

A Study on Measures to Promote Bicycle Usage in Japan

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Summary

The bicycle plays an important role to achieve a sustainable city toward the next century. However, it is not clear yet about how people come to use bicycle or what factors prevent people from using it. This study tries to find out the characteristics and people's perception of bicycle transport so that one can systematically trace the process of bicycle usage and to seek comprehensive measures to promote its usage.

The study begins with the international comparison of bicycle usage based on the survey done in several cities in Europe and Japan. The major difference between Europe and Japan was found in the people's attitude toward bicycle.

Another aspect of bicycle usage characteristics was obtained from the person trip survey and a questionnaire survey in Utsunomiya city. Two groups of bicycle users were identified, namely primary users and occasional users, with the difference in their frequency and trip length distribution of bicycle usage.

Then the study tries to explore various measures to promote bicycle usage. It concludes that the improvement of people's attitude toward bicycle is essential to increase its usage as well as bicycle-related facility improvements and a legitimate status of bicycle in the urban transportation spectrum. This is already done in many European countries, but not yet in Japan where automobile still plays predominant role over bicycle in the urban transportation system. The same observation may be applicable to some developing countries where motorization takes over the non-motorized mode such as bicycle.

1. Introduction

In recent years, there is a growing concern about the sustainability of the earth due to the increasing amount of emission of carbon dioxide and other gases, which result in the global warming effect. Automobile is one of the major causes of the global environmental problem, and many people try to find the way to curb the proliferation of automobile usage. For example, No Car Day in many parts of the world is an experimental effort toward reducing automobile usage. Various TDM measures and policies are implemented in many cities. However, the number of automobiles is on the steep rise especially in the developing countries as their economy grows. Motorization in the developing countries sometimes accompanies the restriction or reduction of non-motorized transport including bicycles to give space to automobile. In these countries, NMT has a long history as a major mode of transport. However, the government policy or people's preference moves toward motorization.

The hypothesis in this paper is that there is a fundamental difference between developed countries and developing countries with regard to the perception of bicycle status in the urban transport spectrum. In developed countries, especially in Europe, bicycle is considered as an important and major mode of transport, which is an alternative to automobile. Bicycle is increasingly gaining recognition as a viable mode of urban transport. A bicycle is relatively inexpensive, very convenient, energy efficient, pollution-free and good for health. There is no question that a bicycle plays an important role to achieve a sustainable city now and in the near future. It is necessary to understand the characteristics of bicycle transport in order to develop an effective transportation system plan based upon it. For example, a bicycle is used as an access or egress mode in conjunction with mass transit such as trains and subways. More desirably, modal shift from automobile to bicycle and other transport mode should be encouraged. However, it is not clear yet about how people come to choose whether or not to use bicycle or what factors prevent people from using it. This study tries to find out the characteristics and people's attitude about bicycle transport so that one can systematically trace the mechanism of bicycle usage and to seek comprehensive measures to promote its usage.

2. Current Status of Bicycle Usage

2.1 Bicycle Usage Characteristics in Japan

Bicycle became popular in Japan, especially after the World War II. Although the motorization in Japan gained momentum since 1960's, the bicycle ownership rate is always higher than that of automobile. Two oil crises in the 1970's accelerated the rate of bicycle increase, and now over 80 million bicycles are in Japan. Per capita ownership rate is one bicycle for every 1.6 persons. There are several reasons why bicycles became so popular in Japan beside the reasons already listed above. One reason is that bicycle was rediscovered as an alternative transport mode to automobiles which generate aggravating problems of pollution and congestion. People buy bicycles as inexpensive and convenient means of transport. The price of bicycles is relatively low due to the mass production and imports from abroad.

Many Japanese cities conduct person trip surveys on regular interval in order to give the basis for comprehensive urban transportation planning. According to these surveys, major trip purposes of cyclists in urban areas in Japan are commuting to schools and workplaces, followed by shopping and business trips. Recent national census shows about 17 percent of total commuting trips are done by bicycle between their homes and workplaces or schools, although this ratio varies by size and type of city. Commuting trips using bicycle is divided in two types. One is single mode in which a bicycle is used for the entire trip from home to destination such as school or workplace. The other is such a trip that a bicycle is used as an access means to and from public transport terminals like railway stations. Generally speaking, the average bicycle trip length of the former usage pattern is longer than the latter, in which bicycle ride is only a part of commuting trips. Majority of commuting trips using bicycle is single mode pattern. But in large urban areas, the dual mode commuting pattern using bicycle as an access or egress means to a railway station is more frequently found. The parking duration of such trip is generally very long, from half a day at the home-side station to overnight at the destination station. In addition, many people own two bicycles in order to use in both ends of a railway trip route. Shopping and business trips using bicycle are predominantly single mode, and their trips are less frequent and over short distance. The

capability to carry goods on a bicycle is sometimes cited as a reason for using bicycle. Parking duration at the destination is generally short. Other use of bicycle is recreational for pleasure, sports, or sightseeing. The usage pattern in terms of location, time or trip length of recreational purpose bicycle trip is different from other trip purposes discussed above, and the volume of such trips is neither significantly large nor concentrated.

Another aspect of bicycle usage characteristics was obtained from the person trip survey in Utsunomiya city in 1994. The share of bicycle trip is 17% for all trip purposes. For trip to school, a higher share of 29% is done by bicycle. Among bicycle users, only 25 % have drivers license, while 56% of the all people own drivers license. Two groups of bicycle users were identified. The first group is those who do not have drivers license and have to use bicycles as primary and sole means of transport. This group is defined as Fixed Group. The other group is those who own automobiles and can choose between automobile and bicycle. They use bicycles occasionally and defined as Selective Group. The difference of these two groups is found in their frequency of bicycle usage and trip length distribution, with the former more frequent use and longer trip length.

2.2 Usage Comparison among Different Cities

In 1996, a series of questionnaire surveys were conducted in some cities in Europe and Japan. The survey was a preliminary attempt to compare the attitude toward bicycles between European countries and Japan. The selected cities for survey are: Vienna, Austria; Bremen and Muenster in Germany; Amsterdam and Tilburg in Netherlands; Utsunomiya, Nerima, Musashino and Amagasaki in Japan. Sample size was about 50 in each European city and about 300 to 700 in Japanese cities. Although the sample size for European cities are rather small comparing with those in Japan, and the data may not be statistically consistent, there is a clear difference between Europe and Japan in terms of people's attitude toward bicycle. The major difference between Europe and Japan was found in the people's attitude when purchasing a bicycle. The former emphasize on quality, while the latter prefers lower price. This difference between Europe and Japan is found in many aspects of people's perception of bicycle status, as will be discussed later.

2.3 Factors Influencing Bicycle Usage

In order to find out the causal relationship between various factors and bicycle usage, two approaches are attempted. One is quantitative and the other is qualitative approach.

2.3.1 Modal Choice Model Approach

From the data collected in the person trip survey conducted in Utsunomiya city in 1994, a statistical method using binary choice aggregated logit model was developed. All trips are divided in binary choice between walk or bicycle trips and trips using other modes. The factors that influence bicycle usage are: the distance between origin and destination zones, the drivers license ownership, and availability of car parking spaces in the destination zones, among other factors.

2.3.2 Questionnaire Survey Approach

An extensive questionnaire survey about the factors to promote bicycle usage was conducted to the citizen in Utsunomiya city in 1998. About 450 samples are collected. The questions include the attitude toward bicycles, the experience of bicycle usage and the relationship with bicycle-related facility provisions or bicycle usage environment. The factors are grouped in 2 by 2 matrix as follows. One division is whether the factor is related to bicycle users or the road environment, and the other division is between physical and psychological or institutional aspects.

The first group of factors is related to the performance of bicycle. For example, an electric power-assisted bicycle is recently introduced and gaining popularity. The second group is the improved image of bicycle in comparison with other transport modes. People's attitude toward bicycle has some relationship with bicycle usage promotion. The past experience is also in this category. The third group is the improvement of bicycle-related facilities, such as bicycle road and bicycle parking facilities. The last group is institutional factors such as the traffic law or government policy to give priority or preference to bicycles. For example, the parking restriction of automobiles in the destination zones will encourage the shift to bicycle usage. In the next section, these four measures to promote bicycle usage are closely examined.

3. Possibility of Promoting Bicycle Usage

3.1 Electric Power-Assisted Bicycle

An electric power-assisted bicycle is relatively new and still expensive. However, it will become popular if the price comes down to the competitive level with regular bicycle. The advantage of comfort when riding on the climbing slope and longer distance ride will make it an attractive factor to promote bicycle usage increase. The questionnaire survey revealed that about 40% of non-bicycle users would use electric power-assisted bicycles.

3.2 Improvement of Bicycle-Related Facilities

People's perception of the level of bicycle road provision is high in European cities with almost half of those answered in favor. But the same question in Japan shows strong dissatisfaction. There are major differences about the level of bicycle road provisions among countries. The table 1 shows the bicycle road length, its ratio of all roads, and length per thousand bicycles.

Table 1. The Comparison of Bicycle Road

Country	Bicycle Road Length	_Ratio of total road	Meter/1000 bicycles
Germany	23,100 km	4.7%	660
Netherlands	14,500	8.6	1,317
United States	24,000	0.4	240
Japan (1)	93,172	8.1	1,278
Japan (2)	6,925	0.6	95

Source: From reference 4, p.6 and data from Ministry of Construction, Japan

The first figure of Japan in the table is comparable with that of Germany or Netherlands, but there is a big difference. In Japan, bicycle roads are classified into three categories. They are as follows: a) exclusive bicycle road, b) exclusive bicycle and pedestrian road, c) bicycle and pedestrian road. The length for these facilities and ratio to the total length of road in Japan (1.15 million km) as of 1997 is shown as follows:

a) Exclusive bicycle road	1,978 km (2 %)
b) Exclusive bicycle and pedestrian road	4,163 km (4 %)
c) Bicycle and pedestrian road	93,172 km (94 %)

Majority of bicycle road in Japan is the so-called sidewalk bikeway. “Bicycle and pedestrian road” is defined as the portion of sidewalk where both pedestrian and bicycles use the same right-of-way. This policy to accommodate bicycle on the sidewalk was originally adopted in 1978 to curb the increase of traffic accidents involving bicycle. The tentative separation of bicycles from automobile traffic by allowing bicycles on sidewalk became the part of traffic law, which is still in effect to date. The use of sidewalk as the passage for bicycles (sidewalk bikeway) presents undesirable problems such as the conflict between bicycle and pedestrian with danger of accidents. Sidewalk bikeways are used bi-directionally, and relatively high speed of bicycles and unpredictable pedestrian movements generate serious accident potential. Small children, older people, and physically handicapped people are particularly vulnerable to such conflicts. From the standpoint of cyclists, sidewalk is not always a safe and comfortable path to ride. There are roadside trees, electric poles, signal signs, street furniture’s, parked

bicycles and many other hazards on the sidewalk. Some sidewalks are very narrow and cyclists may find it difficult to use. Sidewalk elevation may not be even where it crosses driveways, and pavement is often poorly maintained. Cyclists may find it easier to run along the street with automobiles, which is also legally permitted in most of streets but with high risk of accidents. The second figure for Japan in the table above is a realistic comparison with European countries, and is very unsatisfactory as survey result indicates.

The analysis between the level of bicycle usage and bicycle-related facility provision indicates that there is a functional relationship expressed by a logistic curve. If the infrastructure is in low level, the bicycle usage stays low while increment of facility improvement is not enough. But when the infrastructure reached a certain level, the bicycle usage increases steeply and reaches to a plateau level, which is determined by other factors.

3.3 Social Acceptance of Bicycle

Bicycle has not been accepted as a legitimate mode of transport in the Japanese transport hierarchy. Although a bicycle is defined as a light vehicle, which is in the same category with rickshaw, horse-drawn cart and other non-motorized transport, little is mentioned about bicycle in the current Road Traffic Act in Japan. One reason may be attributed to the ambiguous nature inherent in bicycle. A bicycle is categorized as a light vehicle if a cyclist rides it. However, if he is walking while carrying his bicycle aside, the same cyclist is regarded as a pedestrian. These two modes are easily interchangeable depending on the cyclist's will. This ambiguity of dual states of a bicycle makes it difficult to strictly enforce the traffic law.

Cyclists also take advantage of not obeying traffic rules any more than ordinary pedestrians. The revised Road Traffic Act of 1981, which permits bicycle to share the same sidewalk space with pedestrian, contributed this general attitude to make light of traffic rules. General lack of adequate education or training opportunities leaves many cyclists to go out to street at their own risk. Some introductory education or training may be given in elementary schools, but it is far from satisfactory.

It is important to give an appropriate status to bicycle legally so that people use bicycle in orderly manner with responsibility. This will elevate the relative status of bicycle in the urban transport spectrum. The analysis revealed that there is a synergistic effect between image improvement and facility improvement, both of which jointly increase the bicycle usage. This is especially true to that Selective Group who at present do not ride bicycle. They will shift from automobile to bicycle if the bicycle-related infrastructure reaches to a certain level and good image of bicycle transport prevails.

3.4 Restricting Automobile Usage

Finally, the questionnaire survey shows various conditions when people switch from automobile to bicycle if one has to go to a place, which is within 3 km from home. More than half of people change from automobile to bicycle when car parking becomes difficult in the destination, followed by 20% when it takes more time by car. The modal shift equation also estimates the increase of bicycle usage between 2 and 4 km distance.

Other incentives are introduction of rent-a-cycle system, or collaboration with public transport. Needless to say, the bicycle-related infrastructure must be well established to make these other measures effective.

4. Conclusion

It is vitally important to control the exploding growth of automobiles in order to maintain sustainable cities. Bicycle is a critical choice of alternative transport modes. The success of bicycle usage promotion is dependent upon the improvement of people's attitude toward bicycle, as well as bicycle and bicycle-related facility provision and improvement. It is necessary to give bicycle a legitimate status in the urban transportation spectrum. This is already done in many European countries, but not yet in Japan where automobiles still play predominant role over bicycle in the urban transportation system. The same observation may be applicable to some developing countries where motorization dominates the traditionally major role of non-motorized mode such as bicycle.

The key issue is the shift of attitude from developing country mode to developed country mode. In developing country mode, people think that bicycle is an obsolete means of transport to be replaced by automobile. On the other hand, in developed country mode, people use bicycle because it is environmentally more desirable than automobile. In this study, this shift of attitude is achievable with the improvement of bicycle and bicycle-related facilities, and with the restriction of automobile usage to some extent.

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