Paratransit Planning: Application of a Systematic, Market-Oriented Planning and Programming Process

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A scheme for the paratransit planning and programming process in major metropolitan areas is outlined. The classical systems analysis approach to planning—i.e., goal setting, alternative design, alternative analysis, alternative evaluation, and choice—is examined with respect to its market-segment orientation. It is argued that market segments (defined as mixes of socioeconomic characteristics, trip purpose, spatial pattern, and time pattern) must be introduced into the alternative-design step of the process. Furthermore, because of the inherent uncertainties and shortcomings of the five-step systems analysis planning process, the entire approach must pragmatically be couched in an incremental, time-staged, short-range programmatic approach, conceptually analogous to a hierarchical decision-tree analysis. The theoretical concepts presented are illustrated by using as an example the promotion of commuter ridesharing in the Minneapolis-St. Paul region. The example focuses on both the market orientation and incremental programmatic properties of the ridesharing aspects of the paratransit planning process.

The purpose of this paper is to outline a workable scheme for the paratransit planning process in major metropolitan areas. The phrase "planning process" refers to the set of activities, or steps, undertaken during the course of deciding (in this case) the nature of paratransit services to be offered in a metropolitan area. Thus, the planning process is broad enough to include needs inventory, data collection, analysis of alternative options, and evaluation of ongoing demonstrations and/or operations. Planning, along with goal setting, funding, regulation, and service demonstration and operation, defines the range of activities that constitute the public sector's efforts to provide mobility, a basic urban service, to the citizens within an appropriately defined jurisdiction.

The second and third sections of the working paper focus on two of the more relevant elements of the process of providing paratransit service: (a) planning and (b) the programming of potential demonstrations and operations. The planning discussion details the importance of a market-segment orientation in planning, examines long- and short-range planning, outlines the roles of sketch planning and detailed planning, and presents the needed aspects of the formalized evaluation task.

The third section develops a case study that is intended to illustrate how the theoretical model described in earlier sections can be related to real-world planning and implementation processes. The development of ridesharing programs in the Twin Cities of Minneapolis-St. Paul is traced and related to the theoretical framework presented earlier to illustrate where the theoretical model both parallels and diverges from the actual historical process that has occurred.

As a preface to this discussion, it should be emphasized that paratransit service planning should not be viewed as an activity or process separate and distinct from other transportation planning activities. Paratransit services represent a set of potential responses to identified market needs; however, it would be myopic to approach paratransit service options and planning for those options with a perspective limited to paratransit options alone, just as it may be inappropriate to assume that highway construction, automated-guideway transit, conventional bus transit, or rail technologies are the "only" appropriate responses to identified market needs in other contexts. The paratransit planning process should be carried out in logical integration with other transportation planning activities to the greatest extent possible.

PARATRANSIT PLANNING PROCESS

The paratransit planning element can be thought of as composed of three main subelements: participants (who does the planning), process (what the participants do and when they do it), and methodology (how the participants do what they do). This paper deals with the second subelement, process.

Long-Range Approach: Market-Segment Orientation and Systems Analysis

A primary requirement of any paratransit planning process is that it be oriented to market segments. Market segments can be defined by the use of four dimensions:

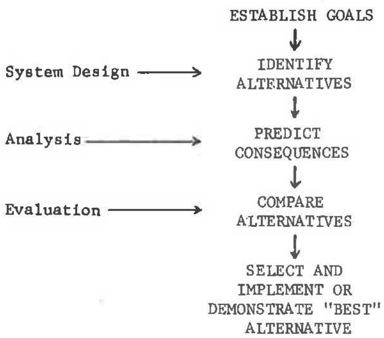
1. Socioeconomic characteristics, including automobile ownership, income, age, family status, employment status, occupation, health, other;
2. Trip purpose, including (a) home-based work, home-based other, and non-home-based; or (b) work and other; or (c) work, shopping, personal business, social, recreation, and other;
3. Spatial pattern, including activity center [e.g., central business district (CBD), major employer, university], central city, inner suburb, outer suburb (semirural); and
4. Time pattern, including day of the week (i.e., weekday, Saturday, Sunday or holiday) and time of day (i.e., morning peak, midday, afternoon peak, evening, night).

The concept is that a market segment, at its most basic level, is defined by a mix of these four dimensions. In other words, the work trip would not qualify for market-segment status, but a white-collar work trip from the suburbs to a CBD during a weekday morning peak period is a valid market segment. Of course, market segments can be meaningfully aggregated (e.g., "work trip"), since almost all transportation services can accommodate more than one strictly defined segment. To examine how to fully introduce consideration of market segments in the planning process, it will first be useful to examine a simplified and idealized representation of a planning process.

The classic systems analysis process can be illustrated by the flowchart shown in Figure 1. Of course, the fact that this model for the planning process is an unworkable idealization has been well documented (1). For example, it is patently unreasonable to claim the ability to identify all relevant and important (or even realistic) alternatives: The "optimal" solution can easily be overlooked; the state of the art in the prediction of consequences, or impacts, makes such predictions highly uncertain; and alternatives cannot be rationally or objectively compared (not to mention ranked) because associated with each alternative are a large number of attributes (those measures forecast in the analysis step) and the relative importance, or weight, attached to those attributes is highly sensitive to the personal preferences of the individuals involved in evaluating the alternatives. Therefore, the systems analysis model must pragmatically be couched in an incremental, time-staged, short-run programmatic approach conceptually similar to a hierarchical decision-tree analysis.

In the classic systems analysis model, the key to introducing a market-segment orientation into the planning process is the adequate consideration of

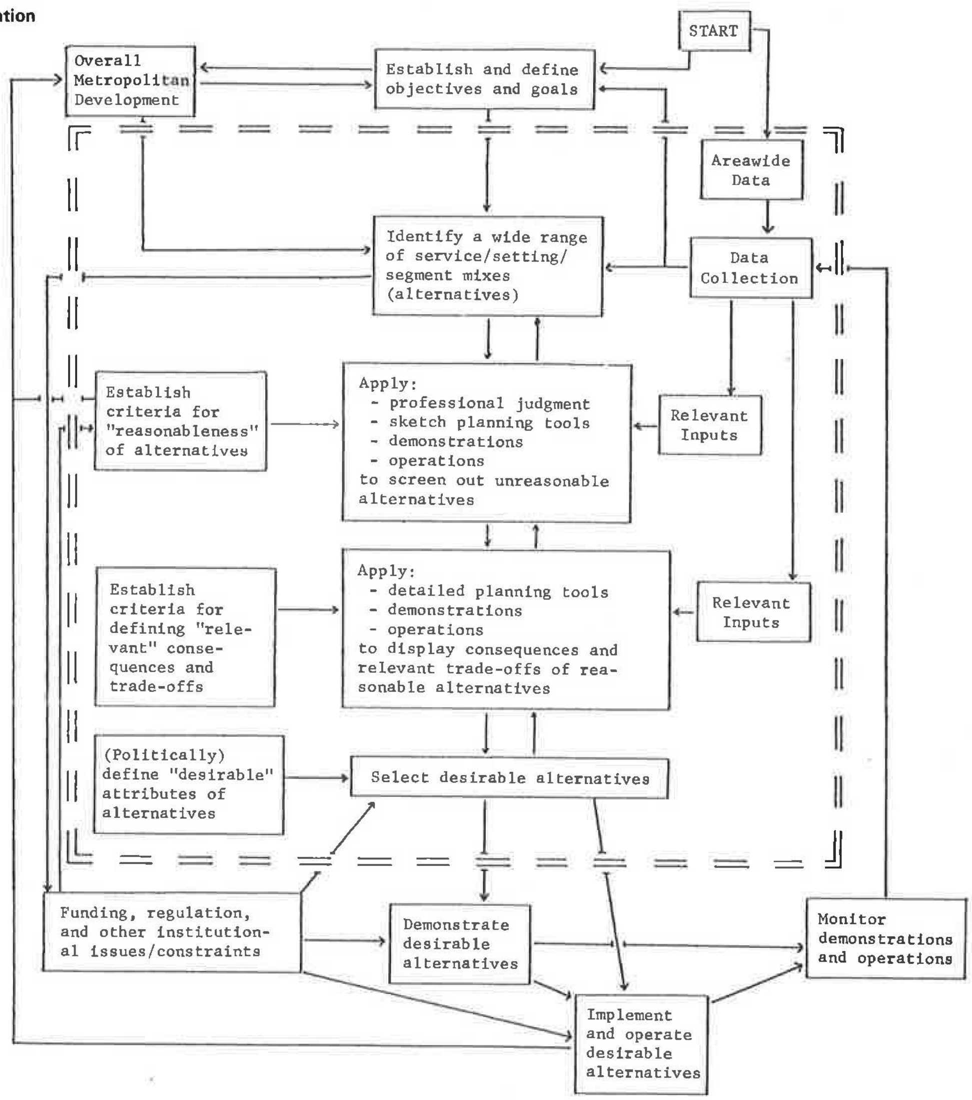
Figure 1. Systems analysis planning process.



market segments in the step referred to as identification of alternatives (system design). Historically, there was initially little or no consideration of market segments in transportation planning, travel demand was considered homogeneous, and a transportation system would be designed to accommodate the predicted demand (2). As transportation analysis techniques and processes matured, the consideration of market segments became a part first of prediction [e.g., travel demand was recognized as being sensitive to such elements as automobile ownership, trip purpose, origin-destination pair, and time of day (3)], then of evaluation [primarily as the result of the widespread application of citizen participation, which provided for the direct representation of a number of market segments in the planning process (4)], and then of the establishment of goals and objectives [e.g., the special consideration given lately to service for the transportation disadvantaged (5)].

Currently, there is an increasing need in paratransit planning for the explicit and careful consideration of market segments in the identification of alternatives (system design). This hypothesis has been given preliminary confirmation by the example of carpool incentive programs. Initially, such incentive efforts were not market oriented but tried to encompass entire metropolitan areas with

Figure 2. Planning-analysis-evaluation process.



ambitious matching endeavors (6). Such programs were generally unsuccessful. More recently, carpool and vanpool matching programs that are based on an employer or activity center have met with considerably better response (6). This is an example of designing a system based on the explicit consideration of particular market segments.

To ensure that market segments are routinely considered in the system-design step of paratransit planning, it is suggested that the way in which an alternative is defined be changed. Instead of defining an alternative simply in terms of the mode or service to be offered--e.g., dial-a-ride, vanpooling, and/or rail rapid transit--an alternative should be defined as the particular mix of all service-setting-segment combinations. This has the effect of changing the nature of the entity that is being analyzed as part of the planning process (i.e., the alternative or option), which creates a profound change in the output of the planning process. The implication is that the methodological tools used in planning must be sensitive to paratransit options, as well as conventional options, and to market segmentation and should also treat demand homogeneously. Thus, the present methodological backbone of transit planning--the Urban Transportation Planning System--could usefully be augmented by new analysis tools that have the requisite capabilities.

Figure 2 shows an expanded diagram of the planning process. Because of the already-mentioned shortcomings of the classic systems theory approach, there is a start point indicated in Figure 2 but no end point. Uncertainties mandate a continuing, iterative process. Such an incremental process can be called "programmatic".

Short-Range Approach: Programmatic Planning

The key features of the programmatic planning approach are the following:

1. It is incremental. Although alternatives that require many related actions are planned, only the next year's actions are considered fixed; actions beyond the immediate time horizon are recognized as tentative.
2. It is forward seeking. Increments are designed to move toward the accomplishment of a predefined (but possibly changing) set of goals and objectives.
3. It is backward looking. Current and past successes and failures are explicitly examined, not only in formulating the next incremental action, or set of actions, but also in reformulating goals and objectives.

Programmatic planning can be thought of as analogous to a decision tree, such as the simplified version shown in Figure 3. The actions represent programming decisions of individual demonstrations, operations, or projects. Of course, it is possible to define a set of demonstrations as a single "action". The arrows denote time sequence, which implies the incremental nature of the process. The contingency structure of the tree--i.e., future actions are taken if a particular response to a past action has resulted--characterizes this set of planning activities as a learning process. If an approach is to be truly forward seeking, there must be a strong link between long- and short-range planning (or between system- and project-level planning). Since that link comprises the programming decisions for the next year's funds, it is clear that both long- and short-range planning goals and objectives must be brought into the programming decision-making process.

Although the entire incremental approach should therefore be laid out in advance for as great a time horizon as is feasible, it must be recognized that all but the initial actions are tentative. Nevertheless, the design of a tentative decision tree serves to make all goals and objectives explicit and is an excellent means by which to direct short-range (programming) decisions toward the accomplishment of an ultimately more desirable state.

TWIN CITIES CASE STUDY

To relate the preceding, primarily theoretical, discussion to an existing planning process, an example has been developed to show how the programmatic approach and the systems analysis process relate to ongoing programs and activities in the Twin Cities of Minneapolis-St. Paul. This case study is intended to highlight how (a) the programmatic approach can be applied to ongoing and proposed projects and programs and (b) the systems analysis approach, with a greater than typical market-segment orientation, can be applied to the decision process as programmatic decisions are being made. The program area examined here (purely for exemplary purposes) is the ongoing effort to increase commuter ridesharing in the Twin Cities region.

Ridesharing programs have been the focus of a significant amount of time, energy, and financial resources in the Twin Cities over the past five years. Among those participating in these efforts are the Minnesota Department of Transportation, the Metropolitan Transit Commission (MTC), and private corporations. The region has had a long-standing dual objective: to promote ridesharing and to significantly decrease single-occupant-vehicle travel, particularly for the work trip. Both activities can be viewed from a programmatic vantage point and linked together through a logical systems analysis approach.

Examine, for example, the pilot vanpooling program initiated by the 3M Company in the Twin Cities (7). The program has specific corporate objectives as well as important regional objectives. Briefly stated, the corporate objectives have included (a) reduction in parking land-use opportunity costs and (b) improved employee productivity (through better on-time performance and reduced "negative benefits" of commuting). The regional objectives have included reduction in vehicle miles of travel and resulting decreases in infrastructure investment, air pollutant emissions, and energy consumption.

Figure 4 shows the 3M pilot program in the context of a programmatic decision tree established from the regional perspective. This type of decision tree could have been consciously developed by regional planners at the time the 3M program was first initiated. (In fact, while no such decision tree was formally developed prior to initiation of the project, some basic understanding of future strategy clearly did exist in the minds of the parties involved.)

The existence of such a decision tree allows a rational basis for application of the systems analysis approach to planning "next steps". Equally important, however, is the fact that the development of such a decision tree provides an explicit basis for unified and coordinated action by the many participants involved in planning, funding, regulating, and evaluating services. Objectives are made explicit, and the relation between program elements that proceed either sequentially or in parallel can be more clearly identified.

Figure 3. Time-staged demonstration-implementation program.

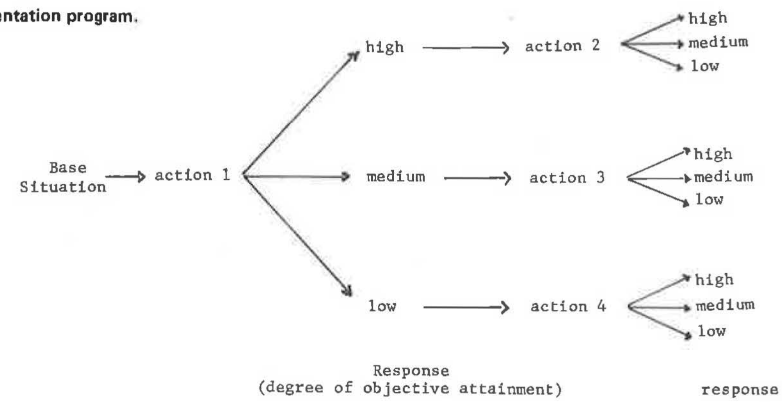
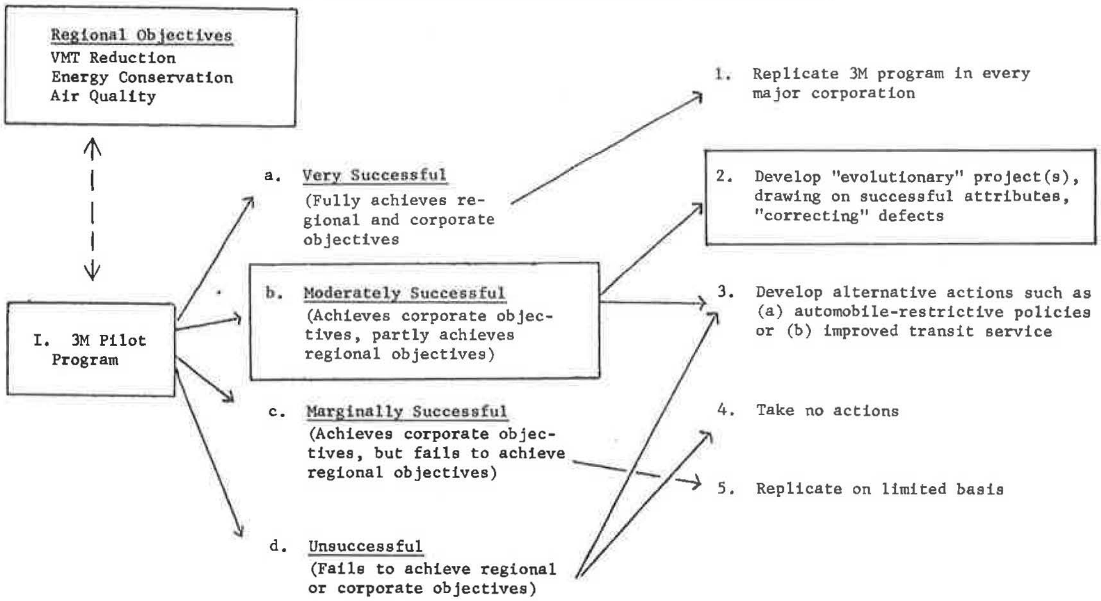


Figure 4. Time-staged decision tree for development of a ridesharing program in the Twin Cities region.



In Figure 5, the 3M pilot demonstration is placed in an analytic framework that parallels the framework developed earlier (Figures 1 and 2). As noted, the process identified earlier is iterative and continuing. It is theoretically possible to "enter" the process from the top (establishment of objectives) and assume that actions wait until planning studies are completed; however, the real world clearly cannot, will not wait (and has not waited) for such study efforts to conclude before actions are taken; entry into the process by means of implementation of demonstrations or ongoing operations is both logical and in greater conformity with real-world requirements.

The 3M demonstration was initiated in 1973. Data collected during the course of the initial project provided important new understanding of and knowledge about the economics of vanpool operations, the behavioral responses of 3M employees to ridesharing options, and the potential impact of the vanpooling concept under similar conditions elsewhere. These data were reviewed and assessed from a regional perspective (i.e., evaluated with respect to regional objectives) in a 1975 study carried out by Public Service Options, Inc. (PSO) (8). That study evaluated the potential of a replication of the 3M example on an areawide basis to meet regional goals and concluded that the corporate-based vanpooling concept was a positive step in the right direction but could not, by itself, fully succeed in meeting regional objectives. PSO developed what might be termed an "evolutionary" form, or permutation, of the 3M ridesharing program, based on an areawide, multiple-employer, trip-end concept (rather than a corporate base), and suggested that this revised design appeared to have the potential for meeting regional objectives but that a demonstration was needed to examine whether the behavioral response of users would be sufficient to actually realize the identified potential.

The next step in the process is the detailed project planning for a ridesharing program based on the evolutionary, multiple-employer concept. This was carried out by MTC (through PSO, its consultant) in the phase 1 activities of the South Hennepin Total Commuter Ridesharing Demonstration. Phase 2 of that project is the actual implementation of the demonstration. If the ridesharing demonstration is successful, it is the intention of MTC to replicate it on a regionwide basis (see Figure 6, which shows a "next time period" in the original decision tree developed in Figure 4).

Thus, it is possible to examine certain existing activities in the Twin Cities region and place them in both programmatic and systems analysis contexts.

Figure 5. Planning-analysis-evaluation process for ridesharing in the Twin Cities.

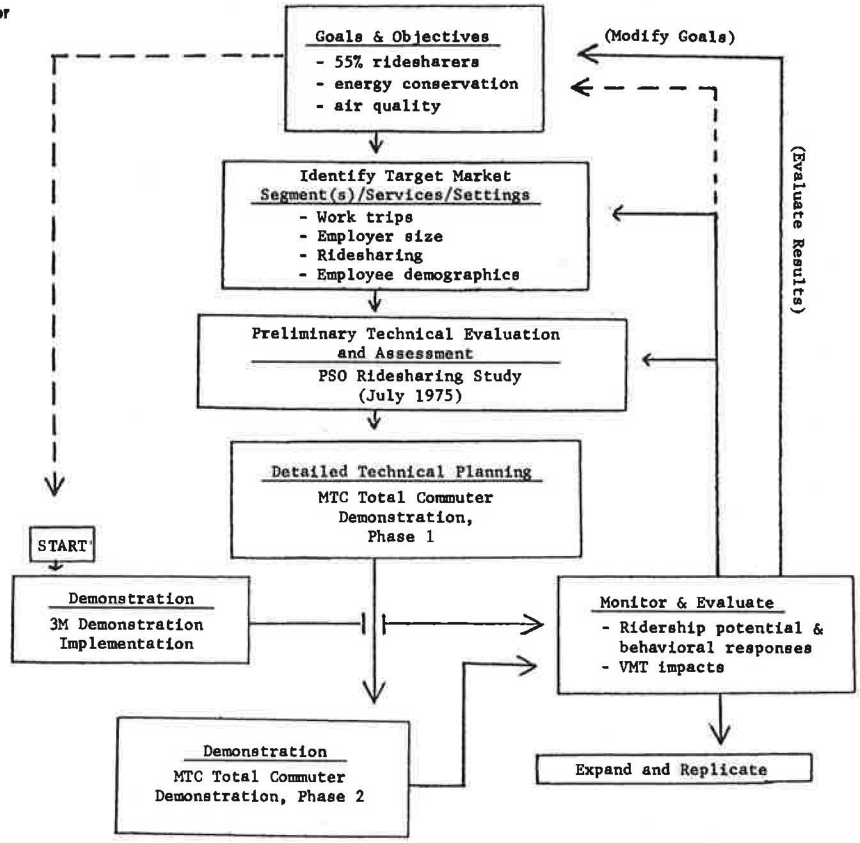
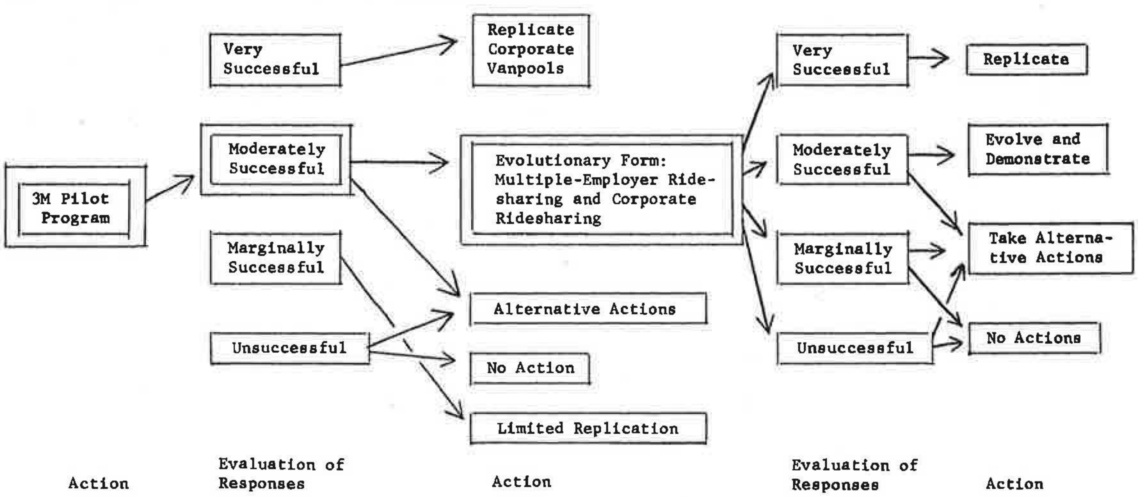


Figure 6. Programmatic approach: Expanded ridesharing decision tree.



This suggests that the theoretical process described earlier in this paper is realistic and compatible with the incremental decision processes that generally characterize the real world.

It is also possible to point out where the evolutionary path followed to date diverges from the theory sketched out earlier. Although it is relatively easy to reconstruct a programmatic decision tree "after the fact", it is questionable whether any decision tree developed in such a way has been a conscious part of past planning processes. The 3M ridesharing project, for example, was initiated, in large part, by the 3M Company in response to both internal (corporate) and perceived external (regional and national) objectives, without strong regional stimulus. It was not part of any real, systematic, regional-level process of meeting regional objectives, although it was certainly compatible with those objectives. It was only after the initiation and initial success of the program that the planning process began to reveal the potential impacts of the program in any overall regional context.

The development of such a "strategic" decision tree, accompanied by a plan for the evaluation of program results and analysis of future program options, appears to be an important and desirable part of the planning process. These decision trees, evaluation processes, and analytic approaches should be identified to the greatest extent possible before program implementation rather than as an afterthought or as an outcome of the projects.

Thus, it appears reasonable to conclude that, although the process that is actually occurring at this time is generally compatible with the systems analysis approach (Figure 2), the planning process methodology clearly can be further structured to be sensitive to the full range of market-segment characteristics and transportation system attributes that influence both the supply of and demand for paratransit services.

SUMMARY AND CONCLUSIONS

This paper proposes a theoretical, process-oriented concept for structuring paratransit planning activities. The proposed process differs from traditional planning processes in that it is simultaneously programmatic and systematic in nature and seeks to combine a rational process for analysis of transportation problems with the action-oriented nature of the actual decision process.

Paratransit systems planning requires a level of disaggregation and focus on detail not found in more traditional transportation planning processes or methodologies. Paratransit planning must be based on a concept of market-segment analysis, in which market segments may be defined as combinations of trip purpose, demographic characteristics, spatial patterns, and time patterns. In short, the identification of traveler groups, which in paratransit analysis are assumed to be homogeneous, is much less tolerant of variances within market segments than would be the case in planning for more traditional modes. Paratransit services are closely tailored to market needs, and the planning process must be sensitive to the market characteristics that define that need. This suggests that more market-sensitive planning methodologies may be required to assist in the planning of paratransit services.

The more well-defined orientation toward market segments and the use of methodologies that are sensitive to the defining market-segment characteristics also implies the need to develop a more detailed and disaggregate data base to be used in the planning process, a data base that must be compatible with the planning methodologies to be used.

Finally, it should be emphasized that systematic planning and analysis of paratransit options are possible at this time. The state of the art is not advanced, but it is able to provide relevant and useful information to decision makers for purposes of both systems planning and project planning. The systematic planning process can be integrated with the programmatic nature of the decision process; to do so, however, requires understanding and coordination of the different process elements carried out at various levels of government.

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