




The feasibility of developing bicycle based urban transportation as a means to reach the goal of sustainable transportation: The case study; zone 2 of Tabriz municipality

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Abstract

As a result of the expansion of automobiles and motor vehicles after the Industrial Revolution, the expansion of roads, and passages outside the city and inside the city without considering the conditions and standards. Over time, complex problems have taken place. It created a new trend in the urban transportation network, especially in big cities and urban centers. One of the solutions of developed countries is encouraging people to use non-motorized travel models (such as walking and cycling) along with motorized types (public and personal transportation) through the building of necessary infrastructures and public awareness. The expansion or non-expansion of cycling is influenced by various factors including natural and artificial obstacles, social and economic structure and factors, legal framework, traffic policy, safety, and safety of cyclists. The present research is practical and descriptive-analytical due to the description and analysis of the features governing the range. In this research, various library tools, interviews, observation and field observations, statistics and documents of relevant organizations, and scientific sources have been used to collect quantitative and qualitative data, and to analyze the gathered data, the chi-square test, and Kruskal-Wallis were used. According to the participants in the interview, the aspects of sports and recreation, reducing environmental pollution and traffic, and the reasonable price of bicycles compared to other vehicles are the most important incentives, and the absence of an exclusive bicycle path, the social view of people towards cyclists, harassment of some drivers towards cyclists, lack of safety, and security are among the most important obstacles for citizens to use bicycles as a means of travel.

1. Introduction

The industrialization process caused the separation of areas such as housing, work, health and education, and cities began to grow and spread. The distance between these areas has led to longer travel distances and brought about transportation problems [1].

During many years in the past, our cities were transformed to facilitate the use of the private vehicle. As a result of this massive use and the rising motorization rate, which reached its maximum value in 2007 with 481 vehicles per 1000 inhabitants, our cities suffer nowadays problems of congestion, saturation of public areas, contamination and noise. The changes for increasing the capacity of the roadways used by private vehicles are more expensive to build and carry greater sacrifices [2]. Movement in urban space is one of numerous challenges of the modern world. Problems with transport result from both endogenous and exogenous functions performed by cities, which has a critical impact on the number of people interested in commuting and the need to meet their transport requirements [3].

The following are the overall consideration of transportation:

1- Climate change aspects: Some of the most significant impacts of climate change on transportation infrastructure and operations arise from severe adverse weather conditions. As these weather incidents increase in frequency and severity, their related damages also increase [4]. This means that careful and effective governance of transportation operations and infrastructure is crucial to limiting disruptions and accidents caused adverse weather conditions [5].

2- Social and health aspects: Different cities differ in how they provide public transportation services, facilities for pedestrians and cyclists, and car usage. Similarly, there are significant differences between reality and the application of policies for speed limits and blood alcohol control. These observations show that the impact of transportation policies on public health and social equity among different groups is diverse [6]. In addition, economic development has led to increased demand for passenger and freight transportation. Increased car use, pollutant emissions, and traffic congestion have given rise to multiple health problems, including traffic-related injuries and respiratory disease risks caused by harmful emissions and noise [7].

3- Economic aspects: Transportation is a fundamental part of the global economy, making it possible for people and goods to move across borders. It drives economic growth and development by supporting trade, investment, tourism, global supply chains, and employment. Its economic impact can be measured in a number of ways, including the value of transportation, such as passenger and freight fares, and the value of goods transported [8]. In turn, the economic benefits of transportation are reflected in other sectors of the economy. These include increased economic productivity, investment and trade, and the attraction of new businesses and activities to areas with efficient transportation infrastructure. In addition, transportation can improve cost efficiency by facilitating access to resources and markets around the world. It can also improve people's lives by providing access to jobs, education, health care, and other essential services [9].

4- Energy use aspects: Energy consumption in transportation has become a major concern for researchers. Accordingly, assessing the relationship between economic development, the transportation industry, and energy consumption in this sector is one of the key issues for investigation. This relationship involves the possibility of improved transportation quality and consequently, a decrease in energy consumption [10]. Other factors have an impact on energy consumption, i.e., passenger-kilometers, fuel efficiency, distance, and emissions from the transportation sector, which all depend on vehicle type, combustion engine, and fuel type [11].

Sustainable transportation system is one of the most important elements of a sustainable and livable city. Approaches to developing sustainable urban transportation systems will assist the achievement of a sustainable city [12]. A move towards sustainable mobility necessitates a reduction in the inefficient use of private vehicles and an increase in access to environmentally-friendly and sustainable transport [13]. Cycling offers part of a solution as an active mode of transport that is inexpensive, healthy, free from local emissions, and consumes very little space compared to motorized traffic [14]. It is known that the majority of inhabitants tend to move in areas where journeys require less than a quarter of an hour via walking, cycling or unmotorized transport [15].

In Iran, population growth, rapid urban development, an unbalanced spatial structure, changes in the way of living, and job patterns and have led to increase in travel demand in big cities. The increase in travel demand, need to move and the dynamic of citizens has led to an expansion in the number of cars, an increase in traffic congestion in the main roads, and then environmental pollution and disruption of traditional social relationships and the mental health of residents [16].

Despite the costs are allocated for the construction of bicycle paths in the streets of Tabriz, it has not been effective in promoting the culture of using bicycles, and the public's willingness to use bicycle paths in Tabriz is much lower than international standards [17].

1.1. Theoretical Foundations

Sustainable Urban Transportation: Although there is no standard definition of a sustainable transport system, the widely accepted definition recognizes that sustainable transport is a set of policies and guidelines that are integrated, dynamic, continuous, and include economic, social, and environmental objectives.

It is a background that brings fair distribution and effective use of resources to meet the transportation needs of society and future generations [18]. Sustainable transportation systems can reduce the pollutants related to transportation and greenhouse gases, and improving the sustainability and vitality of communities through investment in transportation facilities, from priority systems, especially green transportation supporting system and environmentally friendly non-motorized traffic [19].

Principles of Sustainable Transportation: In the book "Our cities belong to us" which was published by Walter Hook from researchers of ITDP Institute in 2010; 10 principles that are necessary for sustainable transportation in urban life are stated, which include [20] (Figure 1).

1	•Creating suitable places for walking
2	•Creating suitable places for cycling and other non-motorized vehicles
3	•Low-cost and comprehensive public transportation
4	•Managing trips by increasing walking, reduced number of vehicles and safe speed
5	•Transportation goods in cleanest and safest way
6	•Mixing landuses or consolidating people with activities, buildings, and spaces
7	•Increasing density of buildings, creating pedestrian-orientnted and public transportation-oriented zones
8	•Adding natural, cultural, social, and historical attractions
9	•Straighthen walking paths by decreasing size of blocks
10	•Making them durable and sustainable

Figure 1. Principles of sustainable transportation

Types of Cycle Routes

1- Exclusive Paths: These routes are independent and separated from the routes of other motor vehicles. They are created only for bicycle traffic. These routes are created for parks, recreation areas, out of town areas, and new cities, where there is no space limitation and the traffic separation is possible.

2- Semi-Exclusive Paths: If the volume of bicycle traffic is low, and the creation of exclusive routes is limited by space, semi-exclusive routes are used. These paths are built near and parallel to the automobile lane and are separated by physical obstacles such as the difference in height, tabulation, fence, or border.

3- Mixed-Used Paths: This type of route is used in a mixed manner for the traffic of bicycles and motor vehicles, and the direction of movement is determined by symbols on the pavement and signs.

4- Shared Pedestrian and Bicycle Paths: Mix use by pedestrians and cyclists will be possible when the traffic volume of both is sufficient compared to the allocated place. In cases where the volume of vehicular traffic is high compared to the capacity of the street, the width of the street is not efficient to be built a separated cycle path next to it, if it is impossible to reduce the width of the vehicular lanes, or if the speed of motor vehicles endangers the safety of bicycle traffic, the use of shared pedestrian and bicycle paths is allowed.

Designing Cycle Route Tips: For designing cycling networks, not only the necessities of current situation, but also the future terms should be considered.

1- Continuous Network: For designing cycling network, one should try to create continuous and direct paths. The network should be started from the center of urban activities to its outside. In other words, residential, work, shopping, and leisure areas should be connected by cycle lanes in the whole city.

2- Observing the longitudinal slope: the longitudinal slope and its length determine the quality of bicycle traffic. For network designing, each part of the road must be divided into parts with the same slope, the length of the slope and the amount of the slope should be determined.

3- Route safety: It should be avoided as much as possible from Interference and collision between bicycle paths and motor vehicles, and the speed of motor vehicles should be kept as low as possible in the areas where the volume of bicycle traffic is high.

4- Route clarity: Bicycle paths should have enough clarity and legibility to inform cyclists about the facilities around the path, and try to make the route continuous and direct in the shortest way, connect the distance of origin and destination and avoid routes that increase the travel distance.

5- Route Beauty: Due to the low speed of bicycle traffic, it is important to consider the surroundings compared to traffic with motor vehicles; therefore, it is necessary to observe the beauty of the route and its diversity. At the same time, the routes should be equipped with urban furniture, green places, bicycle parking and signs [21].

Effective factors in using a bicycle: There are various factors that influence the use of a bicycle in different time and place conditions [22].

Effective factors in using a bicycle: There are various factors that influence the use of a bicycle in different time and place conditions [22] (Figure 2).

According to the research of Adam and Urtar, the dominance of motor vehicles was revealed from the time of their inception until the late 1960s. Despite the small number of motor vehicles, city streets were mainly converted into throughways and city squares into car parking lots. Following such dilemmas, the youth movements of the 1960s and the events of 1968 redefined and visualized cities as vibrant places, which is seen in the analysis of Lefebvre (1968). The right to the city focuses on returning the city to its residents, creating an excellent quality of life for people, and building the city as a starting point for collective life [23].

Natural Obstacles	Traffic Structure	Social Factors	Goal of Trip	Artificial Obstacles	Social Structure	Individual Factors	Advertising Activity
Topographi	Cycle Infrastructure	Economic Factors	Traffic Planning	Residential Blocks Size	Traffic Policies	Legal Framework	Risks and disadvantages

Figure 2. Effective factors in using bicycle

1.2. Literature Review

Hatami nejad (2006) in his article entitled Bicycle and its role in sustainable urban transportation (case example: Bonab city), has concluded that the bicycle is the most sustainable urban transportation system next to walking. In addition, to travel short distances in cities (up to 6 km), the average speed of a bicycle is higher than the average speed of other vehicles [24].

Gharib (2012) in his article on the feasibility of creating pedestrian and bicycle paths in the area of old Tehran, has put forward some essential points for bicycle and pedestrian traffic. These points include improving the current public transportation system, reducing the volume of driving traffic and banning motorcycle traffic in the central core, the safety of bicycle traffic, predicting bicycle parking, and compliance with slopes [21].

Kashani jou (2008) has described various theories in his studies on the evolution of theories related to inter-city transportation. In the meantime, according to the Economic Corporation and Development Organization, sustainable transportation does not endanger public health or biological systems and uses fewer renewable and non-renewable resources. The most important criterion proposed by the organization is sustainable mobility, including public transportation, walking, cycling, electric vehicle technology, and other types of green transportation [25].

Eftekhari (2009) in the article titled, analyzed the travel demand pattern in the city of Isfahan and based on the analytical knowledge of the subject, the potential and actual features of this metropolis intended to develop and create cycling transportation system infrastructures as a main mode of transportation and an option for public transportation [26].

Wesley and Norman (2011) in the article evidence on why bike-friendly cities are safer for all road users, investigated the number of fatal accidents. According to the studies, the risk of fatal or severe accidents for all users is much fewer in bicycle-oriented cities, which is caused by the low traffic speed on the roads. At first look, these observations seem to be due to the design of the road network suitable for bicycle movement, But the bicycle infrastructure itself helps to calm the traffic, the presence of a large number of cyclists changes the dynamics of the street and effective to reduce the speed of the car. This study, unlike its peers, investigated the behavior of vehicle drivers and concluded that reaching a threshold of the number of cyclists forces drivers to move more slowly [27].

Ghaffari Gilandeh (2014) in the article has concluded that the citizens consider cultural factors (such as lack of sufficient advertising, lack of cycling culture, lack of use by community managers, etc.) as the most important factors of unwillingness to use bicycles and even the weather factor that is considered as an important deterrent, is placed in the next ranks. In addition, people with less education than people with higher education and people with lower income than people with higher income use bicycles more. It shows that either education or high income cannot be a factor for more acceptance of cycling in city trips. It can be due to the cost-effectiveness of cycling and demonstrates the need for enhancing culture among all classes of society. Furthermore, the purpose of most bicycle users is sport and pastime, which requires planning to encourage them to cycle to do daily tasks [28].

Kwiatkowski [2018] in his article on urban cycling as an indicator of socio-economic innovation and sustainable transport, investigated the citizens' perception of the bicycle as a means of transportation in the city and concluded that Commuting by bicycle due to the existence of various obstacles and incentives (on the one hand, the advantages of the cycling include its positive effects on the budget and health of the residents, the environment, and the urban economy, and on the other hand, the problems and restrictions imposed on cyclists) has become a considerable challenge for urban residents. One of the solutions to overcome some of the applied limitations related to system performance in spatial, socio-economic, and technology is the use of the bicycle-sharing system as an innovative element in the urban transportation system [3].

Fistola, Gallo, LaRocca, and Russo (2020) in an article entitled the effectiveness of urban cycle lanes; From dyscrasias to potential solutions, is devoted to analyzing urban bicycle lanes as an infrastructure that can be improved. According to the sustainable methods of moving in cities and the framework of European policies, cycling is adjudged an environment-friendly transportation model; Because it is related to the stability and health of people. The promotion of cycling in the urban context should be accompanied by safe movement and a feeling of satisfaction with the urban space, which requires the planning of mobility infrastructure and land use to ensure the high effectiveness of urban infrastructure for sustainable mobility [29].

Achieving bicycle-oriented sustainable transportation requires some important modeling and applications in various technical, engineering, social, economic, media, and similar fields at different regional, urban, national, and international levels, because this is in the interaction of factors with Each other and mobilization can be achieved together. The conceptual framework of this major goal can be seen below [30] (Figure 3).

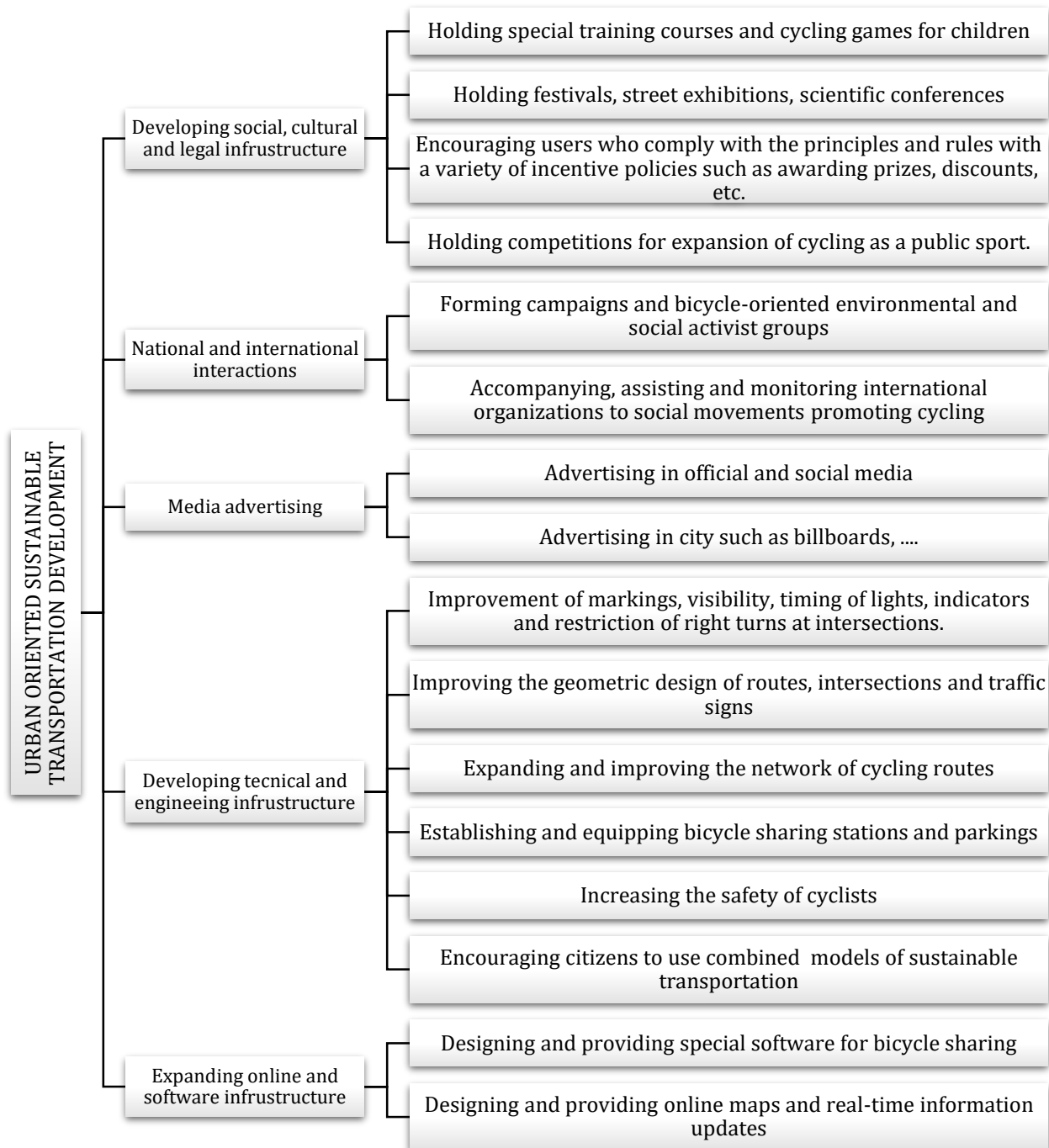


Figure 3. Bicycle-oriented sustainable transportation development framework

2. Material and Method

2.1. Study Area

District 2, one of the ten districts within the Tabriz metropolis, is situated in the southwestern part of the city, bordered by districts 9, 5, 1, 8, and 3. To the east, north, and west, it is encircled by Shahid Kasaei Highway, Basij and 29 Bahman Boulevards, Imam Khomeini Street, Jodeiri Street, Montazeri Street, and Azadi and Molla Sadra Boulevards, respectively.

According to data provided by the Statistical Center of Iran in 2016, the population of Tabriz was 1,558,693, with 12.6% of the residents located in District 2. Notably, the district exhibits a higher population of women

compared to men, resulting in a sex ratio of 96.6, a significant deviation from the city's average. The socio-economic distribution in District 2, as well as throughout Tabriz, indicates that the affluent and privileged segment of society predominantly resides in a few districts, including the one under study. Moreover, in comparison to other districts, this stratum has a relatively higher representation among other socio-economic groups.

Within various social groups, there is a notable allocation of resources to middle social groups, a factor that significantly influences the region's development and its ability to address demands, interests, and claims effectively.

2.2. Field Data or Spatial Datasets

Travel and population absorption centers encompass a variety of facilities at both metropolitan and regional levels, such as higher education institutions (Tabriz University), recreational and leisure facilities (El Goli Complex, Shamim-e-Paydari, and Abbas Mirza Parks), administrative buildings (East Azerbaijan Broadcasting Center), medical institutions (Shohada Hospital), commercial centers, and more. These centers serve as daily destinations for thousands of Tabriz residents, particularly in the studied area, and play a pivotal role in the daily travels of these individuals. The significance of these centers, effective planning and design of various transportation models, including infrastructure for public and private transportation systems, bicycles, and pedestrian pathways, become imperative. The objective of the mentioned research is to qualitatively enhance and encourage users' willingness to incorporate bicycles into their daily travel routines, encompassing trips to workplaces, educational institutions, shopping areas, entertainment centers, and more. As can be seen in the following map, most of these centers are located on the northern border of the district (29 Bahman Blvd., and Basij Blvd.) and in the middle of it (Shahid Bakri Blvd.), and they require special attention from officials, planners, and urban designers (Figure 4).

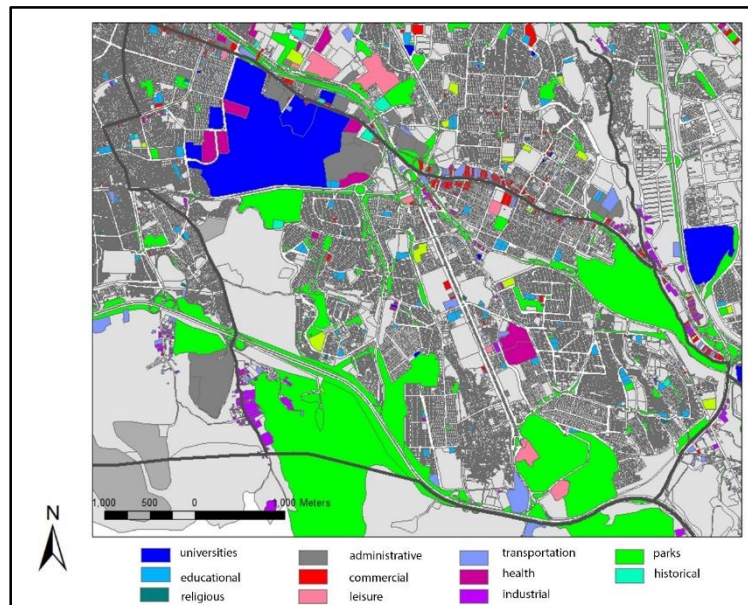


Figure 4. Travel Attractive Centers

The transportation structure and road network of this region, which was the focus of the present study, are poorly described (Figure 5);

[1] Peripheral roads are part of the highway, the central roads inside the part are often arterial, and a limited number are collectors.

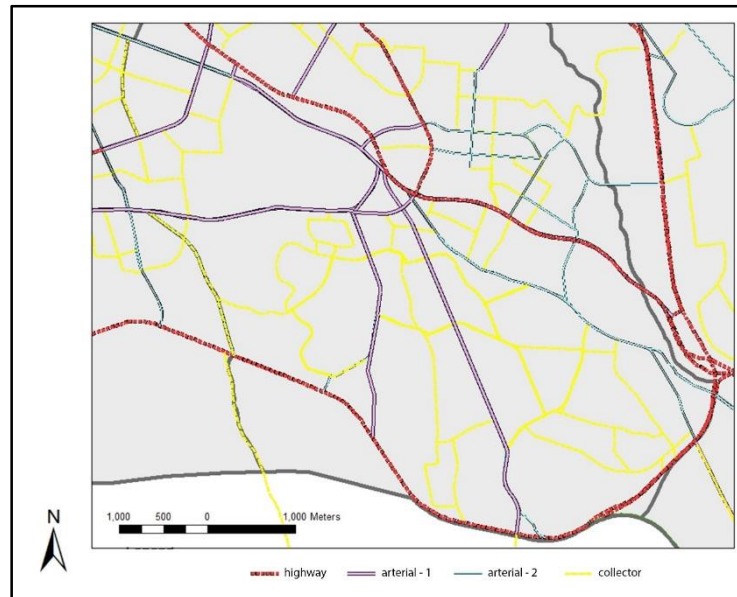


Figure 5. Communication Network

[2] Most of the intersections are in the coplanar subcategory, which was the self-facilitating factor of crossing with bicycles.

[3] The public transportation system focused on the northern area, and the subway system only passes through Bakri Blvd (Figure 6).

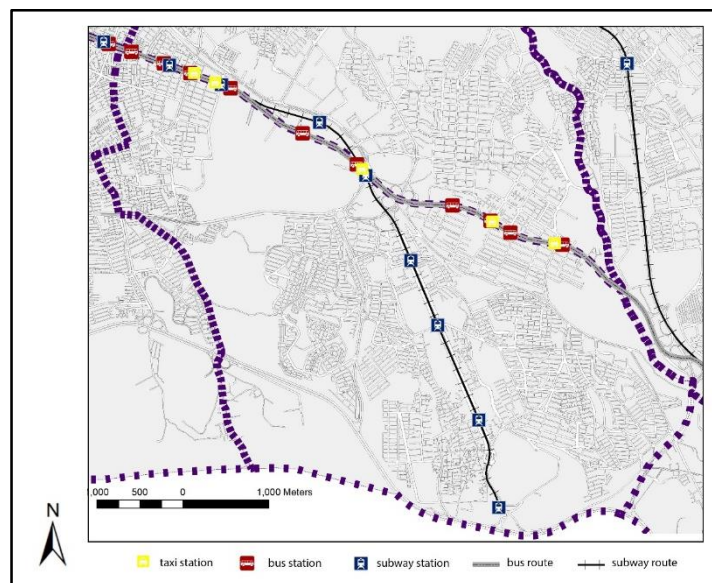


Figure 6. Public Transportation System

[4] The zone is in an acceptable state in terms of travel time and level of service, and people don't suffer from roadblocks and wasted time during the trip.

[5] The slope of the roads is also below 5% in general, which is an obstacle for cycling. In addition, by installing electronic mechanisms, one can ride a bicycle in long and steep passages (Figure 7).

[6] According to the field observations, the specific bicycle paths in the area are in a state of disarray, and at some points, they are interrupted and discontinuous, infrastructure is inadequate and depreciating and has various obstacles and needs to be revised.

2.3. Used Methods

Analyze the features prevailing in the area, and the factors affecting the use and non-use of sustainable transportation approaches to decrease the obstacles, and to increase and develop the relevant incentives. In this type of research, besides illustration, the researcher will describe and explain the reasons for how and why the problem is and its dimensions. One of the attributes of this type of research is that the researcher will not intervene

in the situation, conditions, and the role of the variables, and he/she will not manipulate or control them; simply, the researcher will study what is available, describe, illustrate, and analyze it [31].

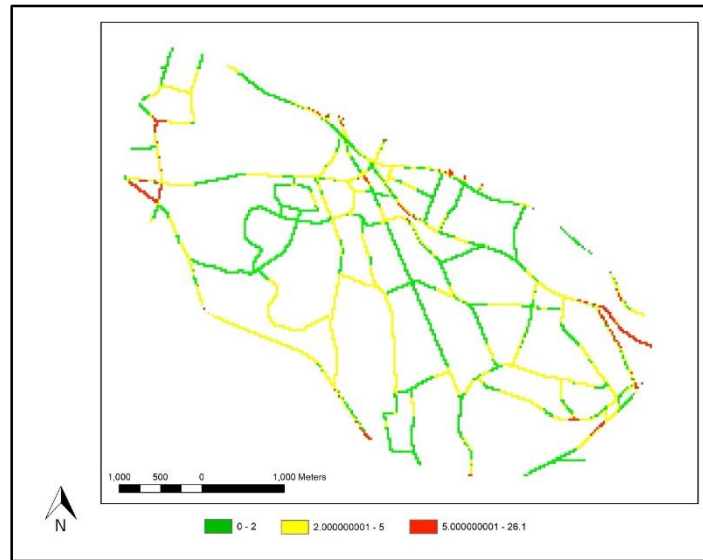


Figure 7. Slope

In the present study, the relevant data were collected based on library methods, interviews, observation, field perception, and questionnaires. Thus, quantitative and qualitative data were extracted from [1] the documents of various organizations, including the Statistical Center of Iran, the Meteorological Organization of East Azerbaijan Province, Tabriz Municipality and City Council, and the like, [2] the studies and researches available in various scientific articles and references, and urban development plans, [3] various and reliable websites. Then, an interview was made with the officials of the transportation department of the district municipality. Finally, the views of civilians and users were investigated through closed questionnaires.

In this survey, some individual information, including gender, age, education, and income, was requested (Table 1). Then, the people were asked if they had or did not have a child in their home. The purpose of this question was to examine whether adults prefer to utilize bicycle as a full or partial substitute for leisure sports and a joint activity with their children or not. Then, the people’s weekly cycling, and their preference to use travelling models were investigated; their intentions and purposes to use bicycle, including recreation and leisure, sports, going to the workplace and educational centers, daily shopping, etc., the influence of material and financial issues on bicycle buying and utilization, and their willingness to utilize shared bicycles were studied. Next, people’s cycling skills, intentions, and interest in this travelling method were discussed. The purpose of this discussion is to describe skilled and regular cyclists, beginner cyclists (having sufficient skills in cycling, but not having the required self-confidence in urban traffic), false beginners (tending to be useful cyclists), and real beginners (having no skills in this field); so, to train people and make them eager and interested, many training courses and seminars can be held, based on their interest and skills. Then, individual attitudes towards travelling models, obstacles, and incentives were asked by some questions with text answers [24].

Table 1. Crosstabulation [age * cycle path design]

Age	Exclusive Path	Semi-Exclusive Path	Mixed Path	Bicycle and pedestrian path	Total
Less than 20 years old	22	0	0	0	22
20-30 years old	72	68	0	0	140
30-40 years old	0	0	0	0	0
40-50 years old	18	0	0	0	0
total	112	68	0	0	180

Table 2. Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.96	2	0.03
Likelihood Ratio	9.98	2	0.007

a. 4 cells [66.7%] have expected count less than 5. The minimum expected count is 1.5.

Table 3. Symmetric Measures

	Value	Approximate Significance
Phi	0.41	0.03
Cramer's V	0.41	0.03

Accordingly, based on the Chi-Square test, about two-thirds of people preferred exclusive cycle tracks and the rest chose semi-exclusive tracks. No one chose mixed tracks or ones shared with pedestrians. The value of Pearson's chi-square was less than the threshold [0.05], implying the correlation between the variables of age group and cycle track choice (Table 2). The coefficients of Phi and Cramer's V were used to check out their correlation; accordingly, their correlation is relatively strong (Table 3-4).

Table 4. Ranks

Age	N	Mean Rank
Less than 20 years old	23	59.8
20-30 years old	140	102.42
30-40 years old	0	0
40-50 years old	17	55.25
total	180	

Table 5. Test Statistics ^{a,b}

Kruskal-Wallis H	df	Asymp. sig.
6.79	2	0.33

- a. Kruskal Wallis Test
- b. Grouping Variable: age

Based on the Kruskal-Wallis Test, its significance value is less than the threshold (0.05), implying the verification of correlation among variables (Table 5).

According to the participants in the interview, sports, recreation, environmental pollution reduction, and traffic reduction are the most significant incentives; the lack of a cycle track, individual social views, and the price of the bicycle are the major obstacles to cycling.

3. Results

Research shows that countries, having made significant progress in the field of transportation, have taken some measures to increase bicycle utilization, as a mode of travelling, and improve civilians' experiences in this field. To understand this issue better, some of the major actions, taken in these countries, are as follows:

- ✓ Training and informing civilians: teaching cycling rules, advantages, and benefits to civilians, as well as promoting the use of sustainable transportation, such as cycling and walking, from childhood and adolescence, can be effective.
- ✓ Creating appropriate infrastructures: building and developing special tracks for cycling and walking, creating public cycling stations and related facilities, establishing traffic restrictions, and speed reduction in urban areas can encourage civilians to utilize this model of sustainable transportation.
- ✓ Encouraging people to utilize shared bicycles: providing shared cycling services and creating various facilities may encourage civilians to utilize bicycle and facilitate the option of this sustainable transportation.
- ✓ Rules and regulations supporting cyclists and pedestrians: developing rules and regulations supporting cyclists and pedestrians to increase their safety and convenience, as well as facilitating some dedicated tracks and areas for them, can be an incentive to choose this sustainable mode of transportation.

4. Discussion

In general, experts advocate for returning the city to its residents and enhancing their quality of life through sustainable urban transportation, with a particular emphasis on promoting cycling. This mode of travel is well-suited for short distances and necessitates thoughtful planning of both mobility infrastructure and land use. Beyond the individual benefits for cyclists, such as improved health and reduced environmental impact, cycling contributes to the overall safety of the community. Cycling alters the dynamics of the streetscape and helps mitigate risks by reducing the speed of motor vehicles. This not only enhances the safety of cyclists but also reduces the likelihood of fatal or severe accidents for all road users. The integration of cycling into urban transportation systems aligns with the broader goal of creating safer, healthier, and more livable cities for residents.

In many Iranian cities, the utilization of bicycles by citizens faces numerous obstacles, with the most significant hurdles stemming from social factors such as inadequate advertising and the absence of a cycling culture. The present research, focusing specifically on the 2nd region of Tabriz, reveals that environmental factors do not pose significant obstacles to promoting cycling in this area. However, according to the perspective of citizens, the most critical obstacles are cultural and social in nature. These include the overall societal perception of cycling, highlighting the need for public education and cultural development through various initiatives and plans. Overcoming these cultural and social barriers is crucial for fostering a positive attitude toward cycling and encouraging its widespread adoption among the residents of the 2nd region of Tabriz.

Indeed, the sources, in conjunction with the mentioned research, collectively underscore the importance of establishing the requisite infrastructure for cycling to guarantee the security and safety of cyclists. Simultaneously, there is a consensus on the necessity of public education initiatives aimed at altering the relatively negative societal perception of cycling.

For cycling promotion plans to succeed, it is so significant to ensure cyclists' security and safety. Allocating dedicated and safe cycling tracks, developing and enforcing rules and regulations supporting cyclists' rights, and providing safety training to drivers and civilians can lead to a significant safety improvement, and encourage people to utilize bicycle.

Also, it is so important to consider the local economic and social requirements. To study people's views and attitudes towards cycling, to understand the problems, that may arise for them, and to find solutions to manage these problems can help the increase of participation and public acceptance of cycling.

In addition, financing required for cycling projects, as well as intelligent planning to use these resources, play a fundamental role in the success of cycling promotion plans. Economic and intelligent utilization of available resources and sustainable financing will provide the possibility of further development.

Finally, the success of a cycling promotion plan will require population attention and cooperation between all different strata. Understanding the society's requirements, the population's awareness of the benefits of sustainable transportation, the interaction between associated organizations and local communities, and research and careful planning are among the factors, affecting the success of a cycling promotion plan.

To be more successful in cycling promotion, collaboration between the government, associated organizations, urban planners, and local communities is so critical. Additionally, the effectiveness of local rules and regulations, providing the required infrastructure, public culture, and training; applying appropriate technology to create a proper cycling infrastructure should be of primary concern.

5. Conclusion

Generally speaking, cycling promotion and building a sustainable infrastructure for it are a gradual process that requires collaboration and interaction between different population strata. Through improving public awareness, economic and intelligent utilization of financial resources, and using the best methods and experiences of other countries, a sustainable and eco-friendly transportation system can be achieved.

Nonetheless, today, bicycle, as a travelling mode, is not prevailing in the cities of Iran for the following reasons:

- The lack of coherence and integration in plans;
- Relatively high intervals between various plans, and plan development and implementation;
- Inadequate attention of the city officials and managers to increasing public awareness and providing the required infrastructure, due to the budget limitations and the high costs of the associated projects;
- Civilians' social view towards the cyclists;
- Not to provide the safety and security for the cyclists;
- The harassment of some drivers, and . . .

Among the approaches for increasing people's willingness to cycle and utilize bicycle in the city, there are the following cases:

1. Providing the cycling infrastructures, including building cycle tracks, modifying the geometry of roads and crossroads appropriate to cycle tracks, providing bike parking lots;
2. Social training and culture creation through training courses for different age groups, using the capacity of various media, institutions, and groups;
3. Providing shared bicycles, creating software infrastructures, and the associated stations and parking lots;
4. Holding continuous seminars and programs appropriate to cycling;
5. Developing various policies, supporting cyclists and restricting the utilization of private automobiles;
6. Integrating different applications and compressing the city blocks to facilitate active trips;
7. Integrating public and active travelling models, and locating parking lots and stations for personal and shared bicycles;
8. Providing financial facilities to supply, maintain, and repair bicycles.

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Paria Ali Mohammadi: Methodology, Software, Writing-Original draft preparation, Writing-Reviewing and Editing, Investigation, Data curation. **Iraj Teimouri:** Conceptualization, Validation, Visualization, Editing. **Murat Yakar:** Conceptualization, Validation, Editing

Conflicts of interest:

The authors declare no conflicts of interest.

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