SUMMARY AND CONCLUSIONS

A number of advantages may be expected from the use of the adequacy rating techniques described in this report. Computerization of the procedures will permit the coding of numbers from forms without the need for tables, graphs, and charts. Traffic-control devices in urban areas can then be rated quickly and easily. The inclusion of accident and skid resistance data will be accomplished by merging computer tapes with those of the adequacy rating. The total cost of the rating program will be reduced; much of the work will be done more quickly and efficiently with the aid of the computer. Faster updates of adequacy ratings will be possible.

Improved reliability of the results can also be expected from the revised techniques. Conversion from tables, charts, and graphs will no longer be done by hand. Human error, therefore, will be reduced. Skid resistance will be a measured determination rather than a subjective rating. Several important elements, such as accident experience, traffic safety features, and traffic-control devices, add to the overall data base of the adequacy ratings and, therefore, improve reliability of the rating. Another improvement is the revision of the figures and tables to meet current design criteria in Kentucky. The revisions incorporate 1978 standards.

The revised procedure involves simple addition of numbers for each element to obtain the final adequacy rating. Maximum points and assigned points may be printed on the output format so that the specific deficiencies can be quickly noted. Another simplification is the use of mileposts, reference numbers, and federal-aid route numbers for each section. This will permit easier site identification. The revised technique uses only two classifications of highway instead of three, since intermediate highway sections are to be designated as either urban or rural.

The addition of accident experience, traffic efficiency measures, and traffic-control devices was judged to be important. Skid resistance data (measured values) will also be added to replace the subjective evaluations. The revision of the lane-width factor would allow for modification of the adequacy rating for urban sections if the design level of service were to be changed.

The recommended adequacy rating procedures in this paper are currently being implemented by the Kentucky Department of Transportation.

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Determination of Priorities for Incremental Development of the MARTA System

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The Urban Mass Transportation Administration has recently established a policy for the incremental development of fixed-guideway transit systems. This policy necessitates the evaluation of system components and the subsequent assignment of priorities to system components. The Metropolitan Atlanta Rapid Transit Authority undertook a comparative analysis study to determine the most appropriate order of construction for its "referendum" rail system. This paper reviews the study methodologies and final results. The referendum system, excluding that currently under construction, was divided into 13 operational segments (11 rail and two busway). Analytical information was compiled for each segment, including expected patronage, estimated construction and operating costs, annual revenue, travel time, and various nonquantifiable data. Three criteria were employed in the evaluation of segments: cost efficiency, travel utility, and an index representing nonquantifiable factors. The study was performed in a series of iterative analyses based on sequential decisions. The following conclusions are made: (a) the concept

of iterative analysis provides a reasonable method for determination of system extension priorities, (b) the analyses were sensitive to differences among segments, (c) wide variations of effectiveness were found among segments, and (d) the incremental development policy may adversely affect the ability of local areas to obtain local support for mass transit plans.

Recent federal policy has stressed the need for the incremental development of transportation improvements, specifically for fixed-guideway systems (1,2). The concept of incremental development raises an important issue for local planners: What methodologies can planners employ to evaluate not only the net impacts of a transportation plan but the comparative values of elements within the plan? These issues are of immediate concern to planners in those cities that are developing fixed-guideway transit systems (i.e., Miami, Baltimore, Detroit, Honolulu, and Atlanta).

In response to this federal policy and the uncertainties of federal funding, the Metropolitan Atlanta Rapid Transit Authority (MARTA) undertook a comparative analysis study, the MARTA phasing study (3), to determine the most appropriate order of construction of MARTA's 85-km (53-mile) "referendum" rail system.

BACKGROUND

MARTA was established in 1965. In 1971 a local referendum was passed that levied a 1 percent sales tax for transit use. The sales tax revenue is used to subsidize bus operations and for the local share of a new rapid transit system. The referendum system, including several minor revisions since 1971, includes 85 km (53 miles) of rapid-rail transit, 13 km (8 miles) of exclusive busways, and an extensive feeder-bus system. The fixed-guideway system is shown in Figure 1. (The figure is scaled in customary units as these were the units used in this study.) The 1971 referendum called for completion of the entire system by 1980. However, federal grants have not been sufficient to meet this schedule.

In 1975 the Urban Mass Transportation Administration (UMTA) committed a total of $800 million for the first increment of the MARTA system. Phase A includes the construction of 22 km (14 miles) of rail (see Figure 1) and will open in stages during the next two years.

Although no federal funds are currently committed to construction beyond phase A, funding is expected to be available within the next few years. However, enough funds are not expected at one time to finish the balance of the referendum system; grants will probably be awarded over an extended period of time. Therefore, the system will be constructed one or two segments at a time. Progress will depend on the amount of federal funds available and whether the 1 percent sales tax is extended beyond 1982. (The 1971 referendum calls for the tax to drop to 0.5 percent.) Since a considerable period of time could elapse before the last segment of the system is built, it is important to give careful consideration to the order of construction.

STUDY DESCRIPTION

The phasing study was a comparative analysis of all possible extensions of the system beyond phase A. When construction money becomes available, decisions will have to be made on which lines should be extended. Obviously, many political considerations are involved in this decision. The purpose of the phasing study was to provide technical direction about the advantages and disadvantages of each choice and to determine the most advantageous order of construction for all extension segments.

The referendum system beyond phase A was divided into 13 operational segments (11 rail and two busway). Each of the busways and 4 of the rail branch lines comprised segments, and the rail main lines were broken into segments that reflect logical end-of-line stations. Each of these segments contains one to three stations. The segments are listed in Table 1 and illustrated in Figure 1. Analytical information was compiled for each segment, including expected patronage, estimated construction and operating costs, annual revenue, effects on travel and travel time, and various nonquantifiable data.

Iterative Analyses

The phasing study was performed in a series of iterative analyses based on sequential decisions. In iteration one, the phase A system, now under construction, was used as the base rail-feeder-bus system. Each segment that could be added to the phase A system was analyzed as though it would be the only segment added to phase A. At the completion of the analysis stage in iteration one, the segments chosen as having the highest priority were added to the phase A base. The expanded system then served as the base for iteration two. These steps were repeated for iteration three.

The iterative methodology reflects the interdependency of segments for both operating costs and travel demand. For example, expected patronage on the Proctor Creek Branch varied depending on whether the North Avenue to Arts Center segment or any other segment was added to the base system. Each time a new segment was added to the system, new transit access was provided to the base system, and new transit destinations were provided for the base system. Therefore, if a segment was analyzed in iteration one but was not chosen for construction priority, its estimated operating costs and patronage forecasts in iteration two would be somewhat different. As a result, the priority rankings of segments in one iteration are sometimes reversed in subsequent iterations.

Patronage Forecasts

The operational segments were grouped into five test networks. These networks represent the phase A base system and four progressively larger networks, the last of which represents the referendum system. The networks beyond phase A each added about 16 km (10 miles) of rail to the previous network. The grouping of segments into networks was done in a logical manner, but, as can be seen by the conclusions of the study, this initial grouping was incidental to the results.

Patronage forecasts were based on conventional transportation planning techniques. This included the use of the urban transportation planning system (UTPS) programs. Highway networks for modal split analysis were built by the Georgia Department of Transportation, and population and employment forecasts for 1990 (the base year in the study) were supplied by the Atlanta Regional Commission, the metropolitan planning organization (MPO) for Atlanta.

Trip generation and distribution were common to each of the respective networks. Thus, for any zone-to-zone interchange, the total number of person-trips was constant for each network. Modal choice was simulated for each network. As the level of transit service increased among the successive networks, the portion of trips by transit also increased. The transit trips were then assigned to the bus or rail components of the transit network on the basis of shortest time paths. Manual adjustments were made to the network results to determine the patronage for each individual segment.

Three measures of patronage were estimated for each segment of the system. These measures were used in the analysis in order to assess the various transportation benefits that would be attributable to each additional segment of the system:

1. Total daily patronage on the segment—This is the number of passengers who would use any of the stations in the new segment. This measure of total use was used in the analysis of savings of travel time.
2. New rail riders—This is the number of persons who use a new segment who would not otherwise have used rail; thus, passengers who would switch from bus to rail when a new segment opens may be included. This measure is used to determine incremental operating costs of the rail.
3. Net systemwide patronage increases—This is the net increase in ridership on the total bus and rail system (i.e., trips diverted from automobiles). Induced trips were not included in this study due to the difficulty in estimating latent demand. This measure includes trips diverted directly from automobile to rail and trips diverted from automobile to bus that are the result of improvements to the bus system that are implemented in conjunction with rail extensions.

This latter point deserves amplification. When a rail line is built or extended, the bus system in the corridor will generally be converted from radial to feeder configuration. This has two significant effects:

1. The bus-kilometers that are no longer required for radial corridor service can be reallocated to increase the level of service or the area covered by bus. In either case, new trips would be attracted to transit.
2. The implementation of feeder service also improves crosstown service. Many trips that would have required a downtown transfer in a radial system can be made directly in a feeder-crosstown configuration. Again, new trips would be attracted to transit.

About 70 to 75 percent of the new transit trips in this study were directly attributable to the new rail line. The other 25 to 30 percent were due to related improvements in bus service.

The net increase in overall transit patronage is not only an indicator of diversion from the automobile but also a good indicator of other related benefits, such as reduction of air and noise pollution, energy conservation, and savings in travel time for many individuals.

Figure 1. MARTA referendum system and phasing study segments.

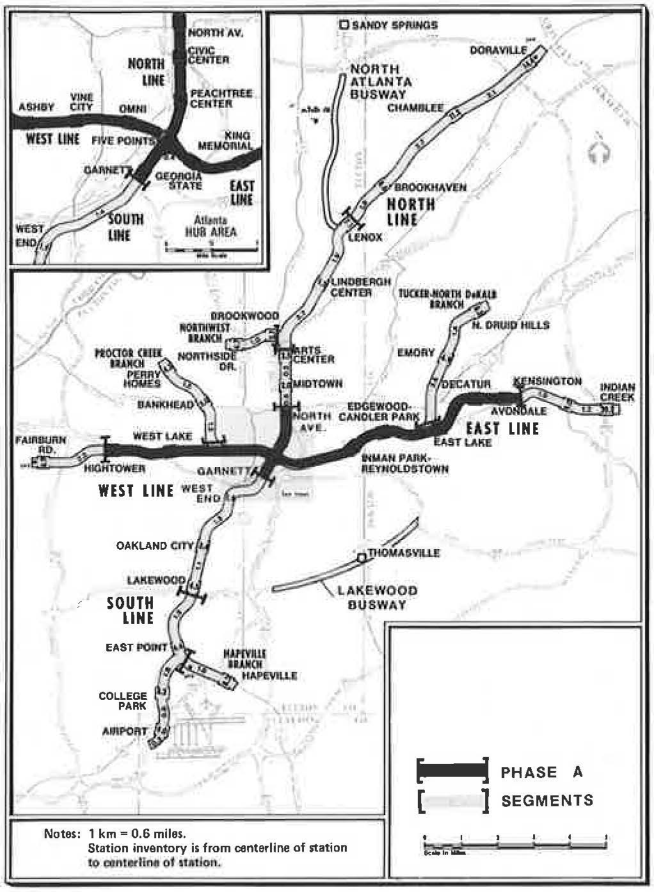

Table 1. Description of test segments.

Line	Segment	Test Network No.	Service (km) Rail[a]	Service (km) Busway	Number of Stations
South	Garnett to Lakewood	2	6.9	-	3
	Lakewood to Airport	3	6.8	-	3
	Lakewood Busway	2	-	5-8	1
	Hapeville Branch	5	2.7	-	1
West	Proctor Creek Branch	2	4.8	-	2
	Hightower to Fairburn Road	5	3.5	-	1
North	North Avenue to Arts Center	2	1.8	-	2
	Arts Center to Lenox	3	7.4	-	2
	Northwest Branch	5	2.6	-	2
	North Atlanta Busway	5	-	8	1
	Lenox to Doraville	4	11.8	-	3
East	Tucker to N. DeKalb Branch	5	6.0	-	2
	Avondale to Indian Creek	4	5.0	-	2
Phase A		1	22.2	-	17
Total			81.5	13-16	42

Note: 1 km = 0.62 mile.
[a]Tail track excluded.

Cost Estimations

The phasing study considered both capital costs and operating costs. Each was evaluated to determine the relative expense associated with each new rail segment.

The capital cost estimates used in the phasing study analysis were based on 1974 estimates, which included escalation to the midpoint of construction. The construction schedule at that time called for completion of the full referendum system by 1980 at a capital cost estimated to be $2.1 billion. Construction costs were allocated by segment, and equipment costs (such as transit vehicles) were apportioned among segments based on expected operating patterns (see Table 2). Inflationary increases will occur in the costs of all segments, but these increases are immaterial in the phasing study since the comparison of various segments was made on a relative basis.

The operating costs of the system are composed of the costs of direct rail operations, direct bus operations, and common overhead and administrative costs. Rail operating costs were derived for each segment in each iteration. When a new segment is added to a base system, rail ridership increases and operating costs change, due to decreased headways and longer train circuit times. These costs are related to increased ridership, but they are also dependent on the configuration and operating characteristics of the base system, thus the marginal operating cost of a particular segment may change from iteration to iteration.

The total level of bus service provided was assumed to remain constant for the various test networks in the year 1990. As rail segments were added, bus kilometers were redistributed to new service areas. The bus fleet size and bus vehicle-kilometers provided annually remained constant, but the areas receiving bus service expanded as rail service was extended. Therefore, direct operating costs of buses and the percentage of common costs associated with bus operations were not considered in the comparative analysis.

Methodology

The comparative analysis for each segment included the following factors:

1. Total patronage on segment,
2. Total increase in rail patronage,
3. Total increase in transit system patronage,
4. Travel time to major generators,
5. Total capital cost,
6. Total increase in operating cost,
7. Improvement of transit service to special groups,
8. Impacts on land use and development, and
9. Environmental impacts.

From these, three summary evaluation criteria were derived: cost efficiency, travel utility, and nonquantifiable measures.

Cost Efficiency

One criterion of influence in decisions among alternatives is the greatest return per dollar spent. The total capital-cost and rail operating-cost increases associated with each new rail segment were compared to patronage increases to provide one basis for comparative analysis among segments.

Patronage forecasts provided estimates of total systemwide increases in daily patronage in 1990 for any given segment. Therefore, costs were also determined on a daily basis over the life of the project. The estimated construction cost for each new segment was divided by the service life of rail transit facilities, assumed to be 50 years. Systemwide equipment (i.e., vehicles, train control, and escalators) was assumed to have a 25-year life. An annualization factor of 285 was used. Daily operating costs were also determined for 1990. No assumptions were made regarding inflation and the future cost of money. This may affect the relative differences between capital and operating costs in future years.

The sum of daily operating and capital costs divided by the increase in total daily system patronage provided a relative measure of the efficiency of each segment in attracting new patrons. This figure is not a full measure of transit service cost per person and should not be misconstrued as such. Bus operating costs, for example, were not included. Also, many quantifiable benefits directly attributable to transit were not included, such as time savings for former bus riders.

Table 2. Capital cost summary.

Line	Segment	Capital Cost[a] ($000 000s)
South	Garnett to Lakewood	109
	Lakewood to Airport	134
	Lakewood Busway	18
	Hapeville Branch	50
West	Proctor Creek Branch	73
	Hightower to Fairburn Road	48
North	North Avenue to Arts Center	63
	Arts Center to Lenox	136
	Northwest Branch	78
	North Atlanta Busway	20
	Lenox to Doraville	166
East	Tucker to N. DeKalb Branch	90
	Avondale to Indian Creek	113
Subtotal		1098
Phase A		1017
Total		2115

[a] 1974 estimate.

Travel Utility Analysis

The travel utility analysis provided a second criterion for the comparative evaluation of segments. The travel utility analysis is based on the difference in travel time by transit to major destination points in the Atlanta area before and after the addition of a new segment. The travel time analysis compares transit travel time via each new rail segment to the previous transit travel times. An origin along the new segment is used for five sample major destinations: Five Points, Lenox Square, Fulton Industrial Park, Decatur, and the airport. The time saved in each case is multiplied by the number of estimated peak-hour riders in 1990 who will make those trips from the new segment's tributary area. The sum of peak-hour time savings to all of these destination points is divided into the total daily cost of providing the service. The resulting number is called travel utility.

Travel utility as discussed here is inappropriate for any purpose but the relative comparison between segments. This is because only a sample of trips and destination points was used. Because of this, and to simplify evaluation, the analysis results were converted to an index by dividing the value for each segment by the lowest segment value. Thus, the travel utility index for the most efficient segment is 1.00, and a value of 2.00 can be interpreted to mean that the associated segment is only half as cost effective in terms of travel time savings as the segment that has an index value of 1.00.

Nonquantifiable Factors

In addition to costs, patronage, and travel time (for which quantitative estimates were made), nonquantifiable factors were considered. These include community and environmental impact, effect on land use and development, and service to special groups of potential riders, such as handicapped, elderly, and other transit-dependent persons (captive riders). Some communities, for example, are opposed to MARTA alignments in their areas because the residents perceive property requirements and other undesirable effects. In those cases, a lower construction priority of that segment is indicated; a higher priority should be given to a segment whose overall impact is regarded as more beneficial by the community.

Nonquantifiable factors were summarized in a single nonquantifiable rating for each segment. The nonquantifiable ratings were represented by letter grades, with A being the most desirable and E being the least desirable. Segment ratings were determined by subjective weighing of the various factors. The rating for each segment was compared to the quantitative factors to determine the overall priority of a segment.

Table 3. Phasing study—iteration one.

Segment	Net Systemwide Patronage Increase[a]	Cost-Efficiency Analysis ($)	Total Daily Rail Ridership[b]	Travel Utility Index	Nonquantifiable Factors
Garnett to Lakewood	18 300	1.32	57 100	1.00	B
Proctor Creek Branch	4 390	2.14	17 700	4.51	B
Hightower to Fairburn Road	1 510	5.86	7 700	4.90	E
North Avenue to Arts Center	7 900	1.24	54 100	1.29	A
Tucker to N. DeKalb Branch	4 300	3.24	12 200	4.18	D
Avondale to Indian Creek	9 470	2.34	26 700	4.23	C

[a]Total daily transit ridership increase due to addition of segment.
[b]Total daily rail patronage per segment.

Table 4. Phasing study—iteration two.

Segment	Net Systemwide Patronage Increase[a]	Cost-Efficiency Analysis ($)	Total Daily Rail Ridership[b]	Travel Utility Index	Nonquantifiable Factors
Lakewood to Airport	21 260	1.16	59 600	1.39	B
Lakewood Busway	2 300	0.67	10 500	0.68	-
Proctor Creek Branch	4 590	3.13	18 500	3.49	B
Hightower to Fairburn Road	1 640	4.90	8 500	2.26	E
Arts Center to Lenox	20 000	1.43	80 600	1	B
Northwest Branch	4 450	4.02	17 500	3.45	D
Tucker to N. DeKalb Branch	4 710	3.50	13 800	2.58	D
Avondale to Indian Creek	11 700	1.95	33 100	2.31	C

[a]Total daily transit ridership increase due to addition of segment.
[b]Total daily rail patronage per segment.

Table 5. Phasing study—iteration three.

Segment	Net Systemwide Patronage Increase[a]	Cost-Efficiency Analysis ($)	Total Daily Rail Ridership[b]	Travel Utility Index	Nonquantifiable Factors
Hapeville Branch	4 250	2.63	19 000	1.28	B
Proctor Creek Branch	4 640	2.90	18 700	3.71	B
Hightower to Fairburn Road	1 720	3.84	9 100	1.68	E
Northwest Branch	4 500	2.45	17 900	2.54	D
Lenox to Doraville	12 700	2.53	39 300	1	B
North Atlanta Busway	1 880	0.93	9 500	0.16	-
Tucker to N. DeKalb Branch	5 020	2.93	14 700	2.63	D
Avondale to Indian Creek	12 380	1.94	36 500	2.51	C

[a]Total daily transit ridership increase due to addition of segment.
[b]Total daily rail patronage per segment.

COMPARATIVE ANALYSIS

Iteration One

The first iterative analysis considered the relative merits of the addition of each of six possible segments to the phase A system. The evaluation factors are summarized for each of the six segments in Table 3.

When net daily patronage (column 1) was divided by the total daily cost (cost-efficiency analysis), the resulting cost per new patron (column 2) was lowest for North Avenue to Arts Center and Garnett to Lakewood, followed by the Proctor Creek Branch and Avondale to Indian Creek. In the travel utility index (column 4), which relates travel time savings to cost, Garnett to Lakewood was estimated to be the best segment, and North Avenue to Arts Center was next best. In summary, the analysis of quantifiable factors found North Avenue to Arts Center and Garnett to Lakewood to be the highest priority segments.

The last consideration in the selection of priority segments in iteration one was the nonquantifiable factors (column 5). The Proctor Creek Branch will provide improved transit service in an area that is very transit dependent; however, disruption is associated with construction of the branch line and development potential is only expected to be fair. North Avenue to Arts Center has considerable development potential, and transit would be a catalyst for growth. The Garnett to Lakewood segment will cause some disruption and relocation but will stimulate southside development and provide service for many blue-collar workers. The overall effect of nonquantifiable factors is supportive of the quantitative data.

The results of the first iteration clearly show that the North Avenue to Arts Center and Garnett to Lakewood segments should be the first two segments to be added to phase A.

Iteration Two

The system base used as the beginning point in the second iteration was the phase A system plus the extensions to the Arts Center and Lakewood selected in the first iteration. Eight possible segments could be added to the new base system; data for these segments are summarized in Table 4.

In the cost-efficiency analysis, the Lakewood Busway proved to be the most cost-effective segment, followed by Lakewood to Airport and Arts Center to Lenox. One reason for the high efficiency of the busway was that bus operating-cost increases were not added to capital costs. This is because the overall level of bus service was assumed to be constant for all levels of system development. As a result, no operating costs were attributed directly to the busway segment despite the possibility that additional bus-kilometers may have been required. However, since the implementation of the busway is dependent on the construction of I-420, its priority in the phasing study is of limited value.

The segment from Arts Center to Lenox fared well in the travel utility index because the North Line would penetrate a major bottleneck in a highly developed and congested corridor. The segment from Lakewood to Airport also had favorable savings of travel times. Both segments also rate well in nonquantifiable factors.

The conclusion of iteration two was that Arts Center to Lenox and Lakewood to Airport were the next two priority segments. As in the summary of iteration one, these two segments were also very close in priority; the Arts Center to Lenox segment was slightly more favorable.

Iteration Three

The base system for iteration three included phase A plus the four segments selected in the previous iterations (East-West Line from Avondale to Hightower and North-South Line from Lenox to the Airport). All of the remaining segments of the referendum system were candidate segments in iteration three. For this reason and because the interdependency between outlying segments for trip-making and operating-cost considerations was not very significant, iteration three was the last iteration required. The relative rankings for net increase in total patronage, cost-efficiency, total daily ridership, travel utility, and nonquantifiable factors are in Table 5.

A comparison of the quantitative factors shows that the North Atlanta Busway appeared to be the most cost efficient. However, the same reasoning used in the discussion of the Lakewood Busway applies to the North Atlanta Busway. Since the busway is to be built in the median of the proposed North Atlanta Parkway, its construction depends on that of the parkway.

The final selection of rail segments was derived as follows: Lenox to Doraville had superior ratings in each of the quantitative factors. The projected patronage was very high, including many reverse commuters; travel-time savings were considerable, and the segment had a good nonquantifiable rating. Lenox to Doraville was, therefore, selected for the third priority category.

The Hapeville Branch had fairly good two-way patronage. Costs were moderate for both construction and operations. The Avondale to Indian Creek segment had considerably higher patronage but also higher costs. These two segments were ranked together in the fourth priority category.

The differences among the remaining four segments (Hightower to Fairburn Road, Northwest Branch, Tucker to North DeKalb Branch, and Fairburn Road) were relatively minor. Patronage increases were generally low due to high existing levels of transit use or too low densities. Since the construction of any of these segments is a number of years off and conditions could change in the interim, the assignment of exact priorities was not essential. Therefore, these last four segments were grouped together in the fifth priority category.

CONCLUSIONS

The concept of incremental development of extensions to the MARTA rapid rail system required the establishment of construction priorities. Such priorities were determined in the phasing study. The following conclusions were derived from a review of the methodology and the results of that study.

The cost-efficiency and travel-utility analyses are sensitive to differences among segments. Each iteration revealed a significant difference between at least some of the alternatives. This confirms the assumption, implicit in incremental development, that priorities among system segments can be determined with some degree of certainty.

The concept of iterative analysis provides a reasonable method for determining system extension priorities. With a series of networks, developed through conventional transportation planning techniques, patronage forecasts can be manually allocated to segments. Experience has shown that no network should contain more than one segment that extends from a given base line in the same direction. Also, the overall complexity of the study is a function of the number of segments and networks. This relation is more geometric than linear, particularly with respect to the projection of operating costs and patronage.

The feasibility of the MARTA referendum system has previously been established on a systemwide basis through an analysis of alternative systems and a benefit/cost analysis (4, 5). Until recently, the entire MARTA system was to be put into operation as fast as it could be built. However, the lack of sufficient federal funds to accomplish this has imposed an incremental development approach. The phasing study revealed a considerable variance in the cost efficiency of the various segments of the system. Therefore, after the completion of the higher priority segments, a reassessment of the weaker links in the system is called for. This process (a) would determine alternative configurations for building the weaker links to enhance their cost-effectiveness, such as more attractive or accessible station sites and shorter or cheaper line construction, and (b) would evaluate alternatives to the heavy rail mode.

An apparent conflict exists between the concept of incremental development and the reality of local politics. It is doubtful that many transit systems could gain local support under a strict policy of incremental development. In order to gain the widespread public support that is required to pass a referendum that calls for higher taxes, substantial benefits must be offered to all segments of the region within a relatively short time frame (5-10 years). MARTA's 1971 referendum passed by only 471 votes. Had any one of the branch lines that now appear to be weak links been omitted from the plan, the referendum probably would have failed.

The incremental analyses approach used for the MARTA phasing study proved to be workable and produced very satisfactory results. The most immediate applications to other cities, transit systems, and types of planning could be found in those cities that are in the process of developing fixed-rail or similar transit systems. Other applications could be the determination of priorities for major components of a regional transportation plan where several expressway and transit projects are proposed. Applications could also be found in any number of other planning endeavors where funding resources are limited and implementation of projects is additive (i.e., extensions to existing systems).

Since the phasing study was completed in late 1977, MARTA has developed a program for expansion of the system beyond phase A. In May 1978, MARTA submitted a grant application to UMTA for phase B of the system. Phase B consists of the North Line from North Avenue to Lenox [9.2 km (5.7 miles)] and the South Line from Garnett to Lakewood [6.4 km (4.0 miles)]. These segments follow the recommendation of the phasing study. Also, the next additional construction beyond phase B is expected to be the extension of the South Line to the airport. While political considerations played a major role in the selection of priority segments, the phasing study results had a significant effect on this decision.

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Potential for Multimodal Transportation Trust Funds on the State Level: A Recent Survey

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This paper presents the results of a recent study of the feasibility of multimodal transportation trust funds on the state level. Recent experience has shown that the slowdown in the growth of motor fuel tax revenues and rapid inflation in transportation construction and operations have created a serious challenge for states. The multimodal trust fund would provide a method that expands the fiscal base for transportation finance while it increases the flexibility for transportation planners in their short- and long-term decision making. The transportation departments of all 50 states were asked to respond to a survey of their present financial positions and policy stances on both the concept of a multimodal trust fund and a variety of other state and federal proposals for revising transportation financing and planning methods. Based on the 36 responses received at the time this article was written, the concept of such a trust fund is viewed favorably, but the problems that it might raise and the political battles that such a plan would face make its enactment in most states highly unlikely. The respondents expressed strong support for the continuation of the Highway Trust Fund and noted that (a) rapid completion of the Interstate highway system is not a very high priority in many states and (b) greater flexibility in the use of federal transportation assistance is needed. The respondents gave a strong mandate to the need for a stable, dependable source of federal mass transit assistance.

A number of recent political and economic factors have combined to create a minor fiscal crisis in the financing of the nation's transportation expenditures. The energy crisis of 1973-1974 and its repercussions brought a halt to the seemingly endless increases in vehicular travel and a decline in fuel sales. Although travel and energy trends have at least partially returned to their pre-1973 status, the threat of tighter and more expensive energy supplies will combine with the gradual increase in the energy efficiency of vehicles to level off and possibly reduce the sale of transportation fuels. This presents a serious challenge to transportation agencies, especially on the state level, that have traditionally depended on a variety of highway-user charges (principally gasoline taxes) to finance their highway construction and maintenance programs. The problem is worsened because the costs of providing adequate highways have increased tremendously in recent years. Betweeen 1967 and 1977 the nation's consumer price index increased by 85 percent; the index for highway construction rose by over 133 percent (1, 2). This fiscal squeeze has affected almost all states and was the force behind a survey in fall 1976 by the American Association of State Highway and Transportation Officials (AASHTO) and TRB of all state departments of highways or transportation. Two interrelated conferences in Denver and Washington, D.C., also addressed the need to find new sources for transportation revenues (3). The fiscal crisis was also a major reason for our request for funding to test the applicability of the multimodal fund concept as a possible approach to this perplexing problem.

There is an additional rationale behind the analysis of this type of fiscal mechanism. Many mass transit supporters, although pleased by the steady growth of federal aid to mass transit since 1970, think that transit will not be able to make meaningful inroads without a major source of guaranteed, continuous revenues similar to both the Federal Highway Trust Fund and the state gas tax revenues, typically earmarked for highway-related expenses and programs. Although a number of regional transit systems do have a variety of tax sources earmarked to support their capital and operating expenses, these funds have generally been well below the needed levels. Requests for additional state and local support through annual legislative approval become necessary; however, this support can easily fluctuate and is susceptible to political maneuvering.

Larger allotments of guaranteed annual funding