

Characteristics of Bicycle Users in Shanghai, China

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The characteristics of bicycle users in Shanghai, China, were examined through questionnaire surveys. A total of 2,613 completed questionnaire forms were returned from 72 survey locations. The results indicated that bicycles in Shanghai are used by commuters irrespective of sex or age. The majority of Shanghainese rode their bicycles at least 6 days per week as a form of private transport for various purposes, but mainly for work. Despite some dangers, the majority of users still used their bikes because of the convenience and reliability of this transport mode. Moreover, they indicated that they are not willing to shift to the bus system unless bus services are improved.

Although the expansion in urban transport demands mainly focused on the increase of automobiles in many industrialized countries, this phenomenon is not evident in many urban cities in China due to the high costs and restrictive national policies on the usage of such vehicles (1). As a result, the bicycle has become a predominant mode of transport in many cities in China, including Shanghai. According to a study of the distribution of trip purposes in Shanghai (2), among the various modes used for home-based work trips, bicycles dominated the total trips made (41.4 percent), compared with walking (28.2 percent), transit (27.6 percent), and others (2.8 percent). Furthermore, with the rapid increase of bicycle ownership in Shanghai from 1.77 million in 1980 to 6.55 million in 1989, it is necessary to study the characteristics of bicycle users. This paper presents research conducted at the Asian Institute of Technology on the characteristics of bicycle users in Shanghai.

DATA COLLECTION

Questionnaire surveys were conducted to collect data. A total of 3,100 questionnaires were distributed randomly to bicycle users at 72 survey locations. Only 2,613 questionnaire forms were returned and used for the analyses. Included in the survey sites were various public parking places throughout the city. Several government as well as private offices were also included as survey sites. Details of various survey locations along with questionnaire response rates are summarized in Table 1. Information on bicycle ownership, trip frequency, trip purpose, average travel time, opinion of safety, age, sex, educational background, income level, and employment status was included.

BICYCLE USER CHARACTERISTICS

Though in Shanghai the number of males and females is nearly even, with the males slightly more numerous (50.6 percent versus 49.4 percent) (3), results of the surveys indicated more male than female users (60 and 40 percent, respectively). Regulations of the Chinese government forbid children younger than 12 years old from riding bicycles along the streets. Bicycling appeared to be intense among the age groups 21 to 35 and 36 to 45, which represented 37.3 and 36.8 percent of the total respondents, respectively. These dominant groups are typical of motorized transport users in other developing countries and Taiwan. Studies conducted at the Asian Institute of Technology on public transportation users in Bangkok, Karachi, and Taipei (4-6) all indicate that the dominant user age groups are between 20 and 40.

Further analysis of the age and sex of bicycle users indicates that female cyclists shy away from riding bicycles as they become older, compared with males (see Table 2).

Of all the bicycle users surveyed, 71.3 percent responded that their average earned income was rather low, ranging from 100 to 300 Yuan (U.S. \$22 to \$66). However, these respondents' incomes compare well with the average earned income of the Shanghainese. According to statistics published by the Shanghai Municipal Bureau (3), in 1988 the average annual earned income in Shanghai was 2,258 Yuan, or roughly 188 Yuan per month. Despite the low earned income, the number of bicycle owners is still relatively high. Whereas the average price of bicycles sold in China was between 200 and 400 Yuan (7), the 1990 annual growth rate of bicycle ownership in Shanghai was 14 percent (8). Furthermore, the questionnaire surveys indicate that nearly two-thirds of the households surveyed have at least two bicycles per family. These results support other studies indicating that Shanghai is a highly non-motorized city, one of the dominant modes of transport being the bicycle.

In addition to the restrictive policy on car ownership, the low average earned income of Shanghainese is a deterrent to obtaining private cars. In China, car prices range between 80,000 and 200,000 Yuan (7), much more than average annual income. In fact, in Shanghai there were only 8,400 cars in 1985, and they were primarily used by high-ranking government and party officials (1). It is clear that bicycles will remain one of the dominant modes of transport in Shanghai.

Table 3 indicates that bicycle users are relatively well educated. Nearly one-third of the respondents have completed university education. However, for certain groups of users, income does not completely depend on educational background. Some well-educated users who obtained higher than

TABLE 1 Survey Sites

Location of Survey		No.	No. of Distributed Forms	No. of Return	Rate of Return
Factory		21	700	620	88.6%
Government Office		25	930	769	82.7%
Company		10	300	263	87.7%
Department of Education	University	4	104	96	92.3%
	School	5	126	114	90.5%
Hotel		1	60	59	98.3%
Bank		1	50	41	82.0%
Hospital		1	30	19	63.3%
Bicycle Parking Places		4	800	632	79.0%
Total		72	3100	2613	(84.3%)

TABLE 2 Age and Sex Distribution

Sex	Age Group (Years)								Total
	12-15	16-20	21-25	26-35	36-45	46-55	56-65	>65	
M	17 68%	59 59%	132 53.2%	403 55.5%	561 58.4%	215 63.4%	166 86.9%	16 69.6%	1569 (60.0%)
F	8 32%	41 41%	116 46.8%	323 44.5%	400 41.6%	124 36.6%	25 13.1%	7 30.4%	1044 (40.0%)
Total	25 (0.9%)	100 (3.8%)	248 (9.5%)	726 (27.8%)	961 (36.8%)	339 (13.0%)	191 (7.3%)	23 (0.9%)	2613 (100.0%)

Note: M - Male; F - Female

TABLE 3 Monthly Income and Occupation

Education Levels	Monthly Income (Yuan)									Total	
	< 100	100 to 200	201 to 300	301 to 400	401 to 500	501 to 600	601 to 750	751 to 900	> 900		No Income
Primary School	1	26	15	10	2	7	0	5	0	2	68 (2.6%)
Middle School	14	218	243	101	17	11	7	7	1	38	657 (25.3%)
High Middle School	14	294	429	128	28	23	5	8	1	28	958 (36.9%)
Bachelor Degree	19	232	344	117	24	22	17	10	0	38	823 (31.7%)
Above Bachelor Degree	0	26	21	22	4	7	1	1	1	0	83 (3.2%)
Others	1	3	2	0	0	1	0	0	0	1	8 (0.3%)
Total	49 (1.9%)	799 (30.8%)	1054 (40.6%)	378 (14.6%)	75 (2.9%)	71 (2.7%)	31 (1.2%)	31 (1.2%)	3 (0.1%)	107 (4.0%)	2597 (100%)

Note: Number of Missing Observations = 6

a bachelor's degree still earned between 100 and 200 Yuan per month. Though some of these users earned a higher income, there were only a few of them, and they were even fewer than those who had only received a primary school education (see Table 3). The less-educated bicyclists who earned higher incomes could be private businessmen. Nevertheless, as indicated in Table 3, the majority of users classified as well educated earned within the expected average income level.

TRAVEL CHARACTERISTICS

Though obviously the dominant trip purpose is working trips, which constituted 85.3 percent of the total, other trip purposes such as shopping and recreation are evident, even with the rather small percentages. Responses from the questionnaire surveys indicated that an overwhelming majority of users interviewed (85.7 percent) used their bicycles at least 6 days per week. Whereas in China people work 6 days per week in both private and public offices, only 20 percent of the respondents stated that they used their bicycles every working day. Another 65.7 percent rode on their bicycles every day. This means that they were riding not only for working purposes but for other purposes as well. Thus, it can be said that generally those who own a bicycle would not easily refrain from riding unless the trip distances proved to be too far or the environmental conditions were not favorable.

To verify the previous statement about the duration of the trip affecting the usage of bicycles, the Shanghai bicyclists were asked about average riding time as well as maximum bearable riding time. Generally speaking, bicycles are more suitable for short trips, and these are commonly practiced in western countries. However, the results of this study indicated that bicycles in Shanghai are used not only for short trips but for long trips as well. Twenty percent of the respondents indicated an average riding time between 16 and 20 min. Other responses on average riding time were nearly uniformly distributed among 5-min intervals, including those who rode their bicycles longer than 45 min, as indicated in Table 4. The range of 1 to 5 min average riding time had the smallest group of users, only 1.4 percent (37 respondents). On the contrary, 347 bicyclists (13.5 percent) spent an average of longer than 45 min riding. The average riding time of all respondents was 25.3 min. If the average riding speed of bicyclists in Shanghai

is 13 km/hr as mentioned in another study (9), they ride their bicycles for about 5.5 km per trip.

Results in Table 4 indicate that males can tolerate longer trips than females. Average riding time for males and females were 26.9 and 22.8 min, respectively. Average trip distances were 5.8 and 4.9 km for males and females, respectively.

The overwhelming majority of bicycle users (91.7 percent) stated that they can bear a maximum riding time longer than 20 min, as indicated in Table 5. Moreover, nearly half (45.4 percent) of the bicyclists surveyed claimed that they could ride a bicycle at least 1 hr. Many females as well as males indicated the same ability and willingness to ride their bicycles for such a long duration. Nevertheless, Chinese males can tolerate longer riding times than females, with the average maximum riding time found to be 46 and 38 min, respectively.

As indicated in Table 6, regular users, defined in this study as those who used their bicycles at least 6 days per week, can tolerate much longer riding times than nonregular users. In fact, nearly 52 percent of the daily users were able to ride at least 1 hr or even longer. Nevertheless, even among the nonregular users, a number could manage to ride for longer durations, though a majority of these users could tolerate only between 20 and 30 min riding time.

REASONS FOR RIDING BICYCLES

In a motorized urban society, even among the developing countries, one may never expect that bicyclists asked about their reasons for riding bicycles will put more emphasis on convenience and reliability rather than the low expenses of this transport mode. In Shanghai, however, more than 80 percent of all bicycle users surveyed used their bicycles because of convenience and reliability. Other reasons, such as "saving money" and "safety aspect," were not the main concerns of Shanghainese bicyclists. Only 59 persons (2.3 percent) indicated that the reason they used bicycles was to save money, even though obviously it costs practically nothing to ride a bicycle. Moreover, only 106 users (4.1 percent) chose safety as a reason.

The convenience and reliability of the bicycle mode were selected as the dominant reasons by both regular and nonregular users. Even among those who seldom used their bicycles, these two reasons were dominant, as indicated in Table 7. These results could reflect the poor public transport services

TABLE 4 Average Riding Time

Average Riding Time	Sex		Total
	Male	Female	
1 - 5 minutes	16 (43.2%)	21 (56.8%)	37 (1.4%)
6 - 10 minutes	121 (55.8%)	96 (44.2%)	217 (8.3%)
11 - 15 minutes	198 (51.8%)	184 (48.2%)	382 (14.7%)
16 - 20 minutes	279 (53.2%)	240 (46.8%)	519 (20.0%)
21 - 25 minutes	208 (61.5%)	130 (38.5%)	338 (13.0%)
26 - 30 minutes	255 (60.4%)	167 (39.6%)	422 (16.2%)
31 - 45 minutes	229 (68.2%)	107 (31.8%)	336 (12.9%)
> 45 minutes	255 (73.5%)	92 (26.5%)	347 (13.5%)
Total	1561 (60%)	1037 (40%)	2598 (100%)

Note: Number of Missing Observations = 15

TABLE 5 Maximum Riding Time

Maximum Riding Time	Sex		Total
	Male	Female	
20 minutes	112 (53.6%)	97 (46.4%)	209 (8.3%)
30 minutes	295 (52.8%)	264 (47.2%)	559 (22.3%)
45 minutes	331 (68.2%)	268 (31.8%)	599 (24.0%)
60 minutes	239 (59.5%)	163 (40.5%)	402 (16.1%)
> 60 minutes	522 (71.3%)	210 (28.7%)	732 (29.3%)
Total	1499 (60%)	1002 (40%)	2501 (100%)

Note: Number of Missing Observations = 112

TABLE 6 Maximum Bearable Riding Time, by Frequency of Usage

Frequency	Maximum Bearable Riding Time					Total
	20 min.	30 min.	45 min.	60 min.	> 60 min.	
Everyday	122 7.4%	286 17.6%	379 23.3%	273 16.8%	568 34.9%	1628 (65.3%)
Working days	33 6.5%	128 25.2%	142 28.0%	90 17.7%	115 22.6%	508 (20.4%)
3 - 4 days	21 10.2%	88 42.7%	44 21.4%	22 10.7%	31 15.0%	206 (8.3%)
1 - 2 days	15 16.8%	33 37.1%	21 23.6%	11 12.4%	9 10.1%	89 (3.5%)
Seldom	18 29.0%	21 33.9%	12 19.3%	5 8.1%	6 9.7%	62 (2.5%)
Total	209 (8.4%)	556 (22.3%)	598 (24.0%)	401 (16.1%)	729 (29.2%)	2493 (100.0%)

Note: Number of Missing Observations = 120

TABLE 7 Reason for Riding, by Frequency of Usage

Frequency	Reason for Riding					Total
	Faster	Convenient	Safer	Save Money	Reliable	
Everyday	149 8.9%	946 56.2%	51 3.0%	30 1.8%	506 30.1%	1682 (66.1%)
Working days	54 10.7%	254 50.4%	26 5.2%	14 2.8%	156 30.9%	504 (19.8%)
3 - 4 days	17 8.2%	91 44.2%	15 7.3%	10 4.9%	73 35.4%	206 (8.1%)
1 - 2 days	6 6.5%	56 60.9%	7 7.6%	4 4.3%	19 20.7%	92 (3.6%)
Seldom	3 4.8%	38 61.3%	7 11.3%	1 1.6%	13 21.0%	62 (2.4%)
Total	229 (9.0%)	1385 (54.4%)	106 (4.2%)	59 (2.3%)	767 (30.1%)	2546 (100.0%)

Note: Number of Missing Observations = 67

being provided. Bicycles require no waiting time or transferring, unlike other public transport, particularly bus services. In many instances, they can offer door-to-door services, which probably cannot be offered by bus services. Thus, it can be concluded that bicycles will remain one of the dominant transport modes in Shanghai unless other public transport services are improved.

OPINIONS ON THE SAFETY ASPECT

Although 106 persons rode on bicycles because of the safety reason, as mentioned in the preceding section, this mode is not totally safe. When asked whether they have ever experienced any accident while riding a bicycle, though nearly 90 percent never experienced an accident, the other 295 (11.6 percent) indicated that they had experienced accidents. According to the *1990 Traffic Accident Yearbook in Shanghai* (10), among the 7,527 accidents that occurred in Shanghai in 1989, 2,393 (31.8 percent) involved bicycles. Furthermore, among the 652 fatalities by traffic accidents in 1989, 250 (38.3 percent) were bicycle victims. Thus, the safety aspect of the bicycle mode cannot be overlooked.

When asked their opinions on the safety aspect of the bicycle mode, 599 persons (23.3 percent) said that riding bicycles in Shanghai was "quite dangerous" (16.9 percent) or "very dangerous" (6.4 percent) (see Table 8). Nevertheless, a considerable number of Shanghaiese bicyclists still have faith in the safety of this transport mode. Nearly two-thirds (64.1 percent) of the respondents claimed that riding bicycles was "not really safe but not dangerous either." Table 8 indicates that of the 434 users who expressed the "quite dangerous" opinion, 83.6 percent (363 persons) were regular users who rode the bicycles at least 6 days per week. In addition, 140 other regular users chose the "very dangerous" category, representing 84.9 percent of the 165 persons who chose that category. It would be understandable if nonregular users expressed fear of riding bicycles due to the safety aspect, but

having the majority of daily users criticizing the safety of this mode deserves attention.

It is interesting to note that residents of Bangkok had more faith in patronizing their boat services (11) than did the Shanghaiese in riding their bicycles. Though it may sound impractical to compare two different modes from two different countries, it is impossible to compare the attitude of other bicycle users in other places even among the Chinese cities. The same five choices regarding the safety of the boats in Bangkok were offered the boat users. One of the psychological factors that may affect the ridership of the water transport mode is the safety aspect of the system. Among the total 1,075 boat users interviewed, the following responses were gathered: "very safe," 38 persons (3.5 percent); "quite safe," 445 persons (41.4 percent); "not that safe but not dangerous either," 456 persons (42.5 percent); "quite dangerous," 99 persons (9.2 percent); and "very dangerous," 13 persons (1.2 percent). The remaining 24 persons did not give any comment. Thus, it can be clearly seen that Thai people expressed more positive feelings toward their boat services, whereas the Shanghaiese expressed rather negative attitude toward their bicycle mode.

OPINIONS ON BUS SERVICES

As discussed earlier, one reason why Shanghaiese prefer to ride their bicycles may be the poor bus services being provided. To verify this finding, users were asked whether they would use bus services under the present conditions. Nearly 90 percent of the users interviewed indicated that they would not use the bus services. Then, those who ignored the bus services were requested to state their reasons. Nearly two-thirds of these commuters expressed unwillingness to use the buses because of poor service. Whereas 890 persons (39.5 percent) were concerned about the unreliable services being provided, 545 people (24.2 percent) complained about the buses being too crowded. It is apparent that bus services in

TABLE 8 Opinion on Safety, by Frequency of Usage

Frequency	Opinion on Safety						Total
	Very Safe	Quite Safe	Not Safe but Not Dangerous Either	Quite Dangerous	Very Dangerous	No Comment	
Everyday	24	86	1143	279	109	47	1688 (65.6%)
Working Days	8	50	327	84	31	15	515 (20.0%)
3-4 days	5	32	105	36	20	14	212 (8.2%)
1-2 days	2	17	47	16	3	7	92 (3.6%)
Seldom	4	5	27	19	2	10	67 (2.6%)
Total	43 (1.7%)	190 (7.4%)	1649 (64.0%)	434 (16.9%)	165 (6.4%)	93 (3.6%)	2574 (100%)

Note: No. of Missing Observations = 39

Shanghai need to be improved and that there is a need to provide efficient and adequate services to ensure the trust of the local commuters.

If the bus services can be improved, they may be able to attract more users. Slightly over half of the total bicycle users interviewed (51.8 percent) indicated that they may shift to the bus system if the services improve (see Table 9). Furthermore, 1,057 regular cyclists may shift to bus services if they are improved. However, 434 regular users are still loyal to the bicycle mode, as indicated in Table 10. Undoubtedly, the majority of nonregular users will shift to bus services, as also indicated in Table 10.

Exclusive bike lanes, similar to the bus lanes being provided for bus transit in many urban areas, are also being provided at certain streets in Shanghai. This study also emphasized the significance of this bicycle facility through the opinion of actual users. The results indicated that 1,914 users (74 percent) strongly agree with the need for more "bike only lanes" in Shanghai. Only 8.6 percent did not appreciate this preferential treatment, whereas 17.4 percent did not express any comment. Thus, to provide an efficient flow of bicycle traffic and to avoid conflict with other vehicular traffic, exclusive bike lanes are strongly recommended. This will not only ensure a smoother flow of traffic but also could help minimize bicycle accidents.

PROPOSED IMPROVEMENTS

When asked to state their preference for improving the bicycle system in Shanghai from the seven attributes given in Table 11, Shanghainese bicyclists expressed more concern about bicycle facilities than about the price of bicycles or other given transport attributes. The two outstanding attributes, as indicated in Table 11, were the provision of more exclusive bike lanes (31.0 percent of respondents) and an increase in parking spaces in the public area (30.3 percent of respondents).

The bicycle users' preference for more exclusive bike lanes along the streets of Shanghai may not be well accepted by a number of researchers, even among the Chinese researchers themselves. Setty pointed out (9) that some Chinese researchers expressed concern either to discourage the use of bicycles or to curb bicycle ownership. The provision of more exclusive bicycle lanes may attract more users, which would contradict these researchers' desires. Nevertheless, considering the alarming rate of bicycle accidents in Shanghai, would it not be worthwhile to consider exclusive bike lanes? This would not only help ensure the safety aspect of bicycles but would also help minimize conflicts with other vehicular traffic, which may lead to the smoother flow of all traffic in Shanghai.

The second preference, an increase in parking spaces, reflected the inadequate bicycle parking spaces in Shanghai.

TABLE 9 Attitude Toward Bus System

	Willingness to Use Bus System Now?*			Willingness to Use Bus System in Future?***			
	Yes	No	Total	Yes	No	Not so sure	Total
Frequency	310	2,294	2,604*	1,320	485	742	2547**
Percentage	11.9%	88.1%	100%	51.8%	19.0%	29.2%	100%

Note: * Number of Missing Observations = 9
** Number of Missing Volume = 66

TABLE 10 Willingness To Use Bus System in the Future, by Frequency of Usage

Frequency	Opinion			Total
	Yes	No	Not so sure	
Everyday	800 48.3%	337 20.3%	520 31.4%	1657 (65.3%)
Working days	257 50.2%	97 18.9%	158 30.9%	512 (20.2%)
3 - 4 days	144 68.6%	29 13.8%	37 17.6%	210 (8.3%)
1 - 2 days	60 65.2%	12 13.1%	20 21.7%	92 (3.6%)
Seldom	53 81.6%	6 9.2%	6 9.2%	65 (2.6%)
Total	1314 (51.8%)	481 (9.0%)	741 (29.2%)	2536 (100.0%)

Note: Number of Missing Observations = 77

TABLE 11 Preference for Improvement of Bicycle Transport in Shanghai

Preference	Frequency	Percentage	Rank
1. Increase number of exclusive lanes for bicycles in the central area.	742	31.0	1
2. Increase number of parking spaces in the public area.	724	30.3	2
3. Improve the safety aspects of the bicycle.	351	14.7	3
4. Reinforce the traffic consciousness of bicycle users to ensure safety and efficient flows of traffic.	274	11.4	4
5. Provide central parking in the residential area.	170	7.1	5
6. Reduce the price of bicycles.	74	3.1	6
7. Control bicycle traffic in the city center.	58	2.4	7
Total	2,393	100.0	

Note: Number of missing observations = 220.

This problem has been mentioned by other researchers (9,12). Shortages of parking spaces are evident in Shanghai. Some bicyclists parked their bikes along the sidewalks, and many parked illegally at different places. It is recommended that the concerned authorities not overlook this problem, because this is not only intruding on the pedestrians but could extend to other vehicular traffic.

The safety aspect, though not ranked first, was mentioned by nearly 15 percent of the users interviewed. A moderate number of cyclists (11.5 percent) expressed the need for bicycle users to be more aware of traffic regulations. A very small percentage (3.1 percent) of total users interviewed wished to reduce the price of the bicycles. Thus, it can be concluded that bicycle users in Shanghai were highly concerned about bicycle facilities and worried about the safety aspect.

CONCLUSION AND RECOMMENDATIONS

Bicycles have been used by people regardless of sex or age. They rode their bicycles as a form of private transport for various purposes, not just for pleasure or recreation, but mainly for work and other essential daily needs. Despite some dangers involved in riding their bikes, the majority of bicyclists still used their bicycles because of convenience and reliability. Bus transit did not receive substantial support from the local commuters. Whereas the only means of attracting more users to the transit system may be to improve its services, bicycles will remain a versatile transport mode in Shanghai.

Much attention has been given to searching for measures to prevent the deterioration in environmental conditions. One

interesting question concerns whether to encourage or to discourage the popular usage of bicycles in Shanghai. The latter can be achieved through the improvement of bus services or by introducing larger capacity in the rail transit system. Whereas many motorized communities have been attempting in vain to discourage the usage of the more polluting and the least energy-saving vehicles, private cars, some encourage their commuters to shift to the pollution-free mode, the bicycle. Is it premature to consider a proposal to discourage the usage of bicycles in Shanghai? Is there any alternative transport mode to cater efficiently to the needs of the commuters? Standard of living, expected earned income, ability to substantiate the higher transit fare, and traditional way of life are related issues. Of course, this study cannot provide the solution to this argument, but it may be appropriate to inquire whether it is time for transportation engineers and planners to seriously consider the theory related to bicycle traffic and design facilities.

The highway capacity manual has been published since 1965 and revisions have been made twice, yet no bicycle capacity manual exists in any motorized or nonmotorized city. When such a manual materializes, it is strongly recommended that, whether practices or standards are put forward, the culture and characteristics of the populace be considered.

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