NCHRP 3-93 Copy No.

# Automated Enforcement for Speeding and Red Light Running

FINAL REPORT
APPENDICES

Prepared for:

National Cooperative Highway Research Program

Transportation Research Board

The National Academies



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# APPENDIX A. SURVEY FINDINGS

## INTRODUCTION

The survey team collected information about cities and counties across the country that have operated or currently operate red light or speed camera programs. In all, 358 jurisdictions were contacted for participation in the survey. When an email address was available, that communication method was employed. For remaining jurisdictions, the survey team placed phone calls in order to contact the appropriate person.

Table A-1 provides a list of the jurisdictions contacted for the survey, along with the date and method by which they were contacted.

**Table A-1. Jurisdictions Contacted for the Survey**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| Montgomery | AL | 12/12/08 | Email |
| Avondale | AZ | 12/12/08 | Email |
| Chandler | AZ | 12/12/08 | Email |
| Glendale | AZ | 12/12/08 | Email |
| Mesa | AZ | 12/12/08 | Email |
| Paradise Valley | AZ | 12/12/08 | Email |
| Peoria | AZ | 12/12/08 | Email |
| Phoenix | AZ | 12/12/08 | Email |
| Prescott Valley | AZ | 12/17/08 | Phone, then email |
| Scottsdale | AZ | 12/12/08 | Email |
| Tempe | AZ | 12/12/08 | Email |
| Tucson | AZ | 12/12/08 | Email |
| Bakersfield | CA | 12/12/08 | Email |
| Baldwin Park | CA | 12/16/08 | Phone |
| Belmont | CA | 12/12/08 | Email |
| Berkeley | CA | 12/12/08 | Email |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| Beverly Hills | CA | 12/16/08 | Phone, then email |
| Burlingame | CA | 12/12/08 | Email |
| Capitola | CA | 12/12/08 | Email |
| Cathedral City | CA | 12/12/08 | Email |
| Cerritos | CA | 12/16/08 | Phone |
| Citrus Heights | CA | 12/12/08 | Email |
| Commerce | CA | 12/16/08 | Phone |
| Compton | CA | 12/16/08 | Phone |
| Costa Mesa | CA | 12/12/08 | Email |
| Covina | CA | 12/17/08 | Email |
| Culver City | CA | 12/12/08 | Email |
| Cupertino | CA | 12/12/08 | Email |
| Daly City | CA | 12/12/08 | Email |
| Davis | CA | 12/12/08 | Email |
| Del Mar | CA | 12/17/08 | Phone, then email |
| El Cajon | CA | 12/18/08 | Email |
| El Monte | CA | 12/12/08 | Email |
| Elk Grove | CA | 12/12/08 | Email |
| Emeryville | CA | 12/16/08 | Email |
| Encinitas | CA | 12/12/08 | Email |
| Escondido | CA | 12/12/08 | Email |
| Fairfield | CA | 12/16/08 | Email |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| Fremont | CA | 12/12/08 | Email |
| Fresno | CA | 12/12/08 | Email |
| Fullerton | CA | 12/12/08 | Email |
| Garden Grove | CA | 12/12/08 | Email |
| Gardena | CA | 12/12/08 | Email |
| Glendale | CA | 12/12/08 | Email |
| Grand Terrace | CA | 12/12/08 | Email |
| Hawthorne | CA | 12/12/08 | Email |
| Hayward | CA | 12/12/08 | Email |
| Highland | CA | 12/17/08 | Phone, then email |
| Indian Wells | CA | 12/18/08 | Email |
| Inglewood | CA | 12/18/08 | Phone |
| Laguna Woods | CA | 12/12/08 | Email |
| Lancaster | CA | 12/12/08 | Email |
| Loma Linda | CA | 12/12/08 | Email |
| Los Alamitos | CA | 12/17/08 | Phone, then email |
| Los Angeles City | CA | 12/12/08 | Email |
| Los Angeles County | CA | 12/16/08 | Phone, then email |
| Lynwood | CA | 12/12/08 | Email |
| Marysville | CA | 12/17/08 | Phone, then email |
| Maywood | CA | 12/18/08 | Phone |
| Menlo Park | CA | 12/12/08 | Email |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| Millbrae | CA | 12/17/08 | Email |
| Modesto | CA | 12/12/08 | Email |
| Montclair | CA | 12/12/08 | Email |
| Montebello | CA | 12/18/08 | Phone |
| Moreno Valley | CA | 12/12/08 | Email |
| Murrieta | CA | 12/12/08 | Email |
| Napa | CA | 12/12/08 | Email |
| Newark | CA | 12/12/08 | Email |
| Oakland | CA | 12/12/08 | Email |
| Oceanside | CA | 12/12/08 | Email |
| Oroville | CA | 12/12/08 | Email |
| Oxnard | CA | 12/12/08 | Email |
| Pasadena | CA | 12/12/08 | Email |
| Poway | CA | 12/12/08 | Email |
| Rancho Cucamonga | CA | 12/12/08 | Email |
| Redding | CA | 12/12/08 | Email |
| Redlands | CA | 12/18/08 | Phone |
| Redwood City | CA | 12/12/08 | Email |
| Ridgecrest | CA | 12/12/08 | Email |
| Rio Vista | CA | 12/12/08 | Email |
| Riverside | CA | 12/12/08 | Email |
| Rocklin | CA | 12/12/08 | Email |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| Roseville | CA | 12/12/08 | Email |
| Sacramento City | CA | 12/12/08 | Email |
| Sacramento County | CA | 12/12/08 | Email |
| San Bernardino City | CA | 12/12/08 | Email |
| San Bernardino County | CA | 12/12/08 | Email |
| San Carlos | CA | 12/12/08 | Email |
| San Diego | CA | 12/12/08 | Email |
| San Francisco | CA | 12/12/08 | Email |
| San Juan Capistrano | CA | 12/12/08 | Email |
| San Leandro | CA | 12/12/08 | Email |
| San Mateo | CA | 12/12/08 | Email |
| Santa Ana | CA | 12/12/08 | Email |
| Santa Clarita | CA | 12/12/08 | Email |
| Santa Fe Springs | CA | 12/12/08 | Email |
| Santa Maria | CA | 12/17/08 | Phone |
| Solana Beach | CA | 12/12/08 | Email |
| South Gate | CA | 12/18/08 | Phone, then email |
| South San Francisco | CA | 12/17/08 | Phone |
| Stockton | CA | 12/12/08 | Email |
| Union City | CA | 12/17/08 | Phone |
| Upland | CA | 12/12/08 | Email |
| Ventura | CA | 12/12/08 | Email |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| Victorville | CA | 12/12/08 | Email |
| Vista | CA | 12/12/08 | Email |
| Walnut | CA | 12/12/08 | Email |
| West Hollywood | CA | 12/17/08 | Phone, then email |
| Whittier | CA | 12/12/08 | Email |
| Yuba City | CA | 12/15/08 | Email |
| Yucaipa | CA | 12/12/08 | Email |
| Aurora | CO | 12/12/08 | Email |
| Boulder | CO | 12/12/08 | Email |
| Denver | CO | 12/12/08 | Email |
| Fort Collins | CO | 12/12/08 | Email |
| Greenwood Village | CO | 12/12/08 | Email |
| Lone Tree | CO | 12/12/08 | Email |
| Northglenn | CO | 12/18/08 | Phone |
| Pueblo | CO | 12/12/08 | Email |
| District of Columbia | DC | 12/12/08 | Email |
| Dover | DE | 12/12/08 | Email |
| Elsmere | DE | 12/12/08 | Email |
| Newark | DE | 12/17/08 | Phone |
| Seaford | DE | 12/12/08 | Email |
| Wilmington | DE | 12/12/08 | Email |
| Apopka | FL | 12/12/08 | Email |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| Aventura | FL | 12/12/08 | Email |
| Casselberry | FL | 12/12/08 | Email |
| Gulf Breeze | FL | 12/12/08 | Email |
| North Miami Beach | FL | 12/15/08 | Phone |
| Orlando | FL | 12/12/08 | Email |
| Palm Beach County | FL | 12/17/08 | Phone |
| Palm Coast | FL | 12/12/08 | Email |
| Pembroke Pines | FL | 12/12/08 | Email |
| Winter Springs | FL | 12/12/08 | Email |
| Alpharetta | GA | 12/17/08 | Phone |
| Athens-Clarke County | GA | 12/17/08 | Phone, then email |
| Atlanta | GA | 12/12/08 | Email |
| Brunswick | GA | 12/12/08 | Email |
| Dalton | GA | 12/12/08 | Email |
| Decatur | GA | 12/17/08 | Phone, then email |
| Duluth | GA | 12/17/08 | Phone, then email |
| Fulton County | GA | 12/12/08 | Email |
| Georgetown | GA | 12/18/08 | Phone |
| Griffin | GA | 12/12/08 | Email |
| Gwinnett County | GA | 12/12/08 | Email |
| Hapeville | GA | 12/12/08 | Email |
| Lilburn | GA | 12/12/08 | Email |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| Marietta | GA | 12/12/08 | Email |
| Morrow | GA | 12/12/08 | Email |
| Moultrie | GA | 12/12/08 | Email |
| Rome | GA | 12/12/08 | Email |
| Savannah | GA | 12/12/08 | Email |
| Snellville | GA | 12/12/08 | Email |
| Suwanee | GA | 12/12/08 | Email |
| Thomasville | GA | 12/18/08 | Phone |
| Tifton | GA | 12/18/08 | Email |
| Clive | IA | 12/12/08 | Email |
| Council Bluffs | IA | 12/12/08 | Email |
| Davenport | IA | 12/12/08 | Email |
| Sioux City | IA | 12/12/08 | Email |
| Alsip | IL | 12/18/08 | Phone |
| Aurora | IL | 12/12/08 | Email |
| Bellwood | IL | 12/12/08 | Email |
| Burbank | IL | 12/18/08 | Phone |
| Cahokia | IL | 12/12/08 | Email |
| Calumet City | IL | 12/12/08 | Email |
| Carol Stream | IL | 12/12/08 | Email |
| Chicago | IL | 12/12/08 | Email |
| Countryside | IL | 12/18/08 | Phone |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| Elk Grove | IL | 12/18/08 | Phone |
| Evergreen Park | IL | 12/18/08 | Phone |
| Forest Park | IL | 12/12/08 | Email |
| Geneva | IL | 12/12/08 | Email |
| Gurnee | IL | 12/12/08 | Email |
| Libertyville | IL | 12/15/08 | Phone |
| Lyons | IL | 12/18/08 | Phone |
| Naperville | IL | 12/12/08 | Email |
| New Lenox | IL | 12/18/08 | Phone |
| North Chicago | IL | 12/18/08 | Phone |
| North Riverside | IL | 12/18/08 | Phone |
| Northfield | IL | 12/18/08 | Phone |
| Northlake | IL | 12/18/08 | Phone |
| Oak Lawn | IL | 12/18/08 | Phone |
| Olympia Fields | IL | 12/18/08 | Phone |
| Orland Park | IL | 12/12/08 | Email |
| Palos Heights | IL | 12/12/08 | Email |
| Richton Park | IL | 12/12/08 | Email |
| Roselle | IL | 12/12/08 | Email |
| South Holland | IL | 12/12/08 | Email |
| St. Charles | IL | 12/12/08 | Email |
| Stickney | IL | 12/18/08 | Phone |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| Streamwood | IL | 12/12/08 | Email |
| Waukegan | IL | 12/12/08 | Email |
| Baker | LA | 12/18/08 | Phone |
| Baton Rouge | LA | 12/12/08 | Email |
| Broussard | LA | 12/18/08 | Email |
| Gretna | LA | 12/18/08 | Phone |
| Jefferson Parish | LA | 12/12/08 | Email |
| Lafayette | LA | 12/12/08 | Email |
| Livingston Parish | LA | 12/18/08 | Phone |
| New Orleans | LA | 12/12/08 | Email |
| Annapolis | MD | 12/12/08 | Email |
| Anne Arundel | MD | 12/12/08 | Email |
| Baltimore City | MD | 12/12/08 | Email |
| Baltimore County | MD | 12/12/08 | Email |
| Bel Air | MD | 12/12/08 | Email |
| Bladensburg | MD | 12/12/08 | Email |
| Bowie | MD | 12/12/08 | Email |
| Brentwood | MD | 12/19/08 | Phone |
| Charles County | MD | 12/12/08 | Email |
| Cheverly | MD | 12/12/08 | Email |
| College Park | MD | 12/12/08 | Email |
| Colmar Manor | MD | 12/18/08 | Email |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| Cottage City | MD | 12/18/08 | Email |
| Forest Heights | MD | 12/12/08 | Email |
| Frederick | MD | 12/12/08 | Email |
| Greenbelt | MD | 12/12/08 | Email |
| Howard County | MD | 12/12/08 | Email |
| Hyattsville | MD | 12/12/08 | Email |
| Landover Hills | MD | 12/12/08 | Email |
| Laurel | MD | 12/12/08 | Email |
| Montgomery County | MD | 12/12/08 | Email |
| Morningside | MD | 12/19/08 | Phone |
| New Carrollton | MD | 12/12/08 | Email |
| Prince Georges County | MD | 12/12/08 | Email |
| Riverdale Park | MD | 12/19/08 | Phone, then email |
| Rockville | MD | 12/12/08 | Email |
| Arnold | MO | 12/12/08 | Email |
| Bellerive | MO | 12/18/08 | Phone |
| Beverly Hills | MO | 12/18/08 | Phone |
| Brentwood | MO | 12/12/08 | Email |
| Creve Coeur | MO | 12/12/08 | Email |
| Dellwood | MO | 12/19/08 | Email, then fax |
| Edmundson | MO | 12/18/08 | Phone, then email |
| Festus | MO | 12/12/08 | Email |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| Florissant | MO | 12/12/08 | Email |
| Gladstone | MO | 12/12/08 | Email |
| Hannibal | MO | 12/12/08 | Email |
| Hazelwood | MO | 12/12/08 | Email |
| Moline Acres | MO | 12/19/08 | Phone |
| Springfield | MO | 12/12/08 | Email |
| St. Charles | MO | 12/12/08 | Email |
| St. John | MO | 12/12/08 | Email |
| St. Louis | MO | 12/12/08 | Email |
| St. Peters | MO | 12/19/08 | Phone, then email |
| Sugar Creek | MO | 12/19/08 | Phone |
| Washington | MO | 12/19/08 | Phone |
| Wentzville | MO | 12/12/08 | Email |
| Columbus | MS | 12/12/08 | Email |
| Jackson | MS | 12/12/08 | Email |
| Cary | NC | 12/12/08 | Email |
| Fayetteville | NC | 12/12/08 | Email |
| Knightdale | NC | 12/12/08 | Email |
| Raleigh | NC | 12/12/08 | Email |
| Rocky Mount | NC | 12/19/08 | Phone |
| Wilmington | NC | 12/12/08 | Email |
| Albuquerque | NM | 12/12/08 | Email |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| New York City | NY | 12/12/08 | Email |
| Cleveland | OH | 12/19/08 | Phone, then email |
| Columbus | OH | 12/12/08 | Email |
| Dayton | OH | 12/12/08 | Email |
| Middletown | OH | 12/12/08 | Email |
| Northwood | OH | 12/12/08 | Email |
| Springfield | OH | 12/12/08 | Email |
| Sylvania Township | OH | 12/12/08 | Email |
| Toledo | OH | 12/12/08 | Email |
| Trotwood | OH | 12/12/08 | Email |
| West Carrollton | OH | 12/12/08 | Email |
| Albany | OR | 12/19/08 | Phone, then email |
| Beaverton | OR | 12/12/08 | Email |
| Medford | OR | 12/12/08 | Email |
| Newberg | OR | 12/12/08 | Email |
| Portland | OR | 12/12/08 | Email |
| Salem | OR | 12/12/08 | Email |
| Philadelphia | PA | 12/12/08 | Email |
| Providence | RI | 12/19/08 | Phone |
| Sioux Falls | SD | 12/12/08 | Email |
| Gallatin | TN | 12/12/08 | Email |
| Germantown | TN | 12/12/08 | Email |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| Jackson | TN | 12/12/08 | Email |
| Kingsport | TN | 12/12/08 | Email |
| Knoxville | TN | 12/12/08 | Email |
| Morristown | TN | 12/19/08 | Phone |
| Red Bank | TN | 12/19/08 | Phone |
| Selmer | TN | 12/19/08 | Phone |
| Allen | TX | 12/12/08 | Email |
| Arlington | TX | 12/15/08 | Email |
| Austin | TX | 12/12/08 | Email |
| Balch Springs | TX | 12/12/08 | Email |
| Balcones Heights | TX | 12/19/08 | Phone |
| Bedford | TX | 12/12/08 | Email |
| Burleson | TX | 12/12/08 | Email |
| Carrolton | TX | 12/12/08 | Email |
| Cedar Hill | TX | 12/12/08 | Email |
| College Station | TX | 12/12/08 | Email |
| Coppell | TX | 12/12/08 | Email |
| Corpus Christi | TX | 12/12/08 | Email |
| Dallas | TX | 12/12/08 | Email |
| Dalworthington Gardens | TX | 12/19/08 | Phone |
| Denton | TX | 12/12/08 | Email |
| Duncanville | TX | 12/19/08 | Phone |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| El Paso | TX | 12/12/08 | Email |
| Farmers Branch | TX | 12/12/08 | Email |
| Forney | TX | 12/12/08 | Email |
| Fort Worth | TX | 12/12/08 | Email |
| Frisco | TX | 12/12/08 | Email |
| Garland | TX | 12/12/08 | Email |
| Grand Prairie | TX | 12/12/08 | Email |
| Granite Shoals | TX | 12/19/08 | Phone |
| Haltom City | TX | 12/16/08 | Email |
| Harlingen | TX | 12/12/08 | Email |
| Houston | TX | 12/12/08 | Email |
| Humble | TX | 12/19/08 | Phone |
| Huntington | TX | 12/12/08 | Email |
| Hurst | TX | 12/19/08 | Phone |
| Hutto | TX | 12/12/08 | Email |
| Irving | TX | 12/12/08 | Email |
| Jersey Village | TX | 12/19/08 | Phone |
| Killeen | TX | 12/12/08 | Email |
| Lake Jackson | TX | 12/12/08 | Email |
| Lancaster | TX | 12/12/08 | Email |
| Lewisville | TX | 12/12/08 | Email |
| Longview | TX | 12/16/08 | Email |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| Lubbock | TX | 12/12/08 | Email |
| Lufkin | TX | 12/12/08 | Email |
| Marshall | TX | 12/12/08 | Email |
| McKinney | TX | 12/12/08 | Email |
| Mesquite | TX | 12/12/08 | Email |
| Mission | TX | 12/19/08 | Phone |
| Montgomery County | TX | 12/12/08 | Email |
| North Richland Hills | TX | 12/12/08 | Email |
| Oak Ridge North | TX | 12/12/08 | Email |
| Plano | TX | 12/12/08 | Email |
| Port Lavaca | TX | 12/12/08 | Email |
| Richardson | TX | 12/12/08 | Email |
| Richland Hills | TX | 12/12/08 | Email |
| Roanoke | TX | 12/12/08 | Email |
| Rowlett | TX | 12/12/08 | Email |
| Southlake | TX | 12/12/08 | Email |
| Sugar Land | TX | 12/15/08 | Email |
| Terrell | TX | 12/12/08 | Email |
| Tomball | TX | 12/12/08 | Email |
| University Park | TX | 12/15/08 | Email |
| Auburn | WA | 12/15/08 | Email |
| Bremerton | WA | 12/12/08 | Email |

**Table A-1. Jurisdictions Contacted for the Survey (continued)**

| Jurisdiction | State | Date Contacted | Method Contacted |
|---|---|---|---|
| Burien | WA | 12/15/08 | Email |
| Fife | WA | 12/12/08 | Email |
| Lacey | WA | 12/12/08 | Email |
| Lakewood | WA | 12/12/08 | Email |
| Lynnwood | WA | 12/12/08 | Email |
| Monroe | WA | 12/12/08 | Email |
| Moses Lake | WA | 12/12/08 | Email |
| Mountlake Terrace | WA | 12/12/08 | Email |
| Puyallup | WA | 12/12/08 | Email |
| SeaTac | WA | 12/12/08 | Email |
| Seattle | WA | 12/15/08 | Email |
| Tacoma | WA | 12/12/08 | Email |

## GENERAL PROGRAM INFORMATION

As of January 2009, 74 completed surveys had been submitted. Among these surveys, jurisdictions from 18 different States were represented. Only 2 responding jurisdictions have suspended their automated enforcement programs. Nine of the 74 jurisdictions operate a speed enforcement program. Seventy of the 74 jurisdictions operate a red light camera enforcement program. The 4 jurisdictions that do not currently operate a red light camera program are in the process of implementing such a program. Appendix B provides a list of the responding jurisdictions, along with the number of cameras and initiation dates.

The initiation dates of both red light and speed camera programs varied greatly among jurisdictions. Table A-2 provides data on the age of responding jurisdictions' programs.

**Table A-2. Age of Responding Jurisdictions' Programs**

| Age of Program | Red Light Camera Programs | Speed Camera Programs |
|---|---|---|
| More than 5 years | 11 | 4 |
| 2 to 5 years | 25 | 1 |
| Less than 2 years | 32 | 4 |

The automated enforcement programs are run by a variety of agencies. Table A-3 provides information about the leading agency for automated enforcement. For jurisdictions with both speed and red light camera programs, the same entity oversees both programs.

**Table A-3. Leading Agency for Automated Enforcement**

| Enforcement Agency | Red Light Camera Programs | Speed Camera Programs |
|---|---|---|
| Police Department (including designated traffic unit) | 44 | 7 |
| Department of Public Works | 11 | 1 |
| City or County | 10 | 1 |
| Other | 2 | 0 |

For the jurisdictions operating red light camera programs, all of the jurisdictions capture a rear image of the offending vehicle. Thirty-one jurisdictions also capture a front image. Four jurisdictions specifically report that they capture an image of the driver, and 16 jurisdictions record video in addition to still images.

Likewise, all jurisdictions that operate a speed enforcement program capture a rear image of the offending vehicle. Seven of the nine jurisdictions also capture a front image. Two jurisdictions record video in addition to capturing still images.

Jurisdictions reported a variety of vendors with whom they work to operate their enforcement programs. Table A-4 includes information about vendors and the number of programs using each. Eight of the nine jurisdictions with both speed and red light camera programs use the same vendor for both programs.

**Table A-4. List of Vendors used by Jurisdictions**

| Vendor | Red Light Camera Programs | Speed Camera Programs |
|---|---|---|
| RedFlex | 34 | 5 |
| American Traffic Solutions | 15 | 2 |
| Affiliated Computer Services | 7 | 2 |
| Nestor | 3 | 0 |
| LaserCraft | 6 | 0 |
| Other | 3 | 0 |

For vendor payment, 39 jurisdictions pay a flat fee for vendor services. Fifteen jurisdictions pay vendors based on the number of paid citations, while 11 pay vendors based on the number of citations issued. Two jurisdictions pay vendors a flat fee plus a fee for each citation issued. Two jurisdictions pay vendors a flat fee for each camera installation. The same vendor payment method is used for each jurisdiction that operates both red light camera and speed camera programs.

The reported fines for red light or speed camera violations varied by jurisdictions. Table A-5 presents data on the range of fines. In several states, such as Colorado and California, the enabling legislation specifies the fine amount for all jurisdictions in that State. For speed violations, the fine range from $40 to $220, depending on the number of miles per hour over the speed limit and whether the violation occurred in a school zone.

**Table A-5. Red Light Running Violation Fines**

| Violation Fine | Red Light Camera Programs |
|---|---|
| $50 or less | 5 |
| $50 to $100 | 27 |
| $100 to $200 | 14 |
| $200 to $300 | 5 |
| Greater than $300 | 18 |

In 40 jurisdictions, any surplus revenue generated by automated enforcement programs is directed into a general fund. The surplus funds are put into a school zone fund in three jurisdictions and into a highway safety fund in three other jurisdictions. The remaining

jurisdictions reported directing the funds into a variety of places, such as traffic safety improvement projects, the local school board, or splitting the funds among several entities.

## LEGISLATIVE AND ADJUDICATION INFORMATION

In California, the enabling legislation for automated enforcement programs is the California Vehicle Code (CVC) 21455.5. In Texas, Senate Bill 1119 and Chapter 707 of the Texas Transportation Code enable the state's automated enforcement programs. In most other states, the enabling legislation is provided by home rule, local ordinances, or state statutes.

In 52 of the jurisdictions, violations are adjudicated in court. For 13 jurisdictions, violations are not adjudicated in court. Violations are owner responsibility offenses in 57 jurisdictions, and are driver responsibility violations in 11 jurisdictions.

Sixty-one jurisdictions send citations to out-of-state vehicles, while only 6 do not send them to out-of-state vehicles.

## ENGINEERING AND SAFETY

A formal engineering study is conducted and documented in 53 jurisdictions prior to deploying cameras. Of the remaining jurisdictions that did not report conducting a formal engineering study, several did conduct an informal study, such as analyzing crash rates or accident history.

For red light camera programs, a variety of methods were used to determine camera sites. Table A-6 provides a summary of those methods. In many cases, jurisdiction implemented a combination of several methods.

**Table A-6. Method Used to Determine Red Light Camera Sites**

| Method | Jurisdictions (out of 70) with Red Light Camera Programs | Jurisdictions (out of 9) with Speed Camera Programs |
|---|---|---|
| Crash Frequency | 53 | 4 |
| Crash Type | 42 | 2 |
| Violation Data | 47 | 3 |
| Selected by engineering personnel | 37 | 3 |
| Selected by enforcement personnel | 32 | 7 |
| Traffic Volume | 29 | 3 |
| Public Input | 10 | 3 |
| No specific methodology | 1 | 0 |
| Other | 7 | 4 |

The ability to conduct traditional enforcement efforts, citizen complaints, and priority for school zones were a few of the other methodologies reported by jurisdictions.

Forty-eight jurisdictions have conducted a safety evaluation comparing before and after crash data. However, twenty jurisdictions have not conducted such an evaluation of their red light or speed camera programs.

Jurisdictions with red light camera programs often have a grace period after the onset of the red signal. Only vehicles which enter the intersection after the designated grace period will be issued a citation. Table A-7 shows the various grace periods used by reporting jurisdictions.

**Table A-7. Grace Period Used by Jurisdictions for Red Light Camera Sites**

| Grace Period (after onset of red signal) | Red Light Camera Programs |
|---|---|
| None (0 seconds) | 28 |
| 0.1 second | 8 |
| 0.2 seconds | 3 |
| 0.3 seconds | 6 |
| 0.5 seconds | 2 |
| 1.0 seconds or longer | 4 |
| Officer discretion | 3 |

For jurisdictions with speed camera programs, four have a tolerance of 10 or 11 miles per hour over the posted speed limit. In one jurisdiction, the tolerance varied from 5 to 10 mph based on the speed limit. In another jurisdiction, there is no tolerance in school zones, while an 11mph tolerance applies elsewhere in the locality. One jurisdiction has a tolerance of only 4 mph.

## PUBLIC EDUCATION AND INFORMATION

Twenty-seven jurisdictions conducted an assessment of public support prior to the implementation of the automated enforcement programs. Thirty-nine jurisdictions did not conduct any assessment of public support. Public meetings were the most common method of determining public support, and one jurisdiction reported that a statewide survey indicated an 80 to 90 percent approval rating for automated enforcement.

Sixty-two jurisdictions reported informing the public of program initiation through one or more means. Table A-8 provides details about the methods of reaching the public.

**Table A-8. Methods Used by Jurisdictions for Public Education and Information**

| Methodology | Number of Jurisdictions |
|---|---|
| Public service announcement on TV or radio | 37 |
| Print ads | 29 |
| Public Meetings | 40 |
| Mailing to residents | 10 |
| Other | 25 |

Other methods commonly used include newspaper articles, the locality's website, press releases, media coverage, and brochures available at public buildings.

Once programs were started, 64 jurisdictions continued publicity about the program and enforcement sites. Table A-9 gives a summary of the types of on-going publicity implemented.

**Table A-9. Types of On-going Publicity for Red Light Camera Programs**

| Type of Publicity | Number of Jurisdictions |
|---|---|
| Public service announcement on TV or radio | 12 |
| Print ads | 6 |
| Signs on approach to enforcement area | 57 |
| Signs at the entrance to the jurisdiction | 23 |
| Website | 36 |
| Other | 7 |

Other on-going publicity includes public meetings, billboards, and presentations at school and neighborhood meetings.

## TERMINATION

Only two of the responding jurisdictions reported having terminated their enforcement programs. In Clive, Iowa, the red light camera program was suspended in February 2007, and in Fayetteville, NC, the program was suspended in May 2007. Both programs were suspended due to a legal challenge. Neither jurisdiction has conducted an analysis of any change in crashes or violations since the removal of the cameras. The respondent for Clive, Iowa, did not that the program was temporarily suspended and that it might continue operation in the future.

# APPENDIX B. ONLINE SURVEY INFORMATION

Table B-1 provides a list of the jurisdictions that responded to the survey, along with the number of cameras and program initiation dates.

**Table B-1. Red Light and Speed Camera Programs by Jurisdiction**

| Jurisdiction | State | Red Light Camera Program | | Speed Camera Program | |
|---|---|---|---|---|---|
| | | # of Cameras | Initiation Date | # of Cameras | Initiation Date |
| Montgomery | AL | 10 | 4/1/2008 | | |
| Chandler | AZ | 12 | 2000 | 12 | 2007 |
| Peoria | AZ | 6 | 1/1/2008 | | |
| Phoenix | AZ | 1 | 2001 | 2* | 2001 |
| Prescott Valley | AZ | 4 | 10/1/2006 | 8 | 10/1/2006 |
| Scottsdale | AZ | 7 | 1996 | 13* | 1996 |
| Burlingame | CA | 1 | 1/1/2009 | | |
| Capitola | CA | 2 | 10/1/2005 | | |
| Costa Mesa | CA | 15 | 6/1/2003 | | |
| Covina | CA | 6 | 4/19/2007 | | |
| Daly City | CA | 1 | 3/1/2008 | | |
| Davis | CA | 4 | 12/1/2005 | | |
| Del Mar | CA | 4 | 12/30/2003 | | |
| El Cajon | CA | 10 | 11/1/1997 | | |
| Fairfield | CA | 1 | 12/16/2003 | | |
| Fremont | CA | 11 | 1999 | | |
| Garden Grove | CA | 14 | 10/5/2004 | | |
| Lancaster | CA | 5 | 10/9/2006 | | |

**Table B-1. Red Light and Speed Camera Programs by Jurisdiction (continued)**

| Jurisdiction | State | Red Light Camera Program | | Speed Camera Program | |
|---|---|---|---|---|---|
| | | # of Cameras | Initiation Date | # of Cameras | Initiation Date |
| Newark | CA | 5 | 2004-2005 | | |
| Oxnard | CA | 11 | 7/1/1997 | | |
| Poway | CA | 5 | 3/18/2005 | | |
| Sacramento | CA | 10 | 1998 | | |
| San Bernardino County | CA | 0 | TBD[1] | | |
| Vista | CA | 9 | 6/1/2004 | | |
| Walnut | CA | 2 | 1/1/2007 | | |
| West Hollywood | CA | 24 | 5/1/1999 | | |
| Denver | CO | 4 | 2007 | 4 | 1998 |
| Lone Tree | CO | 1 | 8/1/2008 | | |
| Apopka | FL | 2 | 6/1/2007 | | |
| Decatur | GA | 2 | 9/9/2002 | | |
| Duluth | GA | 7 | 2/1/2005 | | |
| Gwinnett County | GA | 3 | 2005 | | |
| Clive[2] | IA | 8 | 7/1/2006 | | |
| Council Bluffs | IA | 7 | 8/4/2005 | | |
| Libertyville | IL | 0 | 4/1/2009[1] | | |
| Naperville | IL | 2 | 12/1/2008 | | |
| Richton Park | IL | 0 | TBD[1] | | |
| Waukegan | IL | 7 | 10/15/2007 | | |
| Baton Rouge | LA | 25 | 2/1/2008 | | |

**Table B-1. Red Light and Speed Camera Programs by Jurisdiction (continued)**

| Jurisdiction | State | Red Light Camera Program | | Speed Camera Program | |
|---|---|---|---|---|---|
| | | # of Cameras | Initiation Date | # of Cameras | Initiation Date |
| Jefferson Parish | LA | 19 | 10/24/2007 | | |
| Lafayette | LA | 10 | 1/1/2008 | 12 | 9/1/2007 |
| Bladensburg | MD | 1 | 8/1/2008 | | |
| Hyattsville | MD | 3 | 2005 | | |
| New Carrollton | MD | 2 | 5/1/2008 | | |
| Springfield | MO | 12 | 2000 | | |
| St. Peters | MO | 5 | 11/1/2006 | | |
| Charlotte[2] | NC | 15 | 1998 | 3* | 2005 |
| Fayetteville[2] | NC | 10 | 1999 | | |
| Raleigh | NC | 12 | 8/1/2003 | | |
| Wilmington | NC | 13 | 2001 | | |
| Toledo | OH | 30 | 2001 | 20* | 2003 |
| West Carrollton | OH | 5 | 11/1/2008 | 5 | 11/1/2008 |
| Medford | OR | 2 | 5/1/2002 | 2 | 5/1/2002 |
| Portland | OR | 11 | 2001 | 8* | 1996 |
| Salem | OR | 3 | 4/1/2008 | | |
| Philadelphia | PA | 13 | 2003 | | |
| Germantown | TN | 16 | 9/1/2002 | | |
| Arlington | TX | 17 | 6/1/2007 | | |
| Austin | TX | 10 | 5/1/2008 | | |
| Balcones Heights | TX | 7 | 4/1/2007 | | |

**Table B-1. Red Light and Speed Camera Programs by Jurisdiction (continued)**

| Jurisdiction | State | Red Light Camera Program | | Speed Camera Program | |
|---|---|---|---|---|---|
| | | # of Cameras | Initiation Date | # of Cameras | Initiation Date |
| Cedar Hill | TX | 5 | 4/1/2007 | | |
| College Station | TX | 4 | 2/18/2008 | | |
| Dallas | TX | 65 | 1/15/2007 | | |
| Denton | TX | 6 | 4/1/2006 | | |
| Duncanville | TX | 8 | 7/1/2007 | | |
| Fort Worth | TX | 20 | 1/1/2007 | | |
| Garland | TX | 9 | 9/1/2003 | | |
| Humble | TX | 10 | 11/1/2007 | | |
| Hurst | TX | 2 | 2008 | | |
| Hutto | TX | 3 | 10/16/2008 | | |
| Mesquite | TX | 2 | 2/28/2008 | | |
| Richardson | TX | 9 | 2006 | | |
| Southlake | TX | 0 | TBD[1] | | |
| Terrell | TX | 3 | 2/8/2008 | | |
| Fife | WA | 2 | 4/1/2008 | | |
| Lynnwood | WA | 10 | 2006 | | |
| Moses Lake | WA | 3 | 11/1/2008 | 1 | 2/1/2007 |

**Includes one or more mobile cameras*

[1]*Planned program*

[2]*Terminated program*

# APPENDIX C. PHONE INTERVIEW INFORMATION

Table C-1 provides contact information about the follow-up phone interviews conducted during the effort to create an inventory of past and current automated enforcement programs. All interviews were conducted in March, 2009.

**Table C-1. Phone Interviews**

| **Jurisdiction** | **Contact** |
|---|---|
| Prescott Valley, AZ | Wayne Nelson |
| Scottsdale, AZ | Paul Porell |
| Newark, CA | James Leal |
| Clive, IA | Robert Cox |
| Lafayette, LA | Tony Tramel |
| Charlotte, NC | Charlie Jones |
| Fayetteville, NC | Rusty Thompson |

# APPENDIX D. LITERATURE REVIEW

## REVIEW OF THE EFFECTIVENESS OF AUTOMATED SPEED ENFORCEMENT IN REDUCING COLLISIONS

A recent report on automated enforcement technologies prepared for the National Highway Traffic Safety Administration (NHTSA) provides a very good summary of the more reliable studies available. Decina et al. (2007) reviewed the available literature on the safety effects of automated speed enforcement as well as red-light-running cameras. Studies were evaluated based on several key criteria:

1. Did the study design and analysis document changes in driving speeds as well as crashes to provide a causal link between the treatment and effect (safety outcome)?
2. Did the study account for crash severity (to ensure that the treatment is not having counteractive effects on different types or severity of crashes)?
3. Did the study methods and analysis control/account for changes in traffic volumes before/after the implementation?
4. Did the study design and analysis account for possible time trend effects (such as general trends in crashes, or changes in the motoring population, vehicle fleet, weather, etc.)?
5. Did the study account for other possible confounding factors such as concurrent treatments/enforcement, or changes in data measures (such as reporting thresholds), or other factors that may overlap with before/after periods?
6. Did the study examine possible crash migration due to the treatment, either to non-enforced sections of the same roadways, or to non-enforced alternate roads?
7. Did the study account for regression toward the mean?

An additional possible criterion not specifically mentioned is how the study accounted for possible spillover, or general deterrence effects that result in collision reductions even at locations without cameras. Studies reviewed in detail did not necessarily address each of these criteria satisfactorily but they were nevertheless deemed to be of sufficient quality to merit such a review.

The reports reviewed in detail in the NHTSA report are also reported with further detail in a paper by Thomas et al. (2008). With respect to speed enforcement, both fixed and mobile automated speed enforcement programs were reviewed. A summary table provided in that report is reproduced below as Table D-1. The next few paragraphs emphasize some points of interest in a few of these studies.

(Chen et al. 2002) is the only known published, peer reviewed study using Canadian data. The results showed a 16% corridor-wide reduction (i.e., a general deterrence effect) in all crashes along a single 22 km (13.75 mile) corridor in a rural environment with 12 specific camera-enforced sites. The enforcement program was covert; and the comparison group used to control for time trends in collisions unrelated to photo radar may also have been affected by a province-wide program, resulting in an understatement of effect in this study. The study also found speed

reductions at the treated sites and a non-treated location in the corridor for two years following implementation.

Other studies found a wide range of crash reductions – from about 9% to 18% for all crashes, and from 21% to 51% for injury crashes. Confidence in these results is limited based on a general lack of control for regression-to-the-mean, short study periods for some studies, issues with comparison groups, and other factors. None of these studies separately examined both enforced and non-enforced locations to investigate the possibility of crash migration or spillover to non-enforced routes or segments.

Two of the studies reviewed examined system-wide effects of mobile enforcement. One reported a 25% reduction in daytime unsafe speed-related crashes province-wide and the other reported a reduction of 30% in daytime injury crashes State-wide. One of these two studies documented generalized speed reductions, and the other found a relationship between crash reductions and program intensity. Both studies used time-trend analyses to account for general trends, proxy measures to adjust for travel exposure, and one also used a neighboring similar State as a comparison group. One study found that crash reductions were highest in the two kilometers (1.25 miles) closest to the camera sites but reductions were found up to six kilometers (3.75 miles) from the camera sites.

Finally, Elvik (1997), referred to in Table D-1, deserves noting for two aspects. First, it also undertook a meta-analysis to amalgamate the results of the Norway photo radar evaluation with the overall results with those from six other studies of automatic speed enforcement in Germany, Australia, Sweden, England and the Netherlands. The meta analysis found a highly significant 17% decline in injury collisions. Second, the results from the Norwegian evaluation are by themselves of interest since they were able to distinguish between targeted and untargeted enforcement. After 1993, installation was done on sections meeting warrants based on accident and speed experience as follows:

- Accident rate warrant: A road section should have an accident rate higher than normal for the type road, where type of road is defined by road class, number of lanes and speed limit.
- Accident density warrant: A road section should have at least 0.5 injury accidents per kilometer per year (0.8 accidents per mile per year).
- Speed warrant: The mean speed of traffic on a section should be above the posted limit.

For road sections conforming to the accident warrants, the effect was stronger, with a significant 26% decrease in injury collisions compared to an insignificant 5% decrease where the warrant was not met, suggesting that there is validity to the warrants used.

**Table D-1. Summary of Safety Effectiveness of Automated Speed Enforcement (Thomas et al., 2008)**

| Study | Program Type | Treatment and Comparison Groups | Study Period and Limitations | Key Reported Outcomes |
|---|---|---|---|---|
| Elvik R. (1997). Effects on accidents of automatic speed enforcement in Norway, *Transportation Research Record* 1595: 14-19. | Fixed, conspicuous, automated speed enforcement | · 64 sections on a variety of roads/speed limits. Later sections added to the study had to meet both higher than normal accident density and higher than normal accident rate warrants for the road type, and have mean speeds above the posted speed limit. Earlier sections did not necessarily meet all of these requirements.<br>· Comparison using Empirical Bayes (EB) procedures and county crashes for each location to account for general trends and volumes and<br>· Regression to the mean (RTM). | · Before = 3.94 years (avg.); After = 4.61 years (avg.)<br>· Effects on speed not determined.<br>· Apparently, no direct accounting for before/after traffic volume changes. Expected crashes may also have been estimated assuming a linear relationship with vehicle miles traveled.<br>· To adjust for time trends, used the ratio of comparison group crashes in after period to comparison group crashes in before period. More recent studies have estimated annual factors for each year in the study period to more accurately account for time trends.<br>· No discussion of other potential confounders but may have been controlled with procedures used.<br>· Crash migration not examined. | · Average segments of 5.2 km:<br>· *-20% (-26%, -13%) injury crashes*<br>· Sections conforming to crash rate and crash density warrants:<br>· *-26% ( -36%, -16%) injury crashes*<br>· Sections not conforming to either warrant:<br>· *-5% (-28%, +24%) injury crashes*<br>· Data for only one section:<br>· *-12% (-38%, +26%) property damage only crashes* |
| Hess S. (2004). Analysis of the effects of speed limit enforcement cameras: differentiation by road type and catchment area. *Transportation Research Record* 1865: 28-34. | Fixed, conspicuous, automated speed enforcement | · 49 sites on rural trunk roads and urban roads; major (A roads) and minor roads (non-A); speed limits not described.<br>· Time-dependent coefficients were derived using all crashes in the county (including at camera sites). These were then used to remove time dependent components including RTM, trend, and seasonality. | · Before = varied; after = varied, minimum 1 year. Total study period 13 years.<br>· Effects on speed not determined.<br>· Fatal and injury crashes considered by developing weights based on likelihood for each crash injury level (except no injury).<br>· No explicit examination of traffic volume.<br>· Crash migration due to traffic flow changes not considered.<br>· Time-dependent coefficients were intended to control for factors that have regional effects.<br>· Unclear whether time-dependent coefficients sufficiently account for regression to the mean. | · Area within 250m (if linked by road) of camera sites:<br>· *-45.7% weighted injury crashes*<br>· Area within 500m of camera sites:<br>· *-41.3% weighted injury crashes; effects higher on major roads and trunk roads*<br>· Area within 1000 m:<br>· *-31.6% weighted injury crashes*<br>· Area within 2000 m:<br>· *-20.9% weighted injury crashes*<br>· [Confidence intervals/ significance levels not reported.] |

**Table D-1. Summary of Safety Effectiveness of Automated Speed Enforcement (Thomas et al., 2008) (Continued)**

| Study | Program Type | Treatment and Comparison Groups | Study Period and Limitations | Key Reported Outcomes |
|---|---|---|---|---|
| Mountain L., W. Hirst, and M. Maher (2004). Costing lives or saving lives? A detailed evaluation of the impact of speed cameras on safety, *Traffic Engineering and Control* 45: 280-287. | Fixed, conspicuous, automated speed enforcement | · 62 sites on 48 kph (30 mph) roads with reported severe speeding problems throughout country.<br>· Comparison using EB procedures and comparison group of national crashes and traffic flows used to account for general trends and traffic flow changes. | · Before = 3 years; After = 2.3 years (avg.)<br>· Other potential confounders may have been controlled using study methods /national crashes as comparison group. However, treatment spillover or effects of other speed camera programs may have affected estimates of effects.<br>· Time trend adjustments were used to compensate for using older safety performance functions in EB procedures. | · Within 500m either direction:<br>· *-25% (-35%, -14%) injury crashes*<br>· *-20% attributed to speed/behavior changes, and*<br>· *-5% attributed to traffic diversion*<br>· Within 1km either direction:<br>· *-24% (-33%, -13%) injury crashes*<br>· *-19% attributed to changes in speed*<br>· *-5% to traffic diversion.* |
| Cunningham C.M., J.E. Hummer, and J-P. Moon (2005). An Evaluation of the Safety Effects of Speed Enforcement Cameras in Charlotte, NC, Final report presented to NC Governor's Highway Safety Program. | Mobile, overt, automated speed enforcement | · 14, 35 – 50 mph (56 – 80 kph) high volume, urban corridors.<br>· Comparison group of 11 corridors within the City (lower volume but similar crash trends). | · Before = 4 years; after = 4 months; short after period – consider results preliminary.<br>· Severity reporting changes during the study; separate analyses by severity confounded.<br>· Before/after traffic volume not explicitly considered.<br>· Crash migration not considered.<br>· RTM not explicitly controlled – some analyses to examine possible RTM effects. | · Corridor-wide:<br>· *-12% +/- 4% all crashes* |

**Table D-1. Summary of Safety Effectiveness of Automated Speed Enforcement (Thomas et al., 2008) (Continued)**

| Study | Program Type | Treatment and Comparison Groups | Study Period and Limitations | Key Reported Outcomes |
|---|---|---|---|---|
| Newstead S. and M. Cameron (2003). *Evaluation of Crash Effects of the Queensland Speed Camera Program*, Monash University Accident Research Center Report No. 204. | Mobile, overt, automated speed enforcement | · 1500 high crash zones throughout state. Zones could include multiple marked camera sites; defined as high crash area within 6 km boundary (polygon).<br>· Comparison group of sites outside the 6 km boundaries intended to reflect effects of other enforcement programs (started before the speed camera program) and general trends. | · Before = 5 years; after = 4.5 years.<br>· Effects on speed not determined.<br>· No explicit control for traffic volume.<br>· Long-term trends accounted for.<br>· Seasonality was not considered.<br>· No examination of crash migration.<br>· RTM not directly controlled, but relatively long study periods may reduce RTM effect. | · Within 2 km area:<br>· *-17.5% (p < .0001) all severity crashes*<br>· *-15.6% (p = .0002) fatal & medically treated crashes*<br>· *-21.9 (p=.0001) hospitalization crashes*<br>· *-20.3% (p < .0001) no-injury crashes*<br>· Also reported significant crash reductions in various categories within 2 - 4 km, and 4 – 6 km.<br>· Significant effects of program intensity (number of zones and hours of operation per site) on all severity crash reductions) |
| Christie, S.M., R.A. Lyons, F.D. Dunstan, and S.J. Jones (2003). Are mobile speed cameras effective? A controlled before and after study, *Injury Prevention* 9: 302-306. | Mobile, overt, automated speed enforcement | · 101 sites; Majority on 30 mph (48.3 kph) roads; About 1/4th on higher speed roads.<br>· Matched comparison sites from neighboring police enforcement district. | · B = 38 months (avg.); A = 17 months (avg.)<br>· Effects on speed not determined.<br>· Effects on severity not examined.<br>· Traffic volume data not available.<br>· Unclear if trends in crashes were same for treatment and comparison group.<br>· Cameras introduced in the region prior to the study.<br>· Data precision (crash location) improved in the after period.<br>· Crash migration not considered.<br>· RTM not controlled. | · Within 500m either direction:<br>· *-51% injury crashes all roads*<br>· *-51%)injury crashes 30 mph roads*<br>· *-59% injury crashes 70 mph*<br>· *roads* |

**Table D-1. Summary of Safety Effectiveness of Automated Speed Enforcement (Thomas et al., 2008) (Continued)**

| Study | Program Type | Treatment and Comparison Groups | Study Period and Limitations | Key Reported Outcomes |
|---|---|---|---|---|
| Goldenbeld C. and I. van Schagen (2005). The effects of speed enforcement with mobile radar on speed and accidents: An evaluation study on rural roads in the Dutch province of Friesland, *Accident Analysis and Prevention* 37:1135-1144. | Mobile, overt, automated speed enforcement | · 28 segments on 80 and 100 kph (50 – 62 mph), rural single carriageway roads.<br>· Comparison group included all other rural roads in the province, approximately 5200 km total length. | · Before = 8 years; After = 5 years<br>· Traffic volumes were substantially lower on comparison roads and not explicitly considered in analyses.<br>· Possible confounding from engineering measures implemented during study period.<br>· Possible confounding due to spillover effects on unenforced segments (extensive media campaign).<br>· Crash migration considered only indirectly.<br>· RTM not controlled, but long study period may mitigate RTM effect. | · Average of 4.1 km segments:<br>· *-21% injury crashes [0.79 odds ratio (0.66, 0.95, 95% CI)]*<br>· *-21% serious traffic casualties [0.79 odds ratio (0.63, 0.99 95% CI)]* |
| Tay R. (2000). Do speed cameras improve road safety? In *Traffic and Transportation Studies, Proceedings of ICTTS 2000,* Ed K.C.P. Wang, G Xiao, and J. J. Beijing, People's Republic of China, pp 44-51. | Mobile, overt, automated speed enforcement | · 24 sites in city of Christchurch. Cameras increased from 3 to 24 during the study period.<br>· Comparison group included all non-speed camera zones in the city. | · Total before/after study period 1993<br>· – 1995; B and A periods not described but varied by site.<br>· Only city-wide mean and 85th percentile speed trends were described.<br>· Traffic volume not explicitly considered.<br>· Crash migration not considered.<br>· RTM not controlled. | · *-9.2% +/- 5.9% reduction in all crashes (treatment length not reported)*<br>· *-32.3% +/- 12.5% reduction in serious injury crashes* |

**Table D-1. Summary of Safety Effectiveness of Automated Speed Enforcement (Thomas et al., 2008) (Continued)**

| Study | Program Type | Treatment and Comparison Groups | Study Period and Limitations | Key Reported Outcomes |
|---|---|---|---|---|
| Chen G., J. Wilson, and P. Meckle (2002). Speed and safety effect of photo radar enforcement on a highway corridor in British Columbia, *Accident Analysis and Prevention* 34: 129-138. | Mobile, covert, automated speed enforcement | · 12 radar locations along a single 22 km segment of an 80 to 90 kph (50 or 56 mph) rural, divided highway.<br>· Comparison group of 3 police jurisdictions in study area. | · Before = 2 years; after = 2 years.<br>· Effects on varying severity of crashes not determined.<br>· Unclear if before/after traffic volumes explicitly considered.<br>· Comparison group may have been affected by province-wide program and publicity.<br>· Traffic flow and crash migration to other routes deemed unlikely since no alternate routes.<br>· Empirical Bayes methods used to control for RTM, general volume effects. | · Corridor-wide:<br>· *-16% +/- 7% all (police reported) crashes at treated locations (within 1 km either direction).*<br>· *-14% +/- 11% all crashes at non-treated interleaving sites along*<br>· *Corridor (> 1 km from camera sites).*<br>· *-19% +/- 10% all crashes (not significantly different from treated segments)* |
| Cameron M., A. Cavallo, and A. Gilbert (1992). Crash-Based Evaluation of the Speed Camera Program in Victoria 1990-91. Phase 1: general affects, Phase 2: effects of program mechanisms, Monash University Accident Research Center Report No. 42. | Mobile, covert, automated speed enforcement | · 54 cameras used on 60 and 100 kph (37 and 62 mph) urban (Melbourne, 70%) and rural (30%), mostly arterial, roads.<br>· Comparison group:<br>· Comparable areas from neighboring state. (Cameras introduced into comparison areas during after period; analyses took this into account.) Time series models controlled for seasonal and time-trend. | · Before = 7 years; After = 18 months (full implementation)<br>· Effects on speed not determined.<br>· Economic indicators used to control for exposure.<br>· Daytime (low alcohol hour) crashes used to reduce confounding with alcohol-related program.<br>· Program was covert and widely publicized so traffic diversion and crash migration not considered likely; examination not possible with system wide analysis.<br>· RTM not likely a factor due to using system-wide crashes and long before period. | · System- (state)-wide (full intervention period, before cameras introduced into NSW):<br>· *-20.9% (-27.9%, -13.3%) 3-day time casualty crashes (injury and fatality).*<br>· *-27.9% in crash severity (ratio of fatal + serious*<br>· *inj./minor injury*<br>· *crashes)*<br>· City-wide (Melbourne):<br>· *-21.1% (-28.9%, -12.4%) daytime casualty crashes.*<br>· Rural areas (Victoria):<br>· *-19.5% (-27.5%, -10.7%) daytime casualty crashes* |

**Table D-1. Summary of Safety Effectiveness of Automated Speed Enforcement (Thomas et al., 2008) (Continued)**

| Study | Program Type | Treatment and Comparison Groups | Study Period and Limitations | Key Reported Outcomes |
|---|---|---|---|---|
| Chen G., J. Wilson, W. Meckle, and P. Cooper (2000). Evaluation of photo radar program in British Columbia, *Accident Analysis and Prevention* 32: 517-526. | Mobile, covert, automated speed enforcement | · Province-wide deployment of 30 cameras operated primarily during daytime at high crash sites or sites with perceived speeding problem.<br>· No comparison group. Time series models to control for seasonal and time-trend effects. | · Before = 5 years; after = 1 year (following 5-mo. phase-in).<br>· Gasoline sales used as proxy covariate to account for exposure (in lieu of traffic volume).<br>· Use of daytime-only unsafe speed-related collisions to reduce confounding with alcohol interventions introduced during the study period.<br>· No comparison group to account for other/unknown trends. Program was covert and widely publicized so traffic diversion and crash migration not considered likely; examination not possible with system wide analysis.<br>· RTM not likely a factor due to using system-wide crashes. | · System- (province)-wide:<br>· *-25% daytime unsafe speed-related crashes (significance level presumed p = .05)*<br>· *-11% day-time traffic collision injured carried by ambulance (sign level presumed p = .05)*<br>· *-17% daytime traffic collision fatalities (p = .10, one tailed)* |

Beyond the studies reviewed in the Federal Highway Administration (FHWA) effort, there are a few more of interest. These are the focus of the next few paragraphs.

Sayed and DeLeur (2006) in a review of photo enforcement for the City of Edmonton cite several additional studies. Rogerson et al. (1994), found a significant reduction in injury crashes within 1 km. of photo radar. The effect was confined to high alcohol use hours on arterial roads. Hitchens (1994) estimated a crash reduction of 16%, a reduction of injuries of 21% and a 30% reduction in fatalities. Mara et al. (1996) reported a significant reduction of 13% in fatal and serious crashes in urban areas during low alcohol exposure times and a reduction of 23% in non-alcohol exposure times. In rural areas an 11% reduction in injury crashes was found in the photo radar areas but no general deterrence effect was found for the road network as a whole.

Cunningham, Moon, and Hummer (2007) cite a Norwegian study showing reductions of 20% in injury crashes, an Australian study showing reductions of 21% for all severity levels and a United Kingdom study showing an 18% reduction for all crashes and a 31% reduction for injury crashes. All studies were reported to control for regression-to-the-mean and other confounding factors. This paper further presents an analysis of the program in Charlotte, North Carolina updating a preliminary analysis cited in the NHTSA report. The Charlotte program uses automated enforcement at fourteen corridors selected based on high numbers of collisions, perceived speeding problems and an attempt to spread the locations geographically. The roadways are high volume multi-lane urban arterials. Both the enforced and comparison corridors had higher intersection densities than typical thoroughfares ranging from between five and eleven intersections per mile. To study the effectiveness of the program, eleven similar but non-treated corridors were selected. The authors do note that the comparison sites did have lower crash frequencies and a lower perception of speeding problems than did the treated corridors. The trends in the before period for both treated and comparison sites were checked and confirmed that the comparison group was an appropriate one to account for time trends in crash counts. Total crashes were estimated to decrease between 9% and 14%.

Shin et al. (2009) analyzed the safety effects of a 9 month demonstration program of fixed photo speed enforcement on a 6.5 mile stretch of limited access freeway with a 65 mph speed limit in Scottsdale, Arizona. The program included 6 speed detection locations, with 3 cameras in each direction and used a tolerance speed of 76 mph for issuing a ticket. Three methods were applied for before-after studies but only the Empirical Bayes (EB) will be discussed as it is the state-of-the-art method. The other methods did however support the EB findings. Target crashes were accidents in non-peak periods, which have free-flow traffic conditions, and were analyzed into four groups, including: single-vehicle, side-swipe same direction, rear-end and other. The available before period was 5 years in duration while the after period was 244 days. Total target crashes were estimated to have been reduced by 54%, injury crashes by 48% and PDO crashes by 56%. For all severities combined, the estimated reductions by crash type were 63% for single-vehicle, 48% for side-swipe same direction, 26% rear-end and 88% for other. An assignment of crash costs to the estimated reductions indicated a benefit of $17.1 million per year.

In summary, the safety effects for mobile enforcement vary widely, likely due to various aspects of the programs and evaluations, including:

- Conspicuity of the enforcement.
- Enforcement intensity.
- Study methods used for evaluation of crash reduction.
- Differing crash outcome measures used.
- Differing assumptions on the distance downstream that automated enforcement is effective.

The effects vary from roughly a 9% to 18% reduction in all collisions and a 21% to 51% reduction in all injury collisions. The length of roadways where a collision reduction was found ranged from 800 ft. to 4 miles either side of the enforcement location. For policy making purposes, it does seem reasonable to conservatively estimate the benefits to be 10% for total collisions and the area of impact downstream of the enforcement location to be at least 0.5 mile. These benefits are under the assumption that the enforcement impact on speed is maintained through sufficient enforcement intensity. The estimate of a 10% reduction is also an average effect. Locations with greater numbers of speed-related collisions would be expected to have larger collision reductions.

## REVIEW OF THE EFFECTIVENESS OF RED LIGHT CAMERA ENFORCEMENT IN REDUCING COLLISIONS

The first part of this review is taken from a review conducted by the authors for a FHWA study. The goal was not to review a large number of studies but to focus on a shorter list of 17 international studies judged to be "critical studies." The studies reviewed varied widely in a number of areas including:

a) Type of accident considered (all, right-angle, those caused by red light running, etc.).
b) Accident severities (all, injury plus fatal, weighted).
c) Area of study (treated intersections, treated approaches, jurisdiction-wide).
d) Use and designation of comparison sites.
e) Treatment type (cameras only, cameras plus warning signs, red light and speed cameras).
f) Sample sizes, ranging from three to 78 camera-equipped intersections.
g) Countries – several from Australia and the UK but very few from the US.

Study methodology (simple before-after, before-after with comparison group, chi-squared tests, statistical modeling etc.).

Not surprisingly, estimates of the safety effect of red light running cameras varied considerably. A summary of the more relevant study findings is provided in Table D-2, including a synopsis of the main difficulties. As can be seen, most studies reviewed were tainted by methodological difficulties that raise questions about any conclusions from them. One difficulty – failure to account for regression to the mean – can exaggerate the positive effects,

while another – ignoring possible spillover effects at intersections without red light cameras (RLCs) – will lead to an underestimation of RLC benefits, and more so if sites with these effects are used as a comparison group. ("Spillover effect" is the expected effect of RLCs on intersections other than the ones actually treated, due to jurisdiction-wide publicity and the general public's lack of knowledge of where RLCs are actually installed.) Almost all studies had one or the other of these flaws and many had both, in addition to other flaws.

A similar assessment was made independently in a meta-analysis by Retting, et al., whose review included most of the same studies cited in Table D-2 and some others. That work found, expectedly, that largest safety benefits were reported by studies that did not control for regression to the mean and that small effects tend to be found where the possibility of spillover was ignored. The one study that measured both spillover and specific effects, while ensuring that regression to the mean was not a factor, was an evaluation of the Oxnard, California program by the Insurance Institute for Highway Safety. That study found a significant reduction in injury crashes overall but did not separate the specific effects at treatment sites from citywide effects.

**Table D-2. Summary of findings from past studies (prior to the 2005 FHWA study)**

| Reference | City | Camera Sites | Comparison/Reference Group | Crash Type Studied and Estimated Effects (negative indicates reduction) | | Comment |
|---|---|---|---|---|---|---|
| Hillier et al. (1993) | Sydney, Australia | Installed at 16 intersections | 16 signalized intersections | Right-angle and left-turn opposed | -50% | RTM* possible; spillover may have affected comparison sites; results confounded by adjustment to signal timing in middle of study period. |
| | | | | Rear-end | +25% to 60% | |
| South et al (1988) | Melbourne, Australia | Installed at 46 intersections | 50 signalized intersections | No significant results. Looked at Right Angle, Right Angle (Turn), Right Against Thru, Rear End, Rear End (turn), Other, All crashes, No. of casualties.<br>No significant results | | RTM* possible, no accounting for changes in traffic volumes. Comparison sites possibly affected by spillover and other treatments. |
| Andreassen (1995) | Victoria, Australia | | | No significant results | | Lack of an effect may be due to the fact that the sites studied tended to have few red-running related accidents to begin with. Comparison sites may have been affected by spillover. |
| Kent et al. (1995) | Melbourne, Australia | 3 intersection approaches at different intersections | non-camera approaches | No significant relationship between the frequency of crashes at RLC and non-RLC sites and differences in red light running behavior | | Cross-sectional design is problematic and there were likely spillover effects to the non-camera approaches at the same intersections. |
| Mann et al. (1994) | Adelaide, Australia | Installed at 13 intersections | 14 signalized intersections | Reductions at the camera sites were not statistically different from the reductions at the comparison sites. | | RTM*and spillover to comparison sites are issues not dealt with |
| London Accident Analysis Unit (1997) | London, U.K. | RLC at 12 intersections and 21 speed cameras | City-wide effects examined | No significant results. | | The results are confounded by the fact that two programs are being evaluated |

**Table D-2. Summary of findings from past studies (prior to the 2005 FHWA study) (continued)**

| Reference | City | Camera Sites | Comparison/Reference Group | Crash Type Studied and Estimated Effects (negative indicates reduction) | | Comment |
|---|---|---|---|---|---|---|
| Hooke et al. (1996) | Various cities in England and Wales | Installed at 78 intersections | | All injury | -18% | A simple before-after comparison not controlling for effects of other factors, RTM* and traffic volume changes; therefore there is limited confidence in the results. |
| Ng et al. (1997) | Singapore | Installed at 42 intersections | 42 signalized intersections | All | -7% | RTM* and spillover effects at comparison sites are issues |
| | | | | Right-angle | -8% | |
| Retting and Kyrychenko (2001) | Oxnard, California | Installed at 11 intersections | Unsignalized intersections in Oxnard and signalized intersections in 3 similarly sized cities | All | -7% | Looked at city-wide effects, not just at RLC sites<br><br>29 months of before and after data used |
| | | | | All Injury | -29% | |
| | | | | Right-angle | -32% | |
| | | | | Right-angle Injury | -69% | |
| | | | | Rear-end | +3% (non-significant) | |
| SafeLight, Charlotte | Charlotte, North Carolina | Installed at 17 intersections | no comparison group | Angle - all approaches | -37% | Probable RTM in site selection |
| | | | | Angle - camera approaches | -60% | |
| | | | | All - camera approaches | -19% | |
| | | | | Rear-end - camera approaches | +4% | |
| | | | | All | < -1% | |

**Table D-2. Summary of findings from past studies (prior to the 2005 FHWA study) (continued)**

| Reference | City | Camera Sites | Comparison/Reference Group | Crash Type Studied and Estimated Effects (negative indicates reduction) | | Comment |
|---|---|---|---|---|---|---|
| Maryland House of Delegates (2001) | Howard County, Maryland | Installed at 25 intersections | | Rear-end | -32% | Probable RTM in site selection |
| | | | | Right-angle | -42% | |
| | | | | Other | -22% | |
| Fleck and Smith (1998) | San Francisco, California | Installed at 6 intersections | city-wide effects looked at | City-wide Injury collisions caused by red-light violators. It is not clear how these were defined. | - 9% | Question on definition of RLC crashes. Did not examine specific effects at treated sites. |
| Vinzant and Tatro (1999) | Mesa, Arizona | 6 intersections with RLC only 6 with RLC plus photo speed enforcement | 6 signalized intersections | total crash rates – crashes per million entering vehicles at each intersection | | It is not clear whether the assignment of treatment/no treatment to the four quadrants was random. |
| | | | | combined-treatment quadrant; | - 15.9% | |
| | | | | photo-radar quadrant | - 7.5% | |
| | | | | RLC quadrant | - 9.7% | |
| | | | | Control quadrant | - 10.7% | |
| Fox (1996) | Glasgow, Scotland | Installed at 8 intersections and 3 pelican crossings. | Area-wide effects on injury crashes looked at. | Crossing Carelessly | - 54% | RTM effects likely.<br>Because the decreases in non-RLR crashes are greater than the RLR decreases at times, it is difficult to say what citywide effect the cameras have |
| | | | | Unsafe Right Turn | - 29% | |
| | | | | Fail to Keep Distance | + 8% | |
| | | | | Other | - 29% | |
| | | | | All per month | - 32% | |
| Winn (1995) | Glasgow, Scotland | 6 locations on 1 approach | Various | injury crashes related to RLR violations | - 62% | Probable RTM effects. |

* RTM – Regression to the mean, also called bias by selection

While it was difficult to make definitive conclusions from studies that generally fail the tests on the validity of the methodology, the results did provide some level of comfort for a decision to conduct a definitive large-scale study of US installations. That study is reviewed next, along with several other studies published since that time, following a citation list for the FHWA study review.

Council et al. (2005) conducted a multi-jurisdictional empirical Bayes before-after evaluation of 132 intersections equipped with red-light running cameras. The fundamental objective was to determine the effectiveness of RLC systems in reducing crashes and specially derived rear-end and right-angle unit crash costs for various severity levels. The results showed little difference in total crashes, with approximately 25 percent reduction in right-angle crashes and a 15 percent increase in rear-end crashes. Considering only injury crashes (KAB on the KABCO scale, thus excluding possible injury and property damage only) the results were a 16% decrease for right-angle and a 24% increase for rear-end. The extent to which the increase in rear-end crashes negates the benefits for the reduction in right-angle crashes was examined in the economic analysis, which showed that there was indeed an aggregate crash cost benefit of RLC systems. In this economic analysis there was an estimated 9% reduction in crash costs. The second perspective of the opposing effects for the two crash types is the implication that RLC systems would be most beneficial at intersections where there are relatively few rear end crashes and many right-angle ones. A disaggregate analysis found that greatest economic benefits are associated with the highest total entering annual average daily traffic (AADT), the largest ratios of right-angle to rear-end crashes and with the presence of protected left turn phases. The possibility of spillover effects at untreated signalized intersections was also examined. A statistically significant reduction of 9% in right-angle crashes was found, however, for rear-end crashes no change was detected. The authors state that this latter result, which differs from the treated sites, somewhat detracts from the credibility of an observed general deterrence effect.

Perhaps the most important study since the FHWA one in terms of its prominence was a 2007 effort by Garber et al. A recent critique of that study by Persaud et al. (2008) found possible substantial difficulties with that study. The Garber et al. report documents the safety impacts of red light cameras deployed in six Virginia jurisdictions at some point during the 10-year period when they were permitted under Virginia law. Based on 7 years of crash data from 1998 to 2004, the study found that cameras are associated with an increase in rear-end crashes (about 27% or 42% depending on the statistical method used) and a decrease in red light running crashes (about 8% or 42% depending on the statistical method used). The report also shows that there is significant variation by intersection and by jurisdiction: one jurisdiction's results suggests that cameras are associated with an increase in all six crash types that were explicitly studied (rear-end, angle, red light running, injury red light running, total injury, and total) whereas two other jurisdictions saw decreases in most of these crash types. When the comprehensive crash costs for rear-end and angle crashes are monetized, the cameras were found to be associated with a net increase in crash costs. However, the Persaud et al. critique suggested that the application of the methods of analysis and the quality of the data, particularly the data on traffic volumes at camera and non-camera intersections, may not support these conclusions.

Burkey and Obeng (2004) collected data for 18 camera equipped sites and 285 non-treated signalized intersections. A Poisson regression model was developed using monthly data

on the observed crashes, average daily total entering volume, presence of camera, weather and various intersection characteristics for geometry and traffic control. The authors claim that the red-light cameras increased crashes overall and for most crash types by a significant margin. However, the study methodology is poor which explains the results being counter to most published studies. The principal study flaw is that the comparison group sites exhibit observed crash rates that are a fraction of those observed at the treated sites, over and above which regression-to-the-mean could be expected to explain. The calibrated model includes a variable identifying a site as either having a camera or not in each month, but no variable indicating if a site is a treatment site or not, meaning that crash frequencies for camera equipped sites are being compared with sites with much lower crash rates, the difference which is not in fact attributable to the cameras. The model suggests that RLC programs result in an increase in crashes but what it really shows is that the crashes at treated sites do not reduce to the much lower level observed in the comparison group. Other flaws in the study include the inclusion of insignificant parameter estimates in the models and not accounting for potential spillover effects.

Washington and Shin (2005) conducted an of red light cameras in the cities of Phoenix and Scottsdale using a total of 24 treated sites. Several analysis methods were used, however, the EB before-after study method is considered the state-of-the-art and the results of this method are considered the most reliable. We do note though that the other methods support the results of the EB study. For Scottsdale, where the EB method was applied, the results were:

All approaches (with and without cameras):

- 17% reduction in angle crashes.
- 40% reduction in left-turn crashes.
- 45% increase in rear-end crashes.
- No significant change in total crashes.

Target approaches:

- 20% non-significant reduction in angle crashes.
- 45% reduction in left-turn crashes.
- 41% increase in rear-end crashes.
- 11% reduction in total crashes.

The city of Phoenix did not have a complete dataset for performing an EB study so the results of a before-after study with comparison group were given. These results should be reviewed keeping in mind that this is not the preferred analysis method. That there were only 10 comparison sites used also limits the reliability of the results.

All approaches (with and without cameras):

- 14% non-significant reduction in angle crashes.
- No reduction in left-turn crashes.
- 20% increase in rear-end crashes.

- No significant change in total crashes.

Target approaches:

- 42% reduction in angle crashes.
- 10% non-significant reduction in left-turn crashes.
- 51% increase in rear-end crashes.
- No reduction in total crashes.

The economic impacts of red light cameras were investigated by assigning average costs to the estimated crash reductions or increases. The results in Phoenix show a slight economic benefit on treated approaches but an increase in costs for all approaches. The authors cite that crashes being reduced were mostly of the property damage only (PDO) severity being the cause of the small or negative benefits. Given the concerns with the methodology, these results are not considered reliable. The Scottsdale analysis, which applied the preferred EB method, indicates overall benefits of $684,134 and $836,460 per year for target approaches and all approaches respectively. The report cites camera costs between $50,000 to $100,000 plus $60,000 per year to operate. Thus, from the Scottsdale analysis red light cameras can be very cost effective.

Further analyses of these benefits identified characteristics of sites more likely to show benefits from red light cameras.

### Warning Signs

When a warning sign is installed at an intersection, the crash reduction benefits from angle and left-turn crashes appear to be greater than those at intersections without a warning sign. In contrast, the crash costs (negative benefits) from rear-end crashes are greater for intersections with a warning sign. That both positive and negative effects are seen to be greater when warning signs are present suggest that the warning signs are effective.

### Approach Speeds

Approach speeds to intersections (as measured by posted speed limits) appear to be positively associated with the net crash benefits. As the authors point out, high speeds are associated with higher injury severities and red light cameras may reduce severities considerably.

### Signal Timing

Longer cycle lengths and longer green phases are associated with higher benefits.

## REVIEWS CONCERNING COST-EFFECTIVENESS, RESOURCE REQUIREMENTS, PUBLIC PERSPECTIVE

Cunningham et al. (2005) cite a NHTSA study (Fredrick and Molnar, 1995) which investigated public opinions regarding automated speed enforcement devices in Kalamazoo and Oakland County, Michigan where the majority of respondents had not seen it in use. A mail survey was conducted with 2,000 randomly selected drivers, 141 drivers who had seen a warning

letter after speeding in an enforced area, and 147 drivers who also were seen speeding but who had not been sent a warning letter. The survey results found widespread support for automated speed enforcement in specific areas, including work and school zones. Drivers who had received multiple citations for speeding were more opposed to automated enforcement than the general public. A second study cited, carried out by Polk (Polk, 2002), identified several characteristics for a successful implementation of automated enforcement. These criteria included:

- Being respectful of privacy concerns.
- Passing enabling legislation first.
- Getting the judiciary system involved.
- Combining enforcement with a public campaign.
- Not publicizing enforcement locations too widely.
- Not using photo-radar where speed enforcement tolerances are unrealistic.
- Keeping notification lag time short.
- Not demanding more from the technology than it can deliver.

Cunningham's study convened four focus groups in two regions of North Carolina consisting of two community groups and two composed of professionals such as traffic engineers and police officers who work in the subject area. Significant findings of the survey include:

- Most participants agreed that enforcement of speeds needed to increase, but many were unsure of the automated process.
- Participants thought this program helped decrease the equivalent number of officers on the streets.
- A system should be set up to allow money to be used in the enforced municipality, thus supporting the community, such as other road safety improvements.
- Enforcement of this type does not allow the officer the one-to-one contact with the motorist which could be important, for example, if a speeding driver was impaired.
- Many police, as well as drivers, believe there is a speed tolerance that, when driving, should not be crossed or a citation will be issued. The tolerances suggested ranged from 5 – 10 mph, with most suggesting 10 mph.
- Fines of $50 were thought to be fair and media campaigns were timely and pointed.
- There was an emphasis on the need for continuous driver education to increase the effectiveness of the program.
- Drivers need to be aware of program motives, operational details, and statistics through web sites, media, and perhaps other methods.
- Participants felt that having an individual interact with the radar and camera in a mobile van was a very good idea.

Rodier et al. (2008) reviewed the available literature on automated enforcement in the U.S. This review indicated that contrary to claims by foes of automated enforcement programs, few programs actually make money and many are either revenue-neutral or require a subsidy. This finding was attributed to the differences in how revenues and administrative costs are distributed. The example of six cancelled programs in California is cited where state law imposed restrictions on "the amount of revenues that cities could receive from traffic fines". In addition, California law did not allow for direct legal service of photo-radar speed citations through the mail resulting in increased administrative costs to ensure fines are paid. Previous surveys of public opinion are cited which indicate that a majority of respondents support automated enforcement; however, the margins of support vary widely, from a low of 51 percent in Washington, D.C. to a high of 77 percent in Scottsdale, Arizona. Common reasons for opposing automated speed enforcement include privacy concerns, preference of officer contact, as well as concerns about effectiveness, enforceability, and inaccuracy.

A national survey sponsored by NHTSA in 2002 (Royal, 2003) is cited where 68 percent of the respondents indicated that the use of automated speed enforcement systems was a good idea for those "going 20 mph or move over the posted speed limit" and 78 percent for speeding in a school zone. In addition, 56 percent of drivers favored photos taken of the driver from the front of the vehicles and matched to the driver's license, and 32 percent were in favor of taking photos of the rear license plate only. A second NHTSA sponsored survey (Boyle, 1998) reviewed found that 71 percent of the respondents indicated they favored the use of automated devices for speed enforcement. Further findings included that females are more likely than males to endorse automated speed enforcement by 15 percentage points and that 76 percent of drivers believed that the use of automated speed devices would reduce speeding-related accidents. Those who were in favor of automated enforcement cited the following reasons:

- Photo evidence proves a violation (20 percent).
- Increased driver awareness (19 percent).
- Fewer police needed for traffic enforcement (19 percent).
- Drivers would obey traffic laws and regulations (18 percent).
- Freeing up police for other types of enforcement (9 percent).
- Deterring speeding (7 percent).
- Reducing accidents (9 percent).

Those who were not in favor of automated enforcement cited:

- Invasion of privacy, violation of rights, or government infringement (26 percent).
- Preference for in-person contact with an officer (18 percent).
- Licensee must pay ticket no matter who was driving (14 percent).
- Camera failures including error, malfunction, and other (13 percent).
- Machines should not do police work (12 percent).
- Could be ineffective or unenforceable (11 percent).

The case studies reviewed by the authors stressed the importance of engaging stakeholders, such as citizens, special interest groups, elected officials and governmental agencies, in the development and implementation of automated speed enforcement programs. Public information and outreach should make citizens more aware of the safety consequences of the violation, explain program objectives and results, and provide advanced warning that there will be increased enforcement. A study reviewed in Washington D.C. (Retting, 2003) of a telephone survey conducted nine months after speed cameras were put into use indicated that 51 percent of respondents favored and 36 percent opposed the use of the speed cameras with thirteen percent of respondents reported having no opinion. Further results suggested that "support for camera enforcement was higher among middle-aged and older drivers, among drivers who had not received a speeding ticket in the mail and did not know anyone who had, and among drivers who said speeding was a problem". A 2004 survey of Scottsdale (Arizona) residents (Behavior Research Center, 2005) indicated seventy-seven percent supported the programs, 17 percent opposed, and 6 percent were unsure. Female respondents were more likely to support the program than men (by 10 percentage points). Seventy-four percent of respondents supported the expansion of the current automated enforcement programs. Forty-five percent indicated that they were more careful about observing speed limits after the implementation of photo radar. About 25 percent of respondents indicated that the programs had "done a great deal" to "improve traffic safety in Scottsdale".

The authors state that many automated enforcement programs in the U.S. were also initiated in response to a strong public outcry over a sharp upward trend in crashes or several high-profile crashes citing San Francisco as an example, where a serious crash caused by a driver running a red light "led then Supervisor Susan Leal to wage a campaign to use red-light phone enforcement in San Francisco".

A NHTSA document is cited (National Highway Traffic Safety Administration, 2005) for red-light camera program implementation provides outreach strategies and identifies the following public information objectives as necessary for red light camera implementation:

- Make citizens more aware of the safety consequences of the violation,
- Explain program objectives and results, and
- Provide advanced warning that there will be increased enforcement.

Several further studies are cited which indicate that the program's acceptance by the public and effectiveness on safety is impacted by the degree of public notification. For instance, some enabling legislation in the U.S. requires each camera to have a sign, and others require only that signs be posted at entrances to the city. The U.K. requires camera housings to be yellow, but exceptions are considered, such as for areas of outstanding national beauty. In Australia, signs are posted in zones in New South Wales where radar is enforced, but motorists in Victoria are not notified of the location of the speed cameras so that "the optimum effect of both general and specific deterrence to speeding is obtained". A New Zealand study is cited that suggests there is a more specific effect at the signed cameras, but that the overall deterrent effect is greater when the cameras are hidden (Keall et al., 2001).

Retting et al. (2008) reviewed the automated speed enforcement program in Montgomery County, Maryland. An extensive public information campaign was undertaken which emphasized the dangers of speeding and the role of speed cameras prior to their use and then informing the public when speed cameras were in use. The information was communicated through various methods, including:

- Press releases.
- A program website.
- Informational materials.
- A speaker's bureau.
- A logo to create public brand recognition of the "Safe Speed" program.

Citizen advisory boards were also involved in site selection, in addition to consideration of crash data and vehicle speed data. A 30-day warning period during which cameras photographed violators, but no tickets were issued preceded the issuing of tickets. A press conference held at the start of the warning period attracted extensive media coverage, including print and broadcast media and local and regional coverage. A second press conference, held when enforcement began, also generated extensive media coverage. Signs advising motorists of speed camera enforcement were posted on major roadways entering Montgomery County, and "photo enforced" placards were installed below the speed limit signs on roads designated for camera enforcement. Six months prior to, and six months following introduction of the program, driver attitudes were measured through a telephone survey. Significant findings of the survey include:

- When asked if speeding was a problem on residential streets, about 74 percent of drivers during both study periods said it was; about 18-19 percent said it was not, and about 7-8 percent did not know.
- Among drivers who said speeding was a problem, close to half during both study periods said it was a big problem.
- During both study periods about 78 percent of female respondents thought speeding was a problem compared with 67-68 percent of males.
- There were no consistent differences by age group.
- Before camera enforcement, 46 percent of drivers responded correctly that speed cameras were not in use (32 percent said cameras were in use, and 22 percent said they did not know).
- After enforcement began, 60 percent of drivers responded correctly that speed cameras were in use (20 percent said cameras were not in use, and 20 percent said they did not know).
- During camera enforcement, young drivers (ages 18-34) were more likely than drivers ages 35-64 and 65 and older to respond correctly that speed cameras were in use (68 versus 61 and 53 percent, respectively.

- The proportion of drivers who favored speed cameras was 58 percent before camera enforcement and 62 percent 6 months after.
- One-third of respondents said they were opposed to surveillance cameras in general, about half (45 percent) were opposed only to speed cameras, and 21 percent had no opinion.
- Of drivers aware of the camera program 57 percent said they had reduced their speed.
- The level of support for expanding camera enforcement to arterial streets was 62 percent, the same proportion of drivers that favored use of speed cameras on residential streets. Only 47 percent of drivers favored expanding the use of speed cameras to interstate highways.

Retting et al. (2008) reviewed a pilot program for fixed speed camera enforcement on an 8 mile section of freeway in Scottsdale, Arizona. In this program signs were used to warn drivers of camera enforcement and the camera housings were in clear view. A tolerance of 11 mph over the 65 mph speed limit was used for issuing tickets which began after a 30 day warning period in which only warnings were issued. Telephone surveys were conducted two months before enforcement began and eight months after. Significant findings of the survey include:

- The proportion of drivers who favored speed cameras increased from 63 percent before camera enforcement to 77 percent during enforcement.
- Support for cameras increased markedly among drivers ages 35 to 64 (from 55 percent before enforcement to 78 percent after) and declined among younger drivers ages 18 to 34 (from 53 percent before enforcement to 40 percent after).
- Male and female drivers had somewhat similar opinions while older drivers were most in favor of speed cameras.
- 54 percent indicated they had reduced their speed.
- Of drivers who said speed cameras had caused them to reduce their speeds in the enforced area, 61 percent said they had reduced their speeds elsewhere.

A TRB special report (TRB, 254) states that candidates for automated speed enforcement include school zones, work zones and known high-crash locations. High-crash locations where traditional police enforcement is not feasible due to lack of adequate shoulders, high traffic volumes, and so forth are particularly deserving. The report states a number of program characteristics that should be met, including:

- That installations must be publicized and defended.
- Signage upstream or downstream of the actual installation can be used to allay driver complaints of police unfairness.
- It must be understood that the purpose of the enforcement is to reduce high speeds, not to “catch” speeders.
- A fairly high tolerance, say, 20 mph (32 km/h) over the limit, should be used, at least initially. It has been found that there are enough drivers with such speeds to keep the

equipment, the police, and the courts busy.

- If the jurisdiction is serious about the program, convictions should be accompanied not only by fines but also by points, and consideration should be given to license suspension if the violation is serious enough.

Willis (2006) reviewed studies on automated speed enforcement and summarized a number of implementation issues affecting the successful outcome of a program. This list is stated to borrow liberally from Cameron et al. (2003).

1. Speed cameras should be used where high speed results in a high risk such as school zones, roads near playgrounds, work zones, streets in retail shopping, dining, and drinking districts with a lot of pedestrian traffic, residential neighborhoods, and high speed roads built to low geometric standards (narrow lanes, no shoulders, no edge markings, sharp curves, poor sight distances, etc.). Using speed cameras in low-risk environments (e.g., on rural freeways with low volumes of traffic and no history of speed-related crashes) generates public skepticism about the motives for their use and leads to accusations that the cameras are being used to generate revenue, not to improve road safety – a frequent accusation.
2. The purpose of the speed camera program must be clearly and persuasively communicated to the public, and the public must understand the "rules of the game." Otherwise the public may perceive the program as being run for creating revenue instead of improving safety. Rules of the game refer to such decisions such as if the cameras are fixed or hidden and moving, signs should be provided in the enforcement area alerting drivers to automated enforcement. Similarly, the public needs to understand what enforcement tolerances are being used. Research shows that reduced tolerance levels increase compliance with speed limits. High levels of publicity, especially of a hidden camera program, in and of itself can reduce speeding, even with relatively low levels of enforcement.
3. Public acceptance of fixed cameras at problem locations is high, but not at lower risk locations. Hidden cameras tend to be the most controversial.
4. Revenue generated by speed cameras should be used principally to cover the costs of the enforcement program, with any surplus being used only for other traffic safety programs. Diversion of surplus revenues for other purposes will quickly erode public acceptance of the program. Programs that employ revenue sharing with the camera vendor are also often criticized as being too generous to the vendor.
5. Speed cameras must be accurate and run by properly trained operators.
6. Speed cameras should not substitute for human enforcement. Motorists' organizations oppose speed camera programs when there is even a hint that they may lead either to reduced levels of conspicuous police patrol or decisions to not increase the police presence on problem-plagued roads.
7. Privacy concerns should not be ignored, even though the U.S. Supreme Court has ruled that neither individuals in motor vehicles on public roads nor the license plates on those vehicles deserve privacy protections. In particular, legislators and others are often most sensitive to photographs taken of vehicle occupants, so the decision must be made

whether such photos are needed for enforcement of the ticket (depending upon the particular jurisdiction, speed camera tickets may be civil or criminal violations; criminal violations will often require a photograph of the driver while the parking ticket-like civil violations do not). If the driver is photographed there remains the issue of whether to mail the photograph with the ticket or just keep it in the file for reference if the individual cited disputes the ticket.

8. Citations issued as a result of speed camera photos should be severe enough to deter future speeding, with more serious infractions being punished more severely than lesser ones. The research literature on general deterrence theory generally concludes that to be effective a deterrence program must 1) create a high probability that the bad behavior will be detected; 2) punish the behavior severely; and 3) punish promptly, though there is some question about the severity principle. The research literature generally agrees that principle #1 – certainty of detection – is the most powerful deterrent, regardless of the severity or celerity of the sanction. Speed cameras certainly increase the risk of detection. Arguably, the penalty for a speeding violation detected by a camera should be no less than that for a ticket issued by a police officer; doing otherwise, as is frequently the case, "…further reinforces the public view that enforcement by speed cameras is primarily designed to raise revenue and not to save lives and injury – because it attracts a 'less serious' penalty." Unfortunately, many speed camera program tickets are much less costly than tickets issued by a law enforcement officer. For example, the ticket issued under the speed camera program in Charlotte, North Carolina is only $50, with no license points and no effect on insurance premiums; in Denver the ticket is only $40, again with no points or insurance consequences. It is hard to imagine that such minimal fines really deter speeding or send a strong message that speeding is a safety concern; instead they lead to public cynicism that speed camera programs are just another way to tax the driving public. The severity of punishment issue is also complicated by the fact that, in some jurisdictions, speed camera tickets are treated as minor civil infractions (like parking tickets) rather than criminal infractions in order to avoid having to photograph the driver as well as the license plate. Photographing drivers creates invasion of privacy concerns that can help torpedo a speed camera program. In order to have a better deterrent effect, citations issued as a result of speed camera photos should be sent promptly.

The Federal Highway Administration (FHWA, 2003) published guidance on the use of red light cameras. Several elements of a successful public information campaign are cited:

- A clear description of the operation of red light camera equipment in non-technical terms.
- Clear statement of the program objectives.
- Description of the advantages of automated enforcement over enforcement by law enforcement officers.
- Explanation of other measures being taken to improve safety at intersections.
- Description of the use of red light camera program revenues.
- Outreach efforts to schools, driver education, community groups and area media.
- Telephone and web-based information centers that include a hot-line for calls about

intersection problems and traffic safety concerns in addition to handling inquiries regarding the operation of the red light camera program.

- Ability to respond to telephone and e-mail inquiries and correspondence within not longer than one working day.

## OVERVIEW OF SIGNIFICANT FINDINGS

For automated speed enforcement programs, evaluation results on the affect on collisions vary from roughly a 9% to 18% reduction in all collisions and a 21% to 51% reduction in all injury collisions. The length of roadways where a collision reduction was found ranged from 800 ft. to 4 miles either side of the enforcement location. The safety effects for mobile enforcement vary widely, likely due to various aspects of the programs and evaluations, including:

- Conspicuity of the enforcement.
- Enforcement intensity.
- Study methods used for evaluation of crash reduction.
- Differing crash outcome measures used.
- Differing assumptions on the distance downstream that automated enforcement is effective.

For policy making purposes, it does seem reasonable to conservatively estimate the benefits to be 10% for total collisions and the area of impact downstream of the enforcement location to be at least 0.5 mile. These benefits are under the assumption that the enforcement impact on speed is maintained through sufficient enforcement intensity. The estimate of a 10% reduction is also an average effect. Locations with greater numbers of speed-related collisions would be expected to have larger collision reductions. Elvik (1997) indicated this by confirming that road sections conforming to accident warrants showed a significant 26% decrease in injury collisions compared to an insignificant 5% decrease where the warrant was not met.

For red-light running camera programs, estimates of the safety effect of red light running cameras varied considerably. Most studies reviewed were tainted by methodological difficulties that raise questions about any conclusions from them. The most methodologically sound evaluations were conducted by Council et al. (2005) and Washington and Shin (2005).

Council et al. (2005) found little difference in total crashes, with an approximately 25 percent reduction in right-angle crashes and a 15 percent increase in rear-end crashes. Considering only injury crashes (KAB on the KABCO scale, thus excluding possible injury and property damage only) the results were a 16% decrease for right-angle and a 24% increase for rear-end. An economic analysis indicated an overall 9% reduction in crash costs. The possibility of spillover effects at untreated signalized intersections was also examined. A statistically significant reduction of 9% in right-angle crashes was found, however, for rear-end crashes no change was detected. The authors state that this latter result, which differs from the treated sites, somewhat detracts from the credibility of an observed general deterrence effect.

Washington and Shin (2005) when applying the EB before-after method also found little difference in total intersection crashes, with a 17 percent reduction in angle crashes, a 40% reduction in left-turn crashes and a 45% increase in rear-end crashes. Similar results were found for the specifically targeted approaches, where an 11 percent reduction was found for total crashes. An economic analysis of the EB results indicates overall benefits of $684,134 and $836,460 per year for target approaches and all approaches respectively. The report cites camera costs between $50,000 to $100,000 plus $60,000 per year to operate thus indicating the program is very cost effective.

The two studies also offer insights into what makes a red light running camera program more effective.

- Higher total entering AADTs.
- Larger ratios of right-angle to rear-end crashes.
- Presence of protected left turn phasing.
- Presence of warning signs at enforced intersections.
- Higher posted speed limits.
- Longer cycle lengths and green phases.

The various studies reviewed dealing with public acceptance of automated enforcement programs provide useful guidance:

- Being respectful of privacy concerns.
- Passing enabling legislation first.
- Not publicizing enforcement locations too widely.
- Not using photo-radar where speed enforcement tolerances are unrealistic.
- A system should be set up to allow money to be used in the enforced municipality, thus supporting the community, such as other road safety improvements.
- Drivers need to be aware of program motives, operational details, and statistics through web sites, media, and perhaps other methods.

Common reasons cited for opposing automated speed enforcement include:

- Preference of officer contact.
- Invasion of privacy, violation of rights, or government infringement.
- Licensee must pay ticket no matter who was driving.
- Camera failures including error, malfunction, and other.
- Machines should not do police work.
- Installations must be publicized and defended.

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## APPENDIX E. LEGAL REQUIREMENTS

The following tables provide information on legislation for State's automated speed and red light camera programs.

**Table E-1. Automated Speed Enforcement Legislation**

| State | Locations | Warnings | Signage Req. | Owner/ Driver | Max Fine | Program Limitations | Vendor Limitations | Public Awareness | Speed Over Limit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| Arizona | Statewide | | X | | $165 fine; 3 points | | Restricted processing work | | | |
| Arkansas | School zones, residential, work zones | | | | | Req. Citation Issue at Violation | | | | |
| Colorado | School zones, residential, operational work zones | 1st violation within 10 mph | X | Driver | Speed: $40, $80 in school zone. Red light running: $75 | Local ordinance required | Cannot be % revenue or citations | | | Govt. employee present |
| DC | District-wide | | | Owner | $75; no points | | | | | Automated enforcement (AE) for all moving violations |
| Florida | | | | | | | | | | No State law. Attorney General: AE not allowed by home rule |
| Hawaii | | | | | | | | | | AE discontinued |
| Illinois | operational work zones or IL Toll Authority roads | | X | Driver | $250 fine or 25 hours community service | Images restricted for law enforcement use only | Cannot be paid based on citations or revenue | X | | |
| Maine | | | | | | | | | | All AE prohibited |

**Table E-1. Automated Speed Enforcement Legislation (Continued)**

| State | Locations | Warnings | Signage Req. | Owner/ Driver | Max Fine | Program Limitations | Vendor Limitations | Public Awareness | Speed Over Limit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| Maryland | Montgomery Co. school & residential districts; Prince George's Co. school zones; Statewide in school zones by local ordinance and work zones | | | Owner | $40; no points | | Cannot be paid based on citations | | 10 MPH+ | |
| Nevada | | | | | $1,000 max; 4 points | | | | | AE only if hand-held by officer, installed in vehicle, or facility of law enforcement agency |
| Mississippi | | | | | | | | | | All AE prohibited |
| New Hampshire | | | | | | | | | | AE prohibited unless specific statutory authorization |
| New Jersey | | | | | | | | | | Speed cameras prohibited |
| Ohio - Toledo | | | | Owner | $120 | | | | | |
| Oregon | School zones, residential, other safety problem areas not on controlled access highway | | | Owner, or driver if identifiable | $300 max fine | Display vehicle speed 150' prior; Photos only for red light running (RLR); biennium evaluation; law enforcement review issue; no more than 4 hours in same place | X | | | |

**Table E-1. Automated Speed Enforcement Legislation (Continued)**

| State | Locations | Warnings | Signage Req. | Owner/ Driver | Max Fine | Program Limitations | Vendor Limitations | Public Awareness | Speed Over Limit | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| South Carolina | Limited | | | | | Citations must be served in person within 1 hour of violation | | | | AE only when State declares emergency |
| Texas | | | | | | | | | | Speed cameras prohibited |
| Utah | School zones, where speed limit is under 30 mph | | X | Owner | | Requires law enforcement officer presence | | | | |
| West Virginia | | | | | | | | | | All AE prohibited |
| Washington | School | | | Owner | Up to the max for parking violations; no record; no points | Law enforcement officer required to issue | Cannot be paid based on % fine or revenue | | | |
| Wisconsin | | | | | | | | | | Speed cameras prohibited |

**Table E-2. Red Light Running Automated Enforcement Legislation**

| State | Locations | Engineering Study Required | RLR Min Yellow | Warnings | Signage Required | Owner/ Driver | Max Fine | Program Limitations | Vendor Limitations | Public Awareness | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Alabama | Montgomery | | | | | owner | $110; no points | | | | |
| Arizona | Statewide | | | | X | | $165; 2 points | | Restricted processing work | | |
| California | Statewide | | X | | X | Driver | $100 fine; 1 point | Public hearing required | Cannot be % revenue or citations. Specific parts of work only | Public hearing required | Law enforcement required |
| Colorado | Statewide | | | 1st viol within 10 mph | X | Driver | $75; no points or record | Local ordinance required | Cannot be % revenue or citations | Govt. employee present | Local ordinance required |
| Delaware | Statewide | State Approval | X | | | Owner | $110; no record | | | | |
| DC | District-wide | | | | | Owner | $75; no points | | | | Jurisdiction-wide authority to use AE to capture all moving infractions |
| Florida | Statewide | | | | | Owner | $158; no points | Attorney General: AE not allowed | | | |
| Georgia | Statewide | X | Std Plus 1 sec | 30 days each new site | X | Owner | $70; no record, no points, not a moving violation | | | | Public hearing required; Annual report |

**Table E-2. Red Light Running Automated Enforcement Legislation (Continued)**

| State | Locations | Engineering Study Required | RLR Min Yellow | Warnings | Signage Required | Owner/ Driver | Max Fine | Program Limitations | Vendor Limitations | Public Awareness | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Illinois | Certain jurisdictions | | | | X | Owner | $100 or completion of traffic education program, or both; no record, not a moving violation | | Can't be paid based on citations or revenue | X | Images restricted to law enforcement use only |
| Louisiana | | | | | | | no record | Local authority required | | | Local authority required |
| Maine | | | | | | | | | | | All AE prohibited |
| Maryland | | | X | | | Owner | $100 civil penalty; no points, no record, not a moving violation | | Cannot be paid based on citations | | |
| Mississippi | | | | | | | | | | | All AE prohibited |
| Montana | | | | | | | | | | | All red light cameras (RLC) prohibited; rail crossing excepted |
| New Hampshire | | | | | | | | | | | AE prohibited unless specific statutory authorization |
| New Jersey | | | | | X | Owner | $85; no points | Images for official duties | | | local jurisdiction must pass ordinance and apply to participate in pilot program |

**Table E-2. Red Light Running Automated Enforcement Legislation (Continued)**

| State | Locations | Engineering Study Required | RLR Min Yellow | Warnings | Signage Required | Owner/ Driver | Max Fine | Program Limitations | Vendor Limitations | Public Awareness | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| New York | | | | | | owner | $50; no record | Tech employed by the City | | | Permitted in NYC |
| New Mexico | | | | | Sign with beacon or rumble strip | | | | | | |
| North Carolina | where specified by statute | | X | | X | Owner | $75 civil penalty; no points | 90% funds to school board | | | |
| Ohio - Dayton | | | | | X | Owner | $250 | | | | |
| Ohio - Toledo | | | | | | Owner | $120 | | | | |
| Oregon | Cities statewide | | Per ITE | | | Owner | $300 | Photos only for RLR: biennium evaluation; law enforcement review | X | | |
| Rhode Island | Statewide | | | | Sign at int. | Driver | $75; no record, not moving violation | Images not public record; issue by law enforcement; annual report required | | | |
| Pennsylvania | Philadelphia | | X | 1st 120 days then 60 days each new site | X | Owner | $100; no record | Use by law enforcement for ordinance violation; annual report; sworn officer by law enforcement | | | |

**Table E-2. Red Light Running Automated Enforcement Legislation (Continued)**

| State | Locations | Engineering Study Required | RLR Min Yellow | Warnings | Signage Required | Owner/ Driver | Max Fine | Program Limitations | Vendor Limitations | Public Awareness | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South Carolina | | | | | | | | Citations must be served in person within 1 hour of violation | | | AE only when State declares emergency |
| Tennessee | Statewide except for interstate highways that are not work zones | | 3s | | | Owner | $50; no points | Can't lower yellow to increase violations; issue by employee of law enforcement | | | |
| Texas | Statewide; requires local ordinance | X | X | | X | Owner | $75; no record | Funds after cost to safety and trauma center; annual reporting, traffic study results to governing body first; requires local ordinance | | | |
| Virginia | | X | Per Institute of Transportation Engineers (ITE) | | X | Driver | $50; no points | Local Ordinance required; no more than 10 or more than 1 per 10,000 residents; sworn law enforcement officer | | X | |
| Washington | Statewide | | X | | | Owner | | Limited to 2 arterial intersections; law enforcement officer required to issue | Cannot be paid based on % fine or revenue | | |

# APPENDIX F. 2009 TRB WORKSHOP

**Improving Intersection Safety Through Safety Reviews and Automated Enforcement, Transportation Research Board Annual Meeting, January 11, 2009**

On January 11, 2009 a workshop was held at the Transportation Research Board's Annual Meeting. The workshop was called "Improving intersection safety through safety reviews and automated enforcement." The workshop was designed to look at intersections holistically from a safety perspective.

Fred Ranck, of the Federal Highway Administration, provided an overview of the safety challenges presented by intersections. Mr. Ranck discussed taking a systematic approach to intersection safety. He later introduced the concept of "Clarify and Simplify" as a method of reducing the mental processing required of drivers as they approach an intersection. Mr. Ranck described performance degradation as a driver's information processing is overloaded or under loaded.

Glenn Hansen presented automated red light camera enforcement as one possible tool to make intersections safer. Mr. Hansen introduced the concept of considering a red light camera program on two levels. Intersection safety issues could be examined at the community level as well as the specific intersection level. The macro view at the community level is often discussed as part of legislative debates. Does the community perceive red light camera systems as a privacy intrusion? If so, do they perceive the red light running safety problem as significant enough to accept such a privacy intrusion? Does the community believe other safety alternatives would be more effective? Does the community understand how the systems can improve safety or do they perceive them as a revenue generator? Much of the current literature focuses on community wide red light camera programs.

The second part of problem identification is intersection specific or the micro view. If a community establishes a legal mechanism to permit automated red light camera enforcement, it does not mean that a red light camera system would improve safety at any intersection within that community. Multiple studies have indicated that red light camera systems lead to decreases in right angle crashes (Hillier et al., Retting & Kyrychenko). Studies have indicated rear end crashes have increased after red light cameras were installed (Hillier et al.). An intersection that is experiencing rear end crashes and no right angle crashes would not be a good candidate site for a red light camera system for example. Participants were asked to look at sample intersections within an imaginary community to decide if a red light camera system would be appropriate. Participants discussed real world pressure from public officials to implement systems where they may be inappropriate.

Mr. Hansen suggested a crash screening process to determine the optimum candidate sites within a community. He discussed a screening process using annual crashes, annual injured people, and crash type ratios to determine a priority list of candidate sites based on potential safety impact. Candidate sites would then be subjected to a field evaluation. The field evaluation would determine if engineering changes would improve the safety of the intersections without needed a red light camera. Inadequate sight distance, inadequate yellow signal phase, poor signal conspicuity and other issues would be examined at the site.

# APPENDIX G. CURRENT AND SUGGESTED PRACTICES AND LESSONS LEARNED

This chapter formed the basis of the automated enforcement guidelines found in Chapter 3. It is an elaboration of the material in Chapter 3, and includes information from the survey, telephone interviews, literature review, and enabling legislation review.

## PROBLEM IDENTIFICATION

The first step in any traffic safety initiatives is to determine if a traffic safety problem exists. Proper problem identification up front helps the stakeholders to define the best countermeasures to address the defined problem. It also helps the stakeholders to establish a communication strategy that would help their community to understand and appreciate the problem. While this may seem obvious, some jurisdictions may be tempted to jump to the conclusion that a program that has worked well in another community may work for them without carefully considering their individual problem.

In simple terms, a red light camera program is designed to reduce red light running violations and thus lead to fewer crashes caused by this violation. Similarly, an automated speed enforcement program is designed to reduce speeding, crashes caused by speeding and the severity of crashes. Properly identifying that either a red light running or speed problem is causing crashes is critical to establishing a program. Additionally, they should ensure that there are not other contributing factors, such as limited sight distance, that are increasing the occurrence of violations.

Each community should first examine their individual problem and then explore the possibility of adding an automated traffic law enforcement program as part of a comprehensive traffic safety initiative to address their needs.

Once a community understands that a problem exists, they can begin to accept changes designed to address the problem. Communities that do not recognize a traffic safety problem are more likely to suspect that an automated enforcement program is being initiated for reasons other than safety.

## PLANNING

Prior to the installation or deployment of a system a jurisdiction must first launch several components of an automated enforcement program. First, a jurisdiction must obtain authorization for beginning a program; enabling legislation varies from State to State. The lead agency and other involved entities must be established, followed by the implementation of a public education campaign. The planning stages are critical to the success of any automated enforcement program.

A stakeholder group should be established to plan the automated enforcement program together. The lead agency would benefit from not planning this program alone. Law enforcement agencies, transportation departments, public information offices, the courts, finance

offices, and facility departments will all eventually be impacted by an automated enforcement program. It is better to get their perspectives and concerns on the table early in the process. By working on program development together these agencies are much more likely to buy into the eventual program outcome. The courts, for example, may be very concerned about a large increase in citizens requesting trials. By understanding this concern in advance, the stakeholder group can learn from the experience of others how large the problem may be and how best to mitigate the issue.

More discussion about each of these aspects of planning an enforcement program is included in the following sections.

## ENABLING LEGISLATION

Strong enabling legislation is one of the most critical components of a successful automated enforcement program. Enabling legislation should be tailored to the local community needs and existing legislative constraints. The legislation should provide authority for operating an automated traffic enforcement program without attempting to specify every component of a program. The legislation must establish the required elements of documenting violations, for example, but it should not attempt to specify the exact technology to be used to document the violation. Technology changes over time and the enabling legislation should be flexible to allow for future enhancements.

A community should first examine the existing legislation. If the authority already exists for automated traffic law enforcement, they should evaluate if that authority would permit them to institute an effective program. Many states already have automated traffic enforcement legislation.

In most states a local jurisdiction would need specific state authority to permit automated traffic law enforcement. In states like Maryland an officer must witness a traffic violation in order to charge a driver with a violation. The few exceptions to this rule are specifically designated in law. (For example, officers investigating a collision can issue a citation based on their investigation.) Provisions for automated red light camera and speed enforcement had to be specifically added to the state law before any local jurisdiction was permitted the authority to conduct this type of enforcement.

In several states, local jurisdictions have home rule authority to establish local traffic safety initiatives without any changes to the state law. Each state allows local jurisdictions different types of individual authority so each state law needs to be evaluated independently. Automated traffic law enforcement programs have been established under home rule in Florida, Iowa, Louisiana, Massachusetts, Minnesota, Missouri, New Mexico, Ohio and South Dakota. Local jurisdictions establishing programs under home rule authority should keep in mind that changes to state law can limit or even prohibit their programs. Even if a program is established under home rule, efforts to educate state legislators about the safety benefits of the program would be well worth the investment of time.

When establishing a program under home rule authority, a jurisdiction must establish the entire legal framework for the program in a local ordinance or law to permit the program. The key elements of the enabling legislation are similar to those required of a state law.

The following sections discuss the key elements that are required for good enabling legislation.

## Responsibility

Should the driver of the vehicle or the owner of the vehicle be held responsible for the violation? Several states hold the driver accountable and several hold the owner accountable. Each approach has positives and negatives that must be considered before the right approach is selected for a community.

*Driver Accountability*

Holding the driver accountable for a traffic violation seems to be a pretty common sense method for establishing accountability. The driver committed the violation. Most people tend to recognize the logic behind holding the driver accountable. Under driver accountable laws, points can be assigned to the violator's driver's license and facilitate enhanced driver sanctions for chronic violators. Holding the driver of a vehicle accountable for an automated traffic law violation typically requires a frontal photograph into the passenger compartment so the driver can be identified for a trial. The frontal photograph increases privacy concerns that are often raised in opposition to automated traffic law enforcement legislation. It is often difficult to get high quality facial images of the driver of a vehicle through the angled windshield and considering that a visor or a hat could block the view. Even with a high quality facial image it may still be difficult to tell siblings apart that could each have access to a family vehicle. In many States motor vehicle administration driver's license images are not available for comparison to the violation images.

*Owner Accountability*

In most States the owner of a vehicle is held accountable for many types of actions. Parking citations have always been issued to the owner of a vehicle without regard to who actually drove the vehicle to the parking place. Following a traffic collision, the owner of the vehicle may face increased insurance costs even if someone else drove the vehicle in the crash. A mechanic's lien could be made against vehicle owners for vehicle repairs that were not paid for by the driver. Holding the owner accountable for an automated traffic law enforcement violation requires only a rear photograph of the vehicle registration plate. This greatly reduces the privacy concerns raised by some advocates. It is much easier to positively identify a vehicle registration plate than to identify a driver in a moving vehicle. This results in a greater percentage of violators receiving violation sanctions.

States and jurisdictions vary on who is responsible when a violation occurs. Arizona, for example, was a driver-responsible state in 2009, rather than an owner-responsible state. Paul Porell, director of the program in Scottsdale, Arizona, admits that his jurisdiction, as well as the entire state, has struggled with the issue of responsibility. Although the concept of driver responsibility seems more legally defensible, the task of identifying and citing the driver is more complicated than for owner-responsible States.

## Violation Enforced

The legislation should establish the specific violation that can be enforced by automated enforcement technology. In most states the legislation specifies red light or speed violation.

Only in the District of Columbia does the legislation allow any type of moving violation to be automatically enforced. Most locations prefer to limit the scope of automated enforcement authority granted so that each violation can be examined individually.

## Violation Notice Requirements

The legislation should define the minimum required elements for violation notices. The notice should contain the name and address of the responsible party, the registration data from the vehicle involved in the violation, the amount of the penalty to be paid, information on how to contest the violation, and the sanctions to be imposed for not paying or contesting the violation properly. If the law permits the recipient to identify a different person that should be held accountable for the violation, the notice should advise the recipient how to identify the driver at the time of the violation. The violation notice should also include a signed statement by a technician law enforcement officer, or other authorized person employed by the agency that specifies, based on inspection of the recorded images, that the motor vehicle was being operated in violation of the specific law. In a red light violation, the legislation should require an image showing the vehicle prior to the legally defined start of the intersection and then another image of the vehicle in the intersection. Each of these images should show that the governing traffic signal is red and clearly show the registration plate and the driver image if applicable. Along with the image, relevant data including the date and time of the violation, the location of the violation, the amount of yellow time displayed prior to the red signal, and the time duration of the red signal at the time of the image should be included. Some jurisdictions add data such as vehicle speed at the time of the violation. Some jurisdictions use moving video instead of still images. As long as the minimum requirements are met for the legislation, the local jurisdictions can add information to meet their individual needs.

The minimum image requirement should be open to allow jurisdiction to determine the technology that best meets their needs. The National Committee on Uniform Traffic Laws and Ordinances (NCUTLO) recommended the following definition of recorded images:

1. "Recorded images" means images recorded by an automated traffic law enforcement system on:

    a. Two or more photographs;

    b. Two or more microphotographs;

    c. Two or more electronic images; or

    d. A video tape;

2. Showing the motor vehicle, and on at least one image or portion of tape, clearly identifying the registration plate number of the motor vehicle.

## Due Process

The legislation should describe how a citizen can contest an alleged violation. In some states, civil owner accountable type laws are reviewed by an administrative hearing officer. In some states, particularly those states using a driver responsibility law, judges hear automated traffic law enforcement cases in the state district court. The important element in this situation is

to establish an independent review of the violation notice. A person is not guilty in a criminal case or responsible in a civil case just because they have been issued a violation notice.

The violation notice should explain to the recipient what actions they need to take to contest the violation. If the violation notice recipient takes no action in the specified time period, the jurisdiction can proceed with the understanding the violation notice will not be contested.

Jurisdictions should establish a maximize amount of time after the violation occurs to the issuance of a violation notice. An extended delay before receiving a violation notice can limit a person's ability to recall the incident and properly defend their actions. Several states currently use a 14 day limitation that has been achievable from a violation notice processing standpoint. The 14 day limit has been acceptable in the communities where it has been utilized.

## Rules of Evidence

When the owner of a vehicle is responsible for the violation it is a civil offense. In these situations the adjudication of liability is based on a preponderance of the evidence. In many states the law specifically notes that the violation image is self authenticating. This means that a representative does not have to testify about the origination of every individual violation image that is presented to court.

When the driver of a vehicle is accountable for a criminal violation under law, the burden of proof is a higher standard. In a criminal case, the driver must be found guilty beyond any reasonable doubt.

## Image / Data Privacy

Many states limit the use of automated enforcement images, and the data associated with them, only for law enforcement use. Some limit it only for law enforcement use for the prosecution of the one specified offense. These limitations help to reduce legislative opposition from groups that feel sharing this information would violate their privacy. In owner responsibility cases, it prohibits insurance companies from obtaining the record of anyone committing such a violation for the purpose of raising an individual's insurance rates. It prohibits the media from obtaining specific violator images for their use.

These limitations have successfully helped to ease concerns among special interest groups and have contributed to legislation being successfully passed in several states. In Arizona, the legislature recently started to consider that it may lead to unintentionally masking bad driving behavior by operators with a commercial drivers license (CDL). None of the states surveyed had a mechanism in place to make a motor vehicle administration notification of a CDL operator in a private vehicle that committed an automated traffic law violation. According to Richard Schweinsburg of the Arizona Department of Transportation, the motor vehicle administration should have access to any driver information that would indicate a CDL driver is operating any vehicle in an unsafe manner. This issue is yet to be resolved.

## Public Notice / Warning

Jurisdictions should let their communities know about automated traffic law enforcement before a program is initiated. The enabling legislation should require a public information campaign to inform the public about the program. How much of this notification period should be mandated by law is less clear. Many states require a warning period to take place for the first 30 days of a program initiation before citations can be issued. This means violators within that first 30 day period would receive warning notices in the mail instead of a citation. Some agencies apply this 30 day warning period to every new site installation as well. This helps the community see the program as being operated "fairly" but it may result in very few community members actually receiving a warning notice.

The display of automated enforcement signs are legislated in many states. Some laws are specific about sign locations to the point that every approach to an intersection with a red light camera must display a red light camera sign. New Mexico requires a sign with a beacon or rumble strips to supplement the signage. Many states require signs but are not as specific to locations. Many agencies place signs at the most traveled entrances to the community where automated traffic enforcement takes place. The use of signage is recommended to increase the voluntary compliance with the traffic law. Which specific signage strategy yields the best overall crash reduction benefit has yet to be determined through research.

## Legal Exceptions

The enabling legislation should specify certain acts that permit a driver to enter an intersection against a solid red traffic signal. For example, a vehicle may be permitted to enter the intersection while facing a red signal to yield the right of way to an emergency vehicle. If the existing state law allows subsequent vehicles in a funeral procession to continue through an intersection against a red signal as long as the lead vehicle complied with the traffic signal, the automated enforcement legislation should permit this act as well. If the vehicle or registration plate had been reported stolen prior to the violation or a report was filled after the violation indicating it was stolen at the time of the violation, the violation should be dismissed. If a uniformed police officer waived the driver through the intersection even though the signal was red, the driver would be excused from the violation notice. In many states, if the judge or hearing authority is satisfied that another person was driving the vehicle at the time of the infraction and the owner fully identifies the driver, the violation notice can be reissued to the identified driver.

## Vendor Payments

Vendors play an important role in automated enforcement programs. They provide expertise and equipment that would not be practical for many agencies to replicate on their own. It is important that vendors be paid adequately for their efforts but not be paid based on citations issued. There is a concern that a "for profit" company may find some way to influence a program into issuing more citations if they receive more pay as a result. In San Diego, California a judge stopped the red light camera program and threw out many citations as a result of a combination of two main principles. The court felt the vendor could exert control over the program. The court decided that paying the vendor based on citations issued could cause the

vendor to influence the program to issue more citations then it may have otherwise *(1)*. In San Diego, a new program was launched with more governmental control and a different vendor pay structure. The same concerns can be raised in contracts that pay vendors based on citations paid. As a result of these concerns most states now restrict vendor payments to be based on the value of the equipment or services provided and prohibit vendor payments based on a percentage of revenue or citations issued.

## Use of Revenue Generated

Not all automated traffic law enforcement programs generate revenue in excess of the cost of managing the program. The generation of revenue should not be the motivation for a program. The law should specify where automated enforcement fine money is sent. The same specification should be made for late fees and any other related program administration fees. It is appropriate for these funds to be used to pay for the operation of the automated enforcement program. Funds in excess of these costs should be used for highway safety functions.

## Failure to Pay or Contest

If an individual received a violation notice and fails to pay the fine or contest the violation, a sanction should be imposed. Many jurisdictions charge administrative late fees. Several states also permit flagging a vehicle registration for failing to pay a fine. In these circumstances, a vehicle owner could not reregister a vehicle until they have paid the outstanding fine and associated administrative fees.

## Evaluation

The law should require a program evaluation to ensure that the desired safety results are being achieved. This evaluation would allow for program modifications as needed.

## Service

Some states require personal service by a law enforcement officer for a traffic violation. This is an easy requirement to meet in a traditional setting when an officer affects a traffic stop, speaks directly to the driver and hands a charging document directly to the driver at the same time. This in person service defeats many of the advantages of an automated enforcement program. The enabling legislation should specify that service of the violation notice by mail is acceptable.

## Technology

The law should not specify any particular technology to capture the violation. A law specific to radar technology could limit agencies abilities to use the advantages of a laser based system and vice versa. As the technologies mature and change, the law should not have to change.

Red light camera technology in some respects is fairly easy to evaluate. A red light camera system image should clearly show the violation, the vehicle committing the violation, the registration plate of the vehicle and the red traffic signal. If the legal definition of the

intersection is a painted stop bar and the system captures the vehicle on the bar instead of before the bar as the agency specified, the system is not operating properly. If the signal phase is green when the image is captured, the system is not operating properly. But how well can an individual agency determine how accurate the yellow time is displayed on the violation notice? How can the agency know that the system captures every red light running incident and not one out of every ten?

Speed enforcement technology is even more difficult to evaluate. The violation images taken with high speed camera systems seem to show a vehicle frozen in time while the accompanying data indicates the vehicle speed. Properly trained personnel know how to check the calibration of equipment on a regular basis and how to determine when speed readings could be influenced by another vehicle.

In each case, an agency can be confident that they are capturing accurate data by being diligent in their own use and supervision of the equipment. Agencies may well have difficulty in evaluating several different types and manufactures of technology to determine what can most reliably meet their needs. The International Association of Chiefs of Police (IACP) and the National Highway and Traffic Safety Administration have teamed up to work with manufacturers and other stakeholders to address this concern. The IACP Enforcement Technology Advisory Technical Subcommittee (ETATS) has established standards traditional radar and LIDAR speed enforcement devices, and for automated photo radar speed enforcement systems. Specific testing criteria have been established to test manufacture's equipment against these standards. Many of these tests have been completed. Many automated enforcement systems now appear on the ETATS Conforming Product List (CPL). Agencies that select CPL equipment can be assured that the equipment has been carefully evaluated in a very structured process. ETATS is currently finalizing the standards for red light camera systems and will be testing these systems for placement on the CPL in the near future.

Enabling legislation should consider mandating that the automated enforcement technology utilized be on the CPL. The downside of this approach would be a delay in the introduction of new technology that has yet to be tested and evaluated. The advantages of this approach would include an enhanced public perception and understanding of the equipment accuracy and integrity.

## ENFORCEMENT AND LEAD AGENCY

Automated enforcement programs can be operated by a variety of groups within an agency or department of transportation. Table G-1 provides information about the leading agency for automated enforcement as reported in the survey. This includes both existing programs and programs that are no longer in operation. For jurisdictions with both speed and red light camera programs, the same entity oversees both programs. There are some economies of scale to having one agency responsible for both programs. The only exception was in Charlotte, North Carolina, where the police department oversaw the red light camera program and the city oversaw the speed enforcement program.

The majority of the programs were led by the police department. Because the camera programs are an enforcement function, this is a logical organization structure that has been

successful for many programs, particularly when there is collaboration with other agencies. Using law enforcement as the lead agency must be examined. No agencies reported any difficulty other structures such as traffic engineering as lead. However, the contractor should not be the lead agency.

**Table G-1. Reported Agencies Leading the Automated Enforcement Program**

| Lead Agency | Red Light Camera Programs | Speed Camera Programs |
|---|---|---|
| Police Department (including designated traffic unit) | 47 | 11 |
| Department of Public Works | 4 | 0 |
| City or County | 17 | 1 |
| Other | 3 | 0 |
| Unknown | 2 | 0 |

## AGENCY COLLABORATION

Although one agency leads the automated enforcement effort, many jurisdictions seek to involve several agencies in the development and management of the programs. This is necessary to have a truly collaborative approach to reducing speeding and red light running. An example of this is the program in Lafayette, Louisiana. The City is the lead agency for the enforcement program in Lafayette. Tony Tramel, the program director, emphasized the importance of collaboration with other city agencies. Early in the implementation process, Mr. Tramel engaged the sheriff, police department, district attorney's office, city council, and other stakeholders. He attributes the success of the program in part to this early collaboration between all involved parties. A similar respect for the importance of collaboration was stressed by the Scottsdale, Arizona program director, Mr. Paul Porell. Mr. Porell noted that effective programs require, "a collaborative effort among the police department, traffic engineering division, and especially the court system."

Beyond enforcement, operations, and the court system, elected officials such as the city council and majors should be involved in the planning and operation of the program. This collaboration must be a continuing effort as successive elections can bring new elected officials into office.

### Staffing of Program Personnel

The creation of an enforcement program in a jurisdiction can necessitate establishing a new traffic unit or hiring new personnel to oversee the program. Of the jurisdictions contacted for the phone interview, all used existing personnel to staff the program. In most cases, police assistants were reassigned from regular traffic duty or work was absorbed by senior officers and supervisors. In Newark, California, the police department runs the enforcement program.

Rather than using officers who could be doing other police work, the department uses a non-sworn citizen who was already on staff to process the citations.

## Public Education

One key component of developing a new enforcement program is informing the public of the program, especially the installation of camera at locations, the adjudication of citations, and the use of revenue. In addition to conducting a public information campaign, a city can be aided by also conducting an assessment of public support prior to and during implementation of the program.

## Assessment of Public Support

Surveys of public opinion of automated enforcement programs have indicated that a majority of respondents support automated enforcement both before and after program implementation; however, the margins of support vary widely, from a low of 51 percent in Washington, D.C. to a high of 77 percent in Scottsdale, Arizona. Support for the programs typically remains the same or increases after the program is implemented.

A National Highway Traffic Safety Administration (NHTSA) sponsored survey *(2)* reports that those who were in favor of automated enforcement cited the following reasons:

- Photo evidence proves a violation (20 percent).
- Increased driver awareness (19 percent).
- Fewer police needed for traffic enforcement (19 percent).
- Drivers would obey traffic laws and regulations (18 percent).
- Freeing up police for other types of enforcement (9 percent).
- Deterring speeding (7 percent).
- Reducing accidents (9 percent).

Those who were not in favor of automated enforcement cited:

- Invasion of privacy, violation of rights, or government infringement (26 percent).
- Preference for in-person contact with an officer (18 percent).
- Licensee must pay ticket no matter who was driving (14 percent).
- Camera failures including error, malfunction, and other (13 percent).
- Machines should not do police work (12 percent).
- Could be ineffective or unenforceable (11 percent).

The literature on the public perspective of automated enforcement programs provides some useful guidance on running a successful program. This guidance is aimed at raising and maintaining the support of the public for automated speed or red light running camera enforcement. Suggested practices identified in this area include:

- Passing enabling legislation first.
- Making drivers aware of program motives, operational details, and statistics through web sites, media and other methods in non-technical terms.
- Provide a description of the advantages of automated enforcement over enforcement by law enforcement officers.

- Explanation of other measures being taken to improve safety.
- Outreach efforts to schools, driver education, community groups and area media.
- Telephone and web-based information centers that include a hot-line for calls about traffic safety concerns in addition to handling inquiries regarding the operation of the program.
- Ability to respond to telephone and e-mail inquiries and correspondence within not longer than one working day.
- Being respectful of privacy concerns.
- Not using photo-radar where speed enforcement tolerances are unrealistic.
- A system should be set up to allow money to be used in the enforced municipality, thus supporting the community, such as other road safety improvements.

Common reasons cited by the public for opposing automated enforcement programs include:

- Preference for officer contact.
- Invasion of privacy, violation of rights, or government infringement.
- Licensee must pay ticket no matter who was driving.
- Camera failures including error, malfunction, and other.
- Opinion that machines should not do police work.
- Installation locations are not publicized and defended.

Based on the survey respondents, 27 jurisdictions conducted an assessment of public support prior to the implementation of the automated enforcement programs. Forty-two jurisdictions did not conduct any assessment of public support or did not report that they conducted an assessment. Public meetings were the most common method of determining public support, and one jurisdiction reported that a statewide survey indicated an eighty to ninety percent approval rating for automated enforcement.

Of the jurisdictions that participated in the phone interview, several had conducted a formal assessment of public support shortly after beginning their program. In Prescott Valley, Arizona, for example, a phone survey of approximately 500 people was performed in the spring of 2007. At that time, the program had been in place for six months, and the results found 73 percent of respondents were in favor of the program. Similarly, a public opinion poll executed by the town of Lafayette, Louisiana, prior to beginning their program indicated a 67 percent approval rating. The city of Scottsdale, Arizona, hires an independent research firm to conduct annual public opinion polls. The polls have been performed since the beginning of the program in 1996. Over the most recent several years, the percentage of people who support or strongly support the program has stayed consistently between 60 and 70 percent. With a program as mature as Scottsdale's, the city could likely discontinue the polls. However, it is important for a city to monitor the level of support for the program from the beginning and during implementation as national and even international events can affect public support at any time.

The remaining jurisdictions from the phone survey did not conduct a formal assessment of public support of the programs. However, the lead agency or manager of the program could often speak to the level of public support and the most common issues raised by opponents. Charles Jones of Charlotte, North Carolina, opined that while a small percentage of the public

opposed the SafeSpeed and SafeLight programs, the majority accepted or were in favor of them. In his opinion, the most criticism of the programs came in response to the placement of the speed cameras; many people wanted them in neighborhoods and around school zones. The issue of "Big Brother," which can be a hot topic for some communities, was not an issue for Charlotte. However, in Fayetteville, North Carolina, the protection of privacy was the primary issue for those in opposition to the cameras. The city was accused of shortening the yellow phase length, when actually the city did not change the yellow phase and even lengthened the green phase at several camera locations. In response to the vocal opposition, the city conducted a publicity campaign; the campaign included the results of a safety evaluation which showed the positive effect the cameras had on the crash rate at site locations. After this campaign, the town saw a significant increase in overall public support for the program.

Public support is essential to establishing a successful enforcement program. In Lafayette, Louisiana, the city first deployed mobile vans in neighborhoods to begin the speed enforcement program. Mr. Tramel, the director of Lafayette's program, stated that the public backlash over the speed vans operating in neighborhoods was overwhelming. He indicated that if he could start the program over, he would not use the mobile vans.

## Public Information Campaign

There are many methods available to inform the public about an enforcement campaign. Seventy-one jurisdictions reported informing the public of program initiation through one or more means. Table G-2 provides the survey responses regarding methods used by jurisdictions to inform the public of program initiation. Seventy-one jurisdictions responded to this question and used one or more means.

**Table G-2. Reported Methods for Public Information**

| Method | Number of Jurisdictions |
|---|---|
| Public service announcement on TV or radio | 40 |
| Print ads | 30 |
| Public Meetings | 41 |
| Mailing to residents | 10 |
| Other | 25 |

Other methods commonly used include newspaper articles, the locality's website, press releases, media coverage, and brochures available at public buildings.

The public information campaign should emphasize that the objective of the program is to improve the safety of the roadway system. This is especially important in interviews with the media as some press agencies may try to illuminate the revenue generation aspects of the program.

Public information should extend beyond program initiation. This will help to maintain public support for the program and can be used to communication information on the effectiveness of the program. Table G-3 provides the survey responses regarding methods for public information once a program has been established. Sixty-seven jurisdictions continued publicity about the program and enforcement sites. Signs on the approach to the enforcement area were used by almost every reporting agency. Websites were the second most reported method. More traditional means such as public service announcements and print ads were not used by as many agencies once the program was started. Other on-going publicity includes public meetings, billboards, and presentations at school and neighborhood meetings.

**Table G-3. Methods for Continued Public Information Campaigns**

| Type of Publicity | Number of Jurisdictions |
|---|---|
| Public service announcement on TV or radio | 13 |
| Print ads | 6 |
| Signs on approach to enforcement area | 59 |
| Signs at the entrance to the jurisdiction | 23 |
| Website | 38 |
| Other | 8 |

### WARNING PERIOD

A warning period prior to the full implement of an automated enforcement program is also an effective way to inform the public about a program. Most jurisdictions conduct a warning period prior to fully implementing an enforcement program. During this warning period, which is usually at least 30 days in duration, the jurisdiction operates cameras and sends citations for violations. However, the citations are warning tickets only. The period serves to further inform the public of the new program and can help ease the transition for the community. Most jurisdictions only use the warning period at the onset of the program. However, it can also be used throughout the program as new enforcement locations are added. An example of an extended warning period is in Prescott Valley, Arizona. In Prescott Valley, the mobile speed vans and speed and red light cameras were deployed gradually over a few years. Each time new cameras were added to the program, the jurisdiction conducted a 30-day warning period at the affected enforcement zone.

## OPERATION

### Vendor Contract and Payment

Table G-4 provides the vendors operating automated enforcement programs as reported by survey respondents. Jurisdictions reported a variety of vendors with whom they work to

operate their enforcement programs. Of the nine jurisdictions with both speed and red light camera programs, all except one use the same vendor for both programs.

**Table G-4. Survey Responses on Enforcement System Vendors**

| **Program Vendor** | **Red Light Camera Programs** | **Speed Camera Programs** |
|---|---|---|
| RedFlex | 36 | 7 |
| American Traffic Solutions (ATS) | 15 | 2 |
| Affiliated Computer Services (ACS) | 7 | 2 |
| Nestor | 3 | 0 |
| LaserCraft | 6 | 0 |
| Other | 6 | 1 |

Vendor payment arrangements varied greatly by jurisdiction. As reported in the survey,

- 39 jurisdictions pay a flat fee for vendor services.
- 17 jurisdictions pay vendors based on the number of paid citations.
- 11 pay vendors based on the number of citations issued.
- 2 jurisdictions pay vendors a flat fee plus a fee for each citation issued.
- 2 jurisdictions pay vendors a flat fee for each camera installation.
- For jurisdictions with both a red light camera and a speed camera program, the same vendor payment method is used.

Most jurisdictions solicit vendors through competitive bid based on specifications identified by the jurisdiction. A flat fee structure for vendor services or for each camera is the most acceptable arrangement from the public's perspective as the fee paid to the vendor is not dependent on citations.

The contract should allow an agency to place a camera in a location for safety reasons even if the violation rate is low. Some contracts have provisions that allow camera installation if a study demonstrates sufficient violations to reasonably pay for the cost of the installation. These provisions reflect the reality of contract work that the vendor requires compensation for their services and their equipment. This could prohibit the placement of some cameras at law violation sites that have catastrophic collisions when those rare violations occur. However, both the needs of the agency and the needs of the vendor can be accommodated if the agency is allowed to pay the installation cost directly.

For jurisdictions that are beginning a new program, a short first contract period can be helpful. The city will have time to evaluate the operation of their program and their satisfaction with the current vendor. Once the contract period has ended, the jurisdiction will then have the

freedom to find a new contractor that better fits their needs or to readjust arrangements with the current vendor. The City of Charlotte, North Carolina operated its SafeLight program for almost ten years. During that time, the city contracted with two different vendors. Once the initial contract expired, the City re-advertised the contract and a different company won the new contract period.

## Fines

*Payable Amount*

The reported fines for red light or speed camera violations varied by jurisdiction. Table G-5 presents data on the range of reported fines. In several states, such as Colorado and California, the enabling legislation specifies the fine amount for all jurisdictions in that state. The red light camera fines ranged from under $50 to over $300. The wide variation in reported fines is directly related to owner versus driver responsibility penalties. For example, in California, the red light camera tickets are driver responsibility offenses and carry a larger penalty. In order to issue these citations, front photography is required to confirm the identity of the driver since the ticket is issued to the driver. In Maryland, the violations are civil penalties and are similar to parking tickets in that the ticket is assigned to a vehicle. (They are not similar in the severity of the offense, only the type of process.) As such, the violation fines are smaller. For speed violations, the fine range from $25 to over $200, depending on the number of miles per hour over the speed limit and whether the violation occurred in a school zone.

**Table G-5 Reported Violation Fines**

| **Violation Fine** | **Red Light Camera Programs** |
|---|---|
| $50 or less | 6 |
| $51 to $100 | 32 |
| $101 to $200 | 10 |
| $201 to $300 | 5 |
| Greater than $300 | 18 |
| Unknown | 2 |

*Surplus Revenue*

Many automated enforcement programs generate surplus revenue. The use of the surplus revenue can be a subject of contention and a target for the media. As reported in the survey, any surplus revenue generated by automated enforcement programs is directed into a general fund by 41 jurisdictions, into a school zone fund in four jurisdictions, and into a highway safety fund in three jurisdictions. The remaining 23 jurisdictions reported directing the funds into a variety of

places, such as traffic safety improvement projects, the local school board, or splitting the funds among several entities.

The intended allocation of the proceeds of the camera program, including surplus funds, should be clearly identified at the start of the program and communicated to all involved parties. Most jurisdictions in the state of North Carolina were forced to terminate their programs following a legal challenge regarding the use of camera proceeds. In May 2006, the North Carolina Court of Appeals ruled that 90 percent of the program proceeds had to be directed to the state school system based on state constitution. For most jurisdictions, the operation of the program costs more than 10 percent of the proceeds. Cities such as Charlotte, Fayetteville, Greensboro, Greenville, and High Point were not able to afford their programs independently.

## Camera Installation

*Number of Cameras*

As reported in the survey, the number of cameras used varied by jurisdiction, with the larger jurisdictions using more cameras. In most cases, the number of cameras used was less than 20. The literature review identified studies that indicated there is a halo or spillover effect *(3)* from cameras in that cameras are not needed at every intersection or along every corridor as they also have an effect on surrounding locations. The optimal number of cameras has not been identified.

*Preliminary Engineering Study*

The most defensible and successful camera programs are based on a clearly identified safety need and an engineering analysis. A formal, documented process can help to identify the most effective deployment locations. It can also help to defend a program against media or public criticism. For red light camera locations, an engineering study should ensure that red light violations are not the result of a deficiency at the intersection such as insufficient signal timing, poor sight distance, or low visibility. For speed camera locations, the program director should ensure that the speed limit is clearly communicated to approaching drivers, that the speed limit is set based on an engineering study, and that the speed limit is appropriate for the location.

A formal engineering study is conducted and documented in fifty-six of the jurisdictions that responded to the survey prior to deploying cameras. Of the remaining jurisdictions that did not report conducting a formal engineering study, several did conduct an informal study, such as analyzing crash rates or accident history.

*Methodology of Site Selection*

A variety of methods were used to determine camera sites. Table G-6 provides a summary of those methods. In many cases, jurisdiction implemented a combination of several methods.

**Table G-6. Reported Methods for Site Selection**

| **Method** | **Jurisdictions (out of 70) with Red Light Camera Programs** | **Jurisdictions (out of 9) with Speed Camera Programs** |
|---|---|---|
| Crash Frequency | 56 | 6 |
| Crash Type | 45 | 4 |
| Violation Data | 49 | 3 |
| Selected by engineering personnel | 37 | 3 |
| Selected by enforcement personnel | 34 | 9 |
| Traffic Volume | 30 | 3 |
| Public Input | 10 | 3 |
| No specific methodology | 1 | 0 |
| Other | 7 | 5 |

The ability to conduct traditional enforcement efforts, citizen complaints, and priority for school zones were a few of the other methodologies reported by jurisdictions.

Proper site selection is central to ensuring a successful enforcement program. For those agencies that have been involved in establishing successful programs, support for the potential intersections or locations based on data and statistics is absolutely necessary. Charles Jones, of the Charlotte, North Carolina, enforcement program, acknowledged that in his jurisdiction the method for selecting red light camera sites was not the best; he would have looked only at high crash sites rather than giving more influence to which sites would produce the maximum revenue.

Selecting sites by the potential to reduce crashes, both for speed and red light enforcement, should be the standard for all agencies. This can be accomplished by reviewing crash frequency, crash rate, or potentially violation data as a surrogate for crashes in the absence of crash data.

*Grace Periods and Speed Tolerances*

Some jurisdictions have a set time into the onset of red indication before the automated enforcement "captures" the vehicle. This is often referred to as a grace period. Only vehicles which enter the intersection after the designated grace period are issued a citation. The majority of the survey respondents reported not using a grace period. The summary of responses is presented in Table G-7. Most jurisdictions that did have a grace period used a very short period.

**Table G-7. Reported Grace Periods for Red Light Cameras**

| Grace Period (after onset of red signal) | Red Light Camera Programs |
|---|---|
| None (0 seconds) | 30 |
| 0.1 second | 9 |
| 0.2 seconds | 3 |
| 0.3 seconds | 6 |
| 0.5 seconds | 2 |
| 1.0 seconds or longer | 4 |
| Officer discretion | 3 |

The use of a grace period will reduce the number of citations issued. It may also have the benefit of decreasing the number of citations that are contested in court.

For automated speed enforcement, the tolerance above the speed limit at which tickets are issued is referred to as the speed tolerance. As part of the survey, jurisdictions were asked about their speed tolerance practices. Several noted that the tolerance used varied based on the speed limit and the location of the enforcement. Generally, the tolerances ranged from 0 to 11 miles per hour, with most jurisdictions using tolerances on the higher end of the range.

The literature review found some indication that informing the public of enforcement tolerances is helpful. A study by Willis *(4)* concluded that reduced tolerance levels increase compliance with speed limits. Willis reviewed studies on automated speed enforcement and summarized a number of implementation issues affecting the successful outcome of a program. Included in these, the purpose of the speed camera program must be clearly and persuasively communicated to the public, and the public must understand the "rules of the game." Otherwise the public may perceive the program as being run for creating revenue instead of improving safety. The public therefore needs to understand what enforcement tolerances are being used. It is also stated that reduced tolerance levels increase compliance with speed limits.

## Violation Data Collection and Adjudication

For the jurisdictions operating red light camera programs, 69 of the jurisdictions capture a rear image of the offending vehicle. Twenty-nine jurisdictions also capture a front image, while 3 jurisdictions capture only a front image. Four jurisdictions specifically report that they capture an image of the driver, and 17 jurisdictions record video in addition to still images.

Likewise, 11 jurisdictions that operate a speed enforcement program capture a rear image of the offending vehicle. Eight of the 11 jurisdictions also capture a front image, and 1 jurisdiction captures only a front image. Two jurisdictions record video in addition to capturing still images.

The program policy should establish clear issuance criteria that delineates when a violation has occurred and should be ticketed. For example, the criteria for red light camera enforcement could be that the vehicle bumper must be before the stop bar in the first red light camera image and the second image must show the entire vehicle passed the stop bar.

Once a violator has received a citation in the mail, in most cases, the individual has the option to contest the citation in court. The police department in Clive, Iowa, has a unique process. Police Chief Robert Cox indicated that most individuals want an opportunity to vent their objections or frustrations over receiving the citation. Additionally, in the majority of cases, those persons calling to contest their ticket had not viewed the citation pictures on the department's website. The police department enacted a policy of scheduling a pre-court meeting for all individuals who asked to contest their citations in court. During the meeting, an officer shows the individual pictures of the violation, provides evidence of the legal support of the program, and provides him/her an opportunity to vent. Chief Cox reported that this meeting often resolves the issue, the ticket is paid, and the extra court costs are avoided.

# EVALUATION

## Safety Effects as Reported in the Literature

*Speed Programs*

The safety effects for automated speed enforcement found in the literature vary widely, likely due to various aspects of the programs and evaluations, including:

- Conspicuity of the enforcement.
- Enforcement intensity.
- Study methods used for evaluation of crash reduction.
- Differing crash outcome measures used.
- Differing assumptions on the distance downstream that automated enforcement is effective.

Confidence in the results of several studies is somewhat limited based on a general lack of control for regression-to-the-mean, short study periods for some studies, issues with defining comparison groups, and other factors.

Published evaluation results on the affect on collisions vary from roughly a 9% to 18% reduction in all collisions and a 21% to 51% reduction in injury collisions. The length of roadways where a collision reduction was found ranged from 800 ft. to 4 miles either side of the enforcement location.

Few studies have examined system-wide effects of automated speed enforcement or investigated the possibility of crash migration. One study reported a 25% reduction in daytime unsafe speed-related crashes province-wide and the other reported a reduction of 30% in daytime injury crashes State-wide. One of these two studies documented generalized speed reductions, and the other found a relationship between crash reductions and program intensity. While there may be confounding factors, both studies used time-trend analyses to account for general trends, proxy measures to adjust for travel exposure, and one also used a neighboring similar State as a comparison group. One study found that crash reductions were highest in the two kilometers (1.25 miles) closest to the camera sites but reductions were found up to six kilometers (3.75 miles) from the camera sites.

For policy making purposes, it does seem reasonable to conservatively estimate the benefits to be 10% for total collisions and the area of impact downstream of the enforcement location to be at least 0.5 miles. These benefits are under the assumption that the enforcement impact on speed is maintained through sufficient enforcement intensity.

The recommended estimate of a 10% reduction is also an average effect. Locations with greater numbers of speed-related collisions would be expected to have larger collision reductions. Elvik *(5)* indicated this by confirming that road sections in Norway conforming to accident warrants showed larger collision decreases than where the warrant was not met. In this study, installation was done on sections meeting warrants based on accident and speed experience as follows:

- Accident rate warrant: A road section should have an accident rate higher than normal for the type road, where type of road is defined by road class, number of lanes and speed limit.
- Accident density warrant: A road section should have at least 0.5 injury accidents per kilometer per year (0.8 accidents per mile per year).
- Speed warrant: The mean speed of traffic on a section should be above the posted limit.

For road sections conforming to the accident warrants, the effect was stronger, with a significant 26% decrease in injury collisions compared to an insignificant 5% decrease where the warrant was not met, suggesting that there is validity to the warrants used.

There remain substantial gaps in the knowledge of safety effects of automated speed enforcement. Filling these gaps would lead to more efficient use of resources and results.

*Red-Light Camera Programs*

For red-light running camera programs, estimates of the safety effect of red light running cameras in the literature vary considerably. Most studies are tainted by methodological difficulties that raise questions about any conclusions from them. Among the most

methodologically sound evaluations were those conducted by Retting and Kyrychenko *(3)*, Council et al. *(6)* and Washington and Shin *(7)*.

Retting and Kyrychenko *(3)* studied city-wide effects of eleven cameras installed in Oxnard, California. Signalized and unsignalized intersections in three similarly sized cities were used for a comparison group to account for confounding factors affecting crashes such as economic conditions, fuel prices and weather. A generalized linear model was used to model crash counts with the independent variables including city, signalized vs. unsignalized control, and period (before or after enforcement). Findings included a 7% crash reduction overall, 29% reduction for injury crashes, 32% reduction for right-angle crashes, 69% reduction for right-angle injury crashes and a non-significant 3% increase in rear-end crashes.

Council et al. *(6)* found little difference in total crashes, with an approximately 25 percent reduction in right-angle crashes and a 15 percent increase in rear-end crashes. Considering only injury crashes (KAB on the KABCO scale, thus excluding possible injury and property damage only) the results were a 16 percent decrease for right-angle and a 24 percent increase for rear-end. An economic analysis, which considered average total crash costs by crash type and severity, indicated an overall 9 percent reduction in crash costs. The opposing effects for the two crash types implies that red light camera (RLC) systems would be most beneficial at intersections where there are relatively few rear end crashes and many right-angle ones. A disaggregate analysis found that greatest economic benefits are associated with the highest total entering annual average daily traffic (AADT), the largest ratios of right-angle to rear-end crashes and with the presence of protected left turn phases. The possibility of spillover effects at untreated signalized intersections was also examined. A statistically significant reduction of 9 percent in right-angle crashes was found, however, for rear-end crashes no change was detected. The authors state that this latter result, which differs from the essence of the results for the treated sites, somewhat detracts from the credibility of an observed general deterrence effect.

Washington and Shin *(7)* when applying the empirical Bayes (EB) before-after method also found little difference in total intersection crashes, with a 17 percent reduction in angle crashes, a 40 percent reduction in left-turn crashes and a 45 percent increase in rear-end crashes. Similar results were found for the specifically targeted approaches, where an 11 percent reduction was found for total crashes. An economic analysis of the EB results indicates overall benefits of $684,134 and $836,460 per year for target approaches and all approaches respectively. The report cites camera costs between $50,000 to $100,000 plus $60,000 per year to operate, indicating that the program is very cost effective. Further analyses of these benefits identified characteristics of sites more likely to show benefits from red light cameras:

*Influence of Warning Signs*

When a warning sign is installed at an intersection, the crash reduction benefits from angle and left-turn crashes appear to be greater than those at intersections without a warning sign. In contrast, the crash costs (negative benefits) from rear-end crashes are greater for intersections with a warning sign. That both positive and negative effects are seen to be greater when warning signs are present suggest that the warning signs are effective.

*Influence of Approach Speeds*

Approach speeds to intersections (as measured by posted speed limits) appear to be positively associated with the net crash benefits. As the authors point out, high speeds are associated with higher injury severities and red light cameras may reduce severities considerably.

*Influence of Signal Timing*

Longer cycle lengths and longer green phases are associated with higher benefits.

Despite these definitive studies, gaps remain in the knowledge of safety effects of red light camera programs. Filling these gaps would lead to more efficient use of resources and results.

## Monitoring a Program's Performance

Agencies should strive to monitor the performance of their program. This will help to maintain public support of the program and ensure that the program is meeting the objective to improve safety. Guidance is available for agencies conducting their own evaluations *(8)*. Fifty-one jurisdictions reported in the survey that they have conducted a safety evaluation comparing before and after crash data. However, twenty-two jurisdictions have not conducted such an evaluation of their red light or speed camera programs or did not report if they have conducted an evaluation.

The City of Newark, California used their internal safety evaluation to response to program opponents who argued that rear-end crashes would increase as a result of the cameras. The City has been operating five red light cameras since 2004. The Chief of Police, James Leal, reported there has been no increase in rear-end crashes. In fact, they have seen a decrease in all crash types and there has not been a single right-angle crash at any of the camera intersections since installation. Chief Leal and his staff attribute the reductions to a change in driver behavior; drivers are paying closer attention and are slowing down.

## Resource Requirements

Automated enforcement programs allow jurisdictions to employ continuous enforcement at selected intersections, while freeing police officers for other tasks. In Clive, Iowa, police officers issued approximately 200 red light violation citations a year prior to the beginning of their program. In the first month of operation, the cameras saw more than 800 violations.

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# APPENDIX H. CASE STUDIES

# CITY OF PORTLAND, OREGON AUTOMATED ENFORCEMENT PROGRAM

## OVERVIEW

The City of Portland, Oregon's automated enforcement program started in January 1996 as a demonstration project to test the effectiveness of photo radar as a speed enforcement tool. The red light camera program followed suit in October, 2001. Portland's program, operating now for almost 15 years, has been very successful with a firm foundation in the public trust. They have also been committed to operating a transparent program that is marked by their availability to the news media.

The following document presents an overview of their program and illuminates some of the best practices present that could be replicated by other agencies in the development and operation of an automated enforcement program. The information is based on interviews with key personnel associated with Portland's programs and published reports.

## BACKGROUND

### Problem Identification

The citizens of Portland are very concerned about the livability of their community. The transportation system is structured to accommodate all modes including motor vehicles, pedestrians, bicycles, various transit vehicles, and other non-motorized users. In the mid 1990s, speeding in neighborhoods was identified as a safety concern by both the city and neighborhood associations.

**Figure H-1: Bicyclists in Portland, Oregon (Source: Greg Raisman)**

The Portland Bureau of Transportation (PBOT) had been working with neighborhood groups to implement traffic calming measures. However, these measures were not enough. The Bureau identified automated speed enforcement as a potential tool to reduce speeding in neighborhoods. This was vetted with the neighborhood associations in what can be best described as grassroots campaigning and community building. The City has 95 neighborhood associations across seven districts. Bureau staff met directly with the neighborhood associations and initiated discussions about the potential benefits of this tool as a complement to the traffic calming efforts. The neighborhood associations overwhelming embraced this tool.

Enabling legislation did not exist in Oregon in the mid 1990s. The Bureau encouraged each neighborhood association to write a letter to the legislature voicing their support for the

adoption of enabling legislation for automated enforcement. The overwhelming support voiced at the grassroots level by these neighborhoods prompted the legislature to develop and pass enabling legislation.

## Enabling Legislation

In 1995 the City of Portland received authority from the Legislature to conduct a two year trial of photo radar enforcement. The legislature required certain elements to be completed as part of the trial period, along with regulations on how the program can be operated. Specifically, the legislation required Portland to:

1. *Provide a public information campaign to inform local drivers about the use of photo radar before citations are issued.*

2. *Conduct a process and outcome evaluation of the demonstration for the Department of Transportation that includes the effect of the project on traffic safety, the degree of public acceptance of the project, the process of administration of the project and suggestions for design or planning changes that might reduce traffic congestion on residential streets or use of such streets as thoroughfares.*

3. *Implementation requirements:*

    a. *Shall be confined to streets in residential areas or school zones.*

    b. *Shall be used no more than four hours per day in any one location.*

    c. *The photo radar equipment is operated by a uniformed police officer out of a marked police vehicle.*

    d. *An indication of the actual speed of the vehicle is displayed within 150 feet of the location of the photo radar unit.*

    e. *Signs indicating that speeds are enforced by photo radar are posted, so far as is practicable, on all major routes entering the jurisdiction.*

    f. *The citation is mailed to the registered owner of the vehicle within six business days of the alleged violation.*

    g. *The registered owner is given 30 days from the date the citation is mailed to respond to the citation (1).*

The legislation allowed for a pilot program, restricted to certain communities in Oregon, including Portland. After completing a successful trial phase, the Legislature extended the use of photo radar under Oregon Revised Statutes (ORS) 810.438 and 810.439. These statutes address photo radar authorization, evaluation, and citations. The red light camera legislation is enabled under ORS 810.434, 810.435, and 810.436. These statutes are on the operations and evaluation of red light photos, the use of photography, and citations based on red light photos. The most recent legislations just removed the 12 camera limit that was required under the statutes. The very restrictive legislation has helped with public acceptance of the program *(2)*.

## Initiation of Enforcement

With the legislative backing, Portland initiated a pilot automated speed enforcement program in January 1996. The Bureau had a dedicated, full-time staff to start up the program. Mr. Robert Burchfield, the City Traffic Engineer, noted that in the initiation of the program, he thought about the process, not just the outcome *(3)*. At the forefront of his mind was the public trust. He wanted to ensure that a process was developed for the program that not only satisfied the legislation, but also was transparent for the public.

The Portland program demonstrated success and the pilot restriction was lifted. The remainder of this document discusses the current program.

# SPEED ENFORCEMENT PROGRAM

## Program Administration and Structure

The Portland Police Bureau's Traffic Division leads the speed enforcement program. They work closely with the currently contracted vendor (Affiliated Computer Services, ACS), and the Portland Bureau of Transportation. The program is a driver liability program. The violations are issued to the registered owner of the vehicle if a good quality photograph is captured and the gender of the observed driver matches the registered owner.

## Operations

Portland currently operates four photo radar vans – two full-time vans, and two part-time vans. Two vans operate using film and two use digital photography. One benefit to the digital photography is that it allows the officer to identify any problems with the photos (e.g. glare on the windshield) and fix the problem in the field; with film there could be problems with the positioning of the van that will not be noticed until the film is developed. The vans are operated and run by the Portland Police Bureau. Figure H-2 through Figure H-4 show outside and inside views of Portland's digital photo radar van.


**Figure H-2. Portland's digital photo radar van.**


**Figure H-3. Rear view of Portland's digital photo radar van.**

**Figure H-4. Computer and camera monitor inside digital photo radar van.**

There are certain restrictions that guide the operations of the photo radar program. Captain Nelson, who started the program, felt the more restrictive the program, the better the public opinion of it *(2)*. The vans can only operate a maximum of four consecutive hours at one location during a deployment. Deployment is restricted to residential streets, construction zones, and school zones. The vans must be operated by a sworn police officer. At the site the officer must display a portable sign within 100 to 400 yards of the van that warns drivers of the photo radar enforcement ahead. Figure H-5 shows the portable sign used by the Portland Police Bureau. There is no time of day restriction for photo radar deployment.


**Figure H-5. Portable sign placed in advance of photo radar van.**

*Site Selection*

Through City Ordinance #172517, the Portland Police Bureau is directed to use the photo radar vans in school zones, highway work zones, residential streets, and SAFE (Strategic and Focused Enforcement) zones. SAFE zones are areas within the jurisdiction that have been identified as having a high number of speeding violations and speed related crashes. Currently, there are 18 SAFE zones in the City of Portland *(4)*. The SAFE zone sites are selected by PBOT and vetted with the Police.

Sites that the public requests for speed enforcement are first observed by the police to determine the best way to alleviate the speeding problem. The photo radar vans are rotated throughout the city between the SAFE zones and areas with complaints. Each site has a unique four-digit code that they use to monitor coverage. On average, the Police Bureau deploys the vans at 26,000 sites per year *(2)*. They also generally do one deployment per day in a school zone.

*Warning Periods*

There was a warning period when the program started in 1996, along with an information campaign to notify and educate the public *(2)*. An additional warning period is not used when new locations are added since the program is well established in the community and advancing signing is provided.

*Citation Process*

There are five steps involved with issuing photo radar citations:

1. Violation detection,
2. Violation processing,
3. Quality control checks,
4. Citation review and approval, and
5. Citation mailing.

Speeding violations are detected when the police officer operating the photo radar vehicle visually observes a violation. The speed tolerance is 11 mph over the speed limit. In some cases, such as inclement weather, the tolerance will be lowered. The vehicles speed is displayed in the van, and the officer keeps a log and takes notes on each violation. When a violation occurs, a minimum of three photographs are generated, which include the vehicle approaching the van, a close up of the driver in the vehicle, and a close up of the vehicle's license plate *(4)*.

The film in the cameras from the photo radar vans are developed by the vendor, ACS. ACS uses the photos to identify the license plate of the violating vehicle, and then requests the vehicle registration from the Oregon Department of Motor Vehicles (DMV). The vendor reviews the details of the violations, such as location, date, time, and speed. Violations are gender matched, meaning violations are discarded when the gender of the driver does not match the gender of the registered owner of the vehicle. Violations are also thrown out if an identification cannot be made due to glare on the windshield, face blocked by a visor, etc.

The vendor is responsible for the quality control checks of the citations. The photos are viewed by multiple people before being sent to the Oregon DMV for registration information. After the DMV sends the registration, the photos and viewed again and verified against the registration for gender match. The citations then go into an electronic queue on secure website where the Police Officer can logon and approve the citations. The citations from photo radar can be approved in batches by the police, rather than individually. After the citations are approved, ACS conducts one more review for accuracy before mailing them to the vehicle owner *(5)*.

After the quality control checks, the citation is mailed to the registered owner within six business days. Included with the citation is a photo of the offending driver, and a Certificate of Innocence. If the DMV has a flag on the registration, a Certificate on Innocence is not included with the citation. The registered owner has thirty days to respond in which they can either pay the violation fee or, if they were not the violating driver, file a Certificate of Innocence *(5)*.

The citation issuance rate for the photo radar is about 60 percent for film, and 75 percent for digital. Factors that help increase the issuance rate are proactive maintenance of the equipment, and proper training of the police officers. The most common factors for non-issuance are gender match and glare on the windshield *(5)*.

*Police Department Role*

The Portland Police Bureau is the lead agency of the photo radar program. Their primary responsibility is in the operation and deployment of the photo radar vans. They currently have two full-time photo radar officers, and 13 other trained officers. They have found that officers that are usually assigned to motorcycle duty are good candidates for this duty. The operation of the vans provides a safer duty for motorcycle officers during inclement weather.

The Police Bureau's goal is to have 200 hours per month of deployment, although with recent budget cuts the numbers have reduced to 100 to 140 hours per month.

The Police Bureau is also responsible for the vendor selection. The vendor is selected through a competitive bid process.

The Police Bureau is the liaison with the vendor. This involves daily communication and regularly scheduled weekly meetings. The Police Bureau also maintains frequent communication with the Bureau of Transportation and the City elected leaders.

*Vendor Role*

ACS is responsible for the daily processing of the photos and citations, from developing and reviewing the film, collecting registration information, to conducting the quality assurance/quality control, and mailing the citations. They also have a call center to respond to questions and comments from the public. The vendor works directly with both the Portland Police Bureau and the Portland Bureau of Transportation, and is in contact with both Bureaus' on a daily basis. ACS is also responsible for providing training courses for the police officers.

The contract period is now five years with the vendor. Originally the contract period was shorter, allowing for more flexibility. However, now that the program is well established, the longer contract period is useful since it is a big effort to re-compete the contract.

The Police Bureau noted that contract should outline in detail the requirements of the vendor. For example, if a media blitz is needed, this should be outlined in the vendor's contract.

## Adjudication

A Certificate of Innocence is included in each citation mailing. If the registered owner of the vehicle was not the driver at the time of the violation, they must fill out the Certificate of Innocence and include a copy of their license. If the photograph in the citation does not match the photograph on the license, the citation is thrown out. However, if the photographs match, a second citation is mailed out, this time with no Certificate of Innocence included *(5)*. If the registered owner still contends they were not driving the vehicle, they must appear in court to contest the ticket.

In 2007 the Portland Police Bureau started an electronic citation program. All the data required by the courts is now electronically sent to them which helps increase the efficiency of both the courts and the photo radar program *(4)*. Less staff time is now required.

## Public Education and Information

Prior to the start of the program in 1996, Portland conducted an extensive public education campaign to inform and educate the public about photo radar as a tool for speed enforcement. Part of the campaign included outreach to the media through press conferences, radio, newspapers, and cable access televisions. They also provided informative material in the form of newsletters and direct mailings to reach local residents.

PBOT manages a Traffic Safety and Liability Hotline. Concerns that are called in by the public are relayed to the Police Bureau, who then decides an appropriate action to take. The hotline receives more than 600 requests for speed enforcement a year *(6)*. The Police Bureau also does education missions.

As part of the requirements set by the legislature for the program's trial period, the City of Portland conducted a public opinion poll in September 1996. The poll showed 74 percent approval by residents of using photo radar in neighborhoods, 89 percent approval for use in school zones, and 88 percent awareness that photo radar is used as a police speed enforcement tool *(1)*. During the trial period PBOT set up a photo radar hotline to yield comments and concerns from the public. The hotline received 789 calls during the first nine months of the program, 58 percent of which were calls expressing support for the program.

Another study in 2003, conducted by a private firm, showed 87 percent of Portland residents were concerned about speeding. In 2005 the same firm conducted a telephone survey of 400 Portland residents. Sixty-eight percent of respondents agreed with the use of photo radar in school zones, and 85 percent responded that they would drive slower all the time if they saw photo radar being used at least three times per week.

## Program Evaluation

Starting in 2005, the Oregon Revised Statute that authorizes photo radar requires cities to report once each biennium to the Legislation on the effects of the photo radar system on traffic safety, the degree of public acceptance, and the process of administration *(4)*.

According to the 2007-2008 biennium report for Portland, the number of speed violations monitored decreased by 5.3% from 2007 to 2008, while the number of enforcement hour increased. Table H-1 shows the program numbers from 2007 to 2008. Three of the top five deployment locations in 2008 were posted school zones, while the other two locations had a history of speed related crashes and speeding complaints.

**Table H-1. Photo Radar Program Numbers, 2007-2008 *(4)***

| Item | Year - 2007 | Year - 2008 |
|---|---|---|
| Enforcement Hours | 2,602 | 2,713 |
| Vehicles Monitored | 1,118,811 | 1,208,048 |
| Violations Captured | 44,044 | 41,706 |
| Citations Issued | 27,018 | 22,904 |

Officer Frolov, a full-time photo radar enforcement officer with the Portland Police Bureau, observed a residual effect throughout the city since the start of the program. He noted that at the start of the program in 1996 there would be 250 speeding violations at a single location; now, at the same location, there are only 60 speeding violations *(2)*.

In 2005 an independent evaluation study was conducted by Dr. Christopher M. Monsere from Portland State University using data from the photo radar vans. The data was from 1996 through 2004 and included the total number of vehicles passing the van, the number of citations issued, and the percentage of vehicles passing the van that were in violation of the speed limit. During the time frame the number of vehicles passing the photo radar vans increased by approximately 6.5%, however, the number of speed limit violations decreased by 5.8%, and the number of issued citations dropped by 3.6%. Similar to the anecdotal observations of Officer Frolov, this study provided evidence of the historical impact that program has had on speeds in Portland *(7)*.

### Fiscal Considerations

The automated enforcement program is costly to operate and generates a very modest amount of excess revenue. The fee from the citations is split between the court, the county, and the city. Any excess revenue that is generated goes back into the program.

The fee structure is established in the vendor contract as is part of the public record. The fee structure for the vendor has changed over time as the program evolved, with the issuance of new contracts.

## RED LIGHT CAMERA PROGRAM

In 2001, after five years of successfully using automated enforcement as a tool to reduce speeding, the City of Portland expanded their automated enforcement program to include red light running enforcement.

### Program Administration and Structure

The Portland Red Light Camera (RLC) program is operated jointly by the Portland Bureau of Transportation and the Portland Police Bureau. PBOT leads the site selection process, analyses, and most media relations, while the enforcement and review of citations is conducted by the Police. Both Bureaus work closely with the vendor, ACS.

As with the speed enforcement, the red light running program is a driver responsibility program. The violations are issued to the registered owner of the vehicle if a good quality photograph is captured and the gender of the observed driver matches the registered owner.

## Operations

Portland currently has 11 red light cameras at ten intersections throughout the city. The first six cameras were installed between October, 2001 and April 2003 at five intersections. Five more cameras were installed between October, 2007 and August 2009. There are no "dummy" cameras in the city, and the locations of the RLCs do not rotate between camera housings.

Ten of the cameras use color film. These cameras take one picture of the vehicle in advance of the violation line, and one picture of the vehicle beyond the violation line (in the intersection). In 2009 Portland installed its first digital RLC. The digital camera takes a front and rear picture of the violating vehicle, plus a 12 second video. Both the pictures and the video can be viewed online by the violator.

### *Site Selection*

Candidate intersections for RLCs are selected by PBOT based on crash history primarily related to crashes involving disregard of the traffic signal. Intersections undergo a formal evaluation performed by a private consulting firm to determine if the location is suitable for an RLC. The evaluation of each site follows Oregon Department of Transportations' Red-Light Running Camera Guidelines *(8)*. Other considerations when selecting RLC sites include clearance intervals, offsets, signal timing plans (both peak and non-peak periods), spacing, conspicuity, and existing infrastructure *(9)*.

### *Warning Periods*

There is a two-week warning phase with each new installation of an RLC. If a violation occurs during the time frame at the new location, the registered owner is sent a warning in the mail. PBOT also writes a press release notifying the public of the new camera location *(2)*.

### *Citation Process*

The citation process for the RLCs is very similar to the photo radar. The cameras are operated by a contractor, currently ACS. ACS processes the film from the cameras daily. They screen the photographs and retrieve owner data for the vehicles observed in the violations. ACS gathers the registration information from the violating vehicle from the Department of Motor Vehicles Databases. The information is then posted to a secure website for viewing by the Portland Police Bureau. A traffic officer trained in photo enforcement views the evidence and determines whether or not to issue a citation; this is done for each individual violation. If a citation is issued, it is mailed to the current registered owner within 10 working days of the time the violation occurred.

Approximately 50% of the observed violations result in a citation being issued. For example, during 2008, 18,083 observed violations were processed, resulting in 8,767 issued citations. The biggest factors for non-issuance are gender match failure (19% of total citations not issued), and no front plate (16%), and clarity of driver (9%) *(10)*.

The State of Oregon's vehicle code for adherence to the yellow interval can be classified as a restrictive yellow state. That is, a vehicle must stop on yellow unless it is unsafe to do so (ORS 811.265). However, the Police Bureau's policy is more lenient. A citation is not issued unless the vehicle entered the intersection on red.

*Vendor Role*

As with the photo radar program, ACS is responsible for the daily processing of the photos and citations, as well as the maintenance of the camera equipment. ACS develops, digitizes, and reviews the film, collects registration information, conducts the quality assurance/quality control, and mails the citations. They also operate a call center to respond to questions and comments from the public. The vendor works directly with both the Portland Police Bureau and the Portland Bureau of Transportation, and is in contact with both Bureaus' on a daily basis.

## Adjudication

If the registered owner receives the citation in the mail and they were not the driver at the time of the violation, they have the option to fill out and return a Certificate of Innocence, including with that a photo copy of their driver's license. If the photo on the driver's license does not match the photo from the RLC, the citation is dismissed.

If the registered owner of the violating vehicle is a business (i.e. not a private citizen), an Affidavit of Non-Liability is sent to the owner. The business can then either pay the violation fine, or identify the driver at the time of the violation. If they identify the driver a citation is re-issued and mailed to that driver *(10)*.

## Public Education and Information

The City of Portland ensures that all traffic signs at the equipped intersections conform with Oregon law and Manual on Uniform Traffic Control Devices (MUTCD) standards. Each enforced approach has a traffic signal ahead warning sign (W3-3) with a supplemental plaque that reads, "PHOTO ENFORCED." An example approach sign is shown in Figure H-6.


**Figure H-6. Advance warning sign for red light camera enforced intersection.**

In addition to the signs at each equipped intersection, each major entering route into the City of Portland has a “TRAFFIC LAWS PHOTO ENFORCED” sign (R10-18) as illustrated in Figure H-7.


**Figure H-7. Advance warning signs of photo enforcement upon entering city limits.**

## Program Evaluation

*Requirements*

The City of Portland is required to provide a biennial report to the legislature on the program. There is no systematic follow-up for any of the sites; however PBOT does do monitoring on an as-needed basis.

*Results*

The most recent biennial report was submitted in 2009. At the time of the report, there were ten cameras in operation at nine intersections total. The report provided the results of a before and after evaluation of the impact of the cameras on violation rates and crashes. The crash analysis considered crash type and severity. The evaluation used the most recent four years of data before the cameras were installed and four years of data after they were installed for eight of the nine intersections. For one of the intersections, only three years of before and after period data were available.

The evaluation found a reduction in red light violations at all equipped intersections. The amount of reduction varied by intersection between 69% and 93% reduction in violations. The report concludes that Portland's experience has been positive and that very positive trends are occurring at equipped intersections, pointing to reduction in injury crashes and reductions in red light violation crashes.

## Fiscal Considerations

As with the photo radar program, the payment structure for the RLC program is established in the contract. In the most recent contract period, the payment structure changed.

Originally, the City paid the cost of the RLC installation. Now the vendor pays for the cost. However, the locations are still determined by the Police Bureau and PBOT.

The vendor payment structure is a blended contract. The vendor receives a fixed amount per intersection and an amount based on the number of citations that are issued. The marginal amount decreases with more citations. The current payment structure is $27 per citation for the first 500 paid citations in a month, $20 for citations 501-700, and $18 for each paid citation over 700 in a month.

## Lessons Learned

*Improving Issuance*

The vendor, ACS, tracks the factors resulting from non-issuance of citations. The distribution of these factors is illuminating. Table H-2 presents the distribution for 2008.

**Table H-2. Factors resulting in non-issuance of citations *(10)***

| Factor | # Citations Not Issued | % of Total Not Issued |
|---|---|---|
| No Plate | 1504 | 16% |
| Gender Match Failure | 1736 | 19% |
| Clarity of Driver | 811 | 9% |
| Framing of Car | 537 | 6% |
| Issuance Criteria Not Met | 437 | 5% |
| DMV No Hit | 379 | 4% |
| Emergency Vehicle | 483 | 5% |
| Glare on Windshield | 611 | 7% |
| Dark Interior | 661 | 7% |
| Clarity of Plate | 197 | 2% |
| Other | 1960 | 21% |
| Total | 9316 | 100% |

As reported in the biennial report, the issuance rate of citations increased from 41% in the first year of operation (2002) to 53% in 2004. By tracking the factors affecting non-issuance, the Police Bureau was able to improve their enforcement operations and establish better procedures. This in turn increased their issuance rate.

*Driver Anticipating Signal*

One problem noted by the Police Bureau was drivers anticipated the green signal and therefore triggering the camera. The digital cameras, with better photo quality and video capability, should help eliminate some of the guess work in determining if the vehicle were in the intersection during the red light. Agencies should be aware of this potential problem and be ready on how to handle this issue with the public.

*Accessibility to the News Media*

Periodically, the Portland program has been scrutinized by the news media or publicly scrutinized by citizens receiving violations. The City of Portland has maintained tremendous accessibility to the public and to the news media. If a problem with the program is alleged, the City responds immediately with a press conference or similar open response.

*Cautious Evolution*

Portland's program, although operating for 15 years, is just now evolving to digital photography. Similarly, Portland has very cautiously and prudently expanded the program, opting in both cases to favor a slower evolution. This has helped them to maintain the public trust and avoid problems that other agencies have faced (e.g., public scrutiny of selecting sites for revenue generation).

## RECOMMENDATIONS FOR STARTING A PROGRAM

During interviews with key personnel of Portland's photo radar and red light camera programs, we asked what recommendations they would give to an agencies looking to start an automated enforcement program. The following lists recommendations and advice from the vendor, the Portland Police Bureau, and the Portland Bureau of Transportation.

*Vincent Parke, Northwest Regional Program Manager, ACS:*

- Identify a need – the program needs to be about safety; you need to have an existing problem or you won't have violations and you'll end up losing money.
- Need support of the Police Department.
- Determine the best solution for your agency.
- Communication with the client is key.
- Get the right stakeholders involved.

*Peter Koonce, Signals and Street Lighting Manager, Portland Bureau of Transportation:*

- "It's all about trust with the public."
- Make sure you have your objectives right – do you have a safety problem?
- Get people with experience to support you and do a study (not as credible if the city does their own study); need an independent party and a second set of eyes to check your work.
- Get constituents on board with the program.
- Be mindful of what your revenue looks like. Don't set up the fee structure so you get lots of money – it will look bad to the public.

*Sgt. Todd Davis, Portland Police Bureau:*

- Pick a good vendor.
- Be consistent.
- Be receptive to public input.

*Robert Burchfield, City Traffic Engineer, Portland Bureau of Transportation:*

- "Make sure you don't abuse the public trust."
- Safety focus – be honest about the safety; it's not about traps or fooling people; be conservative with the number of cameras you have.
- Identify stakeholders (community, police, and first responders) and tailor the program so it meets their interests.

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# CITY OF VIRGINIA BEACH, VIRGINIA AUTOMATED ENFORCEMENT PROGRAM

## OVERVIEW

The City of Virginia Beach, Virginia started its first automated enforcement program in September 2004 with red light running cameras. Nine months later, the Virginia General Assembly allowed the automated enforcement legislation to end by sunset clause and the program was discontinued. The legislation was enabled again in 2007, and by March 2009 Virginia Beach became the first jurisdiction in the State to restart their program. The success of Virginia Beach's red light camera program is apparent, as their program's structure, operation, and public relations are being replicated in cities and towns across the State.

The following document presents and overview of Virginia Beach's program and illuminates some of the noteworthy practices present that could be replicated by other agencies in the development and operation of an automated enforcement program. This information is based on interviews with key personnel associated with Virginia Beach's program and published documents.

## BACKGROUND

### Enabling Legislation

In 1995 the Virginia State Legislature approved the use of red light running cameras for a period of time that would end by a sunset clause in 2005. In 2005 the Virginia General Assembly voted not to renew the use of the cameras. As a result, Virginia Beach, as well as other localities across the State, had to discontinue the use of their red light camera systems *(1)*.

In 2007, the Virginia State legislature voted to reauthorize the use of red light camera enforcement under State Code 15.2-968.1. The new legislation allows localities to install and operate red light cameras at one intersection for every 10,000 residents. With the new legislation came requirements for the implementation and operation of the red light camera programs *(2)*. Some of the key State regulations on photo enforcement included, but are not limited to:

- *No monetary penalty imposed shall exceed $50, nor shall it include court costs.*
- *If a locality does not execute a summons for a violation of this section within 10 business days, all information collected pertaining to that suspected violation shall be purged within two business days.*
- *No locality shall enter into an agreement for compensation based on the number of violations or monetary penalties imposed.*
- *Before the implementation of a traffic light signal violation monitoring system at an intersection, the locality shall complete an engineering safety analysis that addresses signal timing and other location-specific safety features.*

- *All traffic light signal violation monitoring systems shall provide a minimum 0.5 second grace period between the time the signal turns red and the time the first violation is recorded.*

- *Any locality that uses a traffic light signal violation monitoring system shall evaluate the system on a monthly basis to ensure all cameras and traffic signals are functioning properly.*

- *Prior to or coincident with the implementation or expansion of a traffic light signal violation monitoring system, a locality shall conduct a public awareness program (2).*

One of the biggest differences between the 1995 legislation and the 2007 legislation is the involvement of the Virginia Department of Transportation (VDOT). Under the new legislation localities need VDOT approval for each red light camera installation. VDOT's involvement in the site selection process for each automated enforcement program in the State helps ensure the cameras are being installed for the right reasons, which in turn helps boost public approval.

## Problem Identification

Red light running was a growing concern in Virginia Beach. The City Council was first approached about starting an automated enforcement program in 1997, but it was not until 2004 that the first red light camera was installed. Red light running violation decreased during the 10 months of that initial program, but after they had to stop the program in 2005 due to State laws, violations began to rise again.

Since the beginning, the goal of Virginia Beach's program has been to change driver behavior. Changing driver behavior to reduce, and hopefully eliminate, red light running will ultimately make for safer roads and intersections. After the State legislation re-enabled the use of automated enforcement in 2007, Virginia Beach began the process of restarting their program. The underlying problem and reason for restarting their program was red light running violations contributing to a high number of crashes. The police department did not have enough officers to conduct the continuous amount of enforcement that would be needed to achieve a change in driver behavior. With a high number of right turn on red (RTOR) violations, they expanded their original program to included enforcement of right turn lanes.

## Initiation of Enforcement

The Traffic Engineering Division first approached the City Council in 1997 about starting an automated enforcement program; the program was tabled at that time. The City Council was approached again in February 2002, this time by the Police Department's Special Operations Bureau. In May of the following year, the City Council approved the start of a red light camera program and allocated funds to the program. Mike Shahsiah, Senior Traffic Engineer for Virginia Beach, suggested that for better success of the program being supported, initiation should come from the police department rather than traffic engineering *(3)*.

The initial program, which ran from September 2004 through June 2005, enforced a total of 30 lanes at eight different approaches. This program did not enforce RTOR violations. The

current program, which has been in place since March 2009, enforces 106 lanes at 13 different intersections, including 36 left, 54 through, and 16 right turn lanes.

It is important to note that the legislation allows the City of Virginia Beach to have automated enforcement at 43 intersections based on the population of the City (i.e., one intersection for every 10,000 residents). However, the City only currently uses it at 13 intersections because these are the intersections that have been identified as having an intersection safety program where automated enforcement can help to reduce violations.

## RED LIGHT CAMERA PROGRAM

### Program Administration and Structure

The Virginia Beach Police Department leads the red light camera program. They work closely with the Virginia Beach Traffic Engineering Department for site selection and intersection analyses. VDOT also has a stake in the program, as it is required by State law to have VDOT approve each site before installing any automated enforcement. In reality, there are many other stakeholders and people involved with the program (see Figure H-8). This graphic illustrates the complexity of the program structure and the importance of collaboration between all the different stakeholders.

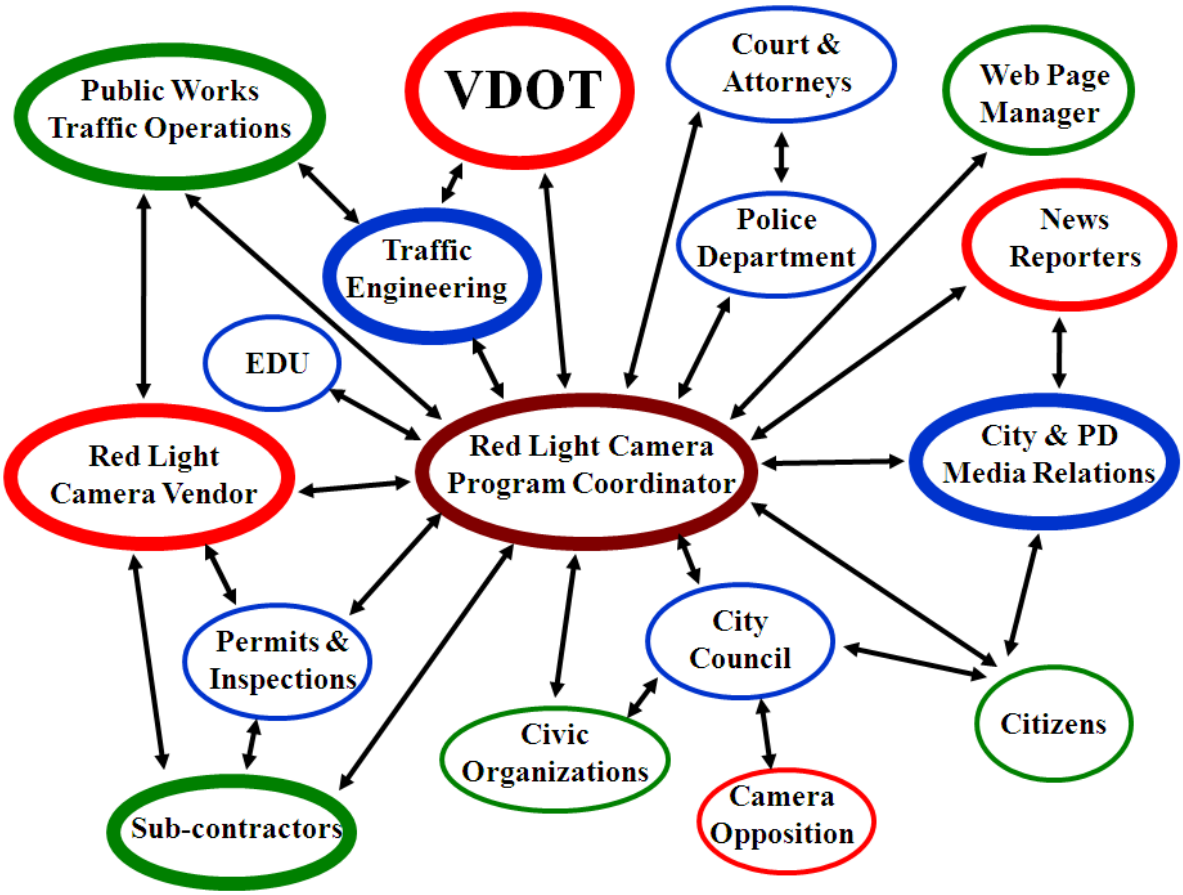


**Figure H-8. Stakeholders involved in a red light camera program (Source: Officer Brian Walters).**

Virginia Beach's program operates as an owner liability program, as mandated through the State legislation. Violations are issued to the owner of the vehicle. The penalty for a red light violation is a $50 fine. This is civil penalty, meaning there are no driver license points assessed and no insurance implications.

The Police Department serves as the lead agency for Virginia Beach's red light camera program. The Police run the program, which includes the day-to-day operations, public relations, maintaining the program's website, and media relations. They also work with Traffic Engineering in the site selection process. Virginia Beach currently has six officers with responsibilities dedicated to the red light program, as shown in Table H-3. In addition to the staff in Table H-3, they also utilize the Police Department's public relations and marketing officer to deal with all media correspondence.

**Table H-3. Virginia Beach Police Department Red Light Camera Program Staffing**

| Current Staffing | Job Description |
|---|---|
| 1 Sergeant:<br>Program Supervisor | Supervises Red Light Camera Program, Alarm Reduction & Telephone Reporting Unit. |
| 1 Master Police Officer:<br>Program Coordinator | Public Awareness, Presentations & Media Spokesperson; Program Assessment & Reports; Intersection Safety Analysis; VDOT Approval and Annual Recertification Packages; Coordinates program with REDFLEX, Traffic Engineering & Traffic Operations; completes administrative correspondence; process violations (see description below). |
| 1 Master Police Officer:<br>Program Manager<br><br>3 part-time officers | Review (accept/reject) violations; process vehicle license plates/tags; mail correspondence – affidavits, hearing requests, undeliverable, etc.; interact with citizens by phone, walk-ins, etc.; contact owners for court, prepare court packages, and attend court; process unpopulated violations; utilize Accurint to locate current or valid addresses and readdress to resend notice. |

The vendor, Redflex Traffic Systems, provides the equipment for the red light camera system. Unlike some other programs, the vendor does not have a large role in the operations or management of this program. In discussions with the Virginia Beach Police Department, they believe that as the end user, the Police Department should be the lead agency, and the vendor should have little involvement *(4)*. The vendor is simply providing a service. The selection of sites, public information, structure, and general operation of the program should be driven by the police department in coordination with traffic engineering and other partners. The police department should have control of the program.

## Operations

Virginia Beach currently has red light cameras monitoring 20 approaches at 13 intersections. The cameras monitor all lanes on an approach - left, through, and right turn lanes - for a total of 106 lanes.

All cameras were activated between March and December 2009. The digital cameras capture three rear photographs of the violating vehicle - one prior to the stop bar, one beyond the stop bar, and one close-up picture of the rear license plate. A video camera also records a 12 second video that captures six seconds before the violation and six seconds after the violation.

The City of Virginia Beach has established that their cameras will only be activated if a vehicle crosses the loop sensors at a designated speed of 15 mph or above after the light has turned red. The City does not publicize this tolerance. The vendor had recommended a lower speed of 12 mph, which would result in more citations. However, the Virginia Beach program staff were concerned that this did not reflect the program's goal of improved safety and that all decisions related to the operation of the program should reflect that goal. They also found that moving the loop sensors closer to the stop bar reduces the number of false triggers.

There is a half-second grace period after the light turns red (Virginia Beach refers to this as the amnesty period). The system is set up so that it does not activate during the period of 0.00 to 0.49 seconds after the light turns red. All violations occurring during this time are not captured. The State of Virginia currently mandates the highest grace period in the country. However, this means that there are vehicles entering the intersection up to 0.49 seconds into the red that do not receive any form of citation or warning. The Police Department still uses traditional enforcement of signal violations at the intersections. In one comparison situation, the automated enforcement system identified one signal violation for every ten identified by traditional enforcement due entirely to the amnesty period.

Advance warning signs, as shown in Figure H-9, are posted within 500 ft. of the enforced intersections on all approaches, even if all the approaches are not monitored. Gateway signs (Figure H-10) are also posted on the major thoroughfare entering the city to warn drivers that Virginia Beach uses automated enforcements.


**Figure H-9. Advance warning sign for red light camera enforced intersection.**


**Figure H-10. Advance warning sign of photo enforcement upon entering city limits (Source: Officer Brian Walters).**

As previously noted, the systems use loop sensors in the pavement. Working with the Traffic Engineering Department, the Police Department explored the use of other sensor technologies. They tried flush mount sensors and light detection and ranging (LIDAR). Neither provided the desired accuracy.

*Site Selection*

As part of the Virginia State Code, site selection should be based on four factors:

1. Crash rate for the intersection.
2. Rate of red light violations at the intersection.
3. Difficulty of law-enforcement officers to patrol the site and apprehend violators.
4. Difficulty of law-enforcement officers to apprehend violators safely and within a reasonable distance.

The Police Department and Traffic Engineering work together to identify high crash locations at signalized intersections, and locations with a high number of red light running

citations. These two lists are combined to find the sites that overlap. Traffic engineering then reviews each crash report for these sites, identifying crashes by approach.

Required by State code is a safety analysis of the intersection, which includes addressing the signal timing and other location-specific safety features *(2)*. Virginia Beach takes the review of the potential intersection a step further and initially conducts an informal road safety audit (RSA) of each location. The Virginia Beach Police Department organizes the RSA team, consisting of enforcement, engineering, design, and other specialists as needed, depending on the unique characteristics of the intersection. They may also involve local business owners. The RSA team considers the safety performance of the intersection from the perspective of all road users, including unfamiliar drivers, older drivers, pedestrians and cyclists. The Virginia Beach Police Department has found these RSAs to be an incredibly useful tool to improve the locations of candidate intersections. The RSAs provide a low cost assessment of perspective intersections and also help to increase the collaboration of all the involved parties and public relations.

After the detailed safety analysis is completed, an application packet is sent to the VDOT District Engineer for their review. Virginia State Code requires all intersections with photo enforcement to be approved by VDOT. Following the review, the City and the District Engineer discuss any changes that need to be made, and the application is then sent to VDOT headquarters for final approval. During the review, VDOT takes a rigorous look at the whole intersection, not just the approaches with proposed cameras. Both Traffic Engineering and the Police Department agree that the VDOT review of every intersection is an advantage to the program because it adds another layer of review, and it insulates the City from any potential lawsuits *(3, 4)*.

*Warning Periods*

There is a 30-day warning period at all sites after the cameras are installed. If a violation occurs during the warning period, a warning notice is mailed to the violator. The warning period is not only a way to educate the public about the cameras, but is also helps find any glitches in the system before citations are issued. It also helps send a message to the public that the program is for safety reasons, not monetary reasons. This warning period is also used to work with the media to educate them about the program. The initiation of a system at an intersection generates a lot of curiosity and interest from the media in covering the story. Each new installation is a public education opportunity and is used for the purpose to encourage changes in overall driver behavior beyond the enforcement intersections.

During the warning period the program coordinator and traffic engineering staff are continuously monitoring the reported violations, looking for any irregularities and comparing it to field observations. For example, there was one location where there was an abnormally high number of right turn on red violations during the warning period. After observing this location in the field, they noted the stop bar was functionally set back too far from the intersection and crosswalk. Vehicles were coming to a stop beyond the stop bar. The advance loop detectors were too far back so the cameras were triggered and registering these as violations. The team relocated the right turn lane stop bar closer to the intersection, show in Figure H-11, resulting in accurate enforcement. Without the warning period, this discovery would have taken place after multiple violations would have issued and challenged in court, creating unnecessary burden on many departments.


**Figure H-11. Location where right turn lane stop bar was relocated after observing a high number of false violations during the warning period.**

*Citation Process*

Citations are issued by police officers viewing pictures and video collected through the automated process. Since all the cameras are digital, the process of putting together the picture and video packages is done automatically by a computer. When the packages are complete, a sworn police officer reviews each violation. Each photo includes a data bar which displays the speed, yellow time, time into red, and the date and time of the violation. Most of the quality assurance and quality control comes from the officers checking the data bar. If a signal timing issue is found then the intersection is flagged and the violations are rejected. The benefit of the doubt always goes to the violator. The intersection is also immediately reviewed to resolve the problem.

Fifty-eight percent of total violations captured by the cameras are thrown out. The biggest reason for dismissal is the vehicle completed a safe turn on red. Table H-4 shows the top five reasons for dismissing a violation. After the officer approves a violation, the violators are sent a citation package in the mail. This includes the three photos taken of their vehicle during the violation, as well as a link to the website where they can view the 12 second video of the violation. The citation must be issued within ten business days from the time of the violation. If not, State legislature mandates that all information collected pertaining to the suspected violation must be purged within two business days *(2)*.

**Table H-4. Top reason for violation dismissal from January 1, 2010 to December 31, 2010**

| Reason for Dismissal | Percent of Total Captured Violations |
|---|---|
| Safe turn on red | 30.32 % |
| License plate obstructions | 5.44% |
| Police discretion | 3.30% |
| Emergency vehicles | 2.58% |
| Vehicle obstruction | 2.02% |

## Adjudication

By State law, Virginia Beach operates as an owner liability program. Violations are a civil penalty and can be challenged in the civil court. Virginia Beach is required by the State Code to provide instructions in the citation on how to file an affidavit if the owner of the violating vehicle wishes to declare their innocence. Initially, violators were brought to traffic court, but after receiving complaints from lawyers the proceedings were moved to civil court by the City. The use of video technology substantially assists with the adjudication process. Several judges have voiced their appreciation of the video; it provides a strong base of evidence and allows the judges to view the violation in its entirety.

The judges are actively involved in the red light camera program and interested in the camera effects on driver behavior. Discussions with the judges resulted in the installation of additional warning signs specifically designed toward reducing right turn on red violations. The Virginia Beach Police Department believes it is very important that agencies brief their judges on the system activation and process being used in capturing violations in order for the judges to have the confidence in the system's fairness and increase their commitment to uphold the issued violations *(4)*.

## Public Education and Information

As part of the public education and outreach to the community Virginia Beach developed their own name and logo for the program: PHOTO*Safe* Virginia Beach. Referring to the program as PHOTO*Safe* helps emphasize to the public that the program is about safety, not about increasing revenue for the city, a common misconception. Virginia Beach uses the PHOTO*Safe* branding, which includes the logo shown in Figure H-12 and the slogan "Red means stop!" in every aspect of public information and outreach. Both the logo and slogan are even incorporated into the advance warning signs noting the use of photo enforcement when vehicles enter city limits.

**Figure H-12. Virginia Beach PHOTO*Safe* logo and slogan (Source: Officer Brian Walters).**

A majority of the public education is done through the use of the program's website: www.vbgov.com/photosafe. The webpage provides information about the PHOTO*Safe* program including where the cameras are located, how they operate, frequently asked questions, signal timing information, City and State ordinances and codes, as well as links to related information. Officer James Barnes, Jr., the public relations and marketing officer, said they often get Freedom of Information Act (FOIA) requests for information on their program. If enough FOIA requests come in for the same information, they will often make the information available on their website for all to see and use *(5)*.

The police department makes a strong effort to put as much information as they can on the website because it helps reduces the number of phone calls they receive. However, they also aim to make the webpage as low maintenance as possible, since they do not have a dedicated staff member to make frequent updates. Information on the website is updated as needed, but the objective was to create a website that could stand on its own with minimal maintenance so that resources can be directed towards other aspects of their program.

In addition to the website, the police department makes frequent presentations about their program to civic organizations and various groups, as well as making program information readily available to the media. Transparency and accessibility is important to the success of the program and general public acceptance.

## Program Evaluation

*Frequency of Evaluations*

Once a year, Virginia Beach is required to recertify each intersection with VDOT, as are all agencies in Virginia with programs. This involves rechecking the signal timings and noting any changes that may have occurred to the geometry. The State also mandates a monthly evaluation of each camera system. The purpose of this evaluation is to ensure that the signals and cameras are functioning properly.

Whenever an intersection signal is taken offline (e.g. for modifications or special events), traffic engineering staff download the signal data overnight to make sure the signal was put back

online correctly. Incorrect signal timing would affect camera operations, so they are continually monitoring this to ensure there is not any improper function. They monitor not only the signal timings but also the rate of violations. Sharp increases in violations on a given day indicate there may be a problem with the system set-up and/or the signal timings. Any erroneous signal timings would result in the dismissal of all violations at that location for that time period. This check has helped to identify and resolve problems in an immediate and efficient manner.

*Results*

There has not been a full safety analysis of this second installation of Virginia Beach's red light camera program since it has only been operational since the spring of 2009. However, the Police Department and Traffic Engineering have been tracking the number of violations at each intersection. One location, shown in Figure H-13, has seen a 69 percent reduction in violations over the first 16 weeks after cameras were installed.

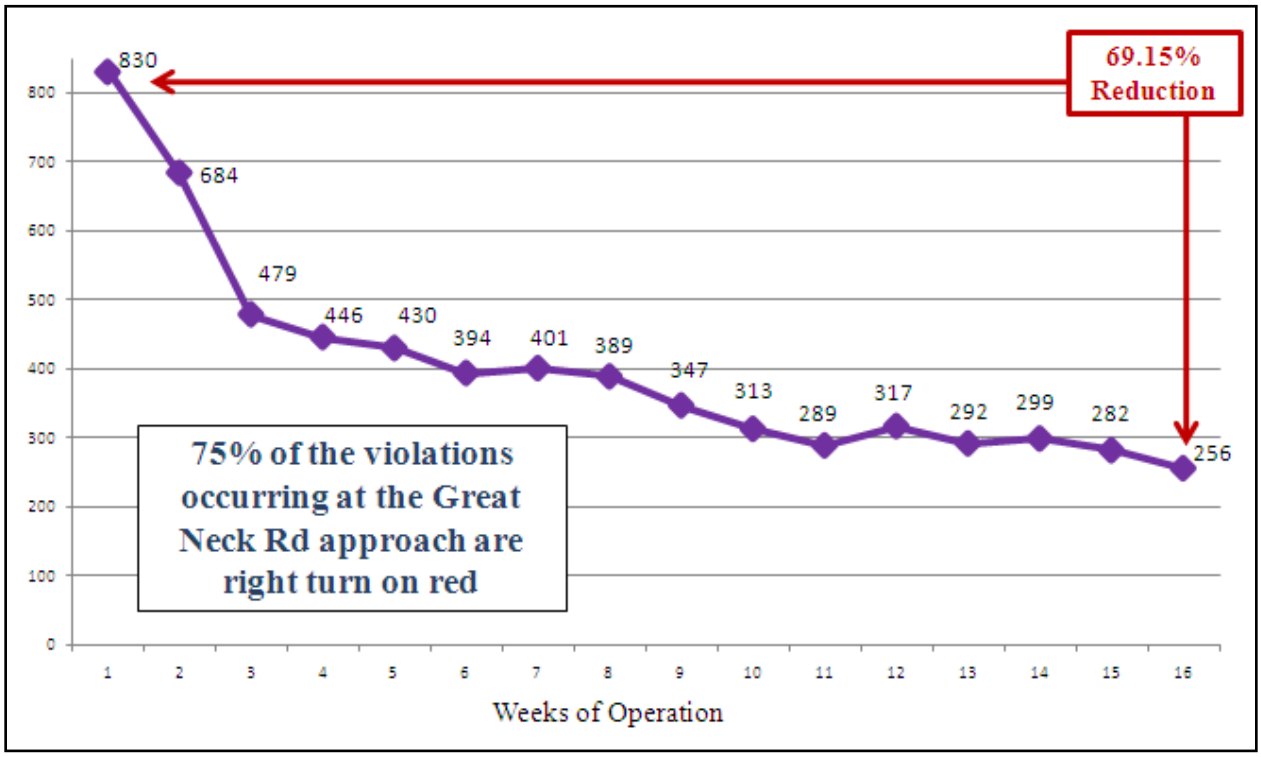


**Figure H-13. Sixteen-week comparison of red light running violations at Virginia Beach Blvd. and Great Neck Road (Source: Officer Brian Walters).**

The first safety assessment of the program will be in 2011. This will involve a comparison of one year of crash data before camera installation (2008), one year during camera installation (2009), and one year after camera installation (2010). A more in-depth analysis will be available in 2013, comparing three years of before and after crash data. The results of these studies will determine if the City needs to expand the program to more intersections. That is, the City prudently will use the results of the crash analysis to determine the effect on crashes and use that to inform their decisions on expansion or any modifications to the program.

The police officers and traffic engineers acquire and compare violation rates for every 1,000 vehicles traveling in each lane that is enforced. For example, a detailed analysis of the data of the Great Neck Road approach shows that the right turn lane had reductions in violations from a rate of 8.0 (Sept. 2009), to 5.5 (May 2010), to 4.0 (Aug. 2010), as shown in Table H-5. The violation rate indicates that the number of violations occurring in the right turn lane was reduced by 50% in one year. In other words, statistical data indicates that for every 1,000 vehicles traveling in the right turn lane, four vehicles are probable to make the turn on red without stopping.

**Table H-5. Right turn lane violation reduction calculations at Great Neck Road**

| **Violation Rate = Number of Violations / Traffic Volume X 1,000** | | | |
|---|---|---|---|
| **Dates of Sample** | **Number of Violations** | **Traffic Volume** | **Violation Rate** |
| 6/1/09 – 9/2/09 | 7,659 | 957,082 | 8.0024 |
| 9/30/09 – 5/4/10 | 10,909 | 1,968,916 | 5.5406 |
| 5/5/10 – 8/4/10 | 3,618 | 891,021 | 4.0606 |

Figure H-14 displays comparable violation processing information over a 13 month period. Month one on the figure is September 2009, the month that the camera was activated. Warning letters were sent to drivers during this month. The change in the number of violations captured to number of violations mailed to registered owners represents the number of violations reviewed and rejected by police officers. The data displayed in this table does not include the number of violations occurring during the 0.5 second amnesty period.

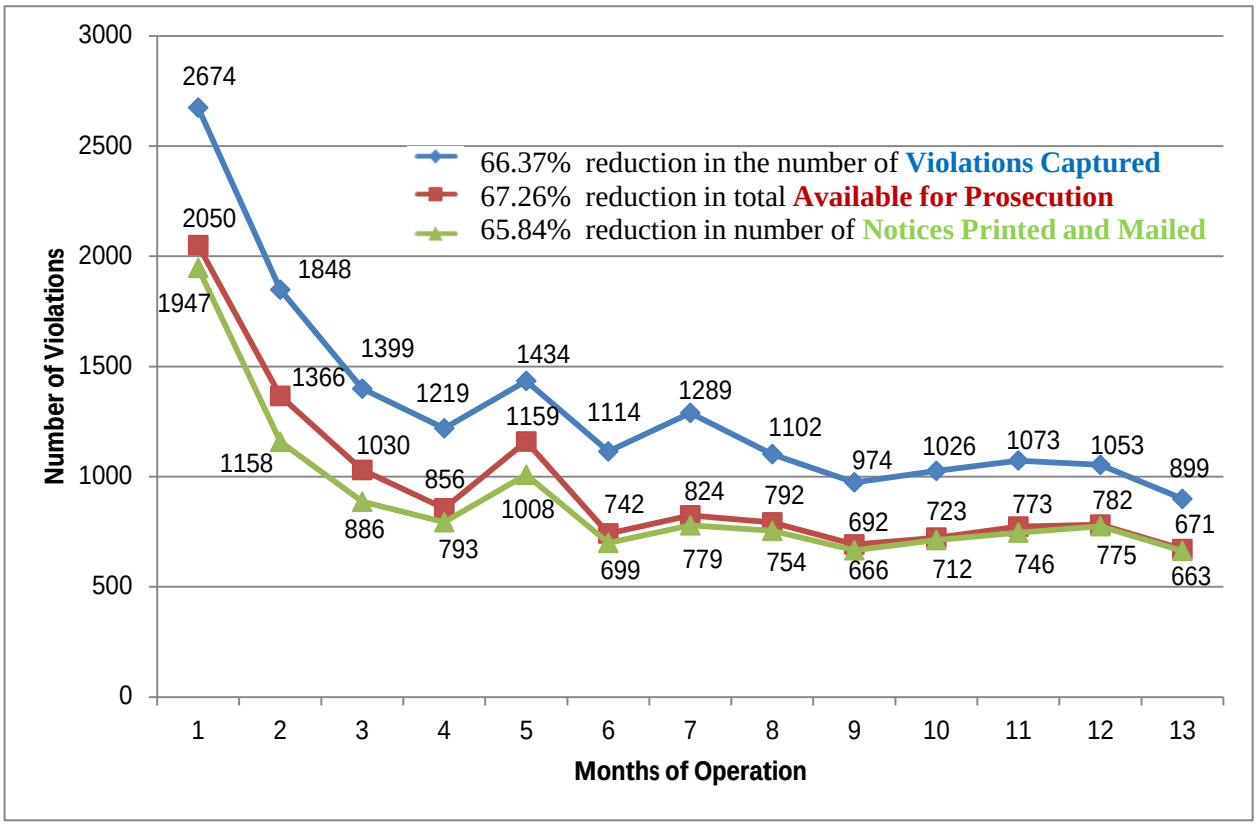


**Figure H-14. Thirteen-month comparison of red light running violation data of the Great Neck Road approach at the intersection with Virginia Beach Blvd (Source: Officer Brian Walters).**

The Traffic Engineering Department conducts ongoing assessments of the PHOTO*Safe* program by collecting and reviewing crash data at the enforced locations as part of their annual intersection crash assessment report. They are also working with the psychology department at Old Dominion University in the completion of a scientific study to determine the effects the photo enforcement cameras are having on crashes.

*Evaluation of Right Turn on Red Traffic Control Devices*

As previously noted, one of the reasons Virginia Beach started the automated enforcement program was the high number of red light violations for right-turning vehicles. The police department, traffic engineering staff, and even the court judges have collaborated on how to address this problem and modify driver behavior. One of the solutions was to try different warning signs to emphasize the right turn on red enforcement. The current signage, shown in Figure H-15, is a "photo enforced" placard underneath the "Stop here on red" sign and is located next to the stop bar. Previous efforts, shown in Figure H-16, included the "Stop here on red" sign without the "photo enforced" placard, and a "Right on red after stop" sign with "photo enforced" in red letters underneath. The police have already noticed a higher compliance rate at certain locations with these signs. These locations tend to be where there is less visual clutter around the intersection. They are using data from the cameras, including the data collected during the amnesty period, to determine the most appropriate sign to use that influences drivers

to stop on red. This effort is a great example of how to use not only the cameras to change driver behavior, but how to use the data the cameras provide to change other traffic control devices to influence driver behavior.


**Figure H-15. Current photo enforced warning sign for right turns.**

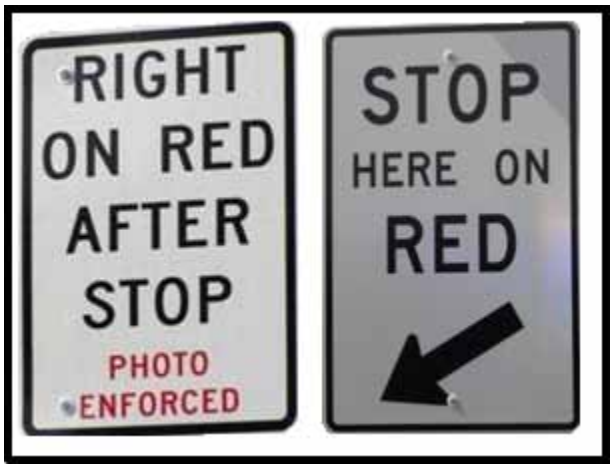


**Figure H-16. Previous sign efforts to enforce right turn on red.**

## Fiscal Considerations

The program generates modest revenue from the citations. In the first 18 months the program collected $2.45 million. As part of the vendor payment agreement, $1.31 million was

sent to the vendor. The remaining $1.14 million went into the City's general fund and can be used to fund traffic safety improvements. A well-run program is expensive to maintain. Currently, the Virginia Beach contract cameras cost $4,350/per month for monitoring up to five lanes and $4,740 per month for monitoring up to seven lanes. The number of lanes affects not only the time and effort needed but also the cost to operate. The cost to pay for the system is covered by three to five violations per day. The payment recovery rate from citations is 68%.

The program operation costs are paid out of the Police Department budget. One hundred percent of the money collected is deposited in the City's general fund. As such, the budget for the program and the revenue it generates are independent funding streams. The agency staff notes that this separation is necessary in order to maintain the integrity of the program, clearly associating the program with safety.

Virginia Beach's program uses two full time police officers. One of the officers is the program coordinator who interacts with the public, media, VDOT, camera vendor, and city traffic engineering and operations departments. The second is the program manager who runs the violation processing components of the program. This ensures that the program is under tight control and that the operation of the program is closely monitored in the interest of the traveling public. Additionally, three retired officers are employed to review the citations. The retirees are sworn officers in the department with duties strictly limited by the Chief of Police to photo enforcement. This reduces the program costs and releases officer resources for other patrol duties.

## Other Notable Practices

*Training Sessions for Other Agencies*

The Virginia Beach program has generated a lot of interest from other municipalities in Virginia that are exploring the use of automated enforcement as a tool in their jurisdiction. Virginia Beach receives frequent requests for information about their program. This prompted the program manager to develop a course entitled PHOTOSafe 101. The one-day course was presented in April and May of 2009, and again in 2010, for agencies interested in learning about the structure of their program and the process of proposing an intersection for automated enforcement to VDOT. The course included the following topics:

- Overview of Virginia Beach's program with capture and processing demonstrations.
- Review of Virginia's photo enforcement law and the importance of public awareness.
- City and VDOT expectations and the public perceptions on photo enforcement.
- Review of VDOT guidelines and the completion of Engineering Safety Analysis.
- Discussion on request for proposal (RFP) selection processes and varied technology used in photo enforcement.

Virginia Beach has been overwhelmed by the attendance at the course. Agency representatives drove to Virginia Beach from all over the State to gather information on the

program. This included representatives from police departments, traffic engineering departments, and individuals at VDOT interested in learning more about the program. The demand for the course illustrated the lack of information available about structuring a program and conducting intersection reviews. Based on the demand for this course, it was given a second time. Virginia Beach continues to provide this information when requested.

*Opportunity for Observation*

The automated enforcement system provides an opportunity for observation of driver behaviors in response to the roadway environment. As previously discussed, the City of Virginia Beach has used their systems to make observations about the best signing to convey RTOR prohibitions. The system allows them the ability to evaluate the impact of different signs on driver behavior. They have also observed that downstream merges increase violations in the outside lanes and that intersections with less visual clutter have better compliance.

*Regional Consistency*

As noted in the previous section, other jurisdictions in the State have reached out to Virginia Beach for information on their program structure. This includes the neighboring cities of Newport News and Chesapeake. Virginia Beach provided these agencies their program materials including their program branding. The two agencies now have a similar look in their signing, logos, and program materials as Virginia Beach. The media in the Hampton Roads area of Virginia refer to the red light camera enforcement as the "PHOTO*Safe* program." It appears to drivers that the PHOTO*Safe* program is a regional program versus an agency specific program. This likely helps to increase any spillover or halo effect as it appears to broaden the scope of each individual program.

In addition to sharing a similar look to their program, the three programs also have a similar structure and processes as Virginia Beach. This is critical to the Virginia Beach program manager. Before allowing these agencies to use Virginia Beach's materials, he met with each of them to ensure that their program would follow the same stringent structure. Consistency is necessary to preserve the integrity of the program, as any scrutiny of the program in any other jurisdiction would also be directed at Virginia Beach. Drivers seeing the PHOTO*Safe* as a regional program strengthens its credibility.

Public Information Officers in the region meet every other month to discuss common issues, including the PHOTO*Safe* programs. The collective group is called the Hampton Roads Media Council. Participating jurisdictions provide accessibility to the public through the media and use the media as a tool for educating and information sharing.

This practice of regional consistency benefits both the agencies and the driving public. For the driving public, drivers know what to expect as far as policies and practices regarding automated enforcement. They also see standardized signing. For the agencies, the program development costs are greatly reduced by using the pioneering agency's (in this case, Virginia Beach) materials. Additionally, learning from the pioneer agency's existing practices helps the agencies to have a successful, well-structured program operating within months.

Unfortunately, in some regions, neighboring agencies may be interested in having programs for the potential revenue. If so, agencies should consider the implications of regional consistency. Employing Officer Walter's practice of meeting with the program managers and reviewing their structure may help to avoid potential problems.

*Problem Identification and Resolution*

When problems are identified at intersections, the program coordinator uses the same multi-disciplinary process that was employed in selecting and reviewing the initial intersections to resolve the issue quickly and in the best interest of the traveling public. An example of this occurred when a review of the systems identified that occasionally a camera view was blocked. An investigation revealed that when the air temperature was high, a cable at the intersection would expand and hang into the view of the camera. The program coordinator initiated a multi-disciplinary field review to explore the problem and identify a resolution. The field review team included representatives from the police department, traffic engineering, the vendor, and the cable company. By having the various agencies in the field at the same time, they were able to collectively explore different solutions together, greatly reducing the time from problem identification to problem solution. They considered raising and lowering the camera, raising and lowering the traffic signals, moving the camera to another pole, and moving the cable to another pole. For each proposed solution, the viability of the proposal, the impact on the intersection safety and operation, and the cost were considered. The resolution of the problem was to install a near side traffic signal.

## Lessons Learned

The Virginia Beach program coordinator and program partners have thought through and explored their program in great detail. Their attention to detail and the structure of their program has helped them to identify many lessons learned for other agencies. These include the following notable points for other agencies.

- Continue Other Inventions. RTOR violations can be a pervasive problem at some intersections and the movement may represent the greatest number of violations. The signing at the intersection should clearly convey to the driver that they are required to stop on red. The City has tried multiple sign variations to communicate this message. The standard signing in the MUTCD does not appear to be adequate. The City is tracking drivers' responses to different signs to identify the optimal signing configuration to reduce the amount of these violations. The automated enforcement data also provides a great method to measure driver's response to the different signs. When the optimal sign is identified, it can be used at other intersections as well. Although this is still a work in progress, the important lesson here is that City continues to use a comprehensive approach that includes signing and markings to reduce violations at their intersections. <u>They do not simply install automated enforcement and allow the violations to continue without attempting other interventions.</u>

- Heavy Vehicles. Most intersections in the program capture rear images. However, for locations with high truck traffic (10% or more is suggested by Virginia Beach staff as a good threshold) front cameras are used to capture license plate on the truck unit rather

than the trailer. The license plate on the trailer differs from the front license plate. The front plate is the plate that corresponds with the truck's owner.

- Communication. *"Positive PR is of the upmost importance." – Officer James Barnes, Jr.* Good communication with the media and the public, especially in the beginning of the program, saves a lot of time and helps to dispel concerns or misunderstandings about the program. Providing detailed information on the website (e.g., signal timings at each intersection in the program) or through other readily available program material reduces the number of calls and requests for information. One person should be identified for all media requests to maintain a consistent message and to establish a relationship with the media. He or she should meet with the media and agency public relations early in the process. Ask the media to meet you at the sites so that you can explain the system structure and illustrate the safety problem that the program is trying to address. This will likely have a two-fold benefit in that the media will be better educated to report on your program and their coverage of your program will help to educate the public about the dangers of signal violations at all intersections.

- Comprehensive Approach. Automated enforcement is only one part of the package to improve intersection safety and will contribute a portion towards safety improvement at the intersection. Road Safety Audits, good traffic engineering, appropriate design, traditional enforcement, and public education should all be employed to improve intersection safety. Additionally, the courts and judges should be involved in the process. Program staff should proactively provide information to the court system regarding the program and should be available to respond as needed to any questions that may arise.

- Continue Traditional Enforcement. Automated enforcement does not take place of an officer; the systems are there to enforce when the officer cannot be there. Officers should continue to provide traditional enforcement at intersections with red light cameras.

## RECOMMENDATIONS FOR STARTING A PROGRAM

During interviews with key personnel of Virginia Beach's red light camera program, we asked what recommendations they would give to an agencies looking to start a similar program. The following lists recommendations and advice from the Virginia Beach Police Department and the Virginia Beach Traffic Engineering staff.

- The public must have the following three items:
    - Public knowledge of the systems (how do they work?).
    - Public awareness of the systems (where are they located?).
    - Public assurance of the systems (will it stop red light running?).

  *"There are three keys to success: public knowledge, awareness, and assurance." – Officer Brian Walters.*

- The intersection reviews are critical. The yellow and red timings have to be right.

- Make sure you do all your homework. Make sure you are selecting the appropriate locations.

- Coordination with traffic engineering, traffic operations, and the police department is critical. *"You need teamwork to make it happen." – Mike Shahsiah*

- The program initiation should come from the police department, not traffic engineering. The program will have more support if it's initiated as an enforcement function, not a traffic engineering function.

- The number of lanes that are enforced has a large impact on the time, effort, and cost to operate the program. When planning out your program, don't think purely on the number of intersections or approaches that will be enforced, consider the number of lanes.

- Be prepared for FOIA requests and media requests. Share these requests with police department and other agency staff.

- Assign people roles within the program (e.g., media relations, technical aspects, etc.).

- If possible, establish uniformity between neighboring jurisdictions if multiple programs exist in a region.

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# CITY OF SAN DIEGO, CALIFORNIA RED LIGHT PHOTO ENFORCEMENT PROGRAM

## OVERVIEW

The City of San Diego, California began operating the current red light photo enforcement program in 2002. They operate 15 red light running cameras in the City. The program is a joint effort between the San Diego City Council, Traffic Engineering Division, and the Police Department. The program was designed and implemented using solid principles, as well as lessons learned from the City's initial photo enforcement program.

This document will provide an overview of the program as it exists today. Best practices will be identified that could benefit other agencies as they develop automated enforcement programs. The information contained in this report is based on published reports and personal interviews with key personnel involved in the operation of the program.

## BACKGROUND

The Safe Lights for San Diego program is very different than the automated red light camera program that was first operated in San Diego in 1998. The current program is a testament to how well a red light camera program can be implemented in a community that has significant reservations about automated enforcement.

In 1996, the State of California enacted California Vehicle Code Section 21455.5 which authorized local government entities to use automated photo enforcement systems at intersections. In 1998, San Diego initiated a Red Light Photo Safety (RLPS) program. The program was met with public concerns. A class action suit was filed against the program. On September 4, 2001, Ronald Styn, Judge of the Superior Court of California, affirmed a lower court decision that evidence from the red light camera program could not be admitted as evidence in court. The decision was broadly based on the red light camera contractor having too much control over the program combined with a financial incentive to issue more citations. The judge determined the vendor was actually operating the program, not the City of San Diego as required by law. The court considered the fact that the vendor had moved inductive loops used for incident detection without the knowledge of the City. The vendor also conducted the installation, calibration, and maintenance of the camera equipment. The City did not inspect the camera system even after construction was completed. The judge determined that this combination of events tainted the evidence. The judge also ruled that because the vendor was essentially operating the program and being paid on a contingency basis there was a potential conflict that undermined the trustworthiness of the evidence. Based on this court ruling, approximately 250 red light camera citations in San Diego were dismissed *(1)*.

Since that time, the City of San Diego and the State of California each completed red light camera program audits. The California State Auditor Report stated that, "although they have contributed to a reduction in accidents, operational weaknesses exist at the local level," and made specific recommendations for San Diego and other cities to improve their programs. The report encouraged more rigorous oversight of vendor operations *(1)*.

The California audit went on to question if the San Diego camera locations were chosen with safety as the top criteria. They reported five of the 19 red light camera sites were not on the most dangerous intersection list. The report recommended that other engineering improvements be considered before a red light camera was installed at any specific intersection. Also, San Diego had not provided the vendor with specific, written business rules about when to issue a citation, relying on verbal communication only *(1)*.

Positive news coming out of the California audit was the reduced crash experience related to the red light camera program. San Diego reported an eight percent decrease city-wide in red light running crashes after the implementation of the program. At intersections in San Diego equipped with red light running cameras, crashes decreased 16% *(1)*.

It is reasonable to conclude that the San Diego community would be predisposed to be skeptical of a new red light camera program. This report will focus on the structure of the new red light camera program. If a red light camera program can be successfully launched in San Diego after the experience of the initial program, a red light camera program has the potential to be successfully implemented in many other communities across the United States.

## Problem Identification

A published list of the most dangerous intersections in San Diego provides the list of candidate intersections with high red light running crash experiences. Other candidate sites, in addition to those on that list, are selected based on high red light running crashes *(2)*.

## Enabling Legislation

California Vehicle Code Section 21455.5 was enacted in 1996. This law holds the driver of the vehicle responsible for a red light violation documented by a camera program. The law requirements include the following key components:

1. Identification of the system by signs visible to traffic approaching from all directions, or posted signs at all major entrances to the city.

2. An intersection with a system must have a minimum yellow light interval established by the Department of Transportation.

3. Must make a public announcement of the program at least 30 days prior to commencement of enforcement.

4. May only issue warning notices for the first 30 days of program operations.

5. Only a government agency, in cooperation with a law enforcement agency, may "operate" an automated enforcement system. An automated enforcement operation includes:

    a) Developing uniform guidelines for screening and issuing violations, processing and storing confidential information, and establishing procedures to ensure compliance with those guidelines.

b) Perform administrative functions and day- to- day functions to include:

i. Establishing guidelines for site selection.

ii. Ensure the equipment is inspected regularly.

iii. Certify the equipment is properly installed, calibrated and operating properly.

iv. Regularly inspect and maintain the warning signs.

v. Oversee the establishment and any change to signal phases and timing.

vi. Maintain controls necessary to assure that only those citations that have been reviewed and approved by law enforcement are delivered to violators.

vii. Items i, iv, v, and vi in the above list may not be contracted out by the governmental agency but item iii may be contracted out to an equipment supplier or provider if the governmental agency maintains overall control and supervision of the system.

6. Photographic records made by an automated enforcement system shall be confidential and shall be made available to governmental agencies and law enforcement agencies only for the purpose of this law.

7. A contract between a governmental agency and an equipment supplier or manufacturer may not include provision for the payment or compensation based on the number of citations generated, or as a percentage of the revenue generated, as a result of the use of the equipment authorized.

## SAFE LIGHTS FOR SAN DIEGO

The current red light camera program was launched in November 2002 with a new five-year agreement with ACS. The new program was designed around the specific recommendations and lessons learned from the San Diego and California audits. Many of the San Diego politicians did not support starting a new red light camera program. Mr. Jon Hannasch, an engineer in San Diego's Traffic Engineering Division, manages the program for the City. According to Mr. Hannasch, the City Manager supported the new program and after many public meetings, the City gained approval to start a new program by one vote *(2)*.

### Program Administration and Structure

The program relies on a close working relationship between the San Diego Traffic Engineering Division and the San Diego Police Department. The Traffic Engineering Division is the lead agency, although most of the work is done by the San Diego Police Department. Mr. Hannasch of the Traffic Engineering Division described this configuration as an effort to gain more control over the program *(2)*. Before an automated enforcement program would be

initiated again in San Diego, the City Manager wanted to ensure he had control over the program. The Traffic Engineering Division reports to the City Manager but the San Diego Police Department does not. While many parts of the San Diego Government play a role in the program, these two agencies are the most involved.

## Operations

San Diego currently operates red light cameras at 15 intersections. Each of these camera locations are identified on the San Diego Red Light Photo Safety Program website *(3)*. The system uses sensors buried in the road surface to identify vehicles that enter the intersection against a red signal. The system automatically photographs the front and rear of each vehicle with close up images designed to identify the driver and registration plate of the vehicle. In addition, the system also captures a 10 second video of the vehicle entering the intersection. Figure H-17 shows a diagram of the red light camera system. Figure H-18 is a close-up image of an actual camera in the field.

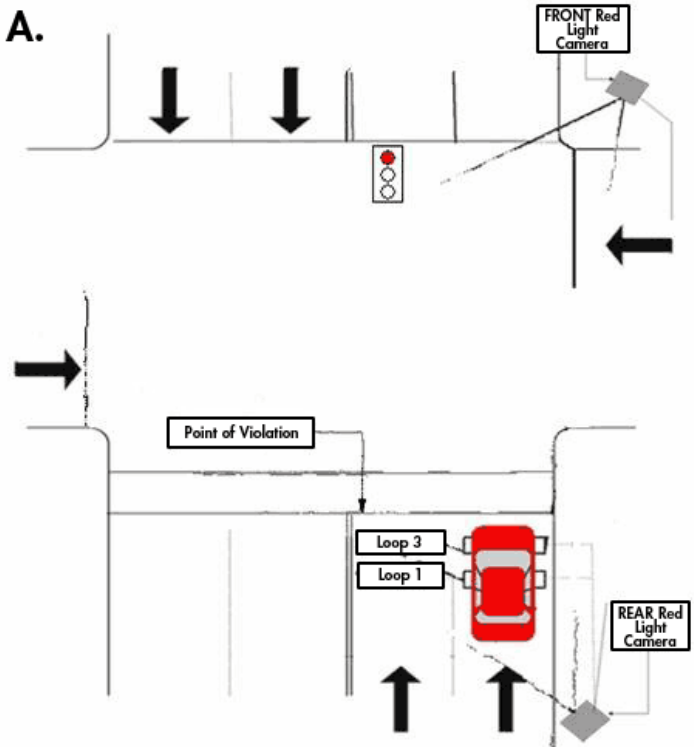


**Figure H-17. Red light camera system location (3).**

**Figure H-18. San Diego red light camera system.**

*Site Selection*

The most dangerous intersections based on collision history and collision type are reviewed by the Traffic Engineering Division to determine potential sites for the red light cameras. If one of those intersections experiences a high number of red light running crashes it is placed at the top of the list of potential sites. Input is accepted from the San Diego Police Department, who keeps a running list for implementation at a future date. Traffic volume increases and red light violation numbers are also considered, but the decisions have all been made with red light running crashes as the top criteria. Current red light camera locations, as well as red light camera locations under consideration, are posted on the San Diego website *(3)*. This website notification allows citizens to offer input about the potential future camera sites. There are over 1,500 signalized intersections in the City, but only 15 (one percent) have red light camera systems. Mr. Hannasch said he was surprised that more of the most dangerous intersections in San Diego did not have higher red light running crash experience *(2)*. By focusing on the intersections that are both on the most dangerous intersection list and have a high number of red light running crashes, Mr. Hannasch expects that the number of red light camera systems will remain a low percentage of the overall signals. He is currently exploring the possibility of moving the camera systems to different locations instead of adding systems *(2)*.

*Warning Periods*

San Diego issued warnings for the first 30 days of the program. They also issue warnings for 30 days after each new red light camera installation. Warning periods are set by the California Vehicle Code Section 21455.5.

*Citation Process*

Images that are automatically captured at red light camera locations are electronically sent to Arizona where they are reviewed by vendor personnel. Following specific business rules established by the City of San Diego, the vendor personnel make an initial decision if an image may capture a violation of the law. The vendor obtains the registered owner information for California registered vehicles. San Diego Police obtains the registered owner information for out of state registered vehicles. The vendor puts the potential violation images onto a website in Arizona *(4)*.

San Diego Police Department personnel examine each set of photo images to determine if an image supports a conclusion that a violation of the law took place. For vehicles registered in California, a San Diego Police officer will compare the driver image in the violation photo to the California DMV driver's license photograph of the owner. If the comparison of the violation image with the DMV license image is inconclusive, they will check other databases that may have photographs of the vehicle owner. Sgt. Joel McMurrin manages the program for the San Diego Police Department. Sgt. McMurrin described the face image identification as being critical to the process. He will not issue a citation unless they can identify three distinct identifiable points of comparison between with DMV image and the violation face image. They look at the nose, mouth, unusual marks, etc. to try to make a match. They also consider the time difference between the dates each of the two images were taken *(4)*.

For vehicles registered out of California, the San Diego Police officer does not have a DMV image to compare with the violation image. Instead, they look at the violation face image and issue the citation only if the gender and race match and if they could identify the driver in court based on the violation image. Sgt. McMurrin advised, "We would rather miss issuing ten citations than issue any notice of liability in error" *(4)*.

A San Diego Police officer reviews both rear and front images to determine if all of the established violation criteria are met. They will review the ten second video of the incident if there is any question in their mind about the violation taking place. According to Sgt. McMurrin, they want to decide to issue the citation based on the totality of the circumstances.

**Figure H-19. Sgt. Joel McMurrin reviewing a violation image with Officer John Labo.**

*Traffic Engineering Role*

The Traffic Engineering Division is responsible for the overall management and accountability of the program. They are responsible for making the site selection, requesting approval of any new location by the San Diego City Council, and the program operational policies. Before the grace period of 0.5 seconds into the red phase was eliminated in 2002, Mr. Hannasch had to describe the rationale behind the change. The ultimate decision to change the grace period was made by the City Council. They maintain and update the website that describes the program to the public. They led the request for proposal process that ultimately selected American Traffic Solutions (ATS) to replace ACS in 2008. They are responsible for managing the vendor contracts with input from the other City stakeholders *(2)*.

The Traffic Engineering Division checks for the proper placement of the warning signs, and conduct system checks every month with the Police Department and the vendor.

**Figure H-20. Jon Hannasch, P.E. conducts a system checks on a red light camera system.**

*Police Department Role*

The San Diego Police Department is responsible for the issuance of notices of liability. Only a San Diego Police employee may approve a notice of liability for issuance. For the review and approval of notices of liability, the San Diego Police Department uses police officers that are assigned to the Traffic Division. At times these are motorcycle officers, officers recovering from an injury, as well as parking enforcement officers. They never use civilian employees for notice of liability approvals.

The officers that testify in court for red light camera cases are always motorcycle officers that conduct traffic enforcement operations of all types on a regular basis. They progressively receive more training on the red light camera operations. Training includes an annual day long training session, with monthly updates, from the vendor on the camera system operation, as well as teachings on the legal aspects related to the red light camera program.

The Police Department conducts monthly system inspections with the vendor and the Traffic Engineering Division. They check for the proper placement of the warning signs and conduct system checks.

*Vendor Role*

San Diego currently works with ATS. ATS is responsible for installing and maintaining the red light camera systems at the locations selected by the San Diego Traffic Engineering Division. They must inspect every red light camera system a minimum of twice a month.

ATS is responsible for the automatic capture of violation images at each red light camera system. They transmit each image to the ATS processing center at the ATS Headquarters in Arizona. At the center, ATS personnel review each set of images based on the business rules established by the City of San Diego. They access DMV records for vehicles registered in California, and several other States, and then incorporate the appropriate data in a record attached to the vehicle images. If the images meet the established business rules, they post the combined violation record to their web site to wait in a queue for a review and approval decision by a member of the San Diego Police Department.

ATS personnel print and mail notices to appear that have been approved by the San Diego Police Department. They prepare evidence logs in support of adjudication cases when citizens request a court trial. They manage citizen inquiries for issues such as lost notices to appear, how to request a court date, and how to pay a fine.

*Vehicle Owner Role*

The owner of a vehicle that receives a notice to appear has a few decisions to make. They can either accept responsibility and pay the fine, or file a form stating their innocence. The minimum fine is currently $480 for a violation. The owner has up to 45 days to request a hearing on the alleged offense. If the owner was not the driver of the vehicle at the time of the offense, they could return a form at least ten days prior to their court appearance date that describes the issue and identifies the actual driver. The San Diego Police would then be able to issue a notice to appear to the actual driver of the vehicle.

## Adjudication

A San Diego Police Officer testifies in court for red light camera citations if a citizen requests a trial. According to Deputy City Attorney, Melissa Ables, this is the same practice that is used in San Diego for other traffic cases *(5)*.

Sgt. McMurrin advised that more individuals are scheduled for trial at the same time then the court can manage. Officers triage the cases and meet with defendants before the case is called for trial. Officers consider each case and decide if they would have issued a traffic citation themselves had they witnessed the violation in person. Officers are permitted to amend the violation to a lesser offense with a lower fine, or dismiss the case at this point.

If a defense attorney requests information in advance of a scheduled trial and an officer is anticipating a complicated defense, they can request that a representative from the City Attorney's Office be available for court.

*Recent Court Issue*

On August 16, 2010, Karen A. Riley, Commissioner of the San Diego Superior Court, issued a decision that dismissed eight red light camera cases. The main issue in the motion to dismiss evidence case related to the evidence prepared by ATS for the initial court cases. It included hearsay and 6th Amendment Confrontation Clause objections *(6)*.

The court determined the data on the data bar superimposed on each red light violation image was an accurate representation of the data in the computer, but there was no presumption that the data itself was accurate or reliable. The court concluded that if contested, the data on the violation images could not be admitted into evidence unless a person could offer foundational evidence that the computer was operating properly. The judge decided since there was no evidence presented to support a finding that the computer itself was operating properly, the information imprinted on the photographs would be excluded in the eight cases *(7)*.

The judge also determined that evidence logs prepared by ATS for the initial court trials were inadmissible as evidence. The judge determined that they were not actual logs prepared contemporaneously with the act or event; they were more like reports dated several months after importing the images. They appeared to have been created solely for the purpose of litigation. She decided that they did not meet the foundational elements for either hearsay exception *(7)*.

In conclusion, the court decided that several parts of the ATS affidavit, the evidence logs, and the superimposed data on the violation images, were not admissible without a live witness in court to testify to their knowledge of the contents. The judge dismissed the case concluding the people would be unable to prove the eight cases beyond a reasonable doubt without this evidence *(7)*.

Sgt. McMurrin advised that since this negative decision, a revised training program was established. The San Diego Police Department began annual training put on by ATS and monthly update training with all officers that process and testify in court on photo red light cases. Since this training has been conducted, very few cases are ever lost at trial. Those that are found not guilty are usually based on identity issues. Even experienced traffic court defense attorneys do not wish to go to trial due to the revised professionalism and knowledge of the San Diego Police officers who testify in court on these cases. Most trials now are by individuals who just want to plead their case in front of a judge and take their chances. A more recent court decision found that everything in the evidence package submitted by ATS to include the Field Service and Inspection Logs were admissible as evidence. All images, video and documentation were found not to be hearsay *(4)*.

Similar cases are still being debated in other locations that operate automated traffic enforcement programs based on criminal laws. The Superior Court of Orange County, California dismissed seven red light camera cases in an August 19, 2010 decision *(8)*. A Superior Court of the State of California, County of San Bernardino filed a similar decision on December 21, 2010 *(9)*.

These issues are likely to be raised in other jurisdictions in the United States that operate automated traffic law enforcement programs. The original precedent for the recent cases was the

United States Supreme Court case Melendez-Diaz v. Massachusetts *(10)*. The case was argued before the Court on November 10, 2008 and decided on June 25, 2009. The defendant in the case had been arrested in possession of a white powder. A lab analysis report was submitted as evidence that described the white powder to be cocaine. The Court decided that the affidavit submitted by the lab analyst was not admissible as evidence unless the analyst was available to be questioned about the testing methods that he had utilized.

## Public Information and Education

San Diego wants their community to know they are operating a red light camera program. Prior to the new program being implemented in 2002, the City held many public briefings and meetings. Major changes to the program continue to be discussed in open hearings, and the media continues to publish stories about the program. The San Diego website describes the program operation, documents where the systems are installed, and answers frequently asked questions. Signs are posted at each red light camera equipped intersections.


**Figure H-21. Photo Enforced Signs are posted at every red light camera location. This one faces drivers on the approach to the intersection being enforced.**


**Figure H-22. This Photo Enforced sign faces drivers approaching the intersection from the side that is not enforced.**

## Fiscal Considerations

The San Diego Red Light Camera Program provides a flat fee to ATS for their services. This eliminates the concern about a vendor having an incentive to issue more notices of liability, placing all of the financial risk on the City of San Diego. As a result, the Traffic Engineering Division must ensure the contract with ATS has strong language in reference to required performance measures. ATS is responsible to pay liquidated damages if their system is not functioning as required by the contract. The Traffic Engineering Division has the burden and responsibility to carefully manage the performance of ATS.

Mr. Hannasch reported the San Diego Red Light Camera program had recently passed the breakeven point with revenues surpassing the program costs. San Diego receives $152.68 from every paid Notice of Liability. This money is used to pay for the program operation, including payments to ATS and City personnel salaries. The rest of the money goes to the State of California and to the courts. The increases in the overall fine amount have been the result of additional fees, security costs, and other fees not directly associated with the program.

## Lessons Learned

- The San Diego experience has demonstrated that a successful red light camera program may be implemented in a location that has already had a negative experience with a red light camera program.

- The program must be operated with the objective to improve traffic safety.

- Media outreach and an open public hearing process is important to ensure the community understands the safety focus of the program.

- Paying a vendor a flat fee is important for eliminating concerns about compromised evidence but it necessitates strong contractual performance requirements.

## Program Legal Suggestions to Consider

In a roundtable discussion with Mr. Hannasch, Sgt. McCurrin, and Deputy City Attorney Ables, the following items were suggested to consider as potential future changes to consider for the California law:

- An owner liability law would be easier to manage and could reduce the burden on the courts.

- The law could be changed to allow a criminal offense for flagrant first violations (based on the time into red) and all subsequent violations with civil violations for other first offenses.

- California law for the misuse of a disabled person sticker currently allows an officer to decide if it should be charged as a misdemeanor or a ticket based on the violation circumstances; this could be used as a model for a potential new red light camera law.

- The current law only permits the violation images to be used for the purpose of providing a red light running violation. This should be adjusted to allow for the images to be used during the investigation and prosecution of major crimes, serious crashes, missing persons and similar cases. Currently the law prohibits the use of these images even if the information would be exculpatory.

### Recommendations for Starting a Program

- Start with problem identification.
- The program must focus on safety.
- Red light camera systems should be designed to maximize crash reductions.
- Ensure the agency, not the vendor, is in control of the program.
- The vendor should be compensated based on a flat fee.
- Operate a program as transparent to the public as possible.
- Communicate to the public about the safety effectiveness of the program.
- Personnel testifying in court should be well trained.

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# CITY OF EDMONTON, ALBERTA, CANADA AUTOMATED ENFORCEMENT PROGRAM

## OVERVIEW

The City of Edmonton in Alberta, Canada has multiple automated enforcement programs, including covert and overt mobile photo radar, conventional red light cameras, and intersection safety cameras which form part of a speed management continuum. The initial Red Light Camera program started as a pilot project in 1998 at a single location. From 1999 on, Edmonton was adding 12 more red light camera sites every year until in 2003 the final number of 60 sites and 24 rotational camera units was reached. Now, with new legislation allowing police to use intersection safety cameras to capture both red light running and speeding vehicles, the program covers 50 locations with 50 stationary Intersection Safety cameras, while conventional red light cameras are being phased out. The success of Edmonton's program is apparent, with a recent empirical Bayes evaluation study showing that the red light running program has been effective in reducing the number of collisions and collision severity, overall, and at most camera locations.

The following document presents an overview of Edmonton's program and illuminates some of their noteworthy practices present that could be replicated by other agencies in the development and operation of an automated enforcement program. The information is based on interviews with key personnel associated with Edmonton's programs and published reports.

## BACKGROUND

### Problem Identification

The City of Edmonton has identified 12 corridors that receive daily photo radar automated enforcement as part of an Integrated Corridor Safety Program. The selection of these corridors is based on collision problems identified by the City of Edmonton Office of Traffic Safety. Complementary to this enforcement program, two corridors are reviewed annually for engineering safety improvements. These reviews have been part of the program since 2009. Specific attention is given to at least two identified high collision contributors, namely right turn cut-offs, and left turns across the path of oncoming vehicles. As the traffic safety reviews are done, identified changes are entered into a master engineering traffic safety priority list. This list includes a review of corridors against city-wide infrastructure to identify engineering changes that would provide a good cost-benefit ratio if changed, or can be accommodated into future capital budgets or rehabilitation programs.

The initial foray into the red light automated enforcement program was piloted by the Edmonton Police Service (EPS) to help reduce the high prevalence of intersection-related collisions. Two aspects relate to this decision. First, over half of the collisions in Edmonton were intersection-related; these contributed a disproportionate number of fatalities and serious injuries which, at the time of the program introduction, was very high in Edmonton and across Canada. Second, the increased danger associated with manned enforcement of red light running necessitated the use of this new technology for officer safety reasons, as well as public safety (i.e., other drivers lawfully traveling through the intersection). In addition, manned enforcement

augmented by mobile photo radar enforcement increases the impact of the deterrence theory, which enhances driver perception of increased enforcement.

### Enabling Legislation

In 2004 the City of Edmonton established a Mayor's Task Force on Traffic Safety. The task force recommended the creation of a municipal Office of Traffic Safety (OTS). By late 2006, the OTS was established and created an Edmonton Traffic Safety Strategy that was reflective of the provincial and national strategies, but specific to Edmonton. One specific target of the Edmonton strategy was addressing the issue of speeding. In 2007, the Edmonton Police Service requested that the city council assume responsibility for the administrative aspects of the automated enforcement program from a private contractor. The City Council approved this request and the OTS became the lead agency for the administration of automated enforcement equipment, which at the time related to red light cameras and photo radar. The EPS retained responsibility for the direction of enforcement.

In January 2009, provincial legislation was passed to allow police to use intersection safety cameras (ISCs). ISCs capture both red light running and speeding vehicles. The guidelines state that ISCs detecting speed can only be used at intersections where there is also detection of red light running *(1)*. In other words, enforcement of red light running and speeding is a package deal with the ISCs.

Current legislation does not allow for unmanned photo radar enforcement equipment. The Edmonton Police Service stated they would like to see a change to this legislation so as to provide them with the opportunity to install unmanned speed enforcement devices at mid-block locations and highways in addition to intersections.

### Initiation of Enforcement

The Edmonton Police Service started using mobile speed enforcement in 1995 with a single vehicle. By 2008 the City had five photo radar vehicles. The first red light camera was installed in 1998. Eleven more red light cameras were added in 1999. By 2003 Edmonton had 24 cameras that rotated randomly between 60 sites.

## PHOTO RADAR PROGRAM

### Program Administration and Structure

The intersection safety camera and photo radar program is run jointly by the Office of Traffic Safety and the Police Service. At the request of the EPS, the administration of the program was re-assigned to the City of Edmonton. The OTS is responsible for the management and installation of the cameras, as well as the engineering analyses for program evaluation. The EPS maintains all enforcement related responsibilities.

Each organization has a lead role that is complementary to the process. This was specifically done to address the perception of automated enforcement as purely a revenue generator, or "cash cow." This joint effort provides scientific basis for site selection by OTS, which is reviewed and approved by EPS from an enforcement context *(2)*.

## Operations

Edmonton has both covert and overt mobile photo radar vans. Currently there are ten covert vans, with three more being added this year. The new equipment allows for instantaneous feedback to the operator of the van. The operators are able to see the images of the speeding vehicle on the laptops in the van and ascertain if the camera settings are correct. The ability to make field adjustments to the cameras during changing environmental conditions ought to improve image quality. It also allows the operator to immediately confirm their visual observations on the laptop. As data is electronically uploaded at the end of each working shift, the equipment also allows for more rapid processing of violations, thereby ensuring violators get their violations in a timelier manner. The City also has four additional vans, known as the Safe Speed Community Vans. These vans are designed to stand out to drivers, with photos of Edmonton citizens covering the sides of the vans. They are located in areas that communities have identified as hot spots for speeding, and are equipped with the same photo radar equipment as the covert vans. These vehicles are primarily used for educating drivers to be aware of their speed, but are also used to generate tickets for those that fail to comply with the speed limit.

The Edmonton Police Service has established a speed tolerance for the photo radar, which varies depending on the circumstances of the location it is being utilized in. The tolerance used for the equipment is constant with the ISC system and is the same tolerance given by most police agencies when manually enforcing speed.

The photo radar speed enforcement is specifically targeted at 12 designated corridors for daily enforcement for a minimum period of time. Typically, seven to eight photo radar vehicles are deployed every day for two shifts. Photo enforcement signs are posted throughout the city based on the provincial guidelines.

*Site Selection*

For both photo radar and ISCs, Edmonton currently uses several state-of-the art empirical Bayes based methods to prioritize sites. These methods include expected collisions, expected excess collisions, expected net collision reduction (using crash reduction factors for different crash types), and applying weights for collision costs. For photo radar, an additional method is used that estimates expected collision reduction based on anticipated reduction in mean speed, a procedure documented in the National Cooperative Highway Research Program (NCHRP) Report 617 *(3)*. Edmonton does not yet know if one method is more successful than the others; they continue to look at sites highly ranked by any method, giving particular attention to sites that are highly ranked by more than one method.

*Warning Periods*

Alberta Provincial guidelines mandate a four-week warning period for any automated enforcement program. During the warning period a notice is sent out to all violators notifying them of their infraction. The notice includes the violation data such as location, date and time of the offence, speed of the violating vehicle, fine amount, registered owner and vehicle information, and two images of the violation along with the image of the plate close up. If a new site is added during the initial warning period, a notice is sent out to violators at that location.

Any new site that is installed after the warning period does not require warning notices to be sent out.

*Citation Process*

At the end of each deployment of the photo radar vans, the violations are uploaded and the images and data are synchronized. The data is sent to the vendor, ACS, for initial screening and license plate viewing. Following the screening, the data is returned to the EPS and then sent to Service Alberta for information on the registered owner of the violating vehicles. Service Alberta is a private sector company that serves as a registry agent providing motor vehicle services to the Province of Alberta.

The data from Service Alberta is returned to the EPS, who then sends it to ACS. ACS conducts a blind verification of license plates. If the license plate data matches then the violation is forwarded to the EPS in a violation review queue. The violations in the queue are then approved by a Peace Officer. Upon approval, the violation is printed and mailed by ACS.

*Vendor Contract and Payment*

Vendors were identified through a competitive bidding process. A request for proposal was issued and based on responses to the solicitation, a vendor was identified and a contract was awarded. In order to choose the best equipment Edmonton looked at numerous factors such as compliance with all technical requiems, ease of use and minimal maintenance, developed training manuals and schedules, existence of customers with similar programs, good references, warranty period, and financial stability of the vendor.

The equipment supplier is paid according to the equipment pricing list included in the contract. It is a onetime payment for each order based on a purchase order. Spare parts needed for equipment maintenance are also paid based on the contract pricing list and specific purchase orders. Back-end processing for photo radar and intersection safety camera tickets is paid on a monthly basis as a flat monthly fee plus additional fee per paid ticket.

Up until September 2009, the outside vendor was responsible for all aspects of supplying the necessary equipment and services to operate photo radar and intersection safety cameras. This included equipment supply, installation, and maintenance. All these services were paid through the flat fee portion of the monthly payment. The outside vendor was also responsible for back-end processing of photo radar and red light camera tickets and monthly reporting. These services were paid partially through flat fee portion and fee per paid ticket. The City is progressing towards management of all aspects of back end processing.

The contract period is five years for the equipment vendor and month-to-month for the processing vendor.

*Collaboration*

Several city departments and sections work together. This includes the City of Edmonton transportation department, transportation operations, OTS analytical staff, and provincial automated enforcement audit personnel.

The EPS and the OTS have a standing equipment management committee. Speed management is handled by an integrated committee involving the EPS, the OTS, and transportation engineers. A data committee is responsible for the integration of required data across departments and between agencies. The initial project to integrate new automated enforcement equipment and processes for the City of Edmonton are managed through an inter-departmental steering committee. Operational issues identified outside the scope of these committees are handled at a management level through direct contact and meetings as required.

The collaboration between departments and agencies has proven successful in Edmonton. Both political will and a commitment of the chief of police and the general manager of the transportation department have reduced barriers and encouraged strong integrated and joint traffic safety plans that increase collaboration.

## Public Education and Information

The Edmonton Police Service maintains a website with information on the photo radar program: http://www.edmontonpolice.ca/TrafficVehicles/PhotoRadar.aspx. The website provides background information on the program, information on how to pay traffic fines, a list of photo enforcement sites, and answers to photo radar frequently asked questions.

Currently, there is a gap between public perception of support for automated enforcement and actual support. In 2010, most adult Edmontonians (78%) either agree or strongly agree with using automated enforcement. However, only a third (34%) of the adult population believes that automated enforcement has public support.

Red light camera programs have higher levels of support than automated enforcement activities that address speeding. While 83% of Edmontonians agree or strongly agree with using red light cameras to ticket drivers who run red lights, 75% supported the use of intersection safety cameras to ticket drivers who speed through intersections. Even fewer Edmontonians (73%) supported the use of photo radar to ticket drivers who are speeding.

Perceived support for specific automated enforcement programs parallels actual support. There is more perceived support for red light cameras than there is for intersection safety cameras and photo radar. While 45% of adult Edmontonians believe that red light cameras have public support, fewer believe that the population supports automated enforcement that targets speeding (33% perceived support for intersection safety cameras that ticket drivers who speed, and 30% for photo radar).

Edmonton is working to address the gap between perceived support and actual support through social norms marketing. Social norms marketing combines social marketing techniques (using marketing techniques to change behavior rather than sell products) with social norms theory (which posits that most people's behavior is influenced by their perceptions of what is normal or typical). If Edmontonians learn that most of the population supports the use of automated enforcement, then they're more likely to openly support the technology and the behaviors that it deters. The OTS is working with the EPS to plan how to use social norms marketing to address perceptions about automated enforcement.

## Program Evaluation

Traffic and violation data are collected during photo radar vehicle deployment. Based on data analysis and site performance (e.g., a decrease or increase of the speed related problems) the site becomes permanent, continues in use from time to time, or is abandoned. There has been no formal crash based evaluation of the program but this is in the future.

The Office of Traffic Safety is responsible for monitoring the program. The program is also subject to external audit and monitoring by provincial solicitor general employees. A quarterly report is prepared and provided to the province for their audit purposes.

## Fiscal Considerations

Revenue from automated enforcement is used to support the cost of the program as well as support traffic safety initiatives. In addition, Edmonton City Council approved the expenditure of 1.5 million Canadian dollars to establish a permanent Urban Traffic Safety Research Chair at the University of Alberta, Department of Civil Engineering. The funding for the research chair is from automated enforcement revenue.

Any additional funds generated above the cost of operations can be dedicated to a standing list of traffic safety projects and priorities that have been established based on cost benefit reviews. No additional surplus revenues are anticipated based on this use.

# INTERSECTION SAFETY CAMERA PROGRAM

## Program Administration and Structure

The Office of Traffic Safety provides recommendations for intersection safety camera locations based on safety performance analyses, which include an analysis of the number of collisions. In addition to the recommendation of sites for ISCs, the OTS also manages all equipment purchased for the program, maintenance and repair or the equipment, coordinating construction of new ISC sites, and working with the vendor. Similarly to the photo radar program, the EPS maintains all enforcement related responsibilities.

## Operations

Edmonton currently has intersection safety cameras monitoring 50 approaches at 28 intersections. Twenty-three ISCs were installed in 2009 as a result of the new legislation. Twenty-seven more cameras were installed in 2010. The cameras monitor approximately three percent of the City's 928 signalized intersections. The intersections did not undergo any improvements (e.g. optimization of the cycle length or yellow intervals) prior to the use of automated enforcement.

All cameras are permanently installed; they do not rotate between multiple sites. In 1998 the program started out using wet film in all their cameras. The switch to digital equipment was made in September 2009 with the advent of the use of ISCs.

The optimal number of cameras is dictated by the number of locations at which the safety benefits will outweigh the costs. Edmonton is currently working on determining this optimal number. Edmonton police feel the fixed and mobile speed enforcement methods are complimentary to each other. The zone of influence of the fixed installations is currently being studied with a view to avoid the use of mobile enforcement in that zone.

The City of Edmonton has established a grace period of 0.2 seconds after the light turns red. Violations are not issued for cars entering the intersection between 0.0 and 0.199 seconds. This is consistent for all intersections throughout the city. The reason a grace period was established is because at time 0.0 seconds both the yellow and red light is visible on the image. Edmonton police also found it difficult to enforce as drivers would state that the light had not been red for the time stated. They had strong public reaction when there was no grace period, but have since found that the public thinks the 0.2 second grace period is fair.

The Edmonton Police Service has also established a speed tolerance for the ISC's, which can vary dependant on the circumstances of the location of deployment. The tolerance used for the equipment is consistent with the ISC system and is the same tolerance given by most police agencies when manually enforcing speed.

The Province of Alberta mandates that permanent gateway signs be placed on primary roads entering municipalities that use automated enforcement to alert the drivers of the use of automated enforcement technology. There is also a requirement of a speed limit sign, photo enforcement sign, and type of enforcement sign (i.e. red light and/or speed camera) on all approaches to an intersection where the ISCs are in place.

*Site Selection*

The site selection is a joint effort between the Office of Traffic Safety and the Edmonton Police Service. The OTS reviews the collision statistics and any other available data to compare locations and prepare a list of proposed sites. OTS technicians then visit the site and perform the site inspection to determine the feasibility of installation. After the site visits, the EPS reviews the revised list, approves certain sites, and then prioritizes the locations for ISC installation. As previously discussed, Edmonton currently uses several state-of-the art empirical Bayes based methods to prioritize sites. These methods include expected collisions, expected excess collisions, expected net collision reduction (using crash reduction factors for different crash types), and applying weights for collision costs.

As a result of this site selection process, half of the existing ISCs are located on the 12 corridors that are part of the Integrated Corridor Safety Program.

*Warning Periods*

Alberta Provincial guidelines mandate a four-week warning period for automated enforcement. Edmonton's warning period lasted two months due to technical problems at the beginning. The Police also did not send out a sufficient number of notices in time, so the warning period was extended beyond the four-week mandate.

During the warning period a notice is sent out to all violators notifying them of their infraction. The notice includes the violation data and images. If a new site is added during the initial warning period, a notice is sent out to violators at that location. Any new site that is installed after the warning period does not require warning notices to be sent out.

*Vendor Contract and Payment*

Vendors were identified through a competitive bidding process. A request for proposal was issued and based on responses to the solicitation, a vendor was identified and a contract was awarded. The request for proposal included both intersection safety cameras and photo radar components. The same vendor was successful in the competition bid for both programs.

Since the same vendor is used for both photo radar and ISCs, the payment process is the same. The equipment supplier is paid according to the equipment pricing list included in the contract. It is a onetime payment based on a purchase order. Back-end processing is paid on a monthly basis as a flat monthly fee plus additional fee per paid ticket.

Up until September 2009, the outside vendor was responsible for all aspects of supplying the necessary equipment and services to operate the cameras. This included equipment supply, installation, and maintenance. All these services were paid through the flat fee portion of the monthly payment. The contract period is five years for the equipment vendor and month-to-month for the processing vendor.

*Collaboration*

Collaboration among the city departments for the ISC programs is similar to that for the photo radar program. In addition, the various city departments work together with the vendor and contractor to run a smooth program.

## Adjudication

The legislation enables the collection of unpaid fines for violations that are adjudicated in court by attaching the fines to renewal of annual license plate fees and driver's licenses. A screening tool is under development to identify multiple offence violators for closer scrutiny by manned law enforcement personnel.

## Public Education and Information

Edmonton held a media conference before the initiation of the intersection safety cameras. The city received feedback that the media and public were very supportive of the cameras. Similar to the photo radar program, they created a webpage on the City's website that contains information about the cameras, camera locations, and frequently asked questions: http://www.edmonton.ca/transportation/roads_traffic/intersection-safety-cameras.aspx. The website explains that Edmonton uses automated enforcement at high-collision intersections to discourage drivers from running a red light or speeding, to lower the number and severity of collisions, and to improve the safety of Edmonton's roads. It also provides statistics on collisions at intersections. The OTS provides evidence-based statistics for collisions in Edmonton.

In addition to the City's website on ISCs, the Edmonton Police Service also maintains a website: http://www.edmontonpolice.ca/TrafficVehicles/IntersectionSafetyCameras.aspx. These pages provide background information on the program, information on how to pay traffic fines, a list of camera locations, and answers to frequently asked questions. The OTS and EPS are also prepared to respond to media inquiries about the ISCs and the program.

To raise awareness of the enforcement cameras, Edmonton organized a competition between the local high schools for the best drawing to be painted on the camera poles. As a result, 12 cameras poles were painted by the winners. The cameras poles that were painted were all in close proximity to schools so that students could be reminded every day about the role of the cameras and the consequences of poor driving behavior and the role of the cameras.

As with photo radar, there is a similar gap between public perception of support for ISC's and actual support. Less than 30% of the population believes that the ISC program has public support. It appears that over 86% may actually support the program. Red light camera programs have higher levels of support than intersection safety cameras. Edmonton is working to address this through positive social marketing. A marketing campaign is targeted for development in 2011.

## Program Evaluation

The Office of Traffic Safety is responsible for monitoring the program. The program is also subject to external audit and monitoring by provincial solicitor general employees. A quarterly report is prepared and provided to the province for their audit purposes.

Edmonton has not yet reached the formal evaluation stage for their current ISC program, as it is relatively new and the deployment of sites is still in progress. A planned evaluation will also study the effects of the ISCs on surrounding intersections and corridors.

The Edmonton Police Commission has completed a peer-reviewed study that has established the benefits of the original red light program. The study report is available to the public on their website: www.edmontonpolicecommission.com. Results from this study show a reduction in the total number of collision at most sites after the cameras were implemented, as well as a reduction in the collision severity *(4)*.

## Fiscal Considerations

Revenue from the intersection safety camera program is distributed in the same manner as revenue from the photo radar program. All revenue from automated enforcement is used to support the cost of the program as well as support traffic safety initiatives. In addition, the revenue is also used to support the Urban Traffic Safety Research Chair at the University of Alberta.

Any additional funds generated above the cost of operations can be dedicated to a standing list of traffic safety projects and priorities that have been established based on cost benefit reviews. No additional surplus revenues are anticipated based on this use.

## NOTABLE PRACTICES

Notable practices from Edmonton's automated enforcement program include:

- The unique cooperation arrangement between the EPS and the OTS. The OTS provides the scientific expertise for crash based site selection and the EPS does the enforcement.

- The use of statistical rigor in site selection for both ISC and mobile photo radar. They use crashes, Safety Performance Functions, target crashes, and crash costs in methodology based on the Highway Safety Manual (HSM) procedures.

- The use of statistical rigor in program evaluation. The empirical Bayes (EB) methodology has been used to evaluate both programs.

- Coordination of the use of ISCs with mobile photo radar. A research project is underway to determine the influence zone for ISCs to ensure mobile photo radar locations will not overlap.

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