ELSEVIER
www.elsevier.com/locate/jsr

Journal of Safety Research 38 (2007) 399 – 405

www.nsc.org

Fatal accidents in nighttime vs. daytime highway construction work zones

David Arditi [a], Dong-Eun Lee [b,*], Gul Polat [c]

[a] *Illinois Institute of Technology, Department of Civil and Architectural Engineering, Chicago, IL 60616, USA*
[b] *Kyungpook National University, School of Architecture & Civil Engineering, DaeGu, 702-701 South Korea*
[c] *Istanbul Technical University, Istanbul, Turkey*

Received 7 September 2006; received in revised form 6 April 2007; accepted 25 April 2007
Available online 16 July 2007

Abstract

Introduction: Awareness about worker safety in nighttime construction has been a major concern because it is believed that nighttime construction creates hazardous work conditions. However, only a few studies provide valuable comparative information about accident characteristics of nighttime and daytime highway construction activities. *Method:* This study investigates fatal accidents that occurred in Illinois highway work zones in the period 1996–2001 in order to determine the safety differences between nighttime and daytime highway construction. The lighting and weather conditions were included into the study as control parameters to see their effects on the frequency of fatal accidents occurring in work zones. *Results:* According to this study, there is evidence that nighttime construction is more hazardous than daytime construction. The inclusion of a weather parameter into the analysis has limited effect on this finding. *Impact on Industry:* The study justifies establishing an efficient work zone accident reporting system and taking all necessary measures to enhance safety in nighttime work zones.
© 2007 National Safety Council and Elsevier Ltd. All rights reserved.

Keywords: Safety; Accidents; Nighttime construction

1. Introduction

The first study addressing differences between daytime and nighttime highway construction was conducted in Colorado back in 1986 (Price, 1986). Comparing the quality and cost of daytime and nighttime projects, Price concluded that the material delivery at nighttime was more efficient due to less traffic but temperature extremes could have an adverse effect on crew and equipment performance. Ellis and Kumar (1993) investigated differences in cost and productivity between daytime and nighttime construction in Florida. They found that there is no significant difference in productivity, but that nighttime projects cost less. Dunston, Mannering, Nam, Lee, and Savage (1998) found that the weekend closure strategy implemented in Washington State improved quality and productivity over nighttime construction. Ellis and Amos (1996) developed work zone lighting standards for nighttime highway work.

Researchers have also noticed the potential adverse effects of nighttime construction on quality (Hinze & Carlisle, 1990; Price, 1986). Concerns about reduced visibility, increased traffic speeds, and the higher frequency of drunk or sleepy drivers after dark limit the use of the nighttime construction alternative. But nighttime construction is being conducted more and more in many states in recent years (McCall, 1999) because nighttime construction/maintenance is expected to mitigate the impact of construction operations on the traveling public (less congestion), to lead to improved productivity (less interference), to achieve safer work practices (reduced exposure to the traveling public), to operate in cooler working conditions versus daytime temperatures during summer months, and to obtain quicker material delivery cycles (less machinery idle time). However, awareness about worker safety in nighttime construction has been a major concern because it is believed that nighttime construction creates hazardous work conditions. The biennial audit report of the

* Corresponding author. Tel.: +82 53 950 7540; fax: +82 53 950 6590.
E-mail addresses: arditi@iit.edu (D. Arditi), dolee@knu.ac.kr (D.-E. Lee), gpolat@ins.itu.edu.tr (G. Polat).
URL's: http://www.iit.edu/~arditi (D. Arditi), http://www.webbuild.knu.ac.kr/~cm/ (D.-E. Lee).

0022-4375/$ - see front matter © 2007 National Safety Council and Elsevier Ltd. All rights reserved.
doi:10.1016/j.jsr.2007.04.001

state of New York DOT (McCall, 1999) regarding the nighttime construction program in New York states that one of the factors to be considered in deciding to undertake nighttime construction is the safety of both the traveling public and the workers involved in nighttime construction. Though a number of references are indirectly dealing with worker safety issues in nighttime construction, only a few studies provide valuable information about how hazardous nighttime construction is compared to daytime construction, because only limited data are available comparing accident characteristics of nighttime and daytime highway construction activities (Birch, 1998).

Based on a nationwide statistical analysis, American Association of State Highway and Transportation Officials (AASHTO, 1998) indicates that work zone fatalities occur in every functional highway classification. It also reports that reliable and accurate work zone crash data are not presently available due to a lack of uniform reporting procedures and addresses the necessity to facilitate uniform reporting of work zone crashes. While it is difficult to assess the relative safety of nighttime construction for workers and the traveling public in relation to daytime construction, accident rates can be a valid indicator for assessing work-zone safety.

The study reported in this paper investigates fatal accidents that occurred in Illinois highway work zones in the period 1996–2001 in order to determine the safety differences between nighttime and daytime highway construction. The lighting and weather conditions were included into the study as control parameters to see their effects on the frequency of fatal accidents occurring in work zones.

2. Methodology

The raw data of fatal accidents were downloaded as a fat file from the FTP site in Web-Based Encyclopedia of Fatality Analysis Reporting System (FARS) that is serviced by the National Highway Traffic Safety Administration (NHTSA, 2001; http://www-fars.nhtsa.dot.gov). FARS is a collection of files documenting all qualifying fatal crashes since 1975 that occurred within the 50 states, the District of Columbia, and Puerto Rico.

FARS does not allow complex queries for the retrieval and analysis of fatal crash information under specific conditions. For example, it is not possible to get information about construction work zone-related fatal accidents that occur at nighttime. That is why the fat file had to be downloaded in its original format and converted into an MS Access database file. The instructions in the FTP site (Tessmer, 2002) were carefully followed in transferring the raw data to a new database file.

The accident database was designed in such a way as to include the proper relationships among tables. All the entities and relationships were set and designed based on the description of the variables in the web site. All the attributes of the accidents including the accident ID, the year of the accident, the state in which the accident occurred, whether the accident occurred in a construction zone as opposed to a maintenance zone, lighting and weather conditions at the time of the accident, the number of persons and workers involved in the accident, and the day of the week on which the accident occurred are part of the information contained in the database and are briefly described in Table 1.

Table 1
Description of Variables used in the Study

Variable	Description of variables
ST_CASE	This variable is in each Accident, Vehicle and Person record. It is a unique identifier for the crash within the year. It is used as the key, when any two of these files from the same year, are merged. This variable is stored as a numeric variable of six characters; the first two characters are the state code, and the next four characters are case number, with leading zeros if necessary.
YEAR	The year in which the crash took place
STATE	This is the state in which the crash occurred. 17 Illinois
C_M_ZONE	This variable identifies crashes that occurred in a construction or maintenance zone. Use of the codes does not imply that the crash was caused by the construction or maintenance activity or zone. 0. None 1. Construction 2. Maintenance 3. Utility 4. Work Zone, Type Unknown
LGT_COND	This variable identifies the lighting conditions at the time of the accident. 1 Daylight 2 Dark 3 Dark but lighted 4 Dawn 5 Dusk 6 Unknown
WEATHER	This variable identifies the weather conditions at the time of the accident. 1 No Adverse Atmospheric Conditions 2 Rain 3 Sleet 4 Snow 5 Fog 6 Rain and Fog 7 Sleet and Fog 8 Other: Smog, Smoke, Blowing Sand or Dust 9 Unknown
PERSONS	The number of persons involved in the crash except for uninjured bus and train passengers. A form describing all other persons involved in a crash will be filed, i.e., this variable is a count of the persons in the crash.
PEDS	Number of non-motorists, i.e., any person(s) who is (are) not an occupant of a motor vehicle in transport.
DAY_WEEK	This variable identifies the day of week on which the crash occurred. 1 Sunday 2 Monday 3 Tuesday 4 Wednesday 5 Thursday 6 Friday 7 Saturday 8 Unknown

Download English Version:

https://daneshyari.com/en/article/587818

Download Persian Version:

https://daneshyari.com/article/587818

Daneshyari.com