EVALUATION OF SIGHT DISTANCE AT AN INTERSECTION WITH STOP SIGN CONTROL

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This project is submitted in partial fulfilment of the requirements for the degree of
Bachelor of Engineering with Honours
(Civil Engineering)

Faculty of Engineering
UNIVERSITI MALAYSIA SARAWAK
2006

UNIVERSITI MALAYSIA SARAWAK

BORANG PENGESAHAN STATUS TESIS

Judul: EVALUATION OF SIGHT DISTANCE AT AN INTERSECTION WITH STOP SIGN CONTROL

SESI PENGAJIAN: 2002 - 2006

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Dedicated to my family and beloved one

ACKNOWLEDGEMENT

In the name of ALLAH, the Most Gracious and the Most Merciful

In the completion of this project, the author hereby would like to acknowledge and express her deepest gratitude to her supervisor, Mr. Zamri Bin Bujang, for his guidance, advice and encouragement. The author would also like to give special thanks to Mr. Mohd Hafiz bin Mafadi and Mr. Saiful bin Edi for the kind assistance offered during the period of this project.

Not forgetting lots of gratitude and thanks to her parents and brothers for their endless supports and encouragement. Last but not least, special acknowledgement to the author's friends who shared concern, point of views while completing this report.

Thank you all.

ABSTRACT

A primary feature in highway design is the arrangement of the geometric elements so that sufficient sight distance is provided for safe and efficient operation. This can be achieved by installing traffic control devices which have an important role in highway design and it can control vehicles movement on highway. This project is about an evaluation of sight distance at an intersection with stop sign control. Therefore, the performance of sight distance at an intersection will be examined. A method from American Association of State Highway and Transportation Officials (AASHTO) is used to evaluate the recommended intersection sight distance. Experiments were done at four intersections which have T-intersection with stop sign control. Those intersections are: Jalan Muda Hashim intersection, Jalan Rubber intersection, Jalan Perimat intersection and Jalan Bayor Bukit intersection. Consequently, the data from the experiments are analysed and then compared with the recommended intersection sight distance. If the existing sight distance is less than the recommended sight distance, some suggestions are proposed to mitigate the problem. It was found that sight distance at Jalan Muda Hashim intersection and Jalan Rubber intersection are adequate while sight distance at Jalan Perimat intersection and Jalan Bayor Bukit intersection are inadequate. Therefore, some suggestions are recommended to mitigate the problem.

ABSTRAK

Antara ciri penting dalam pembinaan jalan raya adalah aturan elemen geometri dan dengan itu jarak penglihatan yang mencukupi dapat diaplikasikan untuk penggunaan jalan raya yang selamat dan efisien. Ini dapat dicapai dengan pemasangan Alat Kawalan Trafik dimana ia merupakan peranan yang penting dalam pembinaan jalan raya serta dapat mengawal pergerakan kenderaan di jalan raya. Projek ini adalah untuk menilai jarak penglihatan pada simpang yang dikawal dengan tanda Berhenti dan dengan itu jarak penglihatan pada simpang akan dianalisis. Kaedah dari *American Association of State Highway and Transportation Offici*als (ASSHTO) digunakan untuk menilai jarak penglihatan minima. Eksperimen ini telah dijalankan pada empat simpang yang dikawal dengan tanda Berhenti. Simpang-simpang tersebut adalah; Simpang Jalan Muda Hashim, Simpang Jalan Rubber, Simpang Jalan Perimat dan Simpang Jalan Bayor Bukit. Data dari eksperimen yang telah dijalankan dianalisa dan dibandingkan dengan jarak penglihatan minima. Jika jarak penglihatan sedia ada kurang daripada jarak penglihatan minima, cadangan untuk memperbaiki masalah tersebut akan disyorkan. Jarak penglihatan di simpang Jalan Muda Hashim dan di simpang Jalan Rubber adalah mencukupi manakala jarak penglihatan pada simpang Jalan Perimat dan simpang Jalan Bayor Bukit adalah tidak mencukupi. Oleh itu, cadangan telah dibuat untuk memperbaiki masalah pada jarak penglihatan di kedua-dua jalan tersebut.

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ABREVIATIONS

AASHTO	-	American Association of State Highway and Transportation Officials
FHWA	-	Federal Highway Administration
ISD	-	Intersection Sight Distance
JKR	-	Jabatan Kerja Raya
MUTCD	-	Manual Uniform Traffic Control Devices
V	-	Design Speed
ΔT	-	Time Gaps Increment
km/hr	-	Kilometer per Hour
t_g	-	Time Gaps

CHAPTER 1

INTRODUCTION

1.1 General

Traffic engineering is a part of engineering that applies principles of engineering to help solve transportation problem. Traffic engineering can be defined as phase of engineering that deals with the safe and efficient movement of people and goods on streets and highway. The aspects that must be considered are (Roger et. al.);

a) Planning of street and highway facilities.

b) Geometric design of street and highway facilities

c) Traffic operations and control

d) Traffic safety

e) Maintenance and management of traffic facilities and control

Traffic safety and quality of traffic flow require certain sight distances for stopping in time or for safe overtaking. According to AASHTO, the path and

speed of motor vehicles on highways and streets are subject to the control of drivers whose ability, training and experience are quite different with respect to safety on the highway. Therefore, the engineer must provide a sight distance of sufficient length that would allow driver to control the operation of their vehicles and avoid collision.

The importance of this project is to provide adequate intersection sight distance and to provide safe movement of vehicle at an intersection. Therefore, the sub topic that related to this project will be discussed.

1.2 Intersection

An intersection can be defined as an area where two or more roadways join or cross. Intersection is an important part of the road system and it is the most critical elements in highway design. The efficiency, safety, speed, cost of operation and capacity of the highway system is depend on the intersection design.

According to AASHTO Green Book, the main objective of an intersection design is to reduce the severity of potential conflicts between motor vehicle, buses, trucks, bicycles, pedestrians and facilitating the intersection.

Each roadways extending from the intersection is referred to as a leg. A typical intersection can be divided into areas between each leg known as quadrants. There are three types of at-grade intersection;

1) T intersection
2) Four-leg intersection
3) Multi-leg intersection

Intersection should be designed to provide safe movement of traffic on all legs with minimal amount of delay. There are many factors that must be considered in designing an intersection, such as (Rueger, L et. al.):

a) Traffic volume on all legs
b) Sight distance
c) Traffic control devices
d) Horizontal and vertical alignment
e) Radius return
f) Drainage design
g) Islands
h) Left turn and right turn lanes
i) Additional through lanes
j) Pedestrians and bicycles
k) Lighting
l) Drainage design

1.3 Sight Distance

A primary feature in highway design is the arrangement of the geometric elements so that sufficient sight distance is provided for safe and efficient operation. The sight distances that must be considered are;

(a) Stopping Sight Distance (SSD)

Stopping sight distance can be defined as the cumulative distance traversed by a vehicle from the moment a driver see an unexpected object in the roadway, applies the brakes and able to bring the vehicle to stop or the distance that allow the drivers to perceive, react and safely stop the vehicle.

(b) Passing Sight Distance (PSD)

Passing sight distance is the distance that the driver should be able to observe oncoming traffic on a two lane, two way roads in order to pass a vehicle safely. It is important to provide adequate passing sight distance for as much of the project length as possible to compensate for missed opportunities due to oncoming traffic in the passing zone.

(c) Decision Sight Distance (DSD)

Decision sight distance known as the distance needed for a driver to detect, recognize, select, initiate and complete an appropriate course of action for an unexpected or otherwise difficult to perceive condition in the roadway.

(d) Intersection Sight Distance (ISD)

Intersection sight distance can be defined as the distance that the driver of the vehicle should be able to see other traffic operating roadway in order to enter or cross the roadway safely and to avoid any unexpected conflicts in the intersection area.

1.4 Traffic Control Devices

Traffic control devices have an important role in highway design. It can control vehicles movement on highway. The Manual on Uniform Traffic Control Devices (MUTCD) states that the purpose of traffic control devices is to promote highway safety and efficiency by providing for orderly movement of all road users on street and highway, throughout the nation.

Traffic control devices inform road users of regulation and provide warning and guidance needed for the safe, uniform and efficient operation of the entire traffic stream. Traffic control devices can be divided into three board categories;

(a) Traffic Marking

Marking on highways have important function to provide guidance and information for the road user. There are several types of traffic marking; pavement and curb marking, object markers, delineators and islands. Traffic

marking is used to convey regulation, guidance or warning in ways not obtainable by the use of the other devices and to supplement other traffic control devices.

(b) Traffic Signal

Traffic signal is a valuable device for the control of vehicular and pedestrian traffic. Traffic signal allocate the main concern to the various traffic movements by alternative directing which traffic is to stop and which traffic is to move.

(c) Traffic Sign

The purpose of traffic sign is to ensure safety by providing for the orderly and predictable movement of vehicle and to provide guidance and warning as needed to ensure the safe and informed operation of the user of the system. Signs are necessary to regulate and guide traffic over established routes and provide information concerning direction and destination. Traffic sign fall into three major categories;

a) Regulatory Signs - to convey information concerning traffic regulation.
b) Warning Sign - to inform drivers about upcoming hazard that drivers might not see and to allow driver for safely react.
c) Guide Sign - to provide information to drivers concerning destination, available services and recreational facilities.

1.5 Objective

The principle objective of this thesis is to measure and evaluate the sight distance at an intersection with stop sign control. For the purpose of this study, the performance of sight triangle at an intersection will be analyzed. Thus, the objectives are;

a) To measure the existing sight distance of each leg at an intersection.

b) To evaluate the recommended sight distance by using the equation from AASHTO, Green Book.

c) To compare the recommended value with the existing sight distance and proposed alternative solution to mitigate the problem.

1.6 Structure of Thesis

The First chapter is the introduction chapter, which consists of the objectives of this project and also some briefing about intersection and sight distance.

Chapter Two describes literature review, which cover on the standard design of an intersection and the sight distance at an intersection with stop sign control.

Chapter Three consists of the methodology of this project, which explains how the sight distance are measured and calculated.

Chapter Four describes the characteristic of an intersection that has been surveyed. This chapter includes the data and analysis of the sight distance at an intersection that has been conducted.

Chapter Five gives the conclusion and proposed some suggestions to improve the sight distance at an intersection.