

PROBLEMS IN INTEGRATING BICYCLE TRAVEL INTO THE URBAN TRANSPORTATION PLANNING PROCESS

Susan Hanson and Perry Hanson, State University of New York at Buffalo

With bicycle sales increasing rapidly and with attitudes that regard the bicycle as a toy declining, bicycle travel must be integrated into the urban transportation planning process. The bicycle is being recognized more and more as a viable means of urban transportation, but rational planning for the bicycle requires detailed information concerning the nature of intraurban bicycle travel, information that currently does not exist for U. S. cities. This paper uses detailed travel data gathered recently in Sweden to demonstrate that bicycle travel closely resembles motor vehicle travel. The data show that, when bicycle ownership is high and when planners treat the bicycle as a viable means of transportation, the bike is used extensively in daily travel for a variety of trip purposes. In planning for bicycle facilities in U. S. cities, transportation planners must recognize that viewing the bicycle primarily as a recreational vehicle will not meet the needs of most cyclists. The bicycle must be integrated into the urban transportation planning process like any other urban transportation mode.

•MUCH has been said about America's love affair with the automobile, but evidence indicates that the car will soon have a new rival to contend with as Americans rediscover the bicycle. In 1973 bicycles outsold cars in this country for the first time since reliance on the automobile became a way of life; furthermore, most of those bikes were sold to adults (9). Both urban residents and transportation planners are recognizing the bicycle as a potentially viable means of urban transportation. The purpose of this paper is to review the potential of the bicycle as a means of transportation and, by using detailed travel data from a medium-sized Swedish city, to demonstrate how the bicycle is used in comparison with other modes of transportation and why the bicycle should be viewed as an integral part of any urban transportation system.

THE NEED FOR RATIONAL BIKEWAY PLANNING

The list of advantages to be gained by using the bicycle in urban transportation is impressive. Besides benefits to the health of the bicyclist, the urban transportation system itself stands to gain from increased use of the bicycle. Reduced levels of air and noise pollution, fewer serious traffic accidents, lower levels of fuel consumption, less urban space consumed by parked vehicles, and lower levels of traffic congestion are some of the advantages that substitution of bicycle trips for motor vehicle trips would bring to urban areas.

In addition, the bicycle offers a cheap and efficient means of transportation for those who are either too young, too old, or too poor to own or operate a car. Currently this carless portion of the population has little choice in matters of transportation, and for this reason the transportation disadvantaged have been referred to as captive public transit riders (2). If they do not use public transportation, they must either walk or rely on the use of a friend's, neighbor's, or relative's car. Therefore, another factor (13) in support of safe bicycling facilities is the increased freedom of choice that it affords many urban residents in matters of transportation.

However, transportation facilities in most urban areas today do not encourage use of the bicycle; in fact riding a bicycle in motor traffic is usually so hazardous that it

discourages anyone from frequent bicycle use, let alone from substituting bicycle trips for automobile trips. As many have already recognized (1, 4, 11, 18), if the bicycle is to become a viable, safe, and frequently used means of transportation, proper facilities must be provided. This means primarily constructing separate bicycle paths or delimiting bicycle lanes on existing streets to separate bicycles from motor traffic. In addition, a number of secondary support facilities, such as showers in places of employment and secure parking places at destinations, are necessary to encourage increased bicycle use. The critical point is that the number of bicycles on the road is growing so rapidly that the number of accidents involving bicycles and motor vehicles will continue to skyrocket unless appropriate steps are taken to provide bikeways that are separate from motorized traffic. For safety, environmental quality, and increased options for the carless, therefore, transportation planners can no longer afford to ignore the bicycle.

If it is accepted that providing bicycle facilities in U. S. cities is a necessity or perhaps even an inevitability, then attention must be paid to the careful planning of bikeways and to the integration of bikeways into the urban transportation system. Although constructing facilities will not be so costly as providing highways for automobiles, the cost of building a comprehensive bikeway system for one city can amount to many millions of dollars (1). This means that in most cases provision of bicycle facilities will need to be analyzed within a cost-benefit framework so that facilities are installed where the demand is greatest. It will be necessary, therefore, to assess variations in the level of demand for bicycle transportation throughout the city.

The alternatives to trying to predict bicycle demand so as to allocate resources efficiently are either to do nothing, which is unacceptable, or to provide a comprehensive system of bicycle paths throughout the urban area, which may be, for reasons of cost, impossible. Any scheme that provides bicycle paths on a selective basis must, if it is to be rational, forecast demand so that bike facilities are located where they will be most heavily used. Citizens and city officials who have begun to plan for bikeways recognize the necessity of predicting levels of demand and the difficulty in doing so (3, 4, 5, 7, 12).

LACK OF ADEQUATE DATA ON BICYCLE TRAVEL

Bicycle demand is currently very difficult if not impossible to predict because so little is known about the nature of bicycle travel, especially how bicycle trips compare with those made on other modes of transportation (4, 11, 14, 16). This lack of knowledge about bicycle travel reflects the dearth of appropriate data sources in this country. Urban transportation studies (8) have consistently overlooked nonmotorized transportation, and so it is not surprising that the needs of the pedestrian and the cyclist remain poorly understood.

To overcome the lack of information on bicycle travel in this country, a number of surveys have been undertaken. Some have identified potential bicycle trip generation or destination areas (6, 7, 20), some have studied levels and types of bicycle use (6, 7, 16, 17, 20) or have identified the characteristics of bicycle users (6, 17, 19), but none of the data collected contains detailed and comprehensive information on bicycle travel, and only one study permits comparison of bicycle trips and trips made by other modes of urban transportation. The one study that does compare bicycle use with other modes (16) deals only with commuting; information on bicycle trips for other purposes was not collected.

Major drawbacks to the data gathered in these studies relate to the sampling procedures, the method of data collection, and the scope of the studies. The sampling procedures used do not permit inferences to be drawn to the general population because the respondents either are selected nonrandomly (4, 7, 20, 16) or are taken from a particular segment of the population such as those with registered bicycles or members of bicycle clubs (4, 6, 17). The method of data collection also presents a problem because (a) the questionnaires were mailed and (b) respondents were asked to

recall in general terms how often they used their bicycles for each of a small number of trip purposes such as shopping or going to work. The problems associated with data gathered in this way have been documented, and ways of circumventing the problems have been outlined (10). The most critical problem with the data obtained in these studies, however, is that the information pertains only to bicycle use and does not permit evaluation of the role of the bicycle in the total intraurban travel of the household. There is no way to view bicycle use in perspective or to compare bicycle trips with trips made by other modes. Because no suitable U. S. data source was found, this study uses data gathered recently in Sweden to investigate questions regarding the place of the bicycle in urban transportation.

UPPSALA HOUSEHOLD TRAVEL SURVEY

The best data currently available for assessing the use of the bicycle in urban transportation were collected in the Uppsala, Sweden, household travel survey. In spring 1971 a unique, disaggregate, longitudinal data set was collected in Uppsala, a medium-sized city with a population of 120,000 located about 50 miles (80 km) northwest of Stockholm. Marble, Hanson, and Hanson (15) give a detailed description of the survey design and procedures. The survey collected detailed data on the intraurban travel behavior of a panel of about 300 sample households selected randomly from six predefined life-cycle groups.

A self-administered travel diary was kept by every household member older than 16. For 5 consecutive weeks, members of the panel recorded the details of all trips made outside the residence. A trip is defined as a series of movements that begin and terminate at the home. One or more locations may be visited in the course of the journey, and these interruptions on the trip are referred to as stops. For each stop on each trip, the panel members recorded the times of arrival at and the departure from the stop, detailed information on the reason for making the stop, amount of expenditure (if any) made at that stop, and the mode of transportation used on that leg of the journey. The following seven modes were explicitly recognized: walk, bus, bike, car driver, car passenger, taxi, and motor scooter. An eighth category, designated other, was used for all other modes including motorcycle, horse, and even elevator.

When the study was undertaken, Uppsala had no special provisions for bicycle transportation although about 70 percent of the households owned one or more adult bicycles, and the bicycle was considered a means of transportation rather than a toy. Therefore, these data should be of particular interest to planners in this country because they show how the bicycle can be used in urban transportation when bicycle ownership is relatively high but when the bikeways and attendant facilities are lacking, as is the case in most U. S. cities. The Swedish data, therefore, give some idea of what the situation could be like in the United States shortly if bicycle ownership among adults continues to rise and no special bicycle facilities are installed.

EXTENT OF BICYCLE USE

The first question to be addressed in analysis of the travel data deals with the extent of bicycle use in comparison with other modes. That is, How often is the bicycle used, and how does bicycle use vary with stages in the life cycle? The data show that, although as in the United States the car is frequently used, walking, biking, and riding the bus are important modes. Bicycle movements accounted for 11.6 percent of the total number of movements made by the 296 households during the 5-week recording period. Because the study was conducted in early spring (March 31 to May 6), this figure represents serious bicyclists who are not deterred by cold and often wintry weather.

Bicycle use appears to remain fairly stable throughout the various stages in the life cycle until retirement, when, as might be expected, bicycle use is less frequent.

The elderly are also the only group who do not use a bicycle more often than the bus. The predominance of the bike over the bus was unexpected inasmuch as bus system operation in Uppsala at the time of the survey was efficient and extensive. The remainder of the analysis examines the nature of bicycle use for the sample as a whole.

CHARACTERISTICS OF BICYCLE USE

To estimate the nature of the demand for bicycle transportation requires that a number of bicycle travel characteristics be examined. Among those considered here are the distribution of bicycle trips throughout the week, the trip purposes accomplished by bicycle, the length of bike trips, and patterns of expenditure on bicycle trips.

When the distribution of bicycle movements throughout the week is examined in comparison with other modes, it is clear that the bicycle is used primarily on weekdays. Only a small proportion of bicycle movements are made on the weekend: 6.5 percent on Saturday and only 4.2 percent on Sunday. Although the overall level of travel activity declines on the weekend and especially on Sunday, the weekend proportions of movements on other modes are not so low as they are for the bicycle. This temporal pattern of movement frequencies suggests that the bicycle in particular might be closely associated with the journey to work. Also, the fact that bicycle use does not increase during the leisure time provided on the weekend indicates that the bicycle is being used primarily as a means of urban transportation rather than for recreation. To determine whether the bicycle is frequently used for the journey to work and whether recreation is, in fact, of relatively little importance in bicycle travel, the next portion of the analysis examines the specific purposes for which bicycle trips were made.

The data show that in Uppsala the bicycle plays an especially important role in the journey to work; 21.6 percent of all stops made at the workplace were made by bike. Just how important the bicycle is on the work trip is clear in the light of the fact, mentioned earlier, that about 11 percent of all movements are made by bike; for travel to the workplace, the proportion nearly doubles. This high incidence of bike use on the work trip could in part account for the relatively low level of bicycle usage among the elderly who, by definition, no longer make the journey to work.

Analysis of trip purpose indicates, further, that the bicycle is used relatively often to run errands or to carry out business within the neighborhood. For instance, at least one-tenth of all stops at supermarkets, kiosks, flower shops, libraries, banks, and post offices were made by bicycle. However, although bicycle stops at these local retail and service establishments are well-represented, the bicycle does not appear to be used frequently to make social visits, nor is its use for recreational activity outstanding. One interesting point is the frequency with which the bicycle is used to travel to a stop where the purpose is to change mode. These are most likely trips wherein cyclists ride to the train station, park their bikes, and take the train.

The fact that the bicycle seems to be used primarily for the journey to work and for local trips raises the question of whether the bicycle is used primarily for single-purpose trips or whether longer, multistop trips are made by bicycle as well. The analysis shows that about 40 percent of all movements by bike are associated with traveling to the first stop on a trip; similar percentages are found for bus (43 percent) and automobile (37 percent). The bicycle is also comparable to the other modes in terms of the proportion of stops that occur on trips of greater duration. Thus, although the majority of bicycle movements occur on one- or two-stop trips, the bicycle, like other modes, is occasionally used for longer, multistop journeys.

The final question about the nature of bicycle use concerns patterns of expenditure related to bicycle travel. If the bicycle is used like any other mode of urban transportation, expenditures at locations visited by bicycle should be comparable to those made when other modes are used. In Uppsala, 80 percent of all stops involved no expenditure at all, and 11.8 percent of the no-expenditure stops were made by bike. Inasmuch as 11.6 percent of all stops are made by bicycle, it is clear that the bicycle

is being used as often as other modes for travel that involves making an expenditure. Furthermore, in regard to the amount of the expenditure, the bicycle is not used only for making minor purchases.

SUMMARY

This paper has examined the rationale for gaining greater understanding of bicycle travel in urban areas and has described how the use of the bicycle compares with the use of other modes of urban transportation. If concern for the safety of cyclists is genuine, facilities appropriate for bicycling must be provided. If these facilities are to be provided on a rational basis, we need to know more about the characteristics of bicycle travel and the nature of the demand for bicycle travel in urban areas. Information enabling the rational planning of urban bikeways does not currently exist in this country.

The primary purpose of this paper has been not to review bicycle use in Uppsala, Sweden, but to demonstrate that when detailed data like these are examined it is evident that the bicycle is used as a viable means of urban transportation, not as a means of recreation. Integration of bicycle travel into the urban transportation planning process requires recognition of the fact that the bicycle must be planned for like any other mode of urban transportation. Scenic bikeways along abandoned railroad rights-of-way will not suffice.

REFERENCES

1. R. Ashton. Cycleways in Greater Peterborough. *The Planner*, Vol. 60, 1974, 596-603.
2. C. K. Ballard. Transportation Dependents. *Traffic Quarterly*, Vol. 21, 1967, pp. 83-91.
3. Berkeley Bikeways Plan. Local Transit Committee, Berkeley, Calif., 1971.
4. Bicycles in Berkeley. Local Transit Committee, Berkeley, Calif., 1971.
5. Bikeways for Lakewood. Citizens Advisory Committee on Trails, Lakewood, Colo., 1971.
6. Bikeway Planning Criteria and Guidelines. Institute of Transportation and Traffic Engineering, Univ. of California, Los Angeles, 1972.
7. Boise Bikeways Plan. Boise City Traffic Engineering Division, 1972.
8. Chicago Area Transportation Study, Final Report: Volume 1—Survey Findings. Dec. 1959.
9. M. E. Dowd. What Does It Take to Ride a Bicycle Safely? *Christian Science Monitor*, July 3, 1974.
10. W. Garrison and R. Worrall. Monitoring Urban Travel. Department of Civil Engineering and Transportation Center, Northwestern Univ., Evanston, Ill., Final Rept., 1966.
11. A. T. Germano, P. H. Wright, R. G. Hicks, and P. H. Sanders. The Emerging Needs of Bicycle Transportation. *Highway Research Record* 436, 1973, pp. 8-18.
12. R. Hansen. Preliminary Study of Bicycle Facilities for the City of Portland. Office of Engineer, Portland, Ore., 1971.
13. I. Illick. To Pedal a Theory. *Social Policy*, Nov.-Dec. 1973, pp. 11-16.
14. W. Lum. Bicycles in Mixed-Mode Travel. Graduate School of Engineering and Applied Science, Univ. of California, Los Angeles, 1973.
15. D. F. Marble, P. Hanson, and S. Hanson. Household Travel Behavior Report 1: Field Operations and Questionnaires. Transportation Center, Northwestern Univ., Evanston, Ill., 1972.
16. M. L. Moody. Use of Bicycles as Commuter Vehicles in Denver. Department of Civil Engineering, Univ. of Denver, 1973.
17. B. Poirer. Preliminary Analysis of Bicyclist Survey Conducted in May and June

- 1973 in the Metropolitan Washington, D. C., Area and in California and Illinois. Iroquois Research Institute, Falls Church, Va., 1973.
18. N. Rosen. Planning for Pedal Power. Swedish Information Service, New York City, 1973.
 19. R. Sommer and D. Lott. Behavioral Evaluation of a Bikeway System. Department of Psychology, Univ. of California, Davis, 1972.
 20. R. Sommer and D. Lott. Bikeways in Action: The Davis Experience. Univ. of California, Davis, 1972.

DISCUSSION

Kenneth Markve, Metro-Transportation Program, New Orleans

The paper by Hanson and Hanson is a positive step toward integrating the bicycle mode into the urban transportation planning process. I would question whether the survey done in Uppsala, Sweden, has applicability in the United States. The authors make an analogy between travel in the United States and travel in Sweden, and it is difficult for me to resolve whether the factors governing travel in the United States are the same as those in Sweden. If they are, then the bicycle is a viable mode of transportation for U. S. urban areas. However, engineers lack the criteria or the know-how to determine the bicycles per hour or per time interval needed to justify an exclusive lane or partial use of an ordinary transportation lane for bicyclists.

I advocate incorporating bicycles into the urban transportation planning process and would suggest that all bicycle advocates in urban areas include bicycle planning as a line item in all of the unified work programs they deal with. It was through this process that an adequate bicycle plan was developed for Boise, Idaho, when I was the transportation planner there.

If the bicycle is to be planned for like any other mode of transportation, then a bicycle or pedestrian capacity manual, similar to the Highway Capacity Manual developed by the Highway Research Board in 1965, must be developed. This bicycle capacity manual should have speed, volume, and density curves similar to those in the Highway Capacity Manual. Bicycle lane widths should be specified, and methods of predicting bicycle person trips per typical household should also be included. The type of signing and signaling for bicycle lanes, equestrian trails, and pedestrian walkways should be included in this manual and in the Manual of Uniform Traffic Control Devices.

We must not forget the objectives of urban transportation planning. In too many cases advocating a specific mode has left that mode in a framework that cannot be incorporated because of its merits as a people-moving facility into the total transportation picture.

Again let me state that I advocate including bicycle planning in the urban transportation planning process, but, until clear-cut objectives and clear-cut information on the characteristics of bicycles, pedestrians, and all nonmotorized vehicles have been thoroughly examined and documented, it will be very difficult for engineers to justify bicycle lanes for urban areas.

AUTHORS' CLOSURE

We wholeheartedly agree with Markve's point that we need clear-cut objectives and clear-cut information on the nature of bicycle and pedestrian travel before we can plan wisely for bicycle or pedestrian transportation systems. Our paper was offered as one

step toward providing the kind of information needed. The intent was not to draw analogies between bicycle travel in Sweden and that in the United States but to show the extent to which bicycles can be used as a mode of transportation in a medium-sized city when people view the bicycle as a transport vehicle rather than as a recreational one. The other major purpose of the paper was to illustrate the kinds of insights into bicycle travel that can be gained from detailed travel data such as those contained in the Uppsala household travel survey. At present there are, unfortunately, no such data available for an American city. U. S. studies of bicycle trip generation and distribution are an essential prerequisite to the planning process.