

Current Issues and Problems of Bicycle Transport in Japan

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The number of bicycles in Japan has been increasing steadily, and there are now more than 66 million bicycles in use, or one bicycle for every 1.8 persons. However, facilities to accommodate bicycle transport, such as bicycle roads and bicycle parking spaces, are either nonexistent or limited, and so are laws and regulations to deal with bicycle transport. The lack of bicycle facilities and poor bicycle transport policies generate various problems associated with bicycles such as illegal parking in the vicinity of railway stations and traffic accidents involving bicycles. The historical background and current issues of bicycle transport in Japan are reviewed with regard to traffic laws and regulations, bicycle road conditions, parking facilities, education, and the public attitude toward bicycles. Case studies involve reduction of illegally parked bicycles and field observations of cyclist performance that resulted in intersection design changes.

As the most important nonmotorized transport mode, bicycling has gradually gained popularity in Japan, especially after World War II. Although motorization in Japan has been in rapid and constant progress, the bicycle ownership rate has always been higher than the car ownership rate. The two oil crises in the 1970s particularly accelerated the rate of bicycle increase. There are now about 66 million bicycles in Japan, or one for every 1.8 persons, and the number is increasing (Figure 1). This ownership rate is higher than that in most countries in the world except the Netherlands, Finland, Sweden, Denmark, and West Germany. In terms of the volume of ownership, Japan is the third largest bicycle-owning country following China and the United States (1, p.234).

There are several reasons why bicycles have become so popular in Japan since the 1970s. One reason is that the bicycle was rediscovered as an alternative transport mode to the increasing numbers of automobiles, which presented many problems such as traffic congestion and air pollution. The energy- and ecology-conscious general public turned to bicycles, which were becoming less expensive and more convenient, and were good for one's health. The convenience factor of a bicycle is increasingly being recognized as urbanized areas expand and people have to travel longer distances to railway stations or shopping districts. People buy bicycles as an inexpensive and convenient means of transport. The prices of bicycles are becoming relatively low because of domestic mass production and increased imports from abroad. This is especially true with the lightweight minicycle, which is popular among students and housewives.

However, the increase in bicycle ownership in Japan is accompanied neither by corresponding policy guidance from the government nor by facility provision from the public sec-

tor. Despite the fact that bicycles are favored by the general public, they still remain of secondary importance in the Japanese transport community.

CHARACTERISTICS OF BICYCLE USE

Surveys indicate that the major trip purposes of cyclists in urban areas in Japan are commuting to schools and workplaces, followed by shopping and business trips. The national census of 1980 indicates that about 15 percent of total commuting trips are made by bicycle between homes and workplaces or schools, although this ratio varies by size and type of city. Commuting trips using a bicycle are divided into two types. In one type the bicycle is used for an entire trip from home to destination such as school or workplace. In the other type a bicycle is used as a means of access to and from public transport terminals such as railway stations. Generally speaking, the average bicycle trip length of the former use pattern is longer than that of the latter, in which the bicycle ride is only a part of the commuting trip. Most commuting trips using a bicycle are in the single-mode pattern. But in large urban areas, the dual-mode commuting pattern using a bicycle as an access means to a railway station is more frequently found. Parking duration is generally long, from half a day at the home-side station to overnight at the destination station. In addition, some persons own two bicycles for use at both ends of a railway trip route.

Shopping and business trips using a bicycle are predominantly single mode, and these trips are less frequent and over shorter distances. The capability of carrying goods on a bicycle is sometimes cited as a reason for using the bicycle. Parking time at the destination is generally short.

Other uses of the bicycle are for pleasure, sports, or sightseeing. The use pattern in terms of location, time, or trip length of a recreational bicycle trip is different from other trip purposes discussed earlier, and the volume of such trips is not significantly large or concentrated.

BICYCLE ROADS

In 1970 the Act Pertaining to the Construction of Bicycle Roads was passed, accompanied by design standards. Bicycle roads are officially classified into four categories: (a) exclusive bicycle road, (b) exclusive bicycle and pedestrian road, (c) bicycle road, and (d) bicycle and pedestrian road. The first two are built mainly in suburban and rural areas to accommodate recreational bicycle traffic, and the latter two are

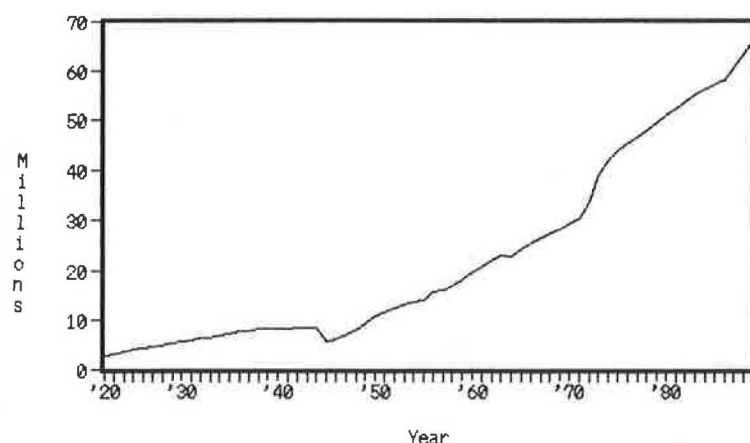


FIGURE 1 Number of bicycles in Japan.

found in urban areas as a part of roads and streets. The lengths for these facilities and ratios to the total length of roads in Japan (1.09 million km) as of 1988 are as follows (*Ministry of Construction statistics*):

Category	Length	
	Kilometers	Percent
Exclusive bicycle road	1,392	0.13
Exclusive bicycle and pedestrian road	3,025	0.25
Bicycle and pedestrian road	54,032	4.92

In the last category, only 2 percent are bicycle roads that have separate bicycle lanes, sidewalks, and automobile lanes. These figures are extremely low compared with those in west European countries, especially the Netherlands and West Germany, whose exclusive bicycle road ratios to total road length are 8.6 and 4.7 percent, respectively (unpublished data from Ministries of Transport in West Germany and The Netherlands, 1985). About 90 percent of bicycle roads in Japan are the so-called "sidewalk bikeway." Bicycle and pedestrian roads are defined as the portions of sidewalk where both pedestrians and bicycles use the same right-of-way. This policy to accommodate bicycles on the sidewalk was originally established in 1978 to curb the increase in traffic accidents involving bicycles. The tentative separation of bicycles from automobile traffic by allowing bicycles on the sidewalk became a part of traffic law that is still in effect.

The use of sidewalks as passages for bicycles (sidewalk bikeways) presents some undesirable problems, as pointed out by Smith (2), such as the conflict between bicycle and pedestrian or automobile. Poor visual relationships between cyclists and motorists at intersections and driveways increase the accident potential. Also, sidewalk bikeways are likely to be used bidirectionally despite signs and markings to the contrary. Furthermore, the relatively high speed of bicycles and unpredictable movements of pedestrians generate serious potential for conflict. Small children, older people, and physically handicapped persons are particularly vulnerable to such conflicts.

From the standpoint of cyclists, the sidewalk is not always a safe and comfortable path to ride. There are roadside trees, electric poles, signal signs, street furniture, parked bicycles, and many other hazards. Cyclists may find it difficult to use some narrow sidewalks. Where the sidewalk crosses a drive-

way, sidewalk elevation may not be even and pavement is often poorly maintained. Cyclists may find it easier to pedal along the street with automobiles, which is legally permitted in most streets.

Bicycle lanes are another means of providing usable space on the street for bicycles. They have an advantage over sidewalk bikeways, in that they can lead bicycles to conform to the directions of automobile traffic. However, bicycle lanes are usually delineated as leftover spaces after automobile lanes have been set aside. This procedure results in use of the narrow and often poorly maintained space next to regular automobile lanes. Furthermore, many illegally parked automobiles make it virtually impossible for a bicycle to stay within the bike lanes. Quite often, bicycles are involved in sideswipe accidents that are caused by passing or turning automobiles. Another problem is the lack of continuity of bike lanes, which may suddenly end at an intersection, causing confusion for the cyclist.

Exclusive bicycle roads are generally found in suburban or rural areas. Their primary purpose is to accommodate recreational bicycle trips. Riverbanks and abandoned railway rights-of-way are commonly used for this purpose. The traffic volume is not high except during holidays and the tourist season. In recent years, construction of these recreational bicycle paths has been increasing. However, such paths do not necessarily form networks to accommodate continuous riding from one system to the next, nor are they provided with access roads.

BICYCLE PARKING PROBLEMS

Recently, bicycles have begun to present serious problems in the urban transport environment in Japan. One problem is the proliferation of illegally parked bicycles around railway stations and shopping areas that become hazards to pedestrians and automobiles. As was mentioned previously, one of the most common uses of bicycles in urban areas is to gain access to railway stations. At the station, bicycles are parked in garages, if any, or left on the sidewalk and in the street.

Traditionally, the residential suburbs of large urban areas in Japan were developed in conjunction with railway construction. Therefore, it is a common commuting pattern to

gain access to a railway station by automobile, bus, or bicycle, or on foot. Bus and bicycle are in a competing relationship as far as access to the railway station is concerned. Increasing automobile traffic has resulted in road congestion, so that buses cannot operate on schedule at normal cruising speeds. This, in turn, brings about fare hikes, unreliable service schedules, reduction of operating frequency, overloading, and as a result, sharp decreases in bus ridership.

Statistics indicate that in Japan bus patronage has dropped to one-third of that in the peak era two decades ago. Most of these former bus passengers changed to automobile, bicycle, or walking. But the bicycle is preferred over the other two modes because it is (a) faster than the car in congested urban streets and does not have the parking problem, (b) more flexible to use at any time without need of waiting for the fixed-time schedule of a bus, (c) economical to purchase and maintain, and (d) pollution-free, healthier, and environmentally more acceptable. Therefore, there is always a large population of potential bicycle users who are willing to use bicycles for various trip purposes. Even those who used to walk now tend to ride bicycles even for short distances because they can afford to buy their own bicycles, and bicycle riding requires less effort than walking.

Because of the extremely high land cost around railway stations and major shopping areas and the lack of responsibility for provision of adequate parking facilities on the part of those who operate railway services or stores, bicycles are left on sidewalks near railway stations and in front of stores. Some railway stations in the suburbs of Tokyo have several thousand illegally parked bicycles on the sidewalks near each station. These bicycles prevent other cyclists, pedestrians, and even cars from traveling safely and smoothly and also become hazards in the case of fire or emergency. In addition, they become an eyesore on the urban landscape.

To remove these illegally parked bicycles, local public authorities have tried various measures, among which the three discussed in the following paragraphs are commonly being tested by a number of local governments. Successful parking control by public authorities depends on a combination of these three measures, taking the psychology of bicycle users into consideration.

Zones To Restrict Illegal Bicycle Parking

There is no authority to confiscate bicycles that are illegally parked in public space not designated for bicycle parking under the present Road Traffic Act. Therefore, to discourage citizens from parking their bicycles illegally, many local governments enact bylaws to restrict illegal parking in the areas surrounding railway stations, for example, within a 200- to 300-m radius. The problem with this measure, if enforced, is that people tend to park their bicycles adjacent to the zone, thereby spreading illegal parking to an even wider area.

Removal, Storage, and Return of Illegally Parked Bicycles

An effective way to demonstrate that public authorities should strictly impose such bylaws is by removing those bicycles left

on sidewalks to a temporary storage area. To some extent, successful removal discourages cyclists from parking illegally on the street. However, it requires personnel and money to move bicycles to storage areas. Once the bicycles are stored, the chances of owners' claiming them is relatively low, particularly if removal and storage charges are imposed on the owners. Sometimes as many as 50 percent of the removed bicycles are unclaimed.

The price of bicycles is low in Japan and people tend to leave their bicycles in the public road without much fear of their being stolen. The low price also induces a psychological attitude among many cyclists that they can buy another bicycle if one is stolen while parked on the sidewalk or street. Therefore, those whose illegally parked bicycles are removed often buy new ones without claiming the old ones.

The removed and unclaimed bicycles, together with other abandoned bicycles, cause other problems for local authorities. Even though the bicycles are not claimed by the owners, recycling or scrapping other people's property is illegal. Even if the bicycles were recycled, their market value would be much lower than that of new bicycles, and they would likely be abandoned again. Last, to scrap and dump a large number of unclaimed bicycles would be ecologically undesirable.

Provision of Bicycle Parking Facilities

Along with the two measures first mentioned, it is necessary to provide parking facilities within or near the restricted zone. A parking facility could be provided either publicly or privately, and it could be with or without charge, depending on various circumstances. Usually, the price of land near a station is high, and it is thus acceptable to charge bicycle users, just as it is to charge for automobile parking. However, the low price of bicycles incurs an attitude that bicycle parking should be free. Another dilemma in providing parking facilities is that they encourage those who previously walked or rode the bus to a station to switch to the use of bicycles. An increased number of bicycle users will soon create a shortage of parking spaces in the newly created parking capacity.

CASE STUDY: BICYCLE PARKING FACILITY AND RENT-A-CYCLE

Among many attempts by local authorities to solve illegal bicycle parking problems, a successful case of clearing illegal parking around a railway station is presented. Ageo, located 35 km north of Tokyo, is a typical bedroom community for the Tokyo metropolitan region; its population has increased to 180,000. A large number of commuters travel to Ageo station by bicycle. In 1980 Ageo station became the 12th-worst railway station in Japan, with 4,400 illegally parked bicycles around it. The municipal government provided parking spaces jointly with privately operated parking garages. By 1983 more than 8,000 pay bicycle parking spaces had been constructed. Then a strict bylaw was enacted to restrict illegal bicycles. The result was the drastic reduction of illegal bicycles to a few hundred (Figure 2)(3).

Another strategy by this city was to introduce a rent-a-cycle system. Registered commuters and students could rent bi-

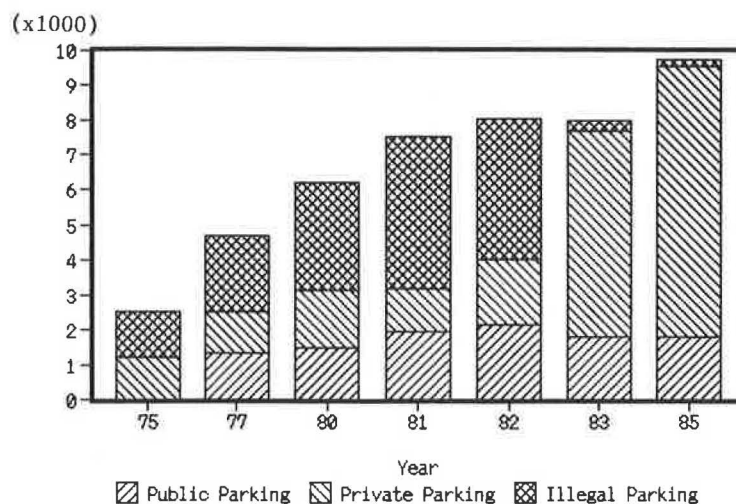


FIGURE 2 Bicycle parking near Ageo station.

cycles to go home, to school, or to the workplace. Under this system, bicycles were used by more than one person. For example, one bicycle would be rented by a student who came to Ageo by train and went to school in the city. After this bicycle had been returned in the afternoon, it would then be rented to a worker who lived in the city. The bicycle would be kept overnight at the worker's home and returned to the station next morning. In this manner, a bicycle would be used two or more times a day, and hence efficient use of bicycles and parking spaces would be achieved. The actual operation of renting out and returning is done with a computer-controlled card system suitable for a station where two kinds of trips, home-based and non-home-based, exist at a similar level.

BICYCLE TRAFFIC ACCIDENT PROBLEMS

Another major problem is the increasing number of traffic accidents that involve bicycles, especially among students and older people. Japan experienced a serious traffic accident

increase that peaked in 1970. Total deaths were 16,765 with injuries of 981,096 in 1 year. In those days, the majority of victims were pedestrians and cyclists. However, since then the number of traffic accidents has been steadily decreasing thanks to massive investment of capital in traffic safety facilities such as guardrails to separate cars and pedestrians, grade-separated pedestrian crossings, signalized intersections, and various safety operational countermeasures. One of the countermeasures was to permit bicycles on sidewalks.

The number of deaths halved to 8,466 in 1981, and during the 1980s the number of traffic accidents and deaths was stable despite the ever-increasing automobile traffic. However, since 1987, traffic accidents have started to increase again. For the first time since 1974, the number of traffic deaths exceeded 10,000 and it was increasing at a rate of close to 10 percent per year.

The number of traffic accidents involving bicycles has been consistently correlated with the number of total accidents. For the past two decades, the ratio of cyclist deaths to total traffic deaths has remained about 10 to 12 percent, whereas that of injuries has been about 14 to 15 percent (Figure 3).

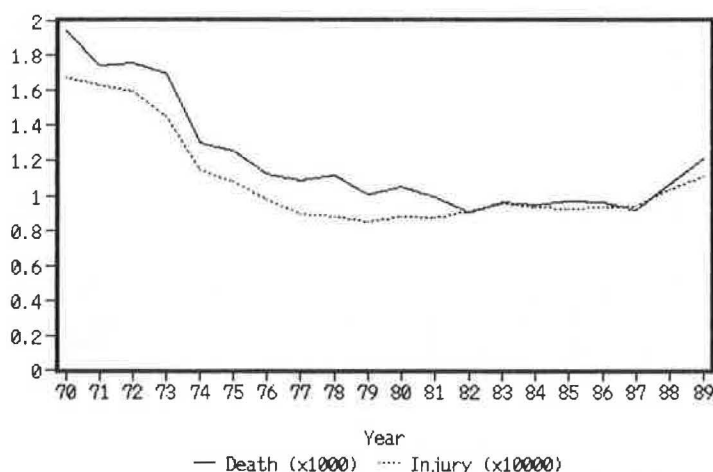


FIGURE 3 Bicycle accidents in Japan.

Two age groups have higher accident rates than others, those between 13 and 19 years old and those over 60. The younger group has a higher injury rate (over 200 injuries per 100,000 population), but the older group shows a higher death rate (3 to 5 deaths per 100,000). The national average is 95.2 injuries and 1 death per 100,000 people. The age group between 25 and 35 shows the lowest injury and death rates (0.1 death, 43 injuries) (Figure 4) (unpublished statistics from the National Police Agency).

As for the increase of total traffic accidents in recent years, the accidents involving bicycles are also increasing. Finding the cause for and taking measures to curb the increasing trend are urgently needed. The high accident rates in the two age groups mentioned above are attributed to lack of education or training as well as inadequate traffic laws, which are discussed next.

EDUCATION AND LAW

The bicycle has not been accepted as a legitimate mode of transport in the Japanese transport hierarchy. Although the bicycle is defined as a light vehicle in the same category as rickshaw, horse-drawn cart, and other nonmotorized vehicles, little is mentioned about the bicycle in the current Road Traffic Act. One reason may be the ambiguity that is inherent in a bicycle. A bicycle is categorized as a light vehicle if it is ridden by a cyclist. However, if a cyclist is walking while carrying a bicycle, the same cyclist is regarded as a pedestrian. These two modes are easily interchangeable, depending on the cyclist's will. The possibility of dual states of a bicycle makes it difficult to strictly enforce the traffic law.

Cyclists do not observe traffic rules any more than do pedestrians. The revised Road Traffic Act of 1981, which permits bicycles to share the sidewalk with pedestrians, contributed to this general attitude of disregarding traffic rules. At present, there is no requirement for a rider's license to ride a bicycle. However, one can ride a bicycle at a fairly high speed, which is dangerous to pedestrians and other bicycles and makes the rider vulnerable to automobiles.

The general lack of adequate education or training opportunities in bicycle riding leaves many cyclists to ride at their own risk. Some introductory education or training may be given in elementary schools, but it is far from satisfactory compared with the training courses given in some European countries. An example of an advanced training program is that in Germany established by the Allgemeiner Deutscher Automobil Club (ADAC) to increase bicycle riding skills.

In Japan, traffic safety training in junior high and high schools is not popular among students, who take for granted that they know enough about traffic rules and possess sufficient bicycle riding skills. However, simple tests of traffic law reveal the contrary, and students' higher accident rates indicate that their skill levels are not high enough for safe bicycle riding.

As for the older generation, they believe strongly that they have been riding bicycles all their lives with sufficient knowledge and skills, and they are reluctant to accept the suggestion that their physical capabilities such as alertness, attentiveness, and correct judgment in case of conflict on the road have deteriorated. It is necessary that some kind of training program be offered to them. This is increasingly important as the number of older people continues to increase because of their longer life span, and their opportunities to engage in outside activities also increase.

An example of the ambiguous nature of the bicycle in the present Road Traffic Act is found in the method of crossing at a signalized intersection. Two methods of bicycle crossing are widely used. One is the provision of a pedestrian crossing where cyclists are expected to alight from the bicycle and to walk with pedestrians subject to the pedestrian crossing signal light or run along the left side of the automobile lane following the signal for automobiles.

The other type of crossing has a narrow exclusive bicycle crossing strip along with a pedestrian crossing, and bicycles can be ridden within this strip. In this case, they have to follow the pedestrian crossing signal light (Figure 5).

Few cyclists realize the difference between these two types of crossing or can use them correctly. Together with the convention of permitting bicycles to be ridden on sidewalks, this

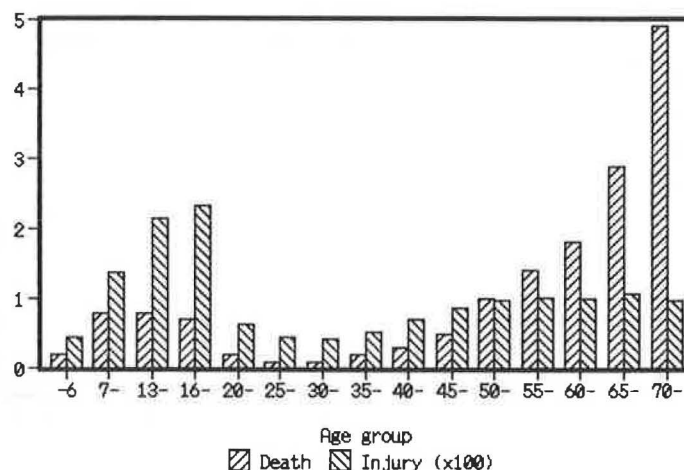


FIGURE 4 Bicycle accident rates by age group for 100,000 population.

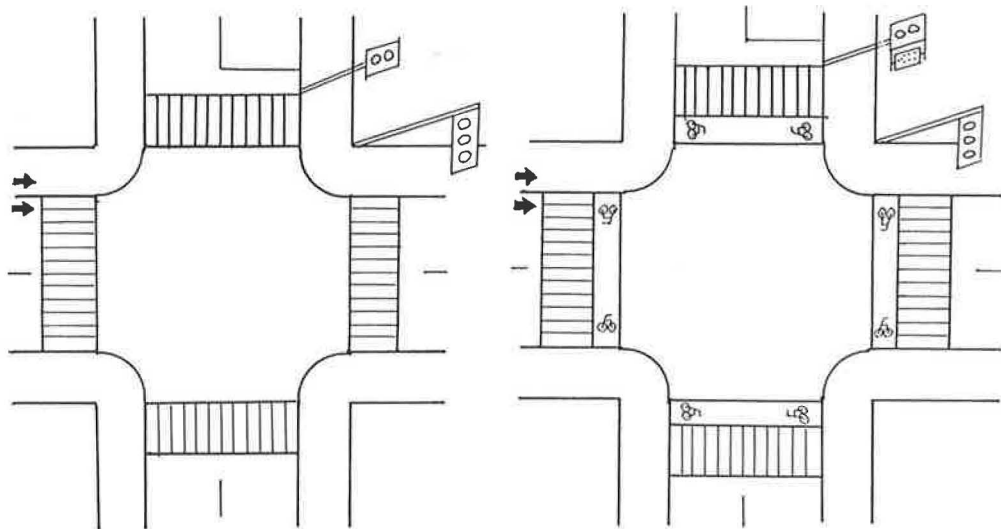


FIGURE 5 Two types of intersections: *left*, pedestrian crossing only; *right*, with bicycle crossing strip.

difficulty further confuses most cyclists. This is one example that warrants a review of the Road Traffic Act from the standpoint of the bicycle.

CASE STUDY: INTERSECTION IMPROVEMENT

In a case study that resulted in the improvement of intersection design (4), dangerous conflicts between pedestrians and bicycles were observed at a scrambled intersection. After various analyses, the recommendation to change the intersection system resulted not only in resolving conflicts, but also in improving vehicle traffic flows.

The purpose of this study was to point out the shortcoming of the present traffic law and to demonstrate an improved method of modifying pedestrian crossing at an intersection. The scrambled intersection is located in the busy street of Utsunomiya City, a prefectural capital that has about half a million population. Because this intersection is situated on the commuting route of several high schools, there are a large number of students who ride bicycles. During the commuting period, the majority of pedestrian and cyclist traffic is students traveling to and from school.

A scrambled intersection is designed to allow pedestrians to cross in any direction within the intersection while all car traffic is stopped. During this period, cyclists are expected to get off their bicycles and to walk as pedestrians. However, in actual traffic few cyclists walk to cross. Almost all cyclists continue to ride on bicycles at high speeds while crossing the intersection. This causes a dangerous situation of possible conflict and accident potential between pedestrians and cyclists.

A survey method was developed using a video camera to take pictures of the intersection from a high location (5). Then each video image was combined with a microcomputer to record the spatial coordinates of bicycles and pedestrians. The system recorded conflicts between bicycles and pedestrians,

their relative locations, traces of movements, speed, density, and so forth. By analyzing the videotaped observation, it was found that this particular intersection had a low diagonal crossing rate. Usually, 20 to 30 percent of pedestrians cross diagonally in a typical scrambled intersection, but this one showed only a small percent.

Therefore, it was recommended that the pedestrian scramble phase be discontinued and the intersection be converted to a regular signalized intersection with a wide bicycle crossing zone where a cyclist could cross without getting off the bicycle. The result was a smoother and safer intersection crossing for both cyclists and pedestrians. In addition, the automobile traffic congestion was reduced because the omission of the pedestrian-only phase increased the green light time for automobiles. Although review of the traffic law is warranted, this small example indicates that it is possible to modify the operating method of a facility to improve traffic safety and reduce congestion.

CONCLUSION

In Japan, bicycles are accepted as a convenient, economical, and environmentally sound mode of transport indispensable to many people. This is especially true for students and commuters in local cities and suburban metropolitan areas as well as for housewives with shopping and personal needs. However, the increase of bicycles generates problems in the urban transportation scene. Among them are the proliferation of illegally parked bicycles in the vicinity of train stations and increasing bicycle accidents, especially among young and old people.

Some of the solutions to the current bicycle problems in Japan include providing facilities such as bicycle roads and bicycle parking spaces, reviewing and restructuring of traffic laws and regulations to ensure safe and smooth bicycle transport, and providing adequate safety education and skill train-

ing to bicycle users. It is necessary that society accept the bicycle as a legitimate mode of urban transport and give appropriate rights as well as responsibilities to bicycle users.

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