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3-1-2005

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### Recommended Citation

Shin, Yong; Garrett, Mike; McCord, Jamie; and Witsell, Bob, "Perceived Impact of Technology Adoption: Red Light Camera " (2005).  
*SAIS 2005 Proceedings*. 1.  
<http://aisel.aisnet.org/sais2005/1>

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# PERCEIVED IMPACT OF TECHNOLOGY ADOPTION: RED LIGHT CAMERAS

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## Abstract

*This position paper evaluates the growing use of red light cameras (RLCs) across the United States and the growing concerns associated with this technology. RLCs are quite simply the installation of cameras at traffic intersections that are designed to photograph and catch drivers that run red lights. In a perfect world, the use of RLCs would appear to be innocent enough and encourage safety on our roads. However, the growing use of RLCs has created many problems. There are three main issues (legality, safety, and money) that have arisen from the introduction of RLCs. This study found that despite all of the concerns about the legality of RLCs, they have withstood most of the challenges against them.*

**Keywords:** technology adoption, red light cameras, legality issues, safety

## Introduction

“Technology can be a tool of freedom. Communication advances like the Internet, for instance, have broken down barriers and spread the message of democracy around the globe. Unfortunately, technology can sometimes serve the opposite effect. New technologies can actually undermine our freedoms and create problems far greater than those they are meant to solve (Arme y, 2001).” This is a very powerful statement from a very powerful person. Dick Arme y was the Majority Whip in United States House of Representatives. He made this statement on July 31, 2001 before the House Transportation Subcommittee on Highways and Transit Hearing in regards to the growing use of Red Light Cameras (RLCs).

RLCs are quite simply the installation of cameras at traffic intersections that are designed to photograph and catch drivers that run red lights. In a perfect world, the use of RLCs would appear to be innocent enough and encourage safety on our roads. However, the growing use of RLCs has created many problems. The issues range from accusations of invasion of privacy to questions whether safety is actually increased to additional accusations that it is all about creating a new revenue source for governments. As Dick Arme y said, technology can be a tool for freedom. However, if used improperly technology can be abused and cause more problems than it is worth.

This position paper evaluates the growing use of red light cameras across the United States and the growing concerns associated with this technology. There are three main issues that have arisen from the introduction of RLCs. First, the issue of legality of using RLCs has been questioned. America is the “land of the free”. The use of RLCs is considered a threat to those freedoms by some. Second, on the surface, the whole point of having RLCs is to improve safety on our roads. Intersections are where a large percentage of vehicle accidents occur. If RLCs can create disincentives for red light violators, accident prevention and therefore safety would be enhanced. Third, the result of catching so many violators has resulted in a large revenue stream for governments across the United States. Many question the practice of RLCs when they hear that the camera service providers are paid a percentage of the revenues generated rather than a flat fee.

# Issues on RLCs

## *Legality Issues*

What's the big deal about cameras taking pictures of drivers running red lights? After all, if greater awareness or greater fear of being given a citation changes the behavior of drivers and lives are saved, then we should be willing to give up a little freedom for the public good. In fact, most people view RLCs as a good thing for this very reason. Surveys have indicated 75% to 85% public approval of RLCs (Blakey, 2003).

From a freedom perspective, it is generally the civil libertarians and groups like the American Civil Liberties Union (ACLU) that see a problem with RLCs. Several problems with RLCs are Orwellian threat, surveillance society, constitutional issues, privacy matters, and mission creep. These issues are discussed further below in this section. However, privacy matters and mission creep are a part of the Orwellian threat and the surveillance society issues and are included as part of these sub-headings.

**Orwellian Threat:** In 1949, George Orwell wrote *1984*. In the book, *1984*, Orwell creates a strong imagery of a negative utopia where people sacrifice freedom and autonomy to the elitist. In Orwell's depiction, the elitist work toward complete power and control. The term "Big Brother" gained popularity from *1984*. Big Brother becomes a symbol to the people in the society as a deified icon that is omnipresent. Hence, the saying "Big Brother is Watching You".

By saying that RLCs are an Orwellian threat and understanding where the terminology comes from, it is easy to see why groups like the ACLU are concerned. This is also where mission creep is applicable. The ACLU is concerned that governments will not stop with RLCs. As time goes on, cameras will be watching us not only at red lights but other places as well. Of course, with growing government surveillance, people's civil liberties could be threatened.

**Surveillance Society:** The events of September 11, 2001 have increased the pace of surveillance for the sake of safety. However, even before September 11<sup>th</sup>, the United States was well on its way to a surveillance society (Penenberg, 2001). The surveillance society is not limited to RLCs. Surveillance is done using cameras, digitally, monitoring, global positioning systems (GPS), and personal information collection. Cameras are used for other applications besides RLCs, such as casinos, police cars, public parks, sports stadiums, and shopping malls. Digital examination is accomplished through data trails from bank accounts, credit card accounts, medical claims, mortgages, retirement funds, etc. Records and receipts from tollbooths, employees ID work entry cards, phone cards, credit card purchases, airline tickets, and cell phones can monitor our daily activities and travels. With the growing addition of global positioning systems (e.g., General Motor's OnStar onboard communication system) to new vehicles, where we drive and our current location can be tracked. Finally, our personal information is widely available in databases owned by credit card companies, phone carriers, rental car agencies, police departments, Internet service providers (ISPs), and the Internal Revenue Service (IRS) (Penenberg, 2001). With all this information about each of us available, it is easy to understand why some have become fearful of doing anything more than just leaving the house.

**Constitutional Issues:** The United States (U.S.) Constitution was written to protect individuals' freedoms. After all, the Founding Fathers fought for independence to escape government tyranny. The first 10 amendments to the Constitution, called the Bill of Rights, further strengthened the freedoms of U.S. citizens. In essence, the Constitution and the Bill of Rights put the burden on the government to prove the guilt of an individual in a given situation.

According to critics, RLCs violate the judicial principles of presumption of innocence, the right to face one's accuser, and the right to avoid self-incrimination. Furthermore, many jurisdictions do not even attempt to identify the driver of the vehicle. Instead, the owner of the car is presumed guilty (Hall, 2001)

## *Safety Issues*

Behind the controversy surrounding the privacy and revenue stream of traffic cameras lives the core issue of safety. Were these cameras not proven to reduce major accidents in intersections, they would be merely disrespectful inconveniences to drivers. As the population continues to grow, more and more drivers populate city roads. Thus, it is no surprise that red light running is increasing along with other aggressive driving behaviors (McGee, 2003). Next to speeding, it is probably the most common violation observed (See Table 1). So red light running is a major traffic issue that needs to be addressed.

**Table 1: Observed Traffic Violations**

DEPARTMENT OF MOTOR VEHICLES MODULE					
When driving what moving violations do you see?					
	Richmond City	Chesterfield County	Henrico County	Hanover County	Metro Area Total
Drunk or drugged driving	3%	5%	6%	4%	4%
Speeding	55%	65%	66%	62%	62%
No full stop at sign	26%	15%	21%	21%	21%
Illegal turns	11%	11%	16%	4%	12%
Tailgating	8%	14%	14%	24%	13%
Failure to signal turn	31%	21%	26%	19%	25%
Reckless driving	17%	14%	14%	15%	15%
Running red light	40%	35%	33%	27%	35%
Other	20%	18%	31%	26%	24%
None	2%	2%	2%	3%	2%

Virginia Commonwealth University Survey

- \* All percentages are weighed percentages.
- \* Sampling error for questions answered by ALL respondents is approximately +/- 4%
- \* Sampling error for subpopulations will vary and are higher than that for the full sample.

According to Federal Highway Administration (FHWA) statistics, “red-light running was to blame for as many as 218,000 crashes and 880 fatalities in 2001 (Blakely, 2003).” The Insurance Institute for Highway Safety reports that, “from 1992 to 2000, the number of fatal crashes at signalized intersections in the U.S. increased by 19%” (Pirotskaya, 2002). Red-light running was cited as the dominant cause. Thus, there exists a problem, which necessitates a solution.

Cameras were first proven successful at road intersections with railroads. Local authorities in Los Angeles California found that most railroad incidents were the result of motorists attempting to make illegal left hand turns trying to beat an oncoming train. After installing sophisticated photo enforcement systems at three intersections, LACMTA (Los Angeles County Metropolitan Transportation Authority) recorded an 84%, 80%, and 40% reduction in violations over a four-month period (Vantuono, 1994). Was the success in the railroad environment transferable to pure auto intersections?

So far, the track record for red light camera enforcement is convincing. Reported violation reductions range from 20% to 87% with a mean of 40% to 62%. International reports have been equally reinforcing. A study in Queensland, Australia showed a 40% reduction in right angle crashes over a 10-year period. A similar study in Scotland indicated an 88% reduction in collisions in a three-year period compared before and after installation of red light cameras (See Table 2) (Maccubbin, 2001).

**Table 2. Violation and crash reductions for various RLC enforcement programs.**

Site	Violation Reduction	Crash Reduction	Source Type(s)	Source(s)
<b>Arizona</b>				
Scottsdale, AZ	62%		Trade Press Article	“Applications Increase...”, 2000
<b>California</b>				
Oxnard, CA	42% <sup>1</sup>	29% reduction injury crashes, 32% reduction right-angle crashes <sup>2</sup>	Insurance Institute for Highway Safety (IIHS) Studies	<sup>1</sup> Retting, 1999 <sup>2</sup> Retting, 2001
San Francisco, CA	42%		Conference Paper	Fleck and Smith, 1999

Santa Rosa, CA	yes	yes	Newspaper Article	“Exposed: SR...”, 2001
Los Angeles, CA	75%		Conference Paper	Rocchi, 1999
<b>Colorado</b>				
Boulder, CO	37%	57%	Newspaper Article	“Speeders may be...”, 2001
<b>District of Columbia</b>				
Washington, DC	56%		Newspaper Article	“Red-light Cameras.”, 2001
<b>Florida</b>				
Polk County, Florida		7.3%	FHWA Synthesis Report	<i>Synthesis and Evaluation...</i> , 1999
Fort Meade, FL	50%		Conference Paper	Rocchi, 1999
<b>Maryland</b>				
Howard County, MD	42-62%	21-44% at individual intersections	Agency Data	“Maryland House of Delegates...”, 2001
<b>Michigan</b>				
Jackson, MI	83%		Synthesis Report	ITE, 1999
<b>New York</b>				
New York, NY	34%	60-70% reduction in angle crashes at one site	FHWA Website	FHWA, <i>undated</i>
<b>North Carolina</b>				
Charlotte, NC	20%	24% reduction at enforced intersections, 20% reduction in crashes caused by RLR	Agency Report	“Safelight Charlotte: First-Year Report.”, <i>undated</i>
Greensboro, NC	20-25%		Newspaper Article	“Cameras curb red...”, 2001
High Point, NC	20%		Newspaper Article	“City Shoots for...”, 2001
Wilmington, NC	40-60%	26% reduction in right-angle and 8% increase in rear end, 22% decline in total collisions	Agency Brochure	“Safelight Wilmington: First Year in Review.”, 2001
<b>Virginia</b>				
Fairfax, VA	44%		IIHS Study	Retting, August 1999
<b>Australia</b>				
Perth, WA, Aus		32% decrease in right-angle crashes and 10% decline in injuries	Independent Evaluation	South, 1988
Queensland, Australia		40% right-angle crash reduction at enforced intersections, little change in average number of rear-end crashes	Independent Evaluation	Office of the Auditor General, 1996
South Australia	70%		Agency Website	“Technology versus the Lawbreakers.”, <i>undated</i>
Sydney, Australia		33% reduction in serious right-angle crashes, 5-10% increase in rear-ends	Conference Paper	Rocchi, 1999

Victoria, Australia		50% reduction in angle and right-turn opposing collisions, 20-60% increase in rear-end collisions	Conference Paper	Rocchi, 1999
<b>Canada</b>	30%		Synthesis Report	ITE, 1999
Victoria, BC				
<b>Hong Kong</b>	73%		Conference Paper	Rocchi, 1999
Hong Kong				
<b>Singapore</b>	40%		Conference Paper	Rocchi, 1999
Singapore				
<b>United Kingdom</b>	40%		Conference Paper	Rocchi, 1999
Glasgow, Scotland		88% reduction in injury collisions	Conference Paper	Rocchi, 1999
Nottinghamshire, UK	69%	62% reduction in injury accidents	Independent Evaluation	Winn, 1995
	60%			Rocchi, 1999

Source: (Maccubbin, p.8)

One unforeseen outcome from installing intersection cameras was a reported increase the number of accidents. Local drivers are aware of the cameras and over react to yellow lights in order to avoid a ticket. Uninformed drivers behave in a normal fashion and sometimes rear-end local drivers (Wall Street Journal, 2001). Further analysis of the different types of collisions, however, reveals that angle crashes are more severe than rear-end collisions. Studies support that angle crashes can be reduced by cameras. The net effect is that while rear-end collisions may increase, a reduction in angle crashes results in a safer net result (McGee, 2003).

Perhaps balancing the unpredictable phenomena of over cautious drivers is another unexpected benefit, a placebo effect in cities where cameras are installed. Studies find similar violation reductions at intersections not equipped with cameras (Dignam, 2003 and Blakely, 2003). Therefore, “automated enforcement programs are effective in reducing violations at both camera-equipped and non-equipped locations (McGee, 2003).”

### **Money Issues**

While RLCs have been effective in reducing red light violations, the revenue generated has been somewhat controversial. The following states currently have legislation that allows the use of RLCs: Arizona, California, Colorado, Delaware, Georgia, Hawaii, Illinois, Maryland, New York, North Carolina, Ohio, Oregon, Texas, Virginia, Washington, and the District of Columbia (Maccubbin, 2001). The majority of systems are high-resolution, 7 mega-pixel, digital cameras that capture photographs and videos of vehicles that enter into an intersection after the signal has changed to red. Equipment installation ranges from \$60,000 to \$70,000 per enforced approach with monthly operating costs varying from \$1,500 to \$5,000 per month. Fines vary from state to state and range from \$50 to \$271 and depending on state law and are sometimes split between the vendor and the city (See Table 3). The controversy is that citizens see this as only another revenue source for governments and some having incentives to issue additional tickets.

**Table 3: Revenue Distribution**

Site	Fine	Fine Split
Phoenix, AZ	\$175	\$93 vendor, \$82 city
Mesa, AZ	\$170	\$74.01 state, \$95.99 city with \$48.50 going to vendor
San Francisco, CA	\$271	\$123 state, \$148 city/county Split to city/county: \$48.50 vendor, \$99.50 to further program, educational campaign, and equipment vendor
Santa Rosa, CA	\$271	\$100 vendor
San Diego, CA	\$271	\$70 vendor

Baltimore, MD	\$75	15% - 35% of fine to vendor
Howard County, MD	\$75	Sliding scale. State receives no revenue from fines.
Washington, DC	\$75	\$26 vendor (as much as 40%), \$49 city
Garland, TX*	\$75	\$74.50 vendor, \$0.50 city
Wilmington, NC	\$50	\$35 vendor, \$15 city
Greensboro, NC	\$50	\$35 vendor, \$15 city
High Point, NC	\$50	\$35 vendor, \$15 city
Charlotte, NC	\$50	1st notice: \$28 vendor, \$22 city
	\$50	2nd notice: \$23 vendor, \$27 city
	\$100	3rd notice: \$76 vendor, \$24 city
Oahu, Hawaii*	\$77	As much as \$50 vendor, \$27 city
Fairfax, VA	\$50	\$20.85 vendor, \$29.15 city

\* Automated camera enforcement program in start-up phase.

Source: Maccubbin, 2001

Washington D.C. was one of the first to implement an RLC program. Most installations generate more than enough revenue to cover costs associated with a photo enforcement program. From August 1999 through October 2002, the automated red-light enforcement program in Washington D.C. collected more than \$19 million in fines based on almost 335,000 tickets issued (Ramsey, 2003). Washington D.C. initially paid a fee to the equipment vendor for each ticket processed. This arrangement made citizens feel that there was incentive to issue more tickets. Eventually, the contract was renegotiated to a flat monthly rate for operating their equipment. This along with a web site maintained by the D.C. Police Department that lists statistical data and other public information about the program, has increased the understanding and acceptance of this new technology, while also improving public safety (Ramsey, 2003).

In 2001, the Georgia General Assembly passed HB 678 enabling municipalities that employ at least one full time certified police officer to use cameras to enforce red light violations (Georgia General Assembly, Title 40). The maximum fine allowed cannot exceed \$70 and vendors cannot receive any portion of the fine. Flat monthly operating fees are established with the vendor by each municipality, relieving fear of an incentive for issuing tickets. Georgia law also requires that any net revenue generated by RLCs must go toward approved transportation facility improvements and not used for general fund expenditures by the municipality. Georgia's laws are geared toward encouraging public trust in these programs. Georgia cities that currently have active RLC enforcement programs include Savannah, Albany, Decatur, and Marietta.

## Findings and Discussions

With the RLC technology, you would think that once the system was properly developed that there would be few problems implementing the program. However, there are numerous problems with the execution of the program. Some states already recognize the problems with RLCs and have banned their use. "Alaska, Nebraska, New Jersey, Wisconsin, and Utah have banned photo-enforcement systems. Maryland's state senate is mulling bills that would curtail or eliminate the cameras (Savoye, 2002)." In addition to these states, San Diego has had tremendous problems with RLC performance and has voided hundreds of tickets. Although RLCs have been in operation for several years in other countries such as England and Israel, other countries like Canada are headed towards banning RLCs. Truth be told, politicians are actually campaigning and winning elections based on who will ban them the quickest.

This study found that despite all of the concerns about the legality of RLCs, they have withstood most of the challenges against them. The initial as well as the sustaining force behind red light camera installations is the safety issue. Local communities exert enormous effort and money following any serious accident to dispatch law enforcement, transport patients to hospitals, provide medical care (sometime indigent), try and prosecute violations, tow vehicles, pay insurance, etc. Over the course of a year, each accident weights on the community.

Red light cameras are one preventative source of traffic accidents. Used in conjunction with education, consistent patrolling, and safe intersection design, red light cameras are the technological force in saving lives and community resources. Safety improvement is the most tangible part of any position on the issue.

The major issue with ticket revenue appears to be the vendor based split for ticket revenue or the appearance of an incentive for private vendors to be paid based on the number of tickets written. As Georgia did initially, other states are following suit in disallowing vendors to be paid on a per ticket basis. San Diego, California recently passed legislation banning vendors from operating under a ticket-based revenue agreement. A flat monthly maintenance agreement will be understood much easier. Also publicizing revenue and its uses such as Georgia's requirement to use any positive revenue towards approved transportation facility improvements, would also improve public perception of the program.

## Limitations and Conclusions

The research presented was assembled in the form of a position paper. Yellow light time intervals were mentioned but not addressed in detail due to federal regulation of traffic law and enforcement. Intersection improvements from a civil engineering perspective were not addressed, but are an alternative solution. Problem intersections can be redesigned in order to allow better traffic flow, larger intersection spacing, and improved visibility. While the outcome may be similar, the cost of implementation is significantly more restrictive and was therefore not discussed in depth.

In order to make the most of limited resources, certain areas of government have embraced technology. One such area is traffic enforcement. Red light cameras are changing the look and the flow of intersections across America. Their strongest proponents tout the stellar safety record. Beyond this core group, traffic cameras battle two stigmas: greed and government conspiracy.

Whether red light cameras are good or bad is a matter of perspective. Regardless, for public safety and/or for the revenues generated, you can expect to see this technology employed in greater and greater numbers as time goes by. What better excuse does Big Brother need to keep his eye on you?

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