REPORT ON RED-LIGHT TRAFFIC CONTROL SIGNAL MONITORING SYSTEMS

Third Annual Report

Prepared by the New Jersey Department of Transportation

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. Because the law establishing the pilot program authorizes the use of traffic control signal monitoring systems only during the five-year pilot program, this pilot program will end in December 2014. Notably, after December 16, 2014, municipalities will lack statutory authority to continue the operation of traffic control signal monitoring systems, including the issuance of citations for red light violations. This third 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, 2012.

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, the Department will evaluate the effectiveness of these systems by analyzing the citation data for month-by-month and annual milestone-month 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 December 31, 2012, there were eighty-three (83) intersections in twenty-five (25) municipalities within eleven (11) counties authorized for program participation. Based on the established reporting parameters, monitoring systems at two (2) RLR locations now have three (3) years of data for study analysis. Additionally, twenty-two (22) intersections have been active for two (2) full years and another twenty-three (23) intersections have been operating for one (1) full year. This annual report analyzes the data generated within each distinct group, as well as provides a program-wide analysis of the data generated within each year of operation.

For the two (2) locations with three (3) years of data, when the Pre-Camera year crash data is compared to Year 3, right-angle crashes are down 86%, rear-end crashes are down 58%, total crashes are down 72%, and estimated crash severity costs have been reduced by $246,200. Regarding the citations issued at these locations, comparing Month 1 (the first month) of operation with Month 36 (the last month at the end of the three year period), citations are down 83%. While there is no expectation that either

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

For the twenty-two (22) locations that have been active for two (2) full years, when the Pre-Camera year data is compared to Year 2, right-angle crashes are down 60%, rear-end crashes are down 7%, total crashes are down 27%, and estimated crash severity costs have been reduced by $787,200. Regarding the citations issued at these locations, comparing Month 1 of operation with Month 24, citations are down 61%. However, when compared with the data reported within the 2012 Annual Report, which showed increases in all categories except right-angle crashes, the Year 2 data emphasizes the importance of collecting a sufficient amount of data before drawing conclusions for programs such as this.

For the twenty-three (23) intersections that have been operating for one (1) full year, when the Pre-Camera year is compared to Year 1, right-angle crashes are down 15%, rear-end crashes are down 3%, total crashes are down 5%, and estimated crash severity costs have decreased by $2,176,100. Regarding the citations issued at these locations, comparing Month 1 with Month 12, citations are down 31%. These first-year statistics are markedly different from the 2012 Annual Report, suggesting that the driver-behavior learning curve may have become stronger with continued program operation.

Conclusions and Recommendations

The data show overall decreases in crashes, as well as decreases in the number of annual citations issued, for all program years. For the Group 1 signals, having three (3) full years of data, it appears reasonable to conclude that RLR is a viable safety tool at those locations and at locations having similar speed and volume characteristics. However, it is not prudent at this time to draw any final programmatic conclusions, as two (2) data points in a single city do not have a substantial bearing on RLR data collected within other statewide regions at locations with varying engineering attributes. Additionally, while the safety trends recorded in Year 2 within Group 2 and in Year 1 within Group 3 indicate that driver behavior is being modified, less than three (3) data years is not adequate to develop conclusions, let alone recommendations.

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 500 communities, including jurisdictions in New York, Pennsylvania, and Delaware 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 (5)-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

The accepted national discussion regarding RLR is from the Institute of Transportation Engineers' (ITE) report "Establishing a Uniform Definition of Red-Light Running Crashes", published in the March 2006 edition of the ITE Journal. The purpose of that report was to unify thoughts on how RLR crashes should be defined, thereby solidifying estimates of national data. As a result, it was determined that, on average, 219,000 annual RLR crashes, about half of which resulted in persons injured, caused an estimated 188,000 injuries and 940 deaths.

While P.L. 2007, c.348 outlines various programmatic requirements, it does not speak to any process of selecting program participants. With the ITE report as its basis, the Department considered crash data and enforcement efforts, as well as traffic volumes, in creating a safety score methodology by which to evaluate municipal participation in the pilot program. Municipalities desiring selection were required to submit an application to the Department pursuant to N.J.S.A. 39:4-8.14(a). Upon receiving this application the Department extracted the crash, citation and volume data, which was analyzed by staff within the Department's Division of Highway and Traffic Design, producing an overall intersection safety score. The applications were then ranked. At locations receiving authorization for the installation of RLR cameras, the affected municipalities were required to pass ordinances establishing the monitoring system pursuant to N.J.S.A. 39:4-8.14(b).

Program Participants

The Department has capped participation in the RLR pilot program at twenty-five (25) municipalities. The following is a list of the authorized participants as of December 31, 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

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 required. 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 Third 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.

2012 Program Suspension

On June 19, 2012, the Department temporarily suspended the issuance of RLR citations, either completely or in part, within 21 of the 25 participating municipalities. Pursuant to N.J.S.A. 39:4-8.14(a)(3), the yellow time required at RLR intersections must be based upon the speed of vehicular traffic approaching the signal; however, New Jersey's nationally-accepted practice uses the posted speed limit when determining yellow time. As such, camera operation was suspended at 63 intersections to allow the affected municipalities to complete speed studies and submit yellow-time certifications based on the language of the statute. As a result of these certifications, no yellow-time corrections were required at any of the 63 intersections, thereby confirming that the existing yellow times were compliant with both the MUTCD and with the statute. The suspension was lifted on July 25, 2012, allowing the affected municipalities to resume citation issuance, as well as the issuance of all citations held in abeyance during the five (5)-week suspension.

In concert with the initial suspension, the Department also suspended any program expansion, holding all newly-received applications in abeyance pending further RLR evaluation. As of December 31, 2012, the freeze on expansion remained in effect.

Overall Data Analysis

As per N.J.S.A. 39:4-8.17, authorized municipalities must submit reports after every twelve (12) months of operation, detailing increases or decreases in crashes or citations. The Department is focused on two (2) types of crashes: right-angle and rear-end (same-direction). 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 rear-end crashes due to sudden stops by motorists knowing of the presence of RLR cameras. It should also be noted that this report presents overall trends in crashes for the intersection groups, but does not suggest that every intersection reflects these trends, as is shown in the data provided in the Technical Appendix.

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" **http://safety.fhwa.dot.gov/hsip/resources/fhwasa09029/fhwasa09029.pdf** the National Safety Council's development of a scale of five (5) categories of injuries: fatality, disabling injury, evident injury, possible injury, and property damage only (no injury). The following table shows these categories and associated costs.

Crash Severity Costs

Severity	**Associated Costs**
K = Fatality	$4,008,900
A = Disabling Injury	$216,000
B = Evident Injury	$79,000
C = Possible Injury	$44,900
O = Property Damage Only	$7,400

But, similar to the discussion that raw crash numbers fail to provide a complete picture regarding the effectiveness of a safety tool, the same discussion must be applied to severity costs as well. For example, a right-angle crash in one year may have occurred violently and appeared severe; however, thanks to all vehicle occupants wearing their seat belts, the crash resulted in a C (Possible Injury) severity and its associated cost of $44,900. The following year, a similar right-angle crash occurs, but a front-seat occupant was not wearing a seat belt and was ejected, resulting in a K (Fatality) severity and its associated cost of over $4 million. One can see that increased severity costs (net public cost) are not necessarily an indication of the failure of a safety tool, but conversely, decreased severity costs (net public benefit) are not necessarily an indication of success. As such, raw crash numbers and severity costs must be considered, both separately and in concert.

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 a newly-installed RLR system would result in an initially-high number of automated citations issued but would experience substantial reductions in citations after, certainly year-to-year if not month-to-month. Such reductions would indicate 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.

RLR Group 1 – Three-Year Analysis

Out of the forty-seven (47) total locations detailed within this Report having at least one (1) 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 three (3) full years. As discussed within the 2012 RLR Report, when compared to the Pre-Camera installation year of 2009, the Year 2 (2011) data revealed that right-angle crashes were down 86%, rear-end crashes were down 42%, and total crashes were down 57%. Additionally, crash severity costs were reduced by an estimated $268,900, and both locations experienced a decreasing milestone-month trend line regarding the number of citations issued, with citations decreasing by 85%.

When comparing Year 2 data to Year 3 (2012), right-angle crashes remained constant (1 to 1), rear-end crashes decreased 29% (7 to 5), and total crashes were down 35% (20 to 13). Regarding severity costs, rear-end crash costs were reduced by $14,800, but right-angle crash costs increased by $37,500, resulting in a net public cost of $22,700. It should be noted that the single right-angle crash recorded within these Group 1 intersections was caused by a circumstance that could not be addressed by RLR cameras.[1] However, keeping true to the data collection methodologies, this crash must be considered within the official statistics regardless of circumstance.

Regarding the number of citations, 558 were issued in Month 24, while 619 were issued in Month 36, resulting in an increase of 10%. This marks the first Report in which citation issuance in a milestone month exceeded that of the previous milestone month. The data from these Group 1 signals have never exhibited a constant month-to-month downward trend, and 2012 was no different; January (376) marked the lowest citation volume and July (1,186) marked the highest. Viewing violations on an annual basis, the total number of citations issued in 2012 decreased 9% when compared to those issued in 2011 (9,033 to 9,911), so the overall annual downward trend continues; however, five (5) of the 2012 months registered higher citation issuance than their 2011 counterparts, which also is a first for this Group. The increase in milestone month data and the month-to-month comparison may be indications that the point where RLR citations settle into annual constancy has been reached.

When comparing the Pre-Camera year crash data to Year 3, right-angle crashes were down 86 % (7 to 1), rear-end crashes were down 58% (12 to 5), and total crashes were down 72% (47 to 13). Regarding severity costs, right-angle costs decreased $81,900 and rear-end costs decreased $164,300, resulting in a three (3)-year net public benefit of $246,200. Regarding citation trends, with 3,652 issued in the first month of operation versus 619 issued in Month 36, citation issuance has decreased 83%.

For more detailed information, see *Technical Appendix*.

[1] In this case, the crash at Broad Street & Raymond Boulevard was a result of a police pursuit in which the violator purposefully ran the red light to avoid apprehension. If this crash was removed from the data due to its unique circumstances, the resulting analysis would show that right-angle crashes were reduced by 100%, right-angle crash costs were reduced by $7,400, and, when combined with the rear-end data, total crash costs resulted in a net public benefit of $22,200.

With this Report, the engineering standard of three (3) years of data analysis is now satisfied, enabling the Department to begin drawing conclusions for the first time. Considering the crash, severity and citation data, both annually and over the three year period it can be concluded that RLR has made a difference and therefore appears to be a viable safety tool at these Group 1 intersections. This conclusion comes from an analysis of the data that showed reductions in right-angle and rear-end crashes, as well as a reduction in crash severity costs, as discussed above. However, even with these location-specific conclusions, two (2) points of data within a statewide program are too limited to draw programmatic conclusions. As such, it is anticipated that the 2014 Annual Report, which will analyze three (3) years of data from an additional twenty-two (22) locations, should allow for more concrete statewide conclusions to be drawn and with the final report in 2015 the Department will be able to make its final recommendations regarding this pilot program.

RLR Group 2 – Two-Year Analysis

As discussed within the 2012 Annual Report, when compared to the Pre-Camera installation year ending in 2010, the Year 1 data revealed that right-angle crashes decreased 15%, rear-end crashes increased 20%, and total crashes were up 0.9%. Additionally, right-angle crash severity costs increased $444,800 and rear-end crash costs increased $728,000 for a combined net public cost of $1,172,800. Milestone month citation issuance experienced a 50% decrease.

However, to coincide with the analysis methodologies of the 2013 Report, the Year 1 numbers detailed above require revision. This is based on two (2) factors. First, based on revised methodologies of researching and providing second-year data, two (2) municipalities submitted to the Department revised prior-year data with their submissions for the 2013 report. These revised methodologies involve a review of each individual crash report and determination of signal influence and severity, as opposed to preparing data based on a computerized crash printout and a defined distance from the intersection. Second, the 2012 report grouped all twenty-four (24) locations with one (1) year of data into the same cohort, even though two (2) of those intersections had a second year of data that was analyzed separately. As such, the first-year data from those locations now identified as Group 1 should be eliminated from the Year 1 analysis of the 2012 Report, leaving twenty-two (22) intersections, identified now as Group 2. (It should be noted that the data analysis by distinct year of operation has still been accomplished and will be detailed within a later section of this Report.) As a result, the revised Year 1 (2011) data revealed that right-angle crashes decreased 9% (6% less than previously reported), rear-end crashes increased 20% (same as previously reported), and total crashes increased 2% (1.1% greater than previously reported). Right-angle crash costs increased $474,400 ($29,600 greater) and rear-end crash costs increased $847,400 ($119,400 greater), resulting in a net public cost of $1,321,800 ($149,000 greater). As it was unaffected by revised crash analysis methodologies, the Year 1 citation trend remained at a 50% decrease.

When comparing the revised Year 1 data to Year 2 (ending in 2012), right-angle crashes decreased 56% (48 to 21), rear-end crashes decreased 22% (330 to 256), and total crashes decreased 29% (543 to 385). Regarding severity costs, right-angle crash costs decreased $1,123,700 and rear-end crash costs decreased $985,300, resulting in a net public benefit of $2,109,000. Discussing citations, 16,949 were issued in Month 12, while 12,598 were issued in Month 24, resulting in a decrease of 26%.

When comparing the Pre-Camera year to Year 2, right-angle crashes are down 60% (53 to 21), rear-end crashes are down 7% (274 to 256), and total crashes are down 27% (530 to 385). Regarding severity costs, right-angle crash costs are down $649,300 and rear-end costs are down $137,900, resulting in a two (2)-year net public benefit of $787,200. Regarding citation trends, with 32,592 issued in Month 1 versus 12,598 issued in Month 24, citation issuance has decreased 61%.

For more detailed information, see *Technical Appendix*.

Based on the Group 2 data, one can ascertain that Year 1 was an inconclusive year. However, as stated in the prior report, it is important to remember that safety trends are never established over a single year, and the results after a second year of data from this cohort bolster that statement. Not only were the Year 2 numbers positive when compared to Year 1, they were strong enough to move the negative values into positive categories for the full two (2) years of operation, however, two (2) years of data is inconclusive to establish supportable safety recommendations. It is anticipated that the 2014 Report will be able to draw more concrete programmatic conclusions when three (3) years of data has been analyzed.

RLR Group 3 – One-Year Analysis

For calendar year 2012, twenty-three (23) locations statewide have had RLR systems in operation where citations have been issued for at least one (1) 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-three (23) 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.

When comparing the Pre-Camera year to Year 1, right-angle crashes decreased 15% (41 to 35), rear-end crashes decreased 3% (326 to 315), and total crashes decreased 5% (533 to 507). Regarding severity costs, right-angle crash costs went down $788,300 and rear-end crash costs decreased $1,387,800, resulting in a net public benefit of $2,176,100. Discussing citations, 21,855 were issued in the first month of operation, while 15,028 were issued in Month 12, a decrease of 31%.

For more detailed information, see *Technical Appendix*.

It is important to remember that the purpose of this program is to see if RLR "could serve as an effective tool in encouraging drivers to strictly obey traffic control devices at intersections" (N.J.S.A. 39:4-8.12); in other words, change driver behavior. It is certainly a fact that driver behavior does not change overnight. As was expected and as has been previously experienced, individual signals recorded both positive and negative comparisons, but as a whole, this cohort recorded overall decreases in crashes and costs. Still, with only a single year of data for this group, additional sustained analysis is needed before concrete conclusions can be drawn.

Reference Intersections

The Department requires each municipality to designate a control or "reference" intersection, the purpose of which is to provide as much of a comparison as possible between locations with and without RLR systems. Most authorized municipalities designate a single reference intersection as the control location for multiple RLR intersections. Additionally, depending on the dates of system activations, a single reference intersection can be the designated control location for RLR intersections within multiple groups. Because of this, any direct comparison with RLR locations will not be a one-to-one analysis and therefore will have limited significance.

For Group 1 and its two (2) RLR intersections in Newark City, one (1) reference intersection was designated. Comparing the latest available year (Year 2 to Year 3), right-angle crashes remained the same (0 to 0), rear-end crashes increased numerically by 1 (0 to 1) and total crashes increased numerically by 9 (0 to 9). Regarding severity costs, right-angle crash costs remained the same and rear-end crash costs increased by $7,400, resulting in a net public cost of $7,400.

For Group 2, with nine (9) municipalities encompassing the twenty-two (22) RLR signals analyzed, nine (9) reference intersections were designated. For these reference locations, comparing Year 1 to Year 2, right-angle crashes decreased 71% (21 to 6), rear-end crashes decreased 35% (83 to 54) and total crashes decreased 40% (135 to 81). Regarding severity costs, right-angle crash costs decreased $272,400 and rear-end crash costs decreased $551,600, resulting in a net public benefit of $824,000.

For Group 3, with fifteen (15) municipalities encompassing the twenty-three (23) RLR signals analyzed, seventeen (17) reference intersections have been designated. For these reference locations, comparing the Pre-Camera Year to Year 1, right-angle crashes decreased 12% (25 to 22), rear-end crashes increased 8% (192 to 208) and total crashes decreased 2% (313 to 308). Regarding severity costs, right-angle crash costs increased $3,880,400 and rear-end crash costs increased $452,500, resulting in a net public cost of $4,332,900. This significant cost increase is due mainly to a right-angle fatality occurring at one (1) of the reference intersections.

For more detailed reference signal information, see *Technical Appendix*.

Statewide RLR Analysis

In addition to the group analysis based on dates of RLR activation, it is helpful to analyze the data based on operational year. Such an analysis provides more of a statewide perspective, since additional signals throughout the state have been activated with each year of the program. Combining the signal groups in this manner, there would be forty-seven (47) intersections with Pre-Camera year and Year 1 data, twenty-four (24) intersections with Year 2 data, and two (2) intersections with Year 3 data. The number of intersections and the amount of associated data contained within the cohorts of the earlier operational years will always increase with each subsequent Annual Report, while the latest operational year and its data will always include just the two (2) original pilot program signals in Newark City.

When comparing the Pre-Camera year to Year 1 for all forty-seven (47) locations, right-angle crashes decreased 15% (101 to 86), rear-end crashes increased 6% (612 to 651), and total crashes decreased 2% (1,110 to 1,076). A total of 58,099 citations were issued in Month 1 versus 32,962 issued in Month 12, resulting in a decrease of 43%. Right-angle crash costs decreased $343,500 and rear-end crash costs decreased $659,800, resulting in a net public benefit of $1,003,300.

Comparing Year 1 to Year 2 for the twenty-four (24) signals with such data, right-angle crashes decreased 57% (51 to 22), rear-end crashes decreased 22% (336 to 263), and total crashes decreased 29% (569 to 405). A total of 17,934 citations were issued in Month 12 versus 13,156 issued in Month 24, resulting in a decrease of 27%. Right-angle crash costs decreased $1,213,500 and rear-end crash costs decreased $1,015,400, resulting in a net public benefit of $2,228,900.

Being the latest operational year, the comparison of Year 2 to Year 3 for the two (2) signals with such data is the same analysis of Group 1 signals, which begins on page 7 of this Report.

Adding the severity costs for each operational year, right-angle crash costs at all RLR intersections have decreased $1,519,500 and rear-end crash costs have decreased $1,690,000, resulting in a combined net public benefit of $3,209,500 for the program up through December 31, 2012. However, it is important to remember the inconclusiveness of such a comparison, as explained on page 6 of this Report, increased severity costs (net public cost) are not necessarily an indication of the failure of a safety tool, and conversely, decreased severity costs (net public benefit) are not necessarily an indication of success. As such, raw crash numbers and severity costs must be considered, both separately and in concert.

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 answers is available at the following website http://www.state.nj.us/transportation/refdata/rlr/.

Conclusions and Next Steps

The Department is focused on the analysis of the data to evaluate the effectiveness of this pilot program. Following that focus, the data show overall decreases in crashes, as well as decreases in the number of annual citations issued, for all program years. For the Group 1 signals, having three (3) full years of data, it appears reasonable to conclude that RLR is a viable safety tool at those locations. However, it is not prudent at this time to draw any final programmatic conclusions, as two (2) data points in a single city do not have a substantial bearing on RLR data collected within other statewide regions at locations with varying engineering attributes. Additionally, while the safety trends recorded in Year 2 within Group 2 and in Year 1 within Group 3 indicate that driver behavior is being significantly modified, less than three (3) data years is not adequate to develop conclusions, let alone recommendations.

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 for their roles in administering the pilot program and for researching and compiling this Annual Report.