STATE-OF-THE-ART:
LAW ENFORCEMENT SURVEILLANCE IMPACT ON
CONSTRUCTION ZONES

*Tulio Sulbaran, Ph.D ¹, David Marchman ²*

Abstract – Maintenance and construction programs are arguably one of the most important functions of states’ DOT (as represented by the percentage of the budget invested). On the other hand, during the construction period, there are temporarily traffic disruptions, which increase the number of accidents with associated deaths and injuring thousands of people every year. Therefore, several states have taken a proactive role in implementing special measures in construction work zones to reduce the number of accidents. One of these special measurements is the increase of law enforcement surveillance in construction zones. This paper presents a series of assessments done nationwide to measure the impact of law enforcement in construction zones. The content of this paper was then used as the foundation to establish a method to determine the impact of a law enforcement surveillance increase in Mississippi. This work followed a descriptive research methodology with meta-analysis based on a systematic literature review performed in the databases of several organizations. The results presented in this paper could be used as the foundation for similar studies in other states, and they have the potential to directly benefit construction education by serving as an example of good practice in engineering education.

**Keywords:** Law Enforcement Surveillance, Construction Zone, Impact, State-of-the-Art

**INTRODUCTION TO CONSTRUCTION ZONES**

Construction zones are a necessary part of maintaining and upgrading the United State’s aging highway system. Although necessary, the construction zones temporarily negatively affect traffic flow causing frustration for the road users. Additionally, the potentially hazardous nature of construction zones increases the likelihood of accidents that impact both road users and construction workers. Furthermore, construction zone’s fatalities are on construction zones are a necessary part of maintaining and upgrading the United States’ aging highway system. Although necessary, the construction zones temporarily negatively affect traffic flow causing frustration for the road users. Additionally, the potentially hazardous nature of construction zones increases the likelihood of accidents that affect both road users and construction workers. Furthermore, construction zones’ fatalities are on the rise and are likely to continue climbing as departments of transportation continue repairing and upgrading the United States’ aging roadways [Safe Roads 2003]. This is particularly compounded in Mississippi due to an all time peak volume of construction zones as well as the 1987 four-lane highway program and TEA-21 [Young, 2001]. The construction zone issue is not limited to Mississippi; it actually affects all the United States. It is estimated that every year over 1000 people are killed and over 40,000 people are injured nationwide in construction zones [Safe Roads, 2003].

The work presented herein is a part of a project funded by the Mississippi Department of Transportation to determine the safety effectiveness of increased law enforcement surveillance in construction zones in Mississippi.

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More specifically, this paper presents a series of assessments done nationwide to measure the impact of law enforcement in construction zones.

This paper begins by presenting the characteristics of construction zones and an overview of some of the safety measures used to reduce the potentially hazardous nature of these zones. This is followed by a description of the methodology used in the project. Finally, the results of the meta-analysis regarding the effect of law enforcement in construction zones are presented.

**Characteristics of Construction Zones**

The construction zones could be characterized from different perspectives. This section focuses on the characteristics of the construction zones from the safety perspective. The following are safety characteristics that are supported by the current literature:

**Construction work zones are necessary, and frustrating to road users:**
Unfortunately, work zones are a necessary part of maintaining and upgrading our aging highway system. The combination of more work zones and heavier traffic volumes means work zones are having a greater effect on roadway systems. Between 1982 and 2002 there was a 79% increase of miles of travel but only 3% increase of miles of highway, so there are many more road users traveling on the same road system. Between 1982 and 2002 the rush “hour” increased from 3-4 hours to 6-7 hours per day, causing delays and greatly increasing driver frustration. The American public has cited work zones as second only to poor traffic flow in causing dissatisfaction with the roadway system [FHWA, 2004a].

**Construction work zones have a dramatic negative impact on traffic flow:**
Work zones account for nearly 24% of non-recurring congestion, and 482 million vehicle hours of road user delay. Since 20% of National Highway System is under construction during the summer, and 7% of National Highway System is under construction during winter, the traffic effect of work zones is seasonal. Departments of transportation have tried to affect the negative impact of work zones by being creative, as shown by the fact that 33% of work zones are active primarily at night [FHWA, 2003].

**Construction work zones cause accidents:**
The rate of accidents in work zones is 3 to 10 times greater than in areas with no roadwork. Total accident rates during construction increase from 7.5% to 21.4% above rates experienced before construction. Thirty-one percent of projects experience a reduced accident rate during construction, while 24% experience a rate increase of 50% or more [Tsyganov, 2003].

**Construction work zones are costly and potentially hazardous to road users:**
Accidents involving motorists account for 70% of the total highway work zones accidents. Motorists suffer approximately 700 fatalities, 40,000 injuries, and 52,000 property-damage-only accidents, at a total cost of $6.2 billion/year [Mohan & Gautam, 2002]. Between 1997 and 2001 there was an increase in number of people killed in motor vehicle crashes from 693 to 1079. To understand the potentially hazardous nature of work zones, other facts about work zones have been documented. Eighty-five percent of those killed in work zones are drivers or occupants. Rear-end crashes are the most common kind of work zone crash. In 2001, the majority of fatal work zone crashes for all vehicles occurred on roads with speed limits of 55 miles per hour or greater (57 percent and 70 percent, respectively). That same year, more than 50% of all fatal work zone crashes occurred during the day. In 2001, more than twice as many fatal work zone crashes occurred on weekdays as on weekends; and fatal work zone crashes occurred most often in the summer and the fall [FHWA, 2003].

**The driving behavior of road users with respect to lane changing and speed reduction:**
The driving behavior of road users with respect to lane changing and speed reduction in the work zone has an effect on accidents and must be understood in the analysis of work zones. Documented driving behavior of road users with respect to lane changing: 40% of drivers change lanes at a distance of 3,000 to 2,000 feet from lane closure; 30% of drivers change lanes at a distance of 2,000 to 1,000 feet from lane closure; 30% of drivers change lanes at a distance...
of 1,000 to 0 feet from lane closure; 50.7% of drivers change lanes at the first opportunity; 12% of drivers attempt
to pass vehicles in the adjacent lane prior to changing lanes; 18% of drivers wait until they actually see construction
to change lanes; and under low-volume conditions (less than 1,000 vph), drivers wait even longer to change lanes.
Documented driving behavior of road users with respect to speed reduction: 46.5% of drivers indicated that they
begin to reduce speed when they see the signs directing them to do so; 21% of drivers indicated that they begin to
reduce speed when they actually see construction work; 17.3% of drivers watch the behavior of other drivers for
cues; and there is a 16% to 50% speed reduction in work zones with lane closures [Tsyganov, 2003].

OVERVIEW OF SAFETY MEASURES IN CONSTRUCTION ZONES

Based on the potentially hazardous nature of construction zones, departments of transportation have tried many
methods to reduce accidents and fatalities in construction work zones. As an example, the Mississippi Department
of Transportation has invested for several years valuable resources to implement a series of programs to improve
work zone safety. These programs include: “The Buckle up Mississippi Campaign”, “The Work Zone Safety
Awareness Week”, “Deployment of Changeable Message Board”, “A Partnership with Child Safety Program”, “The
Drive Smart Program”, “Rumble Stripping”, “Widening Road Strips”, “Clear Zone Projects”, “Distribution of GPS to
Highway Patrol”, and “Increased Law Enforcement Surveillance in Construction Zones” among many others.

Each of these programs has been implemented with the expectation of improving safety conditions in construction
zones; and the Mississippi Department of Transportation is very interested in quantifying the benefits of each of
these programs. Therefore, this paper is presenting a part of a project focusing on quantifying the impact of the
resources used to increase law enforcement surveillance on construction zones grounded on the literature available
nationwide on this subject.

RESEARCH METHODOLOGY

A descriptive research methodology was followed to summarize the available literature on increased law
enforcement surveillance impact on construction zones. As part of the research methodology, a systematic literature
review and a meta-analysis were performed. The meta-analysis combined the results from a number of previous
studies, in an attempt to summarize the evidence of law enforcement impact on construction zones. The meta-
analysis included a qualitative component (pre-determined search criteria) and a quantitative component (integration
of numerical information) [CHP, 2005].

The qualitative component (search criteria) of the meta-analysis is challenging for most research projects. Because,
it could vary from very general keywords, resulting on an unbearable amount of data to be analyzed or very
specialized and precise technical keywords, resulting on very limited data. Additionally, the databases used during
the meta-analysis, also play an important role on the results of the search.

A slight variation in the search criteria (keyword and database) could result in differences in the outcome.
Therefore, it is important to explicitly state the search criteria used. The keywords used in this project are presented
in Table 1. These two keywords were used after several preliminary searches with a variety of keywords related to
the subject. The databases used in this project were limited to the seven databases presented in Table 2. These
databases were used based on the studied subject and recommendations from the Mississippi Department of
Transportation.

Table 1. Keywords/Phrases Used for the Search

<table>
<thead>
<tr>
<th>Keywords</th>
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<tr>
<td>Work Zone Safety</td>
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<td>Highway Patrol</td>
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Table 2. Databases: Name, URL Location and Information used to Search

<table>
<thead>
<tr>
<th>Database’s Name</th>
<th>URL</th>
<th>Information</th>
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<tr>
<td>Transportation Research Board (TRIS)</td>
<td><a href="http://trisonline.bts.gov/">http://trisonline.bts.gov/</a></td>
<td>TRIS Online provides links to full text and to resources for document delivery or access to documents where such information is available. These may include links to publishers, document delivery services, and distributors.</td>
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<tr>
<td>Federal Highway Administration (FHWA)</td>
<td><a href="http://www.fhwa.dot.gov/search.html">http://www.fhwa.dot.gov/search.html</a></td>
<td>FHWA search provides information regarding the outcomes of partnerships with the state and local agencies to meet the nation's transportation needs. The information provided relates to the FHWA work done cooperatively with governmental agencies, industry, and research community partners to research, develop, test, and implement the latest proven technological advancements including intelligent transportation systems.</td>
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<td>National Highway Traffic Safety Administration (NHTSA)</td>
<td><a href="http://www.nhtsa.dot.gov/nhtsasearch/index.asp">http://www.nhtsa.dot.gov/nhtsasearch/index.asp</a></td>
<td>NHTSA site has valuable information and statistics related to the many ways that NHTSA works to reduce deaths, injuries and economic losses resulting from motor vehicle crashes. The site is organized by three major sections: 1- Vehicles and Equipment, 2- Traffic Safety and Vehicle Occupants, and 3- General Information.</td>
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<td>Transportation Research Board - Research In Progress (TRB-RiP)</td>
<td><a href="http://rip.trb.org">http://rip.trb.org</a></td>
<td>TRB-RiP database contains over 7,800 current or recently completed transportation research projects. Most of the RiP records are projects funded by Federal and State Departments of Transportation. University transportation research is also included.</td>
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<td>The National Work Zone Safety Information Clearinghouse (WZSRD)</td>
<td><a href="http://wzsafety.tamu.edu/searches/research.stm">http://wzsafety.tamu.edu/searches/research.stm</a></td>
<td>WZSRD database contains 1686 records of journal articles, research reports, research projects, and other types of publications that are related to work zone safety. Each publication record includes bibliographic information, a summary, and a link to full text if available. Each project record includes a description, sponsor, and contact information.</td>
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There have been a number of studies documenting the relationship between the presence of law enforcement surveillance and traffic speed. In 1999, traffic enforcement reduced 47% of crash fatalities in Tennessee [Traffic Safety Digest, 2004]. In Utah, the presence of law enforcement surveillance reduced the average speed by 9 mph [Saito & Bowie, 2003]. In Minnesota, Uniformed Police Officers reduced motorist speeds 8-10 mph [FHWA, 2004]. In Illinois, the average speeds of the cars inside the work zone were 4.3 – 4.4 mph lower when police were patrolling the work zone compared to the no-police condition. Trucks presented speed reductions of 4.3 – 5.0 mph due to police presence. The percentages of cars and trucks exceeding the speed limit decreased by 14% and 32%, respectively, at a location before the work zone due to police presence [Benkohal, 1992].

Benekohal et al. (1986) evaluated the impact of mobile patrol vehicle enforcement on car and truck speeds through a highway construction zone. They found that the presence of a marked patrol car reduced average car and truck speeds while no reduction occurred in an un-patrolled condition. Additionally, the proportion of cars traveling faster than conditions permitted in the work zone were reduced by 14 percent, and trucks traveling faster by 32 percent, when the patrol car was present. Average car speeds increased immediately after patrols ended. Vaa (1997) found that intensive enforcement (an average of 9 hours of police presence per day) resulted in reductions in vehicle speed that lasted up to 8 weeks [FHWA, 2005].

Although not work zone related, Armour (1986) examined the impact on traffic speeds of parking a marked patrol car along an urban street. The presence of the patrol car was associated with (1) a 2/3 drop in the number of vehicles violating the speed limit; (2) an increase in community awareness of police enforcement in the surrounding area; and (3) a measurable decrease in speed at the site of enforcement. Stuster (1995). The study found significant declines in unobtrusive measures of vehicle speed and speed-related crashes in the special enforcement zones of the experimental communities. In addition, time series analysis found 112 fewer crashes that expected [FHWA, 2005].

**SUMMARY**

An important component of this study is the literature review of nationwide work zone highway patrol increased surveillance. This review focused on identifying the impact on safety of increased highway patrol surveillance. Additionally, nationwide criteria disseminated by the U.S. Department of Transportation's Federal Highway Administration [FHWA 2003], the American Association of State Highway and Transportation Officials [AASHTO 2003], and the American Traffic Safety Services Association [ATSSA 2003] were considered. All this information was evaluated for its possible implications on Mississippi work zone safety improvement relating to the increase of highway patrol surveillance.

As documented in the literature, accidents in work zones are rising. Therefore, it is critical to expedite the assessment of work zone safety programs, especially in Mississippi, with its all time peak volume of work zones and the worst safety ranking in the nation.

It is essential that assessment methods be developed to evaluate the effectiveness of the resources invested on work zone safety programs. Therefore, it is imperative that MDOT promptly demonstrate its commitment to highway safety by funding safety programs (as it has been doing) and studies to measure their effectiveness (as the one proposed here).
REFERENCES


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