

On top of this, the essential air service provision of the Act will ensure service with subsidy through 1988, and the aircraft loan-guarantee program will also help to stabilize the financial picture of some commuters. Air carriers will come and go subject to the weeding process in the business world. This, together with the concomitant voids generated by graduating class dynamics, will introduce inconvenience to travelers at specific locations. But by and large, the process is likely to continue and the transition is likely to be stabilized in the long run.

Major uncertainties that may discount my reserved optimism include the following:

1. Congestion at major-hub airports where commuters fly their passengers to connecting long-haul airlines, and

2. Safety regulations that govern commuters, which tend to be more stringent due to the accident records that accompanied commuter traffic growth over recent years.

The economy and the fuel-cost spiral are certainly significant factors, but they are not exclusive to low-density service alone and tend to affect all transportation modes. All these factors tend to put a damper on service to small communities if they are not taken into account in a timely fashion. It goes without saying that the provisions of the Airline Deregulation Act need to be monitored closely as time progresses. Among the key elements to be scrutinized is the essential air service program, particularly at the time when it is scheduled to terminate in 1988.

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The views expressed in this paper are strictly mine. They do not represent those of the U.S. Congress or the State University of New York at Stony Brook.

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#### Abridgment

## Marketing Bicycle Transportation: A Critique of National Comprehensive Bicycle Transportation Program

MICHAEL D. EVERETT

The U.S. Department of Transportation (DOT) bicycle transportation program, which emphasizes promotion of bicycling through advertising and education and which generally opposes separate bikeways or lanes, is reviewed. This paper finds no evidence in the existing literature and bicycle transportation experience to support the DOT position that such a program would shift substantial numbers of short-distance commuters to bicycles. This paper concludes with suggestions for DOT to improve its analysis and marketing of bicycle transportation.

In response to the National Energy Conservation Policy Act of 1978, the U.S. Department of Transportation (DOT) published Bicycle Transportation for Energy Conservation (BTEC) (1). BTEC presents a national comprehensive bicycle transportation program that strongly deemphasizes separate facilities for bicyclists and that strongly emphasizes promot-

ing bicycling and educating bicyclists about sharing the road with motor vehicle traffic (1, p. 8; 2, pp. 33-34, 99). BTEC predicts that these policies will increase bicycle commuting from less than 0.5 million in 1975, which also included persons 14 years and older bicycling to part-time jobs, to between 1.5 and 2.5 million adult bicycle commuters by 1985 (2, pp. 83-84). This includes 15-30 percent of the 6.4 million car commuters aged 19 to 45 who do not need a car at work. Adjusting for environmental conditions further increases the proportion of the final target group shifted.

Attempting to capture such large percentages of short-distance car commuters represents an extremely ambitious marketing program that has a number of economic and social implications. This paper uses basic economic and marketing concepts along with the

available literature on bicycle transportation to evaluate BTEC.

#### MAJOR DETERMINANTS OF SHIFTING DRIVERS TO BICYCLES

BTEC provides no support or citation for its policy conclusions and merely states the following (2, p. 69):

The effectiveness of these program components (education and promotion in particular) in increasing bicycle use has not been evaluated to date. It is our belief, however, that the selection of these elements is based on the best available data, and they constitute a reasonable approach to increasing the use of the bicycle for transportation.

Unfortunately, rather than using the best available data, BTEC ignores most of the solid, replicative published literature on the determinants of bicycle commuting and misinterprets its own data.

BTEC rests its recommendations for promotion and education as the major determinants of future mass commuter bicycling primarily on the opinions of a panel of experts. That focus-group study, however, remains so flawed that I cannot draw any conclusions from it. [For the study and a critique, see paper by Ryan and Schermerhorn and my discussion (3).]

BTEC supports its conclusions on the ineffectiveness of separate bicycle facilities, including striped-off lanes, with a draft of the national survey by Robinson and others (4). Although this represented a well-designed survey of 16 000 households in five cities, the early drafts seriously misinterpreted the data. The final published draft concluded (4, p. 47):

Separate facilities play an important role in people's preference for nonmotorized modes, second only to that of compact land use. The significance of facilities is further emphasized by the fact that the compact land-use scenario contains not only the very important element of short trip distances, but also the element of separate facilities for nonmotorized travel.

Compact land use and separate facilities together made the bicycle the preferred mode for 29-33 percent of the respondents (4, p. 43). Numerous other surveys also find that the overwhelming majority of existing and potential bicyclists fear traffic and want separation from high-speed, high-volume traffic (2, p. 26; 5, pp. 8-21; 6). Sophisticated multinomial logit models estimate that separation would increase bicycling substantially (7). These models have provided accurate predictions for a wide range of consumer behavior from market share for new small-packaged goods to modal choice.

Moreover, the BTEC position on minimizing separation and emphasizing education conflicts with observations where mass bicycling actually takes place, i.e., low-speed (about 20 mph, average) and/or low-volume traffic, or on facilities through heavily traveled high-speed barriers and generally along arteries over much of the heavily bicycled area. This does not mean a network of facilities exists that takes bicyclists to every destination, but only that facilities separate bicyclists from high- to moderate-speed and high- to moderate-volume traffic. Furthermore, reasonably well-controlled studies have documented specific examples of separate facilities actually increasing bicycling in the United States and Europe (6, 8-10).

BTEC also fails to review and incorporate the substantial literature on the major determinants of

modal choice in general. This literature finds that relative costs, including time costs, play a major role in modal choice (11). Two studies on bicycling (12,13) find time costs quickly swamp vehicle savings costs for trips in excess of 2-3 miles. Updating the data for increased fuel costs and poor fuel efficiency for short trips did little to change these overall conclusions. Even for short trips, the net economic returns remain around 20¢-50¢/mile, or levels intuitively too low to induce many commuters to overcome their fear of traffic and other disutilities of bicycling. Observations suggest that mass bicycling takes place around campuses that severely restrict student parking, around elementary schools where students cannot drive, and in European cities where automobile ownership remains low, if separation from high-speed and high-volume traffic exists.

In summary, BTEC violates one of the major principles of successful modern marketing: Find out what the target market wants and design a product or service to satisfy that want rather than merely attempting to sell a preconceived product or service.

#### BICYCLE TRANSPORTATION SAFETY

Potential increases in traffic accidents associated with mass bicycle transportation, at least for the drivers who shift to bicycles, raise serious ethical questions. For example, English officials estimate that bicyclists face a fatal-accident risk 10 times greater per mile than drivers (14). Unfortunately, neither BTEC nor earlier bike-safety workshop reports (15,16) build systematically on Cross's rigorous national accident survey (17) to shed much light on these questions.

The overall shared value of most participants in the workshops emphasizes the importance of bicycle education to reduce accident hazards. Most bicycle and transportation analysts, including those who emphasize separate facilities, would strongly support education. The workshop reports, however, provide no coherent theoretical or empirical estimates on how much education would be needed to reduce accidents or the costs of education (15, pp. 32-35).

Looking at fatal accidents, the data in BTEC seem to conflict rather strongly with its conclusions that separate facilities provide ineffective countermeasures. Cross's well-regarded national survey (17) found that the largest portion of fatal accidents (nearly 40 percent) involved motor vehicles overtaking bicyclists. Most of these accidents occurred on rural-type roads (narrow two-lane roads with no shoulder and 50 percent undeveloped area along the roadside) often found on the fringes of urban areas. But substantial numbers of fatalities also occurred on wider urban-type roads, particularly after dark. Cross recommends against riding rural-type roads and against riding anywhere at night with currently available reflectors and lights. Commuter bicycling, however, involves substantial night riding during winter months, and many university communities with actual or potential mass bicycling have a number of rural-type roads that serve residential developments. Thus, it seems to me that a separate facility that removed the bicyclist from the road would eliminate this major fatal-accident category for that particular corridor.

Finally, BTEC and the workshops fail to review and analyze several readily available reports on the impact of separate bike facilities on accidents. Several European studies found that well-designed separate facilities substantially reduced most intersection accidents (18, pp. 44-47). An earlier, well-defined DOT study found well-designed bike



lanes reduced bike-car conflicts (5, p. 54).

Although Kaplan in a mail-back survey of club bicyclists found more accidents on bikeways per mile than bicycling in the road (14), this may arise from greater bicycle congestion in areas that have bikeways. My observation of university campuses that have mass bicycling is a very high level of accidents on campus bikeways, but few fatalities.

I can only conclude from the available data that we do not know nearly enough about the determinants of bicycle safety to make any specific statements about the cost-effectiveness of one input over another. All inputs seem to have important roles in some situations. Blanket encouragement to shift from driving to bicycle commuting, even with a full array of inputs, probably would increase accident hazards for those who shift. For example, according to Dutch officials, even with extensive separation, education, and enforcement, bicycling carries a 3.5-fold greater risk of a fatal accident per mile than driving (14). This raises serious ethical questions of whether we should try to market bicycle transportation to masses of short-distance automobile and bus commuters.

#### ECONOMIC EVALUATION

BTEC estimates that its program will reduce driving by 8.3-16.5 million miles/year and generate \$492-\$705 million/year in savings on oil (16.4-23.5 million barrels at \$30/barrel). Because the BTEC program would cost \$244 million over five years, the program would generate very high payoffs on the order of 10:1 (approximately \$500 million, i.e., \$50 million/year). BTEC and the workshop reports, guided by the same author, strongly imply that the social costs of providing separation from moderate- to high-speed and moderate- to high-volume traffic would exceed the benefits (1, pp. 8, 22, 23; 2, pp. 33-34, 99; 16, pp. 32-36, 80-82).

BTEC's benefit/cost analysis, however, has a number of serious shortcomings, ranging from grossly inadequate data to conceptual errors. The benefit/cost analysis obviously suffers from an inability to make any reasonable prediction on bicycling and the reduction in driving that result from the BTEC program. If BTEC only generated a trickle of bicycle trips (around 1 percent of total vehicles on a given route at a given time), as seems likely from the available data, what will the \$244 million over five years buy us? Would we encourage a few people to expose themselves to both greater fatal-accident risks and long-run air pollution hazards? Would such a program slow down traffic on affected traffic arteries, causing greater congestion, energy use, and air pollution?

BTEC ignores other benefit/cost analyses of bicycle transportation systems that find high returns to facilities and provide a broader set of variables for assessing both the costs and benefits of these systems. For example, one readily available study assumed from the literature that the highest per mile returns for two campus bicycle systems resulted from reductions in congestion, parking, and time costs and increases in consistent exercise (19). The major costs were the reduction in consumer surplus of drivers who lost their parking places and access to the central campus. Computer simulations generated estimates of benefit/cost ratios ranging from 7:1 to 14:1.

Conceptually, the DOT study position of rejecting separate facilities because they cost too much does coincide with the financial marketing approach: Give the market what it wants if you can do so at a profit (or a net increase in social welfare). However, the relevant economic decision rule to maxi-

mize private or social welfare directs planners to use an input as long as the present value of the long-run expected incremental benefits (change in total benefits) exceeds the present value of the long-run expected incremental costs. BTEC policies may minimize costs, but they probably also would forgo the opportunity to shift important commuter segments (for example, students) to bicycles with cost-effective facilities and programs.

#### CONCLUSIONS

In essence, BTEC is not a study that uses the best available data without preconceived notions or biases (2, p. 1) but, rather, a policy position that represents one group of bicyclists. As early as the 1930s and 1940s, the English recreational Cycle Touring Club used most of the same assumptions to oppose bikeways as a threat to their rights to the road and instead promoted education and minor road modifications. In England after World War II, the government did not build separate bicycle facilities but did guarantee bicyclists their legal rights to the road as motor vehicle traffic grew. Bicycling declined in England to where I saw virtually none around London in 1974, and other estimates put bicycling at less than 4 percent of trips in England as a whole (6). In the Netherlands, which did develop extensive separate facilities as well as education and enforcement programs and which perhaps maintained relatively high driving costs, the bicycle still represents the major mode in terms of trips--25-35 percent (6).

A more objective and sophisticated program to market bicycle transportation would modify BTEC in several ways beyond a more objective review of the literature. First, such a program would segment the short-distance commuters into various groups (student, white collar, suburban, downtown, etc.) and would design several different bicycle transportation programs tailored to the wants and constraints (e.g., road space and ability) of each segment.

Second, a truly innovative and comprehensive program also would include road pricing (20). This would raise the price of driving cars and other vehicles with relatively high social costs compared with bicycles by charging vehicles in terms of the space (congestion), air pollution, noise, and the other external costs they impose. If prices were high enough, this theoretically could shift enough drivers to transit and bicycles to free up road space so that bicyclists could share most roads with motor vehicle traffic.

Extensive road pricing and/or facilities undoubtedly remain politically infeasible in the foreseeable future but, by presenting its program as an effective means of shifting masses of target-group drivers to bicycles (2, pp. 82-84), BTEC simply confuses and weakens our understanding of the determinants of bicycling for rational planning in some future national emergency when mass bicycling may become feasible. Also, by promoting bicycling as a safe alternative mode (1, p. 3), BTEC may actually increase traffic accidents and net social costs for the few commuters who do experiment with bicycles.

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