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The Importance of Bicycles for Transportation and Bicycle Path Recommendations for Erzurum Technical University Campus

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Abstract

The use of motor vehicles in our country continues to increase every day with the increase in the number of vehicles and expansion of town council boundaries. As the area of towns expands, the use of environmentally friendly transportation forms powered by human strength, such as walking and cycling, is observed to continuously reduce. Instead of using hybrid and electric cars, bicycles or walking for transport, motor vehicles powered by fossil fuel are used which negatively affect the physical environment, social and cultural communication of society and human health. Towns that have attempted to solve transportation problems with passenger vehicle projects with low levels of occupancy have reduced the use of public transport and increased duration of travel, and environmental and societal costs. Globally in the area of urban transport the use of renewable or clean energy sources with lower energy consumption, supporting environmentally sensitive transportation modes and improving transportation possibilities on foot or bicycle are among topics given increasing importance in recent times. In our country it was announced that to increase the use of bicycles the Ministry of Environment and Urban Planning will support, including by budgetary means, appropriate projects prepared to create bicycle paths. This study aimed to provide both individual and societal benefits by reducing the environmental problems caused by traffic and easing transportation in areas with intense use by people by appropriate transportation planning for possible locations and assessing routes for a bicycle path project within Erzurum Technical University Campus.

Keywords: Use of bicycles, urban transportation, transportation types, environmental problems, environmental protection

Ulaşımda Bisikletin Yeri ve Erzurum Teknik Üniversitesi Kampüs Alanı Bisiklet Yolu Önerisi

Özet

Ülkemizde motorlu taşıt kullanımı araç sayılarının artması ve kent belediyelerinin sınırlarının genişlemesiyle her geçen gün artmaya devam etmektedir. Kent yüzölçümleri genişledikçe tamamen insan gücüne dayanan yaya ve bisiklet ulaşımı gibi çevre dostu ulaşım türlerinin sürekli azaldığı görülmektedir. Ulaşımı hibrit ve elektrikli otomobillerle, bisiklet ile veya yaya olarak sağlamak yerine fosil yakıtla çalışan motorlu taşıt kullanmak, fiziksel çevreyi, toplumun sosyal ve kültürel iletişimini ve insan sağlığını olumsuz yönde etkilemektedir. Araç doluluk oranının düşük olduğu binek taşıt odaklı projelerle ulaşım sorunlarının çözülmeye çalışıldığı kentlerde toplu taşıma kullanımı azalmakta, ulaşım süreleri, çevresel ve toplumsal maliyetler yükselmektedir. Dünyada, kentsel ulaşım alanında yenilenebilir veya enerji tüketimi daha az olan temiz enerji kaynaklarının kullanılması, çevresine duyarlı ulaşım türlerinin desteklenmesi, özellikle yaya ve bisikletle ulaşım olanaklarının iyileştirilmesi son zamanlarda önem verilen konular arasındadır. Ülkemizde, bisiklet kullanımının yaygınlaştırılması için Çevre ve Şehircilik Bakanlığı bisiklet yollarının yapılmasına yönelik hazırlanmış projelerden uygun bulunanları bütçe imkânları dâhilinde destekleyeceğini duyurmuştur. Bu çalışmada, gerek bireysel, gerekse toplumsal yararlar sağlaması, trafikten kaynaklanan çevre sorunlarını azaltması ve insanların yoğun kullanımında olan alanlarda ulaşımı rahatlatması amacıyla; Erzurum Teknik Üniversitesi Kampüsü içinde bir bisiklet yolu projesinin mümkün olan yerlerde uygun bir ulaşım planlaması ve bisiklet yolu güzergâhı ile değerlendirilmesi yapılmıştır.

Anahtar Kelimeler: Bisiklet Kullanımı, kent içi ulaşım, ulaşım türleri, çevre sorunları, çevre koruma

INTRODUCTION

Developments in urban transportation in recent years, especially trends for development based on private automobiles, have brought serious environmental, economic and societal disadvantages and with the aim of creating habitable towns, the transportation sector has become the leading area requiring intervention. A transportation system nearly completely dependent on gasoline economically does not appear sustainable in terms of pedestrians and people with different journey requirements and in terms of society. As a result, topics such as the use of renewable energy resources in the urban transportation field and applications to increase energy productivity are rapidly increasing, with support of transportation types that consume less energy, use clean energy and are environmentally sensitive, especially im-

proving transportation facilities for pedestrian and bicycle users, coming to the top of the agenda.

Environmental Pollution due to Transportation

Currently, together with increasing demand for transportation, the energy consumption of the transportation sector has increased. In the world in general, the share of gasoline consumption by the transportation sector was 30% in 1980 and reached 52% in 2006 [1]. This value is expected to reach 54% in 2015 and 57% by 2030. Traffic caused by automobiles and other vehicles with high energy consumption, especially in urban areas with greater vehicle density, makes control of polluting emissions difficult and negatively affects quality of life causing a variety of environmental problems [2].

Stopping due to traffic jams consumes even more fuel and especially at peak times, the lower speed of vehicles releases high levels of exhaust gases causing air pollution [3]. In addition to carbon dioxide (CO2) and water vapor, nitric oxides (NOx), carbon monoxide (CO), unburnt hydrocarbons (HC) and particulate matter (PM), all of which are harmful to human health, are released into the atmosphere as products of combustion. Nitric oxides transform to highly oxidizing compounds after a variety of reactions due to the effect of sunlight in the atmosphere and combine with water vapor in the atmosphere to create acid rain. Acid rain is one of the causes of increased soil pollution in industrialized countries and especially causes deforestation. Additionally acid rain damages historical buildings and statues. Carbon monoxide when inhaled by the respiratory system binds to hemoglobin in red blood cells and thus reduces their capacity to carry oxygen. Unburnt hydrocarbons are directly toxic or carcinogenic. Particulate material enters the respiratory system and accumulates in the lungs causing a variety of respiratory system diseases, led by cancer [4]. Among other negative effects of atmospheric particles on air quality are reduced visibility, with effects on agricultural and natural ecosystems summarized by the damage they cause to structures and sculptures [5]. As a result of the greenhouse effect caused by carbon dioxide and other gases in the atmosphere, global warming negatively affects ecosystems and especially life in coastal areas. Of carbon dioxide released into the atmosphere, the most important factor in climate change, global warming and the greenhouse effect, 23% comes from the transportation sector globally, with this level above 35% in industrialized European countries. While reductions in carbon dioxide released by other sectors have been provided, especially industry and heating, continuous increases are present in the transportation sector [6]. In our country, the clearest irritating environmental problem present due to the rapid increase in motor vehicles in recent years, especially in large cities, is noise. Traffic, which directly affects human health by causing nervous system disruption, stress, tiredness, reduced hearing and concentration disorders, is one of the most important sources of noise pollution.

Use of Bicycles for Inner City Transportation

The bicycle, providing high efficiency and mobility with low investment, is an ideal form of transportation for distances up to 8 km. In societies with the majority of the population from 15 to 35 years of age, strong traditions of outdoor activities and high environmental awareness, use is especially high. While it is a primary choice in Far East countries with bicycle use reaching 60%, in developed countries like USA, the Netherlands and Germany, 15% choose bicycle transport for reasons such as sport, relaxation and others. Since 2008 in the Italian capital of Rome with a population of 4 million, the number of daily commuters reached 6.5 million. Of total commutes 48% are completed on foot, with bicycles and two wheel motor vehicles. In the Japanese capital of Tokyo, the daily mean total commutes was 51 million in 2010. Fourteen percent of home and work commutes were completed on foot or by bicycle. In Germany in university towns or in places with educational facilities, bicycle use for daily commutes reaches 25% [3,7,8].

Despite increases in recent times, the rate of bicycle use in Turkey is at lower levels than Europe and Far East countries. While statistics are available showing that bicycle use in Turkey has tripled compared to past years, the rate is still 5%. If bicycle use can be brought up to European standards, relevant parties have determined that the state may save 1 billion dollars from 8 billion dollar monthly gasoline expenditure [9]. Bicycle paths and their use are governed by Road Traffic Law No. 2918 and the Road Traffic Regulations derived from this law. The Turkish Standards Institution has published standards such as TS 9826 and TS 11782 on this topic. However, bicycle paths in our country are so few as to be nonexistent. As in other developing countries, in our country there are no provisions made to develop bicycle use, though it is economic for inner city transportation, takes up less space on the road platform and is environmentally friendly, however it is regressing due to the effect of projects focused on commuter vehicles. A model province in this regard is Konya, with 240 km of bicycle paths and around 800 thousand bicycles, making it the city with most bicycles in Turkey. The Metropolitan Municipality took account of the opinions and recommendations of bicycle users, and with the aid of academic studies and other relevant organizations, continues to improve bicycle use within the city. In Erzurum province a study was completed on this topic and applied to the campus of Atatürk University. In 2012 the Ministry of Environment and Urbanization announced they would support, including budgetary means, projects for construction of bicycle paths to increase the use of bicycles due to their known positive contribution to the economy, importance in terms of human health and protecting the environment, and positive effects on air pollution, noise pollution and global warming due to traffic. Within this scope, the 1,174,327.50 TL budget provided by the Ministry for the project named Elimination of Environmental Pollution (Bicycle Path) Construction for bicycle paths in the Central Campus of Atatürk University was accepted in July 2013 and the facility with a total of 9,150 m of bicycle path was completed within a year. To provide a transportation alternative, the route mainly passes over roads and pavements, with a section created within a forested area to provide a riding and walking route away from traffic and noise.

The basic problem with bicycle transport, which is successfully combined with other transportation systems in developed countries, is that local government does not implement it as a form of transportation. Just as bicycle paths should be a road belonging completely to bicycles, roads for motor vehicles should be useable by bicycles. Thus implementation should be seen as a topic for urban transportation planning. Not creating bicycle parking areas, not designating areas to carry bicycles in public transportation vehicles, neglect of maintenance of organized bicycle paths and lanes or removal due to widening of vehicle lanes, are insufficiencies of infrastructure that prevent widespread use of bicycles.

Figure 1. Campus area of Erzurum Technical University

Insufficient implementation and other problems that may lead to accidents include; parking on sections designated for bicycles, not organizing traffic signs, perception of wide bicycle lanes as vehicle roads, not continuing bicycle paths at parking entrances and exits or significant junction points and not providing warning traffic signs where bicycle users pass vehicle roads.

Benefits of Bicycle Use

The bicycle, light and directed by the rider transforming human energy into pushing force, is used for transportation and sport throughout the world. The bicycle is accepted as the most efficient of all transportation types, including walking, in terms of energy use [10].

By increasing the share of bicycle users within total people-commuters the following contributions to urban transportation may be provided:

• Reduction of new infrastructure, maintenance and business investment for other transportation systems,

• Increased accessibility in cities and prevention of traffic jams,

• Improved quality of life in urban areas

• Does not cause environmental problems like air and noise pollution,

• Positive effects in terms of health,

• Increased traffic safety.

Bicycles either in motion or stopped, do not require much space and on the road or parked cover much less area than other vehicles, allowing road surfaces and parking areas to be used more productively and at higher capacity. In addition to these characteristics, they can complement public transport, limit energy expenditure, provide lowest cost commutes of all vehicle commutes, and have lower initial investment costs, business and maintenance expenditure, providing the bicycle with greater importance for urban transportation.

Purpose and Scope of the Study

The aim of this study is to reduce the negative environmental effects of vehicle traffic to a minimum, and recommend the choice of bicycle as an alternative transportation vehicle for a healthy town and healthy individuals by completing 10,000 m of bicycle paths within Erzurum Technical University Campus. This study, with the aim of providing individual and societal benefits of a bicycle path project, reducing the environmental problems due to traffic and easing access in areas with intense human use; will assess possible areas within Erzurum Technical University Campus for transportation planning.

MATERIALS AND METHODS

Study Area and Data

Erzurum is the largest city in the Eastern Anatolian region with an area of 25,355 km2 and a population of 763,320 in 2014. Containing many historic buildings and resembling a cultural center, the city currently has significant tourism potential. At an elevation of about 1800 m above sea level on the slopes of Mount Palandöken, the city has gained importance for winter tourism in recent years. It hosted the Universiade in 2011, the 17th World Junior Snowboard Championships in 2013, and the Short Track Speed Skating World Cup 6th Stage Races in 2014. In addition Erzurum Airport is the only point accepting international flights in the region. This situation has effectively increased the potential population coming to the region along with the number of rental vehicles, increasing the intensity of traffic in the city. Also the east west route provides great importance for freight and passenger transportation.

Erzurum has two state universities; Atatürk University founded in 1957 and Erzurum Technical University founded in 2010, one of six technical universities in the country. The campus area designated for Erzurum Technical University is shown in Figure 1.

A campus plan with 1500 hectares useable area has been prepared for the campus to be built at this location. The campus plan for the university is presented in Figure 2. The campus area will include Rector's Office and administration building, Congress and Culture Center, Engineering and Architecture Faculty, Science Faculty, Economics and Administrative Sciences Faculty, Sports Science Faculty, Literature Faculty, Health Sciences Faculty buildings, institutes and student services building, school of foreign languages building, central research laboratory, dormitories and school

areas, dining hall, place of worship, theatre, car park, guesthouse and residence area.

Figure 2. Campus Plan of Erzurum Technical University

The bicycle path project will accept the bicycle as a method of transportation and take care to integrate its use with other modes of transportation. Bicycle rental areas in the campus or various areas of the city, especially near large public transportation stops, will encourage individuals to complete all or part of their journey within campus and surroundings by bicycle, by allowing bicycles taken from one point to be left at many other points in the city center. The announcement that the Ministry of Environment and Urbanization will support appropriately prepared projects to create bicycle paths has encouraged studies on this topic and completing them carries great importance.

Technical Characteristics to be Aware of during Bicycle Path Construction

Bicycle paths shall be continuous, shall have no obstacles and road safety shall be ensured. In the campus area to allow intense use of bicycles, in areas with integration of bicycle paths with other forms of transport, bicycle parking areas shall be created [11].

Care shall be taken that the bicycle path complies with standards published by the Turkish Standards Institute. Taking account of the minimum measurements and the slope of the road required for a bicycle to move on a bicycle path, plans shall ensure that bicycles shall not disrupt pedestrian and vehicle traffic. The minimum and recommended lane widths for one way and two way traffic are given in Table 1.

Table 1. Lane Width of Bicycle Paths

		One way (m)	Two way (m)
Lane Width	Minimum	1.0	2.0
	Recommended	>=1.5	>=2.4

Bicycle paths shall be;

• One way in the same direction as motor vehicle traffic on one way roads,

• On both sides of two way roads in the same direction as motor vehicle traffic, or two way on one side of two way roads in areas where this is not possible,

• Two way on one side of one way roads, designed with appropriate measurements.

The surface of bicycle paths shall be appropriate for bicycle riding. It is recommended that the surface be asphalt if possible, though bicycle paths may be made of material such as paving stones in areas where this is not possible. The surface of the bicycle path shall reduce road violations and coloring to encourage perception of the bicycle path is important. It is recommended that surface coloring of bicycle paths be a different color to the color of the majority of pedestrian pavements. In current implementation blue is generally the color used. Bicycle paths shall be separated into lanes and to ensure safety care shall be taken to separate from the road with safety strips. Additionally the surface of bicycle paths shall show a bicycle shape to indicate the bicycle path, shall have a parking forbidden sign and shall be marked with white color. The surface and edges of bicycle paths shall have directive signage and panels and if necessary signaling marking shall be provided. Bicycle parking areas shall be included in planning. Bicycle parking areas shall not obstruct pedestrian or vehicle traffic, shall not damage bicycles, be easily used systems and be designed using durable materials. Depending on the safety situation, lock mechanisms through the wheel or frame shall be used. Additionally parked bicycles shall not cause visual pollution and disorder in the campus, shall not obstruct pedestrian and vehicle traffic, lack of parking spaces shall not be a limiting factor to bicycle use, modern design parking areas shall be built and located at points required [11].

The above points were assessed within the framework of the bicycle path project for Erzurum Technical University campus and the routes shown by blue lines on Figure 3 have been determined. In light of the routes determined within the campus, with the aid of the director of construction, design processes for the project will be presented to the Rectorate. It is considered that bicycle parking areas will be provided in front of faculties that emphasize bicycle use within the campus generally.

Figure 3. Route of Bicycle Path within Erzurum Technical University Campus

CONCLUSIONS AND RECOMMENDATIONS

An alternative mode of transportation to motor vehicles should be chosen to increase quality of life of individuals, to reduce negative effects of road transport on the environment like air pollution, noise pollution and global warming, to limit the use of non-renewable energy resources, to resolve traffic jams and reduce traffic accidents. The use of bicycles is a mode of transport that provides a regular physical activity to people, is environmentally friendly adding positive effects to social relationships in daily life and has high energy productivity.

As the long snowy winters in Erzurum province make the use of bicycles difficult, in campus areas with short distances and a majority of young people, the bicycle appears

to be an appropriate form of transport. In this study a project implementation in light of routes determined within Erzurum Technical University campus was completed. To ensure bicycle parking areas do not cause visual pollution and disorder on campus, do not obstruct pedestrian and vehicle traffic and that parking spaces are not a limiting factor to bicycle use, modern designed bicycle parking areas shall be organized within the scope of the project. It is recommended in this project that bicycles be provided by rental and park areas be equipped with systems appropriate for rental of bicycles. The next stage of the study is planned as training and information studies on the use of bicycles. Bicycle use shall be promoted among automobile owners and students, studies to increase safety of bicycle riding shall be completed and continuously keeping rights related to bicycles according to the law on the agenda shall create sufficient traffic awareness.

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