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Tampa Bay Region Mass Transportation: Phase II

Harvey N. Kreisberg

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**TAMPA BAY REGION
MASS TRANSPORTATION**

PHASE II

TAMPA BAY REGION MASS TRANSPORTATION

PHASE II

Prepared for the

TAMPA BAY REGIONAL PLANNING COUNCIL

April, 1971

by

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- Long-Range Objectives
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ABSTRACT

TAMPA BAY REGION, MASS TRANSPORTATION, PHASE II examines mass transit in the five Counties of the Tampa Bay Region. The objectives of the study are to improve Regional mass transportation through a program of short-range actions and to take the initial steps in the long-range process of implementing future transit systems in the Region.

An estimated one-quarter of the Region's 1.3 million residents have little or no access to an automobile and are dependent on public transportation. The recommended program of short-range actions is designed to create more extensive Regional mass transit services and to make these services more accessible. This is done through better coordination of existing transit services and facilities and through the application of new technology.

A principal recommendation for coordination of services is the creation of a bus coordination center at Seminole Mall. The concept provides hourly service between most of the urban areas in Pinellas County with only one transfer. Another recommendation institutes new service between Tampa and St. Petersburg. Several other recommendations for coordination of services and facilities are identified.

A principal recommendation for the application of new technology is that promising sites for a demand responsive system (such as dial-a-bus) be identified in the Region and that near-term implementation be pursued. The system would utilize computerized real-time route optimization to serve areas of the Region with lower population densities.

A practical means must be provided for translating mass transit plans into meaningful action. Accordingly, another principal recommendation in the short-range improvement program is that a multi-purpose public corporation be created with responsibility for transportation operations in the Tampa Bay Region. The need, jurisdiction and conceptual details associated with this recommendation are presented.

ABSTRACT (CONT'D)

In preparing to deal effectively with future transportation needs, the establishment of long-range objectives and the development of necessary planning instruments represent two of the earliest steps to be taken.

A comprehensive set of long-range Regional mass transportation goals and objectives are presented. These encompass social, economic, environmental and business considerations, and they are developed in the light of community views and priorities.

A basic and complex transportation planning instrument is the computer model for design and evaluation of future transportation systems. Specifications and a program for developing such a model are presented.

The study included a one-day transit user survey. A primary objective of the survey was to determine needs for new Regional mass transit services. Questionnaires were distributed on-board buses throughout the Region. Results and conclusions are presented.

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THE STUDY AND ITS FINDINGS

INTRODUCTION

There are two key points to be made regarding transportation in the Tampa Bay Region (TBR). First, while an estimated one-quarter of the Region's 1.3 million residents have little or no access to an automobile and must depend on public transportation for their travel needs, only 1 to 2 percent are counted among the present users of mass transit. Second, the Tampa Bay Region shows disquieting signs of going the way of other well-known areas in the nation, with automobile oriented development patterns that ultimately produce pervasive urban sprawl and agonizing traffic jams for people traveling to and from work or shopping downtown. Thus, the short-range problem is to increase the mobility of the Region's captive riders, those people who must depend on public transportation, and the long-range problem is to achieve rational balance between all modes of transportation, with service at all levels from neighborhood to interstate.

The Tampa Bay Regional Planning Council (TBRPC), in cooperation with citizen groups, business interests, and local, state and federal government, has been working since 1967 to find ways of improving mass transportation through short-range action and through long-range planning. The Council's goal is to bring the necessary balance to mass transportation and to provide maximum service to all residents of the Region. Regional transportation is conceived of as a three-level system. The first level meets neighborhood and metropolitan area needs, while at the same time serving as a feeder service to the second level of the system. The second level is higher speed service connecting urban areas throughout the Region and interfacing with the third level, which is inter-regional or statewide high speed service. The three levels are dependent on one another and all must evolve within a common planning framework if any one is to be really useful and successful.

BACKGROUND

The Tampa Bay Region, composed of Pasco, Pinellas, Hillsborough, Manatee and Sarasota Counties, constitutes a very major area on the west coast of Florida. Literally millions of present and future residents will be affected directly or indirectly by transportation developments here. And the Region has a continually growing interaction with transportation state-wide and across the nation.

At present, mass transportation in the Region exists primarily at the first or neighborhood and metropolitan area level, although there is considerable need for improvement at this level, as will be discussed later. Higher speed inter-urban or second-level service is almost entirely nonexistent. This void would be filled by a Regional rapid transit system. The third level of service is outside the Council's realm of responsibility. However, there must be close coordination

between Region and State at this level because of the potentially significant interaction between design decisions associated with new Regional and state-wide transportation systems.

Previous Studies

As noted above, the Tampa Bay Regional Planning Council has been actively involved in transportation planning for the past four years. In 1967, the TBRPC undertook work on a Major Highway Plan, an Airport Systems Plan, a Ports and Waterways Study, and a Rail, Bus and Other Carriers Study. The Council worked closely with the Florida State Road Department in making use of data and results from the comprehensive urban area transportation studies previously conducted in Tampa and St. Petersburg.

In June of 1969, the TBRPC engaged the Consultant to begin Phase I of the Regional Mass Transportation Study. Phase I examined the potential for future transit systems in the TBR and established a Study Plan to improve present mass transit and implement new systems in the future. The Study Plan established in Phase I covered a 12-year period with the first four years devoted to incrementally improving present service and to general planning for new transit systems. The work described in this report is Phase II of the Council's Regional Mass Transportation Study and it is in accordance with the Study Plan developed in Phase I.

STUDY OUTLINE

Phase II of the Council's Regional Mass Transportation Study has two primary objectives:

1. Identify short-range improvements
2. Prepare for future needs

Short-Range Improvements

The first objective seeks to identify those actions that can be taken quickly to accomplish incremental improvements in the Region's mass transportation services. The emphasis here is to achieve improvement through more effective interaction between existing transit services, through application of presently available new technology and through reorganization to permit greater operational and financial flexibility. The study attempts to provide greater opportunity for Regional travel through better coordination of routes, schedules and facilities of local transit operators in the Region. Hardware and operational technologies are surveyed in order to identify those that best meet the

short-range needs of the Region. And organizational concepts are examined to determine which are likely to be most effective as the mechanism needed in the Region for translating transportation plans into action.

Future Needs

The second objective seeks to take the first steps in the long-range process of evaluating and implementing future transit systems in the Region. In this case the study focuses on establishing long-range mass transportation objectives and developing specifications for a transportation analysis computer model. The long-range objectives constitute a basis for postulating new transportation systems and for evaluating their net worth or relative desirability. The transportation analysis computer model provides the instrument needed to objectively evaluate candidate systems representing potential investments of several hundred million dollars. Specifications for the transportation computer model define the modeling approach to be taken, the essential functional characteristics of the primary model elements, data requirements, and a detailed plan for proceeding with the actual engineering design and programming of the model.

Transit User Survey

The Phase II effort included a one-day transit user survey in support of both long- and short-range study objectives. On November 24, 1970, questionnaires were distributed on-board buses throughout the Region. Approximately 1200 questionnaires were filled out by bus riders and returned to the Council. The fundamental purpose of the survey was to determine specific needs for additional Regional transit service. In addition, the survey data will assist in the design and calibration of the transportation analysis computer model.

Throughout the course of the study, a continuing effort was maintained to ascertain community views and priorities so that recommendations would be responsive to the desires of all those affected by mass transportation in the Region. In addition to meetings with transit operators, planners, local and state government officials, and members of local chambers of commerce, the Transit Survey was helpful in determining the views and priorities of present transit users. Finally, the Survey provides a data baseline for measuring the impact of future incremental transit improvements.

REPORT ARRANGEMENT

The report consists of three main Parts plus three Appendixes. The three Appendixes, described briefly below, are not published as an

integral part of the main report. Copies of the Appendixes are available from the TBRPC, on request.

Part I of the report presents the Transit User Survey, including survey objectives, survey method, experimental evaluation and final results.

Part II briefly summarizes mass transit as it is today in the Tampa Bay Region and describes a Short-Range Improvement Program for Regional mass transit. Recommendations are made with respect to coordination of existing services and facilities, application of new technology and establishment of a Regional Transit Service Corporation.

Part III contains the statement of long-range mass transportation goals and objectives for the Region, along with the specifications for the transportation analysis computer model. A summary of community views and priorities and a postulated long-range evolution of mass transit in the Tampa Bay Region are presented as background for the discussion of mass transportation goals and objectives.

Appendix I contains all of the raw data obtained from the Transit User Survey, as well as a disaggregation of transit rider suggestions for improving bus service. The latter shows how the Region's bus operations compare with one another and how user priorities vary between the different local services.

Appendix II is a summary of vehicle technology applicable to transit equipment, including exhaust emission kits, gas turbine engines, natural gas engines, other engine types, noise reduction and safety devices. The summary addresses bus-related technological innovations presently available, in an advanced stage of development or being given serious attention in the context of a longer time frame.

Appendix III consists of a survey of existing transportation analysis computer programs. Model purpose, underlying theory, operational method, data usage and degree of aggregation are discussed.

SUMMARY

REGIONAL TRANSIT SURVEY

The transit user survey was experimentally successful and produced data that satisfied all survey objectives. Statistically satisfactory sample sizes were obtained from the riderships of Clearwater Transit, Cities Transit, Gulf Beach/Pinellas Park Transit, Gulf Coast Motor Line, Tampa Transit, the State Department of Transportation Fleet Demonstration Project and St. Petersburg Municipal Transit. Coverage varied from a high of 23.8 percent of the Clearwater Transit daily ridership to a low of 5.7 percent of the St. Petersburg Municipal Transit daily ridership. Overall, a sample of 7.3 percent was obtained for the total daily Regional bus ridership of approximately 16,000 people.

The survey data yielded a description of the present ridership in terms of social characteristics and home area location, it defined transit usage in terms of who is doing the riding and why, it identified needs for new services both work and non-work, and it supplied a profile of transit user priorities.

The Sample

Makeup of the survey sample was as follows:

female	75%
working	64%
over 60	44%
35 to 60	37%
16 to 35	17%

Interestingly, no sharp differences in trip frequency are apparent between the various rider categories as distinguished by age, sex and retired status, although non-retired riders do account for more weekly trips than retired riders, as would be expected.

Sixty-nine percent of those sampled live in either Tampa or St. Petersburg. In addition, significant portions of the sample reside in Dunedin, Clearwater, Largo, the Beaches and Pinellas Park in Pinellas County, Temple Terrace in Hillsborough County, Bradenton in Manatee County, and Sarasota in Sarasota County. The survey showed an extreme dominance of female over male riders in Dunedin and Sarasota, and a significantly greater proportion of non-retired riders in Tampa and Temple Terrace.

Present Usage

Considering all rider categories, those people who normally make 5, 6 or 7 round trips per week account for 72 percent of the total weekly

travel. Female riders who normally make 5, 6 or 7 round trips per week account for 56 percent of all travel throughout the Region.

Riders were asked to identify the main purpose for most of their bus trips. Non-work trip indications dominated over work trip indications for all home locations except two, Tampa and Temple Terrace.

Travel Needs

Approximately one-quarter of all transit users surveyed indicated that lack of bus transportation was keeping them from going after a better job. And approximately one-half of all those surveyed indicated they needed additional bus service for non-work trip purposes.

The greatest desire for new work trip bus service occurs between Pinellas Park and St. Petersburg. A corridor of fairly uniform desire exists between the lower beaches, St. Petersburg, Tampa and Temple Terrace. The other work trip link of some significance shows up between Largo and St. Petersburg.

The greatest desire for non-work trip service occurs between Tampa and St. Petersburg. The corridor of fairly uniform desire continues to exist for non-work trips between the lower beaches, St. Petersburg and Tampa, with reduced desire for non-work service between Tampa and Temple Terrace. Links with fairly significant desire for non-work trip service are found between St. Petersburg and Largo, the upper beaches and Clearwater. The heavy desire line between Pinellas Park and St. Petersburg exists as it did for work trips, second only to the Tampa-St. Petersburg link.

It must be remembered that these are the results of a transit user survey and therefore they give no indication with regard to the induced patronage that might be found in areas presently without transit service.

User Suggestions

The highest priority of present transit users is to have more frequent service. Twenty-two percent of those surveyed recommended more frequent service as the way to improve mass transit. The next most often repeated suggestion also related to frequency, expressed as a desire for more service on Sundays and holidays.

A large number of comments had to do with achieving better coordination between bus schedules and working hours. Recommendations for more evening and early morning service were frequently accompanied by an explanation that the service was needed for off-hour work at places like restaurants or hospitals, or for attending regularly scheduled evening entertainment functions.

SHORT-RANGE IMPROVEMENTS

A program for the short-range improvement of Regional mass transit was developed. Recommendations are made with respect to coordination of existing services and facilities, application of new technology and establishment of a Regional Transit Service Corporation. Recommendations range in scope from steps that can be taken immediately with little or no capital investment, to actions that may take up to two or three years to complete and involve substantial capital outlay.

Coordination of Services

The primary thrust here is to identify a practical plan requiring relatively uncomplicated interjurisdictional agreements, minimum investment and having a commensurately high probability of successful early implementation.

Viewing the Region as a single system, a concept for interlocking existing bus routes and schedules was evolved. The concept seeks to maximize the convenience of Regional travel by creating direct routes with minimum transfer requirements. It seeks to enhance existing bus operations by increasing the number of accessible attractions, increasing service frequency, expanding the potential ridership that can be drawn upon, and improving operating efficiency.

Four interrelated recommendations are made with respect to coordination of existing services. The overall effect of the recommendations is to provide hourly service between southern and central portions of Pinellas County, higher frequency service between St. Petersburg and the lower beaches of Pinellas County, new service between Tampa and St. Petersburg and greater access to the Region-serving routes of Greyhound and Tamiami Trailways that reach out to Dade City, Plant City, Brandon, Palmetto, Bradenton, Sarasota and Venice, as well as other points in the Region. Recommendations for coordination of services chiefly impact Pinellas and Hillsborough Counties. The reason is that these Counties presently have the greatest concentration of transit operations and hence opportunities for coordination naturally occur here.

The four recommendations for coordination of services are as follows:

Create a bus coordination center at Seminole Mall

The Seminole Mall Shopping Center is geographically well situated to serve as a bus coordination center linking the lower and central portions of Pinellas County. It lies at the intersection of a rational network of Regional routes and is strategically located with respect to the routes of the separate bus operations presently serving various portions of the County.

The Seminole Mall Center could provide a focal point where services offered by Southern Tours (Gulf Beach and

Pinellas Park routes), St. Petersburg Municipal Transit, Gulf Coast Motor Line and the State Demonstration Project in central Pinellas County could all be coordinated for the purpose of providing maximum Regional travel opportunities. The concept provides hourly service between most of the urban areas in Pinellas County, with only one transfer required, at Seminole Mall.

Four recommendations are made in support of the Seminole Mall Coordination Center concept. These describe in detail how the concept could be implemented. The recommendations include extending one or more St. Petersburg Municipal Transit routes to Seminole Mall, providing direct service between Pinellas Park and Seminole Mall, linking Gulf Beach's North Redington route into the Seminole Mall Center and providing hourly service from Seminole Mall to central Pinellas County.

Employ beach transit for collection/distribution and feeder service

The transit user survey showed the presence of a demand corridor between the lower beach area (Madeira Beach, Treasure Island, St. Petersburg Beach), St. Petersburg, Tampa and Temple Terrace. In addition, the survey showed that the greatest percentage of requests for more frequent service was obtained from the Gulf Beach ridership, with 32 percent so indicating.

In response to these results, it is recommended that Gulf Beach's Pass-A-Grille route be modified to fulfill a collection/distribution and feeder role. Details are discussed with regard to coordinating the Pass-A-Grille route with St. Petersburg Municipal Transit route 3 (Central Avenue). The recommended changes would increase the frequency of service offered to lower beach residents from the present one hour to one-half hour, with no increase in the number of buses used. The price paid for the increased frequency is one transfer on a trip from the beaches to St. Petersburg.

Institute locally responsive service between Tampa and St. Petersburg

Tamiami Trailways and the Greyhound Bus System together account for a reasonably large number of daily trips between Tampa and St. Petersburg. However, these are both interregional operations, and their schedules are dictated by the requirements of a very large geographic

service area, wherein Tampa and St. Petersburg are only a small part. This unavoidably leads to inconvenient scheduling and lack of operational flexibility from the viewpoint of satisfying local needs.

There are several approaches that could be taken to provide locally responsive service between Tampa and St. Petersburg through coordination and extension of local services. The recommended approach is for Tampa and St. Petersburg Transit to each extend some number of runs on one or more lines to the downtown hub of the other's urban area. St. Petersburg's route 4 and Tampa's route 9 could interchange across the Gandy Bridge, and St. Petersburg's route 9 could interchange with Tampa's route 10 across the Howard Franklin Bridge. Operational procedures for implementing such a scheme are discussed.

The motivation in recommending this concept, which has scheduling complexities and problems associated with bus identification, stems from a desire to provide one-transfer service between the Tampa and St. Petersburg urban areas, while at the same time making maximum use of available equipment and maintaining present services relatively undisturbed.

Since the greatest demand for service between Tampa and St. Petersburg is for non-work trips, the service between the two urban areas might be concentrated during off-peak travel times. Further recommendations are made regarding flag-down service and some limited flexibility in destination stops.

Make people aware of the new travel opportunities being offered

This last of the four main recommendations for coordination of services is both obvious and essential. As part of the initial publicity campaign dealing with new services and changes to existing services, the public must be educated with regard to how the new services will work and exactly what routes and schedules will be available. While publicity provided by the mass media is helpful, experience has shown that new transportation services are most effectively publicized by means of person-to-person contact. One way this might be accomplished is to enlist the aid of high school and/or college students in distributing promotional material, routes and schedules, and answering questions that people may have concerning the new services.

In addition to the initial public education process, route and schedule information should be conveniently available to transit riders on a routine basis. Extreme care should be taken to make the format of routes and schedules as simple and understandable as possible. Suggestions are included regarding a route and schedule information device, bus markings and a central phone information service.

Coordination of Facilities

In support of the Short-Range Improvement Program, the major application of facilities coordination relates to the establishment, maintenance and usage of primary inter-operational waiting facilities at nodes of the Regional network. The recommended Regional bus node at Seminole Mall is a case in point. Affected operators and other business interests will have to cooperatively approve and support the delegation of responsibility for such Regional facilities to a single authority. In the case of a facility like the waiting accommodations at Seminole Mall, that responsibility could be given to one of the operators, or it could reside with an organization like the proposed Regional Transit Service Corporation, discussed below.

Another application of facilities coordination arises in connection with the idea of establishing Regional shops for major bus overhaul and repair. These shops could be used in common by all of the bus operators, and would be strategically located throughout the Region to provide maximum possible convenience for all users. Routine, daily maintenance and minor repairs would continue to be done in the operators' own facilities. The administration of Regional shops for major overhaul and repair would appear to be another responsibility that could be conveniently delegated to an organization like the Regional Transit Service Corporation.

Application of New Technology

The major recommendation for application of new technology relates to the use of a demand responsive or dial-a-bus type system. Such a system utilizes real-time computerized route optimization in conjunction with small bus-like vehicles to offer door-to-door service in areas not populated densely enough to support conventional fixed route bus service.

The demand responsive system has the potential to successfully reach a significant portion of the Region's captive riders who presently live in areas with little or no mass transportation. A demand responsive system might be employed initially in an area such as Pinellas Park or perhaps North Tampa. Satellite services might then be established in other parts of the Region, for example in Plant City, Palmetto, Bradenton, Sarasota and Venice, with all systems making use of a single centrally located main computer facility for real-time routing computations.

It is recommended that promising sites for a demand responsive system demonstration in the Tampa Bay Region be identified and that the essential characteristics of the demonstration service be defined in sufficient detail to provide the basis for pursuing near-term implementation.

The demand responsive system is particularly well suited to meet the needs of the Tampa Bay Region. The technology lends itself to the kinds of population densities found in the Region, and the door-to-door capability is particularly attractive for the many elderly residents of the Region. The demand responsive concept has been exhaustively studied. It is technologically feasible and can be implemented with state-of-the-art techniques and hardware, although a substantial effort will be required to integrate the existing technology into a smoothly functioning service.

While there have been many so-called demonstrations of demand responsive systems, these have not utilized real-time computerized route optimization, which is the very essence of the concept. More often than not, demonstrations have amounted to little more than a shared-taxi service with conventional manual dispatching of vehicles.

Establishment of a Regional Authority

An array of specific plans has been identified for improving mass transportation in the Tampa Bay Region. This final element in the Short-Range Improvement Program provides the mechanism which is needed to effectively translate these plans into meaningful action.

As new local, regional and state-wide transportation systems are put into operation in the years ahead, it is essential that these activities be coordinated to best meet locally determined needs and objectives. The Tampa Bay Regional Planning Council presently provides such coordination and regional perspective in the area of planning. A corresponding organization is needed to fulfill much the same function in the area of implementation and operation.

A means must be provided for guaranteeing continuity and follow-through on plans that involve hundreds of millions of dollars and many years of work to accomplish. Organizational stability must be assured, a mechanism for interjurisdictional operation must be established, and transportation throughout the Region must be represented by a single voice with responsibility, the authority to discharge that responsibility, and the necessary public standing to qualify for state and federal funding on behalf of mass transportation throughout the Region.

It is recommended that a multi-purpose public corporation be created with responsibility for transportation operations in the Tampa Bay Region.

It is envisioned that the presently constituted board of elected officials governing the TBRPC, or some modification of that board, could also be the governing body of the new Tampa Bay Regional Transit Service Corporation (RTSC). The RTSC would have two functional divisions initially; transit planning and transit operations. Transit planning services should be supplied to the RTSC by the existing TBRPC technical staff, which would continue to have the same responsibilities, authority and basic mode of operation as at present. This avoids duplication in the planning area and at the same time recognizes the need for a certain level of transit planning responsibility and authority within the RTSC. The transit operations division would be responsible for the construction, management and/or operation of Regional transit services. Both divisions would be fully responsible to the governing board of city and county elected officials.

The motivation for this approach is to insure the close coordination of planning and operations, and build upon the working relationships and spirit of cooperation already established by the voluntary association of governments that constitutes the TBRPC. Procedures for financial support and representation from city and county governments have been established for the TBRPC and could provide at least a convenient basis for initial operation of the RTSC. Just as the cities and counties are now provided with fair representation regarding planning activities, the same representation would be applied to operational activities under the recommended approach.

In a general sense, the RTSC would represent transportation in the Tampa Bay Region, provide for coordination and balance between all levels of service throughout the Region and constitute the enabling force permitting implementation of new transportation systems.

Initially, the emphasis of the RTSC should be to provide specific services not presently being supplied, while at the same time insuring that the activities of private and municipal transit companies within the Region are not compromised, in fact that they are materially aided and assisted. Circumstances within the Region are changing rapidly, and the RTSC must be structured so that it can change the emphasis of its function accordingly.

Depending on the time needed for new enabling legislation, voter approval or other such steps in the creation of the Tampa Bay Regional Transit Service Corporation, it may be desirable to implement an interim solution. Accordingly, a concept for an interim, quasi-governmental Regional transit organization which supersedes the Regional Transit Coordinating Committee and paves the way for the establishment of the Regional Transit Service Corporation is described.

PLANNING FOR THE FUTURE

Long-Range Objectives

Long-range mass transportation goals and objectives are a derivative of broader development goals set by the Region. As used here, a goal is defined to be a generalized statement of a community aspiration or an end toward which the community strives.

The following long-range mass transportation goals were identified:

Provide necessary services for those who are dependent on mass transportation.

This is primarily a social goal reflecting acknowledgement by the community that mass transportation is in fact an essential public service for a large percentage of the Region's citizens.

It has been estimated that approximately one-quarter of the Region's population are captive riders; people who must depend on public transportation for mobility because they have limited or no access to an automobile.

The goal expresses the community's acceptance of the fact that these captive riders should have access to reasonably priced transportation that satisfies work, medical, shopping and other essential travel needs.

Contribute to the overall economic growth of the Region.

This goal is a statement of responsibility for mass transportation industries to collectively represent a positive and dynamic force in the Region's overall economy.

Mass transportation is capable of contributing to the overall economic growth of the Region in many ways, including stimulation of other commerce and industry, direct creation of new jobs and increasing the number of job opportunities accessible to the present labor force.

Implicit in this goal is the idea that the true measure of success for mass transportation should not be limited to an accounting of fare box receipts, but rather that it should include the total net impact on Regional economy that is legitimately attributable to the presence of mass transportation.

Promote desired regional forms, appearances, ecological balance and environmental purity.

This goal is responsive to the very high priority placed by residents on aesthetically pleasing Regional development patterns and satisfactory environmental protection.

Implicit in this goal is the idea that mass transportation can in fact be used as an instrument to bring about desired effects in commercial and industrial development as well as residential building patterns.

Whereas goals are generalized statements of the ends that one strives to attain, objectives normally represent the steps necessary to achieve the goals. Objectives derive naturally from goals. They are statements specific enough so that progress toward their achievement can usually be measured quantitatively. Objectives in turn lead directly to the identification of supporting plans and criteria.

The following long-range mass transportation objectives were identified:

Develop a stable base for all mass transportation operations in the Region.

This is a fundamental business objective which must be accomplished if any of the stated goals are to be reached. The objective refers to the achievement of operational and financial stability for mass transportation in the Region, posturing to pursue major Regional mass transportation projects involving substantial capital investment and organizing so that it becomes possible to effectively translate transportation plans into operating systems.

The basic action following from this objective is the establishment of a Regional Transportation Authority as discussed previously in conjunction with the Short-Range Improvement Program.

Function as a unified multi-level Region-wide system.

Region-wide transportation should be developed with services at all levels functioning as one integrated system. Service levels here refer to short-distance, low-speed, downtown systems, major urban and suburban area services, and inter-urban rapid transit. The multi-level concept is essential since each level is normally an incomplete service without the existence of adjacent levels.

In functioning as a unified system, all efforts must be expended to avoid conflicts between component operational elements of the system, to maximize net Regional benefits and to profit from collective experiences through frequent and routine communication between operators, planners and other involved agencies.

Improve mass transportation's image within the Region.

The use of mass transportation as a device for achieving overall Regional objectives should be emphasized. Ultramodern appearance should be stressed in new equipment purchases and facility construction.

New transportation technology should be demonstrated and tested for public reaction. This could be accomplished by utilizing unconventional modes (such as vehicles with air cushion suspension or linear electric motor propulsion) for small-scale service to tourist attractions, recreational areas, or perhaps as an airport access service.

Increase the number of employment opportunities within reach of captive riders.

Mass transportation services should be provided in response to the needs of residents who are dependent on public transportation for travel to and from work.

Rapid transit can play a major role in accomplishing this objective. Rapid transit married with appropriate

collection/distribution services can significantly expand the boundaries of the area within which captive riders may seek employment.

In addition, the planning and implementation of rapid transit systems are frequently accompanied by significant new job-creating commercial and industrial development.

Increase the mobility of captive riders with respect to non-work travel.

Demand responsive systems are a particularly appropriate action in support of achieving this objective. While obviously suited for both work and non-work trips, the demand responsive system is especially suited to the lower level of demand density that would probably be associated with captive rider non-work travel needs.

The needs of retirees and handicapped persons should be given consideration. Service could be provided from retirement communities to major medical facilities, shopping and recreational areas.

Support Regional efforts to compete successfully for export market income.

The importance of exported goods and services to the Regional economy was highlighted in the TBRPC's "Economic Study for the Tampa Bay Region." Mass transportation could take actions that would benefit tourism/retirement industry groups.

Off-peak transit capacity could be used in support of a highly organized sightseeing service. Mass transportation could engage in cooperative advertising with tourism, retirement, new housing and other such interests, in order to build a reputation outside the Region for superior public transportation.

Support the successful achievement of desired compact development patterns.

Mass transportation should be employed to promote future patterns of forms and appearances that are in consonance with overall Regional goals.

Initially unprofitable service to new cluster or planned unit development projects might be subsidized for the primary purpose of encouraging rhythmic development and breaking the pattern of urban sprawl development.

Advantage should be taken of rapid transit's ability to create concentrations of commercial and industrial development in the immediate vicinity of stations and terminals. In this way, rapid transit can be used to help produce development density variations with commercial activity encouraged in those areas where such development is desired.

Blend in with the overall atmosphere of the barrier islands.

Island routes and networks should discourage through traffic, including extensive inter-island travel. Service on barrier islands should fulfill a collection/distribution function and be linked to trunk service on the mainland.

Mass transportation should promote the water-oriented recreational activities of the barrier islands. Desired "windows" or "doors" to Gulf or bay waters should not be obstructed by transportation operations.

Minimize mass transportation's contribution to pollution and ecological unbalance.

New vehicle technologies that minimize environmental pollution should be introduced to the fleet as they become available and as opportunities arise in connection with normally scheduled fleet improvement programs.

Whenever appropriate, new systems should utilize routeways provided by existing causeways or routes offered by bridging natural land forms in close proximity so as to avoid disruption of natural habitat, drainage or tidal flows.

Route selection and fixed guideway construction associated with new mass transportation systems should be sensitive to scenic viewing and should not obstruct fields of vision.

Transportation Model

Specifications for a transportation analysis computer model were developed. The model is to be a planning instrument for designing and evaluating candidate transportation systems. It contains subroutines that compute number of trips generated, their geographic distribution, how they become apportioned among competing travel modes and specifically what routes are used between the various origin-destination pairs. The model simulates proposed transportation systems and objectively forecasts what conditions would exist if one or more of these systems were actually placed in the Region at a specified time in the future.

A hybrid or multiple approach is anticipated in constructing the functional relationships for the model. The approach will be to use available travel data for the Region to the maximum extent possible, tailor the various functional relationships in an attempt to represent the special behavioral patterns of TBR transit riders and make use of some of the theory that has been widely applied in other models, such as the analogy between trip distribution social forces and physical gravitational forces.

Inputs to the model consist of a forecasted state of the Region for the time period to be studied, along with a description of the total Regional transportation system, including new systems to be evaluated.

The forecasted state of the Region would be described in terms of population, age distribution, residential density, income levels, land use, employment opportunities and other such demographic data. The total transportation system, including new systems to be introduced, would be described in terms of trip cost, travel time, service frequency, link capacities, network configuration and other such descriptors.

Basic subroutines within the model are trip generation, trip distribution, modal split and traffic assignment. An overview of probable logic flow within the program is as follows:

The first subroutine, trip generation, makes use of the multiple regression technique and produces total potential number of trips that will originate within a zone. Then a break-out is performed on the basis of zonal age and income distributions, and total potential trips are segmented into the categories of captive rider potential trips and choice rider potential trips.

For the captive rider potential trips, a predistribution modal split determines number of trips made. This is then fed into a trip distribution subroutine to determine zonal exchanges and person trips. Trips are categorized by purpose throughout.

For the choice rider potential trips, a trip distribution subroutine is used first to translate trip originations into zonal exchanges. The exchanges are then passed on to a post-distribution modal split subroutine to generate person trips by mode, as well as vehicle trips.

Zonal exchange trips thus determined for each rider category are then brought together in the traffic assignment subroutine. This subroutine assigns predicted vehicle trips to the relevant links between zones in a specified transportation network. Link loading conditions and realizable travel times are then computed and fed back into the modal split subroutines. This recycling continues until a balance (within predetermined tolerances) is achieved between computed interzonal travel times across the entire transportation network and travel times used in the modal split calculation.

Induced travel considerations are introduced as part of the modal split and trip distribution subroutine formulations for both the captive and choice rider categories.

The output of the model consists of a total picture of transportation in the Region for the forecasted period, including the impact that any new systems would have. Patronage estimates are provided for each mode of transportation, level of usage is computed and described in terms of individual link loading, and realizable travel times are projected for all transportation modes between origin-destination pairs.

A program for developing the transportation systems analysis computer model is described. Principal tasks in the program are the creation of a data bank, engineering design of model subroutines, preparation of instructions for programming the model, computer programming, integration and checkout, model calibration and program documentation. It is estimated that the model can be developed in one year if some amount of task concurrency is accepted and, of course, if the necessary financial resources are available. Alternatively, the program can rationally be divided into two one-year efforts to accomplish the development at a lower level of funding.

PART I

REGIONAL TRANSIT SURVEY

INTRODUCTION

On Tuesday, 24 November 1970, bus riders throughout the Tampa Bay Region were asked to fill out a survey form comprised of a small map of the Region and eleven questions. The questionnaire focused on Regional transportation needs and was designed to support all elements of the Phase II study effort.

Generous cooperation was received from the TBRPC technical staff, the transit operators and the mass media, in coordinating, publicizing and carrying out the survey. The collective effort resulted in a very good response from the transit riders. Statistically satisfactory sample sizes were obtained from the riderships of Clearwater Transit, Cities Transit, Gulf Beach/Pinellas Park Transit, Gulf Coast Motor Line, Tampa Transit, the State DOT Demonstration Project, and St. Petersburg Municipal Transit.

The survey provides a description of transit riders throughout the Region, identifies the relative contributions of various ridership subgroups to total patronage, reveals the needs of present bus riders for new inter-zone Regional services, and enables a ranking of user views and priorities on mass transportation.

Survey objectives, survey method, the extent to which the survey was an experimental success and a presentation of results are included in the pages that follow. A complete presentation of the unprocessed survey data and additional derived results are included in Appendix I (available from the TBRPC on request).

OBJECTIVES

Survey objectives include the establishment of a Regional transportation data base, the determination of Regional needs for additional transportation services, the solicitation of transit user comments and suggestions, and the obtainment of data needed to establish transportation parameter correlations and functional dependencies. Figure I-1 shows the inter-relationships between survey objectives and overall Phase II program objectives. The lines indicate which of the program objectives are supported by each of the survey objectives.

Establish Regional Data Base

The survey provides a data base describing transit users and transit usage throughout the Tampa Bay Region. For the first time, homogeneous mass transportation survey data were obtained for the entire Region, simultaneously and by means of a single test instrument.

These data constitute a baseline against which the effectiveness of any improvements can be quantitatively measured. Effectiveness may be

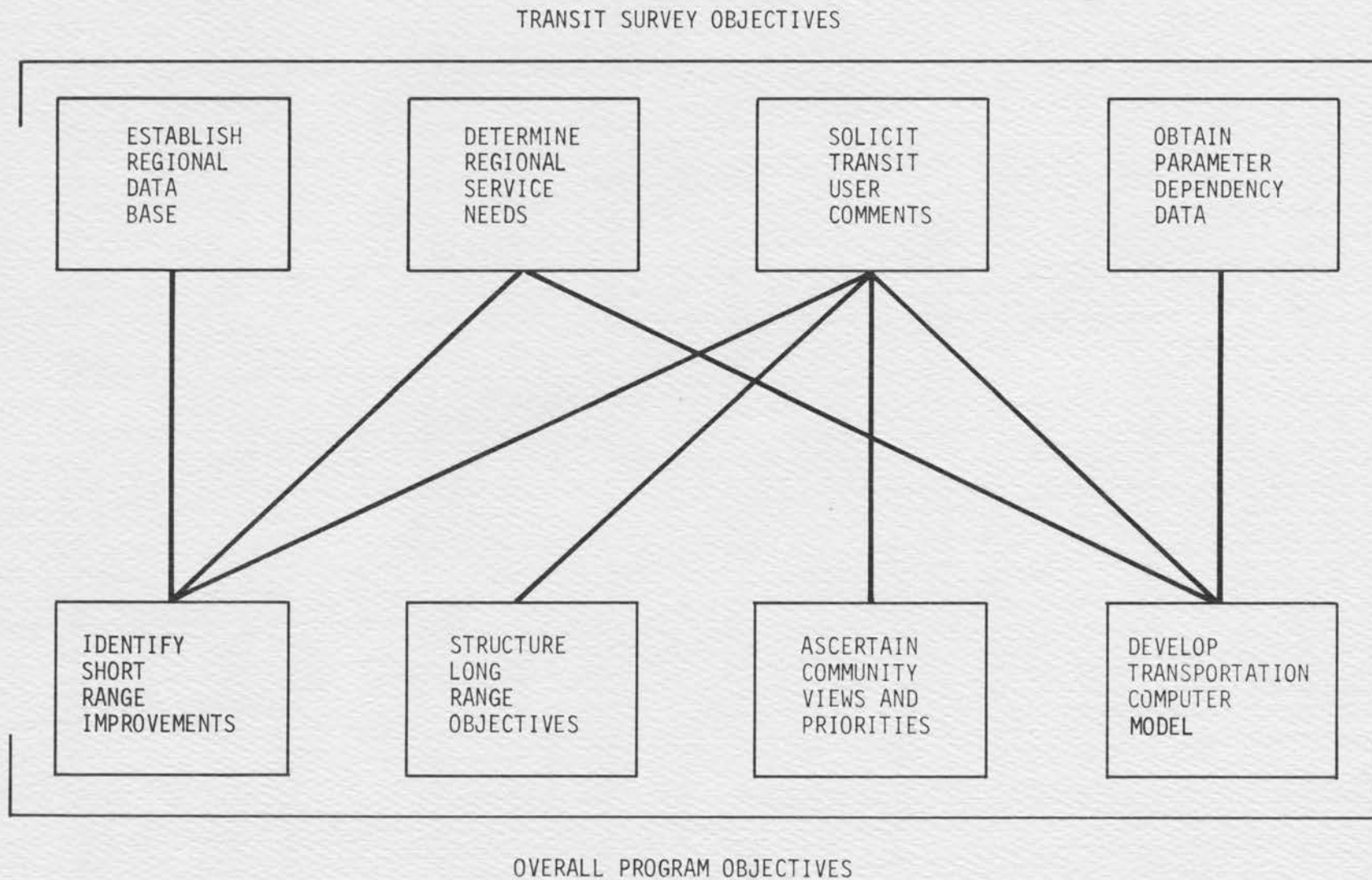


Figure I-1. Survey Support of Overall Program Objectives

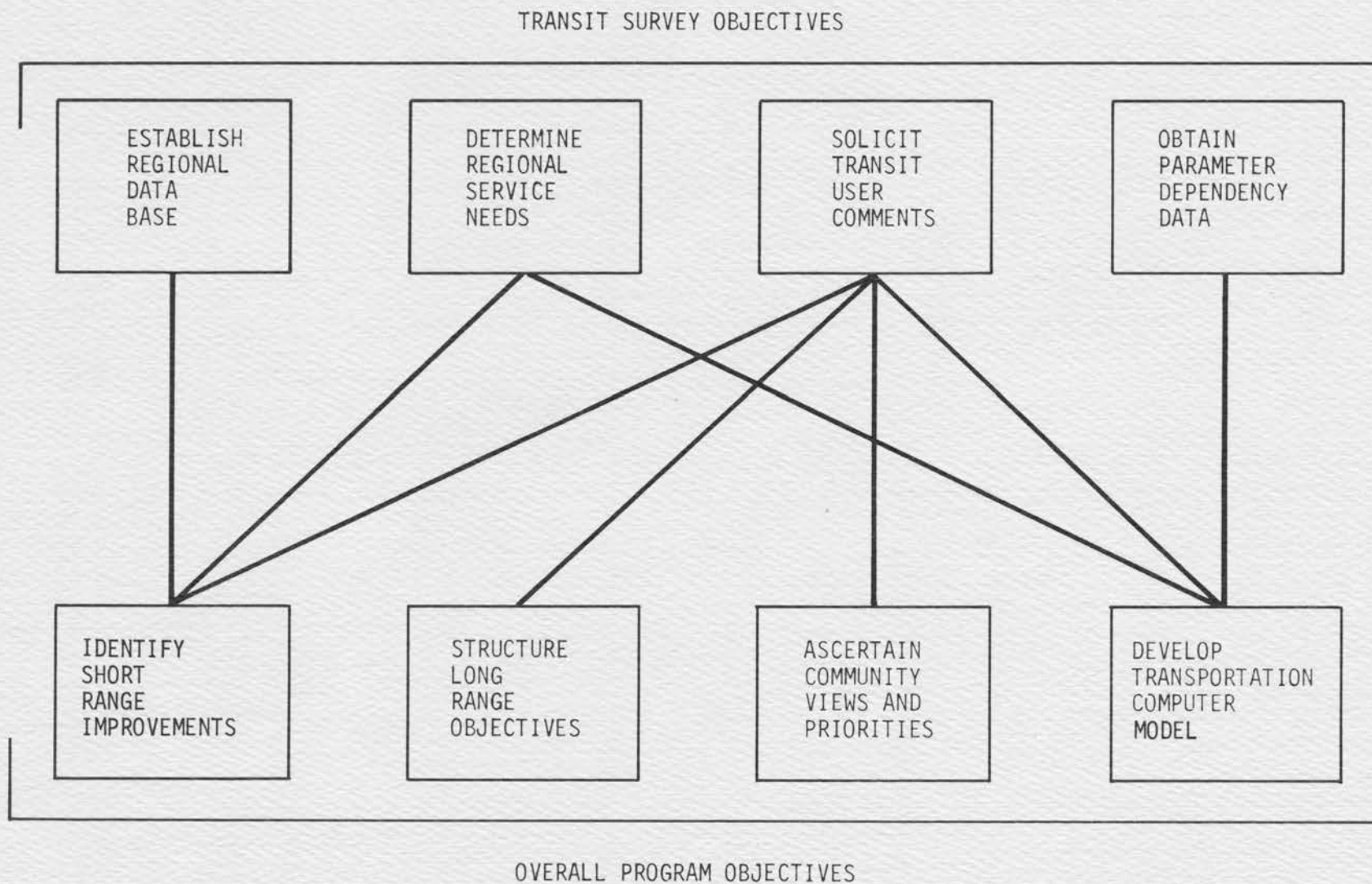


Figure I-1. Survey Support of Overall Program Objectives

described in many terms, including additional patronage induced from specific ridership subgroups, changes in expressed desires for new services, or a reordering of transit user priorities. The survey data permit quantitative evaluation in any of these terms.

Regional uniformity of data for planning and evaluation will become increasingly important in the future as mass transportation in the TBR evolves closer to a unified Region-wide system and it becomes more and more critical to preserve a Regional perspective. Uniform data permit valid comparisons to be made between transit users and transit usage throughout the Region, thereby supporting any efforts to achieve equality and balance of services. The survey showed that many transit riders are both knowledgeable and sensitive about differences between services in their home area and services offered elsewhere in the Region. These people are resentful of inequities which in their eyes seem unjustifiable.

Determine Regional Service Needs

One of the most important objectives of the survey is to gain insight into work and non-work transportation needs that exist but are going unsatisfied. Emphasis was placed on Regional needs between population centers or between local bus franchise areas and specific attractions outside those areas, as opposed to local services.

The identification of Regional links and corridors where significant unsatisfied demand seems to exist was instrumental in the development of the short-range improvement program described later in this report. In addition, the survey indicated whether a given need was substantially work or non-work oriented and gave some information regarding specific attractions to which service was needed or desired. This information further assisted in the selection of particular routes and operating policies associated with recommended actions for the short-range improvement of Regional mass transportation.

A knowledge of interzonal transportation needs is also useful in support of developing the TBR transportation analysis computer model since it provides further insight into the likely Regional network configurations that the model will have to accommodate. In addition, the travel behavior of various ridership subgroups (distinguished by such attributes as age, sex, retirement status, main reason for traveling and home location) has a substantial impact on the overall logic structure of the model as well as the detailed mathematical formulation of some of the subroutines.

Solicit Transit User Comments

Another survey objective was to ascertain the views and priorities of that segment of the Regional community represented by the present transit

ridership. As shown in Figure I-1, survey information of this type is useful in support of all major Phase II program objectives.

To illustrate, a significant desire for higher frequency service on the part of the Gulf Beach Transit ridership influenced the recommendations that were made for short-range improvement of regional service to that area. Further, long-range mass transportation objectives are formulated in light of needs and desires expressed by the transit users as well as all other segments of the Regional community. And, insight into transit rider priorities materially assists in the task of establishing certain judgmental influence coefficients contained in the transportation analysis computer model, particularly those associated with the induced patronage subroutine formulation.

Obtain Parameter Dependency Data

Lastly, the survey was intended to support the design of trip generation, trip distribution and modal split subroutines for the transportation analysis computer model.

The survey data provide an opportunity to determine Region-wide the potential modeling parameters that exhibit statistically significant correlations. These parameters include rider characteristics, such as age, retirement status and sex, trip characteristics such as purpose, length and location, and rider preferences regarding such things as service frequency and the use of minibuses.

Further, for those parameters determined to be significantly correlated, mathematical functions can be derived to express their relationships. These functions can then be used to help in structuring some of the multiple regression equations associated with trip generation, trip distribution and modal split subroutines.

SURVEY METHOD

Distribution

The survey was conducted on one day only, a Tuesday, with simultaneous coverage of all the Region's bus services. It was exclusively an on-board survey, with a written questionnaire the only test instrument used. Packets of questionnaires and containers in which to place them were distributed to the bus operators. On the day of the survey, buses throughout the Region started their first run with questionnaires on-board. Each of the envelopes containing questionnaires had a brightly colored sign on the front, with lettering as shown in Figure I-2. Riders were asked to take a questionnaire, fill it out at their convenience, and mail it back to the TBRPC, postage free.

HELP YOURSELF
to
BETTER TRANSIT

Figure I-2. Front of Envelopes Used for On-Board
Questionnaire Distribution

Questionnaire

A two-page questionnaire form was designed for the survey. It contained a map of the Region and, facing the map, eleven questions. The two pages of the questionnaire are shown in Figures I-3 and I-4. The division of the Region into 27 zones was done to facilitate the data reduction process and to simplify the filling out of the questionnaire. The scheme worked well, with most respondents apparently able to understand the questions and how to answer them.

The first five questions were intended to provide limited rider characteristics information. These questions provided for consistency and completeness in the Regional data base, enabled comparisons to be made between the various local riderships, and supplied needed parameters for the application of survey data to the modeling process. Questions on rider characteristics were kept to a minimum because the general makeup and travel habits of bus riders have been thoroughly identified in previous surveys run locally in the Region.

The main thrust of the questionnaire was to determine the needs of bus riders for services not presently available. Questions six through ten were devoted to this aim. Questions seven and nine were intentionally positive and unequivocal in an attempt to avoid "yes" responses given with a "sure, why not" attitude.

Question eleven provided respondents with an opportunity to express their views on how bus service might be improved in the five counties of the Tampa Bay Region. A large number of respondents took advantage of the opportunity. Their comments and suggestions are discussed later in this section, as well as in Appendix I.

EXPERIMENTAL SUCCESS

Overall Coverage

Survey coverage achieved for the various bus operations in the Region is shown in Table I-1. Coverage varied from a high of 23.8 percent of the Clearwater Transit daily ridership to a low of 5.7 percent of the St. Petersburg Municipal Transit daily ridership. A sample of 7.3 percent was obtained for the total daily Regional bus ridership of approximately 16,000 people.

Clearwater Transit, Cities Transit, Gulf Beach/Pinellas Park Transit, Gulf Coast Motor Line, and the State DOT Demonstration Project were each given quantities of questionnaires equivalent to their estimated total daily riderships. This was done in order to maximize the statistical significance of the data samples from these relatively small

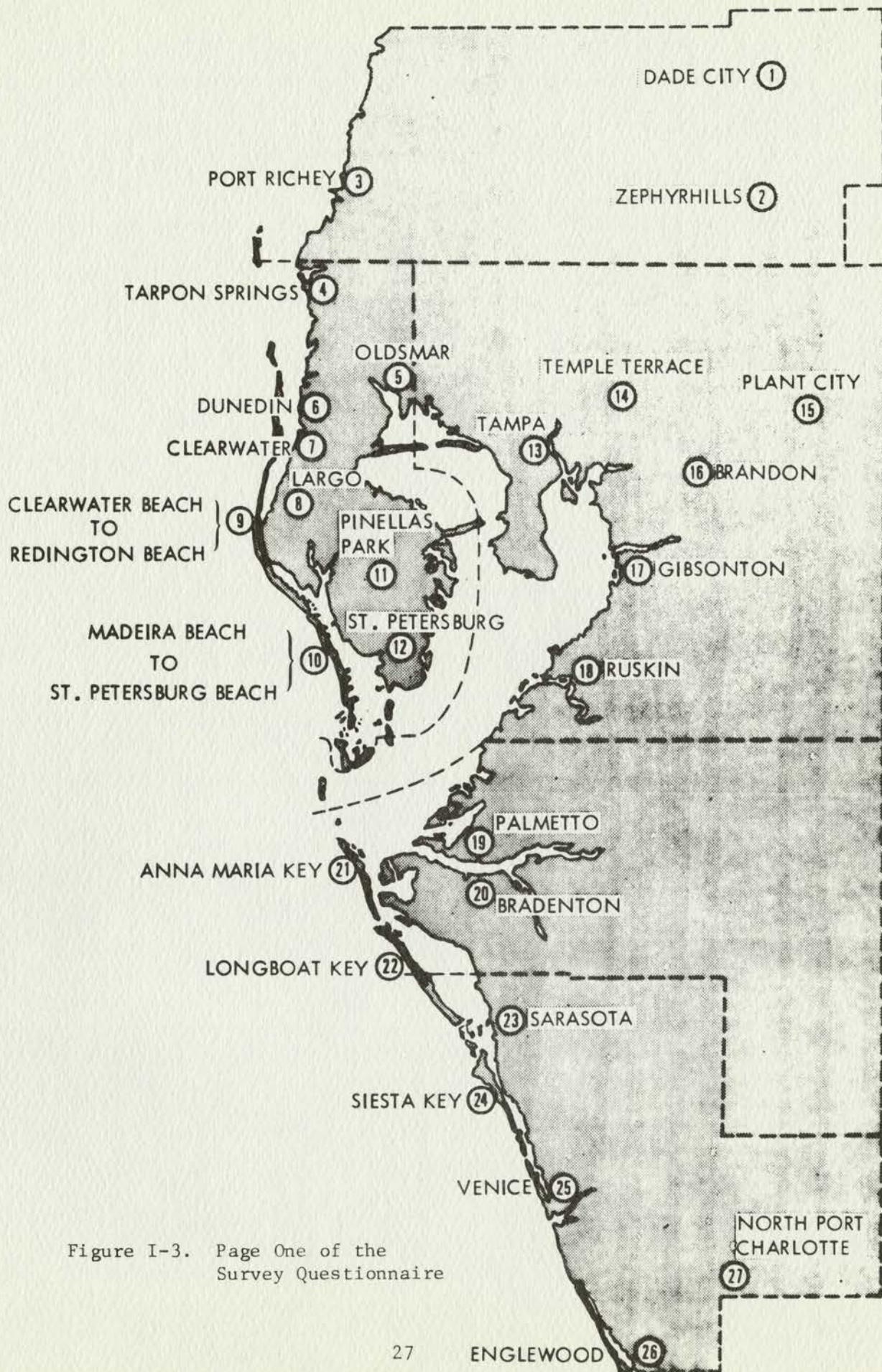


Figure I-3. Page One of the
Survey Questionnaire

PLEASE ANSWER THESE QUESTIONS

1. Age: ☐ under 16 ☐ 16-35 ☐ 35-60 ☐ over 60
2. Are you retired? ☐ yes ☐ no 3. ☐ male ☐ female
4. How many round-trips, for any purpose, do you normally make by bus in one week? _____
5. What is the main purpose for most of your bus trips? You may check more than one.

 ☐ work ☐ shopping ☐ medical ☐ personal business

 ☐ social/recreational ☐ school ☐ other
6. Looking at the map what number is closest to your home? _____
7. Is lack of bus transportation keeping you from going after a better job? ☐ yes ☐ no
8. If your answer to question 7 is yes, what numbers on the map are closest to where you would look for a job? Please limit your answer to no more than three numbers. _____
9. If there are any other reasons why you need additional bus service please indicate by checking one or more of the following:

 ☐ shopping ☐ medical ☐ personal business

 ☐ social/recreational ☐ school ☐ other (non-work)
10. If you need additional bus service for any of the reasons in question 9, what numbers on the map are closest to where you would go on these non-work trips? Please limit your answer to no more than three numbers. _____
11. What suggestion do you have for improving bus service in the five counties of the Tampa Bay Region?

Figure I-4. Page Two of the Survey Questionnaire

TABLE I-1. SURVEY COVERAGE OF TRANSIT RIDERSHIPS

TRANSIT OPERATOR	PERCENT OF RIDERSHIP SAMPLED
CLEARWATER TRANSIT	23.8
CITIES TRANSIT	16.0
GULF BEACH/PINELLAS PARK TRANSIT	16.0
GULF COAST MOTOR LINE	13.5
TAMPA TRANSIT	7.8
STATE DOT DEMONSTRATION	6.5
ST. PETERSBURG MUNICIPAL TRANSIT	5.7
TOTALS FOR THE REGION	7.3

operations. Particular routes were selected for surveying in the case of Tampa Transit and St. Petersburg Municipal Transit. Total questionnaires supplied to these operations were equivalent in number to approximately 40 percent of their estimated total daily riderships.

Statistical Evaluation

Insight to the statistical meaning of the survey results is provided by Figure I-5. For any statistic obtained directly from the data sample, this figure shows the interval about that statistical value within which the true value lies. The true value is that which would be obtained if 100 percent of the population were surveyed instead of some lesser percentage. For example, in the case of St. Petersburg Municipal Transit with a population (total estimated daily ridership) of approximately 10,000 and a survey sample of 5.7 percent, each sample statistic would be expected to lie within around plus or minus 1.5 percent of the true population value. The small dots on Figure I-5 show where the seven riderships listed in Table I-1 fall on the plot. The large dot at the top is for the Region as a whole.

Figure I-5 is developed for a 95-percent confidence level and an assumed survey accuracy of plus or minus 20 percent. This means that one is 95 percent confident about statements made on the basis of this figure, and if the survey were to be conducted again, the results would repeat within plus or minus 20 percent.

While relatively narrow confidence limits can be placed around the survey results in a mathematical sense, it must, of course, be noted that final accuracy levels are also sensitive to the manner in which questions are framed, and consequently the ability of respondents to accurately and objectively supply answers. This source of error is not immediately subject to quantitative evaluation.

RESULTS AND DISCUSSION

The survey data yielded a description of the present Regional ridership in terms of social characteristics and home area location, it defined transit usage in terms of who is doing the riding and why, it identified needs for new services both work and non-work, and it supplied a profile of transit user priorities. Survey results are presented and discussed in each of these four contexts in the paragraphs that follow.

DESCRIPTION OF SAMPLE

Rider Social Characteristics

An overview of bus rider social characteristics for the entire Region is shown in Figure I-6. As is well known, most trips are made by working

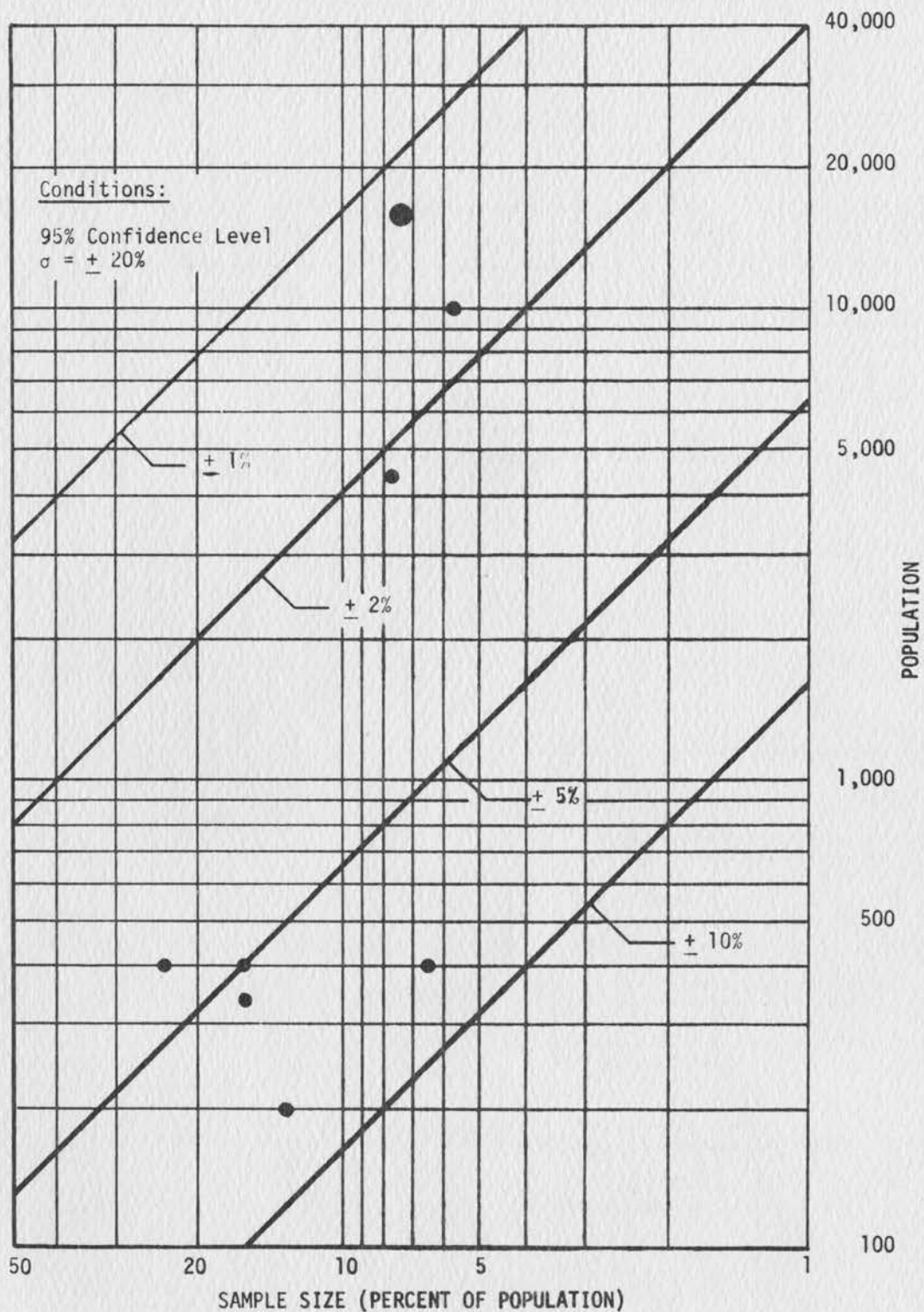


Figure I-5. Statistical Evaluation of Survey Coverage

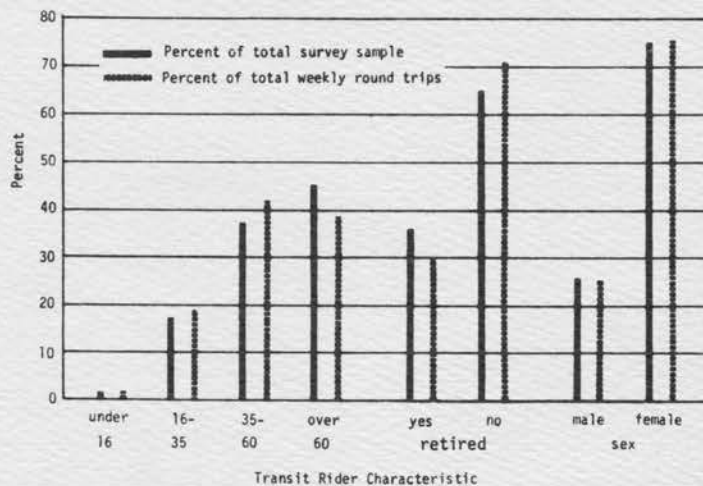
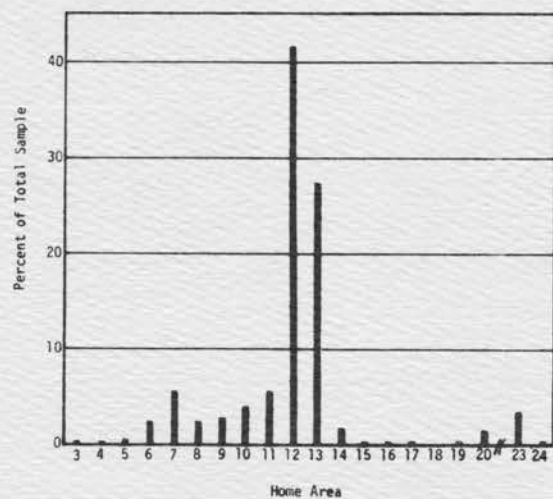
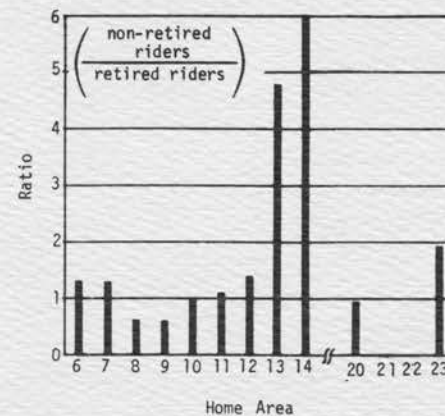
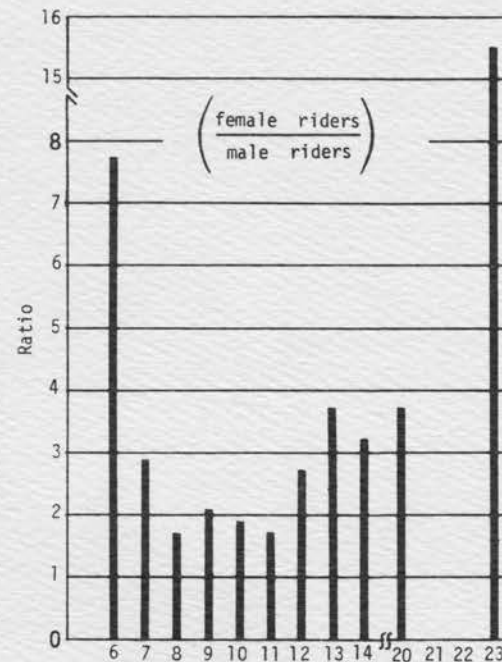


Figure I-6. Social Characteristics and Transit Usage of Riders Surveyed



(Numbers correspond to zones on the questionnaire map)

Figure I-7. Distribution of Riders by Home Area



(Numbers correspond to zones on the questionnaire map)

Figure I-8. Variations in Rider Characteristics between Home Areas

females in the 35-60 age group. Seventy-five percent of the respondents were female, 64 percent were working, 44 percent were over 60 years of age, and 37 percent were between the ages of 35 and 60. The data display internal consistency in that if one assumes all retired respondents are over 60, the remaining respondents over 60 plus all other respondents represent 64 percent of the sample, which is precisely the percentage of "not retired" responses received.

Figure I-6 also shows the percent of total weekly round trips made by each rider category. Total weekly round trips represented by the survey sample are computed to be 5,632 based on responses to question number 4, or an average of 4.7 round trips per week per person, which appears reasonable. Interestingly, no sharp differences in trip frequency are apparent between the various rider categories. As would be expected, non-retired riders account for more weekly trips than retired riders. The 44 percent of the sample over 60 accounts for 39 percent of the trips, whereas the 37 percent who are between the ages of 35 and 60 account for 42 percent of the trips. There is no discernable difference between the sexes as far as amount of travel is concerned.

Distribution by Home Area

The distribution of surveyed riders with respect to their home locations is shown in Figure I-7. The numbers used to designate home areas correspond identically to the numbers on the questionnaire map, shown in Figure I-3. Since this was exclusively a transit user survey, home location subgroup sizes are directly proportional to the extensiveness of transit services presently offered in each area. Between them, Tampa and St. Petersburg account for 69 percent of the sample. In addition, significant portions of the sample reside in Dunedin, Clearwater, Largo, the Beaches and Pinellas Park in Pinellas County, Temple Terrace in Hillsborough County, Bradenton in Manatee County, and Sarasota in Sarasota County.

Differences in makeup of the ridership for each home location are shown in Figure I-8. In addition to the extreme dominance of female over male riders in Dunedin and Sarasota, the significantly greater proportion of non-retired riders in Tampa and Temple Terrace is of interest. As will be seen later, these are also the only two areas in the Region where work trips dominate over non-work trips, as determined by responses to survey question number 5. The similarity between the two profiles shown in Figure I-8 is consistent with the fact that the majority of non-retired riders are female.

ANALYSIS OF PRESENT USAGE

Ridership Subgroup Travel Patterns

Figure I-9 shows how the relative importance of each age group varies with increasing number of round trips per week. Riders over 60 years of age completely dominate for 1, 2, 3 and 4 trips per week. Then the work trip comes into play and the 35 to 60 age group dominates for 5 round trips per week and up.

Percent of total weekly trips attributable to retired, non-retired, male and female riders was shown in Figure I-6. A disaggregation of these data is shown in Figure I-10, along with the corresponding profile for all riders surveyed. Considering all riders, those who normally make 5, 6 or 7 round trips per week account for 72 percent of the total weekly travel. Non-retired riders making 5, 6 or 7 round trips per week account for 57 percent of all travel, and female riders who normally make 5, 6 or 7 round trips per week account for 56 percent of all travel, nearly identical to the percentage for the non-retired.

Work and Non-Work Trip Purposes

Riders were asked to identify the main purpose for most of their bus trips. The results are displayed in Figures I-11 and I-12 as functions of round trips per week and home location respectively. Results are expressed in terms of a trip purpose index whose formula is shown on Figure I-11.

Trip purpose data were obtained from survey question 5, which permitted respondents to check more than one answer. In computing trip purpose indices, if a single respondent checked one or more non-work trip purposes, it was counted as one non-work indication, and if work was checked as well, the respondent then contributed one work indication and one non-work indication to the trip purpose index. The index therefore represents the preponderance of non-work indications with respect to work indications, or vice versa.

There is a complete dominance of non-work trip indications for riders who normally take 1, 2, 3 or 4 bus trips per week. This is also the regime where the over-60 age group dominates. Work trip indications predominate for riders taking 5 or 6 round trips per week, and then there is a slight dominance of non-work trip indications for those who make more than 6 round trips per week.

Figure I-12 shows that non-work trip indications dominate for all home locations except two; Tampa and Temple Terrace. These were the two areas seen in Figure I-8 to have significantly larger ratios of

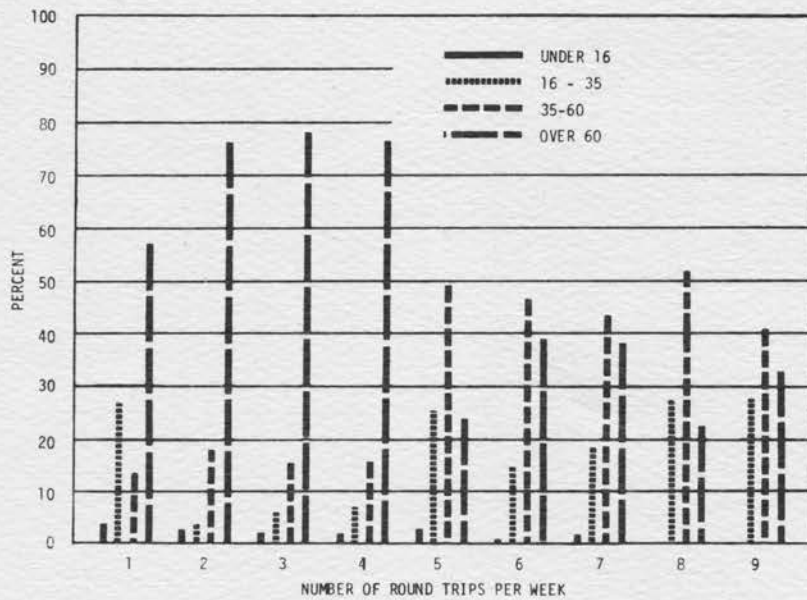


Figure I-9. Travel Patterns for Different Age Groups

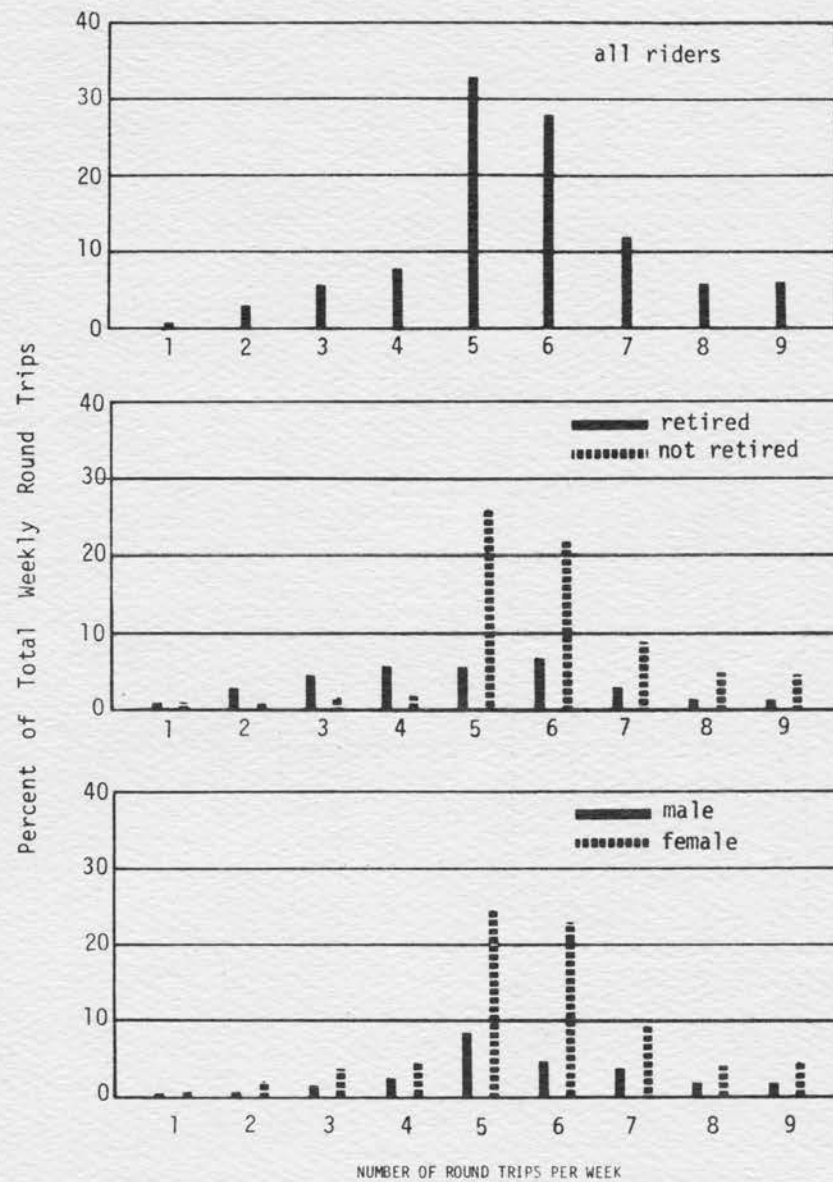


Figure I-10. Transit Usage Profiles

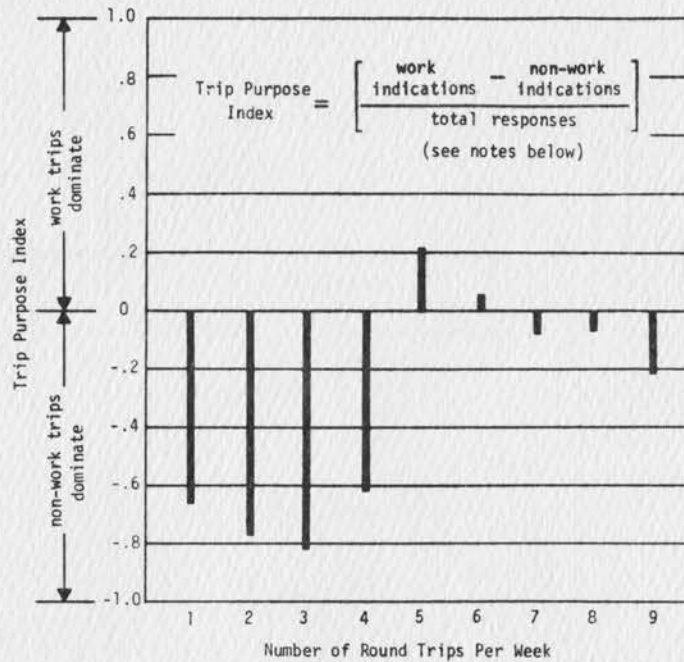
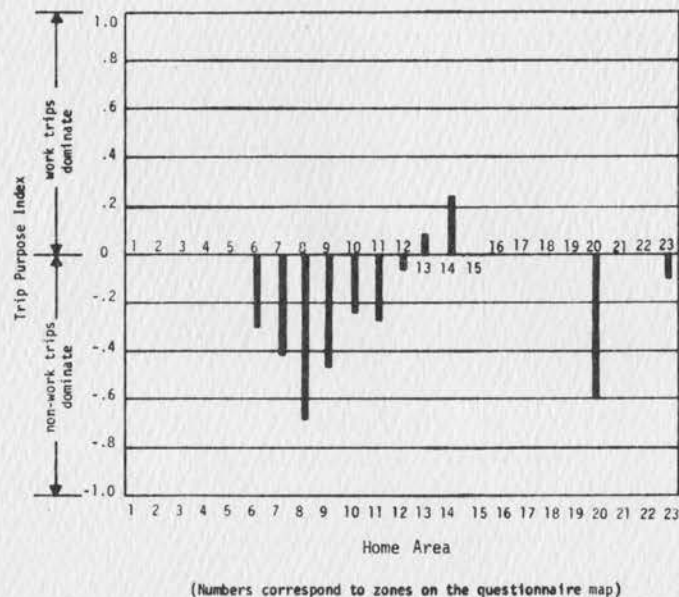


Figure I-11. Trip Purpose Related to Travel Frequency



- NOTES:
1. Data obtained from survey question number 5.
 2. Multiple non-work purposes counted as one indication per respondent.

Figure I-12. Trip Purpose Related to Home Area

non-retired to retired riders compared with all other areas in the Region. St. Petersburg residents gave very nearly the same number of work and non-work indications in response to question 5.

NEEDS FOR NEW SERVICES

Indications Based on the Survey Sample

Approximately one-quarter of all transit users surveyed indicated that lack of bus transportation was keeping them from going after a better job. And approximately one-half of all those surveyed indicated they needed additional bus service for non-work trip purposes. The distributions of responses among the various areas in the Region are shown in Figures I-13 and I-14 for work and non-work trips, respectively.

Both figures show considerable consistency in responses from the various areas of the Region. Tampa and Temple Terrace, which are the two locations having by far the greatest proportion of non-retired riders, are also among the three areas with the greatest indicated need for new work trip services. Sarasota was seen to have the third largest proportion of non-retired riders compared with other areas in the Region, and Figure I-13 shows that Sarasota has the second highest indicated need for new work trip services. Clearwater residents indicate the lowest need for new work trip services.

The four areas with the highest indicated need for additional non-work trip bus service are Dunedin, Largo, Temple Terrace, Bradenton and Sarasota, as shown in Figure I-14. It must again be remembered that this was a survey of bus riders and so observations can only be made in those areas that presently have at least some minimum level of bus service. Temple Terrace and Sarasota stand out as the only two areas where residents give an above-average indication of need for both new work trip services and additional non-work trip services. The two lowest indications of need for additional non-work trip service came from the residents of Pinellas Park and St. Petersburg.

The distribution of reasons given by respondents for needing new non-work trip services is shown in Figure I-15. These data are obtained from survey question number 9. It can be seen that the non-work trip purposes are fairly evenly divided between shopping, medical, personal business and social/recreational, with a much smaller indication for school trips. A significant proportion of the responses shown as other (non-work) are church trips, as determined from comments written in on the questionnaires.

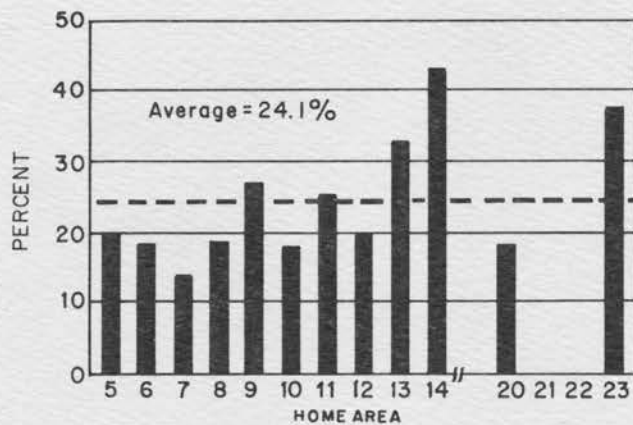
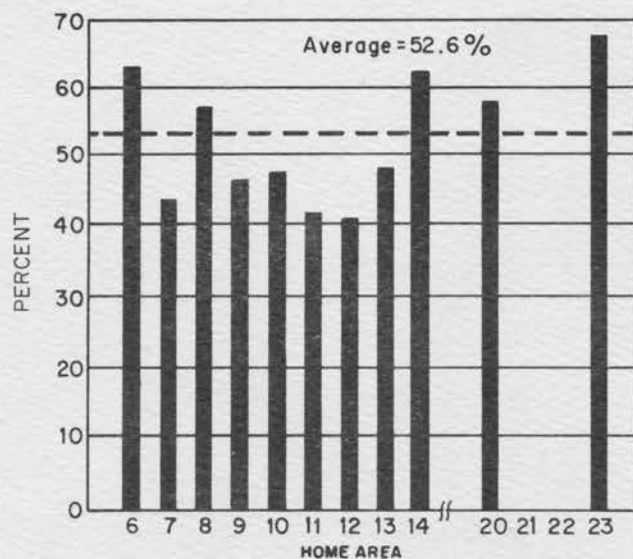


Figure I-13. Percent of Sample Needing New Service for Work Trips



Numbers Correspond to Zones Indicated on Questionnaire Map

Figure I-14. Percent of Sample Needing New Service for Non-Work Trips

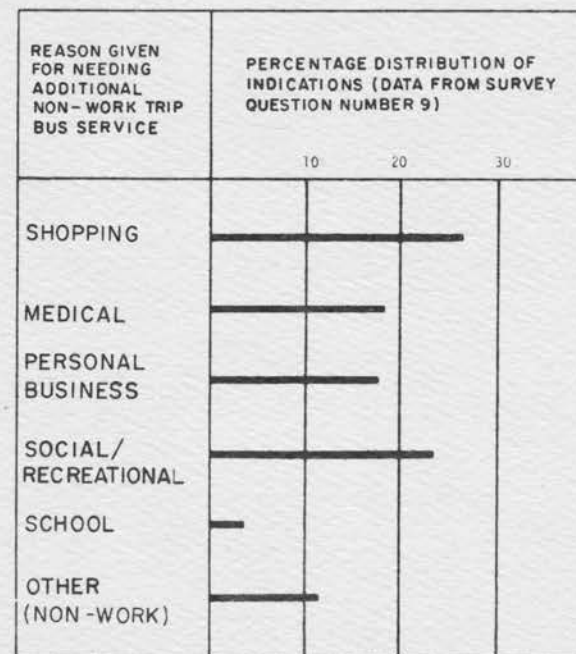


Figure I-15. Reasons Given for Needing New Non-Work Trip Services

Estimates for Total Present Ridership

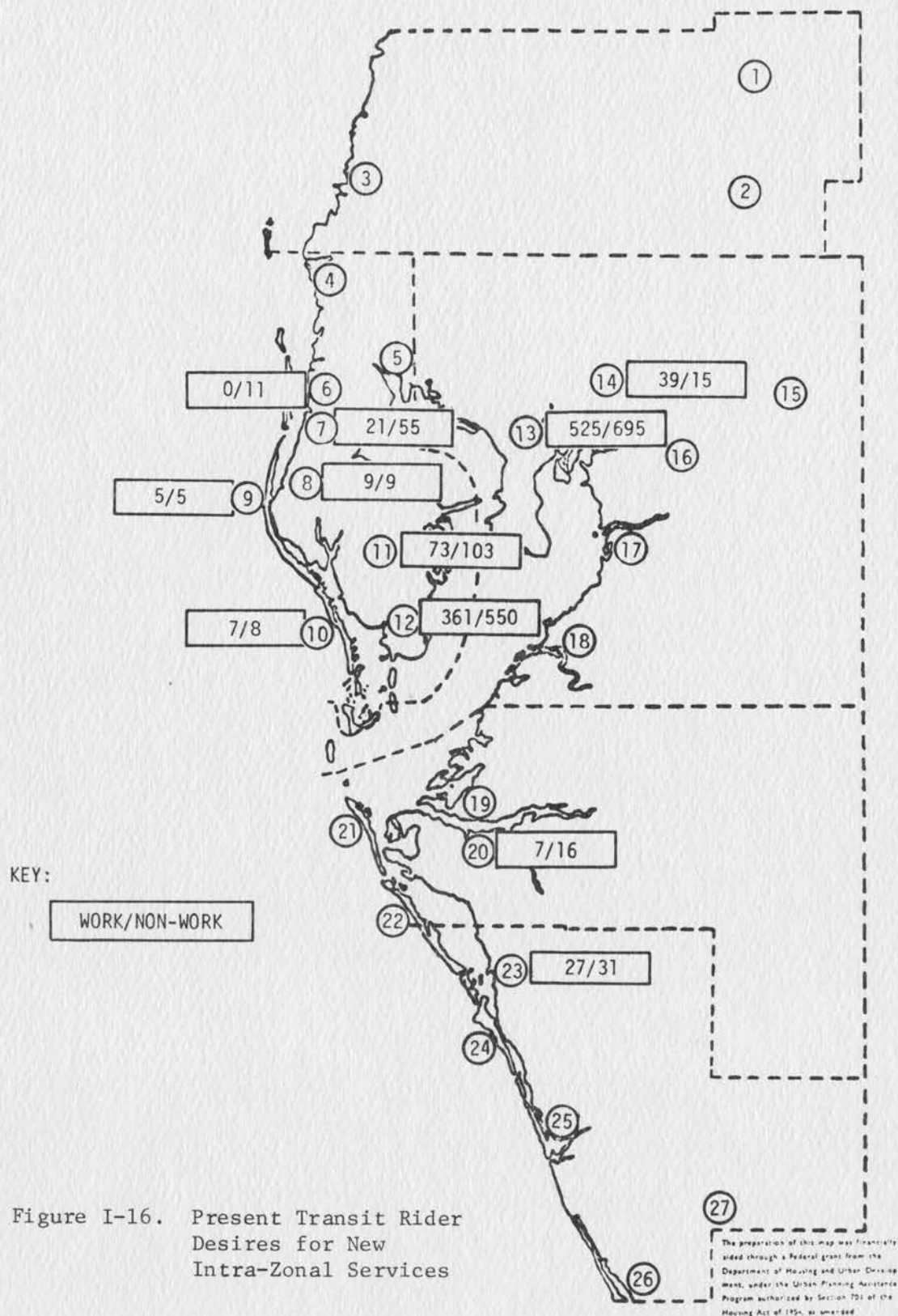
Estimates of total transit users needing additional services and residing in each of the 27 zones identified on the questionnaire map were combined with the directional distribution of travel desires obtained from the survey and values were computed for the total number of present bus riders that would be expected to patronize new intra- and inter-zonal services. Results are shown in Figures I-16, I-17 and I-18.

Total Regional transit ridership was apportioned among the 27 zones in proportion to the distribution of survey returns. The sample percentage data shown in Figures I-13 and I-14 were then applied in order to obtain estimates of total transit users residing in each area and needing new work and non-work transit services. Survey questions 6, 8 and 10 yielded the directional distribution of travel desires originating within each of the 27 zones. The computed number of transit users residing in each zone and needing new services was then allocated to intra- and inter-zonal trips in accordance with the directional distribution.

Indicated desires on the part of present transit riders for new services within their home areas are shown in Figure I-16. Corresponding desires for inter-zonal work and non-work trips are shown in Figures I-17 and I-18. The greatest desire for new work trip service is observed to occur between Pinellas Park and St. Petersburg. A corridor of fairly uniform desire exists between the lower beaches, St. Petersburg, Tampa and Temple Terrace. The other work trip link of some significance shows up between Largo and St. Petersburg.

The greatest desire for non-work trip service occurs between Tampa and St. Petersburg. The corridor of fairly uniform desire still exists between the lower beaches, St. Petersburg and Tampa, with reduced desire for non-work service between Tampa and Temple Terrace. The link with fairly significant desire between Largo and St. Petersburg is now accompanied by links with similar desire magnitudes between the upper beaches and St. Petersburg and between Clearwater and St. Petersburg. The heavy desire line between Pinellas Park and St. Petersburg exists as it did for work trips, second only to the Tampa-St. Petersburg link.

As explained earlier, these figures reflect only the desires of the approximately 16,000 people who daily ride buses throughout the Region. No credit is given for induced patronage that might result if some of these new services were actually provided. Induced patronage could come from the retired or handicapped person who would travel for non-work purposes but presently has no access to service, the unemployed person who is limited in his search for employment by lack of transportation, the tourist who wants to travel around the region and



URBAN TRANSIT STUDY

MAJOR LINKS

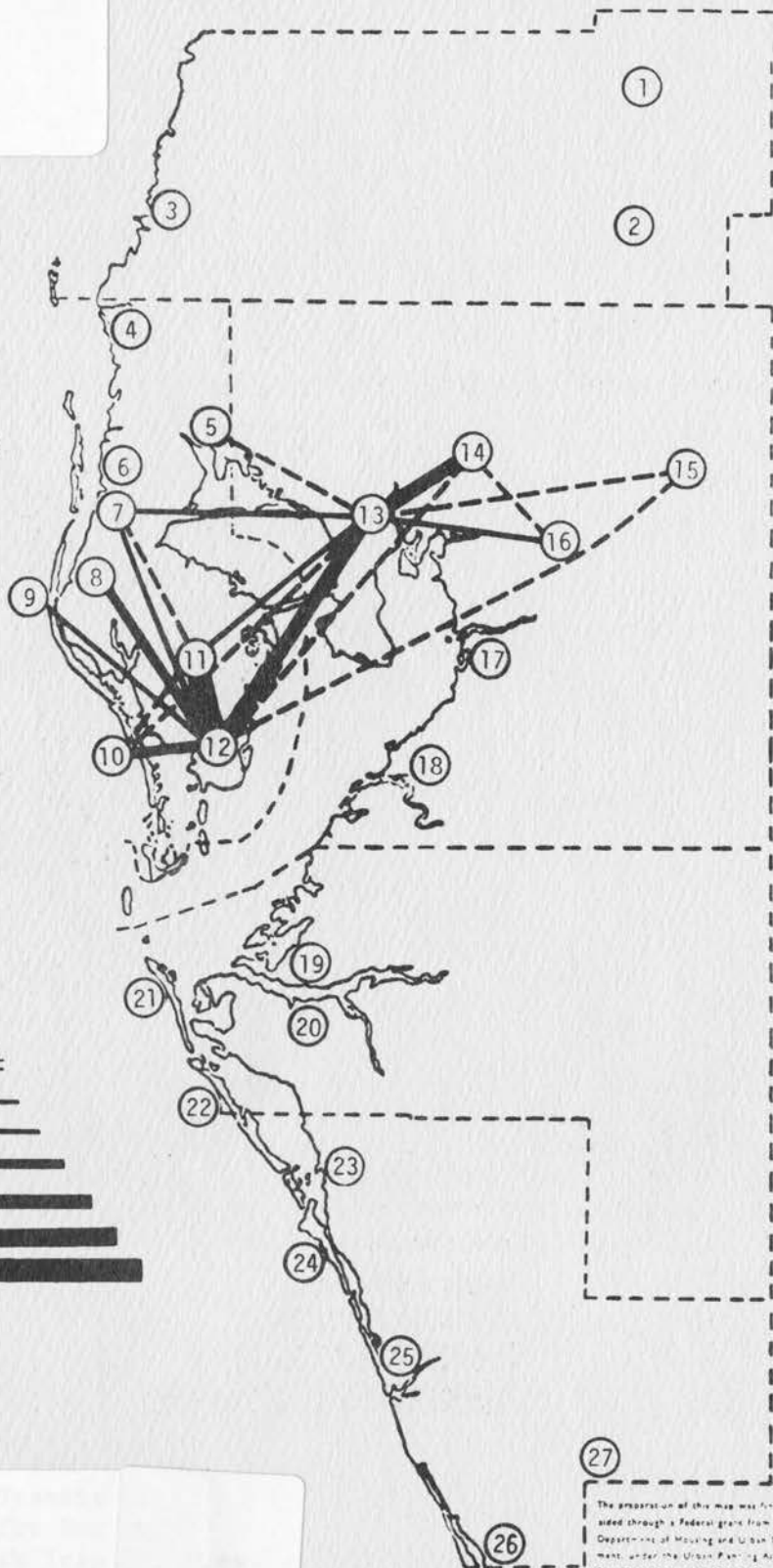
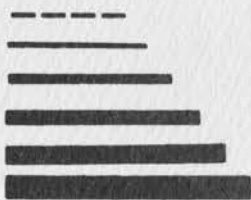
O-D PAIR	NUMBER OF RIDERS
11 - 12	456
12 - 13	285
13 - 14	275
10 - 12	240
8 - 12	200

LEGEND

NUMBER OF RIDERS

25 to 50
50 to 150
150 to 250
250 to 350
350 to 450
450 to 550

SYMBOL



The preparation of this map was financially aided through a Federal grant from the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954, as amended.

MAJOR LINKS		
Q-D PAIR	NUMBER OF RIDERS	
12 13	721	
11 12	628	
10 12	601	
7 12	405	
9 12	372	
8 12	255	
13 14	255	

NUMBER OF RIDERS	SYMBOL
25 to 50	----
50 to 150	—
150 to 250	=====
250 to 350	=====
350 to 450	=====
450 to 550	=====
550 to 650	=====
650 to 750	=====

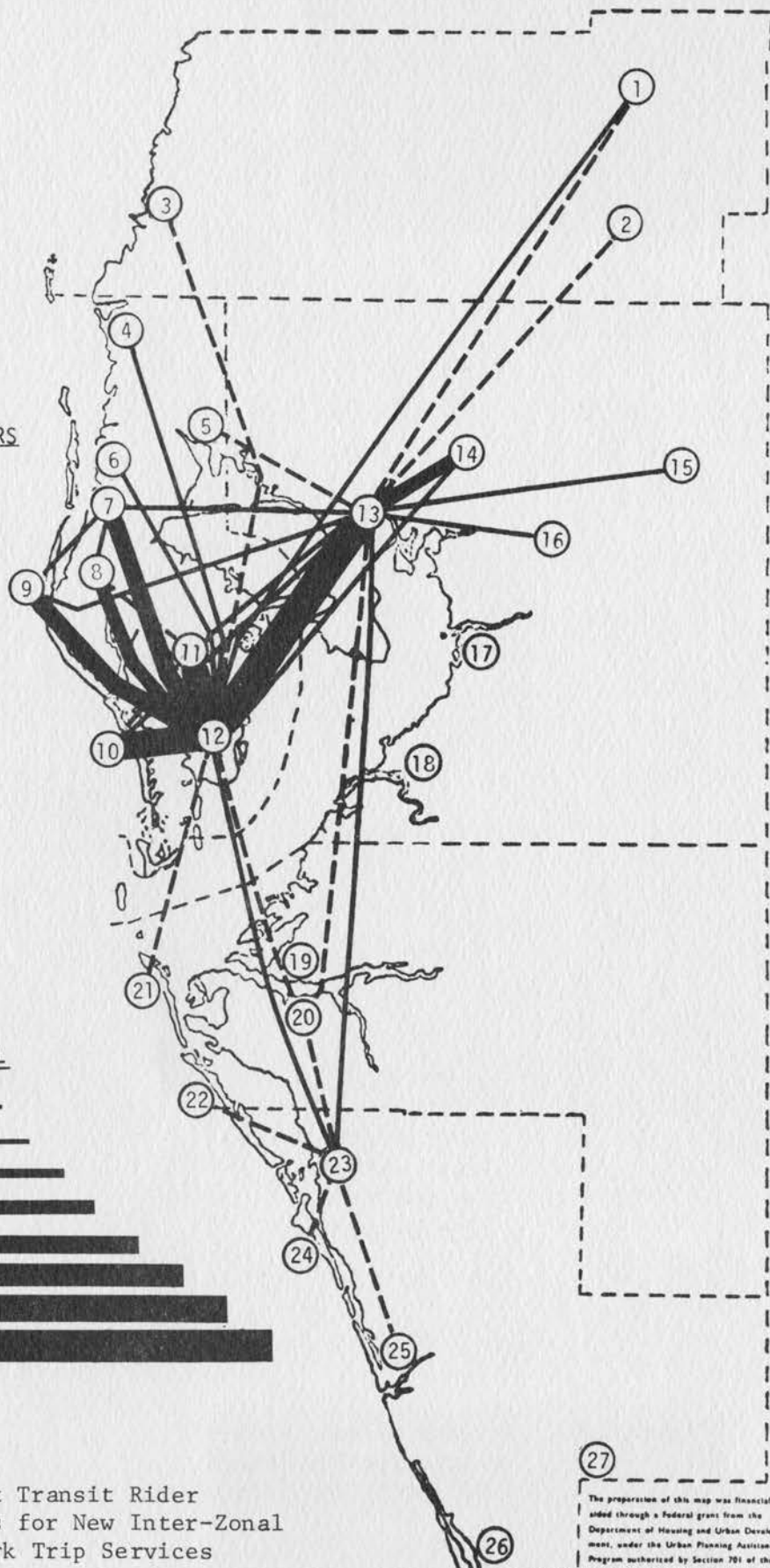


Figure I-18. Present Transit Rider Desires for New Inter-Zonal Non-Work Trip Services

The preparation of this map was financially aided through a Federal grant from the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954, as amended.

either has no car available or would rather travel by public transportation because of unfamiliarity with the roads, or even the choice rider who now drives an intermediate distance to and from work. Surveys covering these and other potential rider categories were not possible within the scope of this study effort.

USER COMMENTS AND SUGGESTIONS

Composite of Transit Rider Priorities

The highest priority of present transit users is to have more frequent service. As shown in Figure I-19, 22 percent of those surveyed recommended more frequent service as the way to improve mass transit. The next most often repeated suggestion also related to frequency, expressed as a desire for more service on Sundays and holidays.

Almost without exception, recommendations for more frequent service were expressed in terms of desire for half-hourly instead of hourly service during the week and hourly instead of two-hourly service on Sundays and holidays. A large number of comments had to do with achieving better coordination between bus schedules and working hours, usually involving a small adjustment backward or forward in work destination arrival or departure time. Recommendations for more evening and early morning service were frequently accompanied by an explanation that the service was needed for off-hour work at places like restaurants or hospitals, or for attending regularly scheduled evening entertainment functions.

The survey showed that transit riders throughout the Region have made an association between the word "minibus" and comfortable, convenient, generally superior transit service. In addition to common usage of the term in connection with newly proposed services, the association clearly stems in large measure from the State DOT Demonstration Project in Clearwater.

Specifics for Local Riderships

The most frequent request by St. Petersburg riders for more complete area coverage was for a bus route along 34th Street from the Pinellas Park area to Central Plaza. The majority of Tampa transit riders who recommended expanded area coverage specifically suggested more service between North Tampa and downtown Tampa, and more East-West service generally.

While the number of negative comments about bus drivers was relatively small in all cases, Cities Transit and Tampa Transit riders expressed

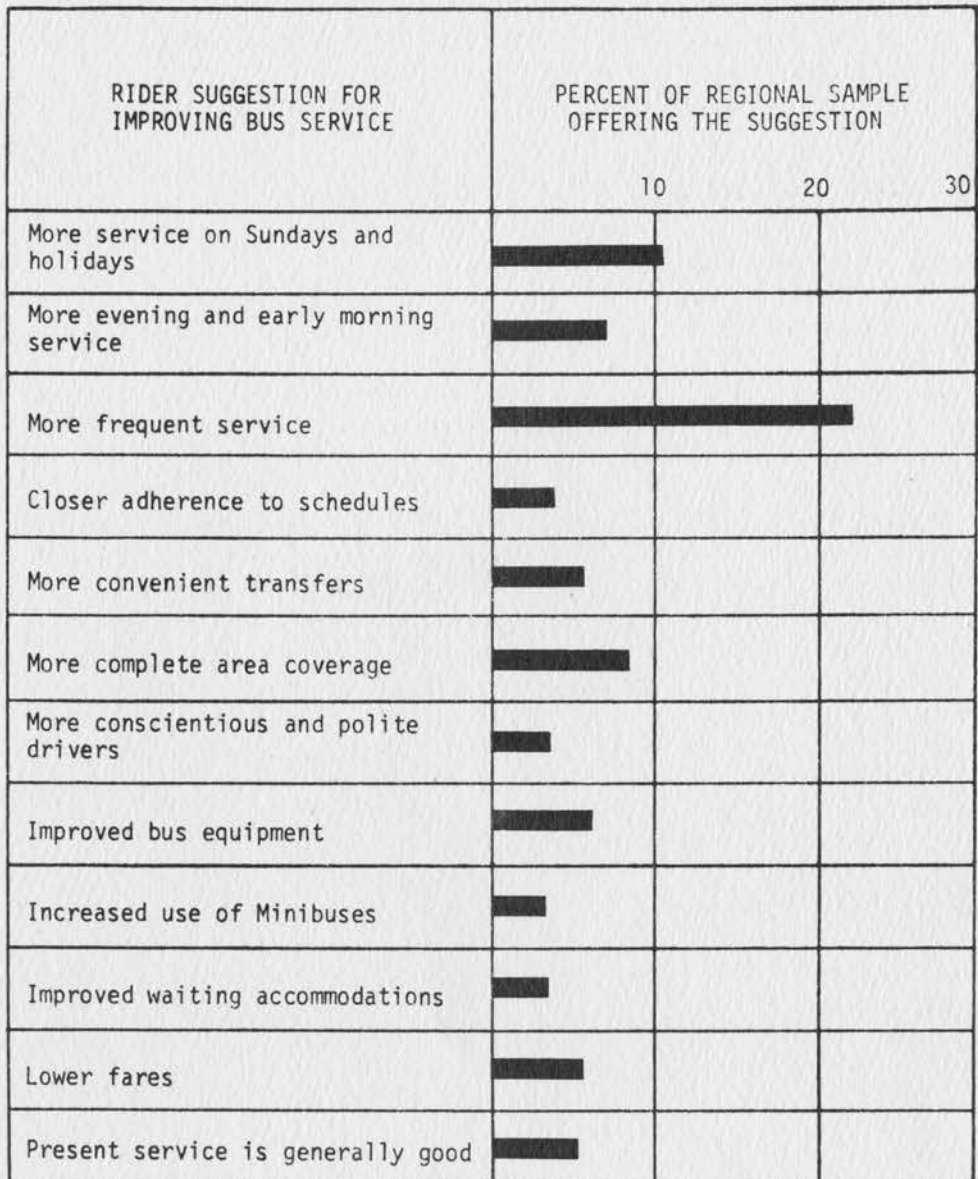


Figure I-19. Regional Transit User Priorities

the most severe complaints. A number of complaints were received from St. Petersburg riders about the failure of buses to pull up to the curb when picking up or discharging passengers. On the other hand, there was also a very large number of St. Petersburg riders who complimented their bus drivers, often referring to particular drivers by name.

Comments with respect to improving bus equipment generally had different meaning depending on the specific local ridership involved. Most equipment complaints from St. Petersburg riders referred to lack of heating and air conditioning. In Tampa the most common complaint was that the buses were not clean. Cities Transit riders complained chiefly about poor equipment reliability and frequent bus breakdowns.

A number of comments were received from Gulf Beach, Gulf Coast and Clearwater Transit riders regarding improved coordination of these services with the State DOT Demonstration buses.

Separate priority profiles for each of the local riderships, and direct comparisons between the riderships on each of the individual suggestions for improving bus service are included in Appendix I.

PART II

SHORT-RANGE IMPROVEMENTS

INTRODUCTION

Existing transit operations provide some opportunity for travel throughout the Region, but there is a potential for achieving expanded, more convenient and more efficient Regional services, through a program of short-range improvements.

The program of short-range actions presented here encompasses steps that can be taken immediately with little or no capital investment, as well as actions that may take up to two or three years to complete and involve substantial capital outlay.

Recommendations are made with respect to coordination of existing services and facilities, application of new technology and establishment of a Regional Transit Service Corporation.

COORDINATION OF SERVICES

This element of the Short-Range Improvement Program chiefly impacts Pinellas and Hillsborough Counties. These Counties presently have the greatest concentration of transit operations and hence opportunities for coordination of services naturally occur here.

The overall effect of the recommendations is to provide hourly service between southern and central portions of Pinellas County, higher frequency service between St. Petersburg and the lower beaches, new service between Tampa and St. Petersburg and greater access to the Region-serving routes of Greyhound and Tamiami Trailways that reach out to Dade City, Plant City, Brandon, Palmetto, Bradenton, Sarasota and Venice, as well as other points in the Region.

NEW TECHNOLOGY

A principal recommendation for the application of new technology focuses on demand responsive systems, such as dial-a-bus. These systems utilize real-time computerized route optimization in conjunction with small bus-like vehicles to offer door-to-door service in areas not populated densely enough to support fixed-route bus service. It is recommended that promising sites for a demand responsive system demonstration in the Tampa Bay Region be identified and that the essential characteristics of the demonstration service be defined in sufficient detail to provide the basis for pursuing near-term implementation.

Demand responsive systems have the potential for providing local service in parts of the Region presently without mass transit, for example, Plant City and Venice, as well as other places in the Region with presently inadequate mass transit coverage, such as Palmetto and Bradenton.

TRANSIT SERVICE CORPORATION

A key element in the Short-Range Improvement Program is the recommendation that a multi-purpose public corporation be created with responsibility for transit operations in the Tampa Bay Region. The Transit Service Corporation would provide for coordination and balance between all levels of service and constitute the enabling force for translating transportation plans into action. The need, jurisdiction and conceptual details associated with this recommendation are presented.

OBJECTIVES AND TRANSIT REVIEW

Preceding the discussion of the Short-Range Improvement Program, the goal and objectives used as a framework for developing the detailed elements of the Program are presented and existing mass transportation operations in the Region are reviewed briefly.

OBJECTIVES AND GROUNDRULES

The goal of the short-range program is to achieve maximum improvement in Regional transportation through relatively uncomplicated actions that can be taken in a short time period. In this context, uncomplicated means institutionally and financially uncomplicated as well as operationally uncomplicated.

The following objectives were identified in support of the above goal:

- Provide for survey-indicated travel needs
- Respond to community views and priorities
- Increase opportunities for Regional travel
- Maximize convenience of Regional travel
- Enhance existing mass transit operations
- Make appropriate use of new technology
- Complement long-range transportation plans

The objectives played a key role in guiding the definition of the Short-Range Improvement Program, including actions recommended for immediate implementation as well as the longer lead time actions.

The following groundrules were used as further guidance in defining plans of action intended to be put into effect almost immediately:

- Minimize capital investment required
- Minimize changes to present services

These groundrules particularly impact the recommendations for coordination of services, where the primary thrust is to identify a practical plan requiring relatively uncomplicated interjurisdictional agreements, minimum investment and having a commensurately high probability of successful early implementation.

TRANSIT TODAY

Before describing the recommended Short-Range Improvement Program, present mass transportation operations in the Tampa Bay Region will be reviewed very briefly. Descriptions of rail routes in the Region are taken from the TBRPC's 1968 report, "Rail, Bus and Other Carriers in the Tampa Bay Region." Equipment inventory data for bus operations in the Region have been extracted from the TBRPC's 1970 report, "Mass Transit Concepts of the Tampa Bay Region." Bus service areas and inter-urban bus routes, as well as rail and bus schedule descriptions, reflect the latest status of these services.

RAIL

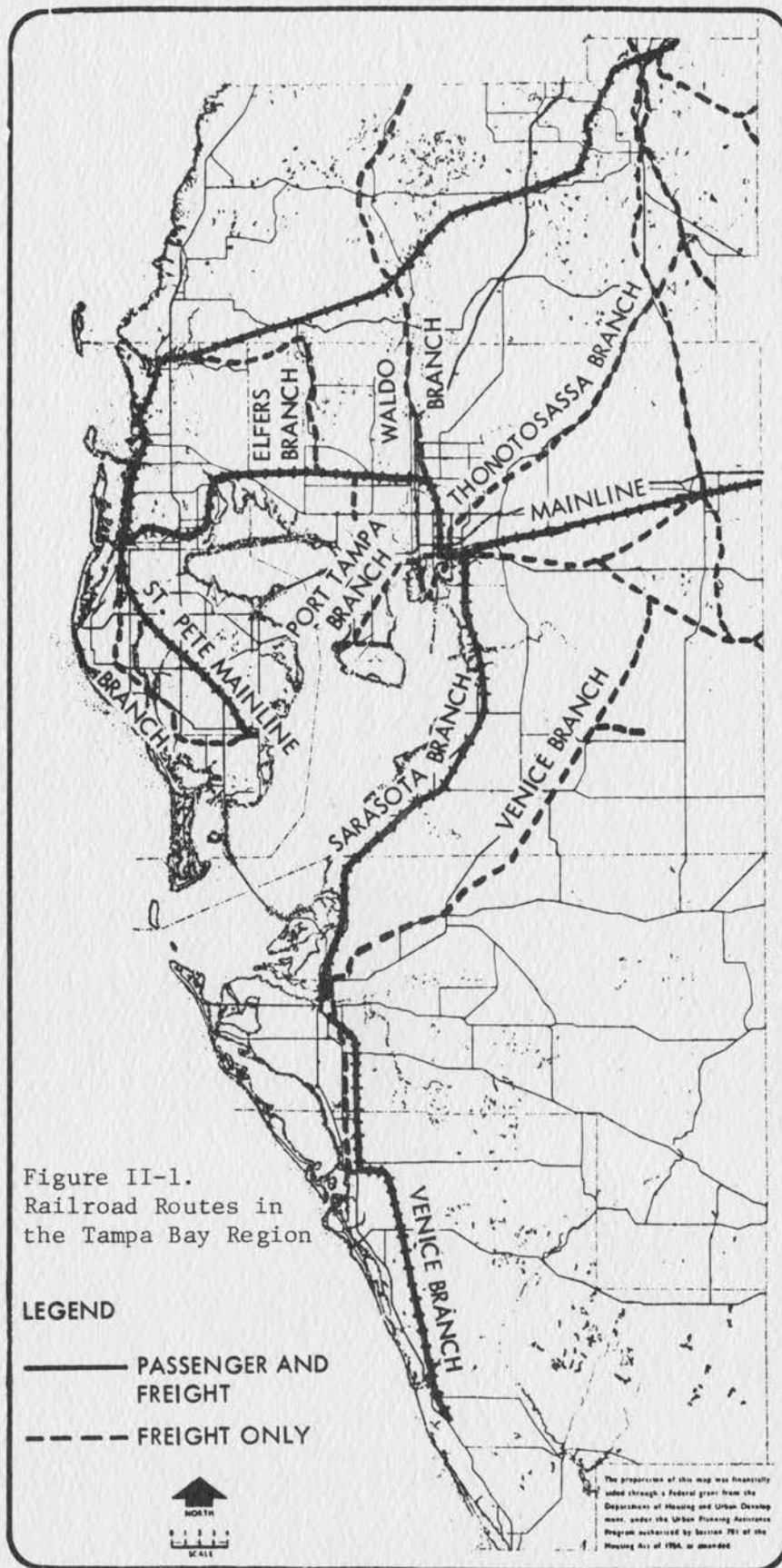
Rail service in the Tampa Bay Region is provided by the Seaboard Coast Line Railroad. Within the Region, Seaboard has approximately 158 miles of mainline track and 190 miles of freight track. The overall network is shown in Figure II-1.

There are three principal mainline links in the Region. One link originates in St. Petersburg, running generally north and northeast through Pinellas and Pasco Counties, to Jacksonville. From Jacksonville, Seaboard passenger service extends west to Tallahassee, northwest to Montgomery, Alabama, and north to Richmond, Virginia, with connecting services to other parts of the nation. Stops along the portion of this mainline in Pasco and Pinellas Counties are St. Petersburg, Clearwater, Dunedin, Tarpon Springs, San Antonio and Trilby.

A second mainline branches off at Clearwater, running east through Pinellas and Hillsborough Counties and north to Orlando and Jacksonville. Stops along the portion of this mainline in Pinellas and Hillsborough Counties are Clearwater, Tampa and Plant City.

The third mainline in the Region extends south from Tampa, through Bradenton and Sarasota to Venice, which is the southern terminus. This link extends over the three Counties of Hillsborough, Manatee and Sarasota.

There is one train per day each way on the mainline running northward from St. Petersburg through Clearwater, Dunedin, Tarpon Springs, San Antonio and Trilby. Another two trains per day each way travel the mainline from St. Petersburg to Clearwater and then east to Tampa and Plant City. There are thus three trains per day each way between St. Petersburg and Clearwater. St. Petersburg departure times are 9:20, 10:05 and 11:45 AM; arrival times in St. Petersburg are 11:15 AM, 5:20 and 5:25 PM. There is one train per day each way on the run from Venice through Sarasota, Bradenton and Tampa. Departure and arrival times at Venice are 8:25 AM and 5:45 PM, respectively. East-bound departure times from Tampa are 11:05 AM and 1:20 PM.



While present rail service obviously is not designed for the purpose of providing convenient intra-Regional travel, portions of the mainline could play a major role as mass transportation continues to develop on all levels. The precise nature of this role depends on presently undetermined factors such as the system designs ultimately selected for Regional rapid transit and intra- or inter-state high speed services, as well as future ownership patterns. In any case, segments of the present mainline right-of-way are strategically situated for entry into and travel within the Region.

BUS

The Tampa Bay Region is served by seven local bus transit systems and three interregional systems.

Local bus services are provided mainly in areas where the population density is greater than three people per acre. As shown in Figure II-2, there are five local bus operations in Pinellas County, one in Hillsborough County and one that serves both Manatee and Sarasota Counties. There is only minimal coordination between the five services in Pinellas County and, except for the one operation servicing Manatee and Sarasota Counties, local services provide no opportunity for inter-county travel. As is generally the case throughout the nation, these services have been undergoing a prolonged period of declining patronage; this despite the fact that approximately one-quarter of the Region's population must depend on public transportation if they are to be able to travel at all.

Routes of the three interregional bus services that operate in the Tampa Bay Region are shown in Figure II-3. While these provide limited inter-urban travel opportunities, the services are understandably oriented to a much larger geographic area than the Tampa Bay Region, and their schedules are dictated by the requirements of the larger networks.

Cities Transit, Inc.

This is a privately-owned operation that serves the urban areas of Bradenton and Palmetto in Manatee County, and Sarasota in Sarasota County. Service is mainly concentrated in Bradenton and Sarasota, with one intercounty route connecting the two cities.

Service within the City of Bradenton is offered on an hourly basis, with buses every half hour to Palmetto. Hourly service northbound and southbound is provided between Bradenton and Sarasota. Hours of service for all these routes generally extend from 7:00 AM to 7:00 PM.

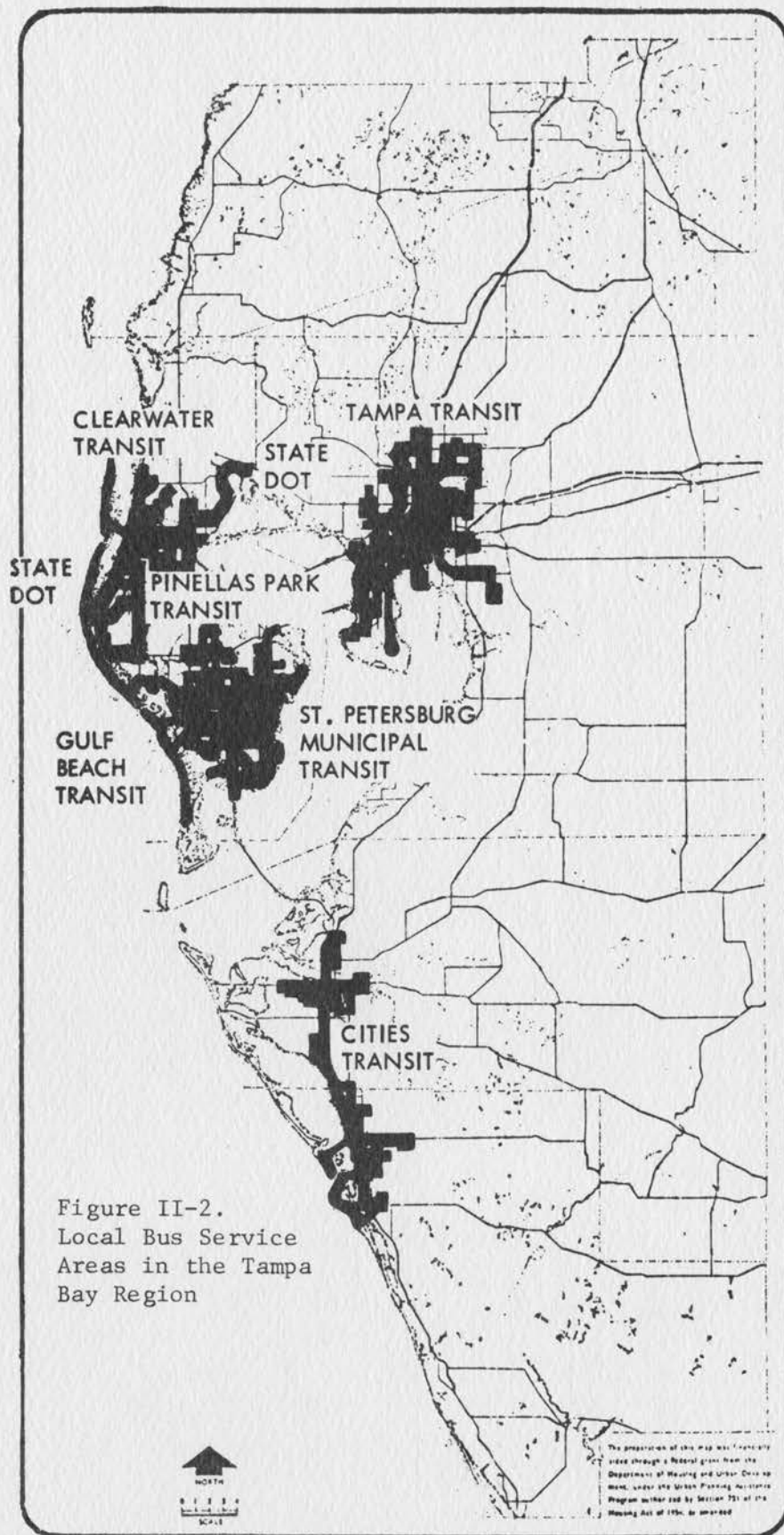
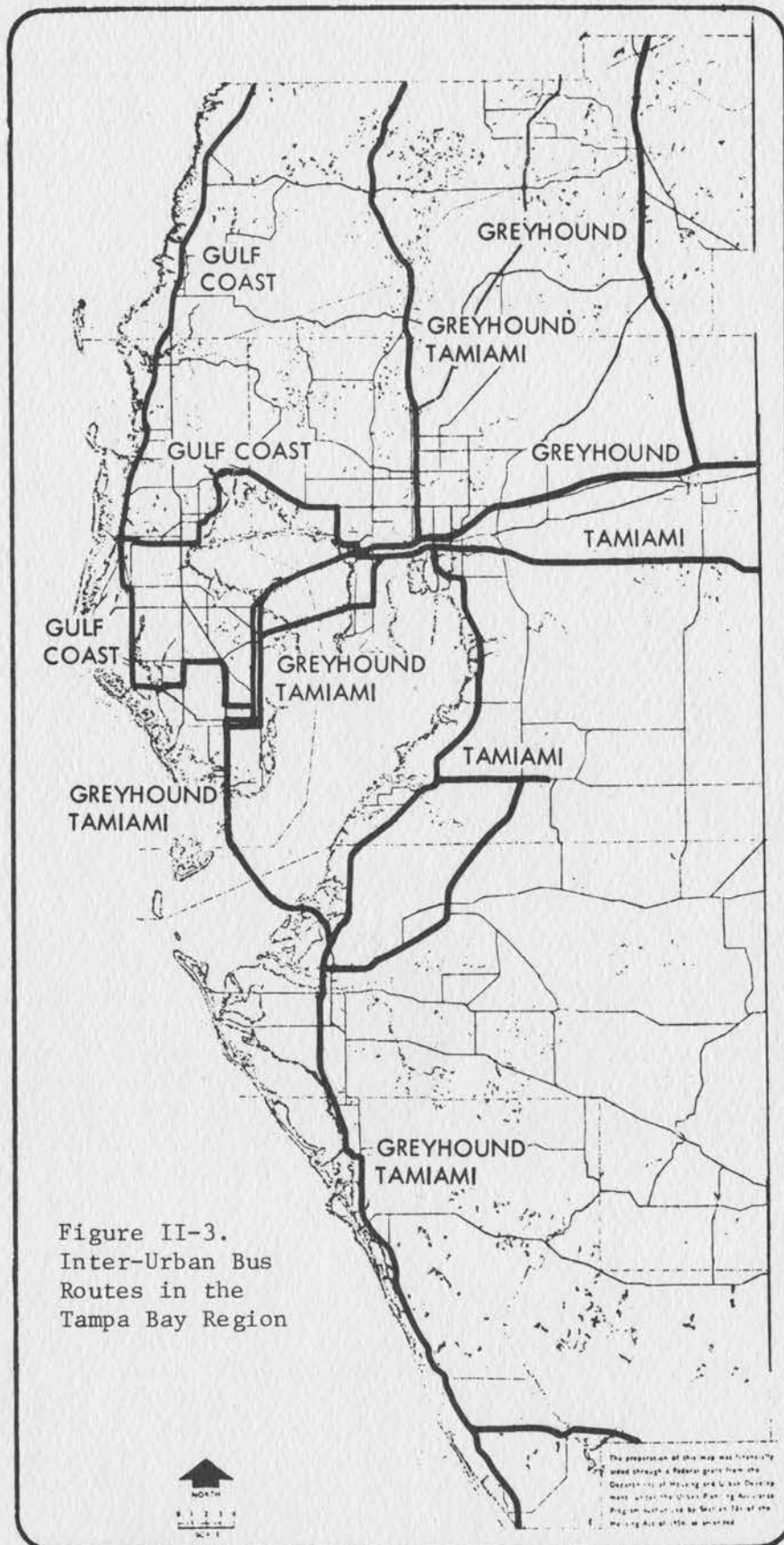


Figure II-2.
Local Bus Service
Areas in the Tampa
Bay Region



Service on most routes in Sarasota starts at around 7:00 AM daily. Four of the runs have service until around 11:00 PM, four have service until around 6:30 PM and two others are abbreviated services starting at 8:00 or 9:00 AM and ending at 3:00 or 4:00 PM. Service frequencies are mixed between half-hour and hour intervals, with considerable curtailment of services on Sundays and holidays.

Cities Transit maintains 24 buses for the above services. Twelve of these range in model year from 1946 to 1952, and the other 12 range in model year from 1961 to 1968.

Clearwater Transit, Inc.

Clearwater Transit is privately owned and operates eight routes over a service area that includes the Cities of Clearwater, Dunedin, Largo and Belleair. Three of the routes consist of very limited service, with just a few runs spread out over the day. Of the other five routes, two offer service at half-hour intervals, two have hourly service and the other has half-hour service during morning and evening peak times with hourly service in between times. Service periods generally extend from 7:00 AM to 6:00 PM weekdays and Saturdays, with some runs deleted on Saturdays.

There are fourteen buses in the Clearwater Transit operation. Ten range in model year from 1949 to 1953, and four range in model year from 1958 to 1959.

State DOT Fleet Demonstration Project

This is a state-funded bus demonstration project for the purpose of investigating mass transit problems, identifying critical operating parameters and establishing the relationship between these parameters and transit patronage. Service was initiated on October 19, 1970, in central Pinellas County. The demonstration service area includes Clearwater, Largo, Seminole, Indian Rocks Beach, Belleair Beach, Safety Harbor and Oldsmar. The project operates a fleet of five 1970 model Twin Coach buses with seating capacities ranging from 21 to 31.

As planned from the outset, several route changes were made subsequent to the inception of demonstration service. There were four routes at the time of the transit user survey which was conducted as a part of this study. Route 1 went from Sunshine Mall in Clearwater to Safety Harbor and Oldsmar; route 2 went from Sunshine Mall to route 19 and Sunset Point Road; route 3 went from Sunshine Mall to the Honeywell facility; and route 4 ran between Belleair Beach, Indian Rocks Beach, Seminole Mall and Largo. As of February 24, 1971, service to the Honeywell facility had been discontinued and routes 1 and 2 were

consolidated into a single route. All demonstration services run at one-hour intervals.

Southern Tours Bus Line, Inc.

Pinellas Park Transit and Gulf Beach Transit are both privately owned by Southern Tours Bus Line, Inc.

Pinellas Park Transit links portions of Pinellas Park with the Crossroads Shopping Plaza and provides connections with St. Petersburg Municipal Transit buses. East and West Pinellas Park each has a single route, with service provided on a two-hour schedule from approximately 7:00 AM to 7:00 PM.

Gulf Beach Transit consists of two routes. The North Redington route joins the areas of Madeira Beach, Redington Beach, Indian Rocks South Shores, Tiki Gardens and Crossroads Shopping Plaza with downtown St. Petersburg. The Pass-A-Grille route connects Treasure Island, St. Petersburg Beach and Pass-A-Grille with downtown St. Petersburg. Buses run every hour on Monday through Friday, and every two hours on Saturday, Sunday and holidays.

The Southern Tours Bus Line operates sixteen buses. Ten are 1948 vintage, three are of model year 1962 and 1963, and three are 1969 models.

St. Petersburg Municipal Transit

The City of St. Petersburg is the only local government in the Tampa Bay Region that operates its own transit service. The service functions as a permanent department within the city administration.

St. Petersburg Municipal Transit has the largest daily ridership in the Region, approximately 10,000 persons. The operation serves the City of St. Petersburg and extends slightly beyond city limits at some points. The St. Petersburg service network is reasonably balanced between north-south and east-west routes, with a general convergence at Williams Park in the downtown area. Buses on most routes run either every half hour or every hour. Full service is generally maintained Monday through Saturday from about 7:00 AM to 7:00 PM, with reduced service evenings, Sundays and holidays.

St. Petersburg Municipal Transit has 61 buses. Forty-four of them range in model year from 1960 to 1968, while seventeen are model year 1959 or older.

Tampa Transit, Inc.

Tampa Transit's daily ridership of approximately 4,500 persons is second in the Region next to St. Petersburg Municipal Transit. Tampa Transit is a private operation that contracts with the City of Tampa for service that is primarily restricted to the urban area of Tampa. Most routes focus on a small downtown area, and routes in North Tampa are largely north-south oriented. Service begins earlier in the morning and buses operate at higher frequencies on many of Tampa Transit's routes, compared with other systems in the Region. Service begins at 5:30 or 6:00 AM on many of the routes in Tampa, with departure intervals of 10 to 20 minutes commonly employed during peak hours of the day. Service is reduced on Saturday and there is very little evening or Sunday service.

There are 83 buses in the Tampa Transit fleet. Thirty-five are 1949 to 1951 models, nineteen range in model year from 1958 to 1959, and twenty-nine are in the model range from 1960 to 1967.

Gulf Coast Motor Line

Gulf Coast Motor Line is an intra-state carrier serving the west central Florida area. It operates in Pasco, Pinellas and Hillsborough Counties, with three basic runs. One run between St. Petersburg and Clearwater includes intermediate stops at Pinellas Park Plaza, Bay Pines, Seminole Mall and Largo. Another run begins at Clearwater and extends north through Pasco County on to Orlando. Within the Region, this run includes stops at Dunedin, Tarpon Springs, New Port Richey, Port Richey and Hudson. The third run is between Clearwater and Tampa, with stops at Safety Harbor, Oldsmar, Tampa International Airport and West Shore Plaza. Buses run fairly infrequently, with departure intervals generally in the range of two to four hours.

Greyhound Lines

Greyhound is an interstate carrier whose routes cross all five Counties in the Tampa Bay Region; however, service is generally concentrated between major loading points or terminals located in Plant City, Tampa and St. Petersburg. Greyhound routes enter the Region from the north through Pasco County via Trillacoochee, Dade City and Zephyr Hills to Plant City and Tampa, or via a north-south route further to the west, leading directly into Tampa on I-75, or from the east on I-4, via Plant City to Tampa. From Tampa, Greyhound takes either the Franklin or Gandy Bridge to St. Petersburg. There are twenty scheduled runs from the Greyhound terminal in Tampa to the Greyhound terminal in St. Petersburg, and 18 scheduled return runs. One Greyhound route extends south from St. Petersburg through Palmetto, Bradenton, Sarasota, Osprey, Nokomis, Venice, Warm Mineral Springs and North Port Charlotte.

Tamiami Trailways

Tamiami Trailways is part of the Nation Trailways Bus System and, like Greyhound, has routes crossing all five Counties in the Tampa Bay Region. One route enters the Region through Pasco County, with stops at Midway and Lutz on the way to Tampa. Another route enters the Region from the east, passing through Brandon on the way to Tampa. From Tampa, some routes cross Old Tampa Bay to St. Petersburg, and then head south with stops at Palmetto, Bradenton, Sarasota, Venice and Englewood. Also, there is some service to Oneco, Arcadia, Palmdale, Osprey, Floridaland, Nokomis, North Port Charlotte and a few other locations. Another route extends south from Tampa along the east shore of Hillsborough Bay. This route serves Gibsonton, Ruskin, Sun City and Rubonia. A variation in this route goes through Del Webb's Sun City, Wimauma, Parrish and Ellenton.

DISCUSSION AND RECOMMENDATIONS

A program of short-range improvements was developed in consonance with the goals, objectives and groundrules presented earlier. Recommendations for short-range action are identified in the following major areas:

COORDINATION OF SERVICES

COORDINATION OF FACILITIES

APPLICATION OF NEW TECHNOLOGY

ESTABLISHMENT OF A REGIONAL AUTHORITY

Suggestions with respect to methods and sources of funding are provided following the recommendations.

Those portions of the Short-Range Improvement Program that deal with coordination of facilities, application of new technology and establishment of a Regional authority have applicability and meaning for all five Counties in the Tampa Bay Region. Recommendations dealing with coordination of services tend to focus on tying together the six local transit systems in Pinellas and Hillsborough Counties. Because of their geographic proximity, it is most practical to modify and coordinate these particular systems for the purposes of Regional travel. Clearly, however, the concept of the Region as a single system, which is embodied in the Short-Range Improvement Program, must be continued and strengthened in the future as development proceeds throughout the Tampa Bay Region. The recommendations given below for coordination of services, as well as the other elements of the Short-Range Improvement Program, may be thought of as the first step in the creation of a truly Regional transportation system with services at all levels, including the element which is essential for traversing the kinds of distances encountered in the Tampa Bay Region, rapid transit.

To illustrate the point, one of the short-range recommendations for coordination of services involves the creation of direct bus service between Tampa and St. Petersburg; service which is responsive to local and Regional needs. Building on experience gained with the Tampa/St. Petersburg interchange service, a similar service might then be worked out between Cities Transit in Bradenton and Palmetto, and St. Petersburg Municipal Transit. St. Petersburg Municipal Transit would in turn be linked to the beach areas of Pinellas County, central Pinellas County and the Tampa urban area, by virtue of the other recommendations made for coordination of services.

As a further example, a new commercial and general aviation airport in the vicinity of the present Sarasota/Bradenton Airport is being given some consideration. Such a facility could become the nucleus of an important employment concentration. The immediate satisfaction of transportation needs associated with this development would then be considered within the framework of the total Regional transportation system existing at the time. In turn, each new development throughout the Region would be viewed as an integral part of a Regional system, with the objective of most effectively using all modes and levels to best advantage.

One final comment before presenting the short-range improvement program. The recommendations given below are largely though not exclusively technical in nature. They reflect the consultant's understanding of the social, economic and political facts of life in the Tampa Bay Region and every attempt is made to be sensitive to non-technical considerations. In the last analysis, of course, these recommendations should be viewed as a starting point and overall framework for use by those who ultimately have responsibility for converting plan into action.

COORDINATION OF SERVICES

Viewing the Region as a single system, a concept for interlocking existing bus routes and schedules was evolved. The concept seeks to maximize the convenience of Regional travel by creating direct routes with minimum transfer requirements. It seeks to enhance existing bus operations by increasing the number of accessible attractions, increasing service frequency, expanding the potential ridership that can be drawn upon, and improving operating efficiency.

Four interrelated recommendations are made with respect to coordination of existing services for the purpose of improving Regional transportation. Briefly, the recommendations call for creation of a bus coordination center at the location of Seminole Mall Shopping Center, the specialization of beach services for collection/distribution and feeder purposes, the establishment of Tampa-St. Petersburg exchange services, and the implementation of new route and schedule information services for users.

The overall effect of these recommendations is to provide:

- a. hourly service between southern Pinellas County (St. Petersburg, Pinellas Park and lower beaches) and central Pinellas County (Largo, Clearwater, Dunedin, upper beaches)
- b. higher frequency service between St. Petersburg and the lower beaches

- c. new service between Tampa and St. Petersburg
- d. improved and expanded access to the Region-serving routes of Greyhound and Tamiami Trailways

The recommendations for coordination of services are discussed in more detail below. The implementation of these recommendations requires the negotiation of limited interjurisdictional operating agreements. Procedures and concepts for negotiating broad and fundamental interjurisdictional agreements are discussed later in this report. However, it is likely that the operational agreements implicit in the recommendations below can be worked out between the affected parties, on a short-range basis and with little or no necessity for additional legal flexibility.

Create a bus coordination center at Seminole Mall

As shown in Figure II-4, the Seminole Mall Shopping Center is geographically well situated to serve as a bus coordination center linking the lower and central portions of Pinellas County. It lies at the intersection of a rational network of Regional routes and is strategically located with respect to the routes of the separate bus operations presently serving various portions of the County. In addition, of course, the mall itself represents an attraction for shopping trips.

The Seminole Mall center would provide a focal point where services offered by Southern Tours (Gulf Beach and Pinellas Park routes), St. Petersburg Municipal Transit, Gulf Coast Motor Line and the State Demonstration Project in central Pinellas County could all be coordinated for the purpose of providing maximum Regional travel opportunities. The concept provides hourly service between most of the urban areas in Pinellas County, with only one transfer required, at Seminole Mall.

Figure II-5 shows the present routing of the separate bus systems in the immediate vicinity of the Seminole Mall Shopping Center. There are many ways to arrange the interlocking of these five systems for the purpose of creating a regional network. Alternatives were evaluated in light of the previously stated short-range objectives and groundrules. The next four recommendations support the Seminole Mall Coordination Center concept and describe in detail how it could be implemented.

Extend one or more St. Petersburg Municipal Transit routes to Seminole Mall

From the standpoint of Regional travel between St. Petersburg and central Pinellas County, the St. Petersburg Municipal Transit System

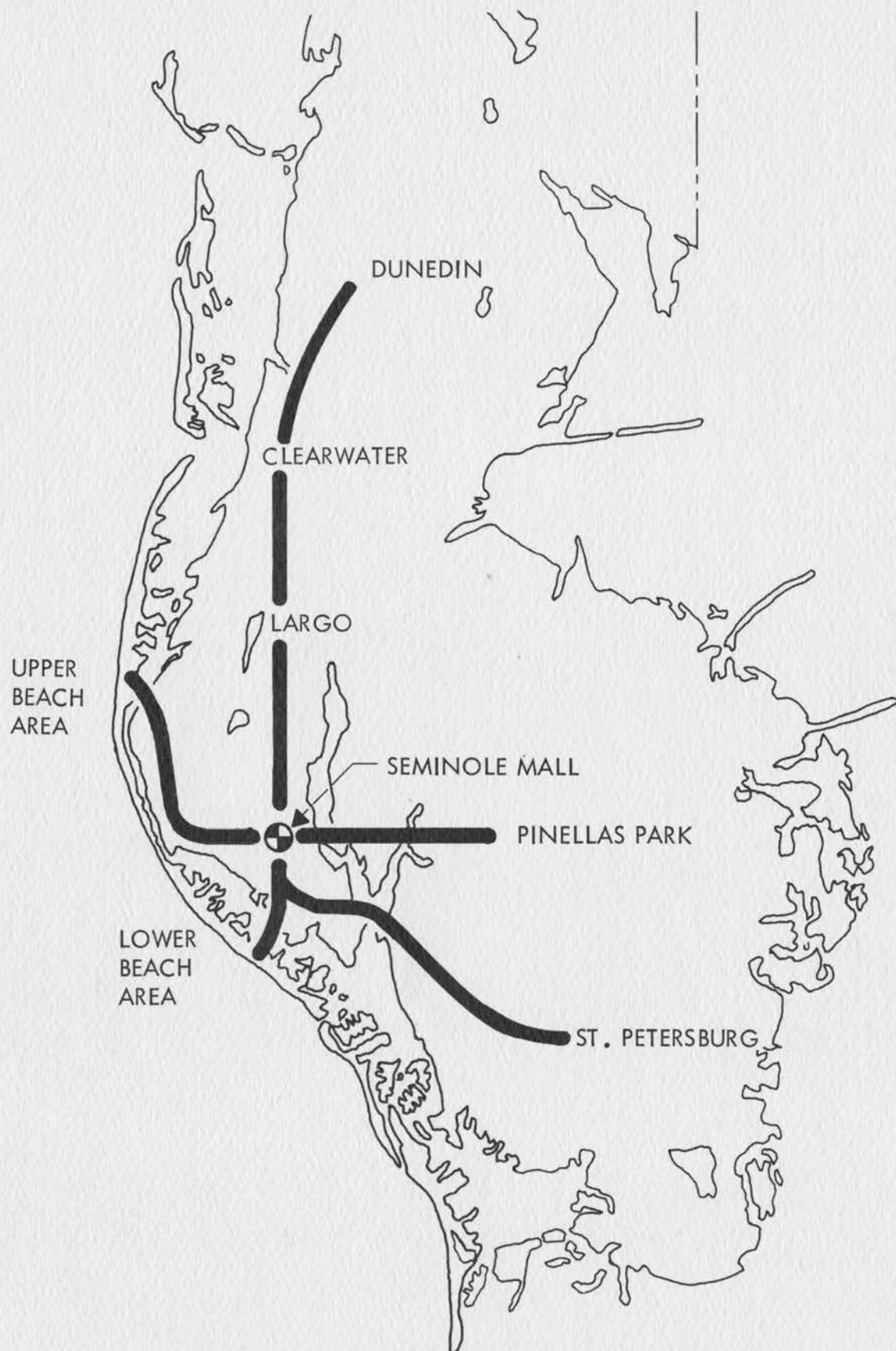


Figure II-4. Lines of Flow to Seminole Mall
Bus Coordination Center

should fulfill the role of a collection/distribution service, linked at Seminole Mall with other services reaching into the central part of the County. The transit user survey conducted as part of this study showed that, out of some 16,000 people who ride the buses throughout the Region on a typical weekday, over 1,000 individuals are estimated to have a need for new service to the Clearwater, Largo and upper beach areas in Pinellas County. The extension of one or more St. Petersburg routes to Seminole Mall would not only serve the purpose of regional exchange with central Pinellas County, it would provide direct access to the Seminole Mall Shopping Center for St. Petersburg residents, a travel opportunity which does not presently exist.

The three routes recommended for extension are those which presently approach closest to Seminole Mall (added one-way travel time would be five minutes for route 13 extended). If it is desired to extend only one St. Petersburg route initially, it is recommended that route 13 be selected. This route presently approaches closest to Seminole Mall and it provides access to the Crossroads Shopping Center, Central Plaza and downtown St. Petersburg. A further alternative would be to extend the route to Seminole Mall only during non-peak hours, since the survey showed the indicated need for non-work trips to far exceed the indicated need for work trips between St. Petersburg and central Pinellas County.

Routes 14 and 21 could be extended to Seminole Mall in place of, or along with, route 13. Their inclusion along with route 13 is attractive from the standpoint of composing a more effective collection/distribution service for Regional travel. Again, extended service could be provided during off-peak periods only. If routes 14 and 21 were extended to Seminole Mall, they could be used to provide service to the Bay Pines Veterans Center in place of route 13. Route 13 could then be routed south on Park Street from 22nd Avenue North, instead of going north to Bay Pines as is presently done. This change would be attractive in support of the recommendations made for the Pass-A-Grille route of Gulf Beach Transit, as will be explained later.

Provide direct service between Pinellas Park and Seminole Mall

In order to provide residents of Pinellas Park with improved access to central Pinellas County, the Pinellas Park Transit operation should be linked into the Seminole Mall coordination center by means of a direct service along 74th Avenue North.

This could be done by substituting service along 74th Avenue North to Seminole Mall for the present service along 66th Street to Tyrone Boulevard and 22nd Avenue, by adding a one-hour round trip route that circulates generally in the present Pinellas Park Transit service area and runs to Seminole Mall along 74th Avenue North, or by changing the Gulf Coast route to utilize 74th Avenue North from Seminole Mall to Pinellas Park, instead of proceeding south to Bay Pines.

Of the three alternatives, the addition of a new one-hour round trip route that circulates in Pinellas Park and provides service to Seminole Mall along 74th Avenue North appears most attractive. The major reason for this is that such a route could fulfill two objectives. The transit user survey showed that the largest demand for new work trip service and the second largest demand for new non-work trip service were between Pinellas Park and St. Petersburg. The new route in Pinellas Park would therefore serve as a third feeder line to St. Petersburg Municipal Transit routes, as well as a Regional connecting service from Pinellas Park to Seminole Mall.

Link Gulf Beach's North Redington route into the Seminole Mall Center

It is recommended that the North Redington service be modified to access both Seminole Mall and downtown St. Petersburg. The route along the beach would be unchanged. The modification is that successive buses would alternately go to Seminole Mall and the Crossroads Shopping Center, and service would terminate at Crossroads Shopping Center rather than continuing on to Williams Park as is presently done. This would require riders on the North Redington route to transfer to a St. Petersburg bus to continue into downtown St. Petersburg. This scheme makes it possible to service both Seminole Mall (with its connecting routes to central Pinellas County) and downtown St. Petersburg with essentially the same hourly departure schedule now offered to downtown only, and with no increase in the number of buses required.

There are alternative schemes that accomplish the objective of linking the North Redington route into the Seminole Mall coordination center. But the recommended approach appears most desirable for several reasons: no additional equipment is required, direct service from the beach to Crossroads Shopping Center is retained, and the present connecting service with Pinellas Park Transit at the Crossroads Shopping Center remains undisturbed (the total plan for the Seminole Mall coordination center would result in Pinellas Park residents having access to the North Redington beach route at both Crossroads Shopping Center and Seminole Mall).

Provide hourly services from Seminole Mall to central Pinellas County

With hourly service between St. Petersburg, Pinellas Park, the beach area and the Seminole Mall coordination center, the network can be completed by providing comparable connecting services from Seminole Mall to Clearwater, Largo and the upper beach area.

The State Demonstration Project provides satisfactory connecting service from Seminole Mall to the upper beach area (Tiki Gardens to Belleair Beach), with buses operating on an hourly schedule throughout the day. The State Demonstration Project also provides hourly service between Seminole Mall and Largo. It could provide the necessary connecting link between Seminole Mall and Clearwater by rerouting to go from Largo City Hall to Clearwater, instead of going from Largo City Hall to West Bay Drive and Indian Rocks Road as is presently done. However, if this approach is used, care must be taken to avoid direct conflict with Clearwater Transit routes 11 and 15. One solution might be to have the State Demonstration bus routed on Highland Avenue between Largo and Clearwater.

An alternative would be to use Gulf Coast Motor Line for the connecting link between Seminole Mall and Clearwater, instead of the State Demonstration service. Gulf Coast presently provides service between Seminole Mall, Largo and Clearwater at approximately three-hour intervals. If Gulf Coast were to operate between Clearwater and Seminole Mall, instead of proceeding into downtown St. Petersburg as it presently does, it could provide hourly service between Seminole Mall and Clearwater, with no increase in the number of buses required. If this was done, Gulf Coast would continue to connect with Clearwater Transit in central Pinellas County and with Gulf Beach's North Redington route, Pinellas Park Transit and St. Petersburg Transit in lower Pinellas County, but with greater convenience (all connections at one location, Seminole Mall) and increased frequency (every hour instead of every three hours).

Employ beach transit for collection/distribution and feeder service

The transit user survey showed the presence of a demand corridor between the lower beach area (Madeira Beach, Treasure Island, St. Petersburg Beach), St. Petersburg, Tampa and Temple Terrace. In addition, the survey showed that the greatest percentage of requests for more frequent service was obtained from the Gulf Beach ridership, with 32 percent so indicating.

In response to these results, it is recommended that Gulf Beach's Pass-A-Grille route be modified to fulfill a collection/distribution and feeder role. This could be accomplished by terminating the route at some convenient location along 107th/Central Avenue, between Gulf Boulevard and Park Street, instead of continuing on to Williams Park as is presently done. The route along the beach would remain unchanged. Connecting service to downtown St. Petersburg could be provided by St. Petersburg Transit route 3 (Central Avenue). As mentioned above (in the discussion of extending one or more St. Petersburg Transit routes to Seminole Mall), it may be possible to bring St. Petersburg route 13 south on Park Street from 22 Avenue North, down to the connecting point selected for route 3 and the Pass-A-Grille route. This could replace the run on Park Street presently made by route 3, and it would provide one-transfer service to the Crossroads Shopping Center for residents of the lower beach area, an opportunity they do not presently have. Use of route 13 in this way is also attractive from the viewpoint of expanding

the St. Petersburg urban area accessible via one transfer to and from the beach area.

These changes would increase the frequency of service offered to lower beach residents from the present one hour to one-half hour, which is consistent with the half-hour schedule presently maintained by St. Petersburg route 3, the proposed connecting service to downtown St. Petersburg. It is assumed here that there is no change in the number of buses operating on the Pass-A-Grille route. The change recommended for the Pass-A-Grille route is consistent with the service concept recommended above for the North Redington route, and is in consonance with the desires of the Gulf Beach ridership as indicated by the transit user survey.

Institute locally responsive service between Tampa and St. Petersburg

According to the transit user survey, the estimated total need for service between the Tampa and St. Petersburg urban areas is approximately the same as that between St. Petersburg and central Pinellas County. The survey indicates further that over 70 percent of these trips are for non-work purposes, such as shopping, medical, personal business and social or recreational.

Tamiami Trailways and the Greyhound Bus System together account for a reasonably large number of daily trips between Tampa and St. Petersburg. However, these are both interregional operations, and their schedules are dictated by the requirements of a very large geographic service area, wherein Tampa and St. Petersburg are only a small part. This unavoidably leads to inconvenient scheduling and lack of operational flexibility from the viewpoint of satisfying local needs. Tamiami and Greyhound both focus loading and unloading operations at downtown terminals, because of legal restrictions intended to prevent them from competing with locally franchised bus systems.

There are several approaches that can be taken to provide locally responsive service between Tampa and St. Petersburg through coordination and extension of local services. The Tampa and St. Petersburg transit systems could conceivably be interlocked by means of a single-purpose connecting service operating back and forth across the Howard Franklin and/or Gandy Bridges and connecting with the two urban systems at the periphery of their respective franchise areas. Or, Tampa and St. Petersburg could alternately extend one or more of their lines across one or both bridges, again interfacing at the edge of the neighboring service area. Thirdly, Tampa and St. Petersburg Transit could each extend one or more lines to the downtown hub of the other's urban area. The last approach is recommended, and the next two recommendations describe in detail how the approach could be implemented.

Use Routes 9 and 10 in Tampa, 4 and 9 in St. Petersburg, for interchange service

St. Petersburg's route 4 and Tampa's route 9 could interchange across the Gandy Bridge, and St. Petersburg's route 9 could interchange with Tampa's route 10 across the Howard Franklin Bridge. The relationship of these four routes with respect to each other and with respect to the two urban areas is shown in Figure II-6.

To illustrate the concept, it could be implemented as follows: Particular runs on St. Petersburg's route 4 and Tampa's route 9, having outbound end of the line times that happen to nearly coincide or can conveniently be made to coincide, would be identified as an interchange pair. Each of the buses in the exchange pair, upon reaching its outbound end of the line, would continue across the Gandy Bridge to the other's end of the line location. The St. Petersburg bus would then continue on into downtown Tampa, taking over that inbound run for Tampa's route 9, and the Tampa bus would continue on into downtown St. Petersburg, taking over that inbound run for St. Petersburg's route 4. The two buses would return to their home franchise areas on the next outbound runs. And similarly for select pairs of runs on St. Petersburg's route 9 and Tampa's route 10.

The motivation in recommending this concept, which has scheduling complexities and problems associated with bus identification, stems from a desire to provide one-transfer service between the Tampa and St. Petersburg urban areas, while at the same time making maximum use of available equipment and maintaining present services relatively undisturbed. From the viewpoint of Regional travel, the St. Petersburg and Tampa Transit systems act as collection/distribution services. For example, the overall flow of St. Petersburg routes into Williams Park, from southwest and south of the Park, and the several east-west routes that intersect routes 4 and 9 north of Williams Park, form a natural collection/distribution network for the service to Tampa. Similarly, the primarily north-south routes in Tampa that all converge on a relatively small downtown area constitute a natural collection/distribution network for service to St. Petersburg via Tampa's routes 9 and 10. So unless a user of the proposed Tampa-St. Petersburg interchange service has immediate access to one of the extended routes, the likelihood is high that he will be transferring from a collector line to the interchange line. As described above, the interchange concept would require no further transfers for downtown across the bay or other "enroute" destinations (destinations are discussed further below). The other two service approaches mentioned briefly above, the peripheral interface concept and the single-purpose connecting service concept, would require an additional one and two transfers, respectively.

Offer flag-down and limited route flexibility on Tampa-St. Petersburg runs

It is recommended that the Tampa-St. Petersburg runs described above offer flag-down service and some limited flexibility in destination

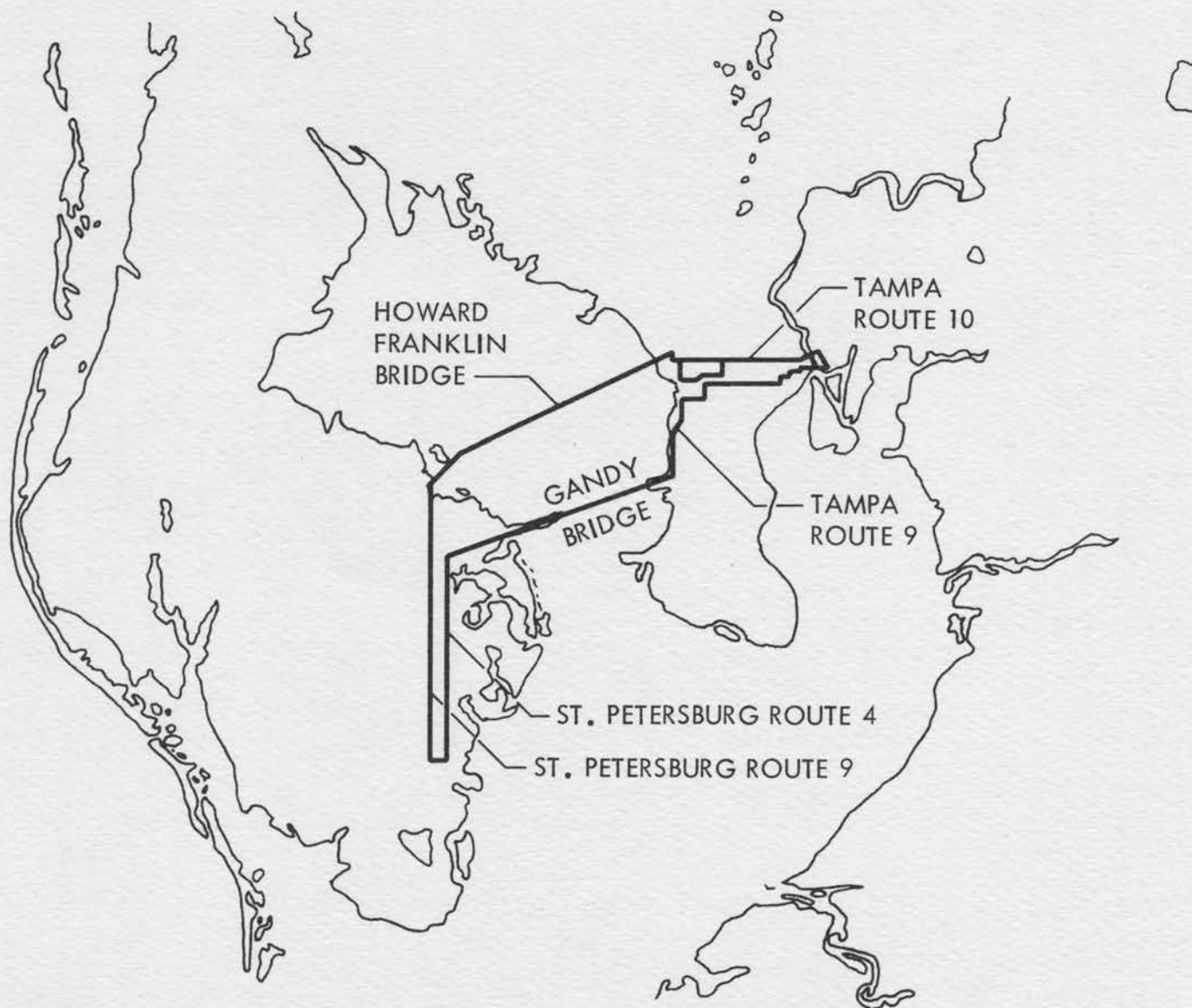


Figure II-6. Tampa-St. Petersburg Interchange Services

stops. While the primary destination in downtown St. Petersburg may be Williams Park (with Webb City being a major attraction), stops at locations such as the Bayfront Center or even an extension of the trip to Central Plaza could be available on request. For the runs to downtown Tampa, a stop at the Curtis Hixon Convention Center could be available on request. West Shore Plaza should be a regular stop for interchange buses coming across the Howard Franklin Bridge, headed for downtown Tampa via Tampa's route 10. In fact, if it is decided that service between Tampa and St. Petersburg should be initiated on a limited basis at first, it is recommended that Tampa's route 10 and St. Petersburg's route 9 be interchanged across the Howard Franklin Bridge, thereby providing St. Petersburg residents with access to West Shore Plaza.

It is estimated that approximately 15 to 25 minutes of added schedule time would be required (depending on whether service is across the Gandy or Howard Franklin Bridge and the degree of destination flexibility permitted) to allow for traveling across the Bay and for the various service flexibilities discussed above. Since the greatest demand for service between Tampa and St. Petersburg is for non-work trips, the service between the two urban areas may offer an opportunity to make use of uncommitted equipment during off-peak travel times.

Provide bus stop tram service within major shopping complexes

All of the new Regional services described above have as a major objective the provision of service for shopping trips. In large shopping complexes, such as West Shore Plaza, walking a relatively long distance to the bus stop with an armload of packages can represent a very real deterrent to the use of public transportation. Therefore, as a corollary to the recommendations for Regional bus services, it is suggested that the larger shopping centers provide tram service between the shopping area and the bus stop servicing the center.

Make people aware of the new travel opportunities being offered

As part of the initial publicity campaign dealing with new services and changes to existing services, considerable effort must be expended in educating the public with regard to how the new services will work, and exactly what routes and schedules will be available.

While publicity provided by the mass media is helpful, experience has shown that new transportation services are most effectively publicized by means of person-to-person contact. One way this might be accomplished is to enlist the aid of high school and/or college students in distributing promotional material, routes and schedules, and answering questions that people may have concerning the new services. People could be contacted

at their homes in areas scheduled to be served, at major trip attraction locations, or even aboard the buses presently operating in the Region. All of the new Regional services recommended in previous paragraphs are designed to complement existing operations, so it should be in everyone's interest to cooperate in their promotion. Promotional material should include one phone number that residents throughout the Region can call to ask questions about the new services or request detailed route and schedule information to be sent.

Provide for routine dissemination of Regional route and schedule information

In addition to the initial public education process, route and schedule information should be conveniently available to transit riders on a routine basis. Extreme care should be taken to make the format of routes and schedules as simple and understandable as possible.

An information device that may prove useful at some number of primary stop locations is a tape recorded message with information on Regional services as appropriate for that particular stop. This could be similar to the tourist information devices commonly used at major sightseeing attractions. The unit is self-contained, reasonably secure and weather-proof. Tapes are easily changed as required, in this case to reflect a route or schedule change.

Buses that provide direct or connecting Regional service should be clearly marked. A frequently repeated comment on the transit user survey questionnaires had to do with people having extreme difficulty in determining where any given bus was headed. Equipment that operates between St. Petersburg and Tampa or Tampa/West Shore Plaza, or equipment that makes connections to other parts of the Region at the Seminole Mall, should be clearly identified.

Attractions that receive request-stop service along new Regional routes should be encouraged to post bus schedules appropriate for their location. And, a central phone information service should be maintained on a continuing basis to answer questions regarding Regional services and furnish routes and schedules through the mail on request.

Seek Active Support from the Business Community

The recommended short-range actions for coordination of bus services in the Region create benefits for members of the business community. The Seminole Mall bus coordination concept provides direct service to the Seminole Mall Shopping Center from St. Petersburg, Pinellas Park and portions of the beach area. These are services that do not presently exist. Service from central Pinellas County to the Crossroads Shopping Plaza would be greatly improved in terms of convenience and frequency. The Tampa/St. Petersburg interchange service provides the opportunity for direct bus service from St. Petersburg to downtown

Tampa, West Shore Plaza, Curtiss Hixon Convention Center and other attractions in the Tampa area. Residents of Tampa could have direct service to the Bayfront Center, Webb City, Central Plaza and other destinations in the St. Petersburg area. And many other examples could be given.

It seems reasonable therefore that the business community should assume some responsibilities in connection with Regional mass transportation improvements, commensurate with anticipated benefits. There are a number of forms that assistance from the business community might take. Very large shopping centers could assume responsibility for providing the recommended tram services between shopping areas and bus stops within their own complex. Businesses could materially assist in the task of educating the public about bus services available and in promoting the use of these services. A program of special bus fares made possible through subsidy by businesses which benefit from new services might be devised. There are many possibilities. The point is that in many instances it is reasonable that business be looked to for active support in implementing certain of the Regional mass transit improvements.

COORDINATION OF FACILITIES

Coordinate construction, maintenance and usage of Regional waiting facilities

In support of the short-range improvement program, the major application of facilities coordination relates to the establishment, maintenance and usage of primary inter-operational waiting facilities at nodes of the Regional network. The recommended Regional bus node at Seminole Mall is a case in point. It was recommended that the operations of St. Petersburg, Pinellas Park, Gulf Beach, Gulf Coast, State Demonstration and Clearwater Transit all be interlocked at the location of Seminole Mall Shopping Center. This should call for a primary Regional waiting facility, with comfortable seating accommodations, protection from the weather and complete route and schedule information for the services available at that junction.

In order to accomplish this cooperative effort, some single authority will have to be approved and supported by all the affected operators, and delegated the responsibility for carrying out the collective effort. In the case of a facility like the waiting accommodations at Seminole Mall, that responsibility could be given to one of the operators, or it could reside with an organization like the proposed Regional Transit Service Corporation, described in more detail below.

Consider establishing Regional shops for major bus overhaul and repair

Discussions with bus operators throughout the Region have led to the conclusion that there appears to be some merit and practicality in the idea of establishing Regional shops for major bus overhaul and repair. These shops would be used in common by all of the bus operators, and would be strategically located throughout the Region to provide maximum possible convenience for all users. Routine, daily maintenance and minor repairs would continue to be done in the operators' own facilities. The administration of Regional shops for major overhaul and repair would appear to be another responsibility that could be conveniently delegated to an organization like the Regional Transit Service Corporation, discussed later in this section.

APPLICATION OF NEW TECHNOLOGY

Three broad areas of new technology were examined in relation to the short-range improvement program. They are vehicle technology, operational innovations and demand responsive systems.

Vehicle technology could play a useful and important role with regard to meeting new federal standards, enabling more efficient transit operations and helping to build transit patronage levels.

Operational innovations include traffic expediting methods and information systems. The former are conveniently implemented in stages on an as-required basis, in response to changing levels of congestion. The latter can be a useful adjunct to near-term as well as long-range transit operations.

Demand responsive systems appear to have very good potential for addressing the particular needs of the Tampa Bay Region. Their availability is such that a full-scale demonstration could be feasible as part of the presently planned Short-Range Improvement Program.

Each of these three areas is discussed in more detail below.

Vehicle Technology

A discussion of new vehicle technological developments in the areas of air pollution control, propulsion, noise reduction and safety is presented in Appendix II (available from the TBRPC on request).

Propulsion

Probably no vehicle component is receiving more development effort at the present time than the propulsion subsystem. Some of the reasons for this intense activity include forthcoming federal standards on air pollution, federal requirements for minimum power ratings and desire for lower operating costs. Reduction of air pollution (and noise) can also be important for improving the image of mass transportation held by both users and non-users. This image can be significantly affected by visible bus exhaust emissions and noise, as well as general vehicle appearance.

It is being widely predicted at the present time that gas turbine engines will be one of the earliest replacements for gasoline and diesel engines in order to meet national air pollution requirements. Recent emission data for gas turbines and diesel engines showed the gas turbine producing half as much carbon monoxide, one-quarter as much nitrogen dioxide and one-seventeenth as much unburned hydrocarbons.

Significant progress is being made in the use of gas turbine engines for long haul bus applications. Ford, GMC, International Harvester and others have test versions of their turbine engines presently installed in trucks and buses; and considerable effort is being directed toward the development of smaller, lower horsepower turbine engines more appropriate for urban bus applications. It would appear that one consideration in the purchase of new buses ought to be relative ease of conversion to turbine engine propulsion at some future date.

Natural gas engines, steam engines, the Wankel engine, engines that use electric storage batteries and engines that use fuel cells for energy sources are covered in Appendix II. Except for natural gas engines and certain hybrid steam engine concepts, all these propulsion systems either have a long development road to travel before transit applications can be considered practical, or they appear fundamentally

unattractive for such applications. Converted diesel engines running on liquified natural gas have demonstrated not only reduced fuel costs but also appreciably lower emission pollutant levels. There is considerable activity in conversion to liquified natural gas, and on balance, this propulsion system appears to rank next to gas turbines in terms of overall attractiveness for near-term transit usage.

One additional consideration as far as vehicle propulsion is concerned has to do with the Federal Government's present interest in specifying a minimum standard for brake horsepower (bhp) per ton of vehicle weight. The primary reason for establishing a minimum requirement for this ratio is to insure compatible grade climbing capability in heavy automobile traffic. The British are considering 6 bhp per ton, while the Germans are considering 8 bhp per ton. At this point, one can only speculate as to what the American standard will be. While it appears that any reasonable standard will not represent a problem for conventional American buses, this forthcoming requirement is another consideration in future bus purchases.

Pollution

The exhaust emission kit developed by the General Motors Corporation offers a near-term approach for reducing bus exhaust emissions. The kit, which is inconspicuous when installed, is currently being tested on several buses in Washington, D. C. Preliminary performance data indicate that emissions from buses equipped with the kits will meet the new city air pollution code. Interestingly, a by-product of installing this kit seems to be a two db drop in interior bus noise level.

Noise

Most of the attention given to vehicle noise reduction has been focused on the engine and exhaust system. The Danes have developed a new exhaust system which is reported to be very efficient at reducing exhaust noise, presumably with no serious increase in exhaust system back pressure. The system has been adopted for the 500-bus fleet in Copenhagen.

Safety

While the majority of recent government instituted bus safety standards have been directed at school buses, it is anticipated that many of these safety requirements, plus others that may be instituted primarily for automobiles, will sooner or later be applied, as appropriate, to urban transit buses.

One safety device under development by several firms (three specific designs are identified in Appendix II) is the high energy absorbing

bumper. Insurance companies, in conjunction with the National Highway Safety Bureau, are working on bumper standards which will require that cars must be able to withstand a 5 mph impact (Florida is calling for 10 mph capability). Another safety device, developed by the Miami Transit Company, is a "dead man" control system that automatically brings a bus to a halt in the event the driver falls or becomes unseated for some reason.

Operational Innovations

Operational techniques for increasing the average speed of buses in congested urban areas include a variety of schemes for reserved bus lanes as well as traffic signal control.

Reserved bus lanes can be created by replacing either a general traffic lane or a line of parked cars with an exclusive bus lane. The reserved lane can run either in the same direction as general traffic or in the opposite direction. The reserved lane policy can be in effect all the time or just during peak traffic hours. And, the lane can be completely exclusive or some sharing can be allowed, for example to permit right turns.

Traffic signal control methods which give priority to buses are under development. Control of traffic signals may be accomplished by the bus driver, by a pre-programmed central computer, or by real-time control with data on street conditions continually monitored and traffic signals adjusted accordingly. The last method is under development and test by the Federal Highway Administration and UMTA.

The key factor which determines the necessity and desirability of implementing any of these concepts is the degree of congestion being experienced. Ideally, it should be possible to show that for each reserved bus lane put into effect, the benefits accruing to buses balanced against any disbenefits to private vehicles represents a net gain for the community. Since the essence of the Tampa Bay Regional mass transportation problem is to provide increased numbers of Region-wide travel opportunities for a relatively disbursed ridership, as opposed to being a problem of overcoming severe congestion in order to increase Regional travel speeds, the reserved bus lane and traffic signal control innovations do not appear to have any significant role in the Short-Range Improvement Program.

However, from the viewpoint of local transit services, particularly within central business districts, the techniques of reserved bus lanes and traffic signal control provide the means for accomplishing, at least to some extent, desired improvements in average bus speed. This can be accomplished on an as-needed basis in response to worsening

traffic congestion, and without major capital investments. Alternatively, of course, an entirely different approach could be taken to the central business district collection/distribution problem, using other technologies such as fixed guideway mini systems and/or demand responsive systems.

In addition to techniques for increasing the average speed of buses in congested urban areas, operational innovations are defined here to include information systems.

From the viewpoint of the transit user, desired information includes routes, schedules and identification of where specific buses are going. Improved transit user information is a small factor but a necessary one. While the availability of improved information will not immediately result in increased ridership or profits, the lack of such information is a negative factor which can contribute to the continued long-term decline in transit patronage.

From the viewpoint of the transit operator, improved information can produce substantial benefits. Information systems using digital computer capabilities are being developed with the assistance of UMTA funding. These systems are directed toward standardization of accounting, operations, maintenance data acquisition, data retrieval, data management and reporting techniques. The implementation of a computer oriented transportation information system for the TBR could be one of the responsibilities of an organization such as the Regional Transit Service Corporation, discussed later in this section. Alternatively, it could be integrated into the computerized Regional Information System developed by the TBRPC as a comprehensive source of information for all phases of Regional planning. Data developed on a standardized basis throughout the Region would not only be valuable for Regional transportation services, it would be useful to local operators in their efforts to improve the efficiency of their individual operations.

A computerized transportation information system for the Tampa Bay Region would also provide a capability to process data necessary for route simulation and optimization, on both a local and a Regional scale. Work in this area is progressing with the assistance of funding from UMTA, and application of route optimization is being tested in Washington, D. C. Computer simulation of alternate routes could materially assist in the task of objectively forecasting the likely profitability of new routes before actual start-up.

Demand Responsive Systems

An area of new technology that has good potential for meeting certain transportation needs in the Tampa Bay Region is the demand responsive or dial-a-bus system.

The demand responsive concept is applicable to many of the needs for new services expressed by the present transit ridership in the transit user survey. In addition, and perhaps more importantly, the concept can help meet the transportation needs of approximately one-quarter of the Region's population who are essentially captive to public transit because they have either limited or no access to an automobile, but are not now a part of the Region's mass transit ridership because their home area simply doesn't have bus service. Many of these people live in areas where the population density is too low to support fixed route bus service. It is in just such areas that the demand responsive system operates most efficiently.

While there have been many so-called demonstrations of demand responsive systems, these have all been either a severe modification of the fundamental concept or a very narrow application of the idea. In most cases vehicle assignments have not been computer-determined. In one instance the system response capability amounts to the driver of a fixed-route bus making small detours in response to requests phoned directly to him by customers. In other demonstrations the system is restricted to act as a collection/distribution service for a rapid transit trunk line. In no case has there been a true demonstration of the demand responsive concept with real-time computer assignment of vehicles providing a mix of many-to-many (many origins to many destinations), many-to-one and one-to-many services.

It is recommended that promising sites for a demand responsive system demonstration in the Tampa Bay Region be identified and that the essential characteristics of the demonstration service be defined in sufficient detail to provide the basis for pursuing near-term implementation.

Concept Description

The demand responsive system is a concept of mass transportation that offers door-to-door service in areas not densely enough populated to support fixed-route bus service. Vehicles are shared by a small number of passengers. Convenience, privacy and trip time are all between what is normally associated with taxi and fixed-route bus service, as is trip cost.

The concept marries computerized route optimization with small (10-20 passenger) vehicles and attempts to achieve the best balance between level of service provided to the customer and the cost of providing that service.

Customers phone in their requests for service to a central computer controller, giving such information as point of origin, destination, desired departure time and/or desired arrival time, number of people

making the trip and level or priority of service desired. The computer then makes real-time decisions concerning the assignment of each request for service to specific vehicles. These decisions are made in the light of such information as vehicle location, number of people in the vehicle, next vehicle destination, destinations for all passengers on board, trip times associated with each passenger on board and a description of the street network within the service area. As an example of the kind of service objective that can be implemented by a demand responsive system, the computer logic can be designed to provide lowest mean service time for all passengers, within fixed cost constraints, and subject to guaranteed limits on the worst service time possible for any single passenger.

Overall Feasibility

The demand responsive concept has been exhaustively studied. It is technologically feasible and can be implemented with state-of-the-art techniques and hardware, although a substantial effort will be required to integrate the existing technology into a smoothly functioning service.

From a purely mathematical point of view, vehicles with seating capacities of 10 to 20 passengers are determined to be appropriate. Any one of a large number of available small vans or buses could be used. No sophisticated vehicle technology is required by the demand responsive concept. As a practical matter of course, vehicle selection will be influenced by many factors. Small vehicles may introduce problems due to the creation of a mixed fleet, and their limited capacity could pose a problem if it is desired that they be available for other duties in addition to demand responsive services. On the other hand, small size is desirable for maneuverability and unobtrusiveness in the residential areas within which these vehicles will be called upon to operate. The extent to which small vehicle size imparts a feeling of personalization to the user and the importance of vehicle size with respect to overall service image and attractiveness are difficult to assess.

Presently available, reasonably uncomplex computer hardware can be configured to handle 1,000 to 2,000 demands per hour in demand responsive service, and with larger and faster equipment, it appears that a demand responsive system could handle at least ten times as many demands per hour. For demand levels above 200 per hour, a computer system is essential. Manual systems are not feasible above these levels.

Operational computer programs have been written, implementing various demand responsive service policies for hypothetical service areas, and employing algorithms of varying mathematical sophistication. While factors peculiar to specific service areas will obviously require the development of a computer program specially designed for the demonstration area, the capability to successfully develop the necessary program has been demonstrated.

Performance and Costs

It has been calculated that a single demand responsive vehicle can be expected to handle between 10 and 20 requests per hour, with the possibility, of course, that a single request can represent more than one rider. More precise values for vehicle productivity require an analysis of the particular area to be served, with estimated average vehicle speeds, average trip lengths, demand densities and other such factors.

It appears that a demand responsive system will operate most efficiently in an area of 10 to 15 square miles or larger, with demand densities on the order of 20 to 80 demands per square mile per hour. These densities are greater than what is normally handled by conventional taxi service and less than what is required to reasonably support a fixed route bus service.

A demand responsive system is a labor-intensive concept, and driver salary is by far the single most important operating expense. Actual cost per trip will fall between that of a taxi service and a fixed route bus service. Operating cost will be essentially equivalent to the cost of conventional bus service plus the cost associated with communication and control. Computer costs for communication and control functions will depend on the particular circumstances of a given application, but these costs have been estimated to be on the order of 10 to 15 cents per trip.

Regional Suitability

The capability of the demand responsive system to offer door-to-door service connecting a geographically dispersed ridership with a large number of similarly dispersed destinations is particularly attractive in the Tampa Bay Region.

Many areas of the Region have population densities that are inadequate to support fixed route bus service, but that fall within the attractive operating range of demand responsive systems.

The Region has a large number of elderly residents for whom the door-to-door capability of the demand responsive system is even more attractive, if not essential, than it would be for other segments of the population.

A significant percentage of transit trips in the Region are made by domestic workers who may work for four or five different employers each week. Thus, their transportation needs may vary drastically from one day to the next, presenting a very difficult problem for conventional fixed route systems.

The Tampa Bay Region has a relatively large amount of growth ahead of it compared with many older and more built-up regions. Therefore, it can be expected to undergo important changes that may require considerable adaptability on the part of the overall transportation system. Demand responsive systems are intrinsically flexible and should be able to adapt to the changing Regional configuration.

The Region contains a number of potential demand responsive system service areas where street patterns are relatively systematic and uncomplicated. This could be a significant advantage in the development of the necessary computer program in support of a demonstration. It may be possible to adapt computer demand responsive service algorithms previously developed for hypothetical situations, thereby reducing the amount of effort required to develop an algorithm for specific application in the Region.

There exists in the Region a large captive ridership that presently has little or no opportunity to travel because of inadequate access to fixed-route bus services. Among the other functions that can be fulfilled by a demand responsive system, it can serve in part as a collection/distribution or feeder service to adjoining transit systems.

And finally, the transit user survey indicated that minibuses as a class of vehicles enjoy an extremely good image in the Region, due in large measure to the well received State Demonstration Project in Clearwater, which makes use of small buses. The demand responsive system, as mentioned above, is a highly appropriate application of vehicles that fall within the category of minibuses.

Demand responsive technology may be appropriate in widely dispersed areas throughout the Region. It might be employed initially in an area such as Pinellas Park or perhaps North Tampa. Satellite services might then be established in other parts of the Region, for example in Plant City, Palmetto, Bradenton, Sarasota and Venice, with all systems making use of a single centrally located main computer facility for real-time routing computations. Customer/controller and controller/vehicle communications systems could exist separately for each operation.

ESTABLISHMENT OF A REGIONAL AUTHORITY

The Need

Plans have been developed for improving local mass transportation, coordinating present services to provide the beginning of real inter-urban service, applying new technology to the Region's transportation problems and designing a future rapid transit system for high speed travel throughout the Region. A practical means must now be provided for translating these plans into action.

As new local, Regional and state-wide transportation systems are put into operation in the years ahead, it is essential that these activities be coordinated to best meet locally determined needs and objectives. The Tampa Bay Regional Planning Council presently provides such coordination and Regional perspective in the area of planning. A corresponding organization is needed to fulfill much the same function in the area of implementation and operation.

A means must be provided for guaranteeing continuity and follow-through on plans that involve hundreds of millions of dollars and many years of work to accomplish. Organizational stability must be assured, a mechanism for interjurisdictional operation must be established, and transportation throughout the Region must be represented by a single voice with responsibility, the authority to discharge that responsibility, and the necessary public standing to qualify for state and federal funding on behalf of mass transportation throughout the Region.

Jurisdictional Area

While the need for a transportation authority of some kind may be agreed upon, the jurisdictional area of such a body requires separate consideration. In establishing the size of the area to be encompassed by a single authority, the systems objective is to make the area large enough to include most of the important forces that directly influence and interact with elements inside the Region, while at the same time restricting it to be small enough so that proper sensitivity and depth of understanding for local problems can be retained.

The Tampa Bay Regional Planning Council has demonstrated that the TBR is a reasonably sized single jurisdiction capable of centralized planning that effectively addresses Regional problems without losing sight of local needs and aspirations. The same geographic Region is appropriate as a single jurisdiction for the implementation and operation of those plans as they relate to mass transportation.

The short-range mass transportation improvement program calls for extensive coordination of transit services throughout Pinellas County, between Tampa and St. Petersburg, and between local and Region-serving systems. Long-range plans include a rapid transit system linking the metropolitan areas of Clearwater, St. Petersburg and Tampa, with eventual expansion north past Clearwater, south to Bradenton and Sarasota, and east to Plant City. It seems clear that a Regional transportation authority will not be fully effective unless it encompasses the entire Tampa Bay Region as presently defined.

The Concept

There are many organizational forms that could be adopted to provide the needed Regional instrument for translating transportation planning into operating services.

Semi-autonomous Regional authorities or special purpose districts have been formed throughout the United States to provide required services or facilities within a region that includes numerous jurisdictional subdivisions. Authorities with responsibility for overall transportation within a region or with responsibility for only mass transit have been established in cities with populations as small as 20,000, such as Williamsport, Pennsylvania, as well as major metropolitan areas such as Chicago and its surroundings. Recently, multi-purpose authorities which include transportation, urban planning and other related areas, have been established to provide overall comprehensive planning and coordination of these interacting activities.

It is recommended that a multi-purpose public corporation be created with responsibility for transportation operations in the Tampa Bay Region.

The proposed concept is illustrated in Figure II-7. It is envisioned that the presently constituted board of elected officials governing the TBRPC, or some modification of that board, could also be the governing body of the new Tampa Bay Regional Transit Service Corporation (RTSC). The RTSC would have two functional divisions initially; transit planning and transit operations. Transit planning services should be supplied to the RTSC by the existing TBRPC technical staff, which would continue to have the same responsibilities, authority and basic mode of operation as at present. This avoids duplication in the planning area and at the same time recognizes the need for a certain level of transit planning responsibility and authority within the RTSC. The transit operations division would be responsible for the construction, management and/or operation of Regional transit services. Both divisions would be fully responsible to the governing board of city and county elected officials.

The motivation for this approach is to insure the close coordination of planning and operations, and build upon the working relationships and spirit of cooperation already established by the voluntary association of governments that constitutes the TBRPC. Procedures for financial support and representation from city and county governments have been established for the TBRPC and could provide at least a convenient basis for initial operation of the RTSC. Just as the cities and counties are now provided with fair representation regarding planning activities, the same representation would be applied to operational activities under the recommended approach.

RTSC Functions

In a general sense, the RTSC would represent transportation in the Tampa Bay Region, provide for coordination and balance between all levels of service throughout the Region and constitute the enabling force permitting implementation of new transportation systems.

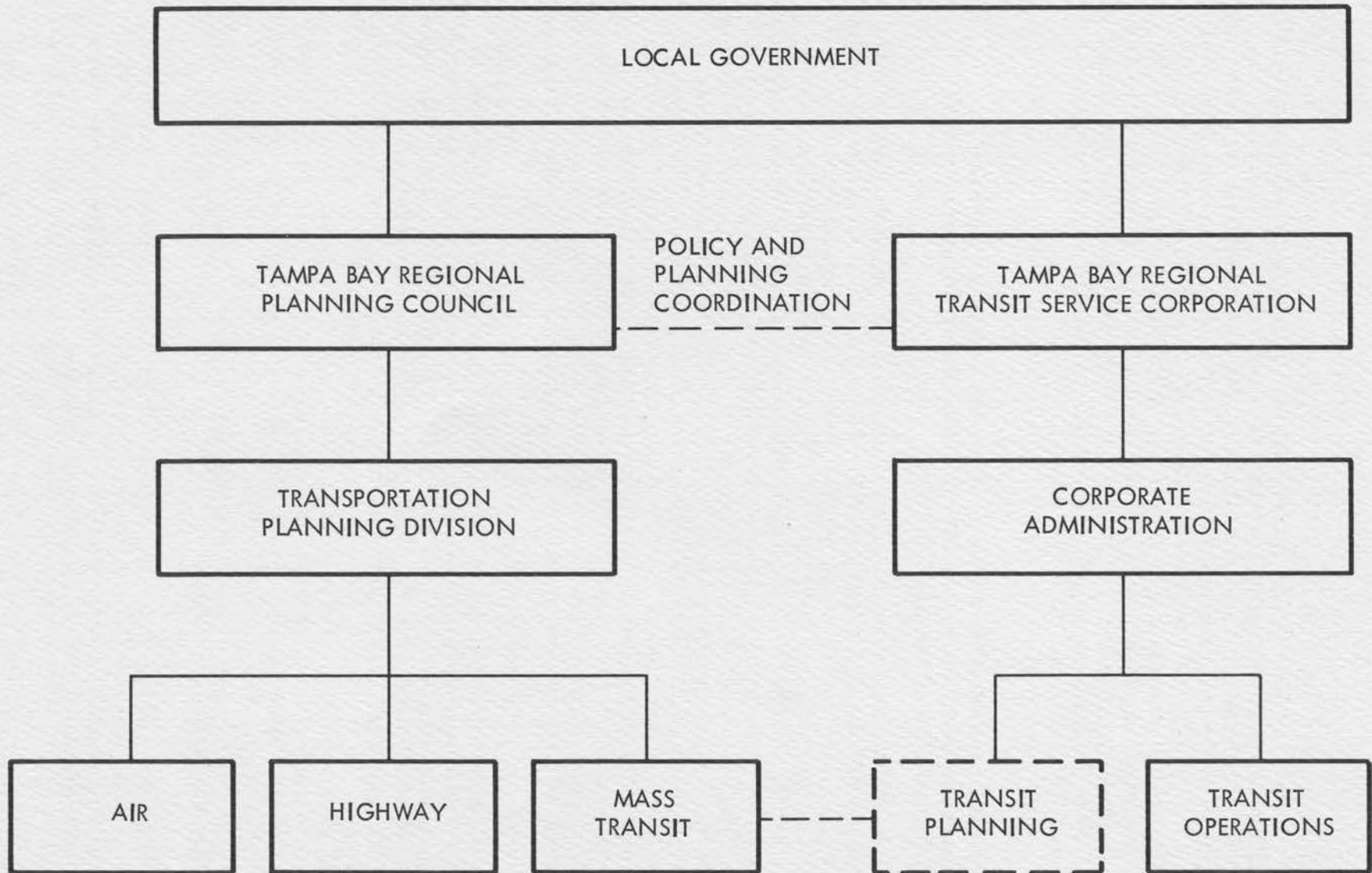


Figure II-7. Concept for Regional Transit Service Corporation

In particular, the RTSC could:

- a. assist in the implementation of new Regional services by being the instrument for negotiation of inter-jurisdictional agreements between operators
- b. construct, manage and operate Regional transportation facilities such as bus transfer centers and major overhaul garages
- c. maintain a public relations and information service on behalf of all Regional transportation
- d. qualify for state and federal funding in support of upgrading present transit operations, implementing demonstration projects or installing a major rapid transit system
- e. assist local operators through equipment leasing arrangements and the furnishing of data or consulting services on request
- f. operate local transit systems if that is the need and desire of the affected municipality
- g. plan and operate demonstration projects applying new technology to the Region's transportation problems
- h. plan, construct and operate major new rapid transit facilities
- i. coordinate plans for Regional rapid transit with plans for state-wide high-speed transportation
- j. develop and adopt rules and regulations with respect to Regional transportation services
- k. take steps to raise money locally in support of transportation throughout the Region.

The key point is that the Tampa Bay Regional Transit Service Corporation must be prepared to function in several modes because of the diversity of elements that must be brought together for the purpose of Regional transportation; a significant number of separate political jurisdictions and a mix of private, municipal and, in the future, RTSC owned and operated transit systems.

Elaborating briefly on the last function identified above for the RTSC, that of raising money locally in support of transportation throughout the Region, one of the driving forces for establishing a public authority has been their ability to circumvent bonded indebtedness or interest rate limitations that may apply to local government jurisdictions. Most

of the authorities that have been established have proposed to repay bonded indebtedness through user charges on the facilities built and operated. In the case of selling bonds to develop mass transit services, however, the situation is complicated by the general decline in mass transit revenues. These circumstances are clearly understood by the financial community. With rare exceptions, mass transit bonds require guarantees by local government jurisdictions and/or a taxing capability for the authority itself in order to interest investors in purchasing such bonds offered by the authority. Given that the full faith and credit of the governmental agencies and/or a taxing capability must be an inherent part of any organization providing Regional transit services, the form and organization of an authority with responsibility for mass transit is likely to be somewhat different than an authority developed, for instance, for construction of a controlled access highway. More representation by the local jurisdictions and full public support are necessary.

Initially, the emphasis of the RTSC should be to provide specific services not presently being supplied, while at the same time insuring that the activities of private and municipal transit companies within the Region are not compromised, in fact that they are materially aided and assisted. Circumstances within the Region are changing rapidly, and the RTSC must be structured so that it can change the emphasis of its function accordingly. For example, a trend toward public ownership of mass transit systems has been established, and it is possible that most of the transit systems in the Tampa Bay Region may eventually be publicly owned.

With the functions of comprehensive planning and transportation operations thoroughly coordinated within its organizational framework, the RTSC could maintain a complete and up-to-date plan for overall short-range and long-range transit developments throughout the Region. The plan could be based on results obtained from transit studies as well as experience obtained from all transit system operations in the Region. In addition, the plan could reflect the total impact of the changing Regional environment.

Interim Solution

Depending on the time needed for new enabling legislation, voter approval or other such steps in the creation of the Tampa Bay Regional Transit Service Corporation, it may be desirable to implement an interim solution. A concept for an interim, quasi-governmental Regional transit organization which supersedes the Regional Transit Coordinating Committee and paves the way for the establishment of the Regional Transit Service Corporation is described in the following paragraphs.

The interim organization, which might be called the Tampa Bay Regional Transit Association, would be composed of the local transit operators and their respective franchise-granting government bodies. The Transit

Association would derive its real source of power from the individual franchise agreements. It would place emphasis on achieving more efficient use of present equipment, facilities and personnel through increased operational flexibility arising from ability to operate in other franchise areas and across political jurisdictions.

The Transit Association would seek to implement better service from certain suburban areas into adjoining urban centers, more extensive distribution services within urban centers, and new cooperative inter-jurisdictional services that connect urban centers and serve communities presently without bus service.

The power to issue bonds or levy taxes, purchase equipment and construct new facilities would await the subsequent formation of the Regional Transit Service Corporation which would then replace the Transit Association.

Some advantages of the interim Regional Transit Association are:

1. It is more easily established than the more powerful and comprehensive Transit Service Corporation.
2. It makes possible the fulfillment of short-range community needs for coordinated Region-wide mass transportation services.
3. It should satisfy the federal capital grants requirement for implementation of an officially coordinated mass transportation system in the Region.
4. It should ease the task of obtaining a voter mandate for the subsequent creation of an authority with money-raising powers.

Briefly, the operation of the Transit Association could be as follows. Proposals for new Regional services could originate either with the TBRPC or the Transit Association. In either case, the proposal would require agreement by both the TBRPC and the affected government bodies before it could be pursued. Equivalent clauses added to each of the operators' franchise agreements could require the affected operators to jointly study the proposal for new service, suggest the most efficient way to implement the service, and then put the service into effect for a predetermined period of time, perhaps three or six months. The criteria for continuation of the new service could be that the overall effect must be to improve the operators' profit/loss picture. Thus, the new service may not make a profit, but it must represent a more efficient use of equipment, personnel and facilities than before. Examples of the kinds of new services that might be considered would be

the use of off-peak transit capacity for highly organized sight-seeing tours and service between outlying retirement communities and urban centers; or off-peak equipment might be transferred from one area to another where there is a greater likelihood of encountering off-peak demand.

PROGRAM FUNDING

Requirements

Elements of the Short-Range Improvement Program that require funding may be described and categorized as follows:

1. Development of new routes to satisfy the work and non-work travel needs of captive riders.
2. Construction of joint-use transfer facilities and Regional maintenance shops for major overhaul.
3. Design, development and demonstration of new technologies embodied in demand responsive transit systems.

Costs associated with the development of new Regional routes involving multiple bus systems include such things as detailed operations planning and establishment of new administrative procedures, promotion and arrangements for routine dissemination of route and schedule information, special requirements for bus identification, additional street furniture and evaluation of new services on the basis of early performance.

Costs associated with the design and development of a demand responsive system include such things as final site selection through comparative cost-benefit analysis, complete system design for the particular site selected, including number and type of vehicles to be used and communication systems to be employed, development of computer software, including routing algorithms, fare determination algorithms and data processing programs, and selection of computer hardware. Demonstration costs include such things as purchase of vehicles, computer facilities and communication equipment, establishment of administrative procedures, promotion and advertising, provisions for routine dissemination of service information, evaluation of the service based on actual performance and generalization of results for application elsewhere in the nation.

Eligibility

The recommended Short-Range Improvement Program described in this part of the report, together with long-range objectives and development plans described in Part III of the report, comprise a transit development program which is in accordance with federal urban mass transportation planning requirements. These requirements call for a program consistent with comprehensive and transportation planning, and providing for the development of a unified or officially coordinated transportation system in the area which forms an economically and socially related region.

The Short-Range Improvement Program examines the total Region and describes in considerable detail specific actions that can be taken almost immediately to (a) eliminate overlap in existing services, (b) coordinate routes and schedules of adjacent transit operations to maximize Regional travel opportunities and minimize transfer requirements, (c) unify efforts to supply the public with information on available transit services, and (d) provide for joint use of operating facilities and major overhaul shops in the Region.

Short- and long-range elements of the transit program are developed to be consistent with Regional planning and comprehensive studies already completed in such areas as land use, population, forms and appearances, Regional economy, natural resources, highway and airport developments. The recommended Regional Transit Service Corporation guarantees continued close coordination between transportation and comprehensive Regional planning. In addition, as stated previously, the RTSC is the mechanism whereby Regional perspective can be maintained, balance and coordination between the various transportation modes can be achieved, and unification of Regional transportation into a single integrated system can become fact.

Sources

Federal Department of Transportation

The development of new routes and the construction of joint-use facilities could be supported by UMTA program number 20.500, Urban Mass Transportation Capital Improvement Grants. Most of the costs associated with new routes and joint-use facilities fit the intended use of UMTA capital grants, which are for the acquisition, construction, reconstruction or improvement of facilities and equipment for use in public transportation service in urban areas. There might also be applicability under UMTA program number 20.504, Urban Mass Transportation Research, Development and Demonstration, in the sense that the new routes and operating policies recommended herein are an attempt to apply new techniques in the coordination of separate transit operations.

UMTA program number 20.505, Urban Mass Transportation Technical Studies Grants, appears to be directly applicable for the economic feasibility studies, engineering surveys and complete system design effort associated with the recommended demand responsive system demonstration. The stated objective of UMTA's technical studies grants is to bridge the gap between federally assisted transportation planning and federally assisted capital investment in mass transportation facilities and equipment. That is precisely the nature of the analysis and design work that must precede the demand responsive system demonstration. The actual purchase of vehicles, computer facilities, communication equipment and other capital investment items associated with implementation of the demand responsive system could be supported either by UMTA's research and development grant program, number 20.504, or their capital grants program, number 20.500.

The recommended demand responsive system demonstration appears to fit well in the overall scheme of present federally assisted projects involving operationally flexible urban mass transit concepts. The results of such a demonstration in the Tampa Bay Region would have wide national applicability. A strong local commitment, good management and developable demand are some of the key ingredients identified by UMTA as being required for success in a demonstration project. Creation of the Tampa Bay Regional Transit Association or Regional Transit Service Corporation and initiation of other elements in the Short-Range Improvement Program would be further evidence of the Region's qualification on the first two counts. And the estimated one-quarter of the Region's population who are captive riders but do not now use mass transit represent significant developable mass transit patronage.

American Revolution Bicentennial Commission

Some elements of the Short-Range Improvement Program are potentially appealing as part of the federally supported activities associated with the nation's bicentennial celebration. The American Revolution Bicentennial Commission in Washington, D. C., has a mandate to prepare an overall program commemorating the Bicentennial of the American Revolution, and of the nation's birth. Among its responsibilities, the Commission is to "give due consideration to related plans and programs developed by state, local and private groups," and "recommend allocations of financial and administrative responsibility among public and private authorities and organizations."

In the Commission's July 4, 1970, Report to the President, three themes were identified for the Festival of Freedom (the name given to the Bicentennial Celebration). Paraphrasing the Commission's report, they are:

1. Heritage '76 - A re-examination of our origins and values, taking pride in our accomplishments and dramatizing our development.

2. Open House USA - Program activities and events to stimulate travel of both Americans and visitors to our country.
3. Horizons '76 - Projects which manifest pride, priorities and community hopes, demonstrate concern for human welfare, happiness and freedom.

While transportation projects might be related to any of the three themes, Horizons '76 is the most likely theme to be appropriate. The celebration is to be nationwide, and "the Commission welcomes and needs additional suggestions and looks forward to receiving them in Box 1976, Washington, D. C."

Florida State Department of Transportation

The five Counties of the Tampa Bay Region constitute a major portion of the Florida west coast. Mass transportation within the Region will therefore have significant state-wide impact. In view of this, full coordination and cooperation between the Region and the state are important, and state support for mass transportation improvements in the Region is essential.

Significantly, the first state-funded mass transit experiment occurred in the Tampa Bay Region. The Region now has specific plans for short- and long-range mass transportation improvements that build in part on the State Department of Transportation Fleet Demonstration Project in central Pinellas County. The mechanism for being able to effectively follow through on these plans is embodied in the Regional Transit Association and Regional Transit Service Corporation concepts. Now, state assistance and cooperation are needed both for the direct benefits of such support and for the purpose of securing additional federal support.

PART III

PLANNING FOR THE FUTURE

INTRODUCTION

In preparing to deal effectively with future transportation needs in the Tampa Bay Region, the establishment of long-range objectives and the development of necessary planning instruments represent two of the earliest steps to be taken.

TRANSPORTATION OBJECTIVES

Long-range objectives give the necessary direction and balance to planning. They provide a foundation upon which to build a long-range Regional mass transportation program which is completely integrated with overall community planning and is responsive to community desires. Objectives were developed in the light of community views and priorities and against the background of a preliminary picture of how mass transportation might reasonably be expected to evolve in the Region over the years.

A summary of community views and priorities and a postulated long-range evolution of Regional mass transportation are presented as background for the discussion of mass transportation goals and objectives. The statement of community views and priorities is a digest of information and expressions of attitude revealed by the Transit User Survey described in Part I, meetings with members of local chambers of commerce and a continuing dialogue with transit operators, planners and local government representatives in the Region. The postulated evolution of mass transportation in the Region reaches out from the present to approximately twenty years in the future.

COMPUTER MODEL

A basic and rather complex transportation planning instrument is the computer model for design and evaluation of candidate transportation systems. Such a model normally contains subroutines that compute number of trips generated, their geographic distribution, how they become apportioned among competing travel modes and specifically what routes are used between the various origin-destination pairs. The model simulates proposed transportation systems and objectively forecasts what conditions would exist if one or more of these systems were actually placed in the Region at a specified time in the future.

Specifications for developing such a model in the Tampa Bay Region are presented. The specifications include consideration for special circumstances in the Region, an identification of the overall modeling approach to be taken, a first-level functional description of primary model elements, data requirements for calibration and operation of the model and a plan for proceeding with the detailed engineering design and programming of the model.

LONG-RANGE OBJECTIVES

Long-range mass transportation goals and objectives are a derivative of broad development goals set by the Region. As used here, a goal is a generalized statement that relates the physical environment to the basic desires of the community. Goals are statements of aspirations or ends toward which the community strives. Objectives are natural outgrowths of goals. Objectives may be simply a component of a goal or they may be a step necessary to achieve a goal.

Goals and objectives provide a framework for system planning by highlighting the interactions between mass transportation and other transportation modes as well as with land use development and other socio-economic factors. In part, goals and objectives identify the type of interaction desired and how that interaction is to be achieved.

Long-range goals and objectives for mass transportation must in turn be developed within the bounds of a framework composed of community views and priorities and a tentative plan for how Regional transportation might be expected to evolve in the future. Community opinion and very long-range plans for transportation are thereby appropriately factored into decisions involving such things as new highway and bridge construction, downtown parking facilities, industrial park locations, commercial planning, building design and incremental improvements in mass transportation.

Mass transportation modal interactions which must be considered in light of tentative plans for long-range development include such things as rapid transit terminal design concessions to accommodate interfacing feeder systems, vehicle and guideway design constraints aimed at permitting one basic concept to function as both an urban area collection/distribution service and an inter-urban rapid transit service, avoidance of mutually detrimental competition between alternative modes and provisions for streamlining intermodal ticketing and baggage handling.

Before proceeding with a statement of goals and objectives, pertinent community views and priorities will be summarized briefly and a postulated long-range evolution of Regional mass transportation will be described in terms of probable chronological order and the technologies involved.

COMMUNITY VIEWS AND PRIORITIES

The picture that emerges as one attempts to coalesce the views and priorities of the Tampa Bay community on the subject of Regional development may be described in terms of point and counterpoint.

There is a desire to maintain a healthy rate of growth, but not at the price of vast and monotonous urban sprawl. There is awareness regarding the economic importance of tourism to the Region, but at the same time there is sensitivity to the danger of beach development so dense that it completely obliterates natural waterfront beauty and utility. There is time in the Tampa Bay Region to retain some balance between dense development and open space, and the community places a high priority on doing so. And, finally, there is an appreciation of the significant role played by elderly people in the overall affairs of the Region, but there is also a desire that the Region not be known exclusively as a retirement community.

FUTURE TRANSPORTATION FORMS

Based on the Region's geography, present development patterns, population distribution, development plans, and the social profile, views and priorities of its citizenry, an overall concept for the evolution and form of future Regional transportation can be reasonably theorized.

The successive technological innovations that make up the long-range mass transportation program of evolution postulated below are all largely complementary rather than mutually exclusive. As each improvement is implemented over the years, it can become integrated with the systems that preceded it. Each level and type of transportation can be used to its particular best advantage, with a synergistic rather than wastefully competitive effect.

Today, the Region's mass transportation consists primarily of local urban area fixed route bus services with a minimum overlay of inter-urban service. Typical of many other areas in our automobile-oriented nation, the Region's population is geographically dispersed far beyond the capability of fixed route systems to economically provide needed transportation services.

Demand Responsive Systems

As discussed earlier in connection with the Short-Range Improvement Program, demand responsive technology (exemplified by dial-a-bus) appears likely as the first step along the way toward significantly improved mass transportation in the Region. The concept combines small buses with real time computerized route optimization in order to be able to serve low density areas unsuitable for conventional fixed route service. The concept requires no technological breakthroughs. It could be implemented, improved and expanded over a period on the order of one to five years from the present. Demand responsive buses would serve the Region in conjunction with fixed route buses, fulfilling a feeder or collection/distribution function and providing door-to-door service in areas not served by fixed route operations.

Rapid Transit

In terms of need, technological availability and being postured to cope with the financing problems involved, rapid transit is postulated to be the next major step after demand responsive systems in the Region.

The time frame for this development may be on the order of five to ten years from the present. Prior to that time, analytical results and test data will gradually become available from federally sponsored programs investigating new designs in such areas as rail transit vehicles, suspended monorail vehicles and tracked air cushion vehicles. A broad spectrum of rapid transit vehicle and guideway technology encompassing power collection, power conditioning, propulsion, suspension and braking will be available for synthesizing an optimum rapid transit system to meet the requirements of the Tampa Bay Region. Other supporting activities which will be completed include development of the Regional Transportation Analysis Computer Program, tradeoff studies and economic analysis of alternative systems, and the development of the strong Regional Transportation Authority needed to initiate and follow through on a Regional rapid transit project.

The earliest rapid transit links would probably connect Tampa and St. Petersburg, with high priority also given to links between St. Petersburg and Clearwater, St. Petersburg and the lower Pinellas County beaches, and a spur from Tampa to Temple Terrace. Subsequent expansion of the system would bring Plant City, Bradenton and Sarasota into the network, with ultimate service completely Region-wide. Fixed route and demand responsive buses would continue to provide intra-urban area transportation in their respective demand density regimes, although there would undoubtedly be some adjustments to more efficiently collect and distribute rapid transit riders and in response to developments induced by the presence of the rapid transit system.

Downtown Collection/Distribution

With the advent of rapid transit and the increased congestion that normally occurs as a function of time, localized downtown collection/distribution systems may well follow on the heels of rapid transit as the next major area of emphasis in the evolution of Regional mass transportation. These systems may only interconnect a few square blocks of the most severely congested downtown areas, moving people at speeds very close to normal walking speed.

Relevant concepts include improved walkways, constant speed walking assists and accelerating/decelerating walking assists. The first two approaches are completely operational in status, while accelerating/decelerating schemes are mostly only conceptual with no prototype hardware or operating installations. Some have been demonstrated at exhibitions or amusement parks.

Improved walkways may provide exclusive pedestrian right-of-way with protection from the weather. Examples include underground concourses and elevated inter-building passageways bridging across busy streets. Constant speed walking assists include the various pallet and belt type moving walk systems. They typically operate at speeds around 1 1/2 miles per hour and have capacities of slightly more than 7,000 people per hour. Accelerating/decelerating walking assist concepts are generally claimed to have top speeds on the order of 10 to 15 miles per hour with capacities of 10,000 to 30,000 passengers per hour. A large number of schemes have been evolved, including parallel belts moving at sequentially increasing speeds and revolving circular platforms entered from above at their center and feeding a constant speed conveyance at their periphery.

Urban Area Collection/Distribution

Perhaps the last of the presently foreseeable technological innovations in the overall Regional transportation system timetable would be fixed guideway collection/distribution systems serving major urban areas. These systems make use of small vehicles captured on a guideway, although multi-modal designs might also be employed. They appear appropriate in fairly dense urban areas where they would fulfill the same kind of transportation function presently assigned to fixed route buses. The tradeoff is between guideway investment cost on the one hand and driver-eliminating automatic vehicle control on the other. The urban area must be well established and stabilized before this kind of system can be considered.

The urban area collection/distribution system covers a much larger area and operates at significantly higher speeds than its downtown counterpart discussed previously. While there are a limited number of special purpose systems of this type now operating, by and large, the more technologically sophisticated concepts are in the early stages of research, design, model development or testing. While there are many claimed exceptions, most of these concepts are asserted to operate at speeds from 15 to 60 miles per hour with capacities from 5,000 to 30,000 passengers per hour. Most employ 2-to-6-passenger vehicles. The field of concepts encompasses practically the entire known spectrum of propulsion and suspension schemes.

GOALS

The usefulness of long-range mass transportation goals is proportional to their comprehensiveness, specificity and responsiveness. They must be comprehensive in the sense that they address all major spheres of community life impacted by mass transportation. And, while goals are defined as generalized statements of community aspirations, they must at

the same time be specific enough so that derived objectives and plans focus on the desired issues. Finally, and most importantly, the set of goals must be entirely compatible with community views and priorities if in fact they are to be useful and practical. A set of long-range mass transportation goals was developed in accordance with these guidelines and is presented below.

Provide necessary services for those who are dependent on mass transportation.

This is primarily a social goal reflecting acknowledgement by the community that mass transportation is in fact an essential public service for a large percentage of the Region's citizens.

It has been estimated that approximately one-quarter of the Region's population are captive riders; people who must depend on public transportation for mobility because they have limited or no access to an automobile.

The goal expresses the community's acceptance of the fact that these captive riders should have access to reasonably priced transportation that satisfies work, medical, shopping and other essential travel needs.

Contribute to the overall economic growth of the Region.

This goal is a statement of responsibility for mass transportation industries to collectively represent a positive and dynamic force in the Region's overall economy.

Mass transportation is capable of contributing to the overall economic growth of the Region in many ways, including stimulation of other commerce and industry, direct creation of new jobs and increasing the number of job opportunities accessible to the present labor force.

Implicit in this goal is the idea that the true measure of success for mass transportation should not be

limited to an accounting of fare box receipts, but rather that it should include the total net impact on Regional economy that is legitimately attributable to the presence of mass transportation.

Promote desired regional forms, appearances, ecological balance and environmental purity.

This goal is responsive to the very high priority placed by residents on aesthetically pleasing Regional development patterns and satisfactory environmental protection.

Implicit in this goal is the idea that mass transportation can in fact be used as an instrument to bring about desired effects in commercial and industrial development as well as residential building patterns.

Whereas the first two goals tend to have their greatest impact on mass transportation operations and service policy, this goal significantly impacts overall transportation system concept as well as specific vehicle and guideway design features.

OBJECTIVES

Whereas goals are generalized statements of the ends that one strives to attain, objectives normally represent the steps necessary to achieve the goals. Objectives derive naturally from goals. They are statements specific enough so that progress toward their achievement can usually be measured quantitatively. Objectives in turn lead directly to the identification of supporting plans and criteria. A plan is a specific course of action to achieve an objective. A criterion is a measure, a test or an indicator of the extent to which an objective is obtained. Stated differently, an objective may be thought of as the mileposts along the way toward achieving a goal, while plans and criteria prescribe which of many paths will be taken to accomplish each objective.

The set of basic goals described in the preceding section is shown in Figure III-1 along with the objectives that follow therefrom. In many cases, a single objective actually pertains directly to more than one goal. The approximate correspondence between these particular goals and objectives is shown in the figure.

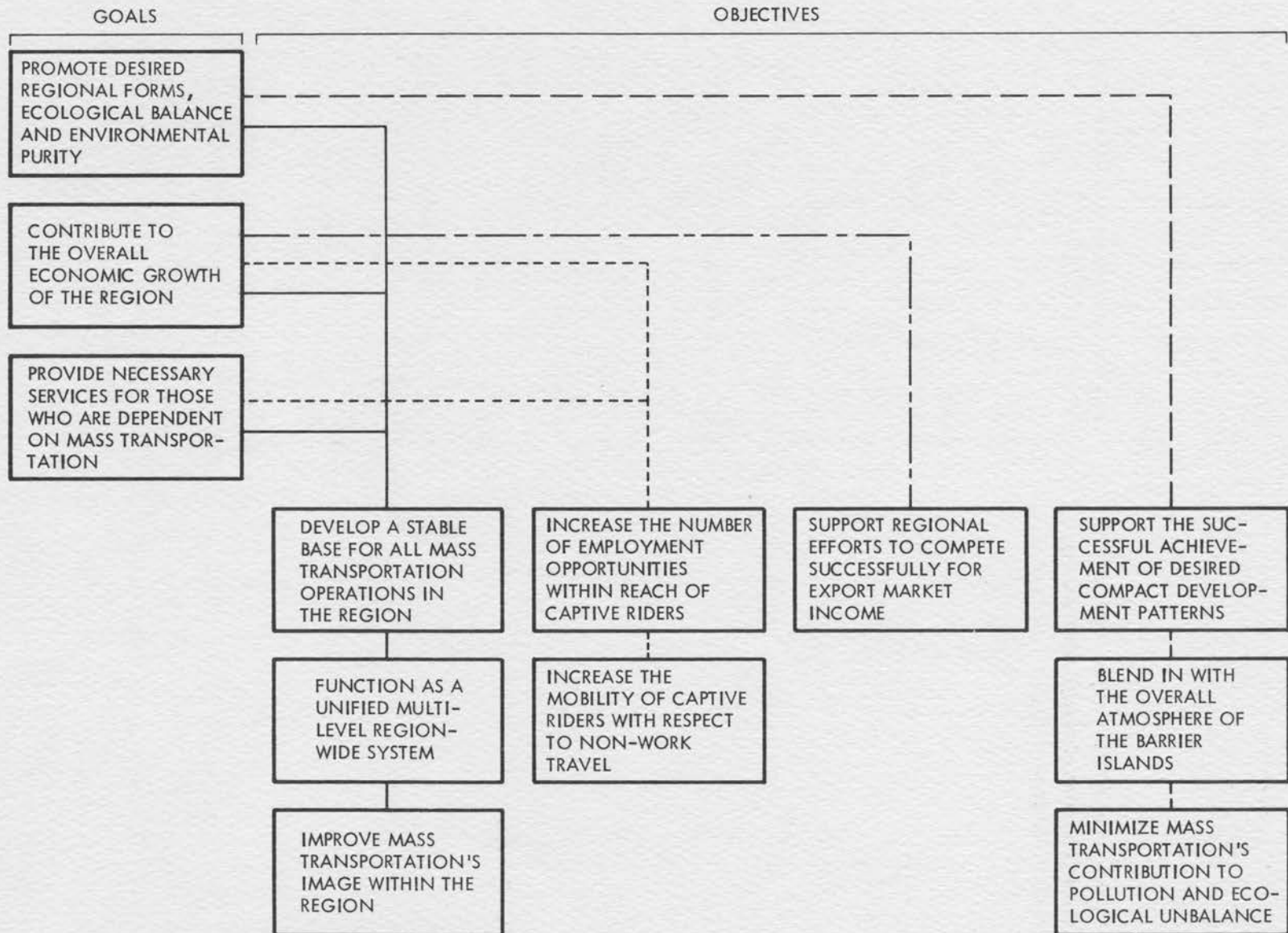


Figure 13-1 Long-Range Transportation Goals and Objectives

In the paragraphs that follow, each of the long-range objectives is described in detail. The title statement for each objective is expanded upon and key plans and criteria that follow from each objective are provided.

Develop a stable base for all mass transportation operations in the Region.

This is a fundamental business objective which must be accomplished if any of the stated goals are to be reached. The objective refers to the achievement of operational and financial stability for mass transportation in the Region, posturing to pursue major Regional mass transportation projects involving substantial capital investment and organizing so that it becomes possible to effectively translate transportation plans into operating systems.

The basic action following from this objective is the establishment of a Regional Transportation Authority as discussed previously in conjunction with the Short-Range Improvement Program. A properly constituted Authority would make it possible to achieve operational and financial stability through Authority management and/or ownership of transportation operations on an as-required basis, subsidy arrangements, equipment lease-back arrangements and other similar measures. Through the Authority the Region could qualify for federal funding assistance and seek local financial support for major transportation projects. And, with local government, professional planning and transportation operators organizationally knit together, the capability would exist to convert transportation plans into meaningful action.

**Function as a unified multi-level
Region-wide system.**

Region-wide transportation should be developed with services at all levels functioning as one integrated system. Service levels here refer to short-distance, low-speed, downtown systems, major urban and suburban area services, and inter-urban rapid transit. The multi-level concept is essential since each level is normally an incomplete service without the existence of adjacent levels.

All modes and service levels should be used to complement one another in the interest of striking the best balance for all community interests. For example, local pipeline distribution might be utilized in lieu of tanker trucks over select routes where there is severe congestion and competition for highway space between trucks, automobiles and buses. Such decisions must be sensitive to all business, community and Regional viewpoints, and should foster the overall image and character desired for the Region.

Regional perspective must be maintained along with sensitivity for local needs. Mass transportation should be viewed as a Region-wide system that will undergo logical and orderly growth over the years. For example, Regional rapid transit plans should be coordinated with evolving plans for new intra- or interstate systems that may ultimately be conjoining and thus have need for compatibility. Whenever appropriate, station and terminal facilities should be designed and constructed for joint use by interfacing modes. The Region should not be in a position of having to depend on intra- or interstate transportation systems for intra-Regional rapid transit. Such operations cannot reasonably be

expected to be sensitive or responsive to purely Regional needs. The long-range needs of the hinterlands in Pasco, Hillsborough, Manatee and Sarasota Counties should be factored into the planning.

In functioning as a unified system, all efforts must be expended to avoid conflicts between component operational elements of the system, to maximize net Regional benefits and to profit from collective experiences through frequent and routine communication between operators, planners and other involved agencies.

Improve mass transportation's image within the Region.

The use of mass transportation as a device for achieving overall Regional objectives should be emphasized. Appreciation for this role of mass transportation is not only good for image, it is needed to encourage an atmosphere where decisions regarding such things as zoning, public parking facilities and highway locations can be made with objectivity and total system perspective.

Other actions in support of this objective include the stressing of ultramodern appearances in new equipment purchases and facility construction. Consideration should be given to the impression created by street furniture, terminal facilities, transit signs and other high visibility components of the transportation system. These have a major impact on the image of mass transportation held by both riders and non-riders. Public knowledge about available mass transportation services should be increased.

Increase the number of employment opportunities within reach of captive riders.

New transportation technology should be demonstrated and tested for public reaction. This could be accomplished by utilizing unconventional modes (such as vehicles with air cushion suspension or linear electric motor propulsion) for small-scale service to tourist attractions, recreational areas, or perhaps as an airport access service.

The previous three objectives were essentially business oriented and act in support of all the mass transportation goals. This objective and the one that follows are established specifically in support of the social and economic goals.

Expanding on the objective, it states that mass transportation services should be provided in response to the needs of inner city residents and others who are dependent on public transportation for travel to and from work. This includes special community needs such as the senior talent employment pool and the requirements it may have for public transportation. Off-peak transit equipment could be used to provide transportation between areas with high concentrations of retirees and part-time employment opportunities such as might exist at major retail shopping centers with requirements for part-time salespeople.

Rapid transit can play a major role in accomplishing this objective. Rapid transit married with appropriate collection/distribution services can significantly expand the boundaries of the area within which captive riders may seek employment. New

suburban industrial parks can become accessible to the core city labor market previously isolated from such sites.

In addition, the planning and implementation of rapid transit systems may trigger significant new job-creating commercial and industrial development. For example, BART system development was accompanied by a building boom in the billions of dollars. The 3,465,000 square feet of office space now under construction in San Francisco's central business district are roughly equal to the total added in the entire eleven-year period from 1955 to 1966, and another 8,000,000 square feet are being planned. Hotel, industrial and retail building construction has also occurred. The host of jobs created by such development is obvious, including construction, maintenance, retail clerk and an assortment of other blue-collar and white-collar jobs.

Increase the mobility of captive riders with respect to non-work travel.

This objective focuses on the needs of the captive riders who must depend on public transportation for travel purposes other than work.

Demand responsive systems are a particularly appropriate action in support of achieving this objective. The technical characteristics and operational capabilities of these systems are discussed in connection with the recommended Short-Range Improvement Program. While obviously suited for both work and non-work trips, the demand responsive system is especially suited to the lower level of demand density that would probably be associated with captive rider non-work travel needs.

The needs of retirees and handicapped persons should be given consideration. Mass transportation serving retirement communities should stress reasonably comfortable waiting shelters, minimum walking and perhaps reduced fares during off-peak hours. Service could be provided from retirement communities to major medical facilities, shopping and recreational areas. A small amount of special equipment designed to meet the needs of the handicapped could be included in the fleet.

The needs of college students should also be considered. A very substantial increase is projected for the University of Southern Florida student population. To assist in achieving the desired interaction between this student population and the surrounding community, public transportation could be provided in support of University and community desires for off-campus student housing. Access could also be provided between the campus area, surrounding shopping centers and beach areas.

Support Regional efforts to compete successfully for export market income.

As noted previously, mass transportation can contribute to the Regional economy by providing increased access to employment opportunities and inducing substantial new economic activity. In addition, mass transportation should contribute to overall economic growth by supporting Regional efforts to compete for export market income. According to the TBRPC's "Economic Study for the Tampa Bay Region," "An analysis of the present economic structure of the Region revealed that both the present and future levels of economic activity and growth in the Region are generated to a great extent by the levels of

industry employment and personal income that results from the production of exported agricultural, manufacturing and tourism/retirement goods and services."

In particular, mass transportation could take actions that would benefit tourism/retirement industry groups. Actions that would benefit retirement industry groups were outlined in connection with the previous objective. Actions that could promote the economic growth of tourism-dependent industry groups include the following.

Off-peak transit capacity could be used in support of a highly organized sightseeing service. Mass transportation could engage in cooperative advertising with tourism, retirement, new housing and other such interests, in order to build a reputation outside the Region for superior public transportation.

Barrier islands with concentrations of tourist facilities should be served by high frequency intra-island collection/distribution systems, and these islands should be linked to the mainland by direct trunk service to major activity centers.

Support the successful achievement of desired compact development patterns.

The three remaining objectives support the environmental goal of promoting desired Regional forms, appearances, ecological balance and environmental purity.

Regarding this objective, mass transportation should be employed to promote future patterns of forms and appearances that are in consonance with overall Regional goals.

The success of new cluster or planned unit development projects should be promoted by instituting supporting mass transportation services concurrently with the establishment of such projects. Initially unprofitable service might be subsidized for the primary purpose of encouraging rhythmic development and breaking the pattern of urban sprawl development.

Advantage should be taken of rapid transit's ability to create concentrations of commercial and industrial development in the immediate vicinity of stations and terminals. In this way, rapid transit can be used to help produce development density variations with commercial activity encouraged in those areas where such development is desired.

Blend in with the overall atmosphere of the barrier islands.

Mass transportation should blend in with the atmosphere and promote the water-oriented recreational activities of the barrier islands.

This objective leads directly to the definition of several criteria for mass transportation on the barrier islands.

Island routes and networks should discourage through traffic, including extensive inter-island travel. As mentioned previously, service on barrier islands should fulfill a collection/distribution function and be linked to trunk service on the mainland.

Mass transportation concepts selected for use on barrier islands should have good intrinsic growth capabilities because of the islands' inherently low capacity for accommodating large automobile flows and the associated parking requirements.

Desired "windows" or "doors" to Gulf or bay waters should not be obstructed by transportation operations. Where necessary, access should be provided from commercial clusters to public beaches via pedestrian overpasses, except when it is desirable to elevate the road or mass transit guideway for other reasons.

Minimize mass transportation's contribution to pollution and ecological unbalance.

This objective refers to all forms of environmental pollution, including air, water, visual and noise pollution.

New vehicle technologies that minimize environmental pollution should be introduced to the fleet as they become available and as opportunities arise in connection with normally scheduled fleet improvement programs. A discussion of technological developments in the areas of air pollution control and noise reduction was presented in connection with the recommended Short-Range Improvement Program.

When considering new fixed guideway systems, advantage should be taken of guideway configurations that suppress noise by partially enveloping vehicle propulsion, suspension and power conditioning equipment.

In accordance with the dictates of overall Regional planning, mass transportation must help preserve the natural state of undeveloped areas and maintain the existing ecological balance. Mass transportation that passes through or provides access to nature-oriented areas should be visually subordinate to the natural appearances of the area. For appearance sake in connection with new fixed guideway systems, the use of overhead power distribution should be avoided

and low embankments should be used to block at-grade guideway sections from view.

Whenever appropriate, mass transportation should utilize routeways provided by existing causeways or routes offered by bridging natural land forms in close proximity so as to avoid disruption of natural habitat, drainage or tidal flows.

Route selection and fixed guideway construction associated with new mass transportation systems should be sensitive to scenic viewing and should not obstruct fields of vision considered important for identifying focal points in the Region's landscape. Mass transportation routeways to shoreline activity centers should not block views or access to shoreline.

TRANSPORTATION MODEL

A vital instrument for the long-range planning of total Regional transportation, and in particular the planning of major rapid transit systems, is the transportation analysis computer model. The model provides the capability to objectively evaluate the economic, social and technical benefits of proposed systems in light of long-range Regional objectives for transportation and overall development.

Specifications for such a computer model have been formulated, including special considerations of the Tampa Bay Region, overall modeling approach, first-level functional descriptions of primary model elements, data requirements for calibration and operation, and a detailed plan for proceeding with the actual engineering design and programming of the model.

The approach taken in developing the specifications included drawing upon available modeling technology to identify areas of possible carry-over between existing models and the TBR model. In support of this approach, the results of a survey of existing transportation models were utilized. The findings of the survey are summarized in Appendix III (available from the TBRPC on request).

REGIONAL CONSIDERATIONS

The Tampa Bay Region has certain distinctive characteristics that must be given careful attention in the development of the transportation computer model. These characteristics, which must be accounted for either explicitly or implicitly, include present level of transit usage in the Region, transit rider characteristics, Regional growth and Regional geography.

Transit Usage

Decreasing transit patronage, the limited nature of services presently offered and the complete absence of any rapid transit system in the Region significantly affect the extent to which the model can be predicated upon TBR travel data. In this regard, new services identified as part of the short-range mass transportation improvement program can be extremely valuable as a source of information for the purposes of model design and calibration.

As a result of this shortage of data, a hybrid modeling approach is recommended. This approach involves the combining of all available travel data for the Region with relationships or subroutines developed for models of other areas and with mathematical formulations that have been developed to describe certain fundamental aspects of human behavior.

Judgment, close familiarity with the Region and a knowledge of what techniques have proven most successful elsewhere are then used to draw the best from each of these sources in support of the TBR model. In trying to apply relationships developed for models of other cities and regions, great care must be exercised in looking for factors which may be important in the TBR but which may have been eliminated in the regression analysis for the other location as being statistically not significant. In some cases, it may be possible to borrow a form or an equation type, and adapt it with appropriate modification of the independent variables. Regional travel data will be more important as a means for checking the validity of the model than for calibrating it, although the data will be used for both purposes.

There is another aspect of transit usage in the TBR that is important and has an impact on the model. While it is estimated that approximately one-quarter of the Region's population are captive riders (have very limited or no access to an automobile), only a very small percentage of these people presently use mass transportation to any significant extent. These non-traveling captive riders represent a most likely source of new transit patronage in the future. To a lesser degree, there is also a potential for inducing patronage among non-captive or choice riders who presently do not use mass transportation, which includes nearly everyone in this category. Therefore, while it is perhaps one of the most difficult aspects of transportation modeling, induced ridership must be taken into account. A formulation exhibiting diminishing returns in response to improvements in such attributes as trip time and trip cost would be appropriate. As discussed below, the formulation for induced patronage must be different for the different types of transit riders.

Rider Characteristics

The Tampa Bay Region has a large number of elderly residents. These people represent a significant proportion of all those who presently use mass transportation, in addition to being a significant proportion of the total captive ridership identified above as a most likely source of induced patronage. Thus, the model must reflect through appropriate use of weighting factors or mathematical formulation the relative priorities of the elderly.

The values of the older person may be quite different than those of the typical choice rider, for example, with respect to factors like trip time, fare, comfort, convenience and aesthetics. While fare and convenience may be most important to the elderly person, factors of primary importance to the choice rider are likely to be relative trip time differential between transit and auto travel, and perceived cost differential, i.e., the difference between transit fare and perceived auto costs such as tolls, parking fees and weekly gas consumption. In

similar fashion, the model must give appropriate consideration to the factors of importance to other types of riders, including the young and the poor.

Also important is the fact that a larger proportion of trips are made for non-work purposes in the Tampa Bay Region, compared with most other areas. As a result, equal consideration must be given to work and non-work trips in the model. This leads to separate formulations by trip purpose, carrying through all of the model subroutines. Specific formulation will be discussed in more detail later.

Tourism is an important factor in the Tampa Bay Region. Tourist origins and destinations, diurnal travel patterns and seasonal fluctuations, and vacation oriented priorities must be included in the model.

Regional Growth

The Tampa Bay Region is one of the most rapidly developing areas in the country. Long-range forecasts of certain demographic parameters needed as input to the transportation model may therefore be difficult to make with precision. The model should be designed to facilitate the updating of forecasted demographic input data. Direct compatibility with punched cards or magnetic tapes generated by the TBRPC Regional Information System would be highly desirable.

Considerable care must be taken to ascertain the sensitivity of model output to variations in the demographic input data. The model should be designed so that successive computations with incremental changes in selected input parameters can be accomplished with ease.

Regional Geography

The nonlinear distribution of urban centers and areas of generally high density development that has been encouraged by the geography of the Tampa Bay Region, combined with large bays that are expensive to cross and barrier islands whose atmosphere might well be destroyed by the presence of rapid transit facilities, dictate the basic form that the Region's future rapid transit system will take.

At least some of the system configurations to be evaluated with the model will be essentially comprised of one or two trunk lines with several spurs and a number of interfaces with collection/distribution systems. This means that access time and transfer characteristics will be important features in the model structure. Access times associated with rapid transit feeder services can easily represent the major part of total trip time, thereby having a crucial effect on the predicted success of any proposed rapid transit concept. This factor must therefore be weighed very carefully in the model.

OVERALL APPROACH

Theory and Methodology

In the specialized language of transportation modeling, the recommended approach may be described as non-optimizing and simulative, with algorithmic and statistical subroutines. These terms are defined and discussed in Appendix III in connection with the model survey findings reported therein.

Optimizing models are mathematically closed form and they seek to find a single "best" or "optimum" solution, whereas non-optimizing models symbolically represent the real system so that its behavior can be analyzed under a variety of conditions. The non-optimizing approach is often the only practical methods for analyzing large complex systems with intractable relationships that defy any reasonable form of optimizing solution, and it is recommended here.

Simulative, algorithmic and statistical models are each a type of non-optimizing model, as explained in Appendix III. Simulation models are powerful tools for producing conditional forecasts, which is precisely the objective of the TBR model. Usually, a simulation model consists of four major components: status variables, exogenous variables, functional relations, and output. The functional relations are used to predict the changes which will occur during the simulated period as a result of the exogenous factors acting on the status variables.

Algorithmic models are replicative, closed-form analytic systems requiring no human judgment in their operational process (as opposed to heuristic models whose operation does depend partly on human judgment). The trip distribution, modal split and traffic assignment subroutines in the TBR model will be algorithmic in form. The commonly used technique for statistical modeling is multiple regression analysis, and this method will be used to some extent in constructing the trip generation and modal split subroutines.

As mentioned previously, a hybrid or multiple approach will be taken in constructing the functional relationships for the TBR model. Both behavioral and growth force theory (discussed in Appendix III) will be employed. The approach will be to use available travel data for the Region to the maximum extent possible, tailor the various functional relationships in an attempt to represent the special behavioral patterns of TBR transit riders and make use of some of the growth force technology that has been widely applied in other models, such as the analogy between trip distribution social forces and physical gravitational forces.

For the purposes of transportation analysis, the Region will be divided into a number of small zones. Zones must be small enough to support the

simulation of a reasonably detailed transportation network, and yet not so small that data requirements and number of program computations become unwieldy or impractical. Substantial disaggregation can cause significant increases in the cost of model operation. The 209 districts defined for the TBR major highway study may serve well as the zones for the transportation computer model. Considerable data are already available on this particular zonal basis and other data could be processed so as to be compatible.

Concept and Scope

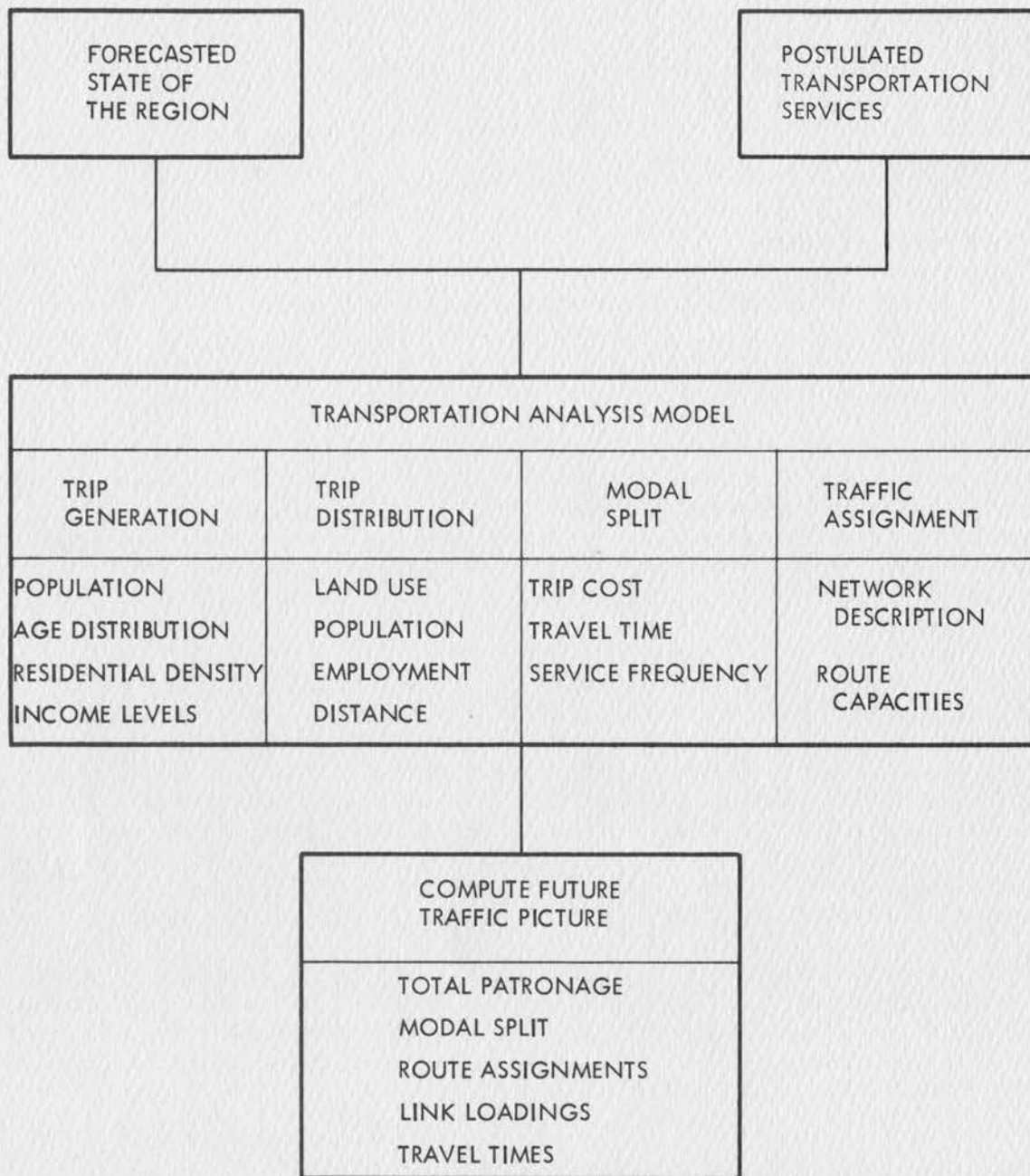
The overall modeling concept is illustrated in Figure III-2. Inputs to the model consist of a forecasted state of the Region for the time period to be studied, along with a description of the total Regional transportation system, including new systems to be evaluated.

The forecasted state of the Region would be described in terms of population, age distribution, residential density, income levels, land use, employment opportunities and other such demographic data. The total transportation system, including new systems to be introduced, would be described in terms of trip cost, travel time, service frequency, link capacities, and network configuration and other such descriptors.

Basic subroutines within the model are trip generation, trip distribution, modal split and traffic assignment. The trip generation subroutine computes total potential trips originating within each defined zone of the Region, trip distribution divides the total trips between the various origin-destination pairs, modal split apportions trips between the available transportation modes (bus, auto, rapid transit) and traffic assignment allots trips by each mode between each origin-destination pair to the links available for that mode. Each of these subroutines will be discussed in more detail in the next section.

The output of the model consists of a total picture of transportation in the Region for the forecasted period, including the impact that any new systems would have. Patronage estimates are provided for each mode of transportation, level of usage is computed and described in terms of individual link loading, and realizable travel times are projected for all transportation modes between origin-destination pairs.

Transportation analysis and land use allocation are usually interdependent, and the interdependency can be accounted for internally within a single model or externally through separate evaluation. The recommended approach assumes that land use allocation will be identified external to the model. The possible impacts that new transportation systems may have on land use would be appropriately reflected in the input demographic data. The model itself would be devoted exclusively to transportation analysis.



Transportation Model Concept

Purpose and Application

The model is designed to permit the evaluation of new transportation systems that could be introduced into the Region at some future date, and to determine the impact that these systems would be expected to have on the total Regional transportation picture.

It could be used as a design evaluation tool. By relating transportation system design features to one or more of the descriptors that are used as input to the model, and by modifying the descriptors accordingly, the overall net benefit or disbenefit of the particular design feature can be identified.

For a given proposed transportation system, the model could be used to assess the likely impact of alternative service and pricing policies on quantities such as patronage and revenues. This type of evaluation is normally accomplished by means of parametric analysis. The model could similarly be used to estimate the consequences associated with alternative financing plans.

FUNCTIONAL DETAILS

A first-level functional flow chart for the TBR model is shown in Figure III-3. Major subroutines, primary output quantities and basic computing logic are indicated.

Logic Overview

The first subroutine, trip generation, makes use of the multiple regression technique and produces total potential number of trips that will originate within a zone. Subsequent to total potential trip generation, a break-out is performed on the basis of zonal age and income distributions, and total potential trips are segmented into the categories of captive rider potential trips and choice rider potential trips.

For the captive rider potential trips, a predistribution modal split determines number of trips made. This is then fed into a trip distribution subroutine to determine zonal exchanges and person trips. Trips are categorized by purpose throughout.

For the choice rider potential trips, a trip distribution subroutine is used first to translate trip originations into zonal exchanges. The exchanges are then passed on to a post-distribution modal split subroutine to generate person trips by mode, as well as vehicle trips.

Zonal exchange trips thus determined for each rider category are then brought together in the traffic assignment subroutine. This subroutine

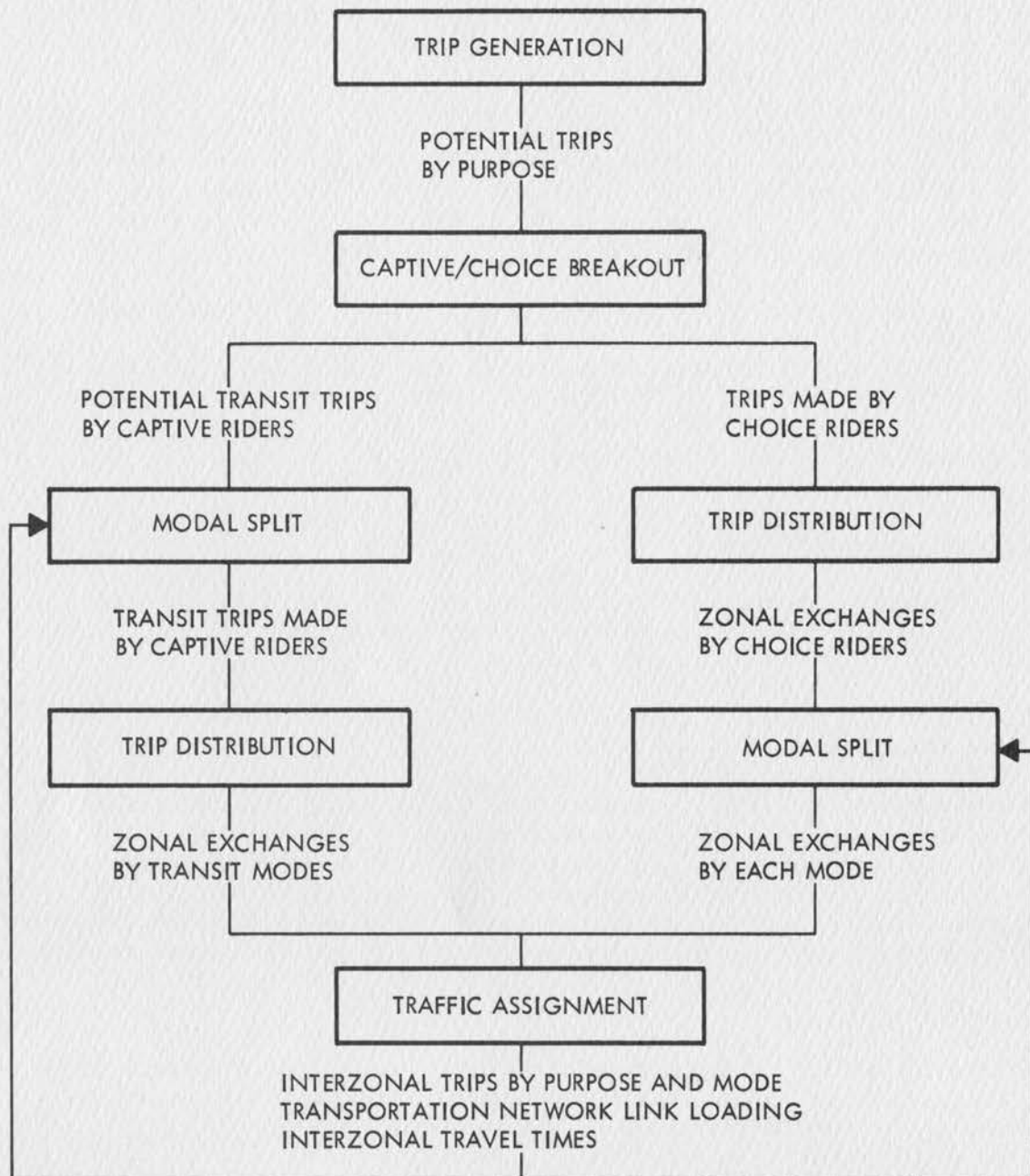


Figure 11-2 Transportation Model Subroutine Flow Chart

assigns predicted vehicle trips to the relevant links between zones in a specified transportation network. Link loading conditions and realizable travel times are then computed and fed back into the modal split subroutines. This recycling continues until a balance (within predetermined tolerances) is achieved between computed interzonal travel times across the entire transportation network and travel times used in the modal split calculation.

Induced travel considerations are introduced as part of the modal split and trip distribution subroutine formulations for both the captive and choice rider categories.

Trip Generation

The trip generation subroutine estimates future trip originations, by purpose, for each zone delineated in the Region. A step-wise multiple-regression analysis is proposed to assist in accomplishing this. Major inputs (on a zonal basis) for this subroutine are: population, age distribution (including school enrollment), residential density, and economic data such as household income and commercial/retail sales volume. The breakout between captive and choice riders is performed within this subroutine, using a regression-analysis approach based on income and age.

A form of this model component suitable for linear regression techniques is as follows:

$$Y = b_0 \pm b_1 X_1 \pm b_2 X_2 \pm \dots \pm b_n X_n$$

where $Y =$ the dependent variable being predicted,
in this case potential trips generated by
a zone

$X_1, X_2, \dots, X_n =$ the independent variables (forecasted to
the time period for which the estimate is
being made), in this case consisting of
economic, demographic and land use data

$b_0, b_1, \dots, b_n =$ the regression coefficients determined
during model calibration.

Separate regression equations are to be derived for each individual trip purpose (e.g., work, shopping, medical, personal business, school and other non-work).

Modal Split

The modal split subroutines determine the proportion of total trips made by each of the available transportation modes. For the captive

rider this involves a division of total potential trips into trips made using available public transit and trips not made at all. For the choice rider, on the other hand, modal split involves an apportionment of total potential trips between all available modes. Depending on the overall Regional transportation system postulated, these modes might include automobile, bus and rapid transit, for example.

As in the case of trip generation, the general mathematical approach for modal split involves regression equations.

For the captive rider category, modal split is performed prior to trip distribution. This simplifies the overall model somewhat since modal split for the captive rider can then be performed once for each zone in the Region rather than once for every origin-destination pair. It is an example of a pre-distribution modal split model.

The modal split for the choice rider category is carried out after trip destinations have been determined in the trip distribution subroutine, and it is therefore an example of a post-distribution modal split model. In this case, modal split calculations must be performed separately for each origin-destination pair.

Independent variables for the captive rider modal split regression equation include number of potential trips, average trip cost and average trip time. Variables in the corresponding choice rider equation include interzonal exchanges, relative differential trip time, transit trip cost, toll cost and parking cost. Relative differential trip time is a function of total trip time by transit (including walking and waiting intervals) and total trip time by auto. It is expressed in non-dimensional form as:

$$\frac{T_t - T_a}{T_t \text{ (or } T_a)}$$

where T_t = total trip time by transit (including walking to transit stop and waiting/transfer times)

T_a = total trip time by auto

Trip Distribution

This subroutine produces a zone-to-zone distribution of trips made. The most common technique used for trip distribution is the gravitational concept or analogy. This approach hypothesizes that trip exchanges between zones will be proportional to the relative attraction between zones and inversely proportional to a zonal separation index.

An example of the gravity model formulation is as follows:

$$T_{ij} = \frac{G_i A_j}{\left[\sum_{j=1}^n A_j \right] \left[F_{ij} \right]^p}$$

where T_{ij} = trips generated in zone i with destination in (i.e., attracted to) zone j

G_i = total trips generated by zone i

A_j = (relative) attractiveness index of zone j

F_{ij} = an empirical factor related to travel time (average or sometimes by mode) between zones i and j. Travel time in minutes or fractions of hours is often used directly, raised to some power.

p = the power to which F_{ij} is raised to account for the effect of spatial separation between zones (in Newton's Law of Gravity, $p = 2$ and F_{ij} is the distance between two masses).

Major input elements to the captive rider trip distribution subroutine are zonal land use, population, employment, school enrollment, zone-to-zone distance (likely to be in terms of travel time) and trip cost. The choice rider subroutine has the same inputs with the exception of trip cost, which is more directly considered in the subsequent post-distribution modal split subroutine.

Traffic Assignment

This subroutine translates interzonal trips into actual traffic volumes on the various links of the total transportation network. Traffic assignment effectively plays two major roles in the overall transportation analysis study.

First, it is used to validate the total model. Using input data that describes the present state of the Region, including demographic parameters and transportation system descriptors, the model computes traffic volumes throughout the existing transportation network, for all modes. The results may then be compared with actual traffic counts, thereby providing a means for calibrating the model and checking its performance.

Second, the traffic assignment subroutine provides estimates of future transportation network utilization. The estimates of link loading allow corrections to be made in assumed interzonal travel times, and corrected travel times are then recycled into the modal split subroutines, as shown in Figure III-3. A comparison is made between corrected travel times and those used in the last cycle through the modal split calculation, and if the two do not agree within pre-determined tolerances, the computational cycle is repeated. This feedback loop feature was mentioned earlier.

The basic inputs to the traffic assignment subroutine are a coded network for the forecast year's transportation facilities and the matrix of interzonal vehicle trips produced by the modal split and trip distribution subroutines.

DEVELOPMENT PLAN

A program for developing the transportation systems analysis computer model is described in this section. It is estimated that the model can be developed in one year if some amount of task concurrency is accepted and, of course, if the necessary financial resources are available. Alternatively, the program can rationally be divided into two one-year efforts to accomplish the development at a lower level of funding. A one-year schedule for the total model development effort is shown in Figure III-4.

Each of the major program elements shown in Figure III-4 is described in detail below. With the preceding model specifications and the following task descriptions available, the next step is to begin the actual model development.

Data Bank

An inventory of data available for calibration and operation of the computer model must be completed. The adequacy of these data should be determined in light of the model specifications discussed previously, and they should be catalogued at the level of detail needed to support subroutine design. Data characteristics to be identified include type, date, granularity, definitions, assumptions or special conditions and storage format.

Deficiencies, special processing needed to resolve inconsistencies between data sets, analyses required for deriving needed statistics from the available data, and requirements for reformatting should be identified.

Complete documentation should be prepared for the data inventory, assigning code identification numbers and giving relevant descriptive information for each piece of data.

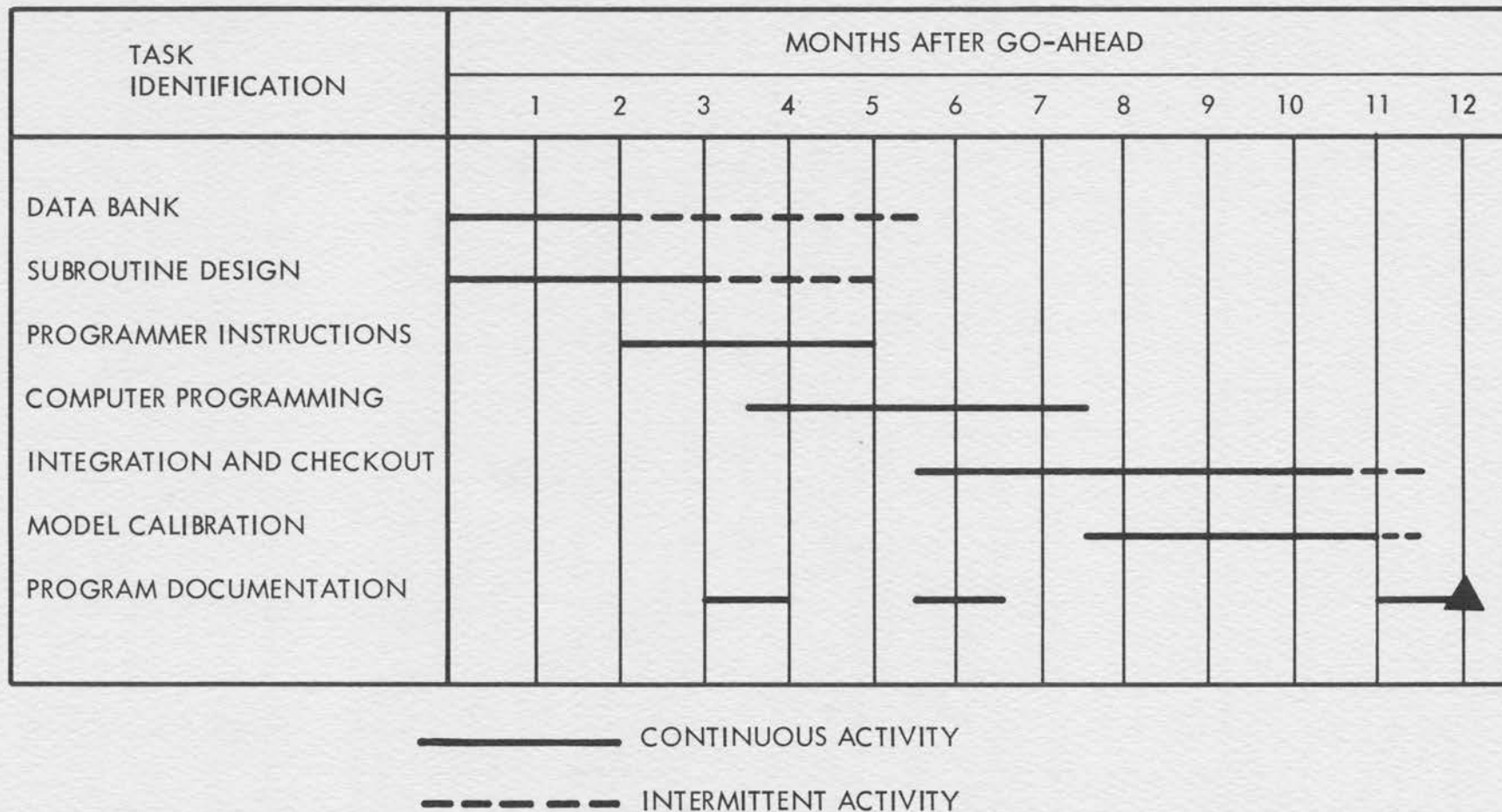


Figure III-4. Transportation Model Development Schedule

The data should be organized in matrices suitable for computer storage and retrieval. All data must be converted to machine readable form. This includes transferring data from documents and tables to computer load sheets for use in generating either punched card input or magnetic tape input.

As a part of this task, peripheral computer programs will be written for processing data to resolve deficiencies, perform reformatting or correct incompatibilities in the data base. Data must be aggregated or disaggregated as required to achieve a single desired level of granularity, and updated as required to achieve time frame consistency.

Subroutine Design

This task provides for the complete engineering design of the model subroutines. It includes the use of transit rider survey data obtained during this study to support the development of the trip generation, trip distribution and modal split subroutines. These data should be analyzed to determine which of the various modeling parameters included in the survey exhibit significant statistical correlations. The parameters include rider characteristics (age, retirement status, sex), trip characteristics (purpose, length, location) and travel habits (frequency of travel, service priorities, other personal preferences).

Mathematical functions that describe the relationship between significantly correlated parameters should be determined. These functions will be used to assist in structuring select equations associated with trip generation, trip distribution and modal split subroutines.

Mathematical and functional details should be delineated completely for each of the model subroutines. This will include descriptions of precisely how data is to be entered into each subroutine, how it is to be processed within each subroutine and how each subroutine's output is to be generated.

Task output will include engineering logic diagrams and functional flow charts for each of the six model subroutines. These will identify the interrelationships between modules within subroutines as well as the data interaction between modules.

Programmer Instructions

Under this task, the engineering specifications and descriptions of subroutine form and function developed in the Subroutine Design task would be translated into detailed instruction documents for use in preparing the individual subroutine computer programs. These documents must be specific enough to permit the actual programming to proceed.

The task includes such activities as resolving mathematical expressions into groupings suitable for programming, identifying logic options and expressing them mathematically, identifying loops, iterations, decision points and computations with the potential for producing program instability, defining units and introducing constants to produce unit consistency, identifying subroutine input/output points and identifying operational sequences.

In addition, computer program language(s) would be specified. Special programming techniques for particular data handling and retrieval situations or unusual computational requirements would be identified. And, programming standards would be defined.

Computer Programming

This task covers the actual programming of the individual subroutines that constitute the major discrete functional elements of the transportation analysis model. The subroutines will be programmed as a series of separate computer programs with their associated data files. Each of the subroutine programs would be prepared in accordance with the detailed instructions established in the Programmer Instructions task.

Procedures needed to link the individual subroutines together in a single integral computer program would be delineated as part of this task.

Integration and Checkout

The separate subroutine computer programs would be brought together in this task and integrated into a single transportation analysis model designed to meet all final requirements.

It is here that the overall model concept and inter-subroutine logic are programmed, including major iteration cycles, feedback loops, primary output format, diagnostic provisions and all other operations except internal subroutine functions.

This task also includes checking out and debugging the computer coding and logic for each subroutine and for the overall program. Error analysis will be performed, and corrections, adjustments and modifications will be made as required. This process typically continues at some level right through the calibration and documentation phases described in the next two tasks. As the program continues to be exercised during calibration, and as preparation of final documentation and user manuals proceeds, necessary and/or desirable program modifications are inevitably identified.

Model Calibration

This task provides for calibration of the total model using the previously prepared data bank. Regression and gravity equation coefficients and other constants will be finalized by exercising the program using present-day demographic data and transportation system descriptors for the Region. Computed network link loadings will be compared with actual experience and the equation coefficients and modeling constants will be adjusted until satisfactory agreement is achieved.

At the same time that the model is being tuned to replicate present-day experience, it will also be tested to determine its predictive characteristics. Sensitivity of model output to variations in parameters describing state of the Region or transportation system descriptors will be examined. This will quantitatively show the impact of possible inaccuracies in the demographic forecast data, as well as point up model formulation weaknesses that might lead to reduced output reliability. Output sensitivity to small changes in certain coefficients and model constants will be investigated. Model adjustments and modifications would be made as required.

Program Documentation

There are basically three types of documentation required; all are included within this task. Together they constitute complete and formal documentation covering all aspects of the transportation analysis computer model work program.

The engineering design, analytical derivations, assumptions and mathematical expressions that form the theoretical basis for the model should be presented and discussed. An overview of the modeling philosophy should be included.

Standard computer program documentation should be prepared. This will cover the specific coding in detail, including programming logic diagrams, flow charts and a computer listing of the complete program. This portion of the documentation would also include a review of the model calibration process and its results.

Lastly, a user manual should be prepared. This would include complete and detailed instructions for operating the model, inputting and modifying data, exercising program options, techniques for modifying output content or format and program diagnostics. Capabilities and constraints in the operation and application of the model should be identified. A sample run with the model should be presented, showing input data, program options exercised and the resulting output.

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