A COMPARISON OF EU'S AND TURKEY'S SUSTAINABLE URBAN MOBILITY*

Bilgesu Güneş YERLİ**

Abstract

The main aim of this paper is to compare the current situation of the Sustainable Urban Mobility in the European Union (EU) and Turkey. For this purpose, Sustainable Urban Mobility in the EU and Turkey is examined via literature review and to evaluate the current situation of sustainable urban mobility more deeply in Turkey, a questionnaire was conducted to Turkish Metropolitan Municipalities. The main conclusion of the questionnaire is that from sustainable urban mobility modes, the main missing mode is the cycling in Turkey. This paper shows that cycling is the sustainable urban mobility solution for Turkish cities. To motivate cycling, cycling indicators are developed for Turkish cities to pre-evaluate bike lane projects and a case study evaluation for the city of Eskişehir is calculated using these indicators.

Keywords: *Sustainable Urban Mobility, EU, Turkey, Cycling, Indicator.*

AB VE TÜRKİYE'DEKİ SÜRDÜRÜLEBİLİR KENT İÇİ HAREKETLİLİĞİN KARŞILAŞTIRILMASI

Öz

Bu makalenin amacı, Avrupa Birliği (AB) ve Türkiye'deki Sürdürülebilir Kent içi Hareketlilik konusundaki mevcut durumun karşılaştırılmasıdır. Bu amaca yönelik AB ve Türkiye'deki Sürdürülebilir Kent içi Hareketlilik konusunda literatür taraması yapıldı ve Türkiye'deki mevcut durumu daha derinlemesine araştırmak için Türkiye'deki büyükşehir belediyelerine bir anket uygulandı. Bu anketin ana çıktısı olarak Türkiye'de sürdürülebilir kent içi hareketlilik türlerinden bisikletli ulaşımın ana eksik olduğu ortaya kondu. Bu makale, bisikletli ulaşımın Türk şehirleri için sürdürülebilir kent içi hareketlilik çözümü olduğunu gösteriyor. Bisikletli ulaşımı teşvik etmek için, Türk şehirleri

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** Dr., e-mail: gunes.yerli@wri.org

için bisiklet yolu projelerinin ön değerlendirmesini yapabilen bisikletli ulaşım göstergeleri hazırlandı ve örnek çalışma olarak Eskişehir bu göstergelerle değerlendirildi.

Anahtar Kelimeler: *Sürdürülebilir Kent içi Hareketlilik, AB, Türkiye, Bisiklet, Gösterge.*

Introduction

In recent years, most cities in the world are facing increasingly urban mobility problems which causes a poor life quality for citizens. "Travel is increasing in virtually all regions of the world, usually at or faster than the rate of economic growth, and generally faster in the long run than the rate of reduction of energy and pollution intensity." (Goldman and Gorham, 2006: 262) Today 9 out of 10 EU citizens believe that the urban mobility problems in their cities need to be improved. (European Commission, 2009) Due to the fast-technological progress in the last decades, particularly private car transport changed the urban life, as city and infrastructure development could either not cope with the negative impacts of motorisation or even supported its rising by providing suitable infrastructure. The consequence is an increase of the urban traffic and its economic, social and environmental effects.

In economic terms, our society suffers from travel time losses due to congestion causing a noticeable reduction of productivity. This diminishes public welfare significantly. Another crucial point is the bad accessibility for people with restricted mobility (e.g. missing car ownership or physical constraints). This large and growing group is kept out of many daily services and thus they are unable to participate in daily life.

Besides its economic disadvantage, it is also an important problem regarding social justice and inclusion. In car dependent cities, personal vehicles play the most important role for individual mobility and flexibility in accessibility. (Aftabuzzaman and Mazloumi, 2011: 698) In other words, the group of car owners can access urban activities easily, whereas non-car owners depend on public transport (PT) or non-motorised transport (walking and cycling). As these modes received less attention in urban planning for many years, a social gap opened. Traffic fatalities and local air and noise pollution, that are more likely to occur with more cars on the streets, underline the mobility triggered inequality, as non-car owners are the ones who need to deal with the dangers produced by cars. From a social point of view, a car dependent mobility pattern hence seems very disparate and undesirable.

In environmental terms, the consumption and the depletion of oil is the leading problem. According to 2014 statistics, transport consumes 64.5% of worldwide oil. (International Energy Agency, 2016: 33) In large part, automobiles are the consumers. Oil is a finite resource and its peak, the point with the highest per year depletion, is estimated in newest research to appear between 2020 and 2030. (Aftabuzzaman and Mazloumi, 2011: 697) We are forced by nature, by the end of oil, to come up with solutions for a new mobility. However, this should not be the main environmental driver, but only the last exit from the unsustainable transport system. “Transport accounts for 26% of global CO2 emissions and is one of the few industrial sectors where emissions are still growing.” (Chapman, 2007: 355) The consequences of global warming are certainly a problem to tackle and in which transport should play a key role. However, also on a local scale environmental problems caused by emissions harm massively the well-being of citizens. These include tail-pipe emissions from road transport like nitrogen oxide, hydrocarbons, ozone, benzene, lead and particular matter which are proven to increase mortality and a range of respiratory and other diseases. (Woodcock, Banister, Edwards, Prentice and Roberts, 2007: 1078) The source for noise pollution, in addition, is mainly caused by urban road traffic. Additionally, transport is not a closed system; it is among the most important public urban schemes that ensure and shape the human way of life in our cities today and tightly intertwined with other systems. (Goldman and Gorham, 2006: 264) It interferes directly with all human activity such as land-use, water supply, food supply, economic success, resource usage, cultural urban life and education. It is the backbone of our cities.

The importance to overcome urban mobility problems with sustainable solutions is hence very evident in our times.

The main aim of this paper is to solve urban mobility problems by sustainable mobility solutions and taking cycling as the main sustainable mobility solution for Turkish cities to be supported. To motivate decision makers on implementing new bike lane projects, cycling indicators are developed for Turkish cities to pre-evaluate bike lane projects and a case study evaluation for the city of Eskişehir is calculated using these indicators. This paper is composed of five sections. The first section -introduction- identifies the main problem. The rest of the paper unfolds as follows: The second section focuses on sustainable urban mobility concept and examines sustainable urban mobility in the EU and Turkey. The third section focuses deeply to Turkey’s current situation on sustainable urban mobility via questionnaire. The fourth section concentrates on cycling indicators as a sustainable urban mobility solution for Turkish cities, with some concluding remarks offered in the last section.

Sustainable Urban Mobility

To solve urban mobility problems, sustainable transport concept stems from the Brundtland Report in 1987 "satisfying current transport and mobility needs without compromising the ability of future generations to meet these needs". (Black, 1996: 151-159) Means of transport considered as sustainable are principally PT, walking and cycling.

Walking and cycling as zero carbon and environmental friendly solutions need more attention in the sustainable urban mobility planning scheme to overcome the urban mobility problems. Implementation strategies are comparatively easy in a technical manner. Public support and political will is crucial though. Pedestrianisation zones in inner city areas, a safe and dense bike network, integration with the PT networks, bike parking facilities, bike-sharing options and bike spaces on buses and urban trains are the principal innovations. This means, walking and cycling are the key to provide a good level of urban accessibility, applying the strength of being very flexible on a local scale and needing no further support such as parking lots.

Though, measures to foster PT and walking and cycling alone do not suffice to increase their modal share to a desirable extent. Additionally, car usage needs to be made unattractive on the one hand, but even more unnecessary on the other hand. Policies should lead people to the decision to leave their cars at home or even sell them, because sustainable mobility solutions became more appealing in financial and convenient ways. Sustainable mobility solutions also comprise reduction of inner-city parking spaces, congestion charging, environmental zones and housing projects missing parking spaces but including bike storages. Events like car-free days help to foster an understanding among the population that mobility without cars is possible and enjoyable.

The relationship between society and the transport system is the ambitious target to be met. To reach this, the political and societal challenges continue being more important than technical issues. Furthermore, this process is not a one to be finished and achieved at one point. Sustainable mobility is a pathway policy, not a vision with an endpoint. (Goldman and Gorham, 2006: 261) However, in many cases transport decisions are taken under larger policy goals like economic growth, job creation, land-use, socio-economic and geographic wealth transfers instead of following a pathway towards a sustainable mobility behaviour in the cities." (Goldman and Gorham, 2006: 262) Sustainable Urban Mobility Plans (SUMPs) are made to address exactly this misunderstanding that caused the fragmentation of our cities and allowed the current unsustainable mobility pattern to be prevented. SUMPs are strategic plans developed to satisfy the mobility needs of people in cities for a better life quality and build on existing plans by taking consideration integration, participation and evaluation processes. SUMPs aim is to ensure all people's accessibility, safety, security, health in cities and enhance the attractiveness and quality of cities for the people and the economy.

Sustainable Urban Mobility in the EU

SUMPs were most detailedly mentioned at the 2013 Urban Mobility Package. (European Commission, 2013: 3) With the Urban Mobility Package, European Commission (EC) supports sharing best practices, fostering cooperation and providing financial support. EC requested the establishment of SUMPs as a comprehensive planning tool for cities to solve urban mobility problems and satisfy the needs of people in the EU cities for a better life quality. SUMPs were not declared mandatory in the EU, EC just put incentive measures like financing to disseminate SUMPs. Despite the diversity of planning cultures inside and outside the EU, there are common SUMP characteristics to overcome urban mobility problems. SUMPs encourage a shift towards sustainable transport modes like PT and walking and cycling, ensure transport system accessibility for all, improve safety and security, reduce air and noise pollution, improve cost-efficiency of transport, enhance better urban environment.

In 2013 in conjunction with the Urban Mobility Package, "Guidelines Developing and Implementing a SUMP" was released to motivate SUMPs in the EU by providing guidance, making awareness raising workshops and trainings. There are 517 EU cities that implemented SUMP.

Sustainable Urban Mobility in Turkey

Turkish cities and their transport systems are subject to a substantial change since 2010s with growing population that is concentrated mostly in cities. With the increasing expansion of cities as well as the economic development, need to travel and travel distances are increasing which PT couldn't answer. This increases private car ownership which reveals urban mobility problems in Turkish cities.

Turkish Municipalities with population more than 100.000 must prepare Transport Master Plans for 15 years for their territorial region and should revise them in every 5 years. In Turkey Transport Master Plans are prepared to solve urban mobility problems by first focusing on PT, then transport infrastructure. But focusing on transport infrastructure rather than walking and cycling couldn't solve urban mobility problems in Turkish cities. On the contrary, it increased private car usage and PT so the traffic in cities.

Since previous Transport Master Plans couldn't solve urban mobility problems in cities, these plans should be revised by including sustainable urban mobility solutions especially walking and cycling. Although objectives and political support for sustainability started to exist in recent years, knowledge and technical possibilities for the preparation of sustainable urban mobility projects are still limited in Turkey.

In Turkey there is no national guidance or legislation on SUMPs yet. Since Turkey is an EU candidate country, funding for developing SUMPs will be available for Turkish metropolitan municipalities under EU Instrument for Pre-accession Assistance (IPA) 2 funds (Bank of Provinces, Turkey The Sustainable Cities Project Executive Summary, 2014). In the following years, metropolitan municipalities are willing to develop SUMPs as they are a precondition to receive funds from the EU.

Sustainable Urban Mobility Questionnaire

Since Turkish cities is now heavily suffering from the same urban mobility problems as EU, pursuing EU cities proved sustainable urban mobility solution: SUMPs are advised in this paper for the Turkish cities to solve their urban mobility problems. Under this idea, to investigate the Turkish cities current situation on sustainable urban mobility, a qualitative model is developed for evaluating the current Transport Master Plans’ relationship with SUMPs. Our theoretical findings are mirrored with an empirical study of 26 Turkish metropolitan municipalities from 30 metropolitan municipalities. Empirical study consists of a research on current information of Transport Master Plans using a questionnaire with the participation of urban transport experts. This questionnaire was carried out in March-April 2016.

The questionnaire consists of 15 questions in 4 different parts. The first part gathers general basic information on the current Transport Master Plans in terms of duration and timeframe. In the second part human and financial resources are investigated to complete the organisational component. The third part asks more directly for the actual inclusion of SUMP elements in Transport Master Plans. The current and potential commitment of all possible stakeholders to SUMPs is determined in this part. The questionnaire closes with a fourth part, Strengths Weaknesses Opportunities Threats (SWOT) Analysis, which respondent metropolitan municipalities are asked to classify given factors into the strengths, weaknesses, opportunities and threats. Analyses for each question are listed collectively.

Considering the sustainable mobility concept is very new in Turkey, aged Transport Master Plans include less SUMP elements than the new ones. Most of the metropolitan municipalities are not adhere to the Transport Master Plans duration of 15 years. When considering the SUMP planning period of 1-3 years, metropolitan municipalities which will revise their Transport Master Plans soon, don’t have enough planning time to convert their Transport Master Plans to SUMPs but they can include some SUMP elements into their Transport

Master Plans. The metropolitan municipalities with later revisions have enough planning time to convert their plans to SUMPs.

Only large metropolitan municipalities are preparing their Transport Master Plans. Smaller sized cities do not possess the necessary resources, both financially and technically to involve in the Transport Master Plans' preparation.

Budgets of the urban transport departments are not compatible with the population of the cities. Converting Transport Master Plans to SUMPs is not directly a financial issue but considering it is a new process and planning from the beginning with all related stakeholders, including new SUMP elements in current Transport Master Plans, taking capacity building trainings and technical support from outside, SUMPs will be costly at the beginning. But SUMPs will reimburse these costs economically, environmentally and socially soon. So, the metropolitan municipalities that have higher budgets is more advantageous at the beginning when converting their Transport Master Plans to SUMPs.

The size of the city and the number of workers are not proportional. The number of workers in Urban Transport Departments are insufficient to prepare SUMPs and, they are not qualified on SUMPs. It is urgently necessary to increase the number of workforces in Urban Transport Departments and then increase their capacity with trainings and consultancies.

PT and Inter-modality are the leading SUMP elements involved in current Transport Master Plans. PT's high involvement in current Transport Master Plans are pleasing when considering that PT is one of the main sustainable transport mode beside walking and cycling. Urban logistics and walking and cycling are the least rated SUMP elements involved in current Transport Master Plans because these categories are comparatively new and not mostly focused in current transport planning. It seems to be crucial to support the least rated SUMP elements especially walking and cycling and to raise awareness for cleaner and more sustainable planning for Turkish Cities. It is surprising that all SUMP elements are partially implemented even some of them are not in their current Transport Master Plans. These results show that SUMP elements' importance and necessity are already recognised, and SUMP elements are started to be partially implemented by most of the metropolitan municipalities so the transition of these metropolitan municipalities to SUMPs from their current Transport Master Plans will be easier.

The importance of SUMP related plans' (Local Land-use Plans and Out Region Transport Plans) inside Transport Master Plans are already recognised by most of the metropolitan municipalities so that the transition to SUMPs from current Transport Master Plans with these metropolitan municipalities will be easier.

Private transport authorities, Citizens, Elderly people, Universities, Metropolitan municipality related transport authorities, Parents/children and Disabled people are the leading stakeholders involved in current Transport Master Plans. Private transport authorities are found as the most important stakeholder in current Transport Master Plans and their existence and importance at the current Transport Master Plans proved the ongoing urban mobility problems. Private transport authorities should be at the last rows because SUMPs offer sustainable transport modes like PT, walking and cycling to solve the problems. Universities are also among the leading stakeholders because lack of qualified workforce in metropolitan municipalities, Transport Master Plans are prepared by universities. It is surprising and pleasing that, groups from society such as Citizens, Elderly people, Parents/children and Disabled people are also among the most important stakeholders. This means that people have already taken as a partner when planning current Transport Master Plans. Since SUMPs are people focused plans, these results show that when converting current Transport Master Plans to SUMPs, people focused stakeholder participation is ready. Bicycle rental operators, Landowners and Car sharing companies are the least rated stakeholders involved in current Transport Master Plans because these categories are comparatively new and not mostly focused in Transport Master Plans. It is necessary to involve inexistent stakeholders to Master Plans and increase the roles of existent stakeholders for a better SUMP development. Bicyle rental operators’ inexistency in some cities or existency but least involvement is the most important problem to be solved because SUMPs main dependency is sustainable transport modes like PT and walking and cycling. So, Bicycle rental operators existency and full involvement to the Transport Master Plans should be provided.

Municipality associations, Disabled people, Citizens, Development agencies, EU authorities/funds, Universities and Metropolitan municipality related transport authorities are the leading stakeholders interested in SUMP implementation. Municipality associations’ interest to SUMP implementation is also a very encouraging picture for Turkey because municipality associations’ support will transfer the idea and best cases of SUMPs to other municipalities and this will help metropolitan municipalities to convert their Transport Master Plans to SUMPs. It is also pleasing that Disabled people, Citizens, Universities and Metropolitan municipality related transport authorities are interested to SUMP implementation because they are also among the most important stakeholders in current Transport Master Plans and their interest to SUMP implementation show that they are close to the SUMP idea and will help metropolitan municipalities on the way towards SUMPs. Expectedly, Development agencies and EU authorities are also among the most rated stakeholders on SUMP implementation because SUMP is an EU concept and Development Agencies in Turkey were established to develop the regions of

Turkey on Turkey's pre-accession period to the EU. Motorist associations, Private transport authorities and Landowners are the least rated stakeholders interested to SUMP implementation. They have interests in maintaining the current car-oriented planning approach since they benefit or believe to benefit from it. Improvement could be achieved by trainings and workshops to teach elements and clear up benefits and chances of SUMPs to negatively positioned stakeholders and gain higher degrees of acceptance overall. It is surprising and pleasing that even Private transport authorities and Motorist associations are inside the least rated stakeholders, some metropolitan municipalities responded Private transport authorities and Motorist associations are actively supportive to SUMP implementation. By taking Private transport authorities and Motorist associations' support for SUMPs, it is easier to leave the car-oriented planning approach in Turkey. Since Ministry of Environment and Urbanisation are responsible from walking and cycling strategy and Ministry of Transport, Maritime Affairs and Communications are responsible from motorised transport strategy, their neutral sight to SUMP implementation should be immediately changed to develop SUMPs. Capacity building trainings about SUMPs including the concept, elements, best practices, benefits should be given to the technical experts and decision makers in these Ministries in order them to put SUMPs on Turkey's transport agenda.

"Content of current Transport Master Plans" is the most rated strength towards developing a successful SUMP. This shows that current Transport Master Plans are not far away from SUMPs, include SUMP elements. This will ease metropolitan municipalities' workload when converting Transport Master Plans to SUMPs.

"Financial resources" are the most rated weakness towards developing a successful SUMP. This shows that metropolitan municipalities will need extra budget, incentive to develop SUMPs. Even annual budgets of urban transport departments are insufficient, current Transport Master Plans were prepared with these limited budgets. By thinking SUMP will reimburse its costs economically, environmentally and socially soon, it is more feasible for metropolitan municipalities to prepare SUMPs with their limited budgets than preparing current Transport Master Plans.

It is encouraging to see that "Political will/vision" is the most rated opportunity towards developing a successful SUMP because in Turkey the decision makers of Transport Master Plans are politicians. So, their desire means that current Transport Master Plans will be easily converted to SUMPs in near future with the help of these politicians.

As being most rated weakness towards developing a successful SUMP, "Financial resources" are also the most rated threat. This result also highlights the need for extra budget for SUMP planning. As a result, costs of developing SUMPs, their economic benefits and financial returns in future should be evaluated and explained clearly to decision makers and all related stakeholders to convince them to develop SUMPs.

To take a full picture from the Sustainable Urban Mobility Questionnaire, SUMP Ranking is prepared by evaluating the 10 variables of the questionnaire which sufficiently describe SUMPs: Transport Master Plan Duration, Transport Master Plan next Revision, Transport Master Plan Preparation, Urban Transport Departments Annual Budget, Urban Transport Departments Workforce, Qualified Workforce for SUMPs, Involvement of SUMP Elements to Transport Master Plans, Involvement of SUMP Related Plans, Involvement of Stakeholders, Stakeholder Interest to SUMPs. Just 12 metropolitan municipalities that answer all questions are evaluated for SUMP Ranking. As a summary of the SUMP Ranking, 2 metropolitan municipalities from 12 (17%), Denizli and İstanbul get Success Rate in between 0%-50% which means variables that describe SUMPs are not included in their current Transport Master Plans. İstanbul get the lowest rate as the most crowded city in Turkey. Since İstanbul is suffering from urban mobility problems at most, İstanbul's involvement in this category proves the necessity of sustainable urban mobility solutions to solve urban mobility problems. But Transport Master Plans adaptation to SUMPs are much more difficult in these cities regarding the cities involved in 50%-100% Success Rate category. Even Denizli and İstanbul's Success Rates are the lowest and in between 0%-50% rate, these two cities rates are around %40s, not so much under 50% which means some SUMP elements have already been involved in their ongoing Transport Master Plans. So, SUMP adaptation for these cities are not difficult as expected. 10 metropolitan municipalities from 12 (83%), Şanlıurfa, Van, Mersin, Malatya, Kocaeli, Eskişehir, Diyarbakır, Manisa, Tekirdağ, İzmir get Success Rate in between 50%-100% which means variables that describe SUMPs are included in their current Transport Master Plans. Şanlıurfa and Van together get the highest score which means most of the SUMP elements have already been involved in their ongoing Transport Master Plans. All 12 cities get scores in between 58%-78% rate. By considering the low difference in between the scores that cities get in this Success Rate category, these cities Transport Master Plans will be more easily converted to SUMPs regarding the cities involved in 0%-50% category. Even necessities are higher for SUMPs, it is harder to plan and develop SUMPs for the cities in between 0%-50% than the cities in between 50%-100%.

Sustainable Urban Mobility Solution for Turkey: City of Eskişehir Case

According to the survey results, PT is the most included while walking and cycling are the least included transport modes in current Transport Master Plans of Turkey.

In March 2012 Ministry of Environment and Urbanisation announced to financially support implementing bike lanes up to 45% of the projected cost to decrease traffic related air and noise pollution and to increase human and environmental health. (Ministry of Environment and Urbanisation, Bike Lane, 2012) But there was no Regulation on Cycling in 2012 and submitted bike lane projects by the municipalities were found inadequate and none of the municipalities could benefit from this support.

In November 2015 Regulation on Cycling was issued by Ministry of Environment and Urbanisation. And then the Ministry of Environment and Urbanisation again announced to support bike lane implementation financially which was planned according to the Regulation. (Ministry of Environment and Urbanisation, Bike Lane, 2016) But at the end of 2016 there was still no selected municipality to be financially supported. In August 2016, a bike lane sample project which was planned according to the Regulation was shared in Ministry of Environment and Urbanisation's web page with the municipalities as a best practice. (Ministry of Environment and Urbanisation, Bike Lane Sample Project Files, 2016) And also in 2016, Ministry of Health announced to donate 300.000 bikes to municipalities, children and youth in order to increase the physical activity and to motivate municipalities for implementing bike lanes. (Ministry of Health distribute 300.000 bikes in order to increase physical activity, 2016) These improvements in Turkey shows that cycling is at the focal point of the Government.

Complying with the Turkish Government's pleasing support to municipalities on cycling in 2016, cycling is found the most important sustainable urban mobility solution for Turkey to decrease car usage and avoid from ongoing urban mobility problems in Turkish cities. So, inclusion of cycling to the Transport Master Plans is crucial. With this assumption, there is need to assess the impact of the future bike lane projects as a new sustainable urban mobility solution to accelerate Turkish metropolitan municipalities to plan and implement bike lanes.

Data and Methodology

In recent years the impact of mobility on quality of life is becoming increasingly recognized by citizens and city authorities. (World Business Council for Sustainable Development, 2015: 14) Since fatalities are direct threats to human life, fatalities are found the most important indicator to evaluate the quality of life.

To assess the future impacts of bike lane projects, indicator set are created from quality of life perspective according to the available data in Turkey. The indicator set is a tool for cities to evaluate the future situation of the bike lane projects and to evaluate the potential impact of selected indicators. There are no indicators in the literature evaluated with the formulas below. 6 indicators are developed for Turkish metropolitan municipalities to evaluate new bike lane projects from quality of life perspective:

- Total bike lane implemented: Comprises total kilometer of bike lanes in the city after the new bike lane project.
- Total bike commuters served: Comprises total number of bike commuters in the city after the new bike lane project.
- Annual bike commuters served: Comprises annual bike commuters in the city during the new bike lane project.
- Annual bike commuters’ fatalities occurred: Comprises annual bike commuters’ fatalities in the city during the new bike lane project.
- Total bike commuters’ fatalities prevented: Comprises total number of bike commuters’ fatalities prevented in the city after the new bike lane project.
- Economic value of total bike commuters’ fatalities prevented: Comprises current economic value of the total number of bike commuters’ fatalities prevented in the city after the new bike lane project.

At first to evaluate the impact of bike lane projects in terms of quality of life, without bike lane project scenario and with bike lane project scenario should be calculated. With bike lane project scenario is an estimated situation so estimated calculations should be done about how commuters, fatalities and their economic value would have changed if new bike lane project will be implemented.

City of Eskişehir is selected as an example because Eskişehir is the first city in Turkey which decided to revise its Transport Master Plan to SUMP in 2015. Under SUMP, Eskişehir decided to implement 8,478 km bike lane in between years 2015-2019. Necessary data for the calculation is obtained from Calibration Report (İstanbul Technical University, 2016: 30-40) and city of Eskişehir Clean Air Action Plan 2014-2019 (Ministry of Environment and Urbanisation Eskişehir Environment and Urbanisation Provincial Directorate, 2014: 56).

Total Bike Lane Implemented

$Bla = Blb + Blp$

Where:

Blb: Bike lane before project (km)

Blp: Projected bike lane (km)

Bla: Bike lane after project (km)

Total Bike Commuters Served

$Bcb = Pb * Bcb\%$

Where:

Pb: Population of the city before project

Bcb%: Bike commuters' percentage before project

Bcb: Bike commuters before Project

For calculating the bike commuters after the new bike lane project, projected bike commuters should be calculated at first, then summed up with bike commuters before project. Projected bike commuters are not increasing directly proportional with the projected bike lanes. Elasticity number should be used to calculate the change rate of the projected bike commuters according to the projected bike lanes. Common procedure of transforming the bike lane per 100,000 population is followed and 0,25 elasticity at mean is found. (Buehler and Pucher, 2012: 420) As a projected bike commuter elasticity, 0,25 is used per 100.000 population. To use elasticity, first projected bike lane kilometer for the city which was known at the beginning of the project should be calculated for 100.000 population:

$Blp100.000 = (Blp * 100.000) / Pb$

Where:

Blp: Projected bike lane (km)

Pb: Population of the city before project

Blp100.000: Projected bike lane per 100.000 population (km)

And then projected bike lane per 100.000 population is multiplied with projected bike commuters' elasticity per 100.000 to find projected bike commuters change rate:

$Bcpcr = Blp100.000 * Bcpe$

Where:

Blp100.000: Projected bike lane per 100.000 population (km)

Bcpe: Projected bike commuters' elasticity per 100.000 population (0,25)

Bcpcr: Projected bike commuters change rate

$Bcp = Bcb * Bcpcr$

Where:

Bcb: Bike commuters before project

Bcpcr: Projected bike commuters change rate

Bcp: Projected bike commuters

Bca = Bcb + Bcp

Where:

Bcb: Bike commuters before project

Bcp: Projected bike commuters

Bca: Bike commuters after project

Annual Bike Commuters Served

Bca% = Bca / Pb

Where:

Bca: Bike commuters after Project

Pb: Population of the city before project

Bca%: Bike commuters' percentage after Project

Yp = Ye - Yb

Where:

Ye: Project end year

Yb: Project beginning year

Yp: Total number of years of the project

Bci% = (Bca% - Bcb%) / *Yp*

Where:

Bca%: Bike commuters' percentage after project

Bcb%: Bike commuters' percentage before project

Yp: Total number of years of the project

Bci%: Bike commuters annual increase percentage

Bcy1% = Bcb% + Bci%

Where:

Bcb%: Bike commuters' percentage before project

Bci%: Bike commuters annual increase percentage

Bcy1%: Bike commuters' percentage for the project year 1

Bcny% = Bcpy% + Bci%

Where:

Bcpy%: Bike commuters' percentage for the previous year

Bci%: Bike commuters' annual increase percentage

Bcny%: Bike commuters' percentage for the next year

To find bike commuters for every year of the project:

*Bcy1 = (Bcb / Bcb%) * Bcy1%*

Where:

Bcb: Bike commuters before project

Bcb%: Bike commuters' percentage before project

Bcy1%: Bike commuters' percentage for the project year 1

Bcy1: Bike commuters for the project year 1

*Bcny = (Bcpy / Bcpy%) * Bcny%*

Where:

Bcpy: Bike commuters for the previous year

Bcpy%: Bike commuters' percentage for the previous year

Bcny%: Bike commuters' percentage for the next year

Bcny: Bike commuters for the next year

Annual Bike Commuters Fatalities Occurred

Bcr = (Bcy1 / Bcb)

Where:

Bcy1: Bike commuters for the project year 1

Bcb: Bike commuters before project

Bcr: Bike commuters rate to the before project

Bcr = (Bcny / Bcb)

Where:

Bcny: Bike commuters for the next year

Bcb: Bike commuters before project

Bcr: Bike commuters rate to the before project

*Bcbdt = Bcb% * Dtb*

Where:

Bcb%: Bike commuters' percentage before project

Dtb: Daily trips for all modes before project

Bcbdt: Bike commuters' daily trips before project

*Bcfb = (Bcbdt * Tfb) / Dtb*

Where:

Bcbdt: Bike commuters' daily trips before project

Tfb: Traffic fatalities for all modes before project

Dtb: Daily trips for all modes before project

Bcfb: Bike commuters' fatalities before Project

Since new bike lane is likely to increase the concentration of cyclists in specific areas and therefore increase the visibility of cyclists to drivers, fatalities are admitted to be decreasing 0,4 power of bike commuters. (Jacobsen, 2003: 208) So to find the bike commuters fatalities for the each project year, bike commuters rate to the before project situation for every project year should be decreased by annual bike commuters fatality decrease rate (0,4 power) and then multiplied with bike commuters fatalities before project.

*Bcfny = (Bcr ^ Bcfdr) * Bcfb*

Where:

Bcr: Bike commuters rate to the before project

Bcfdr: Annual bike commuters' fatalities decrease rate (0,4 power)

Bcfb: Bike commuters' fatalities before project

Bcfny: Bike commuters' fatalities for the next year

Total Bike Commuters Fatalities Prevented

Bcfi= Bcfny - Bcfb

Where:

Bcfny: Bike commuters' fatalities for the next year

Bcfb: Bike commuters' fatalities before project

Bcfi: Annual bike commuters' fatalities increase

Health Economic Assessment Tool (HEAT) for cycling is applied besides annual bike commuters' fatalities increase formula to get bike commuters fatalities prevented with new bike lane project. (World Health Organization, 2014) By entering data which is obtained from previous calculations, annual bike commuters fatalities prevented and their economic value can be easily calculated by using HEAT for cycling.

In addition to the data from previous calculations, just one extra data, population after project which can be easily obtained, should be entered to HEAT. And 124 days for "annual bike commuters' trips", 100 for "proportion of cycling data attributable to your intervention", 0 for "time needed to reach full level of cycling", 5 for "discount rate to apply to future benefits" should be advised to use as default values in HEAT.

Bike commuters' daily trips after project should be calculated by direct proportion in to enter HEAT:

$Bcadt = (Bca * Bcbdt) / Bcb$

Where:

Bca: Bike commuters after project

Bcbdt: Bike commuters' daily trips before project

Bcb: Bike commuters before project

Bcadt: Bike commuters' daily trips after project

After entering all data to the HEAT, a number is found for annual bike commuters' fatalities prevented by HEAT as an outcome.

$Bcfp = BcfpH - Bcfi$

Where:

BcfpH: Annual bike commuters' fatalities prevented by HEAT

Bcfi: Annual bike commuters' fatalities increase

Bcfp: Annual bike commuters' fatalities prevented

$Bcatfp = Bcfpy1 + Bcfpy2 + Bcfpy3 + \ldots\ldots\ldots.$

Where:

Bcfpy1: Annual bike commuters' fatalities prevented (for the project year 1)

Bcfpy2: Annual bike commuters' fatalities prevented (for the project year 2)

Bcfpy3: Annual bike commuters' fatalities prevented (for the project year 3)

Bcatfp: Total bike commuters' fatalities prevented after project

Economic Value of Total Bike Commuters Fatalities Prevented

$BctfpH = BcfpH * Yp$

Where:

BcfpH: Annual bike commuters' fatalities prevented by HEAT

Yp: Total number of years of the project

BctfpH: Total bike commuters' fatalities prevented by HEAT

$EBcatfp = (Bcatfp * EBctfpH) / BctfpH$

Where:

Bcatfp: Total bike commuters' fatalities prevented after project

EBctfpH: Economic value of the total bike commuters' fatalities prevented by HEAT (TRY (Turkish Lira))

BctfpH: Total bike commuters' fatalities prevented by HEAT

EBcatfp: Economic value of the total bike commuters' fatalities prevented after project (TRY)

As a case study, evaluation of Eskişehir Bike Lane Project with this cycling indicators are summarized collectively.

With the 8,478 kilometers long new bike lane project which was started in 2015 under SUMP, city of Eskişehir's total bike lane will be 55,867 kilometers long at the end of the project in 2019.

During the new bike lane project implementation in between 2016 and 2019, the annual number of bike commuters will increase. Number of bike commuters in 2016 in Eskişehir will be 10.387 people. Number of bike commuters in 2017 in Eskişehir will be 11.023 people. Number of bike commuters in 2018 in Eskişehir will be 11.659 people. At the end of the project in 2019, the 55,867 kilometers long new bike lane will serve to 12.294 bike commuters.

By using new bike lane in between 2016-2019, annual number of bike commuters' fatalities will also increase. Number of bike commuter fatality in

2016 in Eskişehir will be 1,071 person. Number of bike commuter fatality in 2017 in Eskişehir will be 1,096 person. Number of bike commuter fatality in 2017 in Eskişehir will be 1,121 person. At the end of the project in 2019, the 55,867 kilometers long new bike lane will cause 1,145 bike commuter fatality.

By thinking the health effects of implementing new bike lane project in Eskişehir with the help of HEAT; new bike lane will prevent 0,68 bike commuter fatality in 2019 and economic value of preventing 0,68 bike commuter fatality is 670.000 TRY.

By taking into consideration both the bike commuter fatality increase with the project and bike commuter fatality prevented during the project by HEAT, new bike lane project in Eskişehir will prevent 0,422 bike commuter fatality in 2019 as a conclusion. And economic value of preventing 0,422 bike commuter fatality is 415.850 TRY.

Conclusion

As a result of the questionnaire, even PT included in current Transport Master Plans, walking and cycling are found to be non-included. Since current Transport Master Plans are motorised modes and infrastructure oriented plans, the metropolitan municipalities are aware and close to the people oriented SUMP planning idea and starting to implement walking and cycling partially even they are not in their Transport Master Plans. But there is not enough qualified, experienced human source, capacity and budget to plan and implement walking and cycling. By considering the metropolitan municipalities are close to the SUMP idea, the only missing issue is to accelerate decision makers in metropolitan municipalities to convert their Transport Master Plans to SUMPs by including walking and cycling. Then the number of workforces in metropolitan municipalities need to be increased and trained via capacity building trainings. When thinking the ongoing Transport Master Plans' high budgets and their congestion caused problematic results which brought more economic loss and unliveable cities, SUMPs costs are not higher than these costs and SUMPs will also reimburse their costs economically, environmentally and socially soon. So, it is more feasible for metropolitan municipalities to prepare SUMPs with their limited budgets than preparing current Transport Master Plans.

By taking into consideration Turkey's ongoing strategic, legal and financial support to cycling; cycling is found the most important sustainable urban mobility solution for Turkish cities to solve ongoing urban mobility problems. Since cycling is a very new planning and implementation concept in Turkey, their future impacts are not evaluated before. To fill this gap and to motivate decision makers at metropolitan municipalities to plan and implement bike lanes, cycling indicators are created to evaluate the future impacts of new bike lane projects according to the available data collected for current Transport Master Plans. Indicators are developed to calculate the bike commuters served with the project, how many bike commuters' fatalities will be prevented and its economic value.

As a result of the Eskişehir case study, since projected bike lane kilometers are not high in Eskişehir Bike lane Project, bike commuters' fatalities prevented after project seems to be low. But when it comes to the economic value of fatalities prevented, it is found significantly high. Economic value of Eskişehir case proves that if Turkish metropolitan municipalities will implement new bike lanes as a sustainable urban mobility solution to solve urban mobility problems, it will also bring high economic benefit besides solving urban mobility problems. Cycling indicators will help evidence-based decision making. This enhanced knowledge will help facilitate effective integration of walking and cycling into Transport Master Plans, transforming them to SUMPs. In doing so Turkish cities will be better places to improve health, increase economic efficiency, enhance access. This will also assist decision makers understand the economic return on investment that can be achieved through increasing expenditure on walking and cycling.

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