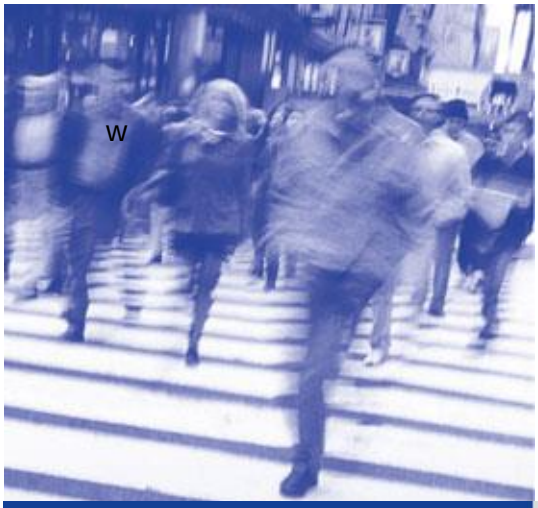

CiViTAS
Cleaner and better transport in cities

CAPITAL

Fostering cycling in city centers via public bike sharing systems

Budapest

Take-up city:	Kocaeli
Population:	1,722,795
Area (km2):	
Take-up level: 4 (Systematic transfer)	
Thematic Focus:	Implementation Scenarios
Cooperating Pioneer City:	Budapest
Responsible Author(s): Çiğdem Çörek Öztaş	
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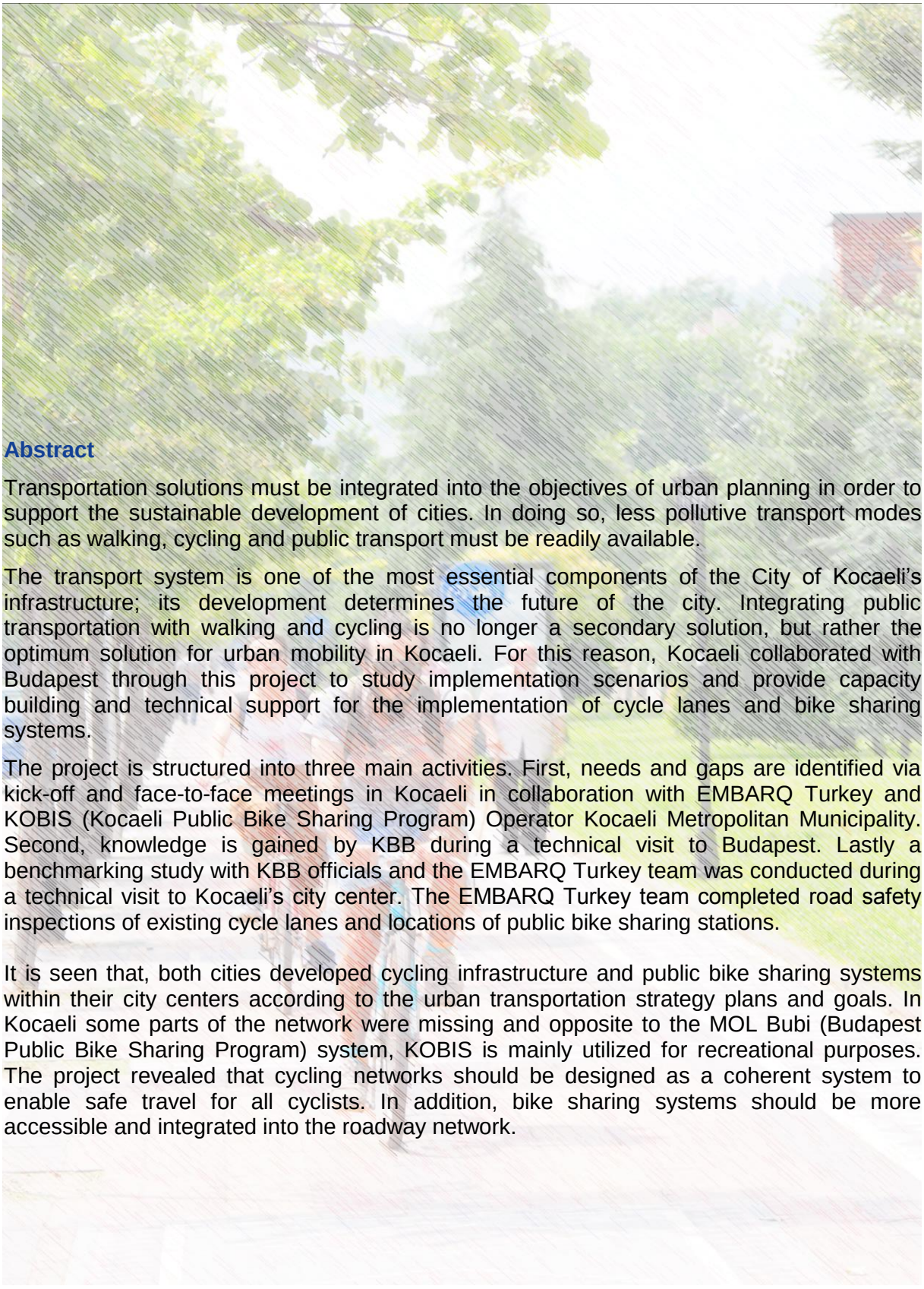
Date:	07.07.2015
Status:	Final
Dissemination level:	Public

THE CIVITAS INITIATIVE
IS CO-FINANCED BY THE



Abstract

Transportation solutions must be integrated into the objectives of urban planning in order to support the sustainable development of cities. In doing so, less pollutive transport modes such as walking, cycling and public transport must be readily available.

The transport system is one of the most essential components of the City of Kocaeli's infrastructure; its development determines the future of the city. Integrating public transportation with walking and cycling is no longer a secondary solution, but rather the optimum solution for urban mobility in Kocaeli. For this reason, Kocaeli collaborated with Budapest through this project to study implementation scenarios and provide capacity building and technical support for the implementation of cycle lanes and bike sharing systems.

The project is structured into three main activities. First, needs and gaps are identified via kick-off and face-to-face meetings in Kocaeli in collaboration with EMBARQ Turkey and KOBIS (Kocaeli Public Bike Sharing Program) Operator Kocaeli Metropolitan Municipality. Second, knowledge is gained by KBB during a technical visit to Budapest. Lastly a benchmarking study with KBB officials and the EMBARQ Turkey team was conducted during a technical visit to Kocaeli's city center. The EMBARQ Turkey team completed road safety inspections of existing cycle lanes and locations of public bike sharing stations.

It is seen that, both cities developed cycling infrastructure and public bike sharing systems within their city centers according to the urban transportation strategy plans and goals. In Kocaeli some parts of the network were missing and opposite to the MOL Bubi (Budapest Public Bike Sharing Program) system, KOBIS is mainly utilized for recreational purposes. The project revealed that cycling networks should be designed as a coherent system to enable safe travel for all cyclists. In addition, bike sharing systems should be more accessible and integrated into the roadway network.

THE CIVITAS INITIATIVE IS CO-FINANCED BY THE EUROPEAN UNION

Table of Contents

1 Project description

Describe your activity in at least 1 page, indicating:

- *Location(s);* İzmit, Kocaeli's city center
- *Date(s);* From February 2015 to June 2015
- *Achieved objectives;*
  1. Needs and gaps are set via kick-off and face-to-face meetings in Kocaeli in collaboration with EMBARQ Turkey and KOBIS Operator Kocaeli Metropolitan Municipality (KBB) Department of Public Transport
  2. Knowledge gained by KBB during a technical visit in Budapest in collaboration with EMBARQ Turkey, MOL Bubi Operator Budapest Center for Transport (BKK) and Közbringa Ltd. (also responsible for Maintenance Services), KOBIS Operator KBB and KOBIS Vendor BAKSİ
  3. Benchmarking study and knowledge gained by three officials of KBB during a technical visit in Kocaeli's city center, İzmit by regarding road safety inspection of current cycle lanes and locations of public bike sharing stations in collaboration with EMBARQ Turkey
  4. Recommendations are set by a report on benchmarking study of MOL-Bubi and KOBIS systems, also safe cycling transportation infrastructure and network strategies
  5. Visibility conducted via different dissemination efforts by EMBARQ Turkey (see below)
- *Target audience;* Cycling infrastructure and Bike Sharing System operator metropolitan municipality of Kocaeli, vendor and replacement parts provider in İzmit, Kocaeli
- *Participants;*
  1. EMBARQ Turkey, Sustainable Transportation Association
  2. KBB, Kocaeli Metropolitan Municipality Department of Public Transport
  3. *BAKSİ* Bike Sharing System Vendor
  4. BKK, Budapest Center of Transport
  5. Közbringa Ltd., Maintenance Services and redistribution
- *Dissemination efforts;*
  1. All meetings and technical visits are posted in social media accounts of EMBARQ Turkey to 2000 followers.
  2. Report is published in the EMBARQ Turkey's website for continuous access.
  3. A blog post is published in thecityfixturkiye.com website to 1500 followers.
  4. Newsletters in Turkish and English sent to almost 4000 readers
- *Other relevant details.*

EMBARQ Turkey coordinated all stages of the project and supported KBB with technical assistance during the systematic transfer study. Within the systematic transfer approach to implement efficient, well-used, profitable and sustainable public bike sharing system in Kocaeli, there were three technical visits; two of which were conducted in the City of Kocaeli-İzmit and one in the City of Budapest. Technical meetings took place during these technical site visits to gain knowledge on urban transportation strategies of both cities. Moreover, since the vendor of the KOBİS system is national and has less experience than MOL Bubi vendor and operators, this project enhances their studies and provides capacity building opportunities to give efficient support to the City of Kocaeli.

2 Outcomes

Three meetings and field studies are conducted during the project cycle. Overview of these events are presented at Table 1 and related photos are given at Annex 1.

Item	Description
Kick-off and Face to Face Meetings EMBARQ Turkey Kocaeli Metropolitan Municipality Department of Public Transport	In addition to the kick-off meeting, face-to-face meetings with Kocaeli city officials and a preliminary field study were conducted. During the meeting, information on cycling networks, user behaviour, needs and gaps were collected. • City officials of Kocaeli conducted stakeholder meetings in 2013 in order to understand their needs and gaps enabling them to better meet their priorities or fulfil future plans. • Within this participatory approach, Kocaeli Metropolitan Municipality collaborated with a district municipality of the city center to construct 30 km of cycle lanes in 2014. • Metropolitan municipality implemented KOBIS, a public bike sharing system with 18 stations and 136 bikes in August 2014, which increased the clean vehicle mode share in the city center from the social attractive area. • Since the warm weather season, approximately 1,000 people used the bike sharing system daily and almost 60,000 rentals occurred during the previous season. • Currently, approximately 7,000 people hold a membership card for the public bike sharing system which can be used for all transit modes. Upon successful application, the smartcard allows public transport users to immediately access the public bike sharing system. • A 24/7 call center is available to oversee possible issues and operations of the system.

Technical Visit in Budapest EMBARQ Turkey BKK and Közbringa Ltd. Kocaeli Metropolitan Municipality Department of Public Transport BAKSİ - Bike Sharing System Vendor for KOBIS	A site visit was organized with the participation of Kocaeli city officials, Budapest city officials, Közbringa Ltd., and the EMBARQ Turkey team. During the meeting, BKK presented its vision for the bike sharing system and its operation in cooperation with Közbringa Ltd., which is responsible for the maintenance and redistribution of the system. A field study was also conducted to observe cycle lanes, bike friendly infrastructure, and integration of bike sharing stations. • Knowledge gained on strategic urban transport planning BKK. In 2001, The Municipality of Budapest approved a complex development plan for the transport system of Budapest (BKRFT). The plan was reviewed in 2009 for regional integration and an action plan with a horizon year of 2020 was drafted. The methodology is comprised of a problem tree based on an analysis of the existing situation, a vision (Budapest is a liveable, attractive capital city with a unique character and is a respected member of the European network of cities as the innovative economic and cultural centre of the country and the city region.") a hierarchy of goals and objectives (complex, strategic. and operational objectives), as well as areas of intervention (priorities) and measures assigned to the strategic objectives. These measures may be broken down to development projects in a synergic relationship with each other. Additional elements include a partnership, communication plan, strategic environmental review, and ex-ante (independent) evaluation prior to implementation. • Knowledge gained on the operational model of a bike sharing system. According to the business model Vendor of the system is one of the biggest in the world, Nextbike where the IT integration of the system is set by T Mobile and osepel. System is operated by two organizations BKK and Közbringa Ltd. where Közbringa is responsible for maintenance and redistribution and reports to BKK. Branding is one of the key success of the system. Mol Group currently sponsors 75 stations and 1100 bikes.

Technical Site Visit in Kocaeli EMBARQ Turkey Kocaeli Metropolitan Municipality Department of Public Transport	A technical site visit to Kocaeli informed the current situation of cycle lanes and the bike sharing system. Future plans were discussed in accordance with the Kocaeli Transportation Master Plan. A comprehensive field study of the cycling infrastructure and bike sharing system were conducted to benchmark the Budapest technical visit, and to inspect the safety and accessibility of the cycle infrastructure and bike sharing system. • Existing cycle lanes and bike-friendly infrastructure that complement the bike sharing system were inspected for road safety and accessibility. • The bike sharing system kiosks, stations, and maintenance building were visited. Staff compared the BUBI and KOBIS during the field study. • The planned cycle lanes map was studied, future plans were discussed, and a road safety and accessibility audit for one of the planned cycle lane road was conducted.

Table 1: Table of project related technical visits outputs

3 Evaluation

Parallel with the previously heavily fragmented cycling network, bike traffic has grown drastically over the past few years whereby cyclists have become natural participants in transport and public spaces in Budapest. According to bike traffic count data, the number of cyclists on working days doubled between 2006 and 2010. In order to ensure bicycle accessibility in the city, a new, continuous, and safe central bike network will be built in the inner city within the Hungária körút. The network will connect parts of the city in a legible way for its users and provide a connection between the Budapest network and regional bike routes. In the outer parts of the city, the development of local bike connections and connections between district centres will assist commuters cycling to work and improve access throughout the region and to tourist attractions. Local bike infrastructure supplements the main bike network in Budapest and facilitates short, 1 to 5 km trips within districts by turning the road network into a bike-friendly network.

In Kocaeli, the Metropolitan Municipality of Kocaeli and a district municipality of the city center constructed 30 km of cycle lanes in the past year. In August 2014, the Metropolitan Municipality also implemented a public bike sharing system called KOBIS with 18 stations and 136 bikes. The goal was to expand the local bike network and reach more people both during the summer and in the winter. The project and site visit to Budapest help to inform the expansion of cycling infrastructure in Kocaeli.

In relation with European Commission's Urban Mobility Package

The European Commission's Urban Mobility Package mainly focuses on the "Sustainable Urban Mobility".

A Sustainable Urban Mobility Plan presents, or is linked to an existing long-term strategy for the future development of the urban area and, in this context, for the future development of transport and mobility infrastructure and services. The central goal of the Sustainable Urban Mobility Plan is to **improve the accessibility of urban areas** and **provide high-quality and sustainable mobility and transportation throughout and within the urban area**. It addresses the needs of the 'functioning city' and its hinterland rather than a municipal administrative region. Therefore, these plans should be developed in **cooperation with different policy areas and sectors** (transport, land-use and spatial planning, environment, economic development, social policy, health, road safety, etc.); with different levels of government and administration; as well as with authorities in neighbouring areas – both urban and rural (European Commission, 2013). **This planning concept maintains that urban mobility is primarily about people**. **It therefore emphasises citizen and stakeholder engagement and fosters changes in mobility behaviour** (European Commission, 2013).

New approaches to urban mobility planning are emerging as local authorities depart from past approaches and develop strategies that stimulate a shift towards cleaner, more

sustainable transport modes, such as **walking, cycling, public transport, and new patterns for car use and ownership**.

With the Urban Mobility Package, the Commission reinforces its supporting measures in the area of urban transport by:

- *Sharing experiences, show-casing best practices, and fostering cooperation*
- *Providing targeted financial support*
- *Focusing research and innovation on delivering solutions for urban mobility challenges,*
- *Involving the Member States and enhance international cooperation*

According to the title "Sharing experiences, show-casing best practices, and fostering cooperation", a face-to-face meeting with Kocaeli Metropolitan Municipality Department of Transportation Representatives, a site visit to Budapest, and a site visit to Kocaeli was conducted. During the face-to-face meeting, data on cycling infrastructure, the number of cyclists, the needs and expectation of cyclists and planned infrastructure investments was taken. After the meeting, a site visit to Budapest took place on the 22nd to 24th of April 2015. The city officials of Kocaeli, representatives from EMBARQ Turkey, and city officials of Budapest participated to the visit. During the visit, city officials shared their experiences with cycling infrastructure and Budapest city officials presented the cities' key challenges and issues with the cycling network. Following the presentations, Kocaeli city officials and EMBARQ Turkey team tried the bike sharing system. A site visit to Kocaeli took place on the 16th of June by the EMBARQ Turkey team. Kocaeli city officials and the EMBARQ Turkey team investigated a way to adapt the system learned in Budapest.

Lagging behind Western European trends, Budapest's approach to urban mobility planning gradually changed at the turn of the century.

The criteria of livability began to be applied at the strategic level; pedestrian zones, cycling infrastructure, and traffic calming projects were implemented. By the site visit to Budapest, Kocaeli city officials had a chance to see the cycling implementations and bike sharing system in accordance with "focusing research and innovation on delivering solutions for urban mobility challenges". The collaboration between Budapest and Kocaeli coincided with the title "Involving the Member States and enhance international cooperation".

4 Issues arising

4.1 Drivers

Cycling brings people together and creates a better balance in the social space. As a sustainable transportation mode, it has several advantages including:

- Promotion of public transport through intermodal share;
- Reduction of private motor vehicle dependency; and
- Contribution to active and healthy lifestyles.

Moreover, the promotion of cycling through public bike sharing systems can contribute to the local economy and carbon-free economic growth. With this in mind, Kocaeli and Budapest developed cycling infrastructure and public bike sharing systems within their city centers to coincide with the urban transportation strategy plans and goals. According to the Kocaeli Transportation Master Plan in 2014, goals and plans for railway and integrated transport are intended to create a comfortable, economic, environmentally- and disabled-friendly transportation network; and to support measures for the safety of public transport. Moreover, strategic objectives under these goals are divided into public transport and the integration of non-motorized transport:

- Reorganizing public transport system to increase quality and service;
    - Completing 7 railway system projects until 2035;
    - Reconstructing public transport systems for disabled people until 2019;
    - Establishing passenger information system, increasing the portion of Wi-Fi services into the public transportation systems, environment friendly bus stations;
    - Establishing a control system for public transportation (The number of integration projects, workshops etc.; and
    - Preparing of education programs for public transport drivers.
- Integrating non-motorized transport with public transport;
    - Building an intermodal infrastructure between railway system, cycle lanes and pedestrianization area; and
    - Expanding the public bike sharing system into the citywide program.

Stakeholder meetings conducted by Kocaeli city officials help understand their needs and gaps and enable them to better achieve their priorities and/or fulfill future plans. Within this participatory approach, the Kocaeli Metropolitan Municipality (KBB) and the central district municipality-İzmit implemented 30 km of cycling infrastructure. In August 2014, KBB independently installed a public bike sharing system, KOBIS, with 18 stations and 136 bikes. This helped to increase the green transport mode share in the city center that serves an approximate population of 338,710. It also increased the usage of cultural and social attractive areas. Since the summer, the public bike sharing system attracted 1,000 users

daily and nearly 65,000 rentals in previous months. Currently, there are over 7,000 bike share members. Immediate membership is possible through a smartcard which can also be used for all transport modes. A 24/7 call center also addresses possible issues and system operations. Due to the high demand from citizens, the Kocaeli Metropolitan Municipality is willing to expand this system to districts

By the end of the first year, more than 500,000 rentals and 10,000 membership applications are expected. Kocaeli Metropolitan Municipality is planning to expand the system in the coming years. With this expansion and data collected from the first year of the program, total demand management of the system will be carried out for the citizens to extend to other districts of the city with new cycle lanes and public bike sharing system utilities.

Social media users contribute to the optimization and improvement of the system each day. All social media feedback and stakeholder requests to the call center are collected before the extension of the system.

Regarding this vision and related work of the municipality, KOBIS (Kocaeli Public Bike Sharing Program) and MOL Bubi (Budapest Public Bike Sharing Program) are studied to transfer good knowledge and technical assistance.

4.2 Barriers

As the benchmark study is carried by both local authorities and EMBARQ Turkey's transport engineer and urban planner, it is agreed that the two bike sharing programs, KOBIS and MOL Bubi, have completely distinctive features as a transportation mode. KOBIS is mainly utilized for recreational purposes. A comparison of the different features, bike usage patterns, and users' travel behaviors etc. provides insights on the factors that make a bike sharing program a truly sustainable transportation mode. The three factors discussed below directly affect the success of a sustainable public bike sharing system

- Fare system;
- Coverage area; and
- System metrics.

Fare System

Public bike sharing system has several cost items including staff, maintenance, fuel for service vehicles, redistribution costs, maintenance, marketing, electricity and internet connectivity for stations, and membership cards. To overcome these costs, operators work on optimized fare system and efficient advertisement budgets. Affordable fare systems along with a significant amount of initial financial investment cause financial deficits for the programs. Moreover, fare revenue does not compensate all expenses.

Both KOBIS and MOL-Bubi provide affordable fare systems and are free for the first 30 minutes. This allows users to make a large portion of short trips for free.

MOL-Bubi charges HUF 12,000 for its annual membership fee. With a membership, users can rent bikes at a reduced fare, HUF 12,000 instead of HUF 18,000. On the other hand, KOBIS does not offer an extra membership policy. It provides availability to use the program in existing smart card urban transportation system (KENTKART). After the first hour, users pay 2 Turkish Liras (approximately 2/3 Euro). The fare increases to 1 Turkish Liras (approximately 1/3 Euro) per hour thereafter.

While KOBIS did not generate any revenue from advertisement while the revenue MOL Bubi was 406.000 euro from MOL-Bubi. KOBIS is in negotiation with private companies. For these reasons, both systems have financial deficits and depend on local subsidies.

Coverage Area (System Metrics)

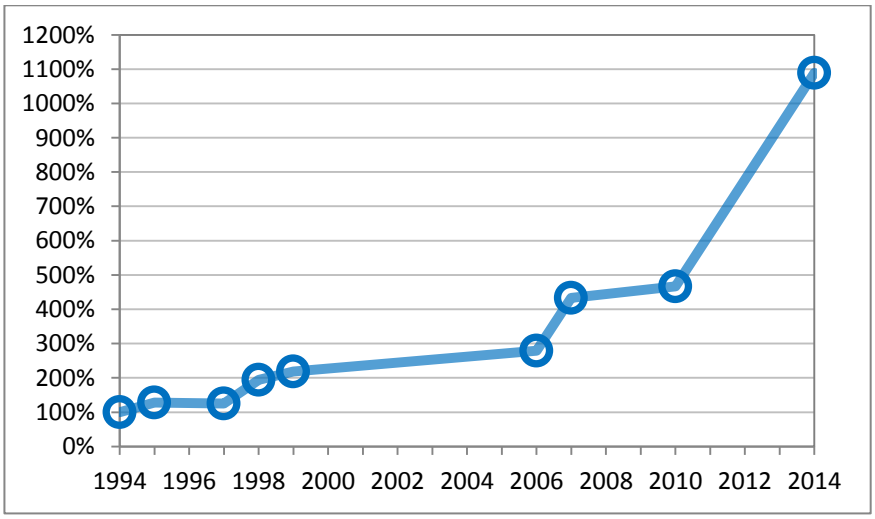


Figure 1: Cycling trend in Budapest (Transport Strategy BKK Centre for Budapest Transport, 2015)

The graph above shows the high increase of cycling traffic in Budapest (1994 – 2014) on the basis of 6 junctions. When beginning to plan a system, the most critical factors of creating a successful system with high ridership are identifying a coverage area (the physical area that the public bike sharing system will cover) and saturating it with the appropriate number of stations. The coverage area must be large enough to contain a significant set of users' origins and destinations. If it is too small to connect meaningfully to other places, the system will have a lower chance of success because its convenience will be compromised.

Dense, mixed-used areas with a high trip-generation capacity (generally city centers) are likely to see the most demand for bike sharing, as they are both the origin and destination

points of many trips. The identification of the appropriate coverage area is best carried out by qualified planning institutions through surveying and statistical data analysis.

According the Budapest Transport Development Strategy; cycling traffic count (see Figure 2) and the cyclist surveys are carried out to identify the coverage area through feasibility studies of MOL-Bubi related to BTM Cycling Strategy (between 2009-2011).On the other hand, Kocaeli's Transportation Master Plan, which was carried out in 2014, offers basic bike network recommendations with customized maps. The Transportation Master Plan cited a 10% modal share of cycling by 2014.

Figure 2: Bike counter in Budapest (Transport Strategy BKK Centre for Budapest Transport, 2015)

Bike counters in Budapest which have been placed in six junctions provide ongoing data updates via real-time cyclist information. Kocaeli should also provide these counters to sustain efficient projections for future developments.

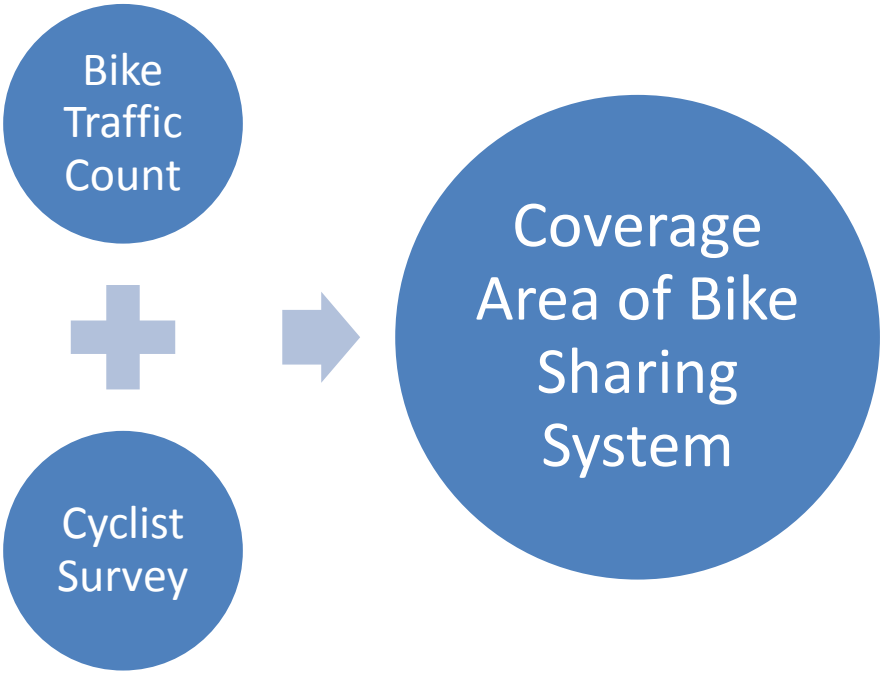


Figure 3: Process of identify coverage area of bike sharing system in Budapest

According to ITDP's Bike Share Planning Guide; to provide a well-used and efficient public bike sharing system, it must have a minimum system coverage area of 10 km^2. Both KOBIS and MOL-Bubi have approximately the same coverage area with 15 km^2. However, the fundamental difference between KOBIS and MOL-Bubi the different geographical service extents of two programs. MOL-Bubi serves the inner city (downtown) while KOBIS serves limited numbers of origins and destinations for recreational purposes along the coast. MOL-Bubi serves utilitarian purposes rather than recreational purposes.

Below two figures show the public bike sharing system coverage areas of MOL-Bubi and KOBIS, respectively.

Figure 4: MOL Bubi's coverage area (Transport StrategyBKK Centre for Budapest Transport, 2015)

Figure 5: KOBIS's coverage area (EMBARQ Turkey, 2015)

System Metrics

At its most basic level, a bike-share system is comprised of a number of bikes, docks, and stations, which serve a given market. These characteristics must be properly planned and designed for a bike share system to be well-used and efficient.

Number of bikes is defined as the number of bikes in active circulation in a system (in a dock or in use). This is not the total number of bikes owned by a system (which may include bikes that are being repaired or are part of the contingency fleet), which is less relevant to measuring the performance of the system. MOL-Bubi has 1100 bikes and KOBIS has 136 bikes in total.

Figure 6: Views of a KOBIS's station (left) and MOL Bubi's station (right)

Number of docks is defined as the number of functional parking locations where a single bike can be checked in or out. *MOL-Bubi has* 1543 docking spaces, KOBIS has 216 docking spaces.

Figure 7: KOBIS's dock (left) and MOL Bubi's dock (right)

Number of stations is defined as the number of specific locations where a bike can be checked in and/or out. Each station consists of multiple docks.

MOL Bubi has 76 stations and KOBIS has 18 stations

The system size is determined by the number of bikes and stations that a proposed system should have. From the user's perspective, the main considerations are the density of stations and availability of bikes and docking spaces to park bikes. A good station density within the coverage area ensures that no matter where a user is, there will be a station within a convenient walking distance to both the origin and destination of his or her trip. The longer the distance between the stations, the less convenient the system becomes for the user. A lack of bikes or docking spaces result in frustrated users.

Station Density Ratio: the average number of stations within a given area. To create a reliable and convenient network, cities should achive a uniform station density throughout the coverage area to ensure users can easily bike and park anywhere in that area. This parameter ideally scales the spacing of stations so they are within a reasonable walking distance within the coverage area. An ideal station density is approximately 10 to 16 stations per square kilometer.

Equation 1-MOL Bubi

$$\frac{X}{Y} = Z$$

$$\frac{76}{15} = 5.066$$

X: MOL Bubi's station number

Y: MOL Bubi's coverage area

Z: Station density

Z ⌴ 5

Equation 2- KOBİS

$$\frac{X}{Y} = Z$$

$$\frac{18}{15} = 1.2$$

X: KOBIS's station number

Y: KOBIS's coverage area

Z: Station density

Z ⌴ 1

The station density per bike sharing system in Budapest and Kocaeli are approximately 5 and 1 respectively. Neither MOL Bubi and KOBİS offer an ideal station density for their current coverage area. Increasing station density will further promote cycling as a mode of urban transportation. For example, the distance between stations is 300 meters in Paris and 250 meters in Mexico City. Both bike sharing system should consider improving their current coverage area by installing additional stations.

Bikes per population Ratio: the average number of bikes per person in the coverage area. This parameter scales the number of bikes to the number to potential users in the area in order to ensure that there is enough supply to meet demand. Large, dense cities or areas

with high numbers of commuters and/or tourists will likely require a bike per population ratio of at least 10 to 30 bikes per 1.000 residents.

The City of Budapest's population is 1,744,665 and MOL-Bubi has 1100 bikes. The number of bikes per population is approximately 0.6 bike in Budapest.

The City of Kocaeli – İzmit's population is 338,710 and KOBİS has 136 bikes. The number of bikes per population is approximately is 0.3 bike in Kocaeli.

Both KOBIS and MOL Bubi do not offer an ideal number of bikes per population. Both bike sharing system should increase the number of bikes according to population through their current coverage area.

Docks-per-bike Ratio: the average number of docking spaces per bike; having more free docking spaces than occupied docking spaces is critical to ensure the availability of a parking space to users in multiple locations. Once the number of bikes needed for the system has been determined, the required number of free docking spaces should be considered as a function of the number of total docks available per bikes in service.

Docks-per-bike Ratio: the average number of docking spaces per bike; having more free docking spaces occupied docking spaces is critical to ensure the availability of a parking space to users in multiple locations. Once the number of bikes needed for the system has been determined, the required number of free docking spaces should be considered as a function of the number of total docks available per bikes in service.

Ideal number of docking spaces per bike ratio is 2–2.5 according the ITDP Bike Share Planning Guide.

MOL- Bubi has 1100 bikes and 1543 docking spaces. The number of docking spaces per bike ration is approximately is 1.4.

KOBIS has 136 bikes and 216 docking spaces. The number of docking spaces per bike ration is approximately is 1.6

Both KOBIS and MOL-Bubi do not offer an ideal number of docking spaces per bike ratio. Both bike sharing system should increase the number of docking spaces per bike ratio according to population through their current coverage area.

Redistribution

Redistribution is broadly defined as the rebalancing of bikes in stations either to prevent totally empty and/or full stations. Successful redistribution is critical for the viability of the system from the users' perspective, and redistribution is one of the greatest challenges forthe operator, accounting for as much as 30% of operating costs in European systems (Optimizing Bike Sharing in European Cities: A Handbook. June 2011).

While a bike sharing system may operate 24 hours a day, most of the trips occur between 7 a.m. and 9 p.m. During those periods, redistribution may be necessary, especially for

stations that experience high peak-demand. For example, most systems have found that stations at the tops of hills are often empty, as people will check out a bike and ride down the hill, but will rarely ride up the hill to park at that station. Lack of free docking spaces for bikes results in frustrated users.

MOL-Bubi addresses the lack of docking spaces related to redistribution with a **green extra stand** located near the station (See Figure 8). If a docking station is full, a user can return bike to the green extra stand by waving a MOL-Bubi pass to the sensor on the rear of the bike and entering in a PIN code. The lock opens and the user can secure his or her bike to the green extra stand so that it cannot be removed.

Figure 8 MOL-Bubi green extra stand

The green extra stand helps solve the redistribution problem including the redistribution vehicles used in the field. By comparing both bike sharing systems regarding redistribution and the station density within coverage area; MOL-Bubis's stations are more convenient located within walking distance to major origins and destinations. On the other hand, KOBIS only has a service vehicle for the redistribution of bikes as shown in Figure 9.

Figure 9 KOBIS's redistribution vehicle (EMBARQ Turkey, 2015)

In conclusion a bike sharing system's operating costs reflect the system's size and sophistication. Currently KOBIS did not generate any revenue from advertisement and KBB should have reduce these operating costs. Extra stands similar to MOL-Bubi's are a viable solution for KOBIS to help reduce the operating. It is easy to adapt by KOBIS however bikes needs to be retrofitted with self-locks like MOL-Bubi.

4.3 Risk assessment

The drivers and barriers discussed in previous sections detail the current situation of the KOBIS and MOL-Bubi systems. The following section presents the possible risks of KOBIS system in the City of Kocaeli. The risk assessment of the KOBIS public bike sharing system is conducted under two topics:

- Bike Lanes Road Safety Inspections; and
- Feasibility study for business model

Road safety inspection is defined as a systematic review of an existing road with the intention of identifying potential hazards to road users. The purpose of road safety inspections of existing roads is to improve the road safety level on existing roads by identifying and remedying hazardous conditions, faults and deficiencies along the road that can lead to serious accidents.

Operational issues are defined as issues of the business model which include maintenance service budgets, procurement of replacement parts and improvement the hardware and software of the system.

Cycling Infrastructure Construction with Road Safety Approach

Safety has been a concern to all cities that have implemented bike sharing, therefore road safety inspections has been carried out by the EMBARQ Turkey Technical Team in June 16, 2015. Due to the scattered structure of the extended cycling network in Kocaeli, the inspection only focused on the cycling infrastructure that lays along the public bike sharing system and general recommendations with several specific points.

When an issue, considered was “not safe” for cyclists and other users within the road safety approach, it was identified by EMBARQ Turkey Technical Team, referred as a ‘problem’. Each problem is followed by recommendation(s) on how the problem can be treated. This study is carried out via well-established experience and knowledge of safe road design and traffic operation as well as knowledge on the effect of road safety measures from Budapest.

(1) Cycling network

Problem

The planned cycling network in Kocaeli is extensive, but has several gaps (see Figure 10). For the use of the network and for the safety of cyclists on the network it is important to have a coherent and a direct route for the users. It is also important that the network is extended to where the demand is highest, which normally is in the city center.

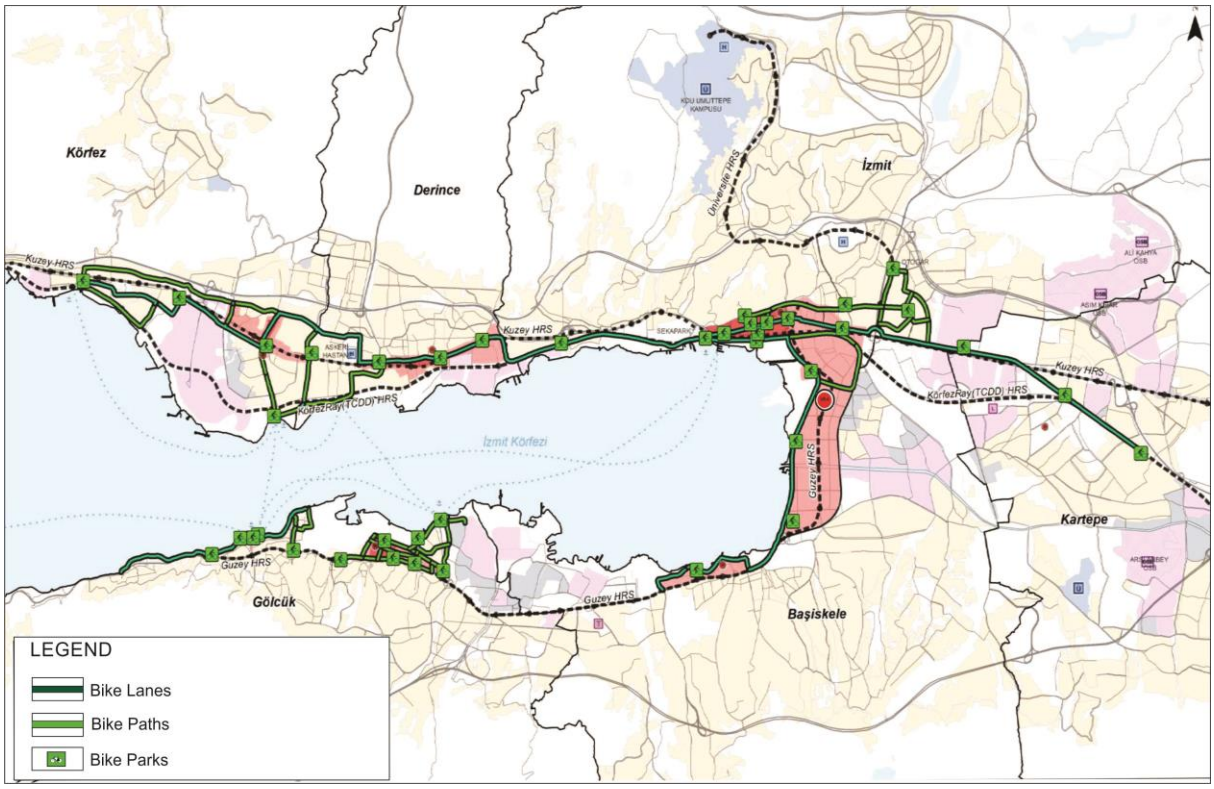


Figure 10 Cycling network in Kocaeli (EMBARQ Turkey, 2015)

Recommendation

The cycling network should be designed as a coherent system for all bike users to travel safely around the central area of Kocaeli. To meet this requirement the system should be supplemented with some missing sections similar to city center of Budapest (see Figure 11). For this reason, it will be useful to use cyclist counters as recommended in section above.

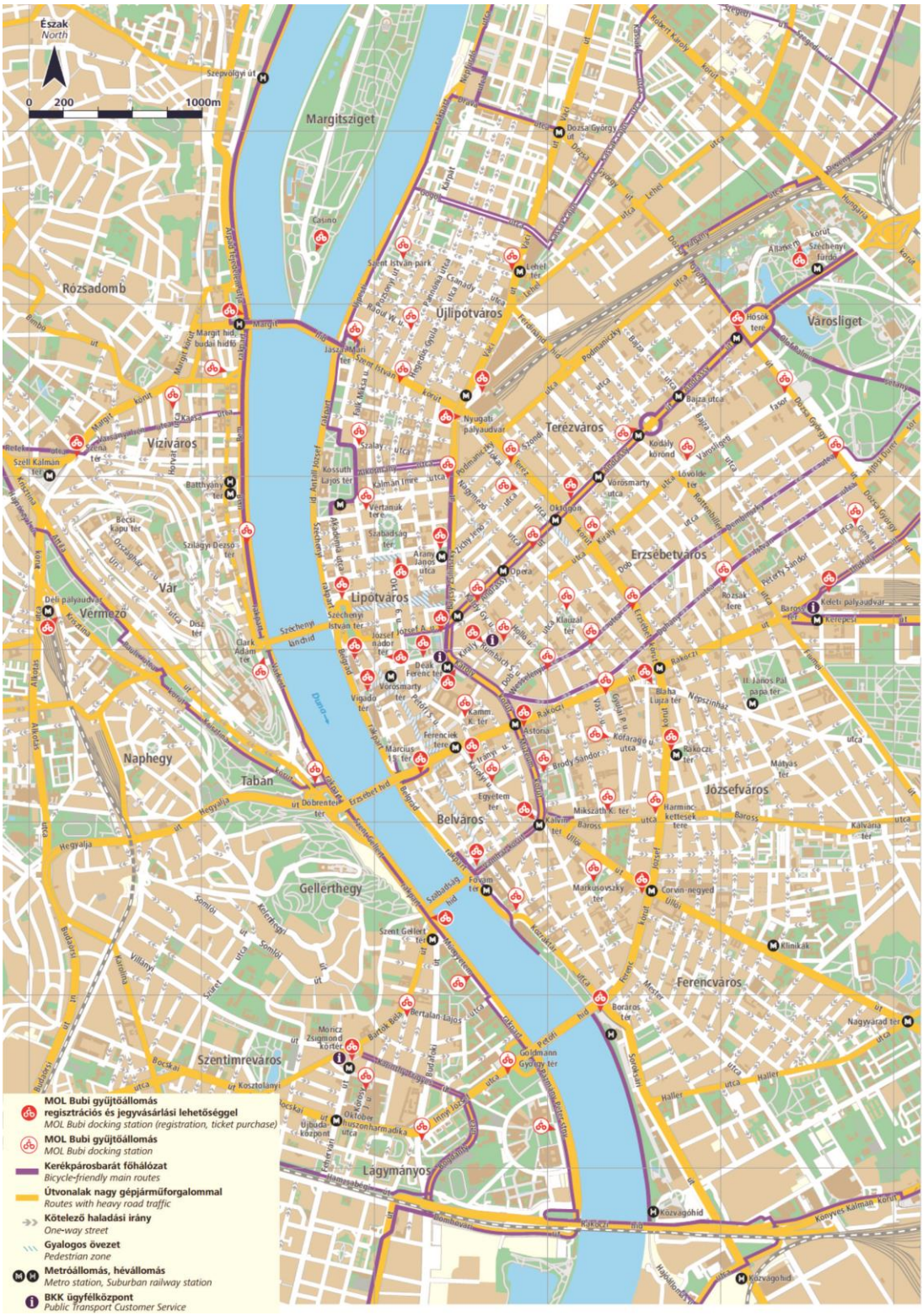


Figure 11 Cycling network in Budapest (Transport Strategy BKK Centre for Budapest Transport, 2015)

(2) Bi-directional Bike Paths

Problem

Some of the bike paths are bi-directional, which create hazards in junctions (see Figure 12). Drivers coming from the side roads will focus their attention on vehicles coming from left and may overlook cyclists coming from right.

Figure 12 Bi-directional bike path in Kocaeli (EMBARQ Turkey, 2015)

Recommendation

Where there is only a path at one side of the road junctions should be redesigned to ensure safe crossing for cyclists in each direction. This can be done by moving the path across the side of the road or establishing stabile barriers that will force cyclists to stop at junctions. Clear signs should be placed on the side of the road to inform drivers that cyclists may approach from both sides.

(3) Width of Bike Lanes

Problem

On most sections, bi-directional lanes have a width of 1.8-2.0m, which is considered to be narrow. On some sections, the width of the bike lane is reduced to 0.8m, which is too narrow for safe cycling.

Figure 13 Bi- directional bike path in Kocaeli (EMBARQ Turkey, 2015) (left) and Recommendation Bi-directional bike path in Budapest (EMBARQ Turkey, 2015) (right)

Recommendation

Bi-directional paths should have a minimum width of 2.5m. For a one-directional path 2m is acceptable but it is recommended to have paths of a least 2.2m.

(4) Pedestrians in the Bike Lanes Problem

As shown in Figure 14, many pedestrians use the bike lane for walking. This is partly due to the low volume of bikes and pedestrians. On most of the sections there is no delimitation between the bike path and footpath and they are often at the same level. This may lead to road users straying into wrong areas.

Figure 14 Pedestrians using bike lane in Kocaeli (EMBARQ Turkey, 2015) (left) and Recommendation stabile bullets between foot path and bike path in Budapest (EMBARQ Turkey, 2015) (right)

Recommendation:

The stabile bullets should be placed between the foot path and bike path with continuous signs on both sides of the bike path and footpath that shows both users.

(5) Slip lanes

Problem

In many junctions a slip lane is provided for left turn. This allows drivers to turn left at relatively high speeds. At the same time, the angle between cyclists attend to cross the junction and the cars turning left is small which make it difficult for cyclists to see approaching cars from the back. Slip lanes for left turning are too wide and allow for too high speeds.

Figure 15 Slip Lane in Kocaeli (EMBARQ Turkey, 2015)

Recommendation

Pedestrian crossings and bike paths across slip lanes should be changed by raising the level of the crossings to reduce speeds. Moreover, the approach to the left-turn lane and the lane itself should be narrowed down so than only one vehicle can pass.

(6) Markings in Junctions

Problem

As shown in Figure 16, junctions with vertical markings of bike paths and pedestrian crossings are often missing. This can lead to conflicts in the junction area not only between vehicles and vulnerable road users but also between cyclists and pedestrians.

Figure 16 No marking of bike paths in junction (EMBARQ Turkey, 2015) (left) and Integrating cycling and pedestrian crossings in Budapest (EMBARQ Turkey, 2015) (right)

Recommendation

Pedestrian crossing points should be clearly marked with zebra markings and bike path crossings with wide dotted lines and coloured surface with bike symbols.

(7) Maintenance of Bike Paths

Problem

On some sections, bike path markings are often missing. Also on some sections the deterioration of the surface of the cycle paths was profound and discouraged cyclists from using the path (see Figure 17).

Figure 17 No clear marking in bike path in Kocaeli (EMBARQ Turkey, 2015)

Recommendation

The bike paths should be maintained to a good high standard to ensure a comfortable and safe ride for cyclists similar to Budapest.

Figure 18 Bike box with clear marking in Budapest (Transport Strategy BKK, Centre for Budapest Transport, 2015)

(8) Bike Parking

Problem

Besides providing a public bike sharing system to increase cycling, providing a sufficient amount of bike parks are very important in the city. According to the Figure 19, there are no sufficient facilities for parking private bikes.

Figure 19 Bike parking rack in Kocaeli (EMBARQ Turkey, 2015) (left) and Recommended Bike parking rack in Budapest (www.eltis.org, Bike parking in Budapest: something got moving Hungary) (right)

Recommendation

Sufficient bike parking facilities should be provided by calculating the needs of cyclists in the city. Moreover, bike parking facilities should be located in high demand, attractive areas such as schools, universities, and city centres to encourage biking instead of driving.

Public Bike Sharing Feasibility Study

Another fundamental difference between MOL-Bubi and KOBIS is the lack of detailed feasibility study and comprehensive integrated urban transportation strategy which includes the critical parameters that guide the planning and design process of the two programs. The feasibility study should lead to a business plan that recommends investment and revenue sources, a contracting model and an organizational structure as the agency or department conducting the feasibility study may or may not be the implementing agency. By comparing two public bike sharing programs; MOL-Bubi's feasibility study offers;

- Financial sources;
- Organizational issues;
- CEE specialties;
- Target market;
- Operation model; and
- Feasibility issues

On the other hand, KOBIS is not based on a detailed feasibility study as MOL-Bubi is. Therefore, KOBIS is facing problems regarding the hardware and software improvements, including vehicle type, station design, IT systems, data collection, security, maintenance and spare parts.

5 Reimbursement

Applicant (CCPs) Bank account number

- IBAN: TR8600067010000000094319604
- Name of bank: Yapı Kredi Bankası
- SWIFT: YAPITRIS
- Address of bank: Yapı Kredi Bankası Taksim Meydan Şubesi Yenitarlabaşı Cad. No: 8 Taksim/İstanbul/Turkey 34437

6 References

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10. www.eltis.org ELTIS, The Urban Mobility Observatory Website, June 2015

7 ANNEX 1

Photos of Technical Visits in Kocaeli

Technical Visits in Budapest