

# Risk Factors in a Road Construction Site

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**Abstract**—The picture of a perfect road construction site is the one that utilizes conventional vertical road signs and a flagman to optimize the traffic flow with minimum hazard to the public. Former research has been carried out by Department of Occupational Safety and Health (DOSH) and Ministry of Works to further enhance smoothness in traffic operations and particularly in safety issues within work zones. This paper highlights on hazardous zones in a certain road construction or road maintenance site. Most cases show that the flagman falls into high risk of fatal accidents within work zone. Various measures have been taken by both the authorities and contractors to overcome such miseries, yet it's impossible to eliminate the usage of a flagman since it is considered the best practice. With the implementation of new technologies in automating the traffic flow in road construction site, it is possible to eliminate the usage of a flagman. The intelligent traffic light system is designed to solve problems which contribute hazardous at road construction site and to be inline with the road safety regulation which is taken into granted.

**Keywords**—Intelligent Traffic Light, Critical Zones, Safety Regulation, Flagman

## I. INTRODUCTION

TRAFFIC accidents [1], [2] in road construction site are continuing problem. Safety regulation is revised by authorities periodically in the effort towards a safer working environment on a road construction site, where by the prime concern is the safety of road users and construction workers. According to acts as stated in the road construction safety regulation, sufficient safety measures have been always considered in all means especially involving human life's. Statistics on road construction accidents which was published by DOSH [4], highlights indispensable measures which have been overlooked by the appointed road contractors. Ignorance of the road safety regulation has results in various fatal accidents for both domestic users and construction workers [3]. In the effort to maintain safety and smoothness in traffic flow on the road construction site, the usage of a traffic controller or so called "flagman" is essential [7], [8]. Such practice was introduced edges ago, since then it is widely in practice throughout the world. The best practice in

neutralizing the traffic flow is indirectly position the flagman's life into the fatal zone. Unrealisingly contractors have put the flagman's life in high risk where incidents shows most fatal cases are among them. The ultimate aim of this research is to implement technological approach which will overwrite the conventional flagman practice. Revolution and modernization have introduced new technologies in assisting and ease human life in various ways. In order to reduce fatalities and injuries from crashes in work zone and to enhance smoothness in traffic operation as well as to ensure safety within work zones, an intelligent traffic light is essential.



Fig. 1 Flagman is positioned in the work zone

## II. IGNORANCE OF SAFETY REGULATIONS ON A ROAD CONSTRUCTION SITE

### A. Contractors

Most of the contractors are less competent and they do not obey the road safety regulations during construction. These regulations are created by responsible authorities and agencies such as The Department of Occupational Safety and Health (DOSH) which contains legal requirements to ensure safety of the workers at work zone and public. Besides that, there are certain contractors who neglect the rules which are listed by the Ministry of Works.

According to the Ministry of Works, during a road construction there should be a minimum of 10 safety alert sign boards that must be placed on specific locations at the construction area. In most cases the contractors overlook the safety regulations and take it for granted. Indirectly, this irresponsible attitude causes problem to numerous parties.

Apart from that, a flagman who is appointed by the contractors might not be well trained by their employment.

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These untrained flagmen could be harmful for the road users and themselves. At times the flagman's concentration on controlling the traffic flow also can result in various miseries not only to his life but also to the public. For an example, when the flagman works under the hot sun, they get tired easily and lose their concentration on work. Nevertheless, miscommunications also occur when these flagmen uses improper method to communicate among themselves in order to control the traffic [4].



Fig. 2 Flagman disobeying the safety rules

#### B. Road user

Statistic published by DOSH, shows that reckless road users are the main cause of an accident on a road construction site. Usually flagman who direct traffic around a road construction site are highly visible in their bright orange vests, as they hold up their "Stop" and "Go" signs or their flags to inform drivers what they must do to get through a single lane bypass. Some reckless driver tends to ignore these directions and causes accidents.

In many countries, disobeying the flagman and speeding in road construction sites is serious a punishable which is finable or imprisonment if it results in a bodily injury accident. Other than that, when knowledgeable driver enters a bypass lane, they know the pavement may not be as smooth as the expressway. In fact, it is likely to be rough and uneven, possibly full of potholes and also muddy and slippery. The good driver enters the bypass slowly and carefully. But when the irresponsible drivers enter the bypass at higher speed than as posted speed limits, it could cause the loss of control. This irresponsible attitude will drift the construction workers and other road user into fatal zone.

Drivers must comply with traffic regulations, as well as security and safety standards for their own safety, other road users' safety and road construction workers' safety as well [4].

### III. CRITICAL ZONES IN THE ROAD CONSTRUCTION SITE

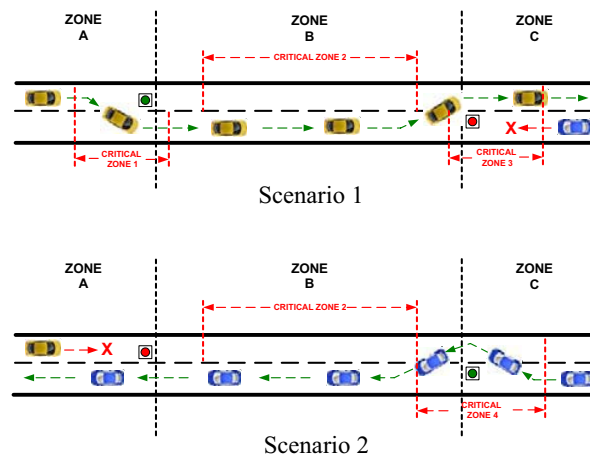


Fig. 3 Straight Lane Road Construction

A road construction site can be categorized into zones and risk level as shown in table 1. Referring to fig 3, the risk factor for both the public users and the flagman is high in zone A and zone C. This zone is defined as a critical or high risk zone due to the stopping point of the oncoming vehicles. The risk factor here involves the road users and also the traffic controller which is the flagman. The next zone is zone B where the construction or road maintenance job is done. The risk in this zone is moderate if the work zone is not close to the road allocated for the users. The contractor should study on possible space for all types of vehicles to pass thru all zones especially between zones as shown in fig. 3 [5].

TABLE 1  
CRITICAL ZONES AND RISK LEVEL IN STRAIGHT LANE

Zones	Scenario 1	Scenario 2
A	HIGH	HIGH
B	MODERATE	MODERATE
C	HIGH	HIGH

There are many types of road construction site and possible danger if safety measures are not taken into account [6]. Fig. 4 [5], shows another scenario of a road structure which is similar to the scenario in fig. 3. The risk level for this scenario is as shown in table 2. The risk factor for both the public users and the flagman is high in zone A and zone C. This zone is defined as a critical or high risk zone due to the stopping point of the oncoming vehicles. The risk factor here involves the road users and also the traffic controller which is the flagman. The next zone is zone B where the construction or road maintenance job is done. The risk in this zone is moderate if the work zone is not close to the road allocated for the users. The contractor should study on possible space for all types of

vehicles to pass thru all zones especially between zones.

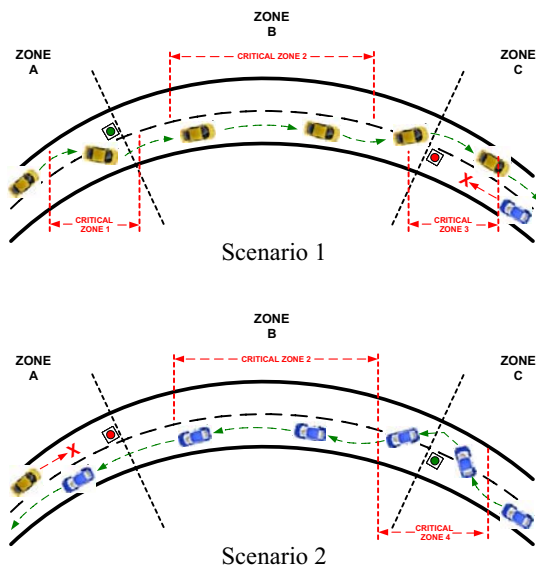


Fig. 4 U Shape Lane Road Construction

TABLE II  
CRITICAL ZONES AND RISK LEVEL IN U SHAPE LANE

Zones	Scenario 1	Scenario 2
A	HIGH	HIGH
B	MODERATE	MODERATE
C	HIGH	HIGH

The risk in road construction site in a T junction is very high for the both the road users and construction workers due to the rigid position and possible movements of vehicles on each junction. Referring to fig. 5-fig. 7 [5], the risk factor for both the public users and the flagman is high in zone A, zone C and zone E. The zone falls under the critical zone due to the stopping point of the oncoming vehicles from all directions. The risk factor here involves the road users and also the traffic controller where the risk level is as shown in the table 3. Zone D has a low risk factor since the space in zone D is used for the vehicle to move to their desired destination. The next zone is zone B where the construction or road maintenance job is in progress. The risk in this zone is moderate if the work zone is not close to the road allocated for the users. The contractor should study on possible space for all types of vehicles to pass thru all zones especially between zones.

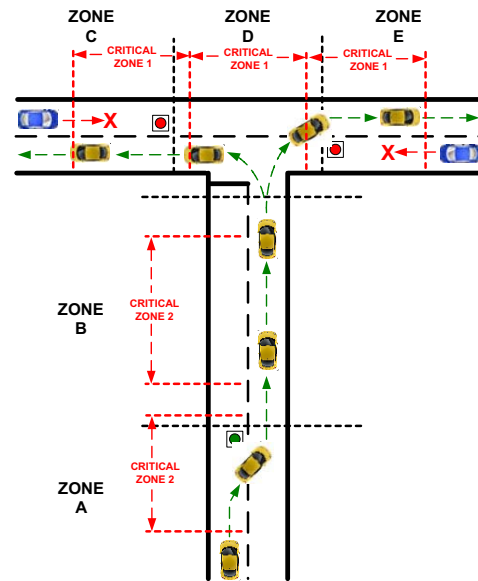


Fig. 5 T-Junction Road Construction - Scenario 1

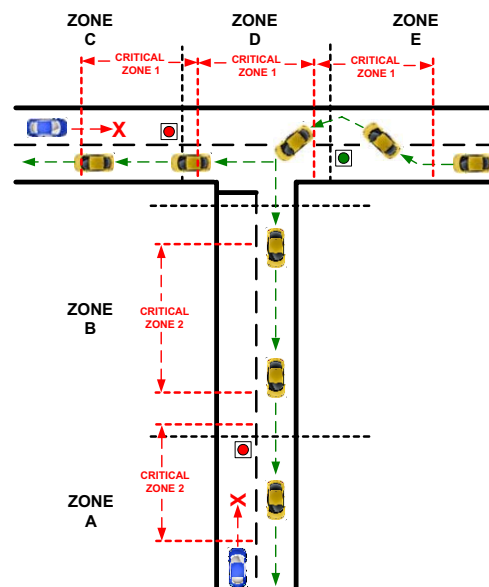


Fig. 6 T-Junction Lane Road Construction - Scenario 2

TABLE III  
CRITICAL ZONES AND RISK LEVEL IN T-JUNCTION LANE

Zones	Scenario 1	Scenario 2	Scenario 3
A	HIGH	HIGH	HIGH
B	MODERATE	MODERATE	MODERATE
C	HIGH	HIGH	HIGH
D	LOW	LOW	LOW
E	HIGH	HIGH	HIGH

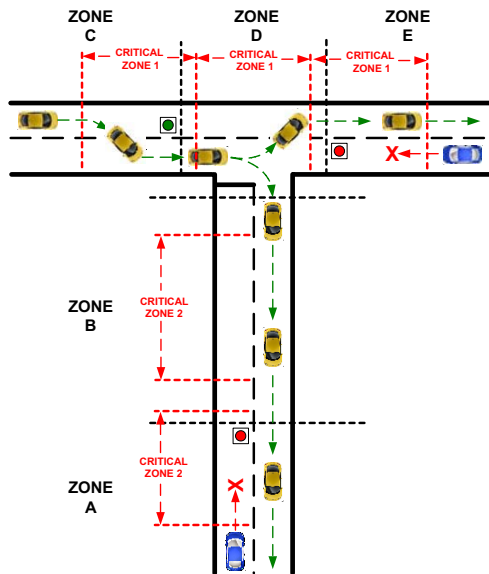


Fig. 7 T-Junction Road Construction - Scenario 3

#### IV. DOWNFALL OF A FLAGMAN

Referring to table 4, it shows the factor that affecting the usage of flagman compare to the proposed system. There are few factors that make the proposed system is reliable compare to the current flagman practice as shown in the table. The Intelligent Traffic Light is one of the best devices in work zone traffic control systems. This system can replace one or both flaggers during the lane closures for the construction. This portable traffic light will be implemented in temporary traffic control for long term and short term lane closures on construction sites, to control two-way traffic in a single lane. A part that, the other advantage of this automated portable traffic light system is it reduces costs and increases safety by eliminating the need for human flagmen. This system is applicable on publicly and privately-funded road construction projects that require overnight or 24-hour traffic control as well as in different weather conditions.

TABLE IV  
COMPARISON BETWEEN FLAGMAN AND INTELLIGENT TRAFFIC LIGHT SYSTEM

Factors	Flagman	Intelligent traffic light system
Working hours	limited	unlimited
Weather condition	not reliable	reliable
Effectiveness	vary	consistence
Fatal Risk	High	Low
Costing	RM 50 per shift	RM 4000 per pair

#### V. CONCLUSION

Road safety signs are a simple tool used in influencing drivers on orientation and information waits ahead. New evolutionary road safety signs by using electronics devices in assisting road users are widely in practice, yet the conventional vertical road signs which are strategically placed along roads will be part of the road environment for many years to come. The modernization of safety signs on road construction site are foresee for generations by various authorizes in ensuring both public and contractors safety. It is important when designing and installing a system to ensure it is visible at all times and to minimize fatal incidents. Although many authorities understand the road safety regulations as a tool to minimize fatal accidents in road construction sites, few have actually put it into practice.

When a traffic control device or flagman is utilized at road construction site for control the traffic flow, a road user who drives a vehicle shall exercise extraordinary care to secure the mutual safety of all persons. Continuous monitoring and integrations of new technologies such as the intelligent traffic light system would provide a better and safer direction to both the contractor and public.

The intelligent traffic light system will be a revolutionary solution towards all miseries as highlighted in (IV). Such technological approach could save thousands of Dollars in damages and prevents lost of life's. As a public conscious researcher in minimizing such miseries stern punishment should be rewarded to those contractors who fail to comply the road construction safety regulation.

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