



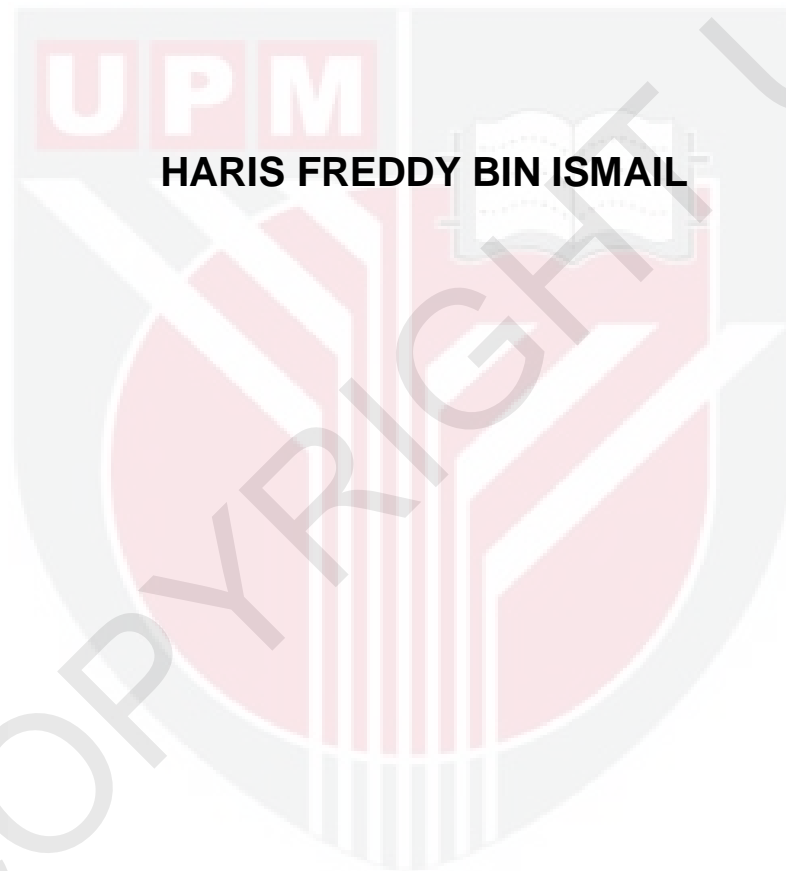
UNIVERSITI PUTRA MALAYSIA

***VISIBILITY IMPACT OF NEW COMMERCIAL
DEVELOPMENT ON HISTORICAL LANDMARKS OF
WORLD HERITAGE SITE IN BANDAR HILIR, MELAKA,
MALAYSIA***

HARIS FREDDY BIN ISMAIL

FRSB 2012 2

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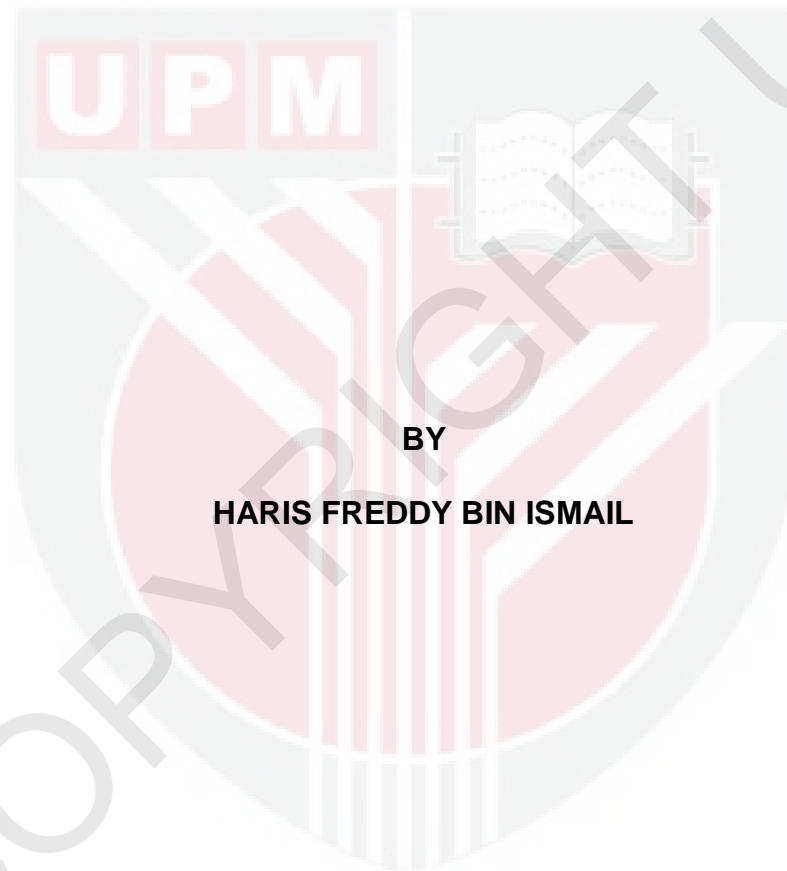


HARIS FREDDY BIN ISMAIL

**MASTER OF SCIENCE
UNIVERSITI PUTRA MALAYSIA**

2011

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HISTORICAL LANDMARKS OF WORLD HERITAGE SITE IN BANDAR
HILIR, MELAKA, MALAYSIA**



**BY
HARIS FREDDY BIN ISMAIL**

**Thesis Submitted to the School of Graduates Studies, Universiti Putra Malaysia,
In Fulfillment of the Partial Requirement for the Degree of Master of Science**

November 2011

DEDICATION

To my beloved parent, Mastiah Binti Suhaili & Ismail Abdullah

My loving sister, Elliana Binti Ismail

My Family members and friends

Thanks for your encouragement, patience and loving support



Abstract of thesis presented to the Senate of University Putra Malaysia in fulfillment of requirement for the Degree of Master of Science

VISIBILITY IMPACT OF NEW COMMERCIAL DEVELOPMENT ON HISTORICAL LANDMARKS OF WORLD HERITAGE SITE IN BANDAR HILIR, MELAKA, MALAYSIA

By

HARIS FREDDY BIN ISMAIL

November 2011

Chairman : Mustafa Kamal Bin Mohd Shariff, PhD

Faculty : Faculty of Design and Architecture

Image and character of a town or city were influenced most by the history of the place. In order to sustain the city's image and character, preservation on the visibility of landmark is important. However recently, the new commercial development which grows surrounds the historical landmark in Bandar Hilir, Melaka have unquestionably effects the visibility in the area. The purpose of this study is to measure the amount of visibility impact by constructing 3D GIS later to be analysed by using "Viewshed Analysis" (GIS). Outcome from the visibility impacts of new commercial development on historical landmark will be measured and validated by conducting a structured survey and in-depth interview. The survey will be focussing on the public awareness on significance of historical landmark while the questionnaire will be

concentrated on the professional perspective on issues of the new development within the historical landmark. A proposed recommendation design to improve the visibility of historical landmark is expected to be produced at the end of the research. This recommendation will be useful for the architects, designers and planners as their strategy in developing commercial buildings especially within a sensitive area in the World Heritage Site of Bandar Hilir, Melaka.



Abstrak yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi sebahagian daripada keperluan ijazah Master Sains

**IMPAK DAYA KETERLIHATAN KE ATAS MERCU TANDA BERSEJARAH
OLEH PEMBANGUNAN KOMERSIAL BARU DI BANDAR HILIR,
MELAKA, MALAYSIA**

Oleh

HARIS FREDDY BIN ISMAIL

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Sejarah sesebuah tempat adalah sangat penting dalam mempengaruhi pembentukan imej dan karektor sesebuah bandar atau pekan. Bagi mempertahankan imej dan karektor sesebuah bandar atau pekan tersebut pemuliharaan daya keterlihatan ke arah mercu tanda, adalah sangat penting.

Namun pada masa kini, mercu tanda bersejarah di Bandar Hilir Melaka telah dikelilingi oleh pembangunan komersil baru yang rancak yang tidak terkawal telah memberi impak dan terhadap daya keterlihatan ke arah mercu tanda bersejarah tersebut. Tujuan penyelidikan ini adalah untuk mengukur jumlah impak daya keterlihatan ke atas mercu tanda bersejarah dengan

menghasilkan model tiga dimensi (GIS), yang kemudiannya akan dianalisa menggunakan Analisis "Viewshed" (GIS). Proses penganalisaan dilakukan dengan mengukur impak daya keterlihatan mercu tanda bersejarah. Hasil analisa ini akan disahkan dan disokong oleh hasil kaedah kaji selidik dan temuramah yang akan dijalankan. Kesedaran masyarakat tentang pentingnya mercu tanda sejarah adalah fokus utama yang akan menggunakan kaedah kaji selidik. Manakala tumpuan bagi kaedah temuramah akan menfokuskan persektif pakar mengenai isu pembangunan komersil baru yang dibina di dalam kawasan bersejarah. Cadangan untuk meningkatkan daya keterlihatan mercu tanda bersejarah akan dihasilkan di peringkat akhir penyelidikan. Cadangan ini boleh diguna pakai oleh arkitek dan jururancang bandar sebagai strategi dalam membangunkan bangunan komersil baru dalam kawasan sensitif bersejarah seperti Bandar Hilir Melaka yang telah dianugerahkan sebagai tapak warisan dunia oleh UNESCO.



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This thesis was submitted to the senate of university Putra Malaysia and has been accepted fulfillment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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DECLARATION

I declare that the thesis is my original work except for quotations and citations, which have been dully acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia



HARIS FREDDY BIN ISMAIL

Date: 5 April 2012

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LIST OF ABBREVIATION

3D	3 Dimensions
AoS	Area of Sight
GIS	Geographic Information System
GPS	Global Position System
JKR	Public Works Department Malaysia
KEKKWA	Kementerian Kebudayaan, Kesenian dan Warisan
MBMB	Majlis Bandaraya Melaka Bersejarah
PERZIM	Melaka Museum Cooperation
PM	Particular Measurement
SAP	Special Area Plan
SSP	State Structure Plan
TCPD	Town and Country Planning Department
UNESCO	United Nations Educational, Scientific and Cultural Organization
VA	Visual Area
VIA	Visual Impact Analysis
VR	Visual Reality
WHC	World Heritage Commercial
WHS	World Heritage Site

CHAPTER ONE

1.1 Introduction

Melaka's historical city is well-known for its World Heritage Tourism Destination. UNESCO's recognition of Melaka as a world heritage site on July 7th 2008 has brought more foreign tourists into the country. Melaka begins as a small fishing village and expanded to become one of the most powerful Sultanate rule of the Malay Archipelago, in 1402 as well as a legendary Malay emporium and international port at the turning point of civilisation between Eastern Asia and the West. The historical timeline of the development of Melaka can be traced back to five important phases; the Malay Sultanate period, the Portuguese period, the Dutch period, the British period the Post-Independence until present time period. Since the last decade, Melaka has witnessed tremendous changes in the townscape with rapid economic development. The new development of Melaka as a historical city concentrated within the heritage zone is experiencing a serious effect on Melaka's image as World Heritage Site (WHS) as it gradually lost its identity and individuality.

1.2 Problem statement

There are numerous problems identified in the local plan preparation such as;

1.2.1 The Poor Visibility of Historical Landmark

This issue has grown in the light of visibility impact of Melaka historical landmark where the tall buildings and high building density has blocked the views of notable historical landmarks such as Kota A'Famosa, Stadhuys and St. Paul Church. According to Sulaiman (1992), the historic core area is now enclosed within the modern entity and thus, the pressure is felt as the development is threatened by its existing original form.

Furthermore, the crisis of the new commercial development is centred on the building of a four high-rise hotel in the heritage core area in the heritage buffer zone. In another similar problem regarding Malaysia World Heritage Site, Penang has violated some guidelines approved by the World Heritage Committee (WHC). This issue was a series of challenge that draws WHC's attention to Melaka historical city, which could also threaten Melaka's World Heritage Site listing. This view is supported by Sulaiman (1992); the legibility of the historical core area, example Malaysian old town centre was reduced gradually due to modern development that intruded the physical appearance and image.

As physical changes occur at an alarming speed, the role of past cultural homogeneity and its physical structure shall comfort to ensure its individuality and uniqueness. This rapid development growth, which surrounds Melaka heritage zone, has affected its historical landmarks such as Fort A'Famosa, Stadhuys and St. Paul Church.

These landmarks were a significant feature in creating the image of Melaka Historic City. Lynch (1960) cited that most people were used to landmarks to an extent in organizing the city and selecting routes for trips. When a history, a sign, or a meaning is attached to an object, its value as a landmark is raised. In addition, Lynch (1962) added that some aspects of landmarks were unique and memorable because spatial prominence can create landmarks by making it visible from many locations. This is clearly seen from many angles and distances over the tops of smaller elements for it has the satisfying qualities of reconcilability at many levels of reference as well as of symbolic coincidence in visual importance.

The new commercial development, which grows around the heritage zone, has unquestionably affects the visibility of the historical landmarks in the heritage zone area. This new commercial development has resulted problems, which have affected Melaka's status as a World Heritage Site. Thus, this study seeks to address the visibility impact of selected new commercial development on the historical landmarks of Melaka.

1.3 Research question

What is the impact of commercial building on the historical landmark?

1.3.1 Sub-research question

- a) How can GIS be employed to measure the impact of commercial building?
- b) How to improve the visibility of historical landmark?

1.4 Significance of study

1.4.1 Significance for Physical Planning

If the fast process of urban growth or rapid urbanization is allowed to take place in an uncontrollable and unregulated manner, it will lead to a less healthy urban environment. Apart from that, improper planning and control mechanisms too shall lead to the deterioration of quality of life, deforestation, inappropriate land use and others. In order to control the high rise development, it is necessary to prepare design proposal and well-built analysis that serves as a tool in development of control and guidelines. The usage of GIS application is a tool to serve in improving the visibility of the historical site of Melaka.

1.4.2 Significance for the Town Planning Profession

GIS application allows town planners to analyse spatial planning decision problems, generate alternative solutions to the decision problems and evaluate the alternative solutions to present those findings to the decision makers. In Malaysia, efforts towards the implementation of GIS application in planning and decision making process have been an ongoing process. The benefits of using GIS application is that it assists in better decision making process for planners, architects and designers in the development of structure in sensitive areas notably in the World Heritage Site in Bandar Hilir, Melaka.

1.5 Goal and objective

The goal of this study is to measure the visibility impact of selected new commercial development on the historical landmarks in Melaka city centre using the Geographic Information System (“Viewshed analysis”, ArcGIS) as a tool.

1.5.1 Objectives of Study

The following objectives have been defined for this study: -

1. To identify characteristics of the selected commercial buildings which influence the visibility of the historical landmark in Melaka city centre

2. To measure the visibility impact of selected commercial development on the visibility of the historical landmark in Melaka city centre.
3. To validate the result using other methods by identifying the purpose of visiting and significance of landmark in Bandar Hilir based on public perception and real issue and problem of current guideline on visibility based on expertise view.
4. To recommend planning guidelines to improve the visibility of the historical landmarks in Melaka city centre.

1.6 Structure of study

This study comprises of six chapters. Chapter one emphasizes the background of the study, which includes an introduction to the research, problem statement, research question, and significance of the study, goal and objectives and structure of the study. Chapter two and three is the literature review, which was obtained from various sources such as books, published journals, magazines, newspapers, and websites. These chapters are very important as it gives a clear picture about the subject matter. Chapter two gives a better understanding on concept of visibility while chapter three gives a brief explanation on the scenario of the development of Bandar Hilir, Melaka. Chapter four shall stress on the research method, which is being applied in this research. In Chapter five, the thesis will be emphasizing on the analysis and findings of the study. This chapter is important in achieving the goals and objectives of the study. Lastly, chapter

six will be the conclusion and recommendations based on the study that had been conducted.

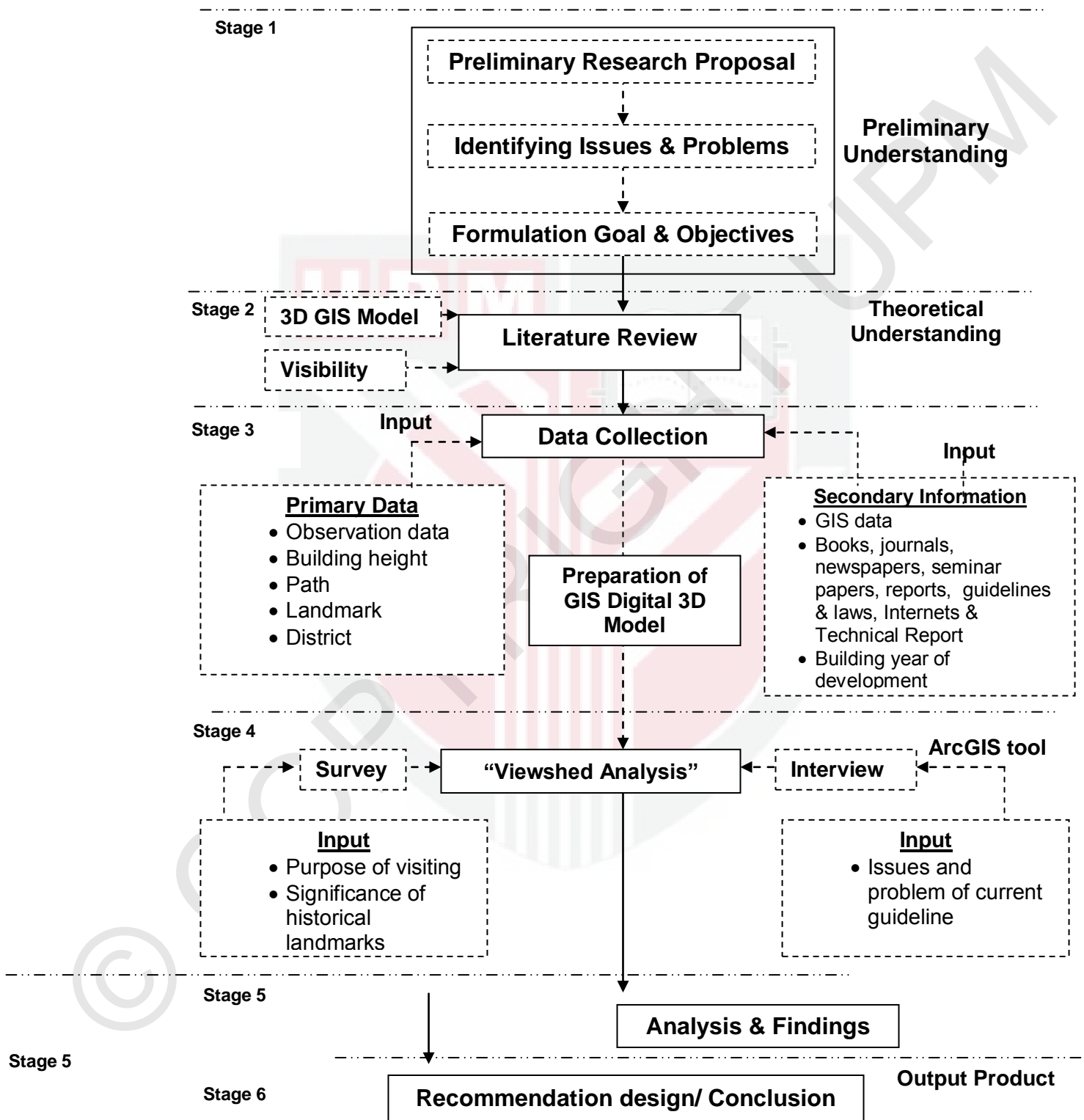


Figure 1.1: Study Approach Flow Chart

1.7 Conclusion

Chapter one acts as the foundation for the study as it ensures the flow of the study to the end as it defines the overall framework of the study and the most important aims to be achieved. This chapter describes in detail on what this study is all about, starting from the identification of the research problems at the initial stage of the work to the scope of the study to the significances of the research. Therefore, this chapter has explained many essential aspects of the study that should be understood before proceeding with the next chapters. The structure of study briefly explains what need to be done in this research in order to achieve the goal and its objectives that have been mentioned earlier. Without a proper organised framework, this project may not achieve its aim.

REFERENCES

- A. Penn (2003). Space Syntax and Spatial Cognition or Why The Axial Line? . *Environment and Behavior*, 35(1), 30-65.
- Bacon, E. (1974). *Design of Cities*. New York: The Viking Press.
- Bafna (2003). Space syntax: Brief introduction to its logic and analytical techniques. *Environment and Behavior*, 35(1), 17-29.
- Bell, P. A., Fisher, J. D., Baum, A., & Greene, T. C. (1990). *Environmental Psychology*. London: Rinehart & Winston, Inc.
- Bell, S. (2001). Landscape Pattern, Perception and Visualisation in The Visual Management of Forests. *Landscape and Urban Planning*, 54, 201-211.
- Benedikt, M.L., 1979. To take hold of space: isovists and isovist fields. *Environ. Plann. B* 6, 47–65.
- Bishop, I.D., Wherrett, J.R., Miller, D.R., 2000. *Using depth variables as predictors of visual quality*. *Environ. Plann. B* 27, 865–875.
- Briggs, A. (1967). Urban Perspective: A Review Article. *Urban Studies*, 4, 165-169.
- Burton, E., & Mitchell, L. (2006). *Inclusive Urban Design: Street For Life*. Oxford, UK: Architectural Press.
- Carmona, M., Heath, T., Oc, T., & Tiesdell, S. (2003). *Public Places-Urban Spaces : The Dimensions of Urban Design*. Oxford: Architectural Press.
- Chase, W. G. (Ed.). (1986). *Visual Information Processing (Vol. 2)*: John Wiley and Sons.
- Clarence H. Graham, Neil R. Barlett, John Lott Brown, Yun Hsia, G.Mueller, C., & A.Riggs, L. (1965). *Vision and Visual Perception*. New York: John Wiley and Sons, Inc.,.
- Darken, R. P., & Banker, W. P. (1998). *Navigating in Natural Environments: A Virtual Environment Training Transfer Study*. Paper presented at the IEEE 1998 Virtual Reality Annual International Symposium, Los Alamitos, California.
- DeFloriani, L., Magillo, P., 2003. *Algorithms for visibility computation on terrains: a survey*. *Environ. Planning. B* 30, 709–728.

- Dolbani, M. (2000). *Responsive Public Open Space in the City Centre of Kuala Lumpur*. Oxford Brookes University.
- Eco, U. (1973). *Function and sign: Semiotics of Architecture, VIA (Structures Implicit and Explicit)*. Philadelphia: University of Pennsylvania Press.
- Egenhofer, M., & R. Golledge (Eds.). (1998). *Spatial and Temporal Reasoning in Geographic Information Systems; Spatial Information Systems*. New York: Oxford University Press.
- Ellis, P. (1982). *Shared Outdoor Space and Shared Meaning*. *International Review of Applied Psychology*, 31, 209-222.
- Evans, G. W. (1980). *Environmental Cognition*. *Psychological Bulletin*, 88, 259-287.
- Evans, G. W., Fellows, J., Zorn, M., & Doty, K. (1980). *Cognitive Mapping and Architecture*. *Journal of Applied Psychology*, 65, 475-478.
- Evans, G. W., Smith, C., Pezdek, K., (1982). *Cognitive Maps and Urban Forms*. *Journal of the American Planning Association*, 48, 232-244.
- G.Vinson, N. (1999, 15 - 20 May 1999). *Design Guideline for Visual Support Navigation in Virtual Environments*. Paper presented at the ACM SIGCHI Conference on Human Factors in Computing Systems, Pittsburgh, Pennsylvania, USA.
- Garling, T., Book, A., Lindberg, E., & Nilsson, T. (1981). Memory For The Spatial Layout of The Everyday Physical Environment: Factors Affecting Rate of Acquisition. *Journal of Environmental Psychology*, 1, 263-277.
- Gauvain, M. (1993). The Development of Spatial Thinking in Everyday Activity. *Development Review*, 13, 92-121.
- Germino, M.J., Reiners, W.A., Blasko, B.J., McCleod, D., Bastian, C.T., 2001. *Estimating visual properties of Rocky Mountain landscapes using GIS*. *Landscape Urban Plann.* 53, 71-84.
- Gibson, J. J. (1950). *The Perception of The Visual World*. Boston: Houghton Mifflin.
- Gibson, J. J. (1979). *The Ecological Approach to Visual Perception*. Boston: Houghton Mifflin.
- Gibson, J. J. (Ed.). (1972). *A Theory of Direct Visual Perception*. New York: Gordon and Breach.
- Golledge, R. G., & Stimson, R. J. (1997). *Spatial Behavior*. New York: The Guilford Press.

- Haq, S., & Giroto, S. (2003). *Ability and intelligibility: Wayfinding and Environmental Cognition in The Designed Environment*. Paper presented at the 4th International Space Syntax Symposium, London.
- Hillier, B., Penn, A., Hanson, J., Grajewski, T., & Xu, J. (1993). *Natural Movement: Or Configuration and Attraction in Urban Pedestrian Movement*. *Environment and Planning*, 20, 29-66.
- Hirtle, S. C. (Ed.). (2006). *Navigation in Electronic Environment*. Heidelberg: Springer.
- Hirtle, S. C., & Jonides, J. (1985). *Evidence of Hierarchies in Cognitive Maps*. *Memory & Cognition*, 13, 208-217.
- Holding, C. S. (1992). *Cluster and Reference Points in Cognitive Representations of The Environment*. *Journal of Environmental Psychology*, 12, 45-55.
- Iser, W. (1978). *The Act of Reading: A Theory of Aesthetic Response*. Baltimore: Johns Hopkins University Press.
- Ittelson, W. H. (1978). *Environmental Perception and Urban Experience*. *Environment and Behavior*, 10, 193-213.
- Janzen, G., Schade, M., Katz, S., & Herrmann, T. (2001). Strategies For Detour Finding In A Virtual Maze: The Role Of The Visual Perspective. [doi: DOI: 10.1006/jevp.2000.0195]. *Journal of Environmental Psychology*, 21(2), 149-163.
- Kaplan, S. (1983). A Model of Person / Environment Compatibility. *Environment and Behavior*, 15, 311-332.
- Kuipers, B. J., & T.S. Levitt (Eds.). (1988). *Navigation and mapping in large-scale space*.
- Lazlo, E., & Masulli, I. (1993). *The Evolution of Cognitive Maps: New Paradigms For The Twenty-First Century*. Amsterdam: Gordon and Breach Publishers.
- Llewelyn-Davies (2000). *Urban Design Compendium*. London: Llewelyn-Davies.
- Llobera, M., 1999. *Landscapes of experiences in stone: notes on the humanistic use of GIS to study ancient landscapes*. Ph.D. Thesis. Oxford University, Oxford.
- Llobera, M., 2003. *Extending GIS-based visual analysis the concept of visualscapes*. *Int. J. Geogr. Inf. Sci.* 17, 25–48.

- Lozano, E. E. (Ed.). (1988). *Visual Needs in Urban Environment and In Physical Planning*. New York: Cambridge University Press.
- Magliano, J. P., Cohen, R., Allen, G. L., & Rodrigues, J. R. (1995). *The Impact of Wayfinder's Goal On Learning a New Environment: Different Types of Spatial Knowledge As Goals*. *Journal of Environmental Psychology*, 15, 65-75.
- Masram, H., Jaafar. Z., Ujang, N. (2009), *The impact of new commercial development on Melaka Heritage site in Bandar Hilir*, Unpublished raw data (RUGS)
- McCormick, B. H., Defanti, T. A., & Brown, M. D. (1987). Visualization in Scientific Computing. *Computer Graphics* 21.
- Miller, D., 2001. *A method for estimating changes in the visibility of land cover*. *Landscape Urban Plann.* 54, 91–104.
- Moar, I., & Bower, G. H., (1983). *Inconsistency in spatial knowledge*,. *Memory & Cognition*, 11, 107-113.
- Montgomery, J. (1998). *Urbanity, Vitality and Urban Design*. *Journal of Urban Design*, 3, 93-116.
- Motloch, J. L. (2001). *Introduction to Landscape Design* (2 ed.). Canada: John Wiley & Sons, Inc.
- Ohsawa, Y., & Kobayashi, T. (2005). An analytical Model to Assess The Visibility of Landmarks. *Geographical Analysis*, 37, 336-349.
- Rana, S., (2003). *Fast approximation of visibility dominance using topographic features as targets and the associated uncertainty*. *Photogrammetric Engineering and Remote Sensing* 69 (8), 881–888.
- Rigaux, P., Scholl, M. O. & Voisard, A. (2001) *Spatial Databases: With Applications to GIS* (San Francisco: Morgan Kaufmann Publishers).
- Paddison, R. (Ed.). (2001). *Handbook of Urban Studies*. London: SAGE Publications Ltd.
- Paliou, E., Wheatley, D., 2011. *Three-dimensional visibility analysis of architectural spaces: iconography and visibility of the wall paintings of Xeste 3*. *Journal of Archaeological Science Applications in Archaeology Conference*. pp. 375 -386.
- Pocock, D., & Hudson, R. (1978). *Images of The Urban Environment*. London: Macmillan.
- Porteous, J. D. (1996). *Environmental Aesthetics: Ideas, Politics and Planning*. London: Routledge.

- Portugali, J. (1996). *The Construction of Cognitive Mapping* Dordrecht: Kluwer.
- Sadalla, E. K., Burroughs, W. J., & Staplin, L. J. (1980). *Reference Points in Spatial Cognition*. *Journal of Experimental Psychology: Human Learning and Memory and Cognition* 6, 516-528.
- Sander, H.A., Manson, S.M., *Height and locations of artificial structures in viewshed calculation: How close is close enough?*, *Landscape and Urban Planning*, Volume 82, Issue 4, pp. 257-270
- Simonds, J. O., & W.Starke, B. (2006). *Landscape Architecture: A Manual of Environmental Planning and Design* (4th ed.). United States of America: McGraw-Hill Companies, Inc.
- Smith, P. F. (Ed.). (1980). *Urban Aesthetics*. London: Studio Vista.
- Southall, J. P. C. (1993). *Mirrors, Prisms and Lenses*, . New York Macmillan.
- Stamps, A. E., & Nasar, J. L. (1997). Design Review and Public Preferences: Effects of Geographical Location, Public Consensus, Sensation Seeking, and Architectural Styles. *Journal of Environmental Psychology*, 17, 11-32.
- Suleiman, S., & Crossman, I. (1990). *The Reader in The Text: Essays on Audience and Interpretation* Princeton: Princeton University Press.
- Tiebout, C. (1956). *A Pure Theory of Local Expenditures*. *Journal of Political Economy*, 64, 416-424.
- Tversky, B. (1981). Distortions in Memory for Maps. *Cognitive Psychology*, , 13, 407-433.
- Tversky, B., Franklin, N., Taylor, H. A., & Bryant, D. J. (1994). Spatial Mental Models From Descriptions. *Journal of the American Society for Information Science*, 45(9), 656-669.
- Ward, L. M., Snodgrass, J., Chew, B., & Russell, J. A. (1988). The Role of Plans in Cognitive and Affective Responses to Places. *Journal of Environmental Psychology*, 8, 1-8.
- Wickens, C. D. (1992). *Engineering Psychology and Human Performance* (2 ed.). New York: Harper Collins Publishers Inc.
- Yaakup, A.B. and Johar, F. Maidin, M.A, Ahmad E.F. (2007). *GIS And Decision Support Systems for Malaysian Development Plan Studies*. *Eprints. Universiti Teknologi Malaysia*.