

Estimation the Effect of the Combination of Different Policies on the Use of Bicycles by Tehran Citizens

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ABSTRACT

In the Tehran Transportation strategic plan, achieving sustainable development through the development of green transportation infrastructure (specially cycling) has been considered. In some projects such as implementation Tehran's Bicycle master plan there is uncertainty in the outcome and consequences of programs success. Success of cycling programs is a particularly risky project. Therefore in this paper, the decision tree used to determine the effect of any decision on the success of the cycling plan in Tehran. To investigate this, in this paper we planned to measure the chance of success of cycling programs. For this purpose, a questionnaire was carried out to determine the probability of the success of the cycling program (in the form combination of different policies). The statistical society consisted of employees and students. A questionnaire of 258 people, including 142 men and 116 women, was performed whom were individuals who experienced at least one time Cycling in 2018. The results of this survey showed that the combination (Electric Bike+Bike Isolated Path+Existence Bike Parking at Destination+Travel length is equal or Below 5 KM+Good Enforcement), is the highest probability of use and composition (Bike(without Gear)+Shared Path+PA/n: without parking at Destination+Travel Length is Bigger than 5 KM+weak Enforcement), is least likely to be used. It is important to mentioned that "Bike Type" has essential role in success of Tehran bicycle programs. The results showed that by taking several possible actions, such as improving bike sharing system and providing bike parking in the main public transportation stations, the number of bicycle trips can be increased to double from the current value. The advantage of the method used in this paper is the simplicity of understanding and the possibility of developing it (to other combinations) and its weakness, its dependence on the responses of the statistical society.

Keywords: bicycle, cycling programs.

INTRODUCTION

Tehran (the capital of the Islamic Republic of Iran) is one of the most populous cities in menna¹ region. Despite Tehran municipality efforts in expanding the Public Transportation, air pollution and traffic congestion are the most prominent problems in the city of Tehran. One of the Remedial measure is Developing Active Transportation, especially cycling. Now the share of travel by bicycle trips in Tehran is less than 0.4percent [1], but this share in many cities in the Europe is several times the amount above. One of the requirements for increasing the share of bicycle mode is to support this sector of transportation. For this goal, ssome actions, including the development of infrastructure, educational and cultural programs and legal

support, should be done. This paper examines the impact some of these actions. Most decisions are subject to uncertainty. In addition, the development of cycling is influenced by various components of hardware², culture, and legal issues. The existence of barriers in each of the subjects mentioned above has reduced the likelihood of using bikes. The success of our strategy is increasing the utility of the bicycle which depends on the existence or absence of appropriate infrastructure, cultural programs and legal support.

In recent years, some measures have been taken, such as the provision of thousands of bikes for citizens, the creation of smart dock, the construction of bicycle paths, but because of not having seen all necessary factors for bike riding

¹ -Middle East and North Africa

² -Related to bicycle infrastructure

in a proper policy package, the strategy of cycling development in Tehran has been a little success.

PROBLEM STATEMENT AND METHODOLOGY

The issue of the present study is to identify major obstacles to cycling and determine the policy package to maximize the use of bicycles with possible conditions.

Because of the topographical conditions In Tehran, the type of bike is very important. In general, the importance of the safety issues is so high that lack of safety and security will prevent citizens about using bicycles. Then, because of the safety issue, the separation or non-separation of cyclists from motorized traffic is important Too. In addition, due to Security issues, the presence of bicycle parking is the Key factor in choice of bicycle as Urban Transportation mode. The other thing to consider is the police's support for cyclists and avoiding to stopping of cars and motorcycle in bicycle paths, through fining. In the conceptual model of this paper, the combination of these factors is asked from citizens.

In this paper I used the Decision Tree for assessing problem. The first step in building a decision tree is to define the problem. Fig1is a decision tree of how people use bikes under different circumstances. In this figure, for simplicity, the abbreviations are used. In the following, a brief explanation will be given.

- B1: Bike (without Gear)
- B2: Bike (with Gear)
- B3: Electric Bike
- P1: Isolated Path
- P2: Shared Path
- PA/y: With Parking at Destination
- PA/n: without parking at Destination
- Le/s: Travel length equal or Below 5 KM
- Le/l: Travel Length Bigger than 5 KM
- EN/y: There is Good Enforcement
- EN/n: There is weak Enforcement
- Usage/Y: He/she Uses Bike as a Travel Mode
- Usage/n: He/she doesn't use Bike

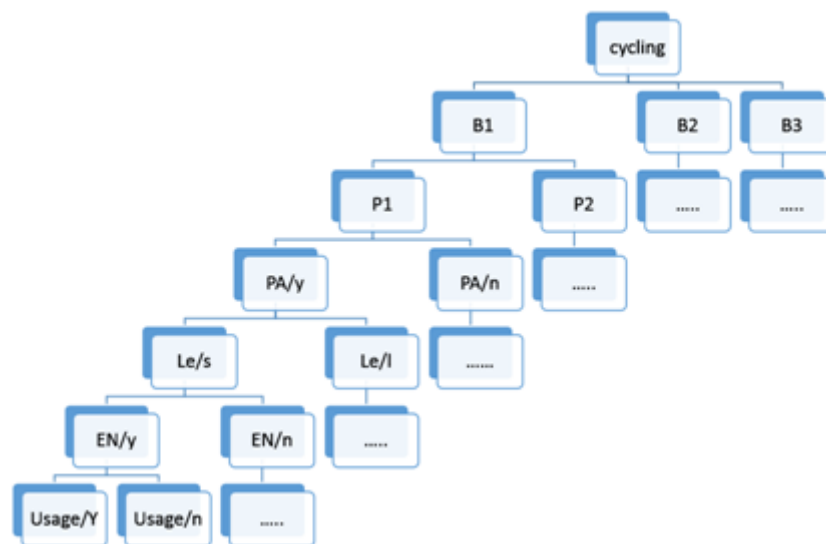


Figure1. Decision Tree which represents people's use of bicycles.

COLLECTING DATA

In the previous section, the method of study was stated. This study, for the city of Tehran, requires a wide range data. As indicated in the methodology of the study, it is necessary to determine the share of the branches .Considering the tree structure of the decision making, a questionnaire was developed in the Web environment. According to the responses of individuals, the next question was asked. Table 1 shows the structure of the database.

Which is used to determine the share of each branch of the tree. Probabilities are quantified by a value ranging from zero to 100. A probability of zero indicates that the event will never happen, while a probability of 100 percent indicates that the event will certainly occur. as so A probability of 10 percent indicates that expected to occur 0.1of the time. Because all interviewees have not responded to all branches, the sum of the probabilities of all outcome branches must not equal 100.

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Table1. Categorization of people's response to defined conditions.

#	Bike Type	Path Type	Parking	Travel Length	Enforcement	Usage
1	B1	P1	No	≤5 KM	OK	Yes
2	B2	P2	Yes	>5 KM	Not OK	No
.....

Using data from the database, the share of bicycle usage has been calculated under different policies. In Table 2, you can see the results.

Table2. Bike Usage under Deferent Scenario (condition)

Branch	Bike Type	Path Type	Bike Parking	Travel length	Enforcement	Usage(Percent)
1	B1	P1	Yes	≤5 KM	Good	13.72
2	B1	P1	Yes	≤5 KM	weak	4.47
3	B1	P1	Yes	>5 KM	Good	5.10
4	B1	P1	Yes	>5 KM	weak	2.01
5	B1	P1	No	≤5 KM	Good	4.30
6	B1	P1	No	≤5 KM	weak	1.21
7	B1	P1	No	>5 KM	Good	1.80
8	B1	P1	No	>5 KM	weak	0.65
9	B1	P2	Yes	≤5 KM	Good	4.19
10	B1	P2	Yes	≤5 KM	weak	1.45
11	B1	P2	Yes	>5 KM	Good	1.92
12	B1	P2	No	≤5 KM	Good	2.07
12	B1	P2	Yes	>5 KM	weak	0.91
14	B1	P2	No	≤5 KM	weak	0.22
15	B1	P2	No	>5 KM	Good	0.72
16	B1	P2	No	>5 KM	weak	0.40
17	B2	P1	Yes	≤5 KM	Good	35.20
18	B2	P1	Yes	≤5 KM	weak	14.99
19	B2	P1	Yes	>5 KM	Good	15.36
20	B2	P1	Yes	>5 KM	weak	5.71
21	B2	P1	No	≤5 KM	Good	15.06
22	B2	P1	No	≤5 KM	weak	6.03
23	B2	P1	No	>5 KM	Good	5.71
24	B2	P1	No	>5 KM	weak	2.29
25	B2	P2	Yes	≤5 KM	Good	14.75
26	B2	P2	Yes	≤5 KM	weak	6.36
27	B2	P2	Yes	>5 KM	Good	6.30
28	B2	P2	Yes	>5 KM	weak	1.87
29	B2	P2	No	≤5 KM	Good	6.01
30	B2	P2	No	≤5 KM	weak	2.57
31	B2	P2	No	>5 KM	Good	2.61
32	B2	P2	No	>5 KM	weak	0.89
33	B3	P1	Yes	≤5 KM	Good	71.39
34	B3	P1	Yes	≤5 KM	weak	30.84
35	B3	P1	Yes	>5 KM	Good	30.62
36	B3	P1	Yes	>5 KM	weak	13.20
37	B3	P1	No	≤5 KM	Good	29.93
38	B3	P1	No	≤5 KM	weak	12.73
39	B3	P1	No	>5 KM	Good	12.58
40	B3	P1	No	>5 KM	weak	4.97
41	B3	P2	Yes	≤5 KM	Good	29.88
42	B3	P2	Yes	≤5 KM	weak	12.42
43	B3	P2	Yes	>5 KM	Good	13.22
44	B3	P2	Yes	>5 KM	weak	4.74
45	B3	P2	No	≤5 KM	Good	13.23
46	B3	P2	No	≤5 KM	weak	5.02
47	B3	P2	No	>5 KM	Good	5.23
48	B3	P2	No	>5 KM	weak	2.43

RESULTS

As shown in Table 2, The highest likelihood of bike usage was related to combination (bike type="B3"+Path Type="P1"+Bike Parking="Yes"+Travel length="≤5km"+Enforcement="Good") with a probability of occurrence of 73.85 % and The smallest likelihood of bike usage was related to combination (bike type="B1"+Path Type="P2"+Bike Parking="No"+Travel length=">5km"+ Enforcement="Weak") with a probability of occurrence of 0.40 %.It's interesting to note that the electric bike has a special place from the users viewpoints. And only by changing the type of bike and Keeping other conditions, the chance of using the bike will be 2.43percent (More than 6 times).

The shared bicycle system is one of the most commonly used systems in the world. There are a Bike Sharing System (BSS) in Tehran. In the short term, it is possible to install gear on BSS. Also, with the mid-term of the Tehran Municipality to create a route for the bicycle, we will have a bicycle integrated network. There is a certainty about parking for personal bikes, according to the plan to build bicycle parking near metro stations and install Rack bikes in schools and offices. Taking into account the strategy of the first mile and the last mile miles of bike trips in Tehran and the possibility of combined bike-subway and bicycle-bus travel, it is also possible to undertake trips of less than 5 kilometers. Application of regulations is the most important challenge of programs. Development of bicycles is due to the fact that thousands of motorcycles travel in the city of Tehran and it is very difficult to prevent traffic and stopping motorcyclists in bicycle paths for police in Tehran, so the probability of fines for all offenders in all locations is low. Considering the above facts and assumptions, the combination of branch 18³ as the possible conditions for the city of Tehran is considered in the medium term. Therefore, the possibility of using bicycling citizens from a bicycle as a daily vehicle is about 15 percent. If the proportion of people with cycling potential is assumed (basis of sample questionnaire in 22 districts of Tehran) to be 11% of population lives in the vicinity of the entire BRT Lines and metro Stations Under the given conditions , according

to the Formula1 we can expect to travel 140882 trips by bike in Tehran.

$$\text{Formula1: } T=C*P*Pe*Pi$$

C: Population coverage (Around 5 Kilometer of Metro Lines and BRT Station.)

P: population

Pe: The percentage of people who use bicycles at least ten Times or more in one year (from a sample questionnaire in 22 districts of Tehran)

Pi: The percentage of tendency to cycling (daily) in the city under the conditions specified in branch i

T: Expected bike trips (daily)

$$C=.96, P=8900000, Pe=0.11, Pi=14.99/100$$

$$T=.96*8900000*0.11*14.99/100=140882$$

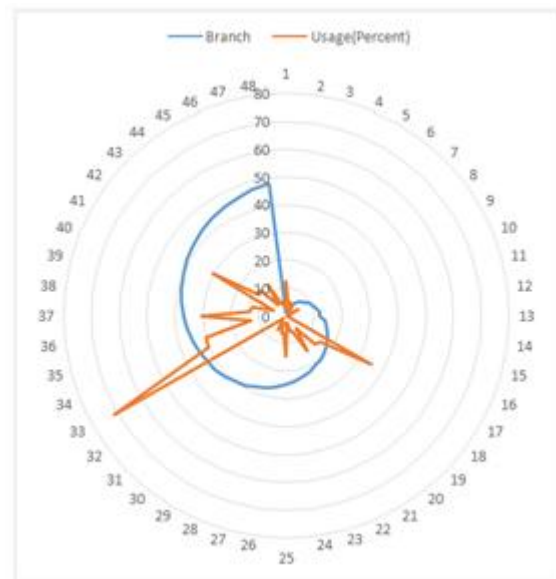


Figure2. The tendency to use bicycles against organizational-infrastructural combinations.



Figure3. Tehran Metro Map

³ -In Basis of Table 2



Figure4. Tehran Bus Rapid Transit (BRT) Map

CONCLUSION

The advantage of the method used in this paper is the simplicity of understanding and the possibility of developing it (to other combinations) and its weakness, its dependence

on the responses of the statistical society. In this study, in order to determine the appropriate combination of Different policies, Different scenarios were defined and surveyed by questioning. The results showed that by taking several possible actions, such as improving bike sharing system and providing bike parking in the main public transportation stations, the number of bicycle trips can be Increased to double from the current value, In this paper, some subjects such as air pollution, cultural issues, high utility of personal transport and some local conditions, such as the difficulty of crossing the highways for cyclist and the high number of intersections in streets, for ease of decision-making by respondents to the questionnaire were not considered, which is suggested in the Future studies should be taken into consideration.

REFERENCES

- [1] Tehran origin – destination survey, 2015.

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