



RESEARCH & DEVELOPMENT

Video Collection of Traffic Violations for Public Education and Regulatory Changes

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<p>Abstract</p> <p>This project has provided the NCDOT Traffic Safety Unit with a searchable database that contains videos of an array of traffic violations and traffic safety issues that are prevalent and need addressing. The videos recorded for this study could be effective in training law enforcement and the general public, changing existing laws, and providing transportation engineers with examples of problems that may exist in areas like current signal timing strategies or highway design. Some of the uses of this database include educational purposes like driver's education, law enforcement training assistance for enforcement on urban, suburban, or rural roadways, engineering design adjustments for things like geometry and signal timing, or even for use by the NCDOT to convey the importance of potential legislation changes for law makers.</p>			
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1. INTRODUCTION

North Carolina has become one of the most sought after states to live in recent years as a result of job growth and affordable housing. This has inevitably resulted in substantial growth in traffic volumes and sometimes even a fast-paced, competitive lifestyle. Unfortunately, a possible consequence is more and more unsafe driving, particularly in areas where congestion is an issue. Legislators are often placed in the difficult position of having to ensure the safety of the driving public through unpopular legislation, such as red light cameras and automated speed enforcement. Likewise, the general public often does not fully understand the reasoning behind such legislation, assuming that lawmakers are simply trying to increase revenue for government spending, and not truly just trying to keep the public safe.

This project has initially served as a proof of concept and has the potential to provide legislators, law enforcement, and the NCDOT with actual footage of dangerous events at known problem areas across Raleigh, North Carolina. Having a database of specific events at intersections and road segments across the capital city will provide legislators a tool with which to educate the general public when legislation is being considered that is unpopular to citizens of the state. This database will also provide law enforcement and the NCDOT the opportunity to adequately train police officers and engineers on what to look for regarding enforcement and design, respectively, at various known or suspected problem areas with respect to road geometry, signal operations, crosswalk configurations, etc.

1.1. Research Need

With the increase in traffic across the state, and particularly the Triangle region, the potential for more frequent and more dangerous traffic violations are a major concern to legislators, law enforcement, and the NCDOT. These violations could include red light running, failure to stop before turning right on red, lefts on red, failure to yield the right of way to pedestrians, and many others. Oftentimes, there are solutions to this problem that involve either legislation, such as the implementation of red light running cameras, concentrated enforcement efforts at known problem areas, or correction through highway engineering, such as signal timing, improving visibility, etc. Unfortunately, a staged traffic incident simply does not suffice when trying to convince the general public, law makers, or engineers of the prevalence of a particular issue. However, recording these instances through video data collection and having them available in a video database would serve to provide proof of any problem that truly exists, which could assist in police training, new legislation consideration, or highway engineering considerations. The objective of this project was to provide the NCDOT, as well as other agencies as allowed by the NCDOT, with a web-based video database that can be searched for particular traffic violation occurrences.

1.2. Scope and Objectives

The purpose of this project is to provide the NCDOT and North Carolina lawmakers with video of traffic violations, which can be used in the following ways, among others:

- Educate the public on problems with adherence to the law,

- Educate law enforcement on areas of concern,
- Provide the NCDOT with real video of traffic violations, which can be used to influence changes necessary for anything from geometric design to signal timing,
- Provide North Carolina legislators with video that can be used to create new legislation or modify existing legislation, resulting in safer North Carolina roadways.

2. LITERATURE REVIEW

The research team was unable to find any directly related projects in which traffic violations were recorded for training purposes. One study observed six intersections and gathered data on driver behavior at the individual intersections. The intent of this study was to measure the effectiveness of education programs, police, and public information in deterring red light running behavior and it found that these programs did significantly reduce the frequency of violations. However, no significant difference was found between the effectiveness of the different programs. Specifically, this study concluded that right angle crashes can be reduced by simply public education programs. Likewise, the vast majority of current scholarly work is specifically regarding red light running and or red light cameras.

In order to understand the relationship between factors involved in traffic violations, such as violations type, intersection type, driver differences and other factors, an analysis was conducted on red light violations from eleven intersections in Sacramento, California by using enforcement camera data. This analysis resulted in finding that drivers under the age of 30 are more likely to commit these traffic violations than any other age group. The study also found that most of the violations occurred almost immediately after the signal changed to red [1]. This has been corroborated in another study [2], which also found that between the hours of 8 PM and 5 AM, drivers tend to travel at higher speeds but committed fewer red light running violations. However, another study found that the time of day correlation to red light running violations differed across intersections, as some intersections saw higher rates during high traffic periods, whereas other intersections saw higher violation rates during low traffic periods [3]. Multiple studies have found that the presence of a red light camera decreased the rate and frequency of red light running events [4, 5, 6, 7, and 8].

As noted in this project's original proposal, there was an interesting study conducted in 2007 by Stefanidis, et. al. [9], who was able to determine that simply watching a video tutorial on a particular surgery three times was more effective in training individuals than watching the video once with the individuals receiving additional feedback from an instructor. The study suggested that this could result in saving resources when training individuals, while also providing the best chance of an individual being able to successfully duplicate the surgery. Inference suggests that using video of traffic violations could be far more effective in training others, be they law enforcement or the general public, or conveying information to legislators or engineers regarding any traffic safety issue.

3. METHODOLOGY

The methodology of this project involved a few simple steps:

- Install cameras at ten selected sites,
- record these sites for two weeks each,
- manually gather traffic violations by watching the videos, and
- store clips of violations in a video database.

More specifically, ten sites were to be selected by the NCDOT and the research team for observation for two weeks using traffic cameras. This video was returned to the office for manual video reduction by research staff who identified traffic violations and clipped them from the original video, which resulted in a short video clip to be included in the video database. These steps are described in more detail below.

3.1. Site Selection

Ten sites were to be observed, as agreed upon in the project contract. Two of these sites came by way of NCDOT suggestion:

1. South Salisbury Street and West Edenton Street
2. South Salisbury Street and West Morgan Street

Five more sites were suggested by the City of Raleigh after the research team contacted them:

3. Wade Avenue and Edwards Mill Road
4. Martin Luther King Junior Boulevard and Rock Quarry Road
5. Martin Luther King Junior Boulevard and South Blount Street
6. Glenwood Avenue and West Johnson Street
7. Lead Mine Road and Sawmill Road

The last three sites were decided upon by the research team based on accident history compared to other intersections across the city:

8. South Dawson Street and West South Street
9. Rock Quarry Road and Jones Sausage Road
10. West Morgan Street and South Boylan Avenue

In some cases, these intersections were presented to the research team as having a recurrence of particular dangerous events, like wrong way driving on some downtown one-way streets. However, the events identified as being prevalent at a particular intersection were not always observed. This could be because of the time of the day or even time of the year that these events usually occur are not when the intersections were observed, but the research team made every effort to ensure that particular events had the best chance to be recorded by either recording longer periods of the day or having research staff observe times of the day when the research team suspected these events would occur. Unfortunately, it is suspected that some of the incidents that had been identified as

recurring are actually rare, but because of the audacity of these events, they stand out more to people who frequent the area.

3.2. Camera Installation

Simple, small video cameras were installed at each location for recording purposes. The camera housing is approximately four inches long and one inch in diameter and was attached to a small plastic shield that covered the camera from rain and sunlight glare issues. The digital video recorder, or DVR, was housed along with two batteries inside of small plastic box that is approximately 16 by 12 by 4 inches. This small setup allowed for discrete camera placement, meaning drivers would not behave any differently at the observed locations because they were unaware of the cameras. The figure below shows an example camera installation.



Figure 1 Example of camera setup

3.3. Video Reduction

As video returned to the office upon the completion of the data collection effort at each intersection, research staff would begin to observe the video, looking for obvious traffic violations or conflicts/near-collisions. This effort proved to be slightly more difficult than had been previously imagined, as there was no audio to accompany the video, which meant no audio confirmation of suspected violations like vehicle horns, screeching tires or even people yelling. Therefore, the violations had to be very obvious in order to be included in the database – for example, vehicles running red lights, near-collisions with pedestrians or other vehicles, etc.

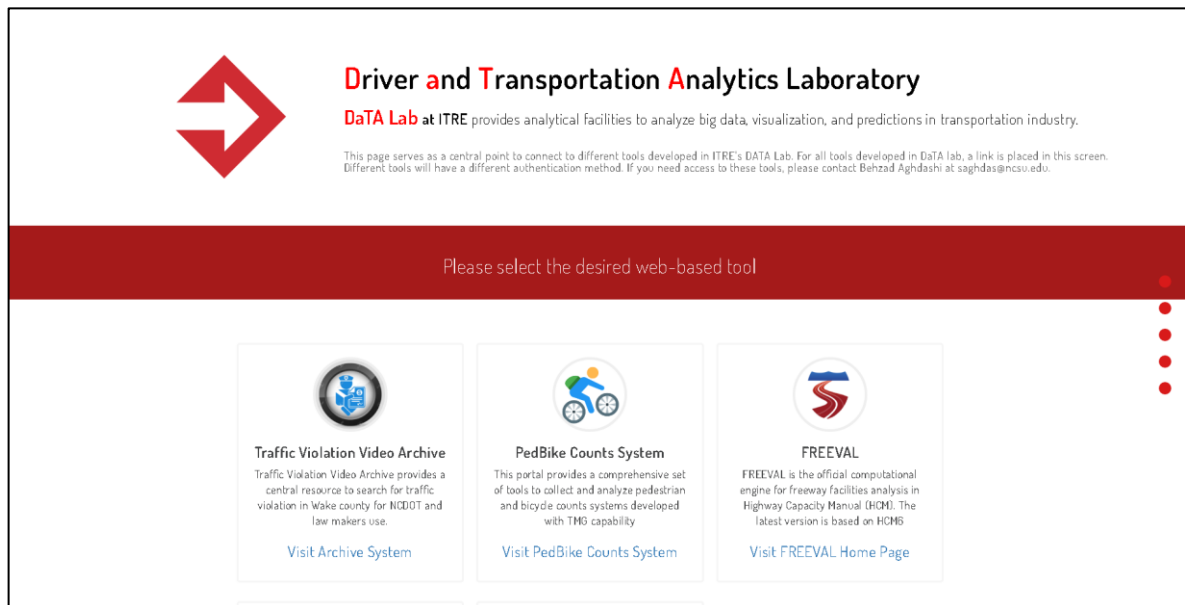
Because two weeks of video was recorded at each site, this meant as much as 168 hours or more of video could be recorded at the sites (based on twelve recorded hours per day). This would have been far too great a job for the research staff on limited weekly schedules; therefore, it was decided to record at least ten obvious violations per site, which would result in 100 violations for this pilot project.

3.4. Video Storage

Upon review of recorded videos, research staff would clip the videos for inclusion in the video database. These video clips were uploaded to the online video service YouTube, as the clips could then be easily embedded on the Traffic Violation Video (TVV) database website. However, the videos cannot be found by the general public, as the videos are classified as “unlisted” on YouTube, meaning they will not appear when someone searches for them – they would have to have the specific URL of each video to find them.

The TVV database (Figure 2 below) is included in the Institute for Transportation Research and Education (ITRE) Driver and Transportation Analytics Laboratory (DaTA Lab), which is shown in Figure 3 below. The ITRE DaTA Lab and TVV database can be found at the following URLs:

- ITRE DaTA Lab – <http://itredatalab.org/>
- TVV database – <http://itredatalab.org/ncdottvv/index.php>



Driver and Transportation Analytics Laboratory
DaTA Lab at ITRE provides analytical facilities to analyze big data, visualization, and predictions in transportation industry.

This page serves as a central point to connect to different tools developed in ITRE's DATA Lab. For all tools developed in DaTA Lab, a link is placed in this screen. Different tools will have a different authentication method. If you need access to these tools, please contact Behzad Aghdashli at saghdas@ncsu.edu.

Please select the desired web-based tool




 <p>Traffic Violation Video Archive Traffic Violation Video Archive provides a central resource to search for traffic violation in Wake county for NCDOT and law makers use.</p> <p>Visit Archive System</p>	 <p>PedBike Counts System This portal provides a comprehensive set of tools to collect and analyze pedestrian and bicycle counts systems developed with TM6 capability</p> <p>Visit PedBike Counts System</p>	 <p>FREEVAL FREEVAL is the official computational engine for freeway facilities analysis in Highway Capacity Manual (HCM). The latest version is based on HCM6</p> <p>Visit FREEVAL Home Page</p>
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Figure 2 ITRE DaTA Lab

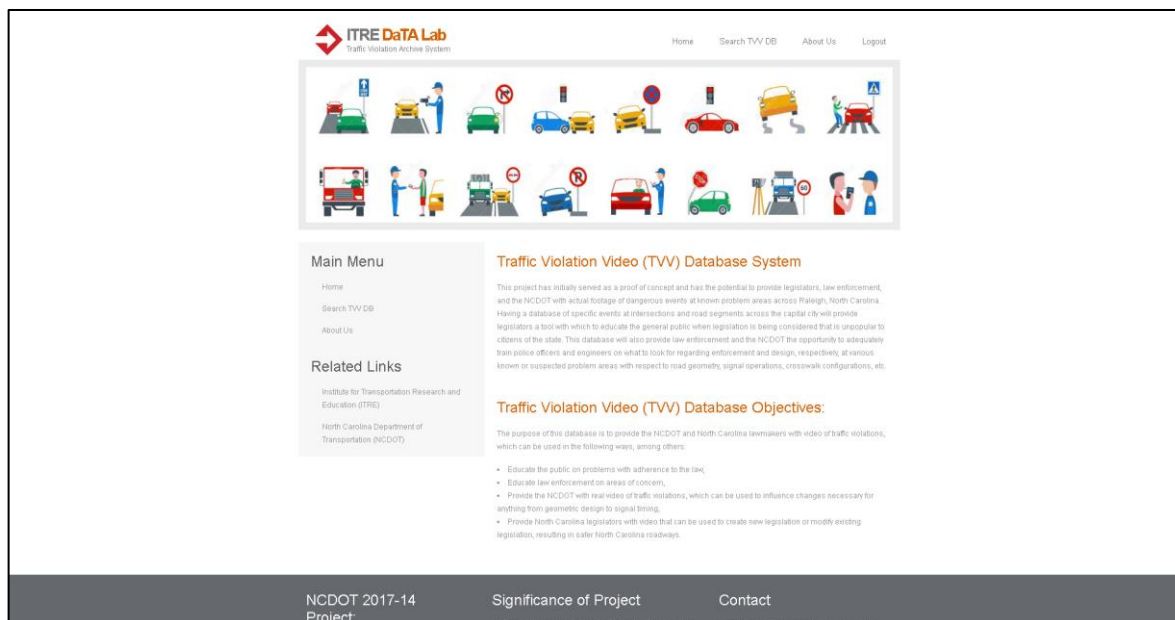


Figure 3 Traffic Violation Video (TVV) database

Traffic violations can be easily queried in the TVV database by the following variables:

- Intersection
- Date
- Time
- Number of vehicles involved
- Number of pedestrians involved

Allowing users to query by all of these fields will result in specific incidents that fit the user's interest, meaning they won't have to search tirelessly through multiple videos to find what they need.

4. FINDINGS & CONCLUSIONS

In all, 789 violations were identified, with 130 of them being clipped for inclusion in the TVV database. The discrepancy in violations identified and those included in the database is the result of many of the violations being simple in nature – for instance, there were many jaywalking events that were not included in the database, nor were some of the random stopping events, where a vehicle would impede traffic temporarily for no obvious reason, as these events were not as dangerous as the ones that were ultimately included.

This project proved to be a simple and cost-effective way to capture traffic violations. These violations have been presented in an online video database that is easy to use for any and all users. Updating the database with new violations is also a simple process for the research staff at ITRE, meaning follow-on to this project would be cheap and straightforward, if so desired by the NCDOT.

5. OPPORTUNITIES FOR FUTURE RESEARCH

The future research opportunities depend solely on the usefulness of the current database to the NCDOT, legislators, law enforcement, and educators. The NCDOT will be responsible for distributing access to this database to these parties if it so chooses. Upon doing so, it would be interesting to find out the opinions of these users and what recommendations they might have. This could greatly influence the future research opportunities.

For example, the videos recorded for this database were generally recorded in lower quality, as it was a simple proof of concept, but users might be interested in recording violations at a higher quality for the sake of clarity and presentation. This could be easily accomplished with another round of video data collection at the same or other intersections across the City of Raleigh or elsewhere.

Ultimately, the research team would like to follow up with the NCDOT and any other users of this database to determine how they plan on using the database. The research team sees the benefit of having such a database for things like driver's education, law enforcement training assistance purposes for enforcement on urban, suburban, or rural roadways, engineering design adjustments for anything from roadway geometry to signal timing, or even for use by the NCDOT to convey the importance of potential legislation changes for law makers.

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