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Behavioral Evaluation of a Bikeway System

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#268

Over the last 50 years the traffic system in the United States has been designed around the automobile to the neglect of alternatives such as rapid transit, the bicycle, and pedestrians. As money and facilities went into more and better highways, people used them in increasing numbers, and a host of related services such as motels, gasoline stations, new car dealers, and repair shops followed the highways. The form and connectedness of many American cities, particularly the bedroom or suburban sections, are built around the automobile. All this cannot be changed overnight. People who locate their homes or businesses with a two-car family in mind will resist attempts to get them to change their commuting patterns. However, the problems associated with a transportation system built completely around the private automobile--including air and noise pollution, and congestion beyond the carrying capacity of more freeways or parking structures--have made it imperative to search for alternative means of transportation. The bicycle has many advantages in terms of cost, maintenance, noise, air pollution, physical health, and an excellent scale relationship with one's surroundings. It will never replace the automobile for 50 mile drives nor the jet airplane for cross-country trips. It is not a universal panacea or even a complete substitute for any other form of transportation, including walking which has much to commend it. However, there are many situations where a bicycle is a more efficient and economical means of transportation than anything else. For many families the alternative would not be doing without an automobile, but rather doing without a second or third car. Yet if the bicycle's potential is to be realized, its unique

environmental requirements will have to be respected. The current pressure for pedestrian malls in downtown areas and for car-free walkways in the suburbs reveals that even pedestrian traffic has its unique requirements. The alternative to the complete domination of the automobile consists of a transportation system that takes into account the unique requirements of all forms of transportation. To neglect any is to overload others beyond their optimal carrying capacity and thereby to do an injustice to all.

The Coney Island cyle path opened in 1895 and was the first path in this country exclusively reserved for bicycles. Its original width of 14 feet was widened another 3 six months later due to heavy traffic, and doubled again in 1897 along its entire 5 mile length. Saint Paul created 50 miles of paths exclusively for bicycles, Seattle by 1899 had 20 miles of path reserved for bicycles, and in California there was a 50 mile system connecting Sacramento and Stockton and another network in the Bay Area.[1] Subsequently the expertise and technology developed for the bicycle literally paved the way for the automobile. It was the League of American Wheelmen who in the 1890's lobbied successfully for good roads, highway signs, road maps, and traffic regulations. Unfortunately the technology of bicycle paths virtually disappeared in this country for almost half a century and all the old paths disappeared. In 1961 Homestead, Florida developed a bicycle path and in 1966 Davis, California began a bikeway path system. These bikeways like their predecessors half a century earlier were developed on the basis of trial and error and frantic pleas of information from one city traffic department to another. The present bicycle boom has sparked a tremendous upsurge of interests in cycling, not only among the general public

but also among city officials concerned about the rising number of bicycle accidents. The Bicycle Institute of America served as a clearinghouse for whatever information existed and published several newsletters on bikeways. Recent pamphlets from the Oregon Department of Highways[2] and the California Department of Highways[3] present a great deal of statistical information from various places and have put it together in the form of bikeway standards. While such information is exceedingly important in bikeway planning, it needs to be supplemented by more detailed studies of the day-to-day operations of bikeway systems. It is not enough to merely know the width of bikeways in Amsterdam, Tokyo, and Austin, one must also know how the paths work in practice, the problems that have been encountered and how these have been resolved.

A bikeway system is more than a lane of asphalt devoted to bicycles. It must also involve the cooperation and support of the police and traffic officials, it must include bike education in the schools, special graphics for bikeways that are clear to both riders and motorists, and the support of downtown merchants and apartment owners who must provide bike parking facilities, as well as special traffic lanes that meet the unique requirements of a city's cyclists. There is no single best bikeway solution for all cities. Fresno, California may be served best by a bikeway system along the irrigation canals, Eugene, Oregon could creatively develop some of the town's alleyways, and Los Angeles could with minimal expense provide curb access to some of its unused sidewalks. A successful bikeway system is a complex network of physical facilities and services involving virtually every segment of the community. The proper evaluation of a bikeway system must take into account the attitudes and actions of all these involved groups. One

cannot simply evaluate a bike system by interviewing dedicated cyclists who have been riding for years without special facilities, one must also interview school officials and PTA groups, police and city traffic officials, downtown merchants and business people as well as ordinary adults who would ride bicycles if adequate facilities were available but not under dangerous riding conditions.

In this article we will summarize six years of behavioral studies of Davis, California bikeways, probably the best developed system in the country. While research has been an integral part of the Davis bikeway system since its inception in 1966, our research budget was generally non-existent and these studies were bootlegged out of existing student and faculty time, and the helpful cooperation of city officials.

Research has accompanied the develpment of the Davis bikeway system at every turn. The presence of a university has made available a pool of talented and dedicated investigators from a variety of fields. Technical studies have been done in the Department of Physical Education on the energy expended at different levels of incline and with different widths of tires. People in engineering studied the width of bike paths, the turning radius of a cycle at different speeds, and similar topics. The present report presents a more complete and up-to-date behavioral evaluation of the Davis bikeway system than did our previous report in the Congressional Record and distributed by the BIA.[4] This behavioral data complements the valuable engineering standards presented by Ramey et al.[5] and will be of assistance to city officials planning bikeways. We do not assume that Davis is typical of other communities. Indeed in its pioneering interest in bicycles, Davis is very atypical. Davis has virtually no snow but surrounding communities which have an identical

climate have no bikeways. On the other hand Amsterdam and Copenhagen have much colder climates but many bikeways. The methods and policies we have evolved for Davis cannot be applied blindly or without modification elsewhere. Yet the basis of human culture is sharing of experiences from one place and generation to another. It is wasteful and inefficient to ignore what other people have learned about a similar problem. In our last report[6] we mentioned the ambiguity surrounding the phrase "bike lane," which many automobile drivers interpreted to mean--"Bikes Stay Inside" rather than "Cars Stay Out"--and we recommended the use of "bikes only" instead. Unfortunately we have seen several instances of new city bikeways that still employ the ambiguous "bike lane" designation.

Here is a summary of our research findings. To present the specific studies in detail would require more space than is available. However, we felt it would still be valuable to make our findings available even in summary form to other cities and organizations involved in bikeway planning.

Summary

1. Bicycle riders will use bike paths when they are available and convenient.

2. In low traffic density situations at least, convenience factors are important to the cyclist. Bicycle riders are unwilling to go several blocks out of their way to use a bicycle path. This finding cannot be generalized to dangerous high traffic situations where data are not available.

3. Automobile drivers do not object to riding on streets that contain bicycle lanes. Very few will avoid streets with bicycle lanes,

and the majority prefer a predictable situation where the cycles remain in bike lanes.

4. Merchants in downtown Davis are either favorable to bicycles or noncommital. Virtually none believes that bicycle lanes reduce business in the downtown area. A number of merchants provide special parking facilities for bicycle customers and provide amenities such as special shopping bags that fit into bicycle baskets for bike customers. Merchants are concerned that bicycle riders park their cycles directly in front of store entrances rather than using available bike racks some distance away.

5. The attitudes of the Davis police are very favorable towards bicycle lanes. The Davis Police Department has one full-time officer working on bicycle problems and two part-time bicycle aides whose salaries are paid from bicycle registration fees.

6. With a large bicycle population, a city-wide registration system is both feasible and desirable. However, even with a registration system, bicycle theft continues to be a serious problem in Davis as it is elsewhwere. Strong locking devices and chains are a deterrent to theft. One study estimated that among college students in Davis the theft rate of bicycles is approximately 1% per month. In addition, about the same percentage will have various parts such as wheels, seats, or bells stolen from them.

7. The probability that a bicyclist will use a device that permits anchoring the bike to a rack or some other fixed location depends in great part on a) the value of the bike and b) the convenience of the anchoring device. In comparing three anchoring devices we learned that anchored chains and loops were used more often than anchored eyebolts.

8. Owners of expensive 10-speed bicycles desire a greater level of parking security than do other bike owners. A higher percentage of them park their bicycles inside their apartments at night and they make more use of secure parking spaces than do owners of less expensive machines. Where anchored parking racks are not available, 10-speed owners are likely to chain their machines to trees, lampposts, and other fixed settings.

9. The creation of bicycle lanes on residential streets by banning curb parking during certain hours was only partially successful. A significant number of illegally parked cars created tight, dangerous and discouraging squeezes at a time when the role of the bike paths as a link in a transportation system was at its peak. The situation was eventually resolved by banning automobile parking altogether.

10. People transporting themselves by bike are as eager to get where they are going as people being transported any other way. A bike path that makes travel slow or inconvenient by requiring deviation around landscaping features will discourage riders from using it.

11. Traveling to school by bicycle increases in Davis at each grade level and peaks at junior high school at 80%, dropping slightly after that as the use of automobiles increases.

12. The existence of bicycle lanes in Davis is one factor in increasing bicycle use among children and teenagers. Comparing the situation in Davis with that of a nearby town of the same population, topography, and climate, twice as many Davis junior high school students ride bicycles to school as do students in the nearby town.

13. Negative stereotypes towards cyclists reduce bicycle riding in some communities. It is probable that the existence of bicycle lanes

indicates civic acceptance of cycling and thereby helps to reduce negative stereotypes.

14. An effective bicycle transportation system reduces the amount of automobile use in Davis. It was estimated that in good weather, the use of bicycles saves one automobile trip per day for every two households in the city. In practical terms this means something like 7,000 single automobile journeys per day that would be undertaken by car if bicycles were not available. There is no guarantee that this figure can be generalized to cities with different sorts of residential or commuting patterns.

15. Even in the best of circumstances, only a minority of store customers can be expected to do their shopping by bike. Most bicycle customers in Davis are teenagers and young adults who do not have automobiles or whose spouses have used the family car for work. At two large supermarkets we observed approximately 10% of the customers using bicycles.

16. Shopping centers were designed around the automobile and there are consequent problems in entering and leaving for the cyclist. Cyclists prefer a separate entrance from a residential street rather than a main traffic artery.

17. Bicycle lanes are very safe while the cyclist is in the lane itself. Problems arise at intersections when the cyclist comes in contact with cars and either or both wants to turn.

18. Bike paths created by painting stripes alongside a car travel lane provide satisfactory auto-bike separation over most of their length. However, in some intersection situations cars sometimes divert into such lanes to make right turns or to pass on the right of left

turning autos. This problem as well as cars parking in bicycle lanes requires the conscientious enforcement of traffic laws by police to keep bike lanes clear. We have observed bike lanes in other cities becoming double-parking lanes for automobiles. Because of strict enforcement of parking regulations by local police, this rarely happens in Davis.

19. Special ordinances were necessary to implement the bikeway system in Davis. Permission was needed to erect special graphics for cyclists. Regulations about parking and designated racks were also necessary.

20. In spite of continued rider education in the school and on the university campus, breeches of regulations and rider courtesy are readily apparent. More often than not, cyclists make left turns on the basis of convenience rather than following the right angle method described by traffic laws. Stop signs are respected only when there is a car in the intersection. At all other times the cyclist scans the traffic both ways and then proceeds through the stop sign with a slight pause at most. Hand signals are virtually extinct among adult riders. Children who learn them in grade school still use them. Many riders feel that keeping one's hands on the handle bars in a tight traffic situation is more appropriate than signaling. The value of hand signals for cyclists must be questioned.

21. Two-way bicycle lanes of a reasonable width are satisfactory but there are problems where the two-way path ends, leaving half the cyclists stranded on the wrong side of the street. Special provision should be made for channeling such cyclists over to the correct traffic lane.

22. The width of a bikeway as well as the distance from the traffic

lane must take into account the speed of automobile traffic as well as the presence of barriers such as high curbs or parked cars. The faster the automobile traffic, the more space needed for the bicycle lane and the further away it should be from the main automobile flow.

23. Available statistics grossly underestimate the number of bicycle accidents that occur. Those accidents reported to the police are only the most serious ones and constitute about 5% of all accidents that occur. In one sample of teenagers who were asked about the severity of the injuries, fewer than half of the bodily injuries rated as moderate or severe were reported to the police

24. Grade separations are a good technique for giving bike paths clear separation from other modes of travel, but bike speeds are very sensitive to length and steepness of grade in such facilities. Bikers anticipating a long, steep climb may reach speeds that greatly increase both the rate and seriousness of accidents.

25. Most cyclists do not use the recommended two-stage right angle procedure for making left turns at a major intersection. This is not a result of ignorance about traffic regulations but rather the cyclist's desire for convenience and safety taking precedence over his respect for minor traffic regulations.

Footnotes

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1 Robert A. Smith, A Social History of the Bicycle. New York: American Heritage Press, 1972.

2 Oregon State Highway Division, Foot Paths and Bike Routes: Standards and Guidelines. January 1972. Report distributed by the Bicycle Institute of America.

3 Institute of Transportation and Traffic Engineering, UCLA, Bikeway Planning Criteria and Guidelines, April, 1972.

4 Robert Sommer and Dale F. Lott, Bikeways in Action: The Davis Experience. Congressional Record, April 19, 1971, Vol. 117, no. 53. Report distributed by the Bicycle Institute of America.

5 Melvin R. Ramey, Report in progress, Department of Engineering, University of California, Davis.

6 Sommer and Lott, op. cit.