THE EVALUATION OF URBAN TRANSPORT MASTER PLANS IN TURKISH CITIES FROM THE PERSPECTIVE OF CLIMATE CHANGE MITIGATION

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

AYÇA KOCAKUŞAK

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
CITY PLANNING IN CITY AND REGIONAL PLANNING

JULY 2021

Approval of the thesis:

THE EVALUATION OF URBAN TRANSPORT MASTER PLANS IN TURKISH CITIES FROM THE PERSPECTIVE OF CLIMATE CHANGE MITIGATION

submitted by **AYÇA KOCAKUŞAK** in partial fulfillment of the requirements for the degree of **Master of Science** i**n City Planning in City and Regional Planning, Middle East Technical University** by,

Prof. Dr. Halil Kalıpçılar
Dean, Graduate School of **Natural and Applied Sciences** _____

Prof. Dr. Serap Kayasü
Head of the Department, **City and Regional Planning** _____

Prof. Dr. Ela Babalık
Supervisor, **City and Regional Planning, METU** _____

Examining Committee Members:

Prof. Dr. Nil Uzun
City and Regional Planning, METU _____

Prof. Dr. Ela Babalık
City and Regional Planning, METU _____

Prof. Dr. Burcu Halide Özüduru
City and Regional Planning, Gazi University _____

Date: 28.07.2021

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name Last name : Ayça Kocakuşak

Signature :

ABSTRACT

THE EVALUATION OF URBAN TRANSPORT MASTER PLANS IN TURKISH CITIES FROM THE PERSPECTIVE OF CLIMATE CHANGE MITIGATION

Kocakuşak, Ayça
Master of Science, City Planning in City and Regional Planning
Supervisor : Prof. Dr. Ela Babalık

July 2021, 158 pages

Climate change is a global challenge that many nations deal with. Consumption patterns and greenhouse gas emission levels indicate that activities in urban areas are one of the main reasons for the climate change problem. Besides, the transportation sector's role in greenhouse gas emissions and energy consumption is undeniable. In the last decades, the increase in car dependency made it challenging to deal with the problems since private cars significantly impact emission levels. Besides, the ever-growing population and economic development goals are likely to affect travel demand, which may cause an increase in demand for the number of private cars and necessary infrastructure in the future. Increasing road capacity due to predictions caused further urban transport problems rather than solving them. This situation turned into a vicious circle in most of the major cities. However, cities can also be considered as solutions to this problem. In the contemporary transport planning approach, it is realized that focusing on changing travel behaviors and patterns has a significant impact on transport planning rather than meeting the demand by increasing the capacity. Transport policies that aim to reduce private car usage with effective travel demand management might help to solve the problems. Policy packages that are part of the urban transport plans may play a key role in climate change mitigation. This research analyzes the policy packages of Urban Transport Master Plans of twelve Turkish cities with a view to assess the extent to which

the issue of climate change is handled and included in these plans. In order to carry out this analysis, the plans are examined in detail and an evaluation framework is developed in accordance with the literature review. The framework, comprising a list of possible climate-change related policies and actions, helps to compare and scale the compatibility of the urban transport master plans. With this comprehensive assessment, the main contribution of this study is to provide an evaluation of the existing urban transport master plans and the urban transport planning practice in Turkey with reference to climate change and in terms of their ability to address the urgent issue of climate change.

Keywords: Climate Change, Urban Transport, Urban Transport Policies, Urban Transport Master Plans

ÖZ

TÜRKİYE KENTLERİNDE KENTSEL ULAŞIM ANA PLANLARININ İKLİM DEĞİŞİKLİĞİ İLE MÜCADELE AÇISINDAN DEĞERLENDİRİLMESİ

Kocakuşak, Ayça
Yüksek Lisans, Şehir Planlama, Şehir ve Bölge Planlama
Tez Yöneticisi: Prof. Dr. Ela Babalık

Temmuz 2021, 158 sayfa

İklim değişikliği, birçok ülkenin uğraştığı küresel bir sorundur. Tüketim aktiviteleri ve sera gazı emisyon değerleri, kentsel alanlardaki faaliyetlerin, iklim değişikliğinin temel nedenlerinden olduğunu göstermektedir. Ayrıca, ulaşım sektörünün sera gazı emisyonları ve enerji tüketimindeki payı oldukça büyüktür. Son yıllarda emisyon seviyesini önemli ölçüde etkileyen otomobil bağımlılığındaki artış, bu sorunlarla başa çıkmayı zorlaştırdı. Sürekli artan nüfus ve ekonomik büyümenin gelecekte seyahat talebini arttırması muhtemel olmakla birlikte bu durum özel araç sayısını ve gereken altyapıyı daha da arttıracaktır. Projeksiyonlara göre yol kapasitesinin artırılması, trafiğin azalmasındansa uzun vadede daha büyük ulaşım sorunlarına neden olmakta. Bu durum büyük şehirlerin çoğunda kısır döngüye dönüştü. Öte yandan şehirler aynı zamanda problemin çözümü olarak da görülebilir. Modern ulaşım planlaması yaklaşımında, kapasiteyi artırarak talebi karşılamaktansa seyahat davranışlarını değiştirmeye odaklanmanın, ulaşım planlaması üzerinde çok daha önemli bir etkisi olduğu anlaşıldı. Özel araç kullanımını azaltmayı ve etkili seyahat talep yönetimi ile sürdürülebilir ulaşımı teşvik etmeyi amaçlayan ulaşım politikaları bu sorunları çözebilecek potansiyele sahiptir. Bu sebeple kentsel ulaşım planlarının bir parçası olan politika paketleri iklim değişikliği ile mücadelede önemli bir rol

oynamaktadır. Bu araştırma, iklim değişikliği konusunun ne ölçüde ele alındığını ve bu planlara nasıl dahil edildiğini değerlendirmek amacıyla on iki Türk kentinin kentsel ulaşım ana planlarının politika paketlerini analiz etmektedir.Planları analiz etmek için, kentsel ulaşım ana planlarının uyumluluğunu karşılaştırmak ve ölçeklendirmek amacıyla literatür taramasına uygun bir değerlendirme çerçevesi hazırlanmıştır. İklim değişikliği ile ilgili olası politika ve eylemlerin bir listesini içeren çerçeve, kentsel ulaşım ana planlarının uyumluluğunu karşılaştırmaya ve ölçeklendirmeye yardımcı olmuştur. Bu kapsamlı değerlendirme ile, bu çalışmanın ana katkısı, mevcut kentsel ulaşım ana planlarının ve Türkiye'deki kentsel ulaşım planlama uygulamalarının iklim değişikliğine ve iklim değişikliğinin sorununu ele alma yeteneklerine göre değerlendirilmesini sağlamaktır.

Anahtar Kelimeler: İklim Değişikliği, Kentsel Ulaşım, Ulaşım Politikaları, Kentsel Ulaşım Ana Planları

Dedicated to people

who touch my heart

ACKNOWLEDGMENTS

I would like to express my gratitude to the people who do not hesitate to support, guide, and encourage me. I could not complete this thesis without them.

First and foremost, I would like to thank my supervisor Prof. Dr. Ela Babalık, for her guidance and contributions throughout the research. Our meetings helped me think from different perspectives and solve the problems that I faced during my research.

I am also grateful to Utku Havuç, METU Aikido Society, and Katsu, as they helped me sustain my motivation, discipline, and mental health during the difficult Covid-19 period.

I would like to express my sincere gratitude to my mother Fügen Kocakuşak, and my father Süha Kocakuşak for their love, support, encouragement, and their patience. I am very thankful to them as they supported me to become who I am now.

I am deeply grateful to my brother Diren Kocakuşak, who did not stop supporting me for 25 years and will forever be the closest person to me during my life.

Finally, I am very grateful to Gürel Sezgin for his encouragement when the times got difficult for me. It was a great feeling to know that you were always there to help me whenever I needed it.

TABLE OF CONTENTS

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

CHAPTER 1

INTRODUCTION

1.1 Context and Problem Statement

Until the last decades, driving pure economic growth without evaluating the long-term consequences was the main agenda of the capitalist states and nations (Storper, 2013). Correspondingly, unsustainable industrial-scale production and exaggerated consumption patterns disturbed the ecosystem and the natural balance. In other words, excessive use of natural resources and production and consumption-related emissions are changing the planet in a harmful manner. As a result, environmental problems, especially climate change, became one of the most significant contemporary world problems that urgently need attention. As time progresses, it becomes more challenging to control climate change caused by anthropogenic activities because of the increasing global energy consumption and CO_2 emission trends. Technically, the increasing rate of heat-trapping greenhouse gas (GHGs) emissions in the atmosphere cause global temperature to rise. Around 65% of the GHGs emissions consist of CO_2 gases (IPCC, 2014). This situation indicates the direct proportion between CO_2 emissions and climate change.

International organizations are working on mitigation and adaptation solutions in cooperation with the nations. Mitigation strategies aim to deal with climate change by managing the heat-trapping gas emissions, while adaptation strategies refer to reducing the cost, adapting to the difficulties of the changing climate, and increase the resiliency of the planet (IPCC, 2014). From so far, mitigation was playing a more crucial role in protecting the planet's sustainability. However, as climate change's harmful consequences started to affect human life permanently, adaptation strategies came into prominence. Both adaptation and mitigation strategies require policies and successful implementation with cooperation at different scales (IPCC, 2014).

Even if different action plans are required for both mitigation and adaptation, decisions made at the urban scale play a crucial role in addressing climate change due to rapid urbanization trends. Turkey has a national scale adaptation plan called Turkey's National Climate Change Adaptation Strategy and Action Plan that aims to conceptualize the national policies required for climate change adaptation. On the other hand, local scale plans in Turkey generally focus on mitigation strategies. As the local governments have a role in the transition of policies into practice, local plans prepared by local governments are essential for mitigating climate change.

It is essential to determine and interfere with the urban activities that increase the emission levels. When examined from the perspective of sectoral distribution, the transport sector's share in causing CO_2 emissions, which is around 27% on the global scale, is undeniable (IEA, 2019). Specifically, the share of private cars in the transport sector-related emissions draws attention, with the highest share around 39% (IEA, 2019). This situation indicates the importance of local-scale decisions and the relationship between climate change, transport, and private car usage.

Private car usage has a massive impact on the transport sector's share in climate change because of the "predict and provide" approach defined by Owens (1995). In basic terms, providing the necessary road infrastructure to meet the demand created a vicious cycle, and meeting demand encouraged private car usage in the long run. However, increasing awareness of environmental problems and the emergence of sustainable development influenced the transport planning approaches. It caused a paradigm shift from "predict and provide" to "predict and prevent." This paradigm shift is also named as *traditional to sustainable* or *conventional to contemporary* approach.

This sustainable transportation approach has been developed as a response to adverse environmental outcomes of the transport sector. In brief, sustainable transport aims to reduce private vehicle usage and encourage alternative modes such as non-motorized and public transport. Similarly, climate change mitigation requires a shift from the automobile, which creates the highest levels of CO2 per passenger carried,

to more climate-friendly modes of public transport, walking, and cycling. However, the gap between theory and practice is one of the fundamental problems of the planning field. Therefore, the adaptation of sustainable transport policies that aim to decrease the transport sector's impact on climate change can be an obstacle at the local scale.

1.2 Research Question

This research aims to understand whether the local authorities successfully adopt transport policies to reduce the negative impacts of the transport sector on climate change. By doing this, I aim to contribute to the literature by addressing the gap between theory and practice in the transport planning field and by evaluating the adaptability of climate change-related transport policies on a local scale. Planning policies function as a bridge to the transfer of theoretical knowledge into practice. In Turkey, local-scale urban transport policies are part of the urban transport master plans. Thus, my research design features analyzing the transport master plans and policies to conduct a case study specific to Turkey.

According to the aim of this study, the research questions are formulated as follows:

- *Are there any policy targets that aim to reduce the negative impacts of the transport sector on climate change in the policy packages of transport master plans in Turkey?*
- *To what degree do proposed policies determine to mitigate the negative impacts? Do they draw attention to the problems on the local scale and offer any tangible implementations or system corrections, or are the problems mentioned without sufficient action plans? Or alternatively, do the proposed plans and policies ignore the link between urban transport and climate change?*

In order to answer the research questions, the transport master plans in Turkey will be analyzed from the framework briefly explained above and further discussed in detail in the literature review section.

1.3 Methodology

The appropriate methodology is chosen to evaluate the current urban transport policies from the climate change perspective. In order to achieve this, a detailed analysis of urban transport master plans is carried out. Therefore, the data collection method consists of collecting plan documents. In Turkey, only a few transport master plans are shared publicly. In order to accommodate this limitation, I communicated with municipalities to collect transport master plans. While many plans were accessed this way, it should be noted that the investigation is inevitably limited with the plans that were shared by local governments and the plans that were accessed online. In total, twelve plans out of twenty-three were analyzed in this study. A qualitative research method is adopted as the content analysis is suitable for analyzing the transport master plans.

The research has proceeded in four steps. In the first step, the relationship between climate change and the transport sector is examined. The definition of climate change and the factors causing it are clarified. Afterward, the transport sector is examined from energy consumption and emissions perspectives. In the second step, transport planning approaches are discussed from the climate change perspective. To this end, the progress of transport planning is examined by comparing contemporary and conventional planning approaches.

Most importantly, urban transport policies to mitigate the transport sector's negative impacts on climate change are defined. In the third step, historical periods and legislations of transport planning in Turkey are examined. In the fourth step, an analysis of the policy packages of the transport master plans is made with regard to the urban transport policies defined in the second step. In order to make the analysis,

an evaluation table is designed by re-organizing the transport policies mentioned in the previous step in accordance with the municipalities' capability and the aim of this research. It is also decided to quantify the answers since the quality of proposals varies in each plan for each policy.

The findings of the analysis are evaluated in two steps. In the first part, each plan content is examined one by one. The compatibility of their policies with the climate change related transport policies is evaluated. A general evaluation framework is created in the second step to conduct an overall discussion for all the transport master plans.

1.4 Structure of the Thesis

This thesis consists of six chapters, including introduction and conclusion chapters. The **first chapter** consists of context and problem statement, research question, methodology, and the thesis structure, respectively. Afterward, the **second chapter** clarifies the relationship between the transport sector and climate change. It starts with expressing general and scientific information on climate change and defining milestone events to increase awareness of climate change. Subsequently, the transport sector's contribution to climate change is discussed on global CO_2 emission and energy consumption trends. Following the purpose of this study, the increasing rate of private vehicle usage is discussed from the climate change perspective.

In the **third chapter**, contemporary and conventional transport planning approaches are clarified. The shift from conventional to contemporary approach is explained. The influence of the sustainability concept on the contemporary approach is also discussed. Next, a comparison of the two approaches is presented to better understand the importance of the new approach. Besides, these approaches are exemplified with the clarification of conventional transport master plans and *Sustainable Urban Mobility Plans (SUMPs).* Subsequently, climate change-related transport policies that aim to promote sustainable transport and lower the impact on

climate change are explained in detail. During the clarification of the policies, classification is made to provide a more straightforward expression of alternative modes, known as pull policies, restrictions on private car usage (push policies), energy efficiency policies and other supportive transport policies. The clarified urban transport policies are used in the determination of the policies for the analysis step.

The assessment of the current situation in Turkey from the perspective of discussions held in the literature review is conducted in the **fourth chapter**. Firstly, Turkey's historical background of transport planning is explained under the categorization as three periods of Turkey as *before 1970, between 1970-1985,* and *after 1985.* Secondly, key administrative and legislative decisions on transport planning are expressed to provide a better understanding of the process of transport planning in Turkey. Thirdly, the preparation of transport master plans in Turkey is examined as this thesis analyzes the transport master plans. Next, the current situation on the preparation of *Sustainable Urban Mobility Plans* in Turkey is clarified as they are explained as successful examples in the literature review. Finally, current climate change-related transport sector trends in Turkey are discussed. The similarities and differences between global trends are explained in the second chapter and trends in Turkey are identified.

In the **fifth chapter**, the methodology of the analysis is explained in a more detailed way. The data used and the logic behind the creation of the evaluation framework are expressed. In addition, how the evaluation framework should be understood is explained.

In the **sixth chapter**, an analysis of the compatibility of the content and policy packages of the selected transport master plans with the identified urban transport policies is conducted. First, local-scale policies that are applicable by local authorities are selected, and an evaluation table is designed. In total, twelve transport master plans out of twenty-three are analyzed and presented in this chapter. The chapter ends with a general evaluation table that is illustrated to generalize the adaptation of the selected transport policies.

The **conclusion chapter** starts with a summary of the research to explain what is done so far. Moreover, the main findings are represented in the next step of the chapter. A general discussion is made by considering both the literature review and the case analysis. Lastly, the conclusion chapter ends with recommendations for future research to improve academic knowledge and practice.

CHAPTER 2

THE TRANSPORT SECTOR AND CLIMATE CHANGE

2.1 General Information About Climate Change

Climate change is one of the primary concerns of humankind to sustain their existence. However, the process of climate change is not progressing in its natural course. Modern climate change results from anthropogenic movements affecting atmospheric consumption (Karl & Trenberth, 2003). Changes in consumption patterns, especially right after the Industrial Revolution, dominated the process (Rodrigue, Comtois, & Slack, 2013). Climate change is defined by the United Nations Framework Convention on Climate Change as "…change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over a comparable time period" (1992, p. 3). Significantly, the emission-increasing activities such as excessive use of fossil fuels and rapid urbanization can be given as examples.

The impacts of climate change manifest themselves in our daily life. Both *natural* and *human systems* are started to experience climate change impacts (IPCC, 2018). Some of these impacts on the *natural system* can be listed as an increase in the atmosphere and ocean temperatures, melting of snow and ice, an increase in the sea levels, and extreme weather events. On the other hand, problems with food supply and health problems can be given as examples of impacts on *human systems*. Along with global warming of around 0.5°C, some extreme climatic and weather events have been observed (IPCC, 2018). Human activities are mainly responsible for these changes since anthropogenic emissions stimulated global warming.

2.1.1 Scientific Explanation of Global Warming and Climate Change

Temperature rise is one of the main determinants of climate change resulting from greenhouse gas (GHGs) emissions. Human movements increase the heat-trapping GHGs emission levels, which cause an increase in the overall temperature. This phenomenon is known as global warming. Since the pre-industrial era around 1850-1900, anthropogenic GHGs emissions have increased due to increased fossil fuel usage. IPCC reports on current global warming indicators and climate change trends and makes future estimations regularly. Human-induced global warming reached around 1°C in 2017, compared to the pre-industrial period, as seen in Figure 2.1 (IPCC, 2018).

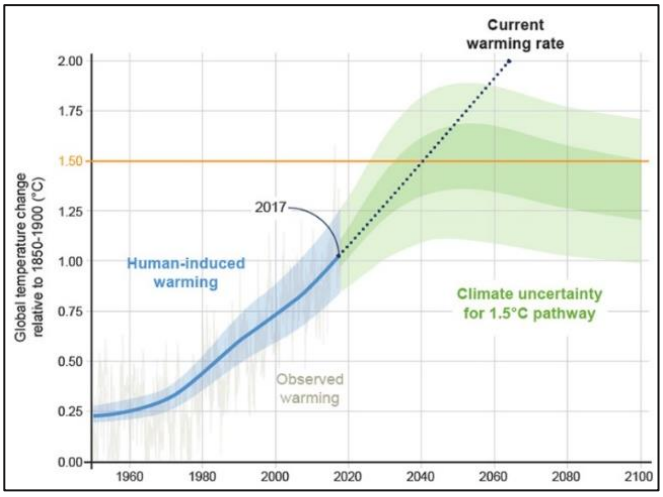

Figure 2.1 Global temperature change relative to 1850-1900 (°C) (IPCC, 2018)

In the Global Warming of 1.5 °C report, different warming scenarios are also examined depending on changes in the consumption patterns. However, there is uncertainty as it is not clear yet how the future decisions of humankind will change in the future. In other words, human-induced global warming will continue to rise, unlike essential changes are made in consumption patterns. Models show that the

global temperature increase will reach 1.5°C around 2040 if the warming trend continues (IPCC, 2018). Another estimation indicates that global temperature increases may even reach up to 4°C before 2100 (Dalkmann & Brannigan, 2007). Changes in the GHGs emission levels will undoubtedly determine future scenarios. Kyoto protocol identifies the ingredients of GHGs as "carbon dioxide (CO_2), methane (CH_4) nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFC) and sulfur hexafluoride (SF_6)" (1998, p. 22). Figure 2.2 presents the share of these gases in total anthropogenic GHGs emissions for 2010.

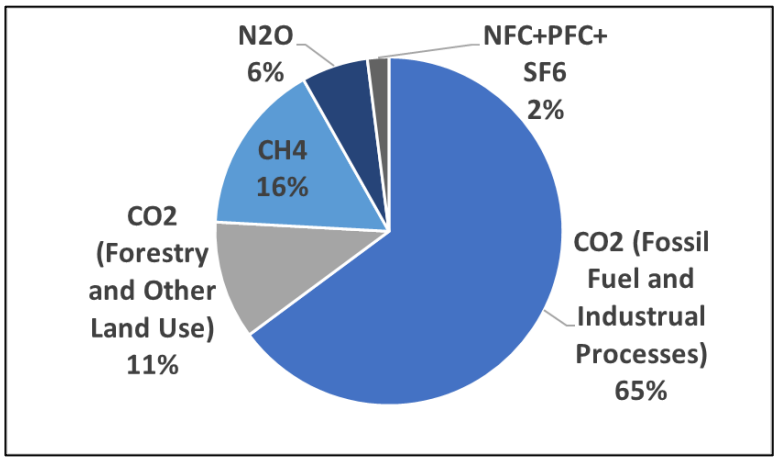

Figure 2.2 Totall anthropogenic greenhouse gas (GHG) emissions for 2010 (gigatonne of CO_2-equivalent per year, Gt CO_2-eq/yr) (IPCC, 2014)

Figure 2.2 also shows that CO_2 emissions from fossil fuel usage and industrial processes contribute around 65% of total emissions. Besides, CO_2 emissions contribute approximately 76% of the total GHGs emissions. As mentioned before, the Industrial Revolution caused an increase in fossil fuel consumption, which is one of the primary sources of CO_2 emissions. Various panels, frameworks, and reports address this issue, and different countries adopt various CO_2 reduction targets that will be clarified in the following part. Despite all, CO_2 concentration continues to rise. Figure 2.3 shows the trend in the concentration of CO_2 in the atmosphere.

According to The Manua Loa Observatory measurements, the monthly CO_2 value exceeded 400 ppm for the first time in 2014 and reached around 412 ppm in August 2020 (NOAA/GML, 2020). Estimations also show that reaching at 450 ppm will result in 2°C warmings relative to pre-industrial levels, which is accepted as a threshold to prevent catastrophic consequences of global warming (IPCC, 2014). Therefore, the International Panel on Climate Change (IPCC) focuses on mitigation scenarios that limit CO_2 concentration around 450 ppm and 2°C global warming increase.

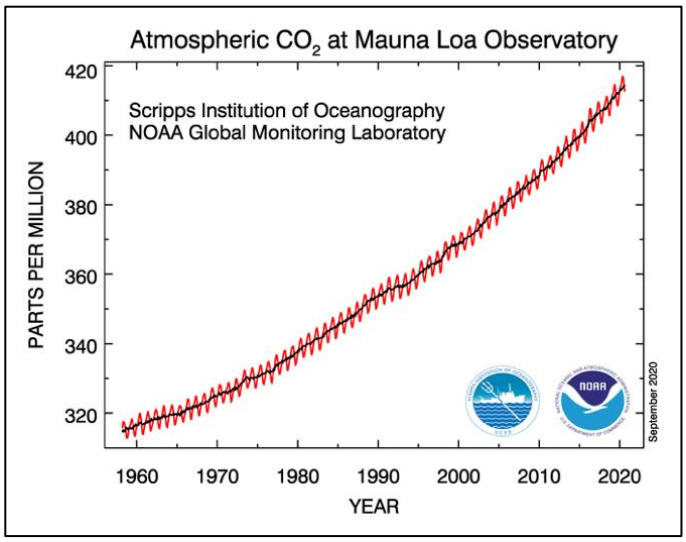

Figure 2.3 monthly mean carbon dioxide measured at Mauna Loa Observatory (NOAA/GML, 2020)

2.1.2 Milestone Events on International Climate Change Negotiations

Movements to draw attention to climate change, its causes and to increase awareness on these issues started earlier. The historical background of environmental concerns covers a considerable period. However, in this chapter, only milestone events related to this study are expressed briefly. Debates on CO_2 levels and emissions were

increasing since the Industrial Revolution. In 1896, Nobel winner Svante Arrhenius published his calculations, which justify that burning fossil fuels causes the planetary temperature to rise by emitting CO_2 and affecting greenhouse gas emissions (as cited in Taylor, 2014). His research drew attention to one of the fundamental problems of humankind by pointing to the future consequences of using fossil fuels. In addition to individual scientific studies, international organizations started to draw attention to the environmental consequences of the development of humankind in this way.

The first international governmental steps about climate change have taken place in the UN Conference on Human Environment held in Stockholm in 1972, focusing on environmental issues from the international perspective. The common view of the conference was that negative human impacts on the environment could be mitigated by international cooperation (Hickman & Banister, 2014). The conference played an essential role in focusing on environmental issues from a global perspective with the participation of 113 states. International movements started to gain importance in the following years. Another important step was taken in 1979 as the First World Climate Conference that initiated the establishment of the World Climate Program. It was organized by the World Meteorological Organization (WMO). The common idea of the conference was the increasing awareness of human activities that affect climate change. Therefore, the deceleration of the conference calls governments "to foresee and prevent potential man-made changes in climate that might be adverse to the well-being of humanity" (United Nations Envrironment Programme, 2000). In 1987, The World Commission on Environment and Development, chaired by the former Norwegian Prime Minister Gro Harlem Brundtland, prepared Our Common Future, also known as Brundtland Report. The report addresses the environmental consequences of economic growth in the long term. The Brundtland Report (1987) also made one of the broadly accepted definitions for sustainable development as "…development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (p. 41). It was the first major

report to acknowledge the importance of considering future generations in environmental deterioration and sustainable development context.

In 1988, the Intergovernmental Panel on Climate Change (IPCC) was established by The United Nations Environmental Programme (UNEP) and the World Meteorological Organization (WMO). The main aim of the IPCC is to inform governments by providing scientific evidence on the consequences of human-induced global warming and climate change; thus, advising on possible mitigation and adaptation strategies (Bolin, 2009). Besides, Assessment Reports published by IPCC play an essential role in understanding the current climate change trends. Over time, IPCC gained importance with science-based and up-to-date reports.

Twenty years after the UN conference on Human Environment, Earth Summit, also known as the United Nations Conference on Environment and Development (UNCED), was held in Rio in 1992. The conference played an essential role in drawing attention to the environmental issues with the agreement on essential documents and with the participation of more than 100 governments. The primary documents that are developed and agreed by the participants of the Earth Summit are Agenda 21, the Rio Declaration on Environment and Development, the Statement of Forest Principles, the United Nations Framework Convention on Climate Change (UNFCCC), and the United Nations Convention on Biological Diversity (United Nations, 1997). The main objective of the UNFCCC is defined as "…stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (United Nations, 1992, p. 4). Earth Summit is an important milestone since it brings governments under this primary objective. Agenda 21 emphasized that the transport sector has a 30% share in total energy consumption and plays a vital role in addressing climate change issues. In Agenda 21, one of the main activities related to *promoting sustainable energy and transport systems in human settlements* is defined as "promoting efficient and environmentally sound urban transport systems in all countries should be a comprehensive approach to urban-transport planning and management" (United Nations, 1992, p. 56). Agenda 21 can be accepted as an

essential document for the transport sector since it draws considerable attention to environmental problems caused by the transport-related activities. As a result of the UNFCCC, the Conference of Parties (COP) meetings were organized annually with the goal of making progress in combating climate change. In 1997, the 3rd COP meeting was held in Kyoto, Japan. Kyoto Protocol has a vital place in the history of climate change since reduction targets are agreed to reduce CO_2 emissions by 5.2% (1990-2012) for the first time by more than 170 industrialized countries, except the United States as the more significant producer of CO_2 (Hickman & Banister, 2014). Also, the transport sector is mentioned as one of the critical sectors that need to be considered to struggle with climate change.

In 2015, COP 21, also known as the Paris Climate Change Conference, resulted in the acceptance of the Paris Agreement to fight against climate change by 196 countries. The primary objective of the Paris Agreement is described as "strengthen the global response to the threat of climate change, in the context of sustainable development" mainly by "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels" (UNFCCC, 2015, p. 22). As mentioned before, future scenarios for reaching 2°C mainly indicated that the result would be irremediable catastrophic consequences of climate change. In addition to its primary objective, the agreement has an important place in history as its acceptance by 196 countries. The USA has left the Paris Agreement under the presidency of Donald Trump. However. In 2021, rejoined the agreement after Joe Biden became the new president of the USA.

International events and conferences covered in this chapter cover essential milestones to deal with climate change and global warming issues. However, there are many divergencies about the effectiveness of these international events. Intended consequences might differ from reality. Eliasson et al. (2015) suggest that it is difficult to reach the goals set or obey these agreements since enforcement is not possible. Besides, it can be argued whether these events mainly focus on environmental consequences or focus on overconsumption's negative economic

outcomes. Nevertheless, it can be accepted that these events played an important role in drawing attention to environmental issues.

2.2 Transport Sector's Contribution to Climate Change

Urbanization levels started to increase since the Industrial Revolution. Rapidly rising urban populations resulted in significant changes in urban areas. Many problems, including congestion, urban sprawl, the inadequacy of clean water, arose since the growth of urban areas is generally faster than the development of the required infrastructure and housing (Hickman & Banister, 2014). Providing the infrastructure to reach from one point to another with minimum resources became the purpose of transport planners and decision-makers. However, this approach in transport planning started to create problems, not for the system itself but also for other contexts such as environmental, economic, and societal. The components of urban systems cannot be considered separately due to interaction among them. For instance, transportation is an integrated discipline with the other components of urban planning such as housing, design, and infrastructure. Goodwin and Dender (2013) argue that urban experience should be evaluated with respect to the transport policy since given decisions on transportation play an essential role in shaping other elements of the city. Nowadays, most of the problems cities experience are derived from the transport sector.

In most international agreements, it is accepted that urban transportation has an undeniable impact on climate change apart from its economic consequences. Rodrigue et al. (2006) describe the transport sector and environment relation as paradoxical because when transport activities are supported with respect to demand, increased motorization and congestion levels will end up with environmental problems related to climate change. Therefore, it can be accepted that the traditional way of improving the transport sector has many problems. One of the reasons for this result might be not considering the transport sector in a multi-disciplinary way. Even though it has been discussed for a long time that the transport sector is one of

the sources of environmental problems, the consequences are just being acknowledged.

2.2.1 The Role of Transport on Energy Consumption

There is a strong relationship between the development level of nations and their energy usage. Until the raising awareness that non-renewable energy is limited, increasing production and consumption patterns was one indicator of development. However, with the adaptation of sustainable development and increasing awareness of climate change, negative consequences of using non-renewable energy sources such as fossil fuel are understood from the economic, social, and environmental perspectives.

Due to the transport sector's growth on the urban, regional, and national scales, energy consumption increased globally as the transport sector is one of the biggest consumers of total energy with a share of 27%, as seen in Figure 2.4. Besides, the transport sector is not sustainable since it is mainly fossil dependent. Road transport has the highest share of energy consumption in the transport sector (European Union, 2020) and private car usage is responsible for this share. In addition to the increasing urbanization trends, the increase in private car usage directly affects energy consumption. Even if technological progress contributes to energy efficiency and the usage of renewable sources, the transport sector continues to be dependent on fossil fuels if the existing pattern does not change. Therefore, it is vital to adopt environmentally considerate transport policies aim to reduce energy consumption to achieve sustainable transport levels and deal with climate change.

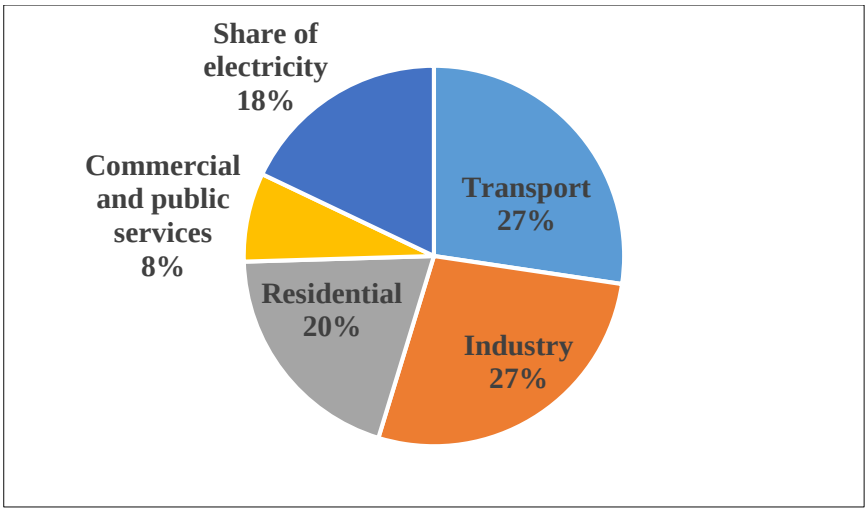

Figure 2.4 Final Energy Consumption by Sector (IEA, 2019)

2.2.2 The Role of Transport on CO_2 Emissions

The transport sector has a critical role in struggling with climate change since it has enormous impacts on the environment. It is known that carbon-based energy sources are the primary source of climate change. Besides, decarbonizing transport is a very challenging goal since the transport sector 92% dependent on fossil fuels (ITF, 2018). Likewise, humankind became more dependent on fossil fuels as the demand for transport steadily increased. In brief, urbanization trends, especially for the transport sector, affected the demand for fossil fuels, and the situation has become insuperable. CO_2 emissions caused by the transport sector have risen faster compared to other sectors within the last three decades, and estimations show that this trend will escalade in the future (Dalkmann & Brannigan, 2007). The role of the transport sector in dealing with climate change gains prominence as time progresses.

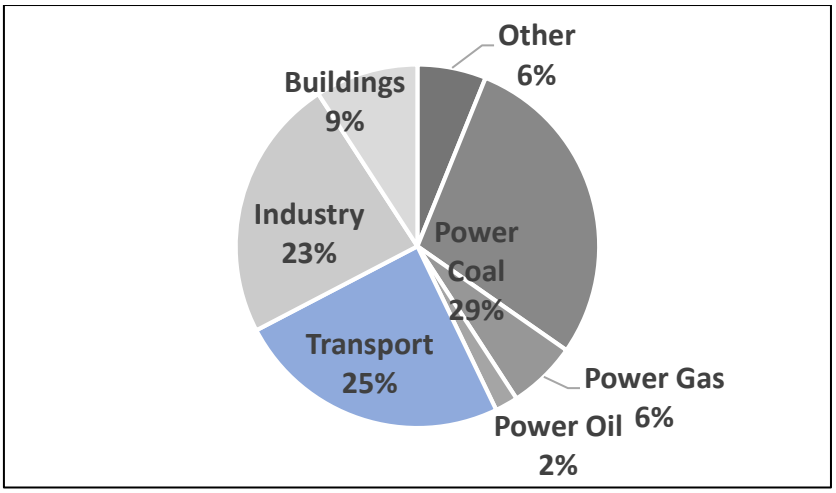

Figure 2.5 Global energy-related CO_2 emissions by fuel sector (2019) (IEA, 2020)

Figure 2.5 shows the sectoral distribution of CO_2 emissions from fossil fuels. As seen in Figure 2.5, the transport sector has a 25% share in total CO_2 emissions. According to Rodrigue et al. (2006) the future of the transport sector is imperiled without understanding environmental sustainability. Also, it can be inferred that future CO_2 emission rates of the transport sector play an essential role in achieving the target of limiting global warming determined by international agreements. As mentioned before, the Kyoto Protocol describes the transport sector as a crucial source of GHGs. Therefore, the aim of reaching GHGs emissions levels of 1990 highly depends on the improvements in the transport sector.

Centuries ago, rail systems were the dominant factor in shaping cities even if the existence of alternative ways of transport. However, the mass-produced T Model of Henry Ford has changed the overall course of processing by being dominant in transportation history. Private vehicles were seemed advantageous in many manners and became more preferable in time. Today, private vehicles are the dominant mode of transport globally. Consequently, the increase in private car usage over the years also increased the transport sector's share of CO_2 emissions.

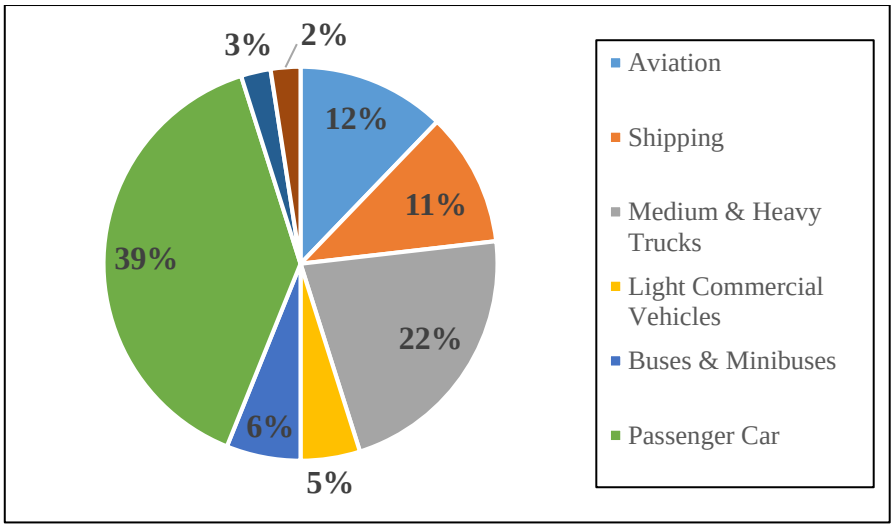

Figure 2.6 Global CO_2 emissions by modes of transport (2019) (IEA, 2019)

Figure 2.6 shows the distribution of global CO_2 emissions by modes of transport. Also, it can be observed that road transport is the highest contributor of CO_2 emissions within the transport sector. Besides, the passenger car category has the most considerable impact with the share of 39% of CO_2 emissions caused by modes of transport. Chapman (2007) states that modes with high demand are also the ones most polluting. He also argues the solution of mitigating the transport sector's impact on climate change lies in technological developments for less polluting vehicles and encouraging fewer polluting modes of transport (Chapman, 2007). Promoting model shift from private car usage to less polluting modes, including walking, cycling, or rail, is essential as well as technological improvements. Lowering the private car usage levels requires an understanding of the factors that creates the problem. Thus, the problem of car usage needs to be examined to provide the necessary solutions.

2.2.3 The Problem of Private Car Usage as a Factor in Climate Change

Until the 21st century, the focus point was on the economic consequences of the transportation sector, such as limited resources and additional costs. However, in the

21st-century, besides the economic outcomes, it is realized that environmental and social impacts, such as congestion, carbon emissions, health impacts, are also substantial and started to draw significant attention (Newman & Kenworthy, 2015). Figure 2.6 shows that road transportation, which can be accepted as the main structure of urbanization, has a significant share in CO_2 emissions. Some decisions made by planners and governments resulted in increasing motorization and private car usage rates.

At this point, it is important to distinguish the difference between car usage and car ownership. Kenworthy (2008) distinguishes the difference between car usage and car ownership in his study on urban passenger transport systems' role in CO_2 emissions and energy use. He states that car usage follows a more drastic trend than ownership and suggests that even if ownership of vehicles has a similar level in different regions, the usage rate may differ due to urban form and availability of alternative modes of transport (Kenworthy, 2008). Besides, he argues that private vehicles negatively impact urban environments not designed for them due to their size by threatening public and non-motorized modes that operate with higher rates of energy efficiency and lower rates of CO_2 emission (Kenworthy, 2008).

Owens (1995) discusses the "predict and provide" philosophy as a decision mechanism that dominates urban transportation policies. It can be defined as projecting future demand and meeting by infrastructure improvements to prevent estimated future problems, such as congestion (Owens, 1995). Briefly, it can be exemplified as increasing road capacity concerning future demand predictions to prevent the congestion problem. She asserts that the "predict and provide" will result in the continuous capacity provision as the demand will gradually increase in correlation with the capacity provision (Owens, 1995). Figure 2.7 is the visual representation of the "predict and provide" philosophy. Increasing road capacity when the demand is higher than the existing capacity does not solve the problem, even if it provides relief in the short run. In the long term, it encourages people to travel on newly constructed and improved roads. Thus, the "predict and provide" philosophy creates a vicious cycle, and also the problem becomes more complicated

over time. *Induced traffic* is one of the critical consequences of this never-ending process. It is defined by Goodwin and Noland (2003) as "all the traffic that would be present if an expansion of road capacity occurred, which would not be there without the expansion" (p. 1451). Therefore, the so-called solution increases traffic levels in the long run rather than solving the problem.

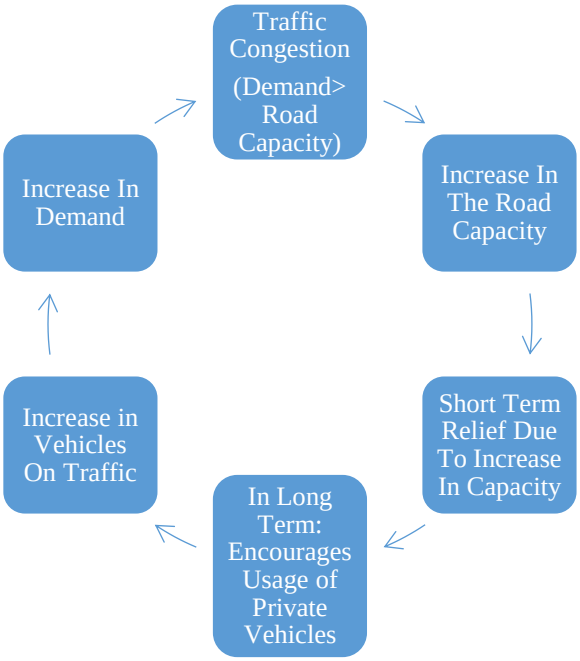

Figure 2.7 Vicious Cycle Representation of Supply Side Policies

Goodwin (1999) criticizes the "predict and provide" approach by examining the white paper titled "A New Deal for Transport" issued by the British Government in 1998. The unsustainability of existing transport trends within the period is accepted as a starting point providing growth in the road capacity due to future estimations. He states that understanding of demand management is shifted to a "predict and prevent" approach (Goodwin, 1999). However, faced problems in the implementation process might affect this process negatively even if the consistency

of the developed ideas. According to Goodwin (1999), the paradigm shift is not an easy process as expected. A shift is required to analyze the existing situation and understand and create a new relationship between demand management and the policies' ability to cope with the problems (Goodwin, 1999). Therefore, it can be inferred that adopting a new approach – "predict and prevent"– is a complicated process since changing the mechanism and the understanding that has existed for many years.

Bertolini (2012) approaches the problem from a different perspective and accepts the urban transportation problem as a dilemma due to its positive role in the development and the negative impacts on society and the environment. According to him, the paradigm shift from "predict and provide" to "predict and prevent" is no longer feasible. Bertolini (2012) supports this idea by saying, "this approach too is no longer useable since it ignores the degree to which the well-being of households and the viability of firms have become dependent on rapid and cheap mobility" (p. 18). At this point, *sustainable mobility* makes sense by considering creating a balance between the two. Difficulties in implementing both ideas – "predict and provide" and "predict and prevent"- engaged the attention of Owens (1995), Goodwin (1999), and Bertolini (2012). However, the urban transportation problem, which is considerably caused by the private car usage trends, and its impacts on social and environmental concerns are obvious focal points.

In this sub-section of the study, so far, the main focus was more on "predict and prevent/provide" approaches. However, urban transportation and private car usage problems are not limited to these frameworks. Besides, urban transport creates its own problems and affects all dimensions of the city and vice versa. Therefore, understanding the relation between private car usage and other components of the cities is essential. One of the well-known studies in this issue is conducted by Newman and Kenworthy (1989), which focuses on the relationship between urban density and the transport field by analyzing 32 cities. As an extension of this study, Kenworthy and Laube (1999), studied the relationship between automobile

dependence and physical and economic dimensions by analyzing 46 cities. Effects of alternative ways of transport on private car usage are known and also mentioned.

According to both studies, an increase in density reduces car usage and relatively energy consumption (Newman & Kenworthy, 1989; Jeffrey R. Kenworthy, 1999). In addition, there is a relationship between the cost of both owning and the rates of usage and ownership (Jeffrey R. Kenworthy, 1999). To summarize, dynamics such as urban form, density, land use, and socio-economic characteristics affect private car usage.

Problems caused by private car usage and reasons for the increase in private car usage are discussed briefly. At this point, it is important to understand the solution proposals as well as to understand the problem well, as each city has different dynamics and requires different solutions. There is growing literature on controlling private car usage and decreasing the environmental consequences of urban transportation.

2.3 Concluding Remarks

In this chapter, the relationship between climate change and the emissions caused by the transport sector is expressed in detail. This review aimed to understand the effect of the transport sector on climate change. In addition, the consequences of the increasing rates of private car usage, as the vital problems of the transport sector, are expressed from the perspective of climate change. It is understood that the share of private vehicle usage on emission levels drew attention as one of the responsible for climate change. This indicates the importance of transport policies aim to reduce private vehicle usage in mitigating climate change.

At this point, it is important to understand the vicious cycle of the transport sector's supply-demand relation that promotes private vehicle usage. In the long term, increasing rates of private vehicle usage can negatively affect climate change mitigation. However, over time, the evolution of the transport sector showed the role

of the transport sector's importance on climate change mitigation and how the harmfulness of the transport sector can reverse. Like other fields of planning, the transport sector is evolved over time. In this process, transport planning started to adopt an approach that considers sustainable development and climate change issues. It is essential to examine this process in order to understand the future problems and the potentials of the transport sector on climate change mitigation. In the next chapter, the development process of transport planning and transport planning approaches for climate change mitigation are discussed.

CHAPTER 3

TRANSPORT PLANNING APPROACHES FOR MITIGATING CLIMATE CHANGE

3.1 Development of Transport Planning

It took time for transport planning to consider social and environmental issues apart from economic concerns, just like other planning fields. The developing world focusing on economic growth is seen as the responsible for high social costs of increasing traffic problems in urban areas (Akerman, et al., 2000). In the previous chapter, the problem of private car usage is discussed. At this point, it is important to highlight that increasing rates of private car usage also allowed cities to grow and increased the travel demand and travel distances which made it difficult to focus urban transport planning from a comprehensive perspective (Schiller & Kenworthy, 2018). The past experiences of transport planning focus on increasing the capacity of each independent unit of a system, such as increasing the capacity of a specific road or terminal (Goulias, 2003). It can be accepted that the transport planning approach was focusing on solving the problems of specific spatial places rather than in a comprehensive manner. For example, in the mid-1940s, the United States' understanding of urban transport planning was to solve specific issues mainly based on congestion, such as bottlenecks at bridges and junctions (Özalp & Öcalır, 2008). Until the 1950s, solving the problems by focusing only on the problematic area rather than an integrated approach, in reality, caused problems to spread to other parts of the city (Elker, 2002). Over time, the importance of adopting an integrated approach in all fields of urban planning, including transport, is understood as the best solution. Goulias (2003) represents the oil crisis in the 1970s as one reason for adopting a more comprehensive transport planning approach. On the other hand, Jones (2014) expresses the contribution of academic knowledge, which influenced the data collecting, analyzing, and methodological phases, as one reason for this

paradigm shift. Eventually, comprehensive approach brought a new dimension to transport planning. The success of considering the urban area as a whole in urban transport planning is proven. Therefore, transportation plans are prepared on an urban scale.

On the other hand, urban transport planning's success depends not only on the integrated planning of space but also on the time dimension. In other words, planning should be meet the needs of the present and the future. For this reason, future projections are essential in today's urban transport planning approach. Although the development of computers in the early 1960s made it easy to analyze large data sets and, therefore, provide successful projections and observe urban areas from a holistic perspective, this situation also caused transport planning to be dominated by a rational perspective (Özalp & Öcalır, 2008). The approaches usually focused on technical issues in transport planning are generally known as the *conventional approach*. In the late 1970s, due to social changes, urban planning has come to be seen as a process that considers technical and political perspectives at the same time (Özalp & Öcalır, 2008). Therefore, a similar paradigm shift also occurred in transport planning. This paradigm shift has formed the basis of the current urban transport planning approach. It is understood that solving the problems from the conventional perspective is not effective in changing passengers' travel behavior, such as encouraging them to use alternative modes to private vehicles while technical solutions are insufficient. Besides, focusing on social issues, including realizing passengers' needs and inequality issues such as the lack of access to all modes of transport, have an essential role in the new approach known as the *contemporary approach.* Subsequently, the arising of new considerations such as environmental and social issues has formed the contemporary approach. In the previous parts of this chapter, the discussion on the difference between two approaches is made in detail.

3.1.1 Conventional and Contemporary Approaches

Transport planning can be evaluated under two categories, which are *conventional* and *contemporary* transport planning. However, an inclusive definition can be made as to the field of planning responsible for preparing, evaluating, and implementing policies, plans, and projects to develop and maintain transport systems at local, regional, and international levels (Transport Planning Society, n.d.). The most apparent distinction between the two planning approaches is that the conventional focus on vehicles while the contemporary method focuses on human movements.

Rodrigue et al. (2013) state that conventional transport planning was based on a more engineering basis, as managed by traffic engineers. Thus, transport planning decisions are mainly based on increasing the capacity since engineers' demand prediction models usually result in future demand not being met with the existing infrastructure (Rodrigue, Comtois, & Slack, 2013). As mentioned in the previous chapter, this approach generally called "predict and provide"(Owens, 1995). On the other hand, Banister (2007) describes the conventional transport planning principles by arguing travel as a derived demand and travel cost minimization. He describes these two principles briefly as follows:

> *Two fundamental principles are embedded in the approach used, namely that travel is a derived demand and not an activity that people wish to undertake for its own sake. It is only the value of the activity at the destination that results in travel. The second principle is that people minimise their generalised costs of travel, mainly operationalised through a combination of the costs of travel and the time taken for travel* (p. 73).

In other words, travel is the cost that must be paid to reach from one point to another. In addition, when transport is accepted as a derived demand, travel time became the highest cost of traveling. Therefore, time minimization, as the second principle, comes into prominence. As mentioned in the previous chapters, this situation has led

to the search for solutions focused on private vehicle usage due to its effectiveness in time minimization. Therefore, conventional transport planning decisions focus on car-oriented development rather than benefiting society. This also prevented transport infrastructure's functioning at an optimal level. Despite the importance of solving transport problems, the increasing environmental issues, lack of equality on accessibility, congestion, and the economic problems such as the oil crisis, triggered all these problems, and such issues have become even more complicated until the 1970s. Problems arising from conventional transport planning have led to the paradigm shift to contemporary transport planning.

The increase in private vehicle use and the associated problems are the most important problems in today's transportation planning field, and contemporary transport planning has the purpose that aims to reduce the use of private vehicles and encourage the use of alternative modes (Babalik, 2013). In the contemporary approach, it is understood that transport planning is based not only on providing infrastructure to minimize costs but also has social and environmental dimensions. Therefore, it must be planned in an integrated way with the other fields of planning. It is crucial to understand that transport issues are actually human-oriented and are associated with almost every problem of societies. However, for the conventional approach, Bertolini (2012) states that "…social sciences have tended to ignore mobility, while transport planning and modeling has tended to ignore the social dimensions of travel" (p. 24). The reason for the emergence of the contemporary approach is these gaps in the transport planning field. Instead of introducing mechanical and demand-meeting solutions to problems, contemporary transport planning focuses on solutions that aim to change travel behavior, effective use of the existing structure, travel demand management, improving safety and health issues, and minimizing the environmental consequences.

The emergence of the sustainability concept also played a key role in shaping the contemporary approach. Increasing environmental problems influenced the awareness on them. Rachel Carson's book, published in 1962 titled *Silent Spring* is one of the milestone events that increase the awareness of environmental problems.

The long-term survival of the planet is the main target of the concept. According to the World Summit on Social Development, sustainable development has three main goals: economic development, social development, and environmental protection (United Nations, 2005). Although there is a debate about which goal is more dominant, the most critical consideration should be given to all three without ignoring any due to interaction between them. Nevertheless, environmental protection is arguably the most problematic among the three goals.

These debates also influenced the transportation sector. Although the transport sector is related to all three goals, it is one of the most important sectors that need to be considered from the environmental protection point of view. Nowadays, transport policies are mostly focused on ensuring sustainability because of their impacts on social, economic, and environmental issues. At this point, it is essential to understand the meaning of sustainable transportation and how it should be. The EU Transport Council (2001) defined sustainable transport system as follows:

> *(1) Allows the basic access and development needs of individuals, companies and societies to be met safely and in a manner consistent with human and ecosystem health, and promotes equity within and between successive generations; (2) is affordable, operates fairly and efficiently, offers choice of transport mode, and supports a competitive economy, as well as balanced regional development; (3) limits emissions and waste within the planet's ability to absorb them, uses renewable resources at or below their rates of generation, and, uses non-renewable resources at or below the rates of development of renewable substitutes while minimising the impact on the use of land and the generation of noise* (p. 15).

Definition of sustainable transportation can be maintained from different sources, but they all resemble the similar inclusive definition in a general sense. In brief, sustainable transport needs to have a low impact on the environment while functioning efficiently from the social and economic perspectives. On the other

hand, it is evident that unsustainable transportation is problematic from the perspective of the three pillars of sustainable development.

In the following parts, the contemporary transport planning approach's planning methods are examined in a detailed way. Since the emergence of the contemporary method is also associated with the emergence of sustainable development understanding, it can also be called *sustainable mobility*, as known in the literature.

Table 3.1 Comparison of Conventional and Contemporary Approaches (Banister, 2007)

The Conventional Approach	**The Contemporary Approach (Sustainable Mobility)**
Physical dimensions	Social dimensions
Mobility	Accessibility
Traffic focus, particularly on the car	People focus, either in (or on) a vehicle Car or on foot
Large in scale	Local in scale
Street as a road	Street as a space
Motorised transport	All modes of transport often in a hierarchy with pedestrian and cyclist at the top and car users at the bottom
Forecasting traffic	Visioning on cities
Modelling approaches	Scenario development and modelling
Economic evaluation	Multicriteria analysis to take account of environmental and social concerns
Travel as a derived demand	Travel as a valued activity as well as a derived demand
Demand based	Management based
Speeding up traffic	Slowing movement down
Travel time minimisation	Reasonable travel times and travel time reliability
Segregation of people and traffic	Integration of people and traffic

Table 3.1 illustrates the comparison between the two approaches. It is evident that two different approaches have significantly different goals. Moreover, the emergence of the contemporary approach highlights from the conventional approach's inadequacy and the additional problems caused. For instance, as a solution to problems caused by speeding up traffic, such as induced traffic, slowing movement down emerged as a more sustainable solution.

Table 3.1 illustrates that the conventional approach focuses on mobility while the contemporary approach focuses on accessibility. Litman (2003) argues that mobility is only the physical relocation of people or goods while accessibility is reaching from one point to the desired location to get the target such as service, good, or activity. He also states that the conventional approach focuses on mobility and considers the physical movement of motor vehicles, while accessibility-based planning focuses on the people's ability to access desired locations and, therefore, considers any problem that affects reaching the desired location (Litman, 2003).

Another important difference between the two approaches is the relationship between supply and demand. It is described in the previous chapters that predicting and meeting the demand does not solve the urban transport problems. Rethinking the supply-demand relation is one of the critical aspects of the contemporary approach. The method of the contemporary approach is managing the demand by changing travel patterns such as promoting public transport and non-motorized modes of transport. This method prevents most of the damage caused by providing additional infrastructure as it aims to manage existing infrastructure more efficiently.

Table 3.1 also explains why the contemporary approach is associated with other fields of planning. For example, observing streets as spaces is related to land-use decisions while focusing on people and social dimensions related to sociology. In order for all the mentioned goals to be achieved successfully- in particular, visioning, scenario development, and modeling - transport plans are needed.

3.1.2 Comparison of Conventional and Contemporary Urban Transport Plans

Urbanization trends are rising globally due to job opportunities and easiness of reaching basic services in urban areas. It also means that the growing population in urban areas increases the changing needs of society. Therefore, increasing demand for urban infrastructure, including housing, public areas, and transportation, results in the spatial growth of urban areas. However, urban transport is fragile against the needs of a growing population and the spreading of urban areas. A comprehensive roadmap is needed so that urban transportation can respond to current and future needs and maintain the cities' sustainability. Therefore, urban transport plans are necessary to initiate these considerations. Although, these plans have a common aim in the global sense, they are known by different definitions and names according to different nations and organizations due to the diversity of the social and political dimensions and requirements. In this thesis, the comparison of two approaches are exemplified on urban transport master plans and Sustainable Urban Mobility Plans (SUMPs).

3.1.2.1 Urban Transport Master Plans

Many municipalities prepare and implement *transport master plans* to govern their long-term and short-term goals. Although the plans differentiate according to urban areas' needs and characters, the main purposes are usually similar. The primary purpose of these plans is generally focused on decreasing congestion, responding to future demand with various strategies, improving public safety and health issues related to urban transport, and decreasing the adverse effects on the environment while maintaining the local character (The Los Angeles County Metropolitan Transportation Authority, n.d.). These plans can be prepared based on transport master plans, such as national strategies and programs. Besides, urban transport

master plans can include sub-plans such as bicycle master plan, roadway master plan, and pedestrianization master plans.

It is uncertain whether these urban transport plans were effective on solving problems because of the lack of general guidelines that clarifies the effective responses given to similar problems faced in cities. On the other hand, the emergence of the sustainability concept highly influenced urban transport plans. Adopting the sustainability approach improved the way of analyzing the problems and the framework for solutions. Eventually, the sustainability concept played an essential role in the effectiveness of urban transport plans compared to the past experiences. One of the reasons for this might be efficiency of sustainability concept on determining the problems and producing the solutions. Sustainability concept highlights the general problems that is possible to face with and provides a general framework on it such as improving non-motorized and public transport in order to deal with emissions. Moreover, adopting a more sustainable approach into urban transportation increased the awareness of the relationship between society and transport, and the environment. Different institutions and nations designed and adopted various guidelines for sustainable transport. One of the well-known examples is Sustainable Urban Mobility Plans (SUMPs).

3.1.2.2 The emergence of Sustainable Urban Mobility Plans (SUMPs)

Considering urban transport problems from a different viewpoint consequently required a new planning approach that embraces a more sustainable and integrated way of solving urban problems. In response to the absence of a general guideline points to the new approach, The European Commission adopted the Urban Mobility Package in 2013, which includes a content called “together towards competitive and resource-efficient urban mobility.” An annex clarifies the concepts of Sustainable Urban Mobility Plans (SUMPs). The Urban Mobility Package states the consideration of SUMPs as follows:

> *…in cooperation across different policy areas and sectors (transport, land-use and spatial planning, environment, economic development, social policy, health, road safety, etc.); across different levels of government and administration…fostering a balanced development and a better integration of the different urban mobility modes… emphasises citizen and stakeholder engagement, as well as fostering changes in mobility behaviour…help cities make efficient use of existing transport infrastructure and services and deploy urban mobility measures in a cost-effective way* (European Comission, 2013, pp. 3-4).

It is clear that these plans do not include only spatial decisions. The relationships between different sectors, different governmental levels, and even the participation of citizens are also part of the plan. On the other hand, in conventional approached plans, distribution of authority and duties is a deficiency and a planning gap that affects the plans' applicability.

SUMPs have begun to be adopted in Europe and throughout the world since their publication. As the planning is a process, SUMP Guidelines have also been updated while the definition always has the same content. SUMP is defined as "…a strategic plan designed to satisfy the mobility needs of people and businesses in cities and their surroundings for a better quality of life. It builds on existing planning practices and takes due consideration of integration, participation, and evaluation principles" (Guidelines for Developing and Implementing a Sustainable Urban Mobility Plan, 2019, p. 9). It can be argued that SUMPs focus on the mobility of the citizens rather than decreasing the travel distance and the time of vehicles. Also, adopting a human-oriented approach means focusing on mobility behavior and using existing capacity more effectively than focusing on increasing capacity. Besides, urban transport planning becomes a continuous process that is ready for updates due to the needs.

It is not possible to obtain a single plan that suits many cities. However, determining a framework that clarifies general concepts may create a similar perspective among

different urban areas. Eventually, SUMPs are based on eight guiding principles listed in Table 3.2.

Table 3.2 Eight principles of SUMP (Adapted from (Rupprecht Consult, 2019, p. 9))

1. Plan for sustainable mobility in the "functional urban area"
2. Cooperate across institutional boundaries
3. Involve citizens and stakeholders
4. Assess current and future performance
5. Define a long-term vision and a clear implementation plan
6. Develop all transport modes in an integrated manner
7. Arrange for monitoring and evaluation
8. Assure quality

The planning discipline is based on different theories that change due to the needs of the time. On the other hand, transport planning did not evolve with the same pattern of the planning discipline. Thus, it took longer for transport planning to abandon the mechanical understanding. Table 3.2 also reflects this shift. First of all, determining the planning borders as "functional urban area" means that municipal borders and travel patterns, such as home-work trips, need to be re-examined for a sustainable way of urban transport planning. Secondly, coordination with different governmental and institutional levels and participation of citizens indicates participatory planning. Integration of different transport modes is a contemporary approach based on a more holistic perspective.

On the other hand, some urban transport plans that are not categorized as SUMP and do not even formally adopt sustainability principles may embrace similar approaches such as long-term visioning and monitoring. It is possible to observe these principles in urban transport master plans as well. In other words, SUMP is one of the most successful but not the only example of contemporary transport planning methods.

Table 3.3 represents the differences between traditional transport planning and *Sustainable Urban Mobility Planning*. The similarity between Table 3.1 and Table 3.3 shows that *Sustainable Urban Mobility Planning* succeeded in adopting the contemporary approach.

Table 3.3 Differences between traditional transport planning and Sustainable Urban Mobility Planning (Rupprecht Consult, 2019, p. 10)

Traditional Transport Planning	**Sustainable Urban Mobility Planning**
Focus on traffic	Focus on **people**
Primary objectives: Traffic flow capacity and speed	Primary objectives: **Accessibility** and **quality of life**, including social equity, health and environmental quality, and economic viability
Mode-focused	**Integrated development of all transport modes** and shift towards sustainable mobility
Infrastructure as the main topic	**Combination** of infrastructure, market, regulation, information and promotion
Sectoral planning document	Planning document **consistent with related policy areas**
Short and medium-term delivery plan	Short and medium-term delivery plan embedded in a **long-term vision and strategy**
Covering an administrative area	Covering a **functional urban area** based on travel-to-work flows
Domain of traffic engineers	**Interdisciplinary** planning teams
Planning by experts	Planning with the **involvement of stakeholders and citizens** using a transparent and participatory approach
Limited impact assessment	Systematic **evaluation** of impacts to facilitate **learning** and improvement

Contemporary transport plans, including transport master plans, are created by adopting similar steps and principles. Many factors affect the success of the plans, but the policy packages and contemporary planning movements have a dominant role in the success.

3.2 Transport Policies for Climate Change Mitigation

Transport policies are essential to solve transport-related problems, pursue the potentials, and ensure sustainability. They are as important as the planning and design movements. Transport policies are essential in terms of applicability of the plans. Rodrigue et al. (2006) define transport policy as "the development of a set of constructs and propositions that are established to achieve particular objectives relating to socio-economic development, and the functioning and performance of the transport system" (p. 228). Besides, adopting the contemporary approach requires transport policies to be prepared in accordance with the understanding of sustainable development. Therefore, policies should be planned in a system where different policies support each other and work together rather than fragmented as in the conventional approach. Owens (1995) states that "a sustainable transport policy means maximising accessibility within environmental constraints and must be achieved by means of a co-ordinated policy package" (p. 43). Policies are generally designed as a part of governmental projects of urban transport plans, such as transport master plans of SUMPs, as they need to be considered as a policy package.

Since the urban areas have different characteristics, the policy packages are also differentiated from each other. However, they have similar objectives to ensure sustainable transportation and mitigate the negative impacts of climate change. In the contemporary transport planning approach, travel demand management (TDM) is the key concept that consists of transport policies that aim to manage the demand on travel by influencing travel choices and patterns, such as time, destination, and mode of travel (Victoria Transport Policy Institute, 2014). In other words, travel demand management methods accept travel as a behavioral study. In general, by

using incentives and disincentives, these policies aim to influence people's travel time and reduce the need for travel and encourage people to use alternative modes of transport instead of promoting the usage of private vehicles.

In the literature, transport policies that aim to influence travel behavior are defined within a similar categorization. These policies categorized as *push* policies, which focus on decreasing the private car usage levels by using disincentives such as congestion charging, fuel taxation, and physical regulations limiting the capacity and *pull* policies, which promote the use of alternative modes of transport by increasing the preferability of public transport and non-motorized modes of transport (Steg & Vlek, 1997). Meyer (1999) uses the metaphor of *carrots and sticks* to categorize the policies similarly. The common point of these negotiations is to decrease the attractiveness of private vehicle usage and increase usage of alternative modes. On the other hand, there are also policies that focus on energy improvements. These policies have an important role in minimizing the harmful effects of vehicles on climate change. At this point, it is important to highlight that sustainable transport policies aim to influence travel behavior. Details of these policies are elaborated on in the following sections.

3.2.1 Improvements on Alternative Modes of Transport (Pull Policies)

3.2.1.1 Improving Public Transport

Public transport (PT) has a vital role in competing with private vehicle usage. Unlike non-motorized modes of transport, public transport provides the opportunity to travel long distances as well as private vehicles. Therefore, well-planned and managed sustainable public transport systems may encourage the modal shift from private car usage to public transport when it provides a more practical and economical way of travel than private vehicles. For public transportation to be sustainable and reduce the emissions from passenger travel, the demand for public transport needs to be increased. Various factors affect the demand for public

transport. For instance, the quality of the public transport is one of the essential determinants of demand. Cities' spatial and social conditions such as land use patterns, density, income distribution are also essential determinants of a successful sustainable public transport system since these have an impact on determining the different characteristics of public transport systems in different cities (Tiwari, Jain, & Rao, 2015).

Public transport can reduce the transport sector's contribution to climate change since it is more energy-efficient and emissions per kilometer traveled are lower compared to private vehicles (Dalkmann & Brannigan, 2007). Kenworthy (2018) compares private and public transport's energy usage in a sample of 44 cities worldwide and illustrates the significant difference between private and public transport's energy consumption. In addition to the environmental impacts, public transport also impacts the social inequality issues by improving accessibility. It can provide mobility to people unable to use a car, such as children and disabled people.

In general, policies required to make public transport sustainable can be listed as follows:

- **Expansion of public transport infrastructure** can be categorized as building new public transport systems that do not exist before to create transit alternatives and additional implementations to the existing infrastructure, such as increasing the coverage area of any public transport network or re-designing the routes. New public transport investments may positively impact existing infrastructure when planned in a coordinated manner with the existing system. Since each urban area's geographical, economic and demographic conditions are different from each other, the efficiency of each transit system differs depending on the urban area. Therefore, careful pre-analysis needs to be completed to understand the existing and future needs of the urban area.
- **Improving service qualities** include both operational and physical improvements of public transport networks, such as improving frequency,

scheduling, comfort, and safety. These improvements affect the quality of public transport that plays an essential role in preferability. Since both private vehicles and transit services have direct costs such as energy costs and indirect costs like emissions, the most crucial way to increase the efficiency is to improve the service quality enough to convince private vehicle drivers to choose travel via public transport (Victoria Transport Policy Institute, 2018).

- **Integration of different public transport networks** is essential to maximize the efficiency of the overall public transport system of an urban area. Each public transport network is planned to meet the predicted demand. In addition, if different public transport systems are planned to support each other, the efficiency of the overall transit system may increase. Integrated scheduling, ticketing, and transfer can be given as examples of an integrated approach. On the other hand, public transport systems that do not work coordinated may negatively affect the system's efficiency. It may decrease the overall system's efficiency in terms of travel distance, monetary, and time cost. For instance, if the different public transport systems such as bus and tram do not integrated into each other in terms of route and scheduling, the overlapping routes may turn into loss.
- **Park-and-ride** is a system that aims to decrease the congestion in central parts that consist of parking facilities generally located at transfer stations with a lower fee or free and encourage drivers to use a transit system to reach from station to central parts. Park-and-ride systems can be designed as a part of transfer stations. They are planned as integrated into transit systems to reduce traffic congestion in urban areas where the city center of workplaces is located. In order to maximize the efficiency of the park-and-ride, a disincentivizing condition can be created for vehicle users to integrate with parking pricing policy by implementing comparatively higher prices in the city centers (Babalık, 2012). It can also decrease the environmental impacts of private vehicle usage, such as air and noise pollution in such areas. In the

literature, park-and-ride is both clarified as both apart from transfer centers and transfer station.

- **Pricing of public transport** is essential in terms of providing an affordable public transport service for all. If public transport becomes a cheaper option compared to private vehicle usage, it can increase the demand for public transport. Therefore, the pricing of public transport needs to be schemed by aiming to be affordable and encouraging. Various pricing schemes can be adopted, such as student discounts, daily/weekly/monthly/yearly tickets.
- **Ticketing of public transport** may encourage users to choose public transport since it can be beneficial in multiple ways. It is based on a smart system that integrates different systems together. Technological developments have influenced public transport ticketing and provided various alternatives such as smart cards, e-ticketing, and credit card. Smart cards are one of the well-known examples of ticketing in the contemporary approach. Technologically improved ticketing systems play an essential role in both pricing and integration of different public transport systems. Besides, the smart-ticketing system enables planners and decision-makers to collect information about the preferences of the citizens.
- **Priority lanes for public transport** aim to increase the efficiency of transit use by preventing public transport vehicles to be stuck in the traffic congestion. There is a difference on relocation of road spaces between conventional and contemporary transport planning approaches. In the conventional approach, road space is generally designed to increase the accessibility with private vehicle while in the contemporary approach, road space design also considers encouraging the transit use by using road design elements such as bus rapid transit (BRT) or high occupancy vehicle (HOV) (Victoria Transport Policy Institute, 2019). Priority lanes can be implemented by constructing new separated lanes and by reducing the capacity for private vehicles and shifting to priority lanes. Therefore, it can also be accepted as a push policy for private vehicle usage, since capacity

reduction may increase travel costs with private cars, such as travel time. The priority lanes can be designed as divided with barriers or semi divided with road paintings and lines to create a public transit vehicle only lanes.

- **Transfer stations,** also known as *mobility hubs,* are the terminals that integrate different modes of transport to increase accessibility and decrease the need for private vehicles (Victoria Transport Policy Institute, 2017). Bus, train, and ferry terminals are the best-known examples. In addition to integrating public transport networks together, transfer stations also integrate non-motorized transport when planned concerning the pedestrian and bicycle networks. In brief, transfer stations aim to solve urban transportation problems, such as congestion, by increasing the ability to travel without private vehicles.

3.2.1.2 Improving Non-Motorized Modes of Transport

Non-motorized transport is generally accepted as walking and cycling, which are typically combined in the literature since they share common features. Unlike motorized vehicles, walking and cycling are suitable for short and medium-distance travel. However, reducing the demand for motorized vehicles to travel within short distances and achieving the paradigm shift to non-motorized transport is essential for making urban transport sustainable and reducing the impact of urban transport on climate change.

Non-motorized modes of transport are one of the beneficial examples of mitigating with climate change. First of all, they are not fossil-dependent, which means that they are not responsible for transport sector-related emissions and energy consumption. Therefore, they do not have a direct negative effect on climate change. Secondly, walking and cycling cover less space in terms of parking and road area. Thus, these modes offer solutions on many urban transport problems, including congestion. Thirdly, it is known that walking and cycling have a positive impact on human health.

In the last decades, the increasing awareness of environmental considerations and private vehicle usage influenced governments to develop policies on increasing the preferability of non-motorized vehicles, especially in European cities. The Netherlands is one of the well-known examples. Successful policy interventions of the Dutch government between the 1970s and 1980s led the Netherlands to have well-planned bicycle routes, land-use, and transport plans supporting cycling (Page, 2005). The rate of people in the Netherlands who preferred cycling as a mode of transport for daily use is 36%, while the car usage rate is 45% (European Comission, 2014). The results show that even if non-motorized transport is insufficient to reach long distances, it can be highly preferable when successful policies are planned and implemented.

Elker (2002) states that in order to reduce demand for motorized vehicles, the factors affecting cycling and walking in a negative manner need to be eliminated. In other words, cycling and walking conditions need to be planned more attractive and advantageous than private car usage to reduce the demand for driving within short distances. The policies that need to be adopted in order to achieve this goal can be listed as follows:

- **Sufficient sidewalks** play a crucial role in designing a pedestrian network. Adequate width and quality to provide service for all people, including disabled people, play an important role in creating a demand for walking. If the sidewalks are qualified enough to prevent pedestrians from being harmed by motor vehicles passing from the road, their preferability may increase.
- **The continuity of pedestrian networks** is important to increase the quality of walking and decrease the safety risks. Any spatial area that promotes walking needs to be part of a network and be continuous in order for pedestrians to travel their final destinations by using the network.
- **Pedestrianization in the city center** can be accepted both as push and pull policies. It can be considered a push policy for motorized transport as it is created by the pedestrianization of roads used by motorized vehicles. At the

same time, it can also be considered a pull policy as it contributes to the non-motorized modes of transport and the pedestrian network. If pedestrianization projects are supported by public transport networks and integrated into the overall system, it can decrease the traffic volumes and increase the commercial vitality of the places in city centers (Goodwin, 1999). Besides, pedestrianization can result in better air quality in the implemented environment since it prevents the increase of the air pollution.

- **Planning pedestrian crossings** effectively decreases the risk of accidents and promotes the pedestrian network when located correctly. In other words, planning and integrating pedestrian crossings in the pedestrian network increases pedestrian accessibility and reduces the risks caused by encountering motorized vehicles.
- **Bike facilities** play an essential role in promoting cycling as they positively affect the quality of cycling. Bike facilities can be parks for storage, racks, road symbols, and lanes.
- **Cycling networks** provide citizens the ability to travel via bicycle. They can differ in terms of their design. For example, they can be fully separated or buffered. Therefore, bike lanes can be designed as separated, semi-separate, or integrated, such as bike lanes, bike boulevards, and shared systems. A safe and dense bike lane network is an essential element of promoting cycling as an alternative mode of transport.
- **Bike-share programs** provide available bicycles for citizens and to use in different times. Bike-sharing systems aim to increase the attractiveness of cycling by providing the service that allows citizens to rent a bike from a station and drop it off when they reach the final destination and eliminating the responsibilities of owning a bicycle such as buying, storing, and maintaining (Victoria Transport Policy Institute, 2018). Today, many cities successfully implement the bicycle sharing system.

3.2.2 Restrictions on Private Vehicle Usage (Push Policies)

Push policies aim to reduce the attractiveness of private vehicle usage. It is mentioned that pull policies make alternative modes more attractive, especially in terms of time and money. However, pull policies are not effective enough to reduce private vehicle usage by themselves. Therefore, push policies are essential to increase the cost of travel with a private vehicle. On the other hand, push policies need to be integrated with pull policies to prevent new urban transport problems. In other words, if the alternative modes are not offered, forcing individuals not to use their private vehicles will create new problems.

In this research, push policies are classified as *physical restrictions* and *pricing policies*. In addition, pricing policies include both national, such as taxation of vehicle ownership or fossil fuel usage and urban decisions. However, national policies are not examined since this study aims to evaluate urban transport policies mainly decided by local authorities.

3.2.2.1 Pricing Policies

Pricing policies are the travel demand management tools that aim to decrease private car usage by increasing the cost of using private cars in terms of money and time. Rodrigue et al. (2013) state that private vehicle users are generally not held responsible for the external costs of driving. Therefore, pricing policies, in addition to reducing demand on private vehicle usage, aim to internalize the social cost of traveling, such as greenhouse gas emissions or congestion, rather than focusing only on the individual cost of traveling (Dalkmann & Brannigan, 2007).

- **Parking charge** is an economic instrument of travel demand management. Basically, parking charges make users pay for using parking areas. The parking charge increases the cost of using private vehicles. Applying parking charges in the city centers or charging a higher price for long-term use improves the efficiency of limited parking places and helps to reduce private

car travel to the center (Elker, 2002). It can be coordinated with the other parking management instruments like parking supply. In addition, applying higher parking charges in the city centers may encourage the use of park-and-ride stations located in the central peripheries.

- **Congestion charging** is another economic travel demand management instrument that aims to control the balance between demand and capacity of the road and reduce the travel cost caused by traffic congestion. Economics and transport planners see congestion charging as an effective way to reduce road congestion (Eliasson, 2008). Road users pay the decided price to use the particular road or network. The aim here is to change the consumption pattern of the drivers by pushing them to use alternative routes or alternative modes. In 1975, Singapore became the first city to test the applicability of this approach. Entering the CBD was charged as one dollar that resulted in a rapid decrease in the number of private cars in the CBD by %73 (Lassiter, 2016)**.** There are various ways of congestion charging including, zone-based, distance-based, and road-based.

3.2.2.2 Physical Restrictions

Physical restrictions generally aim to decrease the accessibility with private vehicles while increasing the accessibility by non-motorized or public transport modes. These restrictions encourage using public transport and improving the quality of life and public spaces (Dalkmann & Brannigan, 2007). Generally, they are small-scale land use implementations such as pedestrianization, public transport prioritized roads, reduction in the road capacities, reducing the parking capacities, especially in the central zones. Reducing the road capacity is generally implemented with pedestrianization or public transport prioritized roads.

- **Reduction of parking spaces in city centers**, where congestion level is high, reducing the available parking capacity can help control the demand to travel to the city center by private vehicle. Knowing that citizens will face

difficulty finding a parking space can push them to use alternative modes of transport. On the other hand, alternatives need to be provided in advance so that reducing parking capacity does not lead to more significant urban transport problems. For example, the combination of the reduction in parking spaces and insufficient public transport may lead to larger problems.

- **Reducing the road capacity** can be understood as re-designing the existing road infrastructure in favor of non-motorized modes and PT, especially in urban centers, for distributing the high traffic volumes to the alternative roads (Elker, 2002). Changing the capacity of existing road infrastructure for motor vehicles may force private car users to travel via public transport as it decreases the travel time of public transport while increasing both traffic time and congestion for private cars. It can be designed as both territorial or road-based and can be exemplified as pedestrianization, prioritizing PT, and separation of road lines for cycling or PT. Therefore, reducing road capacity is also a pull policy for alternative modes of transport.

3.2.3 Energy Improvements

It is an undeniable fact that public or private vehicles are used and will be used in urban areas for transportation. For this reason, minimizing the environmental damage caused by the energies used by vehicles has a vital role in climate change mitigation. These policies aim to reduce emissions caused by energy usage by increasing energy efficiency and encouraging the elternative energy options that has a lower impact on climate. Even if the policies related with fuel economy and fuel quality is the realm of the national authority, local governments also started to take action on the energy of the vehicles passing their boundaries (IRENA, 2021). According to the purpose of this study, the policies that are implemented by local authorities es examined.

- **Restricting the usage of fossil fueled vehicles/ encouragments on clean energy vehicles** can be implemented by local governments in a few ways. For example, this can be adapted to congestion charging by gathering lower fee from the electrical vehicles in order to create low-emission zones. Another example can be given as proposing locations for electrical charging stations. The aim of this policy is to create a disincentive for fossil-fuel powered vehicles and incentive for clean energy powered private vehicles.
- **Promoting the usage of low-emission public transport vehicles** aim to promote the adaptation of clean energy powered public transport vehicles. Generally, local governments have the authority to make enforcement on public transport operators of their cities. A great number of cities have signed the "Fossil Fuel Free Streets Declaration" that includes a target on collaborating with fleet operators to shift zero emission vehicles (C40 Cities, n.d.).

3.2.4 Other Supportive Transport Policies

As mentioned in the previous chapters, there are various policies of travel demand management. It is mentioned that implementing restrictions on private car usage and improving alternative ways of travel is an essential part of travel demand management. In addition to these policies, some other policies promote the previously explained ones.

- **Information and Communication Technology (ICT)** can improve the demand management strategies by influencing travel patterns. The effect of ICT in urban transport can be examined in two ways. First, ICT may provide additional support to reduce the need for travel by providing stay-home options for various activities (Banister, 2007). For example, e-banking, e-marketing, and distance learnings. Second, ICT can influence the mode

choice by improving the quality of transport modes such as sensor technologies, data gathering, and monitoring. For instance, accessing the travel information via phone apps of public transport networks such as cost, schedules, fee, or smart card technologies improves the quality of public transport networks, which directly impacts the preferability. Until the last years, the efficiency of the ICT was a matter of debate. In 2019, the most important secondary problem of the Covid-19 pandemic became social distancing. It is observed that ICT became successful in solving the problems of a socially distanced life, with information and communication tools to provide online education, e-shopping, communication tools, working from home (Bajpai, Biberman, & Wadhwa). The Covid-19 pandemic showed that ICT can play an essential role on the future of human life and can be easily adaptable to the changing needs and trends.

- **Awareness-raising** on sustainable transport and the local transport modes is essential to encourage citizens to use alternative ways of travel. Informing citizens about the social, economic, and environmental impacts of travel is one of the popular ways of awareness-raising (Dalkmann & Brannigan, 2007). One of the most well-known awareness raising method examples is organizing events such as car-free days. Some cities celebrate the "International Car Free Day" every 22nd of September by banning cars from a specific area.
- **Alternative work schedules** aim to reduce the traffic volumes during the "peak hours." Most congested times are known as "peak hours" are generally two times a day which is the start and end time of the overtime period needs to be re-scheduled to distribute the traffic volumes at different times (Rodrigue, Comtois, & Slack, 2013). In other words, planning different work schedules for different sectors may reduce the traffic demand in the most congested times. In addition, it can decrease the travel time cost.

3.3 Sample Cases for Climate Change Mitigation

In the previous parts, how contemporary transport planning was shaped, the paradigm shift of the urban transport plans, and the policies that need to be adopted for climate change mitigation were explained. Dealing with the gap between theory and practice and the success of these implementations have potential to impact future decisions. Therefore, it is essential to observe the implementation of plans and policies. In this part of the study, sample cases for climate change mitigation are discussed to develop an understanding of the success of these approaches.

In 2012, the EU started to give SUMPs awards to encourage the adaptation of Sustainable Urban Mobility Plans. There are various examples of successful SUMPs implementations. In 2015, the 4th SUMP Award finalists were the Malmö, Utrecht, and Vienna. The SUMP of Utrecht has led many successful implementations. In The Urban Mobility Observatory (2017), also known as Eltis, some of the measures implemented are defined as "Creating more room for pedestrian, a new bike network with fewer stops, creating new public transport hubs, traffic management, speed limit, space for experimentation, a new approach to work, user-centered design." The implementations show the given importance of promoting alternative modes. This plan can be considered as an example of implementing theories into practice.

The finalist of the 7th SUMPs Award was the Basel, Switzerland. The plan is in the implementation phase. The plan's main aim is to reduce commuter traffic, deal with congestion, especially in peak hours, and promote alternative modes (Mourey, 2019). Thomas Mourey (2019) exemplified the implementation phase of the plan in his publish on The Urban Mobility Observatory by mentioning the Combi-ticket system that charges car parking and public transport to reduce the congestion in the city center, and the parking management system, also called as commuter funds that used for financing the projects such as Bike & Ride and Park & Ride. The main target of the SUMPs remains similar and can be defined as providing sustainable mobility for all the citizens while being respectful to the environment. Therefore, it is important to encourage governments to adapt these plans.

In addition to adopting such plans, adaptation and implementation of the urban transport policies that positively impact climate change mitigation is important. Congestion charging is one of these policies defined in the previous part. Congestion charging system of London is one of the well-known implementation examples. According to the sixth annual report of Transport for London (2008), the average speed in the inner city was less than 12 km per hour in 2002. In 2003, congestion charging was introduced in London. Comparing the emission rates between the years 2002 and 2003 shows a 13.4% reduction in nitrogen oxide emissions, a 15.5% decrease in the particulate matter, and a6.4% decline in carbon dioxide emissions (Transport for London, 2006). Besides, when the results of 2007 are compared with 2002, it is found that there is a 16% reduction in total vehicles entering the charging zone and 29% reduction in the entrance of chargeable vehicles (Transport for London, 2008).

Ticketing of public transport is mentioned as a pull policy that aims to increase public transport usage preferability. In 2012, with the help of CIVITAS, a new smart ticketing system was introduced in the city of Coimbra, Portugal. The smart ticketing system is covering different public transport operators and providing different pricing schemes. This investment increased the average operating revenues (+0,02 €/v-km) concluded by the increase in the public transport usage (+ 1,2% PT users) and a decrease in the private vehicle usage (CIVITAS, 2013). Besides, the decrease in the emissions and energy consumption per passenger (-0,24 MJ/pkm) helped climate change mitigation (CIVITAS, 2013).

The plans and the policies described as examples seem to have some common points. Both plans and policies align with the goals of promoting the usage of alternative modes and reducing private car usage. These goals are essential due to the role of the transport sector in climate change mitigation. The examples showed that the decisions can be implemented and can give successful results on mitigation.

This chapter explains how the transport sector shifted from a mechanical perspective to a contemporary perspective that focuses on travel behavior. Besides, it is

discussed how climate change mitigation that influenced the planning field is also influenced the transport planning. This chapter aimed to discuss the framework required for climate change mitigation to clarify this study's aim. In the next chapter, the methodology developed with respect to this framework required for the analysis carried out is expressed.

3.4 Concluding Remarks

As expressed throughout the chapter, the paradigm shift that occurred for transport planning is influenced by issues including environmental concerns and climate change. Adverse consequences of conventional transport planning that focuses from a technical perspective to the problems triggered the emergence of the contemporary approach that focuses on solving problems by mostly changing travel behavior. In other words, transport planning started to be accepted as a field that also has a social basis rather than only the engineering basis. Literature review showed that one of the reasons for this paradigm shift is the emergence of sustainability and increasing awareness of environmental issues.

The contemporary transport planning approach also influenced urban plans and caused different plan types to emerge, such as Sustainable Urban Mobility Plans. Urban transport plans share similar goals in the contemporary approach, such as reducing private vehicle usage, promoting alternative modes, increasing accessibility, reducing emissions, and environmental problems. These goals also shaped the urban transport policies required for climate change mitigation.

It is understood that struggling with climate change requires strong urban transport policies as urban transport is considered a source of the problem and a potential solution. For all of the mentioned policies, it can be said that using urban transport as a solution to climate change depends on the successful planning of the transport policies.

In this study, transport policies for climate change mitigation are categorized as improvements in alternative modes, private vehicle usage restrictions, energy improvements, and other supportive policies. A summary of the policies is represented in Table 3.4 below.

Table 3.4 Sum of transport policies for climate change mitigation

Improvements on Alternative Modes of Transport (Pull Policies)	Improving Public Transport	-Expansion of public transport infrastructure -Improving service qualities -Integration of different public transport networks -Park-and-ride
	Improving Non-Motorized Modes of Transport	-Pricing of public transport -Ticketing of public transport -Priority lanes for public transport -Transfer stations
		-Sufficient sidewalks -The continuity of pedestrian paths\sidewalks -Pedestrianization in the city center -Planning of pedestrian crossings -Bike facilities -Bike lanes -Bike-share programs
Restrictions on Private Vehicle Usage (Push Policies)	Pricing Policies	-Parking charge -Congestion charging
	Physical Restrictions	-Reduction of parking spaces in city centers -Reducing the road capacity
Energy Improvements	- Restricting the usage of fossil-fueled vehicles/ encouragement on clean energy vehicles	
	- Promoting the usage of low-emission public transport vehicles	
Other Supportive Transport Policies		-Information and Communication Technology (ICT) -Awareness-raising -Alternative work schedules

The table is also used as a framework for the creation of the evaluation table for the analysis of the urban transport master plans' policy packages. The primary purpose of this chapter was to represent a base for understanding the framework shown in the table. In the next chapter, correspondingly, the methodology of this research is clarified.

CHAPTER 4

METHODOLOGY

4.1 Introduction

In this chapter, the method and methodology of this study are explained in detail. As mentioned in the first chapter, this study aims to question whether the local authorities in Turkey have an awareness of climate change mitigation and successfully adopt the transport policies that positively impact climate change mitigation. Therefore, the research questions are formulated as follows:

- *Are there any policy targets that aim to reduce the negative impacts of the transport sector on climate change in the policy packages of transport master plans in Turkey?*
- *To what degree do proposed policies determine to mitigate the negative impacts? Do they draw attention to the problems on the local scale and offer any tangible implementations or system corrections, or are the problems mentioned without sufficient action plans? Or alternatively, do the proposed plans and policies ignore the link between urban transport and climate change?*

An appropriate methodology is chosen to answer these research questions. The questions are answered by analyzing the policy decisions of the twelve urban transport master plans in Turkey.

4.2 The Method of Analysis and Data Collection

Analysis of the written documents is required in this research to answer the questions. Therefore, conducting qualitative research is decided as the suitable

option. As a qualitative research method, content analysis is selected as the method of the analysis. Krippendorff (2004) describes content analysis as "…a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use" (p. 18).

It is important to note that field trips to cities where their plans were accessed and conducting interviews with responsible persons in the municipalities were also planned. However, these had to be canceled due to the restrictions caused by the Covid-19 pandemic. Therefore, it has been decided to carry out a more comprehensive and in-depth analysis of written documents as the main research method of this thesis.

The data collection method of this research is collecting written documents. In order to conduct a comprehensive study, transport master plans of twelve cities in Turkey are analyzed. The cities that have urban transport master plan in Turkey are determined by conducting internet research. It is understood that 23 cities have an urban transport master plan, except for cities that have contracting authority or that are in preparation stage. These 23 cities are as follows: Ankara, Antalya, Bursa, Diyarbakır, Erzincan, Erzurum, Eskişehir, Gaziantep, Hatay, İstanbul, İzmir, Kayseri, Kırşehir, Kocaeli, Konya, Malatya, Manisa, Mersin, Muğla, Rize, Sakarya, Samsun, Yalova. In Turkey, twenty-three cities have transport master plans. However, only a few of them are shared publicly. Therefore, I communicated with the municipalities that have transport master plans to solve this limitation problem. While some of the municipalities gave access to the plans, some of them did not. Therefore, the study is limited to the plans shared by municipalities and the ones accessed online. As a result, twelve plans are accessed out of twenty-three. The analyzed plan documents of the transport master plans are represented in table 4.1. The transport master plans of Ankara, Antalya, Eskişehir, Hatay, İstanbul, İzmir, Kayseri, Malatya, Manisa, Mersin, Rize and Sakarya are analyzed in this study.

Table 4.1 List of the analyzed transport master plans

1.	Ankara Transport Master Plan (2013-2038)
2.	Antalya Transport Master Plan (2014-2040)
3.	Eskişehir Transport Master Plan (2015-2035)
4.	Hatay Transport Master Plan (2016-2035)
5.	İstanbul Transport Master Plan (2011-2023)
6.	İzmir Transport Master Plan (2015-2030)
7.	Kayseri Transport Master Plan (2017-2030)
8.	Malatya Transport Master Plan (2017-2035)
9.	Manisa Transport Master Plan (2014-2034)
10.	Mersin Transport Master Plan (2016-2030)
11.	Rize Transport Master Plan (2016-2032)
12.	Sakarya Transport Master Plan (2013-2023)

The aim of the analysis is to question the relevance of the plans with climate change mitigation. The analysis is carried out in two steps. In the first step, the content of each plan document is scanned and checked to see if there was any reference to climate change mitigation. In the second step, how the policies of the plans were in line with the policies related to climate change mitigation is evaluated. To make this analysis, evaluation tables are created for each step.

4.3 Creation of The Evaluation Framework

In order to make a comprehensive analysis of the plans, two evaluation tables are determined. The first table is created to question whether key concepts related to climate change are considered in the plan. In other words, the table is created in order to understand whether these plans have an understanding of climate change mitigation or reducing the contribution of the transport sector to climate change. In the literature review, CO_2 emissions are stated as the major reason for climate

change. Also, environmental pollution is accepted as both reason and a consequence of climate change. Therefore, plans are scanned to find any referring to climate change, environmental pollution, and CO_2 emissions. If there are any referring to one of those concepts, the concept is marked with green while marked with grey if there are not any referring. These referring may consist of any strategy, goal, target, or calculation related to those concepts. The evaluation table about the content on climate change is represented in table 4.2.

Table 4.2 Evaluation table of the contents of transpor master plans

CONTENT ON CLIMATE CHANGE
Referring climate change
Referring environmental pollution
Referring CO_2 emissions

Mentioning	Not mentioning

The evaluation table for urban transport policies of the plans is presented below in table 4.3. I used the framework presented by transport policies to decrease the impact of urban transport on climate change in the previous chapter to determine and finalize the criteria. The policies are modified due to the legal authority of the municipalities. For example, alternative work schedules policy is not the responsibility of local authorities, therefore, not included in the evaluation table. In addition, in the literature review, it is mentioned that some of the pull policies can also be accepted as push policies since they require a reduction of the road capacity such as pedestrianization of city center. However, in the analysis, these policies are not accepted as push policies. Instead, policy decisions on road construction are analyzed and questioned whether there is a policy to reduce the road capacity.

Table 4.3 Evaluation table for urban transport policies of the transport master plans

IMPROVEMENTS ON ALTERNATIVE MODES OF TRANSPORT (PULL POLICIES)	
Improving Public Transport	**Improving Non-Motorized Modes of Transport**
Expansion of public transport infrastructure	Sufficient sidewalks
Improving service qualities	The continuity of pedestrian paths\sidewalks
Integration of different public transport networks	Pedestrianization in the city center
Park-and-ride	Planning of pedestrian crossings
Pricing of public transport	Bike facilities
Ticketing of public transport	Cycling network
Priority lanes for public transport	Bike-share programs
Transfer stations	
RESTRICTIONS ON PRIVATE VEHICLE USAGE (PUSH POLICIES)	
Pricing Policies	**Physical Restrictions**
Parking charge	Reducing the road capacity
Congestion charging	Reduction of parking spaces in city centers
ENERGY IMPROVEMENTS	
Low-Emission-Vehicles	
Restrictions on fossil fueled vehicles/ Encouragements on clean energy vehicles	

Detailed proposal	Only mentioning	Not mentioning

The policies are categorized under three headings: push, pull, and energy improvement policies. Pull policies are grouped under sub-categories of those that improve public transport and improve non-motorized transport. On the other hand, push policies are divided into two sub-categories as pricing policies and physical restrictions. The energy improvement category is not divided into any sub-category. Other supportive transport policies are not examined in this research since they

require national-level decisions rather than municipal ones. In order to make a comprehensive analysis, the evaluation table is prepared to be used in the analysis of each plan.

It is also decided to quantify the answers since the quality of proposals varies in each plan for each policy. That is to say, some policies that may help to mitigate climate change are proposed in detail, while others are only mentioned, or their necessity is highlighted. Therefore, when policies are proposed with satisfactory detail such as spatial determinations (e.g., route, station location, etc.), determined standards (e.g., cycling roads, capacity, sidewalk widths etc.), pricing schemes (e.g., pricing, ticketing policies, etc.), the term "Detailed Proposal" is used. For some policies, only the importance of adopting them is mentioned in the plan without any pre-study or detailed proposal in the policy package. If the policy is not proposed in detail but still mentioned, "Only Mentioning" is used. Lastly, if there is not any suggestion about a policy, it is marked as "Not Mentioning."

In the analysis chapter, it is also decided to represent the findings in a general evaluation table to make discussion from a more general perspective. Besides, to make a comparative analysis, the plans are graded due to their number of policies marked as "Detailed Proposal" and policies marked as "Only Mentioning." If a policy is marked as "Detailed Proposal," it got the point of 2. If a policy is marked as "Only Mentioning," it got the point of 1 while the point of 0 was assigned to those marked as "Not Mentioning."

In this chapter, the method and methodology of this study are expressed in detail. Before the analysis of the plans, in the next chapter, it decided to provide information on the current situation of climate change trends in Turkey and the legal framework related to transport planning and climate change in Turkey. Doing this aims to represent what kind of a framework is drawn in Turkey that affects the planning of the transport master plans.

CHAPTER 5

TRANSPORT PLANNING IN TURKEY.

5.1 Historical Background of Transport Planning

Urban transportation in Turkey has changed and developed over time as many countries. Factors such as rapid urbanization, technological developments, and changing lifestyles influenced this change. After the 1950s, the growing population in urban areas due to migration from rural areas to urban areas affected the urban forms and influenced the needs of these areas. This situation highlighted the importance of urban transport planning. Urban transport planning in Turkey can be categorized as three different periods according to the characteristics of the periods that are *before 1970, between 1970-1985* and *after 1985* (Öncü, 1993).

Before 1970, the conventional approach was shaping urban transportation. In other words, a fragmented rather than integrated approach was adopted, and solutions to urban transport problems were only particular to the problematic area. Besides, depending on the conditions of the period, short-term and area-based projects, such as the metro of İstanbul, are performed generally by foreign organizations (Özalp & Öcalır, 2008). As in other countries, Turkey's understanding of urban transport planning shifted from the conventional approach to the contemporary approach.

Between 1970-1985, transport planning started to be considered together with other plans and in a more comprehensive way itself. In the early 1970s, increased demand for alternative modes to the private vehicle due to the oil crisis increased the attention on the issues such as bus, rail system, pedestrianization, public transport ticketing, and an integrated approach is followed for more effective planning (Üstünışık & Bayazıt, 1996). As a response, in the mid-1980s, there was a growing demand for rail investments. The Ministry of Transport has been tasked with evaluating and approving rail system projects and specifications in accordance with Establishment

Law No. 3348 and has performed this with the General Directorate for The Construction of Railways, Ports Airways. Local governments had to prepare a transport study or urban transport master plan following a framework defined by the Ministry to approve urban rail projects to this institution (Öncü E. , 2007). This situation has spread the preparation of urban transport master plans until the responsibility for preparing these plans was legally given to the municipalities. Besides, master plans became more comprehensive, and studies on development scenarios and land-use decisions involved urban transport considerations (Özalp & Öcalır, 2008). The emergence of the understanding that transport planning is part of a planning field and needs to focus on human behavior as part of the discipline is accepted contrary to the belief that a mechanical approach can solve transport problems.

After 1985, steps were taken to meet the demand for the rail system. After the 1990s, the increasing rate of private car ownership due to the increase in household income brought back to the agenda the construction of light rail systems, which did not build before due to their high costs (Şenbil, 2012). The increasing demand caused central authorities to decide on making it compulsory to research to allocate resources for rail projects in metropolitan areas (Özalp & Öcalır, 2008). In other words, importance is given to rail projects to improve the transport systems in urban areas.

In the 2000s, the importance of the urban transport master plans and transport planning issues started to be included in the five-year development plans. In addition, the legislative framework for the preparation of the plans was developed. The given importance on relationship between transport sector, environmental and social issues such as accessibility, affordability, emissions, increased. These changes that occurred in the 2000s are discussed in the next subtitle.

Turkey's historical background of transport planning may also reflect the paradigm shift from a conventional approach to a contemporary approach. Unlike the well-known European and American cases, Turkey has experienced a different process as it is a developing country. Besides, the gap between decisions and implementation

is another developing country problem that needs to be addressed. On the other hand, urban transport planning has been supported by different regulations and laws up until now, and the importance of Transport Master Plans frequently has been mentioned in the five-year developed plans.

5.2 Administrative and Legislative Decisions on Transport Planning

The importance of urban transport planning and transport master plans in terms of energy efficiency and urban planning is mentioned in the five-year development plans. Five-year development plans are the plans prepared every five years in Turkey since 1962 and aim to plan the economic, social and cultural development of the country. Over time, legal regulations were explained in more detail, and the preparation of the transport master plan for cities under certain conditions became mandatory. These administrative and legislative decisions can be listed as follows.

- **Urban Transportation Sub-Commission Report of 8th National Development Plan (2001-2005):** The report states that municipalities are responsible for making and implementing master plans and transport plans within their municipal borders. Besides, municipalities are responsible for coordinating these two plans.
- **9th Development Plan (2007-2013):** In the plan, requirements for sustainable urban transportation that works in harmony with the other dimensions of the city are described, such as housing, environment, and energy. Besides, the main targets of urban transportation are mentioned as follows:

> *Urban transportation planning, which provides equal opportunities for all segments of the society, provides safe and continuous pedestrian movement, protects public interest, minimizes foreign dependency by utilizing domestic resources, and is participatory, sensitive to the environment*

and productive in economical terms, will be made. (pp. 85-86)

To achieve the level of sustainable urban transportation, the importance of encouraging alternative modes of transport is stated in the report as "towards creating a sustainable urban transportation system within the EU harmonization process, pedestrian and bicycle transportation and public transportation modes will be prioritized and the use of these modes will be encouraged" (T.C. Kalkınma Bakanlığı, 2007). These instructions demonstrate the increasing awareness of the importance of sustainable urban transportation.

- **10th Development Plan (2014-2018):** One of this plan's main objectives is to provide energy-efficient, environmentally friendly, and easily accessible urban transportation infrastructure that is compatible with land-use decisions as a response to traffic problems in cities. The plan highlights the importance of integration between different modes of transport. In order to achieve the goals, the plan proposes a corridor approach. It gives priority to transportation systems that ensure energy efficiency, clean fuel, and environmentally friendly vehicle use. Moreover, it states that alternative ways of transport such as walking and cycling should be encouraged.
- **Urban Transportation Sub-Commission Report of 11th National Development Plan (2019-2023):** The report mainly focuses on environmental problems, such as CO_2 emissions and climate change, caused by the transport sector. The report proposes adopting sustainable transport policies with respect to the Sustainable Development Goals (SDGs). The importance of the transport policies which aim to provide a human-oriented development rather than car-oriented is mentioned. Briefly, it is said that paying attention to sustainable transport policies might be an effective solution to the current urban transportation problems and the environmental problems caused by the transport sector. It can be accepted that the plan gives

the most importance to issues such as sustainability, climate change, and energy efficiency from the transportation perspective is the 11th Development Plan.

- **Municipality Law No. 5393:** According to Article 14, municipalities are responsible from the urban transportation infrastructure and urban traffic problems in cities. Besides, according to the Article 15, municipalities are able to establish all kinds of public transport systems including buses, sea transportation, and rail systems in order to provide public transport.
- **Metropolitan Municipality Law No. 5216:** According to the seventh article of the law, one of the duties, authority, and responsibility of the metropolitan municipalities is the preparation and implementation of Transport Master Plans. Besides, planning any kind of public transportation including sea and rail, parking management, and traffic regulations, when needed, are additional responsibilities of the metropolitan municipalities.
- **Regulation on Procedures and Principles for Increasing Energy Efficiency in Transportation:** This regulation has been prepared in accordance with Energy Efficiency Law No. 5627 dated 18/4/2007. It is stated that metropolitan municipalities and other municipalities with more than 100,000 population prepare sustainable urban transportation master plans with respect to the National Transportation Master Plans. These plans must be evaluated every five years. Besides, these plans need to be prepared according to the *Guideline of the Preparation of Transport Master Plans* that mainly focuses on sustainable urban transportation.
- **Republic of Turkey National Climate Change Action Plan 2011-2023:** Higher Planning Council approved the plan in 2010. Seven sectors are defined in the plan for classifying the purposes and objectives as energy, building, industry, transportation waste, agriculture, land use, and forestry. In addition, adaptation strategies are categorized under the titles of management of water resources, agriculture sector and food security,

ecosystem services and biodiversity and forestry, natural disaster risk management, and public health.

The debate about the applicability of the national policies as successful practices is also valid for Turkey. In the five-year development plans, environmental issues are generally mentioned as one of the primary considerations. However, it is observable that national implementations generally consider the economic consequences. Contradictions arise between legal frameworks such as five-year development plans and climate change action plans, as policies between different institutions is not compatible with each other (Öncü & Yıldız, 2011). Besides, in 2013, climate change action plan evaluation report called "İklim Değişikliği Eylem Planı Değerlendirme Raporu" is prepared and published by Tüketiciyi ve İklimi Koruma Derneği with the support of Heinrich Böll Stiftung Association Turkey representative office. The report evaluated the Republic of Turkey National Climate Change Action Plan 2011-2023. In the report, a total of 86 actions in the plan, which are intended to be completed by 2012 and 2013, have been evaluated, and it is stated that the plan has failed in the implementation stage (Tüketiciyi ve İklimi Koruma Derneği, 2013).

5.3 Urban Transport Master Plans in Turkey

The Law numbered 5393, and the Law numbered 5216 indicates the importance of preparing urban transport master plans in Turkey. In general, transport master plans can be prepared at different scales, including national, regional, or urban. In Turkey, apart from the national transport plans that act as a framework for urban scaled transport plans, transport master plans are usually prepared at the urban scale by municipalities. Turkey Association of Municipalities prepared a guideline for the preparation of the transport master plans in Turkey. The guideline defines transport master plans as the plans that aim to solve the traffic problems, within the target years, for both vehicles and pedestrians and improve the current conditions by using demand forecasting models and by considering environmental, economic, and social issues (Türkiye Belediyeler Birliği, 2014). The transport master plans' target periods

are generally divided into short-, medium-, and long-term periods. In addition, the transport decisions can be divided into macro and micro-scaled decisions depending on the vision of the plan.

The guideline also discussed that urban transport master plans need to be prepared in coordination with master development plans so that they are compatible with each other. For example, the future projections given in the master development plans, including population, density, employment, number of students, and land-use decisions, need to be considered in the making of urban transport plans. Besides, medium and long-term period decisions need to be decided in accordance with the master development plans. The urban transport master plan might remain far from the solution unless it is based on the master development plan (Türkiye Belediyeler Birliği, 2014). If prepared in coordination, the transport master plans can also help test and assess the main spatial development decisions of master development plans.

The guideline defines the steps of preparing an urban transport master plan as follows:

1. Analysis of the current situation,
2. New data collection and analysis,
3. Predictions and model development for traffic demand,
4. Target year projections,
5. Determination of problems and bottlenecks in the target year,
6. Development and evaluation of the alternatives,
7. Preparation of selected alternative as Transportation Master Plan (Türkiye Belediyeler Birliği, 2014).

The preparation process of all transport plans in Turkey follows a similar process. I clarify these steps briefly below. However, the purpose of my analysis is to focus on the contents of the transport master plans rather than these steps. Analysis of the current situation is the first step. It focuses on analyzing the general features of the urban area, such as geographical aspects, population, density, trip distribution, and household income. In other words, the first step is the analysis of the already

available data gathered from different institutions. New data collection and analysis is the second step that aims to define the travel patterns. In the scope of the transport master plans, the travel patterns are determined by conducting surveys for dense travel patterns such as house-office or house-school to make future estimations (Babalık, 2012). Therefore, the second step consists of surveys that represent the travel pattern of the urban area. The third step is based on making predictions for future demand and model development. Transport master plans are generally prepared by using a four-stage transport planning model. These stages are trip generation, trip distribution, modal split, and traffic assignment, respectively (Babalık, 2012). In short, the third stage involves estimating the number of trips produced in each spatial area, distribution of these trips to the existing or planned networks, estimating the proportion of trips made by public transport and private vehicle, and route selection of predicted trips. This step is necessary to make essential calculations before the preparation of the transport master plan decisions. The fourth step is the target year projections to understand the expected changes in macro form, land-use, socio-economic structure, and therefore travel demands in the target year (Türkiye Belediyeler Birliği, 2014). The fifth step is determining problems and bottlenecks in the target year after the target year projections. One of the key features of planning is problem-solving. Transport planning focuses on producing solutions for both existing and projected problems. Unlike the conventional approach, contemporary transport planning solutions are based on designing solutions without feeding the predict and provide cycle. Therefore, policymakers need to create a modal shift from private vehicle usage to alternatives by analyzing the existing situation and future projections. In the sixth step, the main target is the development and evaluation of alternative scenarios. In Turkey, transport master plans are typically expected to adopt the contemporary approach and develop well-suited scenarios to create the modal shift. Since the needs of the cities are different from each other, choosing the most efficient alternative scenario can be a good solution as well as focusing on designing the best scenario. Therefore, this step might vary depending on the decision of transport planners. In the final step,

development and evaluation of the selected scenario as a transport plan and creation of the transport master plan report are aimed.

In the last decades, Turkey started to face the adverse outcomes of rapid urbanization. As a response, transport master plans in Turkey include decisions on travel demand management. This resulted in a comprehensive approach to be adopted with environmental and social considerations.

5.4 SUMPs Current Situation in Turkey

Although there are no current legislations, and requirements regarding SUMPs in Turkey, in 2015, the "Livable Cities Symposium" was organized, in which 16 representatives from metropolitan municipalities in Turkey participated to evaluate Turkey's current situation about SUMP and sustainable urban transportation. Moreover, the strengths, weaknesses, opportunities, and threats of the cities were discussed from the perspective of sustainable transportation and SUMPs (WRI Türkiye Sürdürülebilir Şehirler, 2015). Some of the transport master plans are prepared by adopting the concept of sustainability and the main principles of SUMPs. Eskişehir Transport Master Plan is known as the first plan compatible with SUMPs (WRI Türkiye Sürdürülebilir Şehirler, 2015).

In 2019, SUMPs were mentioned as the future of transport plans that consider carbon emissions, environmental issues, and safety (TBB, n.d.). The application of Ankara, İstanbul, İzmir, İzmir, Trabzon, Kahramanmaraş Municipalities' are accepted as priority projects by the Ministry of Transport and Infrastructure and, in this context, it was announced that 25 million Euro funding will be allocated to municipalities by the European Union to support the implementation of these projects and to reduce the private car usage (TBB, n.d.). Applications of the mentioned local authorities for the preparation of the Sustainable Urban Mobility Plans can be accepted as an important step for the adaptation of the SUMP concept in Turkey.

5.5 Current Transport Sector Related Climate Change Trends in Turkey

Turkey faces the consequences of rapid urbanization like many other countries. In the previous chapters, I elaborated on the negative impacts of rapid urbanization. In short, the increase in population, especially in urban areas, causes a change in the production and consumption cycles to respond to the demand. In return, an ongoing increase in the energy consumption patterns negatively influence the emission rates. The transport sector has parallels in terms of global energy consumption and emission trends.

In Turkey, a significant proportion of energy is derived from fuel combustion, which negatively impacts emissions. Figure 4.1 represents the CO_2 emissions from fuel combustion by sector in 2018. It is seen that the transport sector is responsible for 23% of the emissions. Between 1990 and 2018, the CO_2 emissions caused by the transport sector increased more than three times (TUIK, 2021). One of the reasons for this rise might be the wrong responses to the rapid urbanization. In other words, decisions made without sufficiently considering the environmental consequences may be the cause of this situation For instance, increasing the capacity to meet the demand is a solution in the short term but an incentive for private vehicle use in the long term, might be one of the responsibles for this rise.

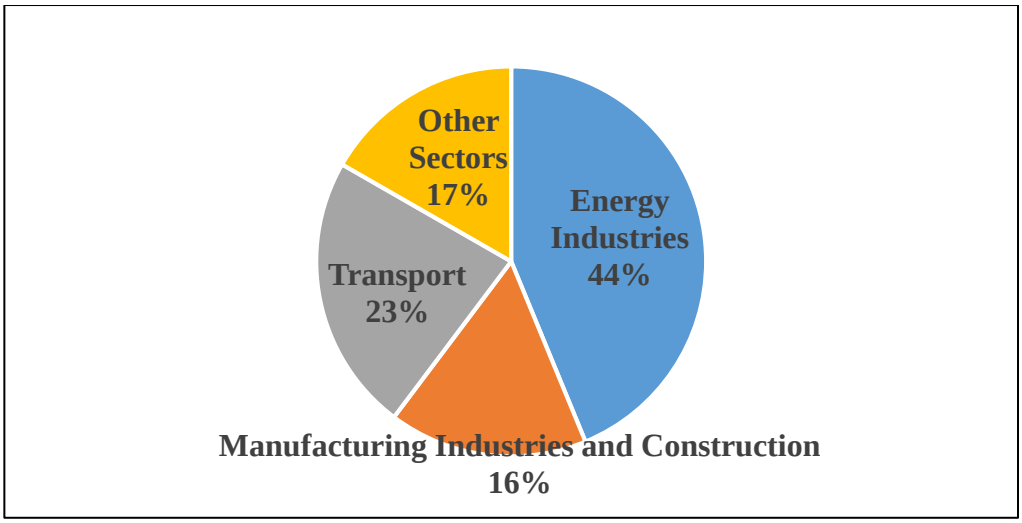

Figure 5.1 The percentage of CO2 emissions from fuel combustion by sector in 2018 for Turkey (TUIK, 2021)

It is argued that share of road transport on emissions is highest compared the other sub-sectors of transport in global trends. Table 4.2 represents the share of sub-sectors on CO_2 emissions in Turkey for 2016. According to the Ministry of Environment and Urbanization (2018), in Turkey, similar to the global trends, road transport is the highest contributor to emissions. Private cars are difficult to manage unlike the public transport systems as they are high in number and under individual responsibility. Therefore, road transport is difficult to manage from the perspective of climate change. Well-planned and implemented transport decisions are required to decrease the emission levels of road transport.

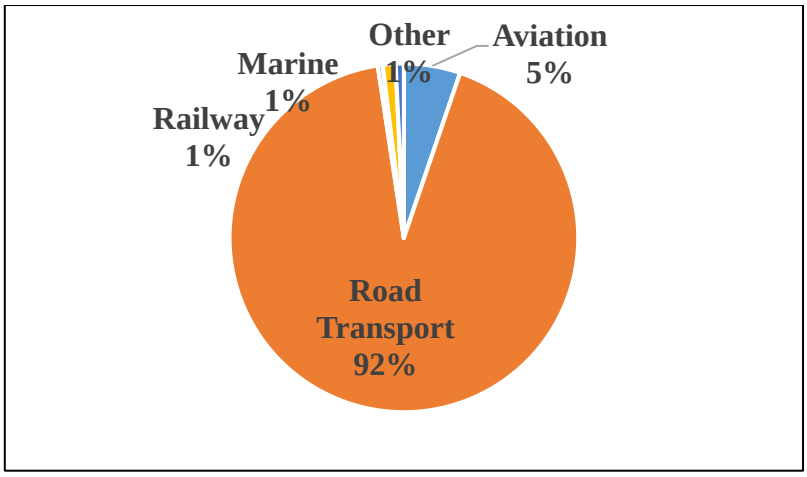

Figure 5.2 CO_2 emission by transport sub-sectors in 2016 in Turkey (kiloton CO_2 equivalent) (Ministry of Environment and Urbanization, 2018)

Energy consumption patterns also follow similarities with global trends. Figure 4.3 shows the share of energy consumption by sector in 2018 in Turkey. According to the International Energy Agency (2019), the transport sector's share of energy consumption is around 24% in Turkey. Dependency on fossil fuels has a negative effect on climate change as discussed above. As in other nations, most of the energy required for the transport sector in Turkey is generated from fossil fuels that are non-renewable and have high emission levels.

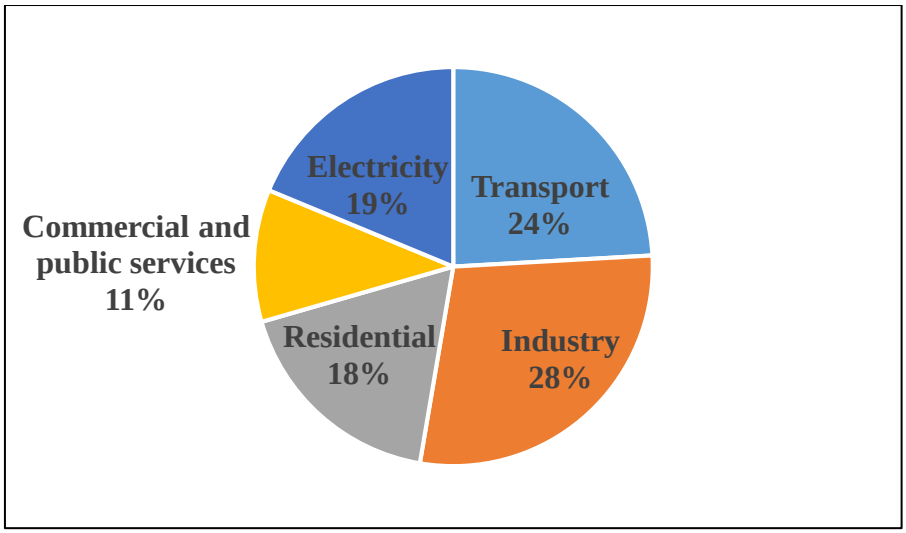

Figure 5.3 Share of energy consumption by sector in 2018 in Turkey (IEA, 2019)

Similar to emission patterns, road transport is responsible for the 93% of the transport sector's energy consumption, as seen in Figure 4.4. Road transport, which plays an essential role in ensuring mobility in the country, is the most energy-incentive sub-sector.

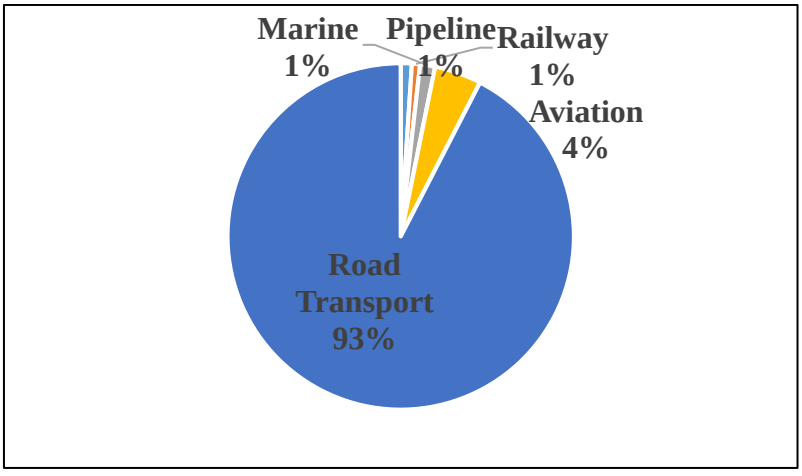

Figure 5.4 Energy Consumption by Transport Sub-sector in 2018 (Thousand TEP) (Ministry of Environment and Urbanization, 2018)

Energy consumption and emission rates in other sectors and sub-sectors of transport are discussed so far. It can be said that the impact of the transport sector on climate change is undeniable. Also, road transport is the key sector that needs to be focused. Figure 4.5 illustrates the number of road motor vehicles between 2002 and 2021 in Turkey. The number of private cars have the highest increase compared to the other road vehicles. In the previous chapters, problems that emerged from increasing private vehicle usage is discussed in detail from the global perspective. Cities in Turkey also experience the same problems in the last decades. Responding to high demand by increasing the road capacity has made private car usage more preferable than the other modes.

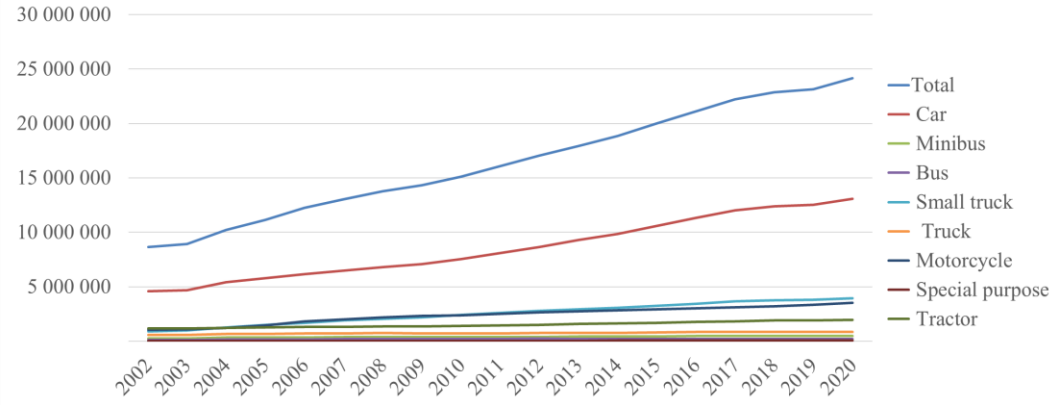

Figure 5.5 The number of road motor vehicles by years, 2002-2021 in Turkey (TUIK, 2021)

Due to the rate of private car usage, road transport has a negative impact on climate change in terms of energy consumption and emissions. One of the most efficient tools for dealing with these problems is the urban transport master plans. Previous discussions show that two critical issues need to be considered for the success of the plans. Firstly, urban transport master plans need to adopt sustainable urban transport policies that encourage sustainable and alternative modes and discourage private vehicle usage. Secondly, urban transport master plans should aim to minimize the

negative impact of urban transport on climate change. In other words, policymakers need to be aware of the relationship between climate change and the transport sector. These two issues are essential to achieve the goals of the plans.

5.6 Summary and Discussion

In this chapter, transport planning in Turkey is expressed. From the historical perspective, it is understood that the development process of the transport sector is triggered by problems and the needs of rapid urbanization trends in Turkey. Like many nations, it is seen that Turkey is faced with an increase in private car usage. Especially in the period after 1985, this problem has caused the transport sector to draw attention. As a response, urban transport planning is supported by different legislations and laws and mentioned in the five-year development plans.

Especially the law numbered 5393, and the law numbered 5216 played a vital role in the preparation of urban transport master plans in Turkey by giving authority to municipalities. In addition, the Turkey Association of Municipalities clarified the steps of preparing an urban transport master plan as mentioned in the previous sub-section. However, this guideline describes how the plan should be prepared while there is limited explanation regarding the content of the plans, such as incorporation of policies for the adoptation of sustainability, climate change mitigation, or environmental issues. In addition, the related described laws in this chapter do not draw a framework about the content of the plans, while it is seen that five-year development plans only highlight the importance of adopting sustainable transport. Lack of a detailed framework on the contents of the urban transport master plans might have a negative impact on climate change mitigation. On the other hand, it is understood that SUMPs which have a detailed framework on the contents of the plans started to be adopted worldwide and very recently in Turkey (still at preparation stage for any Turkish case).

When the current transport sector-related trends in Turkey are examined, it is seen that the guidelines related to the contents of these plans may play a role in climate change mitigation and reducing the environmental impacts of the transport sector. In the next chapter, analysis of the contents and policy packages of the twelve urban transport master plans will be examined in order to understand whether they have content on understanding relevant to climate change mitigation.

CHAPTER 6

ANALYSIS OF URBAN TRANSPORT MASTER PLANS IN TURKEY

6.1 Introduction

Developing sustainable solutions to urban transport problems is crucial to achieve sustainable development and to decrease the impacts on climate change. It is one of the vital characteristics of the contemporary approach. On the other hand, it is challenging to design and adapt the general concepts determined in the global or national frameworks as implementable local scaled transport policies. One of the best ways to understand Turkey's consideration of these issues is to evaluate the urban transport master plans. Analyzing the transport master plans' policy packages and contents to understand Turkey's current phase in this regard is the main objective of this research. Evaluating Turkey's current situation by questioning the concerns on reducing the effects on climate change have been adopted, is an essential contribution to the success of the future phases. Therefore, this chapter represents the analysis of the transport master plans' contents and policy packages of the selected cities in Turkey.

In this research, urban transport master plans of the Turkish cities are analyzed as the case studies to make an analysis and evaluate their policy packages from the perspective of climate change mitigation. In the first part of the analysis, each city's urban transport master plans are analyzed based on their contents and transport policies mentioned in the methodology chapter. The primary purpose of this analysis is to understand the degree of consideration on reducing the impacts of the transport sector on climate change for each plan. The second part of the analysis includes a common evaluation of all the urban transport master plans' policy packages. The primary purpose of the common evaluation is to make a general overview of the situation of the cities in Turkey.

6.2 Analysis of the Selected Cities

The Metropolitan Municipality Law numbered 5216, clearly stated that metropolitan municipalities are responsible for preparing the transport master plans. Besides, Municipality Law numbered 5393 clarifies urban transport infrastructure and urban transport problems as some of the responsibilities of municipalities. Thus, the preparation of the urban transport master plans is the responsibility of municipalities. In Turkey, there are 30 metropolitan municipalities. However, twelve plans out of twenty-three could be accessed because most of the plans are not open to public and there is no regulation on sharing them and because not every metropolitan city has a transport master plan. Table 6.1 shows the transport master plans of the cities analyzed in this research listed in alphabetical order. All the cities are in the metropolitan municipality category except for the Rize municipality.

Table 6.1 Analyzed Transport Master Plans

	Province	**Name of The Plan**	**Preparation Year**	**Target Year**	**Prepared By**
1	Ankara	Ankara Transport Master Plan	2013	2038	KUTEM
2	Antalya	Antalya Transportation Master Plan	2014	2040	Boğaziçi Proje Mühendislik A.Ş.
3	Eskişehir	Eskişehir Transportation Master Plan	2015	2035	ITU-Eskisehir Osmangazi University
4	Hatay	Hatay Transport Master Plan	2016	2035	ITU
5	İstanbul	Istanbul Metropolitan Area Transportation Master Plan	2011	2023	JICA

Table 6.1 (continued)

6	İzmir	Izmir Transportation Master Plan	2015	2030	Boğaziçi Proje Mühendislik A.Ş.
7	Kayseri	Kayseri Transportation Master Plan	2017	2030	EMAY International Engineering and Consultancy Inc.
8	Malatya	Malatya Transportation Master Plan	2017	2035	Altyapı Mühendislik
9	Manisa	Manisa Transportation Master Plan	2014	2034	Mescioğlu Müh.
10	Mersin	Mersin Transportation Master Plan	2016	2030	Boğaziçi Proje Mühendislik A.Ş.
11	Rize	Rize Transportation Master Plan	2016	2032	KUTEM
12	Sakarya	Sakarya Transportation Master Plan	2013	2023	Mescioğlu Mühendislik

Table 6.1 illustrates that the preparation years and the target of the plans are compatible. Besides, all the plans were prepared after 2010. Therefore, adopting the contemporary approach can be expected from the plans.

6.3 Comparative Analysis of the Selected Transport Master Plans

6.3.1 Evaluation of Ankara Transport Master Plan (AUAP, 2013)

Ankara is the second populated city in Turkey and the capital since 1923. It is located in Central Anatolia as seen in Figure 6.1. These characteristics influenced the internal migrations to the city, which disrupted urban planning in the 1950s. The increasing population in Ankara changed the construction sector and caused a more fragmented and rapid development in the urban area. In addition, transit investments that did not

meet the speed of the changing macro form increased private car usage. The population of Ankara was 5,045,083 in 2013 when the plan was prepared and is 5,663,322 as of 2020 (TUIK, 2021).

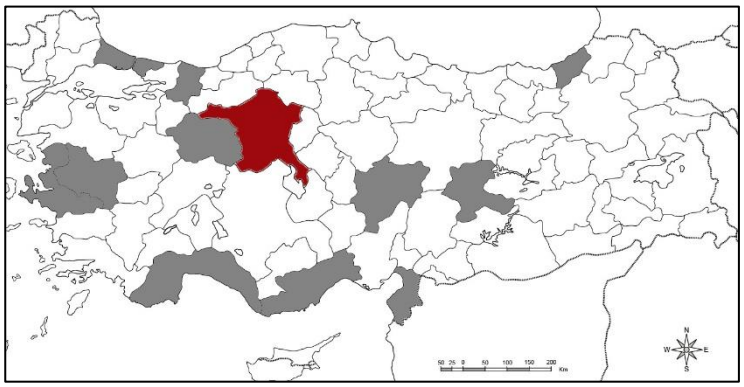

Figure 6.1 Geographical location of Ankara

The Ankara Transport Master Plan (AUAP) is prepared by Transportation Master Plan Office established by Gazi University in order to prepare a transport master plan for Ankara. The name of the office is changed to Urban Transportation Technology Accessibility Implementation and Research Center, known as KUTEM, in 2015. The central vision of the plan is to achieve *sustainability* by adopting compact, concentrated, and public transport-oriented urban development approaches.

The aim of adopting the compact and concentrated approach is to contribute sustainability by reducing the energy consumption and emission rates by reducing travel distance of car journeys and contributing to the efficient use of urban lands. The aim of adopting a public transport-oriented approach is to concentrate the urban population around points where public transport accessibility is provided. However, in the AUAP, it is clearly stated that there are difficulties in adopting a compact and concentrated approach for Ankara, which has already entered sprawl from the compact structure. Therefore, the main focus of the plans is to provide sustainability by focusing on urban public transport.

In the plan, four different scenarios were evaluated that are do-nothing, road infrastructure development, rail system development and hybrid system development scenarios. One of the parameters used to evaluate the different scenarios is the environmental cost of each scenario. As a result, hybrid system development scenario is selected which has the minimum environmental cost such as pollution, CO_2 emission and energy costs. In addition, the scenario aims to deal with the threats mentioned in the SWOT analysis that are inefficient use of energy and dependence on fossil fuels. Therefore, as seen in the table 6.2, it can be concluded that the plan mentions environmental pollution and CO_2 emissions while does not directly mention about climate change.

Table 6.2 Evaluation table of Ankara Transport Master Plan for the content on climate change

CONTENT ON CLIMATE CHANGE
Referring climate change
Referring environmental pollution
Referring CO_2 emissions

Mentioning	Not mentioning

Table 6.3 represents the sum of the evaluation of the policies of Ankara Transport Master Plan on the basis of the transport policies aim to reduce the impact on climate change defined in the literature review.

Table 6.3 Evaluation table of Ankara Transport Master Plan (AUAP)

IMPROVEMENTS ON ALTERNATIVE MODES OF TRANSPORT (PULL POLICIES)	
Improving Public Transport	**Improving Non-Motorized Modes of Transport**

Table 6.3 (continued)

Expansion of public transport infrastructure	Sufficient sidewalks
Improving service qualities	The continuity of pedestrian paths\sidewalks
Integration of different public transport networks	Pedestrianization in the city center
Park-and-ride	Planning of pedestrian crossings
Pricing of public transport	Bike facilities
Ticketing of public transport	Cycling network
Priority lanes for public transport	Bike-share programs
Transfer stations	
RESTRICTIONS ON PRIVATE VEHICLE USAGE (PUSH POLICIES)	
Pricing Policies	**Physical Restrictions**
Parking charge	Reducing the road capacity
Congestion charging	Reduction of parking spaces in city centers
ENERGY IMPROVEMENTS	
Low-emission public transport vehicles	
Restrictions on fossil fueled vehicles/ Encouragements on clean energy vehicles	

Detailed proposal	Only mentioning	Not mentioning

First of all, urban transport policies about *improvements on alternative modes of transport* or *pull policies* are evaluated under the sub-categories *of improving public transport* and *improving non-motorized modes of transport.* In the AUAP, the importance of public transport, especially the rail systems, is frequently highlighted. One of the most detailed transport policies is about expanding the public transport infrastructure, especially the rail systems including metro and commuter train. The plan includes decisions about the new stations planned to be added to the existing infrastructure. Besides, new transport system investments are also mentioned in the plan. The document includes surveys and analysis in order to plan the new routes and new route proposals. Besides, improvements in the quality of public transport in

terms of capacity and comfort is mentioned. The plan includes decisions about the locations of park-and-ride stations as part of the public transport investment.

In terms of *improving non-motorized transport*, AUAP includes policies based on improving pedestrian and cycling conditions. Current situation analysis and assessments and pedestrianization proposals are mentioned in the Pedestrians Transport Master Plan sub-report of the plan document. The streets planned to be pedestrianized in the city center are described. The plan highlights the importance of the quality of pedestrian routes such as road signs, sufficient sidewalks, pedestrian crossing, continuity of the paths without giving spatial details, and proposing standards. The AUAP mentions the preparation of the Bicycle Master Plans as a priority need to encourage cycling and integrate with public transport. The plan includes surveys and analysis about the demand for cycling and proposes cycling routes in a detailed way. However, the bike-share program and planning of the biking facilities are only mentioned without detail.

Secondly, policies related to the *restrictions on private vehicle usage* or *push policies* are evaluated as *pricing policies* and *physical restrictions.* The AUAP mentions the necessity of the Parking Transport Master Plan. Predictably, the demand for parking in the city center is higher during working hours. The AUAP proposes parking charges in the central part of the city and reducing the parking space in the long run without giving any spatial decision. In other words, parking policies are mentioned only as a suggestion.

In terms of promoting clean energy, plan does not include detailed proposals. The usage of clean energy is only mentioned. In the current situation analysis phase, different energy resources are compared in terms of environmental efficiency. However, as the plan focuses on improving rail systems, there is not any detail proposal on energy source of the wheeled public transport infrastructure while energy cost of rail systems is only calculated without explaining the type of resource.

Making a general evaluation for the Ankara Transport Master Plan's consideration on the impacts of urban transport on climate change is another aim of this research.

It is stated that the vision of this plan is to achieve sustainability. Besides, the plan aims to promote public transport and decrease travel distances to reduce the emission rates caused by road vehicles. It can be said that the plan does not include detailed studies on climate change, but decreasing emission is implicitly mentioned.

6.3.2 Antalya Transport Master Plan (ANT-UAP, 2014)

Antalya is located in the Mediterranean Region of Turkey, as seen in figure 6.2. Antalya is the fifth most populated city of Turkey, with a population of 2,548,308 in 2020 and 2,222,562 in 2014, which is the preparation year of Antalya Transport Master Plan (TUIK, 2021). Antalya is one of the touristic cities of Turkey due to its' history and climate. The rapid developments over the decades caused urban transport problems like many other cities. As a response, Antalya Transport Master Plan is prepared in order to find solutions to these problems. The plan is prepared by Boğaziçi Proje Mühendislik A.Ş. The target year of the plan is 2040.

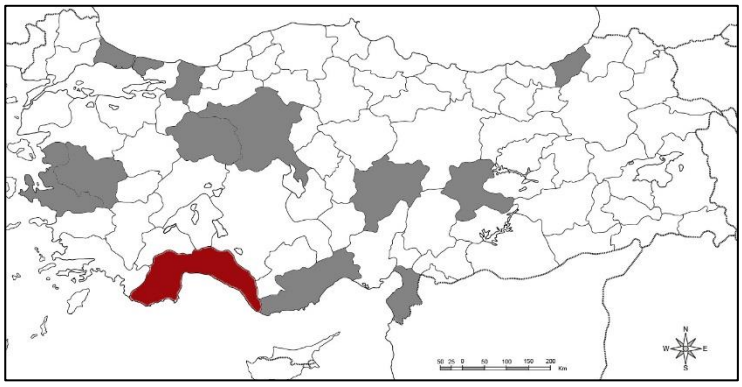

Figure 6.2 Geographical location of Antalya

The plan aims to decrease the increasing rate of private vehicle usage and trips in the long-term by improving public transport. Achieving sustainability is one of the general targets of the plan in terms of environmental, social, and economic

perspectives like most of the plans. On the other hand, as seen in the table 6.4, even if the plan mentions the adaptation of sustainability and decreasing the private vehicle usage, the context analyses showed that there is not any mentioning about climate change, environmental pollution or emissions. The reason of this might be the given importance to increase the preferability of alternative modes rather than improving the efficiency of the system.

Table 6.4 Evaluation table of Antalya Transport Master Plan for the content on climate change

CONTENT ON CLIMATE CHANGE
Referring climate change
Referring environmental pollution
Referring CO_2 emissions

Mentioning	Not mentioning

Table 6.5 shows the evaluation of the urban transport policies of the Antalya Transport Master Plan concerning the transport policies that focus on climate change considerations. In the plan, efficient proposals of the discussed scenarios are combined rather than selecting one scenario.

Table 6.5 Evaluation table of Antalya Transport Master Plan (ANT-UAP)

IMPROVEMENTS ON ALTERNATIVE MODES OF TRANSPORT (PULL POLICIES)	
Improving Public Transport	**Improving Non-Motorized Modes of Transport**
Expansion of public transport infrastructure	Sufficient sidewalks

Table 6.5 (continued)

Improving service qualities	The continuity of pedestrian paths\sidewalks
Integration of different public transport networks	Pedestrianization in the city center
Park-and-ride	Planning of pedestrian crossings
Pricing of public transport	Bike facilities
Ticketing of public transport	Cycling network
Priority lanes for public transport	Bike-share programs
Transfer stations	
RESTRICTIONS ON PRIVATE VEHICLE USAGE (PUSH POLICIES)	
Pricing Policies	**Physical Restrictions**
Parking charge	Reducing the road capacity
Congestion charging	Reduction of parking spaces in city centers
ENERGY IMPROVEMENTS	
Low-emission public transport vehicles	
Restrictions on fossil fueled vehicles/ Encouragements on clean energy vehicles	

Detailed proposal	Only mentioning	Not mentioning

To begin with, *pull policies* are the focal point of the ANT-UAP. It is evident that most of the consideration is given primarily to the improvements on the rail system. The plan includes detailed proposals of the new rail investments. In addition, a public transport hierarchy is part of the plan to provide the integration of different public transport networks and improve service qualities. The plan also mentions the importance of a smart ticketing system for provide a passenger informing system and improve the service quality and support the integration of the public transport network. However, there is not any detailed information about the smart ticketing system. In the plan, it is said that transfer centers are planned to ensure integration between different transport modes. Detailed spatial proposals of transfer centers, including park-and-ride stations, are part of the ANT-UAP. *Improving non-*

motorized mode of transport is another priority of the Antalya Transport Master Plan. The plan includes guidelines about the design of the cycling roads as bike facilities and the proposal cycling network to promote cycling as a mode of transport in Antalya. ANT-UAP proposes a pedestrian circulation proposal that consists of pedestrianized areas and partial pedestrianization. Pedestrianized areas are the places designed only for pedestrian use, while partial pedestrianization is created by expanding sidewalks, planning pedestrian crossing, signalization, urban furniture to improve safety, etc. Although the plan does not mention any standard about them, the areas where these improvements will be implemented are represented in detail.

Parking management decisions are part of the plan as *push policies.* Reduction of parking spaces in the center, parking charge, time limitations, and lower charge policy for central perimeter is part of the plan. In the Antalya Transport Master Plan, it is mentioned that the urban area is categorized in four groups: housing area and central part, and the proposals are determined concerning them.

Plan does not have any proposals on improving the energy efficiency in terms of lowering the emissions and using clean energy sources. Instead, the plan only focuses on spatial decisions to improve the urban transport infrastructure with respect to the sustainable transport.

A general overview can be made on the Antalya Transport Master Plan's attitude towards impacts on climate change. The plan adopts sustainability but does not have any statements on climate change. On the other hand, it prioritizes improving rail and other public transport systems to achieve sustainability and aims to promote non-motorized transport. Transport policies of the plan share common points with transport policies that aim to reduce the impact on climate change.

6.3.3 Eskişehir Transport Master Plan (EUAP, 2015)

Eskisehir is located in Central Anatolia as seen in Figure 6.3. The population of the city was 826,716 in 2015, which is the preparation year of the EUAP, and 888,828

in 2020 (TUIK, 2021). Eskişehir Transportation Master Plan (EUAP) covers the years 2015-2035 and is prepared by İstanbul Technical University and Eskişehir Osmangazi University.

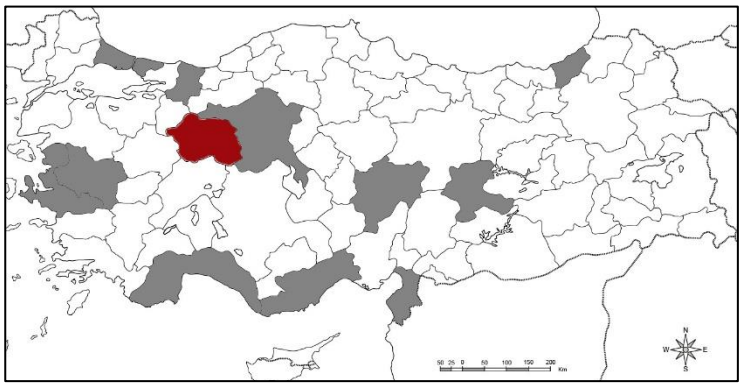

Figure 6.3 Geographical location of Eskişehir

It is the first transport master plan of Turkey that matches with the targets of the Sustainable Urban Mobility Plans (SUMP). The Eskişehir Transport Master Plan vision is mentioned as providing an urban transport infrastructure that improves livability, adapts new technological developments, develops different modes of transport, considers environmental protection, and provides accessible, affordable, safe and sustainable transport for all in the plan. Besides, the strategies of EUAP are listed as integrated planning of land-use and transport decisions, giving priority to people rather than vehicles, planning of integrated public transport, efficient use of existing infrastructure, participatory planning, and re-structuring of transport governance of the city. In the plan, it is also mentioned that the strategies are determined in accordance with the Sustainable Urban Mobility Plans. The plan includes an evaluation phase of all the scenarios developed for Eskisehir from the perspective of SUMPs.

The sum of the given references related with climate change mitigation is represented in the Table 6.6. The plan discusses five different scenarios. Except for the do-

nothing scenario, all of them focus on improving public transport, especially the light rail system, by proposing different routes. One of the evaluation criteria of the scenarios is the comparison of CO_2 emission values per person and per passenger-km. Plan also focuses on reducing the environmental pollution including air and sound, and mitigate with the climate change by adopting required policies.

Table 6.6 Evaluation table of Eskişehir Transport Master Plan for the content on climate change

CONTENT ON CLIMATE CHANGE
Referring climate change
Referring environmental pollution
Referring CO_2 emissions

Mentioning	Not mentioning

Table 6.7 illustrates the evaluation table of the Eskisehir Transport Master Plan. As mentioned, four of the five scenarios of the plan focus on improving public transport in different manners. The table also represents the given importance to improving public transport.

Table 6.7 The evaluation table of Eskişehir Transport Master Plan

IMPROVEMENTS ON ALTERNATIVE MODES OF TRANSPORT (PULL POLICIES)	
Improving Public Transport	**Improving Non-Motorized Modes of Transport**
Expansion of public transport infrastructure	Sufficient sidewalks
Improving service qualities	The continuity of pedestrian paths\sidewalks
Integration of different public transport networks	Pedestrianization in the city center

Table 6.7 (continued)

Park-and-ride	Planning of pedestrian crossings
Pricing of public transport	Bike facilities
Ticketing of public transport	Cycling network
Priority lanes for public transport	Bike-share programs
Transfer stations	
RESTRICTIONS ON PRIVATE VEHICLE USAGE (PUSH POLICIES)	
Pricing Policies	**Physical Restrictions**
Parking charge	Reducing the road capacity
Congestion charging	Reduction of parking spaces in city centers
ENERGY IMPROVEMENTS	
Low-emission public transport vehicles	
Restrictions on fossil fueled vehicles/ Encouragements on clean energy vehicles	

Detailed proposal	Only mentioning	Not mentioning

Pull policies are highly considered in the EUAP. To begin with, the plan proposes both new public transport investments, including priority lanes for bus routes and light rail transit (LRT), and re-arrangement of the existing routes. The plan includes detailed research and proposals for the new investments. Re-arrangements on the existing routes include proposals about removing, changing, and adding new routes. Each proposal is planned so that different public transport routes could be integrated together. New transfer stations also support the integration of different public transport networks mentioned in the plan. Ticketing and pricing of public transport is another consideration of the plan. The transport system of Eskişehir already has a ticketing system. However, to improve the integration between different public transport networks and fair pricing, the plan has proposals for smart ticketing and pricing. In order to improve the service quality, the plan examines the issues such as capacity replacement, improvements, repair, and maintenance.

Eskişehir Transport Master Plan aims to encourage non-motorized transport. Therefore, improving cycling and walking conditions are one of the essential parts of the plan. The pedestrianization of determined areas and pedestrian road improvements are the proposals to support pedestrian circulation. The EUAP mentions that physical problems, including pavement surfacing and sidewalks with insufficient widths, affect pedestrian circulation negatively. Therefore, the expansion of the sidewalks is represented in detail. Also, different pedestrian crossing proposals and designs are specified in the plan. Increasing the rate of cycling is another aim of the EUAP. According to the given standards, re-arrangement of the existing cycling roads and proposing new roads to develop a cycling network is part of the plan. Besides, the requirement to establish an integration between the different parking space designs and facilities and public transport is explained with examples. The transport infrastructure of Eskişehir also has a bike-sharing system since 2014. But there is not any analysis or suggestion in the plan about it.

Pull policies consist of congestion charging and parking management policies. EUAP proposes congestion charging in the central part of Eskişehir to deal with the congestion by evaluating how different pricing schemes will affect the passenger distribution in the proposed area. In terms of parking management, the plan highlights the importance of high parking charges in the central part and the reduction of parking spaces in the city center to decrease the share of private cars and increase the share of pedestrians in the central part.

In terms of improving energy efficiency, plan has proposals on type of the energy. Due to lower purchasing costs and lower emission values, public buses suitable for Euro 6 usage are proposed. Besides, it is mentioned that by 2035, which is the target year, hybrid and electric vehicle technology is projected to be improved.

It is seen that the priority of the EUAP is to plan a sustainable transport infrastructure that decreases the harmful effects of the transport sector on the environment. Evaluation of the plan scenarios based on the SUMP criteria such as the public transport and pedestrian and rail system rate, average trip length and duration for

public transport and private cars, and the number of passengers in public transport annual per capita. All these discussions indicate that Eskişehir Transport Master Plan aims to mitigate the negative impacts of the transport sector on climate change. One of the main reasons of compatibility of the plan policies with the climate change mitigation policies can be accepted as its' similarity with the Sustainable Urban Mobility Plans.

6.3.4 Hatay Transport Master Plan (HUAP, 2016)

Hatay is located in the Mediterranean Region of Turkey as represented in Figure 6.4. By the year 2020, the population is 1,659,320, 1,555,165 in 2016, which is the preparation year of the Hatay Transport Master Plan (TUIK, 2021). In 2016, Hatay Transport Master Plan was prepared after the status of the Hatay Municipality is re-defined as Hatay Metropolitan Municipality in 2014.

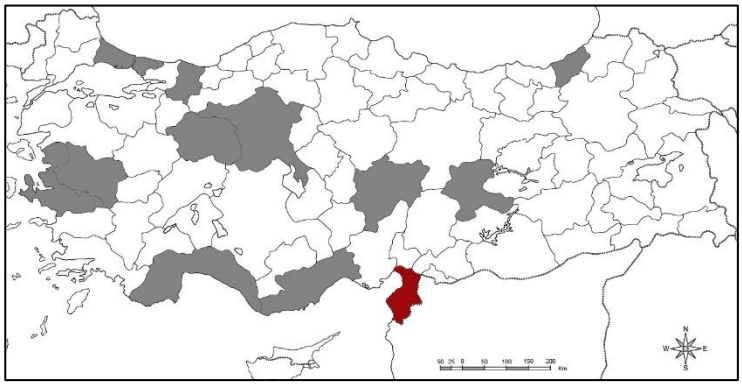

Figure 6.4 Geographical location of Hatay

Hatay Transport Master Plan has been prepared within the "Joint Service Project" protocol between Hatay Metropolitan Municipality and the Istanbul Technical University. The target year of the plan is 2035. The main targets of the plan are defined as strengthening the connections between different sub-centers and between

urban-rural areas, increasing accessibility, decreasing travel times, and designing a safe, economically efficient, and sustainable urban transport network.

It is discussed that transport master plans needs to aim to reduce the impacts on climate change by decreasing private vehicle usage and improving alternative modes of transport. However, Hatay Transport Master Plan is different from other transport master plans in terms of adopted policies. The plan includes three different scenarios: do-nothing, road development-oriented, and public transport-oriented. Comparison of these scenarios concludes the road development-oriented scenario as the most efficient one since it decreases the travel distance substantially even if it has the highest travel time estimation. Therefore, Hatay Transport Master Plan focuses on increasing road capacity and improving road infrastructure while gives less attention to improving alternative modes of transport.

Table 6.8 represents the given references to climate change related concepts. In the plan, adaptation is sustainability is mentioned as one of the strategies. Therefore, the plan also highlights the importance of reducing emissions and environmental pollution rates. However, in the scenario evaluation phase, there were not any parameter on environmental considerations. Therefore, it can be said that Hatay Transport Master Plan gives relatively low importance to environmental considerations although the mentioning such issues.

Table 6.8 Evaluation table of Hatay Transport Master Plan for the content on climate change

CONTENT ON CLIMATE CHANGE
Referring climate change
Referring environmental pollution
Referring CO_2 emissions

Mentioning	Not mentioning

Table 6.9 illustrates the evaluation table of the Hatay Transport Master Plan. It is seen that enough attention did not exerted to improve public transport and non-motorized modes of transport as the chosen scenario focuses on road infrastructure development.

Table 6.9 The evaluation table of Hatay Transport Master Plan

IMPROVEMENTS ON ALTERNATIVE MODES OF TRANSPORT (PULL POLICIES)	
Improving Public Transport	**Improving Non-Motorized Modes of Transport**
Expansion of public transport infrastructure	Sufficient sidewalks
Improving service qualities	The continuity of pedestrian paths\sidewalks
Integration of different public transport networks	Pedestrianization in the city center
Park-and-ride	Planning of pedestrian crossings
Pricing of public transport	Bike facilities
Ticketing of public transport	Cycling network
Priority lanes for public transport	Bike-share programs
Transfer stations	
RESTRICTIONS ON PRIVATE VEHICLE USAGE (PUSH POLICIES)	
Pricing Policies	**Physical Restrictions**
Parking charge	Reducing the road capacity
Congestion charging	Reduction of parking spaces in city centers
ENERGY IMPROVEMENTS	
Low-emission public transport vehicles	
Restrictions on fossil fueled vehicles/ Encouragements on clean energy vehicles	

Detailed proposal	Only mentioning	Not mentioning

Compared to other transport master plans evaluated in this study, it is seen that less attention is given to *improving public transport*. Improving service qualities is one of the policies that is about re-arranging public transport vehicles' distribution into routes based on the relationship between capacity of vehicles and demand. The plan also highlights the importance of the integration of different public transport networks. Pricing and ticketing of public transport is another consideration of plan about improving the PT. The plan mentions smart ticketing systems to decrease the pricing competition between different public transport networks, their integration, and data gathering methods. In addition, the plan suggests that pricing of public transport needs to be determined according to travel distance and capacity. However, these strategies are not supported by any detailed proposals.

In terms of improving the non-motorized mode of transport, the plan focuses on pedestrian and cycling circulation. Potential areas for creating a pedestrian circulation are determined in the plan by using already pedestrianized areas without proposing a route. The Hatay Transport Master Plan includes a detailed cycling network design, including the identification of bicycle station locations.

The *push policies* of the plan consist of parking charges and reduction of parking spaces in the city center. However, these policies are only mentioned as suggestions without proposing any location or primary analysis for charging fees. Plan does not include any decision and mentioning about the usage of clean energy as the plan mainly focuses on physical road improvements.

As a result, it can be accepted that the Hatay Transport Master Plan does not adopt the contemporary approach that aims to achieve sustainability and lower the impact of urban transport on climate change. The plan emphasized the importance of reducing emission and pollution rates rarely while there is not any reference to climate change. It also seems that the policies remain weak in climate change mitigation. It is clear that the "predict and provide" approach dominates the plan decisions. On the other hand, the reasons of adopting "predict and provide" approach might be weaknesses, problems, and financial difficulties.

6.3.5 İstanbul Transport Master Plan (İUAP, 2011)

İstanbul is located in the Marmara Region. İstanbul has some different characteristics compared to the other cities examined in this study. As seen in Figure 6.5, İstanbul is a transcontinental city, and its part in Europe is called European Side, while its part in Asia is called as Anatolian Side. The Bosporus connects the two continents. In addition, İstanbul is the most populated city in Turkey. The population was 15,462,452 in 2020, and it was 13,624,240 in 2011, the publication year of the İstanbul Transport Master Plan (TUIK, 2021).

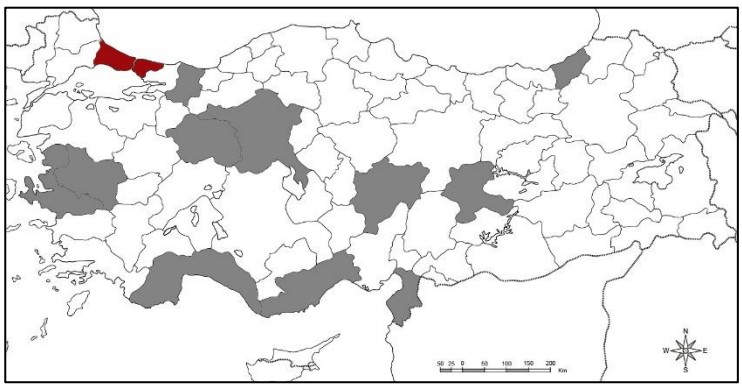

Figure 6.5 Geographical location of İstanbul

In parallel with its economic growth, İstanbul's population has increased rapidly over time. Therefore, İstanbul faced the challenges of rapid urbanization. In other words, the rapidly increasing population increased the demand for urban transport and private vehicle usage. The fact that part of the population in İstanbul does not live in the same continent where they work is one reason that triggers private vehicle usage as a substantial urban transport problem. Also, the polycentric structure of İstanbul may require a different comprehensive planning approach compared to the other cities. Observing the transport planning of cities with similar characteristics might be helpful on this such as Budapest.

The plan's main aim is to decrease motor vehicle traffic and increase accessibility and livability by promoting the paradigm shift from private vehicles to public transport usage. Besides, one of the main targets of the plan is defined as minimizing the emissions for climate change mitigation. It can be said that the plan considers the environmental consequences of the proposed projects. Table 6.10 represents the relativity of the content of the plan with the climate change mitigation. The plan has calculations on fuel consumption and emission costs of road infrastructure investments. The cost of the emissions that cause climate change was defined in the plan separately. In addition, plan aim to decrease the environmental pollution such as sound and air with some policies including congestion charging.

Table 6.10 Evaluation table of İstanbul Transport Master Plan for the content on climate change

CONTENT ON CLIMATE CHANGE
Referring climate change
Referring environmental pollution
Referring CO_2 emissions

Mentioning	Not mentioning

Table 6.11 represents the evaluation table of the İstanbul Transport Master Plan (İUAP). From a general perspective, it is seen that the plan mainly focuses on improving public transport rather than micro-mobility decisions.

Table 6.11 The evaluation table of İstanbul Transport Master Plan (IUAP)

IMPROVEMENTS ON ALTERNATIVE MODES OF TRANSPORT (PULL POLICIES)	
Improving Public Transport	**Improving Non-Motorized Modes of Transport**
Expansion of public transport infrastructure	Sufficient sidewalks
Improving service qualities	The continuity of pedestrian paths\sidewalks
Integration of different public transport networks	Pedestrianization in the city center
Park-and-ride	Planning of pedestrian crossings
Pricing of public transport	Bike facilities
Ticketing of public transport	Cycling network
Priority lanes for public transport	Bike-share programs
Transfer stations	
RESTRICTIONS ON PRIVATE VEHICLE USAGE (PUSH POLICIES)	
Pricing Policies	**Physical Restrictions**
Parking charge	Reducing the road capacity
Congestion charging	Reduction of parking spaces in city centers
ENERGY IMPROVEMENTS	
Low-emission public transport vehicles	
Restrictions on fossil fueled vehicles/ Encouragements on clean energy vehicles	

Detailed proposal	Only mentioning	Not mentioning

Unlike the other plans evaluated in this study, İUAP gives less importance to micro-mobility decisions, such as improving non-motorized modes of transport. Instead, it focuses on developing a road network and rail system to improve the connection between different parts of the city. Policies based on *improving public transport* are dominant *pull policies* of the plan. İUAP has detailed proposals on new rail investments. The rail network is established by considering the land-use plan,

demand forecasting, costs, and current situation. As İstanbul has a polycentric structure and most of the home-job travels are between the sub-centers, a comprehensive rail network plays a vital role in the sustainability of the urban transport infrastructure of the city. In addition to the rail investments, İUAP aims to improve wheeled and seaway public transport. New bus rapid transit (BRT) investment proposals are included in the plan straightforwardly. It can be said that the priority lanes for public transport are considered in the plan as BRT includes roads dedicated to buses. As the road and rail infrastructure investment will take a few years, policies to increase the share of seaway routes are supported in the plan by increasing the capacity and enhancing the existing vehicles. The transfer stations, one of the most important elements connecting seaway transport to land transport, are also included in the plan. Locations and features of the transfer station, including park-and-ride stations, are mentioned in the İUAP. In addition, the plan has suggestions on the pricing of public transport.

Improving non-motorized modes of transport has less consideration in the İUAP compared to the other plans. Due to the city's different dynamics and geographical conditions, the plan aimed to establish a connection with different sub-centers. Therefore, micro mobility decisions are insufficient to ensure sustainability. However, the plan highlights the importance of improving cycling and walking conditions and providing a bike-share program.

İstanbul Transport Master Plan has a chapter in travel demand management. The TDM policies such as parking management, transfer stations, and congestion charging are suggested for İstanbul, including the Historical Peninsula. However, in the İUAP, the main part of travel demand management consists of *push policies*, especially pricing policies. For the different sub-centers in İstanbul and Historical Peninsula, different congestion charging fees are proposed. In addition, there are new suggestions on toll pricing for bridges and highways to keep private car usage at the same level.

In terms of energy efficiency, plan has metro and tram proposals. Low-emission public transport vehicles policy is accepted as mentioned in the analysis as the plan states that the metro line was chosen because it operates with electricity.

A general evaluation in terms of climate change awareness of the plan and the enthusiasm for achieving sustainable urban development is visible. In the plan, emission cost of decisions and the existence of GHGs emissions and air pollution is mentioned. However, lack of attention to the non-motorized transport is an important deficiency of the plan. Focusing on public transport to connect the different sub-centers of the city can be accepted as one of the important reasons of the lack of proposing micro-mobility policies.

6.3.6 İzmir Transport Master Plan (UPİ, 2015)

İzmir is located in the Aegean Region of Turkey with a coast to the Aegean Sea as seen in Figure 6.6. It is the third populated city in Turkey, with a population of 4,394,694 in 2020 (TUIK, 2021). The İzmir Transport Master Plan is prepared by Boğaziçi Proje Mühendislik A.Ş.

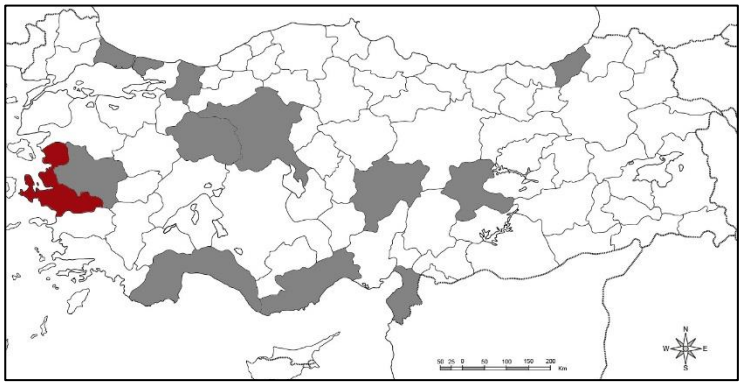

Figure 6.6 Geographical location of İzmir

The vision of the İzmir Transport Master Plan is to create an urban transport system that effectively meets the mobility needs of current and future residents, workplaces, employees, and visitors, while maintaining and improving the quality-of-life economy, safety, accessibility, and protecting the environment. The plan includes main targets, strategies of each target, and actions for each strategy.

When the content of the plan document is analyzed in a general manner, it is understood that the plan draws a framework on promoting sustainable transport. Sum of the content on climate change is represented in Table 6.12. As one of the pillars of sustainability, environmental considerations are stated as a target which includes strategies and actions which aim to reduce the emissions. It is also stated that policies related with pull policies are essential for reducing the environmental pollution. On the other hand, there is not any statement directly includes ideas on climate change.

Table 6.12 Evaluation table of İzmir Transport Master Plan for the content on climate change

CONTENT ON CLIMATE CHANGE
Referring climate change
Referring environmental pollution
Referring CO_2 emissions

Mentioning	Not mentioning

The target year of the plan is 2030. Table 6.13 represents the evaluation table of the İzmir Transport Master Plan (UPI). In a general manner, it is seen that most of the policies are proposed in detail.

Table 6.13 The evaluation table of the İzmir Transport Master Plan (UPI)

IMPROVEMENTS ON ALTERNATIVE MODES OF TRANSPORT (PULL POLICIES)	
Improving Public Transport	**Improving Non-Motorized Modes of Transport**
Expansion of public transport infrastructure	Sufficient sidewalks
Improving service qualities	The continuity of pedestrian paths\sidewalks
Integration of different public transport networks	Pedestrianization in the city center
Park-and-ride	Planning of pedestrian crossings
Pricing of public transport	Bike facilities
Ticketing of public transport	Cycling network
Priority lanes for public transport	Bike-share programs
Transfer stations	
RESTRICTIONS ON PRIVATE VEHICLE USAGE (PUSH POLICIES)	
Pricing Policies	**Physical Restrictions**
Parking charge	Reducing the road capacity
Congestion charging	Reduction of parking spaces in city centers
ENERGY IMPROVEMENTS	
Low-emission public transport vehicles	
Restrictions on fossil fueled vehicles/ Encouragements on clean energy vehicles	

Detailed proposal	Only mentioning	Not mentioning

Within the İzmir Transport Master Plan's scope, the public transport system is classified into three types: rail system, road, and seaway. Besides, rail systems and rubber wheels are also diversified in sub-categories. The main transport axis of the İzmir is planned as a rail public transport system. To improve the rail system, important aspects such as route planning, storage places, staging, location, and type of transfer centers are explained in the plan in detail. For every proposed route, detailed pre-studies are mentioned. Rubber wheeled public transport infrastructure

is classified due to the intended purposes such as transit, express, urban, and rural routes. Besides, until the planned rail systems are put into operation, priority lanes for buses are established to serve. Planned routes for priority lanes are clarified in the plan. There is also a consideration for the integration and support of each public transport system when planning any kind of public transport route. Since İzmir is geographically located around the gulf, seaway transport is another mode used in the city. Therefore, UPI has proposals on seaway transport as well. There are also many suggestions on quality issues of public transport such as stop location and design, passenger information systems, capacity, and comfort. İzmir Transport Master Plan aims to improve the ticketing of public transport. In İzmir, the smart ticketing system is used only in municipalities' public buses. However, it is mentioned that an integrated system needs to be adopted in the plan, including all public transport services, bike-sharing systems, and parking charges. In addition, it has different methods of determining prices, such as distance-based and also proposes about the amount of the pricing. Another issue considered in the UPI is the transfer centers that are important because of the diverse structure of the public transport system of İzmir. Transfer centers proposed in the plan are classified with regard to their functions and locations as main transfer centers, transfer points, park-and-ride, and transfer between different modes centers. The plan includes spatial decisions about the centers.

Improving non-motorized modes of transport is divided into pedestrian and cycling in the plan. In the areas where high rates of pedestrian circulation were observed, it is recommended to remove the elements that prevent pedestrian mobility on the sidewalks and expand the sidewalks by taking into account the existing situation of the road. In addition, partial or complete pedestrianization of the decided places is detailed in the plan. Also, pedestrian crossings for the identified points are presented in the plan. All these decisions aim to improve the continuity of pedestrian circulation.

Improving cycling conditions is another part of the plan. Planning of a cycling network that connects different parts of the city is proposed in the plan with the

cycling routes, types of the cycling lanes, and suggestions for the locations of the facilities. İzmir already has a bike-sharing system called BISIM. UPİ includes policies, recommendations, and preliminary studies to improve the BISIM.

Parking management is recommended in the plan as *push policies*. Increasing parking capacity in surrounding areas of the center and in the transfer stations in order to reduce the parking demand in the center is proposed. To support this idea, a parking charge is suggested as adjusting prices in the center to be higher than the surroundings and transfer stations.

In the plan, there are also proposals on energy efficiency. In the central areas, part of the rubber-wheel lines is proposed to operate as electric vehicles to contribute to increasing awareness of sustainable transport in pedestrian-intensive areas. In addition, some of the park-and-ride stations are proposed with charging stations for electrical buses. Lastly, the plan highlights the importance of charging stations in the parking areas in order to encourage the usage of electrical cars.

It can be said that İzmir Transport Master Plan recognizes sustainable transport and the negative impacts of the transport sector on climate change. Overall, UPİ is a successful example in terms of transforming general sustainable transport policies into spatial decisions. On the other hand, the hierarchical policy structure that consist of targets, strategies and actions, only describes the mentality of sustainable urban transport rather than influencing the policies.

6.3.7 Kayseri Transport Master Plan (KUAP, 2017)

Kayseri is the fifteenth-largest city of Turkey and located at Central Anatolia as represented in Figure 6.7. Kayseri has a growing population as it is the city due to being home to some of the most of the important enterprises in Turkey. As of 2020, the population is 1,421,455; and was 1,376,722 in 2017, the preparation year of the plan, the population (TUIK, 2021). The rapid increase in the population and rate urbanization trends affected people's car ownership and travel patterns.

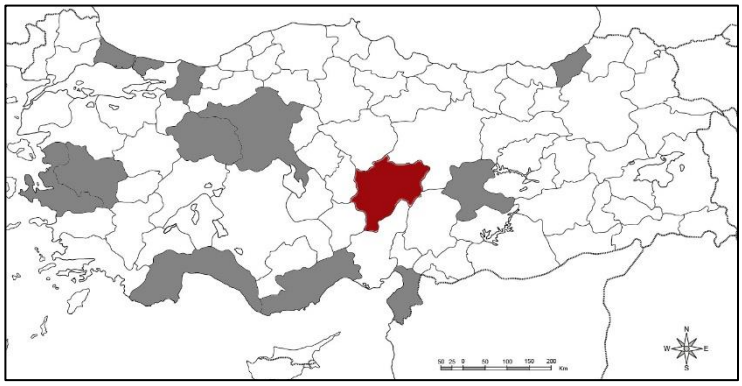

Figure 6.7 Geographical location of Kayseri

In 2017, EMAY International Engineering and Consultancy Inc. prepared the Kayseri Transport Master Plan (KUAP) with the target year of 2035. The main goals of the plan are identified as integrating land-use and transport decisions, increasing accessibility, sustainability, improving health and safety issues, and creating a paradigm shift from private vehicles. Overall, it can be argued that achieving a sustainable transport level is the main target of the plan. The importance of improving public transport and non-motorized transport to reduce private car usage is frequently highlighted in the plan.

The content of the plan document related with climate change is represented in Table 6.14. In the scenario development phase, minimizing the congestion related noise pollution and emission rates is highlighted. The plan evaluates four different scenarios including do-nothing scenario. In addition, emission costs of each scenario were compared in the plan document. As a result, the scenario that gives minimum damage to the environment was chosen as the urban transport master plan. In the plan development phase, the importance of reducing the GHGs emissions that has an impact on climate change and reducing the environmental pollution is highlighted.

Table 6.14 Evaluation table of Kayseri Transport Master Plan for the content on climate change

CONTENT ON CLIMATE CHANGE
Referring climate change
Referring environmental pollution
Referring CO_2 emissions

Mentioning	Not mentioning

Table 6.15 represents the evaluation table for Kayseri Transport Master Plan. As seen in the table, the plan focuses on improving public transport to reduce trips made by private vehicles.

Table 6.15 The evaluation table of Kayseri Transport Master Plan

IMPROVEMENTS ON ALTERNATIVE MODES OF TRANSPORT (PULL POLICIES)	
Improving Public Transport	**Improving Non-Motorized Modes of Transport**
Expansion of public transport infrastructure	Sufficient sidewalks
Improving service qualities	The continuity of pedestrian paths\sidewalks
Integration of different public transport networks	Pedestrianization in the city center
Park-and-ride	Planning of pedestrian crossings
Pricing of public transport	Bike facilities
Ticketing of public transport	Cycling network
Priority lanes for public transport	Bike-share programs
Transfer stations	
RESTRICTIONS ON PRIVATE VEHICLE USAGE (PUSH POLICIES)	
Pricing Policies	**Physical Restrictions**
Parking charge	Reducing the road capacity

Table 6.15 (continued)

Congestion charging	Reduction of parking spaces in city centers
ENERGY IMPROVEMENTS	
Low-emission public transport vehicles	
Restrictions on fossil fueled vehicles/ Encouragements on clean energy vehicles	

Detailed proposal	Only mentioning	Not mentioning

Improving public transport is one of the main considerations of the plan. It includes several changes and improvements on the existing public transport infrastructure, while including new investment proposals for both wheeled public transport and rail system. KUAP states that the reason for the changes in the existing infrastructure is the inefficiency of energy consumption. Providing express routes and re-arranging the routes is another aim of improving public transport by integrating different public transport modes. In addition, KUAP proposes priority lanes for wheeled public transport for one route. A detailed proposal of the public transport network for the target year is part of the plan. The public transport infrastructure of the Kayseri already has a smart ticketing system, which the plan suggests improvements. Within the Kayseri Transport Master Plan's scope, nine transfer centers are proposed in a detailed way.

Improving walking and cycling conditions are part of the plan acting as *pull policies*. Standards for sufficient sidewalks and physical requirements are explained in the plan. Besides, in the KUAP, fully pedestrianized areas in the city center and semi-pedestrianized areas to ensure the continuity of the pedestrian circulation is proposed in a detailed way. Before the Kayseri Transport Master Plan's preparation year, transport infrastructure already had a bicycle network and a bike-sharing system called KayBis. However, the plan includes the identification of these investments' problems and detailed proposals to improve cycling facilities, network, and the bike-sharing system.

Parking management is part of the plan acting as as *push policies.* The importance of parking charges and reducing the parking spaces in the central part is proposed in the plan. The plan includes spatial proposals for the parking charge and highlights the importance of capacity management of the parking spaces.

It is stated that some of the public buses of Kayseri are natural-gas-based buses. In the plan, continuing to adaptation of natural-gas-based buses rather than diesel buses are proposed while adaptation of electrical buses for future are highlighted. On the other hand, there is not any proposal on encouraging the usage of electrical private vehicles.

In the Kayseri Transport Master Plan, it is mentioned that energy efficiency and emissions caused by the transport sector are important issues to deal with to reduce the transport sector's impact on climate change. It is clear that the Kayseri Transport Master Plan considers the environmental consequences of the proposals.

6.3.8 Malatya Transport Master Plan (MUAP, 2017)

Malatya is located in the Eastern Anatolia Region of Turkey as seen in Figure 6.8. It is the 28th most populated city of Turkey, with a population of 806,156 in 2020 (TUIK, 2021). Efforts to prepare the Malatya Transport Master plan is started in

2015 after the Malatya Municipality gained the status of Metropolitan Municipality in 2014.

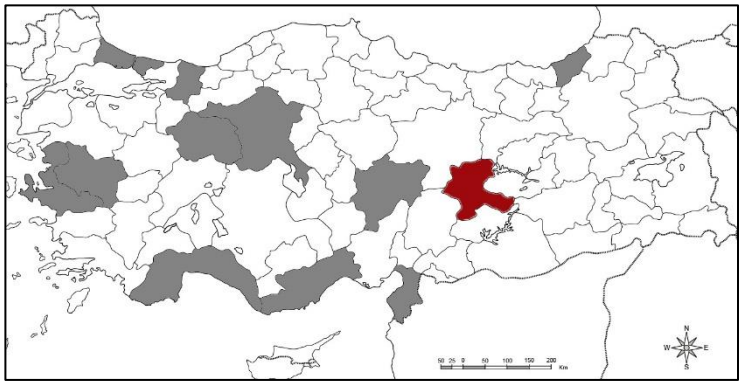

Figure 6.8 Geographical location of Malatya

The plan focuses on increasing the efficiency and preferability of the public transport and improving road infrastructure. As represented in the Table 6.16, there is not any content found regarding to climate change. Unlike most of the plans, emission, energy or pollution cost of scenarios were not evaluated in the plan. Nevertheless, in the plan improving and promoting a public transport infrastructure that reduces the emissions is mentioned.

Table 6.16 Evaluation table of Malatya Transport Master Plan for the content on climate change

CONTENT ON CLIMATE CHANGE
Referring climate change
Referring environmental pollution
Referring CO_2 emissions

Mentioning	Not mentioning

Altyapı Mühendislik prepared the plan. The target year of the plan is 2035, and it does not include any explanation about the vision and the main strategies. Table 6.17 represents the evaluation table of the Malatya Transport Master Plan.

Table 6.17 The evaluation table of the Malatya Transport Master Plan

IMPROVEMENTS ON ALTERNATIVE MODES OF TRANSPORT (PULL POLICIES)	
Improving Public Transport	**Improving Non-Motorized Modes of Transport**
Expansion of public transport infrastructure	Sufficient sidewalks
Improving service qualities	The continuity of pedestrian paths\sidewalks
Integration of different public transport networks	Pedestrianization in the city center
Park-and-ride	Planning of pedestrian crossings
Pricing of public transport	Bike facilities
Ticketing of public transport	Cycling network
Priority lanes for public transport	Bike-share programs
Transfer stations	
RESTRICTIONS ON PRIVATE VEHICLE USAGE (PUSH POLICIES)	
Pricing Policies	**Physical Restrictions**
Parking charge	Reducing the road capacity
Congestion charging	Reduction of parking spaces in city centers
ENERGY IMPROVEMENTS	
Low-emission public transport vehicles	
Restrictions on fossil fueled vehicles/ Encouragements on clean energy vehicles	

Detailed proposal	Only mentioning	Not mentioning

Malatya has an existing tram-bus infrastructure that passes from the primary routes of the city. In the plan, new routes are proposed to increase the coverage of the tram

bus. One of the important reasons for focusing on improving tram-bus is to enhance the quality of service in terms of comfort, safety, time, and cost. It is also aimed to develop bus routes to connect surrounding rural districts that are connected to the last stop of tram-bus at the western part. The wheeled public transport infrastructure is re-arranged considering the tram-bus in the Malatya. The aim here is planning tram-bus as the main public transport infrastructure while planning wheeled public transport as the feeder lines which supports the tram-bus. Re-arranging existing routes considering others also improves the integration of different public transport networks. Besides, main stations connecting wheeled public transport and tram-bus are defined as transfer stations in the plan. In addition, the is a park-and-ride proposal in the perimeter of the city center. In the Malatya Transport Master Plan, there is not any detailed study and estimation about the future prices. Instead, the average of the current prices is used to make a cost analysis. In the plan, it is also stated that 288 vehicles which use diesel oil are decided replaced with electrical vehicles.

The primary attention is given to pedestrian circulation in terms of *improving non-motorized modes of transport.* Increasing accessibility to commercial, socio-cultural, and recreational activities was the priority while deciding on the pedestrian circulation in the city center. Sidewalks in the pedestrian network were controlled to monitor whether they match the standards and make recommendation improvement on the required ones. Increasing the demand for cycling is another aim of the plan. Malatya Transport Master Plan proposes a cycling network that is planned to be completed in the short and long term. The plan also mentions the required standards for the bike facilities such as parking spaces, signs, and the design of the road infrastructure, without any spatial suggestion.

Push policies consist of managing the parking demand in the city center. In order to control the parking demand and the uncontrolled on-road parking in the central part, underground parking garages were proposed in the locations near to perimeters of the city center with high demand for parking. In addition, reducing the road capacity for a specific street, where demand for walking is high, is considered in the future.

A general evaluation can be made to determine the climate change and sustainable development awareness of the plan. There is not any statement about climate change impacts of urban transport in the document. However, one reason to extend tram-bus capacity and to reduce the wheeled public transport capacity is decreasing the emissions caused by the transport sector as tram-buses are electric vehicles.

6.3.9 Manisa Transport Master Plan (MUAP, 2014)

Manisa is located in the Aegean Region of Turkey, as represented in the Figure 6.9. It is the 14th most populated city of Turkey, with a population of 1,450,616 in 2020 (TUIK, 2021). The Manisa Municipality gained the status of "Metropolitan Municipality" in 2014. The preparation year of the Manisa Transport Master Plan is also 2014. Mescioğlu Mühendislik prepared the plan. The target year of the plan is 2034.

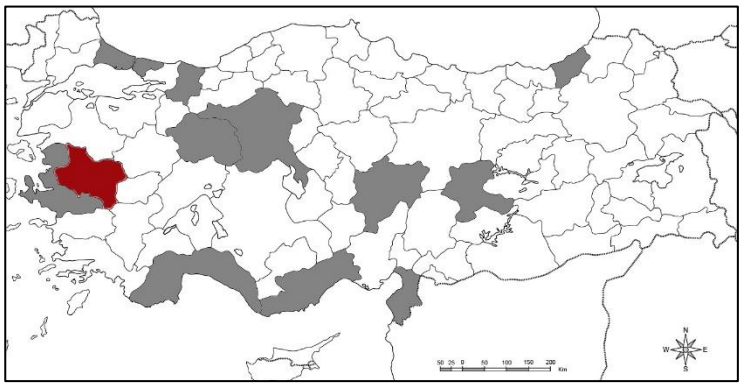

Figure 6.9 Geographical location of Manisa

The main goal of the plan is to provide permanent solutions for existing and future urban transport problems. Improving livability and ensuring sustainability are some of the strategies of plan. Plan compares the three alternative scenarios that are "do-nothing," "improving road network," and "improving public transport." In the plan,

it is stated that the scenario which focuses on improving the road network is the most efficient one. However, it is also stated that the scenario should be focusing on improving public transport, reducing operating costs, more environmentally friendly, gets affected by the road transport problems at a lower level.

It should be noted that plan do not consider the environmental cost of scenarios in the comparison step such as emission and energy cost. In addition, there is not any mentioning on climate change and emissions in the plan document as represented in the Table 6.18. Instead, air pollution in the existing situation caused by traffic congestion is highlighted.

Table 6.18 Evaluation table of Manisa Transport Master Plan for the content on climate change

CONTENT ON CLIMATE CHANGE
Referring climate change
Referring environmental pollution
Referring CO_2 emissions

Mentioning	Not mentioning

As mentioned, the decided scenario in the Manisa Transport Master Plan is focuses on improving road network while also give importance to public transport investments. Table 6.19 represents the evaluation table of the Manisa Transport Master Plan.

Table 6.19 The evaluation table of Manisa Transport Master Plan

IMPROVEMENTS ON ALTERNATIVE MODES OF TRANSPORT (PULL POLICIES)	
Improving Public Transport	**Improving Non-Motorized Modes of Transport**
Expansion of public transport infrastructure	Sufficient sidewalks
Improving service qualities	The continuity of pedestrian paths\sidewalks
Integration of different public transport networks	Pedestrianization in the city center
Park-and-ride	Planning of pedestrian crossings
Pricing of public transport	Bike facilities
Ticketing of public transport	Cycling network
Priority lanes for public transport	Bike-share programs
Transfer stations	
RESTRICTIONS ON PRIVATE VEHICLE USAGE (PUSH POLICIES)	
Pricing Policies	**Physical Restrictions**
Parking charge	Reducing the road capacity
Congestion charging	Reduction of parking spaces in city centers
ENERGY IMPROVEMENTS	
Low-emission public transport vehicles	
Restrictions on fossil fueled vehicles/ Encouragements on clean energy vehicles	

Detailed proposal	Only mentioning	Not mentioning

As in many cities in Turkey, public transport in Manisa is managed by different companies. Therefore, coordination between different public transport services is evaluated as insufficient in the plan. This problem causes different public transport services to serve on the same transport corridor. Public transport vehicles operating on these lines are mentioned as decreasing efficiency and causing competition. Therefore, the plan mostly focuses on re-combination of the lines that overlaps each other. In the Manisa Transport Master Plan, re-arrangement of existing routes and

new route proposals are main considerations to improve public transport. Plan aim to improve and propose tram bus lines as they are electrical public transport vehicles. Also, during the route arrangement, frequency levels, scheduling, quality, and capacity issues are considered in detail to improve the quality of public transport service. Preliminary studies on reasons that prevent integrating different public transport systems and how they can be integrated were discussed in the plan. In addition, it is aimed to support integration by the inclusion of public transport systems that are not included in the existing smart ticketing system. On the other hand, only the importance of fair pricing for all is highlighted in the plan about public transport pricing.

Improving cycling conditions is one of the focal points of *improving non-motorized modes of transport.* The plan proposes cycling routes to create a cycling network. Besides, the standards, required facilities, and the location of the bicycle parking stations are explained in detail. There is a detailed plan for creating pedestrian network and pedestrianization for both city center and for provinces. Also, standards for sufficient and well-designed sidewalks are highlighted without any spatial determination.

Physical restrictions to private cars are part of the plan as *push policies.* New parking area projects are located around the center to reduce the city center's vehicle density. This idea is supported by banning on-road parking, an ordinary parking method in Manisa, in the determined areas where demand is high. It was also suggested that parking charges can support this idea in places with high demand. However, the parking charge policy does not have any pricing proposal or preliminary study.

In brief, the plan does not mention any awareness on the impacts of the transport sector on climate change and environmental issues. However, it can be accepted that there is an awareness for the necessity of sustainable transport policies for the efficiency of the system. Nevertheless, the fact that the selected scenario focuses on improving road infrastructure is not compatible with the considerations of this thesis.

6.3.10 Mersin Transport Master Plan (MUAP, 2016)

Mersin is a port city located in the Mediterranean region of Turkey as represented in Figure 6.10. It is the eleventh most crowded city of Turkey, with the population of 1,868,757 in 2020 (TUIK, 2021). The Mersin Transport Master Plan is prepared by the Boğazici Project in 2016 with the target year of 2030.

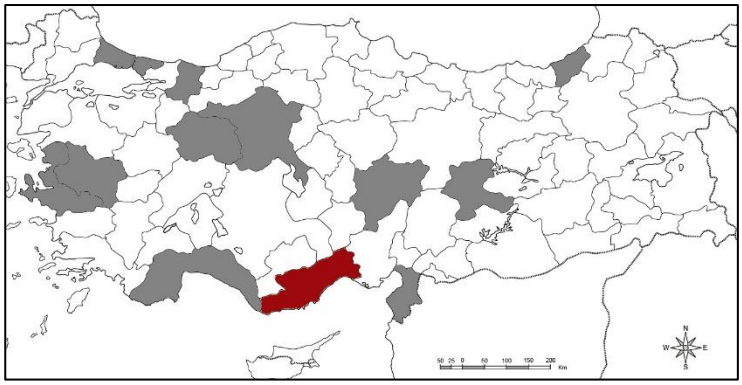

Figure 6.10 Geographical location of Mersin

The main aim of the Mersin Transportation Master Plan is mentioned as providing the effective and highest level of mobility and accessibility for people, which will contribute the most to the economic, social and cultural development of the city. Besides, socially fair, economically efficient, without wasting the resources of the country and without harming the environment. The main strategies of the plan can be summarized as increasing the accessibility where the demand is high, such as central business district, industrial zones, university, hospital, and terminal station. The primary approach is explained as determining the main transport axis to increase the accessibility of mentioned areas, especially by public transport.

In the plan document, six different scenarios are evaluated. Comparison of the emission rates was used as one of the evaluation criteria. In addition, plan underlines the importance of energy efficiency, reducing emissions and reducing environmental

pollution for climate change mitigation frequently. The sum of the referring on climate change issues are represented in the Table 6.20.

Table 6.20 Evaluation table of Mersin Transport Master Plan for the content on climate change

CONTENT ON CLIMATE CHANGE
Referring climate change
Referring environmental pollution
Referring CO_2 emissions

Mentioning	Not mentioning

It can be said that the plan has an awareness on environmental consequences of the decisions. For this reason, it is important to question whether the policies are also determined with respect to the same understanding. Table 6.21 illustrates the evaluation table of Mersin Transport Master Plan.

Table 6.21 The evaluation table of Mersin Transport Master Plan

IMPROVEMENTS ON ALTERNATIVE MODES OF TRANSPORT (PULL POLICIES)	
Improving Public Transport	**Improving Non-Motorized Modes of Transport**
Expansion of public transport infrastructure	Sufficient sidewalks
Improving service qualities	The continuity of pedestrian paths\sidewalks
Integration of different public transport networks	Pedestrianization in the city center
Park-and-ride	Planning of pedestrian crossings
Pricing of public transport	Bike facilities

Table 6.21 (continued)

Ticketing of public transport	Cycling network
Priority lanes for public transport	Bike-share programs
Transfer stations	
RESTRICTIONS ON PRIVATE VEHICLE USAGE (PUSH POLICIES)	
Pricing Policies	**Physical Restrictions**
Parking charge	Reducing the road capacity
Congestion charging	Reduction of parking spaces in city centers
ENERGY IMPROVEMENTS	
Low-emission public transport vehicles	
Restrictions on fossil fueled vehicles/ Encouragements on clean energy vehicles	

Detailed proposal	Only mentioning	Not mentioning

The plan clarifies public transport investments in two different categories as main public transport axis improvements (railed system) and wheeled public transport improvements. By considering the current and future spatial development trends, it is planned to meet the demand in the central axis of the city's transport system. In the determination of the main lines, the focus point was providing access to attraction points that has a direct impact on travel demand. Therefore, the public transport network of Mersin is determined as rail system passes through the main axis and wheeled public transport vehicle routes which are categorized as feeder, rural, central, and transit routes. Therefore, the plan aims to ensure the integration of different public transport systems. In addition, some of the wheeled public transport vehicle routes are proposed with priority lanes of public transport to increase the preferability. Integration of different public transport systems is supported with the transfer stations. Transfer centers proposed in the plan are organized under three categories: main transfer, inter-modal transfer, and park-and-ride transfer centers. The proposals include the types and locations of the transfer centers. Another way of improving the integration is mentioned as smart ticketing system. Municipal buses

in Mersin already have a smart ticketing system. Participation of private bus enterprises is also recommended to improve integration. The applicability of smart ticketing for all the public transport systems in Mersin is discussed in the plan. Different pricing schemes are also mentioned shortly. Improvement of service qualities, including maintenance, repair, scheduling, safety, and capacity, are stated in the plan in detail.

One of the focal points of the plan is improving non-motorized transport. First, ensuring pedestrian circulation is aimed to improve walking conditions. A pedestrian network is provided by proposing pedestrianized areas and pedestrian prioritized roads. In addition, physical improvement is determined for sidewalks such as width, the ground structure of the sidewalks, and pedestrian crossings on streets where the pedestrian movement rate is high. All these strategies have spatial representations. Secondly, the plan has pull policies to encourage cycling. Bicycle networks with required road standards, which are planned to be completed in the short, medium, and long term, were detailed in the plan. In addition, the standards and requirements of bike facilities are explained with examples. A bike-sharing system was proposed in a pilot area to promote bicycle usage. Integration of bike-sharing system into the smart-ticketing system is also suggested.

Push policies were adopted to deal with the urban transport problems caused by private car usage in the city center. The urban area was classified as the center, central development area, and housing area. The policies are determined with regard to this classification. It is decided to forbid road parking and to apply higher charging fees in the center, especially during peak hours. In order to meet the demand for parking, parking areas are proposed in the central development area.

In terms of energy efficiency, policy package of the plan includes a sub-chapter on the energy efficiency of the wheeled public transport buses explaining the importance of using low-emission vehicles. Besides, in the plan, it is stated that concentrated natural gas system should be gradually switched to newly purchased vehicles and fuel costs should be saved.

To sum up, it can be said that the urban transport policies of the Mersin Transport Master Plan are compatible with the urban transport policies, which aim to decrease urban transport's impact on climate change. Besides, most of the policies have detailed proposals rather than only mentioning. It can be concluded that the policies are decided by considering the climate change mitigation.

6.3.11 Rize Transport Master Plan (RUAP, 2016)

Rize is located in the Back Sea region of Turkey as shown in Figure 6.11. The city has a coast on the Black Sea. The population of the Rize is 344,359 in 2020 (TUIK, 2021). Unlike the other municipalities examined in this study, Rize Municipality does not have metropolitan municipality status.

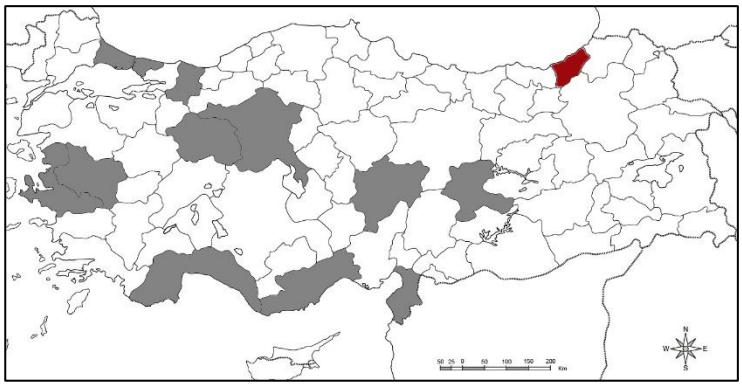

Figure 6.11 Geographical location of Rize

The preparation of the plan is started in 2016 as a joint project project between Gazi University Urban Transportation Technology Accessibility Implementation and Research Center – known as KUTEM – and Rize Municipality. The target year of the plan is 2032. The alternative scenarios in the plan can be classified as do-nothing, Bus Rapid Transit (BRT), monorail based, tram based, and lastly, making these investments separately. The reason of developing monorail and tram scenarios was

mentioned as promoting the usage of electrical vehicles. However, selected scenario does not include any of them. Instead, for the recreational purposes, a historical tram line is proposed. The plan does not mention climate change directly. However, environmental pollution and emission rates were calculated in the scenario comparison step. In addition, minimizing the emissions is mentioned as one of the targets of the plan. The Table 6.22 represents the evaluation of the plan document's context on climate change.

Table 6.22 Evaluation table of Rize Transport Master Plan for the content on climate change

CONTENT ON CLIMATE CHANGE
Referring climate change
Referring environmental pollution
Referring CO_2 emissions

Mentioning	Not mentioning

It can be said that Rize Transport Master Plan aims to solve urban transport problems by improving public transport. Table 6.23 represents the evaluation table or Rize Transport Master Plan (RUAP).

Table 6.23 The evaluation Table of Rize Transport Master Plan

IMPROVEMENTS ON ALTERNATIVE MODES OF TRANSPORT (PULL POLICIES)	
Improving Public Transport	**Improving Non-Motorized Modes of Transport**
Expansion of public transport infrastructure	Sufficient sidewalks
Improving service qualities	The continuity of pedestrian paths\sidewalks

Table 6.23 (continued)

Integration of different public transport networks	Pedestrianization in the city center
Park-and-ride	Planning of pedestrian crossings
Pricing of public transport	Bike facilities
Ticketing of public transport	Cycling network
Priority lanes for public transport	Bike-share programs
Transfer stations	
RESTRICTIONS ON PRIVATE VEHICLE USAGE (PUSH POLICIES)	
Pricing Policies	**Physical Restrictions**
Parking charge	Reducing the road capacity
Congestion charging	Reduction of parking spaces in city centers
ENERGY IMPROVEMENTS	
Low-emission public transport vehicles	
Restrictions on fossil fueled vehicles/ Encouragements on clean energy vehicles	

Detailed proposal	Only mentioning	Not mentioning

In the plan, updating of existing public transport routes is proposed in detail. Due to energy efficiency and environmental considerations, it is proposed to increase vehicle capacities rather than increasing the number of vehicles where demand is higher. A BRT system is also evaluated on the road passes from Black Sea Coast. It is decided to perform priority lanes only in peak hours. In addition, there are other new public transport proposals for the recreative purposes. In order to prevent competition between different public transport operators and improve quality, it is emphasized that public transport integration and smart ticketing systems need to be adopted.

A historical tram line is proposed in the plan in order to take citizen's attraction. As the tram line uses electricity as energy source, it can be said that plan promotes the usage of low-emission public transport vehicles. Besides, decreasing the usage of fossil fueled public transport vehicles are mentioned in the plan.

Planning and design of cycling mode is stated in the plan. Construction of bicycle routes designated for cycling is proposed. Besides, rental areas bike-share program and additional parking areas are planned. Standards and types of the roads are explained with section view drawings. Pedestrian areas are planned on the coastline of the city. In addition to pedestrianization proposals, efforts to improve the pedestrian network, for example, improving sidewalks are proposed. These decisions are exemplified with model and section illustrations. The section illustrations also describe the pedestrian crossing needed to increase pedestrian and cycling safety with spatial proposals.

In the Rize Transport Master Plan, private vehicle usage in the central part aimed to reduced parking management policies. New parking spaces located at the perimeters of the center are proposed to meet the parking demand. On the other hand, the plan does not include any spatial decision or pre-study on reducing the parking capacity in the center, except for briefly suggesting the banning of on-road parking and parking charging.

In conclusion, urban transport policies of the Rize Transport Master Plan are mostly compatible with mitigating the impact of the transport sector on climate change. Especially, focusing on urban transport problems, improving public transport, and proposing low-emission and energy-efficient investment are important points. On the other hand, the plan does not include any special evaluation on the impacts of plan decisions on climate change.

6.3.12 Sakarya Transport Master Plan (SUAP, 2013)

Sakarya is located in the Marmara Region of Turkey, as seen in Figure 6.12. It is the 22nd most populated city in Turkey, with a population of 1,042,649 in 2020 (TUIK, 2021). The preparation of the plan is completed in 2013 by Mescioglu Engineering. The target year of the plan is 2023.

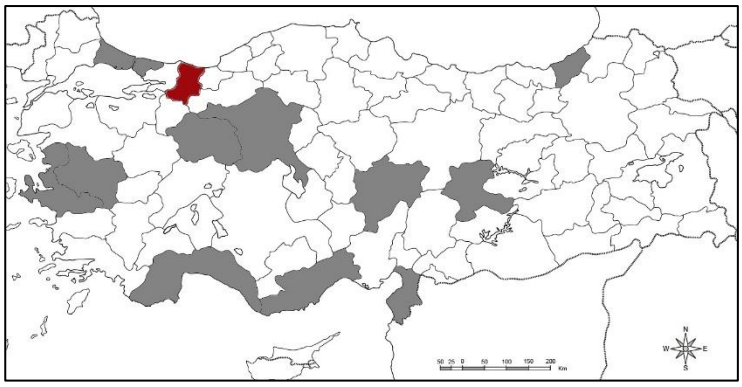

Figure 6.12 Geographical location of Sakarya

The main target of the plan is to produce solutions to urban transport problems experienced today and expected to occur in the future. The scenario developing phase of the plan includes three different scenarios, which are do-nothing, improving road infrastructure, and improving public transport infrastructure.

In the plan importance of reducing emissions and environmental pollution including sound, air and water were highlighted. In addition, emission and environmental pollution cost of the selected scenario was represented. However, it can be said that there is not any direct reference to the climate change in the plan document as represented in the Table 6.24.

Table 6.24 Evaluation table of Sakarya Transport Master Plan for the content on climate change

CONTENT ON CLIMATE CHANGE
Referring climate change
Referring environmental pollution
Referring CO_2 emissions

Mentioning	Not mentioning

The plan favors the improving road infrastructure scenario as the best option. However, the importance of improving public transport is also highlighted. Table 6.25 represents the evaluation table of the Sakarya Transport Master Plan.

Table 6.25 The evaluation table of Sakarya Transport Master Plan

IMPROVEMENTS ON ALTERNATIVE MODES OF TRANSPORT (PULL POLICIES)	
Improving Public Transport	**Improving Non-Motorized Modes of Transport**
Expansion of public transport infrastructure	Sufficient sidewalks
Improving service qualities	The continuity of pedestrian paths\sidewalks
Integration of different public transport networks	Pedestrianization in the city center
Park-and-ride	Planning of pedestrian crossings
Pricing of public transport	Bike facilities
Ticketing of public transport	Cycling network
Priority lanes for public transport	Bike-share programs
Transfer stations	
RESTRICTIONS ON PRIVATE VEHICLE USAGE (PUSH POLICIES)	
Pricing Policies	**Physical Restrictions**
Parking charge	Reducing the road capacity
Congestion charging	Reduction of parking spaces in city centers
ENERGY IMPROVEMENTS	
Low-emission public transport vehicles	
Restrictions on fossil fueled vehicles/ Encouragements on clean energy vehicles	

Detailed proposal	Only mentioning	Not mentioning

In terms of improving public transport infrastructure, restructuring the existing bus routes is discussed in the plan to increase the system's efficiency. Besides, the plan

has a proposal about metrobus investment. Therefore, it can also be accepted that priority lanes for public transport are suggested in the plan as metrobus system requires its own right of way. It is stated that there is an integration problem between different public transport systems in the city. In order to prevent this, integration of these systems is highlighted, and adoption of a smart ticketing system is suggested.

Creating pedestrian circulation in the main central axis is aimed by proposing pedestrian paths. Fully pedestrianization areas and routes that will be qualified for the continuity of the network are explained in the plan. In addition, the plan includes a cycling network to encourage cycling.

Reducing the number of vehicles entering the city center is aimed by proposing the parking areas in the central periphery. Some of the parking areas are planned as park-and-ride stations to decrease the parking demand in the city center.

The plan does not have any proposal on improving energy efficiency. Instead, it focuses on improving spatial conditions such as the road infrastructure.

In brief, the plan gives priority to improving road infrastructure rather than improving alternative modes and adopting disincentive policies against private car usage. The fact that the public transport system is not sufficiently developed boosted the demand for private vehicle usage in Sakarya. Therefore, Sakarya Transport Master Plan does not give attention to the adaptation of urban transport policies that aim to decrease the impacts on climate change.

6.4 General Evaluation of the Selected Plans

So far, transport master plan content and policies are evaluated and presented. This section includes a general evaluation of all the plans to understand the decision patterns of the urban transport master plans in Turkey. First, an overview of the contents of all the analyzed plans is made. Second, a general evaluation of the policy packages of the plans is completed. Third, the relativity between contents and the policies is discussed. Table 6.26 represents the content evaluation of the selected

transport master plans. The concepts that are referred to in each plan are represented with green.

Table 6.26 General evaluation table of the contents

	Ankara UAP	Antalya UAP	Eskişehir UAP	Hatay UAP	İstanbul UAP	izmir UAP	Kayseri UAP	Malatya UAP	Manisa UAP	Mersin UAP	Rize UAP	Sakarya UAP
Referring climate change												
Referring environmental pollution												
Referring CO2 emissions												

It is seen that four out of twelve plans have referring to all the concepts. Only the Antalya Transport Master Plan document does not include any referring to climate change concepts. Besides, it is seen that less referring is given directly to climate change. It can be said that the plans generally have the awareness on climate change. On the other hand, referring to these issues may not mean proposing actual life implementations on these issues. Similarly, a discussion on the transition of theory into practice was conducted in previous chapters. Whether this awareness on climate change mitigation was transferred to the policies to be implemented in the following parts of the discussion.

The sum of the analyzed plans in accordance with the policies is represented in Table 6.27. If the policies are proposed in the plans with sufficient detail, such as spatial decisions, they are represented with green. If the policy proposals are only mentioned in the plan without any detail, they are represented with yellow. Lastly, the policies that are not included in the plan are represented with grey.

Table 6.27 General evaluation of the selected transport master plans

			Ankara UAP	Antalya UAP	Eskişehir UAP	Hatay UAP	İstanbul UAP	İzmir UAP	Kayseri UAP	Malatya UAP	Manisa UAP	Mersin UAP	Rize UAP	Sakarya UAP
PULL POLICIES	Improving Public Transport	Expansion of PT infrastructure												
		Improving service qualities												
		Integration of different PT systems												
		Park-and-ride												
		Pricing of PT												
		Ticketing of PT												
		Priority lanes for PT												
		Transfer stations												
	Improving Non-Motorized Transport	Sufficient sidewalks												
		The continuity of pedestrian paths												
		Pedestrianization in city center												
		Planning of pedestrian crossing												
		Bike facilities												
		Cycling network												
		Bike-share program												
PUSH POLICIES	Pricing Policies	Parking charge												
		Congestion charging												
	Physical Restrictions	Reducing the road capacity												
		Reduction of parking capacity in the city center												
ENERGY IMPROVEMENTS	Low-emission public transport vehicles													
	Restrictions on fossil fueled vehicles/ Encouragements on clean energy vehicles													

Detailed Proposal	Only Mentioning	Not Mentioning

It can be argued that most plans give attention to improve public transport. The transport master plans of İzmir, and Mersin generally have detailed proposals to improve PT, even if both have one policy mentioned without providing any detail. It

is clear that almost all plans give significant attention to improving public transport. On the other hand, the table illustrates that Hatay Transport Master Plan does not include a policy categorized as a “detailed proposal” related to improving public transport. In other words, the Hatay Transport Master Plan gives minor importance to improve public transport and gives most of the consideration to improving road infrastructure. In addition to the transport master plan of Hatay, Sakarya Transport Master Plan gives less attention to improve PT. A conclusion can be made by saying that when public transport is not accepted as effective enough to solve problems, the plans generally aim to solve urban transport problems by improving the road infrastructure, rather than improving public transport. Consequently, the urban transport policies related to public transport are relatively not planned in a detailed way. On the other hand, unlike Hatay Transport Master Plan, Sakarya Transport Master Plan has some proposals to improve public transport even if the selected scenario of the plan focuses on improving road infrastructure. It is understood that the selected scenario plays a key role in enhancing public transport-related policies. In particular, in the plans where the chosen scenario is to develop road infrastructure, enough effort was not exerted for improving PT.

In all the plans, the integration of different public transport systems is mentioned as a critical problem. It is an administrative issue since there are more than one public transport service operated by different companies. This situation complicates the integration and management of the different public transport services.

General inferences can be made about improving non-motorized transport based on the findings. All transport master plans aim to improve the non-motorized transport except İstanbul Transport Master Plan. It is known that İstanbul has unique dynamics compared to other cities such as population, geography, and urban form. Therefore, İstanbul Transport Master Plan mainly aims to improve the connections between different sub-centers of the city. However, İstanbul Transport Master Plan does not have detailed micro-mobility decisions since every sub-center of the city requires individual micro-mobility decisions İstanbul. The policies on improving non-motorized transport is evaluated under two categories: improving walking and

improving cycling conditions. It can be observed that planning of a cycling network is the common point of all plans, except for İstanbul Transport Master Plan. Besides, most plans include standards and spatial proposals about bike facilities. On the other hand, the table illustrates that proposing bike-share programs is missing in most plans. At this point, it is important to mention that some cities already have a bike-sharing system. Therefore, the evaluation for the cities, which already have a bike-sharing system, is made by questioning whether they analyzed the efficiency of their system or whether they proposed improvements on their system. The transport master plans of İzmir and Kayseri have detailed analyses and proposals to improve their existing bike-sharing infrastructure. In contrast, the transport master plan of Eskişehir does not include any proposals to improve its existing bike-share system. In terms of improving waking conditions, it is seen that Eskişehir, İzmir, Mersin, and Rize plans have detailed proposals on all the policies about improving pedestrian transport. Transport master plans of Ankara and Antalya also give importance to all the pedestrian transport-related policies even if some of their policies are yellow labeled. It is also seen that Hatay and İstanbul Transport Master Plans do not give enough consideration to improve pedestrian transport.

Push policies follow a similar pattern in most of the plans. All plans aim to reduce the parking capacity in the city center, except for İstanbul Transport Master Plan,. In the plans, reducing the parking capacity policy is combined with proposing or suggesting parking areas in the surroundings of the central part. Therefore, it can be said that there is an awareness of parking management in the plans. Besides, the parking charge policy is adopted by most plans except the transport master plans of Malatya and Sakarya. The reason for adopting the parking charge policy is generally to support reducing parking capacity in the city center. The plans of Antalya, Kayseri, and Mersin have detailed proposals for both policies. Besides, all the plans, except for the transport master plans of Malatya, Sakarya, and İstanbul, mention or propose both policies. Therefore, it can be argued that parking management policies are considered overall. Reducing the road capacity can be concluded as a common shortcoming for all plans. In fact, all plans have detailed analysis and proposals about

improving the road infrastructure. In addition, congestion charging does not have enough priority in the plans. Only the transport master plans of Eskişehir and İstanbul propose congestion charging in detail, while Ankara Transport Master Plan includes recommendations. It can be concluded that push policies are not generally preferred to achieve sustainable transport. The most important reason for this may be difficulties in public acceptability. In particular, mayors might be concerned about not being elected in the elections as push policies are generally criticized by private car users.

Improving energy policies follow a similar pattern in the plans. Encouragement policy for electrical vehicle usage is encouraged only in the transport master plan of Izmir. There might be two reasons for this result. First, in Turkey, electrical private vehicle usage is not common yet due to the lack of charging stations and vehicle prices. Secondly, on most of the plans, decreasing the excessive energy usage and emissions are aimed by decreasing the travel distances and encouraging alternative modes. Therefore, municipalities may not consider encouraging their usage as an efficient way. On the other hand, usage of low-emission public transport vehicles is proposed in detail most of the plans. The main reason for this can be considered because the local authorities have legal rights to decide on the fuel usage of their public transport vehicles.

Another general assessment of the plans can be made by questioning whether the policies of the plans differentiate in accordance with the dynamics of the cities such as population and urban macro-form. To begin with, İstanbul, Ankara, and İzmir are the three most populated cities of Turkey, respectively. In the most populated cities of Turkey, it can be thought that rail systems and other public transport investments have been given priority to improve the connection between different sub-centers of the cities. Ankara is the capital of Turkey, while Istanbul is the most populated city of the country as well as being much larger in size and consequently in distances. It is believed that due to this high population and significant spatial growth, the İstanbul Transport Master Plan mainly focused on connecting different sub-centers rather than prioritizing micro-mobility decisions. Besides, in the Ankara Transport Master

Plan, it is observed that great attention is given to public transport investments. Correspondingly, the plans of these cities did not focus on improving micro-mobility. On the other hand, the transport master plan of İzmir, as the third most populated city, has detailed proposals on other policies in addition to public transport investments. It is difficult to mention a relationship between the policy adaptation pattern of the plans and the different dynamics of the cities. It can be said that the only exceptional situation in this regard is the İstanbul Transport Master Plan. The lack of legal framework on the contents of the plans can be seen as the reason for not addressing all the policies. This might be the reason of the difference between İzmir Transport Master Plans and the plans of Ankara and İstanbul.

As mentioned in the methodology chapter, the plans are compared by grading the degree of adaptation of the policies. For each policy marked as "Detailed Proposal," 2 points are given. For the policies marked as "Only Mentioning," 1 point is given. Finally, for the policies marked as "Not Mentioning," 0 points are given. Table 6.28 represents the assigned grades and sorts the plans in accordance with their grades.

Table 6.28 Sort of the plans according to their score

Urban Transport Master Plans	**Score**
İzmir Transport Master Plan (2015-2030)	36
Mersin Transport Master Plan (2016-2030)	35
Eskişehir Transport Master Plan (2015-2035)	32
Kayseri Transport Master Plan (2017-2030)	29
Rize Transport Master Plan (2016-2032)	26
Antalya Transport Master Plan (2014-2040)	24
Malatya Transport Master Plan (2017-2035)	23
Manisa Transport Master Plan (2014-2034)	23
Ankara Transport Master Plan (2013-2038)	21
İstanbul Transport Master Plan (2011-2023)	21

Table 6.28 (continued)

Sakarya Transport Master Plan (2013-2023)	18
Hatay Transport Master Plan (2016-2035)	12

In addition, it seems that the plans that have references to three analyzed climate change issues are the plans of İstanbul, İzmir, Kayseri, Mersin, Eskişehir. It is seen that the four most successful plans in terms of adopting the determined policies are sorted as İzmir, Mersin, Eskişehir, and Kayseri. It can be concluded that these four plans' contents and policy packages are compatible with each other. They are the most successful plans in terms of their content's links and relations with climate change and adopting climate change mitigation policies.

Another assessment can be made by questioning the relation between preparation year and content and success in adapting the policies. Table 6.29 represents the sort of the plans due to the preparation years starting from the newest one.

Table 6.29 The transport master plans with respect to their preparation years

2017	Kayseri Transport Master Plan (2017-2030)
	Malatya Transport Master Plan (2017-2035)
2016	Hatay Transport Master Plan (2016-2035)
	Mersin Transport Master Plan (2016-2030)
	Rize Transport Master Plan (2016-2032)
2015	Eskişehir Transport Master Plan (2015-2035)
	İzmir Transport Master Plan (2015-2030)
2014	Antalya Transport Master Plan (2014-2040)
	Manisa Transport Master Plan (2014-2034)
2013	Ankara Transport Master Plan (2013-2038)
	Sakarya Transport Master Plan (2013-2023)
2011	İstanbul Transport Master Plan (2011-2023)

It is difficult to mention a relationship between the preparation year and the success of the plans in terms of adaptation of the policies. The emergence of the SUMP dates back to 2013, as mentioned before. There might be a link between the fact that most of the plans were prepared in 2013 and beyond and their success in adapting themselves to climate change mitigation.

In this part of the study, a general evaluation of all the transport master plans regarding the determined policies is completed. In addition to the observations discussed so far, in the conclusion chapter, overall discussion of the main findings of the research is expressed.

CHAPTER 7

CONCLUSION

In this chapter, the main findings of this research are discussed. The conclusion chapter consists of three parts. A general summary of the literature review and the analysis are presented in the first part. In the second part, the main findings of the analysis are described in a detailed way. In addition, general inferences specific to transport master plans in Turkey are explained. Lastly, the third part consists of final remarks and recommendations for future research.

7.1 Summary of the Research

In the first chapter, the aim of this research has been stated as *understanding whether or not the local authorities adopt transport policies that aim to reduce the negative impacts of the transport sector on climate change.* This thesis consists of seven chapters, including introduction and conclusion chapters. The first chapter starts with clarifying context and problem definition and continues with the methodology and structure of the thesis. In the second and the third chapter, the literature review is presented.

The second chapter discusses the relationship between the transport sector and climate change. The chapter starts with defining climate change and examining global warming. Changes in production and consumption patterns since the pre-industrial era caused GHGs emissions levels to rise. Therefore, the overall temperature of the planet has risen due to the heat-trapping GHGs emissions. This phenomenon is named *global warming*. *Climate change* can be defined as changes in the planet's climate in a measurable period. The catastrophic consequences of climate change threaten the existence of humankind and natural life. Melting of glaciers, increasing sea levels, extreme weather events, problems with food and

water supply, and health problems are becoming parts of daily life. Around 65% of the anthropogenic GHGs consist of CO_2.

As a consequence, CO_2 draws attention while dealing with climate change and global warming. In 2017, global warming reached around 1°C since the pre-industrial era (IPCC, 2018). Besides, IPCC aims to control CO_2 emissions to limit warming to 2°C, which is accepted as a threshold. Next, the milestone events in history that are important in terms of dealing with climate change and global warming are examined. In 1896, Svante Arrhenius argued that burning fossil fuels caused temperatures to rise as it increases the CO_2 emission levels. Also, the important international events are mentioned to remark the importance and emphasis on dealing climate change. It is discussed that some of the documents created during these international events address the importance of promoting sustainable energy and sustainable transport as in Agenda 21. The transport sector is one of the major contributors of climate change as the sector is 92% dependent on fossil fuels (ITF, 2018). The second chapter continues with explaining the transport sector's contribution to climate change in terms of energy consumption and emissions.

In the second chapter, it is argued that the traditional transport planning approach aims to meet the demand by providing more infrastructure. This situation causes motorization levels to rise, which causes more environmental problems due to the increased energy consumption and emission rates. The literature review demonstrated that increasing the road capacity due to the demand provides short-term relief, but it encourages private vehicle usage in the long term. An increase in the rate of private vehicle usage ends up boosting the demand. Breaking this vicious cycle is essential in reducing the transport sector's impact. Transport sector's share in energy consumption and CO_2 emission is undeniable, as discussed in the second chapter. Detailed discussions showed that one of the most important reasons for this situation is the increasing rate of private vehicle usage and its vicious cycle. Subsequently, the literature review showed that adopting new urban transport approaches that are human oriented rather than car oriented, is important for the sustainability of the transport sector and limiting the global temperature rise.

In the third chapter, the development of the transport sector is clarified in detail to represent the historical shift from a conventional approach to sustainable transport. I discussed it by comparing conventional and contemporary approaches, which indicated the sharp contrast. First, unlike the contemporary approach, the mechanical understanding of the conventional approach does not have any impact on changing travel behaviors. Transport planning needs to be considered with its social dimensions rather than only physical. Therefore, the focus needs to be particularly on people rather than vehicles. This also provides new views that accept streets as urban spaces rather than roads and consider environmental and social consequences. Second, all modes of transport need to be taken into consideration, including public transport and non-motorized. A more detailed explanation of the comparison is made in the second chapter. I also supported this argument by also comparing SUMPs and transport master plans.

The transport policies related to climate change mitigation are also explained in detail in the third chapter. Literature review showed that these transport policies need to be planned as policy packages to support each other, and they aim to achieve goals such as maximizing the efficiency of transport infrastructure in terms of social, environmental, and economic manners. With respect to the aim of this study, the policies are defined as compatible with the travel demand management concept. The policies are categorized as push and pull -carrots and sticks- policies. Pull policies aim to encourage the use of alternative modes, while pull policies aim to create dissuasiveness on private vehicle usage.

In the fourth chapter, the methodology of this research is clarified. In the fifth chapter, Turkey's historical and current situation is evaluated with regard to the concepts explained in the literature review. It is understood that urban transportation in Turkey is also affected by rapid urbanization trends. The historical progress is examined in three different periods, namely *before 1970, between 1970-1985, after 1985*. The research demonstrated that before the 1970s, the conventional approach was guiding urban transportation. After that, transport planning is stated to be considered in a more comprehensive manner and with the other planning fields. In

the fifth chapter, also administrative and legislative steps in Turkey is examined. It is understood that the five-year development plans of Turkey highlight the importance of promoting sustainable transportation. The plans also mention the urban transportation planning approach that considers all segments of society safe, accessible, ensure energy efficiency, and environmentally friendly. In addition to five-year development plans, related laws are investigated. The plans draw attention to the sustainability of urban transport. The laws showed that municipalities are responsible for urban transportation and the preparation of urban transport master plans. In this case, providing sustainable urban transport is the responsibility of the municipalities. Therefore, local-scale policy packages of the urban transport master plans are examined. Whether the outlined concepts in the national plans are implemented in the local scale plans is further discussed in the next chapter.

In the fifth chapter, Turkey's current transport sector-related climate change trends are also discussed. It is understood that Turkey has a similar trend with the global indicators. I highlighted similarities between Turkey's climate change and relevant transport sector trends and global trends discussed in the second chapter. Explanations and indicators showed that, the transport sector plays an essential role in CO_2 emissions and private vehicle usage one of the most important factors.

The sixth chapter consists of the analysis of urban transport master plans in Turkey. Contents and the policy packages of the urban transport master plans are evaluated and analyzed from the perspective of climate change. In the first part of the analysis, the compatibility of each plan with the transport policies that aim to reduce negative impacts of the transport sector on climate change is evaluated. The main purpose was to determine the degree of consideration to deal with impacts on climate change. In the second step, a comprehensive and comparative evaluation of all the plans is conducted to develop a general understanding.

7.2 Main Findings

In this part of the conclusion chapter, an analysis of the policy packages of transport master plans and main outcomes are discussed by using the inferences from the literature review. Besides, a generalization specific to Turkey is expressed. These outputs answer the two research questions formulated earlier:

- *Are there any policy targets that aim to reduce the negative impacts of the transport sector on climate change in the policy packages of transport master plans in Turkey?*
- *To what degree do proposed policies determine to mitigate the negative impacts? Do they draw attention to the problems on the local scale and offer any tangible implementations or system corrections, or are the problems mentioned without sufficient action plans? Or alternatively, do the proposed plans and policies ignore the link between urban transport and climate change?*

The literature review showed that plans should establish targets on related issues for the adaptation of the mentioned policies. The concept of *Sustainable Urban Mobility Plans* examined in the literature review can be given as a successful example of this. On the other hand, the literature review also showed the difficulty of adapting and implementing the targets (Goodwin, 1999; Bertolini, 2012). In Turkey, the situation represents this difficulty. In all the urban transport master plans, promoting sustainability is mentioned as one of the targets, even if the content related to climate change is not highlighted all the time. Besides, a general evaluation of the contents showed that the analyzed plans refer to at least one climate change-related concern except the Ankara Transport Master Plan. Therefore, the adaptation of these policies can be expected from these plans. However, it is understood that the development and evaluation of the scenarios step, explained in the fifth chapter as *steps of preparing a transport master plan for Turkey*, play a more crucial role in determining and adopting the policies rather than targets. When the selected scenarios focus on developing road infrastructure, enough effort is not exerted to adopt the mentioned

transport policies. For example, in the transport master plans of Hatay and Sakarya, scenarios focus on improving road infrastructure give less importance to improving public transport. The analysis showed the gap between conceptual targets and practice. One of the reasons for this problem might be the lack of a detailed framework that directs the contents of the plans, unlike the *Sustainable Urban Mobility Plans*. It is mentioned that some of the five-year development plans highlight the importance of considering economic, environmental, and social issues during the preparation of the plans from a very general perspective. On the other hand, Öncü et al. (2011) mention the coordination problem between different institutions and the lack of a more certain framework.

The literature review showed that these policies need to be adopted as policy packages to support each other. Owens (1995) highlights the importance of the adaptation of transport policies as coordinated policy packages. Implementation of certain policies rather than a comprehensive approach may cause additional urban transport problems. For example, especially the push policies, such as reducing the parking capacity, congestion charging that aims to decrease traffic volume, needs to be supported with pull policies that provide alternative ways of reaching city centers. The analysis showed that most of the plans that propose reducing the parking capacity in the city center also have proposals on transfer stations or park-and-ride. On the other hand, the lack of adaptation of the push policies negatively influences the coordination between push and pull policies.

The push and pull policies need to support each other to work efficiently (Steg & Vlek, 1997; Meyer, 1999). Besides, push policies play a key role in decreasing private vehicle usage. Despite their importance mentioned in the literature review, the analysis showed that push policies are the important aspects missing in the plans. It is seen that congestion charging and reducing the road capacity are not proposed in the plans, while the parking management policies are proposed in most plans. The public acceptability of push policies is a process rather than an immediate solution. For this reason, municipalities may have considered it as a risk. Therefore, the municipalities prefer adopting policies which have higher rates of public

acceptability but makes more difficult to break the cycle of "predict and provide" such as improving road capacity.

The literature review demonstrated the increasing awareness on climate change mitigation. The reflection of this awareness is seen in different sectors. Especially reducing the CO_2 emissions and energy consumption became one of the fundamental goals of the sectors to control global warming. From the transport sector perspective, Rodrigue et al. (2006) define the relationship between the transport sector and the environment as paradoxical since providing transport infrastructure due to demand increases the environmental problems related to climate change. From the urban transport perspective, Turkey faces difficulties in balancing between urban transport infrastructure and environmental concerns. Analyzed policy packages showed that there are goals aim to reduce the negative effects of the transport sector. However, economic and administrative issues prevent the preparation of plans that prioritize environmental consequences related to climate change.

By considering both literature review and analysis, it can be argued that *there are policy targets that aim to reduce the negative impacts of the transport sector on climate change during the preparation of transport master plans in Turkey*. However, the preparation of transport master plans in Turkey is affected by several factors that push climate change consideration into the background. For example, more than one company manages public transport in cities as cities have multiple public transport services. This situation complicates the planning of a comprehensive public transport network. In addition, the economic consequences of the investments have an essential place in the decision-making process. Most of the environment-friendly investments, especially public transport, are seen as inefficient in terms of economic gain as public transport generally benefits society rather than economically profitable. On the other hand, analysis showed that, there are transport master plans performing well in terms of adopting these policies, such as Eskişehir, İzmir, and Mersin Transport Master Plans. In general, it can be argued that there is an effort to adapt these policies.

The degree of determination of these policies to reduce those negative impacts is also questioned in this research. In the literature review, the implementation of transport policies is discussed. Adaptation and implementation of such a paradigm shift are evaluated as a difficult process (Goodwin, 1999; Bertolini, 2012). Besides, the necessity to adopt the policies comprehensively is highlighted throughout this study. Therefore, in the analysis, *whether the plans proposed serious implementations or drew a simple attention* is analyzed. Especially in the Ankara Transport Master Plan, most policies are only proposed as simple frameworks rather than detailed proposals. This situation may affect the adaptability of the policies negatively. In addition, İstanbul Transport Master Plan does not have micro-mobility decisions as it focuses on providing connections between different sub-sectors. However, supporting the infrastructure with micro-mobility decisions is one of the essential missing points of the plan. On the other hand, there are plans that are successful in terms of proposing serious implementations, such as the transport master plans of Eskişehir, İzmir, and Mersin. Because Turkey is at the beginning of the paradigm shift process, it is expected to observe the different policy adaptation patterns.

7.3 Recommendations for Future Researches

The awareness of environmental issues and the importance of sustainability are increasing day by day. The transport planning field plays a key role in achieving sustainable development and climate change mitigation. In the future, well performing planning and implementation examples, such as SUMPs, will probably increase the importance of the transport sector in dealing with climate change and achieving sustainable development. In this thesis, policy packages of the transport master plans prepared for cities in Turkey are analyzed in detail to contribute to our existing knowledge.

Climate change needs to be examined from both perspectives of mitigation and adaptation. Adaptation strategies gained importance, especially in recent years, as

negative consequences of climate change become an undeniable part of human life. On the other hand, the lack of adaptation strategies is examined when Turkey's urban transport master plans were analyzed. Assessment of climate change from both mitigation and adaptation perspectives in future studies can provide an essential contribution by increasing the awareness on adaptation strategies.

It is understood that policies play an essential role in the adaptation of theories into practice. This research also investigated how the theoretical policies were adapted as urban scale policies in Turkey. However, to develop a more comprehensive understanding, there are research areas that deserve to be focused on. First of all, the adaptation of the policies into a local scale is only the first part of the implementation process. As a second part, *it is important to examine whether the adapted policies are successfully implemented in real life or not.* There is growing literature on difficulties in implementing these policies. The most efficient way to deal with the *transferring theory into practice* problem is to understand the difficulties in implementation of the local scale policies.

Secondly, it could also be questioned as another research *whether the successfully implemented policies gave the expected results in terms of limiting private vehicle usage, promoting alternative modes, and reducing CO_2 emissions and energy consumption.* The suggested research areas may contribute to the efficiency of these policies.

In this thesis, as mentioned in the methodology chapter, it was also decided to arrange field trips to the cities whose plans were analyzed and to conduct interviews with responsible people in the municipalities of those cities. However, these had to be canceled because there was the Covid-19 pandemic during this research, which imposed severe restrictions on field studies and visits to institutions, not to mention staff presence at these institutions. A future study can be conducted to understand what responsible people in municipalities think about adopting climate change mitigation policies and to understand how the proposed policies are being implemented. In 2019, as mentioned in the previous chapters, in Turkey, some of the

municipalities' application on the preparation of SUMPs is accepted as priority projects and will be funded by EU (TBB, n.d.). Future research might be concluded as a *comparative analysis of transport master plans and SUMPs in Turkey* as SUMPs are accepted as successful examples of sustainable transport planning.

The importance of the urban areas is increasing to ensure sustainability and deal with climate change. In this sense, urban planning needs more attention than it has. For this reason, it is important to conduct research on the relationship between sustainable development and planning fields.

REFERENCES

Akerman, J., Banister, D., Dreborg, K., Nijkamp, P., Schleicher-Tappeser, R., Stead, D., & Steen, P. (2000). *European Transport Policy and Sustainable Mobility.* Routledge.

Antalya Büyükşehir Belediyesi- Boğaziçi Proje Mühendislik Planlama İnş. San, ve Tic. Ltd. Şti. (2017). *Antalya ulaşım ana planı (2017-2040).* Antalya, Antalya Büyükşehir Belediyesi.

Babalık, E. (2012). Kentsel Ulaşımda Park Et-Bin Uygulaması. In M. Ersoy, *Kentsel Planlama Ansiklopedik Sözlük* (p. 262). İstanbul: Ninova.

Babalık, E. (2012). Ulaşım Ana Planı. In M. Ersoy, *Kentsel Planlama Ansiklopedik Sözlük* (p. 452). İstanbul: Ninova.

Babalik, E. (2013). Urban Form and Sustainable Transport: Lessons from the Ankara Case. *International Journal of Sustainable Transportation*(7), 416–430. doi:10.1080/15568318.2012.676152

Babalık, E., & Şenbil, M. (2012). Sürdürülebilir Ulaşım ve Politikası. In M. Ersoy, *Kentsel Planlama Ansiklopedik Sözlük* (pp. 413-416). İstanbul: Ninova.

Bajpai, N., Biberman, J., & Wadhwa, M. (n.d.). ICT Initiatives in India to Combat COVID-19. *Towards a New Indian Model of Information and Communications Technology-Led Growth and Development(32)*. Center for Sustainable Development, Earth Institute, Columbia University.

Banister, D. (2007). The Sustainable Mobility Paradigm. *Transport Policy*(15), 73-80.

Belediye Kanunu. (2005, July 13). Retrieved December 01, 2020, from T.C. Resmi Gazete: https://www.resmigazete.gov.tr/eskiler/2005/07/20050713-6.htm

Bertolini, L. (2012). Integrating Mobility and Urban Development Agendas: a Manifesto. *disP - The Planning Review, 48*(1), pp. 16-26. doi:10.1080/02513625.2012.702956

Bolin, B. (2009). The Intergovernmental Panel on Climate Change (IPCC). In A. Yotova, *Climate Change, Human Systems, and Policy - Volume I* (pp. 117-136). EOLSS Publications.

Büyükşehir Belediyesi Kanunu. (2007, July 23). Retrieved December 1, 2020, from T.C. Resmi Gazete: https://www.resmigazete.gov.tr/eskiler/2004/07/20040723.htm

C40 Cities. (n.d.). *"Fossil fuel free streets declaration"*. Retrieved June 11, 2021, from C40 Cities: https://www.c40.org/other/green-and-healthy-streets

Chapman, L. (2007). Transport and climate change: a review. *Journal of Transport Geography*, pp. 354–367.

CIVITAS. (2013, February). *New Ticketing System (Coimbra)*. Retrieved June 6, 2021, from CIVITAS: https://civitas.eu/content/new-ticketing-system-coimbra-0

Dalkmann, H., & Brannigan, C. (2007, October). *Transport and Climate Change Module 5e Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities.* Deutsche Gesellschaft für Technische Zusammenarbeit.

ECMT. (2000). *Sustainable Transport Policies.* Paris: OECD Publishing. doi:https://doi.org/10.1787/9789264187696-en

Eliasson, J. (2008). Lessons from the Stockholm congestion charging trial. *Transport Policy*, 395-404.

Eliasson, J., & Proost, S. (2015). Is sustainable transport policy sustainable? *Transport Policy*(37), 92-100.

Elker, C. (2002). *Ulaşımda Politika ve Pratik.* Ankara.

Eskişehir Büyükşehir Belediyesi-İstanbul Teknik Üniversitesi; Osmangazi Üniversitesi. (2017). *Eskişehir ulaşım ana planı sonuç raporu.* Eskişehir: Eskişehir Büyükşehir Belediyesi.

European Comission. (2001, May 04). *340th Council meeting - TRANSPORT / TELECOMMUNICATIONS.* Retrieved from European Comission: https://ec.europa.eu/commission/presscorner/detail/en/PRES_01_131

European Comission. (2013, December 12). Annex: "A concept for sustainable urban mobility plans". *COM(2013) 913 final*. Brussels, Belgium. Retrieved from https://ec.europa.eu/transport/themes/urban/urban-mobility/urban-mobility-package_en

European Comission. (2014). *Quality of Transport Report.* Retrieved March 05, 2021, from https://ec.europa.eu/commfrontoffice/publicopinion/archives/ebs/ebs_422a_en.pdf

European Union. (2020). *Energy, transport and environment statistics.* Retrieved 02 02, 2021, from eurostat: https://ec.europa.eu/eurostat/en/web/products-statistical-books/-/ks-dk-20-001

Gazi Üniversitesi AUAP Ofisi - Ankara Büyükşehir Belediyesi. (2013). *AUAP - Ankara metropoliten alanı ve yakın çevresi ulaşım ana planı.* Ankara: Gazi Üniversitesi AUAP Ofisi - Ankara Büyükşehir Belediyesi.

Gazi Üniversitesi KUTEM - Rize Belediyesi. (2018). *Rize ulaşım ana plan raporu.* Rize: Rize Belediyesş.

Goodwin, P. (1999). Transformation of transport policy in Great Britain. *Transportation Research Part A: Policy and Practice*(33), pp. 655-669. doi:https://doi.org/10.1016/S0965-8564(99)00011-7.

Goodwin, P., & Dender, K. V. (2013). ‘Peak Car’ — Themes and Issues. *Transport Reviews: A Transnational Transdisciplinary Journal*(33), 243-254. doi:10.1080/01441647.2013.804133

Goodwin, P., & Noland, R. B. (2003). Building new roads really does create extra traffic: a response to Prakash et al. *Applied Economics*(35), 1451-1457. doi:10.1080/0003684032000089872

Goulias, K. (Ed.). (2003). *ransportation systems planning: Methods and applications.* CRC Press.

Hatay Büyükşehir Belediyesi. (2016). *Hatay ulaşım ana planı final raporu.* Hatay: Hatay Büyükşehir Belediyesi.

Haughton, G. (1999). Environmental Justice and Sustainable City. *Journal of Education and Research*(18), 233-243. doi:10.1177/0739456X9901800305

Hickman, R., & Banister, D. (2014). *Transport, Climate Change and the City.* New York: Routledge.

IEA. (2019). *Energy Transitions Indicators.* Retrieved March 31, 2021, from IEA: https://www.iea.org/reports/energy-transitions-indicators

IEA. (2019, November 22). *Transport sector CO2 emissions by mode in the Sustainable Development Scenario, 2000-2030.* Retrieved from Internatıonal Energy Agency: https://www.iea.org/data-and-statistics/charts/transport-sector-co2-emissions-by-mode-in-the-sustainable-development-scenario-2000-2030

IEA. (2020). *CO2 Emissions from Fuel Combustion.* Retrieved 10 31, 2020, from IEA: https://www.iea.org/subscribe-to-data-services/co2-emissions-statistics

IEA. (2020). *Energy Technology Perspectives 2020.* Retrieved 10 31, 2020, from IEA: https://www.iea.org/reports/energy-technology-perspectives-2020

IEA. (2020, September 9). *Global CO2 emissions in transport by mode in the Sustainable Development Scenario, 2000-2070*. Retrieved 10 31, 2020, from IEA: https://www.iea.org/data-and-statistics/charts/global-co2-emissions-in-transport-by-mode-in-the-sustainable-development-scenario-2000-2070

IPCC. (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Geneva: IPCC.

IPCC. (2018). *Global warming of 1.5°C.* In Press.

IPCC. (2018). *Summary for Policymakers. In: Global Warming of 1.5°C.* In Press.

IRENA. (2021). *Renewable Energy Policies: Transport.* Abu Dhabi: International Renewable Energy Agency.

İstanbul Büyükşehir Belediyesi Ulaşım Daire Başkanlığı Ulaşım Planlama Müdürlüğü. (2011). *İstanbul UAP - İstanbul metropoliten alan kentsel ulaşım ana planı.* İstanbul: İstanbul Büyükşehir Belediyesi.

ITF. (2018, December 19). *How to Better Reflect Transport in Climate Action Efforts.* Retrieved 12 14, 2020, from International Transport Agency: https://www.itf-oecd.org/climate-action-efforts

İzmir Büyükşehir Belediyesi. (2019). *İzmir ulaşım ana planı.* İzmir : İzmir Büyükşehir Belediyesi.

Jeffrey R. Kenworthy, F. B. (1999). Patterns of automobile dependence in cities: an international overview of key physical and economic dimensions with some implications for urban policy. *Transportation Research Part A*, 691-723.

Jones, P. (2014, July 1). The evolution of urban mobility: The interplay of academic and policy perspectives. *IATSS Research*, pp. 7-13.

Karl, T. R., & Trenberth, K. E. (2003). Modern Global Climate Change. *Science*(302), 1719-1723.

Kayseri Büyükşehir Belediyesi. (2017). *Kayseri ulaşım ana planı sonuç raporu.* Kayseri: Kayseri Büyükşehir Belediyesi.

Kenworthy, J. (2008). Energy Use and CO2 Production in the Urban Passenger Transport Systems of 84 International Cities: Findings and Policy Implications. *Urban Energy Transition*, 211-236. doi:10.1016/B978-0-08-045341-5.00009-8

Kenworthy, J. (2018). 2.1 - Reducing Passenger Transport Energy Use in Cities: A Comparative Perspective on Private and Public Transport Energy Use in American, Canadian, Australian, European and Asian Cities. *Urban Energy Transition (Second Edition)*, 169-204. (P. Droege, Ed.) Retrieved from Bicing: https://www.bicing.barcelona/

Krippendorff, K. (2004). *Content Analysis An Introduction to Its Methodology.* United States of America: SAGE Publications.

Lassiter, A. (2016). Congestion Pricing: A Step Toward Safer Streets? New York.

Litman, T. (2003). Measuring Transportation Traffic , Mobility and Accessibility. *ITE JOURNAL*, 28-32.

Malatya Büyükşehir Belediyesi- Altyapı Mühendislik Bilişim Dan. Taah ve Tic Ltd. Şti. (2017). *Malatya ulaşım ana planı.* Malatya: Malatya Büyükşehir Belediyesi Ulaşım Dairesi Başkanlığı.

Manisa Büyükşehir Belediyesi-Mescioğlu Mühendislik Müşavirlik A.Ş. (2014). *Manisa ulaşım ana planı.* Manisa : Manisa Büyükşehir Belediyesi.

Mersin Büyükşehir Belediyesi-Boğaziçi Proje Mühendislik Planlama İnş. San, ve Tic. Ltd. Şti. (2016). *Mersin ulaşım ana planı sonuç raporu.* Mersin: Mersin Büyükşehir Belediyesi.

Meyer, M. D. (1999). Demand Management as an Element of Transportation Policy: Using Carrots and Sticks to Influence Travel Behavior. *Transportation Research Part A*(33), pp. 575-599.

Ministry of Environment and Urbanization. (2018). *Ulaştırma Tipine Göre Nihai Enerji Tüketimi.* Retrieved March 31, 2021, from Republic of Turkey Ministry of Environment and Urbanization: https://cevreselgostergeler.csb.gov.tr/ulastirma-tipine-gore-nihai-enerji-tuketimi-i-85796

Ministry of Environment and Urbanization. (2018). *Ulaştırma Türüne Göre Seragazı Emisyonu.* Retrieved March 31, 2021, from Republic of Turkey Ministry of Environment and Urbanization: https://cevreselgostergeler.csb.gov.tr/ulastirma-turune-gore-seragazi-emisyonu-i-85790

Mourey, T. (2019, November 27). *Finalist of the 7th SUMP Award: Basel, Switzerland*. Retrieved June 6, 2021, from Eltis: https://www.eltis.org/resources/case-studies/finalist-7th-sump-award-basel-switzerland

Newman, P., & Kenworthy, J. (1989). Cities and Automobile Dependence: An International Sourcebook. UK.

Newman, P., & Kenworthy, J. (2015). The Rise and Fall of Automobile Dependence. In P. Newman, & J. Kenworthy, *The End of Automobile Dependence How Cities Are Moving Beyond Car-Based Planning* (p. 2). Washington: Island Press.

NOAA/GML. (2020, 09 28). *Trends in Atmospheric Carbon Dioxide*. Retrieved from Global Monitoring Laboratory: https://www.esrl.noaa.gov/gmd/ccgg/trends/global.html

Öncü, E. (1993). Ülkemiz Kentlerinin Ulaşım Yapısı ve Kentlilerin Yolculuk Özellikleri. *5. Toplutaşım Kongresı.* Ankara.

Öncü, E. (2007). Kentiçi Ulaşımda Karar Süreçleri ve Karar Ölçütleri. *7. Ulaştırma Kongresi.* TMMOB İnşaat Mühendisleri Odası.

Öncü, E., & Yıldız, A. Ö. (2011). Sürdürülebilir Ulaşım: Devlet bunun neresinde? *İMO 9. Ulaştırma Kongresi Bildiriler Kitabı.*

Owens, S. (1995). From 'predict and provide' to 'predict and prevent'?: pricing and planning in transport policy. *Transport Policy*, 43-49.

Özalp, M., & Öcalır, E. V. (2008). Türkiye'deki kentiçi ulaşım planlaması çalışmalarının değerlendirilmesi. *METU Journal of the Faculty of Architecture*, 71-97.

Page, M. (2005). Non-Motorized Transportation Policy. In K. J. Button, & D. A. Hensher, *Handbook of Transport Strategy, Policy and Institutions* (pp. 581-596). Amsterdam: Elsevier.

Pas, J.-W. V. (2017, October 13). *Utrecht's SUMP: moving from theory to practice (the Netherlands)*. Retrieved June 6, 2021, from Eltis: https://www.eltis.org/discover/case-studies/utrechts-sump-moving-theory-practice-netherlands

Rodrigue, J.-P., Comtois, C., & Slack, B. (2006). *The Geography of Transport Systems.* Routledge.

Rodrigue, J.-P., Comtois, C., & Slack, B. (2013). *The Geography of Transport Systems* (Vol. Third Edition). Routledge.

Rupprecht Consult. (2019). Guidelines for Developing and Implementing a Sustainable Urban Mobility Plan. *Second Edition*.

Sakarya Büyükşehir Belediyesi - Mescioğlu Mühendislik Müşavirlik A.Ş. Sakarya. (2013). *Sakarya ulaşım ana planı.* Sakarya: Sakarya Büyükşehir Belediyesi.

Schiller, P. L., & Kenworthy, J. R. (2018). *An introduction to sustainable transportation: Policy, planning and implementation.* Routledge.

Seattle Urban Mobility Plan. (2008). *Best Practices in Transport Demand Management.* Seattle: Seattle Urban Mobility Plan.

Şenbil, M. (2012). Kentsel Ulaşım. In M. Ersoy, *Kentsel Planlama Ansiklopedik Sözlük* (pp. 260-262). İstanbul: Ninova.

Steg, L., & Vlek, C. (1997). The role of problem awareness in willingness-to-change car use and in evaluating relevant policy measures. In J. A. Rothengatter, & E. C. Vaya, *Traffic and Transport Psychology* (pp. 465-475). Pergamon Press.

Storper, M. (2013). *Keys to the City: How Economics, Institutions, Social Interaction, and Politics Shape Development.* Princeton; Oxford: Princeton University Press. doi:doi:10.2307/j.ctt2jc8qz

T.C. Kalkınma Bakanlığı. (2001). *Urban Transport Sub-Comission Report of 8th National Development Plan.* Ankara: T.C. Kalkınma Bakanlığı.

T.C. Kalkınma Bakanlığı. (2007). *Ninth Development Plan Report.* Ankara: T.C. Kalkınma Bakanlığı.

T.C. Kalkınma Bakanlığı. (2013). *10th Deveopment Plan.* Ankara: T.C. Kalkinma Bakanligi.

T.C. Kalkınma Bakanlığı. (2018). *On Birinci Kalkınma Planı Ulaştırma Özel İhtisas Komisyonu Raporu.* Ankara: T.C. Kalkınma Bakanlığı.

Taylor, M. (2014). A chronology of some major climate science/policy milestones. In *Global Warming and Climate Change: : What Australia knew and buried...then framed a new reality for the public* (pp. 181-188). ANU Press. Retrieved from http://www.jstor.org/stable/j.ctt130h8d6.16

TBB. (n.d.). *Sürdürülebilir Kent İçi Hareketlilik Planları*. Retrieved March 30, 2021, from Union of Municipalities in Turkey: https://www.tbb.gov.tr/basin-ve-yayin/haberler/20191121-surdurulebilir-kent-ici-hareketlilik-planlari

The Los Angeles County Metropolitan Transportation Authority. (n.d.). *Transportation Master Plans*. Retrieved 12 28, 2020, from METRO: https://www.metro.net/projects/tod-toolkit/transportation-ma

The Ministry of Environment and Urbanization. (2011). *Republic of Turkey National Climate Change Action Plan.* Ankara: The Ministry of Environment and Urbanization.

Tiwari, G., Jain, D., & Rao, K. R. (2015). Impact of public transport and non-motorized transport infrastructure on travel mode shares, energy, emissions and safety: Case of Indian cities. *Transportation Research Part D: Transport and Environment*, 277-291.

Transport for London. (2006). *Central London Congestion Charging Sixth Annual Report.* 2006: Transport for London.

Transport for London. (2008). *London Congestion Charging Sixth Annual Report.* London: Transport for London.

Transport Planning Society. (n.d.). *What is transport planning and how do I become one?* Retrieved 12 21, 2020, from Transport Planning Society: https://tps.org.uk/profession/careers

TUIK. (2021, February 4). *Adrese Dayalı Nüfus Kayıt Sistemi Sonuçları, 2020.* Retrieved April 4, 2021, from TUIK: https://data.tuik.gov.tr/Bulten/Index?p=Adrese-Dayali-Nufus-Kayit-Sistemi-Sonuclari-2020-37210

TUIK. (2021, March 23). *Road Motor Vehicles, February 2021.* Retrieved from TUIK: https://data.tuik.gov.tr/Bulten/Index?p=37424&dil=2

TUIK. (2021, March 30). *Sera Gazı Emisyon İstatistikleri, 1990-2019.* Retrieved March 31, 2021, from TUIK: https://data.tuik.gov.tr/Bulten/Index?p=Sera-Gazi-Emisyon-Istatistikleri-1990-2019-37196&dil=1

Tüketiciyi ve İklimi Koruma Derneği. (2013). *İklim Değişikliği Eylem Planı.* Ankara: Tüketiciyi ve İklimi Koruma Derneği.

Türkiye Belediyeler Birliği. (2014). *Ulaşım planlama çalışmaları ve ulaşım ana planı hazırlama kılavuzu.* Ankara: TBB Yayınları.

Ulaşımda Enerji Verimliliğinin Arttırılmasına İlişkin Usul ve Esaslar Hakkında Yönetmelik Birinci Bölüm. (2019, May 2). Retrieved December 1, 2020, from T.C. Resmi Gazete: https://www.resmigazete.gov.tr/eskiler/2019/05/20190502-5.htm

UNFCCC. (2015). *Adoptation of Paris Agreement.* Paris.

United Nations. (1992). *Agenda 21.* Rio de Janerio.

United Nations. (1992). *United Nations Framework Convention on Climate Change.* New York.

United Nations. (1997, May 23). *Earth Summit*. Retrieved October 20, 2020, from United Nations: http://www.un.org/geninfo/bp/enviro.html

United Nations. (1998). *Kyoto Protocol to the United Nations Framework.*

United Nations. (2005). *2005 World Summit Outcome.*

United Nations Envrironment Programme. (2000, July 19). *The international response to climate change: A history*. Retrieved May 05, 2021, from Information Unit for Conventions (UIC): https://unfccc.int/cop3/fccc/climate/fact17.htm#:~:text=Climate%20change%20was%20recognized%20as,World%20Climate%20Conference%20in%201979.&text=It%20issued%20a%20declaration%20calling,well%2Dbeing%20of%20humanity%22.

Üstünışık, B., & Bayazıt, S. (1996). Türkiye'de Kentsel Ulaşım Planlaması Yaklaşımları ve Kentiçi Raylı Taşımacılık Problemleri. *Türkiye Mühendislik Haberleri*(384), pp. 53-62.

Victoria Transport Policy Institute. (2014, April 2). *Transportation Demand Management*. Retrieved February 26, 2021, from TDM Encyclopedia: https://www.vtpi.org/tdm/tdm12.htm#:~:text=Transportation%20Demand%20Management%20or%20TDM,address%20a%20variety%20of%20problems.

Victoria Transport Policy Institute. (2017, July 18). *Mobility Hubs*. Retrieved March 2021, 09, from TDM Encyclopedia: https://www.vtpi.org/tdm/tdm135.htm

Victoria Transport Policy Institute. (2018, April 23). *Public Bike Systems*. Retrieved March 09, 2021, from TDM Encyclopedia: https://www.vtpi.org/tdm/tdm126.htm

Victoria Transport Policy Institute. (2018, April 23). *Public Transit Improvements*. Retrieved March 16, 2021, from TDM Encyclopedia: https://www.vtpi.org/tdm/tdm47.htm

Victoria Transport Policy Institute. (2019, March 21). *Road Space Reallocation Roadway Design and Management to Support Transportation Alternatives*. Retrieved March 18, 2021, from TDM Encyclopedia: https://www.vtpi.org/tdm/tdm56.htm

World Commission on Environment and Development. (1987). *Our Common Future*. Oxford: Oxford University Press.

WRI Türkiye Sürdürülebilir Şehirler. (2015). *Sempozyumu, Y. Ş. (2015). Sürdürülebilir Kent İçi Hareketlilik Planları (SUMP) Çalıştay Raporu.*

Zillman, J. (2009). A history of climate activities. *WMO Bulletin*(58).