

## REPORT OF RESEARCH RESULTS

- (a) Title : The Application of Temporary Traffic Calming Devices at School Zones  
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- (c) Summary

Growing number of accidents in Thailand each year has caused substantial effects to economic disaster and the loss of human resources that are essential to national development. According to the incidences, competent authorities have made efforts to find several ways through campaign, training, and cooperation between related sectors and public participation to alleviate traffic accidents caused by many factors. In addition, government pursues policies to improve safety standard in order to vigorously push forward the efficient traffic accident reduction.

Regarding safety management and the campaign of road accident reduction, it has obviously seen that school fronts within the community areas have the trend to accelerate the accidents for road users since the majority of pedestrians using the street crossings in such areas are students who may be slower than adults in perception and decision-making. The Concerned group is usually unaware of the use of the street and lacks concern about accident risks. Sometimes they engage in accident risks from playing outside along the street or unintentionally face in congestion, and are unacquainted with the dangers of street crossing. This is due to the fact that the children cannot guess the vehicle speed in traffic and the appropriate safety distance from traffic to individually cross the street. As well, they might not be familiar with the traffic signals. Moreover, the motorists cannot speculate and handle children's movements that can cause unintentional injuries. Therefore, it is vital to find the preventive measures to reduce the number of accidents within the school and educational zones in order to follow up the government policies and to increase the potential development of national human resources in future.

Currently, the economic situation in Thailand has been deteriorating; hence, the nation is expected to have more effective utilization of budgetary. Additionally, there are many schools located over the non-congested rural areas; therefore, regarding safety management for school zones, it is unnecessary to install permanent devices with the aim of realizing budget exploitation. Moreover, in general, students enter school zones only two times a day when the school starts and finishes. With these reasons, our research team aims to develop the application of temporary traffic calming devices for school zones to manifestly solve the traffic accident problems in such areas. The wishing outcome is to set a line for other rural school areas for self-purposes.

- (d) Aim of Research

The principal objective of the research project of the application of temporary traffic calming devices at school zones endeavours sustainable development concept that comprises six following objectives:

1. To apply several types of temporary traffic calming devices to reduce the traffic speed at school zones
2. To compare the efficiency of each type of temporary traffic calming devices in appropriate with road types and school sizes
3. To set a line for other schools in rural areas in applying temporary traffic calming devices for self-purposes
4. To provide pedestrians and vehicles at school zones with convenient, fast and harmless conditions and safe life and property
5. To provide safety management plan around school and educational areas in order to develop 'livable city' and improve quality of people's lives
6. To make public sectors confident in improving safety standards around school zones.

- (e) Method of Research and Progression

This section describes data collection methods, installation practices of temporary traffic calming devices, and methods for analyzing vehicle speed reduction when compared between before and after installing temporary traffic calming devices.

### 1. Sample group

The study applied purposive sampling and selected the study area of rural schools established in adherence to two-lane roads at Rayong Province based on the rationale that when considering accident statistics reports, the Rayong Province showed the greater severity of crashes, in that 148 deaths, 72 serious injuries, and 117 minor injuries from 250 accident cases were recorded in B.E.2554 (2011).

Sampling was conducted by using laser gun camera to collect the spot speed of passing motorcycles, cars, and trucks. Location of laser gun was designed to install inside the bush to hide it from observation of drivers (if drivers can observe the laser gun, it might affect their speed). The data was gathered in two periods including 07.00-08.00 a.m. (school start time) and 03.00-04.00 p.m. (school finish time) with distance of every 50 m. taken totaling about 500 m. (11 points) in the direction of both west bound and east bound. So, total of spot speed is 13,200 times obtained from 1,200 vehicles.

### 2. Design of temporary traffic calming devices

Each type of traffic calming devices was arranged to suit for the traffic calming devices used in temporary basis since school zones are considerably required to reduce speeds on students entering time in the morning and evening. Three types of temporary traffic calming device were applied including:-

Type 1: Vertical alignment (only in the center)- encompasses the installation of traffic cone in the mid-street along the centerline to reduce speeds as shown in Figure 1;

Type 2: Vertical alignment in the center and two roadsides - purposes to narrow the lanes enabling drivers to deter their speed when passing such zone as illustrated in Figure 2.

Type3: Vertical alignment in the center and two roadsides with warning light in the center – is the type that provides narrower lanes together with using warning light to provide drivers in adequate seeing spot from far-distance with the aim of road hazard prevention as shown in Figure 3.

### 3. Analysis of data

This research analyzes each pattern of average speed to investigate on whether the efficiency of 3 types of temporary traffic calming devices in reducing speeds of traffic flow is significantly different. One way – ANOVA was applied for comparing any differences among average speed of overall test based on a statistical F-test. Albeit, the analysis can only be performed to identify the mean differences among group, but not determining on which of the sample pairs are significantly different, so the further test after ANOVA is required including post hoc test with availability of post hoc multiple comparisons regarded as pairwise comparisons.

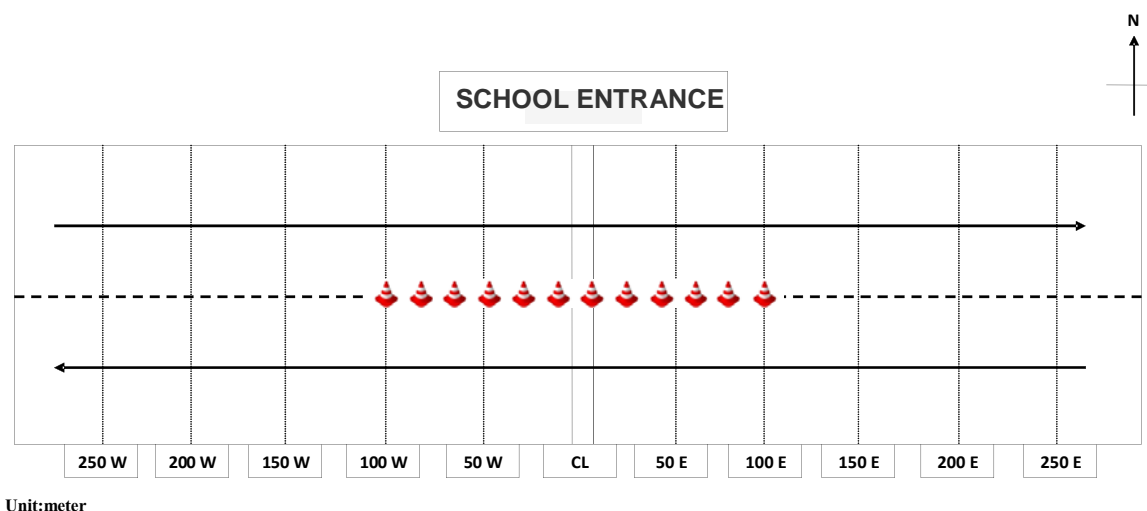


Figure 1 Vertical alignment (only in the center)

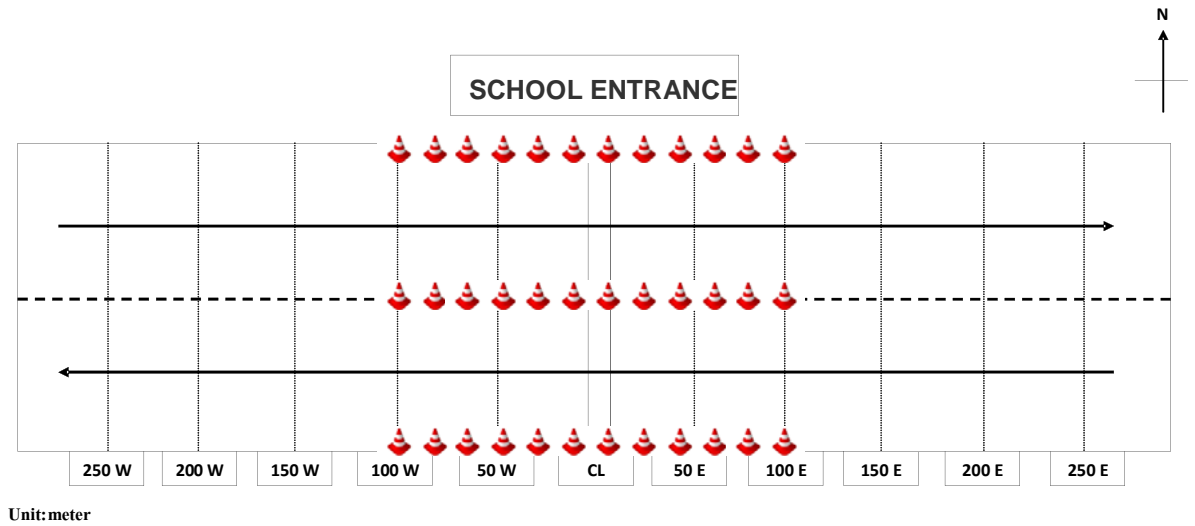


Figure 2 Vertical alignment in the center and two roadsides

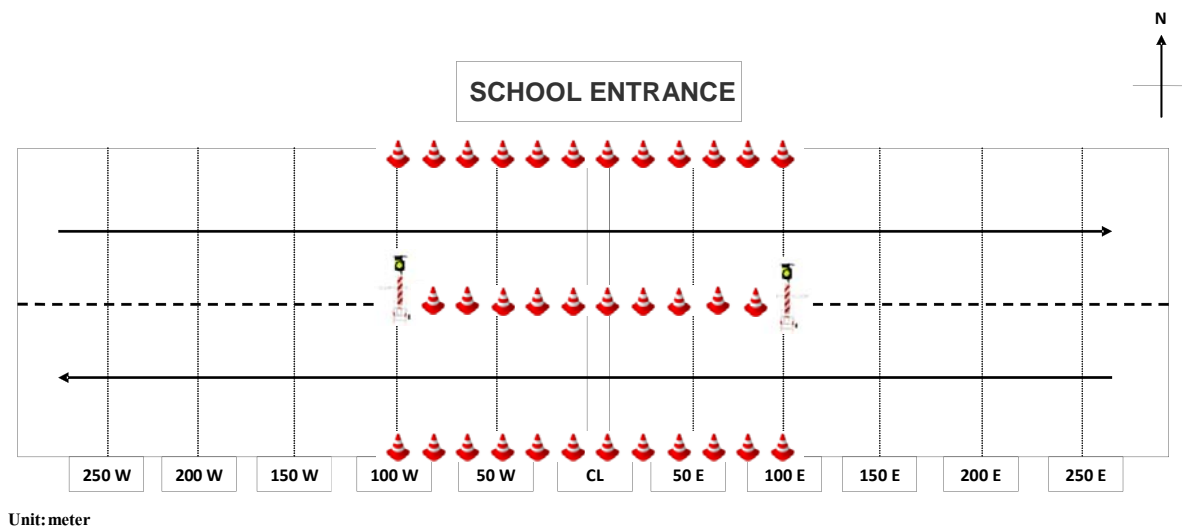


Figure 3 Vertical alignment in the center and two roadsides with warning light in the center

(f) Results of Research

As regards the study of efficiency in three types of temporary traffic calming devices, the comparison of speed reduction between using devices and normal pattern - at installing points (100 W - 100 E) covering a total distance of 200 m., indicated the influences of temporary traffic calming device Type 2 and 3 in decreasing average speed of all vehicle types with statistical significance ( $p$ -value  $< 0.01$ ). Whereas, temporary traffic calming device Type 1 does not have a significant effect on a speed deterrence ( $p$ -value  $> 0.05$ ); nevertheless it significantly affects the reduction of average speed of trucks ( $p$ -value  $< 0.01$ ).

Concerning assessment of efficiency of temporary traffic calming device Type 2 and 3, it effectively moderates car speeds from 29 km/h - 31.76 km/h and from 31.56 km/h - 32.96 km/h, respectively. Similar to trucks, speed reduction is in the range of 11.96 km/h - 15.08 km/h (Type 2) and 12.08 km/h - 15.36 km/h (Type 3). Albeit, the device is able to slightly deter speed in motorcycles, that is, the levels of decrease in speed of motorcycles were ranged from 6.12 km/h - 8.48 km/h (Type 2) and from 8.32 km/h - 13.72 km/h (Type 3), which have the greater values when compared to previous studies that applied temporary traffic sign and portable changeable message sign (PCMS) in construction work. The past results indicated the effective of two devices in reducing car speeds equals to 4.54 km/h and 2.55 km/h, respectively. While temporary traffic sign has perceivably impacts on speed reduction in trucks of 2.10 km/h when compared to portable changeable message sign.

The application of temporary traffic calming devices provides the capability of speed reduction of traffic flow in school zones; especially the device Type 2 and 3 are able to decrease average speed of all types of vehicles with similar efficiency, or possible substitution among both types. As well, the device Type 1 is more likely to be applied for reducing truck speeds. In addition, the devices are also appropriately used in school zones where reduction of speeds is considerably required in some periods of time. Therefore, when the device Type 2 and 3 are acquired for the application of decreasing average speed of vehicles, the significant reduction of speeds is greatly existed (p-value <0.01).

(g) Future Area to Take Note of, and Going Forward

1. The innovative devices can be used for safety management in school zones. Such devices are provided at low prices and can be immediately applicable for schools in rural areas which may have limited budget.

2. Average speed in school and educational areas is reduced, but high traffic flow is maintained.

3. The school environment can be improved to be as safe as possible.

4. Students, parents, staff and related authorities as well as representatives from communities gain knowledge and the understanding of utilization of temporary safety management system in school and educational areas.

5. The potential development of the national human resources in future can be increased.

6. It promotes the people's awareness and participation in understanding of the safety within school zones.

(h) Means of Official Announcement of Research Results

We have already submitted our research to distribute our work to wider audience in Lowland Technology International Journal.