

# Malaysian North South Expressway landscape character: analysis of users' preference of highway landscape elements

Z. Jaal<sup>1</sup>, J. Abdullah<sup>1,2</sup> & H. Ismail<sup>1</sup>

<sup>1</sup>*Center of Environmental Design and Management,  
Faculty of Architecture, Planning and Surveying, Malaysia*

<sup>2</sup>*Malaysian Academy of SME & Entrepreneurship Development  
(MASMED), Universiti Teknologi MARA, Malaysia*

## Abstract

A highway that is scenic and has unique landscape characters makes a journey exciting for highway users. The research discovered that the North South Expressway (E1) users prefers natural landscape characteristic (n) to cultural landscape characteristic (c). The highway landscape elements that are selected as the most attractive to the least attractive are paddy fields (n), limestone hills (n), mountain ranges (n), hilly forests (n), open green fields (n), flat terrain forests (n), palm oil estates (c), villages (c), towns (c), residential areas (c) and industrial areas (c) as the least attractive. For the natural landscape elements group, highway users selected landform, unique character, scenic, psychological and trees as the five top factors why they rated the landscape elements as attractive. And for the cultural landscape elements which received low rating, highway users gave the factors of built environment, psychological, design and unique character as the main reason why they rated cultural low. The research established that the North South Expressway users prefer the natural landscape character more than the cultural and the factors of landform, uniqueness, scenic quality, psychological effect and trees are important in making the attractive.

*Keywords: landscape character, landscape elements, highway landscape elements.*



## 1 Introduction

Landscape elements falls into different physical categories such as, landform (topographic features – open hill tops, coastlines, valleys, open green space, rice fields etc), trees (woodland, forest, hedgerows, meadows, estates, farmlands etc), water bodies (streams, rivers, coast, lakes etc) and built environment (structures, paved areas, bridges, parks, buildings, fences etc). Landscapes are considerably more than just the visual perception of a combination of landform, vegetation cover and buildings, which embody the history, land use, human culture, wildlife and seasonal changes of an area [1–3]. These landscape elements combine to produce distinctive local character and continue to affect the way in which the landscape is experienced and valued. Landscape Characters are formed by categorizing these groups into different group characters as that which are defined by Ariazza [4]; i) Have distinct and recognisable patterns of elements that occur consistently in a particular type of landscape. ii) How it is perceived by people. iii) Combination of all the landscape elements. Landscape character is a description of the landscape features, the whole view of small and large geographical areas. Sezen and Yilmaz [5] defined landscape character as the evaluation of an ecosystem.

### 1.1 Highway landscape characteristics

All types of scenery that road users could experience along the highway are elements of highway landscapes. The landscape characters that have been identified are landforms, land covers, land use, built development, any special values, special interest (nature conservation, historical, cultural heritage), other professional evaluation and past and present perception of local values. The combination of meeting accessible and affective mobility while improving the natural, built and social environment is the essence of sustainable highway (Kehagia [6]).

Garre *et al.* [7] stated that roads do not entirely open up the information content of the visual landscape and the roads plus all built fabric seems to have a negative impact on landscape appreciation and also it was discovered that the first line of elements in the visibility of the road users are the important elements to consider in creating a beautiful acceptable road or line of visual, and the degree of sensitivity depends on the role of the specific element within the whole, and the role, in turn, is sensitive to the observer and to the changing context. Thurstone 1927's Law of Comparative Judgement addressed that individuals making judgements about the same feature would give similar but not identical responses at different times. In this research, we are studying the highway users travelling in different types of transportation. Therefore their line of vision is basically at all angles of vision. Higuchi [8] identified various theories on visual structures; one of the theories by Hans Martens, a German Architect and Urban Planner stated that “total aesthetic impression is related to the range and distance that a normal human eye can encompass”. Marten's ideas with respect to distance and angle of elevation have become standard in the field



of urban design. The angle of incidence defines what the most comfortable angle of view is and in his notable book Higuchi stated that “to obtain the angle of incidence with relation to a frontal surface, we will accept Erno Goldfinger’s and Ashihara Yoshinobu’s figure of 60 degrees for the angle encompassed by our range of vision”. Goldfinger and Yoshinobu are renowned architects whose works and research has been followed and cited by researchers and designers. In this research we look at all angle of vision from a highway traveller’s position in the moving vehicle.

## **1.2 Landscape of the North South Expressway**

The Malaysian North South Expressway is the major connector that connects the Malaysian peninsular to Thailand in the north all the way to Singapore in the south. The expressway’s 742 kilometer stretch starts north at Bukit Kayu Hitam to Johor Bahru at the south (PLUS [9]). It passes through various types of natural and cultural landscapes. More than half of the country’s 329,847 km<sup>2</sup> surface is covered by trees. The topography of Malaysia consists of the flat lands on the northern and southern states and the hilly areas are in the center with the Titiwangsa Range that separates the east coast and the west coast of the peninsula. The North South Expressway totally runs on the west of the peninsula.

REAM Guide on Geometric Design of Roads [10] stated that “topography, physical features and land use plays an important factor in the location of the road and its’ design”. Therefore we need to identify the importance of these 3 elements to the design and construction of Highways in order that designers take into consideration the conservation of the important landscape elements. In this research, the highway refers to the North South Expressway.

## **1.3 Purpose of study**

The purpose of this research is to evaluate the highway users’ preference of the selected landscape elements bordering the North South Expressway. And based on the rating preference of the selected highway landscape elements, indicators as to why the landscape elements were preferred were identified. The research determined the various factors that made the particular landscape element preferred by the highway users. Since landscape appreciation is new in Malaysia, it is hoped that the research will be a start of conservation considerations of the attractive landscape elements bordering the highway. The findings will assist landscape architects, town planners, and highway engineers and designers in the design of future highways and also the upgrading of highways. With this approach, undeniably we will contribute to the development of a sustainable environment and highway landscape design. This research creates the possibility of future in-depth study of each landscape elements and the factors affecting the highway users.



## 2 Structure and organization of the research

This is a descriptive research using the quantitative approach. The findings of this research are based on a convenience sampling of 20 pilot questionnaires survey which was carried out at Rawang rest and service area. The respondents are the highway users travelling by busses, lorries, cars/vans and motorbikes. The participation of the highway users were on a voluntary basis due to factor of location and the function of the rest and service area, and consideration was given on the availability and convenience of the travelers. The selected landscape elements fall into two major landscape groups, the natural and cultural. The research concentrated on 11 selected significant landscape elements which are the flat terrain forest, hilly forest, limestone hills, mountain range, open spaces, paddy fields, palm oil estates, industrial areas, residential areas, towns and villages.

400 photographs of the North South Expressway landscape elements were taken at intervals of 4 kilometers from the 1600km stretch (Johor Bahru to Alor Setar and back to Johor Bahru). The landscape elements in this research start from the boundary of the highway outwards and do not include the highway, the advertisement billboards and infrastructures of the highway. Expert panels (EP) consisted of four academicians from two departments, the Town and Regional Planning, Landscape Architecture and one practicing landscape architect were given the task to group the 400 pictures into various landscape elements. As shown in table 1.0, 20 landscape elements were identified by the five expert panels (EP1-EP5) when they sorted the 400 pictures. The average of pictures in each group of landscape elements was calculated and the landscape element that has the highest number of pictures was selected to be studied. High number of pictures in a landscape element group indicates that the particular landscape element is mostly found on the North South Expressway and therefore is significant to be studied. The landscape elements are the flat terrain forest, hilly forest, mountain range, open green fields, paddy fields, palm oil estates, industrial areas, residential areas, towns, villages and the limestone hills. The limestone hills were included in the selected landscape elements because of its' unique characteristics in Malaysia.


Three most selected pictures from each selected landscape elements were chosen by the expert panels to represent the 11 landscape elements in the questionnaire. The 33 number of pictures were mixed arranged and no label was given except for question numbers. This was done in order not to lead the respondents into answering in group sequence and to avoid biased. A five-point scale was used to rate the preference (1, strongly unattractive; 2, unattractive; 3, average; 4, attractive; 5, strongly attractive). The highway users were asked to give a reason why they rated a particular landscape element attractive or not attractive. The answers given by the highway users' were grouped into factors such as landform, unique character, scenic, psychological, trees, built environment, design and color.



Table 1: Selection of landscape elements.

	EP1	EP2	EP3	EP4	EP5	Total	Average
<b>Forest flat terrain</b>	0	44	17	2	23	86	<b>17</b>
Hills rocks	3	6	10	7	11	37	7
<b>Hilly forest</b>	20	42	19	22	59	162	<b>32</b>
<b>Limestone hills</b>	0	7	7	11	9	34	<b>7</b>
<b>Mountain range</b>	0	15	16	5	24	60	<b>12</b>
<b>Open green spaces</b>	2	27	9	2	19	59	<b>12</b>
Rivers	5	5	4	4	4	22	4
Lakes	0	8	7	1	9	25	5
<b>Paddy fields</b>	24	30	33	23	43	153	<b>31</b>
<b>Palm oil estates</b>	11	19	14	20	12	76	<b>15</b>
Rubber estates	2	0	0	3	1	6	1
Cemeteries/parks	3	4	3	9	5	24	5
<b>Resorts/golf courses</b>	1	2	10	10	12	35	7
<b>Industrial areas</b>	4	33	28	11	20	96	<b>19</b>
Mixed Development	0	12	21	6		39	8
<b>Residential Areas</b>	24	49	40	31	38	182	36
Sprawls	0	0	0	14		14	3
Cities	0	0	0	3	8	11	2
<b>Towns</b>	2	9	9	6	63	89	<b>18</b>
<b>Villages</b>	11	21	27	16	22	97	<b>19</b>

EP1-EP5 = Expert Panel No.1 to No. 5

 11 selected landscape categories

To check the quality of the research instrument that was used in this study, the Croanbach's Alpha Coefficient reliability analysis was performed. According to Haron [11] and Neuman [12], the widely accepted social science cut-off is that alpha value should be 0.70 or higher for a set of items to be considered scale, but some use 0.75 or 0.80 while others are as lenient as 0.60. Croanbach's Alpha values are quite sensitive to the number of items in the scale and the Croanbach's Alpha values will reduce below 0.60. In this case, it may be appropriate to report mean inter item correlation for the items. The optimal range for the inter-item correlation is 0.20 to 0.40 (Briggs and Cheek [13]). The small grouping of the Standard Deviation (SD) indicates that the data points are close to the means and are the ratings are consistent and shows less variability (Field [14]). Table 2 shows the result of the test. The entire instruments that were used in this study have an acceptable internal consistency of measurement range as stated. Therefore, we can confirm that, our measurement is acceptable and valid to be used in the study.

Table 2: Research instrument reliability test.

Instrument	Croanbach's Alpha	Mean	SD
Hilly forest	0.396	4.02	0.769
Residential area	0.844	2.63	0.820
Palm oil	0.555	3.45	0.893
Open green fields	0.625	3.68	0.726
Flat terrain forest	0.423	3.58	0.807
Town	0.790	2.93	0.955
Mountain range	0.325	4.32	0.704
Limestone hills	0.822	4.38	0.862
Industrial area	0.816	2.05	0.970
Village area	0.845	3.28	0.878
Paddy fields	0.860	4.45	0.535

### 3 Results and discussion

A total of 20 highway users from 18 to 50 years old participated in the study. The participants were divided equally between male and female. The participation of the respondents was on a voluntary basis due to factor of location and function of the rest and service area, and also the availability and convenience of the travelers. The various subjective answers given by the highway users' were grouped into various factors that represents the answers. The various factors that represented the answers given by each of the respondents are; scenic, colour, unique character, landform, trees, design, built environment and psychological.

Finally, based on the result of the research, a preference rating of the selected highway landscape elements and also the factors as to why the landscape elements were selected as attractive was identified. The result of the survey is shown in table 3.0. The landscape elements fall into two characteristics, natural (n) and cultural (c). The landscape elements and the factors are arranged in ascending format, landscape element from the most attractive to the least and the factor from the most given to the least. The rating result of the most attractive to the least attractive are paddy field (c), limestone hills (n), mountain range (n), hilly forest (n), open green fields (n), flat terrain forest (n), palm oil estate (c), villages (c), towns (c), residential area (c), and industrial area (c) as the least attractive.

Table 3: Highway users rating of landscape elements.





Landscape elements (LE)	Attractive % *	Factors ***	Picture
1 Paddy field (c)	98.4	Unique character 61.7% Scenic 11.7% Built environment 8.3% Landform 6.7% Psychological 6.7% Trees 1.7% Colour 1.7% Design 1.7%	
2 Limestone hills (n)	91.7	Unique character 55.0% Landform 35.0% Scenic 5.0% Psychological 3.3% Trees 1.7%	
3 Mountain range (n)	91.6	Landform 66.7% Scenic 21.7% Trees 5.0% Psychological 5.0% Built environment 1.7%	
4 Hilly forest (n)	73.4	Landform 36.7% Scenic 16.7% Trees 15.0% Built environment 11.7% Psychological 8.3% Colour 8.3% Design 3.3%	

Table 3: Continued.








Landscape elements (LE)	Attractive % *	Factors ***	Picture
5 Open green fields (n)	58.3	Psychological 28.3% Landform 16.7% Trees 16.7% Scenic 15.0% Built environment 10% Unique character 6.7% Design 5.0% Colour 1.7%	
6 Flat terrain forest (n)	48.3	Psychological 35.0% Trees 23.3% Scenic 16.7% Design 10.0% Built environment 6.7% Colour 5.0% Landform 3.3%	
7 Palm Oil Estate (c)	46.6	Trees 31.7% Design 26.7% Psychological 25.0% Landform 11.7% Scenic 1.7% Colour 1.7% Unique character 1.7%	
8 Villages (c)	41.7	Unique character 38.3% Psychological 30.0% Built environment 28.3% Trees 1.7% Colour 1.7%	



Table 3: Continued.

Landscape elements (LE)	Attractive % *	Factors ***	Picture
9 Town (c)	30.0	Built environment 55.0% Psychological 31.7% Design 6.7% Trees 5.0% Design 1.7%	
10 Residential (c)	11.6	Built environment 60.0% Psychological 23.3% Design 8.3% Unique character 3.3% Scenic 1.7% Colour 1.7% Landform 1.7%	
11 Industrial (c)	7.0	Built environment 85.0% Psychological 11.7% Design 3.3%	

\*Combined percentage total of strongly attractive and attractive for each landscape element.

\*\*Factors in percentage given to each Landscape element.

Natural = n Cultural = c.

Table 4 shows the factors that highly influence the choice of highway users when rating the various landscape elements. Each landscape element has groups of factors that determine the choice as to why it was chosen as attractive or not attractive. Three landscape elements that are seen as *unique* are the paddy fields (61.7%), limestone hills (55.0%), villages (38.0%). The common physical factors of these three elements that were rated as unique are the landform, trees, color and built environment. Landscape elements that are chosen as highly *scenic* are the mountain range (21.7%), hilly forest (16.7%), flat terrain forest (16.7%), open green spaces (15.0%), paddy fields (11.7%) and limestone hills (5.0%). The common factors as to why these elements are scenic are landform, trees, color and built environment. From the observation above, there is a similarity of

physical factors for scenic and unique landscape elements; they both have *landform, trees, color* and *built environment* as the factors that make them attractive.

The Malaysian peninsula’s physical landform consists of hills and plains. The Titiwangsa Range runs in the middle and basically parallel and center in the peninsula, and the flat plains are at the North and South. The North South Expressway runs on the west side of the range beginning at the most northern town Bukit Kayu Hitam to Johor Bahru in the south. All the selected landscape elements are visible when highway users drive from Johor Bahru to Kedah. Highway Users will first experience the flat plains driving from Johor Bahru northwards, and after passing through the Klang Valley in the centre, the highways starts meandering through the hilly range until it reaches the flat plains near northern Perak all the way to Kedah. Malaysia is a tropical country, the United Nation’s FOA [15] stated that 62.3% of Malaysian area is forested and only 18.7% is classified as primary forest, the balance are planted forest which includes plantations with densely planted agriculture trees.

Table 4: Total of percentage for factors of landscape character.

<b>Natural (LE 1 to 6) High (98.4%–48.3%)</b>	<b>%</b>	<b>Cultural (LE 7-11) Low (&lt; 46%)</b>	<b>%</b>
Landform	165.1	Built environment	228
Unique character	123.4	Psychological	121.7
Scenic	86.6	Design	45
Psychological	86.6	Unique character	43.3
Trees	63.4	Landform	11.7
Built environment	38.4	Trees	6.7
Design	20.0	Color	5.1
Colors	16.7	Scenic	3.4

The highway users pass these forested areas as they drive from Johor to Bukit Kayu Hitam. And these forests are located mostly at the central Titiwangsa Range. The highway from Johor Bahru passes through these forested areas. The view of the paddy fields begins from Perak to Kedah. And we find the unique limestone hills at the Ipoh area. The changes in landform, types of trees, the color of the landscape elements, and the view of villages do make the journey interesting.

#### 4 Conclusion

The Road Engineering Association of Malaysia [10] noted that 3 elements, topography, physical features and land use play an important factor in the location of the road and its’ design. The research managed to identify landscape elements that fall into the three features above. We are able to identify as to why the highway users sees a landscape attractive or unattractive. The result shows that highway users prefer the natural landscape elements more than the cultural.



Landscape elements such as limestone hills, mountain range, hilly forest, open green spaces, flat terrain forest, palm oil estates, paddy fields and villages received high percentage on being attractive and strongly attractive. They are categorized as unique and scenic too. The physical factors influencing the highway users to rate the above landscape elements as attractive are landform, trees, color and built environment. Where else towns, residential and industrial areas were rated unattractive, and the reasons given are because of the built environment, psychological and design factors. Therefore the research has proven that highway users do have preference on the 11 selected landscape elements. By looking at the landscape element preference rating, we can conclude that highway users do prefer certain landscape elements to another. They rated the paddy fields as the most attractive, next limestone hills, mountain range, hilly forest, open green spaces, flat terrain forest, palm oil estates and villages. And the following landscape elements: towns, residential and industrial areas as the least attractive. These are the landscape elements to be given full consideration in design and construction of future highways of similar character, not forgetting applying the findings in upgrading of existing highways. In depth study of the factors selected as reasons to the choice of attractiveness and unattractive should be pursued in the future. This will undeniably help in making the highways more sustainable and appealing to the people. Overall in a bigger scale, it will enhance the scenic character of the highway and the environmental quality of the country.

## References

- [1] Guidelines for Landscape and Visual Impact Assessment 2<sup>nd</sup> Edition, *The Landscape Institute of Environmental Management and Assessment*, p. 66, 2002.
- [2] Kaplan, R., Kaplan, A., *The Experience of Nature: A Psychological Perspective*, Cambridge University Press, Cambridge, 1997.
- [3] Lothian, A., *The Landscape Quality Assessment of South Australia, PhD Thesis. Dept of Geographical and Environmental Studies*, University of Adelaide, 2000.
- [4] Arriaza, M., Canas-Ortega, J. F., Canas-Madueno, J. A., and Ruiz-Aviles, P., Assessing the visual quality of rural landscapes. *Landscape and Urban Planning*, **69(1)**, pp. 115-125, 2004.
- [5] Sezen, I., and Yilmaz, S., Public opinions about the use of highways as scenic roads: The sample of Erzurum - Caykara - Of route. *African Journal of Agricultural Research*, **5(8)**, pp. 700-706, 2010.
- [6] Kehagia, P., The implementation of sustainability in Highway Projects. *Int. J. Sus. Dev. Planning*, **4(1)**, pp. 61-69, 2009.
- [7] Garre, S., Meeus, S., and Gulinck, H. (2009). The dual role of roads in the visual landscape: A case-study in the area around Mechelen (Belgium). *Landscape and Urban Planning*, **92(2)**, pp. 125-135, 2009.
- [8] Higuchi, T., *The visual and spatial structure of landscapes*, MIT Press, 1983.



- [9] PLUS, <http://en.wikipedia.org/wiki/Malaysia>
- [10] REAM Guide on Geometric Design of Roads” *Road Engineering Association of Malaysia and Jabatan Kerja Raya*, 2010.
- [11] Haron, H., *Research Methodology [Power Point Slides]* Unpublished Manuscript, STA650, Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia, 2010.
- [12] Neuman, W.L., *Social Research Methods: Qualitative and Quantitative Approaches 7<sup>th</sup> ed.*, Pearson, 2003.
- [13] Briggs, S.R. and Cheek, J.M., The Role of Factor Analysis in the Development and Evaluation of Personality Scales. *Journal of Personality*, **55(1)** , pp. 106-48, 1986.
- [14] Field, A., *Discovering Statistics using SPSS, 3rd. Ed.*, Sage Publication Ltd, 2009.
- [15] FOA Global Forest Resource Assessment 2010 [www.foa.org/docrep/013/i1757e/i1757e.pdf](http://www.foa.org/docrep/013/i1757e/i1757e.pdf)

