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Bicycle as a Collector Mode for Commuter Rail Trips

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This study was designed to identify the potential of the bicycle as a collector mode for commuter rail trips and the conditions or circumstances that inhibit or fulfill realization of this potential. The study consisted of the development and distribution of a survey questionnaire to commuter rail passengers at five target stations and an analysis of the survey results. It was discovered that there is considerable potential for the bicycle to serve as a collector mode for commuter rail trips. Of all respondents, 46.6 percent claimed that they would consider commuting from home to rail station by bicycle. This would result in alleviation of parking congestion or freeing of parking spaces, which would permit increased rail ridership. The improvement that apparently would do the most to foster increased use of the bicycle for these trips is the provision of secure bicycle-parking facilities at rail stations. In some situations, this would have to be accompanied by improvements to the roadway system that leads to the station to make it more compatible to bicycles.

In this age of increasing cost and diminishing availability of fuel resources, American society in general and residents of New Jersey in particular must turn to energy-efficient modes when possible, not merely to extend scarce fuel supplies but also to reduce costs to individual consumers of transportation so they can maintain their mobility. The bicycle is potentially well suited to short-distance utilitarian trips such as collector-distributor trips between home and long-distance commuter rail transit. The bicycle is indeed an energy-efficient mode. It has, however, been an underused mode (1). Generally, it has been believed that one of the primary reasons for this underuse has been the lack of facilities, both bicycle-compatible roadways that lead to rail stations and devices at stations to secure bicycles from theft and vandalism.

In New Jersey, the New Jersey Department of Transportation (NJDOT) and New Jersey Transit (NJ Transit) wish to promote the increased use of the bicycle as a collector mode for commuter rail transit trips. In addition to the energy implications of this increased use, other objectives could conceivably be served. These include reduction in parking demand at commuter rail stations, alleviation of congestion, improved air quality (2), and equity considerations (i.e., the provision of rail services to those who for a variety of reasons cannot use other modes to reach the rail stations).

In order to proceed with a rational program of facilities (or other improvements) to foster the increased use of the bicycle, NJDOT and NJ Transit needed to know what conditions or circumstances inhibit use of the bicycle, what changes would best promote increased bicycle use, and what potential exists for increased levels of bicycle use.

METHODOLOGY

This study was designed to satisfy the needs listed above. The study consisted of the development and administration of a questionnaire distributed to rail passengers at selected commuter rail stations in New Jersey and the analysis of questionnaire responses.

The questionnaire was designed to determine the potential use of the bicycle as a collector mode for commuter rail transit stations and to identify those conditions or circumstances that inhibit the full realization of that potential. The questionnaire (Figure 1) was constructed to determine some characteristics of passengers at the target stations that might have a bearing on their predilection to use a bicycle for the trip to that station (questions 1 through 5). Such characteristics included sex, age, distance from station, length of time to station, and current modal choice for the trip to the station.

Additional questions were designed to elicit any tendencies in current modal-choice selection and to ascertain potential bicycle trip makers. Question 10 was designed to elicit the range and relative magnitude of improvements that might foster increased bicycle use. Questions 11 and 12 were designed to determine commuter preferences toward and potential use of various secure bicycle-parking facilities. Previous analysis by NJDOT personnel had indicated that having secure bicycle-parking facilities at rail stations was likely to be a necessary condition to expanded use of the bicycle for trips to commuter rail stations.

A number of criteria were postulated as having some relationship to the level of potential bicycle ridership and the level of potential demand for bicycle-parking facilities at rail stations. These are the following:

1. Condition of roads that lead to stations,
2. Availability of parking or deficiency of parking at the station,
3. Population clusters within 4 to 5 miles from the station,
4. Station ridership,
5. Existing bicycle use, and
6. Proximity to populations that do not use automobiles (e.g., college students).

By applying these criteria loosely and with the assistance of Stephen Hochman, senior planner of NJDOT's Bureau of Environmental Analysis (in charge of environmental work for NJ Transit's Rail Station Improvement Program), the following rail stations were identified as having significant potential for increased bicycle ridership: Metropark, Metuchen,

Figure 1. Survey questionnaire.

The purpose of this questionnaire is to measure the potential of the bicycle to serve as a means of getting passengers to and from rail stations in New Jersey. Please answer the questions and return.

1. Sex: _____ Male _____ Female

2. How old are you? (Check one)
   10 - 20 _____
   20 - 30 _____
   30 - 40 _____
   40 - 50 _____
   50 - 65 _____
   over 65 _____

3. How far do you live from this train station? (Check one)
   0 - 1 mile _____
   1 - 4 miles _____
   4 - 7 miles _____
   7 -10 miles _____
   10+ miles _____

4. How do you usually get to this train station? (Check one)
   walk _____ dropped off by car _____
   bike _____ carpool _____
   bus _____ car - parks in lot _____

5. How long does it usually take you to get to the train station from home? (Check one)
   0 - 5 minutes _____
   5 - 15 minutes _____
   15 - 25 minutes _____

6. If you do not (ever) ride a bike to this train station why not?
   _____ convenient, affordable alternatives are available
   _____ unsafe roads leading to station
   _____ motorists don't respect bicyclists' rights
   _____ lack of secure bicycle parking at the station
   _____ other (identify)

7. Would you ever (even part-time) consider commuting from home to this station by bicycle? yes _____
   no _____

8. If not, why not?
   _____ convenient, affordable alternatives are available
   _____ unsafe roads leading to station
   _____ motorists don't respect bicyclists' rights
   _____ lack of secure bicycle parking at the station
   _____ other (identify)

9. Can you foresee any circumstances which would encourage you to consider riding a bike to the station? _____ no
   _____ yes (identify)

10. What one improvement might encourage you most to ride your bike to the train station? (Check one)
    _____ improved roads (more bicycle compatible) leading to the station
    _____ secure bike storage facilities at the station
    _____ education of motorists to the rights of bicyclists
    _____ other (identify)
    _____ none

11. What, in your opinion, are secure bike parking facilities?
    _____ designated space for bicycles
    _____ bike racks
    _____ bike lockers
    _____ other (identify)

12. Would you be willing to pay a nominal fee to reserve a bike locker for your use at this station? _____ yes _____ no

Princeton Junction, West Trenton, Cranford, Montclair, Ramsey, Ridgewood, Westwood, Summit, Red Bank, Matawan, Long Branch, Westfield, South Orange, Short Hills, Oradell, Radburn, Glenrock, Convent, Madison, Morristown, and Bound Brook.

SURVEY SITES

Based on the preliminary analysis cited above, five target stations were selected for the dissemination of the survey questionnaire. These were Princeton Junction, Morristown, Red Bank, Westfield, and Metropark.

A description of the stations selected for the survey, including physical and ridership characteristics, is given in the following paragraphs.

Princeton Junction

Princeton Junction is located in Mercer County and is served by the Northeast Corridor Line, which has a ridership here of 1570 passengers daily (3). Existing parking for 1071 automobiles in three separate parking lots is fully used on both sides of the track. There is overflow parking on undeveloped lots and on surrounding access roads. Land is available for parking expansion but it would have to be acquired. A fee is charged for parking in two of the lots, and a monthly permit (acquired by fee) is required to park in the third lot. There is no dense residential development immediately adjacent to the station. This station was selected primarily because of its relatively high ridership and high parking deficiency.

Morristown

Morristown, New Jersey, is in Morris County (4). The station facility is located two blocks from "the green," which is the centroid of the central business district (CBD) in Morristown. The Morristown Line has a ridership of 1428 passengers daily from Morristown. There are 256 parking spaces located in four small lots on either side of the tracks for which a fee is charged or permit (acquired by fee) is required. Space for the expansion of parking facilities is essentially nonexistent. This station was selected because of its extreme parking deficiency, large number of daily patrons, and accessibility to dense residential and commercial areas. In addition, it was noted that there is limited opportunity to expand ridership by expansion of automobile parking facilities.

Red Bank

Located in Monmouth County, Red Bank is served by the North Jersey Coast Line, which has a ridership here of 1467 passengers daily (5). There are 711 existing parking spaces in five small lots scattered about the station site, and parking for the trains has scattered beyond the immediate area of the station to residential side streets. Land owned by the Central New Jersey Railroad is available for parking expansion. The station is located in an area of light industry and commerce and the Red Bank CBD is located to the northeast. There are numerous residential areas in the general vicinity of the station on the periphery of the commercial areas. The station was selected because of the relatively high ridership, parking deficiency, and its proximity to residential areas within a relatively short distance from the station.

Westfield

Westfield, New Jersey, is located in Union County on the Raritan Valley Line; the ridership from here is 1989 passengers daily (6). There are 543 parking spaces in three lots immediately adjacent to the station buildings. A fee is charged for parking. Potential for increasing the number of spaces is limited due to existing development. The station complex is one of the focal points of the town of Westfield. It is located within the CBD and is surrounded by commercial enterprises and numerous residential areas in peripheral locations not far from the station. This station was selected because of its high ridership, parking deficiencies, limited opportunity to increase automobile parking, and the proximity of residential areas to the station.

Metropark

Metropark is in Iselin, Middlesex County, on the Northeast Corridor Line, which carries a ridership of 2089 passengers daily from this station. There are 1300 free parking spaces for cars. The park-and-ride lot is currently operating at 110 percent of capacity, and there are numerous illegally parked cars in every conceivable space in the lot. Parking spills onto adjacent roads. Opportunities to expand parking significantly are limited. The station is surrounded by an office complex and one small and one moderately sized low-density residential area. Access to the station from the moderately sized residential area is somewhat circuitous. This station was selected primarily because of its high ridership and parking deficiency.

DISTRIBUTION PROCEDURE

One hundred questionnaires were distributed at each of the selected stations. The questionnaires were distributed on a weekday between 7:00 and 9:00 a.m. The distribution procedure was as follows.

Approximately 10-15 min prior to the arrival of the train, as passengers began to congregate on the platform or in the vicinity of the station in anticipation of the train's arrival, the individual distributing the questionnaire stood at one end of the platform. Approximately 5-10 min prior to the scheduled arrival of the train, the distributor would pass along the station platform. As individuals or small groups were approached, they were offered a questionnaire. This offer was accompanied by an explanatory statement that the individual distributing the questionnaire was carrying out a survey for NJDOT/NJ Transit on the use of this station and a request that the commuter please fill out the questionnaire and drop it in the mailbox. (It was immediately mentioned that the questionnaire was preaddressed and prestamped.) No additional statements were made to convince or coerce commuters to take or fill out the questionnaire. Acceptance of the questionnaire was therefore essentially a voluntary act, and those who accepted the folded questionnaire had no knowledge that the questionnaire dealt primarily with bicycle transportation to and from commuter rail stations.

If any resistance to taking the questionnaire was encountered for any reason whatsoever, the distributor withdrew the questionnaire and moved on to the next commuter. An estimated 98 percent of those offered the questionnaire accepted it.

No attempt was made to screen out individuals or to select individuals to whom questionnaires were presented. In fact, great care was taken to avoid any conscious selection. Once the distributor had presented one questionnaire, he or she moved on to the next available person on the platform. This procedure was followed to eliminate (as much as possible under the circumstances) a sampling bias, e.g., in which those who appeared unlikely to be bicycle riders or potential bicycle riders due to apparent age or physical condition were passed over and questionnaires were distributed only to those who appeared to be potential bicycle riders.

As the train pulled into the station area and passengers began to move toward the cars, distribution of the questionnaire ceased. For the next train, the distributor would begin to pass along the platform from the opposite end.

By following this procedure, the distributor could hand out approximately 20 questionnaires prior to the arrival of each train. It therefore took four to six train arrivals to complete the distribution of 100 questionnaires.

Since the rail lines on which these stations exist serve primarily patrons whose workplace is in the North Jersey/New York City area, the overwhelming majority of questionnaires was distributed to eastbound commuters. Less than five questionnaires were distributed at each station to westbound passengers.

Questionnaires were distributed on the following dates:

Station	Date
Princeton Junction	May 5, 1980
Morristown	May 7, 1980
Red Bank	May 12, 1980
Westfield	May 14, 1980
Metropark	May 15, 1980

Questionnaires received in the mail within two weeks of the distribution date were included in the survey tally. Those (relatively few) received after this length of time were not included. The vast majority

Table 1. Questionnaire return rate and percentage of ridership surveyed.

Station	Questionnaires Distributed			Ridership		
	Total	No. Returned Within Two Weeks	Percentage of Total	Total	Percentage Surveyed	Percentage Responding
Princeton Junction	100	43	43	1570	6.4	2.7
Morristown	100	44	44	1428	7.0	3.1
Red Bank	100	38	38	1467	6.8	2.5
Westfield	100	57	57	1989	5.0	2.9
Metropark	100	41	41	2089	4.8	2.0
Total	500	223	44.6	8543	5.9	2.6

of returns occurred within three days of distribution.

SURVEY RESULTS

For each station surveyed, the rate of return of the 100 questionnaires and the percentage of ridership surveyed are presented in Table 1.

Table 2 presents the responses to the survey questionnaire by station as a percentage of the sample and the totals. Some percentages may not add up to 100 due to the failure of some respondents to answer all questions; some may add up to more than 100 percent due to multiple selections by some respondents. The responses to questions 7, 9, and 12 extrapolated to the total ridership for each station are given in Table 3. [Specific answers to questions 6, 8, 9, 10, and 11 are available from the author.]

DISCUSSION OF QUESTIONS

Questions 1 and 2 (Sex and Age)

Characteristics by sex and age vary little by station. Analysis of responses by age and sex characteristics was not attempted in this study.

Question 3 (Distance from Station)

It is generally conceded that utilitarian trips by bicycle are quite feasible up to a range of 4 miles. Although some recent surveys indicate that this range is increasing, it is assumed that for this study the distance limit for bicycling trips to rail stations (as only one part of a combined bicycle-train-walk commute) would be 4 miles. This question therefore identifies essentially the upper limit of potential bicycle trip makers in terms of a distance constraint. The proportion of respondents who claim to live within 4 miles of the station represents for all practical purposes the pool of potential bicycle trip makers to the rail station.

This figure varies considerably from station to station (from 34.9 percent at Princeton Junction to 96.5 percent at Westfield); the sample mean is 68.6 percent. This indicates that the effective upper limit of potential bicycle trip makers to rail stations would vary considerably by station and is due to factors or conditions particular to each station.

Question 4 (Mode to Station)

For all stations except Westfield, the majority of commuters arrived at the station by an automobile that was parked in the station lot. If one postulates that reduction in parking demand and fewer vehicle miles of travel (VMT) are goals to be achieved, it is this pool of commuters from which it is desirable to draw and shift to other modes such as the bicycle for trips to the rail station. Table 4 presents the number of car drivers by station who answered affirmatively to questions 7 and 12; i.e., they claimed that they would consider commuting from home to the station by bicycle and that they would be willing to pay a nominal fee to reserve a bicycle locker. This indicates a considerable potential for alleviating parking deficiency, freeing parking spaces for additional transit patronage, or reducing demand for costly additional parking spaces.

As with question 3, the responses to this question indicate that the particular mode-arrival characteristics of the station are an important consideration in the potential of the bicycle to serve as a collector mode and to serve in a socially useful fashion, i.e., by reducing parking congestion and VMT by substituting for trips made by automobile.

Question 5 (Time to Station)

Responses to question 5 show pronounced variability by station; however, responses to this question were not analyzed or considered in this study.

Question 6 (Reason for Not Riding Bicycle to Station)

The most common reason given by those who never ride a bicycle to the train station was the availability of convenient affordable alternatives. This was closely followed by the lack of secure bicycle parking at the station. Again, the rank order of reasons varied considerably by station. At two stations, Princeton Junction and Metropark, unsafe roads that led to the station were the prime impediment to bicycle use.

Question 7 (Willing to Consider Bicycle for Trip to Station)

A total of 46.6 percent of all respondents claimed that they would consider commuting from home to the station by bicycle. This ranged from 36.6 percent at Metropark to 64.9 percent at Westfield. Coupled with the responses to question 3, an estimate can be derived of potential bicycle users who claim they would consider commuting to the station by bicycle and who live within the critical distance. This is shown in Table 5. This derived figure represents an estimate of the maximum number of commuters who would conceivably make some trips to the station by bicycle if given essentially perfect bicycling conditions.

Question 8 (Reasons Not to Bicycle)

The responses to this quetion essentially mirror the responses to question 6. Those who assert that they would never consider riding to the station by bicycle do so in roughly the same proportion and for the same reasons as do those individuals who do not currently ride.

Table 2. Survey results.

Question	Princeton Junction (N = 43)		Morristown (N = 44)		Red Bank (N = 38)		Westfield (N = 57)		Metropark (N = 41)		Total (N = 223)	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
1. Sex												
Male	34	79.1	31	70.0	30	78.9	48	84.2	30	73.2	173	77.6
Female	9	20.9	13	30.0	8	21.1	9	15.8	11	26.8	50	22.4
2. Age												
10-20	0	0	5	11.4	0	0	0	0	0	0	5	2.2
20-30	14	32.5	9	20.5	9	23.7	19	33.3	18	43.9	69	30.9
30-40	20	46.5	17	38.6	12	31.6	19	33.3	15	36.6	83	37.2
40-50	6	14.0	8	18.2	7	18.4	13	22.8	6	14.6	40	17.9
50-65	3	6.9	4	9.1	10	26.3	6	10.5	2	4.8	25	11.2
65+	0	0	0	0	0	0	0	0	0	0	0	0
3. Distance from station (miles)												
0-1	4	9.3	9	20.5	6	15.7	23	40.4	3	7.3	45	20.2
1-4	11	25.6	21	47.7	20	52.6	32	56.1	24	58.5	108	48.4
4-7	16	37.2	9	20.5	10	26.3	2	3.5	5	12.2	42	18.8
7-10	8	18.6	3	6.8	1	2.6	0	0	0	0	12	5.4
10+	4	9.3	2	4.5	0	0	0	0	9	22.0	15	6.7
4. Current modal choice												
Walking	2	4.7	10	22.7	4	10.5	22	38.6	3	7.3	41	18.4
Bicycle	1	2.3	0	0	0	0	5	8.8	0	0	6	2.7
Bus	1	2.3	1	2.3	3	7.9	0	0	2	4.8	7	3.1
Car driven by other	13	30.2	10	22.7	4	10.5	12	21.0	6	14.6	45	20.2
Carpool	2	4.7	0	0	0	0	0	0	3	7.3	5	2.2
Own car	26	60.5	22	50.0	26	68.4	19	33.3	27	65.9	120	53.8
5. Length of time to station (min)												
0-5	6	14.0	5	11.4	12	31.6	21	36.8	4	9.8	48	21.5
5-15	25	58.1	30	68.2	26	68.4	29	50.9	24	58.5	134	60.1
15-25	10	23.3	8	18.2	0	0	7	12.3	13	31.7	38	17.0
6. Reason for not riding bicycle to station												
Convenient alternatives	11	25.6	12	27.2	16	42.1	25	43.9	14	34.1	78	35.0
Unsafe roads	15	34.9	12	27.2	6	15.8	5	8.8	17	41.5	55	24.7
Disrespect by motorists	4	9.3	2	4.5	6	15.8	4	7.0	10	24.4	26	11.7
Lack of secure bicycle parking	11	25.6	21	47.7	12	31.5	15	26.3	15	36.6	74	33.2
Other	21	48.8	20	45.4	13	34.2	12	21.1	16	39.0	82	36.8
7. Willing to consider bicycle for trip to station												
Yes	16	37.2	20	45.4	18	47.3	37	64.9	15	36.6	106	47.5
No	26	60.5	21	47.7	20	52.6	17	29.8	25	60.1	109	48.9
8. Reasons												
Convenient alternatives	6	14.0	8	18.2	9	23.7	10	17.5	7	17.1	40	17.9
Unsafe roads	10	23.3	6	13.6	3	7.9	2	3.5	8	19.5	29	13.0
Disrespect by motorists	4	9.3	1	2.3	3	7.9	1	1.8	7	17.1	16	7.2
Lack of secure bicycle parking	3	6.9	8	18.2	4	10.5	7	12.3	7	17.1	29	13.0
Other	17	39.5	10	22.2	8	21.1	7	12.3	15	36.6	57	25.6
9. Availability of encouraging factor to use bicycle												
No	20	46.5	18	40.9	20	52.6	21	36.8	21	51.2	100	44.8
Yes	15	34.9	21	47.7	17	44.7	30	52.6	20	48.8	103	46.2
10. Improvement to encourage use of bicycle												
Improved roads	11	25.6	9	20.1	7	18.4	7	12.3	14	34.1	48	21.5
Secure bicycle parking	13	30.2	22	50.0	18	47.2	30	52.6	12	29.3	91	40.8
Education of motorists	3	6.9	1	2.3	3	7.9	3	5.3	3	7.3	13	5.8
Other	0	0	0	0	1	2.6	2	3.5	3	7.3	6	2.7
None	17	39.5	13	29.5	10	26.3	17	29.8	13	31.7	70	31.4
11. Opinion of secure bicycle parking												
Designated space	9	20.9	5	11.4	7	18.4	6	10.5	8	19.5	35	15.7
Bicycle rack	19	44.2	18	40.9	13	34.2	25	43.9	15	36.6	90	40.4
Bicycle locker	15	34.9	24	54.5	21	55.3	24	42.1	21	51.2	105	47.1
Other	2	4.7	4	9.1	3	7.9	9	15.8	5	12.2	23	10.3
12. Willing to pay for bicycle locker												
Yes	19	44.2	22	50.0	20	52.6	20	35.1	14	34.1	95	42.6
No	20	46.5	17	38.6	15	39.5	34	59.6	26	63.4	110	49.3

Note: Total ridership was as follows: Princeton Junction, 1570; Morristown, 1428; Red Bank, 1467, Westfield, 1989; Metropark, 2089; total, 8543.

Table 3. Responses to questions 7, 9, and 12 extrapolated to ridership.

Item	Princeton Junction (R = 1570)	Morristown (R = 1428)	Red Bank (R = 1467)	Westfield (R = 1989)	Metropark (R = 2089)	Total (R = 8543)
Question 7						
Yes	584	648	695	1291	764	4058
No	949	681	772	593	1274	4176
Question 9						
No	730	584	772	733	1070	3831
Yes	548	681	656	1047	1019	3945
Question 12						
Yes	693	714	772	698	713	3639
No	730	552	579	1186	1324	4214

Note: R = total ridership for each station.

Table 4. Potential of automobile drivers to transfer to bicycle.

Station	N	No. Car Drivers	Affirmative Response to: Question 7 (consider bicycling)	Question 12 (pay locker fee)
Princeton Junction	43	26	7	10
Morristown	44	22	8	10
Red Bank	38	26	11	12
Westfield	57	19	12	9
Metropark	41	27	11	10
Total	223	120	49	51

Table 5. Pool of potential bicycle riders.

Station	N	Affirmative Response to Question 7: No.	No. Within 4 Miles	Percentage of Sample	Extrapolated Total
Princeton Junction	43	16	9	20.9	328
Morristown	44	20	18	40.9	584
Red Bank	38	18	13	34.2	501
Westfield	57	37	36	63.2	1256
Metropark	41	15	13	31.7	662
Total	223	106	89	39.9	3409

Question 9 (Encouraging Factor to Use Bicycle)

Roughly one-half (46.2 percent) of all respondents claimed that certain circumstances might encourage them to ride a bicycle to the train station as part of their commute. Again, this figure varied considerably by station, ranging from 36.6 percent at Metropark to 64.9 percent at Westfield. The factors most commonly mentioned are lack of fuel availability, increased fuel costs, and improvement of one or more aspects of the bicycling environment.

Question 10 (Improvement to Encourage Use of Bicycle)

Provision of secure bicycle-storage facilities at the station was mentioned overwhelmingly as the one improvement that might encourage bicycle trips to the train. In the overall sample and at all stations except Metropark, improvement of roads leading to the station (i.e., making them more bicycle-compatible) was a distant second. Relatively few respondents identified any other improvements, physical or otherwise, that might encourage them to ride bicycles.

Question 11 (Opinion of Secure Bicycle Parking)

Bicycle lockers and racks were mentioned with roughly equal frequency as providing suitable security while bicycles are parked at the station, and they were the overwhelming choice of respondents. Designated spaces for bicycles was a distant third. Provision of a security guard was another method mentioned specifically by respondents almost as frequently as the designated spaces.

Question 12 (Willing to Pay for Bicycle Locker)

A total of 42.6 percent of all respondents claimed that they would be willing to pay a nominal fee (amount not specified) to reserve a bicycle locker for their use at the station. There was reasonable consistency in this response. The low figure for Metropark may be explained by the fact that automobile parking is currently free at this station and commuters are reluctant to agree to pay a fee for bicycle parking when they do not now pay for automobile parking.

CONCLUSIONS AND RECOMMENDATIONS

Based on the analysis of questionnaire responses, there appears to be considerable potential for increased use of the bicycle to serve as a collector mode for commuter rail trips. Of the total respondents, 47.5 percent claimed that they would consider at least part-time commuting to rail stations by bicycle; 39.9 percent of the respondents who live within 4 miles of the station said that they would use the bicycle at least part-time. Extrapolating this percentage yields a pool of 3409 potential bicycle-using commuters at the five target stations. Even if only one-tenth of this pool used their bicycles part-time, this would represent an astounding increase over the number of passengers who now use bicycles to get to the station.

Of the 223 respondents, 120 now arrive by automobile and park at the station. Of these passengers, 40.8 percent claimed that they would consider at least part-time use of the bicycle. This indicates that fostering increased use of the bicycle might have a considerable impact on the socially desirable objectives of reducing VMT and alleviating parking congestion (or freeing parking spaces and permitting increased ridership) at the various commuter rail stations.

Roughly one-half (44.8 percent of all respondents) claimed that they could foresee circumstances that would encourage them to ride a bicycle to the station. The most commonly mentioned reasons were the increase in gasoline prices or lack of availability of fuel. In addition, the provision of improved facilities (secure parking and improved roads to stations) or provision of multiple improvements was frequently mentioned.

These tendencies hold true for all stations, although there is a considerable variability in degree at individual stations due to local conditions.

Of those (roughly one-half) respondents who stated that they would never consider riding to the station by bicycle, a plurality claimed that the reason was convenient affordable alternatives. Unsuitable roads leading to the station and lack of secure parking each garnered 13 percent of the responses. Of the other reasons specified by respondents, the most commonly mentioned was distance to the station. Surprisingly, relatively few respondents (7.2 percent) claimed that failure of motorists to respect bicyclists' rights was a consideration in their refusal to use the bicycle. These responses essentially mirror the reasons given by those who do not currently ride a bicycle to the station.

The one improvement mentioned most frequently (by 40.8 percent of the respondents) that might encourage passengers to bicycle to the station was the provision of secure bicycle-storage facilities at the station. Provision of improved roads (i.e., bicycle-compatible) leading to the station was mentioned next most frequently (21.5 percent). At the Metropark station, however, improved roads were mentioned most frequently, which suggests that the specific conditions at each station should be investigated prior to the implementation of any plan to foster increased bicycle use. Secure bicycle parking may be a necessary but not sufficient improvement to foster such increased use at some locations. No other improvements (not even education of motorists about the rights of bicyclists) were mentioned with significant frequency.

Bicycle lockers were mentioned most frequently (by 47.1 percent of the respondents) as the facility that constituted secure bicycle parking. Bicycle racks followed closely (mentioned by 40.4 percent of the respondents). At two stations--Westfield and Princeton Junction--bicycle racks were mentioned most frequently. Surprisingly, a designated space for bicycles (a relatively insecure facility) was mentioned by 15.7 percent of the respondents. Essentially all those (10.3 percent) who specified other facilities mentioned security guards. The variability of response by station suggests that the security problem varies (or at least the perception of it varies) by locality. This may be due to several factors, such as the existence of security personnel, the level of pedestrian traffic in the vicinity of the station, the accessibility of the station to noncommuters, the history of or perception of vandalism at the station, etc. This suggests, in turn, that varying mixtures of bicycle-parking facilities might suffice at varying locations.

Bicycle lockers provide the high level of security required by the plurality of potential bicycle users. Racks do not provide the same antitheft and antivandalism characteristics that an enclosed locker does. At stations in which space and the existence of full-time personnel permits, a check-a-bicycle system could provide secure parking. For the occasional bicycle rider or for short-term (not all-day) storage, bicycle racks should suffice.

Of the total respondents, 42.6 percent claimed that they would be willing to pay a nominal fee (amount not specified) to reserve a bicycle locker for their use at the train station. If this is extrapolated to total ridership, it yields a total of 3639 passengers at the five target stations. Again, if even one-tenth of these passengers actually followed through on their claim, this would represent a considerable demand for installing bicycle lockers.

It is concluded that the most likely and most cost-effective method of realizing the potential use of the bicycle as a commuter rail collector mode is through the provision of secure bicycle-parking facilities at commuter rail stations. If purchased in quantity, two-bicycle locker units cost approximately $500 each. Two hundred such units, which provide parking for 400 bicycles, plus racks that accommodate an equal number of bicycles could be purchased and installed for roughly the same cost as that for constructing approximately 1.5 miles of class 1 bikeway and at considerably less cost than that for a typical intersection improvement (intersection modification plus signalization). A minimum of 10 bicycles can be accommodated in the space needed for one car. Providing additional parking costs a minimum of $1200 per space (often more). Thus, provision of five two-bicycle units at $2500 in a parking-deficient situation may save at least part of the cost of providing nine additional spaces (minimum cost $10 800) or it will free parking spaces to permit more commuters to use the station.

Where lockers are installed, they should be rented on a moderate-term to long-term basis, for example, in 3-month increments. Regular bicycle commuters must be assured that a locker will be available for their use. The fee should not exceed the actual cost of the administration of the rental procedure. In fact, it might not be unreasonable to defray or subsidize the rental cost in light of the socially desirable benefits that are likely to accrue.

It is recommended that prior to the installation of lockers at each station, a preinstallation survey be carried out. Such a survey would help determine an appropriate fee structure. Passengers who express interest in renting a locker could be required to pay a preinstallation deposit to ensure use of the lockers. The deposit would be credited against the rental fee once the locker was installed and in service.

The bicycle-locker installation program should be carried out in concert with an effort to improve the bicycle suitability of roadways leading to those rail stations at which the unsuitability of such roads has been identified as a significant impediment to bicycle use (such as Metropark). Discovery of such conditions as well as the determination of the level of potential bicycle use, demand for secure bicycle parking, or other facilities and programs to achieve the potential bicycle use identified could be accomplished by the administration of a survey questionnaire similar to that used in this study. This procedure could be supplemented by coordination with local transportation planners and bicycle-interest groups.

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