REPORT

Mobility and Space: E086602

Making cycling attractive, safe and convenient in cities: Lessons to learn from Amsterdam and Milan

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Abstract

Cycling has been established as a main mode of transport in urban areas. Because of increasing concerns about environment, road safety, congestion and sustainability, cities are constantly seeking to adjust their existing transport systems in favor of sustainable modes. By using various resources, the author examined cycling situations in Amsterdam and Milan. This report presents a detailed overview of cycling policy interventions, infrastructural measures, promotions, education, modal shares and other innovative interventions in these cities.

It was found that a concrete bicycle strategy in urban mobility plan, that ensures implementation of multi-faceted, mutually reinforcing policies, focused on more pro-bike measures while at the same time restraining automobiles from entering city center, is vital for the success of cycling. Lack of common vision between the demand side (users) and the supply side (government), and absence of adequate cycling infrastructure contribute towards the failure of cycling. A clever combination of hard and soft policies for promoting cycling is indispensable. Communicating cycling, raising awareness, offering incentives and making people accustomed to cycling on the roads are as important as safe, complete, comfortable, attractive and high-quality infrastructure in urban bicycle policies.

Without second opinion, Amsterdam's cycling that shows bicycle as equally capable mode transport for every day short trips, is exemplary for Milan and other cities. Following a Dutch example, states, regions and cities can promotion cycling to highest possible level.

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Introduction

Cycling is a sustainable form of mobility. It produces virtually no noise and air pollution and causes no damage to the environment. Cycling consumes far less (non-renewable) resources than the motorized traffic. It needs relatively small space to ride and park a bicycle than a vehicle with internal combustion engine. Personal costs or the direct outlays bear by the owner and government cost, such as, investments in the infrastructure, policy making, etc. are far less for bicycle than that for the automobile, making cycling an economical alternative to motorized traffic.

Nearly everyone except those with the special needs can manage to cycle. It is the most environmental friendly. User provide the required energy that in turn serves as a valuable exercise, increasing physical activity and improving public health. These potential gains have made cycling an integral part of the transport policies in modern cities. European Union has officially acknowledged cycling as a practical mode of urban transport, that could generate health, economic and environmental benefits (OECD, 2004).

Problem statement

Cycling has both personal and collective benefits. Health, safety, affordability, cost-effectiveness, convenience and recreation are benefits on personal level. Collective benefits include reduction in congestion, travel time, emissions, and livability and safety. Bicycles have minimum area requirements for operation and parking, are quicker in congested areas, have no emissions, and are more safe and healthy (Heinen et al., 2010; Horton et al., 2007; Pucher et al., 2010). These advantages have resulted in a significant shift in transportation modes in recent years (Celis-Morales et al., 2017; Götschi et al., 2015; Sá et al.,2017). Besides, cycling has emerged as an integral part of sustainable urban transport policies in many European cities (Heinen et al., 2010; Pucher et al., 2010). Because of increasing concerns about air pollution, greenhouse gases, road safety, congestion and sustainability, cities are constantly seeking to adjust their existing transport systems in favor of sustainable modes (e.g., EC, 2011). Policy makers are interested to increase share of cycling and walking for a wider range of trip purposes. However, only few cities, such as Amsterdam (and Copenhagen), have managed cycling very well, while others, to say Milan (and Stockholm), although good examples of modern cities, have not managed cycling very well (Sick Nielsen et al. 2013 and Emanuel 2012). It is not uncommon to see that, although policies exist, some cities have succeeded in having higher levels of cyclist shares in everyday trips than the others. It is there important to have a closer look at the cities with a successful cycling culture and those with relatively less success in cycling.

Research questions

The research question is;

“Some cities successfully incorporate cycling as a mode of transport while others do not. What makes the difference?”

Based on the literature study, few sub-questions are devised to answer the major research question.

1. Is the distance to cover by bicycle affect the number of cyclists in cities?
2. Does the development form of cities affect the choice of bicycle for transport?
3. What is the popular mode of transport in both urban contexts?
4. Are different means of transports integrated and connected well in two cities and do they also allow the bikes use for long distances?
5. What are the main travel motivations that influence the travel behavior and the bikes mode choice?

6. In both bikes' plans which infrastructural strategy effectively helps to increase the actual number of the urban cyclists?
7. What can be learnt from the case studies of Amsterdam and Milan?

Method

This report presents two case studies (a). successful bicycle planning in Amsterdam-the Netherlands and (b). unsuccessful bicycling planning in Milan- Italy. Various sources, including scientific studies, national level reports, project reports, white papers, newspaper articles and blogs are consulted to carry out the current work. An effort is made to identify the success factors where cycling is managed well and failure factors where cycling is managed poorly and what lesson do they offer to other cities.

Limitation

Major limitation of this work is that the data used for analysis and discussion is obtained by carrying out a desktop research. This work is based on review of available literature that limits its novelty. The data obtained is of a secondary or a tertiary nature. Since this work covers only two European cities, it is advised to generalize these findings to other areas with certain level of caution. The size of the cities, level of income, travel behavior etc. can be other variables that may limit the findings of this work.

Organization of report

This report is divided into different sections. First part is the introduction of topic, problem statement, research question, methodology and limitations. Second part is the literature review. Basic concepts related to urban mobility, EU initiative about urban mobility, cycling, its advantages, and disadvantages, cycling situation in Europe and world, and cycling policies in Europe are given in the literature review. Third section introduces the cases of Amsterdam and Milan. Finally, conclusions and reflection is presented.

Literature review

Urban mobility

Mobility refers to the ability or level of ease to move people, goods and services from one place to another. It also encompasses the flexibility for travelers to decide time and destination of travel in an optimal way. Mobility affect quality of people's lives and functioning of society by influencing the pattern of opportunities it provides to take part in social activities and interact with others. While mobility plays an essential role in socioeconomic development, it has negative consequences. Therefore, it is important to weight the positive effects alongside the negative impacts of mobility, particularly, when observed demand is increasing each year at local and city levels.

European Commission (EC) "Action Plan on urban mobility" has identified cities as a central part of the transport system since more than 72% of Europeans are living in urban areas (United Nations, 2015). Besides, cities are important for economic growth and development. Urban areas generate nearly 85% of GDP (Gross Domestic Product) in the European Union. At the same time, urban traffic produces 40% of total CO_2 emission and 70% of other pollutants.

Transport sector offers challenge, including congestions, safety, environmental impact and air quality, urban sprawl, increasing demand for mobility etc. As of today, the need to solve these problems for maintaining a high-quality living in a sustainable way has become even more crucial. Urban mobility has embedded in the daily life of European citizens to the level that it has become a primary concern for them. 90% of European were not satisfied with the mobility situation in their areas in 2007 survey by Eurobarometer and think that traffic conditions should be improved(Eurobarometer, 2007).

Sustainable mobility is the solution to the identified challenges. All policies should focus on developing transport systems that are more sustainable to the environment and are cost effective, while meeting travel needs and social concerns. Nevertheless, it is not simple to develop an urban mobility system that is not only accessible and efficient but also inclusive and environmental friendly. Not only should it consider all the factors that depends on how urban transport develop in future but also the direction in which it will move based on external factors like technological progress, socioeconomic and environmental developments, and behavioral and environmental changes.

EU initiatives

Urban policies are the primary responsibility of the local authorities according to the principle of subsidiarity, yet the European Union (EU) plays an active role in designing clear guidelines since the adoption of the White paper (European Commission, 2001). EU provides local authorities a support and guidance system for implementing sustainable and affordable mobility strategies. EU's Green paper 'Towards a new culture of urban mobility' (EC, 2007) and the Action plan on urban mobility have comprehensively mentioned vast perspectives of modern mobility (European Commission, 2009). These documents have acknowledged the individual differences that exist between different cities in Europe and has suggested a maximum integrated approach to optimize the use of all modes (concept of co-modality).

Different EU institutions has backed the EC efforts. European Parliament (EP) has adopted the resolution on the Green paper (European Parliament, 2008a) and the own-initiative report on the Action Plan on urban mobility (European Parliament, 2008b). Similarly, the European Economic and Social Committee (EESC, 2008) and the Committee of the Regions (CoR, 2009) respectively, have adopted these two opinions and a discussions held show the urban mobility has been crucial to European transport system. It also showed that other objectives, such as, cohesion, environment, health and economic policies set by EU cannot be achieved if proper attention is not given to urban mobility.

Along with the policy developments, EC also provides a guidance system to help European cities embrace the sustainable urban transport more efficiently. For instance, CIVITAS (CIty VITAlity Sustainability Initiative) and (e.g. EPOMM, ELTIS) are platforms where best practices, databases and guidelines are exchanged. These tools enable the local authorities to (i) involve concretely and successfully and (ii) get financial support when taking part in projects and campaigns.

Cycling

Cycling is increasingly acknowledged as an everyday means of transport. People cycle because they think it is fun, healthy, good for the environment, faster in congested urban regions and is economical. Bicycles make no noise and create no pollution. They do not need fuel. Because of these attributes, cycling has gained a tremendous popularity in some developed countries.

Benefits of cycling

Studies have divided the benefits of cycling into separate groups (i) transport efficiency, (ii) environmental benefits, (iii) health and fitness, and (iv) economic and social impacts.

Transport efficiency

Cycling is the fastest, most flexible mode of transport for short trips in urban environments where traffic congestion is routine. Bicycles occupy a small space when parked. Practically, 10 bikes can be parked in the space required for one car. A study showed a space consumed by a parked bicycle to be only 8% of the space consumed by the car (Héran, 2002). Also, installation of a bike stand compared to constructing a car park is cheap and more convenient.

Environmental benefits

Vehicles generate pollution by burning fuels. When compared to long distance trips, short distance trips are the least fuel efficient for many reasons, like, lower speeds, higher frequency of braking etc. Bicycles may be a potential alternative to cover these trips. Bicycles use energy provided by the rider and thus emit nothing into the atmosphere. Also, it produces no noise. Replacing car with bicycle for short trips reduce substantial proportion of CO2 emissions.

Health and fitness

Cycling has well-established health and social benefits. Better health conditions of community help reduce health costs for a society. Cycling provides necessary exercise to the body. Cycling for four hours a week or 10 km a day is recommended level of exercise, that is usually equal to a daily trip for many people to and from work (WHO, 2010). On personal level, in addition to providing a safe, convenient, enjoyable and affordable means of transport, cycling helps improve health and is a source of recreation. Some of the benefits of regularly physical activity as reported by the chief medical officer of department of health of London (London Department of Health, 2004) are:

- Reduced risk of heart diseases
- Reduced risk of diabetes
- Reduced risk of developing high blood pressure
- Regulate blood pressure who already have high bold pressure
- Reduction in feelings depression and anxiety
- Reduced risk of developing breast cancer and colon
- Controls weight gain
- Build muscles, improve bones health and joints

Economic and Social impacts

Virtually anyone can afford cycling while driving a car is expensive. The travel cost for each km distance travelled is much lower for a bicycle than any other mode of transport except walking. Bicycle parking is usually free of charge which makes it a means of transport for everyone. Cycling can result in a huge cut on the travel budget. A car is a status symbol in some regions and cultures. A bicycle is portrayed as something inferior and cheap as confirmed by several studies. This is, however, more rooted in a cultural attitude and may disappear if cycling is prevalent, such as the Netherlands. Speaking from economic perspective, bicycles are still wrongfully overlooked when gauge an economic growth, instead cars are seemed as symbols of the development. On the other hand, cycling results in livability, particularly at the city centers, making these more accessible and hence flourish businesses. Also, it results in a substantial savings individually and for the society.

Mode for everyone

Bicycle can be used by segments of population who are difficult to travel independently, including those:

- not able to use a public transport
- cannot afford a private vehicle
- have no or limited access to a motor vehicle for the required time

It is important to note that about 21% of Europeans population is below the age of 18 years which is also a legal minimum age to get a driving license. On the other hand, everyone has the right to mobility and move independently. Bicycles provide a solution to this.

Cycling Problems

Cycling is beneficial, but it is not always easy. Cyclists often face certain challenges, for instance, lack of adequate infrastructure, shortage of proper parking facilities, traffic safety and security, and adverse weather. Other problems include poor inter-modality and long-distance trips.

Cyclists' safety and security

Apart from few European countries, like the Netherlands, Denmark, Germany, etc., most countries have poor road infrastructure for the cyclists. Even if there are separate cycle paths, they are poorly maintained, and are not entirely safe. In many cases, cyclist share facilities with other vehicles or pedestrians, making it a safety hazard. Poor visibility on cycle lanes increase the fear for safety and discourage people from increasingly use bicycle in mixed fast moving motorized traffic conditions.

Lack of bicycle parking facilities

Bicycle theft is a real problem for cyclists. Theft frequency is particularly higher when there is a shortage of adequate parking facilities major attractions. Consequently, it discourages people to use bike for their trips. Cities and regional local authorities take different anti-theft measures to combat bicycle theft, for example, guarded or supervised parking facilities at appropriate locations.

Parking facilities should be provided with certain coverage of the whole area for which cycling improvement is to acquire. Facilities like changing rooms for bike wears and everyday cloths is also suggested. Parking facilities must provide services like bicycle accessory shops, repair and maintenance shops, rent bicycles and lockers.

Weather conditions

Weather may be a crucial factor in deciding to make a trip by bicycle or by car. Cyclist should know about the weather forecast in their areas before starting journey. Also, choices like wearing appropriate clothes or using multiple modes of transport to make the trip can be helpful in harsh weather conditions. In the Netherlands, a software community has developed a pilot project "Route Rainfall Prediction" to forecast weather or the cyclists. The software can predict a weather forecast for a 1km by 1km grid for up to two hours ahead.

Poor inter-modality

Poor inter-modality can be a problem specially when the cyclist takes a long trip. Even in the most developed cities for the cyclists, it is very rare to see bicycle hangers on public transport and even fewer allow bicycle carriage. This number is further reduced in peak hours as the carriage is only allowed outside peak hours. To cope with bicycle carriage, many cities have started bicycle sharing scheme, thanks to the outcomes of EU funded projects. The innovative idea that a person can be offered a public bicycle at the major attraction or at railways station gives people more liberty about the choice of the mode of travel.

Cycling Situation in Europe

Cycling plan is an important part of sustainable urban transport policy in many cities. Authorities at all levels promote cycling. Businesses incorporate cycling into work-based mobility management plans. Each year, number of countries that develop national cycling strategies, plans and policies is increasing.

A brief overview of bicycle use in EU and other countries is presented in the following paragraphs.

Statistics on bicycle use

Several agencies publish statistics, showing the modal share of bicycle use related to all trips. Unfortunately, there is no single standard international or European level statistics available. Figure 1 shows the data available from various sources (European Parliament, 2010). It is important to note that it refers to different years. The Netherland with slightly more than one quarter (26%) of all trips made by bike is the global leader, Denmark at the second place with 19% of all trips and Germany is at third with 10%. Despite increasing efforts, cycling is not common, not even in countries like the USA, Canada and Australia as can be seen Figure 1.

Comparing bicycle modal share of different cities to national average bicycle modal share display some interesting results Figure 2 and Figure 3. The stats revealed that, even if the national average bicycle share for trips is low, cities that have adopted bicycle-centered policies have achieved a significant success in improving bicycle shares. The reverse is also true. Cities with poor bicycle policies have lower bicycle share than the national average.

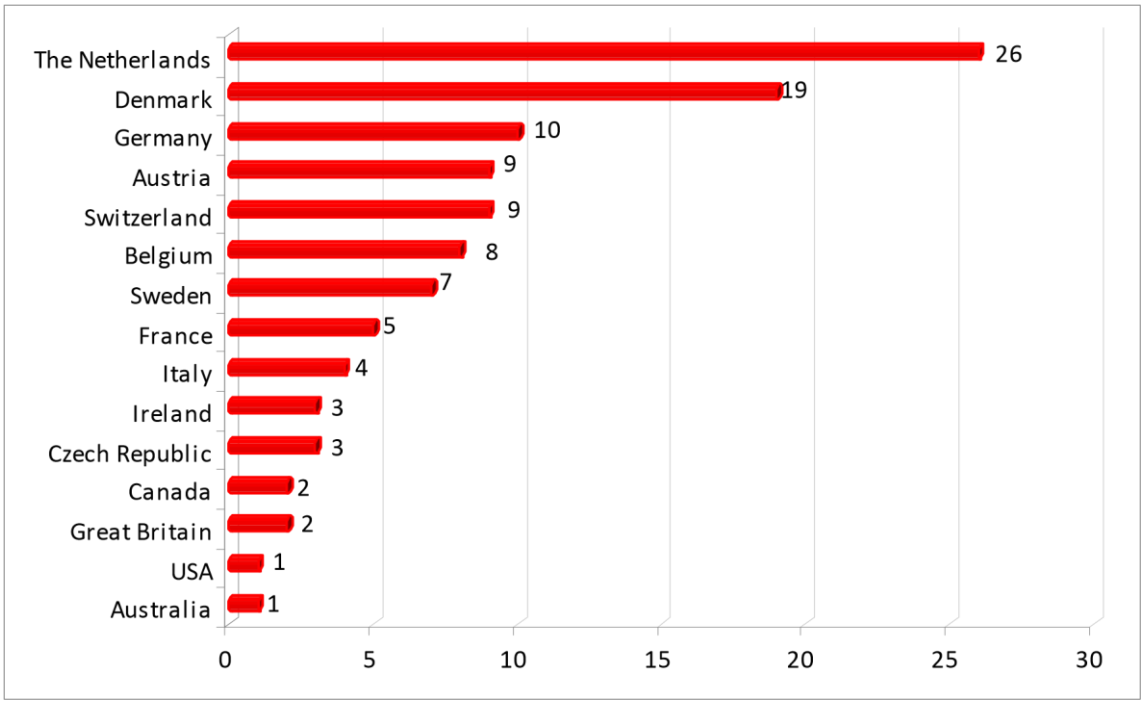

Figure 1 Bicycle modal share for all trips in these countries

Sources: Australian Bureau of Statistics (2007); Netherlands Ministry of Transport (2006); United States Department of Transportation (2003); Isfort Italian survey 'Audimob' (2006); Annex I: Literature search bicycle use and influencing factors in Europe– ByPad Project (2008).

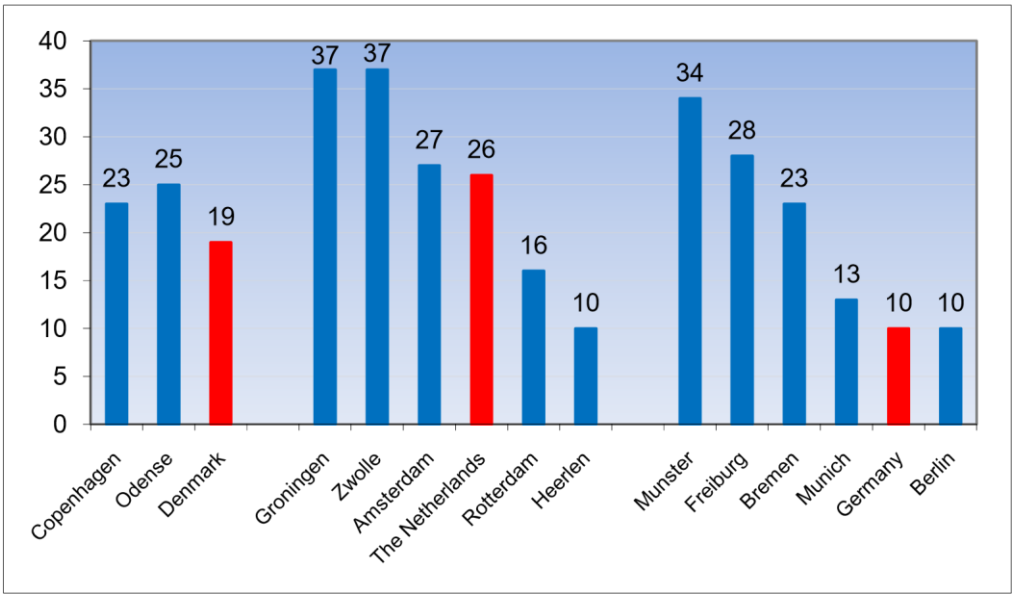

Figure 2 Comparing national average of bicycle modal share to some cities bicycle modal share in Denmark, Netherlands and Germany

Sources: Fietsberaad (NL), publ. 7 (2006),
Federal Ministry of Transport, Building and Housing (D) (2002)

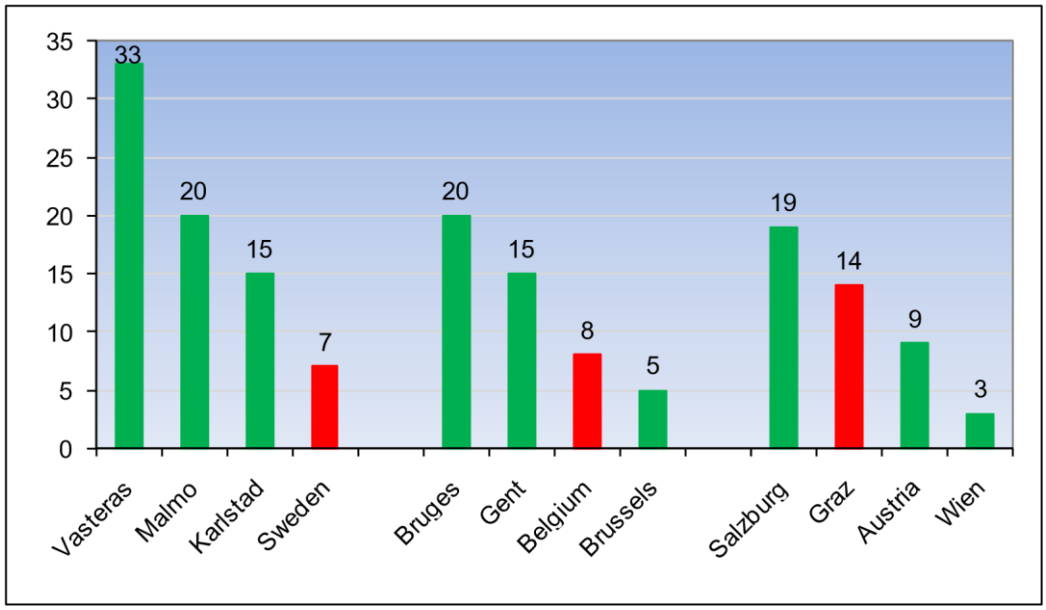

Figure 3 Comparing national average of bicycle modal share to some cities bicycle modal share in Sweden, Belgium and Austria

Sources: Fietsberaad (NL), publ. 7 (2006),
Bypad project, Annex II –City portraits (2008);
Brussels data: Velo-City, 2009.

In some EU cities, share of bicycle use for trips is considerably higher than that in the United States, Canada and Australia. Even the best bicycle-oriented cities in North America (Vancouver, Victoria, Portland and Seattle) lags the least bicycle-oriented cities in the Netherlands, Germany and Denmark for the bicycle modal share (Figure 4).

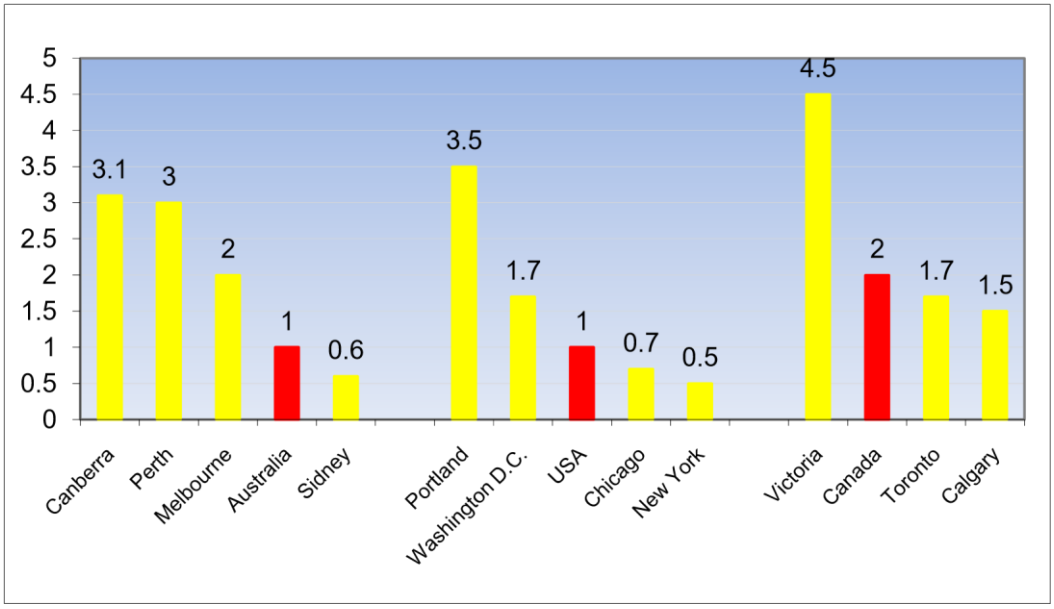

Figure 4 Comparing national average of bicycle modal share to some cities bicycle modal share in Australia, USA and Canada

Sources:(Pucher & Buehler, 2008)

Topography and climate are important but not necessarily the only factors to determine the success of cycling. On the other hand, government policies including transport policies, land use policies, environmental policies, housing policies, taxation policies, urban development policies, and parking policies are equally important. The lack of government interest in past policy development regarding cycling is obvious in Australia and North America. Governments have developed policies in the favor of cars without considering its economic, social and environmental cost. On the contrary, in EU, particularly in the Netherlands, Germany and Denmark, many cities have focused to develop policies that support cycling rather than car use, resulting in more livable and sustainable cities.

National cycling policies

In EU, member states develop their own transport and cycling policies. Some countries include a specific plan for cycling promotion at a national level, others include cycling policies in more general national transport, health and environment plans. Regional and local authorities are usually responsible for cycling. Cycling is an established mode of travel in countries like, the Netherlands and Denmark, thanks to long continuous support of their governments.

State government in EU can support local governments to implement cycling policies in several ways. For instance, state government develop a level policy framework or strategy to ensure safe and convenient cycling through clear legal and regulatory guidelines. National governments are also instrumental in providing sufficient budgets and finances for developing cycling infrastructure. Table shows a summary of the most important cycling plans and their major objective in some EU countries.

Table 1 National Bicycle Plans

Country	National Plan	Description	Objectives
Finland	**Yes**	**Part of 'Transport policy guidelines and transport network investment and financing programme until** 2020**' (2008)**	– **encourage investment by local government in cycle routes** – **promote cycling along with public transport** – **increase quality standards for bicycle routes**
Sweden	**Yes**	**Swedish National Strategy for More and Safer Cycle Traffic (2000)**	– **increase the safety for cyclists** – **increase the modal share of cycling**
Austria	**Yes**	**Masterplan Radfahren ,Strategie zur Förderung des Radverkehrs in Österreich' (2006)**	– **provide national co-ordination, general traffic management, mobility management** – **promote public transport + bike and education** – **provide a legal framework**
Denmark	**Yes**	**'Cycling into the 21st century'** **'Promoting safer cycling – a strategy'** **'Collection of cycle concepts'**	– **The National Bicycle Action Plan consists of the three documents mentioned in the centre column.**
Netherlands	**Yes**	**Dutch Bicycle Master Plan (1990-1997)**	
France	**Partially**	**Plan pluriannuel d'actions de l'Etat en faveur du vélo proposé en 2007 par le Coordonnateur Interministériel pour le Développement de l'Usage du Vélo**	– **promote cycling, increase cyclists' safety, prevent cycle theft** – **promote intermodality train+bike** – **provide training for school children** – **promote cycling as a healthy and green means of transport** – **promote cycling in tourism, leisure and sport issues** – **support cycling services industries**

Source: (National Policies to Promote Cycling, ECMT 2004)

Table 1: National Bicycle Plans (continued)

Country	National Plan	Description	Objectives
Germany	yes	National Cycling Plan 'Ride your bike!' 2002-2012	– initiate new methods and implementation strategies for the promotion of cycling in Germany – supply recommendations for actions – contribute towards creating a bicycle-friendly environment
United Kingdom	yes	National Cycling Strategy (1996)	– increase cycle use – achieve convenient cycle access to key destinations – improve cycle safety – provide traffic management schemes and cycle parking facilities, available at all major destinations (town centre, shopping development, educational establishments, hospital and leisure facilities) – reduce cycle theft
Switzerland	partially	Part of 'Stratégie pour le développement durable: lignes directrices et plan d'action 2008–2011'	– promote sustainable transport – increase bicycle modal share and to assure urban development balanced with a transport system that guarantees reduction of negative impacts of traffic on the population and on the environment. By the end of 2009 the Swiss Federal Department of Transport will provide an action plan specifically for 'slow traffic'.

Source: (National Policies to Promote Cycling, ECMT 2004)

Case Studies

Cycling has become a trending topic in mobility sciences, health, environment, economy, and urban and spatial planning. Given that majority of the trips on average are very short in urban areas, bicycles can practically replace cars for those trips. Many countries on national level and cities on local level have developed transport policies with special emphasis on cycling. Some cities have successfully implemented their policies and therefore, increased cycling modal split (e.g., Amsterdam-the Netherlands) while others did not meet fair share of success (e.g., Milan-Italy). Two case studies — one of Amsterdam, other of Milan — are examined in this report to see what lessons do they offer to one another and to other cities trying to promote cycling.

Cycling in the Netherlands

Nowadays, it is easy to travel long distances, thanks to the faster modes of travel, high quality infrastructure and better traffic management practices. This is also true for the Netherlands. Nevertheless, bicycle still is the popular means of transport among the Dutch. People use bicycle for more than 25% of all journeys. For shorter trips (up to 7.5km or less), 34% of all trips are made using bicycle. This percentage is increasing in some cities, is constant in others while decreasing in the remaining ones. Despite that bicycle use is distance dependent, the fact that 70% of all the trips still falls below 7.5km, there is no immediate threat to bicycle popularity in the Netherlands. On the other hand, the higher percentage of shorter trips extend to increase the share of bicycle in total modality split (26%) (Figure 5). Interestingly, bicycle is also a favorite mode for about 15% of all journeys between 7.5 to 15km.

Cycling is deeply rooted in the Dutch culture. It is not limited as being the choice of school-going children only. Virtually everyone in the Netherlands cycle. Bicycle is used for almost all types of trips including shopping, education, recreation and commuting to work. This is one of the reasons for the high overall shares of bicycles in travel (Figure 6). There is no absolute choice between a car and a bicycle over a shorter distance for many people in the Netherland. A mixed type of response between “sometimes a car and sometimes a bicycle” is prevalent (Figure 7).

Dutch like cycling more than other nationalities, but this in no way, is a conclusion that cycling is equally famous everywhere in the Netherlands. Table 2 lists five cities with the highest percentage of cycling and five cities with the smallest percentage of cycling in the Netherlands. The cities of Groningen and Zwolle has the highest percentage of cycling (percentages) with about 50% above the Dutch average. On the other side, the percentage for the lowest cycling share is normally 50% lower than the Dutch national average bicycle share in (cities).

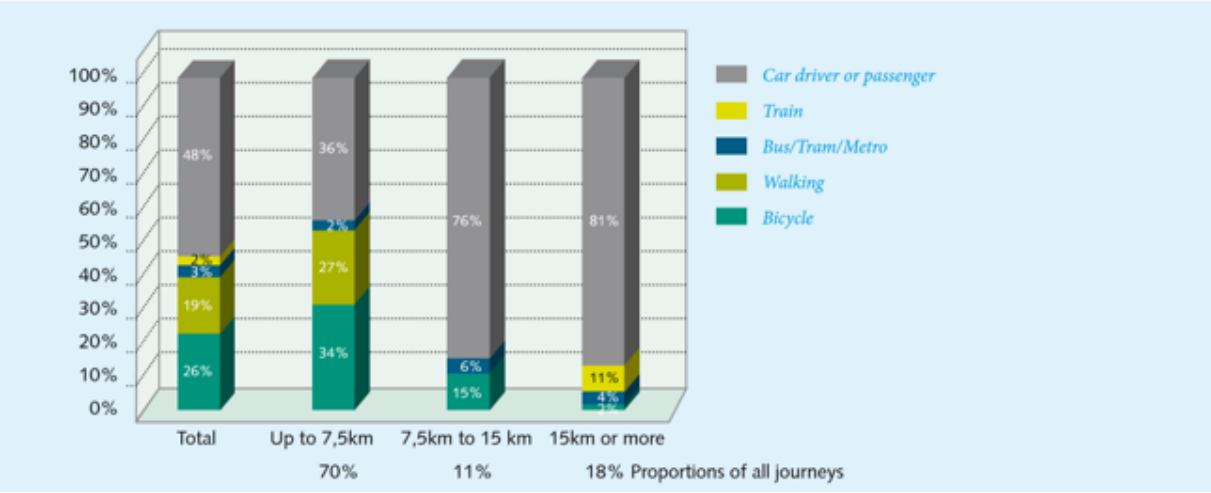

Figure 5 Trips according to mode and distance category in 2007 (Source: Mobility study, Netherlands 2007, AVV)

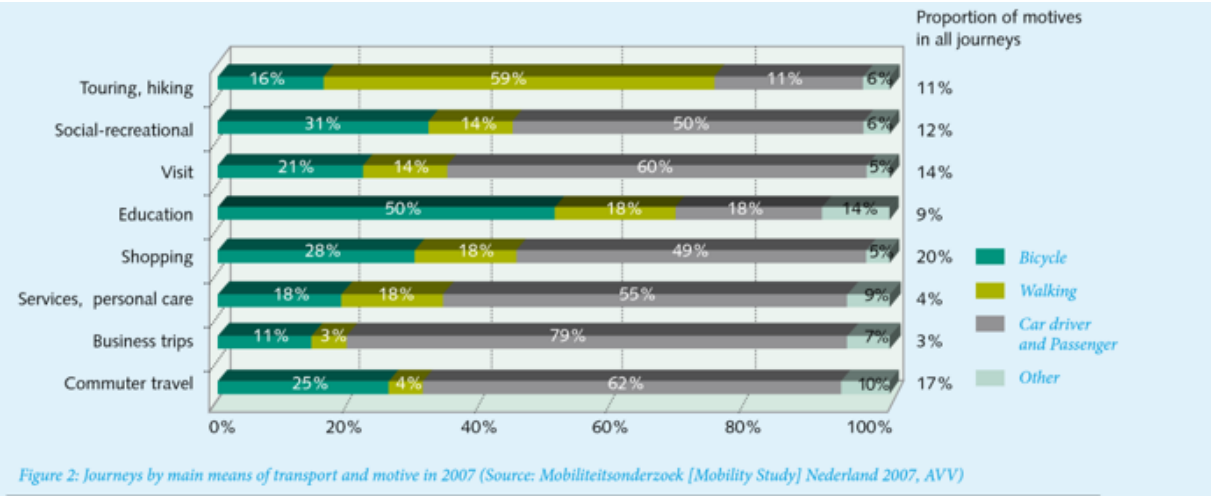

Figure 6 Trip purposes and Transport mode in 2007 (Source: Mobility study, Netherlands 2007, AVV)

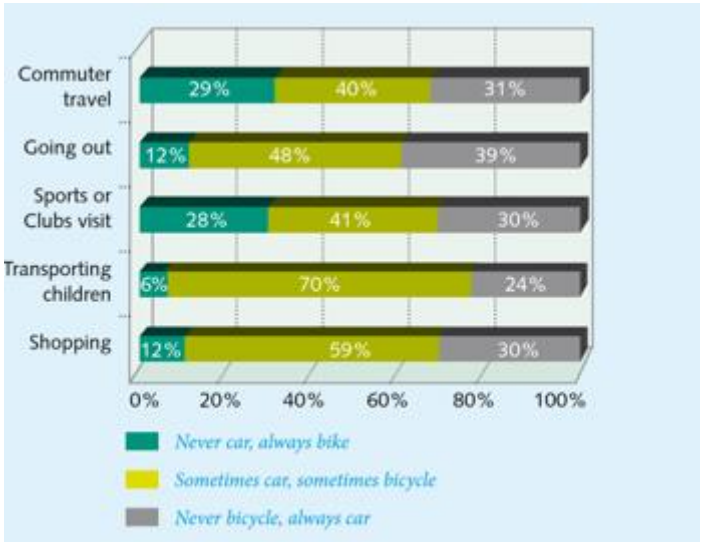

Figure 7 Car vs bicycle for trips up to 7.5km per travel motive (Source: Mobility study, Netherlands 2007, AVV)

Table 2 Percentage of bicycle use in 2003 in different Dutch cities of 50,000 population, Source: CBS

Municipality	Cycle share
Groningen	38%
Zwolle	37%
Leiden	33%
Ede	32%
Veenendaal	32%
Lelystad	19%
Capelle aan den IJssel	18%
Sittard-Geleen	17%
Rotterdam	16%
Heerlen	10%

Virtually every Dutch city has an extensive network of cycling facilities. Urban landscape without the presence of the cyclists is unimaginable in the Netherlands. The case study of Amsterdam, the capital and the largest Dutch city is presented below.

Amsterdam

Cycling is integral part of Amsterdam culture. For many people, Amsterdam and cycling are nearly synonyms. Cycling share has been highest than other modes of transport in the Amsterdam for past few decades. For example, in 2005, the city of Amsterdam reported a cycling share of 37% of all journeys (City of Amsterdam, 2007), which was something completely unheard before about any major city of the comparable size. Similarly, in 2006, there were about 0.75 bicycles per inhabitant in Amsterdam(City of Amsterdam, 2007) and this has increased in later years.

Thanks to the spatial development and topography, Amsterdam is ideal place for cycling. The city is located on a flat ground and is densely developed. Trips lengths are generally not enormous because of the mixed land use. The provision of small bike bridges and bike shortcuts are instrumental in navigation through the city center by bicycle. Limited number of car parking spaces and one way closed streets also reduce car use. High ownership of bicycles, restricting car use policies, better bicycle infrastructure and mixed land use patterns all resulted in about 50% of Amsterdam's residents using bicycle for their daily trips (City of Amsterdam, 2016). More than 85% of Amsterdam's residents use their bicycle at least once a week. Cycling in Amsterdam is so common that men, women, young, elderly, the rich and the poor, all used bicycles (City of Amsterdam, 2003a). Amsterdam residents use bicycle for a variety of purposes. For example, in 2003, 34% of work trips, 33% of shopping and 27% leisure trips were made by bicycle (City of Amsterdam, 2007).

Two major observations are, however, noteworthy for the cycling case in Amsterdam. Firstly, the use of bicycle in Amsterdam is more in the rich than in the poor. The cycling planners describe that poor households see the car as a status symbol while see the bicycle as a vehicle for the poor. This tendency lead to a greater use of car in the lower income households as compared to the rich. On the other hand, the well-off households find bicycle healthy, convenient and faster means of transport. Second observation is related to lower use of bicycle in the immigrant population and their children (Dutch Bicycling Council, 2006). The reason for the lower use is attributed to the absence of the bicycle use in the culture of immigrant' origin. Bicycle, therefore, is not their preferred choice for making trips.

History of cycling in Amsterdam

Cycling in Amsterdam dates to the last century. It has been a primary mode of transport since then. For example, in 1955, people use bicycle for about 75% of their trips in Amsterdam. During the second half of last century, the bicycle share, however, see a decline with only 25% of all trips from 1955-1970 (Dutch Bicycling Council, 2006). The fall in the bicycle share can be related to increased suburbanization, increased dependence on motorized vehicle and higher car ownership. It is, however, important to note that even a bicycle share of 25% was/is not a bad number.

The late 1960s and early 1970s saw a change in people's attitude towards the modal choice for their journeys. Bicycle advocates and environmentalists educate people about air and noise pollution caused by motorized vehicles, traffic congestion problems and unsafe traffic conditions in the cities. Two solutions were under consideration at that time. First to adapt the city development patterns and infrastructure according to the automobiles. Second to promote cycling, walking, public transport and hinder or restrict car use in the city center. The Amsterdam city council chose the second option. By 1978, Cycling became an integral part of transport policy of the newly elected city council to solve transportation problems. A growth in the bicycle use has been observed since early 1970s reaching to 31% of all journeys in mid 1980s and to 37% in 2005 (City of Amsterdam, 2007).

When the distance to the city center increase, bicycle use decreases. For example, 40% of the trips in the inner-city rings were bicycle trips while percentage of all the trips made by bicycle for the sub urban districts are 21%. A decline is also seen in these outlying areas between the same period (1986-2000).

Policy goals in Amsterdam

Non-motorized modes (walking and cycling) are the focus of Amsterdam's transport policy. Although the general objective is to make activity locations more accessible for all modes, still the city gives bicycle a special privilege in transport planning because of the increased concerns about health, pollution and environment.

Cycling is not simple. Every day, cyclists came across different issues. Problems common to cyclists in in Amsterdam include bicycle theft, safety, less and unsecure bicycle parking areas, and long waiting times at the intersections. To resolve these problems, the city developed a special policy "Choosing for Cyclist: 2007-2010" in 2007. It was proposed to increase the number of bicycle parking facilities, combat the bicycle theft, promote safety via training and campaigns, increase the already existing network and get involve young population to cycle more(City of Amsterdam, 2007). A huge amount of development funds was allocated to cycling. City took measures like public relation campaigns, replacing on road bike lanes with separate bike paths, expansion of traffic calm areas in and around the city to improve cycling. The city integrated bicycling planning and transport planning across all the districts and across all many different departments, for example, transport and spatial palling departments.

To combat bike theft, a comprehensive plan was launched that showed a considerable reduction in the theft. In 2006, for example, about 50,000 bicycles were stolen that, although an enormous number, was a 37.5% reduction in the bicycles stolen in 2001 before the launch of theft combat policy. The future goal was to reduce the theft to 6% only. Measures taken included official registration of bicycles, coloration with bicycle stores and random police checks for bicycle ownership.

Cyclist safety

Safety of cyclists has increased over the last few decades as it has increased for all traffic. Compared to mid-1980s, severe cyclist crashes were reduced by 40% as of 2005. Despite that cyclists' safety situation has been improved, cyclists still lost their live each year on the roads of Amsterdam. Cyclist

safety is important consideration of Dutch transport policies. Interestingly, helmet is not an obligatory requirement in the Netherlands for cyclists. People perceive helmet as unattractive, and less comfortable. Bicycle planners see helmets as unnecessity that may discourage cycling. Bicycle planners argue that cyclist may feel less vulnerable because of helmet and they may behave more aggressively. Also, the motorists may judge the cyclists with helmets as safer ad therefore, behave with less than required care.

The Dutch traffic law is very strict about the safety of young ones on the road. A car driver will be responsible for a crash when it hits a young cyclist unless the cyclist deliberately disobeys the law. The Dutch law also advice the drivers to take extra care when encountering elderly.

Cycling infrastructure and facilities

The investments dedicated for cycling projects is mostly spent on the infrastructure project. The infrastructure includes, in addition to paths and lanes, the bicycle bridges and tunnels connecting main bicycle network. The district, city and regional governments provides funds for these infrastructure projects.

In Amsterdam, there are more than 450km of bicycle lanes and paths (City of Amsterdam, 2015). Most of the bicycle lanes and paths have been constructed during early 1980s. By 2007, Amsterdam has had 200km of separate bicycle paths and the same length of bicycle lanes along 30km/h traffic calmed streets. On relatively high-speed streets (speed limit; 50km/h), the bicycle lanes are provided only along 50km of the length. By 2000, there were abound 700km of traffic calm streets in Amsterdam.

Restrictions on cars in city center

City center of Amsterdam is not easily accessible by car due to strict car restraining policies. Many streets in the city center are only one way for car traffic. Some streets are only for the pedestrian and cyclists. There is limited number of car parking in the city center. This reduction in car parking facility in center is as old as of 1970s. On the other hand, parking fee for the remaining spaces is extremely high (Dutch Bicycling Council, 2006). A scarcity of parking spaces and higher fees discourage car trips to city. Many residential streets have been restricted to only 30km/h speed for the cars.

Bike parking facilities

Bicycle parking facilities at various stations in Amsterdam are enormous, and it has been reported even in the past studies. For examples, a studied in 2006, reported approximately 10,000 bikes were parked at Amsterdam Central station during peak hours. Reconstruction projects around the central station at separate times, however, have reduced the unguarded bicycle parking facilities. During late 2000s and early 2010s, the city accommodated the demand in a temporary three-story garage. However, there was an imbalance between demand and supply. Measures taken to accommodate the increased demand include using double parking bicycles in spaces for a single bicycle. Even with such provisions, still the supply did not meet the demand and cyclists were forced to park their bicycles all around the station. The city also used an old ferry with 1,500 bicycle places during these construction project.

Coordination with public transport

Amsterdam stands as an example for the rest for the world with regards to a beautiful integration of automobile and bicycle use. “Park and Bike” program allow motorists to park their vehicles at the outlaying parts of the city before they take bicycle for the city center (Dutch Bicycling Council, 2006). Park and Bike was introduced to meet the shortage of parking spaces for cars and limited coverage of public transport outside city. The parking fee of the car at park and bike stations accounts for the rental fee of the bicycle. 60% of park and bike scheme bicycles are used in summers every day. This program, however, did not generate enough revenue to cover the expenses.

Promotion of cycling

Schools in the Netherlands provide bicycle training to the children and introduced them to basic traffic safety rule. Schools also provide bicycle for the students who do not own one. Children first experience cycling experience in the Netherlands at very early age in their life, like only 3-4 years old when they get their first bicycle. Infants experience their first bike ride on the special back seat for the bicycles with their parents or on a bike trailer. This may not be the case with the children of immigrants whose parents do not use bicycle because of less popularity of bicycle in their cultures. City of Amsterdam also has had plans to target such population segments and make them use bicycles through special promotion schemes.

Innovative solutions

The persistent growth of cycling in the Netherlands is not a news anymore. Different cities have shown a tremendous increase in the modal share of bicycles in all journeys. Such a level of cycling has put an immense pressure on the existing facilities. Building new facilities, off course, help to cope with the increasing demand. But this is only a part of the solution. Over the years, Dutch cities including Amsterdam have come up with rather innovative ways to alleviate the pressure on cycling network. Transport departments and mobility office are shifting their manual or physical based models (hard measures) for regulating traffic to more behavior based approaches (soft measures). What Amsterdam as a global cycling leader offers the rest of the world is a part of the following discussion.

All streets are bike streets with limited or no car access

Contrary to many cities in the world, the street network map in Amsterdam is virtually the same as the bicycle network. Almost every street in Amsterdam has provisions for bicycle lanes or paths. Interestingly, in Amsterdam, there is a better chance that one will need a specialized map if you are a car driver given that many streets are car restricted.

Car free streets

Streets in Amsterdam have been (re-)designed that omit the cars completely. Although, this practice is not very common, but it is getting trendy very recently. A good example is that of Plantage Middenlaan (see Figure 19; Annex A). This street once had a tram track, car lane, a bicycle path and a sidewalk in each direction. Now, after the redesign, there are no car lanes. However, the tram tracks, the bicycle paths and the sidewalks are still there.

Turn off all the traffic lights

In 2016, Amsterdam made a rather unconventional move to manage traffic (bicycles, vehicles, trams, pedestrians) in the famous junction at Alexanderplein. The city runs an experiment by removing all the safety barriers and turn off all the traffic lights and let the traffic sort itself out. The results of the trial showed success. Switching off traffic lights and removal of safety barriers caused the users to be more careful while at the junction. This also improved the traffic flow. About 60% of the users were satisfied with the results.

Intense Traffic Calming techniques

Amsterdam is not reluctant to use intense traffic calming techniques—textured pavement, speed bumps and tables, narrow streets, and raised intersections—to slow down the motorized traffic. Speed table is one such device that particularly helps improve cyclist safety and flow. Speed tables are raised portion of the roads with ramps on either side, usually flat and longer than the regular speed humps. When vehicle approaches the speed table, it is forced to slow down. The speed tables separate low-speed side streets from higher-speed main roads (see Figure 20; Annex A). The bicycle path's level

does not change as cyclists cross the side street, thus experience no interruption while cars are forced to reduce their speed when reach the speed table and give way to the cyclists.

New and emerging problems for cycling in Amsterdam

Amsterdam cycling has its own problems and they are constantly evolving. For example, the Dutch youth is often accused of riding their bicycle to homes while being drunk by the end of night-outs. 68% of young people have admitted having rode the bicycle when drunk (O'Sullivan, 2016). These figures correspond to the Hague, but similar figures are also true for Amsterdam. It is, however, important to note that this 68% of drunk cyclists only corresponds to those who are still on the road after 1am when, off course, most of others have already gone to homes.

Another problem is related to that of cycling tourists. It is not uncommon to see people cycling on the pedestrian lanes as slowly as possible while navigating streets maps on their cell phone devices. Tourists also abruptly choose to stop at some sites to take a picture, do not usually understand the traffic rules, and often block the bicycle lanes. For some Amsterdam's residents, tourists are annoying, others have more positive opinion citing visitors as a part of tourism while few thinks that the most dangerous person in Amsterdam is a tourist on bike.

There is a lot of saturation of e-bike in Amsterdam, but the infrastructure is still not there for e-bikes. For example, in the parking facility, one cannot park e-bike with the same level of ease as one can the city/regular bike.

Streets overcrowded with cyclists are often clogged for pedestrians. Cyclist meet situations where they are forced to lower their speed, wait in queues, maybe sometimes twice for the lights to get green before their turn to cross the junction. The result is poor safety situation and injuries in some cases. Bicycle parking has reached to maximum capacity in Amsterdam. There is scarcity of adequate parking spaces in Amsterdam in city center and near the railway lines.

Cycling in Italy

The idea that bicycle is main mode of transport is still not appreciated by majority in Italy. Cycling is not yet well-integrated into travelling habits of common Italians. Efforts at various levels have been made to increase reliance on bicycles for travelling, especially in dense urban areas. In this perspective, Italian Agency for Environment Protection (ANPA) launched few initiatives to promote cycling in young people by means of training and educational program. For enhancing bicycle shares, it is important to develop a targeted bicycle plans within buildup areas, practical land use regulations and local road policies, and better integration with public transport systems (Santonico in: ANPA, 2002, p.8).

In Italy, some decision-makers think a conflict of interest between cyclist and motorist when bicycle is given priority over the motorist. On the contrary, given the current traffic situations in some Italian cities, giving way to bicycles is a contribution towards a rational use of transport since bicycles are more efficient means of transport over short trips. This argument supports an integration of bicycle within public transport policy (National Agency for Environmental Protection, ANPA, 2002).

Milan

Milan is a city in the northern part of Italy. It is the capital of Lombardy region. A population of about 1.35 million people makes Milan the second most populous city in Italy. Milan can be divided into, the city center, the outer part and the suburbs (also known as "hinterland"). Every day, people make around 5.3 million vehicle trips while entering or leaving Milan. People use car (car ownership in Milan is 0.52 per person) or motorbike for about 37% of trips within the city, and for 57%, public transport is

the preferred choice. On the other hand, when trips between city and external areas are considered, car is used for 62% of journeys.

Milan has a relatively flat topography, standing between 102 and 107 meters above the sea level. Flat surface and relatively dense urban development make it bicycle friendly. Milan has a network of bicycle paths and lanes, but they are poorly maintained. The connections are usually broken, and paths are fragmented. In 2011, bicycle trips account for only 6% of all the trips made by Milan's residents (Municipality of Milan, 2013). Majority of these trips come from students of different universities living in Milan.

Like other European cities, Milan has also taken some measures to support sustainability mobility (particularly, cycling), for example, pollution charge (introduced in 2008) and its subsequent congestion charge (introduced; 2012) in the city center called region "C", car sharing services and bicycle sharing schemes (BikeMi). Also, the city of Milan has 152,000m^2 area for only limited traffic access and 428,000m^2 area for the pedestrians.

History of cycling in Milan

Municipality of Milan prepared a plan for the development of cycle network four decades ago (in 1980). Later in 1995, a work group was created to include the construction of bicycle paths in the urban transport plan (the PUT 95/97). The plan suggested the implementation of 70km of bicycle paths between 1995 and 1997. Only 24km of total urban cycle path network was developed. Transport office of Milan suggested the municipality to establish a specialized office for cycle mobility and to provide, within the city transport policy, a strategy to promote cycling as a real means of transport (Scalia in: ANPA, 2002, p. 69). One of the outcome of the strategic action plan launched in province of Milan to promote cycling was a bicycle sharing service, Bikemi. BikeMi allow those with subscription to take the rental bike, parked at some location in the city and then leave it at some other location after a trip.

BikeMI

BikeMi is a bike sharing service introduced in 2006 in Milan as a part of sustainable mobility package. Politecnico de Milano carried a study for the Municipality of Milan to define the important parameters including the ideal number of bicycle stations, the coverage and distribution of station, business model of the scheme and even the shape of bicycles. The study suggested to use 5000 bicycle units that will serve 300 bicycle sharing stations across Milan. The plan was implemented in three phases. The State made the initial investment worth 5 million euros to start the project. The municipality assigned the management to its own public transport company ATM (Azienda Trasporti Milanes, in English: Milan Transportation Company) which tender the operations to Clear Channel, a world-renowned advertisement company. The outdoor advertisement at the stations earned enough revenue to repay the management cost.

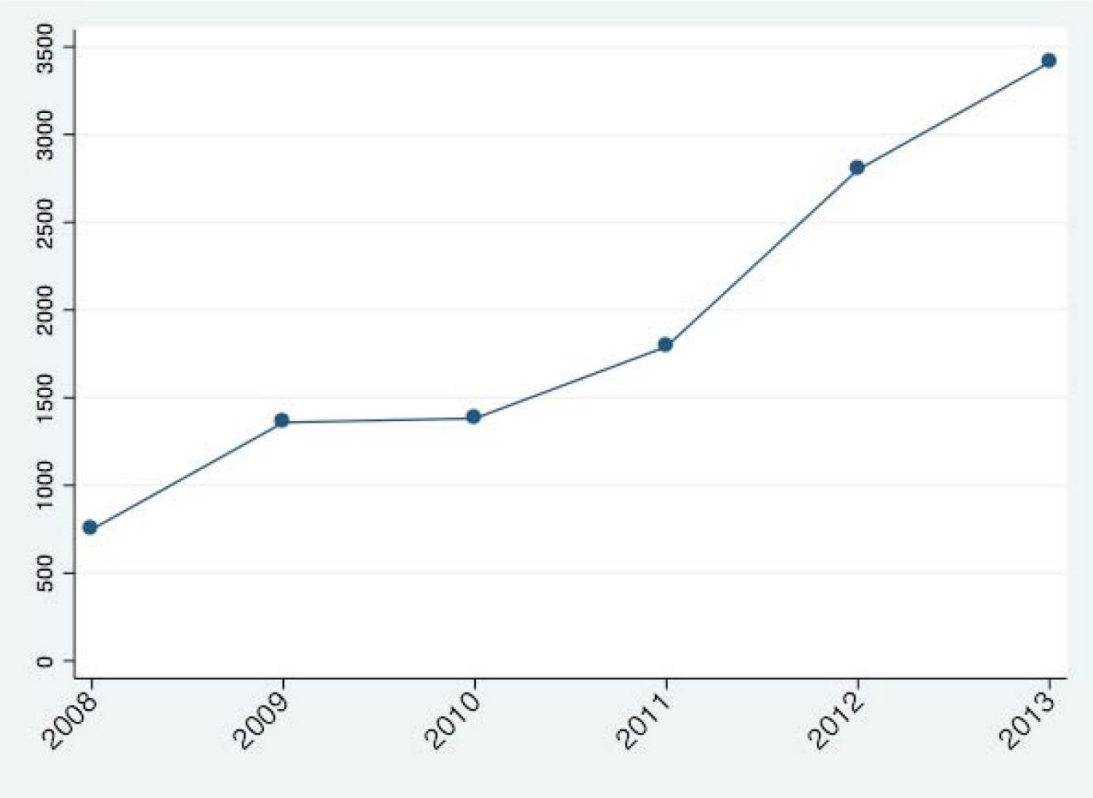

Figure 8 BikeMi byclcle increase (Source: BikeMI, 2014)

BikeMi provides three types of subscriptions to the customers; annual, daily and weekly for 36, 6 and 2.50 euros respectively. A magnetic stripe card is provided for the annual subscription customers while the other two categories use a user name and password services for the services. Bicycles are available at any time for rent between 7am and midnight. The users do not pay for first 30 minutes of the trip and later pay 0.5 euros for every half hour for a maximum of two hours. The users pay 2 euro per hour penalty if they fail to return bicycle after two hours. After three times the limit is exceeded, the service is suspended automatically and a 24-hour delay in returning bicycle after its withdrawal from the station can lead to fine equal to 150 euros. Between two sequential uses, a delay of at least 10 minutes is advised. Bicycle stations are placed in the proximity of the train and metro stations to allow for inter-modality. Also, social attractions like universities and hospitals are given special consideration in location the sharing stations. For a higher density and to ensure walking to the stations, two stations are not more the 300m apart in the served regions.

BikeMi use has witnessed a steady growth over the years. For example, people made 651,720 trips in 2009, 773300 in 2010, 999061 in 2011 and more than a million in 2012. An increase in number of annual subscribers is also observed with only 580 in 2009 to 6913 in 2012 (ATM, 2013).

Policy goals in Milan

Milan has made various efforts to transform into a bicycle friendly city in the recent years. The promotion of cycling for work, school, shopping, leisure, and tourism are key elements of transport policy. Milan transport department think to first redefine the road system from a network, originally designed for automobiles, to a multifunctional network that can accommodate others means of transport (public transit, pedestrians and cyclists) in a sustainable way (Municipality of Milan, 2013).

The city administration has taken key initiates to promote cycling, for example, (a) development of cycling infrastructure ; bicycle lanes, bicycle paths, under- and over-passes, traffic calming devices on

bicycle streets, new rules for bicycle traffic (b) Creating guarded bicycle parking areas (c) Offering a dedicated service for the promotion of cycling (d) Improving bicycle accessibility from the metropolitan area by introducing a strategic plan called MiBici (e) Promote cycling tourism.

Milan has shown a growth in share of bicycle use in surveys conducted by Italian Friends of the Bicycle Federation (FIAB ciclobby), especially in the center and at certain road stretches because of the efforts mentioned. For example, in Corso Buenos Aires; a major shopping street in Milan, people used bicycle for approximately 14% of trips ("Ciclobby," 2014). About 10% of the cyclist has used BikeMi in 2016 that showed an increase of 18% than the previous years, indicating a change in people behavior. Annual censes of cyclists has also confirmed an increase the bicycle use. For example, between 2002 and 2014, FIAB Ciclobby reported an increase of 56% in bicycle use.

Cycling infrastructure and facilities

The quality of cycle routes is poor in Milan because of low priority attached to it in the past. Bicycle paths are less attractive, badly maintained and difficult to use. These paths are constructed with no technical considerations resulting in incomplete/broken network. In some cases, the city has reconstructed few paths, in other cases the reclaiming efforts are not materialized because of other priorities and higher costs.

By 2013, Milan has a total of 167km of cycle routes, including 30km route constructed between 2011-2013 and was increase in later years. Although addition of new routes has now end value if it does not increase the cycle share, but it is a better indicate of actions taken by the city to improve cycling.

Over the years, Milan has made several interventions on road network to increase cycling and reduce car use. These include, upgradation of roads, introduction of limited traffic zones and limited speed zones in residential areas, realization of pedestrian zones and regulatory measures. Such interventions create a road network potentially suitable for the cyclists. Consequently, higher shares for cyclists.

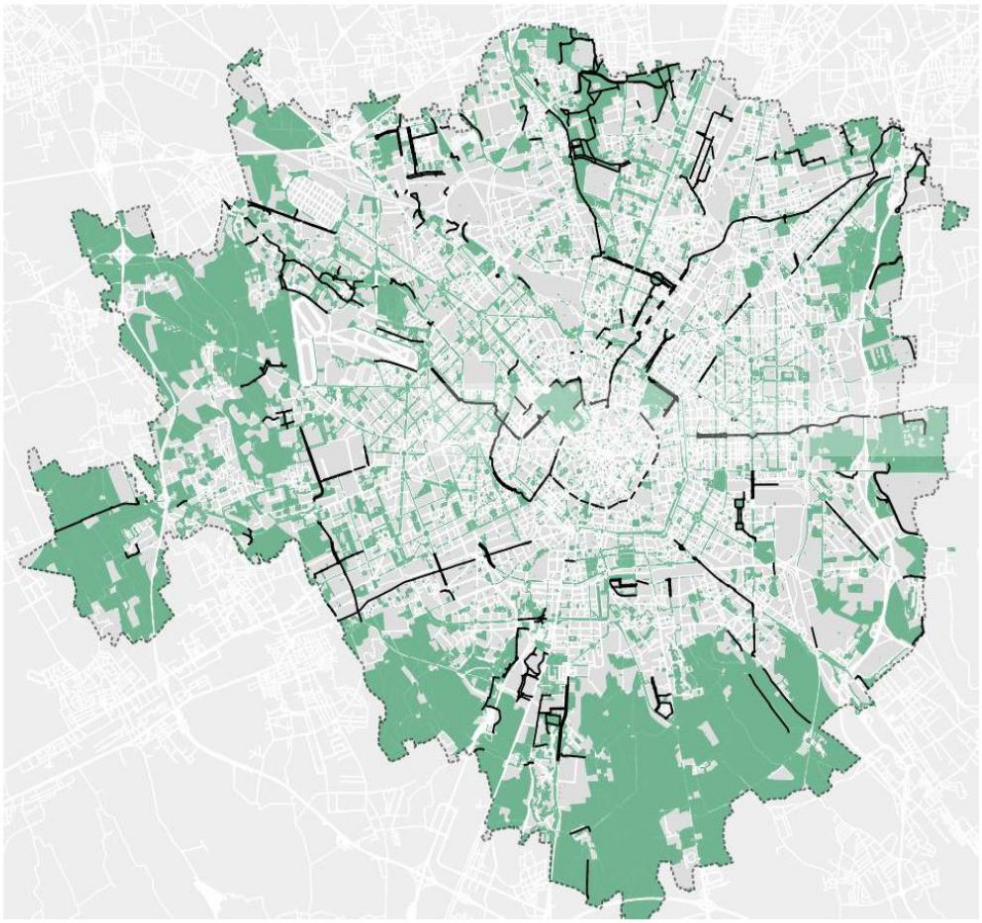

Figure 9 Existing network of bicycle paths in Milan in 2013 (Source: City of Milan 2013)

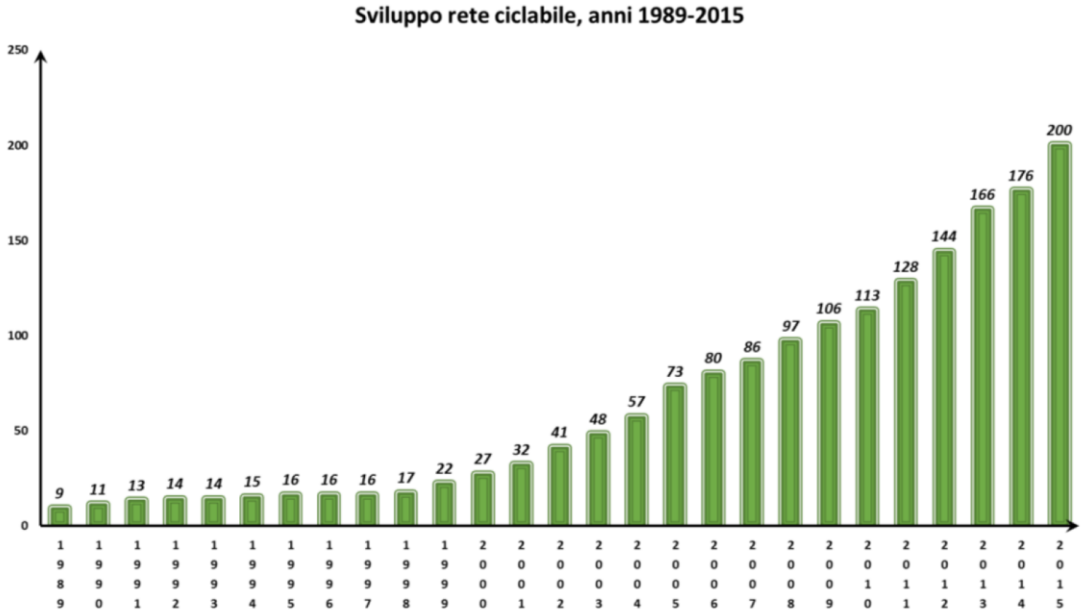

Figure 10 Development of the cycle network facilities in Milan from 1989 to 2015 (Source: FIAB, Ciclobby)

Integration with public transport

The public transport company of Milan has implemented enhanced services to the users and ensured supply of new bicycle carriages on buses, metro and trains. Measures taken to integrate bicycles with public transport are:

- Increase the time slot of the transportation of bicycle on the metropolitan lines and on other lines of local public transport for a medium to long distance trips.
- Provide incentives to companies or businesses or actions aimed at improving accessibility for bicycles and pedestrians
- Promote the provision of space in the parking lots for bicycles and services like information, technical assistance and bike rental schemes

Cyclist Safety

To improve safety on streets, the city takes actions on several fronts. City create separate facilities for the cyclists, reconstruct and expand cycle paths and introduce new rules for the automobile, particularly in pedestrian and cyclist zones. To meet the increasing demand of cycling, many different structuring works of bicycle routes are carried out using best domestic and international practices.

Promotion of cycling

City has developed a plan for sustainable mobility in the line with the wishes of the citizens expressed through an advisory referendum to turn Milan into more livable city. A promotion program to improve cycling shares is one of the element of this plan. It was decided to increase the use of cycling for commuting by providing more safe routes and lanes, creating pedestrian zones, green areas, and a continuous cooperation between local bodies and associations interested in cycling. Bicycle as a means of transport would result in reducing emission millions of tons of CO_2 into the air and thus improve air quality.

Coordination with public transport

Coordination between bicycle and trains is addressed by three possible synergies in Italy; bicycle on the train and metro, park and ride scheme in/near the stations and rental bike schemes near the train stations. Milan has the most developed system of integration in Italy for some years now. Because of the efforts made by FIAB (the Italian Bike's Friends Federation) and others cyclist associations, citizens can take bicycle on trains and in city's underground metro services on weekends, in the evenings and outside peak hours. Some problems still exist with the Italian national railway company that remove luggage bicycles from travelling on the trains because of the higher costs. The good news is that recently, Italian State railways has shown some interest towards meeting cyclists infrastructural needs on trains. Many guarded inner station bicycle parking, on the other hand, have been closed by the Italian State railways because of cost cutting measures. A reverse trend is however, recently observed since more people are parking bicycles at train station, a change in the travel behavior because of the zero cost and time saving traits of traveling by bike to react stations station (Ferrari in: ANPA, 2002, p.56).

Cycling problems in Milan

Urban Sprawl

Cities in northern Italy have experienced strong urban sprawl in past decades (UE, 2006, p. 15). A series of studies have confirmed that sprawling may result in a higher environmental impact of mobility (Travisi, Camagni, & Nijkamp, 2006). Energy consumption of transport sector depends on factors like nature of rail and road network, development of mass transportation network and modal split. When

density falls, a significant increase in transport related energy consumption take place. People tend to use relatively energy inefficient modes like automobile to travel as it become the only practical alternative (UE, 2006, p. 30). The sprawling city of Milan is a typical example. Uncontrolled development does not allow for the sustainable life style because to increased energy consumption and makes it hard to reach destinations by bicycles.

Infrastructure issues

Bicycle paths in Milan inner city are virtually absent. This hinders the use of cycling in the city. Bicycle paths, even if present, are mostly fragmented into individual segment and therefore, are useless (Fabris, 2009, Repubblica newspaper article). Previously, the city has developed very ambitious mobility plan of connecting individual paths in a network and extend the current network in future.

Lack of adequate bicycle infrastructure forces the brave cyclist of Milan to ride bicycle in the middle of the road with other traffic and make this unsafe choice rather than using the broken cycle paths (Ciclobby article journal n.3, 2009, p.1-2). This indicates the absence of common vision and partnership between demand side (road users) and the supply side (policy makers).

Absence of monitoring cycling traffic system

Milan have no system to gauge whether and to what extent the actions taken by the city and other bicycling agencies are increasing bicycle shares in the city. The lack of monitoring system was first notices when questions about success of BikeMi were raised. The voluntary surveys by the Italian Bicycle Friends Federation (FIAB Onlus) is the only existing source to check cycling initiative that, however, has limitation of spatial coverage and survey is conducted only for a single day (Drufuca, 2011). In cities where cycling is naïve, like Milan, due to complex nature of bicycle traffic, it is very hard to measure certain characteristics.

Attitudes and Motivations Issues

Reasons for not using bicycle as a preferred mode of transport by the citizen of Milan as revealed at "The bicycles mobility in urban contexts Conference", (2000), by ANPA (National Agency for the Protection of the Environment) and the FIAB (Italian Federation of Bike's friends) include:

- Safety: The fear of involving in a crash and impression of violence
- Bicycle a cause of traffic barrier effect
- Effort and energy required: The fatigue, the sweat, the pain and difficulty of breathing
- Incompatibility with certain weather conditions
- Exposition to other vehicles emissions
- Public image: Not a convenient and cheap mode

This gives an insight in understanding cyclists' concerns and communicate carefully the promotion schemes and bicycle safety programs.

Lack of national, regional and local bicycle policies

Number of bicycle users in Milan is not increasing due to the lack of solid national, regional and local bicycle policies and a real bicycle network plan. The gap between the actual and potential demand of bicyclists is huge in Milan. Road safety hinders people to use bicycle for trips in Milan as the available infrastructure in not as comprehensively planned with other means of transport. Cycling is far from the fact that it will become an important mode of transport in the city of Milan despite the light municipal attempt to improve it.

Comparison of Amsterdam and Milan

The most important variables to affect cycling share are infrastructure and clear policy measures. Both results in separate facilities for cyclists and ensure well distributed parking and service locations for bikes. More in-depth comparison is as follow:

Distances, development forms and modes of transports utilized

Is the distance to cover by bicycle affect the number of cyclists?

The distance to cover is an important indicator of the choice to or not to use bicycle for the trip. In addition, a good infrastructure, for example, separate bicycle lanes, streets equipped with traffic calming measures, better public transportation, bicycle traffic lights and bicycle parking lots at activity locations enhance the qualitative appeal of the distance to be travelled. Better inter-modality, for example, in case of Amsterdam, shorten distances to the station be travelled by bicycle. Trip length is strongly correlated to the land use and development density of the cities. Compact structure and mixed land use make bicycle a more practical means of daily transport. On the other hand, urban sprawl, like that of Milan, may make the cars as a logical choice to reach far distant locations outside the city.

Does the development form of cities affect the choice of bicycle for transport?

Amsterdam is densely developed. Mixed land use makes the trip length not very enormous. Therefore, bicycle can be used for virtually all trip purposes. In Milan, residential, shopping and business districts are located far from one another. Milan has experienced strong urban sprawl. The city has grown large but no efficient bike system is in place.

What is the popular mode of transport in both urban contexts?

Bicycle is the most popular means of transport in Amsterdam for the trips. People frequently use bicycle for journeys below 7.5km and 7.5-15km. In 2005, the city of Amsterdam reported a cycling share of 37% of all journeys (City of Amsterdam, 2007). On the other hand, in Milan people use car frequently for their journeys. For short trips, even between 0-3km, the popular means of transport is car. Bicycle is the least used mode, also below the public transport.

Are the different means of transports integrated and connected well in two cities and do they allow the bikes use also for long distances?

Amsterdam bicycle network is well connected to the public transport by means of parking spaces for bicycles at the train stations, bus stops, all major attractions and activity centers. Bicycle transport is normally allowed on trains.

Milan, however, lacks a highly integrated transport system despite efforts being made recently. It is not easy to use bicycles in combination with public transport services. Few “green trains’ and special metro wagons, however, do have provision for bicycle transport in Milan.

Travel motivations, trip purposes and attitudes

What are the main travel motivations that influence the travel behavior and the bikes mode choice?

Safety affect the choice of the mode the most in both the cities. While the Dutch use bicycle for daily travel to work, school and shopping, bicycle culture is still very new to the people in Italy.

Urban transports' plans and statute bike plans

In both cities bike plan, which one’s infrastructural strategy effectively helps to increase the actual number of the urban cyclists?

Amsterdam's transport policy is centered around non-motorized modes of transport (walking and cycling). The result is a quality main bicycle network. Infrastructure provisions such as separate bicycle lanes, parking provisions and traffic lights are appealing elements for the users that increase safety and ultimately bicycle use.

On the contrary, Milan has recently started developing a proper bicycle policy and few infrastructural services for the cyclists. There is still a lot to achieve in areas of safety, parking spaces, separated lanes for bicycles and connection with other transport modes to reach the Dutch level. Shortage of bicycle infrastructure in Milan makes the cyclist to take risk for their lives by travelling in the inner-city regions with a mixed traffic. In Amsterdam, the inclusion of the needs of the demand side (users) and social organization is a prime element in policy development for cyclists while in Milan, authorities have do not include FIAB, Ciclobby and other bike's supporters in policy development. This is the most prominent difference between the two cities,

Lessons learnt from the case studies of Amsterdam and Milan

This work presents several key lessons to learn.

Amsterdam offers a set of already tested measures to succeed in obtaining higher level of cycling in overall modal split. The concrete provisions for bicycles in the urban mobility plan, that ensure the implementation of multi-faceted, mutually reinforcing policies, focused on more pro-bike measures while at the same time restrictive policies for the cars in city center, summarizes the success story of cycling in the Netherlands. On the one hand, it is the overwhelming support to encourage cycling and on the other hand, it is making car use more expensive and less convenient makes cycling flourish in Amsterdam. Bicycle and pedestrian friendly streets are there for slow traffic, thanks to the enormous government attention. This has helped people reaching their destinations, activity locations or transit stations on bicycles with relatively low dependence on car. In past two decades, the city government transport department has a special attention to a range of traffic calming measures, giving priority to slow traffic and improved safety in the residential and commercial areas. Amsterdam's efforts to enhance bicycle use also include measures to improve safety and convenience of cyclists, attractiveness of cycling routes, better integration with public transport, combat bicycle theft, reaching to and training of the immigrants and other segments of society with low bicycle use, comprehensive traffic education and cycling training, and a wide range of promotion schemes to obtain public support and acceptance of cycling.

Milan case also offers some lessons to learn about cycling. Milan transport plan showed that the lack of adequate infrastructure is catastrophic for increasing bicycle shares, make cycling unattractive for the users, and may decrease the potential and actual number of cyclists. There should be a coherence between the demand (bicycle users) and the supply (policy makers, planners, politicians) side, they should reinforce each other. In Milan, people are reluctant to use bicycle for their journeys because of the shortage of facilities, while governments make small to no investments because there are only few cyclists. The infrastructure variable has happened to have a strong impact on people's decision to use bicycle and on government policies. It suggests special attention to be given to the spending of municipal money on facilities, ensuring a smooth linkage between bicycle and public transportation facilities. Focus on building bicycle transport arrangements on public transport, parking facilities at stations and transport terminals should be given.

A well-defined set of rules that recognize the status of bicycle as a full-fledged means of transport is crucial for the success of cycling policy. It infers that transport office should develop guidelines for the design of infrastructure for the cyclists, ample enough to address the needs of cyclists. People are concerned about safety if an adequate infrastructure is missing. These arguments suggest a blend of "hard" and "soft" policies for promoting cycling is indispensable. Communicating cycling, raising

awareness, offering incentives and making people accustomed to cycling on the roads are as important as safe, complete, comfortable, attractive and high-quality infrastructure in urban bicycle policies.

Conclusions and reflections

Cycling has multiple advantages, related not only to transportation, but also health, environment and spatial planning. Integration of cycling into overall transport policy, and in other policy domains like health, environment and urban planning can be instrumental in increasing the actual urban cycling shares. Milan and other cities, therefore, should pursue the type of integration like Amsterdam has to enhance their cycling share. Having a national cycling strategy that puts cycling at the forefront (like in the Netherlands) is, however, important before integrating cycling in transport policy. Such step put cycling in the limelight, forcing the local authorities to focus on cycling and hence, in long terms, increase the number of cyclist. Beginner countries, like Italy, needs bicycle master plan while those already have made considerable progress like the Netherlands, require an integrated plan.

Because of cycling road network can relieve from the suppressed demand, increasing the capacity and reducing congestions. Cycle planning is more efficient when different policies, such as transport, environment, health, land-use, economy and finance, integrate it in some form. Bicycle policy in Italy lags far behind than the one in the Netherlands. While in Italy, cycling policy is only perceived from a road safety viewpoint on national level, the Netherland already has a very comprehensive bicycle policy. The Dutch national spatial planning policy consist of provisions for creating bicycle friendly environment. In Amsterdam, cyclists and other social bicycle organizations have a say in policy development. This implies the policy objectives often rely on enough support from these group. Using international experiences to convince politicians about the effectiveness of cycling can be very useful in case of Milan. This, however, requires a further study of successful pro-cycle policies and plans, and of people attitude towards cycling. Bicycle user-groups are important source of information about the needs of cyclists when facilities requirements are devised. National level government should be moderator to enhance cooperation and support between various stakeholders. Influencing and ultimately changing habits of politicians, planners and finally citizen is viable for successful cycling strategies.

On national level, mobility demand of vehicles is the center of transport policy in Italy. It will take some time before Italian realize that cycling and walking are just as much forms of mobility as are automobiles. There is limited awareness about the potential of these modes to replace motorized modes for short trips. Also, Milan has shown a certain degree of deficiency in cyclist data, lack of information and shortage of knowledge about cycling. This highlights why cycling is still not accepted as a means of urban transport.

To conclude, few suggestions for obtaining successful cycling culture are; communication with all stake holders, integration of different policy domains, integration on different policy levels, safety, inter-modality with other modes of transport and suitable infrastructure. Without second opinion, the Netherlands cycling is exemplary for Milan and other cities showing that bicycle is equally a good mode transport for every day trips. Following a Dutch example, state, regional and city governments can promotion cycling to the highest level possible.

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Annex A-More cycling problems

Time consuming

Cycling is slow. It takes may take more time to cover large distances than the automobile. It is never a desirable choice to use cycle for very long distances. Peddling for hours without regular practice may cause a little tightness in the lower or upper back because of being hunched over for longer time. the appreciated advantage of cycling that us it is useful for the joints (specially knee joint) may become its highest liability.

Cyclists share facilities with automobiles. No all the roadways are designed to the needs of cyclists or pedestrians. This means that cyclists are sharing the road with drivers who are not entirely watchful, are forced to ride the bicycles as close as possible to the shoulder, through pieces of broken bottles, beer cans, pieces of car's broken window glass, hidden pits etc. and with an ever-present risk of a crash.

Dangerous Drivers

Some roads provide separate lanes and paths for cyclists, others do not. In mixed traffic, drivers are frequently accused of disregarding cyclists and causing injuries or even deaths of cyclists. Since cyclist are exposed, with only clothing or helmet in some cases, they are often considered at disadvantage considered in the events of crash. Cyclist crashes usually go un reported, so it is not possible for the authorities to determine exactly the safety situation of bike riders. The risk involved of crash involved in sharing a road with motorist cause the two wheelers to shift to some other modes of travel.

Poor Weather Conditions

Dressing properly according to weather is important, particularly covering of hands and feet. Cycling is usually not recommended in poor weather conditions, e.g., ice, rain, etc. It is difficult to ride a bicycle in windy weather. When temperature is high, cyclists may be uncomfortable. Reliability on bicycle as a mode of transportation is compromised in areas with bad or extreme weather conditions. Cyclists must check weather forecast to ensure that they will be able to cover the trip distance without being caught in severe weather and cause safety hazard.

Expenses with Biking

Cycling can be expensive when done as a hobby. According to Forbes, a cost to buy a good used bike is in the range of 150-200$. New bike is substantially expensive than this. The gear needed for recreational biking including a helmet, gloves, lights, and other items, are also expensive. bicycles maintenance is responsible for additional costs. Although the annual cost of keeping bike is far less than a car, infrequent cyclists may find it as an extra burden on their transport budget.

Increased Risk of Injury

Cyclist may experience two types of injuries; traumatic and overuse injuries. Traumatic injuries occur when cyclist is involved in a crash. On the other hand, overuse injuries occur in frequent riders because of excess of use. Lower back pain is common injury in cyclists. Chronic pain is often reported because of the stress added onto the back while riding a bicycle. Other injuries may occur in tendon and knee muscles.

Dangers on the roads

People generally perceive cycling as more unsafe compared to cars, safer than motorcycles and roughly similar level of safe as walking. This is a qualitative inference. More in-depth values depend on whether

it considers the number of crashes per mile distance covered, per journey/trip, per hour of travel etc. depending on the units used for analyses, the level of safety varies with respect to different mode.

Cycling is, however, a lot safer than it feels in practice. The perception of bicycle whether it is a dangerous mode of transport also depends on the choice of the bicycle; a stable city bicycle is more comfortable to use than a frisky mountain bike in traffic on the urban roads.

Close-passing traffic

Drivers are not very supportive when they pass cyclists. It is commonly believed that cyclists only need a small space to travel and forgot about the need for balancing and swearing to avoid potholes and other type of hazards on the roads. Cars win mirror are projected outward from car doors at roughly the same height as the cyclists' elbow which also endangers their safety.

The best to avoid fast moving traffic is to cycle close to the curbs on the roadside that if frint wheel of the bike hits may result in the falling of the rider.

Aggressive drivers

Driving a car is multitasking, stressful and competitive activity. Drivers need to focus on the road and surrounding environment to ensure safety of other road users. Anything that even gets slightly in the way are considered a nuisance. On the other hand, cyclist may be the source of this nuisance. For this reason, car drivers tend not to be great fans of cyclists. Practically speaking, car will overtake the cyclists on the road, only to be overtaken again at the traffic light, junction or in a long queue due congestion. This may sometimes, lead to kind of discomfort in car drivers towards cyclists. Statistics, however, shows that aggressive car drivers are just a minority compared to those who happily choose to co-exist with cyclists.

Wind

Cyclists are sensitive to weather conditions. It is common among non-cyclists to think that rain is the worst weather conditions for cycling. However, when one cycles in the wind, it is soon realized how much effort is required to ride the bike. It is worse when you travel against the wind, requires huge amount of effort on cyclist behalf to move forward.

Long distance cycling enthusiasts reduce the problem of opposite wind by use the dropped down handlebar, that helped them you reduce frontal area by comfortably crouching down in forward direction.

Rain

Rain is another weather-related problem for cyclists. Depending up on the region and time of the region, the frequency of rain may vary. It is normally recommended to use rain coats or many layers of clothing when use bicycle for journeys. Better choice of clothing and checking of weather forecast are precautionary measures against the rain.

Cold

It is extremely hard to cycle in freezing weather. Wearing wind proof clothing and gloves could be instrumental to get warm enough to make journeys by bicycle. Special attention to hands and feet is advised in wintry weather.

Heat

Like cold, cycling can be difficult in hot weather condition. Direct sun may cause heat stroke and other heat related health problems in areas with elevated temperatures in summers. Having and consuming cold water while cycling in sun in warm regions is often recommended.

Helmets

Cycle helmet is a controversial subject. While it is mandatory in Australia, planners in the Netherland considers in inconvenient, less sexy and even a safety hazard. A helmet use may develop a false sense of safety among the cyclist and they ought to take unwanted risk. Similarly, motorist think of helmet wearing cyclist as safe and tend to be less careful around them.

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Annex B-Photo Gallery

Figure 11 A part of bicycle path pained red in north part of Milan

Figure 12 A bicycle bridge in Milan

Figure 13 Parked vehicle on bike lane in Milan

Figure 14 A cyclist in Milan sharing road with other traffic (Source: Hilary Angus)

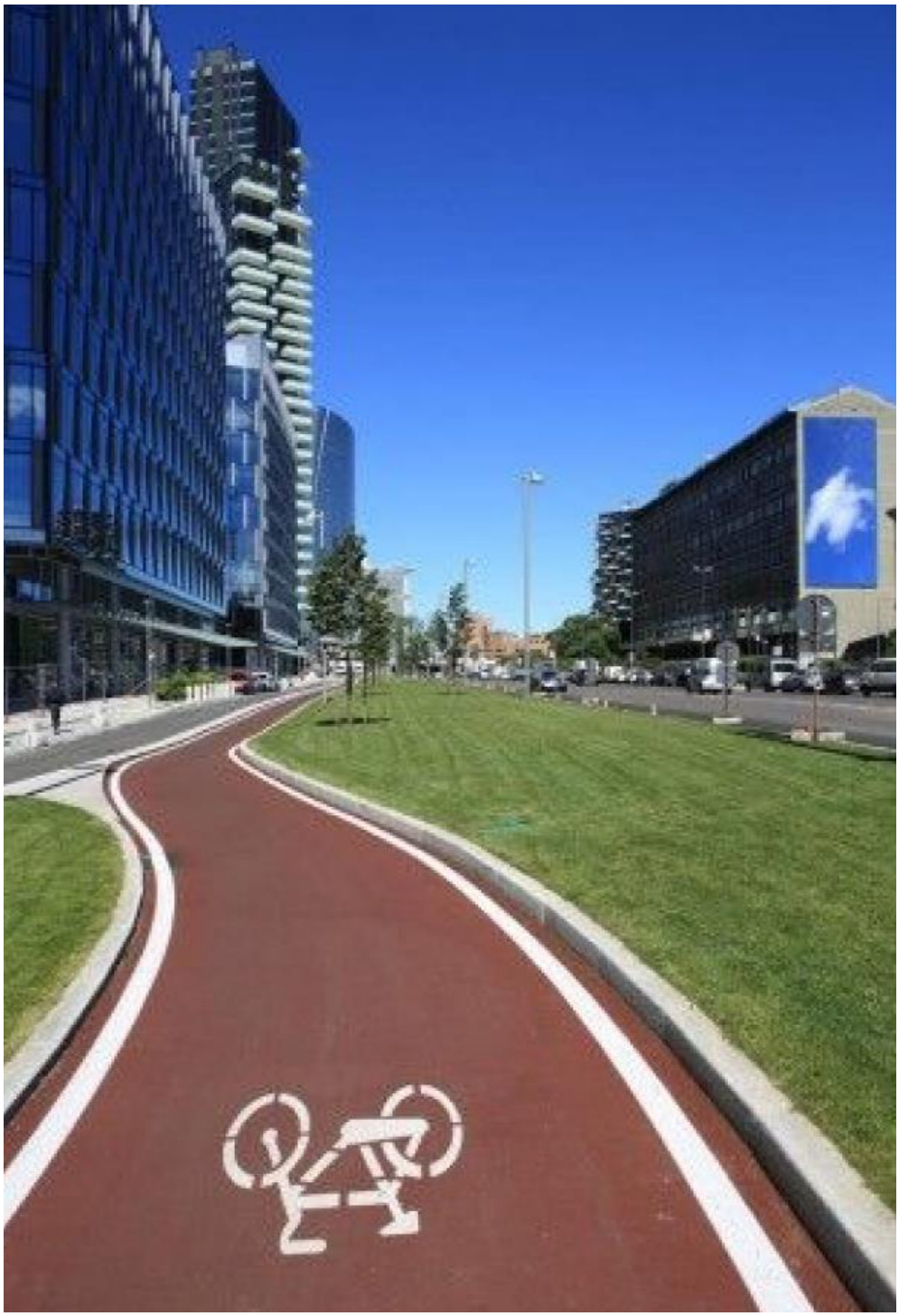

Figure 15 Bike lane in Milan Porta Nuova

Figure 16 Two way-two lane bicycle path with right turn lane in Amsterdam (Source: Pascal van den Noort)

Figure 17 Mobility by bicycle in Amsterdam (Source: Peter Janiszewski)

Figure 18 A protected intersection in Amsterdam (Source: Thomas Schlijper)

Figure 19 Middenlaan Plantage (Source: Norman W. Garrick)

Figure 20 Cycle priority crossing of a minor road (Source: David Hembrow)