss)</b>	<b>Pre-Camera to Year 1</b>		
	<b>Right Angle</b>	<b>Same Direction</b>	<b><u>Total</u></b>
<b>RLR Locations</b>	<b>(\$444,800)</b>	<b>(\$728,000)</b>	<b>(\$1,172,800)</b>
<b>Reference Intersections</b>	<b>\$105,700</b>	<b>(\$420,500)</b>	<b>(\$314,800)</b>

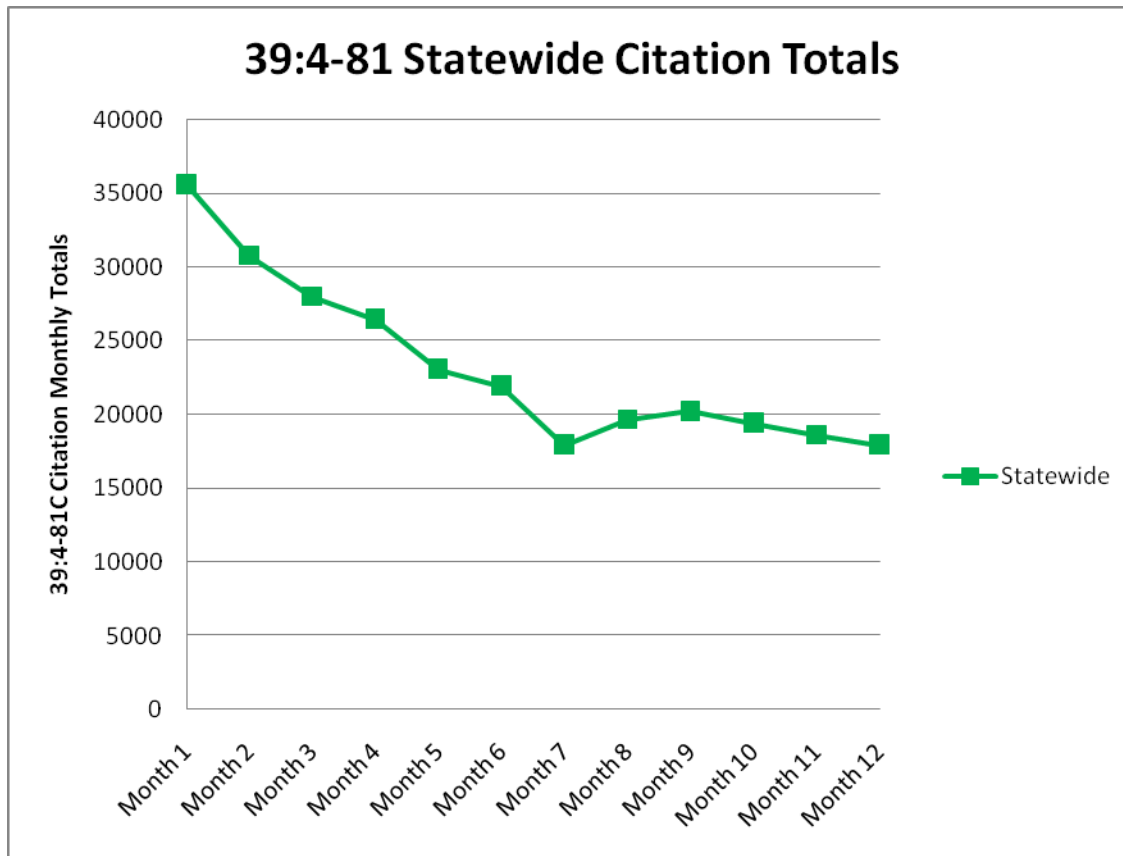
Comparing Pre-Camera year and Year 1, right-angle crash costs at the RLR locations increased by \$444,800. As detailed in Table 5, this was due to a greater number of recorded injury crashes and differences in injury category, even though right-angle crashes decreased numerically by nine (9). For the same time period at the designated reference intersections; right-angle crash costs decreased by \$105,700, even though the same number of crashes were recorded each year. Regarding same-direction crashes, crash costs at the RLR locations increased by \$728,000 while seeing the number of crashes increase by fifty-seven (57). At the reference intersections the crash costs increased by \$420,500 with the number of crashes increasing by two (2).

Combining the data for the twenty-four (24) RLR locations, the focus crash costs had a total Pre-Camera year to Year 1 public cost of \$1,172,800; for the nine (9) reference intersections, the total public cost was \$314,800.

The Statewide – Year 1 crash analysis reveals that the RLR right-angle crash numbers are lower than their reference location counterparts. However, the data appear to be conflicting, with positive decreases in the number of right-angle crashes combined with unexpected increases in the severity of those crashes, as well as a noticeable difference in RLR/reference location same-direction crashes. As such, it is important to remember that safety trends are never established over a single year, and as such additional sustained analysis is needed before concrete conclusions can be drawn.

Regarding citations, the following chart (Chart 2) details the by-month post-RLR citation data for all twenty-four (24) locations.

**Chart 2: Year 1 Statewide Citation Totals**



Combining all twenty-four (24) locations statewide, the overall decrease in citations issued in the first month of RLR operation as compared with the amount issued in the twelfth month was 50%, with 35,644 violations issued in month one versus 17,934 citations in month twelve.

The overall goal regarding RLR citations is decreasing trend lines of citation issuance. While there were some regional and individual location exceptions, and most intersections experienced a monthly fluctuation, Chart 2 reveals a nearly constant decrease in RLR citations issued statewide.

### **Frequently Asked Questions (FAQs)**

Throughout this Annual Report and its Technical Appendix, the narrative is designed to answer all programmatic and data-related questions. However, the Department realizes that there are many additional questions generated by this Pilot Program and by RLR in general. A list of frequently asked questions and their explanations is available at the following website <http://www.state.nj.us/transportation/refdata/rlr/>.

### **Conclusions and Next Steps**

The Department's focus remains solely on the potential safety benefits provided through RLR. Following that focus, the data shows decreases in right-angle crashes; decreases in the number of citations issued; and a continuation of those trends for the locations at which RLR has operated for two years—however, it is not prudent at this time to draw any final conclusions. Of the fifty-nine (59) locations that had been authorized as of June 1, 2011, only 41% managed to initiate RLR operation to the point of achieving one full year of data by the end of 2011. Also, of the authorized municipalities, only nine (9) municipalities (representing 36% of the overall program) are included within this Second Annual Report.

As such, further sustained analysis is needed and the Department recommends that the Traffic Control Signal Monitoring Systems Pilot Program continue.

### **Acknowledgments**

The Department acknowledges its staff within the Bureau of Traffic Engineering and the Bureau of Transportation Data and Safety, along with support from the staff at the Transportation Safety Resource Center at Rutgers University's Center for Advanced Infrastructure and Technology, for their roles in administering the pilot program and for researching and compiling this Annual Report.