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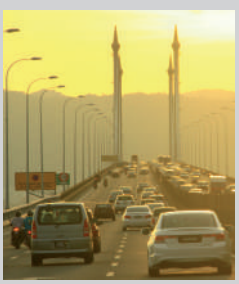
Research Report

Development of 3-Dimension (3D) Driving Animation for Digital Advertising Boards



Nurulhana Borhan
Ahmad Azad Ab Rashid
Low Suet Fin
Mohd Firdaus Mohd Siam
Siti Zaharah Ishak
Khairil Anwar Abu Kassim

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Abstract

There are huge numbers of advertising boards all around Malaysia. The advertising board has evolved from the classic board to modern boards such as electronic advertising, mobile advertising and 3D advertising boards. While the marketing industry gets more benefit on this evolution, the advertising boards may give a distraction to the drivers, especially the LED boards that were located near the road. We need to know the level of distraction from a driver's perspective on the LED boards. To recreate the real situation of the scenario, 3D animation is needed to evaluate the distraction towards LED boards. However, this project aimed to develop the LED glow effect in the animation. This development project is considered as the baseline project to the advanced phase of realistic animation in 3D evaluation scenes. The animation can be an evaluation tool for advertising projects in the future.

Abstract

There are huge numbers of advertising boards all around Malaysia. The advertising board has evolved from the classic board to modern boards such as electronic advertising, mobile advertising and 3D advertising boards. While the marketing industry gets more benefit on this evolution, the advertising boards may give a distraction to the drivers, especially the LED boards that were located near the road. We need to know the level of distraction from a driver's perspective on the LED boards. To recreate the real situation of the scenario, 3D animation is needed to evaluate the distraction towards LED boards. However, this project aimed to develop the LED glow effect in the animation. This development project is considered as the baseline project to the advanced phase of realistic animation in 3D evaluation scenes. The animation can be an evaluation tool for advertising projects in the future.

1. Introduction

There is currently a great deal of interest in the problem of driver distraction. Most research focuses on distractions from inside the vehicle, but objects outside the vehicle can also be distracting drivers. Major roads are increasingly becoming sites for advertising billboards, and there is little research on the potential effects of this advertising on driving performance.

In order to evaluate the advertisement effects, an animation to mimic the real situation has to be created. The effects on the digital lamp board in term of the brightness, font size, board position and dimension is to be measured using the animation video.

The previous study has done the animation focuses on a static billboard and taxi advertisement. No digital billboard animation for driving simulation has been done. This animation is needed to evaluate on to the level of distraction with the digital board on local roads.

1.1 Objectives

To develop a 3-Dimension (3D) animation of driving view with digital advertisement board on the roadside.

1.2 Scope of Study

To create Light-Emitting Diode (LED) glow effect in 3D animation for advertising board.

1.3 Limitation of the Study

The computer's graphics specification that was used in this project was not the latest version in the market. Hence, some software crashes always happened during the development process. The crashes have resulted in slow progress in the project's time line.

2. Literature Review

A study to evaluate the driving distraction on a digital advertisement placed at the roadside was carried out by the Malaysian Institute of Road Safety Research (MIROS) in 2014. The study showed that no distractions were recorded in the absence of digital advertisement panels at the roadside. However, when the advertisement was present, some degrees of distraction were recorded. The distraction was detected when half of the respondents failed to detect the change of traffic light from green to amber, which appeared concurrently with LED advertisements at the roadside. In another experiment, respondents stated that the flashing road sign in the LED panel was confusing to motorists. Apart from that, response time was also recorded. Absence of the LED advertisement in the road environment recorded lesser response time compared to driving in the presence of LED advertisements (Kaviyarasu, Eddy Azuan, Mohd Firdaus, Yusof Ghani, Maslina, Tan, & Wong, 2015).

According to Land Transport Safety Authority New Zealand (2001), in Advertising Design and Location Guidelines, animated, flashing and variable message signs should not be used as roadside advertising if they have any of the following characteristics:

i. They incorporate a revolving light of any colour. Such devices can also be mistaken for an emergency vehicle, road works, etc.
ii. They rotate as a whole about any axis other than a vertical one.
iii. The message is more complex than a single word, logo or symbol displayed in any direction at one time.
iv. The operating speed of the passing traffic is 70 km/h or greater.

Drivers focused their attention on the billboards when driving demand was low, such as when driving on the freeway with light to moderate traffic, in lower speed zones, or when stationary. However, when drivers were required to manoeuvre, or driving demands increased, drivers directed less attention to the billboards and focussed their awareness on the immediate driving task. This suggests that drivers can, at least under

some conditions, effectively self-regulate their attention to billboards when required to focus on the immediate traffic or driving situation (Kristie, Amanda, David, & Michael, 2017).

In Minnesota perspective, the billboards and other signage regulation shall have advertising device that shall not erected or effectively shielded so as to prevent beams or rays of light from being directed at any portion of the travelled way and also the illuminated outdoor advertising devices shall not interfere with the effectiveness of or obscure any official traffic sign, device and signal (Minnesota Department of Transportation Field Study, 1951).

Most of the previous research concentrated on the external distraction from advertisement panels placed by the roadsides, particularly billboards. Edquist, Horberry, Hosking and Johnston (2011) noted even though very little is also known about the effects of advertisements placed on the sides of buildings, back of buses and taxis, and other moving objects. Studies also proven that increasing number of visual information would increase the 'visual clutter' that distract drivers' attention (Edquist & Johnston, 2008).

Digital advertisement fixed at the roadside is expected to create a distraction for two (2) reasons: Firstly, its dynamic content, and secondly, it is at the eye level. This is based on a study by Crundall, Van Loon and Underwood (2006), which concluded that street level advertisements attract and hold attention at inappropriate times compared to an advertisement placed at raised level (three (3) meters from the ground). Therefore, the digital advertisements placed at the roadside, which can be viewed at eye level, has more potential to distract drivers while driving.

A study by Dukic et. al. (2012) found out driver who saw the billboard take quite some times to have a look at the board. The result shows there is significant longer dwell time, more fixation numbers and also longer maximum fixation duration when driving past the electronic billboard compared to other sign boards. This study also has same finding with Mollu et. al. (2018), in term of glance behaviour. Subjects made more eye glances at short display times of the billboard messages than longer display time billboard. This is by the fact people are curious or missed the information when the message changes.

Another research conducted in Iran by Sheykhfard et. al. (2020), suggesting several possibilities to reduce distraction of looking at the digital board, that are human, environmental factors and road factors. Managing human factors is more effective than managing other factors. In terms of human factors, younger, beginner and male drivers were found to be the main factors influencing the possibility of drivers' distraction. In terms of environmental factors, night and unclear weather (rain, fog, and snow) significantly increased drivers' distraction. In terms of road factors, installing digital sign boards near intersections and roundabouts, as well as high sight distance, increases risks of distraction for drivers.

3. Methodology

3.1 Study Design

The flow of animation development is divided into several phases – scenario selection, recording scenario, developing the object models in 3D, animation process and rendering.

3.2 Scenario Selection

Bandar Baru Nilai was chosen as the scene to be developed into animation for this development project. Bandar Baru Nilai is a new township situated in Negeri Sembilan. Along the main road entering the town from PLUS highway, there were several LED advertising boards in the middle of the roads. The advertising boards were fixed at lamp post along the road. A video recorder was used to capture a driving panorama along the road with advertising boards. The video recorder was placed at the centre of front car close to driver to get a driver perspective of road while driving. Figure 1 shows several screenshots from the original recorded video in Nilai. The driving view was recorded approximately 2 km along the road with vehicle speed was 60 km/h. Duration of the recorded video was 7:22 minutes. During the shooting, the weather was not so bright with chances to rain.

Figure 1 Screenshots of video recording

3.3 Animation Development Phase

The development phase was divided into five (5) phases. It took about five (5) months to complete the whole process with some delays occurred regarding computer crashes. Figure 2 shows the process of animation development in the flow diagram.

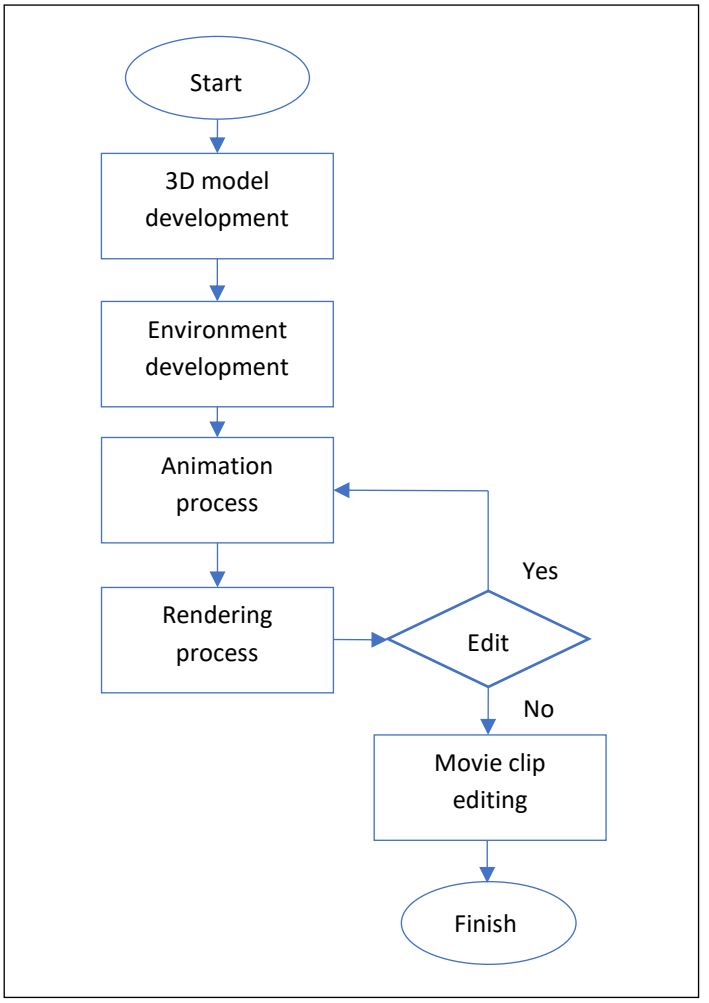

Figure 2 Process phases of Animation Development

3.3.1 3-Dimension (3D) Model Development

The recorded video as mentioned in section 3.2 was the guideline to develop the driving scenario in the form of 3D animation. The process started with modelling 3D objects using 3Ds Max Studio version 2017. In the recorded video, there were objects such as buildings, cars, lorries, trees, guardrails, lamp post, etc. Due to skill and manpower constraints, only several important objects were selected to be modelled in this project. The objects were LED advertisement boards, lamp post, guard rail, road, plant pots and trees. The size of LED board created was approximately 5 x 2 meter with the changeable bright background colour. To create objects that are close to reality, each object were texturized with suitable materials. The objects texturized were using a method called image mapping. The images for each mapping were edited and selected using Adobe Photoshop CC. Figure 3 shows an image of grass that was used to map land and also an image of gradient colour in grey to map cloudy sky. Figure 4 shows the screenshot of the object development view in 3Ds Max.

Figure 3 Sample of images for mapping texture on 3D objects

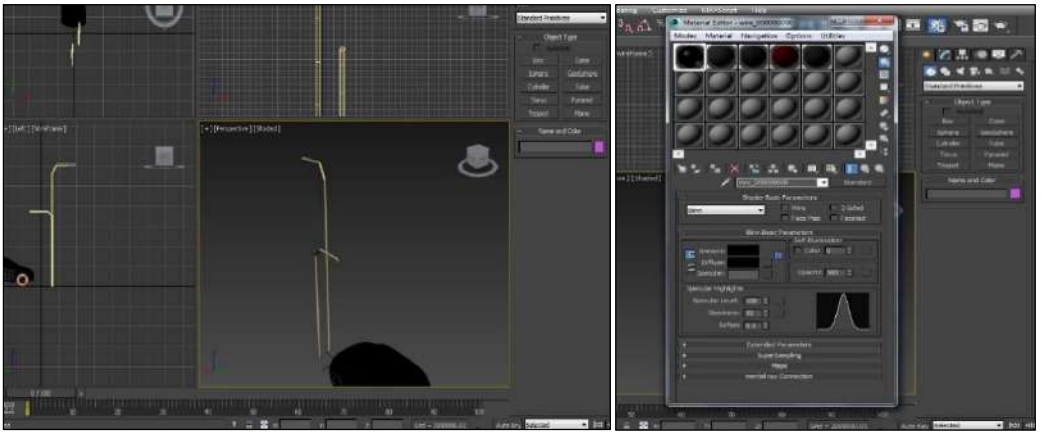

Figure 4 3D object development view in 3Ds Max

3.3.2 Environment Development

Environment development is the phase where the landscape was created. In the landscape, all the driving scenario details were created. During this phase, all of the 3D objects that were done in the modelling phase were then placed and rearranged according to the video recording. Two (2) types of scenarios were produced to see the LED board's effects in the animation– cloudy day and sunny day.

3.3.3 Animation Process

Animation process is the phase where the still scenario is programmed into motions. A camera was used to get a view from a driver perspective. Figure 5 shows the camera location in the scenario from the top view. The camera's view was set to get as close as the same view of the recorded video. Figure 5 shows the screenshot of the camera's view in the animation. The speed of the mock vehicle in this animation was not set to be the same as in the recorded video. Figure 6 shows a front view of the camera that was set as the driver is driving view.

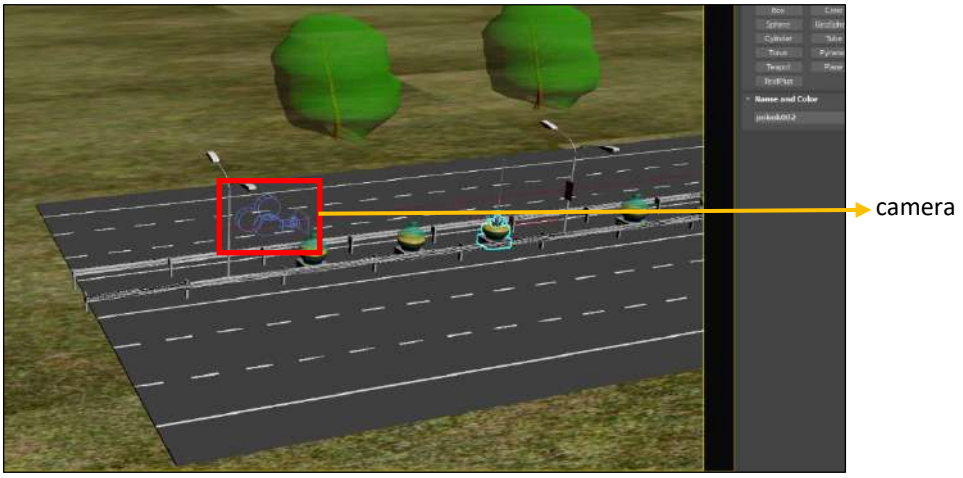

Figure 5 Camera location to create driving scenario

Figure 6 Camera's view from a driver's perspective

3.3.4 Rendering Process

The rendering process is the phase where all of the processes above were produced into a movie clip. The process will render the graphics files one by one base on the animation setting. Default renderer in 3Ds Max Studio was used to render the movie clip. The rendering process took about approximately nine (9) hours to produce one (1) movie

clip, using the computer with specifications details in section 3.4. After completing the process, the movie was compared to the original recorded video to see if there were changes need to be done. When there were some objects or scene need to be changed, the process will go back to the animation process to be edited. The loop was continued until the final movie was satisfied. The movie clip was set to produce in MOVie (MOV) format. MOV is a video file extension for Apple QuickTime.

3.3.5 Movie Clip Editing

To edit the scenario animation, movie editing tools called Movavi Video Converter 18 was used. Movie clips from MOV file format were converted into AVI file format. The files were converted into AVI files to make them easier to play on the Windows platform, as Windows Media Player cannot support the MOV files. Other than that, some captions also were put in the movie to indicate the animation scene. Figure 7 shows the process of editing the animation video clip using Movavi software.

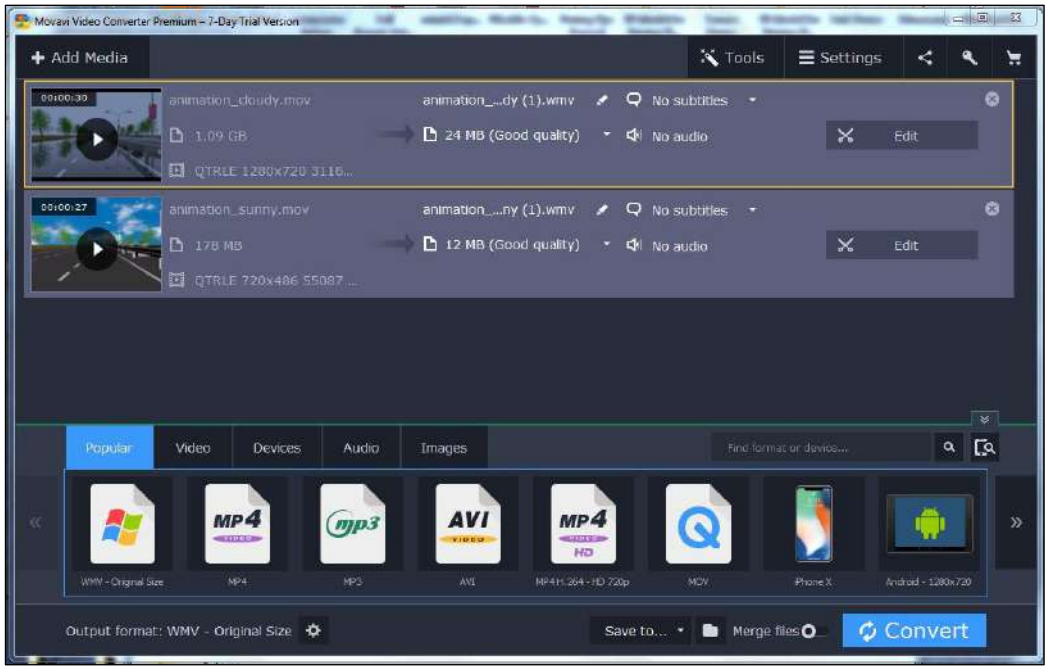

Figure 7 Files converting process from MOV file format to AVI file format

3.4 Instrument and Tools

To develop this animation, desktop computer with the following details were used:

1. Computer specification:

   - CPU: Intel (R) Xeon (R)
   - Graphics card: NVDIA Quadro 600
   - RAM: 12 GB
   - Operating system: Windows 7 Professional
   - System type: 64-bit operating system

   The computer's specification above has fulfilled the minimum requirement to develop a basic 3D and animation works in this projects. However, the graphics card could be replaced with a high-end set to avoid software crashes and computer hanged for future projects.

2. Software:

   - Animation: 3Ds Max Studio version 2017

   There are many 3D development software available in the market, but the common and well-known software among developer is 3Ds Max by Auto Desk. This is the only licensed software to develop 3D animation available in MIROS. Figure 8 shows the 3DS Max software.

Figure 8 3Ds Max 2017 software by Autodesk

- Images editor: Photoshop CC

Photoshop is one of a product from Adobe. This software was used in this project to edit images. Some images need to be crop, resize, colour-retouch or filter to match with the environment in the animation. Figure 9 shows the Photoshop CC software.

Figure 9 Photoshop CC software by Adobe

- Movie clip editing: Movavi Video Converter

Final animation videos were edited with Movavi Video Converter version 18. This software not only can convert video format to any files format but also can do some editing like crop, insert text and merge video files. Because the one that we were using was a free trial version, there were unmovable watermarks of the software company displayed in the video clips. Figure 10 shows the Movavi Version 18 software and Figure 11 shows the watermarks displayed in the video clip.

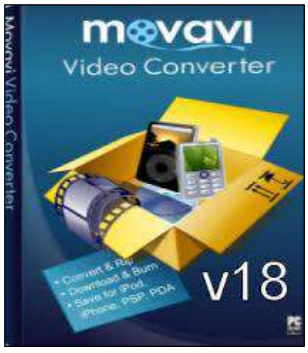

Figure 10 Movavi Video Converter version 18 software

Figure 11 Movavi watermarks displayed on the animation video

4. Results and Discussions

This project has succeeded to create two (2) videos in the 3D animation of the scenario with the LED advertising boards in Bandar Baru Nilai. The animation was rendered in 30 frames per second (fps) in total of three (3) minutes video clip. The scenario was a driving scene with LED advertising boards along the side road in a sunny and cloudy day. Softcopy of the output and all development files were saved in memory drive for future reference.

4.1 Advertising Board Animation

The advertising board that was created in this video was a unipole advertising LED board. Each advertisement was changed into the next advertisement in every 27 seconds. Figure 12 shows screenshots to compare the 3D animation created in this project and the original recorded video.

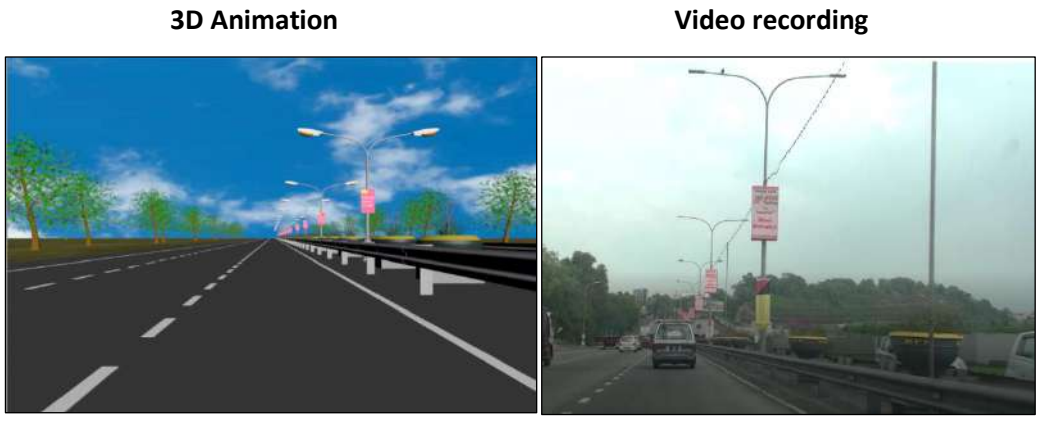

Figure 12 Screenshots of animation scenario and recorded video

During the sunny day, the LED lights of the boards have no obvious effect on the scenario. In the actual video, the bright day light has made the LED looks like a poster from a distance rather than LED board until they were changing the light. The effect was the same as in the animation.

4.2 Ambient

Base on the real video, two (2) scenarios were created in the different background - cloudy day and sunny day background setting. Cloudy day background was set in the grey background with some effects of watery and reflections on the wet road. Figure 13 shows the background on a sunny day was set with the bright, warm colour and some clouds on the sky.

Cloudy day ambient **Sunny day ambient**

Figure 13 View of cloudy day ambient and sunny day ambient

Figure 14 Ambient view of original scenario

In the original recorded video, the LED's glow was also not noticeable as the show in Figure 14. Day light brightness might be the factor of the glow effects. In both of the animations, the LED glow effect also could not be noticed. More brightness with suitable lighting effects needs to be created to produce the realistic glow effects.

4.3 Advertisement Visibility

The visibility of the advertisement board is not clear at both of animation scenarios as the fonts were too small and the background lighting could not be set like in the original video. The board itself would look like a static board if the content were not changing because of the size and the high position at the lamp post. Figure 15 shows the close view of the boards on a sunny day and cloudy day.

Sunny day **Cloudy day**

Figure 15 Advertisement board visibility in bright and grey background

Figure 16 Advertising texts on actual video

In Figure 16, the texts on the boards were easily seen and sharp from a close view. In comparison to Figure 15, the texts in the animation were not sharp and blurred. However, the font was clearer in bright background compare to when in the grey background that represents the cloudy day. Resolutions of the objects need to revise to get a sharper view of the advertising board.

5. Conclusion and Recommendations

The overall of driving scene of the presence of LED advertising boards in this development project needs to be enhanced with more high quality and more complex surrounding scene. More 3D objects need to develop to make the scenario even more realistic and the LED effects more noticeable. More experts with skill in animation are needed to produce a realistic view of the scenario.

It is recommended that night driving scene could be developed for a future development project. Lights effects are more visible during the night and can be more distracting to the drivers; hence, the effects can be evaluated with the animation. Another type of advertorial board such as free-standing billboard and spectacular gantry should be included in the animation too. Different types and sizes of the board will give more variation of advertising boards to be used in the future. More vehicles on the road should be added to have a more realistic driving view. For the development tools, it is recommended to invest in the original software to get full access to the feature that offered by the software and also to remove the watermark as well.

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Malaysian Institute of Road Safety Research
Lot 125-135, Jalan TKS 1, Taman Kajang Sentral
43000 Kajang, Selangor Darul Ehsan
Tel: +603 8924 9200 **Fax:** +603 8733 2005
Website: www.miros.gov.my **E-mail:** dg@miros.gov.my

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