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Project Title : ROAD SAFETY PERFORMANCE

Guide Details
Guide Name: T.Dharanika
Guide Email: dharanikatamil@gmail.com
Guide Phone NO.: 9442761023
Qualification : ME
Department : CSE
Institute name : Narasu's Sarathy Institute of Technology

College address : Poosaripatty, Omalur(TK),Salem(DT)636305

Students Details

Project Team Leader Name: S.Keerthana

Email: keerthna347806@gmail.com

Phone No. : 8248987750

Team Members list : M.Manoj, P.Jaya Prakash, P.Deenashkumar

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ABSTRACT

The lack of traffic signal conspicuity is often cited as a contributing factor by drivers who are involved in accidents at intersections. As such, increasing the conspicuity of traffic signals should lead to improved safety performance. This paper describes a project to determine the road safety effectiveness associated with improved signal conspicuity. The project described in this paper was conducted in two phases. Phase 1 investigated the impact of improved signal head design on road safety performance. In Phase 2, the conspicuity of standard signal backboards was increased by adding yellow diamond grade reflective tape along the outer edge. This was done in an attempt to frame the signal heads and make them more visible to motorists, with the intent of improving intersection safety. A time-series evaluation was completed to investigate the effectiveness of the improvements to the traffic signal on road safety performance. The use of comparison groups, prediction models and an Empirical Bayes analysis technique was used to account for the problematic confounding factors associated with road safety evaluation and ensure that the results are reliable. Anecdotal information concerning the effectiveness of the improved traffic signals were also collected and evaluated. The British Columbia Ministry of Transportation has partnered with the Insurance Corporation of British Columbia on a multi-year program to upgrade all primary signal displays to the improved design. This paper quantifies and describes how the improved signal design and the use of diamond grade yellow tape at signalized intersections can provide cost-effective road safety benefits.

INTRODUCTION

In British Columbia, 46 percent of all accidents occur at intersections that are controlled by traffic signals (ICBC, 1998). In an effort to reduce the number of intersection accidents, the British Columbia Ministry of Transportation (MoT) and the Insurance Corporation of British Columbia (ICBC) have collaborated on numerous road safety initiatives. One of these initiatives has been to improve the visibility of traffic signal displays through improved traffic signal design and increased signal conspicuity. Phase 1 of this project was to test improvements to traffic signal design (i.e., larger signal lens). Sayed (Sayed, et. al, 1998(1)) found that the improved signal design was effective in reducing the frequency of collisions at treated intersections. This paper describes Phase 2 of this project, which deals with visibility improvements to the signal backboard.

HYPOTHESIS

The conspicuity of traffic signal backboards is improved through the application of highly retro-reflective tape around the outside border. The hypothesis is to test that the increase in conspicuity will have measurable road safety benefits.

BACKGROUND AND EARLY INSTALLATIONS

In 1998, MoT and ICBC initiated a project entitled, Safety Benefits of Improved Signal Backboard Visibility. The purpose of the project was to study the safety performance impacts associated with highly reflective tape on signal head backboards. Standard size backboards were fitted with an additional 75mm reflective border. The objective was to determine if the new signal backboard design resulted in a reduction in traffic accidents at signalized intersections. The new signal backboard design is expected to be effective in reducing rear-end accidents and, to a lesser degree, other miscellaneous intersection accident types.

In September 1998, 3M yellow diamond grade VIP reflective tape was placed on the outer edge of the yellow backboards on the signals heads of six intersections located along McKenzie Avenue Expressway between the Patricia Bay Highway and the Trans-Canada Highway in Saanich BC. Figure 1 shows a backboard with tape during the daytime, providing evidence that the tape highlights the border of the backboard. The effect of the tape during nighttime is very pronounced

As shown in Figure 2. The tape provides a distinctive frame around the traffic signal display, allowing drivers to more readily locate the signal head among background lighting. There may be a secondary benefit when there is a power failure since the driver will see the backboard without a signal display.

Fig.1: Signal During The Night

Fig2: Signal During the day

The Saanich Police Department collected the accident data for the study, including the requisite data for both the pre-installation and post-installation time periods. The before and after traffic volume data was obtained from the engineering departments from the Municipality of Saanich. The results from a simplebefore and after safety analysis was undertaken by MoT with the results indicating that the aggregate collision frequency was reduced from the before to the after periods. Although it is known that a simple before and after road safety analysis can be unreliable (and the

Sample size of treated locations was small), a decision was made to expand the number of intersections to which the treatment was applied. This decision was made based on the encouraging results from the simple before-after results and because of the low cost of the improvements. Hence, MoT in partnership with ICBC began applying the highly reflective tape around signal backboards at a number of intersections on Vancouver Island.

USING PREDICTION MODELS FOR ROAD SAFETY ANALYSIS

The methodology used to evaluate the safety performance of improved traffic signal conspicuity is based on the application of an auto-insurance claim prediction model. A claim prediction model is mathematical model that relates the claim frequency experienced by a road entity (intersection, road segment, etc.) to the various traffic and geometric characteristics of that entity. Prediction models that are developed on collision records are more common in the road safety engineering literature, however, in British Columbia the reliability of collision records have deteriorated and as such, alternate road safety data (i.e., claims data) can be used. Collision or claim models have several road safety engineering applications such as the evaluation of the safety for various road facilities, identifying problematic locations, and evaluating the effectiveness of road safety improvement measures.

DATA FOR ROAD SAFETY EVALUATION

Traffic and safety data was collected at 25 locations where improvements to the traffic signals were made. Considerable effort was undertaken to collect reliable traffic volume data for the before and after time periods. Initially, collision data was investigated for use in the road safety analysis. However, the quality and quantity of the police-reported collision data in British Columbia has deteriorated in recent years, making the collision data somewhat unreliable. In addition, the time lag between the time of the collision event and when the data is available from the collision database is lengthy and as such, the data was not useful for this safety analysis. Fortunately in BC, the public nature of the Insurance Corporation of BC (ICBC) provides another complete source of safety data. ICBC warehouses the provincial auto insurance claims data that has been proven to be very useful in road safety analysis (de Leur and Sayed 2001). This auto insurance claims data is very current, comprehensive and considered quite reliable for intersection locations. As such, the

Before and after claims data was obtained and used in the time series safety analysis. Finally, the date of the signal improvements was obtained and verified such that accurate before and after time periods could be established.

ID No.	Site Type	Major Road	Minor Road	City Location	Implementation Date
1	Treatment	Rte 17	Halibuton	Saanich	November 2000
2	Treatment	Rte 17	Island View	Saanich	November 2000
3	Treatment	Rte 17	Beacon	Saanich	November 2000
4	Treatment	Rte 1	Morden	Nanaimo	April 2001
5	Treatment	Rte 1	Cedar Rd N.	Nanaimo	April 2001
6	Treatment	Rte 19	College Rd	Nanaimo	April 2001
7	Treatment	Rte 19	Jingle Pt	Nanaimo	April 2001
8	Treatment	Rte 19	Northfield	Nanaimo	April 2001
9	Treatment	Rte 19	Molstar/Jingle	Nanaimo	April 2001
10	Treatment	Rte 19	Aulds	Nanaimo	April 2001
11	Treatment	Rte 19	Ware	Nanaimo	April 2001
12	Treatment	Rte 19	Cook Creek	Qualicum	April 2001
13	Treatment	Rte 19	Cliff	Courtney	June 2001
14	Treatment	Rte 19	Comox	Courtney	June 2001
15	Treatment	Rte 19	Ryan	Courtney	June 2001
16	Treatment	Rte 19	26th St	Courtney	June 2001
17	Treatment	Rte 97	Rte 33	Kelowna	October 2000
18	Treatment	Rte 97	Prairie Valley	Summerland	October 2000
19	Treatment	Rte 97	Rosedale	Summerland	October 2000
20	Treatment	Rte 97	Banks	Kelowna	October 2000
21	Treatment	Rte 97A	Smith	Armstrong	October 2000
22	Treatment	Rte 97A	Cliffe	Enderby	October 2000
23	Treatment	Rte 16	1st Ave	Prince George	June 2001
24	Treatment	Rte 17	17th Ave	Prince George	June 2001
25	Treatment	Rte 16	20th Ave	Prince George	June 2001

Table: Description Of Improvement Site

METHODOLOGY

METHODOLOGY TO ESTIMATE THE SAFETY IMPROVEMENT EFFECTS

The method used in this study is based on the application of the claims prediction model in an Empirical Bayes (EB) approach, as described by Hauer (Hauer, 1997) and Sayed (Sayed, et al., 1998(2) and Sayed 1999). This approach is used to correct for the regression to the mean effects, an important consideration in road safety analysis. The methodology also uses claim and traffic volume data for a comparison group to represent the time trend from the before to after time periods. Therefore, it is important that the comparison group represents a random sample and not be selected because of high claim experience.

RESULTS

By utilizing the methodology described in the preceding section, the treatment effects can be calculated for each improvement site. Table 3 below shows the results for the reductions in the total claims for the 25 sites.

ID No.	Site Type	Major Road	Minor Road	City Location	Claims Reduction [1.]
1	Treatment	Rte 17	Halibuton	Saanich	-25.5%
2	Treatment	Rte 17	Island View	Saanich	-5.5%
3	Treatment	Rte 17	Beacon	Saanich	-8.2%
4	Treatment	Rte 1	Morden	Nanaimo	-21.0%
5	Treatment	Rte 1	Cedar Rd N.	Nanaimo	-23.4%
6	Treatment	Rte 19	College Rd	Nanaimo	-24.9%
7	Treatment	Rte 19	Jingle Pt	Nanaimo	*6.1%*
8	Treatment	Rte 19	Northfield	Nanaimo	-11.7%
9	Treatment	Rte 19	Molstar/Jingle	Nanaimo	*4.3%*
10	Treatment	Rte 19	Aulds	Nanaimo	*16.8%*
11	Treatment	Rte 19	Ware	Nanaimo	-51.0%
12	Treatment	Rte 19	Cook Creek	Qualicum	-38.3%
13	Treatment	Rte 19	Cliff	Courtney	-2.8%
14	Treatment	Rte 19	Comox	Courtney	-60.7%
15	Treatment	Rte 19	Ryan	Courtney	-15.4%
16	Treatment	Rte 19	26th St	Courtney	-60.7%
17	Treatment	Rte 97	Rte 33	Kelowna	-5.5%
18	Treatment	Rte 97	Prairie Valley	Summerland	*20.6%*
19	Treatment	Rte 97	Rosedale	Summerland	*2.9%*
20	Treatment	Rte 97	Banks	Kelowna	-16.9%
21	Treatment	Rte 97A	Smith	Armstrong	-21.0%
22	Treatment	Rte 97A	Cliffe	Enderby	-47.2%
23	Treatment	Rte 16	1st Ave	Prince George	*3.0%*
24	Treatment	Rte 17	17th Ave	Prince George	-54.0%
25	Treatment	Rte 18	20th Ave	Prince George	-22.3%
				Total Overall	**-14.8%**

Table: Reductions Factor For Each Improvement Site

CONCLUSION

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