An Integrated Framework for Planning Complete Streets towards Sustainable Mobility

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ABSTRACT

This Ph.D. dissertation addresses the relationship between planning successful complete streets and promoting the use of active modes of transportation towards enhancing the level of sustainability in transportation sector within the communities. In this regard, this research by qualitative grounded study has an intention to provide a comprehensive explanation on the concept of sustainable transportation and active transportation in order to enhance the knowledge about the relationship of these two main concepts. Besides, this study is going to clarify the main variables that must be considered by planners in the process of promoting the use of active modes of transportation in communities.

Furthermore, a wide-ranging of clarification by focusing on policy and planning approaches related to complete streets movement provided based on existing literature, technical reports, and guidelines. In this way, the study clarifies the main elements related to the policy of complete street, components, and design treatments and the determinative variables and steps that consideration of them are substantial in the planning process of complete streets.

The outcome of this study reveals that the main determinative variables that must be considered in process of planning successful complete streets towards promoting the use of active modes of transportation are categorized in two main groups include variables related to the social and the built environment contexts. Besides, the study also recommended a new framework towards planning successful complete streets by considering the determinative variables that can guide decision-makers, planners, and

designer to get appropriate decisions in the way of increasing the level of sustainable mobility within the communities.

Keywords: Sustainable transportation, sustainable mobility, active transportation, complete streets.

ÖZ

Bu Doktora tez çalışması, başarılı tamamlanmış (eksiksiz) sokakların planlanması ile aktif ulaşım yöntemlerinin kullanılmasının teşvik edilmesinin arasındaki ilişkiyi, toplum içindeki ulaştırma sektörünün sürdürülebilirlik seviyesinin artması yönünde ele almaktadır. Bu bağlamda, nitel temelli bir çalışma ile yapılan bu araştırma, bu iki ana kavramın ilişkisi hakkında bilgiyi arttırmak için sürdürülebilir taşımacılık ve aktif taşımacılık kavramları hakkında kapsamlı bir açıklama yapmayı hedeflemektedir. Ayrıca, bu çalışma, aktif ulaştırma yöntemlerinin kullanılmasının teşviki sürecinde, plancılar tarafından göz önünde bulundurulması gereken temel değişkenleri açıklığa kavuşturacaktır.

Çalışma aynı zamanda, tamamlanmış (eksiksiz) sokak akımı ile ilgili politika ve planlama yaklaşımlarına odaklanarak, ve mevcut literatüre, teknik raporlara ve kılavuzlara dayanarak geniş kapsamlı bir açıklama sağlamaktadır. Böylece, çalışma, sokakların planlama sürecinde dikkate alınması gereken belirleyici değişkenleri ve basamakları, ve tamamlanmış (eksiksiz) sokak politikası, bileşenleri ve tasarım davranışı ile ilgili ana unsurları netleştirmektedir. Bu çalışmanın sonucu, aktif ulaştırma modlarının kullanımını teşvik etmeye yönelik başarılı tamamlanmış (eksiksiz) sokakların planlanması sürecinde göz önünde bulundurulması gereken temel belirleyici değişkenlerin, sosyal ve yapılı çevre bağlamları ile ilgili değişkenleri içeren iki ana grupta kategorize edildiğini ortaya koymaktadır.

Bunun yanı sıra, çalışma aynı zamanda, topluluklarda sürdürülebilir mobilite düzeyini arttırma yolunda uygun kararlar almak için gereken belirleyici değişkenleri göze alarak

başarılı tamamlanmış (eksiksiz) sokakların planlanması yönünde karar merciine, planlamacılara ve tasarımcılara rehberlik edebilen yeni bir çerçeve önermektedir.

Anahtar Kelimeler: Sürdürülebilir taşımacılık, sürdürülebilir mobilite, aktif ulaşım, tamamlanmış (eksiksiz) caddeler

DEDICATION

This dissertation is humbly dedicated to all my valuable treasures in my life:

To my beloved father, mother & sister

Mohamadhassan & Azam & Adeleh

For their understanding, boundless love and encouragement that made me able to be who I am

"Always do the best job; your reputation is worth more than a quick profit"

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INTRODUCTION

In the current century, promoting sustainable mobility in communities has become the main research topic in the field of urban design, urban transportation and urban health across the world. Hence, many movements and their related strategies are emerged to enhance the level of sustainability in the transportation sector and relieve increasing main urban transportation issues. During the last five decades, the concept of active transportation as a movement that has a focus on the shifting of transportation modes towards using more sustainable active modes of transportation has emerged. Many of transportation planners and urban designers have begun to place substantial emphasis on the encouraging and supporting use of active modes of transportation because of their numerous advantages for balancing current and future environmental preservation, social equalities, economic improvement and communities' health. In this regard, a number of movements are emerged towards promoting the use of active modes of transportation by redesigning the streets' spaces.

In the last decade, the concept of complete streets emerged in the United States, which today is going to be a universal movement. This movement has an attempt to redefine the meaning of streets by the allocation of streets' spaces and giving priority to active modes of transportation; aims to enhance integration and connection of streets for providing safe, accessible and comfortable streets for all users of all ages and abilities. The emphasis of this dissertation is on the complete streets movement towards

increasing sustainable mobility. Accordingly, this chapter elucidates the problem statement, the main research intentions, objectives, main questions, and the research methodology that used for this study as well significance, limitation, and structure of the dissertation.

1.1 Problem Statement

In the recent century, due to urbanization, the population of cities extremely increased and expectations of life changed. During this growth, automobiles adapted with urban spaces since in this period urban design and planning strategies have concentrated more on the automobile usage and active modes of transportation moved off from the streets in both residential and commercial neighborhoods (Gehl, 2010; Kashani Jou, 2012; Newman & Kenworthy, 1999).

This process has created a universal automobile dependency that now seen as harmful to the environment, social, economy and health all around the world. In the other hand, high level of dependency to automobiles causes current problems in terms of environment, economy, social, health and culture by creating unsafe and unpleasant urban environments as well as destroys the attendance of pedestrians in urban areas. Many communities around the world are thinking about solutions to solve these problems (Gehl, 2010; Moudon, 1991).

Obviously, the main solution for solving these problems is encouraging people to use sustainable active modes of transportation. Kashani Jou (2012) and T Litman (2007) indicated, that active modes of transportation by decreasing the number of pollutions related to transportation and improving the sustainability and livability of communities

can create a balance between economic development, social equity, and environmental preservation.

Promoting active modes of transportation include walking, cycling and use of public transportation, which refers to sustainable, multimodal transportation system has been recognized as the main way of promoting sustainable mobility within the communities. In recent decades, urban designers, transportation planners, and public health officials begun to place significant emphasis on encouraging use of active modes of transportation, because of numerous benefits of these modes of transportation relate to public health, environment, social and economic aspects (Gotschi & Mills, 2008; Todd Litman, 2018a; Southworth, 2005).

Recent researches indicated that to promote the use of active modes of transportation, consideration of a full range of transportation modes and users in the transportation sector is indispensable. In other words, there is no way to eliminate automobile and motorized-transportation from current century lifestyle. Thus, designers, planners and policy makers shall attempt to propose new concepts to give priority to active modes of transportation in communities by considering motorized transportation demands in mind as a supporter for long distances (Appleyard, Gerson, & Lintell, 1981; Southworth, 2005).

Hence, the focus of designer and scholars went through redesigning the streets' spaces by considering all users and transportation modes' demands. In this way, several concepts have emerged in European countries and North American to redesign the streets include Woonerf concept, Home Zone concept, and Shared Streets or Integration concept (Mike Biddulph, 2008; Collarte 2012; Gilman, Gilman, & Tem,

2007). The most recent concept in this regard emerges in 2003 in North America as a significant movement in the transportation sector and urban planning with a more comprehensive consideration to a full range of transportation modes and users (Gill 2014; Scott, Patterson, & Nau, 2013). This movement, named as the "Complete Streets Movement", aims to design streets for everyone (George, 2013; Skoworodko, 2012). In this movement, streets must be designed to provide safe access for all users (pedestrians, bicyclists, motorists, and public transit) of all ages and abilities to move safely along and across the streets (George, 2013; Scott et al., 2013). Hence, the complete streets movement redefines the target of streets and break down the traditional separation between motorized vehicles, public transit, cycling, and pedestrians (George, 2013; Gill 2014).

Based on all debates above, this dissertation puts emphasis on the significance of active modes of transportation in urban environments and recognizes different variables that contribute to promoting the use of active modes of transportation. Following this, the research focuses on recognizing the importance and influence of complete streets movement. Besides, defining a planning framework towards achieving successful complete streets by considering determinative variables that must be reflected in the planning process of complete streets, which can guide planners and designer to increase the level sustainable mobility within the communities. Accordingly, in Figure 1 a conceptual model provides to elucidate the relationship between the key concepts that are going to be discussed in this dissertation.

Figure 1: The Relationship between Main Concepts that are used in This Research

1.2 Research Aims, Questions and Objectives

The investigation of the research topic sprang from a purpose to highlight the importance of 'complete streets concept' for urban and transportation planning studies. Accordingly, an initial literature review on complete streets development has shown that no study exists broadly expounding this concern regarding policymaking and planning of complete streets. Thus, this investigation intended to fill this gap in the literature and it seeks to be exemplary by providing a framework for planning complete streets. Complete street and its policymaking and planning are important notions for urban and transportation planners as well as urban designers.

Considering the problems stated above, the core intention of this research is to determine the main key words, steps and variables those must be carefully evaluated and considered by planners and urban designers – and decision makers, in the process of "planning complete streets". Thus, this research aims to set up an integrated planning framework by considering the determinative variables towards planning

successful complete streets in communities, as well as clarifying main design components of complete streets.

The research argues that in order to have successful complete streets in a community, consideration of the physical characteristics of the built environment is not sufficient merely. The other argument of this investigation is that combination of social and the built environment variables it is essential in planning process to develop and enhance successfulness of complete streets in communities. Accordingly, the research stresses to achieve successful complete streets consideration of variables related to the place and people together is substantial.

To reach its main aim, the overarching research questions that will be explored throughout this dissertation are identified as in the following:

- What are the main considerations in process of writing a strong complete street policy?
- What are the determinative steps and variables that must be considered by planners in the process of planning successful complete streets?
- What are the main design components of complete streets?

To respond to these overarching questions, some other embedded questions to address different aspects of the main questions are provided in the following:

- What is the concept of sustainable transportation?
- What is active transportation concept?
- What are the main variables that must be considered by planners in the way of planning towards promoting active modes of transportation within the communities?

- What is the complete street concept?
- What is done in the past regarding planning of Complete Streets?
- What are the main variables that must be considered in the process of planning successful complete streets?
- What are the main steps that must be applied towards planning successful complete streets?
- What should be the future role of complete streets in the transportation sector?

Accordingly, to be able to reach its aim and answer the research questions, the following research objectives are set up:

- Reviewing the understanding of sustainable transportation concept;
- Providing a general understanding of the "active transportation" movement;
- Understanding the main variables that consideration of them is substantial in the process of planning for promoting the use of active modes of transportation within the communities;
- Providing a comprehensive knowledge about complete streets concept;
- Expressing the benefits of promoting complete streets in communities;
- Finding out the main complete streets policy elements and types,
- Expounding the main considerations in the process of writing a strong policy of complete streets,
- Finding out complete streets planning steps and design components.
- Clarifying the determinative variables that must be considered in the planning process of complete streets;
- Defining a comprehensive planning framework towards achieving successful complete streets by considering the main determinative variables.

Consequently, the output of this dissertation will be a useful framework for contemporary urban designers and planners, and transportation planners to improve the level of sustainable mobility within their communities based on planning and designing successful complete streets.

This research is mainly designed to be a qualitative research and documentary research. Hence, a comprehensive literature review was conducted, which is mainly based on published articles in scientific journals (SCI and SSCI), books, published conference papers, technical reports (policies and design guidelines) and published research works (Thesis). The keywords used in literature searching are including "Sustainable transportation", "Active transportation", "Complete streets", "Complete Streets Policy", and "Complete Streets Guidelines". The research methodology - process and methods which have been considered throughout this study will be explained in detail through Chapter 2.

1.3 Significance of the Research

The contribution of this research would be of interest to urban planners, designers, and transportation planners by increasing the level of our understanding regarding the significances of consideration determinative variables related to promoting the use of active transportation, and the position of these variables in the process of planning and designing towards having successful complete streets. In this regard, variables that are more effective related to the built environment and the social contexts will be clarified.

Besides, the study also contributes to clarifying the steps of proposing a strong complete streets policy through investigation on the best complete streets policies are those provided for cities along North America. Moreover, by investigating on

Complete Streets Guidelines related to selected cities along North America and Canada, complete streets design components and planning process of complete streets toward implementation are clarified. In addition to literature, the study will elucidate, determinative variables that must be considered and evaluated in the process of planning towards having successful complete streets and by recommending an integrated planning framework will clarify the steps for planning successful complete streets toward implementation.

1.4 Limitations of the Study

In the process towards achieving sustainable mobility, it has been mentioned in numerous studies, sustainable mobility has a purpose to improve human and ecosystem well-being together note one at the expense of the other. In this way, sustainable mobility by concentration to enhance the qualities of the transportation system and create a balance between demand and supply has an aim to balance current and future economic growth, environmental preservation, social equity and quality of life. Accordingly, consideration of determinative variables related to the environment, social and economic are substantial. This dissertation will focus on main effective variables related to the built environment and the social contexts. Hence, the literature reviewed in this investigation and integrated planning framework that will be proposed is based on the social and the built environment variables.

Besides, there is a lack of sources in scientific journals about complete streets. Accordingly, the author by a deep review of technical reports related to policies and guidelines of complete streets tries to reach the necessary information for this dissertation.

1.5 Dissertation Structure and Overview of Chapters

The structure of the dissertation is advanced out of the literature in the field of sustainable transportation, active transportation, and complete streets. Dissertation structure is organized under six chapters that clarified in Figure 2.

The first chapter expresses the framework of the dissertation. It describes the background of the research, the problems and main aims, and research objectives by emphasizing the significance of the research, methodology, and limitation of the study.

The second chapter presents the research methodology, and data collection and analysis processes which are used in this study.

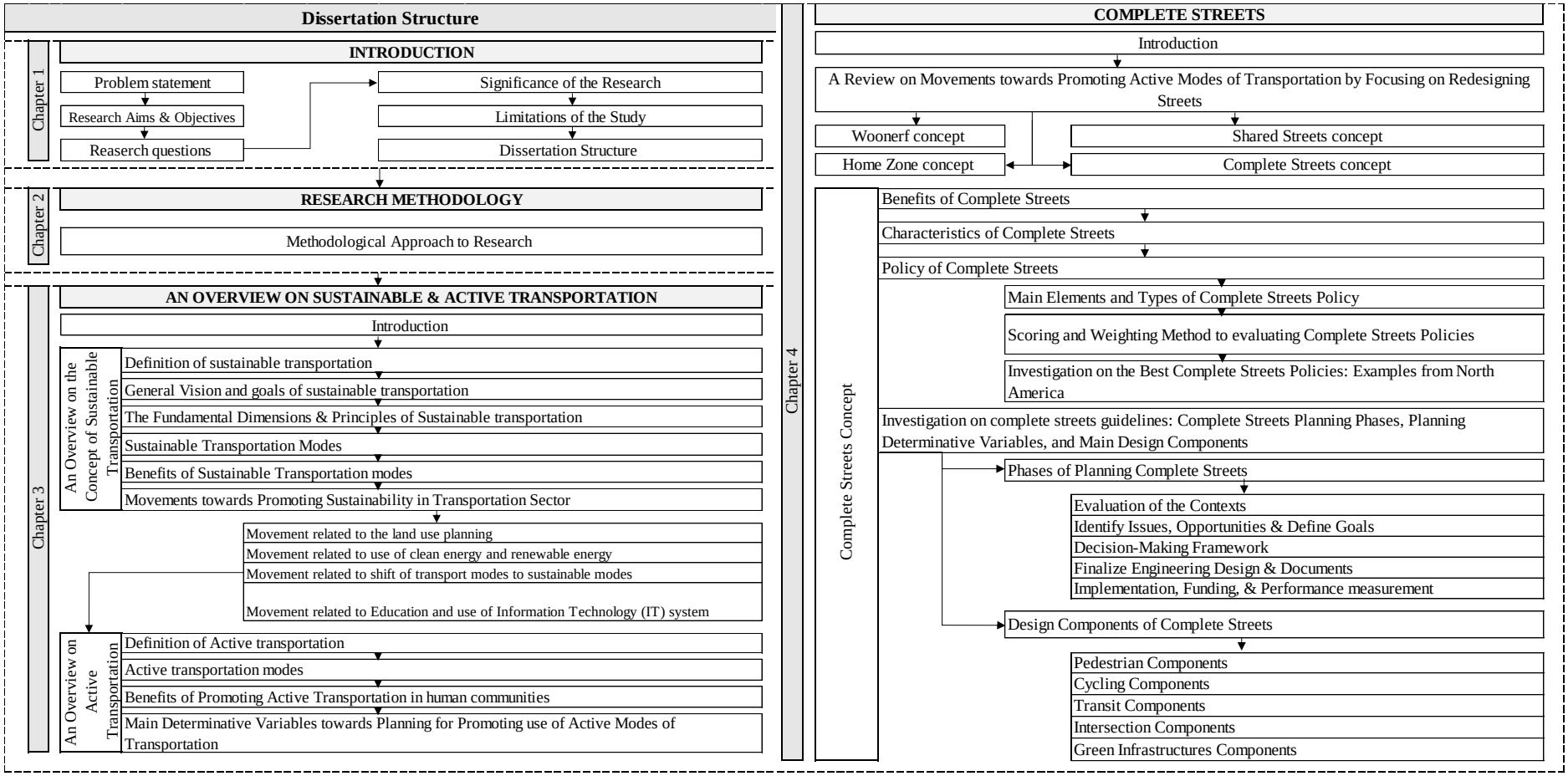
The third chapter makes available a review of the concept of sustainable transportation and active transportation. In the first part, an overview on the concept of sustainable transportation expresses to clarifying the definition, general vision and goals, fundamental dimensions and principles, benefits and sustainable transportation modes by emphasizing the movements related to promoting sustainable transportation in communities. After that in the second part, an overview of active transportation movement provides for illuminating the active transportation definition, benefits, modes, and effective determinative variables that must be considered towards promoting the use of active modes of transportation.

The fourth chapter focuses on the complete streets concept to define the benefits, characteristics, the main elements of complete streets policies and types, and scoring and weighting method for grading complete streets policies. Besides, to clarifying that how to write a strong policy, an investigation on the best complete streets policies

through cases from North America is done. After that, a comprehensive investigation of the complete streets guidelines through cases from North America and Canada is provided to clarify the components, affective variables and the steps towards planning complete streets.

The focus of chapter five is to clarify the determinative variables related to the built environment and the social contexts in the planning process of successful complete streets. Besides, this chapter provides an integrated framework towards planning successful complete streets based on the literature reviewed and determinative variables that clarified.

Chapter six will be the conclusion of this research that will present a considerable summary of the entire research and its findings while ending up with a critical discussion on the applicability of the recommended framework and recommendation for future studies.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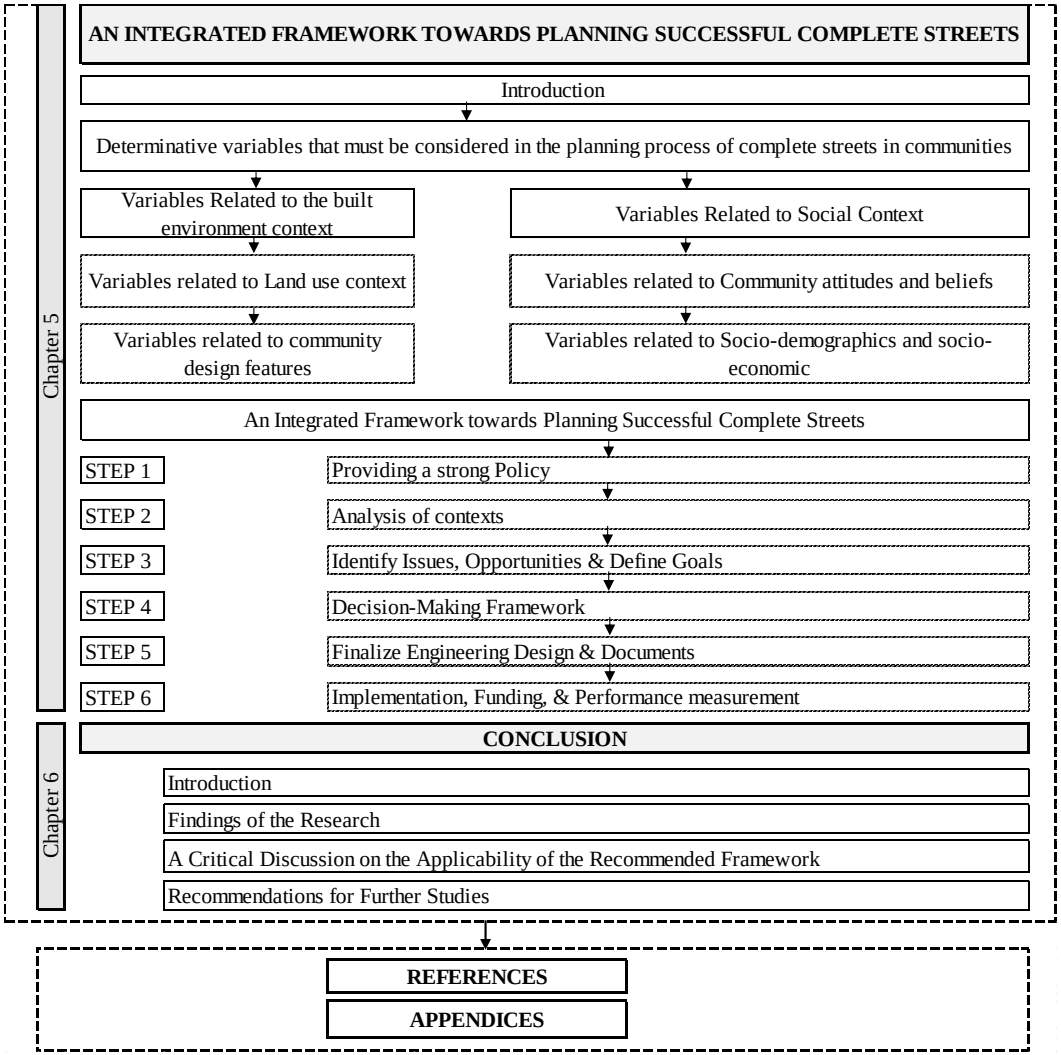


Figure 2: Structure of the Dissertation

Chapter 2

RESEARCH METHODOLOGY

This chapter presents the overall methodology of the research and elucidates the research methods used in this study. This research fundamentally assesses the concept of ‘complete streets’ towards providing knowledge about process of writing a strong policy for complete streets and complete streets planning steps and variables as well as clarifying the main design components of complete streets. There are a limited number of studies and projects about complete streets all around the world. Therefore, the primary motivation of this research is the desire to fill the gap in knowledge about different aspects of this concept involving policy, planning, and design for achieving a successful complete street and its assessments in the urban planning and transportation planning literature. As has been stated in the previous chapter, the main aim of this study is to provide fundamental, useful and practical information for transportation and urban planners and policymakers.

This chapter explores the methodological approach to research concentrating on how the research has been designed to reach its aim and objectives, and to answer its research questions. Thus, the chapter also presents how the data has been collected and analyzed as a part of the research design.

2.1 Methodological Approach to Research

In urban studies, one may refer to various research approaches to be able to understand the key concepts, issues and contexts under study. For all types of research, empirical data is required for answering research questions. It can generally been argued that research in urban studies both falls into social science research and design research. This research is not an exception to this general understanding.

On one hand, this research can be regarded as a social science research, since it involves theory and tries to investigate on "how things" and "why". It has an aim of exploring on a topic, i.e. complete streets, to map it out that may warrant further study in the future. It tries to find some "patterns" in built environment; it relates both concepts – sustainable transportation, active transportation, complete streets, and also variables. On the other hand, it is a planning and design research due to the concepts that it is diving into. It is dealing with planning and design of complete streets as well as policy formulation.

Based on these two research approaches, the research presented in this thesis uses a variety of research methods, i.e. existing data research, comparative research, and evaluation research, yet mainly rely on one data collection technique.

In research arena, data collection techniques usually can be divided into two categories: quantitative and qualitative methods. In quantitative research, data comes as numbers or has potential to be converted into the number (Robson, 2007). However, in social science research, quantitative data sometimes are not enough mainly because this kind of research seeks to understand people (Robson, 2007). Research by using qualitative data try to clarify different aspects of understanding about the research

concerns. Qualitative research depends on non-numerical data such as text or words and data can appear in the form of pictures and drawing (Robson, 2007). For this research, the data collection approach mainly relies on the qualitative techniques through integrative literature review method and documentary research method.

Integrative literature review method is the widest form of research review approaches letting for the concurrent inclusion of experimental and non-experimental investigations in order to more completely comprehend a subject and phenomenon. Besides, integrative literature reviews method has a potential to combine data from the theoretical and empirical literature (Whittemore & Knafl, 2005). In general, literature review method in this study aims to provide a theoretical basis; substantiate the existence of the investigation problem and explain the research as one that offers something novel and original to the cumulated knowledge (Hart, 1998; Levy & Ellis, 2006). Documentary research method is another technique that is used in this study. This method has been one of the main data collection technique of social research since its initial inception. The use of documentary method denotes to the analysis of documents that encompass information about the subject that is going to be study (Bailey, 2008).

Accordingly, for collecting necessary data for achieving the aim of this study, an integrative literature review and documentary research were conducted based on published articles in scientific journals, books, published conference papers, technical reports include policies and design guidelines related to complete streets and published research works. The keywords used in literature searching are including “Sustainable transportation”, “Active transportation”, “Complete streets concept”, “Complete Streets Policy”, and “Complete Streets Guidelines”. The searching results include 11

books, 91 journal articles, 80 technical reports, and 8 research works. Along with the search instruction, the time span of the selected resources is from 1973 to 2018 for considering and using references, which were published in last 50 years. The distribution of the 91 published journal articles in different scholarly journals is presented in Table 1.

Table 1: List of journals and the number of articles selected from each journal

	Title of Journals	Number of selected papers		Title of Journals	Number of selected papers
1	Journal of Transport Geography	11	**26**	Int. J. Environ. Res. Public Health	1
2	Journal of Transport Policy	6	**27**	Journal of Public Health Policy	1
3	Transportation Research Part D: Transport and Environment	5	**28**	International Journal of Environmental Science and Technology	1
4	Procedia - Social and Behavioral Sciences	4	**29**	International Journal of Health Geographics	1
5	Journal of the Transportation Research Board	4	**30**	NSW Public Health Bulletin	1
6	American Journal of Preventive Medicine	4	**31**	Journal of Ecological Indicators	1
7	Transportation Research Part A: Policy and Practice,	3	**32**	Sustainable Development	1
8	Journal of Urban Health	3	**33**	International Journal of Global Environmental Issues	1
9	Socio-Economic Planning Sciences	2	**34**	Environmental Practice	1
10	ITE Journal	2	**35**	Journal of Sustainable Cities and Society	1
11	Annals of Behavioral Medicine	2	**36**	Journal of Economic and Political Weekly	1
12	Transport Reviews	2	**37**	International Regional Science Review	1
13	PloS one	2	**38**	Journal disP - The Planning Review	1
14	Health & Place	2	**39**	Tsinghua Science & Technology	1
15	Journal of Urban Planning and Development	2	**40**	IATSS Research	1
16	Urban Studies	2	**41**	Procedia Engineering	1
17	International Journal of Sustainable Transportation Research Part A	2	**42**	Frontiers of Architectural Research	1
18	Transportation	2	**43**	Journal of Physical Activity and Health	1
19	Urban Design International	1	**44**	Accident Analysis & Prevention	1
20	Journal of the American Planning Association	1	**45**	Environment and Planning A	1
21	Applied Energy	1	**46**	Social Science & Medicine	1
22	Transportation Research Part C: Emerging Technologies	1	**47**	Lournal of Technology in Society	1
23	International Journal of Transportation Research	1	**48**	International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering	1
24	Journal of the American Institute of Planners	1	**49**	International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies	1
25	Geographical Analysis	1			1

Total: 91 Journal Articles

An integrative review of the literature has been used as a methodology in this research. In this regard, “Active Transportation”, and “Complete Streets” were the main terms that appeared through this dissertation. Consequently, in order to provide a context for this dissertation, the research will begin with a literature review by focusing on sustainable transportation and active transportation movement in chapter 3. In the first section of theoretical investigation, a brief review on the concept of sustainable transportation is provided by aiming to clarify the definition, general vision and purposes, principles, benefits, fundamental dimensions, sustainable modes of transportation, and emphasizing the movements related to enhancing level of sustainability in transportation sector within the communities. In the second part, there is a focus on active transportation movement as a worldwide-accepted movement towards increasing usage of sustainable active modes of transportation by providing a wide-ranging explanation on different aspects of this movement.

Accordingly, this study clarifies the definition, benefits, modes, and determinative variables that must be considered for promoting the use of active modes of transportation by planners. To provide a clarification about determinative variables, 30 studies were selected among numerous studies that published in scientific journals by focusing on the aim of studies to be strongly associated to promoting use of active modes of transportation (Table2). After that, through a deep review, all variables that evaluated and considered by these studies as determinative effective variables on promoting use of active modes of transportation in communities clarified and categorized in two main groups include variables related to social and built environment contexts.

Table 2: List of selected studies for clarifying determinative variables towards promoting use of active modes of transportation within the communities

	Author	Year	Title of Study	Journal
1	Atasoy, Glerum, & Bierlaire	2013	Attitudes towards mode choice in Switzerland	Journal disP - The Planning Review
2	Saelens, Frank, & Salli	2003	Environmental Correlates of Walking and Cycling: Findings From the Transportation, Urban Design, and Planning Literatures	Journal of Behavioral Medicine
3	Christiansena, Madsen, Schipperijn, Ersbøll, & Troelsen	2014	Variations in active transport behavior among different neighborhoods and across adult life stages	Journal of Transport & Health
4	Sallis, Frank, Saelens, & Kraf	2004	Active transportation and physical activity: Opportunities for collaboration on transportation and public health research	Transportation Research Part A: Policy and Practice
5	Buehler	2011	Determinants of transport mode choice: a comparison of Germany and the USA	Journal of Transport Geography
6	Lavin, Metcalfe, & Higgins	2011	Active travel – healthy lives	The Institute of Public Health in Ireland
7	Handy and Colifton	2001	Evaluating Neighborhood Accessibility: Possibilities and Practicalities	Journal of Transportation and Statistics
8	Cervero & Kockelman	1997	Travel demand and the 3Ds: Density, diversity, and design	Transportation Research Part D: Transport and Environment
9	Handy, Boarnet, Ewing, & Killingsworth	2002	How the Built Environment Affects Physical Activity Views from Urban Planning	American Journal of Preventive Medicine
10	Clark, Scott, & Yiannakoulias	2013	Examining the relationship between active travel, weather, and the built environment: a multilevel approach using a GPS-enhanced dataset	Journal of Transportation
11	Burbidge & Goulias	2009	Active Travel Behavior	Journal Transportation Letters
12	Cao, Handy, & Mokhtarian	2006	The Influences of the Built Environment and Residential Self-Selection on Pedestrian Behavior: Evidence from Austin, TX	Journal of Transportation
13	Dieleman, Dijst, & Burghouwt	2002	Urban Form and Travel Behaviour: Micro-level Household Attributes and Residential Context	Journal of Urban Studies
14	Fishman , Helbich, & Böcker	2015	Adult Active Transport in the Netherlands: An Analysis of Its Contribution to Physical Activity Requirements	Journal of PLoS One
15	Olojede, Yoade, & Olufemi	2017	Determinants of walking as an active travel mode in a Nigerian city	Journal of Transport & Health

16	Giuliano & Dargay	2006	Car ownership, travel, and land use: a comparison of the US and Great Britain	Transportation Research Part A: Policy and Practice
17	Litman	2016	Land Use Impacts on Transport	Report
18	Scheepers, et al.	2013	Personal and Environmental Characteristics Associated with Choice of Active Transport Modes versus Car Use for Different Trip Purposes of Trips up to 7.5 Kilometers in The Netherlands	Journal of PLoS One
19	Adams	2010	Prevalence and socio-demographic correlates fo "active transport" in the UK: Analysis of the UK time use survey 2005	Journal of Preventive Medicine
20	Frank & Engelke	2005	Multiple Impacts of the Built Environment on Public Health: Walkable Places and the Exposure to Air Pollution	International Regional Science Review
21	Cantell	2012	Assessing the Active Transportation Potential of Neighborhood Models Using GIS	Master Thesis
22	Panter	2010	Towards an understanding of the influences on active commuting	Ph.D. Thesis
23	Feng	2016	The Built Environment and Active Travel: Evidence from Nanjing, China	Int. J. Environ. Res. Public Health
24	Cerin, Leslie, & Owen	2009	Explaining socio-economic status differences in walking for transport: An ecological analysis of individual, social and environmental factors	Social Science & Medicine
25	Freeman, et al.	2013	Neighborhood Walkability and Active Travel (Walking and Cycling) in New York City	Journal of Urban Health
26	Owen, et al.	2010	Bicycle Use for Transport in an Australian and a Belgian City: Associations with Built-Environment Attributes	Journal of Urban Health
27	Leslie, et al.	2007	Walkability of local communities: Using geographic information systems to objectively assess relevant environmental attributes	Journal of Health & Place
28	Owen, et al.	2007	Neighborhood walkability and the walking behavior of Australian adults	American Journal of Preventive Medicine
29	Forsyth, Hearst, Oakes, and Schmitz	2008	Design and Destinations: Factors Influencing Walking and Total Physical Activity	Journal of Urban Studies
30	Pooley, et al.	2013	Policies for promoting walking and cycling in England: A view from the street	Journal of Transport Policy

In the next step, research by focusing on the complete streets movement in chapter 4, clarifies benefits, characteristics, policy (types and main elements), and scoring and weighting method for ranking of complete streets policies. In addition, the study provides an investigation into the best complete streets policies through North America, which are annually announcement by The National Complete Streets Coalition. It is essential to mention here that the announcement by The National Complete Streets Coalition was started from 2011 and there is no any announcement related to complete streets policy for years before 2011.

Accordingly, in this investigation, top 10 complete streets policies related to communities inside North America adapted between 2011 until 2016 were selected and estimated. The list of selected complete streets policies provides in Table 3. After that among these selected policies the 6 highest ranked policies (From each year the highest ranked policy) selected to examine in detail by focusing on making clear how these highest ranked policies are writing a strong statement for main policy elements and clarifying that how other communities must write a strong policy.

Table 3: List of top 10 policies related to communities inside North America adapted between 2011 until 2016

	Name of City/Town/ County	Year	Policy score		Name of City/Town/ County	Year	Policy score
1	Missoula, MT	2016	100	**31**	Littleton, MA	2013	94.4
2	Wenatchee, WA	2016	100	**32**	Peru, IN	2013	92.8
3	Brockton, MA	2016	100	**33**	Fort Lauderdale, FL	2013	89.6
4	Hull, MA	2016	98.4	**34**	Auburn, ME	2013	88
5	Mansfield, MA	2016	98.4	**35**	Lewiston, ME	2013	88
6	Sherborn, MA	2016	98.4	**36**	Baltimore County, MD	2013	86.4
7	Bridgewater, MA	2016	96.8	**37**	Portsmouth, NH	2013	86
8	Brookline, MA	2016	96.8	**38**	Piqua, OH	2013	82.4

9	Chester, MA	2016	96	**39**	Oakland, CA	2013	81.6
10	Muskogee, OK	2016	96	**40**	Hayward, CA	2013	80.8
11	Reading, PA	2015	100	**41**	Indianapolis, IN	2012	89.6
12	West Hartford, CT	2015	94.4	**42**	Hermosa Beach, CA	2012	85.6
13	Park Forest, IL	2015	92.8	**43**	Huntington Park, CA	2012	85.6
14	South Bend, IN	2015	92.8	**44**	Ocean Shores, WA	2012	84.8
15	Longmeadow, MA	2015	92.8	**45**	Northfield, MN	2012	83.2
16	Weymouth, MA	2015	92	**46**	Portland, ME	2012	80.8
17	Omaha, NE	2015	88.8	**47**	Oak Park, IL	2012	80
18	Vincennes, IN	2015	88	**48**	Trenton, NJ	2012	78.4
19	Ashland, MA	2015	87.2	**49**	Clayton, MO	2012	75.2
20	Natick, MA	2015	87.2	**50**	Rancho Cucamonga, CA	2012	73.2
21	Ogdensburg, NY	2014	92.8	**51**	Baldwin Park, CA	2011	92.8
22	Troy, NY	2014	91.2	**52**	New Hope, MI	2011	88
23	Lakemoor, IL	2014	88.8	**53**	Hennepin County, MI	2011	81.6
24	Dawson County, MT	2014	88.8	**54**	Birmingham, AL	2011	79.2
25	Austin, TX	2014	88.8	**55**	Bellevue, NE	2011	78
26	Acton, MA	2014	87.2	**56**	Cook County, IL	2011	77.6
27	Middleton, MA	2014	87.2	**57**	Roanoke, VI	2011	76.8
28	Reading, MA	2014	87.2	**58**	Azusa, CA	2011	76.8
29	Salem, MA	2014	87.2	**59**	Big Lake, MI	2011	76
30	Stoughton, MA	2014	86.4	**60**	Blue Island, IL	2011	76

Additionally, to clarify the main steps and variables that must be considered towards planning complete streets and the main design components of complete streets, 30 completes streets guidelines related to communities inside North America and Canada, which the full technical reports of them were accessible through online resources until data 01/12/2017, selected to be considered in this dissertation. The list of selected guidelines with their basic information presents in Table 4.

Table 4: List of selected complete streets guidelines

	Name	Type	Year	City Population	Country	Access Links	Total number of pages
					North America		
1	Knoxville	City	2009	185,291	USA	https://knoxtrans.org/plans/complete_streets/guidelines.pdf	89
2	Philadelphia	City	2009	1,567,872	USA	http://www.philadelphiastreets.com/images/uploads/resource_library/cs-handbook.pdf	182
3	Tacoma	City	2009	207,948	USA	https://www.cityoftacoma.org/	141
4	New Haven	City	2010	129,934	USA	http://www.aarp.org/content/dam/aarp/livable-communities/act/transportation/city-of-new-haven-complete-streets-design-manual-aarp.pdf	117
5	Alliance	City	2010	22,183	USA	http://www.peoplepoweredmovement.org/site/images/uploads/Updated_Guide_to_Complete_Streets_Campaigns.pdf	124
6	Washington	State	2011	7,288,000	USA	https://www.wsdot.wa.gov/NR/rdonlyres/9E11109A-950D-4A93-A3C2-4AFA34C7C05F/0/CompleteStreets_110811.pdf	66
7	North Carolina	State	2012	10,146,788	USA	http://www.pedbikeinfo.org/pdf/PlanDesign_SamplePlans_CS_NCDOT2012.pdf	167
8	Passaic County	County	2012	507,945	USA	http://www.passaiccountynj.org/DocumentCenter/View/4240	66
9	Cleveland	City	2013	396,815	USA	http://www.city.cleveland.oh.us/sites/default/files/forms_publications/ClevelandCGSTypologiesPlan2013.pdf?id=3364	81
10	Memphis	City	2013	652,717	USA	https://bikepedmemphis.wordpress.com/plans-and-publications/complete-streets-project-delivery-manual/	210
11	Dallas	City	2013	1,317,929	USA	http://dallascityhall.com/departments/sustainabledevelopment/DCH%20documents/pdf/DCS-Design_Manual_TTRPC_092413_Final_UPDATE.pdf	252
12	Burlington	City	2013	42,452	USA	https://www.burlingtonvt.gov/uploadedFiles/BurlingtonVTgov/Departments/DPW/Transportation/Policy_and_Planning/Complete-Streets-Reporting-v2.2.1-workingdraft.pdf	17
13	Boston	City	2013	617,594	USA	http://bostoncompletestreets.org/	292
14	Chicago	City	2013	2,695,598	USA	http://chicagocompletestreets.org/resources/design-guidelines/	140
15	Fort Lauderdale	City	2013	178,752	USA	http://www.fortlauderdale.gov/home/showdocument?id=3565	86
16	Los Angeles	City	2014	3,976,322	USA	http://planning.lacity.org/Cwd/GnlPln/MobiltyElement/Text/CompStManual.pdf	394
17	Austin	City	2015	912,791	USA	http://austintexas.gov/sites/default/files/files/Transportation/Complete_Streets/CompleteStreets_GuidetoCityofAustinResources_1-7-16.pdf	38
18	Newburgh	City	2015	28,200	USA	http://www.cityofnewburgh-ny.gov/sites/newburghny/files/u576/kdllc_2015_dec_9_-_ncsp_ip.pdf	104
19	South Miami	City	2015	12,207	USA	http://miamidadetpo.org/library/studies/south-miami-complete-streets-policies-and-design-manual-2016-05.pdf	62
20	Mankato	City	2015	41,720	USA	https://www.mankatomn.gov/home/showdocument?id=2048	54
21	Alexandria	City	2015	139,966	USA	https://www.alexandriava.gov/localmotion/info/default.aspx?id=91090	163
22	Albany	City	2016	98,111	USA	https://www.albany2030.org/files/Complete%20Streets%20DRAFT%20Policy%20%26%20Design%20Manual%20May%202016.pdf	121
23	Miami-Dade	County	2016	2,712,945	USA	http://www.miamidade.gov/neatstreets/library/complete-streets-design-guidelines.pdf	178
24	Orange County	County	2016	3,010,232	USA	https://static1.squarespace.com/static/5704e4b5cf80a178dae7fa50/t/58a7081d893fc0a0b772ee36/1487341694356/OC_Complete_Streets_Design_Handbook.pdf	370
25	Hampshire	County	2017	158,080	USA	http://www.northamptonma.gov/DocumentCenter/View/6668	52
26	Florida	State	2017	20,612,439	USA	http://www.flcompletestreets.com/Files/CSIHandbookEXTDraft.pdf	90
27	Pompano Beach	City	-	109,393	USA	http://pompanobeachfl.gov/assets/docs/pages/planning_zoning/PrintFinal_Complete%20Streets.pdf	137
					Canada		
28	Toronto	City	2012	2,731,571	CANADA	https://www1.toronto.ca/wps/portal/contentonly?vgnextoid=bdb604f82477d410VgnVCM10000071d60f89RCRD	182
29	Edmonton	City	2013	932,546	CANADA	https://www.edmonton.ca/city_government/documents/Edmonton-Complete-Streets-Guidelines_05062013.pdf	126
30	Windsor	City	2013	217,188	CANADA	https://www.townofwindsor.com/DocumentCenter/View/13675	42

In this step, by investigating on the selected guidelines, the steps and main variables that must be considered and evaluated in planning process of complete streets are elucidated in section 4.6.1 of chapter 4 as well as all common design components are clarified through a deep review on selected guidelines and classified in 6 categories as the following:

- Pedestrian Components
- Cycling Components
- Transit Components
- Vehicle Components
- Intersection Components
- Green Infrastructures Components

Accordingly, in this research, plus literature review technique based on published articles in scientific journals, books, and published research works, comparative technique among selected published guidelines and policies reports are also used to collect data and illustrate the general principles of policy, design components, and planning steps and variables related to complete streets. Consequently, it can be mentioned that, in this research descriptive and comparative methods are used together. The process of research is clarified in Figure 3.

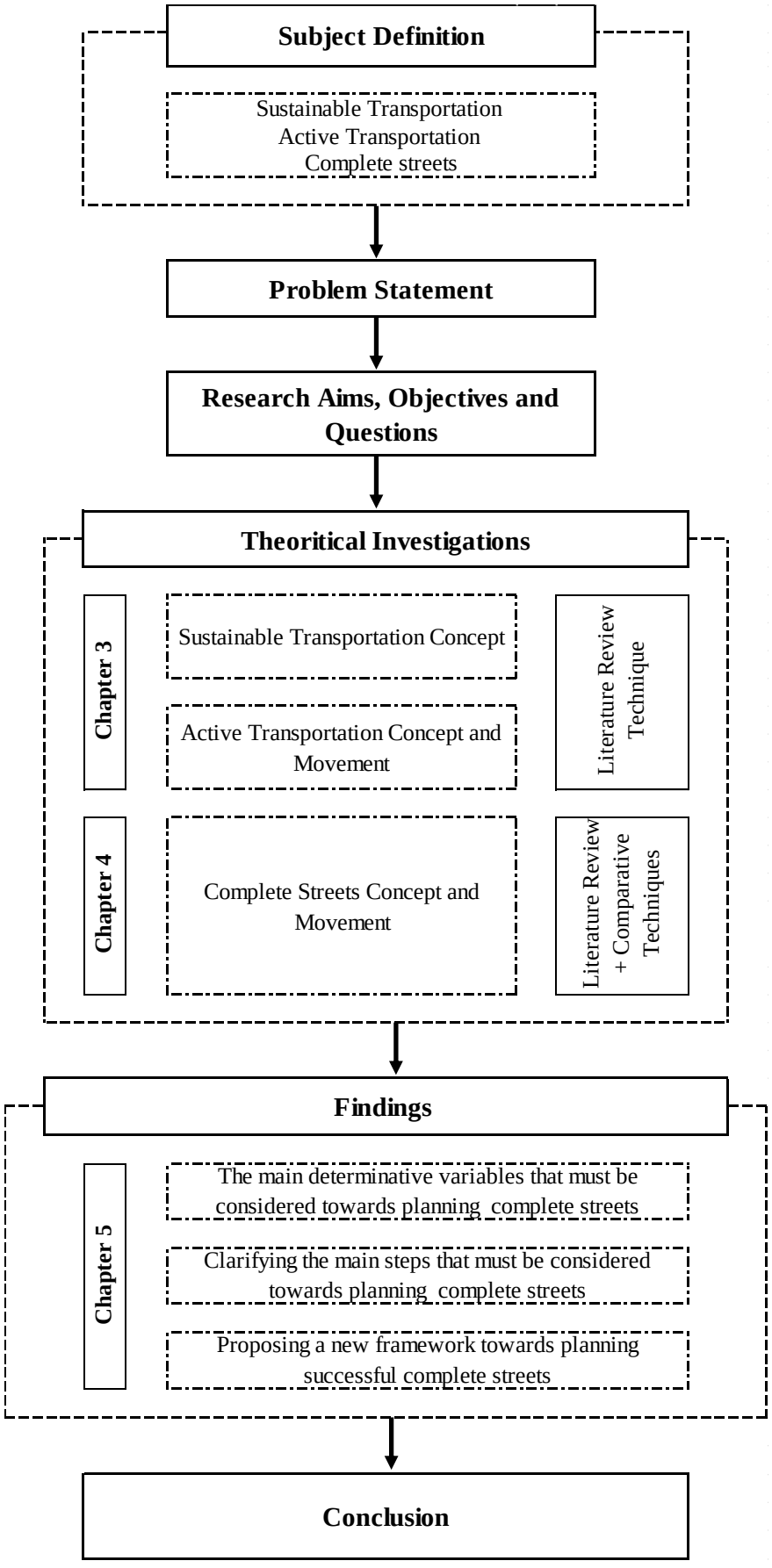


Figure 3: Research Process and Methods

Chapter 3

SUSTAINABLE & ACTIVE TRANSPORTATION CONCEPTS

3.1 Introduction

In the last decades of 19th century and over the 20th century, the industrial revolution, technological advances, and economic development have generated various environmental, social and economic changes throughout the world (Bayramoğlu, 2012; Linda Steg, 2007). During this period, cities around the world acting as attraction centers, which offer a platform to growing economic, social interchange, scientific and technological developments (Bayramoğlu, 2012; Liang, Serrano, Pecorari, & Serrano, 2013).

Furthermore, these growth parameters have been generated a situation to the uncontrolled growth of urbanization, population, spatial expansion and income per capita, which generally expressed with negative consequences on environmental, social, cultural and economic features in the global context (Qureshi & Lu, 2007). Furthermore, nowadays more 50% of the world's population is living in urban settlements, and by 2050, this percentage will go over the 70% (Liang et al., 2013). Hence, it is widely acknowledged throughout the world, that urban population is growing at a very high rate and it is universally recognized that the citizens of the world must support and provide more desirable plan to sustain our planet (Buehler & Pucher 2012; Richardson, 2005).

Nevertheless, the governments all over the world accepted, encouraging policies and strategies in order to access of all people to the environment, economic and social opportunities are indispensable for a meaningful life (Richardson, 2005). In this regard, by increasing concerns about social justice, economic vitality and environmental durability, the concept of sustainable development is emerged and become a significant and central vision among scholars, urban planning policymakers and urban designers (Deakin, 2002; Dur & Yigitcanlar, 2015; Haghshenas & Vaziri, 2012; Yazid, Ismail, & Atiq, 2011).

The concept of sustainable development is defined in the global context as a development that must pay attention to environmentally, economically and socially needs of present generations with considering the ability of generations ahead to meet their own needs (Bayramoğlu, 2012; Haghshenas & Vaziri, 2012). Besides, sustainable development is a simple concept with intricate implications (Todd Litman & Burwell, 2006). Hence, it is notable that sustainability must be applied at a universal level, since we are all part of an ecosystem, which there is a complex interaction between all its sectors (Holden, Linnerud, & Banister, 2013; Shiau, 2013).

However, one the most substantial urban problems of our century is transportation (Babalik-Sutcliffe, 2013; Bayramoğlu, 2012). Transportation sector is responsible to provide basic requirements for safety, well-being, comfort, health, economic growth, and social development in human communities by increasing mobility and accessibility to services, resources, other people, opportunities and markets (Hickman, Hall, & Banister, 2013; Qureshi & Lu, 2007; Linda Steg, 2007; Zuidgeest, 2005).

Unfortunately, current transportation systems in developing and developed countries is a pressing concern and a menace to sustainability at the global level (Qureshi & Lu, 2007; Zuidgeest, 2005). Transportation is one of the main worldwide consumers of natural non-renewable energy resources, approximately 20% and it is responsible for 14% of global GHG emissions, which will be doubled by 2025 (Bayramoğlu, 2012; Buehler & Pucher, 2011; Buehler & Pucher 2012). Besides, rapid growing motorization, mixed with poor transportation strategies, insufficient infrastructures and weak relation between land use planning and transportation planning, all led existing transportation system to be responsible for various social, economic and environmental issues (Buehler & Pucher 2012; Gössling, 2013; Hickman et al., 2013). These issues are such as air, water and noise pollutions, global warming and climate change, road accident, additional fuel consumption, physical inactivity, traffic congestion, decontrolled urban and human sprawl, wasting people's time, absent of livability, and generating a deteriorating urban environment (Buehler & Pucher, 2011; Qureshi & Lu, 2007; Linda Steg, 2007; Zuidgeest, 2005).

Hence, there is a universal agreement that mitigation of transportation externalities needs urgent changes in travel modes, policies, planning process and behaviors for reductions of transport-related negative impacts (Babalik-Sutcliffe, 2013; Prillwitz & Barr 2011; Qureshi & Lu, 2007). In this regards, the idea of sustainable transportation has been emerged in the transportation sector based on sustainable development concept (Babalik-Sutcliffe, 2013; Bayramoğlu, 2012).

Accordingly, in recent years, sustainable transportation in urban settlements has become the main research topic in the fields of urban design, urban transportation planning and urban health across the world. Hence, many countries proposed and

implemented diverse strategies and movements to develop the level of sustainability in the transportation sector and relieve increasing main urban transportation issues. In this regard, focus on shifting transportation modes towards using active modes of transportation is one of the practical approaches that emerge in many countries during the last five decades. Many of transportation planners and urban designers began to place substantial emphasis on the encouraging and supporting of active transportation because of its abundant advantages for balancing current and future environmental preservation, social qualities, economic improvement and communities' health. As result, various movements and their related strategies have been emerged, which effect to increase the active transportation and sustainability in the transportation sector.

Accordingly, in this chapter based on the main aim of the dissertation, a brief explanation of sustainable transportation concept and active transportation movement will be presented. Besides, the determinative variables that consideration of them are indispensable in the process of encouraging and promoting the use of active modes of transportation will be clarified.

3.2 An Overview of the Concept of Sustainable Transportation

Transportation has been a locomotive of growth and change from the beginning of human history (Greene & Wegener, 1997). Hence, the concept of sustainable transportation is vital to provide a serious balance among social equity, economic growth and environmental integrity (Richardson, 2005; Song, Yin, Chen, Zhang, & Li, 2013; Yazid et al., 2011). In this way, the concept emphasis on the fundamental needs of change in existing transportation systems and planning strategies and balance among transportation supply and demand (Liang et al., 2013; Song et al., 2013).

A review on the literature has shown that there is a rising affirmation on encouraging sustainability in the transportation sector and formulating policies to address negative impacts related to transportation throughout the world (Black, Paez, & Suthanaya, 2002; Qureshi & Lu, 2007). In this regard, the first step to promote sustainability in transportation sector is defining a comprehensive meaning for sustainable transportation, since without a clear definition governments and decision-makers do not know where they shall start and how to encourage others into following sustainability in transportation sector (Mullen, Tight, Whiteing, & Jopson, 2014; Zhou, 2012).

3.2.1 Definition of Sustainable Transportation

A fundamental task of sustainable transportation research is achieving a universally acceptable definition of sustainable transportation (Zhou, 2012). A growing number of scholars, government agencies, professionals, and academic units looks through defining sustainable transportation and incorporate the concept of sustainability into the transportation planning and activities process (Jeon, Amekudzi, & Guensler, 2013; Qureshi & Lu, 2007). Sustainable transportation is fundamentally a dynamic manner of management of sustainability and transportation development necessities (Balsas, 2003; Zuidgeest, 2005).

Hence, most researchers believe that the idea of sustainable transportation is emerged from applying sustainable development concept to the transportation sector (Greene & Wegener, 1997; Qureshi & Lu, 2007). Accordingly, the universal used definition of sustainable development, which presented by Brundtland Commission report, is the foundation of the most descriptions for sustainability in the transportation sector (Goldmana & Gorhamb, 2006; Jeon et al., 2013). In this report, sustainable development is defined as ‘‘A development that meets the ‘needs’ of the present

without compromising the ability of future generations to meet their own needs'' (Linda Steg & Gifford, 2005; WCED, 1987; Zhou, 2012). These 'needs' generally accepted to include objectives related to environmental health, economic growth and social equity (Goldmana & Gorhamb, 2006).

In addition, although research initiatives on transportation sustainability around the world are extremely increased, unfortunately, there is no a standard and worldwide acceptable definition for sustainable transportation yet (Mullen et al., 2014; Song et al., 2013; Zhou, 2012). Hence, several definitions proposed for sustainable transportation by different scholars and organizations based on the effectiveness of transportation systems and transportation activities on environmental perfection, economic advance, social equity and quality of life (Mullen et al., 2014; Zhou, 2012). Subsequently, definitions of sustainable transportation are categorized generally under 2 groups "narrow definition" and "broader definition" (CST, 2005; Jeon et al., 2013; Todd Litman & Burwell, 2006; Macbeth, 2004; Zuidgeest, 2005). Narrow definitions are kinds of definitions, which have just focused separately on environmental, economic aspects, and highlights social and justice related to transportation (Table 5) (Buehler & Pucher, 2011; CST, 2005; T Litman, 2007; OECD, 1996; Zuidgeest, 2005).

Table 5: Types of narrow definitions of sustainable transportation based on selected references

	Focus of Definitions	**References**	**Explanation**
1	Environment	1,3	This type of definitions is based on concern about environmentally sustainable transportation (EST) such as preserves natural resources, reduces pollutants, land consumption, and mitigates impacts on ecosystems
2	Economic	1,2,3,4	Considering economic development, financially affordable to each generation, cost-

			effectiveness, and economic viability is the main aim of this type of definition.
3	Social and Justice	3,2	Considering health and safety, comfort, accessibility, a reasonable choice of transport services, and the sharing of benefits and costs between the public groups are the main purpose of this type of definition.
Selected References			
1-Buehler (2011) 2- (Zuidgeest, 2005) 3- (CST, 2005) 4- (T Litman, 2007)			

Accordingly, these narrow definitions are not widespread and detailed, since in these definitions it is not declared what kind of contemporary and future services of transportation is essential for supporting society moving towards sustainability. Besides, environmental definition just focuses on the consumption of natural resource in a sustainable way and on prevention of negative impacts on the ecosystem, and economical definition presented a transportation system pertaining to the evaluation of future costs and social definition only emphasized on equity (Table 6) (CST, 2005; Zhou, 2012).

Table 6: Examples of narrow definitions adapted from selected references

Aspects	References	Examples for Narrow Definitions
Environmental	1,2,3	Transport systems that: Make use of land in a way that has little or no impact on the integrity of ecosystems; Use energy sources that are essentially renewable or inexhaustible; Produce no more emissions and waste than the transport system's carrying capacity; Produce no more noise than an acceptable threshold of noise pollution.
Economic	1,3,4	Transport systems: that Provide cost-effective transport services and infrastructure capacity; be financially affordable to each generation; Support vibrant, sustainable economic activity.
Social	1,3	Transport systems: that Meet basic human needs for health, comfort, convenience, and safety; Allow and support the development of communities, and provide for a reasonable choice of transport services.
Selected References		
1-(CST, 2005) 2-(OECD, 1996) 3-(Zuidgeest, 2005) 4-**(T. A. Litman, 2008)**		

Accordingly, a broader definition of sustainable transportation by considering the all above-mentioned aspects together with ‘‘economic and social welfare, equity, human health, and ecological integrity’’ was essential. Hence, The Toronto based Centre for Sustainable Transportation in1997 introduced a broader and comprehensive definition that is widely accepted throughout the world (CST, 2005; T Litman, 2007; Zhou, 2012). This research will consider the broader definition of sustainable transportation as its bases. In this definition, a sustainable transportation system is one that:

- *Allows the basic access needs of individuals and societies to meet safety and in a manner consistent with human and ecosystem health, and with equity within and between generations.*
- *Is affordable operates efficiently, offers a choice of transport mode, and supports a vibrant economy.*
- *Limits emissions and waste within the planet’s ability to absorb them minimizes consumption of non-renewable resources, limits consumption of renewable resources to the sustainable yield level reuses and recycles its components, and minimizes the use of land and the production of noise.*

3.2.2 General Vision and Goals of Sustainable Transportation

Improving sustainability of the transportation sector is a common dream for countries throughout the world. Then, providing a general vision as a framework for developing sustainability in the transportation sector is indispensable (Shiau, 2013; Zuidgeest, 2005). In this regard, based on preceding discussions, a general vision for sustainable transportation defines as a transportation system that works for providing a dynamic balance among multiple objectives. These objectives include social equity, economic growth, environmental stewardship, accessibility, quality of life and taking care of present generation, without compromising the ability of generations ahead to reach the same objectives, and make cities attractive to live, work and reside in the present time and future as well (Qureshi & Lu, 2007; Zuidgeest, 2005).

Based on preceding debates, sustainable transportation has a purpose to improve human and ecosystem well-being together note one at the expense of the other. In this way, sustainable transportation by concentration to enhance qualities of transportation systems and create balance between demand and supply, aims to balance current and future economic growth, environmental preservation and social equity (Jeon et al., 2013; Todd Litman & Burwell, 2006; Song et al., 2013; Linda Steg & Gifford, 2005). Besides, improving mobility and accessibility among communities by making available an appropriate opportunity for people to choose different transportation modes and reduce negative impacts of the transportation (Bayramoğlu, 2012; Song et al., 2013; Zhou, 2012).

3.2.3 The Fundamental Dimensions & Principles of Sustainable Transportation

Sustainable transportation has a concentration on all aspects of transportation; therefore, to avoid weakening of the concept the fundamental dimensions and principles of sustainable transportation should be clarified by reverting to its origin (Holden et al., 2013; WCED, 1987). The Fundamental dimensions of sustainable transportation can be derived from the Brundtland definition of sustainable development and comprehensive definition of sustainable transportation that presented by The Toronto based Centre for Sustainable Transportation. Accordingly, Holden & Linnerud, 2007; WCED, 1987; and Holden, Linnerud, & Banister, 2013, elucidate three Fundamental dimensions of sustainable transportation as follows:

- Protection long-term environmental sustainability;
- Satisfying vital human requirements;
- The promotion of transport justice within and between generations.

Based on these three fundamental dimensions and preceding discussions, there are number of secondary dimensions, which are subordinated to the fundamental dimensions such as: conserving nature's inherent value, supporting protection of the ecosystem, encouraging public contribution, and satisfying aspirations for enhancing the level of living standards and quality of life (Holden & Høyer, 2005; Holden et al., 2013). Following this logic, economic growth no mentioned as a fundamental and secondary dimension and this is in dissident with definitions and goals of sustainable transportation. However, Brundtland report expresses economic development is required when such needs are not meet. Thus, economic growth will work as a supporter and play an important role to ease the fulfillment of the fundamental and secondary dimensions (Holden et al., 2013; WCED, 1987).

In addition to dimensions of sustainable transportation, understanding the principle of sustainable transportation is necessary to ease the fulfillment of sustainability in the transportation sector. Unfortunately, there is not yet a political and scientific agreement on the principles of sustainable transportation. A set of principles what was presented during The Organization for Economic Co-operation and Development (OECD) conference of "Towards Sustainable Transportation", which titled as 'Vancouver Principles for sustainable transportation' are listed below: (OECD, 1996; Zuidgeest, 2005).

- Intra- and inter-generational equity;
- Individual and community responsibility;
- Protection of health and safety;
- Education and public participation;
- Integrated planning;

- Conservation of land and other resources (Renewal and Non-Renewal);
- Prevention of pollution;
- Economic well-being;

These principles are essential for the short medium and long period protection of the all-ecological resources. These principles can be categorized into three sorts including environmental, social and economic which are clarified in Table 7 (R. P. Hall & Sussman, 2006; OECD, 1996).

Table 7: Categorization of sustainable transportation principles adapted from (r. p. hall & sussman, 2006; oecd, 1996)

	Principles	En	Ec	S
1	Intra- and inter-generational equity	●	●	●
2	Individual and community responsibility			●
3	Protection of health and safety			●
4	Education and public participation			●
5	Integrated planning	●	●	●
6	Conservation of land and other resources (Renewal and Non-Renewal)	●	●	
7	Prevention of pollution	●	●	●
8	Economic well-being		●	
Category of principles: En= Environmental ; Ec= Economic ; S= Social				

The principles related to the environment are trying to apply actions to avoid environmental damages, efficiently use of non-renewable resources and land, and enhancing transportation infrastructure for reuse or recycling (R. P. Hall & Sussman, 2006). The economic principles have an aim to pass the cost of transportation-related contaminations and guarantee that the actions taken are affordable and cost-effective through reach economic well-being among generations. The social principles are essential to make sure the equitable management for all people that are affected by the transportation sector (R. P. Hall & Sussman, 2006; OECD, 1996). The principles

related to the social sector try to promote more diverse transportation modes to provide equitable access of people to other people, places, goods, and services. Besides, the social principles have the focus to enhance the social well-being in different groups of people, health and safety and ensure individual act responsibly as well as all people meet basic needs related to transportation(R. P. Hall & Sussman, 2006). Consequently, transportation cannot be sustainable except all values related to fundamental dimensions and principles are fulfilled (Hickman et al., 2013).

3.2.4 Sustainable Transportation Modes

As has been indicated by many authors since 1950, private car ownership increased rapidly, accordingly, many countries around the world focused to expanding roadway and car parking (Gössling, 2013; Meng, Koh, Wong, & Zhong, 2014). This rapid growth in the number of cars and its related facilities led to numerous hidden costs and environmental, social and economic problems (Balsas, 2003; Meng et al., 2014). By mid-1970s, several countries recognized that transportation requests cannot be satisfied fully by private cars (Frade & Ribeiro, 2014; Liang et al., 2013; Meng et al., 2014). Thus, a dramatic shift in transport modes and policies and replacing motorized travel by alternative sustainable modes of transportation as an integral part of the transportation system has been started (Babalik-Sutcliffe, 2013; Brand, Goodman, & Ogilvie, 2014; Frade & Ribeiro, 2014). Accordingly, the alternative sustainable modes of transport can be divided into two modes (i) Non-Motorized and (ii) Motorized as has been indicated by Mohan and Tiwari (1999) (Figure 4).

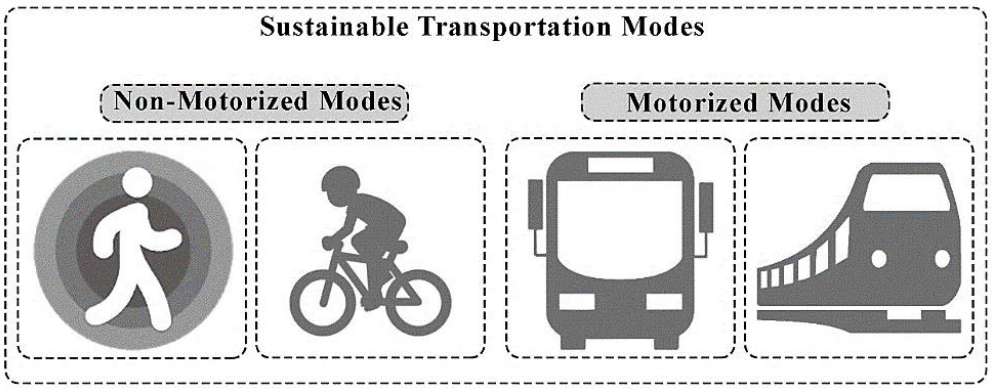


Figure 4: Sustainable Transportation Modes

(i) Non-Motorized Sustainable Transportation Modes

From the last four decades, non-motorized transport (NMT) or "active transportation" mode is being promoted due to various problems that current transportation system based on private cars is the recourse of them (Zhang et al., 2013). Non-motorized transportation plays a vital role in the transportation sector among communities to promote sustainable living (Todd Litman, 2017b; Yazid et al., 2011). This system consists of all forms of transportation, which do not depend to an engine or motor such as "walking, cycling, using small-wheeled transport (skates, skateboards, push scooters and hand carts) and wheelchair" (Mader & Zick, 2014; Rastogi, 2011). This transportation system can offer both recreation and transportation together (Yazid et al., 2011). Furthermore, non-motorized transportation has innate limitations such as, appropriate for short distances with lower speeds and smaller size of facilities. Non-motorized modes of transportation are important and vital elements of multimode transportation change in communities (Todd Litman, 2017b; Yazid et al., 2011). Additionally, non-motorized transportation has special characteristics such as (Brand et al., 2014; Pooley et al., 2013; Rietveld, 2000)

- Providing a door to door transport;
- Time and cost saving,

- Offering environmental friendly and zero carbon transport;
- Healthy activities and a very high spatial permeation transport

To provide efficiently use of non-motorized transportation modes, many factors are effective as follows: Individual feature, Built environment, Land-use planning, Infrastructure quality and planning, accessibility to other transportation alternatives, safety, comfort, government policies, social-cultural condition and spatial structure (Rietveld, 2000; Ryley, 2006). Two common modes of a non-motorized transportation system that used widely throughout the world are walking and cycling. These modes are defined as "active modes" and expressively encouraged in communities during the last four decades (Todd Litman, 2017b). Furthermore, walking and cycling can prove an extensive contribution to sustainable transportation objectives and creating healthier and more sustainable communities as argued by Pooley, et al., 2013; Tight, et al., 2011.

(ii) Motorized Sustainable Transportation Modes

Motorized modes of sustainable transportation include bus, train, taxi, tram, and metro that can be defined as public transportation (PT) modes (Todd Litman, 2018a; Mohan & Tiwari, 1999; Rietveld, 2000). Public transportation modes are using for commuting to and from long and medium distance travel inside cities or between the cities. Well-developed of this transportation mode is beneficial for achieving sustainability in the transportation sector and communities by reducing the use of private cars, traffic, controlling the use of land, minimizing the destroyed green areas, reduce noise and air pollution, increase livability, and enhance the quality of the environment and public health (Liang et al., 2013; Meng et al., 2014). Hence, developing the support of public transportation modes have direct effects on increasing the quality of life and health

condition within cities since travel cost and environmental damage will be reduced. Obviously, to provide efficient public transportation services, adapting path service and quality, providing appropriate strategies, timing, safety, improving the location and accessibility of stops, considering land use program, and mixing public transportation modes with non-motorized transportation modes are an undeniable fact (Todd Litman, 2017a; Alan T. Murray, Davis, Stimson, & Ferreira, 1998; Rietveld, 2000).

3.2.5 Benefits of Sustainable Transportation

The benefits of sustainable transportation can be divided into three general categories including Environmental, Social and Economic benefits. These benefits are summarized in Table 8 as has been gathered from various researches done by different scholars include Babalik-Sutcliffe, (2013); Black, Paez, & Suthanaya, (2002); Henao, et al., (2015); Mullen, Tight, Whiteing, & Jopson, (2014); Shiau, (2013); Song, Yin, Chen, Zhang, & Li, (2013).

Table 8: Benefits of sustainable transportation based on selected references

	Benefits of Sustainable Transportation	References
Environment	Protecting natural and wildlife	1,2,5
	Efficient use of natural scarce resources	2,3,6
	Decreasing level of air, noise, water and soil Pollutions	1,2,3,4,5,6
	Declining GHG Emission	3,6
	Reducing land consumption	2,4,6
Economic	Declining transportation infrastructure spending	1,4,6
	Contribution to increase economic development	2,3,5,6
	Increasing access to goods and services in an efficient way	3,4,5,6
	Growing employment level	1,2,3
Social	Rising equity and social inclusion	2,4,6
	Developing opportunity for the choice of transport modes and services	1,4,6 1,2,4,5,6
	Developing mobility and accessibility of people (Especially children, elderly and handicapped persons)	1,4
	Enhancing traffic safety, healthcare opportunities and physical activities	3,4,5
	Reducing accident and fatalities	2,4,6

Growing cultural activities and public participation	3,6
Enhancing education level	2,5,6
Increasing comfort and convenience	2,3,5,6
Improving aesthetic dimensions and livability of streets and neighborhoods	2,4,6
The increasing connection between social and cultural	1,4,6
Decreasing crimes related to transport	1,2,5,6
Reducing travel time and costs	

Selected References

1-Black, Paez, & Suthanaya, (2002)	4-Mullen, Tight, Whiteing, & Jopson, (2014)
2-Henao, et al., (2015)	5-Song, Yin, Chen, Zhang, & Li, (2013)
3-Shiau, (2013)	6-Babalik-Sutcliffe, (2013)

3.2.6 Movements towards Promoting Sustainability in Transportation Sector

In the way towards having a sustainable transportation system, various strategies are emerged and developed. These strategies are different greatly from city to city or from country to country since effective factors such as people travel patterns, social, political, economic and cultural contexts are not similar (Gössling, 2013; T Litman, 2007; Tood Litman, 2017d; Zuidgeest, 2005).

Based on the literature review, proposing appropriate strategies to achieve the main objectives and sub-objectives of sustainable transportation is indispensable. In this way based on arguments provided by Shiau, (2013); Litman, (2016); Bayramoğlu, (2012) and Gössling, (2013) consideration of the following approaches are more substantial as a foundation to plan movements towards enhancing level of sustainability into transportation sector: (i) Land-Use Planning, (ii) Use of Clean Energy, (iii) Shift Transportation Mode (iv) Use of Education and Information Technology (IT) system.

In this regard, Alizadeh & Abdi, (2014); Babalik-Sutcliffe, (2013); Dur & Yigitcanlar, (2015) and Litman, (2007), argued that land use planning have widely effect on

transportation planning and designing, and decisions related to transportation planning have extremely impact on land use planning too. Land-use planning by distributing of functions and services in the appropriate location and pay attention to the proximity of dissimilar land uses such as residential, commercial and institutional, enhancing connectivity of streets as well, can contribute to reducing the travel distances (T Litman, 2016; Shiau, 2013). Hence, decreasing the travel distances and designing the layout of buildings and centers to serving activities close to each other are substantial to promoting the use of sustainable transportation modes (Buehler & Pucher 2012; Dur & Yigitcanlar, 2015; Gössling, 2013; Tood Litman, 2017d; Mackett & Brown, 2011).

The second group of approaches emphasized to promote the use of clean energy and renewable energy resources such as electricity, Solar, Ethanol, Hydrogen, Clean fossil fuel, Biofuels, and Biomass (Bayramoğlu, 2012; Hickman et al., 2013; Shiau, 2013).

The third group of approaches has focused on shifting of transportation modes to sustainable modes. In this process, the development of public transportation and encouraging walking and cycling by infrastructure expansions and supporter strategies are substantial (Bayramoğlu, 2012; Gössling, 2013; Hickman et al., 2013). Besides, the reduction of private car uses and motorcycles is another side of this process.

The fourth group of approaches is related to education and use of Information Technology (IT) system to reduce and control travel demand and congestion plus providing better service and access to motorized and non-motorized modes as emphasized by Hickman, Hall, & Banister, (2013) and Shiau, (2013).

Consequently, scholars have emphasized different approaches to provide ways to support moving toward sustainability in the transportation sector by considering all determinative aspects. Accordingly, based on approaches mentioned above, movements towards enhancing sustainability in the transportation sector can be classified in four main groups, which are presented in Table 9. It is essential mentioned here that to achieve a successful sustainable transportation system inside the societies all these movements and strategies related to them must be considered in the parallel of each other.

Table 9: Movements towards promoting sustainability in transportation sector adapted from selected references

Classification of movements towards promoting sustainability in the transportation sector	
1	Movement-related to land use planning
2	Movement-related to use of clean energy and renewable energy
3	Movement-related to shift of transport modes to sustainable modes
4	Movement-related to Education and use of Information Technology (IT) system
Selected References	
1-Hickman, Hall, & Banister (2013)	2-Shiau (2013)
3-Bayramoğlu, (2012)	4-Gössling, 2013
5-Litman (2016)	6-Buehler & Pucher, 2012
7-Dur & Yigitcanlar, 2015	8-Mackett & Brown, 2011
9-Litman T., 2017d	10-Alizadeh & Abdi (2014)
11-Babalik-Sutcliffe (2013)	12- Litman (2007)

Accordingly, this dissertation will focus on one of the most widely accepted movement throughout the world related to the shift of transport modes to sustainable modes that entitled as an active transportation movement. In this regard, the next section will clarify the importance of encouraging active modes of transportation towards enhancing the level of sustainability in the transportation sector. Besides, the main determinative variables that consideration of them are indispensable in the process of

planning for encouraging the use of active modes of transportation will be provided at the end of this section.

3.3 An Overview on Active Transportation Movement

Travel-related to walking, cycling and the use of public transportation modes, which generally involves walking and cycling to reach transit stops, are defined as active transportation (Figure 5) (Bassett, Pucher, Buehler, Thompson, & Crouter, 2008; Genter , Donovan , & Petrenas 2008; Alan T Murray, 2001; TRB, 2012).

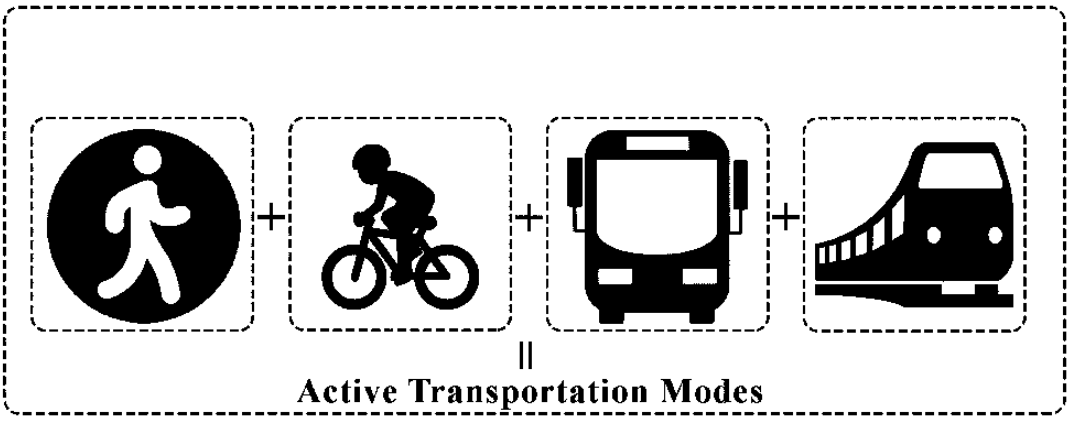


Figure 5: Active Transportation Modes

Many researchers such Bassett, Pucher, Buehler, Thompson, & Crouter, (2008); Genter , Donovan , & Petrenas, (2008) and Murray, (2001) emphases, active modes of transportation will work very well, when a strong synergies be among these modes and they get sufficient support from each other. From mid-1990s active transportation appeared as a fundamentally interdisciplinary field throughout transportation planning, public health, and urban design disciplines. Besides, active transportation takes place primarily to provide travel opportunities based on active modes of transportation by strong support from public transportation (Cantell, 2012; Killingsworth, De Nazelle, & Bell, 2003; Millward, Spinney, & Scott, 2013; Sallis, Frank, Saelens, & Kraf, 2004). Active transportation has a superiority potential to surrogate for automobile travel

because of its capability to provide direct access to greater distances in faster speed for destinations inside urban area (Dill, 2009; Rabl & De Nazelle, 2012).

It is essential to mention here that active modes of transportation are the most popular form of physical activity, which afford an opportunity to combine regular activity into daily habits. Besides, they are the most feasible approach to increase public fitness and health based on studies presented by Killingsworth, De Nazelle, & Bell, (2003); Bassett, Pucher, Buehler, Thompson, & Crouter, (2008) and Litman, (2003a).

Hence, the role of active transportation modes in protecting and enhancing public health by enhancing physical activities and decreasing negative issues and pollutions related transportation is illustrated by many scholars such as Saelens, Frank, & Salli, (2003); Genter , Donovan , & Petrenas, (2008); Huang, Stinchcom, Pickle, Dill, & Berrigan, (2009) and Rabl & De Nazelle, (2012). Besides, as has also been indicated by Litman, (2003a), promoting active transportation provides social equity, health benefits, and economic opportunity by supporting industrial and retail stores inside urban areas.

In this way, active transportation is formulated where the use of walking, cycling and PT modes and integration among these modes have priority over use of private cars (Cantell, 2012; Killingsworth et al., 2003; Rabl & De Nazelle, 2012). The World Health Organization (WHO) mentions that trips of less than 5 kilometers are appropriate for pedestrians and cyclists and for access to places out of this distance, public transportation systems shall be acted as a supporter (Edwards & Tsouros, 2006). Obviously, understanding the characteristics of walking and cycling modes is

essential, since active transportation is based on these modes, therefore; in the following a brief explanation of these two modes will be provided.

(i) Walking

Walking is the initial and oldest mode of transportation that is an inseparable part of human natural behavior. Walking is suitable at any age and is the basic form of physical activity that provides mobility, exercise and pleasure all together (T Litman, 2003a; Lovasi et al., 2013; Millward et al., 2013; Owen et al., 2007). Besides, walking can be done for various purposes involves leisure, health or transportation (Berrigan, Pickle, & Dill, 2010; Owen et al., 2010; Sallis et al., 2004). Walking is the primary system of active and non-motorized transportation throughout human history (T Litman, 2003a). Besides, Pooley, et al., (2011, p.1602), declared that walking is a simple mode of movement that is independent to any tools and is suitable for short journeys between 1 until 2 kilometers inside urban areas.

The level of walking in human communities has a direct effect on the quality of life and level of health within communities. Besides, walking can act as an eco-friendly alternative versus motorized travel inside urban areas (T Litman, 2003a; Millward et al., 2013). Walking is the slowest kind of transportation that this feature gives an opportunity to people spend more time in their environments, therefore; walking is an interaction of individual with and cognition of the surrounding environment (Kashani Jou, 2012; Owen et al., 2007). Hence, walking is the best way to enhance the level of interaction between people and the surrounding environments that provide a chance for walkers to enjoy their around events and get real experience (Lovasi et al., 2013; Sallis et al., 2004). There are various effective factors for encouraging walking in

different environments that main of them are provided in Table 10 based on selected references in the following.

Table 10: Effective factors to encourage walking based on selected references

	Effective factors to encourage walking
1	The suitable condition for sidewalks and pedestrian paths (appropriate with and pavements)
2	Lighting, signage and shading elements,
3	Quality of public spaces through pedestrian paths,
4	The strong connection between pedestrian facilities and other modes of transportation,
5	Providing a safe and comfortable position for the pedestrian by enhancing the quality of built environment features
	Selected References
1-Kashani Jou (2012) 2-Millward, Spinney, & Scott (2013) 3-Killingsworth, De Nazelle, & Bell (2003) 4-Berrigan, Pickle, & Dill (2010) 5-Sallis, Frank, Saelens, & Kraf (2004)	6-Litman (2003a) 7-Lovasi, et al. (2013) 8-Owen, et al. (2007) 9-Owen, et al. (2010)

(ii) Cycling

Another active mode of transportation is cycling and use of this mode is extremely encouraged in many countries, since this mode has more potentials to be a successor for motorized trips as has been stressed by many scholars such as Brand, Goodman, & Ogilvie, (2014); Pucher, Dill, & Handy, (2010a) and Rahul & Verma, (2014). Travel by this mode is faster than walking and can be a better choice for medium trip distance since travel by bicycle is three times faster than walking and can increase the users' physical activity (Basu & Vasudevan, 2013; Winters, Brauer, Setton, & Kay, 2010).

Besides, cycling is not only important and efficient for medium trip distance; likewise, this system can be as a feeder and a supporter mode to contribute to public transportation modes (Rastogi, 2011). Furthermore, trips less than 5 kilometers will be easily covered by bicycle as argued by Cantell, (2012). Thus, focusing on promoting

this type of transportation mode has a direct influence on enhancing health condition among residents of communities and the environment by increasing physical activities and reducing emissions related to motorized transportation (Pucher, Dill, & Handy, 2010a; Tight et al., 2011). Promoting cycling can be done based on some motivator factors, which are summarized in Table 11.

Table 11: Motivator factors for promoting of cycling summarized from selected references

	Motivator factors for promoting cycling
1	Safe and separate bike lines
2	Well defined network among bike lines
3	Appropriate lighting, signage, and shading
4	Safe and well-designed bike parking areas
5	Attractive scenery provided along the routes
6	Well connection between cycling facilities and other sustainable modes of transport
7	Education programs
8	Traffic calming and bike lines being far away from vehicle traffic
	Selected References
1-Basu & Vasudevan (2013)	6-Meng, Koh, Wong, & Zhong (2014)
2-Pucher, Dill, & Handy (2010a)	7-Rahul & Verma (2014)
3-Snizek, Nielsen, & Skov-Petersen (2013)	8- Tight, et al. (2011)
4-Brand, Goodman, & Ogilvie (2014)	9- Rastogi (2011)
5-Winters, Brauer, Setton, & Kay (2010)	10-Cantell (2012)

3.3.1 Benefits of Active Modes of Transportation

Promoting active transportation can provide a variety of benefits to environments, societies, individuals, and businesses. These benefits can be categorized into four groups include environmental, economic, social, and health benefits, which are summarized in the following based on the literature reviewed.

3.3.1.1 Environmental Benefits:

Giles-Corti, Foster, Shilton, & Falconer, (2010); Litman, (2003a) and Shay , Spoon , & Khattak, (2003) indicated, replacing many of short car trips inside urban areas by

active modes of transportation can reduce greenhouse gas, traffic congestion, air and noise pollutions, use of land and natural energy resources. Besides, through reducing the number of travel by cars there is an opportunity to improve local amenity, which all these changes have an effect on the health of environment and people based on the argument is provided by Giles-Corti, Foster, Shilton, & Falconer, (2010).

3.3.1.2 Economic Benefits:

Shifting towards using active modes of transportation can bring significant and wider economic benefits that clarified by Lavin, Metcalfe, & Higgins, (2011). This shifting can reduce healthcare cost, less cost for applying infrastructures related to active modes, and Low cost for users in compeering to car-based transportation (Genter et al., 2008; Giles-Corti, Foster, Shilton, & Falconer, 2010). Besides, people who use active modes of transportation contribute to improving local businesses and economy, since users of active modes of transportation will stay longer, visit more shops and spends more money in local shops (Lavin, Metcalfe, & Higgins, 2011; Litman 2003b). Furthermore, Giles-Corti, Foster, Shilton, & Falconer, (2010); Lavin, Metcalfe, & Higgins, (2011) and Litman & Burwell, (2006) argued that promoting active transportation can improve access to jobs and services as well as develop the economic viability.

3.3.1.3 Social Benefits:

Promoting active transportation by reducing traffic congestion, air, and noise pollutions and greenhouse gas emissions can provide wider societal benefits (T Litman, 2003a; Panter 2010). In this regard, using active modes of transportation have a great potential to increase social equity, generates social interactions, foster social capital and a sense of place, and enhancing the level of positive social norms (Giles-Corti et al., 2010; Panter 2010). Besides, community well-being, health status, the

perception of safety and level of accessibility and mobility particularly for non-drivers will be improved (Deakin, 2002; Giles-Corti et al., 2010; T Litman, 2003a; Panter 2010). Finally, using active modes of transportation can make a community livable and enhance the quality of life inside urban areas ((Litman 2003b).

3.3.1.4 Health Benefits:

Cantell, (2012); Litman, (2003b); Rabl & De Nazelle, (2012); Reis, Hino, Parra, Hallal, & Brownson, (2013) debated that Public health organizations all around the world are extremely alarmed for reducing the level of physical activity throughout population in urban communities and increasing of health problems. In this regard, numerous of authorities consider shifting people from car travel to choose active modes of transportation, can provide an opportunity to increase the level of physical activity in daily life (Genter et al., 2008; Litman 2003b; Rabl & De Nazelle, 2012). Besides, the research completed by Killingsworth, De Nazelle, & Bell, (2003); Lavin, Metcalfe, & Higgins, (2011); Litman, (2003b); De Nazelle, et al., (2011) indicated choosing active modes of transportation by citizen of a society for commuting, can leads to less road traffic and injuries and death. Moreover, less road traffic will decrease greenhouse gas emission and noise pollution. Moreover, active transportation contributes to increasing mental health by growing the level of social interaction (Lavin et al., 2011; Litman 2003b). Subsequently, based on researches presented by Cantell, (2012); Garrard, (2009); De Nazelle, et al., (2011); O′Hern & Oxley, (2015); Reis, Hino, Parra, Hallal, & Brownson, (2013), promoting active transportation provides a greater opportunities for enhancing level of public health. Consequently, Table 12 based on all arguments mentioned above is provided a list of benefits related to promoting active modes of transportation in communities.

Table 12: A list of benefits related to promoting the use of active modes of transportation summarized from selected references

	Benefits of promoting Active Transportation	References
Environmental	-Reduce greenhouse gas	1,2,11,14,15
	-Decline traffic congestion	3,4,6,12,13
	-Decrease air and noise pollutions	5,6,10,11,12,13
	-Reduce use of natural energy resources and land	9,11,12,16,17,18
Economic	-Reduce healthcare cost	1,2,9,10,18
	-Less cost for applying infrastructures related to active modes	2,3,4,8
	-Low cost for users in compeering to car-based transport	3,4,5,11,13
	-Improve access to jobs and services	5,6,8,13,14
	-Develop the economic viability	2,13,17,18
Social	-Increase social equity	2,3,13,14
	-Generates social interactions	6,7,8,13,14
	-Foster social capital and a sense of place	6,11,13,15,16,17
	-Enhancing level of positive social norms	2,13,14,16,17
	-Community well-being	16,17,18
	-More livable community	1,2,3,4,5,6,7,13, 17
	-Rise quality of urban life	2,3,6,8,10,11,12
	-Increase perception of safety and level of accessibility	2,13,14
Health	-Growth level of physical activity	1,9,10,11,12
	-Less road traffic injuries and death	7,8,12,18
	-Increase mental health	1,9,10,17
	-Enhance level of public health	1,9,10,13,16
	-Less noise	2,3,4,13,14,15

Selected References

1-Giles-Corti, Foster, Shilton, & Falconer (2010)
2-Litman (2003a)
3-Shay, Spoon, & Khattak (2003)
4-Panter (2010)
5-Falconer (2010)
6-Deakin (2002)
7-Rabl & De Nazelle (2012)
8-Reis, Hino, Parra, Hallal, & Brownson (2013)
9-De Nazelle, et al. (2011)
10-O′Hern & Oxley (2015)
11-Lavin, Metcalfe, & Higgins (2011)
12-Genter, Donovan, & Petrenas, (2008)
13-Litman (2003b)
14-Litman & Burwell (2006)
15-Cantell (2012)
16-Killingsworth, De Nazelle, & 17-Bell (2003)
18-Garrard (2009)

3.3.2 Main Determinative Variables towards Promoting Use of Active modes of Transportation

There are various variables that have influence on promoting the use of active modes of transportation among residents and can enhance residents' ability and preference to choose walking and cycling for short journeys in combination with public transportation modes for longer journeys (Lavin et al., 2011). Accordingly, in this

section to clarifying the main determinative variables that consideration of them are indispensable in the process of planning for promoting the use of active modes of transportation, 30 studies by focusing on promoting active modes of transportation are selected and reviewed. In Table 13, the list of these studies and affective variables that are considered in these studies towards promoting active modes of transportation are exposed.

Table 13: List of variables associated with promoting the use of active modes of transportation among citizens based on selected studies

	Author	Year	Title of Study	Journal	Variables	
1	Atasoy, Glerum, & Bierlaire	2013	Attitudes towards mode choice in Switzerland	Journal disP - The Planning Review	Age & Gender Car ownership & Lifestyle	Household Type & Income & Education Attitudes & perceptions
2	Saelens, Frank, & Salli	2003	Environmental Correlates of Walking and Cycling: Findings From the Transportation, Urban Design, and Planning Literatures	Journal of Behavioral Medicine	Age Density & Diversity Driver's license status Environmental quality	Facilities and Infrastructures Proximity (Density + Diversity) Street Connectivity & Accessibility Vehicle ownership & Income
3	Christiansena, Madsen, Schipperijn, Ersbøll, & Troelsen	2014	Variations in active transport behavior among different neighborhoods and across adult life stages	Journal of Transport & Health	Age & Gender Density & Land-use-mix	Street connectivity & Infrastructure Household Type & Income & Education
4	Sallis, Frank, Saelens, & Kraf	2004	Active transportation and physical activity: Opportunities for collaboration on transportation and public health research	Transportation Research Part A: Policy and Practice	Age & Gender Education level Income Mixed land use Density	Proximity (Density + Diversity) Connectivity Infrastructure Individual's behavior
5	Buehler	2011	Determinants of transport mode choice: a comparison of Germany and the USA	Journal of Transport Geography	Age & Gender Culture & Attitudes Density Jobs	Mix of land-uses Education level Automobile ownership Household Type & Income
6	Lavin, Metcalfe, & Higgins	2011	Active travel – healthy lives	The Institute of Public Health in Ireland	Attitude Land-use mix & Proximity	Age and Gender Experience in different modes of travel
7	Handy and Colifton	2001	Evaluating Neighborhood Accessibility: Possibilities and Practicalities	Journal of Transportation and Statistics	Accessibility	Facilities
8	Cervero & Kockelman	1997	Travel demand and the 3Ds: Density, diversity, and design	Transportation Research Part D: Transport and Environment	Age & Gender Employment Vehicle ownership Density & Design	Accessible & Infrastructures Possession of driver's license Household Type & Income Land Use Diversity
9	Handy, Boarnet, Ewing, & Killingsworth	2002	How the Built Environment Affects Physical Activity Views from Urban Planning	American Journal of Preventive Medicine	Travel behavior Household Type Street-scale	Street pattern & Street connectivity Aesthetic qualities Density & Intensity & Land use mix
10	Clark, Scott, & Yiannakoulias	2013	Examining the relationship between active travel, weather, and the built environment: a multilevel approach using a GPS-enhanced dataset	Journal of Transportation	Age & Gender Education Land-Use Mix Infrastructure	Land-use intensity & Density Number of cars per licensed driver Household Type & Income Accessibility & Connectivity
11	Burbidge & Goulias	2009	Active Travel Behavior	Journal Transportation Letters	Travel behavior Age & Gender Economic status Education level Habitual behavior Qualities of place	Accessibility Community design factors Density and Intensity Mix of land uses Connectivity of the street Aesthetic
12	Cao, Handy, & Mokhtarian	2006	The Influences of the Built Environment and Residential Self-Selection on Pedestrian Behavior: Evidence from Austin, TX	Journal of Transportation	Age & Gender, Employment status Auto ownership Accessibility	Mixed land uses Interconnected street Facilities Household Type & Income
13	Dieleman, Dijst, & Burghouwt	2002	Urban Form and Travel Behaviour: Micro-level Household Attributes and Residential Context	Journal of Urban Studies	Travel behavior Car ownership Mixed land use & Density	Household Type & income Education Infrastructure

14	Fishman , Helbich, & Böcker	2015	Adult Active Transport in the Netherlands: An Analysis of Its Contribution to Physical Activity Requirements	Journal of PLoS One	Age and Gender Household Income & Education	Number of cars per household Land use diversity & Density
15	Olojede, Yoade, & Olufemi	2017	Determinants of walking as an active travel mode in a Nigerian city	Journal of Transport & Health	Age & Gender Household Income & Education land use	Vehicles and driver's licenses Employment status Facilities
16	Giuliano & Dargay	2006	Car ownership, travel, and land use: a comparison of the US and Great Britain	Transportation Research Part A: Policy and Practice	Age & gender Employment status Car ownership	Household Type Household income Density & Accessibility
17	Litman	2016	Land Use Impacts on Transport	Report	Accessibility Land use mix	Density Road and path connectivity
18	Scheepers, et al.	2013	Personal and Environmental Characteristics Associated with Choice of Active Transport Modes versus Car Use for Different Trip Purposes of Trips up to 7.5 Kilometers in The Netherlands	Journal of PLoS One	Age & gender Educational level Car ownership Land use mix	Density Accessibility Connectivity Quality of buildings
19	Adams	2010	Prevalence and socio-demographic correlates fo “active transport” in the UK: Analysis of the UK time use survey 2005	Journal of Preventive Medicine	Age & Gender	Employment status & Car ownership
20	Frank & Engelke	2005	Multiple Impacts of the Built Environment on Public Health: Walkable Places and the Exposure to Air Pollution	International Regional Science Review	Travel behavior Design of streets	Proximity Connectivity
21	Cantell	2012	Assessing the Active Transportation Potential of Neighborhood Models Using GIS	Master Thesis	Age & Gender Employment status Having a disability Diversity Design & Density	Level of education & Car ownership Individual’s perception of different modes of transportation Household Income & Type Attitudes and social norms
22	Panter	2010	Towards an understanding of the influences on active commuting	Ph.D. Thesis	Age & Gender Connectivity & Street design	Accessibility & Proximity (D + L) Density & Land use mix
23	Feng	2016	The Built Environment and Active Travel: Evidence from Nanjing, China	Int. J. Environ. Res. Public Health	Age & Gender Density Diversity & Design	Household Type & Car ownership level of education Household income
24	Cerin, Leslie, & Owen	2009	Explaining socio-economic status differences in walking for transport: An ecological analysis of individual, social and environmental factors	Social Science & Medicine	Age & Gender Car ownership Employment status Land use mix	Residential density Street connectivity & Facilities Aesthetics & Greenery Household Type & Income
25	Freeman, et al.	2013	Neighborhood Walkability and Active Travel (Walking and Cycling) in New York City	Journal of Urban Health	Age & Gender Density Diversity	Street connectivity Accessibility & Infrastructure Employment status & Education
26	Owen, et al.	2010	Bicycle Use for Transport in an Australian and a Belgian City: Associations with Built-Environment Attributes	Journal of Urban Health	Age & Gender & Education Density & Proximity	working status & Bike ownership Land Use Mix & Street Connectivity
27	Leslie, et al.	2007	Walkability of local communities: Using geographic information systems to objectively assess relevant environmental attributes	Journal of Health & Place	Density Land use mix Street connectivity	Accessibility Proximity (D + L)
28	Owen, et al.	2007	Neighborhood walkability and the walking behavior of Australian adults	American Journal of Preventive Medicine	Age and Gender Land-use patterns	Proximity & Connectivity Household Type & Income & Education
29	Forsyth, Hearst, Oakes, and Schmitz	2008	Design and Destinations: Factors Influencing Walking and Total Physical Activity	Journal of Urban Studies	Age & Gender Education level Household Type	Infrastructure & Connectivity Density & Mixed use Car ownership
30	Pooley, et al.	2013	Policies for promoting walking and cycling in England: A view from the street	Journal of Transport Policy	Age land use factors	Infrastructure & Connectivity Experience and perception of traveling Street pattern & Accessibility

According to variables that are considered by selected studies, determinative variables that must be considered by planners towards promoting active modes of transportation can be categorized in two main groups include variables related to social context and variables related to the built environment context. Hence, variables related to each category will be clarified in the following.

3.3.2.1 Variables related to Social Context:

The variables related to social context based on selected studies in Table 10 can be divided into two groups, (i) socio-demographic and socio-economic variables, and (ii) community attitudes and beliefs variables. The main variables related to socio-demographics and socio-economic and community attitudes and beliefs are exposed in Figure 6 and explained in the following.

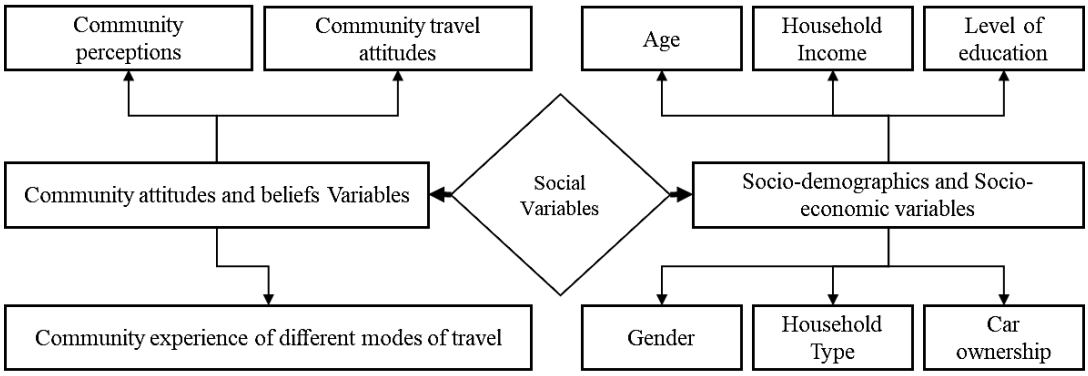


Figure 6: The Main Variables Related to the Social Context that must be considered in Planning Process towards Promoting Active Modes of Transportation

(i) Socio-demographics and socio-economic Variables:

Burbidge & Goulias, (2009) and Lavin, Metcalfe, & Higgins, (2011) claims socio-demographics and socio-economic variables are significant variables that are playing a crucial role in the choice of active modes of transportation by citizens.

Age is one of the significant variables that have a very important effect. Since, based on research presented by Fishman , Helbich, & Böcker, (2015); Giuliano & Dargay, (2006); and Lavin, Metcalfe, & Higgins, (2011), throughout the communities' younger people under 18 age and older people over 65 age are more interested to use active modes of transportation. Thus, in the planning process of promoting active modes of transportation in urban settlements, understanding the residents' average age play a very substantial role. This understanding will help policymakers and designer to provide suitable policies and design solutions to improve using active modes of transportation among residents.

Another important and effective variable is the gender that plays a significant role. Since, due to numerous studies which were done around the world women are more interested to walk while men are more bicycle lover (Adams, 2010; Fishman, Helbich, & Böcker, 2015; Scheepers et al., 2013). Besides, women are more desirable than men to take part in any active modes of transportation (Adams, 2010).

Another notable variable is the level of education, based on several types of research, people with higher level of education use more active mode of transportation (Burbidge & Goulias, 2009; Fishman et al., 2015; Lavin et al., 2011).

Level of household income is another variable that some studies mentioned the high level of income has direct positive effect on the increased level of car ownership and trips since in communities with a high level of car ownership, people prefer to live in suburbs areas. Accordingly, the number of car trips will increase and the use of active transportation will decline (Adams, 2010; Cao, Handy, & Mokhtarian, 2006; Feng, 2016). Another factor is household type since based on numerous researches, a family

with children is more interested to use the private car (Adams, 2010; Cerin, Leslie, & Owen, 2009; Dieleman, Dijst, & Burghouwt, 2002).

(ii) Community attitudes and beliefs Variables:

Variables related to community attitudes and beliefs are including community travel attitudes, community perceptions and community experience of different modes of travel. These variables play an extremely important role in societies to choice active modes of transportation by their citizens. Community transportation attitudes and beliefs are more complex, unobserved and considered latent variable that has a significant influence on travel behavior of people that argued by Atasoy, Glerum, & Bierlaire, (2013); Burbidge & Goulias, (2009); Lavin, Metcalfe, & Higgins, (2011); Sallis, Frank, Saelens, & Kraf, (2004); and Hurtubia, Atasoy, Glerum, Curchod, & Bierlaire, (2010). They are explanatory variables that directly link to culture, lifestyle and individual attitudes (Buehler, 2011; Hurtubia, Atasoy, Glerum, Curchod, & Bierlaire, 2010; Lavin et al., 2011)

3.3.2.2 Variables related to the Built Environment Context:

The built environment is clarified as "all of the physical structures and elements of the human-made environments in which we live, work, travel, and play" (Frank and Engelke, 2005, p. 194). Study of selected references in Table 10 has shown the main variables related to the built environment that can be effective in promoting active modes of transportation and encourage people to choose active modes for commuting. These variables can be divided into two general categories (i) variables related to Land-Use and (ii) variables related to Community Design (Figure 7).

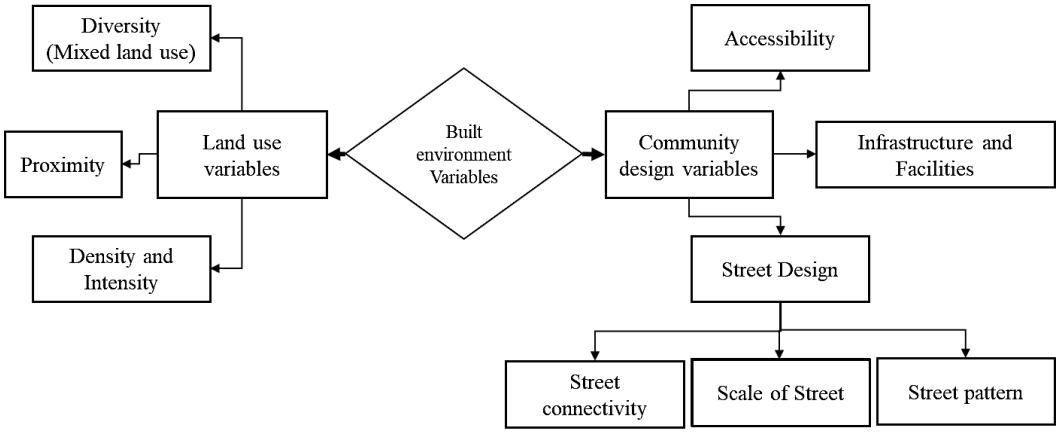


Figure 7: The Main Variables Related to the Built Environment that must be considered in the Planning Process towards Promoting Active Modes of Transportation

(i) Variables related to Land-Use

The main variables related to Land-Use based on selected references in Table 10 are including Mix land use development (Diversity), Density and Intensity of development, and Proximity. Mix land use development refers to the diversity of different land use functions along with an area (Cervero & Kockelman, 1997; Clark, Scott, & Yiannakoulias, 2013). Hence, a mixed-use neighborhood would include different land uses such as homes, stores, and offices (Bassett et al., 2008; Cantell, 2012; Panter 2010). There is no a standard way to measuring of the land use mix. For example, in research done by Handy and Colifton, (2001), the distance from each house in a neighborhood to the nearest shop used for measuring the land use mix. Another research was done by Cervero & Kockelman, (1997), this research used "dissimilarity index" that by this technic an area is divided into grid cells and for each cell, the number of neighboring cells by different land use is counted.

Density and intensity of development are related to the measurement of the rate of activity establish in an area and perhaps is the easiest indicators to measure related to built environment (Cervero & Kockelman, 1997; Handy, Boarnet, Ewing, &

Killingsworth, 2002). Typically, it is demarcated as people per acre, occupations per square mile or building square footage per unit of area (Freeman et al., 2013; Owen et al., 2010). One of the popular methods to measure density is using the floor-area ratio. In this method, the ratio among the floor space (the area of each story) in a building and the size of the parcel that the building sits will be counted (Handy et al., 2002).

Proximity indicator referred to intermingling among density and diversity (Cantell, 2012; Frank & Engelke, 2005; Lavin et al., 2011). In another word, proximity is related to the distance among trip origins and destination in space such as residential and commercial uses(Eva Leslie et al., 2007; Saelens, Frank, & Salli, 2003; Sallis et al., 2004). Thus, proximity is related to more mixed and dense land-use that creates shorter distances among residential areas and destination such as services, commercial areas, workplaces, and public transport stops (Frank & Engelke, 2005; Owen et al., 2010; Owen et al., 2007).

(ii) Community Design Variables

Based on selected studies, the relationship between variables related to community design and encouraging active modes of transportation is very strong and numerous studies have been done towards determining the effect of variables related to community design. Accordingly, based on selected references in Table 10, variables related to community design can be categorized as follow. The first variable is street design, which is including street connectivity, street scale and street pattern (Badland & Schofield, 2005; Handy et al., 2002; Killingsworth et al., 2003; Owen et al., 2010).

Street connectivity indicator refers to attempt to measure numbers of route and transportation options, and directness of transportation linkage among origins and

destinations (Cantell, 2012; Frank & Engelke, 2005; Millward et al., 2013; Saelens et al., 2003). Handy, (1996) mentioned connectivity can be measured by a number of intersections per square mile. In this regard, Hess, (1997) indicated a method to measure connectivity by the ratio between the straight-line distance among two points and the distance along the network between these points. Besides, the average block length is used as a technic to measure connectivity in planning practices.

The scale of the street is another indicator that refers to the three-dimensional space along a street as restricted by buildings, trees, walls and etc. The scale of street generally described in a term such as "human-scale" and "automobile-scale" (Ben-Joseph & Southworth, 1997; Handy et al., 2002). The scale of the street can be measured by the ratio of buildings heights and street widths or the average of distance from the street to the building that named as "building setback". The scale of the street is illustrated graphically rather than measured statistically (S. Hall, 2012; Handy et al., 2002; Jacobs, 1993).

Street pattern is playing a very important role to attract people to choose active transport modes. However, street pattern refers to design approaches or arrangement of streets and blocks (Forsyth, Hearst, Oakes, & Schmitz, 2008; Pooley et al., 2013). Besides, enhancing the street pattern and use suitable pattern can increase active living through transportation and can provide more direct and shorter paths to destinations (Killingsworth et al., 2003; Owen et al., 2010; Paydar & Said, 2012).

The second variable related to community design is infrastructure and facilities that play a crucial role to encourage people to use active modes of transportation. In this sort, the level of aesthetics, attractiveness, and quality of facilities are important

(Badland & Schofield, 2005; Burbidge & Goulias, 2009; Eva Leslie et al., 2005; Shay , Spoon , & Khattak 2003). Accessibility is another main variable that refers to journey duration, access to facilities related to transportation modes and access to destinations such as markets, houses, jobs, goods and services (Freeman et al., 2013; Mavoa, Witten, McCreanor, & O'Sullivan, 2012). Accessibility can be used as a variable for monitoring the performance of the land use and transportation systems being installed in a neighborhood or region. Accessibility levels are significant in terms of the quality of life in urban settlements (El-Geneidy & Levinson, 2006; Mavoa et al., 2012). Accessibility can be measured through the different methods that provided by scholars during more than 4 decades. The traditional measure of accessibility is based on measurements of spatial separation of individuals and activates that named as a place-based measurement. In recent years, methods to measure accessibility are people-based (El-Geneidy & Levinson, 2006; Miller, 1999). One of the basic and early methods is the cumulative opportunity measure (Vickerman, 1974; Wachs & Kumagai, 1973). The most widely used method for measuring accessibility is gravity-based measure (El-Geneidy & Levinson, 2006; Hansen, 1959). The other methods for measuring accessibility are such as Utility-Based Measure, Constraints-Based Measure, Composite Accessibility Measure, and Place Rank Measure (El-Geneidy & Levinson, 2006; Miller, 1999).

Consequently, based on all the facts mentioned above, in the process of planning towards promoting active modes of transportation, consideration of all variables related to the built environment is indispensable.

3.4 Summary of the Chapter

Applying sustainability concept in the transportation sector has become an important part of researches in the field of urban design, transportation planning, and public health. Accordingly, the initial step in this way was defining a comprehensive and acceptable definition, vision and aim for sustainable transportation. Hence, a growing number of scholars, government agencies, professionals, and academic units looks through defining all these scopes and incorporate the concept of sustainability in the transportation planning and activities process. In this way, for avoiding weakness, scholars focus to clarify the fundamental dimensions and principles of the sustainable transportation concept by reverting to its origin.

In this way, The Toronto based Centre for Sustainable Transportation in 1997 introduced a broader and comprehensive definition that widely accepted throughout the world. In this widely accepted definition, a sustainable transportation system is one that:

- *Allows the basic access needs of individuals and societies to meet safely and in a manner consistent with human and ecosystem health, and with equity within and between generations.*
- *Is affordable operates efficiently, offers a choice of transport mode, and supports a vibrant economy.*
- *Limits emissions and waste within the planet's ability to absorb them minimizes consumption of non-renewable resources, limits consumption of renewable resources to the sustainable yield level reuses and recycles its components, and minimizes the use of land and the production of noise.*

Accordingly, in this dissertation, the definition that provided by The Toronto based Centre for Sustainable Transportation will be considered as a foundation. Based on this definition, a general vision is defined for sustainable transportation as a transportation system that works for providing a dynamic balance among multiple objectives. These objective includes of social equity, economic growth, environmental

stewardship, accessibility, quality of life and taking care of present generation, without compromising the ability of generations ahead to reach the same objectives, and make cities attractive to live, work and reside in the present time and future as well. Consequently, the main purpose of sustainable transportation is balancing current and future economic growth, environmental preservation and social equity.

In addition, this chapter focused on modes of sustainable transportation and general benefits related to promoting sustainable transportation in communities. Besides, for designing a comprehensive framework to promote sustainable transportation, factors that are playing a more significant role as a foundation to plan diverse movements towards encouraging sustainability into transportation sector are considered. Based on determinative factors, movements that are trying towards promoting sustainability in the transportation sector in communities are recognized in four categories.

- Movement relates to the land use planning
- Movement relates to the use of clean energy and renewable energy
- Movement relates to shift of transport modes to sustainable modes
- Movement relates to Education and use of Information Technology (IT) system

In the second part of this chapter, based on main aim and limitation of the dissertation, the focus is on the movement of active transportation as a particular movement related to the shift of transportation modes to sustainable modes. Active transportation defined as travel-related to walking, cycling and the use of public transportation systems. Generally, using public transport systems involves walking and cycling to reach transit stops.

In continues, benefits and values of promoting active modes of transportation in communities and the characteristics of walking and cycling that are the foundation of active transportation are clarified, since an understanding of all these knowledge is very important in process of making-decision for decision makers. After that, motivator factors to use walking and cycling, and determinative variables that must be considered in the planning process for promoting the use of active modes of transportation are highlighted. Determinative variables are categorized under two categories include variables related to social and the built environment contexts (Figure 8). Consideration of these variables strongly effects residents' opportunity to choose active modes of transportation.

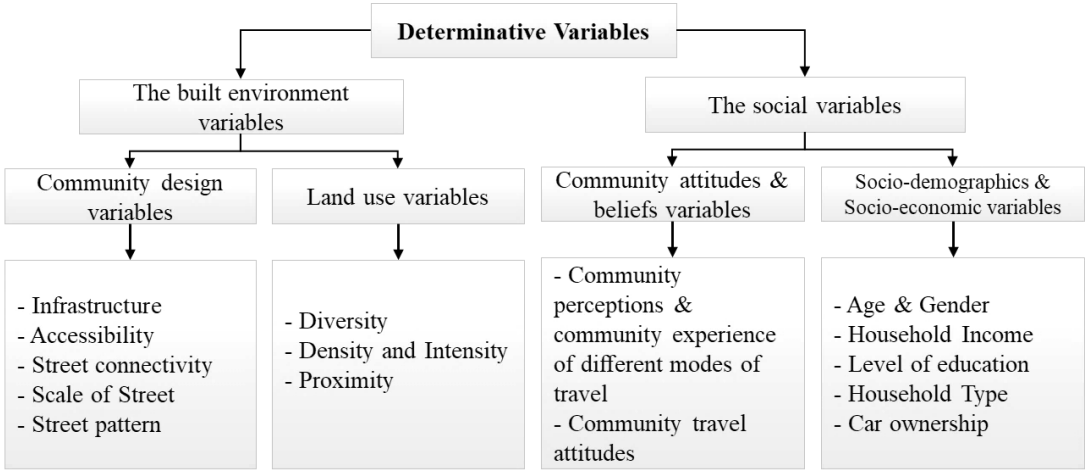


Figure 8: Determinative Variables Related To Social and the Built Environment Contexts

According to all the above explanations, the following figure will bring together all knowledge provided in this chapter and will highlight the connection among all clarifications in this chapter (Figure 9). Based on the main aim and objectives of the dissertation, next chapter has focused to discussing and introducing the concept of Complete Streets as the newest movement towards redesigning streets to provide more opportunity to promote active modes of transportation within communities.

Chapter 3

Introduction

An Overview on the Concept of Sustainable Transportation

Definition	A sustainable transportation system is one that: Allows the basic access needs of individuals and societies to meet safely and in a manner consistent with human and ecosystem health, and with equity within and between generations. Is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy.							
Vision & Golas	A transport system that work for providing a dynamic balance among multiple objectives. These objective includes of social equity, economic growth, environmental stewardship, accessibility, quality of life and taking care of present generation, without compromising the ability of generations ahead to reach the same objectives, and make cities attractive to live, work and reside in the present time and future as well. Improve human and ecosystem well-being together							
Dimensions	1- Long-term environmental sustainability			2- Satisfying vital human requirements			3- Transport justice within and between generations	
Principles	1- Intra- and inter-generational equity	2- Individual & community responsibility	3- Protection of health and safety	4- Education and public participation	5- Integrated planning	6- Conservation of land and other resources	7- Prevention of pollution	8- Economic well-being
Modes	**(i) Motorized**					**(ii) Non-Motorized**		
	Public Transport					Cycling		
						Walking		
Benefits	1- Environmental		2- Economic		3- Health		4- Social	
Movements to Promote Sustainability in Transportation Sector	Movement related to the land use planning		Movement related to use of clean energy and renewable energy		Movement related to shift of transport modes to sustainable modes		Movement related to Education and use of Information Technology (IT) system	

An Overview on Active Transportation

Definition	Travel-related to walking, cycling and the use of public transportation systems which generally involves walking and cycling to reach transit stops, defined as active transportation					
Vision & Goals	Offering an opportunity to combine regular activity into daily habits to increase public fitness and health, decreasing negative issues and pollutions related to transport sector, providing social equity and economic opportunity by supporting industrial and retail stores.					
Benefits	1- Environmental		2- Economic		3- Health	4- Social
Modes	1- Walking			2- Cycling	3- Using public transport	
Main Determinative Variables	**Built environment variables**		**Social Variables**			
	Community design	Land-Use	Community attitudes and beliefs		Socio-demographics and socio-economic	
	Infrastructure & facilities	Diversity (Mixed land use)	Community travel attitudes		Age	Household type
	Accessibility				Gender	Household income
	Street pattern & Scale of Stree	Density and intensity	Community perceptions and community experience of different modes of travel		Level of education	Car ownership
	Connectivity	Proximity				

Summary of the Chapter

Figure 9: Summary of the Chapter Three

Chapter 4

COMPLETE STREETS

4.1 Introduction

In the past century, many authors and scholars including Kevin Lynch, Jane Jacobs, William Whyte, Lewis Munford, Donald Appleyard, and Jan Gehl illuminated the position of streets as physical and social part for living in communities and its influence on social context, civic activities, and motor vehicles movement (George, 2013; Southworth & Ben-Joseph, 2003). Many of these scholars clarified the important role of streets for public realm vitality and supporting all modes equal priority. Accordingly, communities by focusing on the role of streets are trying to apply various movements and their related strategies to bringing back the active modes of transportation to streets for increasing the level of sustainability in communities (Todd Litman, 2014; Marti, Giese, & Kuehl, 2013; Scott et al., 2013).

Accordingly, in 2005 the concept of Complete Streets was born by Barbara McCann a staff member of the Advocacy Group America Bikes (George, 2013; Gill 2014; Scott, Beck, & Rabidou, 2011). The complete streets movement has an aim to define a street for everyone by considering all users for balancing access for all ages and abilities (Burden & Litman, 2011; Cui, 2013). Consequently, the Complete Streets movement by redefining the intention of streets, promise to make communities more livable and sustainable (Kingsbury, Lowry, & Dixon, 2011; Zavestoski & Agyeman, 2015).

Hence, in this chapter based on the main aim of the dissertation a comprehensive explanation and discussion on complete streets movement by focusing on its background, policy, planning process and design components will be presented. Besides, determinative variable and main steps that must be considered in the process of planning towards having complete streets will be clarified.

4.2 A Review on Movements towards Promoting Active Modes of Transportation by Focusing on Redesigning Streets

In the 1960s, in the city of Delft, the movement for bringing back active mobility to streets emerged and developed, which is named as "Woonerf" concept (Collarte 2012; Karndacharuk, Wilson, & Dunn, 2014). The main intention of the concept is to change the way residential streets are used and to enhance the quality of life by redesigning streets for residents, not just for automobiles. In this concept, the living environment dominates rather than automobile infrastructure and streets' spaces while completely accommodating the needs of people. Woonerf concept focuses on a residential street to provide a safe and enjoyable space for the pedestrian. Thus, this concept gives priority to pedestrians over the motor vehicles. In the Woonerf concept, the street is shared between the pedestrians, bicycles, and motor vehicles. Through applying this concept, all street users must travel with precaution, since in this concept there is no clear segregation among pedestrians, bicycles, and cars.

The Dutch Government adopted the initial set of Woonerf design principles in 1976. After that, over the next years, many European countries went through applied this concept (Collarte 2012; George, 2013; Skoworodko, 2012; Southworth & Ben-Joseph, 2003). In the 1980s, several features and ideas of Woonerf concept presented to traffic calming design. Traffic calming focused only on slowing down traffic so there are

several lack elements to increase social interactions and motor vehicles traffic has priority over the pedestrians.

After a while, the concept of Woonerf known and developed in the UK as Home Zone concept from the early 1990s. Home Zone concept has focused on residential streets in which the street space is shared among pedestrians, cyclists and motor vehicles. Thus, Home Zone will consider the needs of residents including people who walk, cycle, and children by reducing the speeds and authority of vehicles (Mike Biddulph, 2008; Engineers, 2002). Hence, the aim of this movement is to transfer the way that roads are used and to enhance the quality of life in residential streets by designing them places for people, not just for traffic flow. However, the concept of Woonerf and Home Zone combine all spaces for children's play and social interactions among residents (Anvari, Bell, Sivakumar, & Ochieng, 2015; Mike Biddulph, 2010; George, 2013).

Within the last 20 years, the Shared Streets or integration concept that is originated from the Woonerf concept, commonly used for streets in USA (Gilman et al., 2007; Skoworodko, 2012). This concept has the potential to apply to residential and commercial streets (Anvari et al., 2015). The shared street is an urban design and planning concept that emphasis on a combination of existing spaces by eliminating the traditional system of street separations between all users of streets (Anvari et al., 2015; Karndacharuk et al., 2014; Skoworodko, 2012). Shared Streets approaches is flexible in the use of street spaces and assigned the right-of-way to street users. Shared Street is not an "anti-car" concept; it is an approach to redesign of the street for the social and physical activities and recovery of the pedestrian environment (George, 2013; Golub, 2014; Southworth & Ben-Joseph, 2003). Moreover, shared streets highlights pedestrians, cyclists, and children at play and allows cars to move and park in same

street space but in a less dominant position. However, it may seem the users of these modes would clash with one another but physical design strategies can support and create a safe situation for pedestrians and bicyclist in common streets configurations. Accordingly, the shared street concept brings back human scale to streets.

In this way, a new concept and movement in 2003 by Barbara McCann a staff member of the Advocacy Group America Bikes is defined as the Complete Streets concept (George, 2013; Gill 2014; Scott et al., 2011). This term communicated to show the capacity of cycling infrastructure within the transportation planning system. However, after a while the term of complete streets expended through adding walking planning and all motorists transit to cycling planning (George, 2013; Gill 2014; Kingsbury et al., 2011). Hence, in the heart of the complete streets concept, a multimodal transport system allows users to choose their transport modes based on the types of trips (Burden & Litman, 2011; Marti et al., 2013; PARSONS, 2014). Thus, complete streets will consider the needs of all users for balancing access for all ages and abilities, ethnicities, incomes, and those that use the street as public space for leisure to socialize (Cui, 2013; Kingsbury et al., 2011; Macdonald, Sanders, & Anderson, 2010).

However, the focus of complete streets is not just on individual streets, in essence, its focus is on the changing process of the decision-making and planning, designing, building and operating of all streets (Laplante & McCann, 2008; Rauf & Quarter, 2010; Skoworodko, 2012). Subsequently, a complete street will be defined as a street that is planned, designed and operated to be safe, convenient and comfortable for all users, including drivers, pedestrians, bicyclists, and transit riders of all ages and abilities (Burden & Litman, 2011; George, 2013; Macdonald et al., 2010; Scott et al., 2011). The Complete Streets movement by redefining the intention of streets, promise

to make communities more livable and sustainable (Kingsbury et al., 2011; Zavestoski & Agyeman, 2015).

4.3 Benefits of Complete Streets

Supplying and adapting complete streets have the potential to benefit the communities in different ways. Complete streets concept by providing an opportunity to encourage a multi-model system of transportation modes and a specific attention to active modes, persuade people to choose different modes of transportation that these modes produce, fewer pollutants (noise, air, soil, water), less use of natural resources, less traffic congestion, fewer roads and parking costs, and more active lifestyle that improved public fitness and health (Burden & Litman, 2011; George, 2013; Todd Litman, 2014; Macdonald et al., 2010; PARSONS, 2014). Green infrastructures are an integral part of complete streets such as street trees and stormwater to mitigate the environmental impact of runoff and other effects of transportation.

Complete streets movement by creating infrastructure and a physical roadway layout and keeping all users of different modes of transportation in mind will increase a users' ability to reach the required destination and provides equal access for all users (Kingsbury et al., 2011). Thus, complete streets by accommodating pedestrians, bicyclists, automobiles and transit users provide appropriate space for all modes and their users. Besides, complete streets by expanding and improving mobility and accessibility options and providing treatments for children, older adults and disable travels through policies and designing approaches, encourage people to use alternative modes of transportation to reduce the use of private cars (Burden & Litman, 2011; Cui, 2013; Todd Litman, 2014).

Moreover, safety and comfort levels of users are very important in complete streets, since paying attention to these aspects can be tools for attracting non-motorized users and users of public transit service. Improving the levels of comfort and safety will provide greater opportunities for vulnerable users (children, older adults and disabled people) to be more independent and active in a safe environment (Burden & Litman, 2011; Marti et al., 2013; Scott et al., 2011).

Accordingly, complete streets movement by focusing on safety, comfort, accessibility, mobility and equity values for people of all ages and abilities and considering all modes of travel will increase livability and quality of life in communities (Burden & Litman, 2011; Marshall & Garrick, 2011; Marti et al., 2013).

However, Complete streets generally will reduce traffic speeds by using various policies treatments and design approaches that directly have an effect on improvement of walking, cycling, and public transit services convenience (Burden & Litman, 2011). Besides, by applying the complete streets concept, the cost of infrastructures will be reduced and by designing a more accessible and safe transportation network among residential areas, shopping destinations, offices, restaurants, public transport and entertainments, economic vitality and level of public investment and commercial activities especially in local economies will increase (Burden & Litman, 2011; Cui, 2013).

Furthermore, complete streets by increasing foot traffic and providing safe access to business areas, contribute to a more attractive and vital economic. Moreover, retail sales and land value also are increasing through applying the complete streets concept and complete streets offer different less costly transportation modes, which has

financial benefits to persons, families, and governments (Burden & Litman, 2011; Sadler 2010; Zavestoski & Agyeman, 2015).

The complete street strategy by encouraging a comprehensive, integrated, and connected network for all modes as well as street connectivity, aims to contribute mode shift to non-motorized modes and invite people to take walk and use alternative modes of transportation versus private cars (George, 2013; Marti et al., 2013). Hence, for inviting people public spaces must be designed for people, not cars to offer more opportunities for residents to have easy, safe convenient access to public spaces (Marti et al., 2013). Thus, complete streets by considering all models and their connection will increase transportation system efficiency and more active use public spaces (Burden & Litman, 2011; Scott et al., 2011).

Additionally, complete streets offer a significant opportunity for community residents to be involved in their communities, interact and reach community destinations (Cui, 2013; Marti et al., 2013). Hence, complete streets term fosters strong communities by contributing to reaching social equity, building social capitals, and increasing residents' sociability and community cohesion (Todd Litman, 2014; Scott et al., 2011).

According to all explanations above, the benefits of Complete Streets can be categorized and summarized into five groups; those are declared in Table 14.

Table 14: Categorization of complete streets benefits summarized from selected references

	Benefits	Explanation	References
1	Environmental Health, Healthy Community and Green design	-Provide a transport system with produce fewer pollutants and less use of natural resources	1,2,6,8,10
		-Less traffic congestion and fewer roads and parking costs	2,4,6,7,9
		-The more active lifestyle and Increase public fitness and health	2,3,5,8,9,10
		-Improve green infrastructures such as street trees and stormwater	3,4,8,9
2	Convenient Access and Transportation Equity and Safety	-Keeping all users of different transport modes in mind and reduce the use of private cars	1,2,3,5,6,8,9
		-Provide equal access for all users	1,2,4,5,7,9,10
		-Increase a user's ability to reach the required destination	3,5,6,8,9
		-Provide appropriate space for all modes and their users	1,3,4,5,7,8,9
		-Increase safety and comfort levels of all mode's users	1,2,3,4,5,6,7,8
3	Lower motor vehicle traffic and Economic Vitality	-Reduce traffic speeds	2,3,4,5,7,9,10
		-Reduce the cost of infrastructures and Enhance the level of public investment	3,4,5,6,7,8,10
		-Increase commercial activities in local economics and growth economic vitality	1,4,5,7,9,10
		-Offering less costly transportation modes	1,2,3,4,7,8,9
		-Financial benefits to persons, families, and governments and increase retail sales and land value	2,3,4,5,6,7,8
4	Intermodal connections and active public spaces	-Encouraging a comprehensive, integrated, and connected network for all modes	3,5,6,8,9
		-Improve street connectivity	1,2,3,4,5,7,8,9
		-Design public spaces and Provide easy, safe convenient access to public spaces	3,4,5,6,7,8,10
5	Fostering social capitals and communities	-Reach social equity	5,6,8,9,10
		-Building social capitals	4,6,7,8,9
		-Increase residents' sociability and Enhance community cohesion	1,2,5,6,7,8

Selected References

1-Marti, Giese, & Kuehl, (2013)
2-Cui, (2013)
3-Kingsbury, Lowry, & Dixon, (2011)
4-Macdonald, Sanders, & Anderson, (2010)
5-PARSONS, (2014)
6-Scott, Beck, & Rabidou, (2011)
7-Litman, (2014b)
8-Marshall & Garrick, (2011)
9-Burden & Litman, (2011)
10-George, (2013)

4.4 Characteristics of Complete Streets

Downing, (2013) and Gill, (2014) argued, the complete streets term is conceptual and changeable from place to place by considering the situation of the road and its location. Besides, communities have different needs, characteristics, and users, therefore; designing of complete streets must be flexible for considering existing and future development and needs of transportation context (Downing, 2013). Hence, organizations and agencies that work by applying complete streets must consider each project within the overall transportation system (Downing, 2013; Gill 2014).

The concept of complete streets by expanding and improving infrastructures and facilities, and providing transportation options by considering all modes of transportation, aims to increase the level of accessibility and address the needs of all users in different ages, abilities, and incomes (Atherton et al., 2016; Downing, 2013; Gill 2014). Complete streets by connecting all modes of transport together and well designed and managed the transportation networks can contribute to mobility, economic vitality, social cohesion, active and healthy communities (Cui, 2013; Downing, 2013).

There is no a common and standard template for adapting complete streets for every street, however, there are several design features related to complete streets. The application of design features shall be flexible and based on the community's vision related to the transportation sector (Cui, 2013). Accordingly, the general characteristics of the Complete Streets due to all explanation above can be categorized into four groups, which are mentioned in Figure 10.

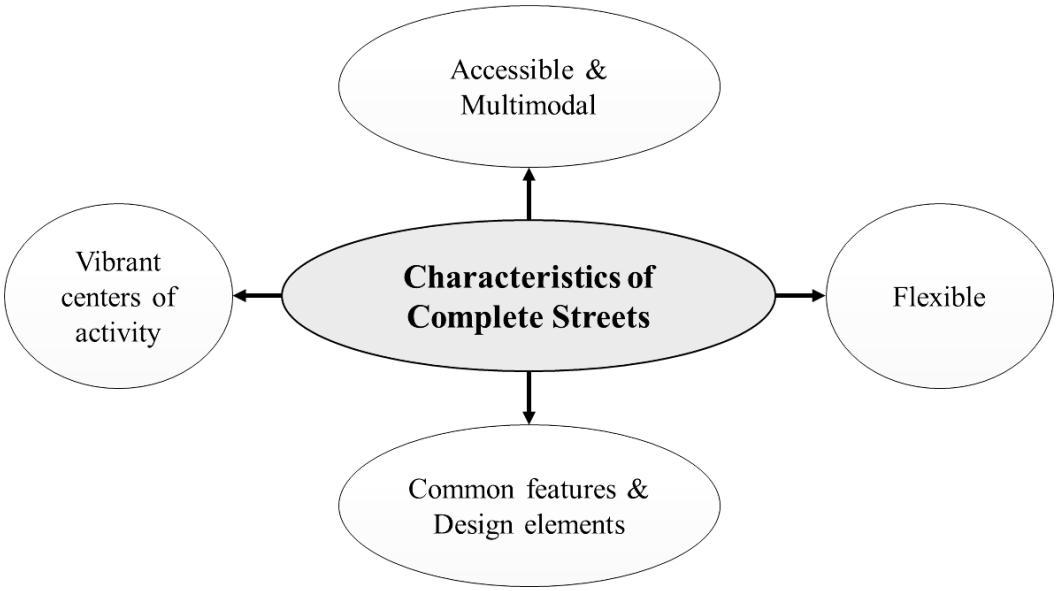


Figure 10: Categorization of Complete Streets Characteristics Based On Cui, 2013 and Downing, 2013

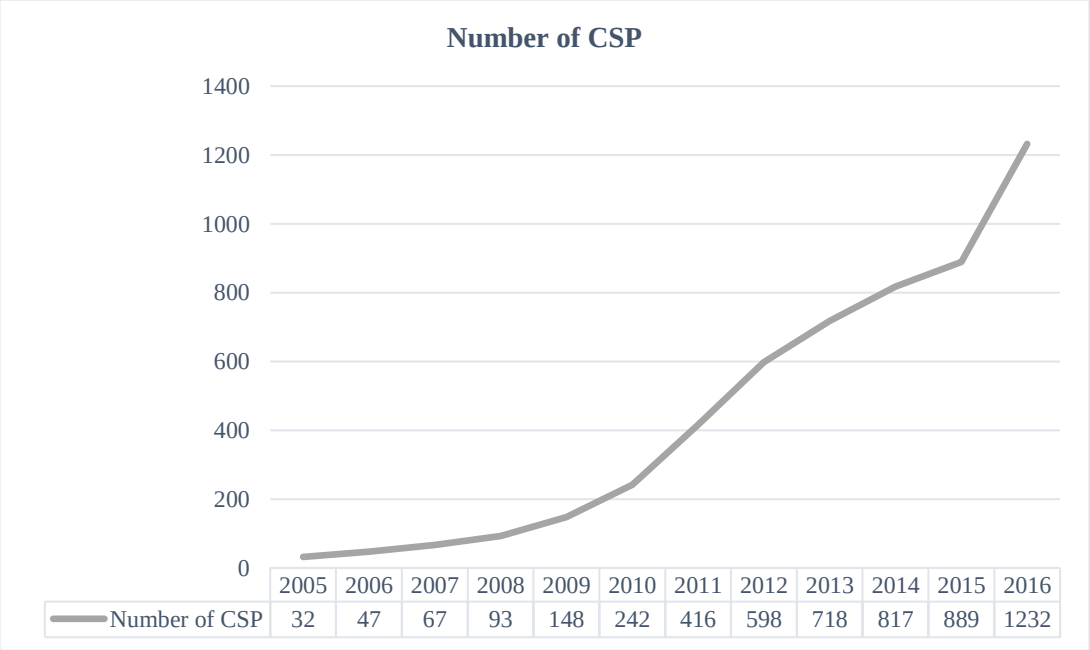
4.5 Policy of Complete Streets

McCann & Rynne, (2010, p.27) argued that Complete Streets represent more than physical changes to the streets. It stands for a change in transportation planning, designing, maintenance, and funding decisions. Hence, McCann & Rynne, (2010, p.24) clarified, the first step in providing a comprehensive process for planning complete streets is defining a strong, straight and accountable written policy. Meanwhile, a strong policy of complete streets encourages projects to be planned and designed to meet the needs of every type of users based on how they are traveling, which allows the community to save money, accommodate more people, and create an environment for all to travel safely. Hence, American Bikes Organization has defined a complete street policy as one which "*ensures that the entire right of way is routinely designed and operated to enable safe access for all users*" (McCann & Rynne, 2010).

Besides, having a complete streets policy signify a community has a strong intent to design, and build a transportation system that offers safe and attractive transportation

options to significant destinations such as home, work, and schools (Seskin, McCann, Rosenblum, & Vanderwaart, 2012). Accordingly, communities around the world see their streets as places more than just a way to pass cars and people. In this regard, in 2003 The National Complete Streets Coalition has been a program of Smart Growth America defines Complete Streets movement. This program supports communities to develop, adopt and implement their own Complete Streets policies throughout North America (Seskin & Gordon-Koven 2013; Seskin et al., 2012).

The number of Complete Streets Policies throughout the United State are growing from the first evaluation of Complete Streets Policies by The National Complete Streets Coalition in 2005 until 2016 (Figure 11). This growing interest in Complete Streets concept shows more communities are using a Complete Streets approaches (Atherton et al., 2016; Seskin & Gordon-Koven 2013).



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Number of CSP	32	47	67	93	148	242	416	598	718	817	889	1232

Figure 11: The Number of Complete Streets Policies (CSP) Adopted, Over Time from 2005 until 2016 in North America (Source: The National Complete Streets Coalition, 2017)

4.5.1 Main Elements and Types of Complete Streets Policy

The National Complete Streets Coalition based on a comprehensive survey, studies, and practices through the United State defined main elements of a Complete Streets Policy. These elements are categorizing in 10 interconnected components which are exposed in Figure 12 (Chin, 2013; Nicholls, Cannon, Duffy, & Stevens, 2011; SANDAG, 2014; Seskin & Gordon-Koven 2013; Seskin et al., 2012). Accordingly, adopting a good and strong Complete Streets Policy is the first step to support an organized effort through all agencies that manage activities related to transportation with a common perception of policy and program objectives (Carissa Schively & Cindy 2013).

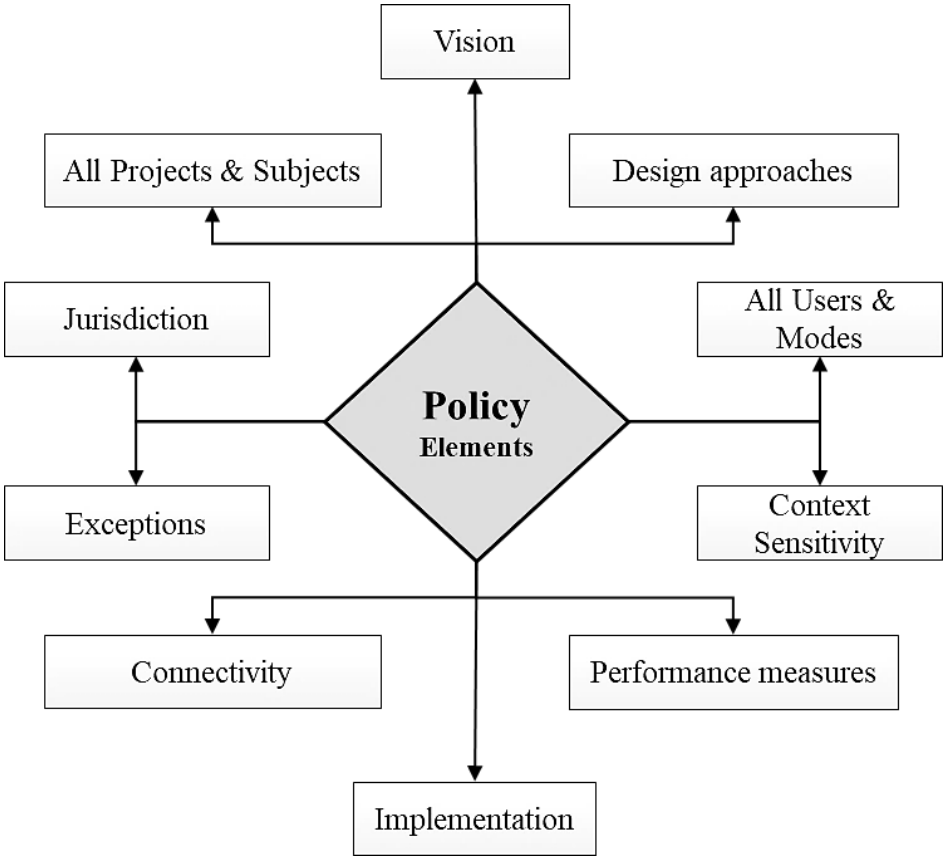


Figure 12: Main Elements of Complete Streets Policy Based On the National Complete Streets Coalition, 2017

Moreover, the National Complete Streets Coalition recognizes types of statements as official commitments to a complete streets approach. These official commitments are including legislation, resolutions, executive orders, internal policies, policies adopted by an elected board, and tax ordinances (Atherton et al., 2016; McCann & Rynne, 2010). These categorize are recognized as types of complete streets policies (Figure 13).

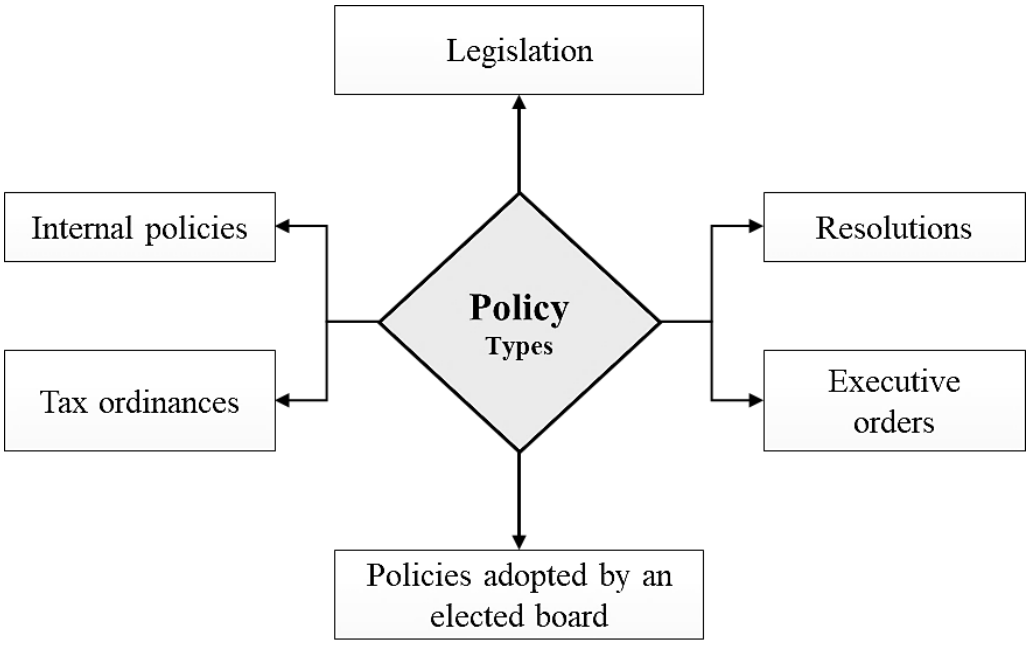


Figure 13: Main Types of Complete Streets Policy (Atherton Et Al., 2016; Mccann & Rynne, 2010)

The legislation includes a document that requires the needs of all type of users to consider in all transportation developments by changing city codes or statutes. Resolutions are non-binding formal declarations from a jurisdiction's legislative office and executive orders are high-level commands delivered by a mayor or administrator. Internal policies approved by the management of a jurisdiction's transportation agency or department without exploit from an elected body. Policies defined by an elected board are documents that usually developed by a group of stakeholders, and accepted

by a chosen leading organization via an approving resolution or ordinance. Tax ordinances are lawmaking or voter-approved ordinance to fund Complete Streets plans. Furthermore, few societies also join Complete Streets into transportation master plans or street design guidance and standards (Atherton et al., 2016; Seskin & Gordon-Koven 2013).

4.5.2 Scoring and Weighting Method to Evaluating Complete Streets Policies

The National Complete Streets Coalition offered and defined in 2005 a scoring and weighting system for evaluating and comparing every policy that is proposed based on the 10 elements of an ideal policy, which defined by this coalition. In this system, for each element a total of 5 points is considered, which reaching five, demonstrates fulfillment of that ideal element (Atherton et al., 2016; McCann & Rynne, 2010; Seskin & Gordon-Koven 2013; Seskin et al., 2012).

McCann & Seskin, (2012) and Seskin & Gordon-Koven, (2013) argued, there is a fact that several elements of policy are more significant and play a more important role to create a successful policy; therefore, The Coalition defines a weighting system to reflect this fact. The Coalition selected weights based on studies, practical cases, the experience of policy improvement and work with different societies across North America. Hence, the total score for a policy is 100. In this way, for evaluating policy, points awarded will be multiplied by identified weight for each element, and then divided by the highest possible number of points that is 5. Therefore, by this weighting system all Complete Streets policies that have been proposed based on The National Complete Streets Coalition system can be evaluated (McCann & Seskin, 2012). The scoring and weighting system is elucidated in appendix A.

4.5.3 Investigation on the Best Complete Streets Policies: Examples from North America

The National Complete Streets Coalition in North America by using a scoring method that described in the previous section above and appendix A, evaluated all complete streets policies, which are planned by communities around North America based on main elements of ideal complete streets policy. The evaluation of existing policies from 2011 until 2016 is announced through annual reports, which these reports were accessible through online resources. In this research, the top 10 policies of each year between 2011 until 2016 have been selected and evaluated. Evaluation of the best policies between 2011 until 2016 based on information provided in Table 15 is showing to us that the most of the communities, which follows the complete streets approaches and achieve the highest score, are small cities with the population under 100,000. Besides, most of these policies achieved through the policy adopted by an elected board. Accordingly, it can be mentioned achieving and applying a strong complete streets policy in small cities has more potential. Furthermore, policies defined by an elected board consist of local stakeholders and scholars that accepted through a chosen leading organization is more effective and successful.

After clarifying the achievements from selected policy in Table 15, the highest ranked policies from each year are selected to be evaluated in detail to clarify exemplary policy to provide other societies a clear way to follow in writing their own complete streets policies and make clear how these top policies explain main elements of the ideal policy. Accordingly, the following complete streets policies mentioned in Table 16 are highest scored policies that ranked across the United States from 2011 until 2016.

Table 15: List of top 10 policies for each year between 2011 until 2016 based on annual announcement of the best complete streets policy by the national complete streets coalition (Developed by Author based on "The Best Complete Streets Policies of 2016", 2017)

	Name of City/Town/ County	Year	Population	Policy score	Policy Type	Online Access	
						Policy	Guideline
1	Missoula, MT	2016	66,788	100	City resolution	●	○
2	Wenatchee, WA	2016	31,925	100	City legislation	●	○
3	Brockton, MA	2016	95,314	100	City legislation	●	○
4	Hull, MA	2016	10,293	98.4	City policy adopted by elected board	○	○
5	Mansfield, MA	2016	23,184	98.4	City policy adopted by elected board	○	○
6	Sherborn, MA	2016	4,119	98.4	City policy adopted by elected board	●	○
7	Bridgewater, MA	2016	26,563	96.8	City policy adopted by elected board	●	○
8	Brookline, MA	2016	58,732	96.8	City policy adopted by elected board	●	○
9	Chester, MA	2016	1,337	96	City policy adopted by elected board	●	○
10	Muskogee, OK	2016	38,616	96	City policy adopted by elected board	●	○
11	Reading, PA	2015	88,082	100	City executive order	●	○
12	West Hartford, CT	2015	63,268	94.4	City resolution	●	○
13	Park Forest, IL	2015	21,975	92.8	City Resolution	●	○
14	South Bend, IN	2015	101,190	92.8	City Resolution	●	○
15	Longmeadow, MA	2015	90,329	92.8	City legislation	●	○
16	Weymouth, MA	2015	53,743	92	City policy adopted by elected board	●	○
17	Omaha, NE	2015	408,958	88.8	City policy adopted by elected board	○	○
18	Vincennes, IN	2015	18,423	88	City legislation	○	○
19	Ashland, MA	2015	16,593	87.2	City policy adopted by elected board	○	○
20	Natick, MA	2015	30,510	87.2	City policy adopted by elected board	●	○
21	Ogdensburg, NY	2014	11,344	92.8	City legislation	●	○
22	Troy, NY	2014	50,129	91.2	City legislation	●	○
23	Lakemoor, IL	2014	6,017	88.8	City resolution	●	○
24	Dawson County, MT	2014	8,966	88.8	County policy adopted by elected board	●	○
25	Austin, TX	2014	790,390	88.8	City legislation	●	○
26	Acton, MA	2014	21,929	87.2	City policy adopted by elected board	●	○
27	Middleton, MA	2014	8,987	87.2	City policy adopted by elected board	●	○
28	Reading, MA	2014	24,747	87.2	City policy adopted by elected board	●	○
29	Salem, MA	2014	41,340	87.2	City policy adopted by elected board	●	○
30	Stoughton, MA	2014	26,962	86.4	City policy adopted by elected board	●	○
The original report is available through online sources						●	
The original report is not available through online sources						○	

	Name of City/Town/ County	Year	Population	Policy score	Policy Type	Online Access	
						Policy	Guideline
31	Littleton, MA	2013	8,924	94.4	City policy adopted by elected board	●	○
32	Peru, IN	2013	11,417	92.8	City policy adopted by elected board	●	○
33	Fort Lauderdale, FL	2013	165,521	89.6	City policy adopted by elected board	●	●
34	Auburn, ME	2013	23,055	88	City policy adopted by elected board	●	○
35	Lewiston, ME	2013	36,592	88	City policy adopted by elected board	●	○
36	Baltimore County, MD	2013	805,029	86.4	County policy adopted by elected board	●	○
37	Portsmouth, NH	2013	21,233	86	City policy adopted by elected board	●	○
38	Piqua, OH	2013	20,522	82.4	City policy adopted by elected board	●	○
39	Oakland, CA	2013	390,724	81.6	City legislation	●	○
40	Hayward, CA	2013	144,186	80.8	City policy adopted by elected board	●	○
41	Indianapolis, IN	2012	820,445	89.6	City legislation	●	○
42	Hermosa Beach, CA	2012	19,596	85.6	City policy adopted by elected board	●	○
43	Huntington Park, CA	2012	58,114	85.6	City policy adopted by elected board	●	○
44	Ocean Shores, WA	2012	5,569	84.8	City legislation	●	○
45	Northfield, MN	2012	20,007	83.2	City resolution	●	○
46	Portland, ME	2012	66,194	80.8	City policy adopted by elected board	●	○
47	Oak Park, IL	2012	51,878	80	City legislation	●	○
48	Trenton, NJ	2012	84,913	78.4	City resolution	●	○
49	Clayton, MO	2012	15,939	75.2	City legislation	●	○
50	Rancho Cucamonga, CA	2012	165,269	73.2	City legislation	●	○
51	Baldwin Park, CA	2011	75,390	92.8	City policy adopted by elected board	●	○
52	New Hope, MI	2011	20,339	88	City policy adopted by elected board	●	○
53	Hennepin County, MI	2011	1.212 million	81.6	City policy adopted by elected board	●	○
54	Birmingham, AL	2011	212,247	79.2	City resolution	●	○
55	Bellevue, NE	2011	53,936	78	City resolution	●	○
56	Cook County, IL	2011	5.246 million	77.6	Ordinance	●	○
57	Roanoke, VI	2011	97,032	76.8	City policy adopted by elected board	●	○
58	Azusa, CA	2011	48,799	76.8	City policy adopted by elected board	●	○
59	Big Lake, MI	2011	10,360	76	City policy adopted by elected board	●	○
60	Blue Island, IL	2011	23,785	76	Ordinance	●	○

Table 16: List of highest ranked complete streets policies from 2011 until 2016 (Developed by Author based on "The Best Complete Streets Policies of 2016", 2017)

	Name of Cities	Year	Population	Policy score	Policy Type	Online Access to Reports	
						Policy	Guideline
1	Baldwin Park, CA	2011	75,390	92.8	City policy adopted by elected board	●	○
2	Indianapolis, IN	2012	820,445	89.6	City legislation	●	○
3	Littleton, MA	2013	8,924	94.4	City policy adopted by elected board	●	○
4	Ogdensburg, NY	2014	11,344	92.8	City legislation	●	○
5	Reading, PA	2015	88,082	100	City executive order	●	○
6	Missoula, MT	2016	66,788	100	City resolution	●	○
The original report is available through online sources						●	
The original report is not available through online sources							○

Consequently, all these six highest-ranked policies is examined in detail by focusing on making clear how these highest ranked policies considered main elements of complete streets policy. Hence, in the first step, a general explanation about each city is provided in the following and original reports of policy related to each city is presented in Appendix B. After that, the policy which is planned for each city is summarized in separate tables based on 10 main elements of ideal complete streets policy that are exposed in Appendix C and then the achievements of analyzing these policies are provided.

4.5.3.1 General Explanation about Selected Cities

- Baldwin Park, California

Baldwin Park is located in the Los Angeles County, California. According to 2010 census data, the population of Baldwin Park was 75,390. This city provided an

Administrative Policy with the subject of Complete Streets Policy that approved by city council in 07/20/2011. This policy was ranked number 1 among 146 policies that adopted in 2011 and original report of this policy is accessible in Appendix B1 ("City of Baldwin Park", 2011). The summary of the complete street policy planned for this city is presented in Appendix C1.

- Indianapolis, Indiana

Indianapolis is capital city in Indiana State that the population of this city due to 2010 census data was 820,445. This city proposed a Complete Streets Policy that approved on 05/31/2012 and ranked by The National Complete Streets Coalition as number one complete streets policy among more than 130 communities adopted Complete Streets Policies in 2012. The original report of policy for Indianapolis is presented in Appendix B2 ("City of Indianapolis", 2014; Bhatt & Ryan, 2012). Besides, the summary of the complete street policy provided for this city is accessible in Appendix C2.

- Littleton, Massachusetts

Littleton is a city in Massachusetts that the population of this city due to 2010 census data was 8,924. This city proposed a Complete Streets Policy that approved on 12/16/2013 and ranked by The National Complete Streets Coalition as number one complete streets policy among more than 80 communities adopted Complete Streets Policies in 2013. The original policy report provided for this city is obtainable through Appendix B3 ("Town of Littleton", 2013; Seskin & Gordon-Koven 2013). The complete street policy defined for this city is summarized in Appendix C3.

- Ogdensburg, New York

Ogdensburg city is located in New York State that the population of this city due to 2010 census data was 11,344. The Complete Streets Policy of this city was approved

by City Council on 13/02/2014 and was ranked by The National Complete Streets Coalition as number one complete streets policy among more than 70 jurisdictions adopted Complete Streets policies in 2014. Through Appendix B4, the original policy report is accessible ("City of Ogdensburg", 2014; "The Best Complete Streets Policies of 2014", 2015). The summary of offered policy for this city is reachable in Appendix C4.

- Reading, Pennsylvania

Reading is one of the largest city in Pennsylvania State that the population of this city due to 2010 census data was 88,082. This city provided a Complete Streets Policy on 29/06/2014 and The National Complete Streets Coalition ranked this policy as number one complete streets policy among more than 82 adopted Complete Streets policies in 2015. The full original report related to complete streets for this city is obtainable through Appendix B5 ("Town of Reading", 2014). Besides, a comprehensive summary of the offered policy for Reading city based on 10 main elements of complete streets policy is accessible through Appendix C5.

- Missoula, Montana

Missoula is a city in Montana State and approximately has 66,788 population due to 2010 census data. This city provided and approved a Complete Streets Policy on 09/12.2016 that ranked by The National Complete Streets Coalition as number one complete streets policy among 222 new Complete Streets policies in 2016. The original report of policy is accessible through Appendix B6 ("The Best Complete Streets Policies of 2016", 2017; "The City of Missoula", 2016). The summary of policy by considering the main elements of ideal complete streets policy is presented in Appendix C6.

4.5.3.2 Evaluation of the Highest Ranked Policies

Evaluation of the highest ranked policies provides very comprehensive information for policymakers that how they must write a strong policy and what kinds of dimensions and aspects directly must be considered and mentioned in the main body of a policy. Accordingly, based on summaries exposed in Appendix C and literature reviewed, the important considerations about each policy's elements, which must be reflected in the way of presenting a strong complete street policy, are clarified in the following.

(i) Vision: An interesting and strong vision statement is indispensable to make clear why and how the community wants to complete its streets to achieve intended targets. Hence, in the vision statement, the primary purpose must be clear for complete streets policy adoption. There is no two similar policies and visions are not one-size-fits-all. Accordingly, clarity in writing of vision makes it easy to understand the goals and intent of policy for those who are responsible to implement of policy (Todd Litman, 2014; McCann & Seskin, 2012; Seskin & Gordon-Koven 2013). Based on the summary provided for selected policies the main keywords that must be mentioned in the body of visions to make clear intent and objectives of policies are clarified in Table 17.

Table 17: Keywords must be reflected in writing a strong vision

Vision			
1	Considering users of all ages and all abilities	4	Offering convenience and reliable mobility
2	Providing safe and high access streets	5	Designing efficient amenities
3	Providing a multimodal transportation system	6	Considering economic development and well-being

(ii) All Users and Modes: The policy must characterize all modes include walking, cycling, public transit, and automobiles plus all users include pedestrians, cyclists and transit passengers of all ages and abilities. Accordingly, a policy is complete streets policy with a clear statement supporting pedestrians and bicyclists who are genuine users of the transportation system. Thus, both modes of walking and cycling must include the policy. Offering more modes next to walking and cycling can help to define a more strong policy (McCann & Seskin, 2012). Furthermore, in a great complete streets policy, the needs of people with different abilities in various ages must be considered (McCann & Seskin, 2012; Seskin & Gordon-Koven 2013). According to the evaluation of selected policies, the main keywords that were used in the body of policies to support all users and modes are summarized in Table 18.

Table 18: Keywords must be considered in providing a strong statement for all users and modes element

All Users & Modes					
All Ages and Abilities				**All Modes**	
1	Children	1	Motorists	5	Pedestrians
2	Seniors	2	Transit Users	6	Emergency responders
3	Persons with disabilities	3	Bicyclists	7	Freight providers
				8	School bus riders
				9	Commercial vehicles

(iii) All Projects and Subjects: The focus of policy must be on all types of transportation projects to design a multi-modal street and all subjects include planning, design, maintenance, and operations for all new and existing streets and amenities. Accordingly, an ideal complete streets policy has attention on all projects related to developments of transportation as a chance to generate harmless and more accessible transport system for everyone (McCann & Seskin, 2012; Seskin & Gordon-Koven 2013). Besides, the evaluation of selected policies made clear that the following

keywords must be reflected in the body of policies to make clear consideration on all projects and subjects (Table 19).

Table 19: Keywords must be considered in providing a strong statement for all projects and subject element

All Projects & Subjects					
All project improvement				All project phase	
1	Streets	7	Retrofits	1	Policies
2	Bridges	8	Reconstruction	2	Programming
3	Parking lots	9	New construction	3	Planning
4	New privately built roads	10	Repair	4	Designing
5	Right-of-way acquisition	11	Rehabilitation	5	Operation and Maintenance
6	All publicly and privately funded projects				

(iv) Exceptions: Providing a practicable policy in real-world needs, define a clear process for handling exceptions about necessities of all modes be accommodated in all schemes is essential. Determining these exceptions and arrangement a clear technique to the policy, needs high-level of official's approval. In this regard, the following three exceptions were used in selected policies that are applicable to limit the potential to weaken the policy:

- Applying policy on paths where particular users are using such as pedestrian malls and interstate freeways is not necessary;
- The cost of executing policy is inappropriate to the need;
- A documented absence of present and upcoming demand.

Furthermore, in addition, to having exceptions in a good complete streets policy, it must be clear, which organization is responsible for granting approval to exceptions? Since, establishing this process will provide clarity and transparency for staffs who are

responsible for implement the policy (McCann & Seskin, 2012; Seskin & Gordon-Koven 2013).

(v) Connectivity: The policy identifies the essential requirement to build a comprehensive, integrated and well-connected network for all transportation modes. Since connectivity of roadway network is the main feature for whom are unwilling to take indirect way. Thus, a successful complete streets policy offers a situation to everyone can safely move across the transportation network with considering this fact that there is no opportunity to all modes to receive the same type of space on every road (McCann & Seskin, 2012; Seskin & Gordon-Koven 2013).

(vi) Jurisdiction: Providing Complete Streets network is not easy since many different companies or agencies are working through building new roads and maintenance of existing ones. Thus, defining the way that agencies can work with other private or government organizations and developer who are funding the projects is indispensable. Besides, the application of policy must be understandable for all agencies that manage activities related to transportation (McCann & Seskin, 2012).

(vii) Design approaches: On the way of implementation of complete streets, using the up-to-date and best design standards and guidelines to achieve the maximum flexibility in design approaches is essential. However, making a balance among users and modes needs is the main aim of designing approaches (McCann & Seskin, 2012; Seskin & Gordon-Koven 2013).

(viii) Context Sensitivity: Surrounding community is playing a crucial role in the success of a complete streets policy. Existing context and current and expected

transportation needs are very important in making decisions process. Hence, adopting streets to fit the character of the surrounding neighborhood is essential. Thus, a comprehensive understanding of contexts is needed.

(ix) Performance measures: complete streets policy must define a number of ways and standards to measure the success of policies. These standards can also refer back to the vision statement of policy (Todd Litman, 2014; McCann & Seskin, 2012). In this way, by evaluating the selected policies, they offer the following ways to measure the success of policies.

- New facilities related to the pedestrian are built
- New infrastructure associated with cycling is built
- New facilities related to disabled people are built
- New facilities related to public transportation are built
- New curb ramps are set up along streets inside the city
- New greenery components are placed along city streets
- Enhancements to the crosswalk and intersection components
- Number of public transit stops with easy to access from sidewalks and curb ramps
- Number of people commuting by bicycle and walking
- Number of children walking or bicycling to school
- Percentage of new street projects that are multi-modal
- Percentage of crashes, injuries, and fatalities by all transportation modes

(x) Implementation: Particular steps for implementation of the policy is essential but taking policy from paper to practice is so difficult. In this regard, the Coalition has attempted to identify the main steps to implement a complete streets policy:

- Develop related methods, plans and guidelines to provide a suitable situation and paying attention to all users and all modes of transportation on every project. Besides, combining Complete Streets into all plans by updating and changing approaches and technical documents to support Complete Streets.
- Define new design strategies and guidelines or improve existing trough the current situation of best practices related to transportation design.
- Increase everyone's knowledge about the importance of Complete Streets by offering various workshops and other educational opportunities. Besides, enhancing the level of understanding of transportation experts and community leaders about ways to support implementation.
- Improve methods to measure development, performance, and collect and distribute data on the level of serving all users on the streets. This provides an opportunity to more seek performance measures.

4.6 Investigation on Complete Streets Guidelines: Complete Streets Planning Phases, Planning Determinative Variables, and Main Design Components

The following section provides a comprehensive information based on selected guidelines that clarified in chapter 2 towards finding out the main steps and variables for planning complete streets as well as main design components of complete streets. It is essential to mention here for all selected guidelines to be evaluated in this study, a separate inventory chart to clarify information provides through each guidelines is presented in Appendix D.

4.6.1 Phases and Main Variables of Planning Complete Streets

In the planning process of complete streets, main ideas and objectives must be considered from the beginning as an integral part. In this process, evaluation of the

existing and future conditions of a street is the main step, which is argued by all selected guidelines. Accordingly, this part of the dissertation aims to clarify the variables and steps that planners must extremely consider in the planning process of complete streets.

The initial step in this way is defining a strong policy. Second step in the process of planning for a complete street that plays a key role in evaluating and understanding the relationships of the street with its surrounding contexts ("City of Memphis", 2015; "Philadelphia Complete Streets", 2009). In this regard, based on the selected guidelines understanding the contexts related to Zoning, Land-use and Transportation are essential, which are explained in the following.

(A) Zoning Context:

The type of area adjacent to the streets has the main influence on the design approach of the streets. Thus, development patterns will categorize based on street network density and diversity of mobility options, land-use pattern, and building placement. This categorization illuminates the conversion of the built environment from rural to the urban context, which defined as Zoning Context (Figure 14) ("Knoxville Complete Streets", 2009; "Newburgh Complete Streets", 2015).

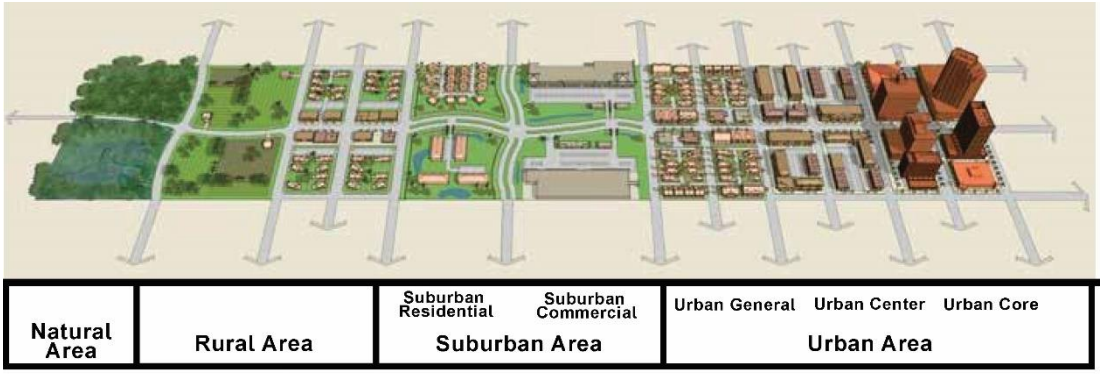


Figure 14: Zoning Context (Source: "Florida Complete Streets ", 2017)

- *Urban area*

Urban context ordinarily demonstrates a mix of land uses and activities. In general, in urban areas density and intensity in terms of residential and mixed-use activities are high, therefore, there is a huge demand for attention for accommodating all modes of transportation. Besides, in urban areas, the transportation network must be highly connected ("Miami-Dade County Complete Streets", 2016).

- *Suburban Area*

In this process after urban areas, suburban areas are located. This area to comparison to urban areas may have less street network and intensively developed but still highly active. In suburban areas, usually there is separation among land uses and residential character is promoted ("Miami-Dade County Complete Streets", 2016).

- *Rural Area*

After suburban areas, rural areas that may have the least network connectivity are located. In rural areas, it is so important to consider how suitable facilities can be provided. Since, rural areas are characterized by huge tracts of land, open space, and sparse of the population ("Miami-Dade County Complete Streets", 2016; "Toronto Complete Streets", 2017).

Accordingly, in this way the following questions related to zoning contexts must be responded in the planning process of complete streets to clarify the existing and future conditions:

- Existing conditions:
    - Is the area adjacent to the street an urban area, a suburban area or a rural area?
    - What is the jurisdiction zoning for the area?
- Future Conditions:

- Are there any development plans for the area?
- What is the future zoning vision on the area?

After clarifying that a street in what type of area is located, land-use context adjacent to the street must be clarified ("Miami-Dade County Complete Streets", 2016; "Orange County Complete Streets", 2016).

(B) Land-Use Context:

In the planning process of complete streets, identify the existing and future land use context adjacent to the street is indispensable. Since, land use context give the opportunity to the planner to have a response for two key questions: ("Toronto Complete Streets", 2017)

- Who will use the street?
- What way they will be using the street?

The answer to these questions will lead to the improvement of safe and appropriate solutions for all users in the area rather than planning a street purely as a channel for vehicles. Accordingly, the context of adjacent land use has a direct effect on street design. The most common land uses based on "Albany Complete Streets", (2016); "Miami-Dade County Complete Streets", (2016); "Alexandria Complete Streets", (2015) are including:

- Residential,
- Commercial,
- Mixed-used, and
- Single-Used (such as a park, educational, industrial, etc)

Accordingly, in the way of elucidating land use context adjacent the street the following questions are essential to consider in defining of existing and future land use context ("Alexandria Complete Streets", 2015; "Dallas Complete Streets", 2013).

- Existing conditions:
    - What is the existing land use adjacent to the street?
    - What are the typical design characteristics of the area?
- Future conditions:
    - What is the future vision for land use of the area?
    - Is there any development plan make specific recommendations regarding the land use characteristics?

(C) Transportation Context:

Understanding the characteristics of transportation context of each street has a direct effect on design approaches. Accordingly, in the planning process, understanding and identifying the street typology and function are the foundation to clarify the transportation context. Generally, there are two systems for classifying the streets include Traditional functional classification and Modern Functional classification. In traditional functional classification which has focused on the typology of streets, streets can be divided into three types involve Arterial, Collector, and Local streets ("Albany Complete Streets", 2016; "Los Angeles Complete Streets", 2014; "The City of Fort Lauderdale", 2010).

An arterial street is usually a higher volume street that serving longer trips which is connected to collector streets. Collector streets play an important role by collecting traffic from local streets and transmission it to the arterial. Local streets usually convey lower traffic volumes and mainly offer access to adjacent land use. Thus, in this type

of classification of streets, traffic volume, vehicle target speed, access, density, and parking capacity are main criteria to classifying the streets ("Albany Complete Streets", 2016; "Edmonton Complete Streets", 2013). Modern functional classification is integrating land-use and street function. Thus, in this method streets will be categorized base on types of land-use around them: ("Complete Streets Chicago", 2013; "Dallas Complete Streets", 2013)

- Mixed-use streets
- Commercial streets
- Residential streets
- Single-use streets (such as industrial streets, parkways, pedestrian streets, Campus streets)

Accordingly, modern functional classification of streets helps to achieve a balance among land-use and street design. Besides, this classification system can provide information about all dimensions of exciting situation and future of the street. This relationship among land-use and street design help designer and decision makers to determine suitable design approaches, design treatments, and facilities in overall dimensions from building face to building face along the street ("Boston Complete Streets", 2013). However, both classification systems of streets that are mentioned above must be considered in the planning process of a complete street, since each system represent useful information about the existing situation, future development and design parameters to be considered.

Furthermore, understanding the characteristics of the streets include quality of services which is evaluated based on existence of facilities related to each modes of transportation, traffic volume, traffic speed, quality of safety and accessibility, level of

crash among existing modes, and trip generators ("Mankato Complete Streets", 2015; "North Carolina", 2012).

Accordingly, based on the all above notes, responding to the following questions are very substantial in the clarifying of existing and future condition related to transportation context: ("Boston Complete Streets", 2013; "Orange County Complete Streets", 2016; "Pompano Beach Complete Streets", 2015; "Toronto Complete Streets", 2017)

- Existing conditions:
    - What is the type and function of the street?
    - What are the daily and hourly traffic volumes in the street?
    - What is the speed target on the street?
    - What are design features and accommodations for different users include pedestrians, cyclists, transit, and vehicle on the street? (Facilities)
    - What is the existing quality of safety and accessibility for each mode? or (Are there any specific issues related to safety and accessibility for each modes users?)
    - What is the general level of crash among motorists, bicyclist, and pedestrians?
- Future conditions:
    - What are the projected traffic volumes along the street?
    - Are there any locally adopted multimodal transportation plans or policies?

- Are there any planned transportation projects in the large scale for the whole area that the target street located there?
- Is there any kind of planned projects around the street that might affect street segment?
- What are trip generators near the street that might affect travel patterns and connections within and around the street?

Consequently, based on all explanations and questions mentioned above, there are several variables related to each context that consideration and evaluation of them are indispensable in the planning process, before starting to offer alternative design solutions. These variables are categorized in Figure 15.

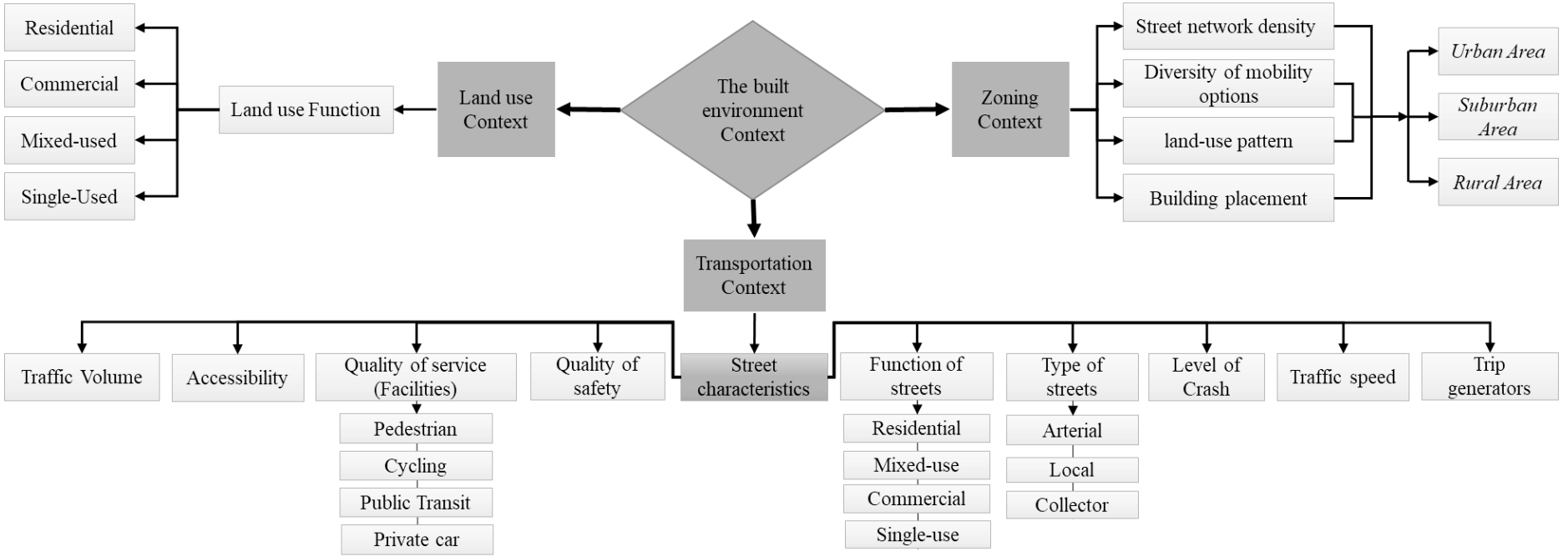


Figure 15: Main Variables that must be considered in the Planning Process of Complete Streets

After evaluating the area in which the street is located, land use adjacent to the street, transportation context, and observations about past, present and future function and characteristics of the street, defining issues and opportunities of the street is third step ("North Carolina", 2012). After that based on issues and opportunities, goals and objectives must be defined by considering the surrounding context. Besides, the order of consideration to travel modes must be clarified as a part of goals. Furthermore, in the process of clarifying the issues and opportunities, the opinion of the public must be gathered, to solidify the vision and determining the goals and objectives based on real users' opinions ("Pompano Beach Complete Streets", 2015).

In this way, to illuminating the issues and opportunities answering to the following questions are very important ("Dallas Complete Streets", 2013; "Orange County Complete Streets", 2016; "Pompano Beach Complete Streets", 2015)

- What are the issues and deficiencies along the street nowadays?
- Are there any gaps in the facilities related to the modes of transport (pedestrian, cycling, transit, and privet vehicles) along the street?
- Are there any gaps along the street network related to safety, connectivity, capacity, etc.?
- Are there inconsistencies among the type of transportation service provided and the type of land use adjacent the street?
- What are the positive and strengths of the street?
- What are the main opportunities for improving the quality of service for all transport modes, and enhance community health, economic development, and active society?

Besides, in the process of defining goals and objectives, respond to the following questions shows that important objectives are not overlooked ("Pompano Beach Complete Streets", 2015; "Toronto Complete Streets", 2017).

- How do the all main users, local governments, and community members want the street to change and improve?
- What are the existing elements and functions, which should stay in the street?
- How can these elements and function be balanced with new users of the street?
- How the needs of community members will be considered?
- How the mobility and safety of all the street's users will improve?

In the fourth step, a decision-making framework must be organized due to the design priorities, objectives, and goals that established in the previous step. In the decision-making step, alternative design solutions must be provided based on all achievements from previous steps. In this way, various alternative design solutions might be proposed that all of these proposed scenarios must be tested against the zoning context, land use context, transportation context, and objectives to determine any discrepancies or restraints. Besides, in the development process of alternatives design solutions, stakeholder engagement is indispensable and an alternative must occur after collecting all stakeholder feedbacks.

In this process, considering the following questions is very important:

- How will proposed alternative accommodate existing and planned facilities of all modes?
- How will the proposed alternative meet the needs of stakeholders?

Besides, in process of defining an appropriate alternative design solution a special consideration must be given to the following items:

- The consonance of alternative with local context, land-use context, transportation context, existing transportation plans and policies, objectives and goals as well;
- Balancing all transportation models performance to reach the maximum of functionality for all users;
- Human and natural considerations;
- Total cost.

Furthermore, a variety of interdisciplinary experts must be involved in the decision-making framework to provide particular guidance in their area of expertise. In this step, the best matches design solutions to the context and future expectations must be selected and provided.

To completion of all previous steps, the agreed-upon alternative design solutions will be passed to the engineers for detailed construction engineering design as the fifth step. In this step, the existing manual, engineering design documents, street planning documents, and standards must be considered very carefully. This is very important that all documents about project outcomes and the process were followed, including consultation and engagement activities, and lessons learned to be documented and shared as a reference for future projects and any questions that might be arisen about why a specific choice was made. The final step of the planning process is the implementation process that before starting this process understanding the cost of implementations and identifying potential funding sources for implementing the

complete streets are substantial fact. Furthermore, performance measurement of the project must be considered during and after implementation.

Consequently, based on all the clarifications mentioned above, the main steps and variables that must be considered by planners in the planning process of complete streets are summarized in Figure 16. Besides, there are substantial questions that must be responded in the process of planning complete streets that are exposed in Table 20.

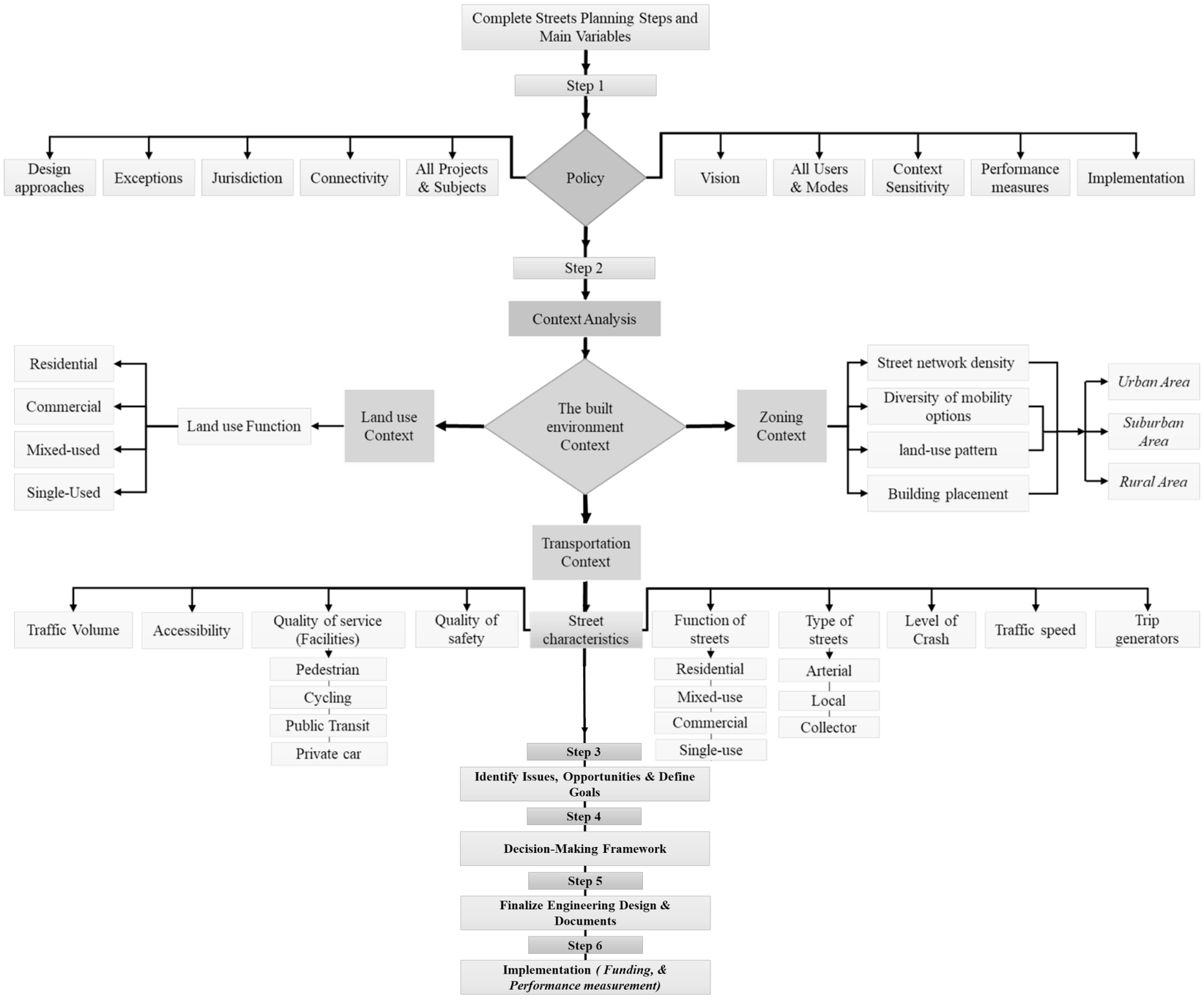


Figure 16: The Main Steps and Variables that must be considered in the Planning of Complete Streets

Table 20: The list of the main questions that must be responded in the planning process of complete street based on all selected complete streets guidelines

Steps	Questions
Evaluation of the Contexts	***Zoning Context:***
	Existing conditions:
	Is the area adjacent to the street an urban area, a suburban area or a rural area?
	What is the jurisdiction zoning for the area?
	Future Conditions:
	Are there any development plans for the area?
	What is the future zoning vision on the area?
	Land-Use Context:
	Who will use the street?
	What way they will be using the street?
	Existing conditions:
	What is the existing land use adjacent to the street?
	What are the typical design characteristics of the area?
	Future conditions:
	What is the future vision for land use of the area?
	Is there any development plan make specific recommendations regarding the land use characteristics?
	Transportation Context:
	Existing conditions:
	What are the characteristics of the street?
	What is the type and function of the street?
	What are the daily and hourly traffic volumes in the street?
	What is the speed target on the street?
	What are design features and accommodations for different users include pedestrians, cyclists, transit users and vehicle users on the street? (Facilities related to each mode)
	What is the existing quality of safety and accessibility for each mode? or (Are there any specific issues related to safety and accessibility for each modes users?)
	What is the general level of crash among motorists, bicyclist, and pedestrians?
	Future conditions:
	What are the projected traffic volumes along the street?
	Are there any locally adopted multimodal transportation plans or policies?
	Are there any planned transportation projects in the large scale for the whole area that the target street located there?
	Is there any kind of planned projects around the street that might affect street segment?
	What are trip generators in the vicinity of the street that might affect travel patterns and connections within and around the street?
Identify Issues, Opportunities & Define Goals	-What are the issues and deficiencies along the street nowadays?
	Are there any gaps in the facilities related to the modes of transport (pedestrian, cycling, transit, and privet vehicles) along the street?
	Are there any gaps along the street network related to safety, connectivity, capacity, etc.?
	Are there inconsistencies among the type of transportation service provided and the type of land use adjacent the street?
	-What are the positive and strengths of the street?
	-What are the main opportunities for improving the quality of service for all transport modes, and enhance community health, economic development, and active society?
	-How do the all main users, local governments, and community members want the street to change and improve?
	-What are the existing elements and functions, which should stay in the street?
	-How can these elements and function be balanced with new users of the street?
	-How the needs of community members will be considered?
	-How the mobility and safety of all the street's users will improve?
Decision-Making Framework	How will the proposed alternative accommodate existing and planned facilities of all modes?
	How will the proposed alternative meet the needs of stakeholders?

4.6.2 Design Components of Complete Streets

A complete street is a combination of different components by considering this fact that there is no single formula for designing complete streets. Since each street has its own characteristics and based on features and requirements design treatments must be planned. However, a complete street can be divided into two main zones including Sidewalk and Roadway ("Albany Complete Streets", 2016; "Alexandria Complete Streets", 2015). Sidewalks from the perspective of complete streets are consisting of four zones: Building Zone (Frontage Zone), the Walking or Pedestrian Clearway Zone, the Furnishing Zone, and the Curb Zone ("Alexandria Complete Streets", 2015).

Roadway defines as the space between curbs. The function of the roadway is supporting the movement of people and goods by providing the opportunity for various modes to be used. Moreover, roadways can be include of five different zones: Parking lanes, Bike lanes, Transit lanes, Medians or Turn lanes, and Motorized vehicle lanes that these zones due to function, characteristic, requirements, and type of a street can be eliminated or combined with each other (Figure 17 & 18) ("Toronto Complete Streets", 2017).

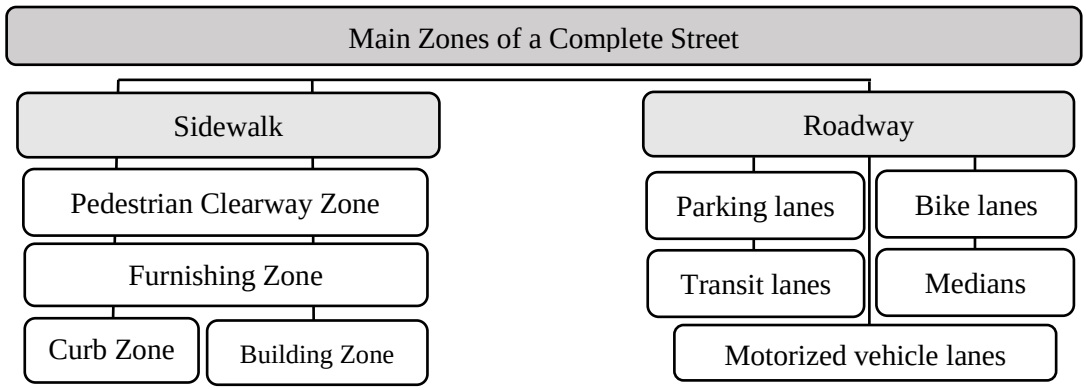


Figure 17: Main Zones of a Complete Street (Adapted From “Toronto Complete Streets", 2017)

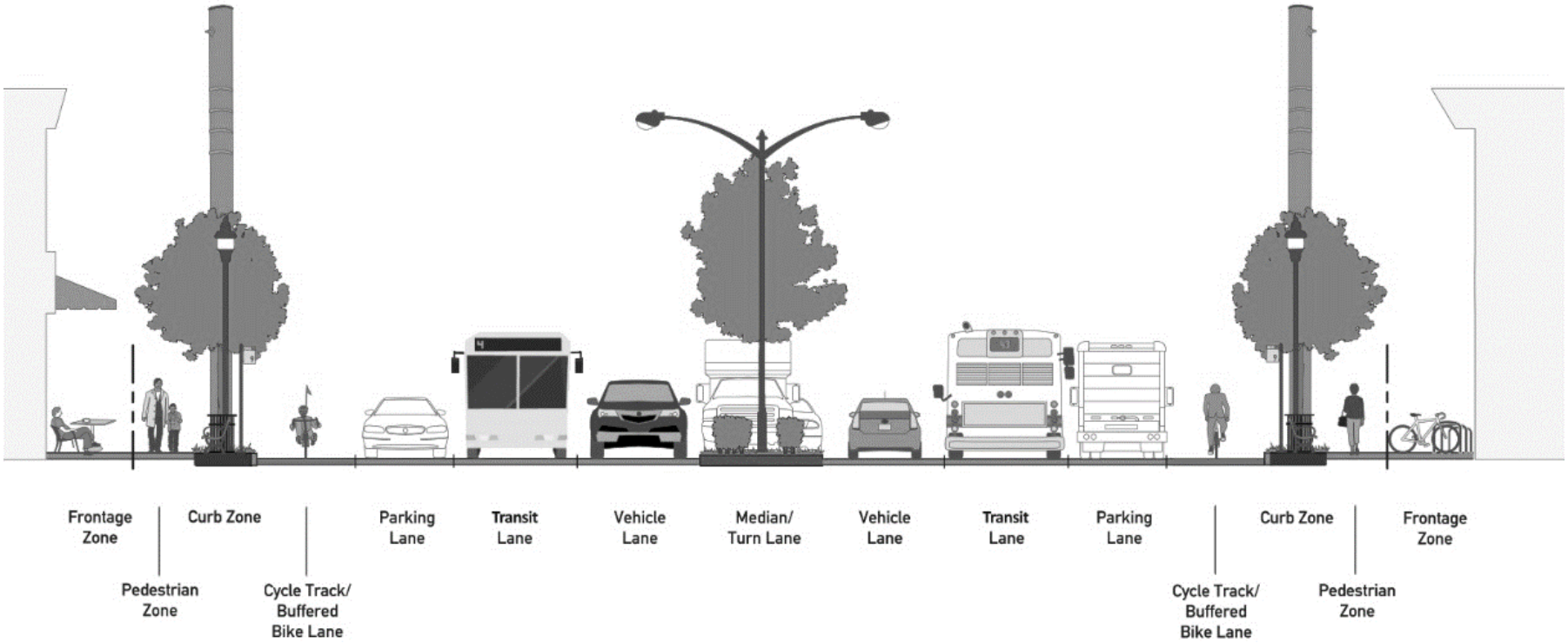


Figure 18: Zones of a Complete Street (Source: Adapted From "Orange County Complete Streets", 2016)

By a deep review on selected design guidelines, it was clarifying fundamental components related to complete streets can be categorized in six-interconnected sorts

- Pedestrian Components
- Cycling Components
- Transit Components
- Vehicle Components
- Intersection Components
- Green Infrastructures Components

4.6.2.1 Pedestrian Components

In planning and designing complete streets, providing convenient, comfortable, accessible, and safe streets for pedestrian has a priority since as we know walking is an integral part of most trips. Besides, the most trips begin and end on foot; therefore, streets that do not pay enough attention to the pedestrian are not complete ("Boston Complete Streets", 2013; "City of Memphis", 2015). In this way, providing a physical structure that encourages citizens to walk as part of their everyday routine is an indispensable fact ("Burlington Complete Streets", 2013; "City of Memphis", 2015). Accordingly, the well-designed pedestrian infrastructure must be provided to the maximum extent possible, incorporating the following components.

(A) Sidewalks

Sidewalks are the most substantial sub-component related to pedestrian components in complete streets. Sidewalks frame the fundamental framework of the pedestrian realm. Hence, using sidewalks zone makes easier to meet the basic needs of all pedestrians, disables and elderly people. Besides, beyond providing safe movement and access for pedestrians, sidewalk zones also serve as vital public spaces that

contribute to the city’s economic, social and environmental well-being ("Boston Complete Streets", 2013; "Florida Complete Streets", 2017; Gresham, 2009).

The primary aim in designing sidewalks is to provide a continuous system of the safe, comfortable, attractive, visible and accessible pathway for pedestrian, with facilities that provide accommodations for people of all ages and abilities. Hence, ensure clear, direct, unobstructed, suitable context-sensitive width to support existing pedestrian flows are substantial. However, lively and attractive sidewalks become places for people to participate in face-to-face activities and support local businesses. In the way of providing an attractive sidewalk, features such as sidewalks width and material, sidewalks café, plazas, vibrant street wall and green walls can play a significant role ("Boston Complete Streets", 2013; "Philadelphia Complete Streets", 2009).

A Sidewalk from the perspective of complete streets is consisting of four zones: Building Zone (Frontage Zone), the Walking or Pedestrian Clearway Zone, the Furnishing Zone, and the Curb Zone (Figure 19) ("Albany Complete Streets", 2016; "Orange County Complete Streets", 2016). All these zones serve a different purpose in Complete Streets and detailed attention must give to each part to make whole work as an integrated system ("City of Memphis", 2015; "City of New Haven", 2010; "North Carolina", 2012).

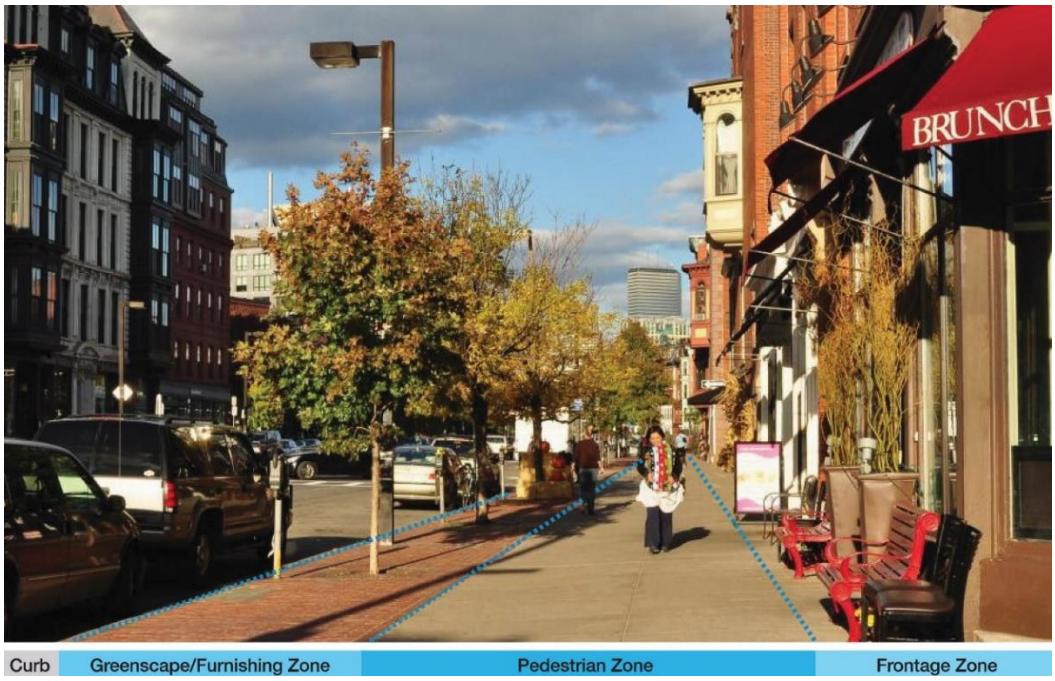


Figure 19: Sidewalks Zones (Source: “Boston Complete Streets", 2013)

The Pedestrian Clearway Zone: This area of sidewalks is specially reserved for pedestrian travel and movement. This zone must be free of any elements and physical barriers related to others zones for unfettered pedestrian movement. In this zone, the quality of the surface is very important and material in this part should be smooth, stable and slip resistant, with negligible gaps, rough surfaces and vibration-causing features ("Dallas Complete Streets", 2013; "Los Angeles Complete Streets", 2014).

The Building Zone (Frontage Zone): The area between Pedestrian Clearway Zone and adjacent buildings defined as Frontage Zone. This area, in streets, provides a safe area for pedestrian from opening and architecture elements related to the buildings. Besides, this area in numerous streets is the space for the entrance of buildings, awnings, stairs, and cafes to put furniture to attract customers, displays area for shops or landscaping and other building elements encroach into the pedestrian clearway zone. It is very important to consider that elements of this area do not exceed to the

pedestrian clearway zone ("City of New Haven", 2010; "Miami-Dade County Complete Streets", 2016; "Passaic County Complete Streets", 2012).

The Furnishing Zone: The area between pedestrian clearway zone and curb zone where is area for locating street trees, stormwater elements, street lights, signage, hydrants, benches, bicycle racks, public art, trash and recycling receptacles, parking meters, transit stops, signal and lighting control boxes, and utility hatch covers. Thus, this zone collects all the elements that may barricade pedestrian flow. Besides, this area will provide a buffer for pedestrian from adjacent street to prevent damage from vehicles and define safe access to and from parked cars on the streets ("Passaic County Complete Streets", 2012; Collarte 2012).

The Curb Zone: The area among streets' edge and the front edge of the furnishing zone defined as the curb zone. The curb zones' width and design is very important and this area should not be accessible by motorists to park on sidewalks, should provide safe access from parked vehicles on the streets as well ("Albany Complete Streets", 2016; "Edmonton Complete Streets", 2013; Nicholls et al., 2011).

(B) Crossing Facilities

Pedestrians in all ages and abilities must be able to cross streets safely to reach their own destinations. In the designing process, each crossing facilities must be fit to the surrounding environment and local vehicle speed must be considered. Besides, crossing lengths must be decreased to increase the safety and provision of curb ramps to provide convenience for disabled users is essential. Accordingly, in designing crossing facilities the following considerations are substantial ("Florida Complete Streets", 2017; "Toronto Complete Streets", 2017):

- The area must be clear of obstructions;
- Crossing Facilities must be accessible and usable for all pedestrians;
- Crossing Facilities shall be visible for both drivers and pedestrians;
- Appropriate lighting with legible signs that suggest a direction for pedestrians must be provided.

(C) Other Pedestrian Amenities

In the way of providing high quality of service with safety and convenience to pedestrians, street furniture such as pedestrian-scaled Lighting, pedestrian signals, wayfinding signs, seating elements, green elements, bollards, waste and recycling receptacles and material of surfaces must be considered (Figure 20) ("City of New Haven", 2010; "Windsor Complete Street", 2013).

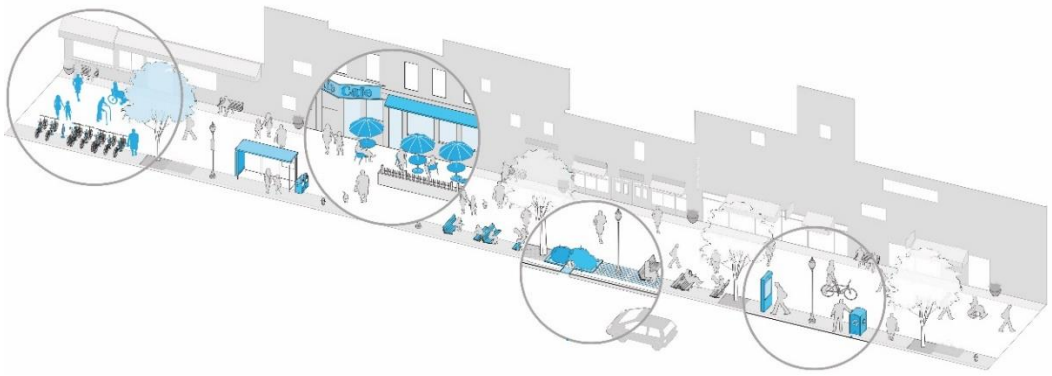


Figure 20: Pedestrian Amenities (Source: “Boston Complete Streets", 2013)

4.6.2.2 Cycling Components

All facility within the public right of way that accommodated bicycle travel are cycling components. Connecting all bicycle sub-components to transit networks for providing a convenient and interconnection bicycle service is essential. Besides, selecting

appropriate design approaches based on streets' contexts is very important and always design approaches must provide maximum comfort and safety of cycling as a transportation option. Accordingly, bicycle facility is a fundamental part of a complete street that provides harmless and calm mobility opportunities for a sort of users. Hence, providing a physical structure is an indispensable fact and in this way, key bicycle components are mentioned in the following ("Hampshire County", 2017; "South Miami Complete Streets", 2016; "Toronto Complete Streets", 2017).

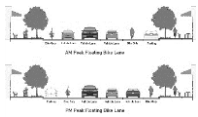
(A) Bicycle Routes

All streets except limited access highways are suitable for bicycle use. Dedicated bicycle routes are a substantial facility to provide the highest range of cyclist on the streets. Thus, car drivers should share the street's spaces with cyclists, and the cyclists have a responsibility to follow all traffic regulations. Hence, bicycle routes are the backbone of a complete bicycle network. Furthermore, bike routes provide various benefits to the streets network such as ("Dallas Complete Streets", 2013; "Edmonton Complete Streets", 2013; Nicholls et al., 2011)

- Traffic calming by reducing the width of the vehicle lane to provide bike lanes and encourage car user to drive slowly;
- Offering sidewalk buffer to provides separation between the motorist travel lanes and adjacent sidewalks;
- Effecting on turning radius to create smaller real corner radius and reduce pedestrian crossing distances;
- Giving drivers awareness about active modes of transportation and alerting them about the presence of other transport modes in the streets.

Many different types of bicycle routes are defined all around the world that designer based on streets contexts must decide, which type is appropriate (Table 21) ("Dallas Complete Streets", 2013; "Hampshire County", 2017; "Mankato Complete Streets", 2015).

Table 21: Common Types of Bicycle Routes (Sources: Adapted from "Hampshire County", 2017; "Dallas Complete Streets", 2013; "Boston Complete Streets", 2013; "South Miami Complete Streets", 2016)

	Bicycle Route Types	Explanation	
1	Marked Shared Lanes	Marked shared lanes use a double chevron and bicycle marking, or "sharrow," in the general-use lane to alert drivers to the presence of bicyclists and to encourage safe bicycle use. Chevron symbols direct bicyclists to ride in the safest location within the lane, outside of the door zone of parked cars and areas where debris is likely to collect. Generally, marked shared lanes are a low-cost treatment suitable for lightly travelled collectors and arterials.	 
2	Bike-Bus Lanes	Bike-bus lanes are shared lanes limited to bus and bicycle traffic. The low traffic volume in these lanes makes them safer for bicycles, while the dedicated lane reduces congestion delays for buses, benefiting transit users.	
3	Shared-Use Paths	Shared-use paths are off-street facilities shared with pedestrians and recreational users. These paths are a good option for high-speed, high-volume corridors with wider block spacing, providing access for users who are not comfortable riding bicycles in heavy traffic.	 
4	Trails	Trails are off-street facilities that can enhance network connectivity, filling in gaps where the street network is incomplete or cannot accommodate bicycle facilities.	
5	Floating Bike Lanes	Floating bike lanes can be used on roadways with high volume traffic during peak hours and where on-street parking is allowed only during certain periods of the day. These lanes are generally adjacent to the curb. During peak traffic hours, on-street parking is not allowed; the lanes are used only by bicyclists. At off-peak hours, the lanes are used for parking and bicyclists move to the traffic lane or to another bicycle facility on the roadway.	 
6	Advisory Bike Lanes	Advisory bike lanes typically installed on narrow roadways with two-way vehicle traffic, low volume and very low speeds. The lanes marked by dashed white lines on both sides of the roadway, creating a single center lane for motor vehicles.	
7	Bike Boulevards	Bike boulevards, also called neighborhood greenways, are a refinement of the shared roadway concept. They are created by modifying a local street to give priority to bicyclists while maintaining local access for automobiles. Traffic-calming measures reduce motor vehicle speeds and through trips; traffic controls limit conflicts between motorists and bicyclists, giving priority to bicyclists' through-movement. They are good options for low-volume, low-speed corridors.	 
8	Contraflow Bike Lanes	Contraflow bike lanes can help to increase network connectivity in areas with many one-way streets, by allowing bike traffic against the flow of vehicular traffic on one-way streets. A double yellow line provides separation and indicates that bicyclists will be moving against traffic. These facilities can make short but necessary connections between important bike corridors.	
9	Left-Side Bike Lanes	Left-side bike lanes can be used on one-way streets that have many conflicts on the right side, such as frequent stopping or parking, or on boulevards where a median separates the lane from oncoming traffic. Under these circumstances, a left-side bike lane allows for fewer disruptions in the flow of bicycle traffic.	 
10	Colored Pavement Bike Lanes	Colored pavement bike lanes improve visibility and identity, and help reduce the perceived width of the vehicular travel way.	
11	Double Bike Lanes	This type of bike lanes provide two separate lanes in the same direction for bicycle travel. Like a buffered lane, a double bike lane provides separation from vehicle and parking lanes; it also allows faster cyclists to pass slower ones. Double bike lanes can be considered on corridors with high-volume bicycle use.	 
12	Buffered Bike Lanes	Buffered bike lanes use a painted buffer area to separate the vehicle travel lane from the bike lane.	
13	Cycle Tracks	Cycle tracks are bike lanes separated from vehicle traffic by wide buffers with curbs, rails or bollards, providing dedicated space for bicyclists who are not comfortable riding on busy streets. Cycle tracks typically are wider than bike lanes, allowing cyclists to ride side-by-side or to pass each other.	 
14	Urban Greenways	An urban greenway is a linear park that extends a regional shared-use path or trail into urban/suburban bicycle networks and core districts. They are a form of raised cycle tracks	

(B) Bike Parking and Racks

Bicycle parking and racks are next significant infrastructure that helps make bicycling a possible transport choice for various trips (Figure 21). By sufficient supplying of bicycle parking and racks, the number of cyclists will be increased. Bicycle parking and racks must be placed in high demand areas such as connection area with transit stops and vehicle parking areas ("Cleveland Complete and Green Streets", 2013; "Complete Streets Chicago", 2013).

Figure 21: Example of Bicycle Parking and Racks (Source: "Boston Complete Streets", 2013)

(C) Bike signs

Another significant facility is bike signs that can be used on all types of streets to increase awareness of users. Moreover, signs can be used to guide cyclist on where and how to ride for decreasing conflict among cyclist and other modes of transportation and enhance safety. In addition, for alerting motorists to the presence of bicycle, signage plays an important role (Figure 22) ("Cleveland Complete and Green Streets", 2013; "Complete Streets Chicago", 2013).

Figure 22: Example of Bicycle Sign (Source: "Cleveland Complete and Green Streets", 2013 and "Complete Streets Chicago", 2013)

4.6.2.3 Transit Components

Designing safe and comfortable transit facilities to send a message to all users of streets that transit is a reasonable and sustainable form of transportation is an indispensable act. Since, transit vehicles such as buses, streetcars and light rail vehicles consume far less space of roadway per passenger trip. Besides, the transit system can help to reduce congestion, decrease greenhouse gas emissions, and enhance air quality.

Accordingly, transit modes must interface seamlessly with other modes and providing appropriate and safe connections to residences, workplaces and other destinations for pedestrians and cyclists. Hence, the transit components address accommodation for transit services within the public right of way. Hence, key transit elements are mentioned in the following ("Dallas Complete Streets", 2013; "Knoxville Complete Streets", 2009).

(A) Transit Lanes

Public transit lanes offer special or private use for transit vehicles to enhance the quality of services and improve efficiency by separating transit from congested traffic.

Transit lanes can be divided physically from other lanes or distinguished by lane markings and signage. In general, there are two types of transit lanes includes Dedicated or Exclusive Transit Lanes and Reserved Lanes or Shared Transit Lanes ("Alexandria Complete Streets", 2015; "Boston Complete Streets", 2013; "Florida Complete Streets", 2017).

Figure 23: Example of Dedicated or Exclusive Transit Lane (Source: "Toronto Complete Streets", 2017)

Dedicated or Exclusive Transit Lanes: this type of lanes are marked for transit by pavement markings, signs or sometimes physical design. This type of lanes is usually used to move the highest volume of passengers and support the frequency of transit vehicles. Besides, only transit and emergency vehicles are permitted in these lanes (Figure 23) ("Florida Complete Streets", 2017; "Toronto Complete Streets", 2017).

Reserved Lanes or Shared Transit Lanes: This system allows the combination of all transit vehicles such as taxis, high-occupancy vehicles, and sometimes bicycle. This

type of lanes is appropriate in many places where right-of-way space is not enough. Besides, Shared-use lanes are useful, where the level of congestion and ridership is high and transit moves together with mixed traffic. On shared-use lanes, transit service can be enhanced through providing appropriate geometric design, signal timing and parking. In all cases, lane width needs to be adequate to serve transit vehicles and passengers (Figure 24) ("Boston Complete Streets", 2013; "Florida Complete Streets", 2017; "Orange County Complete Streets", 2016).

Figure 24: Example of Transit Reserved or Shared Lane (Source: "Boston Complete Streets", 2013)

(B) Transit Stops and Access

Transit stops are one element in a transportation network that provides a place for protecting transit passengers to wait for transit vehicles in a safe place. Location and design of transit stops are so important. Transit stops must be located as close as possible to places travelers will be coming from or going to. Besides, transit stops must be in closest distance to a safe street crossing. In urban contexts, the best place to locating the transit stops is on the Far-side of the intersection but sometimes Near-side of an intersection is better placed if the passenger generator is on the near side or street crossing on the near side be more appropriate. Besides, in areas where there are long blocks and important destinations are exist along the block the Midblock bus stops

must be provided in the middle of the block (Figure 25) ("City of Memphis", 2015; "The City of Fort Lauderdale", 2010).

Figure 25: Example of the Midblock Bus Stop (Source: URL1)

Moreover, closely located stops are more appropriate for pedestrians and cyclists access. It is clear that all transit users are pedestrians or cyclists at the beginning or end of their own trip. Hence, connections among surrounding areas to transit stops by pedestrian and cycling routes are very substantial fact. Besides, locating bicycle racks or parking next to the bus stops can help bicyclist have comfortable access to transit service.

Besides, in designing transit stops special attention to define a safe distance from moving vehicles way and considering particular passengers with a disability is very

important ("Orange County Complete Streets", 2016; "Philadelphia Complete Streets", 2009).

(C) Other Transit Amenities

For improving transit performance and quality of services, providing amenities such as shelter and benches for providing places to sit, rest, and protect travelers from rain and sun, trash receptacles to make sure cleanliness, lighting to increase safety and visibility are very essential. Besides, route/schedule information to make transit a more functional mode, transit stop signage, transit Bulb-outs to eliminate the need for transit vehicles to pull in and out of traffic, and signal timing to give priority to transit vehicles at intersections are very important ("Burlington Complete Streets", 2013; "Mankato Complete Streets", 2015; Nicholls et al., 2011).

4.6.2.4 Motorized Vehicle Components

In the past, the focus was on moving motorized vehicles safely and efficiently but complete streets movement takes a more comprehensive view of the street and users. In this way, complete streets approach to support adjacent land use and balance the efficiency of motorized vehicles travels by considering pedestrians, cyclists, and transit users. Moreover, clarifying main components of complete streets related to motorized vehicles is an essential step that common components are explained in the following section.

(A) Motorized Vehicle Lanes

Vehicle lane is the main element of motorized vehicle components that designing strategies on vehicle lanes have a direct effect on the level of safety and quality of streets services (Figure 26). In this way, the width of vehicle lanes, play a central role in recovering streets' right of way for non-motor vehicle users and has a significant

effect on perception and behavior of all users. Besides, the width of lanes directly has an effect on defining the appropriate motor vehicle speeds ("City of New Haven", 2010; "Philadelphia Complete Streets", 2009). Thus, special attention to providing appropriate width for vehicle lanes and define a suitable speed for vehicles by considering the function, type and characteristics of streets are important steps in providing suitable vehicle lanes fitting to surrounding context.

Figure 26: Example of Motorized Vehicle Lane (Source: "Philadelphia Complete Streets", 2009)

(B) Central-Turn Lanes

Central-Turn lanes are located in the middle of a two-way street. Two-way left-turn lanes are acceptable but not desirable; medians with structured turning movements are preferred. Two-way left-turn lanes are appropriate if used to reduce vehicle lanes, via a road diet. The center lane is regularly used to offer a deceleration and storage lane for left-turning cars, normally used for vehicles making midblock left turns (Figure 27) ("Dallas Complete Streets", 2013; "Knoxville Complete Streets", 2009; "Mankato Complete Streets", 2015).

Figure 27: Example of the Central-Turn Lane (Source: Mankato Complete Streets", 2015)

(C) On-street Parking

On street parking, play an important role in calming traffic by slowing vehicle speeds and helps access to adjacent land use. Besides, on-street parking provides comfortable streets for pedestrians and cyclists by creating a buffer from vehicle traffic (Figure 28) ("Complete Streets Chicago", 2013; Nicholls et al., 2011).

Figure 28: Example of On-Street Parking (Source: "Complete Streets Chicago", 2013)

(D) Emergency Access

In designing of a street, considering standards related to emergency vehicle access such as police, Ambulance, and fire department, cleanness vehicles used for street cleaning and refuse collection is so substantial ("Alexandria Complete Streets", 2015; "Dallas Complete Streets", 2013).

(E) Traffic Calming

Traffic calming is any measure that is designed to slow down speeds and volumes of vehicles. This help enhances the safety of streets, local amenity, and livability of a city. Usual infrastructural components that calm traffic are divided into two kinds include vertical and horizontal infrastructures. Horizontal infrastructures by narrowing the available roadway space for vehicles help to slow traffic. Besides, horizontal infrastructures provide shorter crossing distances and areas to wait for pedestrians. Vertical infrastructure includes raised surface treatments designed to slow traffic. There are different kinds of infrastructures for traffic calming and enhancing safety within the vehicle roads, which common of these infrastructures are exposed in Table 22 ("City of Memphis", 2015; "City of New Haven", 2010).

Table 22: Example of design treatment approaches for traffic calming and enhancing safety (Sources: "Boston Complete Streets", 2013; "City of Memphis", 2015; "The City of Fort Lauderdale", 2010; "City of New Haven", 2010; "Albany Complete Streets", 2016)

	Design Treatment	Explanation	
1	Medians	Medians will use for separating different lanes of traffic within the streets. Medians offer opportunity for planting, define pedestrian refuge islands and generally green infrastructure.	
2	Chicane	Chicane is another infrastructure that use curb extensions in vehicle roadway for designing a serpentine roadway to shift traffic from one side to another side of streets. This treatment by designing an 'S' curving roadway has direct effect on reducing the vehicle speeds. Chicane can be defined by alternating on-street parking. In installation of chicanes, permeable surfaces, planters and green stemware management can be applied.	
3	Speed hump	Speed hump as a raised part in the street pavement surface are reducing the vehicle speeds. This treatment is most effective in combination with other ways to calming traffic speeds but it is not suitable for all location.	
4	Refuge Island	Refuge islands on roadways is another approach, can improve safety of pedestrian and backlists by providing a safe and comfortable access with in two-way traffic roads by reducing the crossing distances. Besides, they can work as a traffic-calming tool by narrowing the street and force driver to move slowly.	
5	Diverter	One of the physical barriers aim to reduce traffic and vehicle speeds on Local Street is diverters. Diverter is not preferred approach since caused a break in connectivity of the network. In designing process of diverters, particular consideration for emergency access and pedestrian and cycling circulation is essential. Besides, diverters provide a good opportunity for locating green infrastructures	
6	Roundabout	Roundabouts are one of the traffic calming elements that main benefit of them is the reduce conflicts of left-turn which is a main cause of accidents in intersections. Hence, roundabouts by guiding the vehicles and decreasing their speeds can enhance pedestrian safety in intersections.	
7	Raised crosswalks	Raised crosswalks are kinds of speed tables outfitted with crosswalk markings and signage to channelize pedestrian crossings, providing pedestrians with a level street crossing. Also, by raising the level of the crossing, pedestrians are more visible to approaching motorists.	
8	Chokers/Pinchpoints	Curb extensions at midblock locations that narrow the roadway space by widening the sidewalk or planting strip is named as Choker. If marked as crosswalks, they are also known as safe crosses.	

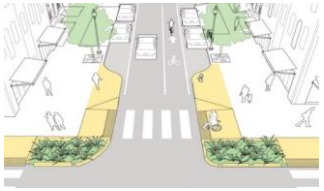
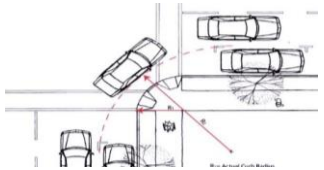
4.6.2.5 Intersection Components

Intersections are the most important and dangerous part of the street network. Complete intersections provide an opportunity to reach the goals of complete streets that are incorporating safety, mobility, accessibility, quality of life, and sustainability perspectives into the planning, design, and operations of streets ("Dallas Complete Streets", 2013). However, intersections are complex environments that two or more streets meet. Thus, each intersection epitomizes a point of both chance and of clash for street users, due to these facts different users are discussing on having the same space ("Boston Complete Streets", 2013).

In intersections, the level of conflict among users can be high; since intersection are also placed, where pedestrians, cyclists, transit users, motorists are expected to cross streets ("Toronto Complete Streets", 2017). Hence, special attention employed by design treatments to control conflict and balancing users' needs, plus providing a secure and comfortable place for all users is essential ("Miami-Dade County Complete Streets", 2016; "Newburgh Complete Streets", 2015; "Pompano Beach Complete Streets", 2015).

The intersection components address design treatments to provide safe movement for all modes of transportation and all users. Accordingly, a list of common design treatments/components of a complete intersection is provided in Table 23 ("Burlington Complete Streets", 2013; "Complete Streets Chicago", 2013; "Passaic County Complete Streets", 2012).

Table 23: List of common design components of a complete intersection (Sources: "Boston Complete Streets", 2013; "Albany Complete Streets", 2016; "Alexandria Complete Streets", 2015; "Burlington Complete Streets", 2013; "Complete Streets Chicago", 2013)

	Components	Explanation	
1	Curb Extensions	Curb extensions that is known as Bum-pout, Neck-downs or Bulb-outs, are created by extending the sidewalks into the street at the corners or middle of streets. Using curb extensions have a variety of benefits including: - Declining distance of pedestrian crossing, - Providing space for pedestrian to queue before crossing the streets, - Increasing visibility of both pedestrian and drivers, - Decreasing speed and calming traffic of vehicles, - Enhance safety, - Adding more space along sidewalks for users and provide enough space for suppling utilities and amenities, - Restricting vehicles from parking too close to the crosswalks.	
2	Curb/Corners Radii	Designing the corners have a substantial effect on how an intersection assists the variety of street users. Corner design must balance the needs of all users and maximize the safety of pedestrians. The smallest curb radii must be used for corner design, since smallest curb radii benefit pedestrian by slowing down the vehicles speed, decreasing the crossing distances, and increase the size of waiting areas.	
3	Signage and Signals	Signage and signals At intersections to provide additional guidance to all users of different modes, signage and signals related to all modes of transport must be supplied. Besides, in alerting motorists to enhance safety, these signals plays a crucial role. The signage and signals serves as a reminder that motorists must be careful about pedestrian and cyclists. Besides, signage and signals help users of all modes to find the way and have easy and safe access to their own destinations.	
		Signal Timing The signal timing affects all modes of transport and well-planned signal timing play a very important role to reduce delay and improve traffic flow at intersections. Especial signal timing for each modes of transport must be considered at intersections to reduce the unnecessary stops, conflicts and improve quality of services.	
4	Crossing facilities	Marked Crosswalks Marked crosswalks provide appropriate crossing routes for pedestrians and alarming other users where pedestrians are crossing.	
		Crossing Refuge Island: Crossing refuge islands by dividing direction of traffic in multilane roadways and providing a space for pedestrians and cyclists to wait while crossing the streets will increase the level of safety and improve access at intersections and midblock crossing.	

4.6.2.6 Green Infrastructure Components

In designing complete streets, enhancing both the environmental quality and aesthetic demand of streets are so important. Landscaping and street trees realize both of these goals by improving air quality by producing oxygen, filtering airborne pollutants, absorbing greenhouse gases and develops the visual qualities of a street and enriches the experience for all road users ("Dallas Complete Streets", 2013; "Florida Complete Streets", 2017).

Besides, greening infrastructure and stormwater management can decrease stormwater runoff by providing permeable surface area, providing valuable shade and shelter for pedestrians, and calming the traffic by decreasing the perceived width of the streets that encourage drivers to slow down and pay attention to their surrounding environment ("Boston Complete Streets", 2013). In this way, plant selections and placement are so important. According to all explanations, greening infrastructure and stormwater management are essential parts of a complete street (Figure 29) ("Cleveland Complete and Green Streets", 2013).

Figure 29: Example of Green Infrastructures (Source: "Toronto Complete Streets", 2017)

4.7 Summary of the Chapter

The investigation reveals that the concept of complete streets as a latest movement which is going to be a widespread concept to redesigning streets for bringing back the active modes of transportation to streets and providing a safe street for every modes and everyone. However, the number of communities that are trying to have a plan for complete streets is increased during the last decade. It is clarified in the chapter that having a strong policy based on defined elements by the National Complete Streets Coalition is the first step for all communities to planning complete streets.

Assessing of the highest ranked complete streets policies during the six years revealed very comprehensive information to policymakers that how they must write a strong policy and what kinds of aspects must be directly considered and mentioned in the main body of a policy. After clarification about all aspects of complete streets policy, to expounding the components, design principles, and the process of planning for complete streets, 30 complete streets guidelines related to communities in North America and Canada selected to be evaluated. The evaluation of these 30 guidelines clarified that design components of a complete street can be categorized under 6 main sorts include:

- Pedestrian Components
- Cycling Components
- Transit Components
- Vehicle Components
- Intersection Components
- Green Infrastructures Components

Besides, steps in the process of planning complete streets that must be considered are clarified. Besides, variables related to contexts that must be evaluated in this process to understand the weaknesses, strengths, and opportunities are explained. After this clarifications, goals, objectives, and priorities must be elucidated. In addition, in process of decision-making, all alternative design solution must be provided and all proposed alternative must be tested against the zoning context, land use context, transportation context, and objectives to determine any discrepancies or restraints.

Besides, in this process consultation and stakeholder engagement are indispensable and an alternative must occur after collecting all stakeholder feedbacks. Finally, the best matches design solutions to the context and future expectations must be selected and provided. The agreed-upon alternative design solutions will be passed to the engineers for detailed construction engineering design. After that, the implementation step want to be started but before that funding resources for implementation must be defined and performance measurement must be applied during and after finishing the implementation process.

According to all above explanations, the following Figure 30 will bring together all knowledge that delivered in this chapter and will highlight connection among them.

Chaper 4

Introduction

A Review on Movements towards Promoting Active Modes of Transportation by Focusing on Redesigning Streets			
Woonerf concept	Home Zone concept	Shared Streets or integration concept	Complete streets concept

Complete Streets Concept

Definition	A complete street will be defined as a street that is planned, designed and operated to be safe, convenient and comfortable for all users, including drivers, pedestrians, bicyclists, and transit riders of all ages and abilities			
Vision & Golas	Providing a multimodal transport system allows users to select their transport modes based on the types of trips. Improving services, safety, performance and comfort in all modes of transportation and both drivers and non-drivers. The goal of the Complete Streets movement will define a street for everyone by focusing on the changing process of the decision-making and planning, designing, building and operating of all streets and considering the needs of all users for balancing access for all ages and abilities, ethnicities and incomes.			
Benefits	1-Contribute to Environmental Health, Healthy Community and green design		4-Contribute to Convenient Access and Transportation Equity and Safety	
	2-Contribute to Lower motor vehicle traffic speeds and enhanced non-motorized transport		5-Contribute to Economic development and Vitality	
	3-Contribute to intermodal connections and active public spaces		6-Contribute to fostering social capitals and communities	
Characteristics	1-Flexible	2-Accessible & Multimodal	3-Vibrant Centers of Activity	4-Common Features and Design Elements

Policy of Complete Streets	Policy Types	Policy Elements		Investigation on the Best Complete Streets Policies: Examples from North America	
	1-Legislation	1-Vision	6-Context Sensitivity	1-Baldwin Park, California	4-Indianapolis, Indiana
	2-Resolutions	2-All Projects and Subject	7-Connectivity		
	3-Executive orders				
	4-Policies adopted by an elected	3-Jurisdiction	8-Design approaches	2-Littleton, Massachusetts	5-Ogdensburg, New York
	5-Internal policies	4-Exceptions	9-Performance measures	3-Reading, Pennsylvania	6-Missoula, Montana
	6-Tax ordinances	5-All Users and Modes	10-Implementation		
	Scoring and Weighting Method to Evaluating Complete Streets Policies				

Designing components and Phases of planning Complete Streets	**Complete Streets Design Components and Planning Phases**							
	Design Components of Complete Streets	Pedestrian Components	**Phases of Planning Complete Streets**	1	Contexts Analysis	Zoning Context	Street network density Diversity of mobility optio Building placement land-use pattern	Urban Areas Suburban Areas Rural Areas
		Cycling Components				Land-Use Context	Function	Residential Commercial Mixed-Used Single-Used
		Transit Components				Transportation Context	Type of Streets Function of Streets Quality of Safety Accessibility Traffic volume Traffic Speed Facilities (Quality of service) Trip Generators Level of Crash	
		Vehicle Components						
		Intersection Components		2	Identify Issues, Opportunities & Define Goals			
		Green Infrastructures Components		3	Decision-Making Framework			
				4	Finalize Engineering Design & Document			
				5	Implementation, Funding, & Performance Measurement			

Summary of the Chapter

Figure 30: Summary of the Chapter Four

Chapter 5

AN INTEGRATED FRAMEWORK TOWARDS PLANNING SUCCESSFUL COMPLETE STREETS

5.1 Introduction

This chapter is developed based on findings in the previous chapters. A systematic literature review provides by focusing on the existing literature and evaluation of selected technical reports of policies and guidelines related to communities in North America and Canada towards clarifying different aspects of complete streets to bring back active modes of transportation to the streets and make available safe paths for everyone and every modes of transportation through redesigning the streets in the way of increasing the level of sustainable mobility in communities.

Accordingly, in this chapter, a list of determinative variables is defined that must be considered by planners in the planning process for achieving successful complete streets in communities. After clarification of the determinative variables, an integrated framework is recommended for illumination of the main steps that must be considered towards planning successful complete streets in communities.

There are numerous tangible and intangible variables, which consideration of them is very substantial, because of their direct strong effect on the performance of complete streets. Hence, the following section is going to elucidate the determinative variables based on all the arguments in this study.

5.2 Determinative Variables that must be Considered in the Planning Process of Complete Streets in Communities

As has been mentioned in preceding chapter one of the main intention of the complete streets movement is to redesigning streets to giving priority to active modes of transportation and providing a safe and comfortable street for everyone and all modes of transportation. In this regard, consideration of all effective variables in the planning process for promoting active modes of transportation is substantial. Besides, one of the main elements of an ideal complete street policy has an emphasis on Context Sensitivity. All selected best-ranked policies in chapter three through an explanation of the context sensitivity element are emphasized that planning of all complete streets must be in harmony with the adjacent land uses and neighborhood characteristics. As a result, in the planning process for redesigning a street, pay attention to the street's surrounding contexts include physical and social contexts are playing a crucial role to provide flexible, innovative and balanced approaches.

Consequently, based on the mentioned explanation above and variables that must be considered in the process of planning complete streets exposed in section 4.6.1, there is a gap in the body of the planning process of complete streets. In this planning process, variables related to the social context, which can be effective on the process of planning towards promoting active modes of transportation, are not considered.

Accordingly, in the following sections determinative variables that must be considered by planners in the planning process of complete streets are divided and provided under two general sorts include variables related to the built environment and social contexts.

5.2.1 Variable related to the Social Context

Based on the literature reviewed in chapter two, the consideration of variables related to social context play a significant role in the process of planning for promoting the use of active modes of transportation. Evaluation and consideration of these variables in the process of planning successful complete streets are substantially based on the defined intention of complete streets.

Consideration of these elements will help to decision makers to have very comprehensive knowledge about the social characteristics of the area that a complete street wants to be applied. This understanding will help planners and designers to be sure defined strategies and approaches are appropriate within the context of a community, and by applying those strategies expected transportation needs of all residents and main users will be responded. Besides, consideration of social beliefs and social values of a community as latent variables that have a significant influence on the travel behavior of community's members will help planners and designers to provide a complete street with a strong sense of place.

Accordingly, effective variables related to social context of a community that must be considered and assessed in the planning process towards having successful complete streets based on literature reviewed in chapter two, can be categorized in two clusters include (i) Socio-demographics and Socio-economic variables and (ii) Community attitudes and beliefs variables that are indicated in Figure 31.

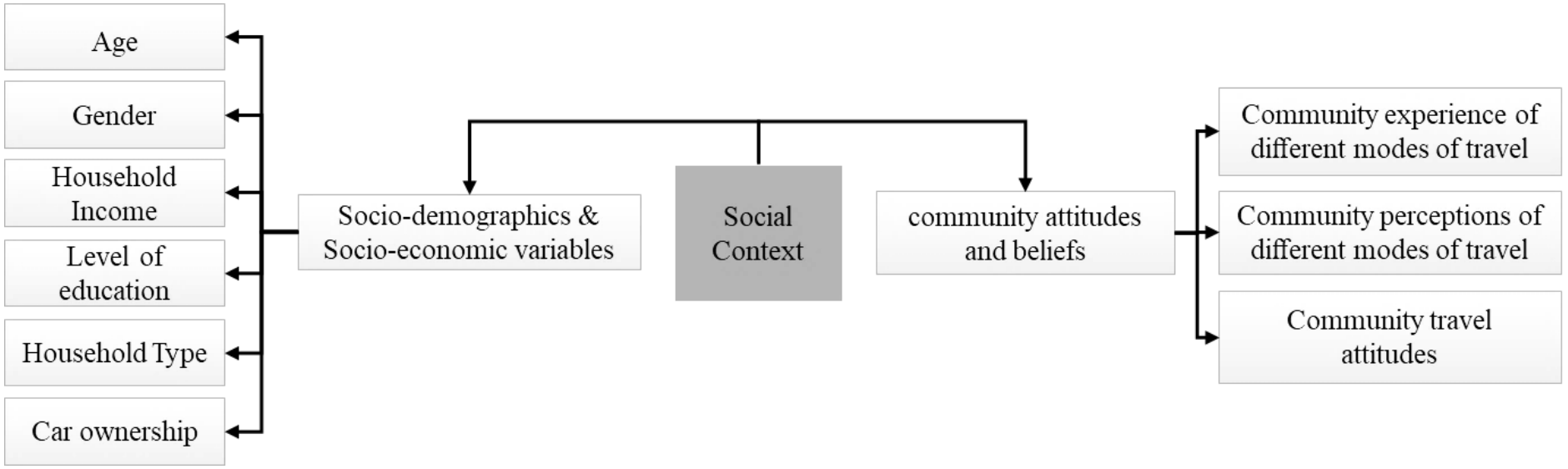


Figure 31: Determinative Variables Related to the Social Context that must be considered By Planners in the Planning Process of Successful Complete Streets

Consequently, in the process of planning successful complete streets in communities towards providing appropriate strategies for promoting residents to use active modes of transportation in their own daily life, consideration of all variables related to the social context that mentioned above are very important and substantial.

5.2.2 Variables related to the Built Environment

Based on the literature reviewed and summarized in chapter two, main determinative variables in the process of encouraging the use of active modes of transportation related to the built environment context can be classified under two groups include (i) variables related to land-use and (ii) variables related to community design features. These effective variables are revealed in Figure 7.

Besides, in the process of planning a complete street as has been mentioned in chapter three, there are several variables related to the built environment context that evaluation and consideration of them in the planning process of a complete street are significant. Since evaluation of these variables will give an opportunity to decision makers to have knowledge about existing and future situation of the built environment that will guide planners to recommend appropriate strategies and design solutions to achieve the main aim of the complete streets. These variables are categorized under three title include variables related to zoning context, variables related to land-use context and variables related to transportation context. These variables are exposed in Figure 15.

Consequently, to clarify the determinative variables related to the built environment, all variables revealed in Figures 7 & 15 provides together in Figure 32 towards providing a comprehensive list of all determinative variables related to the built environment context that have direct effects on performance of complete streets and creating successful complete streets in communities and also consideration of them is substantial by planners in the process of planning complete streets in communities.

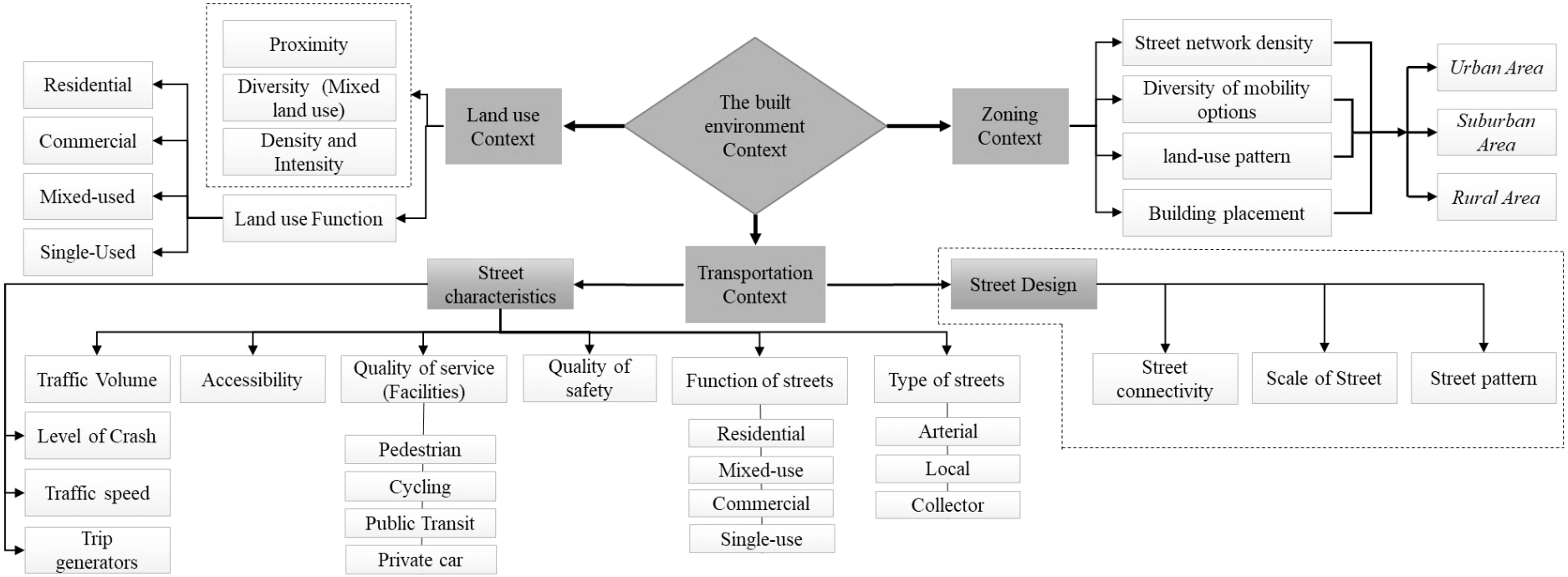


Figure 32: Determinative Variables Related to the Built Environment Context that must be considered By Planners in the Process of Planning Complete Streets

Consequently, determinative variables in the process of planning successful complete streets by focusing on promoting the use of active modes of transportation can be categorized under two general main clusters include variables related to the social context and variables related to the built environment context. Based on the main purpose of complete streets movement that is providing safe streets for all users of all ages and abilities and also bringing back active modes of transportation to the streets, consideration of all mentioned variables by decision makers, planners, and designers, in the planning process of successful complete streets are a substantial fact.

Accordingly, in the following section based on determinative variables that clarified above and the planning process of complete streets that elucidated in chapter three a new framework for planning to achieve successful complete streets will be recommended.

5.3 An Integrated Framework towards Planning Successful Complete Streets

After clarifying the significant and effective variables, those must be figured out and considered in the planning process of complete streets, in this section a general framework would be recommended to illuminating the steps that must be considered towards planning successful complete streets. This framework is trying to define an integrated planning model by considering the determinative variables that clarified in the previous section towards providing an integrated framework for planning complete streets. The recommended framework consists of 6 main steps that these steps will be explained in the following towards providing a clear way for planners and decision-makers, what they must do and consider in each step.

Step1: Based on technical reports reviewed in chapter three, the first step towards planning successful complete streets is defining a clear and strong policy by considering the 10 main elements, which are described in section 4.5.1.

Step2: After defining a comprehensive policy, consideration of the variables associated with the social context of a surrounding community where the complete streets are going to be applied, is playing a crucial role in planning and designing processes. Since the aim of complete streets is providing safe and comfortable streets for all users of all ages and abilities; hence, understanding social characteristics of the existing context and their current and expected needs related to transportation is very important in the planning process. Hence, adopting streets to fit the characters of the surrounding neighborhood is indispensable. Evaluation of all variables associated with the social context will provide initial rudimentary data to planners that they are faced with what type of community and based on achievements, decision-makers, and designers can move forward to propose appropriate recommendations, and design alternatives. After that, the variables associated with the built environment context must be evaluated to clarifying the existing situation of variables related to land use context, zoning context, and transportation context. Evaluation of these variables will give planners comprehensive information about the existing physical condition of the area where a complete street want to be planned.

Step3: After collecting all information about the existing situation of variables associated with the social and the built environment contexts, existing gaps, weaknesses, strengths, and opportunities would be clarified and goals, objectives and design priorities based on all achievements would be defined.

Step4: Then, alternative design solutions would be provided based on all knowledge that achieved from previous steps. All proposed design alternatives would be tested against the social and the built environment contexts to determine any incongruities or restraints. In this step, local stakeholders and their opinions must be engaged and selected adequate solutions and design alternatives need to be applied after collecting all local stakeholder feedbacks.

Step5: After selecting the best design solutions by considering the local stakeholder opinions, the chosen alternative would be passed to the engineers for detailed construction engineering design. In this level, standards related to designing streets for all modes and all users must be considered comprehensively. Besides, all documents about project results and the phases were followed, including discussion and appointment activities, and lessons learned to be documented and shared as a reference for upcoming tasks and any questions that might arise about why a specific choice was made.

Step6: Everything is ready for starting the implementation process, but before that, a cost analysis must be done and based on this cost analysis appropriate funding sources shall be defined. Besides, performance measurement must be applied during and after finishing the implementation process.

Accordingly, in the following based on all clarifications mentioned above an integrated framework towards planning successful complete streets would be proposed (Figure 33).

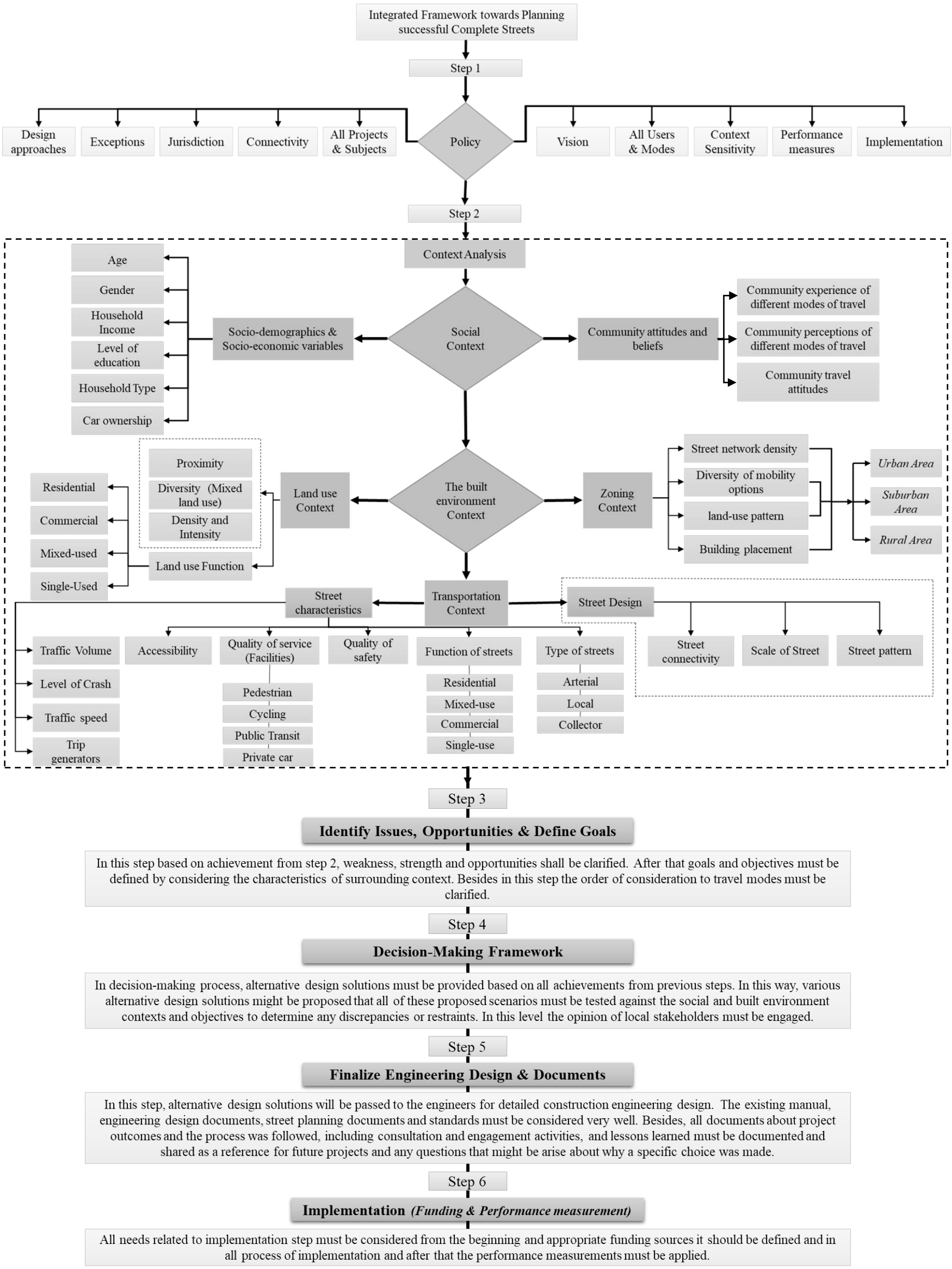


Figure 33: An Integrated Framework for Planning Successful Complete Streets

5.4 Summary of the Chapter

The main variables that consideration of them is indispensable in the planning process of complete streets are clarified and divided into two general groups including variables related to social context and variables related to the built environment context. Consideration and evaluation of these variables will help planners and decision-makers to have enough knowledge about the existing social situation and physical condition in an area that a complete street wants to be planned. Understanding the social and physical conditions will help planners to provide an appropriate solution for responding to the current and future needs of main users of a complete street in an area. Accordingly, for achieving successful and acceptable complete streets, consideration of all defined variables in chapter four is one of the main steps in the planning process of complete streets in all zones.

Besides, this chapter revealed the main planning phases towards achieving successful complete streets. Accordingly, an integrated planning framework consist of 6 main phases is proposed by this chapter, which can be used for planning complete streets in different zones of urban or rural contexts.

Chapter 6

CONCLUSION

6.1 Introduction

The study exposed, moving towards sustainability in all aspects of the transportation sector is a critical challenge through the world in the present century. In this regard, there is a universal agreement that for mitigation of negative impacts related to transportation sector urgent variations in travel modes, policies, planning process, and behaviors are indispensable. Accordingly, scholars in different fields to provide practical approaches done numerous studies around the world. The main practical approaches are classified into four groups by focusing on different aspects of the transportation sector. This classification includes practical approaches related to land-use planning, the use of clean energy, shift transportation modes, and the use of Information Technology (IT) system and education.

The investigation also revealed shifting transportation modes towards using active modes of transportation is the worldwide-accepted fact. In this regard, from the last five decades, a special movement that is named as an Active Transportation Movement is developed towards encouraging people to use active modes of transportation in their own daily life. Besides, various concepts as supportive strategies emerged throughout the world to promote using active modes of transportation. As the newest concept in this regard, the concept of complete streets emerges in North America. The complete

streets concept by redesigning streets has an aim to redefine the intention of streets to provide a multimodal transportation system.

Hence, in the heart of the complete streets concept, a street will be defined for everyone and is planned to be safe, convenient and comfortable for all users, including drivers, pedestrians, bicyclists, and transit riders of all ages and abilities by giving priority to active modes of transportation.

The core emphasis of this dissertation is to clarify the main determinative variables that must be carefully evaluated and considered in the process of planning complete streets. Besides, this investigation will set up a framework by considering the determinative variables towards planning successful completes streets in communities and elucidate the phases that must be considered in this way. In this regard, the research was set out to explore the concept of sustainable transportation and active transportation to create a strong context for moving towards achieving the main aim of this dissertation.

After that, a comprehensive clarification and investigation by focusing on the concept of complete streets are provided. During this clarification, different dimensions and aspects related to policy, design components and planning of complete streets has been elucidated. Hence, the research sought to answer the following main questions:

- What are the main considerations in process of writing a strong complete street policy?
- What are the determinative steps and variables that must be considered by planners in the process of planning successful complete streets?
- What are the main design components of complete streets?

For responding to the main questions and achieving the core goal of this investigation, the main five objectives were determined.

- Understanding the main determinative variables that consideration of them is substantial in the process of encouraging the use of active modes of transportation;
- Finding out the effective complete streets policy elements;
- Finding out complete streets design components;
- Clarifying the main determinative variables that must be considered in the planning process of complete streets;
- Defining a new framework towards planning successful complete streets by considering the determinative variables.

The whole investigation was planned in two main sections. The first section provided a theoretical basis through a systematic review of the literature. Then the second section was to exploit the achieved information towards clarifying the main determinative variables that must be assessed and considered in the process of planning successful complete streets as well as proposing a new integrated framework for planning successful complete streets in societies. The first section of research, which composed of two chapters (chapter 3 and chapter 4), intended to build the theoretical context. In this regard, in chapter 3 the concept of sustainable transportation and active transportation and their definition, vision, goals, fundamental dimensions, principles, and benefits have been evaluated. Furthermore, the study revealed that there are determinative variables towards promoting the use of active modes of transportation that must be considered in the planning process.

In chapter 4, the concept of complete streets by focusing on its policy and design aspects assessed. The studies done in this chapter exposed intention, benefits, characteristics, the main elements of policies, types of policies, scoring and weighting method for evaluating policies, components, and design treatments and phases of the planning of a complete street. Consequently, in chapter 5 the study clarified main determinative variables that must be evaluated and considered in the process of planning complete streets. Besides a new integrated framework by considering the determinative variables towards planning successful completes streets in communities presented in this chapter.

6.2 Findings of the Research

The outcome of the research can be divided and presented in four main sorts, which are mentioned in the following;

- Theoretical findings related to the concept of sustainable transportation and active transportation
- Findings regarding the main determinative variables that must be considered by planners towards promoting the use of active modes of transportation
- Theoretical findings regarding the complete streets policy and planning
- Findings regard main design components of the complete streets
- Findings related to main determinative variables and main steps that must be considered in the planning process of successful complete streets.

The first and substantial point of this investigation is the theoretical findings, which revealed noticeable information about sustainability in the transportation sector, promoting active modes of transportation and planning complete streets. Theoretical findings related to the concept of sustainable transportation and active transportation

elucidated that moving towards promoting sustainability in all aspects of the transportation sector for decreasing the negative impacts and issues related to transportation is an indispensable fact at the present time. Besides, it revealed that applying sustainability in the transportation sector is important for balancing current and future environmental stewardship, social equity, economic improvement, communities' health, and quality of life. Moreover, this investigation exposed that for enhancing the level of sustainability in the transportation sector, four main groups of movements defined as the following.

- Movement-related to land use planning
- Movement-related to use of clean energy and renewable energy
- Movement-related to shift of transport modes to sustainable modes
- Movement-related to Education and the use of Information Technology (IT) system

After that, this research emphasized the active transportation concept and movement that is emerged as the most widely accepted movement regarding shifting of transportation modes. Using active modes of transportation will provide an opportunity for users to have direct access to greater distances inside an urban context. Besides, the study revealed that promoting active modes of transportation modes has many benefits, which are explained in section 3.3.1 of this study. Besides, this research clarified that in the process of promoting the use of active modes of transportation, there are variables that consideration of them are indispensable. These determinative variables based on the literature reviewed are classified into two groups include the social and the built environment variables, which exposed in section 3.3.2 of this dissertation.

In chapter 4 of this investigation, it is revealed that the concept of complete streets as the latest movement, by redesigning streets has a goal to redefine the intention of streets to provide a multimodal transportation system. Hence, in this movement, all modes of transportation and all users are considered, but a special priority must be given to active modes of transportation.

In this research, it was illuminated that the first step towards applying the concept of complete streets is defining a strong, straight and accountable written policy. Hence, this study exposed that there are 10 main elements of an ideal complete streets policy and there are 6 types of complete streets policy. This study by assessing the highest ranked policies related to cities in North America between the years 2011 until 2016 clarified that achieving and applying complete streets policy in small cities has more potential. Furthermore, policies defined by an elected board consist of local stakeholders and scholars that accepted through a chosen leading organization are more effective and successful. Furthermore, it was elucidated that how other societies must write their own complete streets policy and how the main elements of the ideal complete street policy must be described.

In the next step of this investigation, 30 complete streets guidelines selected and evaluated. Based on these guidelines the components and design treatments related to complete streets and phases of planning complete streets towards implementation are elucidated. Besides, the main questions that must be responded in the process of planning complete streets are illuminated.

Chapter 5 of this research exposed the main determinative variables that must be considered and evaluated in the process of planning towards having successful

complete streets. These variables are divided into two main groups include variables related to the social context and the built environment context. Besides, this research revealed an integrated framework for planning successful complete streets. In this framework, all steps and variables that must be considered are clarified.

Generally, the research demonstrates that planning complete streets are an effort in the field of urban design and urban transportation to upsurge the use of active modes of transportation in communities. In this regard, it is revealed that consideration of variables related to the social context and the built environment context plays a crucial role in the process of planning towards having successful complete streets.

The contribution of this research would be of interest to scholars in the fields of urban design and transportation planning and design by enhancing the consciousness concerning to the role of complete streets movement on the promoting use of active modes of transportation. The planning framework is proposed in this research can be used to provide a clear way to apply complete streets in each context.

6.3 A Critical Discussion on the Applicability of the Recommended Framework

The proposed framework in this study is planned and designed through empirical data which is achieved by a deep review on scientific resources and technical reposts towards recommending a clear way to enhance successfulness of implementation efforts of complete streets in the communities. This framework outlines the main steps and variables that must be considered and evaluated in planning process for achieving successful complete streets within the communities. This framework does not recommend planning timeframes, since it has a capacity to be considered for projects

in different scales; and, due to scales of projects, the timeframes can be changed. Besides, just like any planning process, designing and planning complete streets may also involve more than one department and agency - various stakeholders; therefore, suitable timing must be considered for the achievement of all necessity information.

Defining a strong policy as an initial step must be conducted through writing clear statements for all 10 main elements of complete streets policy based on the existing situation and expectations for the future of the streets. The most difficulty that planners may face through the application of this framework would be related to collecting data about variables, which is defined in step two. Hence, consideration of these variables based on expectations that are clarified in body of the policy can be flexible as well as consideration of the variables based on type, function and location of the streets can be changed. In the process of planning for each street through local authorities based on general vision that is defined for a street, the most important, effective and operational variables must be selected to be evaluated and considered.

On the other hand, in process of planning for redesigning a street's spaces to be a complete street based on expectations for future of the street, consideration of the most effective and operational variables among variables clarified in step two of the framework is substantial, and data about them must be collected. Accordingly, local authorities based on their own expectations must give priorities to the most effective variables for achieving the main aims, in appropriate time because during collecting the data there is a possibility for the changing of conditions. However, if any condition is changed, the local authorities and all departments and agencies that are involved in the planning process must come together and take a decision on how they can deal with the new conditions. Sometimes by changing the conditions, evaluation of some

variables, it is not essential or it is out of the project's timeline. In this regard, local authorities those have a responsibly for following the planning process by considering opinion of the experts must take a decision about evaluation of the indispensable variables by considering the timeline of the project.

Consequently, proposed framework through this research provides an overview on planning process towards successful complete streets. Besides, this framework clarifies main variables related to social and built environment contexts whose evaluation is suggested as compulsory by this study. However, consideration of the type, function and location of the street as well as future expectations and process of collecting data related to variables is very substantial. Accordingly, the most important and effective variables that time for collecting data related to them is fitting to timeframe of the project must be selected to be evaluated.

6.4 Recommendations for Further Studies

From this dissertation standpoint, it can be assumed that each research can open a way toward new knowledge, therefore this research disclosed some significant clues for further investigations.

As aforementioned in this study, the term and concept of complete streets is a new movement that emerged in a decade ago and the future of transportation sector strongly is connected to complete streets. Accordingly, it was clarified in this research that consideration of variables related to people and place together in all planning, designing, construction, operation and maintenance steps relate to the transportation sector is an indispensable fact.

Consequently, all variables related to the context where a complete street wants to be planned must be considered. In this investigation as discussed in the limitation of the study, determinative variables related to the social and the built environment contexts were clarified and considered. Hence, consideration of variables related to another context such as economy context which is defined as third pillars of sustainability concept has been proposed as a future study.

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APPENDICES

Appendix A: Scoring and Weighting Method to Evaluating Complete Streets Policies (Developed by Author based on McCann & Seskin, 2012; Seskin, 2013)

	Elements		Points						Weight
			0	1	2	3	4	5	
1	Vision		-	Point is giving to policies, which are indirect. These policies discussed to the application of Complete Streets generally by saying certain principles and features defined elsewhere. For example, “consider the installation of ‘Complete Streets’ transportation elements” and “supports the adoption and implementation of ‘Complete Streets’ policies and practices to create a transportation network that accommodates all users.”	-	Points are awarding to those kinds of policies that use equivocating language. For example, the policy states that the requirements of pedestrians and cyclists “will be considered” or “may be included”.	-	Full points are awarding to those policies that the complete purpose of the policy is understandable and direct. For example, policies that used words “shall” or “must” for saying the necessity of amenities that meet the requirements of pedestrians or cyclists.	6
2	All Users and Modes	All Modes	Point is given to policy include walking and bicycling;	Point is awarded to the policy include public transport next to walking and cycling;	Points are given to policy include one more mode, in addition to walking, cycling, and public transit;	Points are awarded to policy includes two more modes next to walking, cycling and public transit, such as private cars, emergency response cars, and freight traffic;	-	-	20
		All Users	-	Point to policy mentions the needs of people of various ages;	-	-	-	-	
			-	Point to policy references the needs of people with different abilities	-	-	-	-	
3	All Projects and Subjects		Point to policy does not have attention to other projects outside newly constructed roads.	-	Points are awarded to policy by focusing on maintenance, resurfacing and operations or all changes related to transportation system	Points to policy apply to renovation and new construction plans	-	-	12
4	Exceptions		Point to policy without exceptions	Point to policy includes any exceptions but does not define responsible for approval	-	Points to policy consider one or more of mentioned exceptions and no others types of exceptions but do not allocate responsibly for approval	Points to policy with any exceptions and stating who has a responsibility to grant approval to exceptions	Points to policy include one or more exception mentions above and no others types of exceptions and also declaring which organization is responsible for giving approval to exceptions	16
5	Connectivity		Point to policy does not mention about connectivity	-	-	-	-	Points to a policy that acknowledges the importance of transportation network connectivity	2
6	Jurisdiction		Point to policy does not mention the ways of cooperation among agencies and developer to reach Complete Streets	-	Points are awarding to a policy that expresses the need for cooperation among agencies in reaching the Complete Streets vision	Points to a policy that obviously notes about getting money for projects through the organizations expected to follow a Complete Streets approaches	-	-	8
7	Design approaches		Point to policy does not refer to design guidance and balancing among users and modes needs, and flexibility of design approaches	-	Points to policy have focused on a balanced or flexible design approach	Points to a policy that clearly mention the name of recent design guidance or references to use the best existing	-	-	4
8	Context Sensitivity		Point to policy does not remarks context	-	-	-	-	Points to policy remarks community context is a factor in the decision- making the process	8
9	Performance measures		Point to policy without any performance measures	-	-	-	-	Points to policy include one or more performance measure	4
10	Implementation		Point to policy without any implementation and accountability measures	Point to policy states the need to use at least one of the main steps	-	Points to policy include at least two of the main steps	-	-	20
			-	Point to a policy that changes the way transportation projects are prepared	-	-	-	-	
			-	Point to policy defines a person or advisory board to manage the implementation process	-	-	-	-	
Total Weight									100

Appendix B: The Original Reports of Complete Streets Policy Related to Selected Cities in North America

B-1: The original policy report of City of Baldwin Park, 2011

B-2: The original policy report of City of Indianapolis, 2012

B-3: The original policy report of Town of Littleton, 2013

B-4: The original policy report of City of Ogdensburg, 2014

B-5: The original policy report of Town of Reading, 2015

B-6: The original policy report of The City of Missoula, 2016

B-1: The Original Policy Report Related to City of Baldwin Park, 2011

City of Baldwin Park **Administrative Policy # 027**	**Date:** **Approved by: City Council** 7/20/11
SUBJECT: **Complete Streets Policy**	**Authority:** **Public Works Department** **&** **Community Development Department** **Mayor, Manuel Lozano**

The objective of this policy is to establish guiding principles and practices so transportation improvements are planned, designed, constructed, operated and maintained to encourage walking, bicycling, and transit use while promoting safe operations for all users.

The City of Baldwin Park will create a safe and efficient transportation system that promotes the health and mobility of all Baldwin Park citizens and visitors by providing high quality pedestrian, bicycling, and transit access to all destinations throughout the city, and will design its streets for people, with beauty and amenities. The City of Baldwin Park will provide for the needs of drivers, transit users, bicyclists, and pedestrians of all ages and abilities in all planning, design, construction, reconstruction, retrofit, operations, and maintenance activities and products.

The City of Baldwin Park will enhance the safety, access, convenience, and comfort of all users of all ages and abilities. The City understands that children, seniors, and persons with disabilities will require special accommodations.

STREET NETWORK / CONNECTIVITY

(A) The City of Baldwin Park will design, operate and maintain a transportation network that provides a connected network of facilities accommodating all modes of travel.

(B) The City will actively look for opportunities to repurpose rights-of-way to enhance connectivity for pedestrians, bicyclists, and transit.

(C) The City will focus non-motorized connectivity improvements to services, schools, parks, civic uses, regional connections and commercial uses.

(D) The City will require large new developments and redevelopment projects to provide interconnected street networks with small blocks.

JURISDICTION

(A) This Complete Streets Policy is intended to cover all development and redevelopment in the public domain and all street improvement assessment districts within Baldwin Park, but will also focus on regional connectivity.

(B) Every City Department including Administration, Public Works, Community Development, Recreation and Community Services, and Police, will follow the policy.

(C) The City requires all developers and builders to obtain and comply with the City's standards.

(D) The City requires agencies that Baldwin Park has permitting authority over, including, but no limited to, water agencies, electrical utilities, gas and petroleum utilities, communications utilities, and service contractors to comply with this policy.

(E) The City will work closely with Los Angeles County, Caltrans, the Los Angeles County Metropolitan Transportation Authority, the Southern California Regional Rail Authority, and the Southern California Association of Governments to promote compliance.

(F) The City encourages agencies not under Baldwin Park's jurisdiction, including, but not limited to, the Baldwin Park Unified School District, to satisfy this policy.

PHASES

The City of Baldwin Park will apply this Complete Streets policy to all roadway projects, including those involving new construction, reconstruction, retrofits, repaving, rehabilitation, or changes in the allocation of pavement space on an existing roadway, as well as those that involve new privately built roads and easements intended for public use. Complete Streets may be achieved through single projects or incrementally through a series of smaller improvements or maintenance and operation activities over time.

EXCEPTIONS

Complete Streets principles and practices will be included in street construction, reconstruction, repaving, and rehabilitation projects, as well as other plans and manuals, except under one or more of the following conditions:

(A) A project involves only ordinary or emergency maintenance activities designed to keep assets in serviceable condition such as mowing, cleaning, sweeping, spot repair, concrete joint repair, or pothole filling, or when interim measures are implemented on temporary detour or haul routes.

(B) The City Council exempts a project due to excessive and disproportionate cost of establishing a bikeway, walkway or transit enhancement as part of a project.

(C) The Director of Public Works and the Manager of Community Development jointly determine the construction is not practically feasible or cost effective because of significant or adverse environmental impacts to waterways, flood plains, remnants of native vegetation, wetlands, or other critical areas, or due to impacts on neighboring land uses, including impact from right of way acquisitions.

(D) Unless otherwise determined by the City Council, the Director of Public Works and the Manager of Community Development jointly determine it is not practically feasible or cost effective to implement the provisions of this policy through public or private project design or manuals or other plans.

Exceptions described in (B) and (C), above, will be documented and be made available for public access at least 21 days prior to decision. Exceptions described in (A) and (D), above, will be documented.

DESIGN

Additionally, Baldwin Park's City Council declares it is the City of Baldwin Park's policy to:

(A) Adopt new Complete Streets Design Guidelines to guide the planning, funding, design, construction, operation, and maintenance of new and modified streets in Baldwin Park while remaining flexible to the unique circumstances of different streets where sound engineering and planning judgment will produce context sensitive designs.

(B) Incorporate the Complete Streets Design Guidelines' principles into all City plans, manuals, rules, regulations and programs as appropriate.

(C) Provide well-designed pedestrian accommodations on all streets and crossings. Pedestrian accommodations can take numerous forms, including but not limited to traffic signals, roundabouts, bulb-outs, curb extensions, sidewalks, buffer zones, shared-use pathways, and perpendicular curb ramps, among others.

(D) Provide well-designed bicycle accommodations along all streets. Bicycle accommodations can take numerous forms, including but not limited to the use of bicycle boulevards, striping, slow streets, low auto volume streets, traffic calming, signs, and pavement markings, among others.

(E) Where physical conditions warrant, landscaping shall be planted whenever a street is newly constructed, reconstructed, or relocated.

CONTEXT SENSITIVITY

(A) The City of Baldwin Park will plan its streets in harmony with the adjacent land uses and neighborhoods.

(B) The City will solicit input from local stakeholders during the planning process.

(C) The City will integrate natural features, such as waterways, and other topography into design of our streets.

(D) The City will design streets with a strong sense of place. We will use architecture, landscaping, streetscaping, public art, signage, etc. to reflect the community and neighborhood.

(E) The City will coordinate street improvements with merchants along retail and commercial corridors to develop vibrant and livable districts.

(F) The City will practice sustainable storm water management strategies.

PERFORMANCE MEASURES

The City will evaluate this Complete Streets Policy using the following performance measures:

1. Total miles of on-street bikeways defined by streets with clearly marked or signed bicycle accommodation
2. Total miles of streets with pedestrian accommodation (goal – all)
3. Number of missing or non-compliant curb ramps along City streets (goal – 0)
4. Number of new street trees planted along City streets
5. Percentage of new street projects that are multi-modal
6. Number and severity of pedestrian-vehicle and bicycle-vehicle crashes
7. Number of pedestrian-vehicle and bicycle-vehicle fatalities (goal – 0)
8. Track Fitnessgram data of Baldwin Park Unified School District students
9. Sales tax revenue

The City will identify funds and create a methodology to collect data related to those performance measures.

IMPLEMENTATION

(A) *Advisory Group.* The City will establish an inter-departmental advisory committee to oversee the implementation of this policy. The committee will include members of Public Works, Community Development, Recreation and Community Services, and the Police Departments from the City of Baldwin Park. The committee may include representatives from the Los Angeles County Metropolitan Transportation Authority, representatives from the bicycling, disabled, youth and elderly community, and other advocacy organizations, as relevant. This committee will meet quarterly and provide a written report to City Council evaluating the City's progress and advise on implementation.

(B) *Inventory.* The City will maintain a comprehensive inventory of the pedestrian and bicycling facility infrastructure integrated with the City's database and will prioritize projects to eliminate gaps in the sidewalk and bikeways networks.

(C) *Capital Improvement Project Prioritization.* The City will reevaluate Capital Improvement Projects prioritization to encourage implementation of bicycle, pedestrian, and transit improvements.

(D) *Revisions to Existing Plans and Policies.* The City of Baldwin Park will incorporate Complete Streets principles into: the City's Circulation Element, Transportation Strategic Plan, Transit Plan, Traffic Safety Master Plan, Specific Plans, Urban Design Element; and other plans, manuals, rules, regulations and programs.

(E) *Other Plans.* The City will prepare, implement, and maintain a Bicycle Transportation Plan, a Pedestrian Transportation Plan, a Safe Routes to School Plan, an Americans with Disabilities Act Transition Plan, and a Street Tree and Landscape Master Plan.

(F) *Storm Water Management.* The City will prepare and implement a plan to transition to sustainable storm water management techniques along our streets.

(G) *Staff Training.* The City will train pertinent City staff on the content of the Complete Streets principles and best practices for implementing the policy.

(H) *Coordination.* The City will utilize inter-departmental project coordination to promote the most responsible and efficient use of fiscal resources for activities that occur within the public right of way.

(I) *Street Manual.* The City will create and adopt a Complete Streets Design Manual to support implementation of this policy.

(J) *Funding.* The City will actively seek sources of appropriate funding to implement Complete Streets.

B-2: The Original Policy Report of City of Indianapolis, 2012

CITY COUNTY COUNCIL — PROPOSAL NO. 208, 2012

CITY OF INDIANAPOLIS-MARION COUNTY, INDIANA

INTRODUCED: 06/04/2012

REFERRED TO: Public Works Committee

SPONSOR: Councillors Lewis and Barth

DIGEST: amends the Code to add new Secs. 431-801 through 431-807 regarding complete streets

SOURCE:
Initiated by: Councillor Lewis
Drafted by: Fred Biesecker, General Counsel

LEGAL REQUIREMENTS FOR ADOPTION:
Subject to approval or veto by Mayor

PROPOSED EFFECTIVE DATE:
Adoption and approvals

GENERAL COUNSEL APPROVAL: _____ Date: May 31, 2012

CITY-COUNTY GENERAL ORDINANCE NO. , 2012

A GENERAL ORDINANCE amending the Revised Code of the Consolidated City and County by adding new Secs. 431-801 et. seq., regarding complete streets.

WHEREAS, Indianapolis strives to be a "liveable community" and a well-balanced and connected transportation system that allows for safe walking and biking and efficient, robust public transit is a vital component of a "livable community;" and

WHEREAS, Complete Streets are a sound financial investment in our community that provides long-term savings, in that a transportation budget can incorporate Complete Streets projects without requiring additional funding; and

WHEREAS, CEOs for Cities released a report called "Walking the Walk" which measured the dollars-and-cents value that homes in walkable areas — all other things being equal — command over homes with "average walkability," and found that in 13 of the 15 housing markets they studied, increased neighborhood walkability was positively correlated with highly significant price increases; and

WHEREAS, creating Complete Streets also reduces infrastructure costs by requiring far less pavement per user compared to increasing road capacity for vehicles alone; this saves money at the onset of the project and reduces maintenance costs over the long-term; and

WHEREAS, the U.S. Census Bureau projects that by 2025, the portion of Marion County residents over 65 will increase from 11% to 16%, totaling nearly 150,000 people, and they need the public right-of-way to better serve them by safe places to walk, bicycle, or board the bus, and by designing the streets to better accommodate older drivers; and

WHEREAS, more than one third of Americans do not drive due to age, disability, or poverty and need transportation alternatives; and

WHEREAS, in Marion County, 40% of our children are overweight or at-risk for becoming overweight and nearly two thirds of adults are overweight or obese, and incomplete streets mean many people lack opportunities to be active as part of daily life; and

WHEREAS, the Metropolitan Development Commission adopted Multimodal Design Guidelines which address inclusion of biking and walking infrastructure on city roads, and Indianapolis was recently

awarded a bronze designation as a "Bicycle Friendly Community" by the League of American Bicyclists; now, therefore:

BE IT ORDAINED BY THE CITY-COUNTY COUNCIL OF THE
CITY OF INDIANAPOLIS AND OF MARION COUNTY, INDIANA:

SECTION 1. Chapter 431, Article VIII, of the Revised Code of the Consolidated City and County is hereby amended by adding new Sec. 431-801 et. seq., to read as follows:

Sec. 431-801. Definition of Complete Streets.

"Complete Streets" means streets that are designed and operated to enable safe access for all users, in that pedestrians, bicyclists, motorists and public transportation users of all ages and abilities are able to safely move along and across a street.

Sec. 431-802. Complete Streets Policy.

The City shall develop a safe, reliable, efficient, integrated and connected multimodal transportation system that will promote access, mobility and health for all users, and will ensure that the safety and convenience of all users of the transportation system are accommodated, including pedestrians, bicyclists, users of mass transit, people of all ages and abilities, motorists, emergency responders, freight providers and adjacent land users.

Sec. 431-803. Scope of Complete Streets Applicability.

(a) All city-owned transportation facilities in the public right of way including, but not limited to, streets, bridges and all other connecting pathways shall be designed, constructed, operated, and maintained so that users of all ages and abilities can travel safely and independently.

(b) Privately constructed streets and parking lots shall adhere to this policy.

(c) The City shall foster partnerships with the State of Indiana, neighboring communities and counties, and business and school districts to develop facilities and accommodations that further the City's complete streets policy and continue such infrastructure beyond the City's borders.

(d) The City shall approach every transportation improvement and project phase as an opportunity to create safer, more accessible streets for all users. These phases include, but are not limited to: planning, programming, design, right-of-way acquisition, construction, construction engineering, reconstruction, operation and maintenance. Other changes to transportation facilities on streets and rights-of-way, including capital improvements, re-channelization projects and major maintenance, must also be included.

Sec. 431-804. Exceptions

Any exception to this policy, including for private projects, must be approved by the Director of Public Works and be documented with supporting data that indicates the basis for the decision. Such documentation shall be publicly available.

Exceptions may be considered for approval when:

(a) An affected roadway prohibits, by law, use by specified users (such as an interstate freeways or pedestrian malls), in which case a greater effort shall be made to accommodate those specified users elsewhere, including on roadways that cross or otherwise intersect with the affected roadway;

(b) The activities are ordinary maintenance activities designed to keep assets in serviceable condition (e.g. mowing, cleaning, sweeping, spot repair, and surface treatments such as chip seal or interim measures;

(c) The Director of Public Works issues a documented exception concluding that the application of Complete Streets principles is unnecessary, unduly cost prohibitive, or inappropriate because it would be contrary to public safety; or

(d) Other available means or factors indicate an absence of need, including future need.

The Director of Public Works shall submit quarterly reports to the Board of Public Works summarizing all exceptions granted in the preceding quarter. These reports shall be submitted at the first Board of Public Works meeting after the end of the quarter, and shall be posted on-line.

Sec. 431-805. Design Standards.

The City shall follow accepted or adopted design standards and use the best and latest design standards available.

In recognition of context sensitivity, public input and the needs of many users, a flexible, innovative and balanced approach that follows other appropriate design standards may be considered, provided that a comparable level of safety for all users is present.

Sec. 431-806. Performance Measures.

The City shall measure the success of this Complete Streets policy using, but not limited to, the following performance measures:

- Total miles of bike lanes
- Linear feet of new pedestrian accommodation
- Number of new curb ramps installed along city streets
- Crosswalk and intersection improvements
- Percentage of transit stops accessible via sidewalks and curb ramps (beginning in June 2014)
- Rate of crashes, injuries, and fatalities by mode
- Rate of children walking or bicycling to school (beginning in June 2014)

Unless otherwise noted above, within six months of ordinance adoption, the City shall create individual numeric benchmarks for each of the performance measures included, as a means of tracking and measuring the annual performance of the ordinance. Quarterly reports shall be posted on-line for each of the above measures

Sec. 431-807. Implementation and Reporting.

The City of Indianapolis shall view Complete Streets as integral to everyday transportation decision-making practices and processes. To this end:

(a) The Department of Public Works, the Department of Metropolitan Development, the Office of Sustainability and other relevant departments, agencies, or committees will incorporate Complete Streets principles into all existing plans, manuals, checklists, decision-trees, rules, regulations, and programs as appropriate (including, but not limited to, ReZone Indy, ReBuild Indy, the Comprehensive Plan, Transportation Capital Program, the Pedestrian and Bicycle Master Plans, Transit Plan and other appropriate plans);

(b) The Department of Public Works, the Department of Metropolitan Development, the Office of Sustainability and other relevant departments, agencies, or committees will review current design standards, including subdivision regulations which apply to new roadway construction, to ensure that they reflect the best available design standards and guidelines, and effectively implement Complete Streets, where feasible;

(c) When available, the City shall encourage staff professional development and training on non-motorized transportation issues through attending conferences, classes, seminars, and workshops;

(d) City staff shall identify all current and potential future sources of funding for street improvements and recommend improvements to the project selection criteria to support Complete Streets projects;

(e) The City shall promote inter-departmental project coordination among city departments with an interest in the activities that occur within the public right-of-way in order to better use fiscal resources;

(f) An annual report will be made to the City-County Council showing progress made in implementing this policy. The Department of Public Works, the Department of Metropolitan Development, the Office of Sustainability and other relevant departments, agencies, or committees shall report on the annual increase or decrease for each performance measure contained in this ordinance compared to the previous year(s); and

(g) Every Complete Streets project shall include an educational component to ensure that all users of the transportation system understand and can safely utilize Complete Streets project elements.

SECTION 2. This ordinance shall be in full force and effect upon adoption and compliance with IC 36-3-4-14.

The foregoing was passed by the City-County Council this _____ day of _____, 2012, at _____ p.m.

ATTEST:

_____
Maggie A. Lewis
President, City-County Council

_____
NaTrina DeBow
Clerk, City-County Council

Presented by me to the Mayor this _____ day of _____, 2012, at 10:00 a.m.

_____
NaTrina DeBow
Clerk, City-County Council

Approved and signed by me this _____ day of _____, 2012.

_____
Gregory A. Ballard, Mayor

B-3: The Original Policy Report of Town of Littleton, 2013

Town of Littleton **COMPLETE STREET POLICY**	
Effective Date	December 16, 2013
Expiration Date	None
Date Last Revised	
Planning Board vote to recommend	November 21, 2013
Selectmen vote to introduce policy	December 2, 2013
Selectmen vote to adopt policy	December 16, 2013

COMPLETE STREETS POLICY

Vision and Purpose:

Complete Streets are designed and operated to provide safety and accessibility for all the users of our roadways, trails and transit systems, including pedestrians, bicyclists, transit riders, motorists, commercial vehicles, and emergency vehicles and for people of all ages and of all abilities. Furthermore, Complete Streets principles contribute toward the safety, health, economic viability, and quality of life in a community by providing accessible and efficient connections between home, school, work, recreation and retail destinations by improving the pedestrian and vehicular environments throughout communities. The purpose of Littleton's Complete Streets policy, therefore, is to accommodate all road users by creating a road network that meets the needs of individuals utilizing a variety of transportation modes. It is the intent of the Town of Littleton to formalize the plan, design, operation and maintenance of streets so that they are safe for all users of all ages and abilities as a matter of routine. This policy directs decision-makers to consistently plan, design, and construct streets to accommodate all anticipated users including, but not limited to pedestrians, bicyclists, motorists, emergency vehicles, and freight and commercial vehicles.

Core Commitment:

The Town of Littleton recognizes that users of various modes of transportation, including, but not limited to, pedestrians, cyclists, transit and school bus riders, motorists, delivery and service personnel, freight haulers, and emergency responders, are legitimate users of streets and deserve safe facilities. "All Users" includes users of all ages and abilities.

The Town of Littleton recognizes that all projects, new, maintenance, or reconstruction, are potential opportunities to apply Complete Streets design principles. The Town will, to the maximum extent practical, design, construct, maintain, and operate all streets to provide for a comprehensive and integrated street network of facilities for people of all ages and abilities.

Complete Streets design recommendations shall be incorporated into all publicly and privately funded projects, as appropriate. All transportation infrastructure and street design projects requiring funding or approval by the Town of Littleton, as well as projects funded by the state and federal government, such as the Chapter 90 funds, City improvement grants, Transportation Improvement Program (TIP), the MassWorks Infrastructure Program, Community Development Block Grants (CDBG), Capital Funding and other state and federal funds for street and

infrastructure design shall adhere to (comply with) the Town of Littleton Complete Streets Policy. Private developments and related street design components or corresponding street-related components shall adhere to (comply with) the Complete Streets principles. In addition, to the extent practical, state-owned roadways will comply with the Complete Streets resolution, including the design, construction, and maintenance of such roadways within Town boundaries.

Transportation infrastructure may be excluded, upon approval by the Board of Selectmen, where documentation and data indicate that:

1. Facilities where specific users are prohibited by law, such as interstate freeways or pedestrian malls. An effort will be made, in these cases for accommodations elsewhere.

2. Where cost or impacts of accommodation is excessively disproportionate to the need or probable use or probable future use.

Best Practices:

The Town of Littleton Complete Streets policy will focus on developing a connected, integrated network that serves all road users. Complete Streets will be integrated into policies, planning, and design of all types of public and private projects, including new construction, reconstruction, rehabilitation, repair, and maintenance of transportation facilities on streets and redevelopment projects.

Implementation of the Town of Littleton Complete Streets Policy will be carried out cooperatively within all departments in the Town of Littleton with multi-jurisdictional cooperation, to the greatest extent possible, among private developers, and state, regional, and federal agencies.

Complete Streets principles include the development and implementation of projects in a context sensitive manner in which project implementation is sensitive to the community's physical, economic, and social setting. The context-sensitive approach to process and design includes a range of goals by considering stakeholder and community values on a level plane with the project need. It includes goals related to livability with greater participation of those affected in order to gain project consensus. The overall goal of this approach is to preserve and enhance scenic, aesthetic, historical, and environmental resources while improving or maintaining safety, mobility, and infrastructure conditions.

The Town of Littleton recognizes that "Complete Streets" may be achieved through single elements incorporated into a particular project or incrementally through a series of smaller improvements or maintenance activities over time.

The latest design guidance, standards, and recommendations available will be used in the implementation of Complete Streets including:

- The Massachusetts of Department of Transportation Project Design and Development Guidebook
- The latest edition of American Association of State Highway Transportation Officials (AASHTO) A Policy on Geometric Design of Highway and Streets
- The United States Department of Transportation Federal Highway Administration's Manual on Uniform Traffic Design Controls (2009).

- The Architectural Access Board (AAB) 521CMR Rules and Regulations
- Documents and plans created for the Town of Littleton, such as bicycle and pedestrian network plans.

Complete Streets implementation and effectiveness should be constantly evaluated for success and opportunities for improvement. The town will develop performance measures to gauge implementation and effectiveness of the policies.

Implementation:

The Town shall make Complete Streets practices a routine part of everyday operations, shall approach every transportation project and program as an opportunity to improve streets and the transportation network for all users, and shall work in coordination with other departments, agencies, and jurisdictions to achieve Complete Streets.

Town shall review and either revise or develop proposed revisions to all appropriate planning documents (master plans, open space and recreation plan, etc.), zoning and subdivision codes, laws, procedures, rules, regulations, guidelines, programs, and templates to integrate Complete Streets principles in all Street Projects on streets. A committee of relevant stakeholders designated by the Town Administrator will be created to implement this initiative.

The Town shall maintain a comprehensive inventory of pedestrian and bicycle facility infrastructure that will prioritize projects to eliminate gaps in the sidewalk and bikeway network.

The Town will reevaluate Capital Improvement Projects prioritization to encourage implementation of Complete Streets implementation.

The Town will train pertinent town staff and decision-makers on the content of Complete Streets principles and best practices for implementing policy through workshops and other appropriate means.

The Town will utilize inter-department coordination to promote the most responsible and efficient use of resources for activities within the public way.

The Town will seek out appropriate sources of funding and grants for implementation of Complete Streets policies.

B-4: The Original Policy Report of City of Ogdensburg, 2014

The vote was:

CARRIED, AYES ALL

3. Councillor Hosmer moved an ordinance to amend Chapter 189 entitled "Streets and Sidewalks" to add Article III entitled "Complete Streets", and Councillor Stevenson seconded to wit:

ORDINANCE #3 OF 2014
ORDINANCE AMENDING CHAPTER 189 ENTITLED "STREETS AND SIDEWALKS" OF THE CITY OF OGDENSBURG MUNICIPAL CODE

BE IT ORDAINED AND ENACTED by the City Council of the City of Ogdensburg, New York, as follows:

SECTION ONE: That Article III entitled "Complete Streets" is hereby added, as follows:

ARTICLE III
Complete Streets

§ 189-18. Definition.

"Complete Streets" means streets that are designed and operated to enable safe access for all users, in that pedestrians, bicyclists, motorists and public transportation users of all ages and abilities are able to safely move along and across a street.

§ 189-19. Policy.

The City shall develop a safe, reliable, efficient, integrated and connected multimodal transportation system that will promote access, mobility and health for all users, and will ensure that the safety and convenience of all users of the Public transit, people of all ages and abilities, motorists, emergency responders, freight providers and adjacent land users.

§ 189-20. Scope of Applicability.

A. All City-owned transportation facilities in the public right-of-way including, but not limited to, streets, bridges and all other connecting pathways shall be designed, constructed, operated, and maintained so that users of all ages and abilities can travel safely and independently.

B. Privately constructed streets and parking lots shall adhere to this policy.

C. The City shall foster partnerships with the State of New York, St. Lawrence County, neighboring communities, business and school districts to develop facilities and accommodations that further the City's complete streets policy and continue such infrastructure beyond the City's borders.

D. The City shall approach every transportation improvement and project phase as an opportunity to create safer, more accessible streets for all users. These phases include, but are not limited to: planning, programming, design, right-of-way acquisition, construction, construction engineering, reconstruction, operation and maintenance. Other changes to transportation facilities on streets and rights-of-way, including capital improvements, re-channelization projects and major maintenance, must also be included.

§ 189-21. Exceptions.

A. Any exception to this policy, including for private projects, must be reviewed and approved by both the Director of Public Works and the Director of Planning and Development and be documented with supporting data that indicates the basis for the decision. Such documentation shall be publicly available.

B. Exceptions may be considered for approval when:

(1) An affected roadway prohibits, by law, use by specified users (such as an interstate freeways or pedestrian malls), in which case a greater effort shall be made to accommodate those specified users elsewhere, including on roadways that cross or otherwise intersect with the affected roadway;

(2) The activities are ordinary maintenance activities designed to keep assets in serviceable condition (e.g. mowing, cleaning, sweeping, spot repair and surface treatments such as chip seal or interim measures);

(3) The Director of Public Works issues a documented exception concluding that the application of Complete Streets principles is unnecessary, unduly cost prohibitive, or inappropriate because it would be contrary to public safety; or

(4) Other available means or factors indicate an absence of need, including future need.

§ 189-22. Design Standards.

The City shall follow accepted or adopted design standards and use the best and latest design standards available. These standards include, but are not limited to: ITE Designing Walkable Urban Thoroughfares: A Context Sensitive Approach; and AASHTO Guide for Planning, Designing and Operating Pedestrian Facilities.

In recognition of context sensitivity, public input and the needs of many users, a flexible, innovative and balanced approach that follows other appropriate design standards may be considered, provided that a comparable level of safety for all users is present.

§ 189-23. Performance Measures and Reporting.

A. The City shall measure the success of this Complete Streets policy using, but not limited to, the following performance measures:
   (1) Total miles of bike lanes
   (2) Linear feet of new pedestrian accommodation
   (3) Number of new curb ramps installed along city streets
   (4) Crosswalk and intersection improvements

B. An annual report will be made by the Complete Streets Active Living Task Force to the Ogdensburg City Council showing progress made in implementing this policy. The annual report on the annual increase or decrease for each performance measure contained in this ordinance compared to the previous year(s) shall be posted on-line for each of the above measures.

§ 189-24. Implementation.

A. The City of Ogdensburg shall view Complete Streets as integral to everyday transportation decision- making practices and processes. To this end:

(1) The Department of Public Works, the Department Planning and Development, and other relevant departments, agencies, or committees will incorporate Complete Streets principles into all existing plans, manuals, checklists, decision-trees, rules, regulations, and programs as appropriate (including, but not limited to the Local Waterfront Revitalization Program, the Comprehensive Plan, Transportation Capital Program, and other appropriate plans);

(2) The Department of Public Works, the Department Planning and Development, and other relevant departments, agencies, or committees will review current design standards, including subdivision regulations which apply to new roadway construction, to ensure that they reflect the best available design standards and guidelines, and effectively implement Complete Streets, where feasible;

(3) When available, the City shall encourage staff professional development and training on non-motorized transportation issues through attending conferences, classes, seminars, and workshops;

(4) City staff shall identify all current and potential future sources of funding for street improvements and recommend improvements to the project selection criteria to support Complete Streets projects;

(5) The City shall promote inter-departmental project coordination among City departments with an interest in the activities that occur within the public right-of-way in order to better use fiscal resources;

(6) Every Complete Streets project shall include an educational component to ensure that all users of the transportation system understand and can safely utilize Complete Streets project elements.

§ 189-25. Complete Streets Active Living Task Force.

A. There is hereby created a Complete Streets Active Living Task Force for the City of Ogdensburg.

B. The Task Force shall consist of seven (7) members holding staggered three-year terms appointed by the Mayor.

C. The purpose of the Complete Street Active Living Task Force is to promote health through physical activity and active transportation for all users, specifically, the most vulnerable - children, older adults, and those with disabilities within Ogdensburg.

SECTION TWO

This ordinance shall take effect ten (10) days after publication of a notice which shall give the title and describe same in summary form.

Councillor Morley asked if it is mandatory that we do this to every street we redo. City Manager John Pinkerton said it is mandatory that we review our complete streets policy when we do any improvements to a transportation byway. Councillor Morley asked if we are under contract for the Paterson Street project and if it requires a review of our complete streets policy. Mr. Pinkerton said a complete streets review is not necessary because that project was done prior to this change. Councillor Morley asked if all future projects will need to incorporate these additional walking and bicycling lanes. Mr. Pinkerton said if we can incorporate it into the system, we have to consider it. Councillor Morley asked if it will cost the City extra money to create these additional lanes.

Mr. Pinkerton said yes, but the cost for the complete streets portion would be taken into consideration and put before Council for a decision at that time. Councillor Hosmer asked if this means we are required to add the extra lanes. Mr. Pinkerton said no, we are only required to review it. Councillor Skamperle explained Clause 189-21 under Exceptions gives us leeway if it becomes too costly. Councillor Skamperle asked if the same leeway will be given to private developers because he does not want to restrict private developers with housing projects. Mr. Pinkerton said there is no intent to restrict private development, and variances are always an option. Councillor Stevenson said this requirement will enhance the waterfront and marina projects. Mr. Pinkerton explained the intent is to get people out moving, walking and biking.

The vote was:

CARRIED, AYES ALL

4. Mayor Nelson moved a resolution calling for a public hearing and public notice for the purpose of considering the application of Time Warner Cable Northeast LLC, for a franchise renewal to provide cable television services through the City of Ogdensburg, and Councillor Morley seconded to wit:

RESOLUTION OF CITY COUNCIL INTRODUCING A RESOLUTION AND PROVIDING FOR PUBLIC NOTICE AND PUBLIC HEARING

BE IT RESOLVED, that a public hearing be held by the Ogdensburg City Council for the purpose of considering the application of Time Warner Cable Northeast LLC, for a franchise renewal to provide cable television services through the City of Ogdensburg, be and it hereby is introduced before the City Council of the City of Ogdensburg, New York, and

BE IT FURTHER RESOLVED, that the City Council shall hold a public hearing in the matter of the approval of the aforesaid to be held at the Council Chambers in the City of Ogdensburg, New York, on the 24th day of February, 2014 at 7:00 p.m., and

B-5: The Original Policy Report of Reading Town, 2015

Town of Reading **COMPLETE STREET POLICY**	
Effective Date	July 29, 2014
Expiration Date	None
Date Last Revised	
Planning Board vote to recommend	January 27, 2014
Selectmen vote to adopt policy	July 29, 2014

COMPLETE STREETS POLICY

Vision and Purpose:

The purpose of the Town of Reading's Complete Streets Policy is to accommodate a wide range of road users by creating a road network that meets the needs of individuals utilizing a variety of transportation modes. The policy will be applied as a guide in decision-making in related infrastructure planning and construction. The Town of Reading recognizes the health, safety, economic viability, and numerous other benefits that can be achieved through application of Complete Streets principles. By incorporating Complete Streets as a guide, the Town of Reading will advance its efforts to provide safety and accessibility for all the users of our roadways, trails and transit systems, including pedestrians, bicyclists, transit riders, motorists, commercial vehicles, and emergency vehicles and for people of all ages and of all abilities.

The Town of Reading aims to improve the health of its residents and acknowledges that Complete Streets can increase everyday physical activity by enabling additional walking and bicycling by its residents and visitors. It is the intent of the Town of Reading to formalize the plan, design, operation and maintenance of streets so that they are safe for all users of all ages and abilities as a matter of routine. This policy guides decision makers in consistently planning, designing, and constructing streets to reasonably accommodate all anticipated users including, but not limited to pedestrians, bicyclists, motorists, emergency vehicles, and freight and commercial vehicles.

Core Commitment:

The Town of Reading recognizes that roadway projects, whether new, maintenance, or reconstruction, are potential opportunities to apply Complete Streets design principles. The Town will, to the maximum extent practical, design, construct, maintain, and operate all streets to provide for a comprehensive and integrated street network of facilities for people of all ages and abilities.

Where feasible, complete Streets design recommendations shall be incorporated into all publicly and privately funded projects. This includes transportation infrastructure and street design projects requiring funding or approval by the Town of Reading, as well as projects funded by the state and federal government, such as the Chapter 90 funds, Town improvement grants, Transportation Improvement Program (TIP), the MassWorks Infrastructure Program, Community Development Block Grants (CDBG), Capital Funding and other state and federal funds for street and infrastructure design. The same will be applied to private developments and related street

design components or corresponding street-related components. In addition, to the extent practical, state-owned roadways will comply with the Complete Streets resolution, including the design, construction, and maintenance of such roadways within Town boundaries.

The Town Engineer, in consultation with the Department of Public Works and/or the Parking/ Traffic/ Transportation Task Force as needed, will use best judgment regarding the feasibility of applying complete streets principles for routine roadway maintenance and projects. Other transportation infrastructure projects, including but not limited to roadway reconstruction, roadway reconfigurations, or subdivisions, transportation infrastructure may be excluded, upon approval by the Board of Selectmen and/or its designee, where documentation and data indicate that:

1. Where cost or impacts of accommodation is excessively disproportionate to the need or probable use or probable future use.

2. Roadways where specific users are prohibited by law. An effort will be made, in these cases for accommodations elsewhere.

3. Other Town policies, regulations, or requirements contradict or preclude implementation of complete streets principles.

Best Practices:

The Town of Reading Complete Streets policy will focus on developing a connected, integrated network that serves all road users. Complete Streets will be integrated into policies, planning, and design of all types of public and private projects, including new construction, reconstruction, rehabilitation, repair, and maintenance of transportation facilities on streets and redevelopment projects.

Complete Streets principles include the development and implementation of projects in a context sensitive manner in which project implementation is sensitive to the community's physical, economic, and social setting. The context-sensitive approach to process and design includes a range of goals by considering stakeholder and community values on a level plane with the project need. The overall goal of this approach is to preserve and enhance scenic, aesthetic, historical, and environmental resources while improving or maintaining safety, mobility, and infrastructure conditions, with consideration as to reasonableness

The latest design guidance, standards, and recommendations available will be used in the implementation of Complete Streets including:

- The Massachusetts of Department of Transportation Project Design and Development Guidebook
- Documents and plans created for the Town of Reading, such as:
    - Town of Reading South Main Street Design Best Practices (March 2012)
    - The Reading Bicycle Network and Pedestrian Priority Plan (MAPC, completion scheduled for spring 2014)
- Boston Complete Streets Guidelines (2013)
- The latest edition of American Association of State Highway Transportation Officials (AASHTO) A Policy on Geometric Design of Highway and Streets
- The United States Department of Transportation Federal Highway Administration's Manual on Uniform Traffic Design Controls (2009).

- The Architectural Access Board (AAB) 521CMR Rules and Regulations

Complete Streets implementation and effectiveness should be constantly evaluated for success and opportunities for improvement. The Town will develop performance measures to gauge implementation and effectiveness of the policies.

Implementation:

The Town shall make Complete Streets practices a routine part of everyday operations, shall approach every transportation project and program as an opportunity to improve streets and the transportation network for all users, and shall work in coordination with other departments, agencies, and jurisdictions to achieve Complete Streets.

Town shall review and either revise or develop proposed revisions to all appropriate planning documents (master plans, open space and recreation plan, etc.), zoning and subdivision codes, laws, procedures, rules, regulations, guidelines, programs, and templates to integrate Complete Streets principles in all Street Projects on streets, as well as potential off-road trails and paths. The role of the Parking/Traffic/Transportation Task Force will be expanded to implement this initiative.

The Town shall maintain a comprehensive inventory of pedestrian and bicycle facility infrastructure that will prioritize projects to eliminate gaps in the sidewalk and bikeway network.

The Town will reevaluate Capital Improvement Projects prioritization to encourage implementation of Complete Streets implementation.

The Town will make its best effort, as resources allow, to train pertinent town staff and decision-makers on the content of Complete Streets principles and best practices for implementing policy through workshops and other appropriate means.

The Town will utilize inter-department coordination to promote the most responsible and efficient use of resources for activities within the public way and will make a best faith effort to coordinate with adjacent municipalities to ensure a seamless network of facilities for all users of the roadway.

The Town will seek out appropriate sources of funding and grants for implementation of Complete Streets policies.

B-6: The Original Policy Report of the City of Missoula, 2016

RESOLUTION NUMBER 7473

A RESOLUTION OF THE CITY COUNCIL PROVIDING FOR A COMPLETE STREETS POLICY AND DIRECTING STAFF TO DEVELOP IMPLEMENTATION STRATEGIES TO INCREASE THE USABILITY OF ALL STREETS FOR ALL MODES OF TRAVEL FOR CITIZENS OF ALL AGES AND ABILITIES IN MISSOULA.

WHEREAS, The City of Missoula wishes to ensure that all users of our transportation system are able to travel safely and conveniently on all streets and roadways within the public right-of-way in Missoula; and

WHEREAS, a complete street is defined as one which provides a safe, convenient, and context-sensitive facility for all modes of travel, for users of all ages and all abilities; and

WHEREAS, complete streets better serve the needs of those who use transit by providing access to transit systems; and

WHEREAS, complete streets have public health benefits, such as encouraging physical activity and improving air quality, by providing the opportunity for more people to bike and walk safely; and

WHEREAS, complete streets improve access and safety for those who cannot or choose not to drive motor vehicles; and

WHEREAS, complete streets are essential in providing safe routes to school for children; and

WHEREAS, complete streets policies have been adopted legislatively by at least five states, and by at least 36 localities – of which 13 are by local law (resolutions or ordinances); and

WHEREAS, the City of Missoula currently has a limited complete streets policy applying particularly to streets developed in new subdivisions; and

WHEREAS, the City of Missoula Public Works Department has a Master Sidewalk Plan and other programs to improve the ability of Missoula's streets to meet the travel needs of all users; and

WHEREAS, the concept and principles of complete streets are entirely compatible with the direction and plans embodied in the 2008 Missoula Urban Area Transportation Plan update; and

WHEREAS, it is the desire of the City of Missoula to formalize a commitment to the principles of complete streets for all of our streets;

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF MISSOULA, MONTANA, that the City of Missoula commits to a Complete Streets Policy which has the following elements:

1. Any roadway in the city of Missoula which is to be newly constructed or completely reconstructed must be designed and constructed to
   A. provide for the safety and convenience of all users of all ages and of all abilities: pedestrians, bicyclists, transit users, and motorists; and
   B. address the needs of all users both along roadway corridors and crossing the corridors.

2. Any project in which an existing roadway surface is to be restored or rehabilitated, and any remediation of deficient or non-existent sidewalks, shall be reviewed for the potential of making the roadway a complete street. Consideration shall particularly include proportionality: is the scope of work needed to make a complete street reasonable in relation to the scope of the proposed roadway maintenance or improvement?

3. Any exception to applying this Complete Streets Policy to a specific roadway project must be approved by the City Council, with documentation of the reason for the exception.

4. An annual report will be made to the City Council by the City Administration showing progress made in implementing this policy.

AND BE IT FURTHER RESOLVED BY THE CITY COUNCIL OF THE SAID CITY OF MISSOULA, MONTANA, that this Complete Streets Policy will apply to the scoping, design, and construction of projects.

AND BE IT FURTHER RESOLVED BY THE CITY COUNCIL OF THE SAID CITY OF MISSOULA, MONTANA, that the Public Works Department will review current design standards, including the design standards embodied in the most recent version of the subdivision regulations (currently Article 3-2 and 3-3) which apply to new roadway construction, to assure that they reflect the best available design standards and guidelines, and effectively implement the Complete Streets Policy above stated.

AND BE IT FURTHER RESOLVED BY THE CITY COUNCIL OF THE SAID CITY OF MISSOULA, MONTANA, that these design standards also serve as guidance for all existing roadway rehabilitation, reconstruction, or resurfacing, to the extent that the work required is reasonably proportional to the scale of the proposed rehabilitation, reconstruction, or resurfacing.

AND BE IT FURTHER RESOLVED BY THE CITY COUNCIL OF THE SAID CITY OF MISSOULA, MONTANA, that application of design standards will be flexible to permit context-sensitive design, fitting the roadway design within the context of the neighborhood, recognizing that all streets are different and user needs will be balanced.

AND BE IT FURTHER RESOLVED BY THE CITY COUNCIL OF THE SAID CITY OF MISSOULA, MONTANA, that exceptions may be made when

- The project involves a roadway on which non-motorized use is prohibited by law. In this case, an effort shall be made to accommodate pedestrians and bicyclists elsewhere.
- There is documentation that there is an absence of use by all except motorized users now and would be in the future even if the street were a complete street.

AND BE IT FURTHER RESOLVED BY THE CITY COUNCIL OF THE SAID CITY OF MISSOULA, MONTANA, that staff in the Public Works Department be directed to develop ordinances, resolutions, programs, and recommendations for funding to implement the Complete Streets Policy, for consideration by the City Council; and that these shall identify the complete streets needs and recommend a plan to meet those needs, including for sidewalks, throughout the city.

AND BE IT FURTHER RESOLVED BY THE CITY COUNCIL OF THE SAID CITY OF MISSOULA, MONTANA, that the City Council commits to including Complete Streets Policy and principles in all future City plans.

PASSED AND ADOPTED this 24th day of August, 2009.

ATTEST:

/s/ Martha L. Rehbein
Martha L. Rehbein,
City Clerk

(SEAL)

APPROVED:

/s/ John Engen
John Engen,
Mayor

Appendix C: Summary of the Complete Streets Policies related to Selected Cities in North America

C-1: Summary of Complete Streets Policy related to Baldwin Park City

C-2: Summary of Complete Streets Policy related to Indianapolis City

C-3: Summary of Complete Streets Policy related to Littleton City

C-4: Summary of Complete Streets Policy related to Ogdensburg City

C-5: Summary of Complete Streets Policy related to Reading City

C-6: Summary of Complete Streets Policy related to Missoula Cit

C-1: Summary of Complete Streets Policy related to Baldwin Park City (Source: Summarized by Author based on the original policy report of "City of Baldwin Park , 2011")

	Access link:	http://eatbettermovemore.org/sa/policies/pdftext/201110051804330.BaldwinParkCompleteStreets.pdf
Baldwin Park, CA	**Policy Elements**	**Explanations**
	Vision	Creating a safe, efficient and healthy transportation system by considering beauty and amenities for users. Providing high quality pedestrian, bicycling, and transit access to all destination by considering safety, access, convenience, and comfort
	All Users & Modes	Considering the needs of drivers, transit users, bicyclists and pedestrians of all ages and abilities (childern, seniors, and persons with disabilities) in all processes include (planning, design, construction, reconstruction, and maintenance).
	All Projects & Subjects	Applying to all roadway projects including new construction, reconstruction, retrofts, rehabilitation, new privately built roads and easements intended for public use.
	Exceptions	Projects involve ordinary and emergency maintenance activities designed to keep assets in serviceable condition. Exempting a project due to excessive and disproportionate cost of establishing. Determining by Director of Public Work and the manager of community Development that the construction is not practically feasible or cost effective.
	Connectivity	Designing and maintaining a transportation network that provides a connected network of facilities related to all modes. Besides, repuposing right-of-way to enhance connectivity for pedestrians, bicyclists and transit. Focusing on non-motorized connectivity improvements to services (schools, parks, comercial uses and regional connections). Besides, providing interconnected street networks in new developments and redevelopment projects.
	Jurisdiction	Covering all projects (development, redevelopment, street improvments) All city deprtements includes administration, public works, community development, recreation, community services, policy, and builders shall comply the Complete Streets policy.
	Design approaches	Adopting complete streets design guidelines to guide the planning, funding, design, construction, operation, and maintenance of new and modified streets. Incorporating the complete streets design guidelines' principles in to all city plans, rules, regulations. Providing well-designed pedestrian and bicycle accommodations on all streets and crossing. Where physical conditions warrant, landscaping shall be planted whenever a street is newly constructed, reconstructed or relocated
	Context Sensitivity	Planning all streets in harmony with the adjacent land uses and neighborhoods. Besides, using local stakeholders during the planning process, Design streets with a strong sense of place and integrate natural features. Besides, considering sustainable stormwater management strategies, Considering streets improvement with merchants along retail and commercial corridors to develop vibrant and livable districts.
	Performance measures	Total miles of on-street bikeways defined by streets with clearly marked or signed bicycle accommodation, Total miles of streets with pedestrian accommodation (goal-all), Number of missing or non-compliant curb ramps along city streets, Number of new street trees planted along streets, Percentage of new street projects that are multi-modal, Number and severity of pedestrian-vehicle and bicycle-vehicle crashes, Number of pedestrian-vehicle and bicycle-vehicle fatalities, Sales tax revenue.
	Implementation	Establishing an inter-departmental advisory members of Public Works, Community Development, Recreation and Community Services, and the Police Departments. Maintaining a comprehensive inventory list of the pedestrian and bicycle facility infrastructure, plus integrated prioritize projects to eliminate gaps in the sidewalk and bikeways networks. Reevaluating Capital improvement projects prioritization to encourage implementation of bicycle, pedestrian, and transit improvements. Incorporating Complete Streets principles to existing and new plans and policies. Preparing and implementing a plan to transition to sustainable storm water management along all streets. Training city staff on the content of the Complete Streets principles and best practices for implementing the policy. Utilizing inter-departmental project coordination to promote the most responsible and efficient use of fiscal resources for activities that occur within the public right of way. Creating and adopting a Complete Streets Design Manual to support implementation of the policy. Searching to source of appropriate funding to implement Complete Streets.

C-2: Summary of Complete Streets Policy related to Indianapolis City (Source: Summarized by Author based on the original policy report of "City of Indianapolis", 2012)

	Access link:	http://completethestreets.net/documents/Comp_Streets_Indy_Ordinance.pdf
Indianapolis, IN	**Policy Elements**	**Explanations**
	Vision	The City shall develop a safe, reliable, efficient, integrated and connected multimodal transportation system that will promote access, mobility and health for all users, and will ensure that the safety and convenience of all users of the transportation system are accommodated, including pedestrians, bicyclists, users of mass transit, people of all ages and abilities, motorists, emergency responders, freight providers and adjacent land users.
	All Users & Modes	Considering the safety and convenience of all users including pedestrians, bicyclists, users of mass transit, motorists, emergency responders, freight providers and people of all ages and abilities.
	All Projects & Subjects	All city-owned transportation facilities in the public right of way including, but not limited to, streets, bridges and all other connecting pathways shall be designed, constructed, operated, and maintained. Privately constructed streets and parking lots shall adhere to this policy. The City shall approach every transportation improvement and project phase as an opportunity to create safer, more accessible streets for all users. These phases include, but are not limited to: planning, programming, design, right-of-way acquisition, construction, construction engineering, reconstruction, operation and maintenance. Other changes to transportation facilities on streets and rights-of-way, including capital improvements, re-channelization projects and major maintenance, must also be included.
	Exceptions	Any exception to this policy, including for private projects, must be approved by the Director of Public Works and be documented with supporting data that indicates the basis for the decision. An affected roadway prohibits, by law, use by specified users (such as an interstate freeways or pedestrian malls), in which case a greater effort shall be made to accommodate those specified users elsewhere, including on roadways that cross or otherwise intersect with the affected roadway; The activities are ordinary maintenance activities designed to keep assets in serviceable condition (e.g. mowing, cleaning, sweeping, spot repair, and surface treatments such as chip seal or interim measures; The Director of Public Works issues a documented exception concluding that the application of Complete Streets principles is unnecessary, unduly cost prohibitive, or inappropriate because it would be contrary to public safety; or Other available means or factors indicate an absence of need, including future need.
	Connectivity	Indianapolis strives to provide a well-balanced and connected transportation
	Jurisdiction	The City of Indianapolis shall view Complete Streets as integral to everyday transportation decisionmaking practices and processes. The City shall foster partnerships with the State of Indiana, neighboring communities and counties, and business and school districts to develop facilities and accommodations that further the City's complete streets policy and continue such infrastructure beyond the City's borders. The Department of Public Works, the Department of Metropolitan Development, the Office of Sustainability and other relevant departments, agencies, or committees will incorporate Complete Streets principles into all existing plans, manuals, checklists, decision-trees, rules, regulations, and programs as appropriate (including, but not limited to, ReZone Indy, ReBuild Indy, the Comprehensive Plan, Transportation Capital Program, the Pedestrian and Bicycle Master Plans, Transit Plan and other appropriate plans);
	Design approaches	The City shall follow accepted or adopted design standards and use the best and latest design standards available
	Context Sensitivity	In recognition of context sensitivity, public input and the needs of many users, a flexible, innovative and balanced approach that follows other appropriate design standards may be considered, provided that a comparable level of safety for all users is present.
	Performance measures	Total miles of bike lanes; Linear feet of new pedestrian accommodation; Number of new curb ramps installed along city streets; Crosswalk and intersection improvements; Percentage of transit stops accessible via; sidewalks and curb ramps; Rate of crashes, injuries, and fatalities by mode; Rate of children walking or bicycling to school
	Implementation	The Department of Public Works, the Department of Metropolitan Development, the Office of Sustainability and other relevant departments, agencies, or committees will review current design standards, including subdivision regulations which apply to new roadway construction, to ensure that they reflect the best available design standards and guidelines, and effectively implement Complete Streets, where feasible; When available, the City shall encourage staff professional development and training on nonmotorized transportation issues through attending conferences, classes, seminars, and workshops; City staff shall identify all current and potential future sources of funding for street improvements and recommend improvements to the project selection criteria to support Complete Streets projects; The City shall promote inter-departmental project coordination among city departments with an interest in the activities that occur within the public right-of-way in order to better use fiscal resources; An annual report will be made to the City-County Council showing progress made in implementing this policy. The Department of Public Works, the Department of Metropolitan Development, the Office of Sustainability and other relevant departments, agencies, or committees shall report on the annual increase or decrease for each performance measure contained in this ordinance compared to the previous year(s); and Every Complete Streets project shall include an educational component to ensure that all users of the transportation system understand and can safely utilize Complete Streets project elements.

C-3: Summary of Complete Streets Policy related to Littleton City (Source: Summarized by Author based on the original policy report of "Town of Littleton", 2013)

Access link:		https://www.smartgrowthamerica.org/app/legacy/documents/cs/policy/cs-ma-littleton-policy.pdf
Littleton, MA	**Policy Elements**	**Explanations**
	Vision	Accommodating all roadway users by designing a transport network that meets all the needs of different modes of transports. Formalizing all steps include plan, design, operation and maintenance of roadway to provide safe streets for all users of all ages and abilities.
	All Users & Modes	Recognizing users of various modes of transportation such as pedestrians, cyclists, transit and school bus riders, motorists, delivery and service personnel, freight haulers, and emergency responders, are genuine users of streets. Thus, providing safe and comfort facilities for all users of all ages and abilities is main aim.
	All Projects & Subjects	Recognizing all kinds of projects include new construction, reconstruction, rehabilitation, repair, and maintenance of transportation facilities on streets and redevelopment projects. All publicly and privately funded projects and those projects requiring funding or approval by Town organizations must be applied Complete Streets approaches.
	Exceptions	Facilities where specific users are prohibited by law, such as interstate freeways or pedestrian malls. An effort will be made, in these cases for accommodations elsewhere. Where cost or impacts of accommodation is excessively disproportionate to the need or probable use or probable future use
	Connectivity	Developing a connected, integrated network that serves all road users.
	Jurisdiction	Complete Streets Policy will be carried out cooperatively within all departments in the Town of Littleton with multi-jurisdictional cooperation, to the greatest extent possible, among private developers, and state, regional, and federal agencies.
	Design approaches	The latest design guidance, standards, and recommendations available will be used in the implementation of Complete Streets including: The Massachusetts of Department of Transportation Project Design and Development Guidebook The latest edition of American Association of State Highway Transportation Officials(AASHTO) A Policy on Geometric Design of Highway and Streets The United States Department of Transportation Federal Highway Administration's Manual on Uniform Traffic Design Controls (2009). The Architectural Access Board (AAB) 521CMR Rules and Regulations Documents and plans created for the Town of Littleton, such as bicycle and pedestrian network plans.
	Context Sensitivity	Project implementation must be sensitive to the community's physical, economic, and social setting. The context-sensitive approach to process and design includes a range of goals by considering stakeholder and community values on a level plane with the project need.
	Performance measures	No Performance Measuures
	Implementation	Making Complete Streets practices a routine part of everyday operations and developing proposed revisions to all appropriate planning documents. Maintaining a comprehensive inventory of pedestrian and bicycle facility infrastructure that will prioritize projects to eliminate gaps in the sidewalk and bikeway network. Training pertinent town staff and decision-makers on the content of Complete Streets principles and best practices for implementing policy through workshops and other appropriate means. Applying inter-department coordination to promote the most responsible and efficient use of resources for activities within the public way. Seeking out appropriate sources of funding and grants for implementation of Complete Streets policies.

C-4: Summary of Complete Streets Policy related to Ogdensburg City (Source: Summarized by Author based on the original policy report of "City of Ogdensburg", 2014)

	Access link:	https://www.smartgrowthamerica.org/app/legacy/documents/cs/policy/cs-ny-ogdensburg-ordinance.pdf
Ogdensburg, NY	**Policy Elements**	**Explanations**
	Vision	Develop a safe, reliable, efficient, integrated and connected multimodal transportation system that will promote access, mobility and health for all users, and will ensure that the safety and convenience of all users of of all ages and abilities and adjacent land users.
	All Users & Modes	Promoting access, mobility and health for all users, in that pedestrians, bicyclists, motorists, emergency responders, freight providers and public transportation users.
	All Projects & Subjects	All project related to City-owned transportation facilities in the public right-of-way including, but not limited to, streets, bridges and all other connecting pathways shall be designed, constructed, operated, and maintained. Thus, considering all project phase as an opportunity to create a more accessible and safe streets is essential. Privately constructed streets and parking lots shall adhere to the policy.
	Exceptions	Any exception must be reviewed and approved by both the Director of Public Works and the Director of Planning and Development. The activities are ordinary maintenance activities designed to keep assets in serviceable condition. When the application of Complete Streets principles is unnecessary, unduly cost prohibitive, or inappropriate because it would be contrary to public safety. Other available means or factors indicate an absence of need, including future need.
	Connectivity	Developing a safe, reliable, efficient, integrated and connected multimodal transportation system
	Jurisdiction	Fostering partnerships with other State, neighboring communities, business and school districts to develop facilities and accommodations that further the complete streets policy.
	Design approaches	Following accepted or adopted design standards and use the best and latest design standards available. These standards include, but are not limited to: ITE Designing Walkable Urban Thoroughfares: A Context Sensitive Approach; and AASHTO Guide for Planning, Designing and Operating Pedestrian Facilities.
	Context Sensitivity	Recognizing of context sensitivity, public input and the needs of many users, to provide flexible, innovative and balanced approaches.
	Performance measures	Total miles of bike lanes; Linear feet of new pedestrian accommodation; Number of new curb ramps installed along city streets; Crosswalk and intersection improvements
	Implementation	All relevant departments, agencies, or committees will incorporate Complete Streets principles into all existing plans, manuals, checklists, decision-trees, rules, regulations, and programs as appropriate. All relevant departments, agencies, or committees will review current design standards, including subdivision regulations which apply to new roadway construction, to ensure effectively implement Complete Streets. Encouraging staff professional development and training on non-motorized transportation issues through attending conferences, classes, seminars, and workshops. Identifying all current and potential future sources of funding to support Complete Streets projects. Promoting inter-departmental project coordination among departments with an interest in the activities that occur within the public right-of-way in order to better use fiscal resources. Every Complete Streets project shall include an educational component to ensure that all users of the transportation system understand and can safely utilize Complete Streets project elements.

C-5: Summary of Complete Streets Policy related to Reading City (Source: Summarized by Author based on the original policy report of "Town of Reading", 2015)

	Access link:	https://www.smartgrowthamerica.org/app/legacy/documents/cs/policy/cs-ma-reading-policy.pdf
Reading, PA	**Policy Elements**	**Explanations**
	Vision	Accommodating a wide range of road users by creating a road network that meets the needs of individuals utilizing a variety of transportation modes.
	All Users & Modes	Providing safety and accessibility for all the users of our roadways, trails and transit systems, including pedestrians, bicyclists, transit riders, motorists, commercial vehicles, and emergency vehicles and for people of all ages and of all abilities.
	All Projects & Subjects	Recognizing that all roadway projects whether new, maintenance, or reconstruction, are potential opportunities to apply Complete Streets design principles. Complete Streets will be integrated into policies, planning, and design of all types of public and private projects Where feasible, complete Streets design recommendations shall be incorporated into all publicly and privately funded projects. This includes transportation infrastructure and street design projects requiring funding or approval by the Town, as well as projects funded by the state and federal government. The same will be applied to private developments and related street.
	Exceptions	The Town Engineer, in consultation with the Department of Public Works and/or the Parking/ Traffic/ Transportation Task Force as needed, will use best judgment regarding the feasibility of applying complete streets principles for routine roadway maintenance and projects. Other transportation infrastructure projects, including but not limited to roadway reconstruction, roadway reconfigurations, or subdivisions, transportation infrastructure may be excluded, upon approval by the Board of Selectmen and/or its designee, where documentation and data indicate that: - Where cost or impacts of accommodation is excessively disproportionate to the need or probable use or probable future use. - Roadways where specific users are prohibited by law. An effort will be made, in these cases for accommodations elsewhere. - Other Town policies, regulations, or requirements contradict or preclude implementation of complete streets principles.
	Connectivity	Developing a connected, integrated network that serves all road users.
	Jurisdiction	The Town shall make Complete Streets practices a routine part of everyday operations, shall approach every transportation project and program as an opportunity to improve streets and the transportation network for all users, and shall work in coordination with other departments, agencies, and jurisdictions to achieve Complete Streets.
	Design approaches	The latest design guidance, standards, and recommendations available will be used in the implementation of Complete Streets including: - The Massachusetts of Department of Transportation Project Design and Development Guidebook - Documents and plans created for the Town of Reading, such as: - Town of Reading South Main Street Design Best Practices (March 2012) - The Reading Bicycle Network and Pedestrian Priority Plan (MAPC, completion scheduled for spring 2014) - Boston Complete Streets Guidelines (2013) - The latest edition of American Association of State Highway Transportation Officials (AASHTO) A Policy on Geometric Design of Highway and Streets - The United States Department of Transportation Federal Highway Administration's Manual on Uniform Traffic Design Controls (2009). - The Architectural Access Board (AAB) 521CMR Rules and Regulations
	Context Sensitivity	Including the development and implementation of projects in a context sensitive manner in which project implementation is sensitive to the community's physical, economic, and social setting.
	Performance measures	Complete Streets implementation and effectiveness should be constantly evaluated for success and opportunities for improvement. The Town will develop performance measures to gauge implementation and effectiveness of the policies.
	Implementation	Developing proposed revisions to all appropriate planning documents (master plans, open space and recreation plan, etc.) Maintaining a comprehensive inventory of pedestrian and bicycle facility infrastructure that will prioritize projects to eliminate gaps in the sidewalk and bikeway network. Reevaluating Capital Improvement Projects prioritization to encourage implementation of Complete Streets implementation. Making its best effort, as resources allow, to train pertinent town staff and decision makers on the content of Complete Streets Principles and best practices for implementing policy through workshops and other appropriate means. Looking for appropriate sources of funding and grants for implementation of Complete Streets policies. Utilizing inter-department coordination to promote the most responsible and efficient use of resources for activities within the public way and will make a best faith effort to coordinate with adjacent municipalities to ensure a seamless network of facilities for all users of the roadway.

C-6: Summary of Complete Streets Policy related to Missoula City (Source: Developed by Author based on the original policy report of "The City of Missoula", 2016)

	Access link:	https://www.ci.missoula.mt.us/DocumentCenter/View/36556
Missoula, MT	**Policy Elements**	**Explanations**
	Vision	The City of Missoula strives to develop a safe, reliable, efficient, integrated, and connected multimodal transportation system that best enables access, mobility, economic development, aesthetics, health and well-being for people of all ages and abilities.
	All Users & Modes	This transportation system shall be designed in ways that, to the greatest extent possible, ensure the safety, security, comfort, and convenience of pedestrians, bicyclists, public transit/paratransit users, assistive mobility device users, motorists, emergency responders, and routine commercial service providers. It is recognized that all modes cannot receive the same type of accommodation and space on every street, but the overall goal is that everyone – young, old, and of varying ability – can safely, comfortably, and conveniently travel across the network.
	All Projects & Subjects	The City shall approach every transportation improvement and project phase as an opportunity to create safer, more accessible streets for all users. These improvements and phases include: planning, programming, design, right-of-way acquisition, subdivision and land development, new construction, construction engineering, reconstruction, operation, repair, capital improvements, re-channelization projects and major maintenance, and routine maintenance and rehabilitation.
	Exceptions	Any exception to this policy, including for eligible private projects, must be reviewed and approved by City Council, with documentation of the reason(s) for the exception. An accommodation is not necessary on corridors where specific user groups are prohibited. Costs of accommodation are excessively disproportionate to the need or probable use, when factoring in both current economic conditions and economic benefits of initial capital cost. A documented absence of current and future needs exists; Transit accommodations are not required where there is no existing or planned transit service; Routine maintenance, such as sweeping, mowing, and spot repair, does not change the roadway geometry or operations, and as such, does not trigger this policy. A reasonable and equivalent project existing along the same corridor that is already programmed to provide facilities exempted from the project at hand.
	Connectivity	Providing a connected, integrated network. Missoula's street network, while already a robust asset, will further benefit from the following connectivity improvements: a. Identifying opportunities to enhance the network through maintenance activities b. Addressing deficiencies at railroad crossings c. Filling gaps in the trail/non-motorized network d. Identifying and repairing sidewalk segments that form functional gaps e. Implementing the 2011 Active Transportation Plan f. Consistently enforcing parking policies and winter sidewalk clearing ordinances
	Jurisdiction	This policy shall apply to all City-owned transportation facilities in the public right-of-way including, but not limited to, streets, sidewalks, alleys, bridges, and all other connecting pathways. The City will encourage the owners and operators of private streets, sidewalks, alleys, and parking lots to also adhere to this policy through funding requirements and development review. The City shall foster partnerships with the Montana. Department of Transportation, the Missoula Metropolitan Planning Organization, Missoula Urban Transportation District, Missoula County, Missoula County Public Schools, private developers, and public and private utilities to develop facilities and accommodations that further the City's vision of a connected, integrated network and continue such infrastructure beyond the City's borders.
	Design approaches	The City shall use the best and latest design guidance, standards, and recommendations available to maximize design flexibility and innovation, and always be aware that design solutions should balance user and modal needs. The United States Department of Transportation Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations Executive; The United States Department of Transportation Federal Highway Administration's Manual of Uniform Traffic Design Control; The United States Department of Transportation Federal Highway Administration Traffic Monitoring Guide; The National Association of City Transportation Officials (NACTO) Urban Street Design Guide; The National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide; The American Association of State Highway and Transportation Official's (AASHTO) Policy on Geometric Design of Highways and Streets; The American Association of State Highway and Transportation Official's (AASHTO) Guide for Planning, Designing and Operating Pedestrian Facilities; ITE Designing Walkable Urban Thoroughfares: A Context Sensitive Approach; City of Missoula Subdivision Regulations; Missoula Municipal Code Title 12: Streets, Sidewalks, and Public Places; City of Missoula Sidewalk Master Plan; City of Missoula Urban Forest Management Master Plan
	Context Sensitivity	The application of this policy will be will be flexible to permit context-sensitive design. Context sensitivity to the community's overall surroundings, its current and planned buildings and land uses, and current and expected transportation needs of all people will help ensure that projects are appropriate within the context of the neighborhood, sensitive to community values, and balance social, economic, and environmental objectives
	Performance measures	Total miles of dedicated bike facilities built or striped; Linear feet of new pedestrian accommodation; Number of ADA accommodations built; Number of transit accessibility accommodations built; Number of new curb ramps installed along city streets; Number of new street trees planted; Crosswalk and intersection improvements; Percentage of transit stops accessible via sidewalks and curb ramps; Rate of people biking and walking; Rate of children walking or biking to school
	Implementation	The policy shall be implemented through the following directives: Development Services, the Department of Public Works, the Missoula Redevelopment Agency, Parks & Recreation, Missoula Urban Transportation District, and other relevant departments, agencies, and committees will incorporate Complete Streets principles into all existing plans, manuals, checklists, decision-trees, rules, regulations, and programs as appropriate; Development Services, the Department of Public Works, the Missoula Redevelopment Agency, Parks & Recreation, Missoula Urban Transportation District, and other relevant departments, agencies, and committees will review current design standards, including subdivision, regulations, which apply to new roadway construction, to ensure that they reflect the best available design standards and guidelines, and effectively implement Complete Streets, where feasible, When available, the City shall encourage staff professional development and training on non-motorized transportation issues through attending conferences, classes, seminars, and workshops. City staff shall identify all current and potential future sources of funding for street improvements and recommend improvements to the project selection criteria to support Complete Streets projects. The City shall promote inter-departmental project coordination among City departments with an interest in the activities that occur within the public right-of-way in order to better use fiscal resources. The City shall develop and institute better ways to measure performance and collect data on how well the streets are serving all users. Every Complete Streets project shall include an educational component to ensure that all users of the transportation system understand and can safely utilize Complete Streets project elements. The City shall educate on and enforce proper road use behavior by all users and all modes, and adopt additional laws and regulations as necessary to ensure people are protected to the greatest extent possible.

Appendix D: Inventory Tables related to Selected Complete Streets Guidelines in North America and Canada

Knoxville Complete Streets Design Guidelines
Philadelphia Complete Streets Design Handbook
Tacoma Complete Streets Design Guidelines
City Of New Haven Complete Streets Design Manual
Alliance for Biking & Walking Guide to Complete Streets
Washington's Complete Streets & Main Street Highways Program
North Carolina Complete Streets Planning and Design Guidelines
Moving Passaic County Complete Streets Guidelines
Cleveland Complete and Green Streets
City Of Memphis Complete Streets Project Delivery Manual
City Of Dallas Complete Streets Design Manual
Burlington Complete Streets Guidance
Boston Complete Streets Design Guidelines
Complete Streets Chicago
The City Of Fort Lauderdale's Complete Streets Design Manual
Complete Streets Design Guide: Great Streets for Los Angeles
Austin Complete Streets
Newburgh Complete Streets Project
South Miami Complete Streets Policies and Design Manual
City Of Mankato Complete Streets Plan & Policy
Alexandria Complete Streets Design Guidelines
City of Albany Complete Streets Policy and Design Manual
Miami-Dade Complete Streets Design Guidelines
Orange County Complete Streets Initiative Design Handbook
Urban, Rural and Suburban Complete Streets Design Manual
Florida Complete Streets Handbook
Pompano Beach Complete Streets Design Manual
Toronto Complete Streets Guidelines
Edmonton Complete Streets Guidelines
Town Of Windsor Complete Street Design Guidelines

Knoxville Complete Streets Design Guidelines

COMPLETE STREETS DESIGN GUIDELINES

Page: 1

Chapter1

Introduction

Chapter2

What Are Complete Streets?

Flexibility in Design
- Design Process in Constrained Right-of-Way
- Conventional Street Design Versus Complete Street Design

Chapter3

Complete Streets Design Guidelines

Street Design Parameters
- Functional Classification
- Speed
- Capacity
- Design and Control Vehicle
- Sight Distance
- Pedestrian and Bicyclist Requirements as Design Controls
- Road Diets
- Lane Width
- Sidewalks
- On-street Parking
- Bicycle Facilities
- Transit
- Mid-block Pedestrian Crossing
- Crosswalks and Pedestrian Indications
- Curb Extensions
- Street Trees and Street Furniture
- Intersections
- Corner Radii
- Number and Design of Turn Lanes
- Traffic Signals
- Traffic Signal Treatments for Complete Streets
- Lighting
- Pavement Treatments
- Special Considerations for Younger, Older, and Disabled Pedestrians
- Special Considerations for Emergency Access
- Design Factors that Affect Emergency Response Vehicles

Chapter4

The Transportation and Land Use Connection

Creating Supportive Environments for Walking, Bicycling, and Riding Transit
The 3 D's: Density, Diversity & Design
- Density
- Diversity
- Design

Access Management

Chapter5

Networks and Connectivity

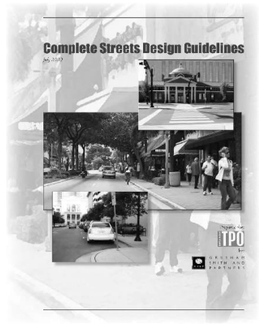
Challenges

Safety and Liability
Cost

Chapter6

Getting It Done: Tools For Implementation

Setting the Vision
Supporting Policies, Ordinances and Resolutions
Public Participation and Stakeholder Involvement
Interdisciplinary Team Approach
Policy and Regulatory Changes
Tag Along Projects
Public Financing



Number of Pages : 89

Access link

https://knoxtrans.org/plans/complete_streets/guidelines.pdf

Year: 2009

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Philadelphia Complete Streets Design Handbook

PHILADELPHIA COMPLETE STREETS DESIGN HANDBOOk

Page:1

Number of Pages : 182

Access link

http://www.philadelphiastreets.com/images/uploads/resource_library/cs-handbook.pdf

Year: 2009

Chapter1

Introduction

How to Use the Complete Streets Handbook
- Components of Complete Streets
- Design Treatment Suitability Matrix

Purpose & Background
- State & Federal Policy Context
- Local Policy Context
- Concurrent Projects

Why Does Philadelphia Need Complete Streets?
- Complete Streets Principles

Philadelphia's Street Planning and Design Process
- Overview of Philadelphia's Street Planning and Design Process
- Street Construction, Reconstruction, & Development Projects
- Street Improvements & Sidewalk Encroachments
- Who's Involved?

Chapter2

Philadelphia Street Types

High-Volume Pedestrian
Civic/Ceremonial Street
Walkable Commercial Corridor
Urban Arterial
Auto Oriented Commercial/Industrial
Park Road
Scenic Drive
City Neighborhood Street
Low-Density Residential
Shared Narrow
Local

Chapter3

Complete Streets Components and Design Treatments

Overview of Complete Street Components
Overview of Design Treatment Application & Suitability
Pedestrian Component
- Sidewalk Width
- Walking Zone Width
- Curb Ramps
- Shared/Pedestrian Priority Streets
- Festival (Curbless)Street

Building & Furnishing Component
- Building Zone Width
- Furnishing Zone Width
- Bicycle Parking
- Lighting
- Benches
- Sidewalk Cafes
- Street Trees & Tree Trenches
- Planters
- Stormwater Planters
- Street Furniture
- Newsstands
- Vendors
- Architectural Features

Bicycle Component
- Conventional Bike Lanes
- Left-side Bike Lanes
- Buffered Bike Lanes
- Contra-flow Bike Lanes
- Climbing Bike Lanes
- Cycle Tracks
- Shared-use Path
- Bicycle-friendly Streets
- Marked Shared Lanes
- Green Colored Pavement
- Bike Route Signs

Curbside Management Component
- On-street Parking
- In-street Bicycle Parking
- Lay-by Lanes
- Loading Zones
- Transit Stops & Shelters
- Alternative Uses of Parking Lanes

Vehicle/Cartway Component
- Lane Width
- Raised Speed Reducers
  - Medians
  - Chicanes
- Bus Lanes

Urban Design Component
- Driveways
- Utilities
- Construction Disruption
- Stormwater Management

Intersection & Crossing Component
- Marked Crosswalks
- Uncontrolled Crossings
- Curb/Corner Radii
- Curb Extensions
- Pedestrian Refuge Islands

Chapter3

- Signal Timing & Operations
- Pedestrian Hybrid Beacons
- Rectangular Rapid Flashing Beacons
- Bicycle Signals
- Bike Boxes
- Raised Crossings
- Two-stage Left Turn Queue Boxes
- Traffic Diverters
- Neighborhood Traffic Circles
- Roundabouts

Chapter4

Implementation & Enforcement

Complete Streets Project Review Checklist

D-02

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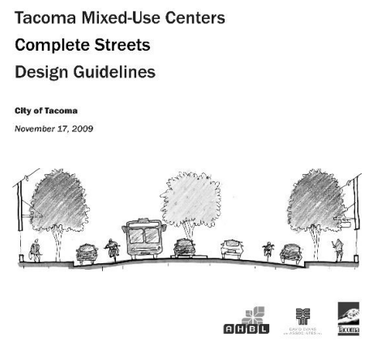
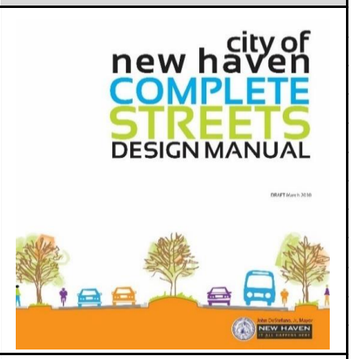
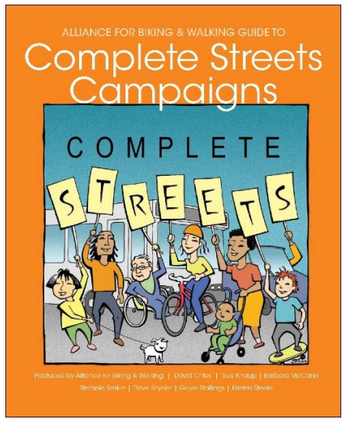
Tacoma Complete Streets Design Guidelines

TACOMA RESIDENTIAL STREETS COMPLETE STREETS DESIGN GUIDELINES			TACOMA MIXED-USE CENTERS COMPLETE STREETS DESIGN GUIDELINES	Page: 1
Chapter1	**Background & Existing Conditions**	Chapter1	**Background & Existing Conditions**	
	Background		Introduction	
	Existing Conditions of Residential Streets		Goals and Guiding Principles for Complete Streets in Tacoma	
Chapter2	**Design Guidance & Typologies**		Complete Streets and Existing Plans and Policies	
	Guidelines for Residential Complete Streets		Existing Street Classifications and Standards	
	Applying These Guidelines		Existing Character of Mixed-use Center Pedestrian Streets	
	Goals for Residential Streets	Chapter2	**Design Objectives & Guidelines**	
	Residential Complete Street Design Considerations and Features		Complete Street Guidelines	
	Pedestrians and Persons with Disabilities		Complete Street Design Objectives	
	Bicycles		Typologies for Complete Street Implementation	
	Accommodating Emergency, Transit and Service Vehicles		Additional Complete Street Elements	
	Landscaping and Street Trees	Chapter3	**Implementation**	**Number of Pages : 89**
	Utilities		General	
	Traffic Calming		Cross Functional Team	
	Low Impact Development Approaches		Integrate Implementation Into Existing Processes	**Access link**
	Signage		Develop Conceptual Plans for Designated Streets	
	Undeveloped Rights-of-Way		Cost	https://knoxtrans.org/plans/complete_streets/guidelines.pdf
	Typologies for Complete Street Implementation		Funding Sources	
	Residential Street with Green Stormwater Features Typology		Phasing Implementation	
	Standard Residential Street Typology		Summary of Policy Questions for Consideration	**Year: 2009**
	Green Street Typology			
Chapter3	**Supporting Research & Analysis**			
	Low Impact Development			
	Ecological Benefits			
	Neighborhood Benefits			
	Property Values			
	Implementation Costs			
	Maintenance and Resident Involvement			
	Traffic Calming			
	Implementation Costs			
	Neighborhood Benefits			
	Property Values			**D-03**
				Abolfazl Dehghanmongabadi Ph.D. in Architecture Department of Architecture Faculty of Architecture

City of New Haven Complete Streets Design Manual

CITY OF NEW HAVEN COMPLETE STREETS DESIGN MANUAL				Page: 1
Chapter1	**Introduction**	Chapter 2	**New Haven Context**	
	Policy & Ordinance		Infrastructure	
	Complete Streets Policy		Demographics	
	BOA Order		Safety Concerns & Community Involvement	
Chapter 3	What are Complete Streets?	Chapter 4	**Why Complete Streets?**	
	Complete Streets are Public Spaces		The Status Quo	
	Complete Streets and Land Use		Bene!ts of Complete Streets	
	Complete Streets as Multi-Modal Transportation Network		Guiding Principles for New Haven Complete Streets	
	Complete Streets are Context Sensitive			
Chapter 5	**Street Design Process**		**How to Create Complete Streets**	Number of Pages : 117
	Project Initiation		Complete Streets Toolbox	
	Plan Development		Sidewalk Widening	
	Funding & Design		ADA Compliant Curb Ramps	
	Installation		Street Furniture	
	Engineering Considerations for Complete Streets		Crosswalks	
	Guidelines		Tree Belt Enhancements	
	Roadway Classi!cation System		Sidewalk Surface Treatments	
	Street Typologies		Roadway Surface Treatments	**Access link**
Chapter 6	General Street	Chapter 7	Pavement Markings	https://www.smartgrowthamerica.org/app/legacy/documents/cs/policy/cs-ct-newhaven-manual.pdf
	Boulevard		Speed Humps	
	Slow Street		Refuge Islands	
	Pedestrian OnlyStreet		Bump-outs/Chokers	
	Vehicle Target Speed		Chicanes	**Year: 2010**
	Design Vehicles, Emergency Access, Sanitation		Diverters	
	On-Street Parking		Road Closures	
	Pedestrian & Bicycle Use		Trafic Patterns	
	Public Transportation		Bike Routes	
	Pedestrian Access In Construction Zones		Bike Routes, continued	
	Environmental Design		Bike Boulevards	
	Land Use Context		Bike Parking	
Chapter 8	**Measurement: Making it Count**		Shared Lane Markings	
	Why Measure?		Bike Signage	
	Who to Measure?		Roadway Narrowing	
	What to Measure?		Mini Roundabouts	
	Objective Data		Roundabouts	
	Subjective Data		Other Complete Streets Tools	
	When & Where to Measure		What NOT To Do	
Chapter 9	**Funding, Future Strategy & Review Process**			**D-04**
	Funding		Overview	**Abolfazl Dehghanmongabadi** Ph.D. in Architecture Faculty of Architecture Department of Architecture
	City of New Haven		Key Early Milestones	
	State of Connecticut			
	South Central Regional Council of Governments			
	Future Strategy			

Alliance for Biking & Walking Guide to Complete Streets

ALLIANCE FOR BIKING & WALKING GUIDE TO COMPLETE STREETS CAMPAIGNS		Page: 1
Chapter1	**Introduction** Alliance for Biking & Walking The Concept of Complete Streets and Complete the Streets Campaigns Why take on complete streets Why Complete Streets Are Important Using This Guide	
Chapter2	**Complete Streets Policies** Introduction Methodology Policies (Model and “Paper” Policies) Existing Complete Streets Policies Policy Issues Examples of Complete Streets Policies and Guides What Is a Good Policy? The Policy Adoption Process Recommendations on an Advocacy Approach	**Number of Pages : 124**
Chapter3	**Implementation** Complete Streets Implementation Issues From Policy to Procedure Making Change on the Ground	**Access link**
Chapter4	**Campaigns** Introduction Model Campaigns Alliance Campaign Planning Blueprint First Step: Campaign Planning Meeting Seven Elements of Successful Campaigns Blueprint for Success	http://www.peoplepoweredmovement.org/site/images/uploads/Updated_Guide_to_Complete_Streets_Campaigns.pdf **Year: 2010**
Chapter5	**Communications** Introduction The Basics for Using Complete Streets Using Complete Streets in Everyday Communications A Complete Streets Response to a Death or Injury Using Complete Streets to Build Coalitions From Vision to Victory	**D-05** **Abolfazl Dehghanmongabadi** Ph.D. in Architecture Department of Architecture Faculty of Architecture

Washington’s Complete Streets

WASHINGTON’S COMPLETE STREETS & MAIN STREET HIGHWAYS PROGRAM

Chapter1

Summary

Chapter2

Washington State Complete Streets

Chapter3

Complete Street Components

- Pedestrian
  - Reduced speed limits
  - Medians
  - Walkway markings
  - Accessibility
  - Bulb-outs
  - Buffer spaces
  - pedestrian Visibility
  - More time to cross
- Bicycles
  - Accessibility
  - Give Bicycles space
  - Communication
  - Bicyclist Facilities
  - Stay off the sidewalk
- Cars
  - Reduced speed
  - Parking area
  - Road diet
  - Communication
  - Noise Barriers
- Transit
  - Accessibility
  - Placement
  - Car Access
  - Waiting Areas
  - Pedestrian Access
  - hov lanes
  - Bicycle Access
  - Pull-outs
- Trucks
  - Regionally specific
  - Rerouting Trucks
  - Noise Barriers
  - Reduced speed
  - Truck Curfews

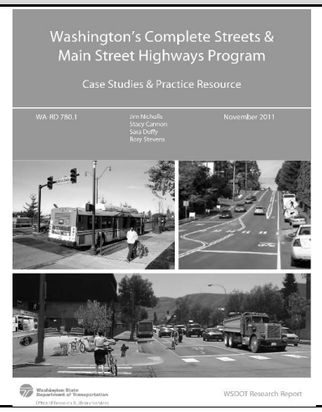
Chapter3

Chapter4

Goals & Benefits

Economic Vitality
Accesss and Mobility
Environmental Stewardship
Health and Safety

Page: 1



Number of Pages :66

Access link

https://www.wsdot.wa.gov/NR/rdonlyres/9E11109A-950D-4A93-A3C2-4AFA34C7C05F/0/CompleteStreets_110811.pdf

Year: 2011

D-06

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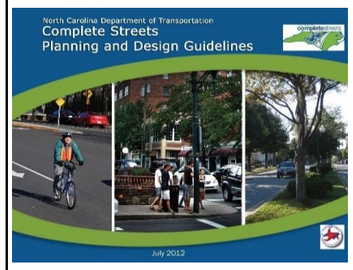
North Carolina Complete Streets Design Guidelines

NORTH CAROLINA COMPLETE STREETS PLANNING AND DESIGN GUIDELINES				Page: 1
Chapter1	**Implementing Complete Streets in North Carolina** What are Complete Streets? Why Are Complete Streets Important for North Carolina? How Will NCDOT Implement Complete Streets? How Will These Guidelines Be Implemented? What Will These Changes Mean for Communities and Stakeholders Across the State?	Chapter3	Bicycle Quality of Service Bicycle Lanes Shared-Lane Markings Multi-Use Path Paved Shoulders Signage Cycling Elements at Intersections Pedestrian Quality of Service Sidewalks Buffer Pedestrian Crossings Curb Extensions Signage Multi-Use Path Shoulders Lighting ADA Requirements Other Pedestrian Amenities Transit Quality of Service Transit Service Bus Shelters Adequate Connections to Transit Schedules & Routes Seating Lighting Signage Transit Design	
Chapter2	**Incorporating Complete Streets in Planning and Design Process** Transportation Planning Process North Carolina Transportation Plan (2040 Plan) Comprehensive Transportation Plan and Long Range Transportation Plan Program and Resource Plan State Transportation Improvement Program (STIP) Project Development Process Formation of the Design Input Team Evaluation of Existing and Future Conditions Define Land Use Context Define Transportation Context Establish Goals and Objectives Identify Issues and Opportunities Define Objectives Decision making Develop Alternatives Deliberate Tradeoffs Recommended Alternative			**Number of Pages : 167**
				Access link
				http://www.pedbikeinfo.org/pdf/PlanDesign_SamplePlans_CS_NCDOT2012.pdf
				Year: 2012
Chapter3	**Understanding Context and Designing for All Users** Context Factors Understanding the Built Environment and Street Type Area Types Urban Area Types Central Business District Urban Center Urban Residential Suburban Area Types Suburban Center Suburban Corridor Suburban Residential Rural Area Types Rural Developed Rural Village Countryside Quality of Service What is Quality of Service? Elements of Quality of Service	Chapter4	**Planning and Design Elements** Planning and Design Considerations Land Use Context and Street Network Area Type Considerations Urban Suburban Rural Street Types Street Types: Integrating Land Use & Street Function Main Street Avenue Boulevard Parkway Rural Road Local/Subdivision Street Street Type Selection	
				D-07
				Abolfazl Dehghanmongabadi Ph.D. in Architecture Faculty of Architecture Department of Architecture

NORTH CAROLINA COMPLETE STREETS PLANNING AND DESIGN GUIDELINES

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Chapter5

Planning and Designing Complete Intersections

- Differing User Expectations
- Principles for Creating Complete Intersections
- Level of Service and Quality of Service for Complete Intersections
  - Motorist LOS at Intersections
  - Pedestrian Quality of Service (QOS) at Intersections
  - Bicyclist Quality of Service (QOS) at Intersections
- Intersection Design Expectations for Specific Street Types
  - Main Street Intersection
  - Parkway Intersection
  - Boulevard Intersection
  - Avenue Intersection
- Unsignalized Intersections
- Turning Paths for Design Vehicles
- Other Types of Intersections
  - Roundabouts
  - Interchanges
  - Mid-Block Crossings
- Greenways and Multi-Use Paths
- At-Grade Railroad Crossings
- Access Management

Chapte6

Designing for Transit in Complete Streets

- Elements of Designing Complete Streets for Transit
  - Access to Transit
  - Transit Stop Spacing
  - Transit Stop Placement
  - Transit Stop Locations
  - Transit Stop Elements

Chapter7

Accommodating Pedestrians and Bicyclists on Structures

- Sidewalks and Bicycle Lanes for Highway Bridges and Underpasses
- Conclusions

Chapter8

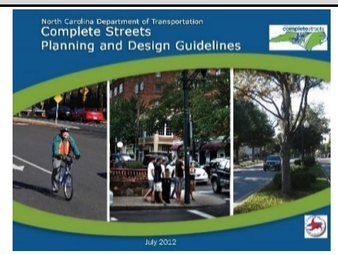
Implementing Complete Streets in Maintenance & Operations

- Complete Streets in Maintenance Projects
- Complete Streets in Operations Projects
  - Design Elements & Features of Operations Projects
  - Process for Implementing Complete Streets Components in Operations Projects
- Lessons Learned and Technical Recommendations
- Project Examples

Chapter8

Street Elements: Design Considerations for Context-Based Solutions

- Street-Side Elements
  - Landscaping and Street Trees
  - Stormwater Facilities
- Provision of Sidewalks: Slopes and Retaining Walls
- Curb and Gutter
- Travel Way Considerations
  - Shoulder Rumble Strips
  - Clear Zone
- Superelevation



Number of Pages : 167

Access link

http://www.pedbikeinfo.org/pdf/PlanDesign_SamplePlans_CS_NCDOT2012.pdf

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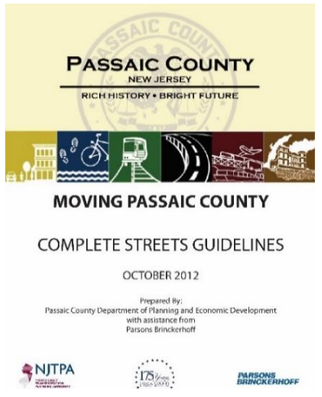
Moving Passaic County Complete Streets Guidelines

MOVING PASSAIC COUNTY COMPLETE STREETS GUIDELINES				Page: 1
Chapter1	Purpose What are “Complete Streets”? Roadway Classifi cation Defi nitions Regional Street Highlands Regional Street Downtown Street Community Street Neighborhood Street	**Chapter3**	Public Transportation Traffic-Calming Measures / Safety Signs Utilities	
Chapter2	Green Streets Goals and Objectives Stormwater Management Maintain Drinking Water Supply Improve Environment and Public Health Better Quality of Life for Passaic County Residents Decrease Capital Costs of Public Infrastructure Typical Design Elements Roadways Public Transit On-Site Design Elements Streetscape Features Plant Street Trees Utilize Stormwater Planters Use Pervious Paving Materials for Sidewalks Integrate Vegetated Stormwater Receiving Areas Install Bicycle Facilities Energy-Efficient Lighting	**Chapte4**	Implementation of Complete Streets Standards for Engineers Relevance of Complete Streets Guidelines to Functional Roadway Classifications Passaic County Engineering Policies Design Exceptions Applicability of Design Guidelines	**Number of Pages : 66**
Chapter3	Roadway Design Elements and Priorities Travel Lanes and Medians Shoulders Parking Streetside Features Intersection Designs Bicycle Facilities			**Access link** http://www.passaiccountynj.org/DocumentCenter/View/4240 **Year: 2012** **D-08** **Abolfazl Dehghanmongabadi** Ph.D. in Architecture Faculty of Architecture Department of Architecture

Cleveland Complete and Green Streets

CLEVELAND COMPLETE AND GREEN STREETS

Chapter1

Introduction

The Need for Complete Streets
- Healthy and Livable Communities
- Air Quality
- Improved Safety
- Improved Access
- Changing demographics
- Economic Development

Planning Process
- Stakeholder Workshop
- Complete Streets Plan Peer Review

Chapter2

Complete and Green Streets Elements

Overview

Design for Pedestrians
- Sidewalks
  - Accessibility
  - Adequate width
  - Safety:
  - Continuity
  - Landscaping
  - Drainage
  - Social space
  - Quality of place

Sidewalk Zones

Intersections
- Clear Space
- Visibility
- Legibility
- Accessibility
- Separation from Traffic
- Lighting

Design for Bicyclists
- Strong and Fearless
- Enthused and Confident
- Interested but Concerned
- No Way, No How

Bicycle Facility Types
- Shared Roadways
- Shared Roadways with Pavement Markings
- Separated Bikeways
- Cycle Tracks
- Shared Use Paths

Bicycle Parking

Chapter3

Transit Design
- Integration into the contextual fabric
- Accessibility via multiple modes
- Functional simplicity
- Security
- Comprehensive systems sustainability
- Articulation of form and identity
- The incorporation of arts in transit

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- Hard traffic calming
  - Speed limit reduction
  - Road diet
  - Lane narrowing
  - Speed humps/Speed tables
  - Traffic Diversion
  - Pinchpoints/neckdowns
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- Soft traffic calming
  - Setback reduction
  - Street trees, landscaping and other aesthetic elements
  - Street material
  - Appropriately scaled street lighting
  - Enforcement and awareness measures

Intersection Improvements
- Minimize curb radius
- High-visibility crosswalks
- Median pedestrian refuge: intersections
- Raised crosswalks and intersections
- Traffic circles
- Bicycle intersection treatments
- Curb extensions/bulbouts
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- ADA compliant curb ramps

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- Median pedestrian refuge: island
- Active warning beacons
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- Bicycle and Pedestrian Signalized Crossings
- Countdown pedestrian signals
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- Bioretention Cells/Bioretention Swales
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- Commuter Street
- Commercial Street
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- Transit Spine Overlay
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Typology Examples
- Typology Cutsheets
- Typology Maps

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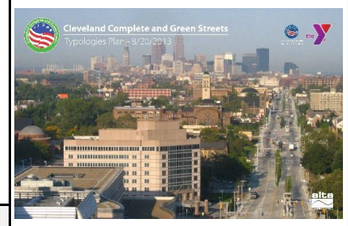

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City of Memphis Complete Streets

CITY OF MEMPHIS COMPLETE STREETS PROJECT DELIVERY MANUAL

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Access link

https://bikepedmemphis.wordpress.com/plans-and-publications/complete-streets-project-delivery-manual/

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Chapter4

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- Shared Lanes
- Wide Curb Lanes
- Paved Shoulders
- Bike Lanes
- Marked Shared Lanes
- Bike-Bus Lanes
- Shared-Use Paths
- Trails
- Floating Bike Lanes
- Advisory Bike Lanes
- Bike Boulevards & Neighborhood Greenways
- Contraflow Bike Lanes
- Left-Side Bike Lanes
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- Double Bike Lanes
- Buffered Bike Lanes
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- Bus Stop Design Considerations
- Shared Lanes
- Near Side/Far Side Stops
- Bus Pull-Offs
- Mid-Block Curb Extensions
- Bus Pads
- Pedestrian Accommodations
- Bike-Bus Lanes
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  - Pedestrian Indicators
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  - Street Signs
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- Establish A Routine Proces
- Bolster Intra-Agency Communications
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Workbook Stages
- Stage 1: Project Selection
- Stage 2: Scoping
- Stage 3: Design
- Stage 4: Construction
- Stage 5: Measurement
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City of Dallas Complete Streets Design Manual

CITY OF DALLAS COMPLETE STREETS DESIGN MANUAL

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Dallas complete streets goals and objectives
- Benefits of Complete Streets
- Community Aspirations
- Survey Results

Foundation
- Forward Dallas
- National Trends
- County, NCTCOG, and State Initiatives

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Complete streets tools summarized
- Complete Streets Vision Maps

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Thoroughfare plan functional classification
- Arterial Roads
- Collector Roads
- Local or Minor Streets

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- Street Improvement Projects
- Complete Streets Improvement Process
  - Factors to consider in roadway design
    - Roadway Characteristics and needs
    - Context and land Use
    - Priority Elements
    - Funding Sources
- Development-Related Projects
- Implementing Complete Streets through Private Development
- City Department Roles and Responsibilities

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- Corridor Planning
- Conceptual Design
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- Construction Management
- Developing a Maintenance Plan

Existing manuals and standards
- Relevant Manuals And Standards by Project Phase
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- Conceptual Design Documents and Standards
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Complete streets context and Development policy

Classifying complete streets
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- Commercial streets
- Residential streets
- Industrial streets
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Dallas complete streets Vision maps
- How the Vision Map was Developed

Complete Streets Policy Framework

General complete streets policy guidance

Intersection Zone policy guidance
- Maximize Safety
- Improve Access, Mobility, and Connectivity
- Design for Predictable Movements
- Reclaim Space
- Minimize Signal Cycle lengths
- Reduce Footprint and Improve Sustainability
- Reduce or Eliminate

The pedestrian Zone Defined
- The Frontage Zone
- Sidewalk Clear Zone
- The buffer/Furnishing/Curb Zone

Pedestrian Zone policy guidance
- Maximize Safety
- Provide a Comfortable Walking Environment
- Promote Active and Inviting building Frontages
- Buffer Parking Areas
- Provide for Universal Access and Continuity
- Provide a Direct Route
- Provide Connectivity
- Enhance Green Infrastructure
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- Maintenance
- Promote a Cohesive and legible
- Coordination with land Use Decisions and Designations

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- The Parking Zone
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- Multimodal Streets
- Safety is a Paramount Concern
- Design for Slower Speeds
- Street Design Should Reinforce Adjacent land Uses

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- Priorities chart for tradeoffs in limited right-of-way

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Complete streets Design elements

Design element priorities chart

Incorporating Bicycle and

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- Signed route only (no lane markings)
- Paved shoulders (signed route)
- Bike Boulevards
- Shared Bicycle lane markings
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- Mixed-use street examples
- Commercial street examples
- Residential street examples
- Industrial street examples
- Parkway examples

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- Design vehicle
- Vehicle performance (acceleration and deceleration)
- Driver performance (age,
- Functional classification
- Traffic characteristics (volume and composition)
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- Capacity and level of service
- Access control and management
- Pedestrian and bicycle facilities
- Safety
- Environment

Target speed Defined
- Target speed by street

Design factors that influence target speed
- Design Vehicle

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http://dallascityhall.com/departments/sustainabledevelopment/DCH%20documents/pdf/DCS-Design_Manual_TTRPC_092413_Final_UPDATE.pdf

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Chapter3

- Control vehicle
- Speed Management
- Existing Speed Management Tools
- Access Management

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Pedestrian Zone Design Elements

- Wider sidewalks
- Trees and greenscape
- Street furniture
  - Seating
  - Bicycle Racks
  - Bicycle Shelters
  - Bollards
  - Parking Meters and Pay Stations
  - Recycling Bins and Garbage Cans
  - Newspaper Racks
- Transit stops
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- Driveways and curb cuts
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  - Plazas, Pocket Parks and Parklets
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- Traffic calming elements
  - Safe Speeds
  - Road Diets
  - One-way/Two-way Street Conversions
  - Slip Streets
  - Center Medians/Islands
  - Mid-Block Curb Extensions (Neckdowns)
- Bikeways
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- Bicycle Boulevards
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Chapter5

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- Street lighting
- Trees and greenscape

Chapter6

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- Intersections at slip streets
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  - Mid-block Cros
  - Stop-Controlled Intersections
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  - Modern Roundabouts and Traffic Circles
- Key geometric Design guidance
  - Curb Radii
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  - Diverters
- Key pedestrian treatments
  - Crosswalk Design
  - Crosswalk Markings At Uncontrolled Locations
- Special paving treatment
  - Advance Yield Markings and Signs
  - In-street yield to pedestrian signs
- Special pedestrian signals
  - Rectangular Rapid-Flash Pedestrian Beacons
  - Pedestrian Signal Heads
  - Accessible Pedestrian Signals (APS)
  - Signal Phases for Pedestrians.
  - Signalization Strategies to Reduce Conflicts
- Key Bicycle treatments
  - Bicycle Lanes at Intersections
  - Bicycles at Signalized Intersections
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  - Integrated Stormwater Management (iSWM)
  - Benefits of green street elements
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    - Planter Boxes
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    - Landscaping in Medians
    - Underground Detention
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Burlington Complete Streets Guidance

BURLINGTON COMPLETE STREETS GUIDANCE

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- Traditional identification
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  - collector,
  - arterial
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    - Sidewalks
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    - Tree Belt
    - Transit Shelters
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    - Street Trees
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    - Street Lighting
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Chapter1

- Slow Streets
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  - Street Lighting
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- Furniture
- Street Lighting
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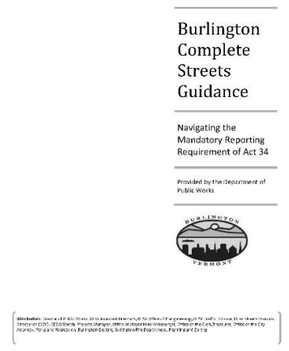
Chapter2

- Mid-block Crosswalks
- Stormwater Planter
- Porous Paving
- Two-way left turn lane
- Traffic Calming
- Curb radii
- Crosswalks
- Medians or refuge islands



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Access link

https://www.burlingtonvt.gov/uploadedFiles/BurlingtonVTgov/Departments/DPW/Transportation/Policy_and_Planning/Complete-Streets-Reporting-v2.2.1-workingdraft.pdf

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Boston Complete Streets Design Guidelines

BOSTON COMPLETE STREETS DESIGN GUIDELINES

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  - Boston's Complete Streets
  - Why Streets Matter
  - Using the Manual
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- Functional Classification and Boston's Street Types
  - Downtown Commercial
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  - Neighborhood Residential
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  - Parkways
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- Roadway Design Principles
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- Optimizing Use of Street Space
  - Road Diet
  - Lane Diet
- Minimum Lane Widths in the City of Boston
  - Minimum Widths for Roadway Lanes
- Design Features that Reduce Operating Speeds
  - Mid-block Neckdowns
  - Chicanes
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  - Neighborways
- Travel Lanes
  - Three Lanes with Center Turn Lane
  - Peak Time Restricted Parking Lanes
  - Routes with Frequent Heavy Vehicles
  - Fire Department & EMS Accommodations
  - Reversible Lanes
- Transit Lanes
  - Curbside Bus Lanes
  - Median Bus Lanes
  - Contra-Flow Bus Lanes
  - Median Protected Busways
- Bicycle Facilities
  - Cycle Tracks
  - Bicycle Lanes
  - Left-Side Bicycle Lanes
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- Features to Activate Sidewalks
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  - Street Lights
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  - Traffic Controls
  - Emissions Reductions
  - Smart Tags
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  - Obeying the Law
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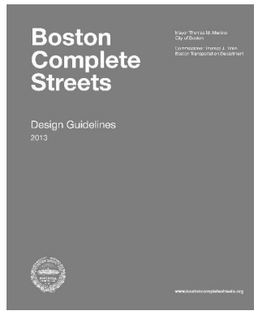

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- Sensors
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- Pedestrian Experience
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- Guidelines for Crosswalk Installation
- Marked Crosswalks at Controlled Locations
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- Rectangular Rapid-Flash Beacons
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- Signal Timing for Pedestrians
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- Leading Pedestrian Interval
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Chapter5

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- Mobility Hubs
- Alternative transportation
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- On-Street Bicycle Parking
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- Public Agency Fiduciary Responsibilities
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Chapter7

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- Public Involvement
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- Step 3: 25% to Final Design and Bid Documents
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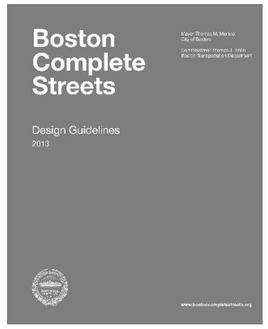
- Maintenance
- Maintenance Agreements
- Maintenance Life Cycle of City Roadways and Sidewalks
- City of Boston Utility Coordination Software (COBUCS) and Guaranteed Streets Program
- Snow Storage and Clearance
- Navigating the Guidelines



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Complete Streets Chicago

COMPLETE STREETS CHICAGO						Page: 1
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	Pedestrian Way		Bus Rapid Transit (BRT)			
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The City of Fort Lauderdale's Complete Streets Design Manual

THE CITY OF FORT LAUDERDALE'S COMPLETE STREETS DESIGN MANUAL

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Complete Streets Policy
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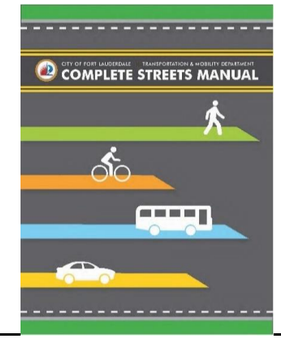

Number of Pages : 86

Access link

https://www.smartgrowthamerica.org/app/legacy/documents/cs/policy/cs-ct-newhaven-manual.pdf

Year: 2013

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Complete Streets Design for Los Angeles

COMPLETE STREETS DESIGN GUIDE: GREAT STREETS FOR LOS ANGELES

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COMPLETE STREETS DESIGN GUIDE
GREAT STREETS FOR LOS ANGELES
NOVEMBER 2014 DRAFT

Number of Pages : 167

Access link

http://planning.lacity.org/Cwd/GnlPln/MobiltyElement/Text/CompStManual.pdf

Year: 2014

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Chapter3	**Creating Multimodal Streets**	Chapter6		**Year: 2015**
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Newburgh Complete Streets Project

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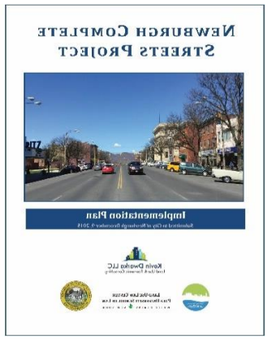
Chapter1	**Introduction**	Chapter5	**Implementation Process**	
	Existing Conditions			
	Roadway Description and Traffic Levels Street Network Traffic Levels Parking Capacity and Utilization Parking Capacity Morning Peak Period Midday Period Evening Peak Period Summary & Further Research Transit Services and Utilization Levels Local Bus Service on Broadway Services and Utilization Levels Bike and Pedestrian Utilization Pedestrian Counts Mid-Block Crossing Bike Counts Zoning and Land Use Existing Land Uses in Study Area Existing Zoning in Study Area Retail Activity and Economic Indicators		**Implementation Barriers & Solutions** Safety and Convenience Barriers Unsignalized Midblock Crossing Safety Concerns of Sharrows Effects of a 'Road Diet' on Congestion Parallel Parking vs. Diagonal Parking Maintenance Barriers Snow Storage and Removal Parklet Responsibilities and Maintenance Parklet Responsibilities and Maintenance Weeding and Maintenance Institutional Barriers Governance Performance Evaluation for Success	**Number of Pages : 104**
Chapter2	**Prior Planning**			**Access link**
	Waterfront Master Plan, 2007 Broadway Corridor Improvement, 2012			http://www.cityofnewburgh-ny.gov/sites/newburghny/files/u576/kdllc_2015_dec_9_-_ncsp_ip.pdf
Chapter3	**2015 Conceptual Plans**			**Year: 2015**
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South Miami Complete Streets Design Manual

SOUTH MIAMI COMPLETE STREETS POLICIES AND DESIGN MANUAL

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Number of Pages : 87

Access link

http://miamidadetpo.org/library/studies/south-miami-complete-streets-policies-and-design-manual-2016-05.pdf

Year: 2016

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City of Mankato Complete Streets Plan & Policy

CITY OF MANKATO COMPLETE STREETS PLAN & POLICY

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- 2016 Bike Facility Projects
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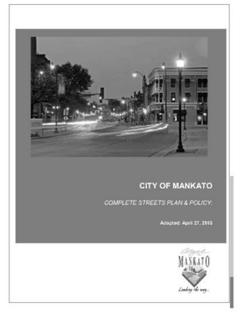

Number of Pages : 54

Access link

https://www.mankatomn.gov/home/showdocument?id=2048

Year: 2015

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Alexandria Complete Streets Design Guidelines

ALEXANDRIA COMPLETE STREETS DESIGN GUIDELINES

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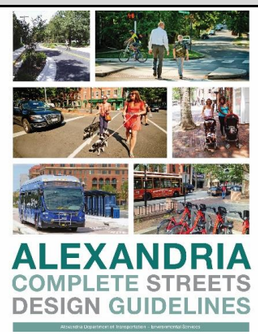

Number of Pages : 163

Access link

https://www.alexandriava.gov/localmotion/info/default.aspx?id=91090

Year: 2015

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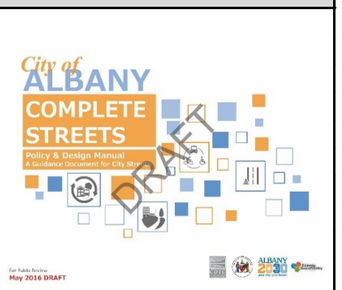
City of Albany Complete Streets Policy and Design Manual

CITY OF ALBANY COMPLETE STREETS POLICY AND DESIGN MANUAL						Page: 1
Chapter1	**Introduction**	Chapter4	Shared Transit-Bicycle Lanes	Chapter5	Streets	
	Purpose		Fundamental Elements		Transit Lane	
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	Compliance		Institutions		Bicycle Lane	
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	Overview		Autonomous Vehicles		Dedicated Transit Lanes	https://www.albany2030.org/files/Complete%20Streets%20DRAFT%20Policy%20%26%20Design%20Manual%20May%202016.pdf
	Descriptions		Electric Bicycles		Enhanced Transit Lanes	
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Miami-Dade Complete Streets Design Guidelines

COMPLETE STREETS DESIGN GUIDELINES

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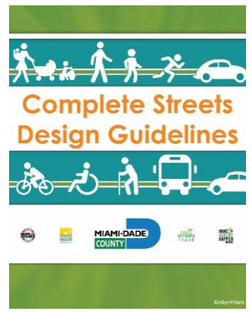

Number of Pages : 178

Access link

http://www.miamidade.gov/neatstreets/library/complete-streets-design-guidelines.pdf

Year: 2016

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Orange County Complete Streets Initiative Design Handbook

ORANGE COUNTY COMPLETE STREETS INITIATIVE DESIGN HANDBOOK

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Urban, Rural and Suburban Complete Streets Design Manual

URBAN, RURAL AND SUBURBAN COMPLETE STREETS DESIGN MANUAL

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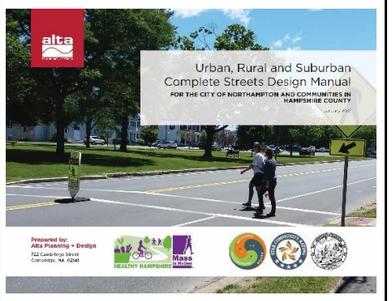

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Florida Complete Streets Handbook

FLORIDA COMPLETE STREETS HANDBOOK

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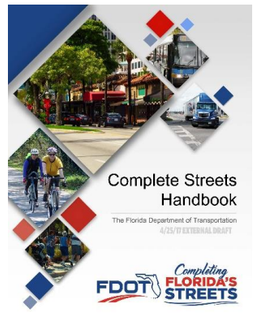

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Pompano Beach Complete Streets Design Manual

POMPANO BEACH COMPLETE STREETS DESIGN MANUAL

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Toronto Complete Streets Guidelines

TORONTO COMPLETE STREETS GUIDELINES

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Chapter5

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Chapter8

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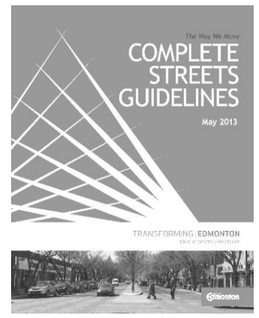
Edmonton Complete Streets Guidelines

EDMONTON COMPLETE STREETS GUIDELINES				Page: 1
Chapter1	**Introduction**	Chapter3	Marked Shared Use Roadway	
	Supporting Edmonton's Vision - The Way Ahead		Bike Boulevards	
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	Industrial		Designing for Goods	
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	Commercial		Complete Streets Context Illustrations	
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Town of Windsor Complete Street Guidelines

TOWN OF WINDSOR COMPLETE STREET DESIGN GUIDELINES

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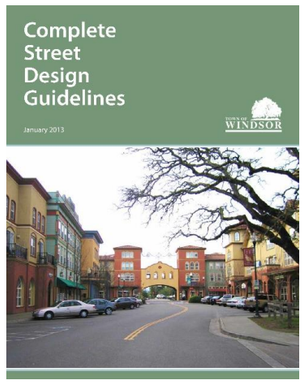

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