

**INFLUENCE OF URBAN FORM ON PEDESTRIAN
PERCEPTION OF WALKABLE ENVIRONMENT**

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This thesis is dedicated to all those who believe in the richness of learning

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ABSTRACT

Planning pedestrian environments requires assumptions about how pedestrians will respond to characteristics of the environment as they formulate and enact their walking itineraries. As a consequence, most research interest in public environments focuses on behaviour in relation to those characteristics. This research is an examination of the relationship between aspects of urban form and pedestrian perceptions toward walking. The concept of Walkability is a popular concept that is widely used in urban centres of developed countries. It is obvious that the concept has contributed a great deal to the urban environment, more importantly; it has returned the urban areas to the pedestrian to use, enjoy, shop apart from the fact that walking contributes to reduce the negative impact of vehicular traffic. To the tourists, walking is the main mode of communication for them to know the life style, culture, architecture of the locals apart from doing some shopping. In relation to this, a study is conducted in a selected study site around historical core of Melaka town, between A'famosa and Dutch Square as the main tourist centers. The characteristics of "Walkable environments" as identified in the literature review formed the basis to evaluate whether the study area meets the characteristics of walkable street. This research also employed observation survey that identified the characteristics of urban forms. Another important component is to study and identify the pedestrian perception of walkable environments by questionnaires were conducted in several selected locations in and around the study area. Based on the findings; issues, problems and suggestions were compiled, analyzed and finally schematic and conceptual solutions were formulated. Because pedestrians value the shortest, safest, least-crowded, and easiest to navigate routes, this study found that confusing routes, unsafe or indirect connections, and a lack of amenities detract from the walkability in Melaka historic centre.

ABSTRAK

Merancang persekitaran pejalankaki memerlukan andaian bagaimana pejalankaki tersebut bertindakbalas kepada persekitaran semasa mereka merangka perjalanan mereka. Kebanyakan kajian hanya tertumpu kepada perlakuan pejalankaki di persekitaran awam dan kurang terhadap kajian tindakbalas ini. Kajian ini akan mengkaji perkaitan di antara aspek rupabentuk bandar dan persepsi pejalankaki. Konsep 'walkability' adalah konsep yang popular yang digunakan secara meluas di kawasan perbandaran di negara-negara maju. Ini menandakan bahawa konsep tersebut telah berjaya menyumbang kepada persekitaran bandar, terutamanya dalam menjadikan kawasan bandar mesra pejalan kaki dan mengurangkan impak negatif kenderaan. Kepada pelancung, berjalan kaki adalah kaedah komunikasi bagi mereka mengetahui tentang cara hidup, budaya, senibina tempatan selain dari membeli belah. Kajian ini tertumpu kepada kawasan bersejarah di sekitar daerah Melaka, di antara A Famosa dan Laman Belanda yang menjadi tumpuan pelancung. Kerekotor persekitaran mesra pejalankaki seperti yang dibincangkan di kajian literatur menjadi asas bagi menilai samada kawasan kajian memenuhi kecirian kawasan mesra pejalankaki. Kajian ini juga mengetengahkan kajiselidik bercorak pemerhatian yang akan mengidentifikasi rupabentuk bandar. Komponen penting yang lain adalah kajian persepsi pejalankaki terhadap persekitaran melalui soalselidik pejalankaki di kawasan kajian. Berdasarkan kepada penemuan kajian, masalah dan pandangan akan dikumpul seterusnya dianalisis dan penyelesaian akan dicadangkan. Pejalankaki mementingkan jalan singkat, selamat, kurang sesak dan mudah, dan kajian ini telah membuktikan bahawa jalan yang mengelirukan, tidak selamat dan tidak bersambung secara langsung serta tidak mempunyai prasarana akan mengurangkan pejalankaki di kawasan Melaka yang bersejarah.

Table of Content

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xi
	LIST OF FIGURES	xii
1.	INTRODUCTION	1
	1.1. Introduction to pedestrian perception of walkable environment	1
	1.2. Background of study	2
	1.3. Importance of walking as a choice to travel	2
	1.3.1. Walking and sense	3
	1.4. Impact of density on travel behavior	4
	1.5. Impact of land use on travel behavior	5
	1.6. Impact of design of street network on travel behavior	5
	1.7. Aim	7
	1.8. Objectives	7
	1.9. Research questions	7
	1.10. Significant of study	8
	1.11. Problem statement	8

1.12. Organization of dissertation	9
2. BACKGROUND OF STUDY	10
2.1. Introduction	10
2.2. Walkability	11
2.2.1. Walkability: A characteristic of Built Environment	11
2.2.2. Walkability : A quality	12
2.2.3. Walkability : A measure	13
2.2.4. Walkability : A condition	13
2.2.5. Walkability: Today	14
2.2.6. Empirical studies on factors influencing walkability	14
2.3. Perception	18
2.4. What the Pedestrian Wants?	21
2.5. Effects of trip purpose on preferred walking environment	23
2.6. Pedestrians and walking behaviour	27
2.7. What Causes People to Walk? (Non physical aspect of urban form)	28
2.7.1. A Reason to Walk	29
2.7.2. A Safe Walk	29
2.7.3. A Comfortable Walk	32
2.7.4. An Interesting Walk	34
2.8. Brief history of urban form	35
2.8.1. Imperfect grids	36
2.8.2. Decay of Grids	36
2.8.3. Curved Streets	38
2.8.4. Antiquity	39
2.8.5. Medieval Times	41
2.8.6. Renaissance	44
2.8.7. Baroque	45
2.8.8. Industrial Era	48
2.8.9. Modernism & Other Viruses	50
2.8.10. The New Urbanism	51
2.9. Influence of urban form on walkability	53
2.9.1. Land Use Impacts on travel behaviour	53
2.9.2. Evaluating Land Use Impacts	53

2.9.3. Individual Land Use Factors	55
2.10. Planning and design for pedestrians	67
2.10.1. Objectives of pedestrian planning	67
2.10.2. Improvement program for pedestrians	70
2.11. Types of pedestrian precincts classified as malls	71
2.12. Pedestrian walking distances	72
2.13. Universal design and accessibility	72
2.14. Perception of personal space: Body Buffer Zone	73
2.15. Perception of urban space	74
2.16. How urban form might influence people's choice of travel	75
2.17. Walking as a choice of travelling	75
3. RESEARCH METHODOLOGY	78
3.1. Introduction	78
3.2. Spatial Immersion	80
3.3. Essential elements of walkability	82
3.4. Survey /Observation/ Recording	83
3.4.1. Pedestrian and Activity	84
3.4.2. On-street Environment survey	84
3.4.3. Elements of visual variety	85
3.4.4. Condition of the Building Structure on both side of the street	85
3.4.5. On-street Commercial Spaces	85
3.4.6. Street definition, and Street width - Building height ratio	86
3.5. Data collection method	86
3.5.1. Primary data	86
3.5.2. Secondary data	87
3.6. Study area	88
3.6.1. General background of study area	88
3.6.2. Study site	90
4. DATA ANALYSIS	92
4.1. Morphological analysis of historic center of Melaka	92

4.1.1. Morphological transformation of public place in historic town of Melaka	92
4.1.2. History and evolution of Padang Pahlawan	93
4.1.3. Form evolution	95
4.1.4. Land use pattern	96
4.1.5. Street layout	97
4.1.6. Buildings	98
4.1.7. The natural components/ elements	98
4.2. Influence of Padang Pahlawan on the historic area of Melaka	99
4.3. Walkability analysis	100
4.3.1. Pedestrian route selection	101
5. FINDINGS AND DISCUSSIONS	108
5.1. Behavioral outcome : the connection to the walking behavior	108
5.2. Summary of walking behavior findings	109
5.3. Synthesis of findings	113
5.3.1. What does the literature tell us?	113
5.4. A working definition of walkability	116
6. CONCLUSION	119
REFERENCES	123
APPENDIX: QUESTIONNAIRE	131

List of Tables

TABLE NO.	TITLE	PAGE
2-1	Illustrate the factors affecting walkability	15
2-2	Summary of studies on non-functional qualities of a good walking environment	26
2-3	Summary of the factor affecting travel behavior	66
5-1	Factor effecting walkability	109
5-2	Summary of Findings from Walking Behaviour Literature	111
5-3	List of variables and prescriptions of walkability	117

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
Figure 1-1	Walking and sense	4
Figure 2-1	Our perceptions enclose us in a bubble, the surface of which can get further and further away from the objective, Cartesian space we stand on	19
Figure 2-2	butchered from Gibson(1958) and Ajzen(1991)`	20
Figure 2-3	Two maps of Aosta	37
Figure 2-4	Erbil, 1944	40
Figure 2-5	Curved "straight" street, Naarden	41
Figure 2-6	Hemicycle, Nancy	46
Figure 2-7	Post-1755 Reconstruction, Baixa, Lisbon	47
Figure 2-8:	Rue de Rivoli, Paris	49
Figure 3-1	Overlay perception of the urban environment on that urban environment	81
Figure 3-2	Galvanic Skin Response to a walk, No attempt is made to relate this to morphological characteristics, and an interview is needed to clarify reasons for high response levels (Nold, 2008)	82
Figure 3-3	Study area	90
Figure 3-4	Destination 1: A'Famosa	91

Figure 3-5 Destination 2: Dutch Square	91
Figure 4-1 Map showing the form evolution of Padang Pahlawan from 1930 to 2008	95
Figure 4-2 Left : View of Padang Pahlawan and Melaka straits taken from St. Paul Hill in 1968,Right; View of Dataran Pahlawan the new open space replacing Padang Pahlawan taken from St. Paul Hill in 2009	95
Figure 4-3 Demographic chart	101
Figure 4-4 Possible routes between proposed destinations	103
Figure 4-5 Percentage of Pedestrian routes selection	104
Figure 4-6 Shows the percentage of important factors for route selection	104
Figure 4-7 Level of agreements and disagreement about route No. 1	105
Figure 4-8 Physical condition of Route No.1	105
Figure 4-9 Level of agreements and disagreement about route No. 2	106
Figure 4-10 Physical condition of route No 2	106
Figure 4-11 Level of agreements and disagreement about route No. 3	107
Figure 4-12 Physical condition of route No.3	107

CHAPTER 1

1. INTRODUCTION

1.1. Introduction to pedestrian perception of walkable environment

This research attempts to investigate how urban form affects pedestrian perception of the walking environment and its contribution towards making an urban area more “walkable”. It intends to uncover some of the relationships between morphological and syntactical qualities of the urban environment and the perceptions of those walking through it and also to focus on the relationship between Urban Form and the pedestrian environment, in order to find ways of improving Urban Design so as to encourage residents to walk.

Planning pedestrian environments requires assumptions about how pedestrians will respond to characteristics of the environment as they formulate and enact their walking itineraries. As a consequence, most research interest in public environments focuses on behavior in relation to those characteristics. For example, there is a substantial body of descriptive and typological studies of pedestrian environments. Metric, geometric, and topological models have proved useful in characterizing density and direction of movement. The need to understand the mechanism travel behaviour has prompted micro scale and laboratory-based research on exploratory spatial behaviour within walking districts. Studies of behavior in relation to comfort,

the way in which images of places interrupt on choices, and how dynamic and serial experience of the city affects individual itineraries have all developed as specialized fields of understanding. In general, studies of pedestrian environment dynamics have both diversified and multiplied as its systems and methodologies are adapted for planning other environments.

1.2. Background of study

Empirical literature dealing with how urban form can influence on pedestrian perception of walking environment has been framed around three attributes of built environment: *density*, *land use* and *design of street network*. By determining the link between urban form and distances walked to/from the station, this research aims to determine the primary factors that can aid in extending acceptable walking distances. The findings of this analysis can provide researchers and planners with specific tools to design urban environments that would induce riders to walk more often and for greater distances.

1.3. Importance of walking as a choice to travel

Walking is different than other modes of transportation because it is so easy to stop, to sit down and take a break – without having to park any vehicle so walking is closely connected to staying.

The data on what people were doing when they stopped walking and were engaged in the many different activities that take place on pedestrian areas clearly showed that

spaces that are of high quality in relation to locality, climate, furnishing and design were used more those spaces of low quality. Walking is not necessarily a sign of quality in itself. But when people are stopping up, sitting down and staying that is a sign of quality.

Although beyond the scope of this study, it is worth noting that transit and walking are inextricably intertwined. It is not possible to have large-scale transit service in a non walking city, because people want to arrive at and depart from transit as pedestrians. If the urban environment surrounding transit stops do not encourage walking, most potential transit users will end up driving.

1.3.1. Walking and sense

Walking differs from other modes of transport by direct interaction between the pedestrian and their environment (Gehl, 1999). Researchers have used the ideas of sense walking, capturing what people feel and sense during a walk (Adams, 2008; Clark, 2008). Nold (2008) used GPS units to record walking routes, and measured galvanic skin response along the route to indicate “arousal” (good and bad).



Figure 1-1 Walking and sense

1.4. Impact of density on travel behavior

There is substantial amount of literature that has acknowledged density as a significant predictor of travel choice (Pushkarev and Zupan 1977; Smith 1984; Marshall and Grady 2005). A plethora of recent studies have suggested that compact developments with higher densities degenerate vehicle trips and encourage non-motorized travel by reducing the distance between origins and destinations; offering a wider variety of choices for commuting and a better quality of transit services; and by triggering changes in the overall travel pattern of households (Cervero and Kockelman 1997; Krizek 2003; Holtzclaw 1994; Ewing et al. 1994). Recent policy initiatives have focused on developing urban-form strategies with attempts to reduce auto-dependence rates by encouraging densification of development infrastructure (Washington State Growth Management Act 1990; Central Puget Sound Vision 2020).

1.5. Impact of land use on travel behavior

Explanations regarding the measurable impact of land-use characteristics on pedestrian travel and how dense land-use patterns play a significant role in encouraging walks follow similar logics. Those high density levels of mix-use and presence of retail activities near residences increase non-work trips and induce non-auto commuting (Cervero 1996; Holtzclaw 1994; Krizek 2003), and that increased levels of land-use mix at the trip origins and destinations yield in increase in walking (Frank and Pivo 1994; Cervero 1988).

1.6. Impact of design of street network on travel behavior

Transportation and urban planners have focused on the design of street networks, discussing its strength as a determinant of walking. Various quantitative measures have been suggested by the urban-design literature to evaluate pedestrian accessibility and measure street connectivity. The distance between origins and destinations for walking and the total length of streets covering an area have been employed by some authors (Handy 1996; Aultman-Hall et al 1997) to describe how the character of streets differs at neighborhood and regional levels. Pedestrian Route Directness, which measures the ratio between a chosen pedestrian route distance and the 'crow-fly' distance to a particular destination, has been studied (Hess 1997; Randall and Baetz 2001) as an indicator of how accessible a neighborhood is to the pedestrians.

Some researchers have chosen to calculate the density and pattern of intersections, average block areas and block face lengths per unit area to capture the degree of network connectivity (Southworth and Owens 1993; Cervero and Kockelman 1997; Siksna 1997). Pertinent analysis has computed higher NA (neighborhood

accessibility) levels for communities with higher street intersection densities or lower average block areas (Krizek 2000; Krizek 2003).

It has been argued that large blocks, having fewer intersections, provide a scale consistent with the automobile (Jacobs 1985), and empirical research has demonstrated an inverse relationship between the size of blocks and the levels of pedestrian traffic (Hess et al 1999). A common theme of this body of research is that inordinate size of street blocks or the lack of a fine-grained urban network of densely interconnected streets fails to promote walking (Ewing et al 2003; Hess et al 1999).

However; most studies report no significant relationships between travel and network design. A California Air Resources Board study (Kitamura et al. 1994), which involved the examination of travel behaviour in 5 selected neighbourhoods in the San Francisco Bay Area, concluded that specific individual street design characteristics (i.e. sidewalk width, intersection characteristics) and neighborhood characteristics may not be significant at every site and location in influencing transit use. Thus, the effect of street network design on overall travel remains unclear.

Another limitation of these studies is the difficulty to develop well-specified statistical models that allow researchers to accurately evaluate the individual effect of street network. Part of the reason is due to collinearity between density, land use mix and urban form. For instance; fairly compact neighborhoods in US cities generally have more varied land-uses, on average shorter block lengths with more grid-like street patterns. One facet underlying the weak explanatory power of built environment is the absence of rich land-use and urban design data. National censuses generally include travel data for large scale models at the tract level or block group level. This is a significant barrier to carrying out small scale studies at the neighbourhood level on how design of street network shapes non-motorized travel. Parcel-level or block-level land use compositions might help elucidate the different attributes of the urban network in explaining the distribution of pedestrian movement, and hence transit patronage.

1.7. Aim

To identify how different aspects of urban form encourage walkability.

1.8. Objectives

- To identify aspects of urban form that encourage walkability.
- To evaluate aspects of urban form that encourage walkability
- To evaluate pedestrian perception of urban form's aspects

1.9. Research questions

1. What are people's sense and feelings about built forms?
2. What elements of urban form have impact on people perception?
3. What elements of urban form enhance people perception of walking?

1.10. Significant of study

The aim of many recent planning investments is to reduce automobile dependence and induce non-auto commuting by implementing various urban design principles along with the ideals of New Urbanism and smart growth in re-shaping the urban form. How can urban form support pedestrian and transit-friendly development? What are the determinants of the link between urban form and non-motorized travel, namely walking and transit usage? Specifically, which urban form characteristics have a more explanatory power in revealing this relationship? These motivating questions have given rise to numerous studies on how design of built environment can change travel behaviour by shaping urban form.

To sum up, perception is a major factor in modelling walkable environments. Eventually we come across number of theories discussing factors affecting improvement of pedestrian perception. This research will analyse aspects of urban form and its influence on perception of pedestrian, which can lead to increase people's walkability sense and ultimately increase walking trips.

1.11. Problem statement

There has been substantial research on the subject of “walkability” and “pedestrianization” in the last decade. However, it has been consistently established that these thoughts and knowledge, to an extent have been restricted to theoretical concepts and have not been executed to an expected level in practice.

A distinct gap exists between the literature and implementation practices. Many communities brand themselves as “walkable community” by merely creating extensive walking trails while neglecting density, urban form, land use, building design, open spaces, streetscapes, safety and such other factors identified in the

literature as crucial for a walkable community. This research attempts to identify how the affect of different aspects of urban form can encourage people to walk.

1.12. Organization of dissertation

This dissertation is organized into six chapters. Chapters One and Two present an overview of the dissertation topic, and a review of prior research in the field. Chapter Three presents the research methodology used, including how data was compiled, and how case study was selected. Chapter Four provides a detailed description and analysis of the case study, including their demographics and urban form. Chapter Five presents the findings from the literature reviews as well as the data collection analysis. Chapter Six presents a final summary of the research findings.

REFERENCES

- Anne Vernez Moudon, et al (1996). *Effects of Site Design on Pedestrian Travel in Mixed Use. Medium-Density Environments*. Washington State Transportation Center: Document WA-RD 432.1.
- Boarnet, M. G., and R. Crane (2001). *Travel by design: The influence of urban form on travel*, New York: Oxford University Press.
- Boarnet, Marlon and Crane, Randall. The influence of land use on travel behavior: specification and estimation strategies. *Transportation Research Part A*. 35 (2001) 823-845.
- Burden, D.(2009) *Rating system for walkability, active living, and active transportation*. Walkable Communities, Inc. Unpublished Manuscript.
- Burden, D.(2009) *Walkable community criteria*. Walkable Communities, Inc. Unpublished Manuscript.
- Burden, Dan. (2009). *What makes a community walkable?* Walkable Communities, Inc. Retrieved January 1, 2009. from
- Cal Trans (2008), *Trip-Generation Rates for Urban Infill Land Uses in California Phase 1: Data Collection Methodology and Pilot Application*. California Department of Transportation
- Cervero R & Kockelman K (1997). Travel demand and the three Ds: Density, diversity, and design. *Transportation Research D*, 2, 199–219.
- Cervero R (1996). Mixed land uses and commuting: evidence from the American housing survey. *Transportation Research*. vol. 30, 361-377.

- Cervero R and Landis J (1995). The Transportation-Land Use Connection Still Matters. 2-10.
- Cervero, R. (2002). Built environments and mode choice: toward a normative framework. *Transportation Research Part D: Transport and Environment* 7. 265-284.
- Cervero, Robert and C. Radisch. (1996). Travel choices in pedestrian versus automobile oriented neighborhoods, *Transport Policy* 3, 127-141.
- Cervero, Robert (1996). Mixed land-uses and commuting: Evidence from the American Housing Survey. *Transportation Research A*, 30(5): 361-377.
- Craig, Cora L., Brownson, Ross C., Cragg, Sue E., and Dunn, Andrea L. (2002). Exploring the effect of the environment on physical activity: A study examining walking to work. *American Journal of Preventative Medicine*, 23(2S): 36-43.
- Cullen, Gordon (1961). *The Concise Townscape*. London: the Architectural Press,
- Eliot Allen and F. Kaid Benfield (2003). *Environmental Characteristics of Smart-Growth Neighborhoods*. National Resources Defense Council
- Ewing, R. and Handy S. (2009). Measuring the Unmeasurable: Urban design qualities related to walkability. *Journal of Urban Design*, 14(1), pp.65-84
- Frank LD and Pivo G (1994). *Relationship Between Land Use And Travel Behavior in the Puget Sound Region*. Olympia, WA: Washington State Department of Transportation. WA-RD 351.1
- Frank, L. D., and G. Pivo (1994). Impact of mixed use and density on utilization of three modes of travel: Single-occupant vehicle, transit, walking. *Transportation Research Record*, No. 1466, Transportation Research Board, National Research Councils, Washington DC, pp. 44-52.

- Frank, Lawrence D. & Pivo, G. (1994). Impact of mixed use and density on utilization of three modes of travel: Single-occupant vehicle, transit, walking. *Transportation Research Record*, 1466: 44-52.
- Friedman, B., Gordon, S.P., and Peer, J.B. (1994). Effect of nontraditional neighbourhood design on travel characteristics. *Transportation Research Record*, 1466: 63-70.
- Gehl, J. (1987). *Life between Buildings – Using public spaces*. New York: Van Nostrand Reinhold
- Gehl, J. and Gemzøe, L. (1996) *Public Spaces, Public Life*. Copenhagen: Danish Architectural Press and the Royal Danish Academy of Fine Arts, School of Architecture
- Gehl, J. (2005). *Close Encounters with Buildings*. Centre for Public Space Publication, Copenhagen, 2005
- Gemzøe, L. and Gehl, J. (2006). Quality for People: A set of quality criteria for the design of pedestrian places and networks with people in mind. *The 7th International Conference on Walking and Liveable Communities*. Melbourne, Australia
- Gemzøe, L (2006). *Public Spaces Public Life*. Copenhagen: The Danish Architectural Press.
- Giles, C , Billie, Broomhall, Melissa H., Knuiman, Matthew, Colins, Catherine, Douglas, Kate, Ng, Kevin, Lange, Andrea, Donovan, Robert J. (2005). Increasing walking: How important is distance to, attractiveness, and size of public open space. *American Journal of Preventative Medicine*, 28(2S2): 169-176.

- Greenwald, M.J. and Boarnet, M.G. (2001) *The Built Environment as a Determinant of Walking Behaviour: Analyzing non-work pedestrian travel in Portland, Oregon*, Centre for Activity Systems Analysis, University of California at Irvine
- Gunnarsson, Olof S. (1996). *Principles towards a walking-friendly and human city*. The Pedestrian Association of Sweden
- Handy SL (1996). Urban Form and Pedestrian Choices: Study of Austin Neighborhoods. *Transportation Research Record* 1552, 135-144.
- Handy, SL. (1996). Understanding the Link between Urban Form and Nonwork Travel Behavior. *Journal of Planning Education and Research*. (15), pp.183-197
- Handy, S., K. Clifton, and J. Fisher. (1998). *The effectiveness of land use policies as a strategy for reducing automobile dependence: A study of Austin neighborhoods*. Research Report SWUTC/98/467501-1. University of October.
- Handy, S.L., M. G. Boarnet, R. Ewing, and R. E. Killingsworth (2002). How the built environment affects physical activity: Views from urban planning. *American Journal of Preventive Medicine*, 23 (2S), 64- 73.
- Hoyt, S.H. (1993). *Old Malacca*. Oxford University Press. Kuala Lumpur. 67-68.
- Nor Zalina Harun. (2005). Problems involved in the conservation of historic settlements in Malaysia. Unpublished master thesis. International Islamic University Malaysia.
- Jacobs, Jane (1969). *The Death and life of Great American Cities*. The Modern Library. New York.
- Jeff, S. (2009). Oklahoma city: downtown walkability analysis and recommendations.

- Keith T. Lawton (2001). *The Urban Structure and Personal Travel: an Analysis of Portland, Oregon Data and Some National and International Data*, E-Vision 2000 Conference.
- Kockelman, K. M. (1997). Travel behavior as function of accessibility, land use mixing, and land use balance: evidence from San Francisco Bay Area. *Transportation Research Record*, 1607, 116-125.
- Lawrence, F. and Gary, P. (1995). Impacts of Mixed Use and Density on Utilization of Three Modes of Travel: SOV, Transit and Walking. *Transportation Research Record 1466*, pp. 44-55.
- Lee, C. & Moudon, V.A. (2006). The 3Ds+R: Quantifying land use and urban form correlates of walking, in *Transportation Research, Part D 11*, p.204-215
- Lovasi, Gina S. et al.(2008). Using built environment characteristics to predict walking for exercise. *International Journal of Health Geographics*. 7:10
- Lynch, K. (1960). *The Image of the City*. Cambridge, USA: MIT Press.
- Marcus, C. and Francis C.(1997). *People Places: design guidelines for urban open space*. John Wiley and Sons.
- Marlon B. and Randall C. (2001). The Influence of Land Use on Travel Behavior: A Specification and Estimation Strategies. *Transportation Research A*, Vol. 35, No. 9 November 2001, pp. 823-845.
- Moudon, Anne V., Hess, Paul M., Snyder, Mary C., Stanilov, K. (1997). Effects of site design on pedestrian travel in mixed-use, medium-density environments. *Transportation Research Record*, 1578: 48-55.
- Pushkarev, BS. and Zupan, JM. (1977). *Public Transportation and Land Use Policy*. Bloomington: Indiana University Press.

- Cervero, R. and Duncan, M. (2003). Walking, Bicycling, And Urban Landscapes: Evidence From The San Francisco Bay Area. *American Journal of Public Health*, vol. 93, No. 9 ,Sept. 2003, pp. 1478-1483.
- Saelens, B. E., J. F. Sallis, J. B. Black, and D. Chen (2003). Neighborhood-based differences in physical activity: An environment scale evaluation. *American Journal of Public Health*, 93 (9): 1552-1558.
- Saelens, B.E., J. F. Sallis, and L. D. Frank (2003). Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures. *Annals of Behavioral Medicine*, 25, 80-91.
- Saelens, Brian E., Sallis, James F., Black, Jennifer B., & Chen, Diana (2003). Neighborhood-based differences in physical activity: An environment scale evaluation. *American Journal of Public Health*, 93(9): 1552-1558.
- Ahmad, S. (2004). *History made at Dataran Pahlawan, Melaka*. New Straits Times.
- Sallis, James F. and Glanz, K. (2006). The Role of Built Environments in Physical Activity, Eating, and Obesity in Childhood. *The Future of Children* 16.1 (2006) 89-108.
- Sandhu, K. S. and Wheatley, P. (1983). *Melaka the transformation of a Malay capital 1400-1980*. Oxford University Press. Kuala Lumpur. pp. 278- 533.
- Scheurer, J (2001). *Car-free housing in European cities. A survey of sustainable residential development projects*. Doctoral thesis, Mourdoch University, Australia
- Schlossberg, M. *et al.* (2006). School Trips, Effects of Urban Form and Distance on Travel Mode, in *Journal of the American Planning Association*, Vol. 72, No. 3, p. 337-346

- Shay, E., Steven C and Khattak, Asad J.(2003). Walkable Environments and Walking Activity. *Final Report for Seed Grant Submitted to: Southeastern Transportation Center University of Tennessee Knoxville, Tennessee.*
- Shriver, K. (1997). Influence of environmental design on pedestrian travel behavior in four Austin neighborhoods. *Transportation Research Record*, No. 1578, Transportation Research Board, National Research Councils, Washington DC, pp. 64-75.
- Shriver, K. (1997). Influence of environmental design on pedestrian travel behavior in four Austin neighborhoods. *Transportation Research Record*, 1578: 64-75.
- Shuhana, S. and Ahmad, B. S. (2002). The role of streets in influencing the sense of place of Malaysian towns and cities. *Paper presented at Great Asean Street Symposium: Public space. National University of Singapore.*
- Shuhana, S. and Norsidah, U. (2008). *Making places: the role of attachment in creating the sense of place for traditional streets in Malaysia.*
- Siksna A. (1997). The evolution of block size and form in North American and Australian city centers. *Urban Morphology*, 1:1, 19-34.
- Sitte, C. (1889) *City Planning According to Artistic Principles*. Translated from German by Collins, G.R. and Collins, C.C. (1965), New York: Random House
- Smith W. (1984). Mass Transit for High-Rise, High-Density Living. *Journal of Transportation Engineering*, 110, 6, 521–535.
- Steuteville, R. (2004). The new urbanism: An alternative to modern, automobile-oriented planning and development. *New Urban News*. July 8, 2004.
- Stokols, D. (1997). *Perspectives on environment and behavior: Theory, research, and applications*. New York: Plenum Press.

- Handy, S. (1996). Methodologies for Exploring the Link Between Urban Form and Travel Behavior. *Transportation Research D*, Vol. 1, No. 2, pp. 151-165.
- Handy, S. (1996). Urban Form and Pedestrian Choices: Study of Austin Neighborhoods,” *Transportation Research Record 1552*, TRB, pp. 135-144.
- Handy, S. and Patricia L. Mokhtarian (2005). Which Comes First: The Neighborhood Or The Walking. *ACCESS 26*, UCTC, Spring, pp. 16-21.
- Handy, S., Xinyu Cao, Theodore J. Buehler, and Patricia L. Mokhtarian (2005), *Link Between the Built Environment and Travel Behavior: Correlation or Causality*, Transportation Research Board 84th Annual Meeting
- Zakiah, H. (1996). Excitement of Padang Court. *New Straits Time*. 19 August.
- Zube, Ervin H. and Moore, Gary T. (1987). *Advances in environment, behavior, and design*. New York: Plenum Press.
- Zube, Ervin H. (1980). *Environmental evaluation: Perception and public policy*. Monterey, CA.: Brooks/Cole Publishing Co.