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Some measures for sustaining red-light camera programs and their negative impacts

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ABSTRACT

Automated enforcement red-light cameras (RLC) have been widely adopted by municipalities around the world as a measure of curbing red-light running (RLR) at signalized intersections and reducing the cost of law enforcement. While a consensus has not yet been reached about whether RLC in general can benefit intersection safety by reducing RLR and crashes, recent debates revolve around using RLC as a revenue generator. Some of the political backlash of RLC is the perception that they are installed primarily to fulfill revenue guarantees and sustain the RLC program. Some municipalities have been charged with changing the signal phasing to trap more red-light runners and increase the revenue from RLC programs. This paper focuses on a number of engineering strategies, mainly related to signal timing that may be used by municipalities to achieve their financial goals. The negative impacts of implementing these measures on the safety and efficiency of intersection operations and public support on RLC programs are also discussed. These strategies are also revealed to increase transparency of the divergent motivations of RLC vendors, municipalities, policy makers and safety advocates.

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1. Introduction

Since invented in 1960s, automated enforcement red-light cameras (RLC) have been widely adopted by municipalities around the world as a measure to curb red-light running (RLR) at signalized intersections and reduce the cost of law enforcement. Technological improvements have made RLC much more effective in recent years, increasing their adoption in the past decade. A 2009 study revealed that about 350 communities in the US used RLC (Chatterjee and Cate, 2009). While a consensus has not yet been reached about whether RLC can benefit intersection safety by reducing RLR and crashes, municipalities are facing a major ethical dilemma around balancing financial guarantees to sustain RLC programs and improving safety. A literature survey reveals that most municipalities implementing RLC are committed to private RLC providers with certain revenue goals to financially sustain their RLC programs. Most RLCs are installed with dual, conflicting purposes, reduce RLR and maximize private (and public) sector revenue from RLR citations. Harmonizing these two purposes is challenging resulting in substantial backlash against RLC. Indeed, as municipal budgets are threatened, the temptation to identify RLC as a revenue generation source is increasing. To achieve their revenue goals, some municipalities have implemented certain engineering measures to trap red-light runners at RLC equipped intersections and increase the citations/revenue from RLC programs.

This paper begins by giving a background on the financial and policy issues related to RLC programs. Next, the key focus of this paper is to present various engineering measures that may be employed by municipalities to increase the RLR and revenue. The measures discussed in this paper are mostly related to the signal timing that is relatively inexpensive to implement. The implementation of these measures affects the safety and efficiency at intersections. Meanwhile, protests and lawsuits concerning the use of RLC have occurred around the United States and, in many instances, lawmakers have restricted their use. The paper discusses the ethical challenges and negative impacts of these measures on intersection safety and efficiency and the credibility and public image of related agencies and elected officials.

2. Background

2.1. Effect of RLC on intersection safety

The primary motivation for installing RLC is safety improvement through the consistent expectation of enforcement. As such, a number of studies have evaluated the effectiveness of RLC as an enforcement mechanism to reduce red-light violations and associated severe crashes. Several studies found a significant difference in crash rate and an improvement in overall safety attributable to RLC. Retting et al. (1999a) and Ruby and Hobeika (2003)

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investigated the RLC in Virginia and found a 36% and a 69% reduction in RLR over the first three and six months of camera operation. The crash rates were also reduced by 40%. Similar RLC positive effects on RLR and crash rates were observed in California (Fleck and Smith, 1999; Retting et al., 1999b), North Carolina (Cunningham, 2004), and Iowa (Fitzsimmons et al., 2009). Lum and Wong (2003a,b,c) found that the RLC installation at three intersections in Singapore reduced RLR by more than 40% while non-camera approaches did not experience such a reduction during the same period. Huang et al. (2006) modeled the crash risk at 15 signalized intersections in Singapore and found that RLCs were effective in reducing RLR and right-angle collisions. However, it had a mixed effect on rear-end collisions depending on the speed of the trailing vehicle and the headway between vehicles. Persaud et al. (2005) reported a similar effect of RLC on right-angle and rear-end collisions in the US. Radalj (2001) investigated the same issue at 58 RLC and 447 non-RLC intersections in Australia and found that the installation of RLCs reduced fatalities by over 50% but increased rear-end crashes by 17%. The reduction in the total number of crashes was 3%.

Some other studies found no significant difference or even negative effects on safety after the installation of RLC. Burkey and Obeng (2004) analyzed crashes occurring near 303 intersections over a 57-month period. They found RLCs increased the crash rates by 40% while the overall trend during the same period indicated that crashes at all intersections were becoming less frequent. The study reported a large increase in rear-end crashes due to RLCs. Regarding crash severity, RLCs were found to increase property damage only and possibly injury crashes, but have insignificant effect on severe crashes. A study in Arizona (Washington and Shin, 2005) found that the total number of crashes were unchanged as a result of RLCs at 10 intersections in the City of Phoenix (14% reduction in angle crashes and 20% increase in rear-end crashes). Total crashes were reduced by 11% in the City of Scottsdale. Garber et al. (2007) also observed an increase in rear-end crashes and a reduction in RLR crashes associated with RLCs. However, when the comprehensive costs for different types of crashes were monetized, RLCs were associated with a net increase in crash costs considering six jurisdictions in Virginia. Kent et al. (1995) investigated RLR data at three RLC intersections and concluded that there was no difference in RLR between camera and non-camera approaches (at the same intersection).

2.2. Financial promise of RLC programs

Many believe that transportation agencies and vendors install RLCs for the purpose of increasing revenue. Before exploring public responses to RLC programs and engineering measures employed to increase RLC revenue, the background of how RLC programs are funded and sustained is given. Chatterjee and Cate (2009) reviewed various RLC programs in the US and interviewed individuals who were responsible for the implementation and operation of RLC programs in the city of Knoxville and Chattanooga, TN and Baltimore, MD. They reported that the installation and maintenance of RLC devices were provided by private vendors with no cost to cities. Cities were responsible for administration of these programs. They also reported that several North Carolina cities had to discontinue their RLC programs since the state law required 90% of the revenue to be used for local schools, which resulted in the inability of these cities to sustain RLC programs. Garber et al. (2005) investigated the fiscal feasibility of RLC programs in six jurisdictions in Virginia. The report documented the detailed funding mechanism and revenue/cost conditions for these RLC programs. The majority of the RLC programs were provided by private vendors in the form of rental. In return, agencies paid the vendors a flat rate per month or a certain proportion of the citations. Overall, three of the six jurisdictions showed revenue/cost ratio below 1 while the other three were slightly above. Due to the decrease of citations after implementing RLCs, the authors recommended to increase the RLC fine from $50 to $100 to improve the financial sustainability. Maccubbin et al. (2001) conducted a literature review on RLC program contracting mechanisms and the fines and penalties associated with the programs in 17 US cities revealing similar private/public cost and revenue mechanisms.

Given that RLC programs are mostly supported by revenues generated from RLC citations and revenue guarantees are usually contracted between private camera providers and municipalities, traffic engineers are facing an ethical dilemma balancing revenue generation to sustain their RLC programs and traffic safety/efficiency goals. Traffic engineers may have seldom been in such a situation across so many cities.

2.3. Policy response to RLC

Political backlash has occurred in many cases because the perception that RLCs are used to generate revenue. Olson (2010) reported the referendum in Houston to cease the use of RLC. A survey of news articles on *theNewspaper.com* highlighted many anti-camera referendums in cities in Texas, Washington, Missouri, California, and Illinois between 2010 and 2012. States like Massachusetts, South Dakota, Mississippi, Maine, Nevada, Virginia, Alabama, Kentucky, and cities, like Albuquerque, NM and San Jose, CA, even voted to reject the use of RLC.

In regions where RLCs were implemented, many lawsuits have been filed challenging the use of RLCs. The Insurance Institute for Highway Safety (IIHS, 2010) reported lawsuits resulted from both citizens and RLC vendors against municipalities. In 2009, a number of cities were sued for the installation of RLC in Florida, where automated enforcement was still illegal in the state at the time of installation. To enable the use of RLCs, these cities created their own ordinance, which was not allowed by the Florida Constitution (Florida Statute Chapter 316) and became the primary argument in the lawsuit against the cities (Ovalle, 2012; Naples News Daily, 2010). Similar cases questioning RLC legality were reported in Minneapolis, MN; Hazelwood, MO; Lafayette, LA; Miami-Dade County, FL; Santa Ana and South San Francisco, CA; and Clive, IA since 2007 (theNewspaper.com, 2009). As a result, some of the illegally collected fines had to be refunded to drivers.

Since 2005, many cities shut down their RLC system after a few months or years of operation mainly because of (1) public pressure and legality, (2) failure to generate adequate revenue, and (3) failure to improve safety. Pinkerton (2010) reported the shut-down of the RLC program in Houston, prematurely ending a contract with the private RLC vendor. Atlanta is likely to join Los Angeles, CA and Houston, TX as major cities that have recently discontinued photo ticketing programs (theNewspaper.com, 2012). Many other cities in Georgia, California, Colorado, Washington, Missouri, North Carolina, and Texas had similar experiences.

Since some municipalities dropped their RLC program in the middle of contract with camera vendors, which led to the loss of revenue for the vendor, there are also legal disputes between municipalities and RLC vendors. A state law in Tennessee took effect in 2011 that prohibited the use of cameras to issue tickets for right-turn-on-red violations (Tracy et al., 2011). As a result, the RLR citations decreased by three quarters diminishing revenue to both cities and camera vendors. Two RLC vendors filed lawsuits against the city of Knoxville and the town of Farragut respectively after the new state restriction was issued in 2011 (Brewer and Jacobs, 2011). A RLC company also filed a lawsuit against the city of Houston for breach of contract after a 2010 referendum shutting down RLCs. Recently the company has reportedly agreed to drop the lawsuit