

Transformation of Signage and Road Markings as a Medium for Safety in School Area

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KEYWORDS	ABSTRACT
Signage Student Safety Environmental Graphic Design (EGD) Light Emitting Diode (LED)	The increased numbers of accident in school area are concerned. Recent report stated that 37 primary schools and 253 secondary school students died because of road accidents. This number increased dramatically until the end of March 2015, a total of 13 primary schools and 296 secondary school students involved reported road accidents and death. Static road signs are no longer enough to provide motorist with all the information they require in a relevant and timely manner. This research proposed a transformation of signage and road markings as a medium for safety in school area by proposing an interactive signage. Environmental Graphic Design (EGD) is a design profession embracing many design disciplines including graphic design, architecture, industrial design and landscape architecture. Practitioners in this field are concerned with the visual aspects of way finding, communicating identity and brands, information design, and shaping a sense of place. It is believed that EGD will help improving student from early age to be able to read the signage with more effective and decipherable. Also help parent and drivers out there too aware with sign. This research was conducted via interview and questionnaire. One interviewer and 26 respondents participated in the questionnaire session. The sample population will be drawn from parents, workers, and drivers at schools area in Shah Alam, Selangor. It is believed that through EGD, Light Emitting Diode (LED) lamps are recommended to be a solution to decrease numbers of accident. Flashing Speed Limit Signs are highly visible and innovative, creating instant awareness of local speed variations. These signs help create safe local traffic conditions for the community, warning drivers to slow down at specific sections of the road. The resulting cost may be too expensive

Received April 2021; received in revised form May 2021; accepted June 2021.

when compared with the previous system, but the effect will be positive if the reduction of accidents in the school could be reduced especially if it involves the lives and could be used for long period of time.

1.0 INTRODUCTION

Recently, there is an increasing of road accidents at school areas in Malaysia public schools. One of the reasons that accidents happen during schools area is due to unsystematic signage at school area. The students probably hard to read the signage and causes accidents at schools areas. Lacking of signage and road marking at schools area also lead to accidents.

Signage is the design or use of signs and symbols to communicate a message to a specific group, usually for the purpose of marketing or a kind of advocacy. The term signage is have been popularized in 1975 to 1980, also means as collectively or being considered as a group. Signs are any kind of visual graphics created to display information to a particular audience. This is typically manifested in the form of way finding information in places such as streets or on the inside and outside of buildings. Signs vary in form and size based on location and intent, from more expansive banners, billboards, and murals, to smaller street signs, street name signs, sandwich boards and lawn signs. Newer signs may also use digital or electronic displays to be more interactive and visible.

Due to increased numbers of accident at schools area, Environmental Graphic Design (EGD) is believed not just to help improving students from early age to be able to read the signage with more effective and decipherable but also help parents and drivers out there to aware with the signs. Even though Malaysia has applied subject to teach students from early childhood to be aware on the road but the numbers of accident are still increased. According to Hamid Reza Zamani B, "Role Environmental Graphic in Urban Spaces" (2013), if these factors are made principally, they can be very effective in social communication neither they can create beautiful sceneries in the area to help human mind health. Theory Environmental graphic design (EGD or Experiential Graphic Design) is a design profession embracing many design disciplines including graphic design, architecture, industrial design and landscape architecture. Practitioners in this field are concerned with the visual aspects of way finding, communicating identity and brands, information design, and shaping a sense of place.

In today's traffic environment, static road signs are no longer enough to provide motorists with all the information they require in a relevant and timely manner. Through EGD, Light Emitting Diode (LED) lamps are a recommend to be a solution to decrease numbers of accident. According to Sassen, Human Settlement Development - Volume III (2009), "The new traffic lights use a cluster of LED lamps instead of a single halogen bulb to light up the traffic signal. This improves the visibility of traffic light signals and enhances road safety for both motorists and pedestrians. LED lamps have lower operating and maintenance costs. This helps to reduce traffic congestion due to traffic signal failures and maintenance work on traffic lights".

Therefore, this research is to understand the criteria of signage and road marking design, understand the criteria of design that may increase the awareness of road safety at school among parents, and create an interactive signage that support road safety at school area. As mentioned earlier, EGD may educate the public about the importance issue that needs to be emphasized plus a creative design message will able to give a new knowledge and benefits to the society. In the context of communication, especially on safety issues it will give an impact to audience to understand the message clearly and they will take the next action to eradicate the issue

1.1 Research Background

The transformation of signage and road marking from static road signs to interactive road sign through Light Emitting Diode (LED). This signage attracts fast feedback from drivers to take an action while on the road. Environmental graphic design (EGD) provide a new finding to help understanding of signage and road markings design that may increase the awareness of road safety.

Analysis on statistics of the increasing accidents at school areas in Malaysia. The analysis based on data of increasing numbers of accidents as report by Malaysian newspaper.


1.2 Research Objective

- To understand the criteria of signage and road marking design.
- To understand the criteria of design that may increase the awareness of road safety at school among parents.
- To create an interactive signage that support road safety at school area.

1.3 Problem Statement

- a. The increase road accidents in the school area
According to Datuk Zainol Fadzi Paharudin, Chairman of the Road Safety Council (MKJR) Perak, in the last two months alone, statistics show that fatal accidents involving students is 68 persons compared to the same period last year by 10 people. He also indicated the causes of accident that occur among students that walk to school are unprovided road, less cautious will crossing (Sinar Harian, Accidents involving students should not be taken for granted in 2016).
According to Tan Sri Khalid Abu Bakar, The Chief Police Officer, 37 primary schools and 253 secondary school students died because of road accidents involved motorcycles. This number increased dramatically this year. Until the end of March 2015, a total of 13 primary schools and 296 secondary school students involved reported road accidents and death (SinarOnline, parents got careless actions in 2014).
Sim Say Kiong, Deputy Director General of Road Safety, 85 percent of 9,586 primary and secondary schools in the country were found to be at high risk because the students are exposed to road traffic accidents (Utusan Online, 85% of schools in Malaysia exposed accident in 2009)
- b. Does not comply with the speed limit warning.
According to Datuk Seri Mahdzir Khalid, Education Minister said the cause of accident ran over by truck in front of students of Sekolah Kebangsaan (SK) Teluk Medan, Bagan Serai, Perak is due to an absence of crossed paths in the school and the driver did not obey the speed limit (Astro Awani, Not observe the speed limit is the cause of the accident in 2016).
- c. Unsystematic signage in the school area
Police suggested that the authorities provide warning signs of a more systematic near school grounds in order to avoid road accidents. Kuala Muda police chief ACP Khalil Arifin said, 'penyediaan papan tanda berkenaan juga perlu bagi memastikan pengguna jalan raya sentiasa berwaspada semasa memandu berdekatan sekolah' (Utusan, Papan tanda lebih sistematik perlu di kawasan sekolah, 21 November 2013).

1.4 Research Question

- What are criteria of signage and road marking design?
- What are the criteria of design to increase awareness of road safety at school among parents?
- How to design signage that supports road safety at school? 

1.5 Research Significance

To optimize safety, signs must be recognized and understood at a glance. This requires simplicity and uniformity of design, and consistency of application and placement. Standardization of design includes color, shape, relative dimensions, message, and illumination or reflection. Standardization of design does not preclude further improvement by minor changes in the proportion of symbols, stroke width and height of letters, width of borders, or layout of word messages. This study was hoping to make parent and all drivers out there aware with signage and road marking in order to reduce accidents at school's area.

1.6 Research Scope

The scope of studying this transformation of signage and markings are focus on parent who has kids on primary and secondary school.

1.7 Limitation

- The difficult of collecting study materials.
- Difficult to archive because the documentation does not organize, unsystematic and don't justification.
- Most of the road marking area at school are sometimes hidden behind the tree or too small. Difficult and slow down the process of research conducted

1.8 Delimitation

The sample population will be drawn from parents, workers, and drivers at school's area in Shah Alam, Selangor.

2 LITERATURE REVIEW

2.1 Transformation

What does it mean by "Metamorphosis"? From scientific perspective, metamorphosis is the concept of integrative from many aspects related to biology, evolution, cell biology and so on. Although civilization have the general understanding upon the view of metamorphosis represent transformation of butterfly but it is also can be use in any other major such as visual communication. According to Christos D. Georgiou (2006) "The basic shape, form, and structure of an organism emerges as a result of a sequence of developmental adjustments. Each of these is usually irreversible within its morphogenetic sequence, although often reversible by some gross disturbance (for example, regeneration after injury). The whole process whereby the final organization and pattern of the organism is established in terms of metamorphosis (a synonym of morphogenesis) applies to all eukaryotic organisms. Each adjustment is made by cells already specified by earlier adjustments to belong to a particular developmental pathway." The other way around, metamorphosis also can be called as transformation from the old version to the new version.

According to Marcia Daszko and Sheila Sheinberg, PhD (2005) "Transformation is what happens when people see the world through a new lens of knowledge and are able to create an infrastructure, never before envisioned, to the future. Transformation is motivated by survival, by the realization that everything needs to change or the organization will die; that a significant

breakthrough in mindset is needed in order to pursue new opportunities. Based on this fact, the transformation is defined as the process of creation something new or change to something new in terms of shape, functions or a new procedure.

2.2 Environmental Graphic Design (EGD)

Environmental graphic design (EGD or Experiential Graphic Design) is a design profession embracing many design disciplines including graphic design, architecture, industrial design and landscape architecture. Practitioners in this field are concerned with the visual aspects of way finding, communicating identity and brands, information design, and shaping a sense of place. The word environmental refers to graphic design as part of creating the built environment, not to the natural environment. Because of the confusion between the two, the field is now becoming known as "Experiential Graphic Design". However, Omar (1984) ""Graphic Communication as a Design Tool, New York" stated the main duty of an environmental graphics is to transfer a useful social message to people so that it can provide the necessary order to see beyond visible surfaces and it can conduct to realize indispensable values for a comfortable and peaceful life. Environmental graphic embraces many design disciplines. In addition, Integrin Niron (1994), "Importance of Environmental Graphic Design in Human Life and its Affection" claimed that Legibility and readability are major issues which affecting all kinds of environmental graphics. Well-designed and readable sign stability can create with color, type and message. High technology and beautiful detailing doesn't always mean that equal visibility. Sign maps color-coding banners website directional information and regulatory information are all examples of graphic communications.

2.3 Signage

Signage is the design or the use of signs and symbol to convey a message to the public. Identification signs have been popularized since 1975. Signs of different shapes and sizes which vary based on location, service, information and belief. The main objective of the communication process where its function is to transmit information, direction, identification, safety and regulatory. In Malaysia, dramatic rise in accidents involving school students emphasis should be taken especially in improving the visual graphics of the signs that are placed as a safety measure not only the students but also to the parents. Very difficult when it comes to describe about students safety issues of primary and secondary Malaysian schools in particular. According to Ministry of Education in 2016, Number of students that too crowded, especially of 10159 schools is difficult to be major emphasis especially in safety matters when the percentage of danger in an accident is greater every day, especially in the early morning hours of 6-7.30 a.m and 1- 3 p.m various factors that make students vulnerable in terms of safety. Direct, effective signage should be reviewed and was made improvements to ensure that all parties concerned and cautious in this dangerous period.

2.4 Student Safety

According to Datuk Seri Mahdzir Khalid, Minister of Education "does not comply with the speed at school Area Causes Accidents". Road accidents involving school students in the area can be avoided if drivers obey the speed limit, traffic control other than that provided by the school. Road traffic deaths and injuries among children remain the leading cause of admission of children into government hospitals, due in large part to poor road safety practices. From 2002 to 2008, an average of 830 children died each year due to road traffic accidents, with the number of deaths increasing each year.

2.5 LED (Light Emitting Diode)

Developments in technology have helped the community in facilitating everything is done every day. But there are only a few countries that apply the concept of Environmental graphic design in the transformation of signage that has attractive graphic interface and it also draws

attention to the visual society. One example of environmental graphic design is the use of LED (light emitting diode), which is said to be eco-friendlier and energy-saving. A light-emitting diode (LED) is a semiconductor device that emits visible light when an electric current pass through it. The light is not particularly bright, but in most LEDs, it is monochromatic, occurring at a single wavelength. An LED consists of two elements of processed material called P-type semiconductors (positive) and N-type semiconductors (Negatives). These two elements are placed in direct contact, forming a region called the P-N junction.

Energy consumption in the light of the street lamps in excess will cause climate change such as light pollution and greenhouse gas emissions drastically. According to United States Environmental Protection Agency (2009), LED lighting helps reduce the greenhouse gas emissions that cause climate change because they replace far more energy intensive light bulbs.

According to the Petaling Jaya City Council (2015) explains that the use of LEDs is categorized in the "energy efficiency" because it uses the minimum power capacity which is able to save up to 90 percent of electricity consumption. In addition, the use of electricity at the traffic light operates all day. There are many traffic signal modules still use incandescent light bulbs which last up to two years and consume about 1,314 kWh per year. LED bulbs last 10 or more years with continuous use and consume 80-90 percent less energy.

3 RESEARCH METHODOLOGY

The method of collecting data that will be implemented is:

3.1 Stage I: Research Approach

- **Qualitative**
The major research approach in this research will be a qualitative data. The strength of qualitative research is identifying intangible factors of transformation of signage and road markings as a medium for safety in school area. Ideally the use of qualitative method in this study method of choice will involve archival data, visual research, observations (non-participant and participant observation) and survey interview in order get the data from sampling population.
- **Quantitative**
To support the qualitative method, the researcher will also use the quantitative method alongside this research. Researcher conducted a survey is to collect the information regarding the issue and the topic study. Survey contains of 16 questions. 26 questionnaires were distributed on Shah Alam area.

3.2 Stage II: Content Analysis

- Findings of each category inside dimensions are systematically counted. The validate findings are analyzed toward the opinion of interviewees and survey questionnaires.

3.3 Stage III: Recommendations

- Propose a reduction in the accident rate with signage that more efficient compared with existing signage.

Sample

The sample for this research will be the industries expert in this area. These were core persons that were responsible to present information in a way that were both accessible and memorable.

4 DATA ANALYSIS

4.1 Observation

This observation was a non - participant observation. The researcher observes on the designing safety signage and safety by local and international has been published by other to gain some data and information. Through this observation, the research shows that the signage is less appropriate in the school area. In addition, most of the signage is also protected by trees, vehicles parking all over the place and the characteristics of the school who are unable to place a signage correctly. This makes it less clear to be seen in the sight of the driver.

4.2 Visual Analysis

a. Signage

On this research, researcher analysis 4 type of signage such as road bump, school children crossing, stop and speed limit from Malaysia, United States, Japan and South Korea. As conclusion from this visual analysis, all countries use the same format, such as forms, color, text and icon except Unite States that using green-fluorescent yellow color started from 2012. According to The Shape And Color Gives Us A Sign, Federal Highway Administration (2009), The new color for this sign fluorescent-yellow green is much easier to see in low light and foggy rainy weather. Although this signage format similar to the rest of the world but adherence to follow such instructions by drivers because of their attitude.

b. New design of Signage using LED

i) United States

LED STOP signs provide greater awareness for new, high-risk and high-incidence intersections where static signs are ineffective. A majority of intersection-related fatal crashes occur at rural crossings where high-speed major highways intersect lower-speed secondary roads. Vertical and horizontal curves can make it difficult for drivers to identify safe gaps in the oncoming traffic when crossing or turning onto the high-speed road (tapconnect.com, 2016). According to this website, in United States there are plenty of company purpose use of the new technologies in solving signage. All this LED is using solar to help reduce electricity consumption. Electricity is only used at night only.

ii) Australia

According to the website ADengineering.com, 2016, Flashing Speed Limit Signs are highly visible and innovative, creating instant awareness of local speed variations. These signs help create safe local traffic conditions for the community, warning drivers to slow down at specific sections of the road. The AD305 features an ultra-bright, high quality and long-life LED display capable of displaying different speed limits from 10 to 100Kph in increments of 10 or 5Kph. Features also include a programmable flashing annulus with 3 rows of red LEDs.

iii) China

China is one of the countries that use the LED system safety. Widespread use in this country makes this LED safety system as a business tool and make this country the largest producer of this system in the world. This country audacious to market this system to the world because this system safe to used and can reduce the risk of accidents dramatically to the country. A 28.9 percent reduction

in the number of vehicles not fully stopping and a 52.9 percent reduction in the number of vehicles moving through the intersection without significantly slowing. Gates, T.J., Carlson, P.J., and Hawkins, H.G., Jr., "Field Evaluations of Warning and Regulatory Signs with Enhanced Conspicuity Properties."

iv) Singapore

The safety measures include the "40km/h When Lights Flash" sign a three-tiered sign comprising a "Children Ahead, School Zone" sign, a "40km/h" speed-limit sign, and a pair of amber light-emitting diode (LED) lights. The LED lights will flash during school peak hours, when motorists would be required to slow down to 40km per hour. (Keneth, 2015). In Singapore, The LED flash sign are use in school area to reduce accidents often involving the students. The resulting cost may be too expensive when compared with the previous system, but the effect will be positive if the reduction of accidents in the school could be reduced especially if it involves the lives and could be used for long period of time.

As conclusion from this visual analysis, signage design comparison between Malaysia and foreign countries, the analysis shows that the US, Australia, China and Singapore have used Signage LED systems in the school. This analysis shows that China could decrease by 52% car stop and slow in the school. In Singapore, can reduce driver in school area. For the United States and Australia, the use of LED has been on innovation with the use of solar electricity to generate the LED lights. This result shows that this system of LED signage has the benefit of more positive compared to the previous system of signage.

4.3 Interview

The researcher has conducted an interview with Mr. Nik Mohd Fadhli Bin Mat Husin, Assistant Architect at Linea Architect, Damansara. The purpose of interview is to gain more evidence and opinion regarding the issue.

In this interview, we asked a series of questions such as what are the factors that lead to an accident in the school? He expressed the attitude of drivers who like speeding without compliance with the speed limit should be. In terms of the aspects of observation warning signboards in the school, he agreed there is when he also difficult to see and read the warning sign especially at a distance, environmental factors such as the warning signs are protected from trees or other objects. The glare is also one of the factors in the difficulty and readable sign of warning.

He explained that most of the most signage is based on the request of the school. If there is no request of the signage, Jabatan Kerja Raya will not build the school alert signage. This result shows that if the school itself did not concern with the school area may cause accident occurred in the area.

As conclusion from this interview, the expertise noted that majority of signage position in front of the school usually blocked by trees, car parking etc. For the Jabatan Kerja Raya, is also acting making the signage according application is taken by the school. This makes this problem persist for long periods of time.

4.4 Survey

Researcher conducted a survey is to collect the information regarding the issue and the topic study. Survey contains of 16 questions. 30 questionnaires were distributed on Shah Alam area including Sekolah Kebangsaan Seksyen 7, Sekolah Menengah Kebangsaan Seksyen 7 and Sekolah Agama Rakyat Seksyen 7. The researcher distributes the survey form to parents, workers, and drivers at peak hours.

Table 1: Gender

<i>Gender</i>	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative Percent</i>
Male	10	38	38
Female	16	62	100
total	26	100	

Table 2: Race

<i>Race</i>	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative Percent</i>
Malay	26	100	100
Chinese	0	0	100
Indian	0	0	100
Total	26	100	

Table 3: Age

<i>Age</i>	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative Percent</i>
<30	12	46	46
31- 40	7	27	73
41- 50	6	23	96
>51	1	4	100
Total	26	100	

Table 4: Academic

<i>Academic</i>	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative Percent</i>
Diploma	9	35	35
Degree	12	46	81
Master's	3	11	92
Phd	1	4	96
Other	1	4	100
Total	26	100	

Table 5: Status

<i>Status</i>	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative Percent</i>
Single	10	42	
Married	16	58	
Total	26	100	

Table 6: Children to school

	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative Percent</i>
Car		46	
Bus		54	
Total	26	100	

Table 7: Warning sign alert

	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative Percent</i>
Agreed		46	
Not		54	
Agreed Total	26	100	

Table 8: Traffic signal and a warning sign (LED)

	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative Percent</i>
Agreed		54	
Not		46	
Agreed Total	26	100	

Table 9: Understand a warning sign in the school area

	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative Percent</i>
Understand		96	
Not		4	
Understand Total	26	100	

Table 10: Difficult to see and read the sign in the school area

	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative Percent</i>
Agreed		58	
Not		42	
Agreed Total	26	100	

As conclusion from this survey, the table shows, parents send their sons to school by car rather by bus. In this survey, driver indicating that they understand a warning sign provided by the authorities and understand all the meaning of the signage are given. The survey also conclude that driver have difficulty to see and read the signage at the school area because some obstacle such as tree, car parking, etc. They also agreed that the traffic signal and a warning sign is able to create awareness in terms of readable.

5 RECOMMENDATION

There are several recommendations the researcher would like to propose for the study of transformation of signage and road markings as a medium for safety in school area. through this transformation, reducing the number of accidents involving school students will be reduced by caving medium and an effective transformation. Reduction in the accident rate with signage that more efficient compared with existing signage. Future researchers should Proposed a most transformation to help and solve this problem. Details of the analysis in this case study would benefit to future researchers in filling the gap or the issues with the same root cause.

6 CONCLUSION

This study conducted a two-pronged investigation of the safety-related effects of signage and road marking at school's area by exploring the design through Environmental Graphic Design (EGD) and also using the Light Emitting Diode (LED) as a solution to reduce accident rate, Due to high risk of accident involving students, this study showed the effectiveness of clear visual of signage and road marking. This study yielded mixed results. Whilst improving the design of signage and road marking through EGD, a new approach that can improve design be able to introduce impact effective and can reduce accidents, especially those involving school students.

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