REFERENCES

1. S.L. Warner. Stochastic Choice of Mode in Urban Travel: A Study in Binary Choice. Northwestern Univ. Press, Evanston, IL, 1962.
2. D.A. Quarmby. Choice of Travel Mode for the Journey to Work: Some Findings. Journal of Transport Economics and Policy, Vol. 1, No. 3, 1967, pp. 273-314.
3. T.E. Lisco. The Value of Commuters' Travel Time: A Study in Urban Transportation. Department of Economics, Univ. of Chicago, dissertation, 1967.
4. M.A. Johnson. A Comparison of Several Methods of Collecting Travel Data in Analysis of Urban Travel Behavior. Metropolitan Transportation Commission, Berkeley, CA, 1974.
5. J.B. Lansing and G. Hendricks. Automobile Ownership and Residential Density. Survey Research Center, Institute for Social Research, Univ. of Michigan, Ann Arbor, 1967.
6. P.L. Watson. Problem Associated with Time and Cost Data Use in Travel Choice Modeling and Valuation of Time. HRB, Highway Research Record 369, 1971, pp. 148-158.
7. A.M. Malecki. Perceived and Actual Costs of Operating Cars. Transportation, 1978, pp. 403-415.
8. W. Brög. Latest Empirical Findings of Individual Travel Behavior as a Tool for Establishing Better Policy Sensitive Planning Models. Presented at World Conference on Transport Research, London, England, April 1980.
9. S.S. Stevens, ed. Handbook of Experimental Psychology. Wiley, New York, 1951.
10. J.E. Engel, D.T. Kollat, and R.D. Blackwell. Consumer Behavior. Holt, Rinehart, and Winston, Inc., New York, 1968.
11. M. Fishbein and I. Ajzen. Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research. Addison-Wesley, Menlo Park, CA, 1975.
12. A. Adiv. Behavioral Determinants of Rapid Transit: Why Don't More People Use BART to Work? Department of City and Regional Planning, Univ. of California, Berkeley, dissertation, 1980.
13. D. McFadden and others. Demand Model Estimation and Validation. Institute of Transportation Studies, Univ. of California, Berkeley, Urban Travel Demand Forecasting Project, Phase 1, Final Rept. Series, Vol. 5, 1977.
14. M.A. Johnson. Field Materials and Data Tape Codebook for the 1975 BART Impact Travel Study-2 Survey. Institute of Transportation Studies, Univ. of California, Berkeley, Urban Travel Demand Forecasting Project, Working Paper 7608, 1975.
15. F.A. Reid. Disaggregated Supply Data Computation Procedures. Institute of Transportation Studies, Univ. of California, Berkeley, Urban Travel Demand Forecasting Project, Phase 1, Final Rept. Series, Vol. 3, 1977.
16. T. Keeler and K.A. Small. The Full Costs of Urban Transport: Part III--Automobile Costs and Final Intermodal Cost Comparisons. Institute of Urban and Regional Development, Univ. of California, Berkeley, Monograph 21, 1975.
17. A. Adiv. A Preliminary Analysis of BART Impact Study-2 Trip Diary. Metropolitan Transportation Commission, Berkeley, CA, 1977.
18. The 1969 Nationwide Personal Transportation Study. FHWA, 1973.

Publication of this paper sponsored by Committee on Traveler Behavior and Values.

Application of the Situational Approach to Depict a Model of Personal Long-Distance Travel

WERNER BRÖG

A study undertaken to determine the amount of personal long-distance travel in the Federal Republic of Germany to explain present modal choice and to forecast the likely future development of modal choice is described. To achieve these goals, an individually oriented behavioral model was developed (the situational approach) that first identifies the individual's (perceived) decisionmaking situation as precisely as possible, then determines the maximum potential for change if external conditions are altered, and, finally, tries to forecast the likely responses to planned policies. It can be shown that in personal long-distance travel the potential number of persons who would change mode if travel duration and travel costs were altered is comparatively small. On the other hand, the question of trip generation is much more important. When trips are classified according to trip purpose, it can be shown that most vacation trips would be made even if external conditions were less favorable to travel, although the type of vacation trips made might be modified. For "other" personal travel, in which a comparable type of modification is frequently not possible, persons would often respond to restrictive measures by reducing trip frequency.

Although personal long-distance travel is quantitatively of considerable importance in the Federal Republic of Germany and major investments are required in order to improve highway networks, comparatively little is known about the number of such long-distance trips and the likely responses of long-distance travelers to planned policies. For these reasons, the Minister of Transport authorized a large-scale, comprehensive study of personal long-distance travel in 1979-1980 (1).

In the quantitative part of this project, it was found that, on a per capita basis, German residents made a total of almost four (3.94) long-distance trips/year to destinations at least 50 km away from their homes. Almost every fourth (0.88) trip was a vacation trip. This means that Germans make approximately 50 million vacation trips and approximately 175 million other personal trips per year. In five out of every six instances (83 percent), they travel by car. Every 10th trip (10 percent) is made by train, and every 33rd trip (3 percent) is made by plane. Every 25th trip (4 percent) is made by bus or by another mode. Thus, Germans make approximately 185 million long-distance trips by car, 23 mil-

lion by train, about 7 million by plane, and about 9 million by bus. Germans spend an average of 23 days/year making these trips and cover an average of more than 2500 km.

A sociodemographic analysis of persons who travel and persons who do not travel is less enlightening than one might assume (2). Therefore, the study discussed in this paper tried to identify the actual reasons for long-distance travel; sociodemographic variables are only of limited use for this purpose.

MAIN FEATURES OF SITUATIONAL APPROACH

In the second (qualitative) part of this project, the (actual) reasons for making long-distance trips with the mode used were to be explained and the likely reactions to changed external conditions were to be forecast. The conceptual considerations were influenced by the fact that modal choice in personal long-distance travel is by no means a simple, one dimensionally explainable form of individual behavior. Rather, a large number of objective and subjective factors are of importance; the resulting subjective decisionmaking situation is, therefore, relatively complex.

Thus, a research concept was needed that could deal with this problem. Although efforts have been made to develop a more sensitive model concept and method of analysis for urban travel (3), an application of these more refined approaches to personal long-distance travel, where they would be so desperately needed, is only possible within limits since the individual can exercise more free will when making personal long-distance trips than in making work trips, for instance. The decisionmaking structure for personal long-distance travel is thus much more complex (4).

Therefore, an approach was chosen to study personal long-distance travel in which each travel situation could be dealt with individually. The actual travel options available to each decisionmaking unit (in this study, the traveler) were identified. The subjective decisionmaking situation was then used to forecast responsiveness to alternative planning situations. Although this so-called situational approach (5) was developed and tested to study urban travel (6), the approach is so flexible that it was relatively simple to apply it to a study of personal long-distance travel.

However, a prerequisite for the application of the situational approach was the use of special explorative techniques--the so-called interactive measurement methods (7). The many variables responsible for influencing individual behavior are processed by using a special qualitative procedure (individual situations are analyzed). These variables are then combined into various dimensions that define particular situations (8).

In this study, 10 such dimensions were selected. As the study was evaluated, these 10 dimensions were condensed to 7 (see Figure 1). Conditions as perceived by the traveler were always used as the basis. These dimensions made it possible to analyze each individual situation to see whether a change in personal long-distance travel behavior was possible if external conditions were altered.

Although the main emphasis of the study was on the possibility of changing modes, other responses were also carefully considered. For this purpose, the combined effect of all dimensions was determined for each individual traveler. This was important in order to establish situational groups. By using this situational group structure, one can explain the given modal choice for personal long-distance travel.

In order to describe situational groups, it is necessary to define a hierarchy of the dimensions. This hierarchy can be arbitrarily changed in the evaluation, since the effect of all dimensions in this paper is oriented to the priorities that the travelers set for themselves. This hierarchy is then used to examine each dimension and determine whether it suffices to explain the given travel behavior. If this is so, then the given traveler is eliminated from further inspection (although information concerning further effects of the dimensions is not lost in the study). Ultimately, this results in the identification of a group of travelers who would have been able to use another mode--the so-called "group with options". This group is especially important because it represents the actual potential for change. The group with options can be identified for status quo conditions as well as for when new policies would affect the structure of the situational group. In each of these instances, the size of the group with options represents the maximum potential for changed behavior (in this case, a change of modes).

The potential for change can be determined for different conditions that would result from planned measures (9). The basis for this is the so-called "explanatory tree", which explains modal choice in the personal long-distance trips actually recorded and shows how high the maximum share of persons is who could change mode given status quo conditions--i.e., with conditions as they now are. Figures 2 and 3 summarize the explanatory tree for car travelers according to travel purpose and alternative mode; the group with options is symbolized by the Roman numeral "VIII".

This shows that the objective and subjective options of the car travelers would have been rather limited. However, this need not necessarily apply to future long-distance trips, since certain constraints might be of only temporary importance. The so-called "sensitization" techniques better explain the general options that are available given status quo conditions. By using sensitization, the size of the threshold group for which constraints pertaining to the mode used can be eliminated in certain (specifically determined) conditions is identified for each dimension. Thus, the general potential for car travelers to change their travel modes is obviously generally greater than in the specific situation (see Figures 4 and 5).

This general potential for change is not yet related to a specific planned measure. In further steps of the study, however, one can determine the share of travelers who would generally react to changes in travel time or travel costs. However, identifying these rather theoretical maximums is not the main goal of this step of the study. Much more important is the fact that, by identifying the travelers who do not belong to the maximum potential, those persons are identified who would definitely not respond to measures that affect travel time and travel cost by changing mode.

The purpose of this study was to identify the impact that the following measures would have on personal long-distance travel:

1. The relative amount of time spent traveling with the different modes was to be changed by 20 and 40 percent.
2. The relative price for travel between train and plane was to be altered by 25 and 50 percent, and the relative price of travel between public modes and car was to be altered by 50, 100, and 200 percent.

Because the goal of the study was to determine

Figure 1. Criteria used to build situational groups.

DIMENSION		ALTERNATIVE MODE: CAR	TRAIN	PLANE
①	Objective options	Always (exception: plane trips with long-distance destination and target persons, for which car travel seems to be totally unrealistic	Place of departure and destination are connected by train	Not for trips covering - less than 150 km - Less than 500 km If place of departure or destination is more than 50 km and target person did not perceive plane connection
②	Constraints (use of mode impossible if)	Car not available, no driver's license (no option of driving along as passenger), too old, health reasons, baggage transportation, bad weather (ice)	Too old, health reasons, baggage transportation, package tour	Too old, health reasons, baggage transportation, weather (fog), package tour
③	Degree to which informed (not informed if)	Mode has never been used for this stretch and person is not fully informed or is inadequately informed about modes that might be used on this stretch		
④	Time	Examination of how important the quality of (door-to-door) connections is, especially with regard to the following criteria:		
	(a) Importance	- Travel duration - Frequency of departures - Location of train station - Connections from train station - Transfer required - Punctuality		- Frequency of departures - Location of airport - Connections from airport - Transfer required - Punctuality
	(b) Perception	If time is important, then a check must be made to see how accurately time is perceived (especially in light of the criteria referred to above)		
⑤	Costs	Examination of how important travel costs are, especially with regard to the following criteria:		
	(a) Importance	- Gasoline price - Other costs	- Price per person - Cost of getting to/from train station	- Price per person - Cost of getting to/from airport
		← - Cost for food (longer trips) - Costs for overnighting (for trips lasting more than one day) →		
	(b) Perception	If cost is important, then a check must be made to see how accurately cost is perceived (especially in light of the criteria referred to above)		
⑥	Comfort/service	Examination of how important comfort and service are, especially with regard to the following criteria:		
	(a) Importance	← - Dependability - Size - Baggage space → - Hygienic facilities - Food services - Cleanliness		
			- Cleanliness of station	
	(b) Perception	If comfort and service are important, then a check must be made to see how accurately comfort and service are perceived (especially in light of the criteria referred to above)		
⑦	Subjective disposition	Examination of other subjective attitudes toward the modes in light of all given responses, including those that are not rational		

market shares, it was initially irrelevant if these relative changes were caused by the fact that the one mode became cheaper or faster or the other mode became more expensive or slower.

DETERMINING POTENTIAL FOR MODAL CHANGE

With the help of the situational analysis, four different potentials for modal change could be identified:

1. The general potential for change irrespective of the implementation of any specific measures,
2. The general potential for change when restrictions in one dimension were done away with (e.g., it was assumed that perceived travel time for the mode used and its alternative would be the same),
3. The general potential for change as the result of a specific measure pertaining to one dimension (e.g., travel time for the alternative mode was reduced by 20 percent and then by 40 percent), and
4. The current potential for change given status quo conditions (i.e., the group with options).

Figures 6 and 7 summarize the different potentials for modal change among persons traveling by car when the relative amount of time spent traveling by different modes is altered. (Group C is subdivided according to the different measures to be studied.) If one looks at "other" personal long-distance trips, one sees that 87 percent of these trips are made by car and 8 percent are made by train (potential A). If the perceived travel costs are hypothetically made equal for train and car, only a maximum of 14 percent of the car travelers would be willing and/or able to respond (potential B). This potential shrinks when the travel time by train is reduced by 40 percent, then by 20 percent, and finally by 5 percent (potential C1) or 4 percent (potential C2). With status quo conditions, the maximum potential was already 2 percent of all persons traveling by car (potential D).

The maximum potential for change is similar when the relative price for different modes is changed. This clearly indicates that the most important way of responding to changed external conditions that affect personal long-distance travel is not by changing mode (see Figures 8 and 9).

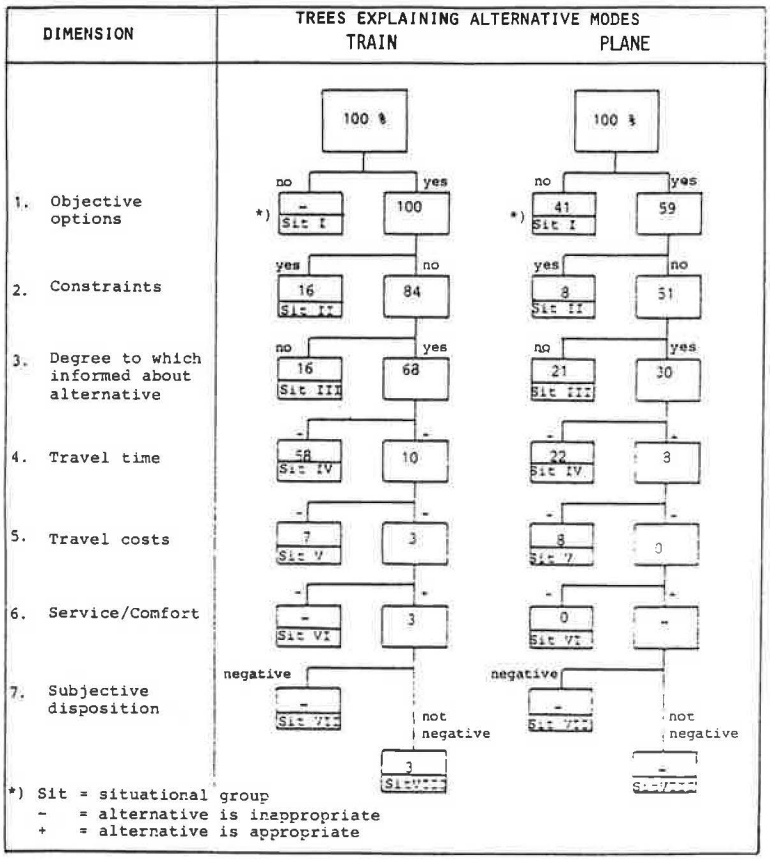

Figure 2. Explanatory tree for vacation trips made by car.

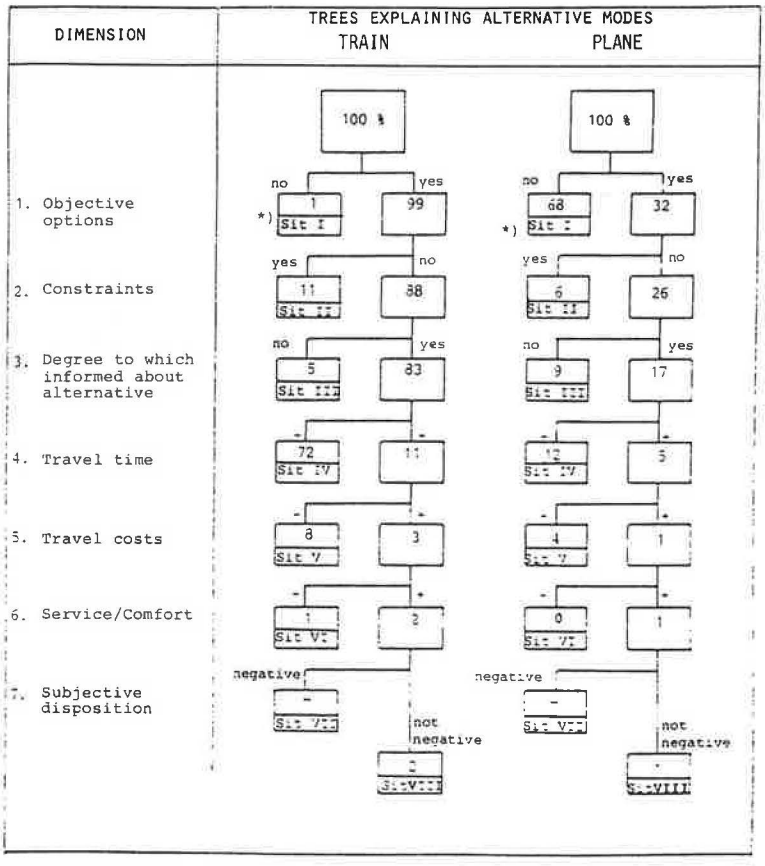

Figure 3. Explanatory tree for other personal trips made by car.

Figure 4. Use of sensitization technique for vacation trips made by car.

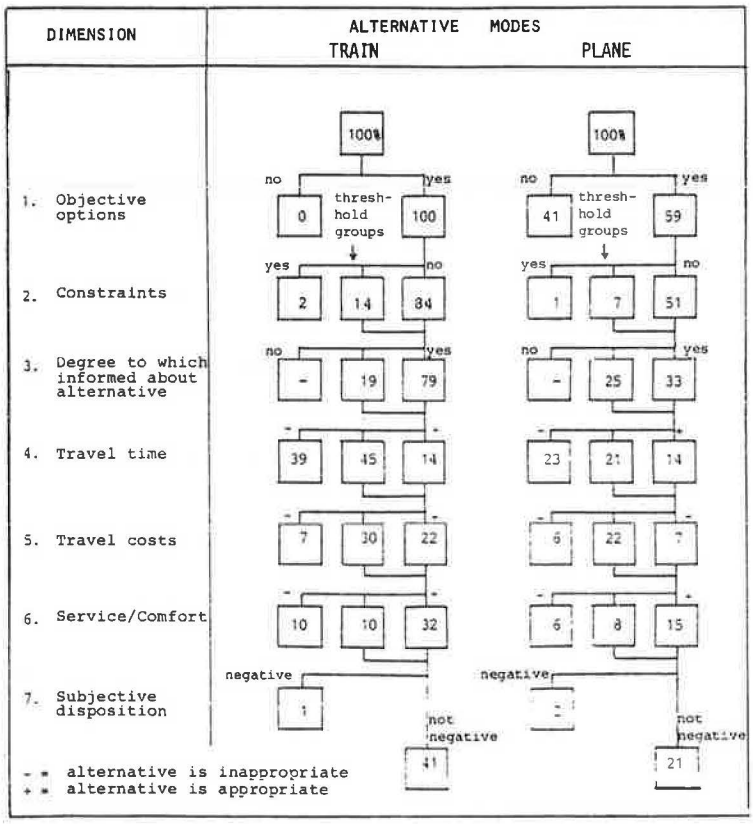

Figure 5. Use of sensitization technique for other personal trips made by car.

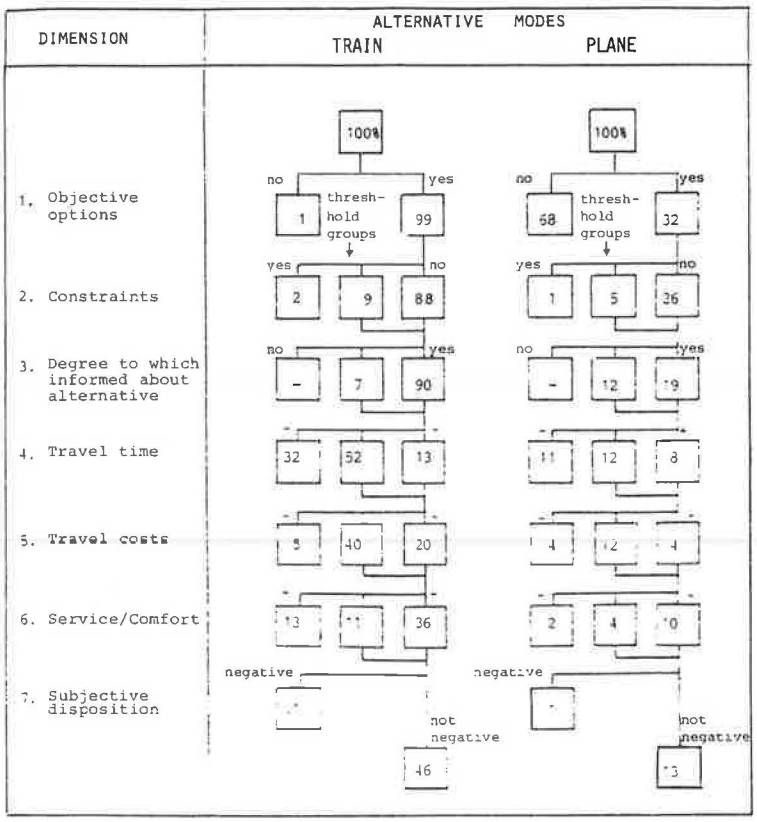

Figure 6. Potential for change to train among car travelers: time scenario.

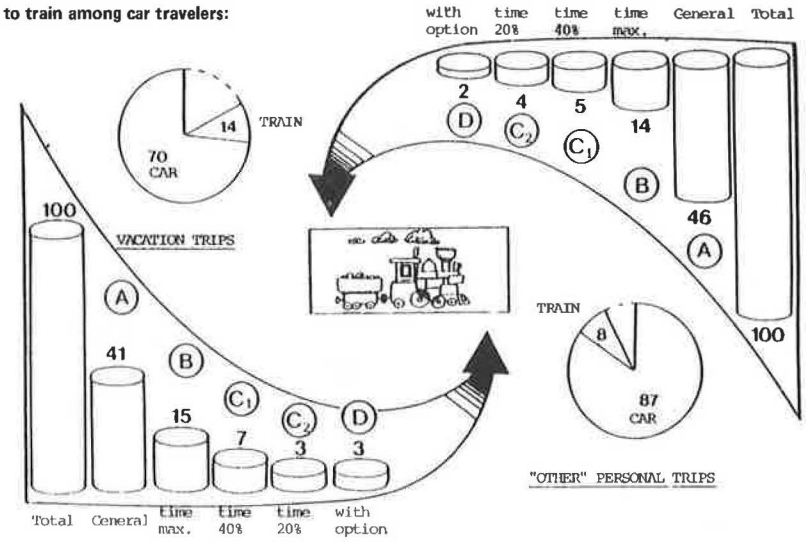

Figure 7. Potential for change to plane among car travelers: time scenario.

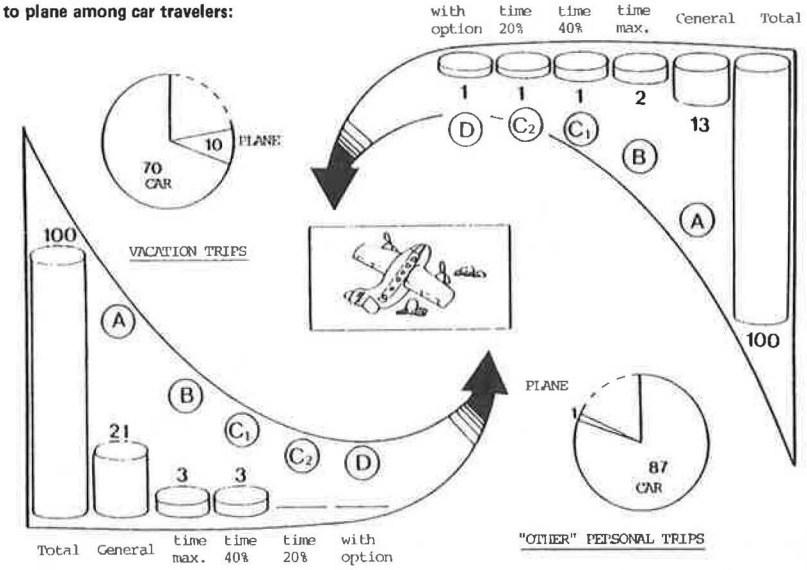

Figure 8. Potential for change to train among car travelers: cost scenario.

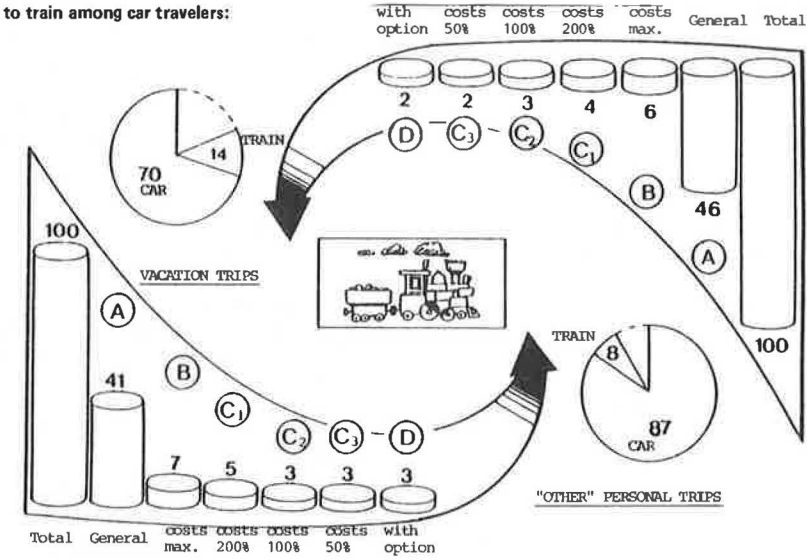

Figure 9. Potential for change to plane among car travelers: cost scenario.

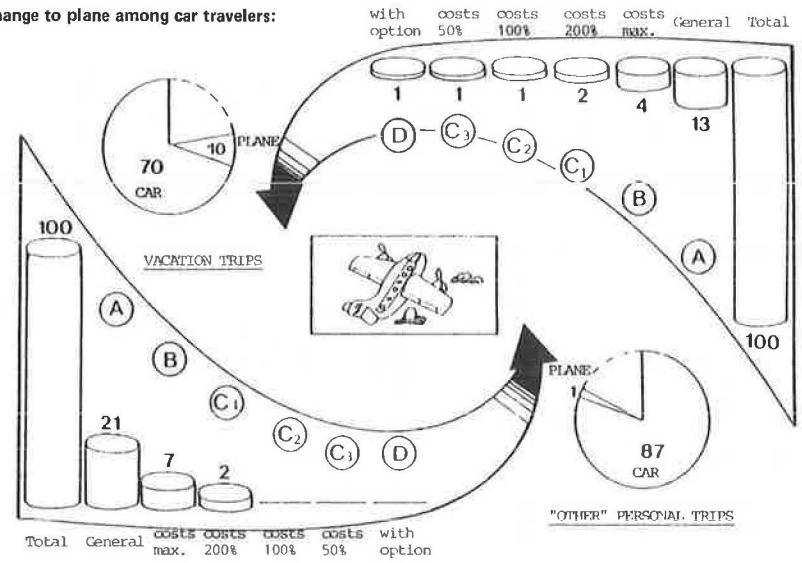

Table 1. Possible share of users for car, train, and plane.

Item	Maximum Possible Share of Users								
	Car			Train			Plane		
	Total Personal Long-Distance Travel	Vacation Trips	Other Personal Trips	Total Personal Long-Distance Travel	Vacation Trips	Other Personal Trips	Total Personal Long-Distance Travel	Vacation Trips	Other Personal Trips
Time									
With options[a]	101	101	101	122	117	123	124	107	237
Improved 20 percent	101	101	101	135	117	141	124	107	237
Improved 40 percent	101	101	101	148	134	152	141	127	237
Cost									
With options[a]	101	101	101	122	117	123	124	107	237
Improved 25 percent[b]	101	101	101	122	117	123	124	107	237
Improved 50 percent[c]	101	102	101	122	117	123	124	107	237
Improved 100 percent[d]	X	X	X	128	117	132	124	107	237
Improved 200 percent[e]	X	X	X	136	128	138	155	117	287
Base or present share (% = 100)	83.2	69.8	87.1	9.5	13.6	8.2	2.9	10.3	0.8

[a] No further measures.
[b] If costs are improved by 25 percent for car versus both alternatives, train versus plane, and plane versus train.
[c] If costs are relatively improved toward both alternatives by 50 percent.
[d] If costs are relatively improved toward car by 100 percent and toward train or plane by 50 percent.
[e] If costs are relatively improved toward car by 200 percent and toward train or plane by 50 percent.

Initially, this analysis disregards the number of persons who use different modes for their personal long-distance trips. However, when the relative number of travelers using the different modes is considered, the maximum share per mode for each planned measure can be given. However, these figures should be used to identify the relative number of persons using the modes and not to exactly forecast the market share, since it is more or less impossible to do this. Thus, it is appropriate to compute these values as indexes. This was done in Table 1.

All in all, the proportion of travelers using different modes defines a realistic upper limit that shows the extent to which a reorientation of the long-distance travelers to other modes can take place in specific situations. However, one should not forget that this upper limit will not be reached in normal situations.

LIKELY RESPONSES TO CHANGED EXTERNAL CONDITIONS

Likely responses to measures were then estimated by analyzing the responsiveness of the travelers (using interactive measurement methods) to changes in external conditions. The responsiveness pertained to all possible ways of reacting--whether the trip was unchanged, modified, temporarily delayed, or not made at all or whether the mode was changed. A change of mode could only be made by that group of persons with options, since the idea of the situational group was used. (Potential increases in demand caused by a changed supply that induces persons who previously did not travel to travel were not accounted for in this project.)

Before the likelihood that different types of responses will occur is discussed, the validity of the study results must once again be checked. The main goal of the study was to determine the demand potential for a modal change. Therefore, measurement instruments were used that would ensure that modal change could be estimated as accurately as possible. Among other things, this means that the persons identified as travelers who would change mode would, in fact, change to another mode. Thus, the values in this paper refer to the lower limit of

Figure 10. Responsiveness of car travelers: time scenario.

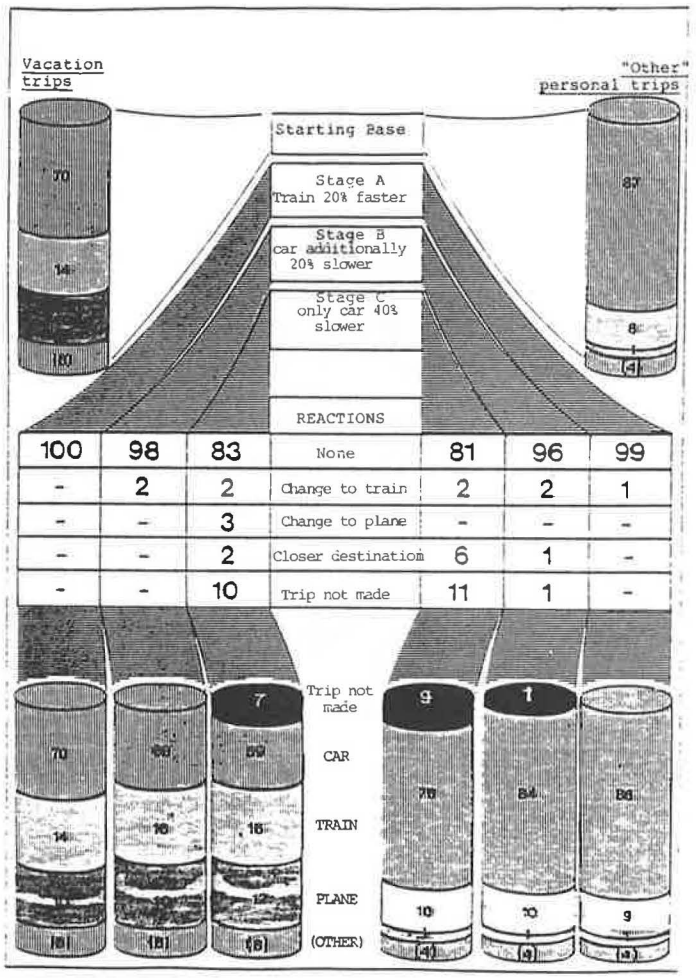

Table 2. Time scenario for vacation and other personal trips: relative changes in modal choice.

Mode	Vacation Trips: Starting Base (%)	Vacation Trips: Relative Change (%) Stage A	Stage B	Stage C	Other Personal Trips: Starting Base (%)	Other Personal Trips: Relative Change (%) Stage A	Stage B	Stage C
Car	69.8	±0	-2	-14	87.1	-1	-3	-13
Train	13.6	±0	+10	+10	8.2	+11	+24	+24
Plane	10.3	±0	±0	+18	0.8	±0	±0	±0
Reduction in total travel	-	-	±0	-7	-	-	-1	-9
Other	6.3				3.9			
Total	100.0				100.0			

modal change. The upper limit has been shown in Table 1. On the other hand, other possible ways of responding (modifying the trip, not making the trip, etc.) were studied by using different types of survey instruments that made it possible to define an upper limit of possible responses. This upper limit will never quite be reached, since it can be assumed that trip frequency will be reduced, especially when persons respond by not making some of their "other" personal long-distance trips. These changes in external conditions deal with time and cost, both of which were studied by using two different scenarios.

The time scenario assumed that the total travel time for the alternative train was reduced by 20 percent and then assumed that the time needed to travel by car was simultaneously increased by 20 percent. This was then compared with a situation in which car travel time was increased by 40 percent while the time it took to travel by train remained the same.

The cost scenario assumed that the price of traveling by car went up by 50, 100, and 200 percent while the relative price of traveling by train and plane remained the same (simultaneous fare increases for plane trips were disregarded here).

LIKELY RESPONSES TO TIME SCENARIO

The likely responses to the three stages of the time scenario are summarized in Figure 10. The potential increase in demand for trains when travel time is simply reduced is rather moderate. When car travel time increases, persons tend to respond by reducing trip frequency or traveling to a nearer destination (Figure 10).

The time scenario showed that restrictive mea-

Figure 11. Responsiveness of car travelers: cost scenario.

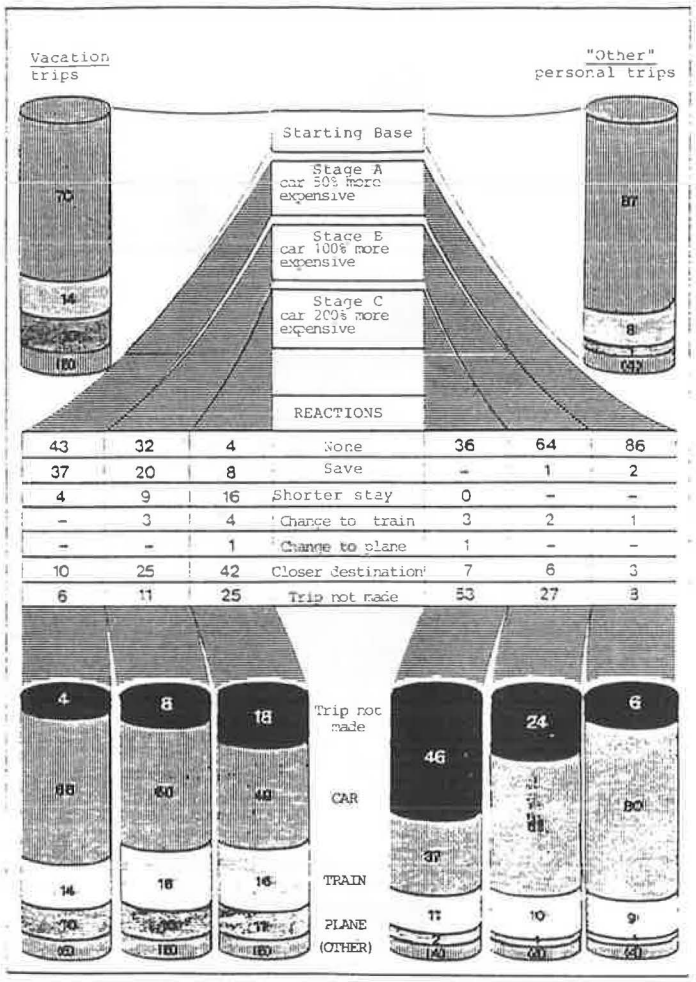

Table 3. Cost scenario for vacation and other personal trips: relative changes in modal choice.

	Vacation Trips				Other Personal Trips			
		Relative Change (%)				Relative Change (%)		
Mode	Starting Base (%)	Stage A	Stage B	Stage C	Starting Base (%)	Stage A	Stage B	Stage C
Car	69.8	-6	-14	-30	87.1	-8	-30	-56
Train	13.6	±0	+13	+18	8.2	+4	+27	+29
Plane	10.3	±0	±0	±6	0.8	±0	±0	+75
Reduction in total travel	-	-4	-8	-18	-	-7	-24	-46
Other	6.3				3.9			
Total	100.0				100.0			

sures pertaining to car travel are much more effective than reducing train travel time. Table 2 gives the relative changes in modal choice that could be expected.

LIKELY RESPONSES TO COST SCENARIO

In studying car travelers' responses to the price of personal long-distance travel, only such expenses as gasoline and oil were taken into consideration. The more drastic price increases would have a considerable impact on personal long-distance travel (see Figure 11).

The travelers would go to almost any extent in order to be able to make their vacation trips, even if these have to be somewhat altered. The vacation trips that are eliminated tend to be the second and third yearly vacation trips that have become so popular in Germany in recent years. On the other hand, it is difficult to similarly modify "other" personal long-distance trips, since the destination of these trips is so frequently fixed--e.g., trips to visit a weekend house or relatives who live in a different city. Thus, the number of these trips can easily be reduced, but it is difficult to "modify" them. This resulted in the relative changes depicted in Table 3.

DISCUSSION OF PLANNING SITUATIONS

The situations depicted above did not deal with the economic and social changes that would simultaneously have occurred had external conditions changed in the manner described. Therefore, the term "scenario", which refers to a specific interview technique, must be used with reservation. On the other hand, it is obvious that, if the relative price for gaso-

line triples, it will have an economic impact greater than the behavioral changes discussed in this paper. Therefore, the results presented here only help to explain the mechanisms of personal long-distance travel and make it possible to forecast the individual behavioral changes that would result under certain conditions.

However, the findings of this paper clearly show that the existence and actualization of personal long-distance travel are the result of highly complex decisionmaking processes within private households. Although travel time and travel costs involved in using different modes are important, it is the subjective perception of these factors that influences decisionmaking. In concrete decisionmaking situations, other factors besides travel time and travel costs are important determinants of behavior. Changes in travel time and travel costs have only a limited effect on modal choice. Thus, the problem of trip generation plays a much larger role than modal choice. When it becomes more difficult to make personal long-distance trips, a change of mode is not the most likely response; it is more frequent for persons taking vacation trips to travel to a nearer destination and for persons making other personal long-distance trips to reduce the frequency with which they make these trips.

Because there is a great need for data (a problem discussed at the beginning of this paper), the main goals of this study were to make explanatory data for the analysis of long-distance travel available and to develop a model that can more realistically depict behavioral changes. The quality of further forecasts dealing with personal long-distance travel in Germany will depend, to a large degree, on the extent to which these new data can be included in the synthetic models that are already operating.

REFERENCES

1. Socialdata. Marktanalyse des Verhaltens im Personenfernverkehr. German Ministry of Transport, Munich, 1981.
2. Socialdata. Marktanalyse des Verhaltens im Personenfernverkehr: Tabellenband. German Ministry of Transport, Munich, 1981.
3. M. Wermut. Verhaltensorientierte Verkehrsnachfragemodelle: Entwicklung und Stand der Kunst. WIST-Information, No. 45, June 1979.
4. Socialdata. Marktanalyse des Verhaltens im Personenfernverkehr: Expert Volume. German Ministry of Transport, 1981.
5. W. Brög. Behavior as a Result of Individual Decision in Social Situations. Presented at Conference on Mobility in Urban Life, Arc-et-Senance, France, Sept. 1978.
6. W. Brög. Latest Empirical Findings of Individual Travel Behaviour as a Tool for Establishing Better Policy-Sensitive Planning Models. Presented at World Conference on Transport Research, London, England, April 1980.
7. W. Brög and E. Erl. Interactive Measurement Methods: Theoretical Bases and Practical Applications. TRB, Transportation Research Record 765, 1980, pp. 1-6.
8. W. Brög. Cooperation Between Empirical Social Research on Transport Behaviour and Transport Policy Making. Presented at Conference on Social Aspects of Transport: How to Use Social Research in Transport Policy Making, Chichester, England, Sept. 1980.
9. W. Brög. Transport and the Challenge of Structural Change, Passenger Transport: Mobility and Lifestyle--Sociological Aspects. Presented at 8th International Symposium on Theory and Practice in Transport Economics, Istanbul, Sept. 1979.

Publication of this paper sponsored by Committee on Traveler Behavior and Values.

Traveler Responses to Reconstruction of Parkway East (I-376) in Pittsburgh

CHRIS T. HENDRICKSON, ROGER E. CARRIER, THOMAS J. DUBYAK, AND ROBERT B. ANDERSON

Reconstruction of urban expressways will be required in many metropolitan areas in the next few decades. A summary is presented of traveler responses to a reconstruction project on the Parkway East (I-376) in Pittsburgh, Pennsylvania, which normally serves more than 100 000 daily vehicle trips. Volume counts, vehicle occupancy counts, travel time measurements, and traveler surveys were made before and during the reconstruction. The major responses observed were in route choice and departure times. Large modal diversion did not occur despite ridesharing promotions and train, bus, and park-and-ride lot service improvements. However, a slight measured shift to shared-ride modes may have resulted in significant local benefits for Parkway East travelers during peak periods. Generally, the roadway system in the parkway corridor accommodated a major change in traffic patterns without substantially increased levels of congestion.

Maintaining traffic and minimizing adverse traffic impacts during reconstruction on roadways have long been a concern to highway departments. This concern is especially critical during the reconstruction of urban freeways that serve large volumes of traffic and may require several construction seasons. Major reconstruction projects of this type will become increasingly frequent in the next decade due to the deterioration of many urban roadways. Planning traffic control measures for these projects requires an understanding of traveler responses to major reconstructions.

This paper reviews the type and range of traveler responses that have occurred during reconstruction of a 10.5-km (6.5-mile) section of the Parkway East (I-376) in Pittsburgh, Pennsylvania. This highway connects the Pennsylvania Turnpike (I-76) to I-279 via downtown Pittsburgh. It is the most heavily traveled highway in the region (see Figure 1): Approximately 84 000 vehicles pass through its Squir-