

Assessment of Bicycle Use as a New Practical Strategy to Achieve Sustainable Development

(Case study: Bahonar Street, Tehran, Iran)

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ABSTRACT: In recent decades, urban planning has tended to humanist urbanism. In this regard foot travels and bicycle use are the two strategies that urban planners and transportation engineers are using them as adequate alternatives for making cities more people friendly. Using bicycle is known as a strategy that has a great role in decreasing traffic among developing countries in recent decades. These countries have taken great steps by reducing traffic congestion and environmental pollutions to reach the sustainable development using comprehensive legislations in this context. This paper aims to assess and analyse the successful countries' experiences specifically Holland and Denmark as countries that have eliminated extensive amount of traffic difficulties by using bicycle transportation system. Also, investigating this form of transportation regarding the improvement of bicycle use culture in the case study of Niavaran district will be conducted. This article has been implemented in the basis of library-based phase of the research, case study method and observation for its field study phase. To sum up, the findings of this study comprise the feasibility of bicycle use in the mentioned case study; in which despite of district's high slope, efficient proposals have been used to achieve sustainable development.

Keywords: Bicycle, Sustainable development, Traffic, Niavaran district.

INTRODUCTION

Nowadays, any city planning must take place within the framework of sustainable development. Transportation is considered as an important parameter in determining all aspects of urban life. Application of modern systems and new methods for urban transportation, traffic and pollution which are severe and need special status are considered important. With the increased use of cars regarding their convenience and speed, the city was forgotten, and by the time elapse problems such as traffic, pollution and environmental sound, non-renewable energy loss were the inevitable causes of urban planners and designers with Relying on pre-industrial city. So, other new town and urban thinking, not with car-based cities, air pollution and noise but the city which was quiet and matches the physical and psychological characteristics of humans, was established. The idea that the expansion is being called human-oriented refers to an urban development which is a movement and displacement on the human scale.

As noted in the human-oriented development, urban citizens play a key role in transportation not based on car but based on human movement. One of the essential elements of human-oriented movement is "bike".

After the invention of the bicycle in 1867, the first transportation device, as a means of attention was fun, but with little evolution of the recreational vehicle and sport vehicles which transport the individual to quickly multiplied Walking speed was brought to the surface was then grew into cities (Gharib, 2002).

In the 1970's energy and environmental crisis increased oil prices which then emerged in the early decades of 1980's that issues related to sustainable development and environmental issues led to widespread use of bicycles as a part of transport system (Unified Facilities Criteria, 2012). In the last two decades, bicycle use as a solution of many problems in terms of environmental, economic and health problems was re-discovered. Several countries in this period set goals and formulate some action plans for national and regional bicycle. The purpose of this paper focuses on making policies to increase the contribution of bike-sharing in terms of total urban trips. Policy states that have been able to correct their cycling rates are high essentially in Europeans.

Currently the countries the Netherlands, Denmark, Germany, Austria and Sweden have provided the best condition; while the United States and Canada, despite overall success in the field of research and implementation of urban transport projects, have gained less successful with States Successful European differences are dramatic (Brog et al., 1999). North American researchers' special attention to the process plans, social studies and developments related to bicycles in Europe to have modelled the rate of cycling to increase in their countries. Access is attractive subject for researchers, because the main reason for the development of cycling in general European countries, in addition to planning, other factors considered by experts is effective. About the importance and priority of these factors is seen vast differences, and this continued its investigation by mid 1980 until the beginning of the decade in

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2000 has had effect (Maddox, 2001).

Bicycle transportation system has many advantages the most important of these advantages can be pointed to the following:

- Reduce the volume of traffic in the city;
- Not deal with parking shortages;
- Economic savings;
- Reduce the risk of accidents;
- Non renewable energy consumption;
- Reduce environmental pollution such as air pollution and sound pollution;
- Create happiness and health for increased passenger.

MATERIALS AND METHODS

The selective approach in the present article is the critical type, while quantitative data for analysis and evaluation process and qualitative analysis based on case study have been conducted. Totally, the methodology is descriptive – analytical. The work style in the present research is as library and field studies and visual observations, which first collects library data and review the experiences on this matter and then the field, required deductions in order to confer with city authorities and space users is implemented. In this regard, the influential qualities and specifications within Bahonar Street is reviewed through visual observations (data sorting, analysis and collecting data, proposed strategies and relative arrangements).

Problem Statement

Today, by expansion of Tehran city and population growth, traffic congestion has converted to one of the fundamental problems that has caused large amount of fuel consumption and time dissipation. On the other hand, air pollution difficulty is compounded regarding the same reason. Niavaran district located in the north of Tehran city is among the regions which has faced buildings' high density followed by population rapid growth. Considering the other side, households' rather appropriate economic situation has caused increases in vehicles number. According to these factors that directly have influenced the traffic congestion of the study area, several strategies should be proposed for decreasing personal vehicles use. In this regard, it could be effective for reducing the volume of traffic congestion and fuel consumption as well as environmental pollution reduction and increasing level of community health.

Research Questions

- Could the use of bikes decrease the traffic congestion in large cities?
- In what ways are citizens encouraged to use bicycles and public transport systems?
- How could we reach sustainable cities by expanding bike use policies?

Sustainable Transportation

Various definitions have been presented considering this concept but sustainable transportation simply can be defined this way: Transport that satisfies the current transport needs without compromising the ability of future generations to meet their own needs (Brog et al., 1999).

Probably in an attempt to be more comprehensive, the Centre for Sustainable Transportation in Canada states that a sustainable transportation system is one that:

- Allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations;
- Is affordable, operates efficiently, offers a choice of transport mode, and supports a vibrant economy;
- Limits emissions and waste within the planet's ability to absorb them, minimizes consumption of nonrenewable resources, reuses and recycles its components, and minimizes the use of land and noise production (Maddox, 2001).

The Role of Bicycle in Transit-Oriented Development

A transit-oriented development (TOD) is a mixed-use residential and commercial area designed to increase access to public transport, and often incorporates features to encourage transit ridership.

Many of the new towns created after World War II in Sweden and France have many of the characteristics of TOD communities. In a sense, nearly all communities built on reclaimed land in the Netherlands or as exurban developments in Denmark have had the local equivalent of TOD principles integrated in their planning, including the promotion of bicycles for local use.

In all countries the fact that "transportation habits of citizens in urban areas need to change" has been accepted and treated. Also, there are numerous countries that various sections of the daily trips are relying on bicycles (Transportation and Traffic Information Center, 2012).

Netherlands as the most prominent country in the world considering the maximum distance travelled on a bicycle with the value of about 2/5 km per person per day, also next rankings refer to Denmark, Germany and Sweden which have respectively the values of 1/6 - 0/9 - 0/7 km per day (Tehran Municipality, 2000). As a result, Netherlands managed a large volume of traffic reduction among its cities. Cycling in this country is considered part of the culture. This country has been successful in this field because of the following reasons: in terms of geography (low downhill and uphill);

- Create an appropriate infrastructure in terms of being seen as a cycling culture;
- Agreement with the government cycling centre;
- Create health and happiness for the citizens that is accounted

Table 1: Various ways to share transportation in some countries of the world (percent)

country	bicycle	Walking	Public Transportation	car	Other
Netherlands	30	18	5	45	2
Denmark	20	21	14	42	3
Germany	12	22	16	49	1
Sweden	10	39	11	36	4
England	8	12	14	62	4
France	5	30	12	47	6
U.S.A	1	9	3	84	3

as a pleasure (Buehler, 2008).

Denmark is located among other leading countries in respect of TOD measures specifically bike use policies. Copenhagen has one of the most extensive networks of bike paths whereas, 20 percent of people use bicycles to move around in the city (Technical and Environmental Administration, 2006) (Fig. 1). Including the important reasons that led to widespread use of bicycles in this country are as follows:

Appropriate opportunities in this field such as, bicycle parking, bike lights separate trips;

Children's education plan from age 3 with toys and themes; Cycling skills training projects in schools and cognitive symptoms such as balance and respect for the law;

construction of separate trails marked with blue dye for the security of cyclists;

providing free bicycles in the city;

Government to adopt measures such as increasing public transport costs to lead people towards the use of cheaper transportation (Tolley, 2003).

All listed factors that led to Denmark listed as a country today without pollution, are accounted as successful examples in the field of transportation. Promoting bicycle use to reduce traffic congestion and pollution in other countries increase the need to mention all these experiences and perhaps tens or hundreds of conducting researches.

Also in Germany 2000, a report on ways to improve cycling conditions was prepared. The report in open session about the transportation, building and housing the German parliament was made public in January 2001 and on the 18th of April 2002 was managed as "National Cycling Program". The program expanded the vision of bicycles as a vehicle of the city from 2002 to 2012. The 10-year program focused on political, economic and social officials, as well as public transport and streets users and the main street.

The major goals of this program are as follows:

To increase the share of urban bike trips in Germany 2012;

To develop cycling as a part of the uniform policy of the sustainable transport;

To increase public acceptance and development of local transportation-oriented nature, in order to reach the "city of short distances"(Federal Ministry of Transport, 2002);

To increase road safety.

The small goals of national program are as follows:

To double the budget for construction and maintenance of



Fig. 1: Providing free bicycle in Copenhagen Denmark (Source: citybike, 2012)

bicycle paths in 2002;

To optimize legal network of bike paths;

To improve road safety (Federal Highway Research Institute, 2001);

To prepare for the national cycling exercise program through the formation of Working Group consisted of state and local officials;

To control the program and the National Cycling and Cycling Development Report;

To prepare research projects worth more than a million Euros and modelling projects;

To evaluate internal and external research projects online;

To commission the cycling competition;

To commission and enhance the Union Institute and German cyclists road safety organizations;

To launch the public information website as "National Cycling Network Program".

RESULTS AND DISCUSSION

Combination of Public Transportation and Bike Transportation System

Considering bike usage advantages as a vehicle, it seems essential to encourage citizens for its use. Following this, it is possible to present solutions through creating facilities for citizens in order to use bike in daily travels regarding leading and developed countries experiences in transportation contexts. Among adequate patterns in the mentioned context, integration of other transportation systems with bicycle transportation system is considered (Pucher and Dijkstra, 2003). For instance in Denmark, cyclists could use some metro wagons (Fig. 2).

Bicycle Lift

This system was designed firstly by Jarle Wanvik, a Norwegian engineer, for Trondheim city and became administrative.

The significant point is that, installing these elevators in the city level doesn't create any barriers for pedestrian movement and other urban vehicles. The mentioned system is suitable for the steep areas and is considered as an encouragement tool for the inhabitants' use and frequency of cycling

(Weburbanist, 2010).

Bicycle Parking

One of the other dependent equipment to bike transportation



Fig. 2: It is been shown that Bike image on the doors of some wagons illustrate that bike entrance to these wagons is permissible (Source: citybike, 2012)

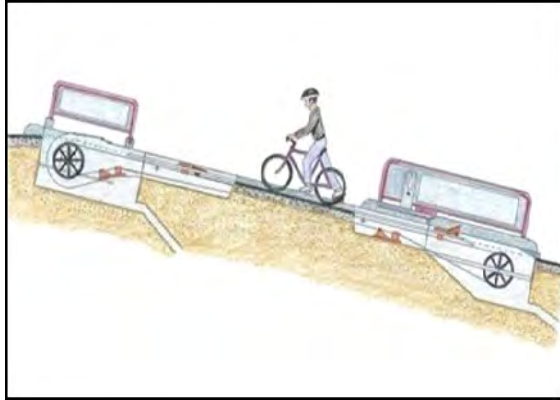


Fig. 3: Bicycle elevators system
 (source: Weburbanist, 2010)



Fig. 4: Bicycle lift
 (source: Weburbanist, 2010)

system is suitable parking. Important parameters in the mentioned parking are:

Security and safety

Access and exit easement

Conservation in various climate patterns (Gharib, 2004) (Fig. 5).

Comparison Level of Bikes in America and Canada

Despite the colder climates of Canada, cycling in this country is nearly three times more than Americans. The main reasons for the differences of high density urban development in Canada and versatile development comprise travelling shorter distances, lower incomes, higher cost of ownership, driving and car park, safe conditions and more extensive cycling infrastructure and training programs. Several studies indicate a higher density and mixed development (mixed user) used in most Canadian cities, transportation improvement, while the lower density zoning to single-user (non-user diversity in selected areas) in most USA cities encourages to use automobile (Pucher and Dijkstra, 2003).

In addition, however, both countries have public policy programs that directly aimed cycling. Most Canadian cities seem to have more cycling, bicycle parking, bicycle training, than American cities. Results of a new study indicate the number of Americans who use the bicycle has tripled from 1990 to 2009. Supporting government plans to use bikes in America, encourage people towards this device.

Bicycle Transportation Systems in Iran

Before World War II, the bike that imported to Iran was allocated for the affluent class due to the high price but after the Second World War bicycle imports also increased gradually because it changed to a public device. Taken as an example, in some cities such as Esfahan, 6 km bicycle line has been constructed (Gharib, 2004).

But soon the use of this tool was forgotten in Iran by the expansion of cars' use in 1971 and the Iranian cities importing numerous cars turned significantly from human-based cities to machine-based cities and also the use of bicycle was changed from urban transportation in to recreational uses. After this traditional Iranian cities coordinated themselves with the element of city, so the city accepted the physical changes regarding car usage, thus it lead to the profound increase in the streets, freeways, bridges and other elements that caused various problems in the built cities; However it should be mentioned that the cars comprise an important role in human life so urban planners and designers should now

Table 2: Models divisions' business trip in Canada and America 2000/2001

Transportmode	United States (%)	Canada (%)
Auto	87.9	80.7
Transit	4.7	10.5
Bicycle	0.4	1.2
Walk	2.9	6.6
Other	4.1	1.0
Total	100.0	100.0



Fig. 5: Bicycle parking (source: Transportation and Traffic Information Center, 2012)

provide conditions to emphasize on bicycle's role in addition to the cars presence.

In this context, a new approach emerged in 25th of December 1989. An example of government attention in terms of bikes' use refers to the Iran Supreme Council of Urban planning and architecture that considered the design of bike paths for the cities with the population over 50 thousand people in 1989 (Ministry of Housing and Urban Development, 2006). The idea of healthy cities is considered another attempt that gives rise to efforts by the Tehran municipality, which identify cultural, social and economic factors in order to reform urban culture among the community different spectra.

Creating especial lines and bike paths based on the mode of creating spaces and places with high potential for specific pathways play an important role in reducing urban traffic and prevents possible accidents and crashes hence the use of special bike paths in terms of short, safe and appropriate routes is effective in reducing urban traffic volume in addition to citizens' bicycle use.

Tehran is considered among the world crowded cities, due to the high volume of traffic that led to serious health and environmental damages. In this regard, to achieve sustainable transport, Tehran Municipality has considered specific planning and bike based 5-year urban designs in addition to the expansion of public transportation such as subway and express buses in 22 regions of the Tehran city (Malekzadeh, 2002).

Study Area

Study area and proposed plan, refers to Bahonar Street which is the passageway between Bahonarsquare (Niavaran) and Ghods square. Actually, Ghods square and Tajrish square areas are considered as heart of the district. Locating important places in this district and also the social – historic precedent,

have converted Tajrish square to one of the main urban centers of northern Tehran. The important landmarks of this area include historical bazaar and holy religious district of Saleh. Some cultural–recreational centers have been located in Bahonar square (Niavaran) such as: Niavaranpalace, museum, park, stadium.

Proposal

According to presented contents, most of the travels in the study area have been made by inhabitants, to access the Ghods square or Niavaran park area and to use service and facilities of these spaces. So to decrease inhabitants' motor travels in order to access Ghods square and Niavaranpark is the first goal of bicycle route design. The second goal refers to creation of recreational attractions in the mentioned area.

Type of Proposed Route

Two types of routes for bicycle passing are assessable in this route.

Specific route for bicycle passing:

These routes are created next to roadways and are separated by physical barriers. Width of these passageways are usually between 1/5 and 1/8 m.

The joint route between pavement and bicycle:

If it is not possible to allocate a roadway to bicycle traffic, the pavement should be used mutually for bicycle passage and pedestrians. Width of these passages are also between 1/5 and 1/8 m (Fig. 6).

Required Equipment Installation

Regarding route slope, the bikes with PABS type are proposed; thereby the cyclists use contributory motive force in inadequate slope.

Establishment of bike lift system in the western side of Niavaran park;

Unlevel creation for bicycle route in the northwest side of Niavaran park;

Establishment of suitable parkings in front of educational and service and commercial centers along the route.

Table 3: 5th annual council plans to expand cycling in Tehran

Executive program	Municipality based on priority areas
The first five- year executive program	4 , 2 , 12 , 11 , 14 , 8
Second five- year executive program	7 , 5 , 6 , 15 , 18 , 16
Third five- year executive program	10 , 13 , 17 , 19 , 9 , 22 , 20

CONCLUSION

Traffic is considered as a major difficulty that most of the metropolises are planning to confront with it. Promoting

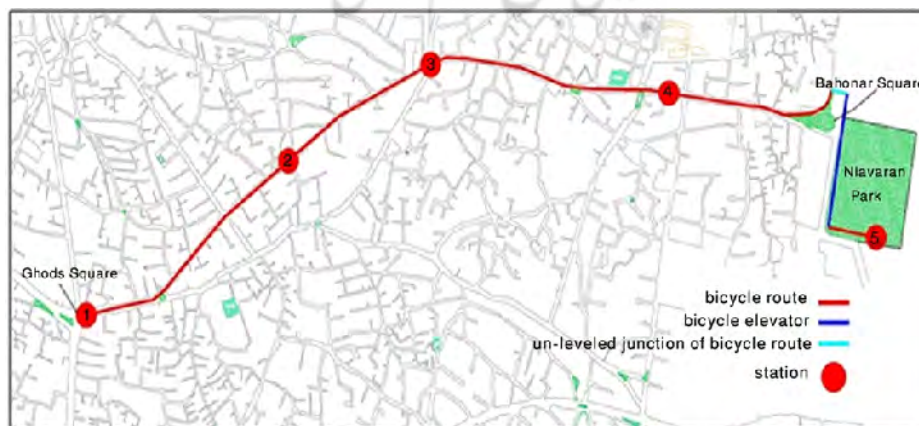


Fig. 6: Plan of proposed route

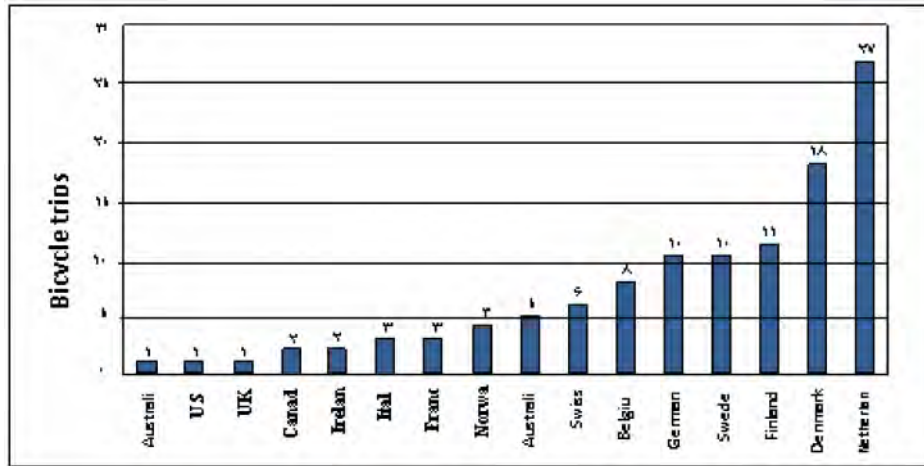


Fig. 7: Proportion of bicycle trips among various countries

bicycle use for citizens, is considered as one of the most effective and efficient strategies. Bicycle use for urban trips is followed by traffic congestion reduction and other beneficial effects such as decreasing air pollutants, reducing energy consumption and creating a happy and healthy society. Nowadays the role of bicycle in urban transportation system in terms of urban transportation master plans has been considered in several developed countries for the next 20 years and it has been particularly emphasized on its reinforcement. As mentioned previously, non-motorized transportation system in European countries, Australia and United States indicate that Netherlands, Denmark and Germany are considered among the leading countries in applying bicycle as safe, comfortable and attractive non-motorized transportation system.

As it can be seen in Fig.5, there is a significant difference for the proportion of bicycle trips among various countries. The proportion of bicycle trips varies from approximate 1 percent in Australia, U.S. and UK to 27 percent in the Netherlands. This apparent difference in the proportion of bicycle trips is approximately proportional to the average distance travelled by bike per person each day (Fig. 7).

The most important factor for city dwellers' encouragement of this type of vehicle is accurate targeting and mentioned design user groups selection. The other fundamental factor is adequate routes recognition regarding hot and arid climate in most cities of country for bicycle riding. Also utilizing lateral equipment along the selected route could be helpful for people encouragement. To sum up, in urban planning this principle always should be considered that designs success has a direct correlation with public participation and community engagement. So, appropriate qualifications should be predicted for urban service users to make a sustainable city.

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