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FINAL PROJECT REPORT
PRELIMINARY ENGINEERING
RAPID TRANSIT SYSTEM

DADE COUNTY TRANSPORTATION IMPROVEMENT PROGRAM

KAISER ENGINEERS

IN ASSOCIATION WITH:

WILBUR SMITH AND ASSOCIATES
POST, BUCKLEY, SCHUH & JERNIGAN, INC.
CONNELL ASSOCIATES, INC.
CARR SMITH AND ASSOCIATES, INC.
DEVELOPMENT RESEARCH ASSOCIATES
BOOZ•ALLEN APPLIED RESEARCH

CONSULTANTS:

HANK MEYER ASSOCIATES, INC.
EV CLAY ASSOCIATES, INC.

MARCH 1976

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FOR THE

DADE COUNTY TRANSPORTATION IMPROVEMENT PROGRAM

PRELIMINARY ENGINEERING DOCUMENT

This document is a work product of the 1973-1975 Preliminary Engineering Program and has been accepted by Metropolitan Dade County, Florida, as a guide but not as a constraint to the performance of the Final Design Program for Transportation Improvements.

"The preparation of this report has been financed in part through a grant from the U.S. Department of Transportation, Urban Mass Transportation Administration, under the Urban Mass Transportation Act of 1964, as amended.

MARCH 1976

ACKNOWLEDGMENTS

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Woodrow L. Moore,
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William L. Strine
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David J. Reynolds, Inter-governmental Liaison
Sara Weitzel, Milestones 3 and 4
Glenn Buff, Milestones 6 and 7
David J. Reynolds, Milestone 8

(Members listed in Appendix 1.)

TRANSPORTATION TECHNICAL ADVISORY COMMITTEE

Fred Burke
Dr. Ralph B. Peck
W. H. Paterson
Herbert Schwartz
Paul Watt

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CONSULTANTS

KAISER ENGINEERS Division of Henry J. Kaiser Company

H. A. Thomas, Jr., Vice President
Ralph Mason, Assistant Project Manager
R. H. Minshew, Project Architect
E. J. Stann, Project Manager
J. V. Ellis, Assistant Project Manager
L. L. Castle, Director of Public Involvement
H. R. Brock, Environmental Coordinator

in association with:

WILBUR SMITH AND ASSOCIATES

G. L. Drake, Senior Vice President
Dr. A. L. Roark, Vice President
Philip Goff, Planner

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DEVELOPMENT RESEARCH DIVISION
BOOZ-ALLEN & HAMILTON, INC.

S. D. Julias, III, Managing Associate
George Knight, Project Manager

BOOZ-ALLEN APPLIED RESEARCH

J. F. Wing, Senior Vice President
J. Mateyka, Research Director

Special Consultants:

Hank Meyer Associates, Inc. - Hank Meyer, President
Stan Johnson, Executive Vice President

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James J. Lyle - Account Supervisor

FOREWORD

The preliminary engineering program for the Metropolitan Dade County rapid transit system was conducted by Kaiser Engineers and its associated consultants under the direction of the Dade County Office of Transportation Administration during the period October 1973 to July 1975. This Final Project Report is a summary of the program as detailed in eight draft milestone reports and a number of other technical documents produced by the program.

A Draft Final Project Report was published in July 1975 and distributed to appropriate federal, state and local agencies for review and comment. During their review of the Draft Report, staff officials of the federal Urban Mass Transportation Administration (U.M.T.A.) prepared interim comments on the program which were discussed with County, state and consultant personnel. As a result of this discussion and in response to the comments, supplemental information was furnished to U.M.T.A. to expand upon or clarify material contained in the Draft Report. Generally, preparation of this supplemental material did not entail additional studies or engineering, but rather the documenting of data or results of work already accomplished but not presented in detail in the Draft Report. For ease of review, this supplemental material has not been incorporated piecemeal into pertinent portions of the Final Project Report but has been included in its entirety in Appendix 3. Footnote notations have been inserted at appropriate points within the text to indicate that Appendix 3 contains supplemental information on the subject under discussion.

Final U.M.T.A. comments and comments of other reviewing agencies are contained in Appendix 4, together with responses prepared by the County staff and consultants. Where such comments have resulted in changes in the report text, such changes are noted. Other very minor changes in the Draft Report, principally editorial, have resulted from review of the document by County staff and consultants subsequent to its publication.

The Dade County Office of Transportation Administration and its consultants are deeply appreciative of the assistance provided by U.M.T.A., the Florida Department of Transportation and other Dade County agencies in the formulation and review of the program. Sincere appreciation is also expressed to officials of Broward and Palm Beach Counties who participated in program planning and review, and especially to the dedicated citizens of Dade County who gave so much of their time that a viable and effective transportation system in the County might become a reality.

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I. INTRODUCTION

A. BACKGROUND

Metropolitan Dade County is the southernmost of three southeast Florida counties characterized as Florida's Gold Coast. Although the County comprises more than 2,100 square miles, much of its western area is occupied by the Everglades and by water conservation areas which limit development to the portion of the County along the coast. The developed and developable portions therefore consist of a north-south oriented band bounded on the east by Biscayne Bay and the Atlantic Ocean, on the north by Broward County, on the south by Monroe County including the Florida Keys, and on the west by the Everglades and water conservation areas.

The County experienced a population growth of 156 percent in the 20 years between 1950 and 1970. Conservative projections are that intensive growth will continue in the future with an anticipated increase of another 37 percent by 1985, an average growth over the 35 year period of over 7 percent annually. Because of the restricted area available for development, population density is relatively high as compared with other urban areas. The 1970 urban population of 1,247,000 persons was contained in a developed area of 247 square miles, or a density of over 5,000 persons per square mile.

This spectacular urban growth of the County has been caused primarily by its natural environmental features: its warm and pleasant subtropical climate, its outdoor recreational facilities and its beautiful setting. These very features make the County extremely sensitive environmentally, since degradation in the quality of its air, its water, its vegetation or its abundant wildlife would destroy its primary assets.

With a 1975 population of about 1,450,000, the total demand for transportation in the County is now approximately 3.6 million person trips per day. This demand is expected to increase to about five and a half million daily trips when the County reaches its projected 1985 population of 1,736,000, augmented by approximately 200,000 daily winter tourists.

The County grew up with the automobile and is strongly oriented to its use. Automobile ownership is among the highest in the nation, with an estimated 1.13 automobiles per household in 1973. The result is that most of the expressways and major arterial highways carry traffic considerably in excess of their design capacities. On a portion of South Dixie Highway, the major arterial to the south, daily vehicular traffic volume approaches 227 percent of design capacity. Portions of Interstate I-95, the only interstate highway in the County and the major thoroughfare to the north, carry daily traffic of up to 150 percent of design capacity.

On the other hand, there is a large number of families below the poverty level (approximately 11 percent) while about 14 percent of the population is over the age of 65. Despite the high average rate of automobile ownership, therefore, about one family in five owns no car and is completely transit dependent.

The growth of population and travel demand is cause for concern over the capability of preserving the quality of life in the County and of meeting the mobility requirements of its people. This concern led to the intensive series of land use and transportation planning studies described in the next section of this report, culminating in approval by the people in 1972 of a bond issue of $132.5 million to provide the local share of the cost of constructing a rapid transit system.

With this approval by the people, the County proceeded with the next step in the development of the program: the conduct of preliminary engineering to define the system with sufficient accuracy to permit an application for federal funds for final detailed design and construction of the system. Over the past eighteen months, the County, under U. S. Department of Transportation Technical Study Grants FL-09-0011 and FL-09-0018 and an interlocal agreement with the State of Florida, as well as its own long range planning, conducted an intensive preliminary engineering effort. The results of this effort are detailed in a number of reports and technical documents, and are summarized in this Final Project Report.

B. OBJECTIVES

The objectives of the preliminary engineering program have been:

- To analyze the rapid transit system proposed by the Transit Technical Studies.
- To determine if less capital intensive transit modes may satisfy the transit requirements and to recommend an optimum core rapid transit system supplemented as required by extensions.
- To develop rapid transit facilities that serve the needs of the people of Metropolitan Dade County that are achievable and that have not only public acceptance but also public support.
- To perform preliminary engineering for the recommended system in a manner that will result in a rapid and smooth transition to the final design and construction.
- To conduct the work in a manner that will provide the opportunity for citizens to participate with the consultants in the planning for land use through the corridors and around stations and to participate in determining the locations and configurations of transit facilities, corridors in which routes are planned and neighborhoods where stations and attendant facilities would be located.
- To carry out a public information program affording the opportunity for citizens to be informed of the work as it progresses.

Achievement of these specific objectives for the preliminary engineering program has required adherence to transportation objectives established by both the federal government and Metropolitan Dade County. The County's transportation objectives are included in Part I of the recently adopted Comprehensive Development Master Plan while those of the federal government are contained in the Urban Mass Transportation Administration's External Operating Manual. Both sets of objectives and policies are quoted below.

1. Dade County Transportation Objectives

"Provide access to employment and the facilities and services of the entire metropolitan area; plan for mobility, opportunity, variety, energy conservation and low travel times and costs, safety, comfort and convenience while traveling; and provide for efficiency, economy and a well-balanced, integrated transportation system within Dade County without detracting from the quality of life of the community.

A. Public or mass transportation should be given top priority.

B. Use transportation as a positive tool to support and improve the viability of the county and the region.

C. Provide a system of transportation facilities which will anticipate the need for the movement of people and the movement and storage of goods and vehicles.

D. Coordinate and integrate the county's transportation facilities with surrounding activities so that these facilities contribute to the enrichment of the physical environment within Dade County."

2. Federal Objectives

"First, to reinvigorate public transportation in order to provide service that will attract new riders regardless of their social or economic group or the purpose of their journey. The aim is to increase transit use differentially with respect to automobiles. A special aim is to attract the auto commuter on his journey to and from work, but stimulation of off-peak transit usage by others should be a complementary effort.

Second, by providing better general service and developing special services, to provide greater mobility for substantial groups of people who are totally dependent on public transportation. This objective is directed at the needs of the transportation of the disadvantaged, young, aged, poor, handicapped, unemployed, and secondary workers -- in full recognition that the urgency of need is not the same for all such people. Indeed, the precise needs of sub-groups of this clientele, and the most effective ways to serve them, require better definition.

Third, to promote transit as a positive force in influencing and supporting desired development patterns in urban areas and in improving environmental conditions. This objective entails arranging land-use patterns and transportation networks so that each affects the other favorably, in accordance with local development objectives, the ultimate intent being to reduce or minimize the need for transportation facilities and the urban space demands made by them. It recognizes that use of the private automobile for the peak-hour work trip is often contradictory of such other community objectives as pure air, quiet and privacy, socially desirable land use, efficient concentration of economic activity without undue congestion, and enhanced quality of the urban environment. When such goals are dominant in local planning, the capital grant program can assist in implementing a transit-oriented development strategy to substantially improve the amenities of urban living. But greater focus must be placed on the full range of transportation impacts, not merely user benefits and direct impacts."

The degree to which these objectives have been met is discussed in the concluding section of this report.

II. STATUS OF TRANSPORTATION PLANNING

Comprehensive planning in Dade County is the responsibility of the Metropolitan Dade County Department of Planning, a branch of county government.

The transportation planning area in Dade County is coterminous with that of comprehensive planning. Dade County's metropolitan government charter gives the County total transportation planning and implementation powers. County government also has land use powers in unincorporated areas, and it can establish "minimum" land use standards for incorporated areas. This unique coincidence of powers allows for the coordination of transportation and land use developments in a fashion that has few parallels in the United States.

In addition, and recognizing that to be truly comprehensive the transportation planning process sometimes must go beyond artificial political boundaries, Dade County participates in numerous transportation activities in coordination with Broward and Palm Beach Counties, the South Florida Regional Planning Council and the State of Florida Department of Transportation.

Transportation planning, as a component of comprehensive planning, is specifically the responsibility of two agencies: the Dade County Office of Transportation Administration and the Miami Urban Area Transportation Study (MUATS). The former office was created in 1973 within the office of the County Manager. It functions under the direction of the Transportation Coordinator who is directly responsible to the County Manager. The duties of the Transportation Coordinator include:

- Coordination, monitoring and evaluation of ground transportation activities in Dade County and supervision of mass transportation operations.

- Review, analysis and evaluation of state fund allocation procedures and funds received directly from federal sources.

- The filing of appropriate grant applications and the receiving of state and federal transportation funds.

MUATS is a joint effort of local, state and federal agencies organized for the purpose of providing the area with continuous, cooperative and comprehensive transportation planning in conformance with federal requirements. Coordination between the various planning agencies is assured by membership of both the Director of Planning and the Transportation Coordinator on the MUATS Technical Planning Committee. The Transportation Coordinator is also the Executive Coordinator of the MUATS Policy Committee, and the Director of Planning is chairman of the MUATS Technical Planning Committee.

A. EARLIER PLANNING EFFORTS

After adoption of the Metropolitan Charter in 1957 County-wide planning began. With the adoption by the County Commissioners in 1965 of a General Land Use Master Plan, prepared by the Planning Department, an initial comprehensive plan became a guide for growth and development. This master plan contained a transportation element as well as a development plan for land use. Since this beginning, both land use and transportation planning have been continuous activities carried out by the appropriate planning agencies. In the field of transportation planning MUATS has played the major role beginning in 1963 with the adoption of a memorandum of understanding by the State of Florida and Metropolitan Dade County.

MUATS is composed of five major elements: the Technical Planning Committee (TPC), the Policy Committee, the Planning Advisory Board, the Board of County Commissioners, and the Florida Department of Transportation.

MUATS Technical Planning Committee (TPC) is responsible for the formulation of detailed, comprehensive, areawide transportation plans, and for the coordination of transportation planning with land use and public facilities planning. City, county, state and federal departments involved in transportation planning are represented on the TPC. The TPC serves as a technical, coordinating, review and advisory body to the Policy Committee.

The Policy Committee is responsible for transportation policy matters. It directs, reviews and approves the inputs of the TPC. Its main responsibility is to make basic recommendations to implement the transportation planning process through: (a) lending the necessary guidance to the process; (b) adopting a multi-jurisdictional, countywide, short-range implementation program; (c) insuring maximum cooperation and coordination at all governmental levels; (d) insuring that the transportation plan faithfully reflects the goals and objectives of state and county. To that effect, membership includes three County Commissioners, two State Senators, one State Representative, one member of the Dade League of Cities, the Chairman of the Planning Advisory Board, representatives of the Florida Department of Transportation, the County Manager and others.

The Planning Advisory Board (PAB) was created by the Metropolitan Charter and is appointed by the Board of County Commissioners to provide broad public inputs to the comprehensive planning process. The PAB is composed of 11 members and one Executive Secretary. The Director of County Planning is the Executive Secretary. Members serve for a period of two years which is renewable. The Chairman of the PAB is the Secretary of the MUATS Policy Committee.

MUATS began work on the first 1985 transportation concept in 1964 and completed its plan in 1969. The five year effort which culminated in the plan proposals included elements for highways, mass transit, seaports, airports, and terminals. The Transportation Plan represented a detailing of the transportation element of the General Land Use Master Plan adopted in 1965. The plan contained recommendations for an extensive network of new expressways both in the already urbanized areas of the County and stretching out beyond the then urban fringe, providing new accessibility to land suitable for urban uses. To meet forecast travel demands, the street and highway plan for 1985 recommended an estimated $800 to $900 million (1969 dollars) program for the addition of nine expressways, the development of eight express streets and the improvement and extension of arterial streets. The nine expressways and their lengths were:

Expressway	Length - Miles
South Dade	14.0
Snapper Creek	2.4
West Dade	26.5
Snake Creek	16.3
Opa-Locka	13.3
South Dixie	25.4
LeJeune-Douglas	16.1
Interama	17.1
Hialeah-Beach	15.7
Total	147.3

Of the nine expressways, the first three listed above have been implemented or are in the process of implementation, while the remaining six have been reexamined for need in the Controversial Corridors Review discussed below. Also, Dade County voters have approved over $80 million of bond financing to implement a series of proposed arterial improvements, which will total $123 million in 1981.

B. CONTROVERSIAL CORRIDORS REVIEW

In 1971 and 1972 a series of public hearings on the MUATS 1969 plan were held by the PAB throughout the County. These hearings revealed strong opposition from neighborhood groups to many of the expressway proposals contained in the plan. As a result, the MUATS Policy Committee had an analysis undertaken by the Technical Planning Committee to determine the implications for the County's transportation network of the deletion of some of the proposed expressways. This analysis, called the Controversial Corridors Review, was undertaken late in 1972 and completed in 1974. It resulted in the recommendation that the last three expressways listed above be deleted in their entirety and that the Snake Creek, Opa-Locka and South Dixie Expressways be shortened by 3.8, 4.5 and 19.0 miles respectively. The Review concluded that the original MUATS arterial improvements plus additional recommendations in the Review and currently contemplated transit improvements would constitute the most acceptable transportation network for 1985.

As a result of the Controversial Corridors Review, the Board of County Commissioners deleted the controversial corridors from the 1985 road network. The cost of the deleted expressways, totaling 76.2 miles, is estimated by MUATS at $801 million in 1974 dollars.

C. TRANSIT TECHNICAL STUDIES

The original 1969 MUATS plan also recommended a program of surface bus improvements and grade-separated transit facilities to be implemented by 1985 to satisfactorily accommodate future travel demands. The original plan envisioned a new rapid transit system connecting Interama, Miami Beach,

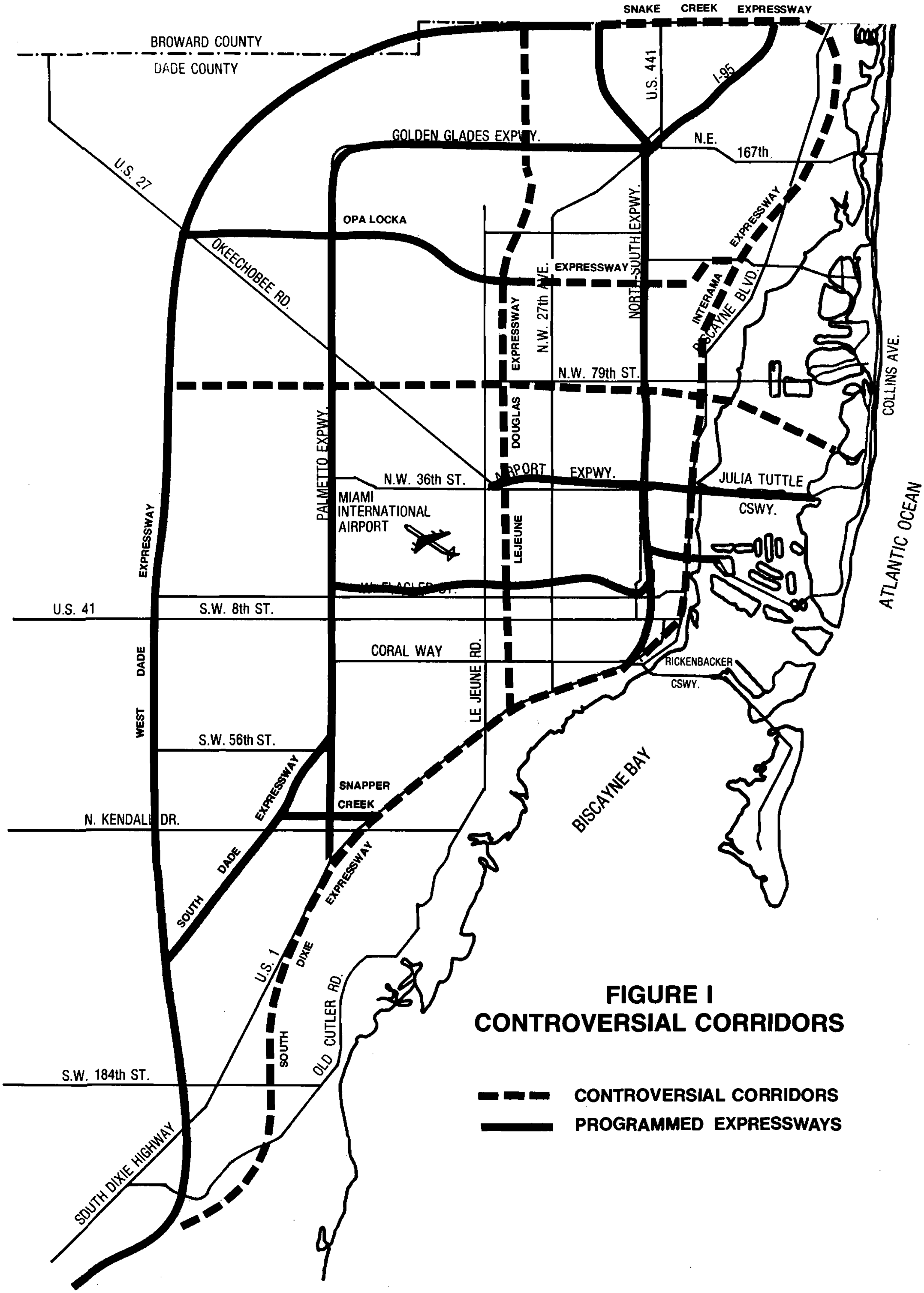


FIGURE I
CONTROVERSIAL CORRIDORS

downtown Miami and Miami International Airport together with a busway on the mainland to accommodate projected north-south movements. Unescalated capital costs of the recommended plan totaled $378 million.

Beginning in 1969 a series of Transit Technical Studies was conducted to determine the feasibility of elements of the plan and to identify the transit facilities required to meet the needs of the rapidly increasing population of the County. The latter studies, completed in 1972, recommended the development of a rapid transit system and tentatively identified the scope and magnitude of such a system, estimated to cost $805 million. On the basis of these studies, the voters of Dade County, in an election in November, 1972, approved the issuance of bonds in the amount of $132.5 million to provide the local share of the cost of constructing a rapid transit system.

D. THE COMPREHENSIVE DEVELOPMENT MASTER PLAN

Recognizing that the 1965 General Land Use Master Plan required updating, and in accordance with the mandatory requirements of the Metropolitan Charter, the PAB and the County Planning Department began work in early 1973 on a new Comprehensive Development Master Plan. To provide citizen input into the plan, six citizen Task Forces comprising 132 citizens were appointed by the Board of County Commissioners to assess the community's aspirations and to advise the Planning Advisory Board. After a number of public hearings and public meetings the Comprehensive Development Master Plan (CDMP) was adopted bv the County Commissioners in March 1975. The CDMP consists of three parts: the Metropolitan Development Policies, the Environmental Protection Guide and the Metropolitan Development Guide. Combined, these three elements constitute the major policies for management of the County's growth and development.

Part I of the CDMP consists of a number of policy statements which not only constitute an integral part of the plan itself, but also provide the overall policy foundation for Parts II and III. In addition, these policies give direction for the preparation of neighborhood plans and other related planning activities. A number of specific transportation policies are included in Part I, while many policies on other subjects affect or are affected by transportation activities.

The Environmental Protection Guide, Part II of the CDMP, provides detailed guidelines for evaluating the effects of different types and intensities of urban development on the natural environment. The Guide also defines areas within the County which are generally suitable for development, conditionally suitable for development, or suitable only for conservation or preservation.

Part III of the CDMP is the Proposed Metropolitan Development Guide, including a 1985 medium-range Metropolitan Development Pattern and a long-range Conceptual Metropolitan Development Pattern for the year 2000.

The transportation elements of the CDMP are virtually identical to those of the 1985 MUATS plan, and both have been heavily used as guides in the development of the recommended transit system. *

E. ONGOING PLANNING ACTIVITIES

Planning within Dade County by MUATS, the Planning Department and the Office of the Transportation Coordinator is a continuing activity.

Since October 1973 the Transportation Coordinator, through his engineering consultants, has been conducting the preliminary engineering for the rapid transit system which is the subject of this report.

Other planning activities include updating of the MUATS plan to the year 2000; creation of a Unified Work Program identifying transportation planning tasks to be undertaken by various agencies; continuation of the South Florida Regional Transportation Study, a joint effort involving Dade, Broward and Palm Beach Counties; development of a multi-modal transportation planning process for the three counties; and a number of short-range transportation improvement projects designed to provide higher levels of service by public transportation. New concepts in mass transit are in operation, are being tested or are being planned.

In summary, the planning effort conducted by the County is comprehensive, thorough and complete. It has as its objective the maintenance of the quality of life in Dade County through careful management of growth and development, and through provision of those services, including efficient transportation, required to sustain that quality of life. The metropolitan structure of the County government places land use control, transportation facilities, community services and necessary financial resources under the policy control of the Board of Commissioners and the executive management of the County Manager. This centralized control permits adopted plans to be carried out in programs authorized for rapid transit development as well as in other modes of transportation.

* Refer to Appendix 3, section B for further description of the interrelationship of the CDMP to the Transportation Improvement Program.

III. THE PRELIMINARY ENGINEERING PROGRAM

The preliminary engineering program was structured to provide a series of planning and engineering studies and analyses leading to the definition and preliminary design of all of the many elements making up the transit system, including the transit corridors and routes, the types of vehicles to be used, the locations and types of transit stations and other fixed facilities and the types of land use and development in the vicinity of transit stations and corridors.

The program consisted of 21 study or design tasks generally divided into three major work areas, as shown in Figure 2. This figure also indicates the actual schedule of performance of the various tasks. These tasks are described by work area in the following subsections. The durations of the tasks shown are from their beginning to their final close out. For many of the tasks most of the substantive work was completed in advance of the end point shown, but the tasks were held open either until final work products were delivered or because additional refinements were made in later stages.

Each of the 21 tasks was further subdivided into from two to 13 subtasks, resulting in a total of 98 subtasks in the program. Although each task was separate and produced its own discrete outputs, each was also closely interrelated with other tasks, both within its own work area and within the other two work areas. The major interfaces between tasks are indicated by the arrows in Figure 2. Interfaces with the public involvement tasks are not shown since all tasks interfaced with this program as described in Subsection C below.

The outputs of the various tasks and subtasks varied in format. Some resulted in separate reports of their own, while the great majority provided inputs to other tasks or to Milestone reports described below. The Professional Services Agreement between Metropolitan Dade County and Kaiser Engineers contains a listing of principal deliverable items required by the contract. This list is contained in Appendix 2 to this report.

The program was designed to provide an orderly process for development of the system characteristics, involving the consultants, the public and County and other officials. As products -- in the form of data, evaluations, alternative concepts and/or preliminary designs -- emerged from the various study and design tasks of the program, the public and public officials were afforded the opportunity to review these products and to provide their input to the decisions to be made concerning the transit system.

The most important decision points in the program were called Milestones. Each Milestone covered a specific element or elements of the system. The eight Milestones were:

1. General System Concept and Criteria
2. Vehicle Technology
3. Development and Land Use Policy
4. Relocation and Right of Way Acquisition Policies and Procedures
5. Route Alignment and Station Location

6. Safety and Security
7. Architectural and Urban Design
8. Final System Plan

Each Milestone was the subject of a Milestone Report, published and given broad public and official distribution in the form of a Presentation of Data, a Draft Milestone Report and an Addendum. The process of reviewing the Milestone information through the citizen participation program is described in detail in Subsection C below.

Although each Milestone covered a different aspect of the total system, each also built upon the information and analyses developed in preceding Milestones, culminating in the final Milestone 8 which presented the total system plan. Milestone reports were not generally the product of a single work task of the program, except for Milestone 4 which resulted entirely from work done in Task E-5. Figure 3 illustrates the principal sources of inputs to the various Milestone reports. The predominant task input is shown by the heavier lines connecting tasks to Milestone reports, while the lighter lines show supplementary or secondary inputs.

A. ENVIRONMENTAL ANALYSIS

The environmental analysis work area consisted of six tasks involving the disciplines of environmental planning, land use and urban design, social and socioeconomic analysis, governmental studies and transportation planning. The first five of these tasks served two major purposes: first, to provide inputs into the planning and preliminary design of the transit system, and second, to provide material for preparation of an environmental impact analysis in Task E-6.

Task E-1 developed a picture of the County urban system and its characteristics to serve as a backdrop against which to measure, in Tasks E-2 and E-3, the impacts of alternative transit systems developed primarily in the preliminary engineering tasks. A large amount of data was collected in Task E-1, covering the demographic, physical, cultural, economic, governmental and institutional characteristics of the area. In addition, a community attitude survey was conducted in which residents were interviewed in their homes to determine their attitudes and preferences with regard to transit. A total of 1,751 interviews were obtained by a random clustering technique, representing a sampling of 447,000 homes in Dade County. Existing transportation facilities were also inventoried and analyzed. The principal output of Task E-1 was a draft report entitled Urban Profile and Environmental Inventory which served as a base, not only for the impact analysis, but also for all other tasks in the program.

Task E-2 analyzed existing and proposed land use patterns and activities and environmental and socio-economic conditions to identify existing tolerance levels in the potential transit corridors and station areas. From this identification, segments of the alternative systems were classified by sensitivity to external intrusion to serve as a guide to the development of routes which would avoid or minimize adverse impacts or, if possible, create favorable impacts. These analyses provided inputs

FIGURE 2

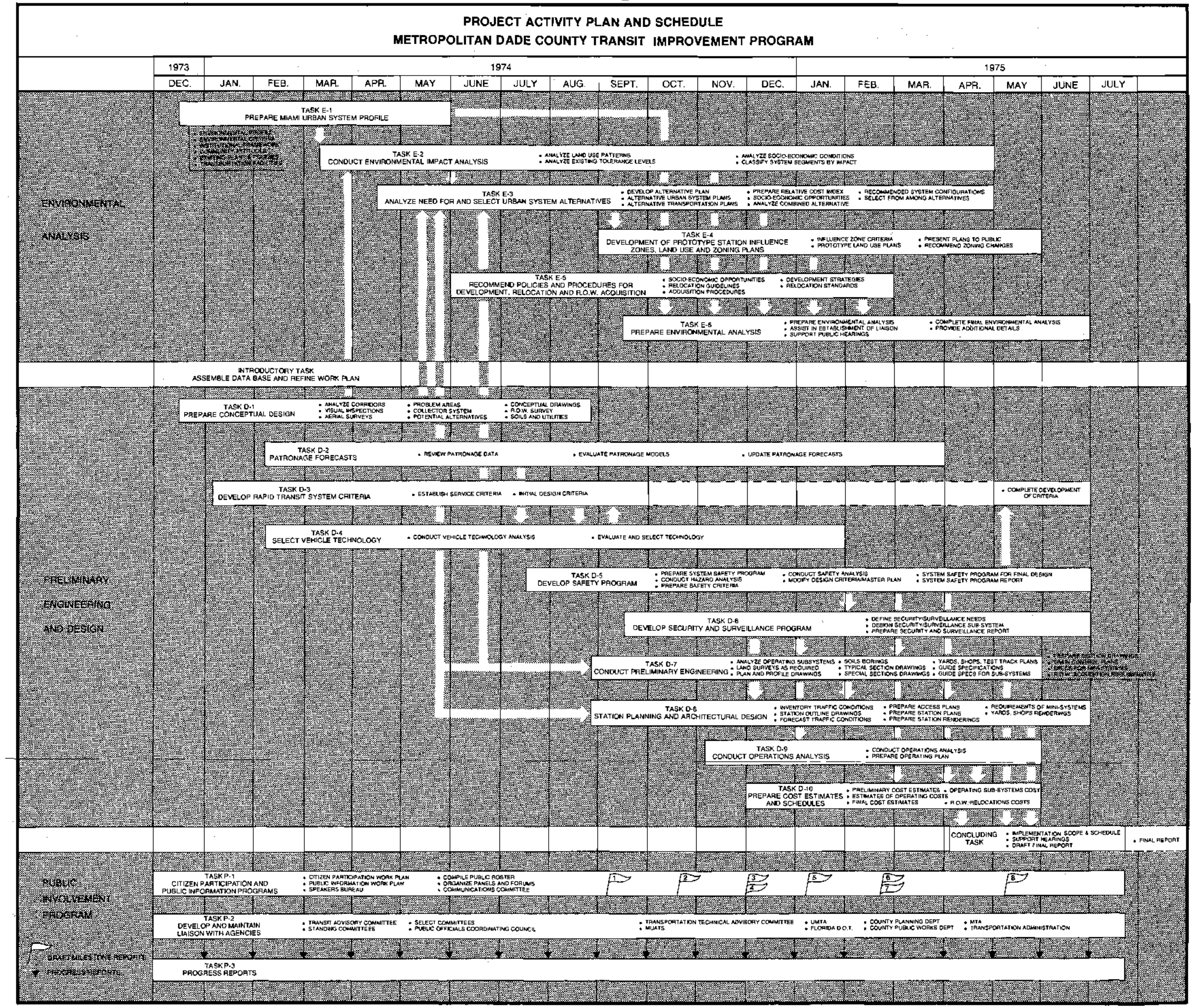
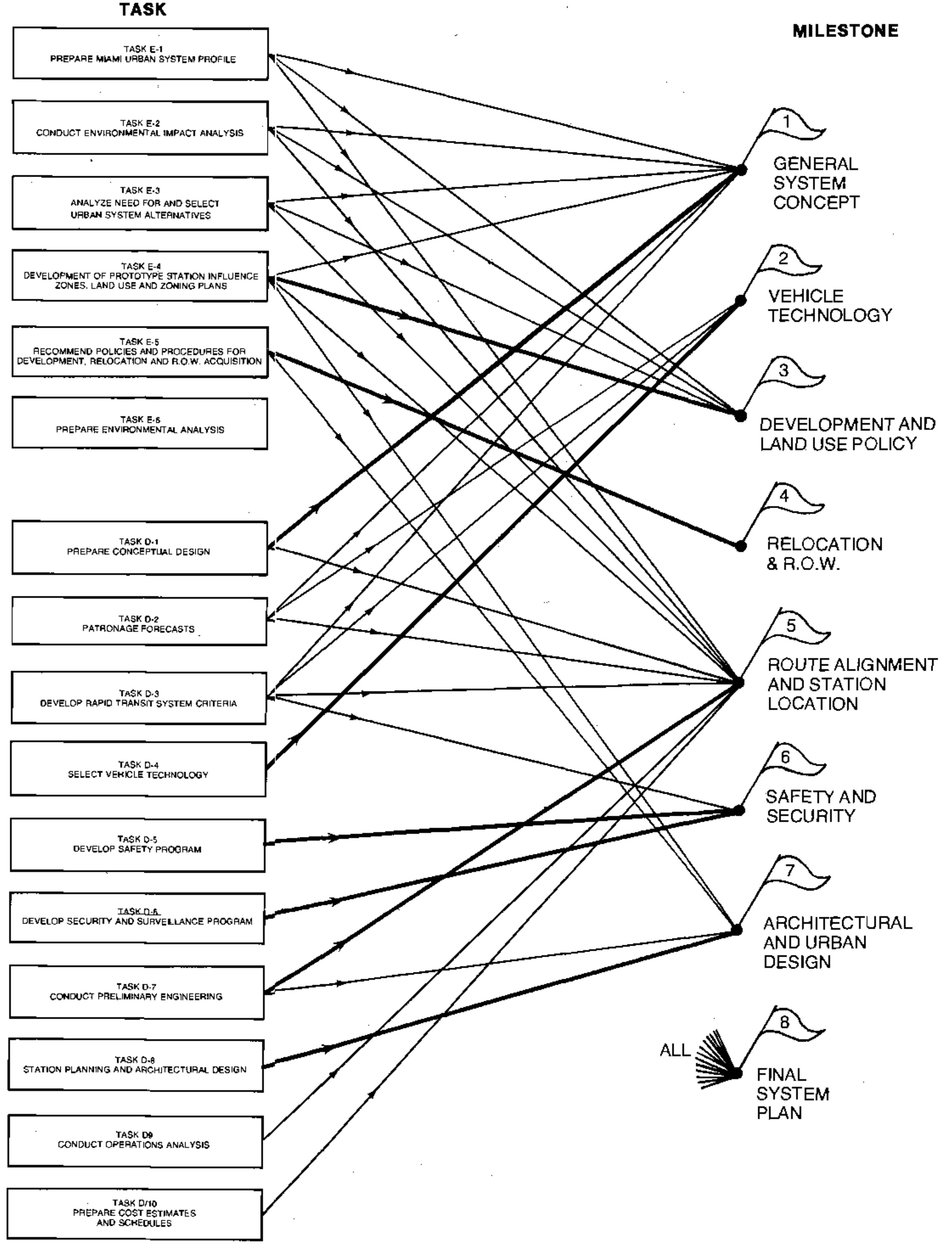


FIGURE 3

PROGRAM TASK INPROGRAM TASK INPUTS TO MILESTONE REPORTS



to the alternatives evaluation in Task E-3, to the preliminary engineering tasks under which alternatives were developed, and to the environmental impact analysis of Task E-6.

Evaluation of alternatives was carried out in Task E-3. Evaluation matrices were developed by which alternatives were compared in terms of a great number of environmental, social and economic parameters. Other parameters designed to measure alternatives in terms of physical and operational characteristics were developed in the preliminary engineering and design tasks and applied in Task E-3. The evaluations produced in Task E-3 provided a major input to selection of route alignments and station locations presented in Milestone 5 and also provided the basis for the alternatives evaluation in the environmental impact analysis. The evaluation technique is described in Section IV below.

Land use and zoning were studied in detail in Task E-4 for six selected prototype stations of the recommended transit system. Prototype stations were selected to represent a broad range of site and environmental characteristics, and a zone around each station was identified as the area in which the station would have a significant effect on development or redevelopment. The types of land use and development to be encouraged within these zones were identified and land use plans were prepared for each site. A detailed study was made of existing regulatory powers related to enforcing or inducing development plans, and recommendations were made as to changes in such powers or procedures by which desired development could be induced. The results of Task E-4 were the basis for the development and land use policies presented in Milestone 3 and for the urban designs and prototypical station land use plans in Part II of Milestone 7.

Policies and procedures for relocation and right-of-way acquisitions were the subject of Task E-5 which gathered and analyzed laws and regulations governing these activities. Recommended plans, policies and procedures, together with the applicable governing regulations, were presented in Milestone 4. Another function of Task E-5 was to assist in inventorying the number of residential and business displacements caused by alternative transit systems, in evaluating the impact of such displacements and in estimating the costs of relocation.

The purpose of Task E-6 was to bring together the outputs of all the environmental analysis tasks, as well as the results of most of the preliminary engineering and design tasks, and prepare a draft environmental impact analysis meeting the requirements of the National Environmental Policy Act of 1969, the Urban Mass Transportation Act of 1964 as amended, the Department of Transportation Act of 1966 and the Historic Preservation Act of 1966. Two drafts and an addendum were prepared. The analysis describes the environmental setting of the County and the proposed transportation improvement program. It then describes and analyzes the probable environmental impacts of the project at the regional level, including a detailed evaluation of alternative transit systems. Finally, the analysis describes the probable environmental impacts on a local scale.

B. PRELIMINARY ENGINEERING AND DESIGN

Ten tasks made up this work area of the program, involving transportation planning, all disciplines of the architectural and engineering professions, computer sciences, operations analysis, specifications writing and cost estimating. The first six of these tasks were planning studies leading to identification of transit corridors, criteria and technologies. The remaining tasks in this group converted the plans into preliminary designs, specifications, cost estimates, operations analyses and schedules for the specific route alignments, stations, yards and shops and all other facilities of the system.

Within this work area, Tasks D-1, D-2 and D-3 were begun at essentially the same time and proceeded together to develop the system concepts and criteria presented in the Draft Milestone 1 Report.

In Task D-1 a number of alternative transit corridor networks and operational concepts were developed for evaluation, considering transportation needs, physical problem areas, potential ridership, environmental effects and the objectives of the County's Comprehensive Development Master Plan. As described in more detail in Section IV below, the alternatives were evaluated and synthesized to develop the 1985 service network and core system of rapid transit.

Task D-2 provided the estimates of 1985 transit ridership that were used in developing the core system presented during Milestone 1, the proposed route alignments and station locations which were the subject of Milestone 5 and the final system plan described during Milestone 8. The innovative features of the ridership analysis used in the program are described in Section V.

In the meantime, service, system and design criteria were developed in Task D-3. These criteria were based upon experience of other transit systems and construction projects as modified by Dade County requirements, and served to guide the development of the proposed transit system. With refinement in the early stages of final design, they will also provide the guidelines for the remainder of final design and construction. The service criteria were presented in Milestone 1, and the system criteria in Milestone 2. Design criteria including the above are contained in a Manual of Design Criteria prepared as the principal product of Task D-3. All of these criteria, as modified by developments subsequent to Milestones 1 and 2, are summarized in Section V.

Task D-4 consisted of an in-depth study of available transit vehicle technologies and their applicability to the Dade County system. Candidate technologies and their characteristics were presented in the Draft Milestone 2 Report, together with a tentative recommendation of a preferred type. After further detailed studies of alignments and profiles carried out in Task D-7, a final recommendation of a steel-wheeled rail system for the fixed-guideway portion of the project was made in the Draft Milestone 5 Report.

Tasks D-5 and D-6, covering system safety and security respectively, were carried out concurrently, and their findings, in terms of analyses and recommended criteria, were presented in the Draft Milestone 6 Report, Safety and Security. Task D-5 included a preliminary hazard analysis, using the fault tree methodology, to identify potential safety hazards involving design, construction and operation of the transit system. Visits were made to existing transit properties in the eastern United States to obtain accident statistics and advice from transit operators, as well as to examine procedures utilized. Safety criteria were developed which were followed by the engineering and architectural designers in the preliminary design of stations, structures and operating subsystems. Security analyses were conducted in a similar manner in Task D-6, also resulting in criteria for design to minimize security problems. In addition to the Draft Milestone 6 Report, each of these tasks also produced a separate report on system safety and system security.

The major engineering effort of the program was carried out in Task D-7. Design analyses and preliminary design were performed in this task for transit structures, the operating subsystems (vehicles, train control, electrification and fare collection), and the vehicle storage and maintenance facilities. The results of this task formed the basis for the route alignments and station locations presented in the Milestone 5 Report and in the definition of the entire system in the Draft Milestone 8 Report. In addition to its contribution to these Milestone reports, Task D-7 also had separate products which will form the basis for final design of the transit system. These products consist of route plan and profile drawings of the entire system at a scale of 1" = 400 ft., showing right-of-way requirements, preliminary design drawings of typical and special transit structures, layout plans for the vehicle storage yard and maintenance buildings, guide specifications for construction and procurement, and plans for the train control and communications system.

Task D-7 required close coordination with Task D-8. The latter was to develop plans for transit stations and station sites and architectural concepts for the entire system. Two major efforts were made in Task D-8, one to examine all station sites and develop access and site plans, and the other to prepare plans for the stations themselves. Station access planning required field surveys of sites, the gathering and analysis of traffic and circulation patterns, analysis of station loadings by mode of access, and, finally, the preparation of site layouts and access plans. These analyses and plans were presented in the Draft Milestone 8 Report. Separate larger scale site plans were also a product of this task to assist in final design.

Station planning concentrated on the development of concepts and overall architectural form rather than on the details of architectural treatment. Circulation patterns were studied in depth to provide efficient movement to and within the concourse and platform areas of the stations, including circulation around fare vending machines, through fare gates and on escalators, stairs and elevators. Typical station designs were developed for a variety of types of stations, including bus stations on the I-95 busway. Task D-8 also included the preparation of color renderings of selected stations and a rendering of the yard and shop area.

The results of this work were described in Part I of the Draft Milestone 7 Report and concepts were also presented in the Draft Milestone 8 Report. Milestone 8 also included the results of a study of collector-feeder-distribution facilities for selected major activity centers, including downtown Miami, the Civic Center and a major regional shopping center. This study was the combined result of Tasks D-7 and D-8, the latter examining requirements for mini-systems and the former establishing functional specifications.

The purpose of Task D-9 was to perform operations analyses of the transit system to be used in determining operating costs and schedules, energy requirements, vehicle miles traveled and fleet size. The analysis was carried out by the use of a computer model using inputs of route alignment and profile, station location, vehicle type and weight and other physical parameters. Results of this analysis were included in the Draft Milestone 8 Report.

The final task in the preliminary engineering and design area, Task D-10, was devoted to the development of estimates of system capital and operating costs. Capital cost estimates were based on structure, station and subsystem designs developed in Tasks D-7 and D-8, and operating costs were derived from the operations analysis of Task D-9.

The concluding task of the entire program involved the preparation of a schedule for final design and implementation of the project, the support of public hearings and the preparation of the Draft Final Project Report and Final Project Report. The implementation schedule is described and presented in Subsection V-B below. Unlike most projects of this type, public hearings were held not only at the end of the program, but also at key points during the program. In addition to the many public meetings which were the basis of the citizen participation program, four separate sets of County public hearings were held at 13 locations. Three hearings were held on each of Milestones 1 and 2, Milestones 3 and 4, and Milestone 5. Four hearings were held on Milestones 6, 7 and 8 and the Environmental Impact Analysis.

C. PUBLIC INVOLVEMENT PROGRAM

1. Summary of Activities

The Public Involvement Program consisted of two separate but interrelated parts--citizen participation and public information. The former provided residents with a structured process for submitting comments and recommendations at each major decision point or "Milestone" during the preliminary engineering phase. The latter consisted of activities designed to keep residents informed about various developments in the project and to encourage broad based involvement from the community.

a. Citizen Participation

The citizen participation program was initiated in mid-June 1974 with a series of 29 community orientation meetings held in different neighborhoods throughout the county. A total of 1166 people attended these meetings which were designed to familiarize residents with the preliminary engineering and citizen participation programs. These sessions were followed in July 1974 with 14 organizational meetings held in the seven regional forum districts established by the County. As a result of these meetings twenty-five neighborhood Public Forums were established. These groups in turn formed seven Citizens Panels to represent them at county-wide general meetings.

Beginning in August 1974, residents began reviewing data on the first of the eight Milestone reports. Comments submitted by participants were channeled from neighborhood forums through district Citizens Panels to the consultants and the County's Transit Advisory Committee. Once each set of recommendations was complete these were forwarded to the Board of County Commissioners for public hearings. Through June 1975, a total of 470 community meetings had been held and were attended by an estimated 14,631 people or an average of 31 people per meeting.

b. Public Information

Coinciding with the start up of the citizen participation program, a series of bilingual mail outs, mass media public service announcements, handbills, news releases, news conferences, radio-television appearances, speaking engagements, and meetings with community leaders were implemented to inform residents about the program and to solicit their active participation. These activities were continued throughout the program and were supplemented by monthly newsletters to participants, storefront displays, shopping center exhibits, bus card advertising, media briefings, and public school programs.

The focus of these activities centered around the Presentations of Data, the Draft Milestone Reports and Addenda written by the consultants for each major phase of the project.

These reports were widely circulated to public officials, participating residents, the media, and government agencies at the local, state and federal level. Supporting these actions to keep all interested parties informed, the County/consultant team made an extensive and continuing effort to involve a broad cross-section of the community in the planning process.

A summary of public involvement activities through June 1975 is presented in Table 1. It should be noted that these figures reflect only those activities in which the consultants have participated. It does not include additional activities conducted by the County staff.

TABLE 1

STATISTICAL SUMMARY OF CONSULTANTS' PUBLIC INVOLVEMENT
(through June 16, 1975)

Type of Meeting	Number of Meetings	Participation Total	Participation Avg.
Orientation	29	1166	42
Organizational	14	962	68
Public Forums	235	4040	17
Citizens Panels	77	4167	54
General	13	1110	85
Transit Advisory Committee (includes sub-committees)	66	920	14
Public Hearings (includes municipalities)	21	1985	95
Public Officials Coordinating Council	13	221	17
Transportation Technical Advisory Committee	2	60	30
	470	14,631	31
Speakers Bureau	40	1320	33
Communications Committee Meetings	35		

SPECIAL EVENTS	
Displays	8
TV Appearances	15
Radio Appearances	Approx. 24
News Conferences	5
News Releases	39
Public Service Announcements	14
Meeting Announcements	34

Reports	
Progress	16
Newsletter	10
Milestones/Data	6
/Draft	8
/Addenda	9

2. Citizen Participation Program

The citizen participation program provided the means for interested and concerned citizens of Dade County to interact with the consultants and public officials on transportation issues as well as related areas of planning and development.

a. Concept

In concept, the program provided an organizational structure through which the citizens were informed of all significant aspects of the project and were given the opportunity to deliberate on the issues and make known their views on these issues to the designers and decision-makers through the Milestone decision process described below. To give the program as broad a base as possible, the structure was designed to encompass three geographic levels of review, deliberation and recommendation: the neighborhood level Public Forums; the district level Citizens Panels, and the county-wide level Transit Advisory Committee. In addition to the geographic structure, existing community organizations having specific interests were afforded the opportunity to participate in the program.

The concept also provided a means for resolving conflicting views and for channeling feedback through the structure to inform residents of decisions taken and the rationale used. While the concept envisioned that the Board of County Commissioners must make the ultimate decisions, it also ensured these decisions reflected the overall values, needs and priorities of the community.

As alternative system concepts were developed by the Consultants, the public was given the opportunity to review these concepts, together with the source material used in their development, and to express preferences or suggest additional alternatives. Public participation was thus active rather than reactive. The role of the consultants was therefore not to design a system and test the reaction of the public to it, but rather to develop technically feasible alternatives which met the perceived needs of local residents.

The citizen participation program also had a significant impact on the County decision-making process. The role of the decision-makers was not one of simply reviewing and approving a consultant design but of resolving conflicting public views and arriving at solutions which best served the needs of the greatest number of people, while also providing a justified, professionally viable course of action for the community.

A fundamental aspect of the program is its long term nature. While its initial function was to provide citizen participation in the decisions in the preliminary engineering phase of the transit improvement program just completed, the program is designed to continue to function through final design, construction and initial operation of the transit system.

b. Objectives and Purposes

The basic objective of Dade County's transit improvement program has been to provide transportation facilities to meet the needs of the people of Dade County. To achieve this objective it was necessary first to identify those needs, second, to satisfy them to the extent permitted by constraints of resources and technology, and third, to gain and maintain public acceptance and support in order to proceed with implementation of the project.

The objectives of the citizen participation program were to:

1) Determine the transit-related needs of the community as expressed by its residents.

2) Identify community priorities which the residents assign to their perceived needs.

3) Maximize public awareness and support of the transit improvement program.

4) Maximize public participation in the deliberations leading to transit-related decisions.

5) Create substantial savings in time and cost from litigation, extensive plans revisions and major construction changes.

6) Provide final decisions which consider the values, needs and priorities of the community.

To attain these objectives it was the purpose of the citizen participation program to:

1) Fully inform and explain to citizens the structure, process, and products of the transit improvement program.

2) Provide a mechanism by which citizens could make known their needs and desires related to the transit improvement program.

3) Provide a means by which citizens might influence the design guidelines for the system and the ultimate decisions relating to the system.

4) Stress the value of citizens recommendations and the degree to which they have been accepted.

5) Encourage citizens to participate in resolving of conflicts.

6) Establish the framework for long range participation in the development of the transit improvement program.

c. The Structure

The citizen participation program was organized around a three-level structure which provided a clearly defined framework to deal with community transportation issues. This structure provided a common meeting ground for interaction among elected officials, citizens, transit consultants and public agencies (local, county, regional, state, federal). Beginning at the "grass roots" level, the structure was composed of the following elements:

- Public Forums - Neighborhood groups meeting at convenient periods to discuss issues and concerns posed by Dade County's Transportation Improvement Program and interacting with the next higher organizational level of the Citizen Participation program, the Citizen Panels.

- Citizens Panels - Designated representatives of the Public Forums meeting in open session with the County/consultant team to receive transit information, discuss priorities, evaluate alternatives and resolve issues, and provide representation at the next organizational level, the Transit Advisory Committee.

- Transit Advisory Committee (TAC) - A committee established by the County to advise the Board of Commissioners on transit matters. It is composed of County Commissioners, County officials, representatives of the Citizen Panels and representatives of the State and other governmental and non-governmental agencies.

A fourth level of participation, though not an organizational structure, was provided in the form of a Public Roster for those expressing a desire to be included on all informational mailings. The Public Roster was both a mailing list and communications network for those citizens who demonstrated an interest in the transit improvement program but who did not elect to participate actively in the Forums or Panels.

In addition, two other groups were established to broaden the community's input and recommendations to the consultant team:

- Public Officials Coordinating Council (POCC) - This council was composed of designated representatives of the governing bodies of Dade, Broward and Palm Beach Counties as well as representatives of the major municipalities within Dade County, the MUATS Policy Committee, the School Board, the Hospital Board and the Dade County Delegation. The Public Officials Coordinating Council provided policy advice and guidance on all public issues involving transportation improvement.

- Transportation Technical Advisory Committee - This committee was composed of nationally known consultants from various transit-related disciplines who have special expertise in transportation areas as well as broader, but related, areas. This committee worked with the County staff and consultants on specific technical issues raised and was in a position to advise on such matters.

For organizational purposes, Dade County was divided into seven geographical districts as outlined on Figure 4. Each district had one Citizen Panel, a number of Public Forums and two representatives on the Transit Advisory Committee. The number of Public Forums in each district was determined by a logical grouping of definable neighborhoods and varied to accommodate travel distances to meetings, population densities of the community and desires of area residents. Figure 5 illustrates the relationship of the Citizens Panels to the County's policy and decision-making structure.

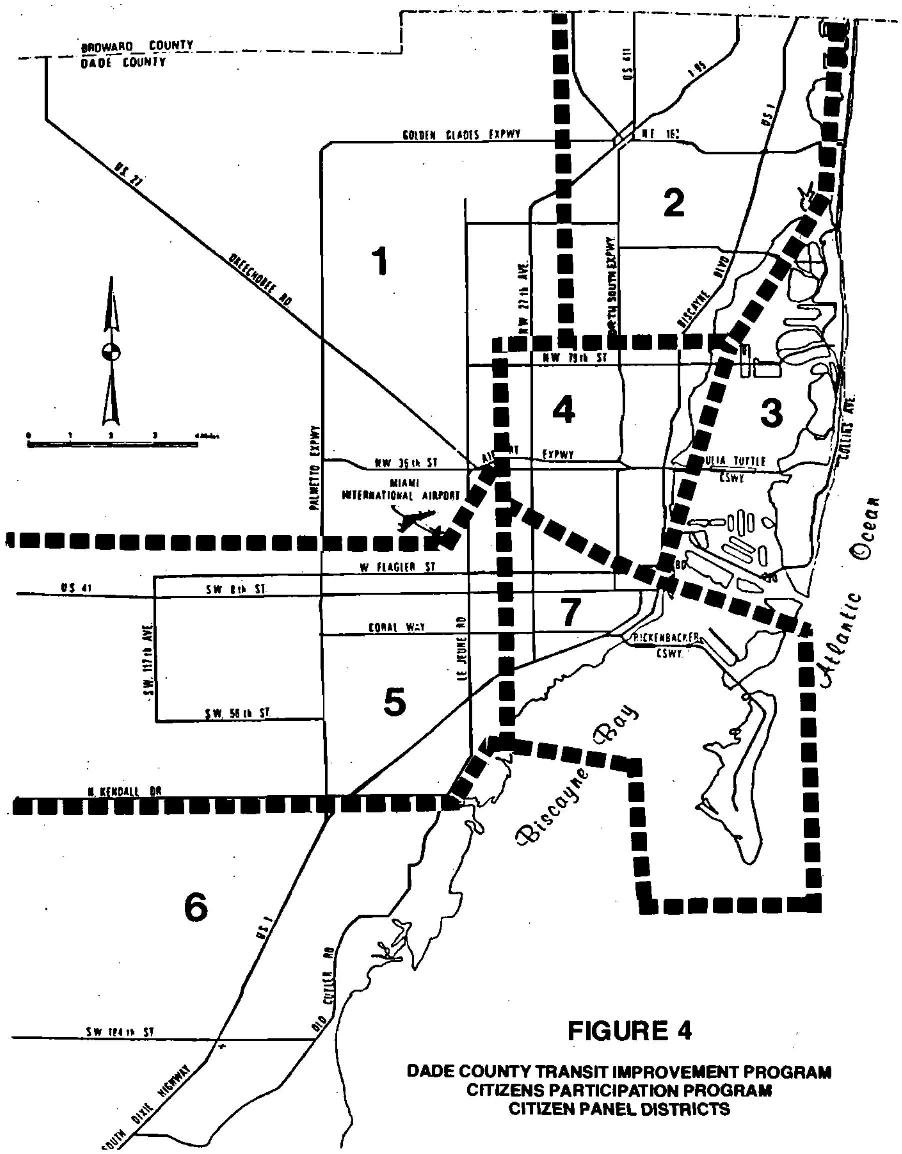
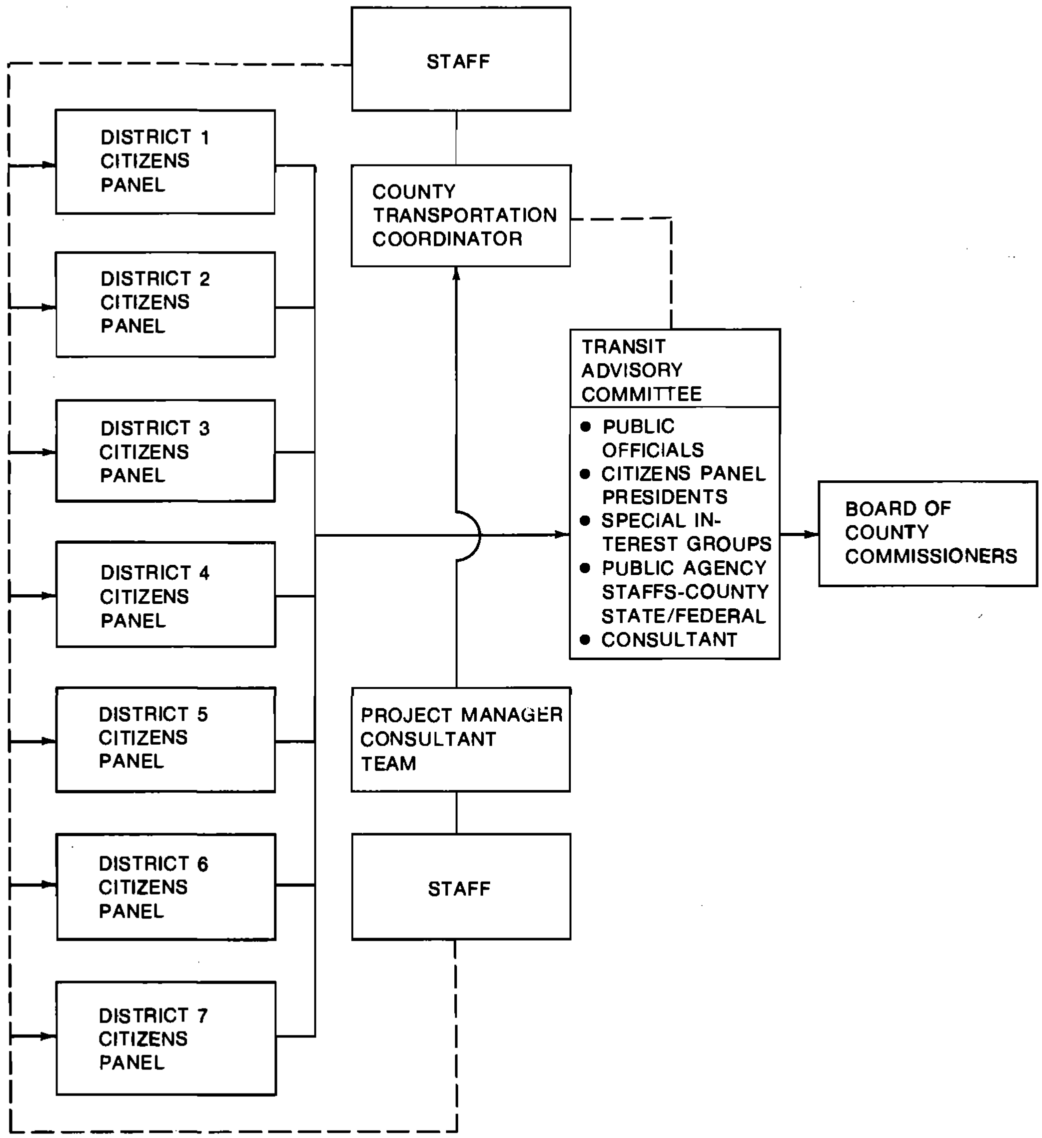


FIGURE 4

DADE COUNTY TRANSIT IMPROVEMENT PROGRAM
CITIZENS PARTICIPATION PROGRAM
CITIZEN PANEL DISTRICTS

FIGURE 5

CITIZENS PANELS RELATIONSHIP TO POLICY AND DECISION-MAKING STRUCTURE



Each Forum had at least three officers -- a chairperson, vice-chairperson and secretary -- who made up the membership of the Citizens Panel for their District. Likewise, each Citizens Panel had at least three officers -- a president, vice-president and secretary -- with the president and vice-president serving as regular members of the Transit Advisory Committee. The primary function of both Forum and Panel officers was to represent the consensus of their respective neighborhoods and districts in submitting community recommendations to the planners and decision-makers.

Special interest groups were actively sought as participants in the program via direct mailings to the Public Roster, various news media, the Speaker's Bureau and informal meetings with representatives of special interest groups. Input on major issues was obtained from these groups by active participation at the Public Forum level, Citizens Panel level, or by appointments to the Transit Advisory Committee's Standing and Select Committees.

The standing committees' major purposes were to insure that the preliminary engineering activities proceeded as scheduled and according to the contract; to study each issue involved in its respective subject area to insure that adequate perspective was maintained; to monitor the quality of the consultant's work, and to report formally to the Transit Advisory Committee.

The select committees were essentially ad hoc committees whose principal objectives were to review each milestone report, monitor the work of consultants, and provide recommendations and professional opinions on the particular Milestone topics assigned to them.

The consultant team interacted frequently with each of the standing and select committees in order to provide information and to receive inputs from the members. This interaction occurred mainly during regularly scheduled committee meetings and was initiated at the request of the committee chairperson.

d. The Process

To activate the citizens participation structure, a series of inter-related events and activities were implemented in three separate phases.

(1) Phase 1 - Community Orientation Meetings - Prior to the actual involvement of the citizens in the study and decision-making process, a series of open public meetings was held throughout the county over a two-week period. The purpose of these meetings was to fully inform citizens about the transit improvement program and its related activities. The meetings were held in Spanish and English and used conveniently located public buildings. An average of four meetings per district were held.

The meetings consisted of a short introduction to explain the purpose of the meetings, a twenty-minute slide presentation highlighting the preliminary engineering and public improvement programs, and a question and answer period to clarify points raised in the slide show. In addition, an orientation brochure was distributed in both Spanish and English which described the key elements of the total program.

Prior to the meetings an extensive public information effort was conducted to inform residents of the meetings. This consisted of:

- Bilingual public service announcements on radio and television.
- Mailings to various community organizations and to a one percent (1%) sample of the Dade County voters.
- Mailings to 5,400 organizations and individuals on the "Third Century" mailing list created for the local U.S. bi-centennial celebration.
- Personal contact with key organizational leaders to reinforce the need for their involvement in the program.
- Posters and bilingual handbills on MTA buses encouraging transit riders to get involved and to contact the County's Citizen Information Service for details.
- A special news conference conducted by the Vice-Mayor of Dade County to brief members of the media on these meetings and to broaden public awareness of the meetings and the role of citizens in the program.
- A news release in Spanish and English distributed to Dade County Newspapers, radio and television stations.

(2) Phase 2-District Organization Meetings - Following the community orientation meetings, a public meeting was held in each District for the purpose of organizing concerned citizens at the neighborhood level into a network of public Forums as described above. Bilingual information publicizing these meetings was prepared by the consultant team and distributed to the public by the County/consultant team. These announcements included mailings, news releases, public service announcements on radio and television, handbills and posters on MTA buses and public buildings and other locations.

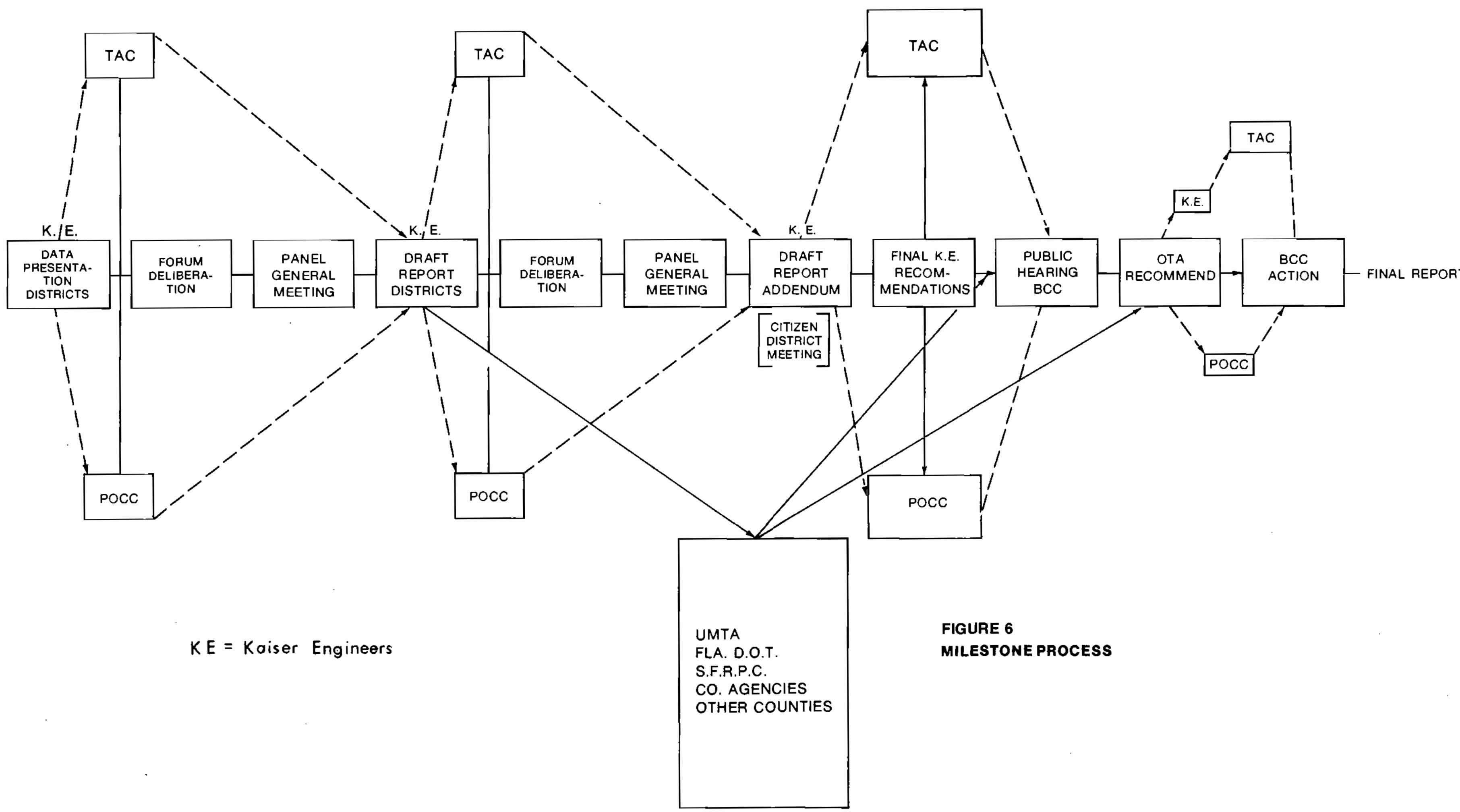
In the mailings to the Public Roster, citizens received notification of the meeting dates, times, and locations. Also, they received a tentative agenda for the meeting and a newsletter containing a summary report on the community orientation meetings.

At the District organization meetings (which were conducted jointly by members of the County/consultant team) residents were briefed on the program, presented organizational guidelines for discussion, and assisted in organizing their Public Forums and Citizens Panels.

(3) Phase 3-Milestone Decision Process - The focal point for citizen participation in the Preliminary Engineering Program were the eight project decision points or Milestones. For each of these Milestones a comprehensive input and review process was jointly developed and implemented by the County/consultant team (see Figure 6).

This process consisted of:

- Milestone Data Presentations - a verbal and written presentation by the consultants to each Citizens Panel highlighting the major issues, alternatives, and background information concerned with the particular Milestone under study at a given point in time.
- Forum Deliberation Meetings - a series of neighborhood review meetings conducted by the Public Forums in each District for the purpose of analyzing the consultants data and preparing recommendations.
- General Meeting - a county-wide meeting of Public Forums conducted by Citizens Panel leaders to exchange information and to formulate district recommendations for consideration by the consultants.
- Transit Advisory Committee (TAC) Review - a process of technical evaluation conducted by the Standing and Select committees assigned to analyze each Milestone and to submit its findings to the consultants and the County Staff.
- Draft Milestone Report - a set of recommendations and supporting data prepared by the consultants for each Milestone (incorporating citizen/TAC input) and presented verbally and in report form to each Citizens Panel.
- Forum Deliberation Meetings - a second round of Public Forum meetings to analyze the consultants recommendations and to prepare further comments/suggestions.
- General Meeting - a follow-up county-wide citizens meeting for the purpose of submitting additional comments relating to the consultants' Milestone recommendations.
- Draft Milestone Report Addendum - supplementary data and ammendments to the Draft Milestone Report issued by the consultants following the second round or review sessions by the Citizens Panels and the TAC.
- Public Hearings - a series of legally prescribed hearings conducted by the Board of County Commissioners for the purpose of soliciting additional public comments on each Milestone Report prior to taking action.



K E = Kaiser Engineers

FIGURE 6
MILESTONE PROCESS

- Office of Transportation Administration's Summary Evaluation - the official position of the County Office of Transportation Administration (OTA) as submitted to the Board of County Commissioners (BCC) following careful evaluation of each Draft Milestone Report.

- Action by the Board of County Commissioners - the conclusion of the Milestone Decision Process; after reviewing the OTA's recommendations, the Board of County Commissioners took whatever action it deemed appropriate for each Draft Milestone Report (i.e., to "adopt", "accept", "reject", "recycle" etc., each report).

e. Products of The Citizen Participation Program

A key indicator in measuring the effectiveness of the Citizens Participation Program is the extent to which local residents are able to influence the planning and decision-making processes. The ability of the program to accomplish this aim depends to a great degree on the manner in which the consultants and the elected and appointed County officials respond positively to the proposals of citizens during the Milestone decision process.

During the preliminary engineering program the interaction of citizens with the consultants and County officials evolved into an extremely constructive and productive exchange of needs, values and priorities. A variety of significant outputs developed from this process and resulted in these major end products:

(1) Citizen Influence on the Consultant Team Planning Process - Citizen participation in the planning process played a significant role throughout preliminary engineering in the recommendations and guidelines submitted by the consultants. Among major program outputs influenced strongly by citizen involvement were the following:

- Definition of the 1985 Service Network (especially the Homestead, Kendall Drive, Miami Beach and the N.W./N.E. Dade segments).

- Development and modification of the 1985 Core System (particularly the Hialeah segments).

- Modifications to the service criteria (approximately 25%)

- Revisions to the system characteristics (approximately 20%).

- Changes in the development and land use policies (approximately 50%).

- Amendments to the safety and security criteria (approximately 15%).

- Modifications in the station architectural criteria (approximately 30%).

- Major revisions in the environment impact analysis (primarily in the evaluation of alternative systems and in the projections of noise/air pollution for the 1985 Core System).

(2) Citizen Impact on the County Decision Making Process - citizen influence on the County's decision-making process has been felt most strongly through three inter-related activities: Citizen Panel input into the project Milestone Reports; participation on the Transit Advisory Committee and its various sub-committees; and input submitted at the thirteen public hearings conducted throughout the project.

The impact of these activities is best evidenced by the fact that the County's policy making body -- the Board of County Commissioners -- has either adopted or accepted each of the eight Milestones (as reflected by the Draft Milestone Reports and the Addenda or Supplements) and the Environmental Impact Analysis with little or no further modification. Since each of these documents contained a substantial number of citizen recommendations prior to submittal to the Commission, the final decisions made by the Commission underscore the significance of public input and clearly demonstrates its impact.

(3) Long Term Citizen Participation Structure - through the efforts of the citizens and the County/consultant staff, the citizen participation program provided the residents of Dade County with a well-established framework for long-term community involvement in the planning and implementation of the transportation improvements. Any interested citizen could participate in this structure by requesting to be included on the Public Roster mailing list, by joining one of the 25 neighborhood Public Forums and by seeking election to one of the 7 district Citizen Panels. Additionally, citizens could seek appointment to the Transit Advisory Committee and its sub-committees.

(4) Identification of Major Community Transit Issues - one of the primary and more beneficial outcomes of the citizen participation program has been the early identification of sensitive community issues relating to the Transportation Improvement Program. By surfacing these issues early in the planning phase, the community has the opportunity to settle these issues in a timely and satisfactory manner.

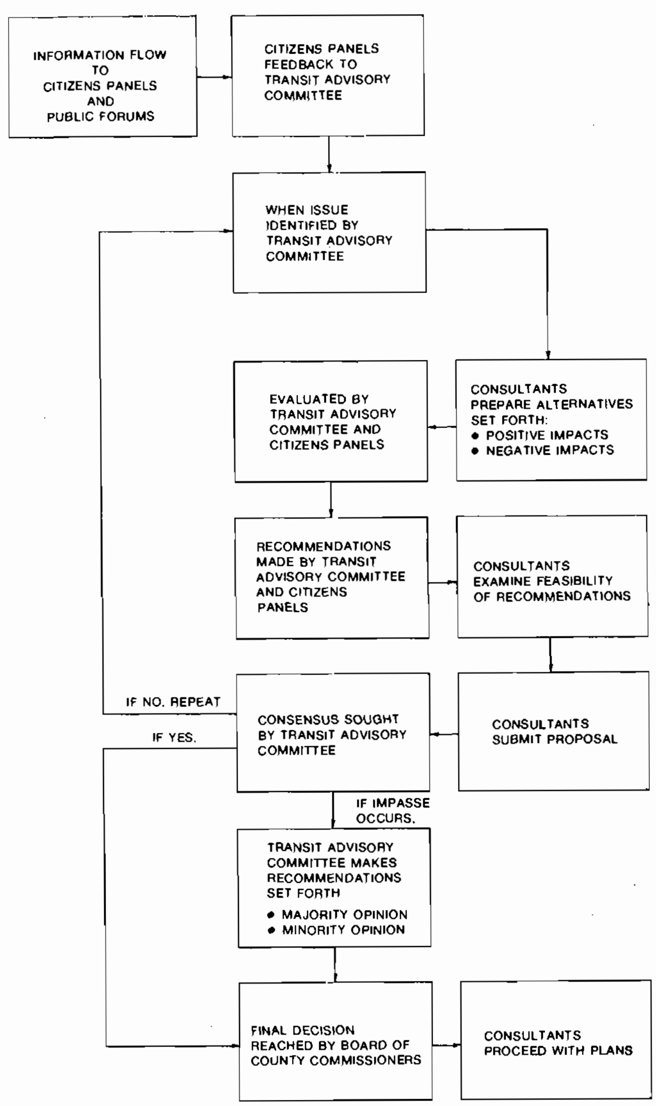
Among the major community issues identified during preliminary engineering which will require resolution during future phases of the program are the restudy of route alignments and stations for the LeJeune-Douglas Corridor and the Miami Beach Corridor, the feasibility and desirability of placing the Flagler Corridor underground in the Central Business District of downtown Miami, and the timetable for possible provision of rail service to northeast and northwest Dade County.

(5) Model for Resolving Conflict on Major Community Issues - through the creation of the citizen participation structure and the Milestone decision process, a systematic means of settling major transit disputes has been established (see model in Figure 7). While "real-life" application of the model was adjusted to fit varying situations, the basic process was followed throughout the preliminary engineering program.

Among the issues which have been addressed utilizing the model were the selection of a vehicle technology for the 1985 core system, the re-examination of ridership projections for transit corridors serving Miami Beach, northeast Dade County and Hialeah, the location of a route alignment and stations for the Little Havana area, and the modification of the Hialeah rail segment in the 1985 core system.

FIGURE 7

CITIZEN PARTICIPATION MODEL FOR RESOLVING ISSUES AROUND MILESTONE DECISIONS



3. Public Information Program

The public information program was the second major element of the public involvement effort. Its primary purpose was to keep participating citizens, the media, transit users and the general public informed on the activities of the transit improvement program.

a. Concept

The concept of the public information program was developed to support the citizens participation program through communication with participating residents, public agencies and community organizations.

Implicit in this concept was the need to sustain public awareness of and support for the transit improvement program and to create an informed citizenry.

Also implicit was the broad dissemination of information to as many residents as possible and also the use of communications techniques tailored to reach selected audiences. In consideration of the large Spanish-speaking population of Dade County, bilingual informational materials were used to achieve this goal.

Additionally, all information pertaining to the major decisions, i.e., Milestones, were made available to the public well before these decisions were reached and were equally presented in form and substance to all interested parties.

Finally, the public information program continually took the iniative in keeping the public informed of events and developments. Regular and timely activities were initiated to communicate directly with the public through the mass media, public agencies, official publications and newsletters, community organizations, special displays and mailings, community seminars, and school programs.

b. Objectives

The objectives of the public information program were to:

- Increase public awareness and knowledge of the transit improvement program.
- Encourage and increase citizen participation in transit planning and decision-making.
- Inform the public of the impact which citizen participation is having on transit planning and decision-making.
- Inform the public on the progress and results of Milestone decisions.
- Develop confidence in the planning of the rapid transit system.

- Control rumors by providing accurate information to correct erroneous information.

- Inform interested municipal, county, regional, state and federal agencies on the progress of preliminary engineering and public involvement.

Each of the above objectives was accomplished according to community feedback received from opinion/attitude surveys, media editorials, news reports, letters to the editor, community seminars, public hearings, Citizen Panel meetings, community organizations, TAC meetings, and correspondence from local citizens.

c. The Structure

The structure of the public information program consisted of an organization responsible for planning, preparing and approving communications strategies and materials, distributing materials, and reviewing and evaluating the progress of the program. (See Figure 8).

- Planning and Preparation

  The organization for planning and preparing communications materials consisted of information specialists on the staff of the prime consultant and selected personnel of two local public relations firms having broad knowledge of and experience in information activities in Dade County. The consultants worked closely with the County staff in carrying out these functions.

- Authorization and Control

  The County Transportation Coordinator designated two staff members, one primary and one alternate, to review and approve all statements, newsletters, news releases and other informational materials that were drafted by the consultants for public dissemination.

- Distribution

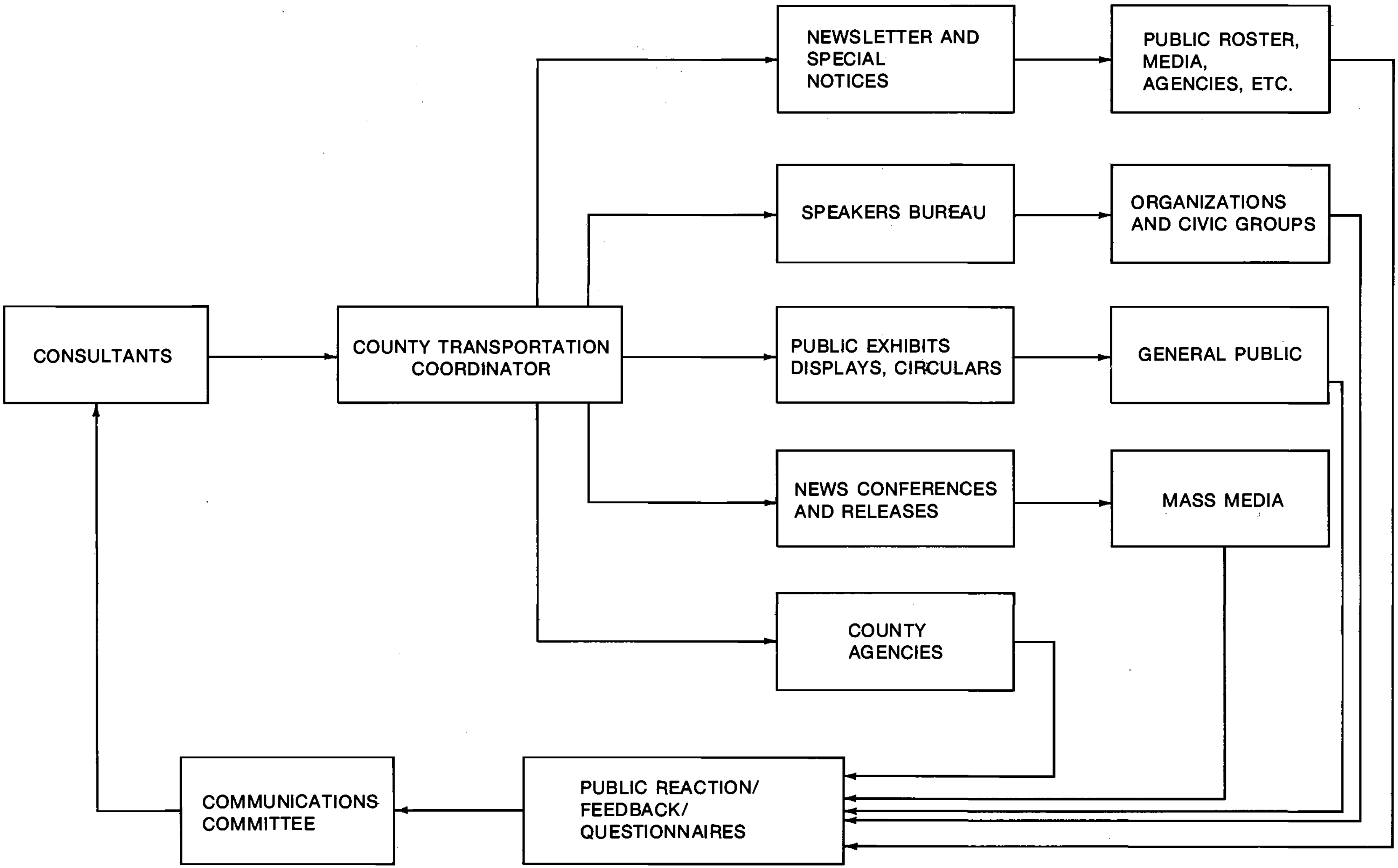
  Distribution was the joint responsibility of the consultants and the County. The distribution of informational materials was carried out by a variety of means utilizing new and existing communications structures. These included the Public Roster mailing list, the County Manager's mailing list, the communications media, County agencies and a Speakers Bureau.

- Evaluation and Coordination

  A Communications Committee was formed to assure that the Public Information Program would be responsive to the needs of print and electronic media and effectively reaching its

FIGURE 8

PUBLIC INFORMATION STRUCTURE



intended audience. The committee consisted of members of the County/consultant team who were directly concerned with the public information program.

This committee met as often as needed to review communications activities, discuss methods of improving the flow of public information and identify means for coordinating these efforts with the local media.

d. The Process

Implementation of the public information program involved procedures for planning, preparing and approving communications strategies and materials, distributing materials and reviewing and evaluating the progress of the program.

- Planning and Preparation

  The planning process consisted of analyzing and evaluating public attitudes toward the transit improvement program, identifying audiences, formulating strategies, approaches and priorities; establishing procedures for distributing the information and identifying criteria for evaluating the effectiveness and impact of the public involvement program.

- Approval of Informational Material

  No official information was disseminated to the public without prior approval of the County. Recognizing that timely release of information was essential to the achievement of the program's objectives, a process for the expeditious approvals of materials was established.

  After preparation of the informational material by the consultants, it was submitted to the County Transportation Coordinator for approval by the designated approving official.

- Distribution

  The distribution of informational materials was carried out by the County and consultants through the use of established communications outlets. These included mass media; ethnic, religious and neighborhood media; direct mail; bus circulars and posters; exhibits and demonstrations; the Speakers Bureau; and handbills, leaflets and circulars.

- Review and Evaluation

  The Communications Committee conducted a continuing review and evaluation of the effectiveness of the public information program. This was accomplished by:

  - Periodic contact with the media to determine their opinion as to the degree to which the program was accomplishing its objectives.

- Soliciting feedback from residents participating in Forum and Panel meetings.

- Analyzing comments and suggestions submitted by TAC subcommittees, community organizations and public agencies.

e. Rumor Control and Inquiries

During the course of the program, rumors or inquiries originated from various sources. The majority of these were identified at public hearings and at meetings of the Panels and Forums; these were clarified before becoming widely circulation. Most Panel and Forum meetings were monitored by at least one member of the County/consultant team who was sufficiently informed on the program to correct erroneous statements or answer questions as they arose.

f. Public Reference Sections

The County Transportation Coordinator's office assisted local county, city and college libraries in setting up and maintaining a public reference section on transit planning. These sections were accessible to any citizen during normal library hours and contained copies of official documents relating to the transit improvement program.

Documents placed in the public reference sections included the Dade County Comprehensive Development Master Plan; Milestone Draft Reports; and the Environmental Impact Analysis.

Periodically, public notices were released announcing the location of the reference sections and the hours and days that they were available for public use. Telephone requests for information were directed to the Office of Transportation Administration.

g. Products of the Public Information Program

The major products of the public information program included:

- A monthly, bilingual Transit Improvement Program Newsletter to keep members of the Public Roster and other interested individuals and groups advised of work progress, upcoming meetings and other important developments.

- A Public Roster mailing list containing approximately 4,500 names and addresses of: residents taking part in the citizen participation program; federal, state and local elected officials; representatives of all Dade County mass media; community opinion leaders, civic organizations, ethnic groups, homeowners associations, etc.; and department heads of key city, county and state agencies.

- The preparation of visual aids for use in public presentation (both English and Spanish) on specific subjects including system criteria, vehicle system technology, relocation policy, route alignments, station locations, etc.

- Public displays (including storefront posters) to keep neighborhood groups throughout the county adequately informed of work progress and opportunities for participating in the Public Involvement Program.

- Organization of a Speakers Bureau providing knowledgeable spokespersons to discuss the transit improvement program with neighborhood groups and associations, organizations or groups representing special interests (i.e., business and professional, environmental, ethnic, civic groups, etc.).

- Formation of a Communications Committee to review and evaluate the effectiveness of the program and to coordinate information activities.

Less tangible, but nevertheless important accomplishments, were two related by-products of the program.

- A nucleus of well-informed citizens that is knowledgeable about the progress of the transit program, the role of citizens in transit development, and the objectives set by citizens groups and the County in the formulation of long-term public transportation policies.

- Increased community awareness and understanding of the goals, methods, process, timing and costs of the transit improvement program.

As planned and executed, the preliminary engineering program resulted in the development of a number of transportation alternatives for Dade County, their evaluation through engineering analyses and citizens' inputs, and the selection of a preferred alternative. The process of alternatives evaluation is discussed in detail in the following Section IV. Section V describes the recommended rapid transit system resulting from this evaluation.

IV. ALTERNATIVES ANALYSIS

The development of the recommended transit system plan resulted from an extensive and complex process of formulation and analysis of alternatives to determine the system which would best meet the needs and objectives of Dade County. The process continued throughout the preliminary engineering program, from Milestone 1 through Milestone 8. Basic alternatives analyses were conducted in three main areas:

- Corridor/Operational Concept Alternatives
- Vehicle Technology Alternatives
- Route Profile, Alignment and Station Location Alternatives

This section of the report describes the process of development and evaluation leading to the recommended system described in Section V.

A. CORRIDOR/OPERATIONAL CONCEPT ALTERNATIVES

1. The Study Process

Development and analysis of concepts were performed in four phases as illustrated in Figure 9. The first phase involved the formulation of alternative transit networks and the synthesizing of these alternatives to form a network of consensus corridors. The second phase consisted of analysis and evaluation of the consensus corridors to develop a 1985 service network and a core system of rapid transit. Phase Three involved the refinement of the core system as a part of Milestone 5, and included a detailed study of route alignments and profiles and station locations. The fourth and final phase consisted of a detailed reanalysis to evaluate the relative merits of the core system as compared with low and high capital cost transit systems using a variety of operational modes. The four phases are described in some detail below.

2. Phase One - Formulation and Synthesis

Utilizing the data and analyses of several of the engineering and environmental study tasks, 14 alternative transit corridor networks covering different geographic areas and using different operational concepts, were developed. The operational concepts considered were grade-separated fixed guideway systems, grade-separated bus systems and non-grade-separated transitways using buses or trolleys on exclusive but at-grade transit lanes or streets. These networks were developed to meet, in varying degrees, the established transit objectives and criteria, and also to determine whether low capital-intensive operational concepts might be effectively used on certain corridors.

Formulation of the 14 alternatives was based on a synthesis of previous studies, the Miami urban profile, and consideration of various transit determinants which included land use, population and employ-

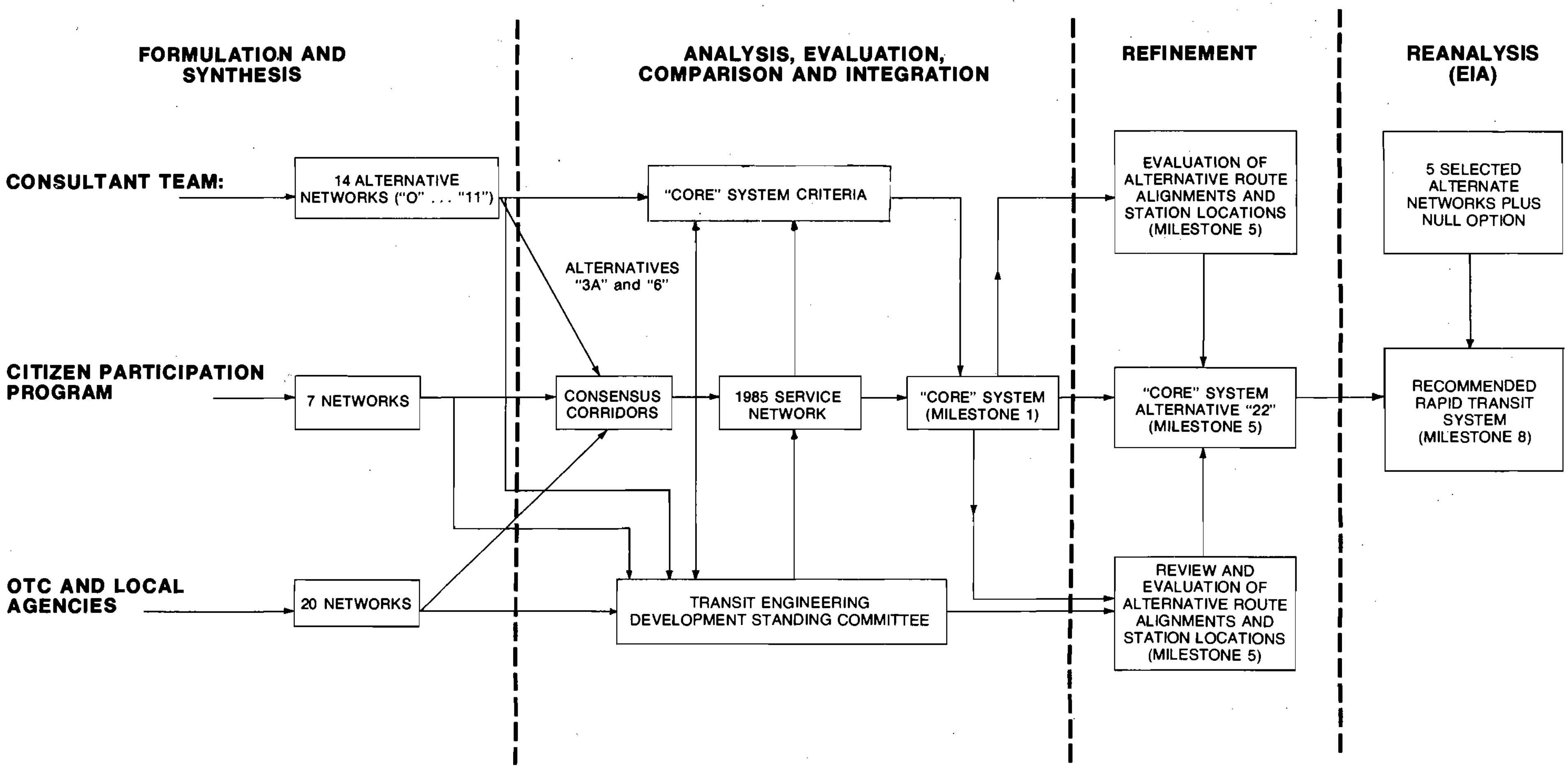


FIGURE 9
REPRESENTATION OF CORE SYSTEM DEVELOPMENT AND EVALUATION PROCESS

ment distribution, travel patterns, demand levels, the needs of transit dependents, and factors relating to the environment. More specifically, the process of identification, definition and culling of the candidate systems alternatives involved the following primary task elements:

- preparation of a Miami urban system profile and environmental inventory which included the documentation of demographic, socio-economic, political, and environmental data and an analysis of these data from the point of view of influence on transit system design and impact of the proposed system concepts on the environment;

- study of existing and proposed land use patterns and activity centers as developed by the Dade County Planning Department;

- visual inspection of candidate rapid transit corridors and routing possibilities throughout the County;

- preparation of aerial photo maps to allow the synthesis and development of corridor alternatives;

- identification of physical and engineering problem areas such as the Miami River and bay crossings, aerial structure intrusion into sensitive community areas, and existing major structural facilities;

- conduct of general soils and utilities surveys to establish any major utility relocation requirements and any geologic problem areas;

- comprehensive review of existing and projected travel demands, volumes, and characteristics, including investigation of the characteristics of users and potential users of transit services and modal choice behavior patterns;

- preparation of preliminary service criteria and standards; and

- investigation of a wide range of vehicle technologies and the synthesis of specific operational concepts based upon the application of candidate general technology types in various operating modes.

Corridor segments, station locations, alignments, and general operational concepts comprised the major elements of the various system alternatives. Patronage estimates for the alternatives were developed using "sketch planning" techniques as described in Section V. These estimates were made in the following context:

- the elimination from previous area plans of the majority of new expressway construction;

- perceived costs of private vehicle operation substantially higher relative to the costs (price) of transit usage;

- significantly greater levels of general traffic congestion in key travel corridors than had been assumed in previous analyses;

- controls on parking in downtown Miami and development of outlying fringe parking facilities designed for "park-and-ride" commuter service; and,

- the implementation of land development policies consistent with activity forecasts and the Comprehensive Development Master Plan.

The 14 alternative system concepts developed by the consultants, together with background data, were presented to the Citizens Panels and Public Forums, the Transit Advisory Committee and the Public Officials Coordinating Council. After deliberation, the Citizens Panels developed comments and recommendations representing a consensus of Public Forums and resulting in seven additional recommended networks. Augmenting these, 20 alternatives from various sources were submitted for consideration by the Office of the Transportation Coordinator, increasing to 41 the number of alternatives for evaluation.

The 14 consultants' alternatives were then evaluated against a set of criteria developed to measure service levels, community disruption and displacement, system characteristics and costs. This preliminary screening was for the purpose of identifying the merits of the various alternatives so that the best features of each could be used as a guide in developing the core system of rapid transit.* A further, more detailed evaluation was made later as described below.

Next, the entire set of 41 alternatives was examined to determine corridor segments which were common to two or more alternatives, in effect a unification or synthesis of alternatives. The method of accomplishing this is illustrated by the matrix in Table 2. Each column of the table shows (by a dot opposite the applicable corridor segment) the corridor segments that comprise each individual network. An analysis of this table revealed that a substantial number of networks were similar to or contained in other networks and this is indicated at the base of the appropriate columns. Opposite each row at the left hand side of the table is the numerical summation of the number of networks in which a given corridor segment appears. This figure is, therefore, a general indication of the frequency of occurrence of a given corridor segment; if a figure of 13 or over appeared opposite any row, then it was considered that this corridor segment represented a two-thirds consensus. Figure 10 shows the corridor segments for which such consensus existed.

3. <u>Phase Two - Analysis and Evaluation</u>

This phase of the process first involved the establishment of a 1985 service network, defined as the recommended corridors for transit improvement which, together with appropriate networks of collector, feeder and on-street transportation, would be needed to meet the 1985 requirements of Dade County.

* See Appendix 3, Section A for a further description of this process.

TABLE 2 CORRIDOR SEGMENT ANALYSIS AND UNIFICATION

CORRIDOR SEGMENTS	SEGMENT FREQUENCY	KE-0	KE-1	KE-1a	KE-2	KE-2a	KE-3	KE-3a	KE-4	KE-4a	KE-5	KE-6	KE-7	KE-8	KE-10	CP-1	CP-2	CP-3	CP-4	CP-5	CP-6	CP-7	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8	T-9	T-10	T-11	T-12	T-13	T-14	T-15	T-16	T-17	T-18	M-1	C-1
I-95-NORTH: CBD to Golden Glades Interchange	30	●	●	●	●	●	●	●		●	●	●				●	●	◐	●	●		●	●	●	●	●	●	●	●					●	●		◐	●	⊗	●	●	●
CBD-NORTH: VIA N.W. 12th Ave., I-95, N.E.6th Ave. to N.E. 167 St.	5								●				●	●	●																											
FEC-NORTH: CBD to N.E. 167 St.	17				●	●											◐	●	●	●	●					●	●			●	●	●	●		◐	●	◐				●	
BROWARD COUNTY CONNECTION: Extensions north of Golden Glades	14															●	●	●	●	●	●	●	●	●	●									●				●	●	●		
FLAGLER: CBD to LeJeune/Douglas	34	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●	⊗		●	⊗	●	●	●	●	●	●	●	●	●	●	●	●	●	●				●	●	
FLAGLER: LeJeune/Douglas to Palmetto Expressway	13	●										●				●		●	●		●	⊗	●			●		●	●											●	●	
SOUTH DIXIE/FEC: CBD to LeJeune/Douglas	35	●	●	●	●	●	●	●	●	●	●	●	●				●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	
SOUTH DIXIE/FEC: LeJeune/Douglas to Cutler Ridge	41	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	◐	●	●	●	●	●	●	●	◐	◐	●	●	●	●	●	◐	●	●	●	
SOUTH DIXIE/FEC: South of Cutler Ridge	2																				●	●																				
MACARTHUR CAUSEWAY: CBD to South Beach	37	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●		●	●	●	●	●	●			●	●	●	●	
MIAMI BEACH: North to Sunny Isles	29	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●		●			●						◐	●			●	◐	●		
CBD-OKEECHOBEE RD.: VIA Civic Center & SCL	5											◐										●			●											●					●	
OKEECHOBEE RD.: To Red Road to Palmetto Expressway	21			◐		◐		◐		◐	◐			◐		◐	●			●					◐	◐	◐	◐			◐	◐				◐	◐	◐	⊗		●	
RED ROAD: North to Okeechobee Rd.	2																																				●	●				
EAST-WEST EXPRESSWAY: CBD to LeJeune/Douglas; to Palmetto	4															◐	●			●																		●				
LeJEUNE/DOUGLAS: South Dixie to Flagler St.	15	●					●	●						●	●	●	●	●		●				●				●									●	◐	●	●		
LeJEUNE/DOUGLAS: Flagler St. to Airport; to N.W.36 St.	30	●	◐	●	◐	●	◐	●	◐	●	●		◐	●	◐	●	●	●	●	●				●	●	●	●	●	●		●		●				●	⊗	●	●		
LeJEUNE/SCL: N.W.36 St. to Opa-Locka	11															●		◐	●	●				●	●		◐		◐				◐						●	●		
RT. 9/SCL: Opa-Locka to Golden Glades Interchange	5															●		●	●					●	●																	
N.W. 27 AVE.: To Opa-Locka	4											●					●	●				●																				
S.W.27 AVE.: To South Dixie	2																	●				●																				
N.E. 163/ 167 ST.: Golden Glades Interchange to Sunny Isles	20								◐		◐		◐	◐	◐	●	●	●	●			●	●	●	●	●	◐	●		◐				⊗	◐		◐			●		
GOLDEN GLADES EXPRESSWAY:	3																	●	◐			●																				
NORTH BAY CAUSEWAY:	3																					●					●						●									
N.W. 79 ST./FEC: To Okeechobee Rd.	16	◐	●		●		●		●			◐	●		●	●	●	◐	●			●					◐		●	●			◐									
JULIA TUTTLE CAUSEWAY:	6																	●	●										●			●				●	●					
AIRPORT EXPWY./N.W. 36 ST.: To LeJeune/Douglas	11	●										●				●		●	●										●			●			⊗	●	●	●				
N.W. 36 ST.: LeJeune/Douglas to Palmetto Expressway	1																		●																							
CORAL WAY:	3																																					●	●	●		
KENDALL DRIVE: West of Palmetto Expressway	4															◐		●		●	●																				●	
PALMETTO: North of Flagler St.	3																	●				●																				
PALMETTO: South of Flagler St.	3																	●			⊗	●																				
S.W. 117 AVE. To Kendall Drive	1																			●																						
SOUTH DADE EXPRESSWAY:	1																		●																							
RICKENBACKER CAUSEWAY:	2																●					●																				
		In: CP3	In: CP3, CP4	In: T3	In: CP3, CP4		In: CP3	In: T6	In: KE7	In: T3	In: CP3	In: CP3, CP7(1)									In: CP3(2)		In: CP3, CP4	In: CP3					In: CP3, CP4	In: CP3, CP4, T5	In: T5		In: T5	In CP3, CP4, T3	In: CP3, CP4	In: T10(1)				In: CP3(3)	In: CP3	In: T3

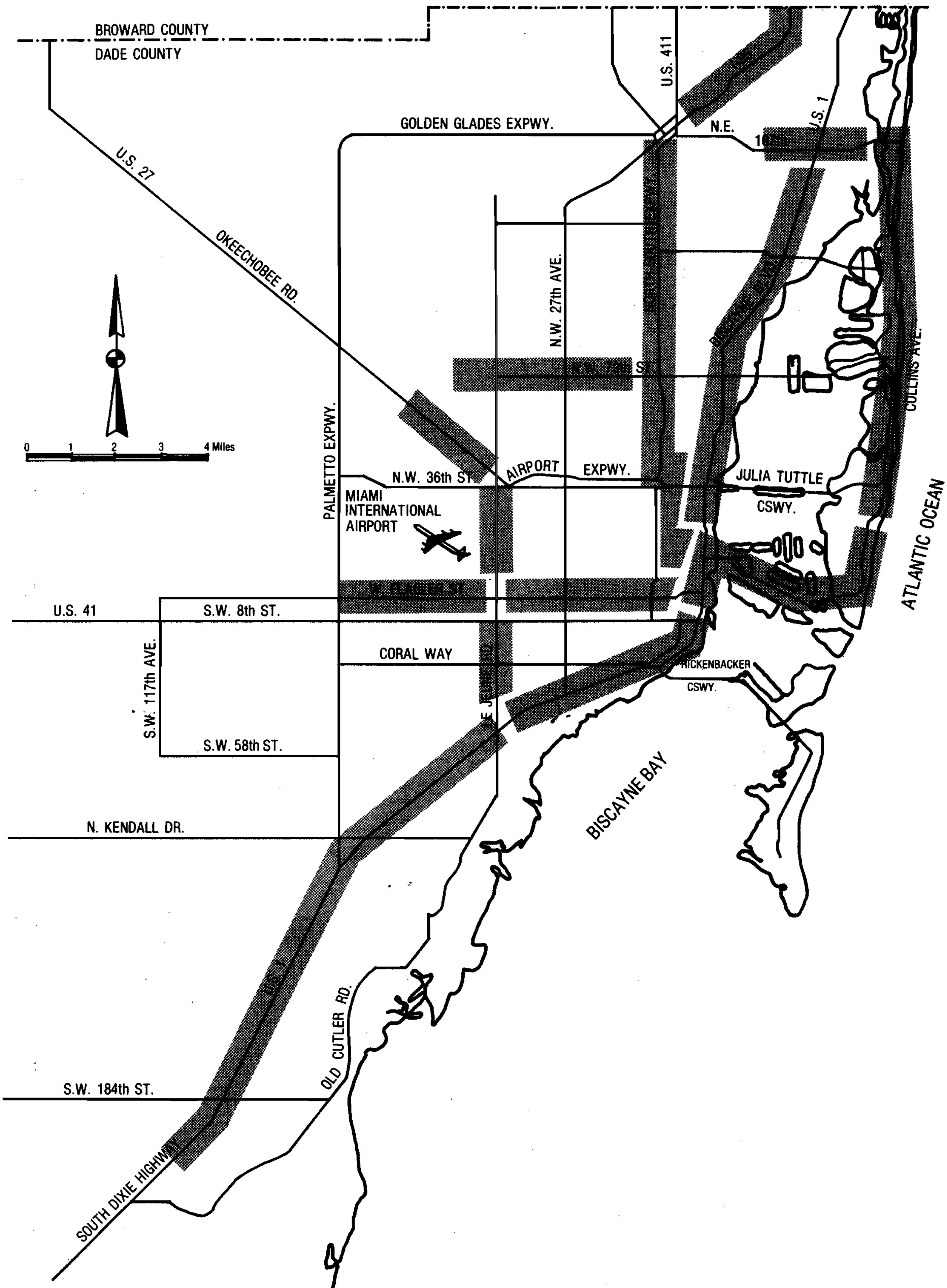
LEGEND:

- ● CORRIDOR SEGMENT
- ⊗ SIMILAR TO OTHER CORRIDOR SEGMENTS
- ◐ PART OF CORRIDOR SEGMENT

NOTES: (1) Variation between CBD and Okeechobee Road
(2) Except South Dixie, south of Cutler Ridge
(3) Except South Dixie, south of Cutler Ridge
(4) CP-1, 4, 5, 7 include extensions west of Palmetto

FIGURE 10

CONSENSUS CORRIDOR SEGMENTS



Development of the service network was based upon:

- the quantitative evaluation of the original 14 networks leading to a conclusion that a hybrid of three networks would appear to offer a system concept with an overall maximum desirability and cost effectiveness;

- the unification and qualitative analysis of the corridor segments contained in all 41 networks as reflected in Figure 10;

- the independent evaluation and analysis of all 41 networks made by the Transit Engineering Development Standing Committee of the Transit Advisory Committee;

- conformance with the recommendations of the Dade County Planning Department as reflected in the draft of the Comprehensive Development Master Plan.

The four separate corridor selection techniques above resulted in the development of a number of service corridors which appeared to be the rational choice of the citizens panels and technical, engineering and planning personnel from the consultant and County organizations. In connecting these corridors together to form the service network, a number of key objectives were kept in mind. These objectives included the desire to provide service to and thus reinforce the principal special and diversified activity centers within the county and also to provide service between these activity centers. A second key feature of the service network is that it will promote and support the other land use and development policies of the county particularly as they relate to the inception and growth of cohesive patterns of land use for 1985 and the year 2000. A further important element is the consideration of the Dade County system as part of a larger regional network serving Broward County and possibly Palm Beach County.

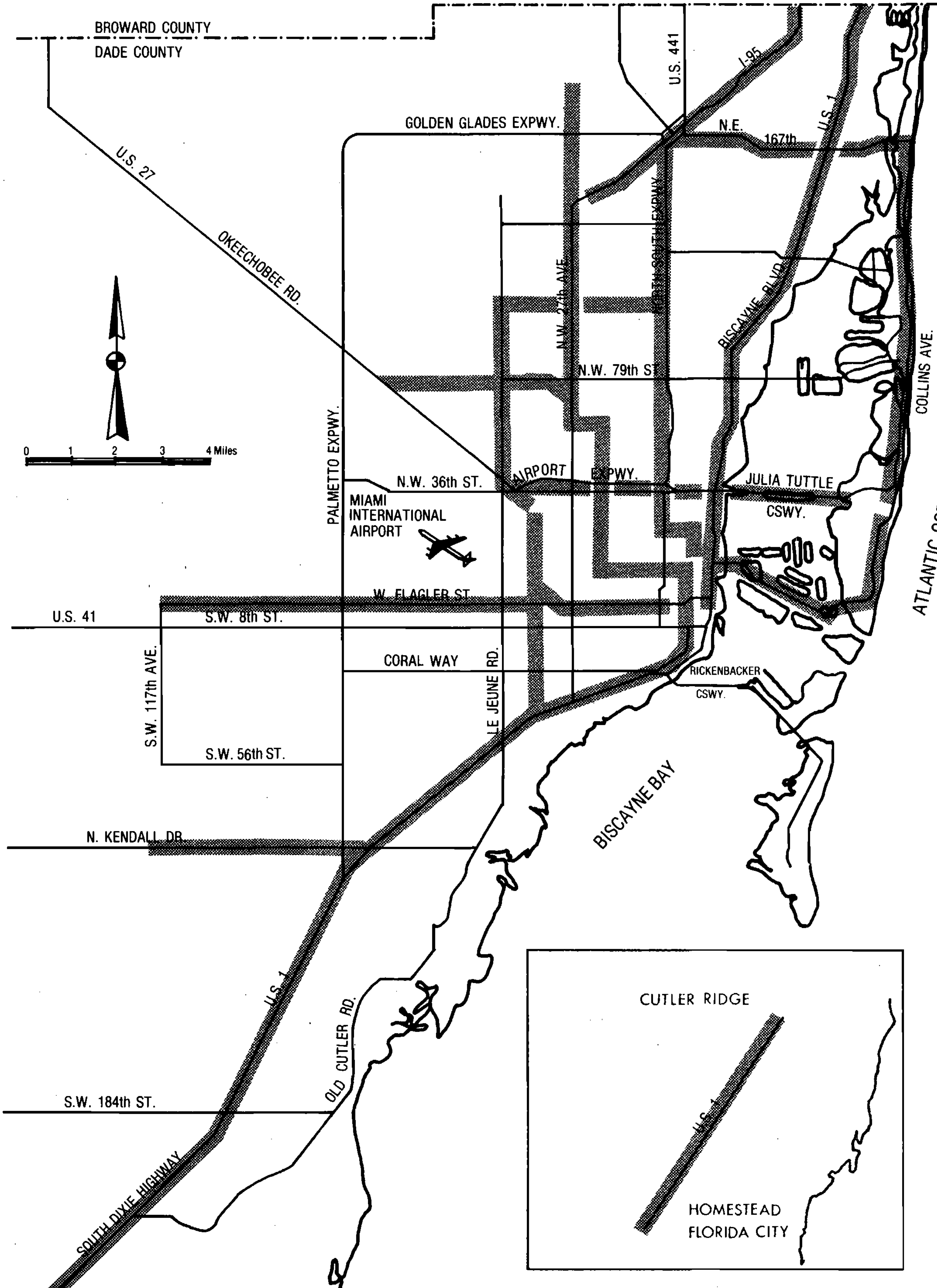
Following identification of the 1985 service network shown in Figure 11, which consists only of transit improvement corridors with no differentiation as to operational concept, this network was then examined to tentatively identify the core system, defined as the minimum rapid transit network that would sustain an integrated and balanced total transportation system for the 1985 travel requirements of the County.

For purposes of preliminary scaling and to identify the most logical directions for further analysis, corridors within the service network which might require grade-separated rapid transit service - i.e., the core system - were identified by comparison with the aims and objectives listed below and by extensive analysis of the alternative networks and transit requirements. The objectives used for this purpose were as follows:

a. <u>Activity Center Service and Reinforcement</u>
The core system should serve the County's principal major activity centers and should promote the reinforcement and interconnection among such areas.

FIGURE 11

THE 1985 SERVICE NETWORK



b. Conformance and Interconnection With and Support of the Non-transportation Elements of the Land Use and Development Plan
The core system should support, conform with, and sustain the extension of the land use and development plan so as to promote the inception of a cohesive pattern of land use in the County.

c. Operational Viability and Expandability
The core system should be operationally viable and capable of expansion within the service network of corridors with minimum disruption.

d. Key Link Inclusion
The core system continuity and integrity should be maintained by the inclusion of key links between segments which might not otherwise satisfy the general goals and objectives.

e. Current Programs
The core system should include use of the I-95 busway currently under construction by Florida Department of Transportation.

f. Accessibility
The core system should be within 10 minute feeder bus ride of 60 percent or more of the 1985 resident population of Dade County. This figure was established through an analysis of the network alternatives to determine what accessibility would be required in order to generate the modal split objective shown in g. below. This analysis identified the fact that based upon the sketch planning patronage analysis model and with the average travel speeds obtainable from a rapid transit system, an accessibility, as defined above, of approximately 60% would be required in order to achieve the modal split objectives. Thus this objective is not really an independent one, and should be viewed together with the modal split objective.

g. Modal Split
The core system should achieve a projected ridership level of 20 percent or more of the 1985 home based work trips and 10 percent or more of the 1985 nonwork trips. This figure was established using a number of inputs including an analysis of the network alternatives studied, a comparison of other U.S. cities with and without rapid transit to determine reasonable and achievable modal split objectives, and a review of the Miami Urban Area Transportation Study policy guidelines and Dade County Comprehensive Development Master Plan policies to determine approximate transit modal split requirements inferred by these studies and plans.

h. Radial Corridor Limitation
Fixed guideway, grade-separated rapid transit alternatives should not be extended to segments of the service network of corridors which are projected to carry less than 6,000 passengers per hour, peak load, peak direction.

Elements of the service network were tested against these objectives, beginning with a basic network of the three most heavily traveled corridors. These three corridors alone were found to fall far short of the core system objectives. Extensions to this basic network were then examined and tested for conformity with the objectives. Extensions were added to the basic network if they met the corridor objectives and contributed to achievement of the overall core system objectives. Extensions which did not meet the objectives were rejected.

The resulting core system essentially met the established objectives and provided the levels of service needed for 1985. The core system would be augmented by non-grade-separated systems, by improved mainline surface transportation along corridors of the service network not included in the core system, and by extensive networks of collector and feeder buses.

It is important to recognize that the use of these initial objectives to achieve a preliminary scaling of an appropriate Milestone 1 core system concept did not delimit or preempt later intensive analyses carried out during a series of 723 zone, fine grained patronage analyses which resulted in the final Milestone 8 concept and plan.

4. Phase Three - Refinement

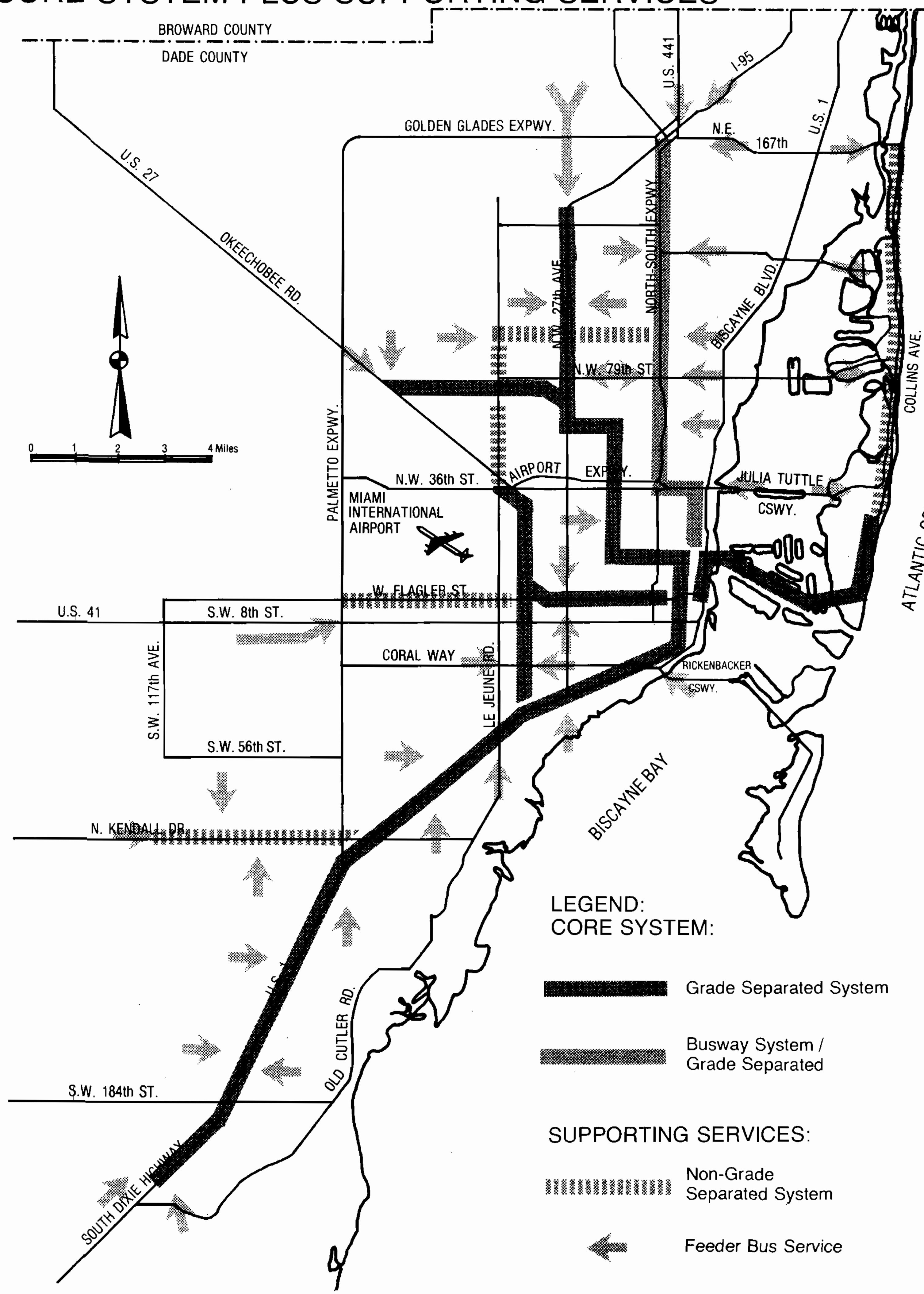
Development of the core system did not end with Milestone 1, and specific optimization analyses and inputs from the citizens' participation program during Milestone 5 resulted in modifications that became the basis for specific route alignments and station locations in the latter milestone. The core system as modified and as adopted by the County is shown in Figure 12.

5. Phase Four - Reanalysis

With the preliminary identification of the core system, the final phase of development and analysis consisted of a detailed evaluation of the system against other alternatives representing a wide range of capital costs and operational modes. A detailed description of this reanalysis is contained in the Environmental Impact Analysis. For this comparison, five of the 14 original system alternatives were selected as representing the full spectrum of reasonable low and high cost all-bus alternatives and low, medium and high cost alternatives containing varying amounts of non-grade separated transitways and grade separated busways or fixed guideway transit. To provide a point of reference and as required for the Environmental Impact Analysis, a "null" or quasi "do-nothing" transit system option was also examined.

FIGURE 12

CORE SYSTEM PLUS SUPPORTING SERVICES



a. Description of Alternatives

The five alternative systems selected for evaluation against the core system and null option were:

- Alternative 0 (as designated in Milestone 1) representing the low cost bus system.
- Alternative 10, representing the high cost bus system
- Alternative 3, representing the low cost fixed guideway system
- A combination of Alternatives 3a and 6 (a combination which rated highest in the original evaluation), representing a medium cost fixed guideway system, and
- Alternative 8, representing a high cost fixed guideway system.

The null option was represented by the existing surface bus system improved to the extent of the Short Range Development Program (1973-1977) already being implemented. This $17 million program (1973 $) calls for various service improvements, new buses, new routes, fare simplification measures, and new service for the disadvantaged.

The low cost all-bus alternative (Alternative 0) represented a low initial cost system designed to improve transit service through the full utilization of current busway and buslane improvements such as the I-95 Busway and the South Dixie Highway contraflow lane programs, and the introduction of other preferential bus treatment measures on other key arteries. The network (see Figure 13) includes 71 corridor miles of which approximately 10% would be the I-95 Busway currently under construction. The remainder of the network would be non-grade separated, and would make use of contraflow and reserved lanes on existing highways. Buses would provide collector service through local neighborhood areas adjacent to the corridors and would then run express to the downtown area to distribute passengers at various destinations.

The high cost all-bus alternative (Alternative 10) was a 59 mile network largely comprised of grade separated exclusive busway (see Figure 14). This bus system would operate in an express collector mode. Buses destined for the Central Business District, Civic Center, and Miami International Airport would first proceed on surface streets through residential areas, picking up passengers along the route, and would stop at satellite parking lots for park-and-ride patrons. Loaded buses would then enter the exclusive busway and proceed directly to destinations without stopping. Busway entry/exit points would serve specific zones. The I-95 Busway currently under construction would be utilized. The surface-street collector portion of the route would be comparatively short. The express-collector mode would be used only in peak periods when patronage density is high enough to fill a bus within the length of the collector portion of the route. Express-collector buses would operate from neighborhood origins in a corridor. Express buses would stop at zone transfer points only on demand to allow across-the-platform transfers to local shuttle buses. Local shuttle buses would operate on the busway at all times and would stop at all stations. Express buses would bypass local buses at nonzone transfer stations. Delays to the majority of patrons to their destinations would thus be minimized. Express feeder mode service would include the use of local neighborhood feeder buses which would take passengers to a station where they would transfer to an express bus to reach their destination.

The three basic fixed guideway configurations investigated all included a mix of both grade separated and non-grade separated elements. However, these alternatives were placed in the grade separated fixed guideway category because they contained varying amounts of this element in contrast to the all-bus alternatives previously described. Each was presumed to be complemented by a local surface bus collector/distributor fleet of a size consistent with current bus fleet projections.

The low cost fixed guideway system (Alternative 3) consisted of a 61½ mile network of which approximately 16 miles were grade separated fixed guideway system. The I-95 Busway was also included in the network (see Figure 15). Distribution of riders would be provided on a basic east-west rapid transit network with service extended to Coral Gables and Civic Center. The grade-separated fixed guideway system route would have branch connections parallel to N.W. 12 Avenue serving the Civic Center complex to approximately N.W. 36 Street and in the south corridor near Douglas Road to a junction with the contraflow bus lane operation along South Dixie Highway. Non-grade separated transitway corridors were used on the South, Miami Beach and Hialeah corridors. The grade separated fixed guideway system was of a conventional type with trains of vehicles stopping at each station along the various routes. The route from Miami International Airport would merge with the route from the south with grade-separated crossings of transit traffic. The branch parallel to N.W. 12 Avenue would connect to the East-West Corridor route by means of a three-way interchange with grade separation of transit traffic. Trains from Miami International Airport and the south branch would operate to the Civic Center area, Central Business District, and Miami Beach Convention Center and vice versa.

Two medium cost fixed guideway networks (Alternatives 3a and 6) were synthesized and are shown in Figures 16 and 17. The 3a alternative was very similar to network 3 except that the grade separated system was extended from Miami International Airport to the northwest to serve Hialeah rather than the non-grade separated service to Hialeah via the east-west route connection to the I-95 Busway. The 61½ mile network also replaced bus service on the south corridor with an at-grade trolley system. Alternative 6 is quite similar to 3a except that the configuration on the grade separated fixed guideway system to the west of the Miami CBD was altered and extended. The network included all other elements of network 3a including the I-95 Busway, zone express bus service on Miami Beach, and non-grade separated trolley service on the south corridor, and measured 75 miles in length.

The high cost fixed guideway alternative (Alternative 8) was a 58 mile network of grade separated fixed guideway rapid transit. The network (see Figure 18) was very similar to that developed by Simpson and Curtin in 1972 and was the basis for a rapid transit system bond issue approved by Dade County voters in 1972, and was used as a point of reference for the system requirements analysis undertaken. The high capacity, grade-separated, fixed guideway system would provide service in all corridors to meet demands of ridership attracted as a result of extensive network coverage. Grade-separated interchanges were provided for train movements at several junctions. These were a three-way interchange at the junction of the North and West Corridors, a junction of the South and West Corridors, and a two-way "y" at the Miami International Airport-Hialeah junction. Turnback switches were located at intermediate points in the routes to allow reversal of trains at transit load dropoff points and to achieve economy in operational costs. These turnbacks were located at such places as Dadeland, Model Cities, Miami Beach Convention Center and N. E. 163 Street.

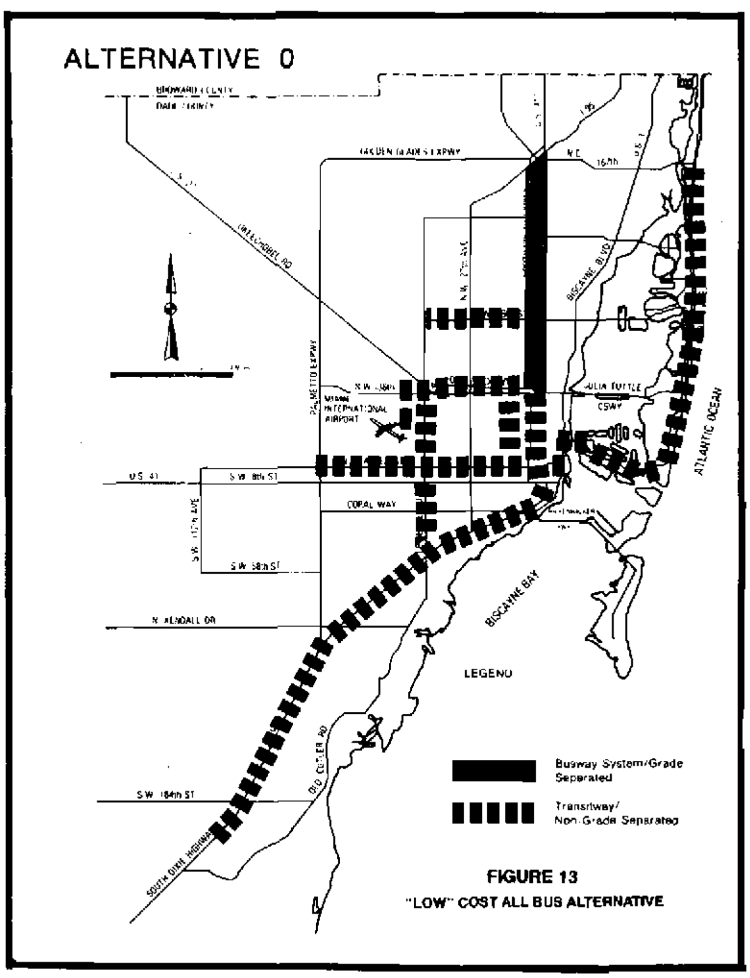


FIGURE 13
"LOW" COST ALL BUS ALTERNATIVE

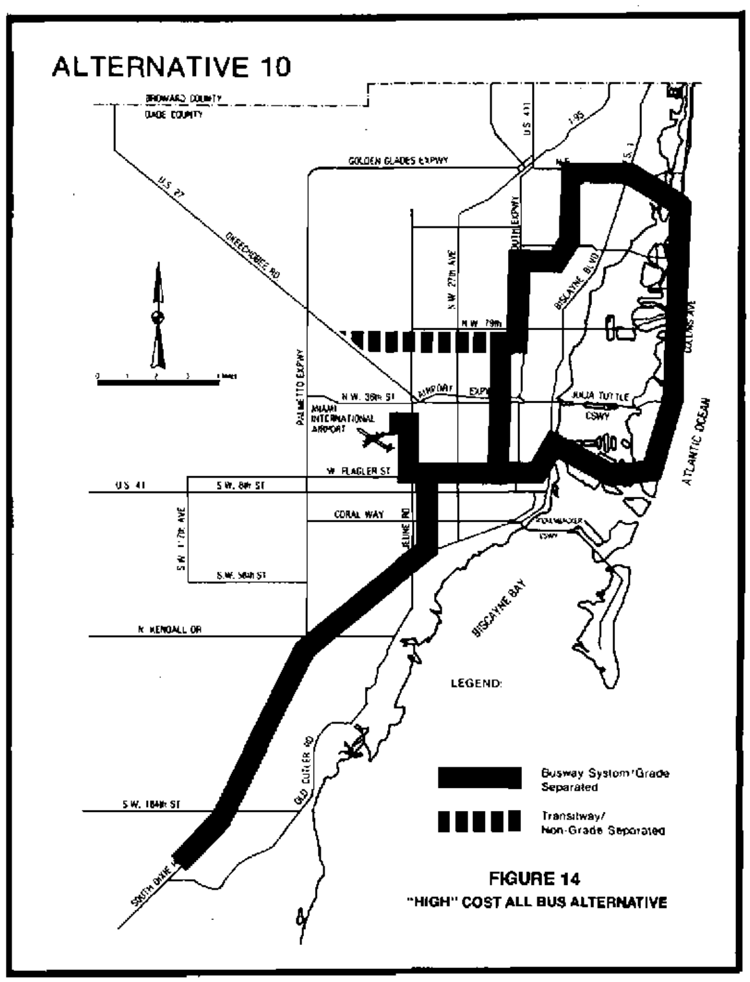


FIGURE 14
"HIGH" COST ALL BUS ALTERNATIVE

ALTERNATIVE 3

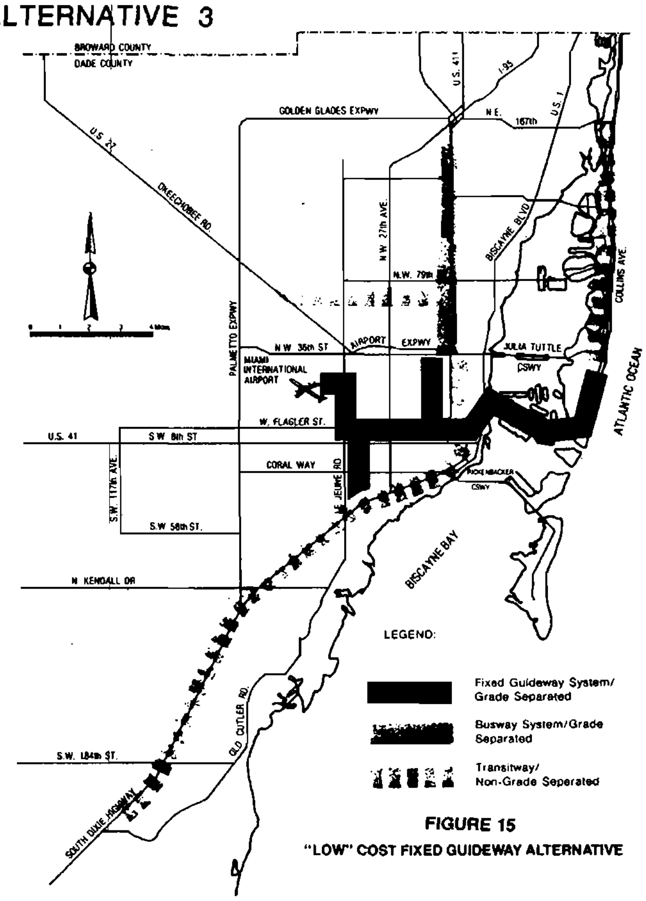


FIGURE 15
"LOW" COST FIXED GUIDEWAY ALTERNATIVE

ALTERNATIVE 3A

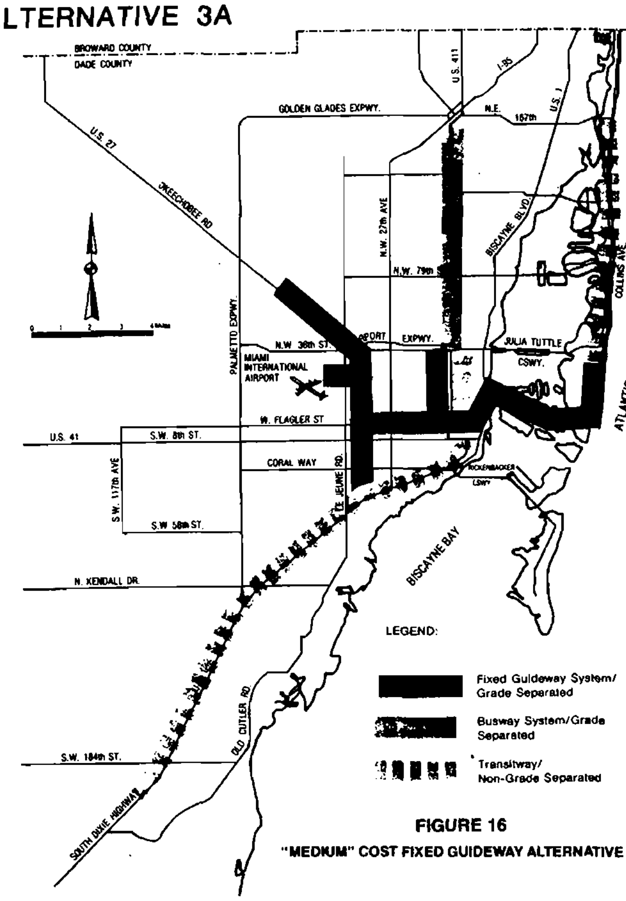


FIGURE 16
"MEDIUM" COST FIXED GUIDEWAY ALTERNATIVE

ALTERNATIVE 6

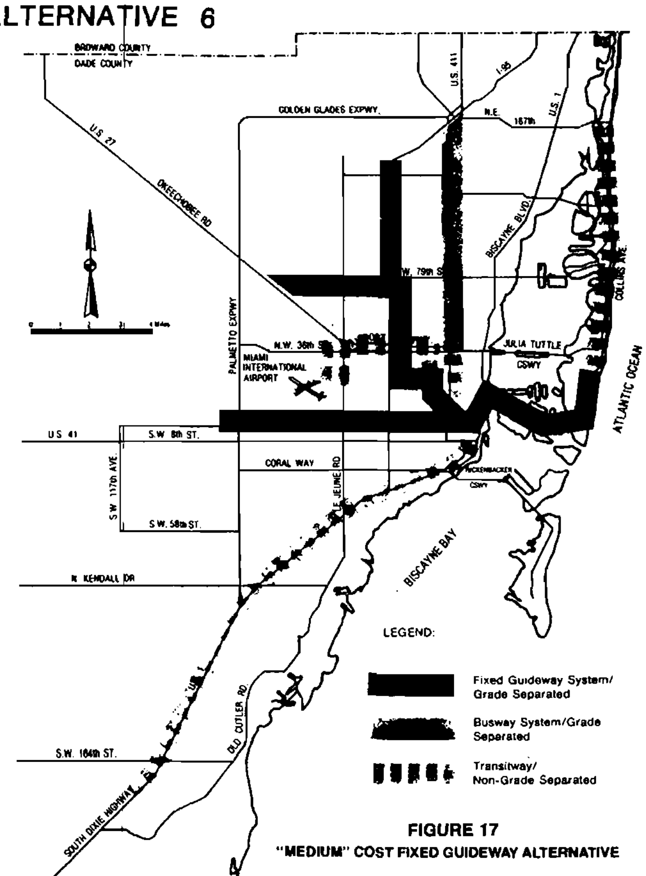


FIGURE 17
"MEDIUM" COST FIXED GUIDEWAY ALTERNATIVE

ALTERNATIVE 8

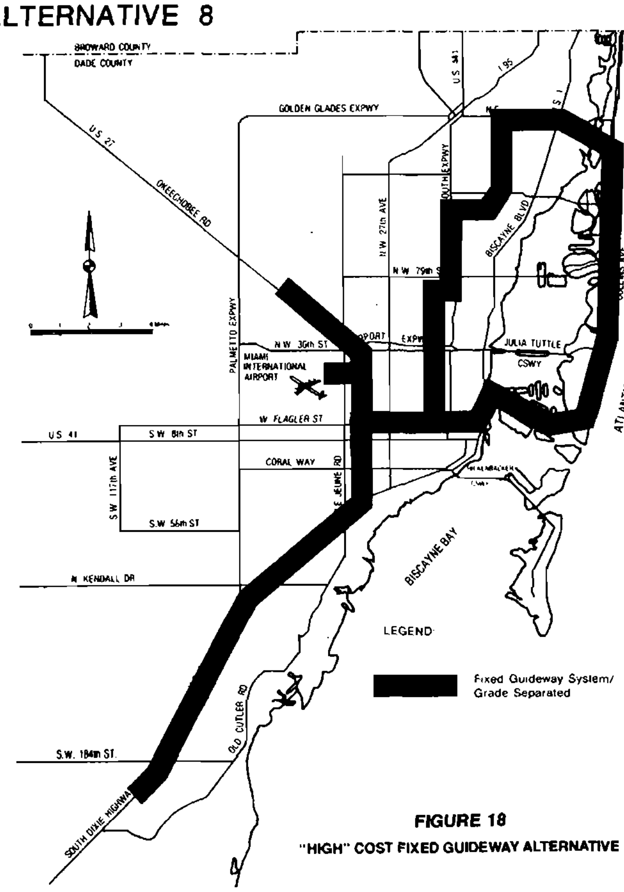


FIGURE 18
"HIGH" COST FIXED GUIDEWAY ALTERNATIVE

b. Evaluation Criteria and Methodology

The basic evaluative approach used included: first, the establishment of a set of criteria and characteristics deemed appropriate and relevant for the measurement of the desirability of any system alternative; second, the generation of values (or ratings, where only judgmental analysis could be made) for each criterion or characteristic for each of the system alternatives; and third, the qualitative and quantitative evaluation of each alternative system leading to the selection of a preferred alternative. This subsection describes the first two steps of this process, while the following subsection describes the third step.

To provide a consistent and systematic framework for evaluating the transit system alternatives, a set of evaluation criteria was developed. Criteria development was structured in such a way that the evaluation results conformed with requirements of the U. S. Department of Transportation's Urban Mass Transportation Administration External Operating Manual and the Environmental Protection Administration's procedures as derived from the National Environmental Policy Act of 1969. Seven major categories, resulting from factors appropriate and relevant to the evaluation, are listed below with sub-items considered.

- Service
  Projected Ridership
  Directness of Service
  Residential Accessibility
  Employment Accessibility
  Special Activity Accessibility

- Urban Planning
  Conformance with Existing Land Uses
  Compatibility with Adopted Plans and Policies
  Urban Design Considerations (Function, Form, Scale)

- Community Disruption and Displacement
  Residential Displacement
  Business Displacement
  Special Disruptions

- Environmental
  Air
  Noise
  Water, Microclimate, Vegetation, and Wildlife
  Visual/Aesthetic

- Energy
  Implementation Energy
  Propulsion Efficiency
  Energy Savings Due to Diversion from Autos

- <u>System Characteristics</u>
  Capacity Increase Potential ("Expandability")
  Network Extension Potential ("Extendibility")
  Safety from Accidents
  Reliability
  Security

- <u>Cost</u>
  Capital Cost
  Annual Operating and Maintenance Cost

Every attempt was made to restrict the criteria to only those which were relatively independent measures and to avoid measuring factors which were completely and directly dependent upon other characteristics or criteria already included in the list. There are obvious differences in the nature of the various criteria, some being purely quantitative and others largely qualitative. The quantitative evaluation parameters (for instance, the residential or business displacements), indicated impacts which were essentially additive in nature. The qualitative criteria, however, relied upon more subjective judgments and were therefore not additive. With regard to a criterion such as the visual/aesthetic effect, for example, there was a certain degree of overlap with principles established for other criteria such as urban design or special disruptions. While not intentionally structured in this manner, some overlap of this kind is inevitable in factors used for a system evaluation.

The generated values or ratings for each criterion were derived from a broad range of analytical techniques and professional judgments based upon the experience, exposure and study of the Dade County urban area and transit requirements. Specific techniques used to develop a value or rating for each criterion are described in detail in the Environmental Impact Analysis. This data formed the basis for evaluation of the system alternatives as delineated in the next subsection, and is shown for each alternative on Table 3. Final preliminary engineering data developed for the core system indicated some differences in values for certain of the evaluation parameters used. While in absolute terms these parameter differences may be significant, there is no evidence to suggest that the other system alternatives analyzed (subjected to the same level of preliminary engineering design) would not undergo equivalent changes. Thus the data contained in Table 3, though in some cases now known to be inaccurate in absolute terms, is valid and consistent for evaluation of system alternatives.

TABLE 3

EVALUATION OF TRANSIT SYSTEM ALTERNATIVES

EVALUATION CRITERIA/CHARACTERISTICS	"NULL OPTION"			ALL BUS						GRADE SEPARATED, FIXED GUIDEWAY									"CORE" SYSTEM		
	(723 Zone Run)			"Low Cost" (Alt. 0)			"High Cost" (Alt. 10)			"Low Cost" (Alt. 3)			"Medium Cost" (Alt. 3a/6 (Avg.))			"High Cost" (Alt. 8)			(Alt. 22)		
	VALUE/ RATING	NORMALIZED INDEX METHOD A	NORMALIZED INDEX METHOD B	VALUE/ RATING	NORMALIZED INDEX METHOD A	NORMALIZED INDEX METHOD B	VALUE/ RATING	NORMALIZED INDEX METHOD A	NORMALIZED INDEX METHOD B	VALUE/ RATING	NORMALIZED INDEX METHOD A	NORMALIZED INDEX METHOD B	VALUE/ RATING	NORMALIZED INDEX METHOD A	NORMALIZED INDEX METHOD B	VALUE/ RATING	NORMALIZED INDEX METHOD A	NORMALIZED INDEX METHOD B	VALUE/ RATING	NORMALIZED INDEX METHOD A	NORMALIZED INDEX METHOD B
1) Service (Units of Value)																					
• Ridership ("mean", daily persons)	317,000	0.38	0.00	388,000	0.46	0.14	734,000	0.88	0.80	800,000	0.96	0.93	805,000	0.96	0.94	731,000	0.87	0.80	836,000	1.00	1.00
• Directness of Service (no. of transfers and/or mode changes per trip)	3.0 (based on Alt. "0")	0.87	0.33	3.0	0.87	0.33	3.2	0.81	0.00	3.1	0.84	0.17	2.8	0.93	0.67	2.7	0.96	0.83	2.6	1.00	1.00
• Residential Accessibility (no. of people within 10 min. access)	208,300	0.20	0.00	920,000	0.90	0.87	1,022,000	1.00	1.00	965,000	0.94	0.93	899,000	0.88	0.85	983,000	0.96	0.95	988,000	0.97	0.96
• Employment Accessibility (no. of jobs within 5 min. walk)	144,300	0.44	0.00	153,000	0.47	0.05	327,000	1.00	1.00	244,000	0.75	0.55	235,000	0.72	0.50	231,000	0.71	0.47	251,000	0.77	0.58
• Special Activity Accessibility *	115	0.28	0.00	217	0.52	0.34	413	0.99	0.99	407	0.98	0.97	373	0.89	0.85	411	0.99	0.98	417	1.00	1.00
2) Urban Planning																					
• Conformance with Existing Land Uses * (1)	50	1.00	1.00	181	0.28	0.72	389	0.13	0.27	382	0.13	0.28	438	0.11	0.16	392	0.13	0.26	512	0.10	0.00
• Compatibility with Adopted Plans & Policies *	20	0.25	0.00	30	0.37	0.17	57	0.71	0.62	50	0.62	0.50	56	0.70	0.60	61	0.76	0.68	80	1.00	1.00
• Urban Design Considerations (function, form, scale)	0	0.00	0.00	82	0.73	0.73	92	0.82	0.82	100	0.89	0.89	98	0.87	0.87	112	1.00	1.00	109	0.97	0.97
3) Community Disruption and Displacement																					
• Residential (no. of people) (2)	0	1.00	1.00	0	1.00	1.00	5,890	0.41	0.16	1,310	0.87	0.81	1,265	0.87	0.82	6,020	0.40	0.15	7,041	0.30	0.00
• Business (no. of employees) (2)	0	1.00	1.00	0	1.00	1.00	7,300	0.27	0.00	6,170	0.38	0.15	6,595	0.33	0.10	7,270	0.27	0.00	6,130	0.39	0.16
• Special ("4-f's") (3)	0	1.00	1.00	0	1.00	1.00	91	0.09	0.00	62	0.38	0.32	65	0.35	0.29	88	0.12	0.03	63	0.37	0.31
4) Environmental																					
• Air *	0	0.00	0.00	52	0.53	0.53	69	0.70	0.70	80	0.82	0.82	90	0.92	0.92	89	0.91	0.91	98	1.00	1.00
• Noise * (4)	0	1.00	1.00	-12.4	0.50	0.41	-21.0	0.16	0.00	-12.2	0.51	0.42	-13.7	0.45	0.35	-17.4	0.30	0.17	-13.2	0.47	0.37
• Other (5)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
• Visual/aesthetic * (1)(6)	0	1.00	1.00	0	1.00	1.00	125	0.17	0.02	46	0.69	0.64	57	0.62	0.55	127	0.15	0.00	116	0.23	0.09
5) Energy																					
• Implementation (kwh x 10^6)	30	1.000	1.00	200	0.150	0.98	5,200	0.006	0.31	2,800	0.011	0.63	4,300	0.007	0.43	7,500	0.004	0.00	6,400	0.005	0.15
• Propulsion (kwh/pass-mi)	0.117	0.83	0.13	0.097	1.00	1.00	0.097	1.00	1.00	0.106	0.91	0.61	0.098	0.99	0.96	0.120	0.81	0.00	0.113	0.86	0.30
• Energy saving due to diversion from autos (kwh yr. x 10^6)	48	0.16	0.00	126	0.43	0.31	179	0.60	0.53	245	0.83	0.79	283	0.96	0.95	158	0.53	0.44	296	1.00	1.00
6) System Characteristics																					
• Capacity Increase Potential ("Expandability" - $) *	20	0.20	0.00	50	0.50	0.37	37	0.37	0.21	74	0.74	0.67	74	0.74	0.67	100	1.00	1.00	92	0.92	0.90
• Network Extension Potential ("Extendibility") *	92	1.00	1.00	92	1.00	1.00	65	0.71	0.69	52	0.57	0.54	55	0.60	0.57	5	0.05	0.00	50	0.54	0.52
• Safety from Accidents *	36	0.44	0.00	43	0.53	0.15	62	0.76	0.57	52	0.64	0.35	65	0.79	0.63	82	1.00	1.00	80	0.98	0.96
• Reliability *	5.4	0.68	0.00	5.4	0.68	0.00	7.9	1.00	1.00	6.3	0.80	0.36	6.4	0.81	0.40	7.2	0.91	0.72	7.2	0.91	0.72
• Security (7)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7) Cost																					
• Capital (1974 $'s x 10^6)	17	1.00	1.00	61	0.28	0.96	635	0.03	0.46	465	0.04	0.61	698	0.02	0.41	1,166	0.01	0.00	869	0.02	0.26
• O & M (1974 $'s x 10^6) (8)	26.0	1.00	1.00	38.7	0.67	0.56	52.3	0.50	0.08	54.7	0.48	0.00	53.8	0.48	0.03	48.7	0.53	0.21	52.3	0.50	0.08

NOTES:

* Figure in left column is a numerical rating assigned to a qualitative characteristic. Detailed discussion of methods of assigning ratings and calculating normalized indices is contained in Appendix B of Environmental Impact Analysis. (See bibliography)

(1) Higher rating produces lower index.

(2) For Method A, a value of 0 displacements is assigned index of 1.00. A value of 10,000 displacements results in index of 0.00.

(3) For Method A, a value of 0 special disruptions is assigned index of 1.00. A value of 100 special disruptions results in index of 0.00.

(4) For Method A, a rating of 0 is assigned index of 1.00. A rating of -25.0 results in index of 0.00.

(5) Includes considerations of water, microclimate, vegetation and wild life which were judged to have insignificant levels of impact among alternatives considered.

(6) For Method A, a rating of 0 is assigned index of 1.00. A rating of 150 results in index of 0.00.

(7) Judged not to be significant between alternatives considered.

(8) All figures include $22 million for operation of existing MTA bus fleet.

c. Evaluation of Alternatives.

Both a qualitative and quantitative analysis of the system alternatives was prepared.

Qualitative Discussion. This discussion is based upon the description of the system alternatives given above, and upon the data contained in Table 3. If transit were to "hold its own" with respect to its current share of the total travel market, a demand level in the 275,000 to 300,000 trips a day range might be expected in 1985. This level is derived by projecting current transit usage forward on the basis of the overall increase in person trips in the county, and does not account for any short range improvements such as those included in the "null option" definition.

The null option reflects as near to a do-nothing option as can be practically synthesized. A 723 zone patronage analysis of the null option generated a weekday patronage of 317,000 persons. As would be expected, this was the lowest figure of any network for which patronage estimates were developed. The directness of service for this option was estimated at 3.0 based upon data obtained from the analysis of alternative "O". Residential employment and special activity accessibility were substantially below any other alternative. In the Urban Planning category, the "null option" conformed with existing land uses best of any alternative due to the complete lack of new structures involved in the operation of this network. In terms of compatibility with adopted plans and policies and urban design considerations, the "null option" was judged the poorest of all alternatives. It simply did not support the adopted comprehensive land use plan for the county or the accepted MUATS policies. The network involved no displacements of any kind. The environmental category consisted, for comparison purposes, of air, noise and visual/aesthetic factors and the null option was the least attractive alternative for the first category and the most attractive for the latter two. This was basically due to the fact that this option removed the least number of automobiles from the highway but involved absolutely no new construction and very little new bus traffic. In the energy category, this alternative required the least implementation energy and the lowest energy savings due to diversion of passengers from autos. System characteristics were very similar to the existing MTA operation, and the capital and O & M costs were the lowest of all alternatives.

The low cost bus alternative (Alternative O) relied upon an extensive application of bus lane priority programs on existing highways in major travel corridors. Under 1985 projected total trip levels, an analysis of this alternative using sketch planning techniques, revealed that transit ridership of approximately 388,000 per day (mean value) could be generated. Operation of the network could only be achieved by preferential treatment for buses at all signalized intersections which could cause substantial disruption to surface traffic crossing the travel corridors. Although not measured as an evaluation characteristic, this effect might seriously disrupt other traffic movements and result in lack of public acceptance for operation of the concept. Residential accessibility was judged reasonable, but employment and special activity center accessibilities were the next to lowest of those estimated for the alternatives presented. The directness of service figure provided by this alternative reflected a reasonable figure for improved surface transit.

In the urban planning category, this alternative appeared relatively attractive and was judged to have the least conflict with existing land uses due to the fact that it involved very little new construction. This judgment also reflected the zero displacements caused by the system and the very low potential land use conflicts generated around bus station or bus stop locations. Because the alternative used corridors identified on the Dade County "Proposed 1985 Metropolitan Development Pattern" as those for which mass transit improvement is appropriate, it was deemed, to that extent, to be in conformance with future land use plans. However, in more general terms, alternative "0" was judged not to be compatible with existing plans and policies, and thus received the next to lowest rating for this important factor. When measured against various urban design considerations, the low cost bus network was judged as a relatively poor alternative.

In the environmental category, this all bus alternative was judged to result in a very slight overall improvement in ecological conditions mainly due to the reduction of auto mileage. Noise levels adjacent to highways used by the bus routes would worsen somewhat from levels currently experienced. On the visual/aesthetic characteristic, this all bus network was judged not to make any impact. In energy measures, the implementation energy and propulsion efficiency were among the lowest of the alternatives presented, but the low ridership carried by this network was reflected in the very low energy savings due to passenger trip diversion from autos.

For the system category, the low cost all bus alternative was judged to have a medium potential for capacity increase, a very high potential for route extension (a valuable feature of bus systems) and a somewhat lower reliability and safety than all other alternatives (except the "null option"), due to use of existing highways with the potential for service disruption and accident caused by other road users. As would be expected, this alternative had the next to lowest estimated costs (capital, and operating and maintenance).

The high cost bus alternative (Alternative 10) utilized a network of exclusive grade separated busways and offered service characteristics especially suited to commuter type journeys. In the service characteristics category, the sketch planning analysis of ridership for the network, generated a figure of 734,000 persons (daily mean value). This figure was about twice that generated by the low cost bus alternative, but was below other alternatives presented. Because of the extensive nature of the bus network, the residential and employment accessibility offered by this alternative was the highest of any alternative shown. The express and commuter nature of much of the service offered leads to the poor directness of service offered by alternative 10. This directness of service measure is an important characteristic for Dade County trips because of the large proportion of non-work trips in the total trip table for 1985 (76% of inter-district trips are non-work trips). Non-work trips tend to have trip ends spread over the County much more than work trips which tend to have one end of the trip located at major employment centers such as the CBD, Civic Center and Airport. Thus the commuter nature of much of the service offered by this bus alternative was (as reflected in the patronage and directness of service characteristics) not well matched to the projected trip patterns.

In the Urban Planning categories, this alternative has been judged very similar to the most extensive fixed guideway alternative. Conformance with existing land uses, was estimated to be substantially less attractive than the low cost bus alternative and very similar to the low and high cost fixed guideway networks. This was due to the large amounts of new structure construction involved with this alternative. The compatibility of this alternative with adopted plans and policies was judged reasonable, and from an urban design considerations viewpoint this bus network was considered least attractive of the higher ridership networks.

Alternative 10 was the worst network in terms of community disruption and displacement, and caused high levels of displacement in all three factors estimated. In the environmental category, the alternative was judged reasonable from an air quality impact viewpoint but very poor in terms of noise and visual/aesthetic impact due to the large numbers of buses required to operate the network and substantial visual impact of the extensive busway structures. In the energy conservation area, the alternative was estimated to have a relatively high implementation energy requirement, a good propulsion efficiency, and a medium level of energy savings due to diversion from autos.

The system category characteristics of reliability and safety were judged equivalent or better than the grade separated fixed guideway systems. However, the extendibility of the network was judged somewhat superior to the fixed guideway high cost network. Of more significance was the expandability of the system which was judged substantially lower than all the fixed guideway systems. In many corridors, the busway operational concept did not have sufficient capacity to carry the expected peak hour loads and thus had no capacity increase potential. This limitation in additional passenger carrying potential, is an inherent limitation in busway operations which tends to prevent the application of this concept for major travel corridors. A further restriction on passenger carrying capacity is the size of terminal facilities at major activity areas such as the CBD. The relatively slow load and unload times associated with bus vehicles, and the large number of such vehicles required in peak hour operations, impose substantial requirements for terminal and ramp structures in the downtown area.

Capital cost of the network was in the middle of the range estimated for all alternatives. Costs did not reflect any changes in the busway operational concept required to make the network fully feasible.

The low cost fixed guideway grade separated alternative (Alternative 3) had good service characteristics with ridership being one of the highest of all alternatives developed. The accessibilities were at the high end of the range of values developed for this significant characteristic. However the directness of service was one of the highest reflecting the substantial transfer requirements imposed by the configuration of the system. In the urban planning category, this alternative was judged to have poor conformance with existing land uses, a medium level of compatibility with adopted plans, and policies, and a reasonable rating under the urban design factor. Construction of the network would have required some residential displacement, and a fairly high level of business displacement.

From an environmental viewpoint, this network was similar to all other fixed guideway alternatives in that a slight improvement in overall ecological conditions was judged to occur as a result of implementation of the system. On visual/aesthetic grounds, this alternative ranks below the "low" cost all bus network, but ranks substantially better than the "high" cost bus or fixed guideway systems. The figures estimated for this alternative for the energy factor show a fairly high implementation energy requirement, and reasonable propulsion efficiency and energy savings figures.

The system characteristics for this alternative showed reasonable figures for extendability (though well below those of the "low" cost bus alternative), reliability and safety from accidents. However, and this is a major deficiency of this network, certain corridors have a zero capacity for increased passenger trips and in fact would not be capable of carrying the peak hour line volumes initially generated. More specifically, peak hour passenger loads on the network's only corridor to the north (the I-95 busway), would exceed the operational capacity of such a concept. Further, peak hour loads on the south corridor of the network would also exceed the practical limit of the transitway concept. However, the east-west corridor would have substantial capacity increase potential. These factors must be borne in mind when reviewing the cost characteristics for this system which reflect the original operational concepts employed in the north and south corridor and do not take account of the revision in concepts (and cost increases thereby incurred) that would be required to make this network completely feasible.

The two medium cost fixed guideway alternatives (Alternatives 3a and 6) exhibited fairly similar values for most evaluation characteristics and have thus been combined into one column on Table 3, with an average value for each characteristic being shown. This discussion thus deals with the average value for both alternatives. In the service category, the averaged ridership figures for the two networks were the highest of the alternatives shown. The range of figures for the accessibility characteristics reflected high values, but again not as high as the "high" cost all bus alternative. The directness of service reflected a network on which longer trips could be made without transfers. In the urban planning category, the lack of conformance with local land uses for this alternative were judged to be medium to substantial due to the extensive construction and displacements required to implement the network. The combined networks were judged to conform well with the adopted metropolitan development pattern and was judged reasonable from an urban design considerations viewpoint. Displacements required were very similar to the low cost fixed guideway alternative.

For the environmental characteristics as a whole, this alternative offered reasonable characteristics, neither outstanding nor deficient. In the system characteristics section, the network was similar to the low cost fixed guideway system in that peak hour demand levels on the south corridor exceeded the practical capacity of the transitway operational concept and thus expandability of that portion of the network would be zero. However, the extendibility, reliability and safety characteristics of this alternative were reasonable middle value figures. In a similar fashion to the previous alternative discussed, the cost categories did not reflect any revision of the original operational concept on the south corridor.

The high cost fixed guideway alternative (Alternative 8) generated ridership very similar to the high cost bus alternative but below that of the low and medium cost fixed guideway alternatives. The accessibility figures were equivalent to the other fixed guideway systems. As would be expected with this extensive network, the directness of service measure was good.

In the urban planning category, this alternative was judged equivalent to the low cost fixed guideway alternative in terms of conformance with existing land uses. Displacement caused by implementation of this network was estimated to be the highest of all the alternatives presented, but the network was judged to be in close conformance with the adopted metropolitan development pattern. In environmental terms, the alternative was judged to be very similar to others in that a long term improvement in air quality (due to reduced auto mileage) was balanced by an increase in noise levels in certain areas. The visual/aesthetic characteristic was based upon the complete elevation of all guideway sections for this network, and was the highest (or most adverse) figure for any alternative presented. The implementation energy requirements were also estimated as the highest of any alternative while the propulsion efficiency was estimated the lowest of any alternative. Energy savings due to diversion of person trips from autos, was estimated to be lower than all alternatives except the low cost bus network and null option.

In the system category this alternative had good expandability but very poor extendibility due to the loop configuration of a major part of the network. The reliability and safety from accidents characteristics were estimated at the top end of the values developed for the various alternatives. The long network and large vehicle fleet requirements were reflected in the high capital cost of the alternative.

The core system (Alternative 22) included fixed guideway, busway and non-grade separated transitway elements as described in section III of this document. This alternative generated a mean daily ridership of 836,000, the highest figure for any alternative. The directness of service was also the best of any alternative reflecting the extensive analysis underlying the configuration of this network. Residential, employment and special activity accessibility were equivalent to the "low" and "high" cost fixed guideway alternatives, but somewhat below the "high" cost bus alternative. In the urban planning category this alternative had the least conformance with existing land uses but the highest compatibility with adopted plans and policies. It was also judged highly from an urban design considerations standpoint. Displacements caused by construction of alternative 22 would be considerable.

This alternative ranked reasonably well from an environmental viewpoint. It was judged to have the most beneficial effect on air quality of any alternative analyzed, to have some noise impact (but substantially less than the "high" cost bus alternative) and to have a fairly high visual/aesthetic impact due to 51 miles of new elevated structures (fixed guideway and busway). In the energy category, alternative 22 has the next to highest implementation energy and next to lowest propulsion efficiency, however the alternative provides the greatest overall energy savings due to diversion of passengers from automobiles. The network ranks well from a system characteristics point of view with capacity increase potential limited to 50% on only the busway portion of the system. Network extension potential was reasonable and the safety and reliability were high. In the cost category, the substantial capital cost was well below the high cost fixed guideway alternative but above all other alternatives. The annual operating and maintenance cost was equivalent to the high cost bus alternative and below the low and medium cost fixed guideway alternatives.

Quantitative Analysis. To complement the foregoing qualitative discussion, a numerically based evaluatory analysis was performed. This analysis provided measures to compare alternatives by placing all of the evaluation factors on an equivalent numerical basis. This approach was used recognizing that dissimilar judgements and assumptions as to the relative comparability of unlike factors may arise, and must therefore be viewed with such difficulties in mind. Notwithstanding these reservations, the numerical analysis provided a second approach to the evaluation of alternatives and was a useful supplement to the qualitative discussion.

The numerically based analysis utilized two normalized indices for each of the evaluation sub-factors. These indices were generated by two separate methods, Method A and Method B. The normalized indices thus developed are shown on Table 3. The Environmental Impact Analysis contains a detailed description of the development of normalized indices by Methods A and B for all sub-factors of all alternatives.

- Method A used a purely comparative scale with an index of 1.00 being assigned to the "best" alternative, with the indices for all other alternatives being determined by comparison of the value or rating of a given alternative to the value or rating of the "best" alternative.

- Method B used an absolute scale where the "best" alternative received an index of 1.00 and the "worst" alternative received an index of 0.00. Alternatives in between were assigned an index based upon their position on the scale between the "worst" and the "best".

The next point in the development of the numerically based analysis involved the generation of a weighting scheme for the sub-factors of a given evaluation category. These sub-factor weightings were developed by the professional staff involved in the preparation of the value or rating for the sub-factor, and thus reflected a purely professional weighting. A further set of weights was developed for the seven major evaluation factors. In this instance, the weighting set was developed from the average of individual weighting sets prepared by fourteen persons reflecting a broad range of professional backgrounds. Weighting sets were provided by members of the consultants team, by members of the Office of the Transportation Coordinator, by a member of the citizen participation program, and by members of other Dade County departments and agencies. Table 4 shows the sub-factor weights and major factor weights thus developed.

Table 5 shows a summary of the total score developed for each alternative by Methods A and B, using

1) raw normalized indices with each sub-factor receiving equal weight,

TABLE 4

EVALUATION SUB-FACTOR AND MAJOR FACTOR WEIGHTS

	Sub-Factor Weight	Major Factor Weight
1) Service		1.54
Ridership	2.14	
Directness of Service	0.68	
Residential Accessibility	0.76	
Employment Accessibility	1.00	
Special Activity Accessibility	0.42	
2) Urban Planning		1.19
Conformance with Existing Land Uses	0.72	
Compatibility with adopted plans and policies	1.53	
Urban Design Considerations (Function, Form and Scale)	0.75	
3) Community Disruption and Displacement		0.91
Residential	1.44	
Business	1.11	
Special	0.45	
4) Environmental		0.84
Air	1.29	
Noise	1.05	
Other (Water, vegetation, wild life, microclimate)	—	
Visual/aesthetic	0.66	
5) Energy		0.63
Implementation	0.51	
Propulsion	1.02	
Energy saving due to diversion from autos	1.47	
6) System Characteristics		0.77
Capacity Increase Potential ("Expandability")	0.68	
Network Extension Potential ("Extendibility")	0.60	
Safety from Accidents	1.36	
Reliability	1.36	
Security	—	
7) Cost		1.12
Capital	0.74	
O & M	1.26	

2) sub-factors weighted only, and

3) both sub-factors and major factors weighted.

Table 6 shows a ranking of system alternatives based upon these scores.

TABLE 5

TOTAL SCORES FOR SYSTEM ALTERNATIVES

SYSTEM ALTERNATIVE	Raw Indices		Sub-Factors Weighted Only		Sub-Factors and Major Factors Weighted	
	Method A	Method B	Method A	Method B	Method A	Method B
"Null Option"	1473	1046	445.6	321.9	436.6	311.4
"Low" Cost Bus (0)	1487	1362	439.9	393.9	431.3	376.7
"High" Cost Bus (10)	1311	1123	395.3	329.2	410.1	339.7
"Low" Cost Fixed Guideway (3)	1478	1294	450.4	379.5	454.5	382.6
"Medium" Cost Fixed Guideway (3a/6)	1500	1352	465.0	393.6	464.4	394.4
"High" Cost Fixed Guideway (8)	1337	1060	408.3	306.5	422.3	329.3
"Core" System (22)	1531	1333	469.9	391.3	477.3	405.1

General Note: Higher value is better

TABLE 6

RANKING OF SYSTEM ALTERNATIVES BASED ON NUMERICAL ANALYSIS

SYSTEM ALTERNATIVE	Raw Indices		Sub-Factors Weighted Only		Sub-Factors and Major Factors Weighted	
	Method A	Method B	Method A	Method B	Method A	Method B
"Null Option"	5	7	4	6	4	7
"Low" Cost Bus (0)	4	1	5	1	5	4
"High" Cost Bus (10)	7	5	7	5	7	5
"Low" Cost Fixed Guideway (3)	3	4	3	4	3	3
"Medium" Cost Fixed Guideway (3 a/6)	2	2	2	2	2	2
"High" Cost Fixed Guideway (8)	6	6	6	7	6	6
"Core" System (22)	1	3	1	3	1	1

General Note: 1 is top rank

d. The Preferred Alternative

The results of the quantitative/qualitative analysis conducted for the seven alternatives clearly indicated the merit of the system configured and designated as the core system network. This conclusion was reached in the context of goals and objectives established by the MUATS, by the Comprehensive Development Master Plan recently adopted by the County and by the service criteria established in Milestone 1 of this preliminary engineering program. The dominance of analysis data for the core system is not surprising in that the core system developed from the evolution process of alternative system networks. Every effort was made to adapt the best points of candidate alternatives to the core system, screen out shortcomings and weak points and optimize system requirements for the area's transit needs. As a result the core system scored first in virtually all rankings by quantitative analysis, and dominated the criteria discussions and conclusions in qualitative analysis.

The selection of a preferred alternative did not come about from clear cut evaluations of the factors. Considerable merit was contained in the other six candidates judged in alternative evaluation and these were not discarded lightly. To be selected the candidates had to stand out above some 42 alternatives considered in rationalizing the selection process. The following critique of the other six candidates was generated and is offered in substantiation of the core system as the preferred alternative.

- The null option was developed as part of the environmental analysis to test the adequacy of transit planning. When compared to the five alternatives selected from those studied in Milestone 1 and the core system alternative, null option has little overall merit.

- The low cost all-bus alternative, by some measures appeared attractive. This was mainly because it did not cause any major land use or environmental conflicts and had no displacements. On the other hand, its service characteristics were generally less acceptable than for the other alternatives and did not satisfy the desired service standards. More importantly, the mean ridership level reflected a low diversion to transit from autos. Thus, while little capitalization would be required, advancing this alternative as a viable, proposed transit action plan would be tantamount to self-defeat of the long range land use and transportation plans for the Dade County metropolitan area.

- The high cost all-bus alternative (Alternative 10) offered advantages only in the area of high average speeds for commuter type journeys. The activity centers in Dade County, with diversified travel patterns, are not well matched to such service. The all-bus system would have a severe local land use effect particularly in the downtown area where very large terminal facilities would be required. Further, the concept has limited expansion potential in passenger carrying capacity and could not accommodate peak hour loads on many corridors in the years beyond 1985. In the numberical based analysis, this alternative consistently ranked among the least attractive of all systems studied.

- The low cost fixed guideway alternative (Alternative 3) was, after consideration of the modifications required in operational concepts to make the network feasible, dropped from further consideration because of its similarity to the "medium" cost alternative.(1)

- The medium cost fixed guideway alternative evolved as a combination of two alternatives (3a and 6) which attracted a high rate of ridership by diversity of service to activity centers with reasonable levels of system facilities. This concept was refined in development of the core system, and, consequently ranked high in the analysis of alternatives.

- The high cost fixed guideway alternative (Alternative 8) was the most costly network analyzed and yet provided lower ridership potentials than the medium cost alternatives. Further, the high displacement and unjustified (by cost, disruption, and potential patronage measures) application of a grade separated system along the full length of Miami Beach substantially reduced the attractiveness of this alternative. Consequently, the system ranked either next to lowest or lowest in the numerical analysis.

Appendix 3, Section D shows a present value analysis of the alternative networks including the core system. This analysis further supports the selection of the core system.

(1) Refer to Appendix 3, Section C for a further statement concerning the comparison of Alternative 3 with the core system (Alternative 22).

B. VEHICLE TECHNOLOGY ALTERNATIVES

Vehicle technology was the subject of Milestone 2 of the Preliminary Engineering program, and in that milestone an extensive examination of different urban transit vehicle systems was carried out over a period of six months. On the basis of that work, inputs received from the citizen participation program and various local agencies, and a detailed examination of route profile and alignment carried out in Milestone 5, recommendations as to the most appropriate vehicle technologies for the core system were made. These recommendations were first adopted by the Dade County Commission on April 2, 1975 and finally adopted July 16, 1975.

The vehicle technology selection process (shown graphically in Figure 19) first involved a review of 34 public transit vehicle technologies covering 7 basic technology types. Data was collected both from previously published sources and from a survey questionnaire sent to various manufacturers and transit properties. From these 34 vehicle systems, 27 were judged as "available vehicle systems" where "available vehicle systems" were defined as:

> Electric powered, internal combustion engine powered or external combustion engine powered urban public transit vehicle systems which are (as of October 1974) beyond the stage of initial full scale system test and demonstration, and are capable of carrying a minimum of 8,000 persons per hour per direction on a single track or roadway lane.

This definition reflected the obvious need in this large, growing County to select vehicle systems technologies which were practical and real systems, as differentiated from lower passenger capacity mini-system vehicle technologies.

A list of general requirements for the Dade County Rapid Transit System was then developed and 23 of the 27 "available vehicle systems" were found to meet, to a greater or lesser extent, these general requirements (see Table 7). From this list of 23 vehicle systems, a set of five candidate vehicle systems was selected as being the most appropriate technology types for the core system plus supporting services. Details of these five systems are shown in Table 8 (as extracted from data contained in Draft Milestone Report 2), and these systems were selected because: (1) substantial data is available on all five; (2) each of the five is judged to represent the most applicable and advanced vehicle system within the category and (3) each of the five has received federal government support either in development or normal production and, therefore, is assumed to be an acceptable and qualified alternative for capital grant funding by the federal government.

Passenger patronage estimates for various alternative system networks were developed as a part of Milestone 1 and were used to determine which elements of the core system should be grade separated. (Please refer to Section X of Draft Milestone Report 1). The patronage estimates were initially developed during Milestones

FIGURE 19

Candidate Vehicle System Selection Method

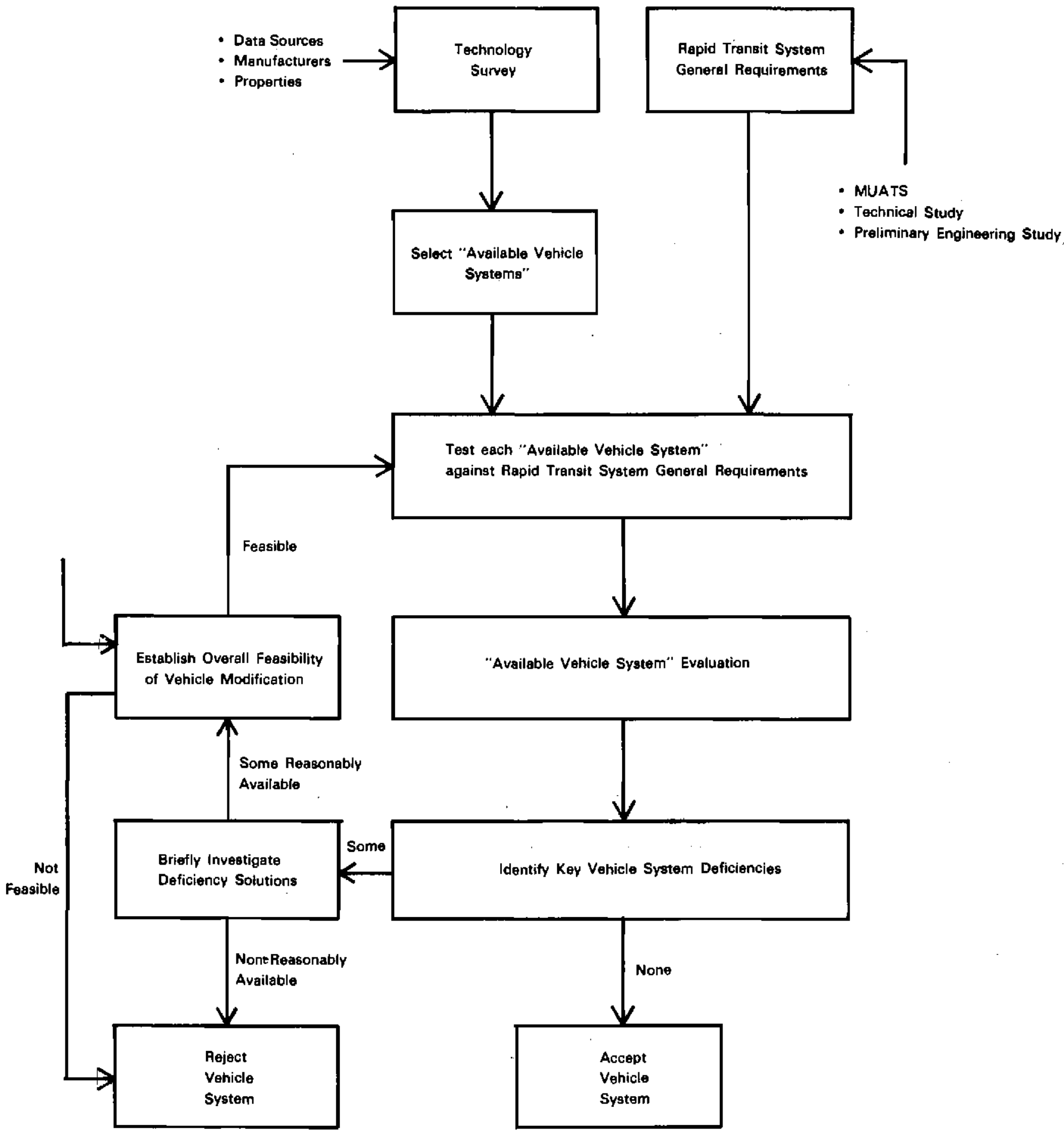


TABLE 7

VEHICLE SYSTEM EVALUATION AND SELECTION

GENERAL REQUIREMENTS	VEHICLE SYSTEMS																										
	TTI	ACT-1	BART	LRV	LINDENWOLD	R-42	SOAC	KRAUSS-MAFFEI	ACT	AIRTRANS	ALWEG-HITACHI MONORAIL	METRO (MONTREAL)	PEOPLEMOVER (BENDIX)	MONORAIL (ROHR)	SAFEGE SUSPENDED MONORAIL	SAPPORO SYSTEM	STRADA-GUIDATA	SHRETL (PITTSBURGH)	TRANSIT EXPRESSWAY	[2] CITY TRANSIT BUS (AM GENERAL)	[2] CITY TRANSIT BUS (FLXIBLE)	[2] SUPERBUS	[2] TRANSBUS (AM GENERAL)	[2] TRANSBUS (GM)	[2] TRANSBUS (FLXIBLE)	[2] TRANSIT BUS (NEOPLAN)	[2] TROLLEY BUS
Technology Type	A	B	B	B	B	B	B	C	D	D	D	D	D	D	D	D	D	D	D	F	F	F	F	F	F	F	F
Speed	⊕	●	●	◑	●	●	●	●	⊕	⊕	●	⊕	⊕	⊕	◑	◑	◑	◑	⊕	◑	◑	◑	●	●	●	◑	⊕
Departure Frequency	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Capacity Capability	⊕	●	●	◑	●	●	●	⊕	⊕	⊕	●	●	⊕	⊕	◑	●	●	●	⊕	◑ [3]	◑ [3]	◑ [4]	◑ [3]	◑ [3]	◑ [3]	◑	◑ [3]
Operating Hours	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Comfort	●	●	●	◑	◑	◑	●	●	●	●	◑	◑	●	⊕	◑	◑	◑	●	●	◑	◑	◑	●	●	●	●	◑
Reliability	[1]	[1]	⊕	[1]	◑	●	◑	[1]	[1]	⊕	◑	◑	[1]	◑	[1]	◑	[1]	[1]	◑	◑	◑	◑	[1]	[1]	[1]	◑	◑
Safety	●	●	⊕	◑	●	●	●	●	●	●	◑	⊕	●	●	⊖	●	●	●	●	◑	◑	◑	◑	◑	◑	◑	◑
Security	●	●	●	●	●	◑	●	●	●	●	●	●	●	●	●	●	●	●	●	◑	◑	◑	◑	◑	◑	◑	◑
Carrying of Handicapped	⊕	●	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	●	●	⊕	⊕	⊕	●	●	●	⊕	⊕
Route Flexibility	◑	◑	◑	◑	◑	◑	◑	●	●	●	◑	●	●	●	◑	●	●	●	●	●	●	●	●	●	●	●	●
Design Life	◑	◑	◑	◑	◑	●	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑
Guideway Configuration and Cost	●	◑	◑	●	◑	◑	◑	◑	◑	●	◑	◑	●	●	◑	⊕	●	●	●	◑	◑	◑	◑	◑	◑	◑	◑
Switching Configuration	●	●	●	●	●	●	●	●	●	●	⊖	◑	◑	◑	◑	⊕	●	◑	⊕	●	●	●	●	●	●	●	●
Community Impact	●	◑	◑	◑	◑	⊕	◑	●	●	●	●	◑	●	●	◑	⊕	●	●	●	⊕	⊕	⊕	◑	◑	◑	◑	◑
System Costs	◑	◑	◑	●	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	●	●	●	●	●	●	●	●
Service Expansion Flexibility	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	◑	● [5]	● [5]	● [5]	● [5]	● [5]	● [5]	●	● [5]
Program Risk	⊖	⊕	●	●	●	●	●	⊖	◑	◑	◑	◑	◑	◑	⊖	◑	◑	◑	◑	●	●	●	●	●	●	◑	●
Selection	NO	YES	YES	YES	YES	YES	YES	NO	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

● = system, as is, completely meets general requirements

◑ = system, as is, partially meets general requirements

⊕ = system, as is, does not meet general requirements, but is judged to be capable of modification to partially or completely do so

⊖ = system does not, and is judged not able, to meet general requirements

NOTES

1. No data available
2. Only in busway operation
3. At headways <23 seconds (50 pass/bus)
4. At headways <34 seconds (75 pass/bus)
5. Limited to approximately 12,000 passengers/hour/lane under normal operation

TABLE 8

CANDIDATE VEHICLE SYSTEMS DATA SUMMARY

SYSTEM Manufacturer or Property Location or Program Identifier Technology	Overall Dimensions (Ft-In)			Weight (Lb)		Passenger Capacity			Ground Support Method	Guidance Reference and Method	Train Size	
	Length	Height	Width	Empty	Normal Full	Seated	Normal Full	Crush			Minimum	Maximum
Boeing Vertol Company U.S. DOT State-of-the-Art Car (SOAC)* B	74-8	12-2**	9-9	90,000	105,000	62	100	220	8 steel wheels (2 bogies) on 2 steel rails.	Steel Support Rails. Flanged support wheels provide direct mechanical steering for both bogies. Bidirectional	1	12
Massachusetts Bay Transportation Authority Boston Light Rail Vehicle (LRV)* B	73-0	11-6**	8-10	70,000	85,000	52	100	no data	12 steel wheels (3 bogies) on 2 steel rails.	Steel Support Rails. Flanged support wheels provide direct mechanical steering for all bogies. Bidirectional	1	4
Port Authority of Allegheny County Pittsburgh SHRETL* D	35-0	10-9**	9-2	25,500	34,900	28	66	103	8 rubber-tired wheels (2 axles) on concrete top of support beams.	Vertical center guide beam depressed below support surface. Vertical axis guide wheels (4/axle) provide mechanical input to wagon steering for both axles. Bidirectional	2	10
Rohr Industries, Inc. The Flxible Company U.S. DOT Transbus F	40-0	8-10	8-5	25,900*	36,500*	45	69	no data	12 rubber-tired wheels (4 axles) on road surface.	Frontwheel Ackerman by driver. Unidirectional	NA	NA
San Francisco Municipal Railway San Francisco Trolley Bus F	40-0	10-3	8-6	22,500	33,800	51	76	102	6 rubber-tired wheels (2 axles) on road surface.	Frontwheel Ackerman by driver. Unidirectional	NA	NA

TABLE 8 (Cont.)

CANDIDATE VEHICLE SYSTEMS DATA SUMMARY

SYSTEM Manufacturer or Property Location or Program Identifier Technology	Minimum Curve Radius (Ft)		Maximum Mainline Grade (%)	Normal Maximum Operating Speed (MPH)	Local Power Source	Propulsion Method	Braking Methods	Switching Method	Noise Generation
	Horizontal	Vertical							
Boeing Vertol Company U.S. DOT State-of-the-Art Car (SOAC)* B	145	2,000	5	80	600 VDC power rail system along guideway side at wheel level.	DC traction motors (4 @ 175 HP), 2/bogie	Dynamic and friction (support wheel tread)	Railroad-type track switch with horizontal moving points. Flanged steel support wheels on vehicle used for guidance in switch area.	70 DBA interior at 50 mph on at-grade structure. 78 DBA 50 ft from track centerline with train passing at 60 mph on at-grade track.
Massachusetts Bay Transportation Authority Boston Light Rail Vehicle (LRV)* B	42	310 crest 460 sag	9	55	600 VDC overhead power supply with single arm pantograph on vehicle roof.	DC traction motors (2 @ 230 HP), 1/end bogie	Dynamic and friction (disc and track brake)	Railroad-type track switch with horizontal moving points. Flanged steel support wheels on vehicle used for guidance in switch area.	no data
Port Authority of Allegheny County Pittsburgh SHRETL* D	100	various (by formula)	10	55	600 VDC power rail system within guideway structure between support beams and guide beam.	DC traction motors (2 @ 120 HP) 1/axle.	Dynamic and friction (wheel drum)	Roadway tangent and curved beam assembly forms movable guide beam steering reference. Transverse motion of beam assembly replaces tangent beam with curved beam and vice versa.	no data
Rohr Industries, Inc. The Flxible Company U.S. DOT Transbus F	42**	no data	no data	70	Vehicle-carried diesel fuel supply.	8 cylinder diesel engine driving both rear axles.	Friction (wheel drum)	Not Applicable	no data
San Francisco Municipal Railway San Francisco Trolley Bus F	42*	no data	14	45	600 VDC overhead power supply with double arm pantograph on vehicle roof.	DC traction motor (1 @ 150 HP) driving rear wheels.	Dynamic (and regenerative) and friction (wheel drum)	Not Applicable	no data

TABLE 8 (Cont.)

CANDIDATE VEHICLE SYSTEMS DATA SUMMARY

SYSTEM Manufacturer or Property Location or Program Identifier Technology	Cost Per Unit ($)-(Date) (not including automatic train control equipment)	Operational Experience	Estimated Maximum One-Way Line-Haul Capacity Capability (Passenger/Hr)	Estimated Vehicle Space Envelope For Double Track Section With 3-Ft Walkway Between Tracks (Ft)	Comments	Notes
Boeing Vertol Company U.S. DOT State-of-the-Art Car (SOAC)* B	no data	In demonstration operation since May 1974. Extensive test program conducted at US DOT facility at Pueblo, Colorado. 2 vehicles built.	24,000, based on 3-minute headway and 12-car trains (100 pass./car)	25-1/2 x 13	Vehicles built under management of Boeing Vertol. Body and final assembly by St. Louis Car Co. Vehicles currently on 5-city demonstration tour.	*All data for No. 1 car **Pantograph removed
Massachusetts Bay Transportation Authority Boston Light Rail Vehicle (LRV)* B	$319,000 (1973)	*Under Construction* 230 vehicles of this and similar type under construction.	12,000, based on 2-minute headway and 4-car trains (100 pass./car)	23-1/2 x 12-1/2	Vehicles being constructed by Boeing Vertol. Vehicle design represents a new version of the P.C.C. trolley car.	*All data for articulated unit **Pantograph locked down
Port Authority of Allegheny County Pittsburgh SHRETL* D	no data	*Design Only* Vehicle system not yet procured. System based on South Park Demonstration Program (Transit Expressway)	19,800, based on 2-minute headway and 10-car trains (66 pass./car)	25 x 11-1/2	Automatic, no attendant	*All data based on design specification values for a single car **Does not include vehicle guidance elements below support surfaces
Rohr Industries, Inc. The Flxible Company U.S. DOT Transbus F	no data	3 vehicles of this type currently under construction and test.	Dependent upon mode of use.	28 x 12	Bus Model R45WT	*Approximate data **Approximate over body corners
San Francisco Municipal Railway San Francisco Trolley Bus F	$ 74,700 (1974)**	*Under Construction* 343 vehicles of this and similar type under construction.	Dependent upon mode of use.	28 x 12	Vehicles being built by Flyer, Industries, Winnipeg Canada. Model E800	*Over body corners **No air-conditioning

1 and 2 using sketch planning techniques and the UTPS Program package, and revealed that mean value line volumes in excess of 15,000 passengers per hour could be expected on a winter weekday in 1985 for various elements of the North-South Corridor of the core system, and mean value line volumes in excess of 10,000 per hour could be expected for elements of the East-West Corridor under the same conditions (both based on a 12% peak hour peak direction factor). In general, the following guidelines were used as a scaling measure in the determination of whether a route segment should be grade separated or non-grade separated and which candidate vehicle technologies would be appropriate:

> If 1985 peak hour line haul capacity requirements were less than 6,000 per hour then grade separation could rarely be justified and only the trolley car, bus, and trolley bus technology types were appropriate.
>
> If 1985 peak hour line haul capacity requirements were in the range 6,000 to 12,000 per hour, grade separation could in most cases be justified with all five technology types being appropriate.
>
> If 1985 peak hour line haul capacity requirements were above 12,000 passengers per hour, then grade separation was always required with only the steel wheel train and rubber tired train being appropriate technologies.

Based upon the foregoing, it was determined that only the steel wheeled train or rubber tired train would be suitable candidates for the grade separated portion of the core system (excluding I-95 Corridor). (1) Because the essential differences between the two technologies relate to route profile and alignment differences and resulting station location differences, the Presentation of Data for Milestone 5 was structured to show differences between the two technologies so as to allow a resolution and final determination of the most suitable vehicle technology.

In Milestone 5 the flanged steel-wheeled, electrically powered train, running on and guided by steel rails, was recommended for use on the North-South, East-West, Central and Hialeah Corridors of the core system. The rubber-tired, operator guided, diesel or turbine powered Transbus type vehicle was recommended for the I-95 Corridor of the core system and for all non-grade separated corridors.

The steel-wheeled train system was recommended for the following reasons:

- ultimate line haul passenger carrying capacity requirements (based upon preliminary estimates of 1985 ridership volumes) are within the capability of this technology. The capacity of the steel wheeled system is further judged to be satisfactory in accommodating substantial increases that can be anticipated for the year 2000 and beyond;

(1) Refer to Appendix 3, Section A for further discussion of this important determination.

- outside the downtown area, none of the routes which could (due to profile and alignment limitations) be used by only the rubber-tired vehicle system, were deemed of sufficient importance and merit to warrant selection of that vehicle technology for the entire system;

- differences in ramp structure lengths attributable to different maximum grades (4% vs. 8%) used by the two technologies are, in overall cost terms, not judged of sufficient significance to disqualify the steel wheeled system;

- additional disruptions and displacements caused by the steel wheel vehicle system, due to profile and alignment differences, are estimated to be less than 5% more than those caused by the rubber tired system for the recommended route profile and alignment. This difference is not considered significant in the context of the total rapid transit system program;

- the use of 4% maximum grades does not constrain the elevation of any stations (including downtown stations) above that required for normal clearances;

- over a route profile and alignment that can be traversed by either a steel wheeled or rubber-tired vehicle technology, and assuming vehicles of equal performance, weight, and size per passenger carried, then the steel wheel system will have a lower power consumption;

- the steel wheel system has a much longer history of proven operational experience than does the rubber-tired system;

- operational and maintenance considerations make the choice of one technology for both corridors most desirable;

- the cost of implementing either technology type is considered equal within the error associated with a preliminary cost estimate; and,

- future expansion of the core system and possible future vehicle technologies make the use of a less restrictive (larger curve radii, lower grades) route profile and alignment desirable. Also, the higher speed capability of the steel wheeled system would be advantageous in the context of a possible regional system in future years.

The Transbus type vehicle was recommended for the following reasons:

- the Transbus type vehicle can meet 1985 line haul passenger carrying capacity requirements;

- citizen participation program inputs indicate a strong preference for this technology;

- operating and maintenance considerations make the choice of one technology for all nongrade-separated corridors most desirable;

- the Transbus type vehicle could be integrated with the existing bus fleet operations and could utilize common storage and maintenance facilities;

- the Transbus type vehicle represents the most modern, safe, comfortable and convenient bus yet produced for urban transit application in the United States. The Transbus type vehicle is also designed to meet the most stringent noise and air pollution limitations ever imposed on a city bus; and,

- the use of non-fixed guideway equipment allows maximum flexibility for route changes and expansion and for providing neighborhood circulation service and lower capacity line haul service with one vehicle, thus reducing transfers and improving core system access.

Although identified as candidate vehicle technologies, the trolley car (or so called Light Rail Vehicle) and trolley bus were not selected for the non-grade separated corridors. These systems were not selected because of the above reasons and because the fixed nature of the routes for such systems, and the additional cost and aesthetic problems created by the required power feed systems, did not appear to provide sufficient service or environmental benefit to warrant their use.

As shown in Table 8, the so called Light Rail Vehicle (this vehicle weighs 70,000 pounds empty or 960 lb/ft compared with the BART-A Car - weight of 62,000 lb or 830 lb/ft) can achieve line haul capacities in the 12,000 passenger per hour range. This specific technology would not be appropriate for use on many of the grade separated fixed guideway routes of the core system due to this practical capacity limitation, and due to various detail design elements which are not considered suitable for core system application. These include the aesthetic problem of overhead power collection, the additional cost and complexity associated with the articulated - 3 truck vehicle, the wasted space of operators' positions at both ends of each vehicle, and the inapplicability of track brakes and manually operated sanding equipment. It should also be noted that the real benefits of the intermediate capacity (or so called light rail) rail concept is closely tied to the system's use of both nongrade-separated (low cost) and grade separated elements on a given route, and simple stations with on-board fare collection. The slower average speeds associated with any non-grade-separated route segments and on-board fare collection, are not appropriate to the core system corridors where higher transit average speeds are essential in achieving the desired countywide transit modal split with associated deemphasis of automobile usage. Many features of the State-of-the-Art car would appear to be appropriate for use in Dade County.

C. ROUTE PROFILE, ALIGNMENT AND STATION LOCATION ALTERNATIVES

The 1985 service network and core system developed in Milestone 1 consisted of rather broad corridors of transportation improvement and grade separated rapid transit designed to serve the needs of Dade County in 1985 and later years. A further step in definition of the rapid transit system was the identification, within the corridors of the core system, of specific route alignments and station locations. The basic work in this identification was carried out in Milestone 5.

In performing the alignment and station location studies, consideration was given not only to the defined corridors of the core system, but also to the service and system criteria developed in Milestones 1 and 2, the vehicle technologies analyzed in Milestone 2, the land use and development policies recommended in Milestone 3 and the urban design and development concepts developed for Milestone 7. Land use and development policies are particularly important in establishing specific siting because they play a major role in determining whether or not new development takes place around transit stations, the character of any such development and the effects of route alignment and station location on the environment, access and movement patterns and urban design and aesthetics. A number of alternative route alignments and station locations were initially developed in Milestone 5 based on the foregoing considerations and on physical surveys of potential locations. These alternatives were presented to the public through the citizens' participation program. A numerical evaluation procedure was developed to compare alternatives in terms of sets of evaluation characteristics including land use, urban design, ecological, service area, access mode, disruption and displacement, physical problems, system operations and cost factors. Application of this procedure, together with the many useful comments received from the citizens' panels and others, resulted in the selection and recommendation of specific route alignments and station locations. As a result of these studies a change in the service network and core system was also recommended, based on citizens' comments and a reevaluation of service to Hialeah. This change substituted an east-west corridor branching from the north corridor for the previously recommended Okeechobee Road corridor.

The development and evaluation process described in this section was a continuing activity begun in Milestone 1 and completed with the preparation of the Draft Milestone 8 Report and the Environmental Impact Analysis. While the work is described above under separate headings covering the three main areas of analysis, it was actually carried out concurrently and with constant interfacing between the various activities. The Corridor/Operational Concept, the Vehicle Technology and the Route Profile, Alignment and Station Locations thus form a homogeneous entity, making up the total transit system described in the following section.

V. RECOMMENDED RAPID TRANSIT SYSTEM

Section I and II of this report have described the various planning and policy considerations that form the general background for the recommended rapid transit system. Section III has described the preliminary engineering program designed to identify and delineate the rapid transit system. Section IV has described the analytic process for evaluation of alternatives. This section presents the basic results of the preliminary engineering program, the recommended transit plan for implementation within the Dade County metropolitan area. The plan is described in terms of criteria, system characteristics and transit facilities.

A. CRITERIA

A major element of the preliminary engineering program involved the preparation of criteria and guide specifications for use not only in the preliminary engineering work, but also as a basic guide and reference tool for those who will perform the final design and construction of the rapid transit system. The criteria and guide specifications prepared cover three general categories, and these are

1) system design objectives

2) specific design criteria for various program elements, and

3) criteria and guide specifications for use in later development of construction or procurement contracts (or "contract packages").

1. System Design Objectives

These criteria, objectives and policy guidelines were prepared during Milestones 1, 2, 3, 6 and 7 of the preliminary engineering program. Initial drafts of criteria, objectives and policy guidelines were reviewed by members of the citizens participation program, by various local and state agencies and by special Transit Advisory Committee subcommittees established for that purpose. The final criteria, objectives and policy guidelines reflected substantial input from these reviews, and many criteria were changed, deleted and added. The 'Manual of Service and Design Criteria', June 1975, contains this material which covers the following subjects:

- service criteria
- system criteria
- safety criteria
- security criteria
- architectural concepts
- development and land use policy guidelines

The service criteria constitute a set of preliminary guidelines and objectives for the transportation function provided by the rapid transit system as would be perceived by the system user. These are key criteria and are reproduced in total below:

TRIP TIME

The total trip time for a passenger using the rapid transit system will be considered to consist of the following elements:

access time + waiting time + corridor travel times + transfer time

The desirable maximum peak hour total trip time from any point within the current Miami Urbanized Area to the Central Business District/ Civic Center will be 45 minutes. The desirable maximum for total rapid transit system access time will be 10 minutes, the desirable maximum for average waiting time will be 2 minutes, and the desirable maximum for average transfer time will be 3 minutes.

DEPARTURE FREQUENCY

The desirable maximum peak hour departure frequency on any corridor of the rapid transit network will be 20 units per hour (i.e., one vehicle or train every 3 minutes). Departure frequencies at other times of the day will vary but should be no less than four units per hour (i.e., one vehicle or train every 15 minutes) and will have maximum values between 6 and 20 units per hour (i.e., one vehicle or train every 3 to 10 minutes).

TRIP CONVENIENCE

Trip convenience is of major importance and will be given specific attention in the design of all elements of the Dade County rapid transit system.

SYSTEM OPERATING HOURS

System normal operating hours for the Dade County rapid transit system (including feeder systems) will be in the range of 16 to 21 hours per day, 365 days a year, with operations variable on different parts of the system to meet the needs of different parts of the county. Consideration will be given to operating outside of normal operating hours at very low service levels.

CORRIDOR PASSENGER-CARRYING CAPACITY

Corridor passenger-carrying capacity for the peak periods will be designed to meet the approved ridership projections to be developed for each corridor for 1985, and will make specific provision for expansion of passenger-carrying capacity to meet the approved projections for 2000, with minimum system disruption and reasonable additional expense.

TOTAL ANNUAL PASSENGER VOLUME

The overall rapid transit system will be designed to carry the volume of total annual passengers projected for 1985. Provisions will be made for expansion to accommodate the approved total annual passenger volume projected for 2000.

PASSENGER COMFORT

- Weather Protection - Complete weather protection will be provided for passengers in all vehicles. Station design will reflect and utilize the subtropical climate by creating covered, but not enclosed, open spaces to protect against rain and direct sun, to promote a feeling of openness and to permit the circulation of air. Where appropriate, overhead protection will be provided at walkways leading to station parking areas, at transfer facilities, and at any other passenger areas to be identified.

- Ventilation and Temperature/Humidity Control - The rapid transit system will be designed to provide (1) complete control of air flow, temperature and humidity conditions within all vehicles to achieve comfortable conditions under all normal climatic and environmental conditions; (2) ventilation in all covered and enclosed public facilities; and (3) shaded areas for pedestrian access around all stations.

- Lighting - Lighting levels will be established (by accepted standards) to provide for comfort, safety and amenity of the system user. Lighting will be designed in a glare-free, orderly manner, using long-life, low power consumption, high-lumen lamps whenever possible. Emergency lighting will also be provided to allow persons to exit the system and facilities under prolonged primary power outage conditions.

- Vehicle Ride Quality - Buses will be designed to provide a ride quality consistent with the highest transit standards as represented by the ride quality requirements prepared by the U. S. Department of Transportation for the Transbus program. Rapid transit system vehicles will provide a ride quality equivalent to a modern inter-city bus on a modern interstate highway.

- Vehicle Seat Space and Interior Layout - The transit system vehicles will include the provision of comfortable passenger seats of durable vandal-proof materials in a configuration that will allow efficient use of vehicles interior space and rapid vehicle loading and unloading.

- Vehicle Seat-to-Standee Ratios - In peak hour periods, buses and rapid transit vehicles will be designed to include provisions for standees but the seat-to-standee ratio will not exceed 1 to 2. In off-peak periods, sufficient vehicle capacity will be operated on the transit system to provide all normally expected passengers with a seat. Consideration will be given to the turnback of vehicles on the core system corridors during peak hours so as to provide an average standing time for standing passengers of approximately 10 minutes and a maximum desirable standing time of approximately 20 minutes.

- Noise and Acoustics - The rapid transit system will be designed so that normal human speech between two persons located within 4 feet of one another will not be interrupted by unwanted sound in any public facility or vehicle (excluding unwanted sound generated by other persons or public service announcements). This goal covers both sound received directly from the source and reflected sound (echoes).

- Scenic Experience - The rapid transit system will take full advantage of available scenic views and vistas by appropriate vehicle window configuration (for seated and standing passengers) and design, by appropriate guideway design, and by appropriate station orientation and design.

RELIABILITY

The rapid transit system will be designed to achieve a reliability expressed in terms of the probability of any passenger completing a rapid transit trip within 10 minutes of the scheduled time on any given day. The recommended probability is not less than 92.5%.

SAFETY

Passenger and operating company personnel safety, and equipment and facility safety, will be overriding and paramount system design and operating considerations. Specific and continual attention will be paid to the safety aspects of all system elements.

SECURITY

Design of the facilities and equipment, and development of operating policies will make specific provision for the deterrence of crime.

FACILITIES FOR THE ELDERLY AND HANDICAPPED

The design of the rapid transit system will first identify the travel needs, experiences and problems that the elderly and handicapped may encounter in use of such transit facilities. The rapid transit system design will then make specific provisions for the reduction and possible elimination of operating barriers on all facilities and equipment which impede the mobility of the elderly and handicapped, thus improving their social and economic opportunities so that they may pursue their interests and aspirations, develop their talents, and exercise their skills.

DIRECT USER COST (FARE STRUCTURE)

The transit fare plan will apportion total annual costs over the residents of Dade County and system users in a manner that will maximize overall benefit. Consideration should be given to a flat-rate fare, coin-operated system as the lowest in cost to own and operate.

The system criteria constitute a set of preliminary guidelines and objectives for the physical implementation of the system required to meet the service criteria. These criteria cover the following topics:

- Network Corridors
- Feeder and Distributor Network
- Design Life
- Operational Characteristics
- Vehicle Technology
- Guideway or Busway Configuration
- Community Impact and Acceptance
- Degree of Automation
- Resource Conservation
- Labor Intensiveness
- Service Expansion Flexibility
- Total Community Costs Per Year
- Total Community Benefits

The safety and security criteria constitute a set of expanded and specific guidelines for achieving the safety and security criteria included in the service criteria above. Examples of the safety and security criteria are shown below to illustrate the broad approach taken. The complete set of criteria is contained in the 'Manual of Service and Design Criteria', June 1975.

STATION DESIGN

- Guideway Trespass from Stations - Specific safety measures to prevent the occurrence of conditions in which persons may accidentally fall from the platform to the track areas should be implemented. These provisions should be designed to monitor persons accessing the system, to provide a safe environment, to provide adequate warning of hazard situations, to provide adequate delineation of hazard areas, and to provide safety pit areas and track power cutoff switches.

- Station Fires

  - Non-combustible materials should be used in station construction.

  - A station emergency escape-way should be available for use in case of fire. In addition, there should be an adequate number of emergency exits with properly illuminated signs.

  - Elevators should have enough reserve power to return to ground level and open door should the primary power be disrupted.

  - The train control system should have the capability to have trains stop or to by-pass stations which are on fire.

  - Emergency provisions should include station attendant public address system, police, fire, first aid provisions and transit attendant communication systems for use by patrons.

  - All transit system personnel, including station attendants, maintenance personnel, security personnel, central control personnel, shall be thoroughly trained in emergency procedures for station fires.

- Passenger Movement and Directional Information - Station design, including directional signs with adequate illumination, should pay special attention to the location of stairs, escalators and elevators so that bottlenecks and misdirection are minimized.

STATIONARY VEHICLE FUNCTIONING EQUIPMENT

- Vehicle doors should be interlocked with the vehicle propulsion and brake system so that the doors will open only when the vehicle is stopped.

- Vehicle doors should be interlocked with the propulsion and brake system so that the vehicle cannot accelerate until the doors are closed.

- Vehicle automatic door closing forces should be at such a low level that a patron struck by doors will not be injured.

- An emergency door manual mechanism should be provided to facilitate door opening should the automatic door operator fail. The manual mechanism should be interlocked with the propulsion and brake system to initiate emergency braking when the vehicle is in motion. The interlock should not allow the vehicle to accelerate should the manual mechanism be activated while the vehicle is stopped.

GUIDEWAY DESIGN

- Trespassing on the guideway should be prohibited and guideway security provisions should be sufficiently thorough so as to protect not only facilities but also potential trespassers.
- The guideway should be insulated and grounded with respect to electrical power used for vehicle propulsion and system lighting.
- Construction materials used for guideways, particularly insulation materials, should not support combustion.
- Provisions should be included in the guideway design to minimize the ability of individuals in the vicinity of the guideway from striking a vehicle with a thrown object.
- In those cases where the guideway must pass under another structure which carries pedestrians or vehicular traffic, screening should be employed on that structure to inhibit the dropping of objects on rapid transit vehicles.
- Insofar as possible, areas under the guideway which are subject to pedestrian or vehicular traffic should be protected from falling debris.

VEHICLE SECURITY

- Police patrols of trains should be used for special situations only and should not be a routine part of the security system.
- Windows should be made of an impact-resistant, hard surface material which does not present hazards in a fire.
- Seat comfort should not be sacrificed, but seat designs should have vandal proof materials used in all but the cushion and seat back area. These "comfort" areas should be of modular design for easy removal and replacement.
- Trim panels should be selected to be vandal proof and/or easily cleaned in accordance with the findings of the American Transit Association.
- There should be visibility between train vehicles by means of windows at both ends of each vehicle.

LAW ENFORCEMENT REQUIREMENTS

- The Dade County Department of Public Safety should have law enforcement responsibility for the rapid transit system.
- The security force should be set up as a division of the Dade County Department of Public Safety containing both deputy sheriffs and police officers. Routine security functions such as station and yard patrols should be performed by police service officers who are paid at a salary scale of approximately 15 percent lower than deputy sheriffs. Stakeouts, other types of surveillance and investigations should be performed by deputy sheriffs.

INTERNAL SECURITY

- All employees should be issued photo identification passes to provide computerized identification.
- Computerized cards should be used to control access to restricted areas such as yards, areas involved in money counting or storage, etc.

- Other uses for the computerized cards could include free fare passes on the transit system for transit employees. Also cards can be tied into the computer for timekeeping purposes and other administrative functions.

- There should be a separate internal audit within the transit authority responsible for the auditing of all transit revenue funds and the investigation of suspected larceny.

- Any disbursement or transfer of funds within the system should require a minimum of two signatures.

- All processing and handling of cash should be automated. To the extent that it is possible, all revenues in the form of cash should never be handled directly by employees.

The Architectural Concepts in this category, consist of certain basic concepts developed to guide the preparation of more specific design criteria. In order to maintain a high level of order and consistency among all the stations and station sites, it is important that certain basic concepts and design criteria be established as determinants of architectural character and performance for the Dade County Rapid Transit System. Recognizing the need for individual input and creativity from the station designers, it is important nevertheless that individual stations reflect certain essential uniformities for the purpose of maintenance, efficiency, ease of flow, identity as a station, and a whole sense of orientation to the total system.

These basic concepts have been brought together to provide a "balanced" architectural style (i.e., one that will allow stations to be individually designed to fit the character of surrounding neighborhoods, yet still convey an image of a unified transit system). It is intended that the final design be individual for each station. However, because of the multiplicities of conditions that exist in the design process which strongly influence and direct the final design of each station, the task of the architect is to search for honest artistic expression in station designs while maintaining continuity to the character of the neighborhood and at the same time maintaining continuity to the character of the system.

The basic concepts cover unification, community influence, public orientation, atmosphere, appearance, circulation, and station area development, and are reproduced below:

UNIFICATION

All the elements of the transit system conform to a continuity of function. It is, therefore, only natural that the entire system be unified aesthetically as well as functionally. This is very essential so as to integrate the travel patterns of patrons in the region through commonalties of function.

This unification should be achieved in order to establish an identity for the transit system as a whole, thus enabling the patrons to find their way easily even in a station new to them. The key to achieving this uniformity lies in adherence to certain solution patterns of various design elements by all the transit stations, each of which can be identified as a member of the total Family of Stations.

COMMUNITY INFLUENCE

Each station will become an integral part of the community in which it is located, both influencing and being influenced by the community. Positive allowance in the design and planning of the stations should be made to reflect the unique elements of the community, yet still maintain unification with the system and the Family of Stations.

The station design should welcome those aspects of the community that are positive and deserve recognition. In doing so, the station can reinforce existing neighborhood pride and possibly even act as a catalyst to generate a spirit of appreciation.

There are several ways that community character might be brought to the core of the station which will tend to establish or reinforce the special identity of each station. Riders will quickly adjust to these station identities which will add to their orientation along with system maps and graphics.

Station names might be chosen from geographical or symbolic names rather than a street or number designation. Neighborhood maps quickly orient the rider to the immediate area and to points of interest or historic significance. Announcements of local events and presentation of local exhibits are encouraged. Areas which might relate to the entrances could provide local garden club features and activity. Photomurals taken from the neighborhood surrounding the station in which it appears, could play a vital role in the station design.

PUBLIC ORIENTED

The public-oriented system provides an environment similar to that of public buildings. Rapid transit being a public enterprise, performing a public function should therefore identify with the public sector. Though serving all manner of individual interests, its own interest and image are on the public side. Dade County is a relatively young community, a community in transition and in many ways unfinished. Since rapid transit will have a great influence on the formation of the desired urban character, the system pattern should incorporate aspects of desirable future developments. Commercial activity such as concessions and private entrances whether immediately adjacent to the right-of-way, sharing the right-of-way or attached physically as in air rights, could be incorporated; however, the main approach must be reserved to the public right-of-way or public open space bringing the most riders closest to their destinations.

Strong individual identity such as these can provide a much more meaningful variety to the system than those variations exemplified in architectural structure, finish or various details, items which too often are unable to adequately fulfill for each station a "sense of place".

ATMOSPHERE

The atmosphere of the stations will be associated with the subtropical outdoors. Fresh air and natural materials will contribute to this feeling. The stations will be as open as possible with larae sheltering elements to protect the people from the hot sun and frequent summer rains, yet allow ventilating breezes to sweep the public areas.

As in all public spaces, an inviting image of comfort, cleanliness and openness will create a friendly atmosphere which will reinforce the experience and encourage frequent use. Spacious and open areas are synonymous with a warm climate and public use. It will be basic then to our concept that the public areas of the stations be designed to optimum dimensions rather than the minimum.

The openness of the station combined with the elevated platform and guideway will render colorful changing vistas at each location, which will aid in orienting the passengers as they go from station to station.

APPEARANCE

The architectural appearance should be such that a function based architecture be created avoiding any imposition of official style. Design should flow from the profession to the government.

Within the bounds of the general concepts and criteria defined herein it will be the responsibility of the architect to develop an individual design for each station. Unique site conditions, entrance considerations and the character of the individual neighborhoods served by the transit facility are major influences which will direct transformation of conceptual designs into final design. Exploitation of unique opportunities compatible with and advancing the concepts are to be encouraged.

Honest architectural expressions through the use of major structural and functional elements should be encouraged. Wherever possible the structure itself becomes the architecture, exposed to exploit the strength and honesty of the material.

CIRCULATION

The rapid pedestrian movement inherent in transit facilities demands that patron circulation be simple, direct, and open. Unnecessary barriers, turns or transitions between the rider and the vehicle must be avoided. Major functional areas should be as spatially and as visually related as possible in order that a patron entering the station be immediately oriented and aware of all vertical and horizontal movements. The rider must always know in the fullest sense where he is and where he is going.

Entrances should be clearly visible. Because the environment is exterior, access into the concourse area should be free of doors or gates during operation hours. High detention-like fencing and exit barriers are not compatible with image of the clientele of a modern system. Although paid areas must be physically separated from free or unpaid areas, it is desirable to visually de-emphasize the separation by designing a low and transparent type of barrier thus maintaining visual continuity.

STATION AREA DEVELOPMENT

The transit station, by means of the accessibility it offers to adjacent property, can become the focal point of more intensive development activity. The principle of joint development recognizes the intricate relationship between transit and land use, and in a narrow sense, involves "the simultaneous, coordinated development of both a transportation and a land use facility, usually involving the same parcel....primarily utilizing air space around and over a transit site and parking facilities." Such a development concept attempts to optimize the use of available land resources. Joint development of stations should attempt to provide appropriate activities in the station area but should not interfere with the internal functions of the station itself. Therefore, the station serves as a transportation unit within a larger development framework with direct connections. In general, combined access points to station and related activity should be encouraged. Recognizing the difficulty of coordinating the activities of public and private entities at the time of transit station or line construction, provisions for future joint development activity should be an integral part of both the design of the station and its facilities, and the land use and urban design planning to be conducted at each station.

The development and land use policy guidelines were generated for general application to transit station land use considerations and station area planning efforts. The basic concept of the policy structure was the establishment of a specific guidance framework which can be applied to any station situation in varying degrees - as circumstances dictate. Continuation of a strong citizen participation process at the neighborhood or service area level will help to assure that principal concerns for each station area will be properly addressed in terms of policy application. The measure of continuity envisioned for the entire system is the process of placing station development policies and plans within the framework of the adopted 1985 Comprehensive Development Master Plan. Thus, station area policies and plans will serve to reinforce and implement major development concepts outlined in the 1985 plan. The policies were organized by land use and neighborhood factors, public services and facilities, access and movement patterns, environmental protection, urban design and aesthetics, and development incentives and controls.

2. Specific Design Criteria for Program Elements.

After development of the system design objectives, and before preparation of preliminary designs and cost estimates, a set of design criteria were generated. These criteria provided specific design recommendations for various disciplines and system elements, including

- Contract Drawings
- Civil
- Structural
- Architectural
- Electrical
- Mechanical
- Train Control and Communications
- Storage and Maintenance Facilities
- Right-of-Way
- Utilities
- Fare Collection
- Vehicle

They will provide the system final designers with a firm and specific starting point in the final design process, and should allow a rapid and effective means of program familiarization for new design personnel.

3. <u>Criteria and Guide Specifications for Program Element Contracts</u>

This third criteria category covered various guide specifications and criteria for the preparation of contract documents. Three documents were prepared, covering:

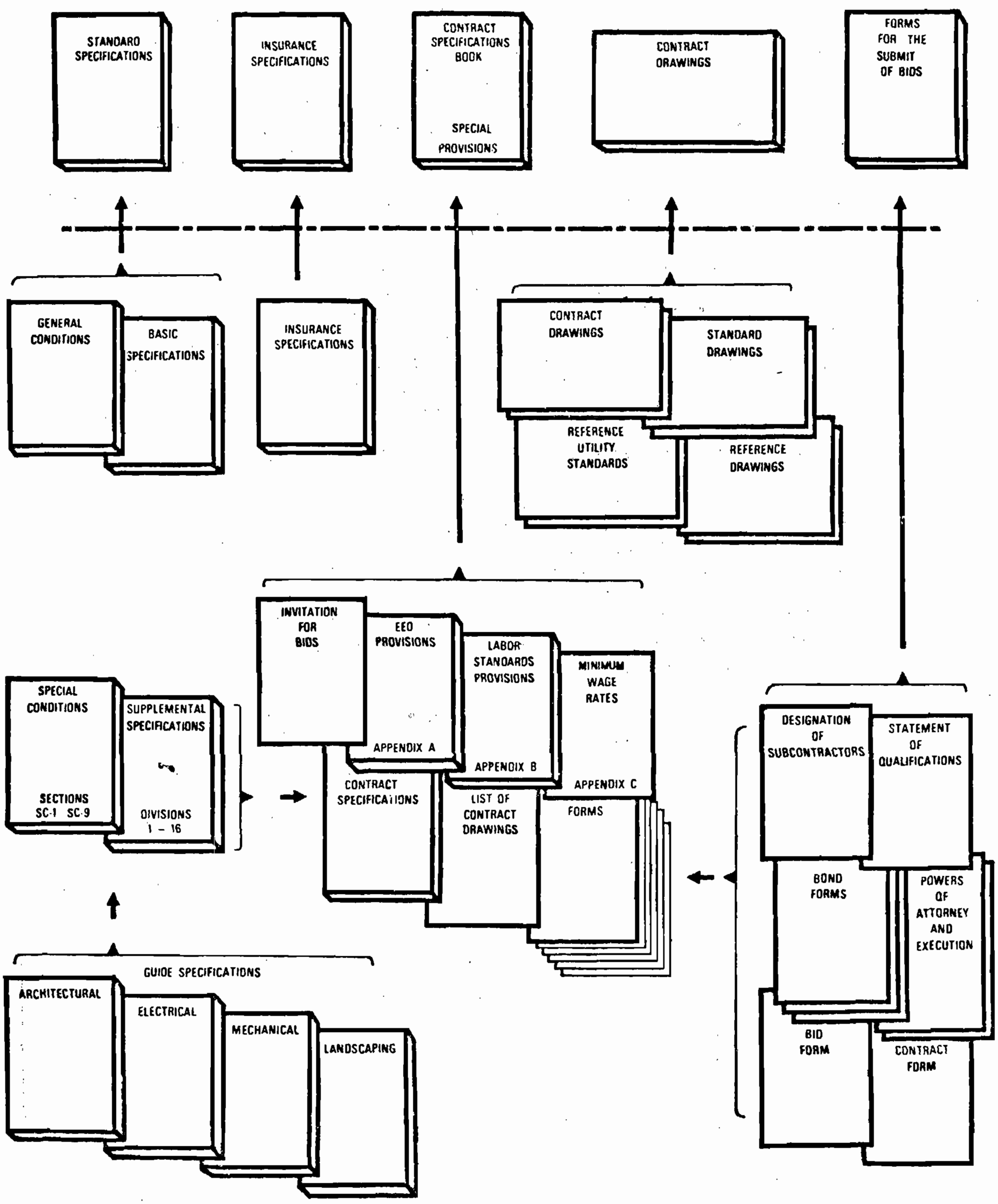
(a) Guide Specifications for Construction Contracts,
(b) Guideline Specifications for the Preparation of Operating Subsystem/Procurement Contract Specifications, and
(c) Criteria for the Preparation of Contract Specifications.

The guide specifications for construction contracts provide specifications for common construction items including site work, masonry, metals, wood and plastics, thermal and moisture protection, doors and windows, finishes, specialties, mechanical and electrical work. These guide specifications should allow the rapid and uniform assembly of specification items for many of the construction contracts contemplated for the rapid transit system. In a similar manner, item (b) above provides guidance to those responsible for preparing both procurement and furnish-and-install equipment contract specifications, and will simplify the preparation of detailed specifications and provide for a degree of uniformity, but not standardization, in the Owner's legal, contractual administrative and management requirements for such contracts. Item (c), the Criteria for the Preparation of Contract Specifications, describes the content, configuration, and relationship of the various Contract Documents required for construction or procurement, and provides instructions for the designer's guidance in the preparation of specifications for such contracts.

Figure 20 shows the elements of contract documents and their relationship to one another, and illustrates the importance of the three documents described above.

FIGURE 20

ELEMENTS OF CONTRACT DOCUMENTS



B. SYSTEM CHARACTERISTICS

1. The Service Network and Core System

The basis for development of the recommended rapid transit system plan was the 1985 service network and the core system of rapid transit, whose development and evaluation were discussed in Section IV. The core system consists of approximately 48 miles of grade separated fixed guideway rail transit, the I-95 exclusive busway and four non-grade separated corridors making use of buses on exclusive lanes, exclusive streets or contraflow lanes. The major portion of the I-95 busway, using two new lanes in the former median of that expressway, has been essentially completed under other programs of the state and federal governments. The recommended rapid transit system plan envisions the construction of a new grade-separated extension to this busway linking the southern terminus of the existing project at the Airport Expressway with the Central Business District (CBD) of Miami. The four non-grade separated busways are along North Kendall Drive from Dadeland to S.W. 110th Avenue, along the Flagler Street corridor west of Douglas Road, from the Miami International Airport to the I-95 busway via E. 9th Avenue and N.W. 103rd Street, and from the Miami Beach Convention Center northward to Sunny Isles via the Collins Avenue corridor. These busways would allow substantially improved average bus speeds and can provide peak hour passenger capacities up to 6,000 passengers per hour at low initial cost. Table 9 shows approximate route mileages for the various elements of the core system plus supporting services. Also shown are the mileages of the three program stages described in Subsection V-B-5 below.

The core system of rapid transit (rail and busway) must be supported by collection-feeder-distribution systems. This feeder network of transit is as vital to the implementation of the overall mass transit system as the hardware, vehicles and structures associated with the core system. In addition, line haul bus service will be required on those elements of the 1985 service network not covered by the core system, and on some other arteries. The feeder network will essentially consist of surface bus lines but will also include a number of special mini-systems at certain major activity centers.

TABLE 9

CORE SYSTEM PLUS SUPPORTING SERVICES
GENERAL LOCATIONS & LENGTH OF CORRIDORS

Corridor	General Location	Approximate Route Mileage
South	CBD/Cutler Ridge area via F.E.C. ROW	18.6 (gs)
Central	Miami International Airport area/US 1	4.8 (gs)
Southwest	Dadeland area/SW 110th Avenue area via North Kendall Drive Corridor	4.8 (ngs)
West	a) CBD/Douglas Road Corridors	3.9 (gs)
	b) Flagler-LeJeune area to Palmetto Expressway area via Flagler Corridor	4.4 (ngs)
Hialeah	F.E.C. ROW from W. 8th Avenue to NW 27th Avenue	3.6 (gs)
North	CBD/Civic Center area/Opa-Locka area via NW 27th Avenue Corridor	10.9 (gs)
I-95	CBD/Golden Glades Interchange via F.E.C. ROW and I-95 median	10.6 (gs)
Cross County	Airport area/I-95 Busway via E. 8th Avenue Corridor and NW 103rd Street Corridor	8.5 (ngs)
East	CBD/Miami Beach Convention Center area via McArthur Causeway	6.4 (gs)
Miami Beach	Miami Beach Convention Center area/ SR-826 (Sunny Isles) via Collins Avenue Corridor	9.9 (ngs)
	Subtotals:	58.8 (gs)
		27.6 (ngs)
	Total Miles:	86.4
Stage I		23.0 + 10.6 (gs)
Stage II		10.0 (gs)
Stage III		15.2 (gs)

ngs = nongrade-separated
gs = grade-separated
ROW = Right-of-Way
CBD = Central Business District

2. Ridership

Ridership forecasts are a key element in the development and evaluation of transit system alternatives because ridership is a measure of the degree to which a system meets national and local objectives of increasing transit use differentially with respect to the automobile. It is also an element in the estimation of cost effectiveness of a system.

Ridership forecasts for the Dade County Transportation Improvement Program were developed through an innovative application of conventional computer modeling techniques developed by the federal Urban Mass Transportation Administration.

The process, which is described in the Draft Milestone 1 Report and in more detail in special task reports, involved several areas of innovation, the first of which was the development of a sketch planning technique which permits relatively fast and economical production of ridership estimates at a coarse level of detail. Previous forecasting had been accomplished through the use of a network which divided the county into 723 traffic analysis zones between which individual person trips were estimated. The sketch planning technique combined or aggregated these 723 zones into 51 districts, greatly simplifying the coding of the networks into the computer programs.

The resulting saving in time and costs permitted the analysis of a large number of transit system configurations for the purpose of comparing ridership among the alternatives. This sketch planning technique, while extremely useful in the comparison of alternatives in the developmental stages, does not of course obviate the necessity for subsequent more detailed procedures utilizing the 723 zone network to produce transit route and station volume data for detailed system design. In this program, both techniques were used for their specific purposes.

Another innovative technique utilized in the program is called risk analysis. This process, which recognizes the uncertainties relative to the basic data and modeling formulas used, involves the determination of the statistical probability that the ridership forecasts will be exceeded. For this program, forecasts were developed at the 80% confidence level and the 50%, or mean, confidence level. The first is the value that one can be 80% confident will be exceeded, and represents the 20% ordinate of a probability distribution curve ("Bell Curve"). The second, which is a higher value, is one which can be expected to be exceeded with 50% confidence, and is the mean value of the "Bell Curve".

The third important innovation was the development of a new set of modal split models based on research into probable behavioral patterns of Dade County residents. These models incorporate the capability of introducing into the model equations certain factors which reflect alternative policy decisions affecting transit ridership, such as parking costs, transit fare structures and automobile operating costs.

In the development of the recommended rapid transit system plan, a total of 19 model runs at the sketch planning and 723 zone levels was made. These included 14 sketch planning runs covering various system alternatives and the core system, and five 723 zone runs. The latter consisted of two simulations of the original core system using different sets of planning assumptions, one final simulation of the modified core system, and two simulations of the so-called "null option" using different planning assumptions. The null option denotes a system of all at-grade bus transit which assumes only certain short range improvements to the existing bus system. The "null option" was analyzed to provide a basic comparison for environmental analysis.

The results of the final 723 zone model simulations of the modified core system and the null option in terms of total daily transit ridership and modal split (both fixed guideway rapid transit and bus for the core system) are shown in Tables 10 and 11.

TABLE 10

1985 Total Daily Transit Trips

Transit System	80% Confidence Value		Mean Value	
	Trips	% Transit	Trips	% Transit
Null Option	316,833	5.9%	Model not applicable	
Core System	445,985	8.4%	723,618	13.6%

It will be noted that the total transit trips in Table 11 are greater than the number of trips shown for the core system in Table 10. This is because the figures in Table 11 include transfers of individual passengers between transit modes in a single trip, whereas Table 10 shows the number of individual trips made daily by transit. In other words, if a passenger uses both bus and rapid transit for a single trip, he is counted twice in Table 11, but only once in Table 10.

The special and express buses listed in Table 11 comprise all of the buses used on the non-fixed guideway portions of the core system plus supporting services. These include buses on the I-95 busway and the preferential bus lanes on N.W. 103rd Street, LeJeune Road, West Flagler Street, North Kendall Drive and Miami Beach. The total core system ridership is therefore the sum of the trips made by fixed guideway rapid transit and by special and express bus. These totals are 404,868 trips at the 80% confidence level and 647,546 trips at the mean value.

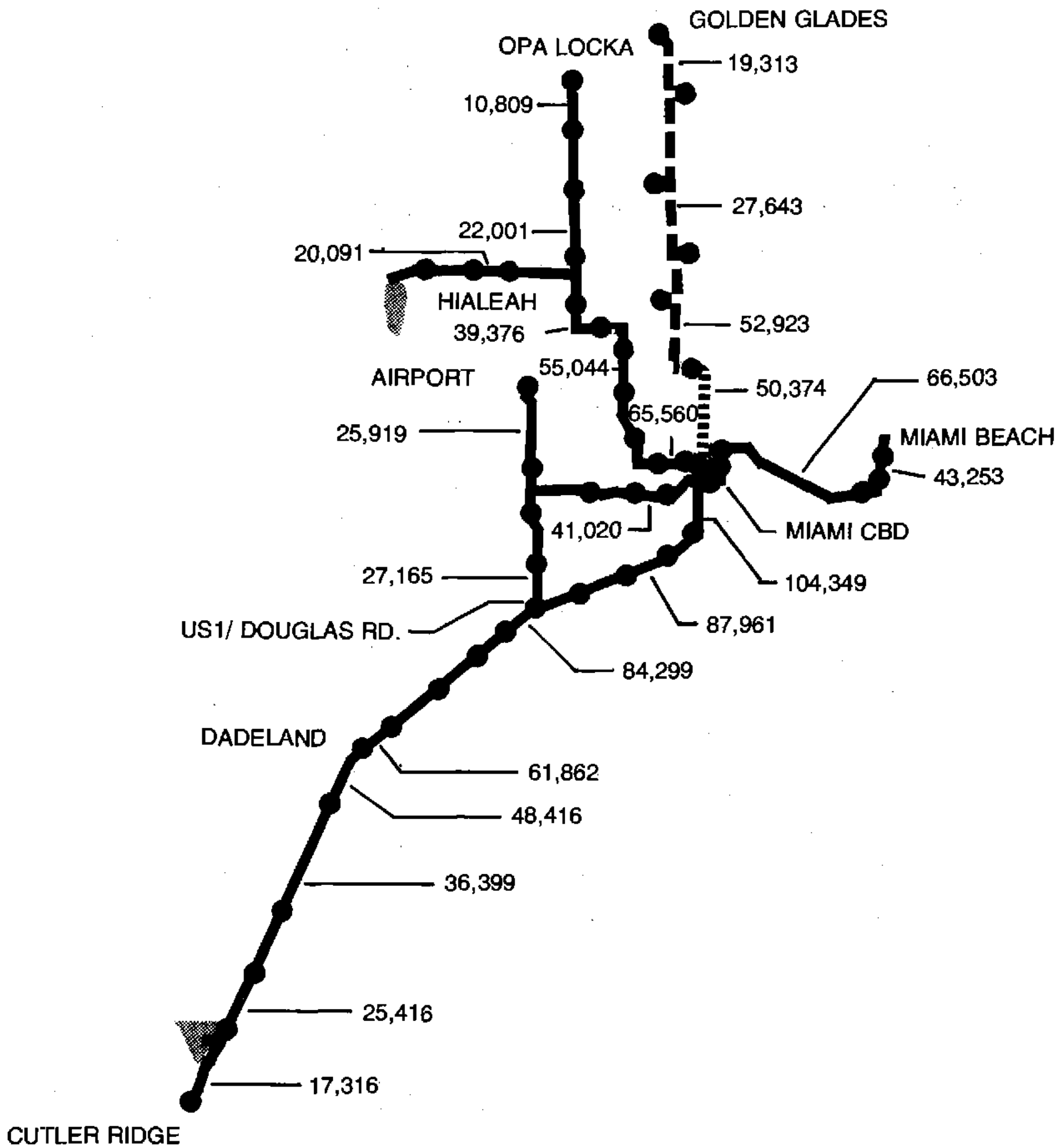
TABLE 11

1985 Core System Daily Trips by Transit Mode

	Passenger Trips		Passenger Miles	
Mode	80% Confidence Value	Mean Value	80% Confidence Value	Mean Value
Local Bus	386,844	650,337	738,842	1,263,849
Special & Express Bus	124,411	204,496	579,230	948,948
Fixed Guideway Rapid Transit	280,457	443,050	1,434,012	2,280,273
Totals	791,712	1,297,883	2,752,084	4,493,070

Figure 21 shows the distribution of total 1985 mean value 2-way daily ridership over selected segments of the core system. The figure indicates that the heaviest volume of ridership occurs in the section of the South Corridor between Dadeland and the Miami Central Business District (CBD). On all routes volumes increase as the routes approach the CBD.

FIGURE 21
Projected 1985 Mean Value 2-Way Daily
Ridership on Selected
Links of the Core System



3. Station Location and Route Alignment

As defined in the Draft Milestone 1 Report, the core system consisted of broad corridors of rapid transit designed to provide the service needed by the County. Following the tentative definition of the core system, studies were conducted as a part of Task D-7 to identify specific route alignments and station locations. The results of these studies were presented in the Draft Milestone 5 Report and are described and depicted in this subsection.

In defining station locations and planning station access, stations were classified by environmental type. Four service environments were established reflecting different station access and egress mode splits. In the type 1 environment, the walk mode served as the dominant type of access with support from feeder buses. Stations classified as Type 1 were located in the Miami CBD, the Civic Center, and South Miami Beach. No on-site parking and only limited kiss-and-ride facilities would be provided at such stations. In the type 2 service environment, more emphasis was placed on feeder bus access with the walk and kiss-and-ride access modes also being significant. Limited parking and expanded kiss-and-ride facilities would be provided in this precinct which is generally within three to four miles of the Miami CBD. Residential development predominates in the type 3 environment. Auto and feeder-bus would provide the principal access modes while walking would be correspondingly less than with either type 1 or type 2 characteristics. Stations in the type 4 service environment were located in generally lower density residential areas or at key auto access locations. The primary mode of access to such stations would be the automobile with both parking and kiss-and-ride access modes. Using these service environment categories, specific facility and site requirements were developed for potential station locations generated in Milestone 5, and adjustments in locations to accommodate the physical and site requirements were made. The resulting station locations and routes are described on a corridor by corridor basis. These corridors are the south, north, east, west, central, Hialeah and I-95 Busway Extension corridors. All corridors are two direction and include either two tracks or lanes.

South Corridor

The South and North corridor routes shown in Figure 22 would be continuous through the Miami Central Business District with the point of demarcation being the major transfer station and downtown terminal station at the Government Center area. The Government Center station would be an elevated multi-level facility serving the north-south routes, the east-west routes and the I-95 Busway. The station would be in the type 1 service environment category and is estimated to serve a total of 186,000 mode trip ends each weekday in 1985 (mean value). Of these, approximately 100,000 are transfers among the three routes. Walking and feeder bus would be the access modes with no parking or kiss-and-ride facilities

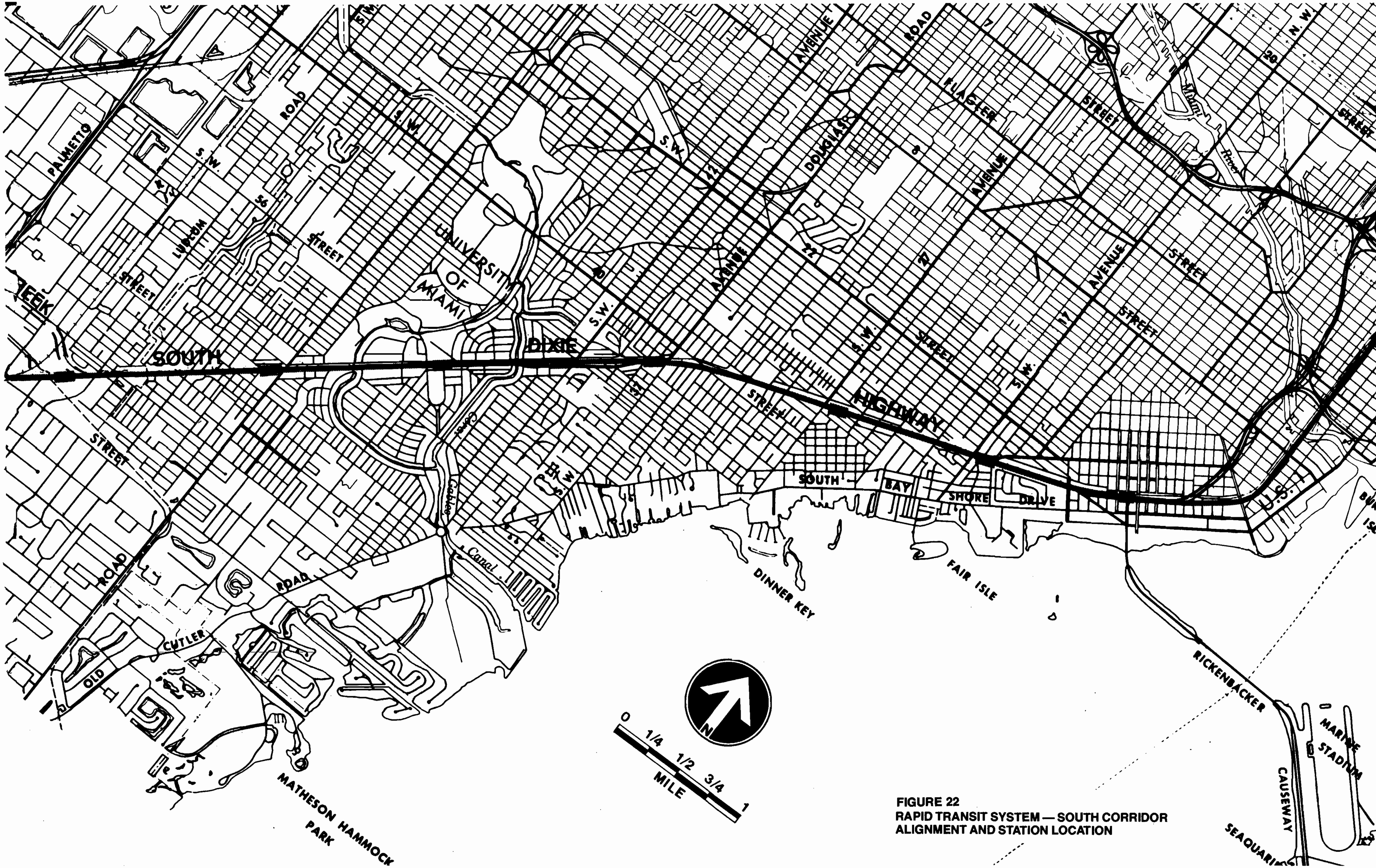


FIGURE 22
RAPID TRANSIT SYSTEM — SOUTH CORRIDOR
ALIGNMENT AND STATION LOCATION

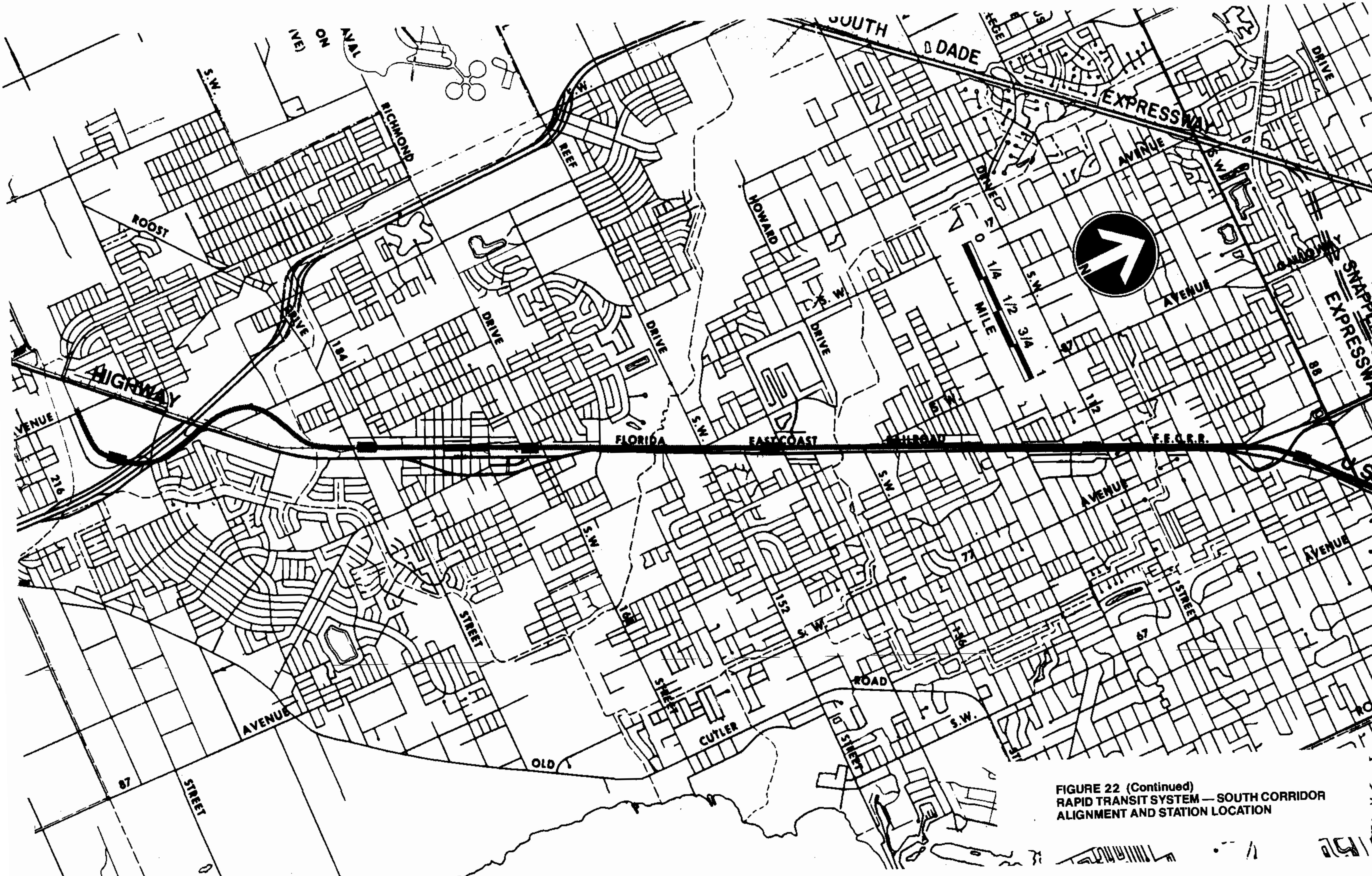


FIGURE 22 (Continued)
RAPID TRANSIT SYSTEM — SOUTH CORRIDOR
ALIGNMENT AND STATION LOCATION

being planned. From the Government Center station location at N.W. 1st Avenue and N.W. 1st Street, the South Corridor route would proceed directly south in aerial configuration within the existing Florida East Coast (FEC) Railroad right-of-way. The route profile would rise in elevation to cross over the I-95 highway access ramps and the Miami River, the latter crossing being a fixed span providing the required 75' clearance above the navigable waterway. The route then continues due south on the FEC right-of-way, skirting the west side of the Brickell Avenue development area, and dropping to a normal height (16'-6" clearance) elevated structure for the station location at S.W. 11th Street. This station is estimated to serve approximately 30,000 rapid transit trip ends (1985 mean value) each weekday, would be of the type 1 service environment category, and would have specific provisions for convenient transfer to minibus service for the Brickell Avenue area. Continuing on the FEC right-of-way, the elevated route would curve to the southwest, drop to an at-grade section to pass beneath the elevated I-95 highway, and then, before reaching the S.W. 27th Road station, would return to normal height structure so as to provide grade separation of cross streets in the area. The S.W. 27th Road station is estimated to handle 11,000 rapid transit trip ends each weekday (1985 mean value) and being of the service environment category 2 would include 425 auto parking spaces to the east side of the station. The elevated line would then continue on the FEC right-of-way paralleling the west side of the I-95 Expressway and South Dixie Highway (U.S. Route 1), to a station located at S.W. 17th Avenue. This elevated station would include 200 surface parking spaces and is estimated to serve 5,000 rapid transit trip ends on a weekday in 1985 (mean value). Proceeding southwest, the South Corridor route would pass along the northwest edge of the Coconut Grove area and would use aerial structure in the FEC right-of-way. At 27th Avenue, an elevated station would be provided and would include 600 surface parking spaces to the west of the station site. This type 2 station (like all others) would include feeder bus access provisions and kiss-and-ride drop off and pick up areas. A total of approximately 16,000 rapid transit trip ends are estimated (mean value) for a 1985 weekday at this station.

At S.W. 37th Avenue (Douglas Road), the South Corridor route would interface with the southern end of the Central Corridor route. An elevated station would provide for transfer between the routes and for service to the surrounding neighborhoods. This station is estimated to serve over 63,000 mode trip ends on a 1985 weekday (mean value), and would include 1,750 parking spaces in a structure adjacent to the northwest side of the facility. The elevated route (still in the FEC right-of-way) would then proceed southwest through Coral Gables to South Miami. This entire route section would use normal height elevated structure to provide clearance over the many cross streets in the area. Elevated stations would be located at S.W. 42nd Avenue (LeJeune Road), at a site adjacent to the University of Miami, and at Red Road, with 600, 225, and 725 parking spaces at each station respectively, and approximately 16,000, 5,500, and 12,000 rapid transit trip ends forecast for 1985 (weekday - mean value) for each station respectively. Continuing southwest the route would pass through South Miami and, before entering the Dadeland area, would cross the FEC RR double wye tracks at Snapper Creek with the required vertical clearance for railroad crossings. The Dadeland (North) station would be located on the FEC right-of-way just south of the junction of the planned Snapper Creek Expressway and U.S. 1. The station would be planned primarily for automobile access with a 2,500 space parking garage structure being planned for in addition to the normal feeder bus and kiss-and-ride facilities. Over 17,000 rapid transit trip ends are forecasted to utilize this station in 1985 (weekday - mean value). Just south of this station, provisions would be made for a junction with a possible future route to the west along the North Kendall Drive corridor. After crossing over North Kendall Drive, the route would transition to an at-grade section on retained fill. The Dadeland (South) station would be located in this area, on the FEC right-of-way just north of the northbound Palmetto Expressway ramp. This type 3 station would be primarily designed for feeder bus, mini-bus and automobile access and is estimated to serve almost 22,000 boarding and alighting rapid transit passengers in 1985 (weekday - mean value). 1300 parking spaces would be provided on the east side of the station site. Proceeding on southwest, the route would continue to parallel the west side of U.S. 1, would cross underneath the northbound Palmetto Expressway ramp, and would then climb up over the southbound ramp before returning to normal height aerial structure. The next station would be located on the FEC right-of-way at S.W. 112 Street, would provide feeder bus, kiss-and-ride and park-and-ride facilities (800 surface spaces), and is forecasted to handle approximately 13,500 rapid transit trip ends on a 1985 weekday (mean value). After traversing the Sunniland area, the aerial route would continue southwest along the FEC RR through the Howard/Rockdale areas, and having crossed over S.W. 152nd Street (Coral Reef Drive) the aerial route would once again transition to at-grade configuration along the southeast boundary of Palmetto Country Club and Golf Course. A station would be located at S.W. 144th Street to serve the surrounding residential area and is forecasted to be used by 7,500 boarding and alighting rapid transit passengers each weekday in 1985 (mean value). The elevated station would include 1,150 surface parking spaces to the west of the site. The next station would be located at S.W. 168th Street (Richmond Drive). Proceeding southwest from the 144th Street station, the route would drop to the previously mentioned at-grade section, and would then return to aerial configuration and cross over Colonial Drive before entering the 168th Street station in Perrine. Continuing on normal height aerial structure alongside and to the northwest of the relocated FEC RR track, the route would continue to a station at S.W. 186th Street (Quail Roost Drive). The 168th Street and 186th Street stations would handle approximately 7,000 and 9,000 rapid transit trip ends respectively (1985 weekday mean value) and would include 1,050 and 1,175 parking spaces respectively.

Proceeding southwest from S.W. 186th Street (Quail Roost Drive), the aerial route would enter the Cutler Ridge area and be located adjacent to the rapid transit system's main vehicle storage and maintenance facility, which would be situated on undeveloped land bounded by Quail Roost Drive, Florida's Turnpike, and the FEC RR. Northbound and southbound yard connections to the main line would be provided, and an aerial test track located alongside the main line tracks would extend north to the vicinity of S.W. 152nd Street (Coral Reef Drive) for a distance of approximately 3 miles. Proceeding south from the yards and shops area, the South Corridor route would rise in elevation to cross over the FEC RR and South Dixie Highway just east of Florida's Turnpike, then continue south along the east side of the Turnpike to Caribbean Boulevard, where the route would turn in a westerly direction and cross over the Turnpike to the terminal station located in a currently undeveloped area between the Cutler Ridge Shopping Center and South Dade Government Center. Provisions would be made for future extension of the south corridor route along S.W. 211th Street and South Dixie Highway toward Homestead and Florida City. The Cutler Ridge station would be a service environment type 4 station, with parking structures for 1,500 automobiles. Daily mean value passenger usage is estimated at over 17,000 for 1985.

A summary of station locations and station access modes for the South Corridor is shown below.

	Access			
Station Location	Walk	Bus	Kiss-Ride	Park-Ride
*Government Center	x	x	-	-
SW 11th Street	x	x	x	-
SW 27th Road	x	x	x	x
SW 17th Avenue	x	x	x	x
SW 27th Avenue	x	x	x	x
*Douglas Road	x	x	x	x
LeJeune Road	x	x	x	x
University of Miami	x	x	x	x
Red Road	x	x	x	x
Dadeland (North)	x	x	x	x
Dadeland (South)	x	x	x	x
SW 112th Street	x	x	x	x
SW 144th Street	x	x	x	x
Richmond Drive	x	x	x	x
Quail Roost Drive	x	x	x	x
Cutler Ridge	x	x	x	x

* Indicates Transfer Station.

North Corridor

The North Corridor route shown in Figure 23 would originate at the Government Center in Downtown Miami as a continuation of the South Corridor, and would terminate in Opa-Locka.

Proceeding north from the Government Center station, the aerial route would be located within the FEC RR right-of-way in aerial configuration to N.W. 11th Street where it would turn sharply to the west to a location along the north side of N.W. 11th Street. Proceeding west along N.W. 11th Street the aerial route would slope downwards in elevation to cross under I-95, then continue in normal height aerial configuration toward the Miami River. Provisions would be made for a future station at N.W. 8th Street on the FEC right-of-way. An elevated station would be located at N.W. 7th Avenue and N.W. 11th Street. This type 1 service environment station would be primarily oriented toward feeder bus and walking access and is forecasted to

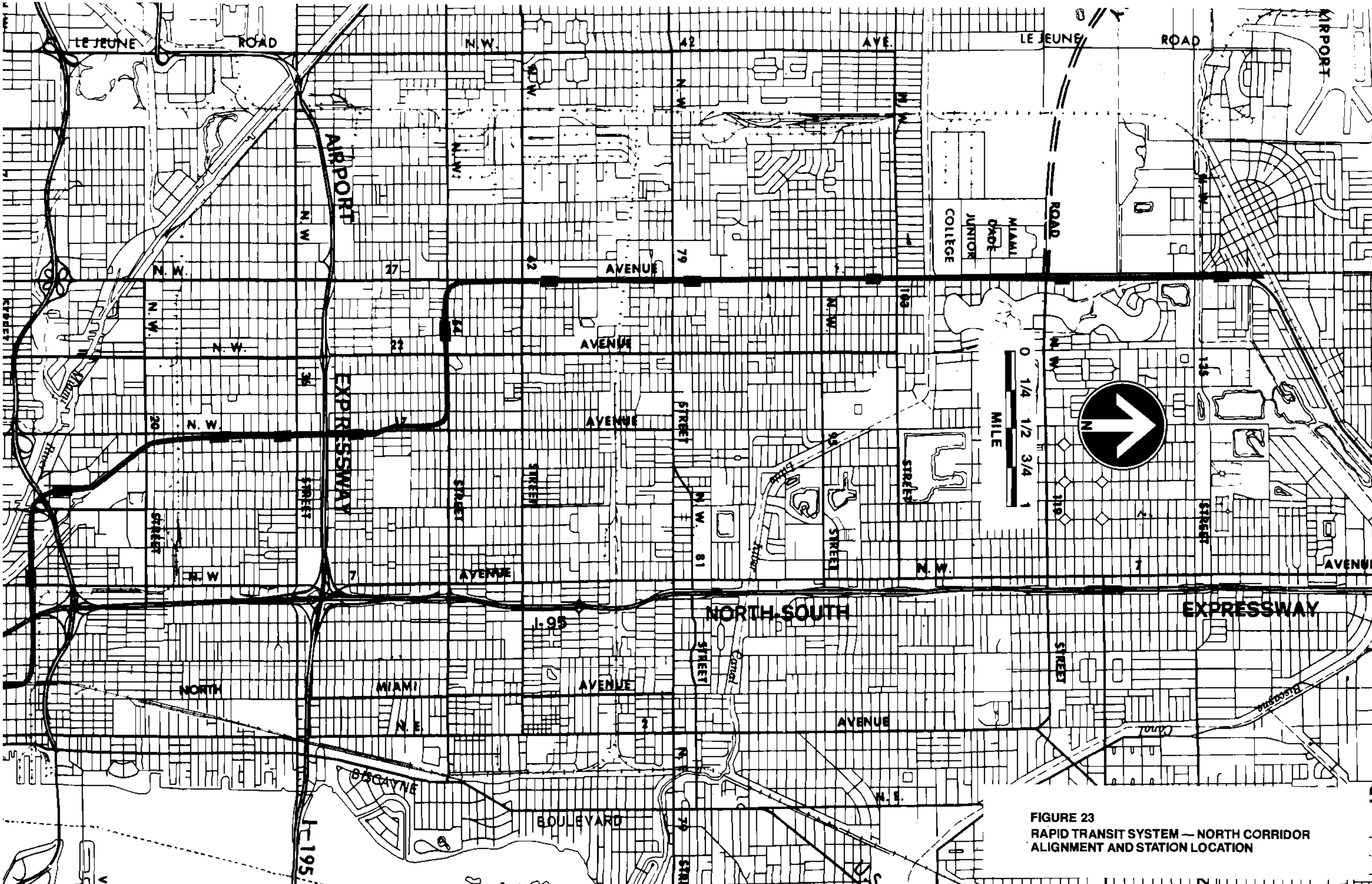


FIGURE 23
RAPID TRANSIT SYSTEM — NORTH CORRIDOR
ALIGNMENT AND STATION LOCATION

serve approximately 12,000 daily rapid transit trip ends in 1985 (mean value). The route would continue due west, then, after crossing over N.W. 12th Avenue it would turn sharply to the north, crossing underneath the East-West Expressway to enter the Civic Center complex in the N.W. 13th Court area. A station would be located at N.W. 13th Court and N.W. 14th Street to serve the Civic Center area. This elevated station would be designed for walk-on, feeder bus, and mini system access modes and is forecasted to handle approximately 19,000 rapid transit trip ends on a 1985 weekday (mean value).

Proceeding north on N.W. 13th Court, the aerial route would turn in a northwesterly direction along the northwest side of Wagner Creek to N.W. 20th Street where it would curve to the north and be located along the east side of N.W. 17th Avenue. The aerial route would continue north in this location through Allapattah and into the Model City area. The route would cross over the Airport Expressway and shift from the east to the west side of N.W. 17th Avenue between N.W. 46th and N.W. 48th Streets. This route section would include three elevated stations, the N.W. 26th Street, N.W. 35th Street and N.W. 44th Street stations, which are forecasted to serve approximately 13,000, 15,000 and 8,500 daily rapid transit patrons respectively in 1985 (mean value). All three stations would be of the type 2 service environment category with limited parking facilities. From the N.W. 44th Street station the aerial route would continue north along the west side of N.W. 17th Avenue to N.W. 54th Street, where it would turn due west and be located in a widened median of N.W. 54th Street through the heart of Model City. The next station would be located at N.W. 54th Street and N.W. 23rd Avenue and again, this station would be primarily designed for walk and feeder bus access modes. 6,500 rapid transit trip ends may be expected for a 1985 weekday (mean value). Continuing along the median of N.W. 54th Street, the North Corridor route would remain in aerial configuration and, at N.W. 27th Avenue, would again curve due north and be aligned in a widened median of N.W. 27th Avenue. The aerial route would continue north in this location through Glenwood Heights, past Miami-Dade County Junior College to a terminal station located in the vicinity of Opa-Locka Boulevard in Opa-Locka where provisions would be made for future extension of the north corridor route to the County Line and beyond. The Hialeah Corridor route would be connected by a grade-separated junction to the North Corridor route at the FEC RR crossing in Glenwood Heights.

Stations on N.W. 27th Avenue would be located at N.W. 65th Street, N.W. 81st Street, N.W. 100th Street, Miami-Dade Community College North and at Opa-Locka Boulevard in Opa-Locka. The N.W. 65th Street station would be of type 2, would serve approximately 9,000 rapid transit trip ends per day and would include 300 surface parking spaces. The 81st Street and 100th Street stations would be of type 3, would be provided with 600 and 550 surface parking spaces respectively, and would handle approximately 11,500 and 10,000 daily rapid transit patrons (1985 mean value) respectively. The MDCC-North and Opa-Locka stations would be type 4 primarily oriented to automobile and feeder bus access and would include 500 and 1,300 parking spaces respectively. The MDCC station is forecasted to serve 4,600 patrons daily and the Opa-Locka station 10,800 patrons daily (1985 mean values).

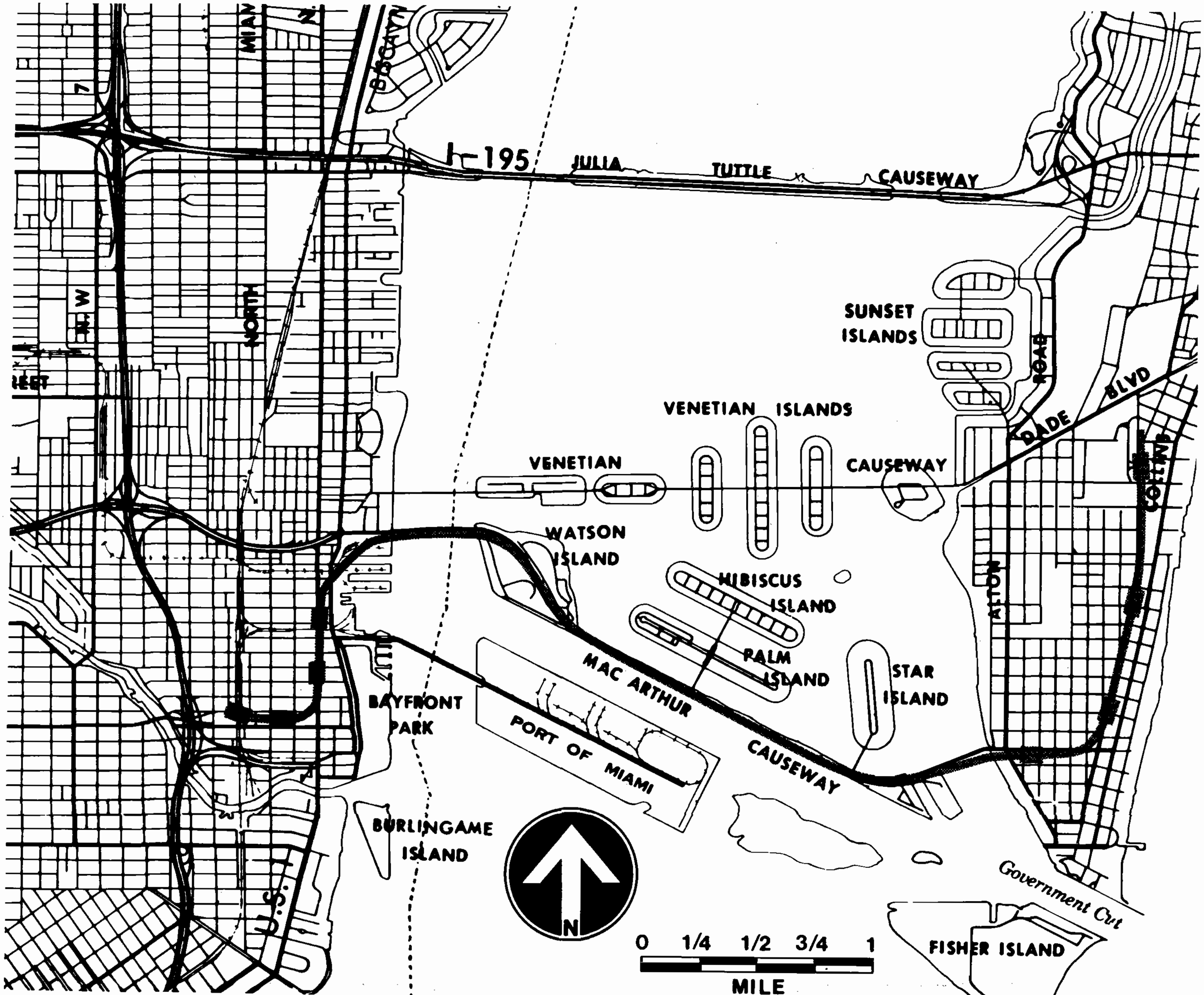


FIGURE 24
RAPID TRANSIT SYSTEM — EAST CORRIDOR
ALIGNMENT AND STATION LOCATION

A summary of station locations and station access modes for the North Corridor is shown below.

Station Location	Access			
	Walk	Bus	Kiss-Ride	Park-Ride
*Government Center	x	x	-	-
NW 8th Street (Future)				
NW 7th Avenue	x	x	x	-
Civic Center	x	x	x	-
NW 26th Street	x	x	x	x
NW 35th Street	x	x	x	x
NW 44th Street	x	x	x	x
Model City	x	x	x	x
*NW 65th Street	x	x	x	x
NW 81st Street	x	x	x	x
NW 100th Street	x	x	x	x
Miami-Dade College N.	x	x	x	x
Opa-Locka	x	x	x	x

* Indicates Transfer Station

East Corridor

The East Corridor route shown in Figure 24 would originate at the Government Center station in Downtown Miami as a continuation of the West Corridor route, and it would be in aerial configuration over its complete length to the Miami Beach Convention Center.

Proceeding in a southeasterly direction from the Government Center the route would transition on a skew alignment to a position along the south side of N.W. and N.E. 1st Street to N.E. 2nd Avenue where it would turn 90 degrees and proceed north along the east side of N.E. 2nd Avenue. Three stations would be located on this downtown section of the East Corridor, and these would be at Miami Avenue and 1st Street north, adjacent to the Miami-Dade Community College Downtown Campus at N.E. 4th Street and N.E. 2nd Avenue, and at N.E. 9th Street and N.E. 2nd Avenue. All of these stations would be elevated structures designed primarily for walking access and feeder bus and mini-bus interface. No parking facilities would be provided. The Miami Avenue station is forecasted to serve nearly 38,000 daily transit patrons in 1985, while the MDCC-Downtown and N.E. 9th Street stations are forecasted to serve approximately 13,000 and 10,500 patrons respectively (all figures are mean values). After crossing over N.E. 9th Street, the aerial route would turn northeast and east, crossing over Biscayne Boulevard and along the north edge of the proposed Bicentennial Park to a location along the south side of I-395 and the MacArthur Causeway. Provisions would be made for a future route extension to the north along N.E. 2nd Avenue (Biscayne Boulevard).

Proceeding east, the East Corridor route would rise in elevation to a fixed structure crossing over the Intra-Coastal Waterway located south of and adjacent to the existing MacArthur Causeway bridge. East of the Intra-Coastal Waterway crossing, the route would descend to normal height aerial structure which would be attained in the middle of Watson Island. A future station would be planned on Watson Island. After traversing Watson Island along the south side of MacArthur Causeway, the route would proceed east on aerial structure located along the south slope of the causeway, thereby allowing installation of a proposed bicycle path underneath the structure. The East Corridor route would continue east in this location crossing over the Meloy boat channel alongside the causeway structure to South Miami Beach, where the aerial route would be located along the south side of Fifth Street. At Washington Avenue the aerial route would turn north and be located in the median of Washington Avenue to Lincoln Road Mall, where it would shift from the median to the west side of Washington Avenue. The route would proceed north in this location to the terminal station at Miami Beach Convention Center located at 18th Street.

There would be four elevated stations to serve the densely populated and heavily transit dependent area of South Miami Beach. These stations would be located at Michigan Avenue and 5th Street, 7th Street and Washington Avenue, 14th Street and Washington Avenue, and adjacent to the Miami Beach Convention Center on Washington Avenue. All stations except the Convention Center would be of the type 1 service environment category designed for walking and feeder bus access, with no parking facilities for automobiles. The Convention Center station would provide 1,400 parking spaces in a structure adjacent to the west side of the station building, and would also provide for extensive feeder and line haul bus interface facilities. The Michigan Avenue station is projected to handle about 16,000 rapid transit patrons daily, the 7th Street station, approximately 10,000 patrons daily, and the 14th Street station approximately 10,000 patrons daily (all figures 1985 mean values). The Convention Center station, with its substantial transfer movements to bus lines serving beach areas to the north, is forecasted to serve over 43,000 patrons per 1985 weekday (mean value).

A summary of Station locations and station access modes for the East Corridor is shown below:

	Access			
Station Location	Walk	Bus	Kiss-Ride	Park-Ride
*Government Center	x	x	-	-
Miami Avenue	x	x	-	-
Miami-Dade College Downtown	x	x	-	-
N.E. 9th Street	x	x	x	-
Michigan Avenue	x	x	x	-
7th Street	x	x	-	-
14th Street	x	x	-	-
Convention Center	x	x	x	x

*Indicates Transfer Station

West Corridor

The West Corridor route shown in Figure 25 would originate at the Downtown Miami Government Center station as a continuation of the East Corridor route.

The West Corridor route would be in aerial configuration throughout. Starting at the Government Center the route would proceed in a northwesterly direction to N.W. 2nd Street, then turn west and southwest rising in elevation to cross over the I-95 Expressway and the Miami River with the required vertical clearance of 75 ft. for a fixed span river crossing. The Miami River crossing would be located between N.W. 1st Street and West Flagler Street. From here, the West Corridor route would descend to normal height aerial configuration proceeding southwest to S.W. 2nd Street, where it would turn due west and be aligned along the north side of S.W. 2nd Street. The first of three stations serving the Little Havana area would be located at S.W. 8th Avenue and S.W. 2nd Street. This type 1 station is projected to serve approximately 10,500 daily patrons in 1985 (mean value), most of whom would access the station by walking or feeder bus. No parking facilities would be provided. The aerial route would continue west on the north side of S.W. 2nd Street to the end of this street at S.W. 17th Avenue. A station would be located at S.W. 16th Avenue and this facility is projected to handle approximately 15,000 rapid transit patrons daily in 1985. This mean value figure would be made up primarily of persons accessing the station by walking and feeder bus, but a small garage structure for 600 automobiles would also be provided. From this station the route would continue straight west across acquired property parcels and transition to a position along the south side of S.W. 1st Street. At Beacom Boulevard, the West Corridor route would continue along the south side of S.W. 1st Street as it turns northwest to join West Flagler Street. At this point, the aerial route would continue straight, crossing over West Flagler Street, then curve due west along the north side of West Flagler Street to N.W. 27th Avenue, where it would transition to the median of West Flagler Street. The third station serving the Little Havana area would be located at N.W. 25th Avenue. This elevated station includes an adjacent surface lot for 600 automobiles and is projected to serve about 15,000 daily rapid transit patrons in 1985 (mean value). Proceeding west in the West Flagler Street median the aerial route would once again shift to the north side of the street at N.W. 33rd Avenue. From here it would proceed due west along the north side of West Flagler Street to a junction with the Central corridor route at Douglas Road. Provision would be made for future extension of the west corridor route along West Flagler Street beyond Douglas Road.

A summary of station locations and station access modes for the West Corridor is shown on the next page:

Station Location	Access: Walk	Bus	Kiss-Ride	Park-Ride
*Government Center	x	x	-	-
S.W. 8th Avenue	x	x	x	-
S.W. 16th Avenue	x	x	x	x
N.W. 25th Avenue	x	x	x	x

*Indicates Transfer Station

Central Corridor

The Central Corridor route shown in Figure 26 would originate at a transfer station and junction with the South Corridor in the vicinity of South Dixie Highway and Douglas Road. From here the Central Corridor aerial route would be oriented northeasterly, crossing over Douglas Road and proceeding north along the east side of Douglas Road to S.W. 7th Street, where it would transition from the east side to the west side of Douglas Road. A station located just south of S.W. 22nd Street (Coral Way) is projected to serve almost 11,000 transit patrons per day in 1985 (mean value) and includes provision for 450 automobile parking spaces. The second station on this corridor is located at S.W. 10th Street and Douglas Road and is forecasted to serve about 8,500 people daily (1985 mean value) with walk on, feeder bus, kiss-and-ride and park-and-ride access modes. 450 auto parking spaces would be provided on the east side of the station. Continuing north along the west side of Douglas Road the Central Corridor route would join the West Corridor route in a junction on the north side of West Flagler Street. A grade-separated type junction would be provided which would link the West Corridor with the Central Corridor for traffic to and from the north, as well as allow future extension of the West Corridor route along West Flagler Street toward the Palmetto Expressway. Proceeding north along the west side of Douglas Road from the West Corridor junction, the Central Corridor route in aerial configuration would occupy the Douglas Road frontage of West Flagler Kennel Club and N.W. 7th Street Shopping Center, then rise in elevation to cross over the East-West Expressway. An elevated station would be located at N.W. 7th Street and would include 575 automobile parking spaces. This station is expected to serve about 11,500 rapid transit patrons daily in 1985 (mean value). North of the crossing of the East-West Expressway the route would return to normal height aerial structure and be located on the Douglas Road frontage of Grapeland Heights Park and LeJeune Golf Course, then cross over Taminami Canal and curve to the northwest in an alignment transition to a position along the west side of the Seaboard Coastline Railroad (SCL) spur track from N.W. 25th Street north.

FIGURE 25
RAPID TRANSIT SYSTEM — WEST CORRIDOR
ALIGNMENT AND STATION LOCATION

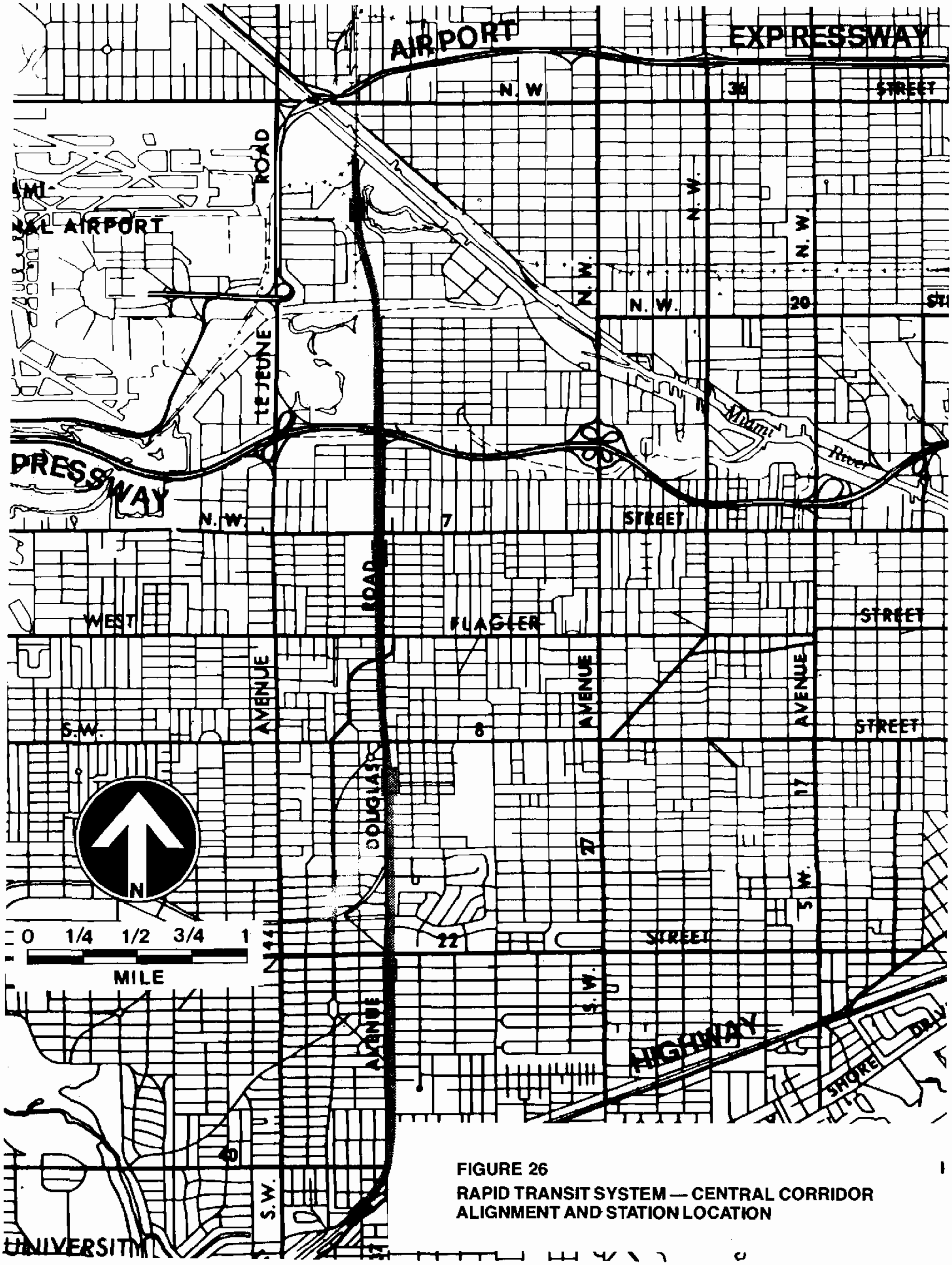


FIGURE 26
RAPID TRANSIT SYSTEM — CENTRAL CORRIDOR
ALIGNMENT AND STATION LOCATION

The Central Corridor terminal station would be located north of N.W. 25th Street and integrated with the proposed Miami Airport Multi-Modal Transportation Center. This facility would provide interface between the rapid transit system, AMTRAK, local and intercity buses, and a peoplemover system to Miami International Airport. Continuing north from this multi-modal terminal the Central Corridor route would curve to the northwest, cross over the SCL wye track to enter a vehicle storage and maintenance facility located on a triangular shaped area bounded by Airport Expressway ramps to LeJeune Road, SCL trackage, and South River Drive. Provisions would be made for future extension of the Central corridor route toward the north. The station is projected to handle approximately 46,000 patrons daily in 1985 (mean value) and would include a 1,300 car parking lot.

A summary of station locations and station access modes for the Central Corridor is shown below:

Station Location	Access			
	Walk	Bus	Kiss-Ride	Park-Ride
*Douglas Road	x	x	x	x
Coral Way	x	x	x	x
S.W. 10th Street	x	x	x	x
*N.W. 7th Street	x	x	x	x
Miami Airport (Multi-modal)	x	x	x	x

* Indicates Transfer Station

Hialeah Corridor

The Hialeah Corridor route shown in Figure 27 would branch off from the North Corridor route at N.W. 27th Avenue/N.W. 73rd Street. A grade-separated junction would be provided, and starting from there, the Hialeah Corridor aerial route would curve to the west, cross over the FEC RR track to the north side of the railroad right-of-way. The Hialeah Corridor route would continue west in this location past the Hialeah Race Track, crossing over Red Road. West of Red Road, the aerial route would continue along the north side of the Hialeah Expressway. Between West 9th and 10th Avenues the alignment would turn southwesterly, crossing over the Hialeah expressway, the FEC RR, Okeechobee Road and Miami Canal to enter a vehicle storage and maintenance facility located on FEC RR property north of their Hialeah Yards.

This corridor would include three stations. These would be located at East 9th Avenue, Hialeah Park, and West 8th Avenue. The first two stations would be of service environment type 3, while the West 8th Avenue station, with a 1,600 car parking lot, would be of type 4. The three stations, in the order mentioned above, are projected to serve approximately 7,000, 7,000, and 13,500 patrons daily in 1985 (mean values).

A summary of station locations and station access modes for the Hialeah Corridor is shown below:

Station Location	Access Walk	Bus	Kiss-Ride	Park-Ride
East 9th Avenue	x	x	x	x
Hialeah Park	x	x	x	x
West 8th Avenue	x	x	x	x

I-95 Busway Extension

This route, shown in Figure 28, is a continuation of the I-95 busway (presently under construction) into the Miami CBD. Leaving I-95 Expressway and using fly-over ramps, the route parallels the Airport Expressway, proceeding in an easterly direction to the FEC RR right-of-way. Turning south at this intersection it continues grade-separated into the Government Center Terminal. A station is proposed in the vicinity of N.W. 36th Street to provide transfer service to buses operating between Miami Beach and the Airport. In addition, neighborhood bus stations would be located adjacent to I-95 in the vicinity of N.W. 62nd Street, N.W. 79th Street, N.W. 103rd and 115th Streets, and N.W. 135th Street. The N.W. 36th Street station is projected to serve approximately 10,000 bus patrons per day. No parking is provided at this location. The N.W. 62nd Street bus station includes parking for 450 cars and is projected to handle over 12,000 patrons daily in 1985. The N.W. 79th Street bus station includes 750 car spaces and should serve about 12,500 patrons daily. The N.W. 103 and 115 Streets is a split facility with 600 car parking spaces being provided at the latter location. Estimated patronage at these facilities totals approximately 12,500 per day in 1985. The N.W. 135th Street bus station includes 750 par-ride spaces and is projected to handle 13,200 patrons daily in 1985. All patronage figures are mean values.

A summary of station locations and station access modes for the I-95 Busway Corridor is shown below:

Station Location	Access Walk	Bus	Kiss-Ride	Park-Ride
*Government Center	x	x	-	-
NW 36th St. & Miami Ave.	x	x	x	-
NW 62nd St. & NW 7th Ave.	x	x	x	-
NW 79th St. & NW 5th Ave.	x	x	x	x
NW 103rd/115th St. & NW 7th/6th Ave.	x	x	x	x
NW 135th St. & NW 5th Ave.	x	x	x	x
Golden Glades (Existing)	x	x	x	x

* Indicates Transfer Station

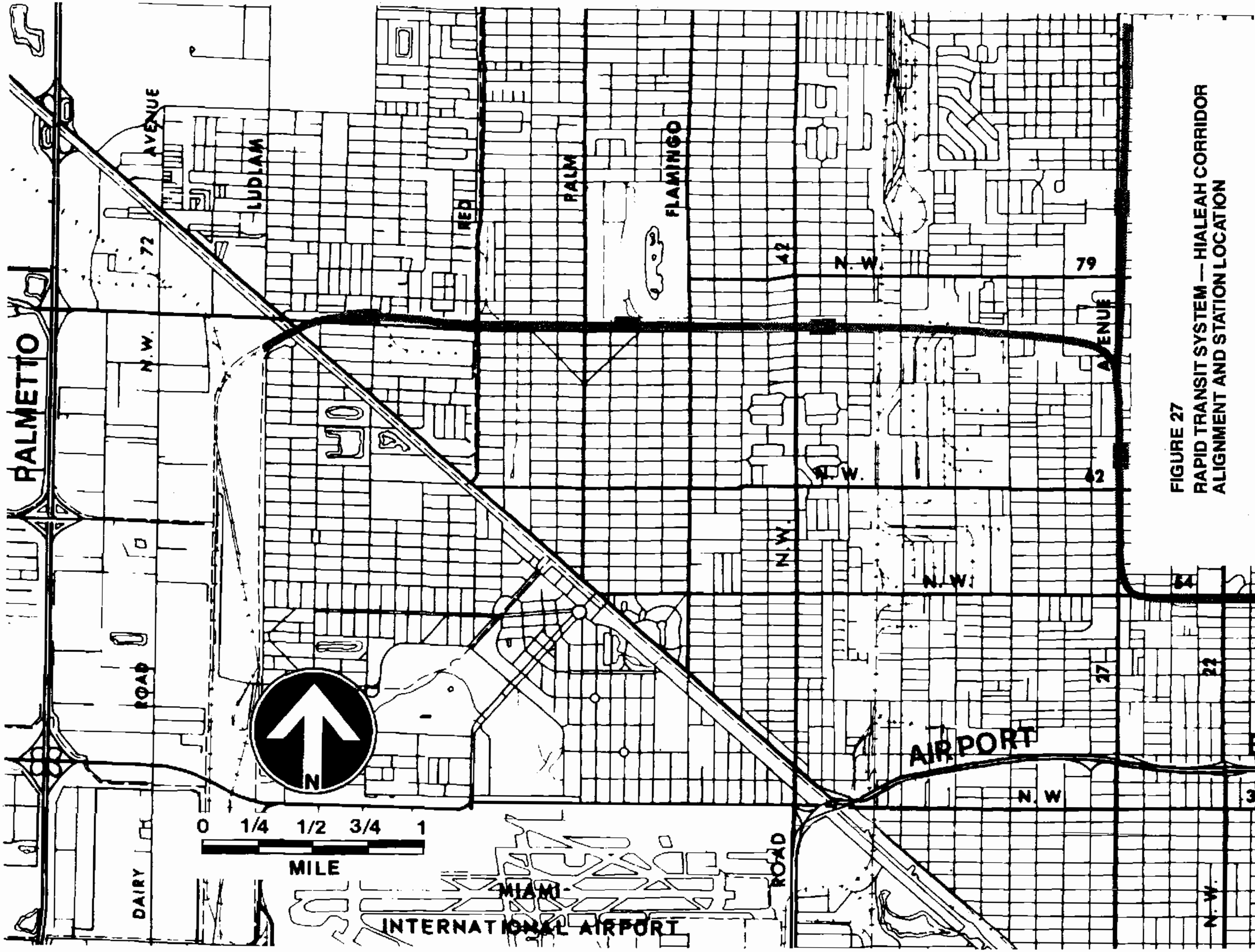


FIGURE 27
RAPID TRANSIT SYSTEM — HIALEAH CORRIDOR
ALIGNMENT AND STATION LOCATION

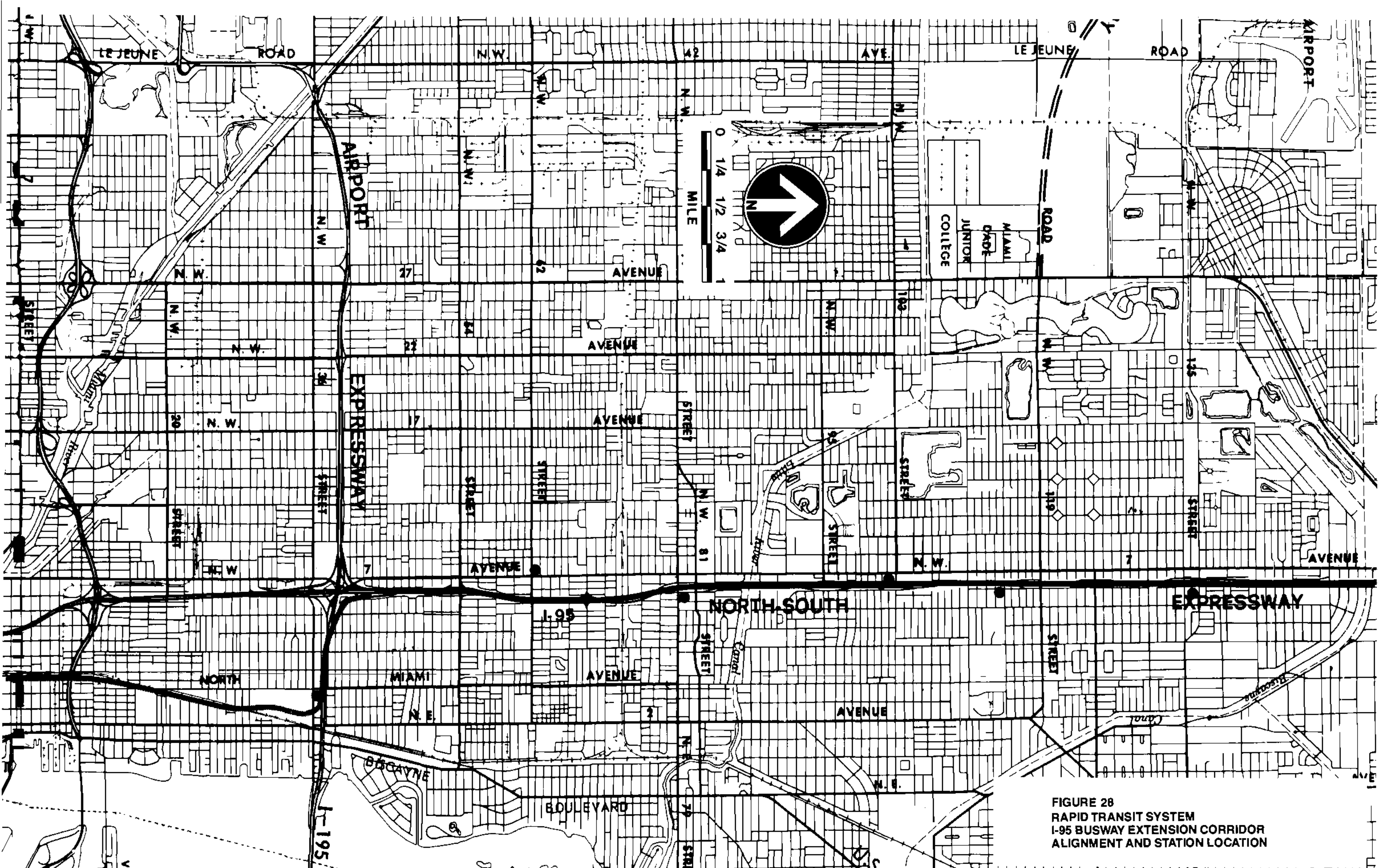


FIGURE 28
RAPID TRANSIT SYSTEM
I-95 BUSWAY EXTENSION CORRIDOR
ALIGNMENT AND STATION LOCATION

4. Vehicle Technology

One of the most important characteristics of a transit system is the type of vehicles to be used. A detailed study was performed in Task D-4 to examine all available vehicle systems and to select the type or types best suited for the Dade County requirements. The analysis and selection process are described in the preceding Section IV. This process lead to selection of electrically powered steel wheeled trains for the fixed guideway portions and the new Transbus for the exclusive busways. Specific characteristics of these vehicle systems are presented in Subsection V-C below.

5. System Staging Plan and Schedule

A key principle involved in the preliminary engineering is the one involving staged implementation. Consideration has been given to planning and implementation of the rapid transit system for Dade County in stages, with initial segments of rapid transit constructed in those corridors and areas having priority needs. The level of service would be raised incrementally as the demand develops, reflecting a balanced concern for short and long range needs. In planning the rapid transit system, a blend of low-cost improvements to existing systems with high-capacity/capital intensive improvements would be integrated in the planning process. The aim is to avoid premature investment in costly facilities in order to preserve the flexibility to respond to future concerns and issues.

The construction of a region-wide rapid transit system is viewed as a continuous long-range process. Rapid transit planning in Milestones 1 and 5 of this study has established a series of levels for transit development. The first is the service network which would serve transit needs beyond year 2000. A second level is the core system network which identifies the rapid transit network to serve transit needs beyond year 1985. The discussion in this section identifies the incremental stages of the core system network at the third level. Dade County is planning and starting to implement a fourth level of existing system improvements which address immediate transit requirements.

In the concept of "usable segments" a rapid transit line or core element is begun in one or more corridors or areas where high capacity transit service is most urgently needed. The initial network is then extended incrementally in subsequent development until the full area-wide coverage is achieved. Service in individual corridors is progressively upgraded from transit operations in mixed traffic, to operations of preferential treatment on reserved lanes, to operation on grade separated facilities, to keep pace with transit projections, ridership densities and demand for higher service quality. In considering usable segments for Dade County, the staging plan for the core system network has addressed a number of objectives in order to be effective.

The staging plan established for Dade County's rapid transit system is considered to be:

- Responsive to the continuous upgrading of transit service.
- Operationally viable for service in the initial and additional stages.
- Compatible with the efficient development of facilities and community.
- Responsive to the public involvement process so that staging contributes to an orderly resolution of community concerns and issues.
- Scheduled to meet demands in order of priority.
- Fundable within resource constraints.

The analysis made of the core system network identifies those segments which fit the above objectives of the usable segment concept. From this analysis, segments were chosen so that, at completion, each stage plays a productive role independent of further staging. The staging also presents deferred development which allows further study of routes through sensitive areas. The staging plan allows flexibility in development to account for changes in goals, policies, land-use, population density shifts, observed impacts of transit use, and changes in life-style caused by energy factors, economy, and community maturity.

Staging provides the opportunity to review and revise the transit plan at successive stages while maintaining long range objectives.

a. Conceptual Stages

An analysis of the ridership projections for the transit program indicates that from the standpoint of ridership volumes on fixed guideway facilities of the Core System Network, the North-South corridor route would attract the greatest number of rapid transit patrons. Extension of the I-95 Busway facility is required to develop the ridership potential and provide the proper service level for residents of Northeast Dade County.

(1) Fixed Guideway Transit System Staging - From the standpoint of operational viability and storage yard access,[1] studies for the staging plan of fixed guideway transit indicated development as follows:

- A major portion of the North-South Corridor could be operated as a Stage I system with service between

(1) Refer to Appendix 3, Section E for further details.

terminals in South Perrine (SW 184 Street) and Model City (NW 62 Street) and with train access to a storage yard at South Perrine.

- The West-Central Corridor could be operated as a Stage II system with service between terminals at MIA, U.S. 1/Douglas Rd. and the CBD, providing good service to residents and airport travel and an interface with transfer points of the North-South Corridor at Douglas Rd. and Government Center. Train access would be to the airport yard in the vicinity of the MIA Multi-Modal Center.

- The East Corridor could be operated as a Stage III system with service extended from the CBD junction of Stage II to a terminal at the Miami Beach Convention Center. Service would be provided to Hialeah, Opa-Locka and Cutler Ridge by extensions to Stage I routes. Trains would be operated from previously staged yards and a new yard at Hialeah.

(2) Busway Transit System Staging - Busway and express bus facilities would be staged to be compatible with the other rapid transit segments.

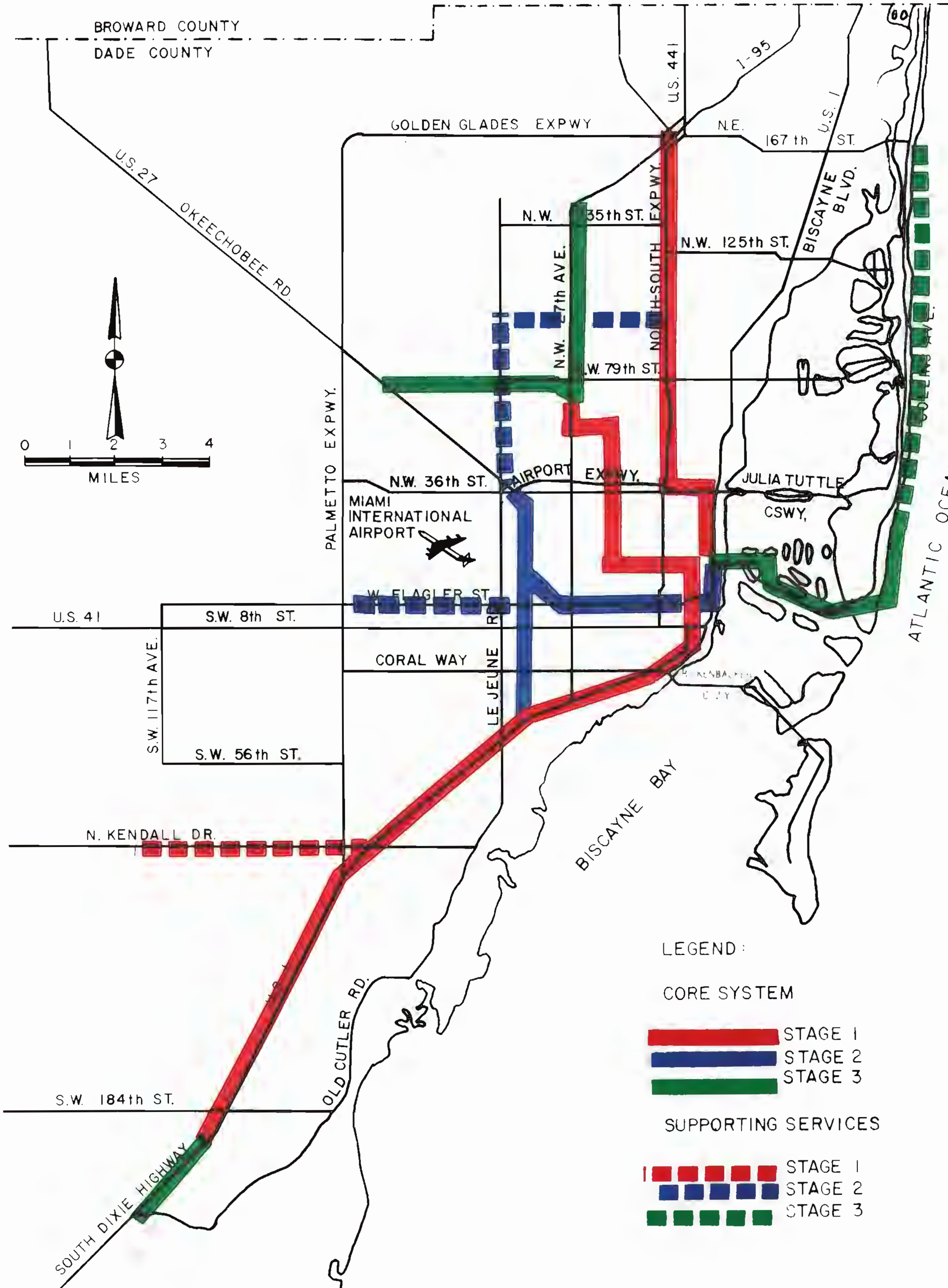
- The I-95 Busway would be extended to a terminal in the CBD and supplied with park-ride lots in Stage I.

- The express bus service for the northeast, Hialeah, West Flagler, and Kendall corridors would be implemented to supplement rapid transit segments in Stages II and III.

(3) Transit System Operational Stage Summary - The following list summarizes the operational stages of the various segments of the rapid transit program which were established from the above analysis of system requirements and operational continuity. The staging plan is illustrated in Figure 29.

FIGURE 29

CORE SYSTEM STAGING PLAN



STAGE I - Trains operate from Perrine (SW 184 St.) to Model City (NW 62 St.)

- Buses operate from Golden Glades to CBD Terminal

- Buses operate from Kendall to Dadeland

STAGE II - Trains operate from MIA to CBD North (NE 8 St.)

- Trains operate from U.S. 1/Douglas Road to MIA

- Buses operate from N. Miami Beach to Hialeah /MIA

- Buses operate from Westchester to Little Havana

STAGE III - Trains operate from Cutler Ridge to Opa-Locka

- Trains operate from MIA to Miami Beach

- Trains operate from Dadeland (South to Hialeah)

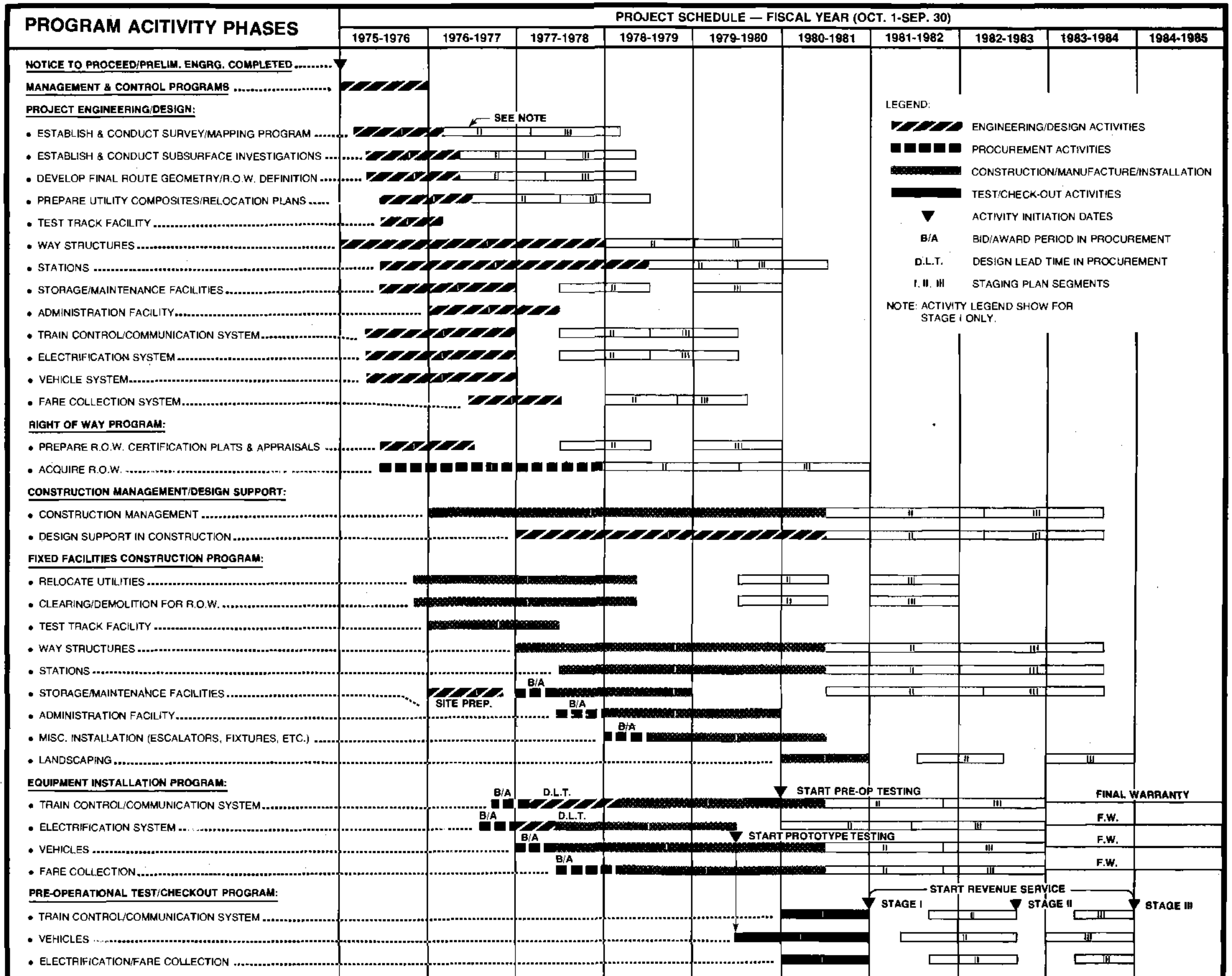
- Buses operate from Sunny Isles to Miami Beach Convention Center

b. Staging Plan Schedule

A schedule to accomplish the development of the full core system network of rapid transit facilities is shown in Figure 30 for the three stages described above. The period of development occurs over a ten year span, with Stage I facilities scheduled for completion in 5½ years, Stage II 1½ years later, and Stage III 1½ years thereafter. Revenue operation would commence after operational testing/de-bugging/shakedown activities, about 1 year after Stage I construction is completed.

FIGURE 30

METROPOLITAN DADE COUNTY TRANSIT IMPROVEMENT PROGRAM CORE SYSTEM NETWORK STAGING PLAN PROJECT SCHEDULE



6. System Operations

The service and system criteria, ridership data, and route alignment and station location data presented in preceeding sections provided the fundamental basis for the definition of system operations for the core system. An analysis of the capacity and performance requirements for these core system elements was performed to establish vehicle size, speed and operating schedules. A train performance computer program was used for the rail portion of the core system. This program provided average train speeds and power requirements based upon a set of input data including the route alignment and profile, station location, vehicle type and weight, vehicle propulsion equipment and various other parameters.

System Configuration. The core system consists of five operating routes or lines as shown schematically on Figure 31. The end points of these lines are as follows:

- Line 1: Cutler Ridge - Opa-Locka
- Line 2: Dadeland (South) - West 8th Avenue (Hialeah)
- Line 3: Airport - U.S. 1/Douglas Road
- Line 4: Airport - Miami Beach Convention Center
- Line 5: Golden Glades (and other points adjacent to I-95) - Downtown Government Center

Lines 1 and 2 use common trackage from Dadeland (South) to the junction of the Hialeah and Opa-Locka branches north of N.W. 62nd Street on N.W. 27th Avenue. Lines 3 and 4 use common trackage from the Airport Multi-Modal Transportation Center to the West Flagler Street/ Douglas Road junction. Line 5 is used by a number of separate bus routes which enter/exit the I-95 Busway at five locations. On-line transfer points are located at U.S. 1/Douglas Road (Lines 1 and 2 to/from Line 3) the Downtown Government Center (Lines 1 and 2 to/from Line 5, Lines 1 and 2 to/from Line 4, Line 4 to/from Line 5), N.W. 7th Avenue/Douglas Road (Line 3 to/from Line 4), and N.W. 62nd Street/ N.W. 27th Avenue (Line 1 to/from Line 2). Many other transfer locations to core system supporting services are provided but are not shown on Figure 31. Trains stop at each and every station on Lines 1 through 4, while buses which use the I-95 Busway (Line 5) travel non-stop except for the station stop in the area of North Miami Avenue/N.E. 36th Street.

As described in the previous section, the core system is scheduled to be constructed in three stages. Figure 32 shows Stage I operating lines for the core system. The turnback of trains at Dadeland (South) is an option feature which may be revised according to actual passenger demand experienced. Stage I - Line 1 and Stage I - Line 2 use common trackage from Dadeland (South) to N.W. 62nd Street. Line 5 operates in Stage I in a similar manner to its operation within the complete core system.

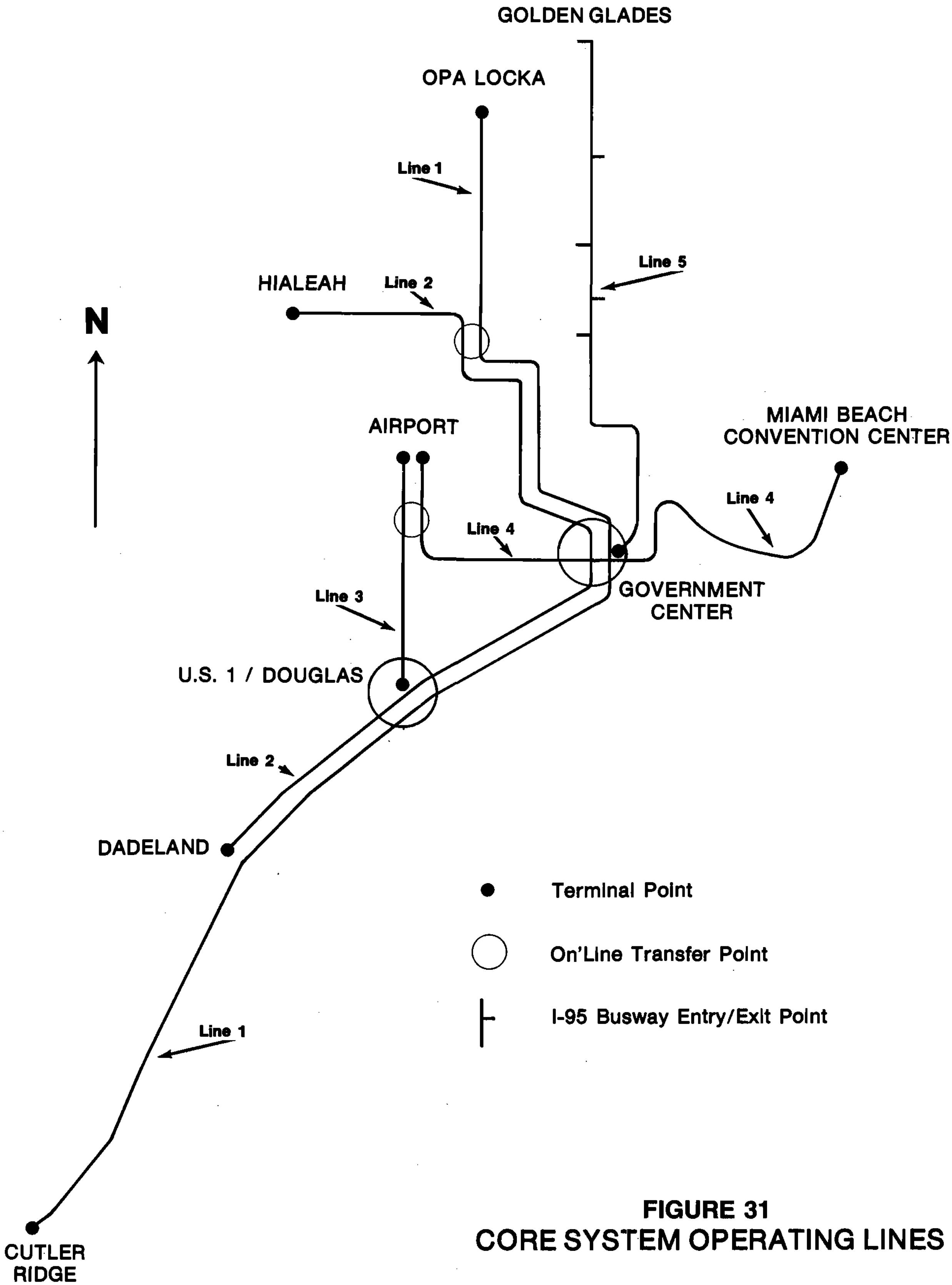


FIGURE 31
CORE SYSTEM OPERATING LINES

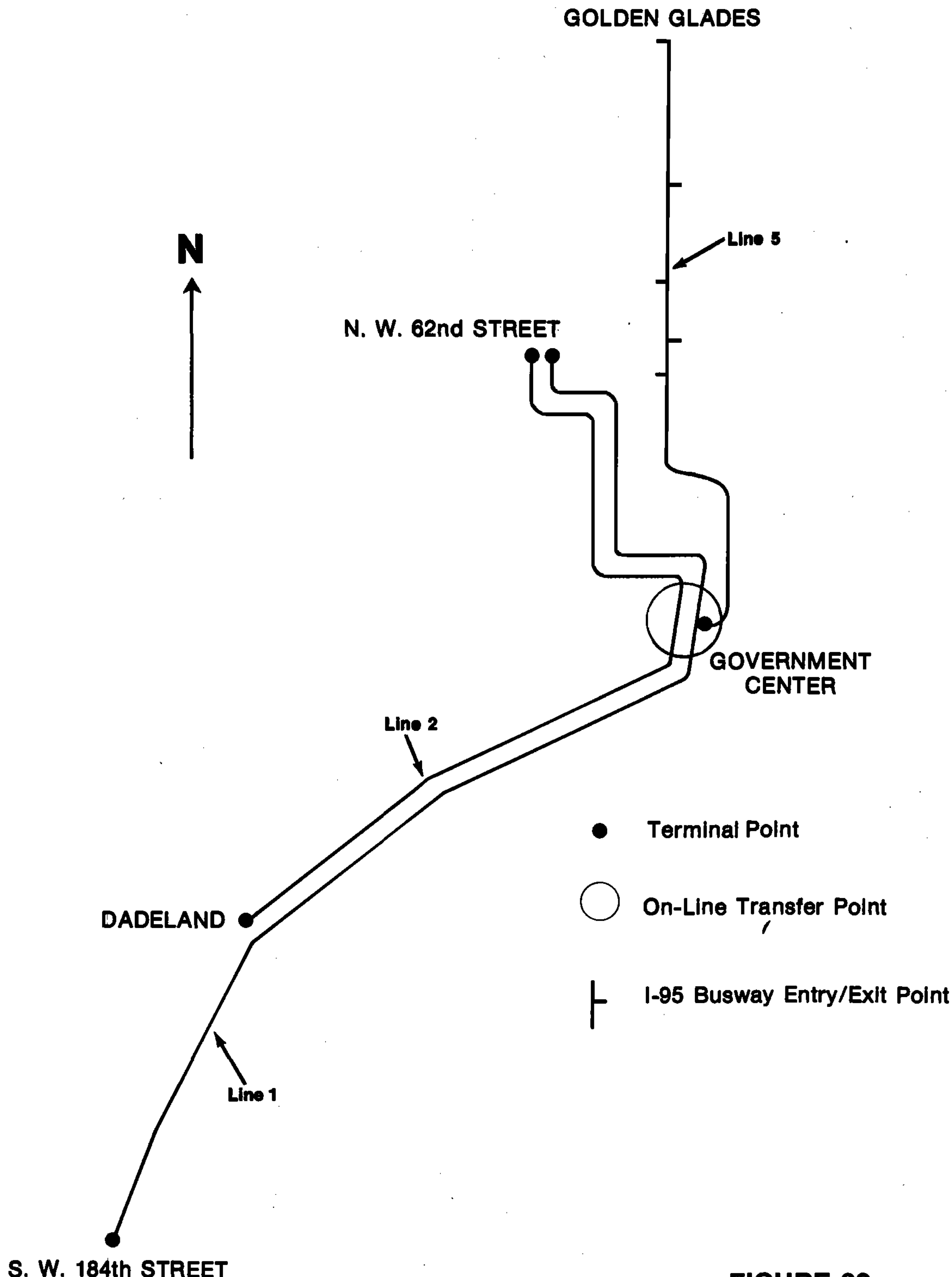


FIGURE 32
CORE SYSTEM STAGE I OPERATING LINES

System Average Speed and Travel Times. Based upon an analysis of vehicle and train performance, average, speeds for the various corridors of the core system were determined. These average speeds included all station stop times and reflect the vehicle performance characteristics described in subsection V-C-3. Table 12 shows average vehicle or train speed on a corridor by corridor basis and Table 13 shows the resulting travel times between various selected stations on the complete core system and on Stage I of the core system.

Service Levels. Criteria established in Milestone 1 and the expected hourly distribution of demand over a winter weekday provided the basis for the service levels shown in Table 14. In the peak hour, the service levels shown provide a 3 minute headway for trains traveling between Dadeland (South) and N.W. 62nd Street, and between the Airport and N.W. 7th Street. It is recommended that the Stage I core system Lines 1, 2 and 5, be operated with the service levels shown. Line 4 has an average peak hour headway of 4½ minutes but in fact will have succeeding train headways of 3 minutes, 6 minutes, 3 minutes, 6 minutes, etc.

TABLE 12

CORE SYSTEM CORRIDOR AVERAGE SPEEDS

Corridor	Average Speeds (mph)*
South	36**
Central	35**
Southwest	20
West (a)	31**
West (b)	20
Hialeah	36**
North	29**
I-95	35
Cross County	20
East	25**
Miami Beach	20

*Includes station dwell times of:
- 60 seconds at Terminals
- 25 seconds at Intermediate Stations
- 35 seconds Downtown and Other Major Activity Centers

**Based upon the following vehicle performance:
- Maximum Speed - 70 mph
- Normal Acceleration Rate - 2.8 mph/sec
- Normal Braking Rate - 2.7 mph/sec
- Jerk Rate - 2.0 mph/sec^2

TABLE 13
SELECTED STATION TO STATION TRAVEL TIMES ON CORE SYSTEM

Line 1
Cutler Ridge to/from Dadeland (South) .... 12 minutes
Cutler Ridge to/from U.S. 1/Douglas Road .... 21 minutes
Cutler Ridge to/from Downtown Government Center .... 31 minutes
Cutler Ridge to/from Civic Center .... 36 minutes
Cutler Ridge to/from Opa Locka .... 53 minutes
Opa Locka to/from Downtown Government Center .... 22 minutes
Opa Locka to/from Dadeland (South) .... 41 minutes

Line 2
West 8th Avenue (Hialeah) to/from Civic Center .... 16½ minutes
West 8th Avenue (Hialeah) to/from Downtown Government Center .... 21½ minutes
West 8th Avenue (Hialeah) to/from Dadeland (South) .... 40 minutes

Line 3
Airport Multi-Modal Center to/from U.S. 1/Douglas Road .... 8 minutes

Line 4
Airport Multi-Modal Center to/from Downtown Government Center .... 10½ minutes
Airport Multi-Modal Center to/from Alton Road (Miami Beach)* .... 19 minutes
Airport Multi-Modal Center to/from Convention Center (Miami Beach)* .... 23½ minutes

Line 5
Golden Glades to/from Downtown Government Center .... 21½ minutes
NW 103rd Street area to/from Downtown Government Center .... 15½ minutes
NW 62nd Street area to/from Downtown Government Center .... 11 minutes

Stage I - Core System
Line 5 .... see above
SW 184 Street to/from Dadeland (South) .... 9 minutes
SW 184 Street to/from U.S. 1/Douglas .... 18½ minutes
SW 184 Street to/from Downtown Government Center .... 27½ minutes
SW 184 Street to/from Civic Center .... 32½ minutes
SW 184 Street to/from NW 62nd Street .... 42 minutes

*Does not include Watson Island station.

Passenger Carrying Capacity - Train Size. The ridership figures show the following 24 hour peak link volumes on the core system:

Line 1 + Line 2	between SW 11th St. and Downtown Government Center	104,349
Line 1	between SW 112th St. and Dadeland (South)	48,416
Line 1	between NW 62nd St. and NW 79th St.	23,035
Line 2	between Palm Avenue and LeJeune Road	20,091
Line 3	between U.S. 1/Douglas Road and Coral Way	27,165
Line 4	between Miami Avenue and Downtown Community College	73,533
Line 5	between NE 36th Street and NE 62nd Street	52,923

A single rail vehicle has a seating capacity of 66 passengers, with a normal full capacity of 130 passengers including standees. Based upon 1) the service level requirements described above, 2) the Passenger Comfort Service Criteria established in Milestone 1, and 3) projections of peak hour movements as a percentage of total daily movements (14% of total daily movement for peak hour, peak direction) a basic train size of 6 vehicles has been established for peak hour service. This train would carry a normal full load of 780 passengers in the peak hour with 51% of passengers being seated. The bus vehicle definition includes a seated capacity of 45 persons and a normal full capacity of 50 passengers. The passenger demand on the I-95 busway will require a bus approximately every 25 seconds between NE 36th Street and the Downtown Government Center.

The peak hour design capacity of all rail routes for the 1985 core system is 15,000 passengers per hour. The peak hour design capacity of the I-95 Busway for the 1985 core system is 8,000 passengers per hour. The rail routes and busway will have the ability to increase passenger carrying capacity in future years. (See below). The peak hour design capacity for the Stage I portion of the core system is equivalent to the figures for the complete core system.

Peak-within-the peak hour effects are allowed for in the design of the rail system, and provisions have been made for a passenger movement rate (over a 20 minute period) 50% greater than the average peak hour rate.

Future Growth Potential. Extension of core system routes and growth of usage of basic routes, can be expected for the years beyond 1985. To accommodate this potential future growth, all elements of the rail portion of the core system have been designed with an allowance for a complete doubling of 1985 passenger carrying capacity levels. Thus the core system ultimate design capacity in throat areas is 30,000 passengers per hour (one direction). This capacity level is achieved by making specific allowance for reduction of operating headways and increase of train length. Under ultimate conditions, 2 minute headways could be operated in throat areas (such as Dadeland (South) to NW 62nd Street), and train length would be increased to 8 cars. All core system stations would have provisions for platform extensions for 8 car trains. The capacity of the I-95 Busway is effectively limited to about 12,000 passengers per hour (one direction) assuming 50 passenger buses and minimum headways at 15 seconds in throat areas. Such limitation would however still allow a 50% increase in the passenger carrying capacity of this line of the core system.

TABLE 14

OPERATING SCHEDULES FOR CORE SYSTEM

Operating Hours: 20 hours per day - 365 days a year
Demand Periods: Peak Hours - 7 am to 9 am, 4 pm to 6 pm (Weekdays Only)
Mid Peak - 6 am to 7 am, 9 am to 4 pm, 6 pm to 7 pm (Weekdays Only)
8 am to 7 pm (Weekends and Holidays Only)
Off Peak - 5 am to 6 am, 7 pm to 1 am (Weekdays Only)
5 am to 8 am, 7 pm to 1 am (Weekends and Holidays Only)

Operating Schedule:

	Peak Hours		Mid-Peak		Off-Peak	
	Headway	Train Length	Headway	Train Length	Headway	Train Length
Line (1)	6	6	12	6*/2**	12	2
Line (2)	6	6	12	6*/2**	12	2
Line (3)	9	6	12	6*/2**	12	2
Line (4)	3/6	6	4/8	6*/2**	4/8	2
Line (5)	8***	—	16***	—	16***	—

*Weekdays, Saturdays, and Certain Holidays
**Sundays and Certain Other Holidays
***Per individual route; effective departure frequencies from bus stations adjacent to I-95 would be 1 to 2 minutes in peak hours, and 2 to 4 minutes in Mid-Peak and Off-Peak.

Note: Headways are in Minutes.
Train Lengths are in Cars.

Daily Operating Schedule. Table 14 shows the recommended daily operating schedule for the core system in 1985. This operating schedule is based upon the assumed 1) hourly distribution of passenger demand over a normal weekday and a normal holiday or weekend, and 2) daily distribution of passenger demand over a normal week. The assumptions were developed from an analysis of MTA survey data collected in September 1974, and from MTA revenue receipts for the period October 1973 to September 1974. The assumptions made allowance for an increased work trip percentage (peak hour travel), and revealed that demand levels between the morning and evening weekday peaks would be in the range of 1/4 to 1/7 of the peak hour demand level. The operating schedule is also based on the service criteria that requires a seat for every passenger expected in hours other than the peak hours. The Stage I core system would operate on the schedules shown for lines 1, 2 and 5, in Table 14.

Vehicle Fleet Size. The peak hour operation of the rail portion of the core system will require 52 trains each of 6 cars. Allowing for 10% spare units, 344 rail vehicle units will be required. The operation of the I-95 Busway will require 124 bus units allowing for 10% spares. The Stage I Core System will require 184 rail vehicles and 124 bus units. Additional feeder bus units will be required to supplement the existing MTA fleet. A precise estimate of these additional feeder bus requirements will only be possible after specific routes and schedules have been established.

7. Supporting Services

The rail and busway portions of the rapid transit system will rely heavily on feeder systems and collection/distribution minisystems to bring people to and from the main line stations. The existing bus fleet of the combined MTA and Coral Gables Municipal System will form the backbone of the feeder bus system. This combined fleet currently numbers 517 vehicles (including 15 minibuses), and a further 172 vehicles (including 30 commuter buses, 12 special buses for the handicapped, 20 minibuses for dial-a-bus service, and 110 standard city buses) have funding applications pending. As described in section III-B-6 of this document, operation of the I-95 Busway portion of the core system will require 124 Transbus units. In addition, a further 190 Transbus units (including 10% spares) will be required for operation of the non-grade separated supporting bus service lines (see Figure 12 in Section IV of this document). Above and beyond these requirements, additional bus units will be required for feeder service to the core system of rapid transit. However, these bus routes and schedules have not as yet been firmly established by the County, and thus accurate estimation of the total bus fleet requirements is not possible at this time.

Collection/distribution minisystems have been studied for connecting various major activity centers in Dade County to stations of the core system. These areas include:

- Downtown Miami including the Omni-Development north of the East-West Expressway and the Brickell Ave./Claughton Island development south of the Miami River.
- Civic Center area.
- Hialeah (NW 103rd Street Shopping Center together with residential areas north hereof).
- Dadeland area.
- Miami International Airport area in the vicinity of a potential multi-modal AMTRAK-Airport-Rapid Transit Terminal east of the airport and the employment centers along NW 36th Street north of the airport.
- Collins Avenue area of Miami Beach from the Convention Center to Bal Harbour.
- North Miami Beach commercial center in the vicinity of NE 163rd Street from Sunny Isles to the I-95 Expressway.

The results of these studies are contained in Draft Milestone Report 8 and in a separate report, Collection-Distribution System Analysis. In general, only on-street minibus systems would be appropriate for collection/distribution service in the initial years of core system operation. However, as patronage and development densities increase, the provision of trolley systems or grade-separated minisystems (particularly in the downtown Miami area and airport area), may become desirable.

C. TRANSIT FACILITIES

1. Way Structure Configurations

One of the dominant items influencing community acceptance of any given section of the proposed transit route is the configuration used in traversing the area. This involves a range of considerations involving values such as aesthetics, noise, and physical barriers. It also involves the economic factors of land value and construction cost. In an aera as large as Metropolitan Dade County, with its vast residential area and a well defined regional core, it is extremely important that the rapid transit system provide the maximum possible coverage. This in turn requires that the per mile cost be minimized since a major portion of total system cost is in way structures and stations. Therefore, various configurations have been investigated including aerial structures, surface, and subway.

a. Alignment Considerations

Much of the decision on configuration selection is governed by the location of a particular route segment. For example, while an at-grade configuration is the least costly and easiest to construct of all configurations, it is limited in its application by the requirement of complete separation of transit and other traffic. Therefore, this configuration is applicable only where grade separation already exists, as in the case of an expressway median, or is not required, as in the case where the transit line parallels a railroad with few road crossings.

The aerial structure is the most favorable from the transit riders point of view, and modern structural techniques plus careful landscaping will produce an aesthetically acceptable configuration. However, one of two conditions must be present to permit use of the aerial structure. Either existing streets or other public rights-of-way must be of adequate width to permit the structure to be incorporated without disruption of traffic flow, or the adjacent land value must be such that acquisition cost of private right-of-way does not become prohibitive.

The subway is influenced by the physical surroundings and topography. The high cost of construction in the Miami subsurface conditions of a high water table flowing through permeable limestone has virtually eliminated any favorable consideration in the rapid transit program. Use of subway may require consideration later where adjacent property values are such that right-of-way acquisition for another configuration becomes prohibitive.

The following data describe alignment parameters for the fixed guideway portions of the rapid transit facilities. Alignment criteria for busways would be similar to suit vehicle speeds to 65 mph.

The alignment parameters for the fixed guideway system are based on maximum vehicle velocity of 70 mph. This has been determined from an analysis of station spacing. Alignment factors based on this criterion are briefly summarized as follows:

- Curvature is designed to sustain velocity within limits of track superelevation and economic restraints of right-of-way. All curves will be provided with spiral easements for superelevation and horizontal transition to improve the comfort of passengers. Minimum curve radius will be 550 feet on main line trackage, and 275 feet in yard areas.

- Profiles are designed to adapt the transit route to the physical features through which the system passes. This involves economic considerations for alignment in congested areas and landscaped ways for aerial structures in suburban areas. The transition gradients are designed to offer least resistance to train movement. Maximum grades of 3.0% will be used for sustained lengths, with 4.0% allowed for short ramps. Vertical curves are provided for safety and comfort at all gradient changes.

- Physical environment has been investigated to determine influence on transit alignment and cost. Elements which were covered in this study phase include topography, right-of-way, drainage channels and structures, substructures, utilities, railroads, and streets and expressways. Consideration of relocation of these elements has been included where required.

- Appropriate clearances for transit vehicles in structural configurations have been taken into account. These consist of vertical and horizontal clearances from the vehicles to surrounding surfaces in stations, on aerial structures, and obstructions.

Within the parameters outlined above, alignment studies were completed consisting of investigation, evaluation and profile development for over 200 miles of alternate route segments in evaluation of corridor networks.

b. Aesthetics

The aesthetic considerations in connection with route configurations involve architectural design and landscape treatment of the transit way and station. The basic considerations in the aerial concepts include:

- Simplicity of shape

- High quality, uniform finish and texture

- Proper proportion of mass to height and span
- Landscape treatment
- Acoustical considerations

On this basis, structures can be aesthetically pleasant, integral with their surroundings, and also provide a strong design element which will be a positive force in creasting an aesthetic urban environment.

Whether or not the transit facility is visually appealing will often depend upon the quality of right-of-way landscaping. The Bay Area Rapid Transit District has set a high standard in landscaping which has enabled rapid transit to gain community acceptance. This standard is equally applicable to Dade County's system, including supporting features such as parking lots, pedestrian walkways, bikeways, etc.

Through careful design of both way structures and stations, combined with a high standard of landscape treatment, an attractive belt of open space will be created within the urban area much like a strip park. The transit way in an aerial configuration will provide an area completely open and accessible to residents of the area. These areas can provide much needed pedestrian walkways which will be pleasant and uncongested. In some areas, the right-of-way will also be utilized as parking area for adjacent commercial activity and permit greater utilization of commercial frontage by reduction of on-site parking requirements.

c. Acoustical Considerations

The constantly increasing sound level in urban areas has become a serious concern to urban planners and residents alike. Therefore, the preliminary design studies have included acoustical studies and analyses of sound and vibration control throughout the system. These studies have included a determination of sound levels and vibrations to be produced by the transit trains in various configurations; measurement of existing sound levels in the areas traversed by the proposed routes; evaluation of acceptable sound levels, and a determination of sound control techniques which will produce acceptable conditions.

These studies have clearly shown that the sound level produced by a six car train traveling at 70 mph will be less than that produced by the average expressway and approximately equal to a busy city street. This is accomplished by incorporating a sound barrier where required into the way structure in the form of a small wall at the edge of the structure, use of continuously welded rail, and reasonable maintenance of the transit vehicle and track surface. All of these measures have been included in the preliminary design of the system and all technological advances and control techniques will continue to be reviewed for incorporation into final design in an effort to reduce sound even further.

d. Way Structure Designs

In the concepts for fixed guideway and busway structural members, extensive effort was devoted to careful analyses of way structure types, their relationship in the community and the physical conditions in each area traversed. The basic transitways considered include:

- Aerial structures - fixed guideway and busway.
- Surface or at-grade - fixed guideway

General Criteria

Public safety is the primary consideration governing the design of all public facilities. Design for rapid transit system facilities must meet all safety requirements of conventional public facilities, and in addition, must include consideration of special design loads from the transit vehicle.

Present-day technology permits accurate failure limit predictions, and it is therefore possible to design structures to a high degree of accuracy if the loads to be applied can be accurately determined. Thus, the primary factor in assuring safe design of the transit facilities is the determination of possible loadings to which the structure could be subjected. Factors of safety used are consistent with those provided for by conventional building codes. The following paragraphs discuss the various types of loads to be expected along with other design considerations.

Criteria established for design of the transit facilities meets or exceeds local code requirements. Further, special codes have been considered where applicable, such as for railroad or highway bridges.

The design criteria and test results of numerous rapid transit systems have been carefully reviewed, and information provided by the concrete and structural steel industries has also been considered in developing criteria and preliminary design.

In addition to the structural design criteria, aesthetic considerations of the structures are of paramount importance in assuring that they will be visually acceptable in the area traversed, and also to insure that their construction or the structure itself will not create hazardous, disruptive effects. While keeping both first cost and maintenance cost as low as possible, the criteria and preliminary designs give foremost consideration to the safety and comfort of the public, as well as aesthetic value to the community.

Moving Car Loads and Impacts

Aerial structures must primarily support the trains safely, and these trains may consist of two to eight cars in length. The magnitude and distribution of the moving car loads vary considerably. Speeds change from 0 to 70 mph. The suspension system for the cars will compensate for track irregularities, passenger imbalance, wind, girder deflection and similar effects, but train acceleration and movement will cause vertical and lateral forces which will add to existing forces in these directions. These forces, or impacts, have been included as a percentage of the loadings, and rapid transit standards were applied to all design conditions.

The preliminary design vehicle length was established at 67'-6" with a vehicle weight of 70,000 pounds and a truck spacing of 46 feet. The maximum number of passengers was set at 240 which, at 150 pounds per passenger, produced an additional load of 36,000 pounds, for a total vehicle weight of 106,000 pounds. With two axles per truck, the resulting design axle load was 33,100 pounds including impact. It is understood that a vehicle design for another major metropolitan area may be adopted for economic reasons and as a move by the U. S. Government toward eventual standardization of rolling stock.

Hurricane Wind and Wave Loading

Structural design for such facilities in the Miami-Dade area must also include special provisions for hurricane disturbances. Past experience, scientific measurements and data, and current scientific theory indicate that there will be hurricane disturbances in the future. Therefore, wind design criteria for the way structures was based on the requirements of the South Florida Building Code for Wind and Wave. Protection against these elements form the basis for hurricane design provisions in local and regional building codes.

The South Florida Building Code prescribes criteria for wind pressure forces to be applied to structures with appropriate shape factors. Based upon this criteria, the Miami-Dade area requires design for loadings ranging from 21 psf to 50 psf depending on height. The design velocity prescribed by the SFBC is 120 mph although higher velocities (up to 138 mph) have been recorded in the Miami area from hurricanes.

In addition to wind forces, structures have been designed for dynamic effect of wind driven waves. Wave height to EL.11.0 M.S.L. has been used in investigating the effect of wave action. Design loads are based on methods for wave effect on piling with drag and inertial forces combined.

Aerial Structures - Girder Designs

Spans (distance between supports) of aerial structure girders should be as long as practical, and still efficiently and safely support the moving car loads. However, they should not be so long as to result in an unreasonably deep girder. The spans should be of near uniform dimensions and be within a range that would allow economical construction and erection techniques. Further, the span should not be so large as to require a column size disproportionate to the girders and environment.

Continuity, obtained through continuous spans over several supports, would generally allow greater length than a simple span. However, this method would sacrifice the economies of prefabricating techniques ideally suited to repetitive construction and erection. Detail analyses of spans for various segments of the system were made. It was determined that spans ranging from 70 feet to 110 feet were possible in 95% of the aerial system. The consideration of the width and depth of the girder, height of the structure above ground, and the size of the column were found to be in proper proportion to these spans. Thus, it was determined that this range of spans would provide an optimum aerial system which will combine visual attractiveness with practical construction techniques.

Numerous types and shapes of girders were developed and included different construction materials. Concept designs for each were carried out and thoroughly analyzed from the standpoing of proportion, aesthetics, quality of finish, constructability, maintenance, and cost.

Of the sections studied, it was determined that the basic "box" section would embody more desired structural and aesthetic features than any other section. For the concrete "box" section, the prestressed precast method of construction was selected as best meeting requirements of cost, appearance, and aesthetic value, as well as other design criteria, and has been used as the cost estimate basis. However, the selection of these sections does not rule out consideration of alternative designs in steel during final design or construction stages. Advances in construction technique and/or economy in construction costs may also justify changes. See Figure 33 for recommended box section for aerial structures of transit facilities.

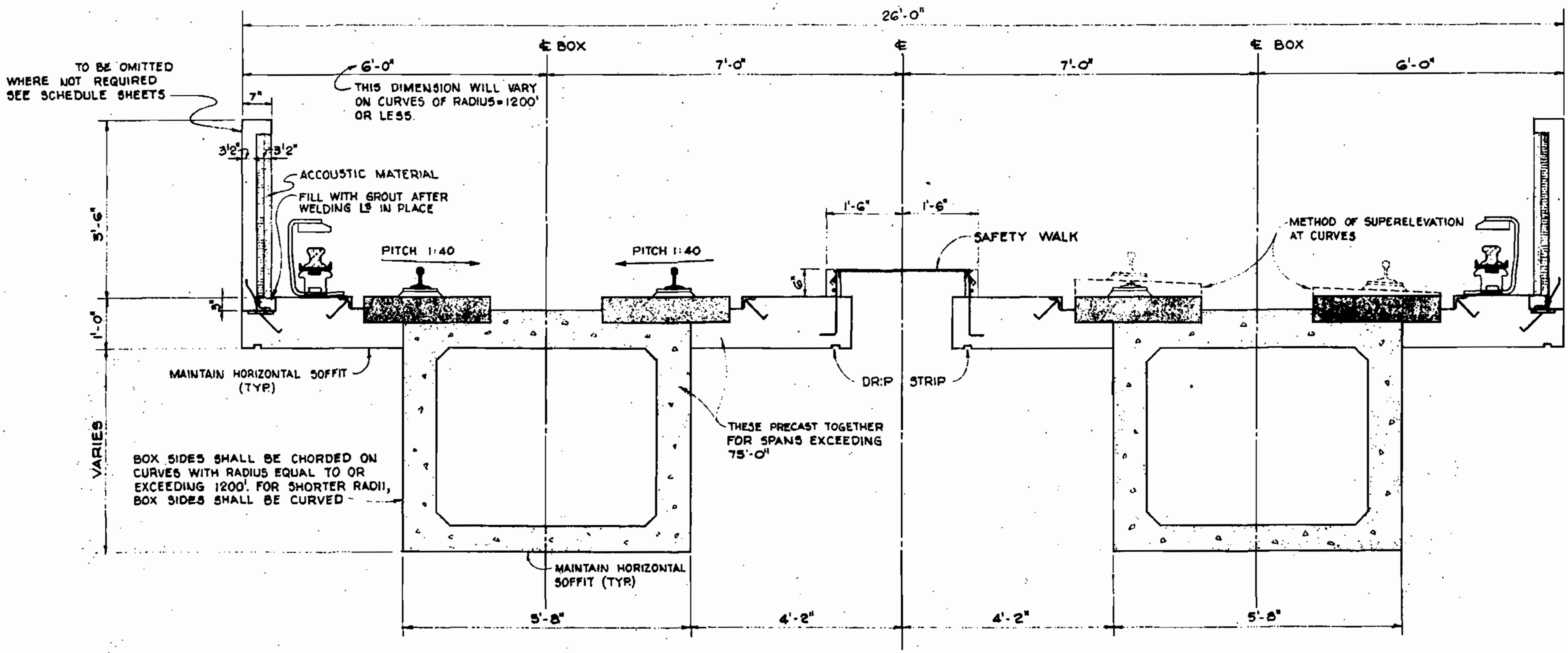
Aerial Structures - Column Designs

Way structures using a single column design to support aerial girders are generally more economical than multiple columns because duplication of loading and increased forming are eliminated. Further, it is more practical where supports are located in a street median. The preliminary design of aerial structures employs a single column concept. Double column bents and straddle bents are used in special cases at alignment transitions.

A column must be large enough to safely support the loads transmitted to it, yet not be out of proportion with the remainder of the structure and its environment. The height of the girders above grade should be as low as possible to minimize the column dimensions (and therefore costs), but must be high enough to allow

FIGURE 33

AERIAL GUIDEWAY STRUCTURE PRECAST CONCRETE GIRDERS



surface vehicles to safely pass beneath. A minimum clearance of 16'-6" has been established. This meets or slightly exceeds all existing street and highway requirements. See Figure 34 for a single column bent type to meet aerial guideway requirements.

An analysis of column shapes was made considering structural efficiency, cost, aesthetics, and construction methods. From this analysis, it was determined that the best resolution of these factors was a column of hexagonal cross-section. This shape, with a basic size of 4 feet breadth has been assumed for cost purposes.

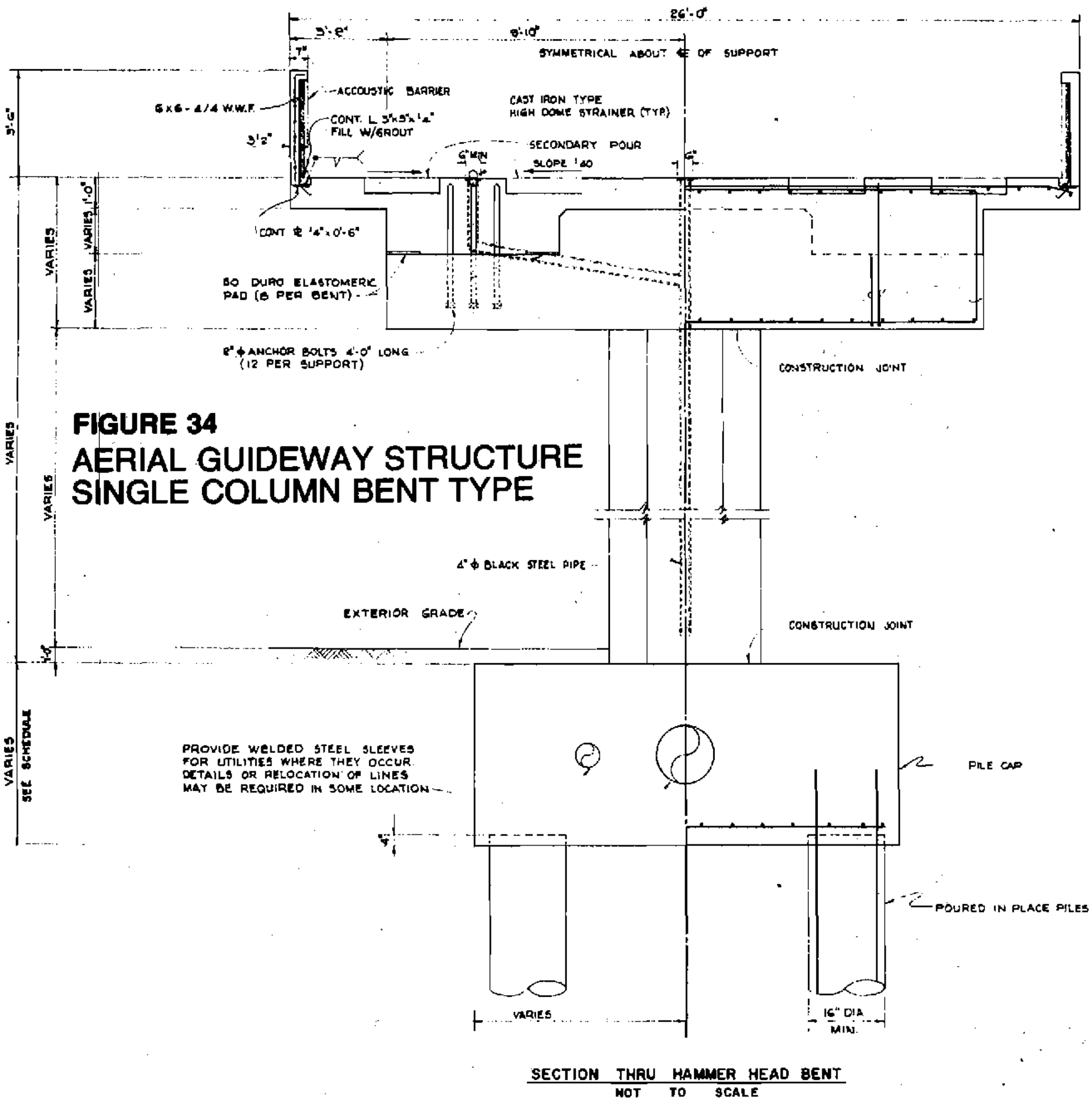


FIGURE 34
AERIAL GUIDEWAY STRUCTURE SINGLE COLUMN BENT TYPE

2. Stations

Transit station design is based upon the concept of providing both the passengers and the community with functional and environmental amenities which provide the highest level of convenience, comfort and visual attractiveness. Stations are the focal points of the system, and every passenger must pass through at least two stations to complete a trip. They are also the interchange points for various travel modes serving the transit system. Therefore, functional, efficient station design which creates a pleasant environment is essential to make rapid transit a preferred mode of transportation.

a. Basic Concept

In searching for the current state of the art, through the vocabulary of modern transit systems, basic concepts have been developed through the advantage of their ideas and experiences. These concepts are fundamental to all station designs and represent a new human spirit which is essential for today's transit systems.

Extensive interpretation and evaluation has processed them into aspirations particularly suited to the local environment and specific needs. Their strengths will be the foundation from which all of the criteria and design will grow.

These concepts transform the transit stations into a public-oriented system, unified together as a large family of stations and responsive to the outdoor character of the atmosphere. Further, the concepts demand that the stations have a functional image incorporating simplistic circulation patterns. These concepts will all be achieved through an integration with the community at large in an attempt to create a widely accepted and responsive system. These concepts defined in subsection V-A are summarized as follows:

Public Oriented provides an environment responsive to the public interest. The main approaches to the entrance are reserved from the public right-of-way or public open space bringing most riders closest to their destinations.

Station Unification of aesthetics and function is necessary for the total system in order that each station be integrated and identified as a member of the Family of Stations.

Community Influence is encouraged in the design and planning to reflect the unique character of the community creating a strong individual identity which will fulfill for each station a "sense of place".

Station Atmosphere is associated with the outdoor semi-tropical environment. Openness, natural breeze, and large sheltering elements are basic to this concept.

Station Appearance will be the responsibility of the architect to develop an honest architectural expression for each individual station within the bounds of the general concepts and criteria.

Station Circulation is simple, direct and open. Major functional areas are as spatially and visually related as possible.

Station Area Development encourages the principles of coordinated and integrated land use development activities whether immediately adjacent to the right-of-way, sharing the right-of-way, or attached physically as in air rights.

b. Station Design Influence

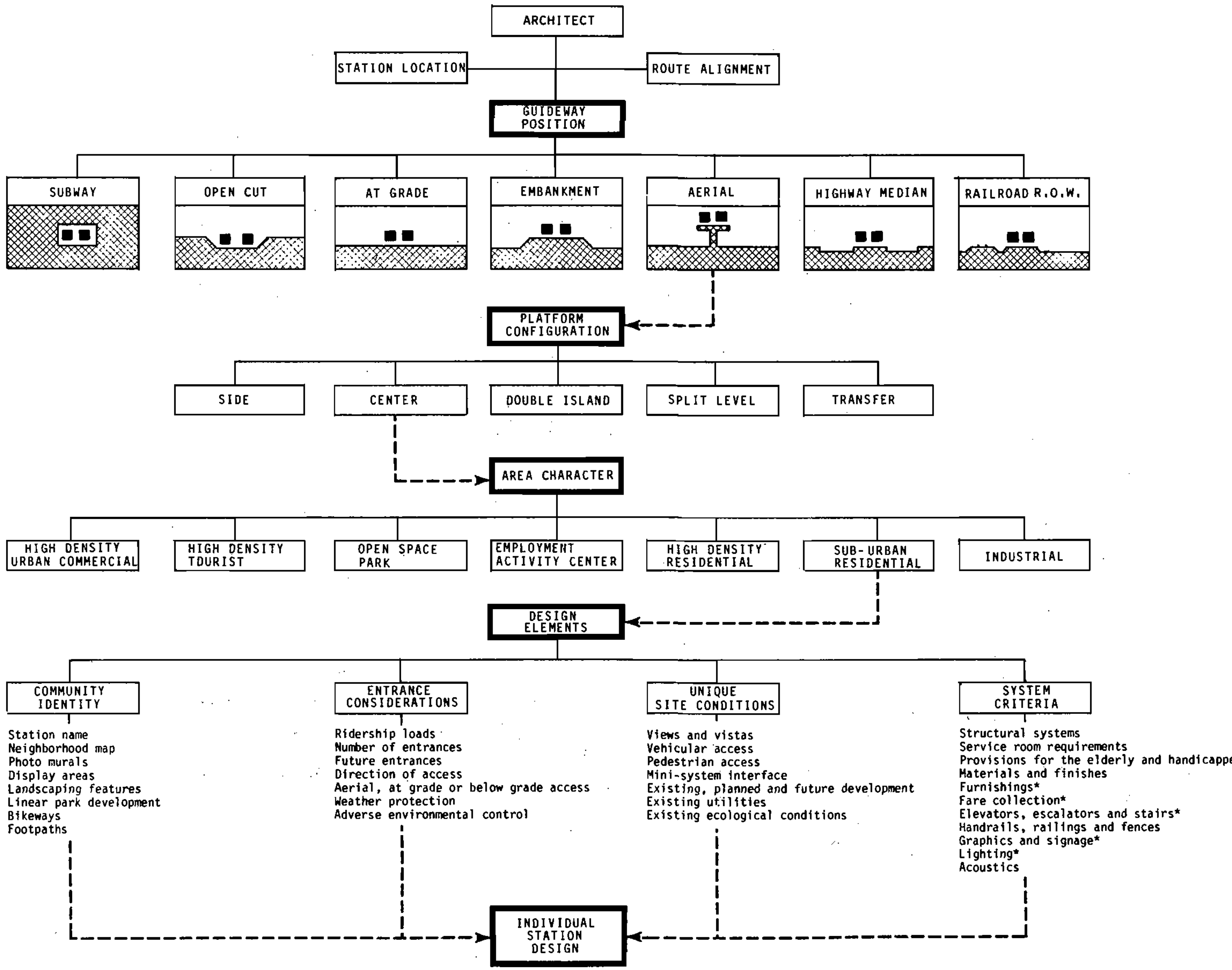
Because of the multiplicities of conditions that exist in the design process which strongly influence and direct the final design of each station, the task of the architect is to search for honest artistic expression in station designs while maintaining continuity to the character of the neighborhood and at the same time maintaining continuity to the character of the system.

The Station Design Influence Chart shown in Figure 35 is intended to typify major elements relative to the architectural design process. Other subsystems and technical conditions which have lesser influence on the visual character of the final design have been omitted. The aerial, center platform station in a suburban residential area is shown as an example of a single combination which immediately suggests its individual character. The introduction of design elements leads further toward an individual station design.

In order to obtain a high level of order, congruity, and uniformity of quality, materials, finishes and construction procedures, it is recommended that the criteria developed for those repeating system elements marked thus * be supplemented and enlarged upon by special consultants to become system standards.

The architectural success of this system will depend on the carefully controlled balance of all these conditions as they relate to both the neighborhood and to the system.

FIGURE 35
STATION DESIGN INFLUENCE CHART



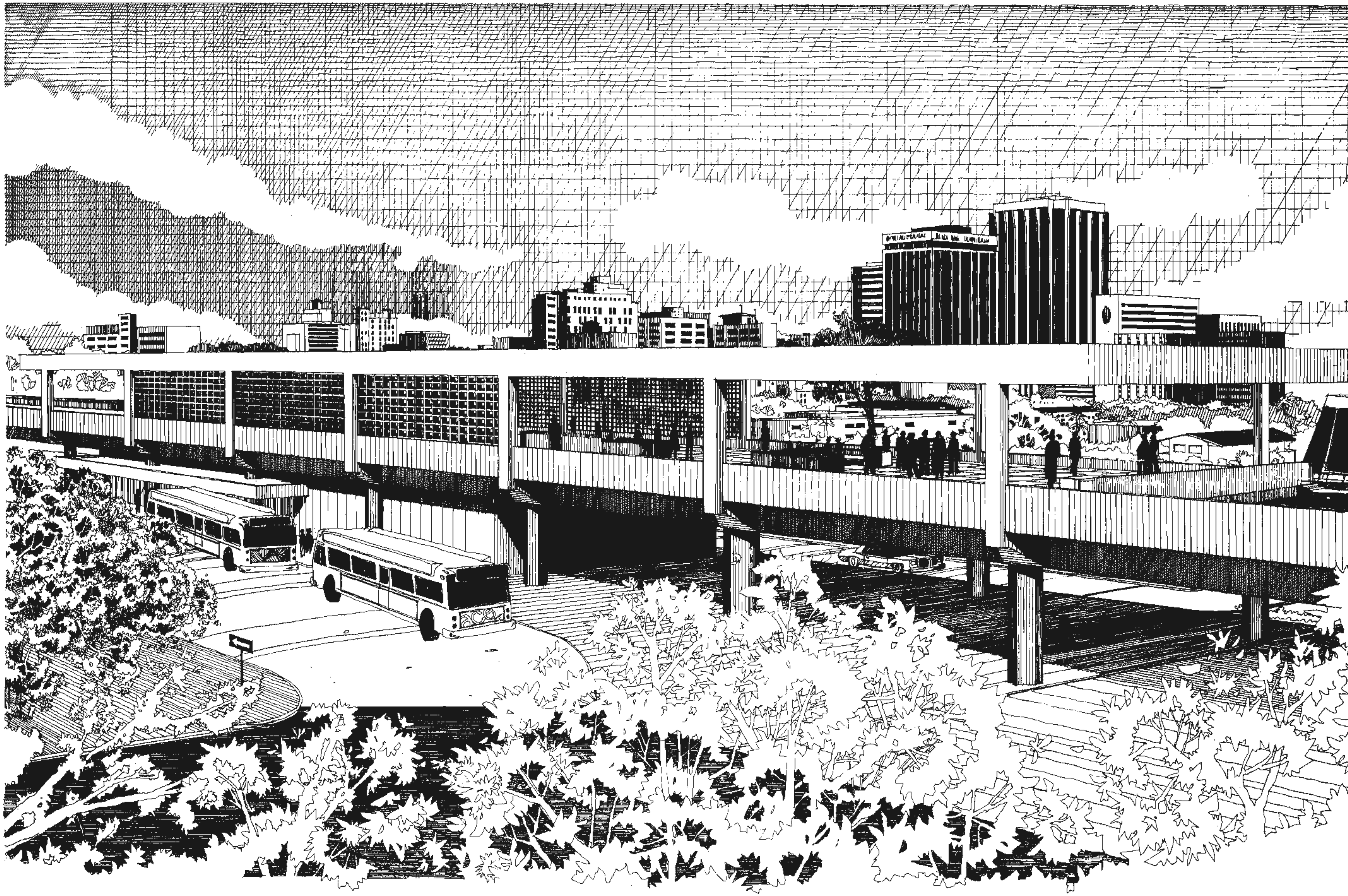


FIGURE 36
S.W. 11th STREET STATION

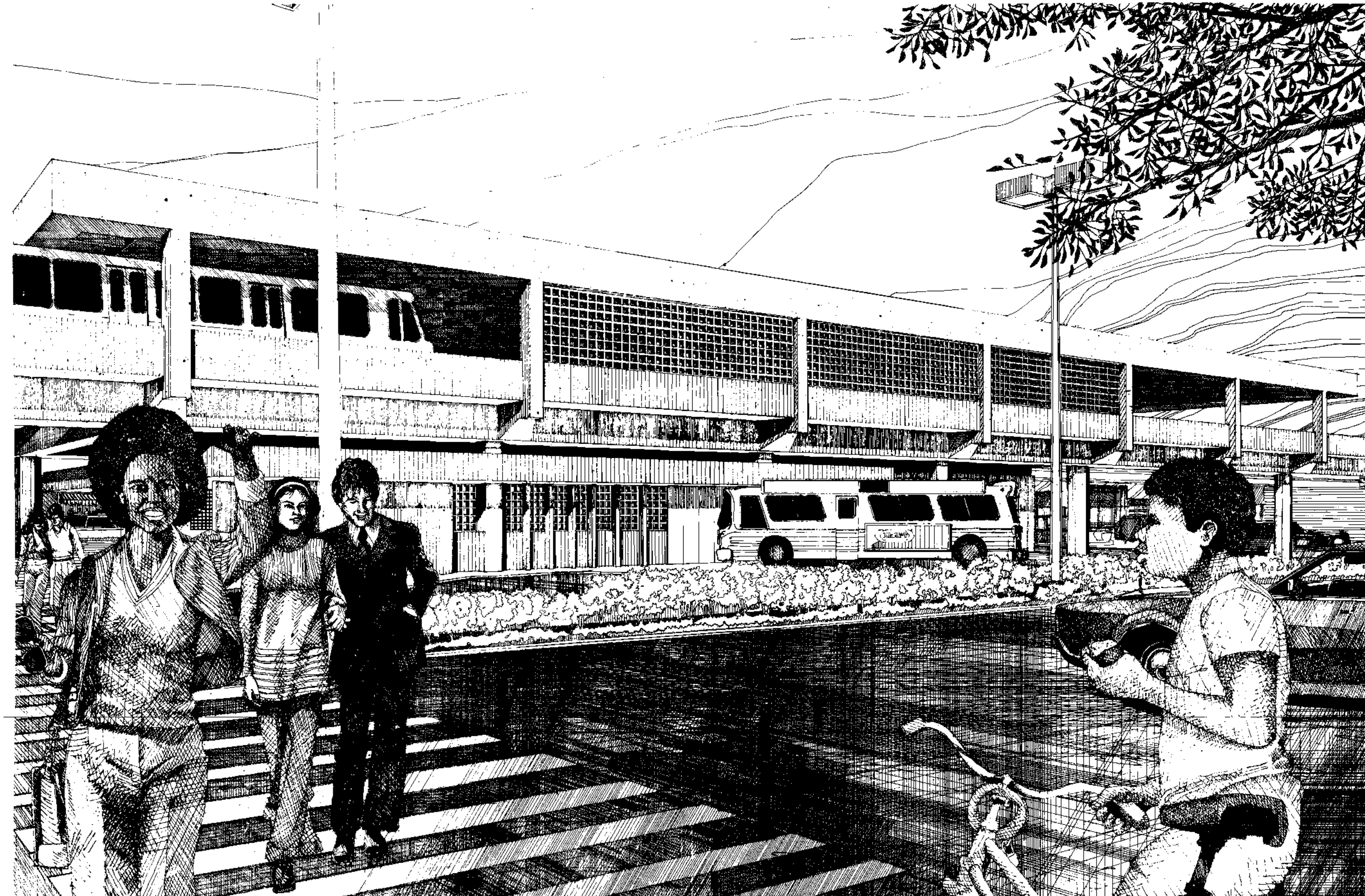


FIGURE 37
N.W. 35th STREET STATION

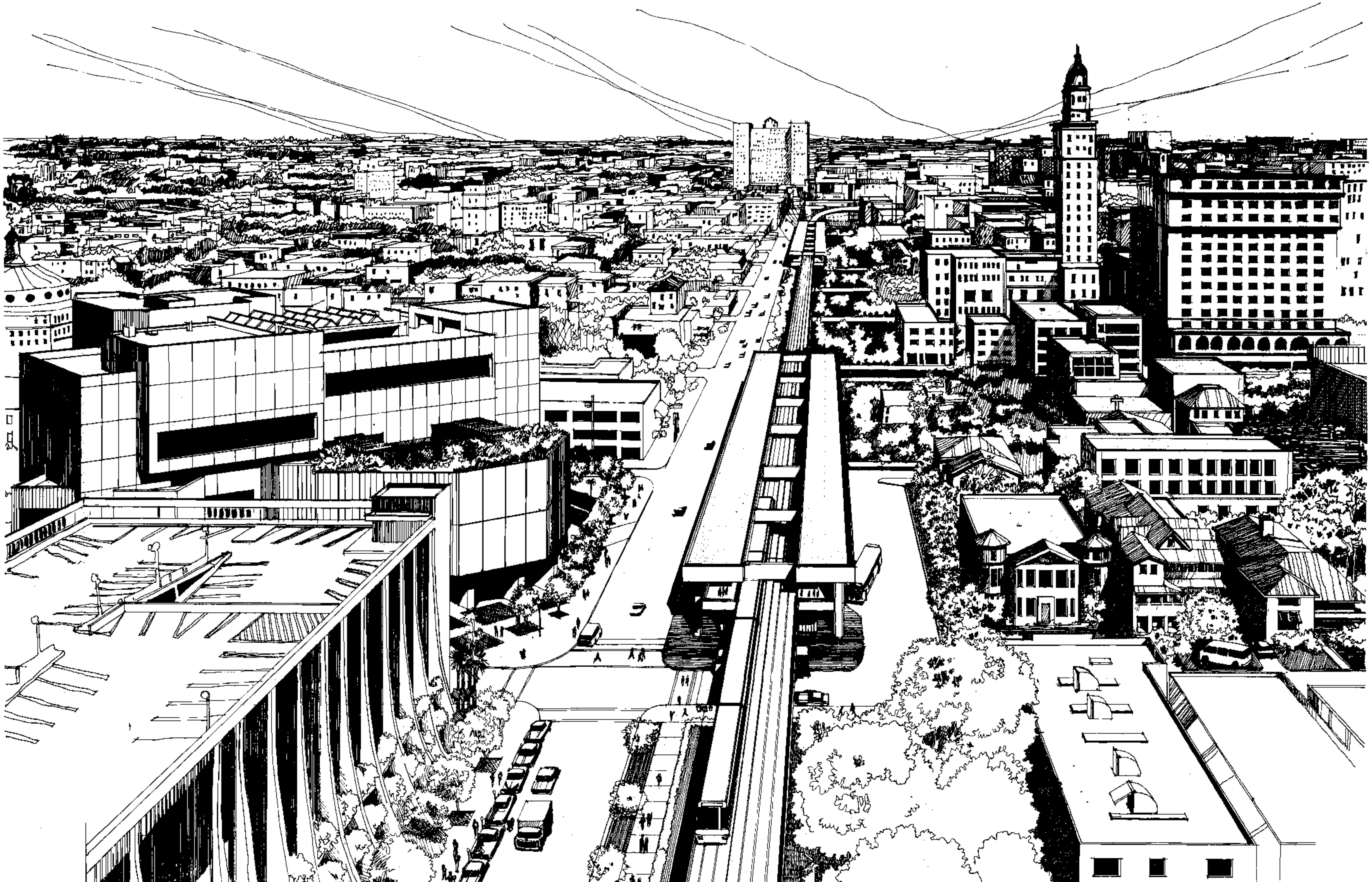


FIGURE 38
MDCC DOWNTOWN STATION

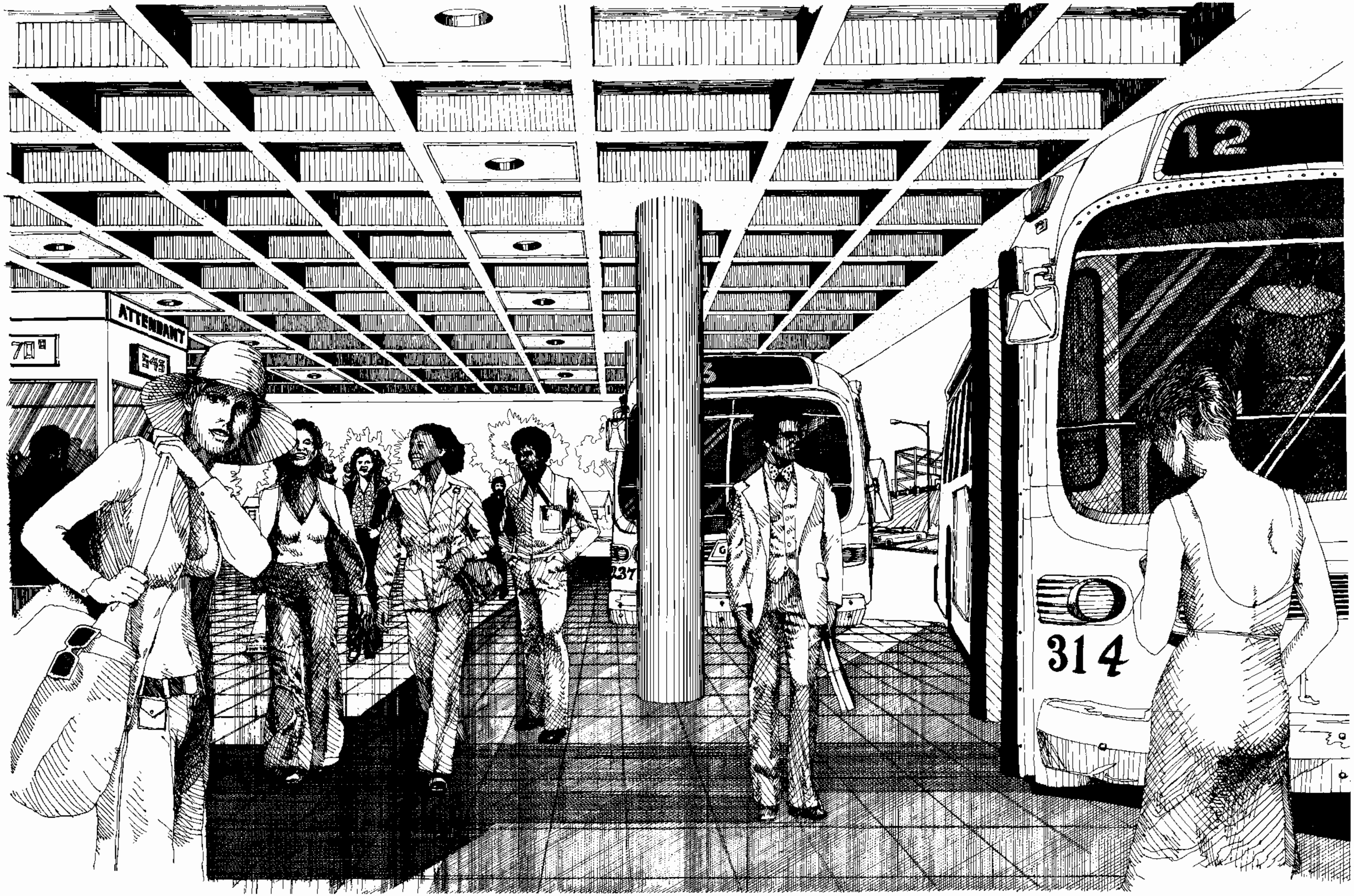


FIGURE 39
N.W. 135th STREET BUS STATION

c. Station Configuration

As a result of the system definition regarding station location, service and operational requirements, guideway positioning and a detailed study of each station's site requirements, preliminary station designs have been identified and developed. Regardless of the special requirements, each station design fulfills the basic concepts. A special effort has been made to maintain the key architectural concepts of unification, atmosphere and circulation. Final station design will be based upon uniform functional criteria as well as definitive architectural specifications which will permit design freedom and produce stations best suited to each particular site and to the desires of the community.

Typical Station

The aerial center platform station has thus far been identified for thirty-six locations although further detailed studies will be required during final design. The aerial way structure provides the grade separation necessary to permit surface traffic to move unimpeded under the transit line of travel. The corresponding aerial platform permits the most direct access to the station entrance. Pedestrians and patrons using the bus, kiss-and-ride and parking facilities may walk directly into the ticketing concourse beneath the structure.

The desirable center platform is most applicable to the user and to the efficiency of the station.

- A more efficient use of platform space is obtained resulting in less restricted areas with a simpler straight-through circulation path.
- A more efficient use of vertical movement requiring common escalators, elevators and stairs to serve both boarding and alighting passengers.
- Added convenience as the passenger need not make a decision as to train direction until reaching the platform, thus avoiding this decision in the concourse where space is more restricted with other activities. Passengers may also transfer from one line to another without delay by crossing the center platform.

This station may occur either in off street right-of-way or in the median of a street.

Other station configurations respond to specific site conditions and system operating functions. They include five (5) aerial side platforms, one (1) aerial double island platform, one (1) aerial center split platform, one (1) aerial transfer station with both side and center platforms, one (1) at grade center platform, four (4) at grade I-95 busway stations, and one (1) elevated I-95 busway station.

d. Station Elements

There are major functional elements common to all stations regardless of configuration or passenger volume. Two major areas common to each station consist of the "free area", which is open to the general public, and the "paid area", which is reached only after passing through the faregates. Relating to one or both of these areas are the following common elements:

The Concourse is the entrance area containing fare collection equipment and controlled access to all vertical circulation. It is an activity area with strict functional requirements. Simple direct flow patterns maintaining right hand orientation for quick ingress and egress are necessary for the convenience and safety of the patron. The concourse features an attendant's booth in line with special service gates and a number of passenger fare gates thereby separating the "free" and "paid" areas of the station. Maps, clocks, telephones, self-service ticketing machines and information centers serve the patron entering and exiting.

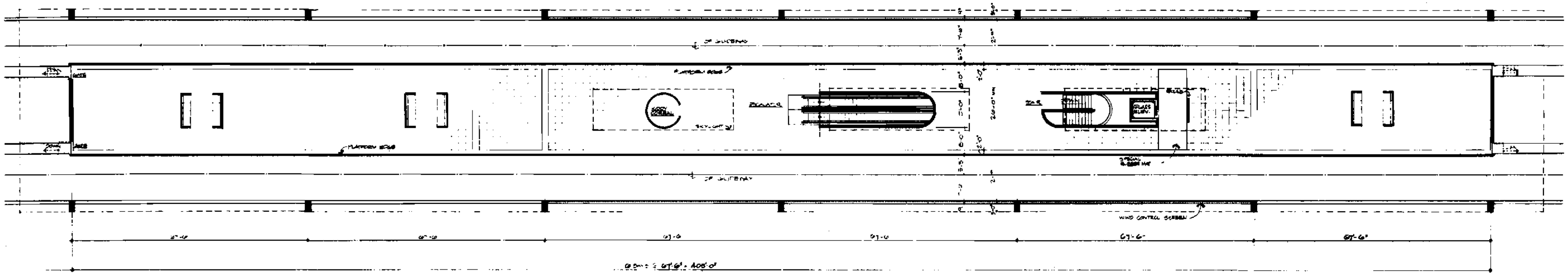
The station attendant's booth is centrally located and accessible from both the "free" and "paid" areas. The station attendant is a representative of the system at the station who has constant contact with the public and who becomes a very important person in the day-to-day operation of the station. The system image is very dependent upon him.

Surrounding the perimeter of the concourse is a low canopy affording weather protection from the sun and rain to both the interior for the highly sensitive fare collection equipment and to the exterior for purposes of patrons arriving, departing or waiting for the various modes of access.

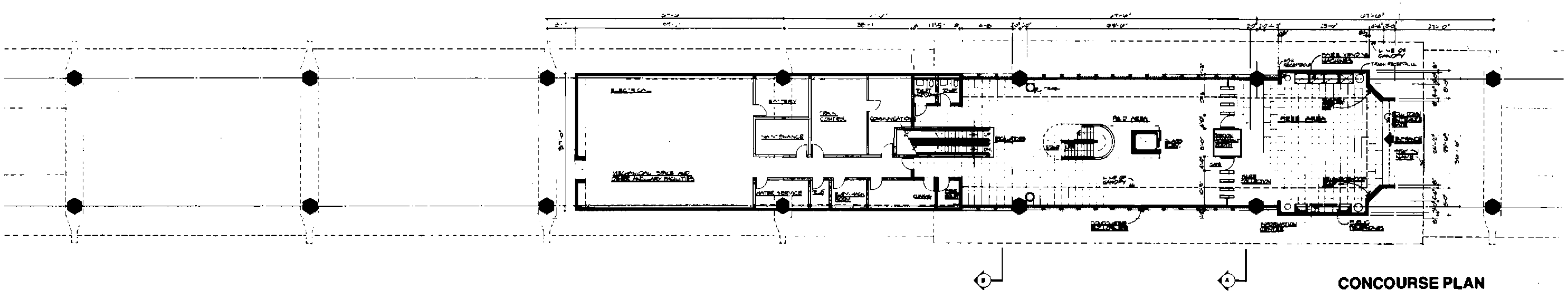
One main objective in the design and layout of the concourse elements has been to maintain openness and visual continuity as much as possible. Low pedestrian barriers, open screen walls, glass enclosed attendant's booth and elevator and open riser stairs all contribute to this.

Vertical Circulation beyond the fare gates inside the concourse is accomplished by an elevator for the exclusive use of the elderly and handicapped, a pair of reversible escalators and one staircase to serve in case of overloading, emergency or use during escalator repair. Both escalators will operate in either direction at speeds up to 120 feet per minute. Escalator widths of 32 and 48 inches will be selected on the basis of meeting capacity requirements. The elevator is located in close proximity to the attendant's booth for maximum supervision.

The Platform is the heart of the transit station. The arrival of a train changes the function from a waiting area to an activity area as passengers transfer between station and vehicle. The platform length is determined by the full train length with provisions for further expansion. Adequate width is provided to facilitate uniform distribution and circulation of patrons. The

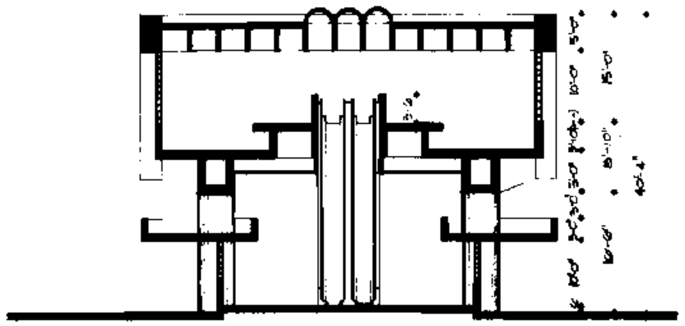


PLATFORM PLAN

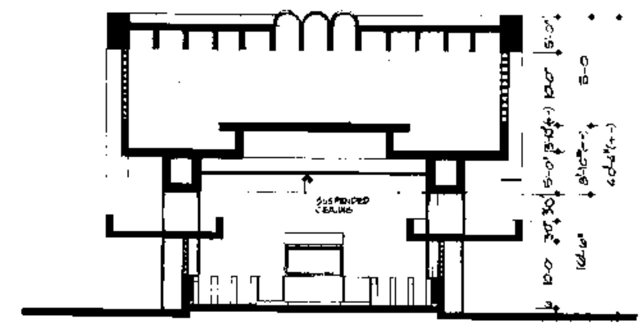


CONCOURSE PLAN

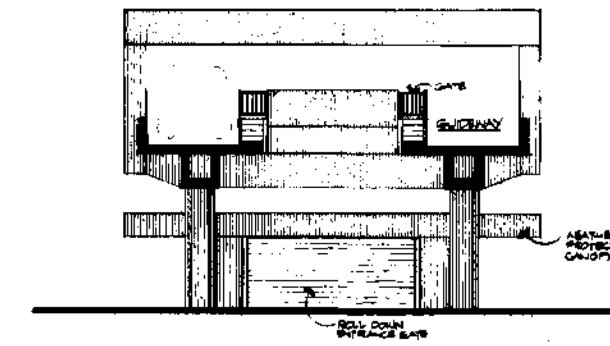
FIGURE 40
AERIAL CENTER PLATFORM STATION—PLANS



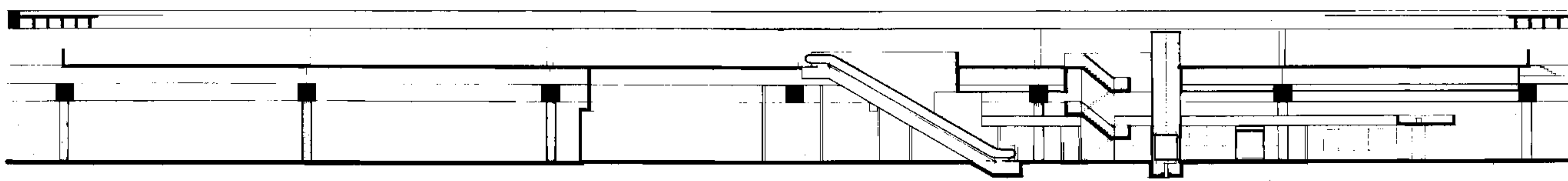
SECTION BB



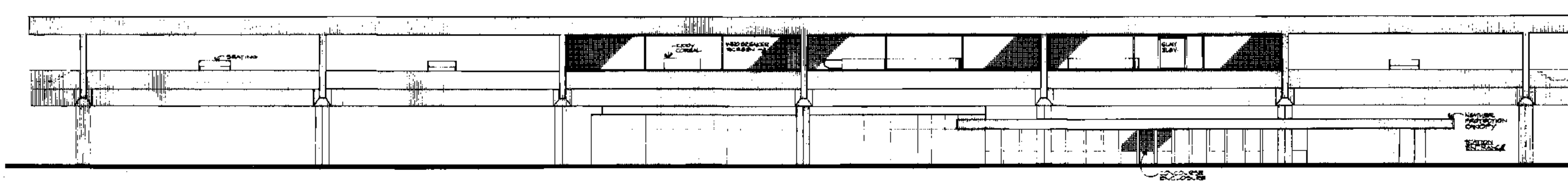
SECTION AA



FRONT ELEVATION



LONGITUDINAL SECTION



SIDE ELEVATION

FIGURE 41
AERIAL CENTER PLATFORM STATION—
ELEVATION AND SECTIONS

edges are accentuated with a 24-inch wide non-slip granite edge-band specially designed to alert patrons to a potentially hazardous area. The platform is distinguished by two main features:

- The absence of columns is provided by a full-span roof structure permitting as much clear open platform space as possible.

- The entire platform is covered by roof structure with sufficient overhang allowing maximum protection from the sun and rain.

While maintaining the basic concept which encourages visibility to the surrounding area, openness and natural breezes, portions of the platform which coincide with the location of vertical elements will be provided with wind control screens to reduce the uncomfortable and often dangerous gusts of wind, to adjust the patron more gradually to his or her elevated position and providing a transition to the more open spaces of the platform.

Other features include:

- Special children's seating (Kiddie Corral) in close proximity to the escalators allowing prompt access to this area. A single entrance into this seating area will provide a parent with sufficient control for safe waiting.

- Seating for the elderly and handicapped, located directly opposite the elevator entrance. Special paving will extend from the elevator to the platform edge corresponding to a vehicle door opening.

- Regular seating grouped in units of two facing towards each other, thereby creating a more secure space from the activity of the platform. Their orientation, parallel to the platform length, allows patrons to face in the direction of their oncoming train.

- Other furnishings such as graphic information centers, emergency telephones and trash receptacles.

<u>Support Facilities</u> required to operate the system are located in non-public spaces in all stations. These include the substation, mechanical, control and communications, storage and maintenance rooms and toilet facilities.

<u>Materials</u> selection places special emphasis for an open exposed structure. To ensure that the basic concept of unification is achieved, exposed concrete is selected for the structure of the stations throughout the system. Its aesthetic and self-protecting qualities preclude added treatment such as veneers and painting and presents itself exposed exploiting the strength and honesty of the material.

The palette of finish materials is limited to achieve unification and to insure quality levels of safety, durability, ease of maintenance, and outdoor exposure. The selection of finish materials should produce a unifying family of natural and rich toned colors throughout the system. Their visual quality should create a feeling of warmth and attractiveness in the stations to provide a pleasant atmosphere that encourages civic responsibility and a resultant decrease in abuse.

The floor, which is the predominant surface to the patron, and which receives maximum wear, requires special attention. Rich, hard and dense pavers are selected with unit sizes large enough to minimize the number of joints yet small enough for easy replacement.

Lighting designs are developed as an integral part of the total architectural concept with the purpose of creating an image consistent with the concepts of optimum comfort. Comfort implies freedom from visual noise, such as disorderly, irrelevant patterns or overly bright lighting fixtures.

Light sources are selected to provide the most attractive station environment consistent with architectural elements of the station and as related to the immediate neighborhood. Light sources define the shape and extent of major areas yet do not compete with the building definition.

Lighting fixtures and components are standardized throughout the system to establish standard solutions to repetitive problems of illumination and lighting background which unify the appearance of all system facilities despite differences in individual station designs, and at the same time assist standardization of maintenance and warehousing techniques on a systemwide basis. Once standardized these fixtures should not preclude freedom of departure from the general lighting standards so that standard lamp types may be integrated into varying station structures in ways that reinforce the individuality of each design while maintaining system continuity.

The lighting system is integrated into the structure or combined with associated components such as acoustical installations or mechanical systems to form a systematic design.

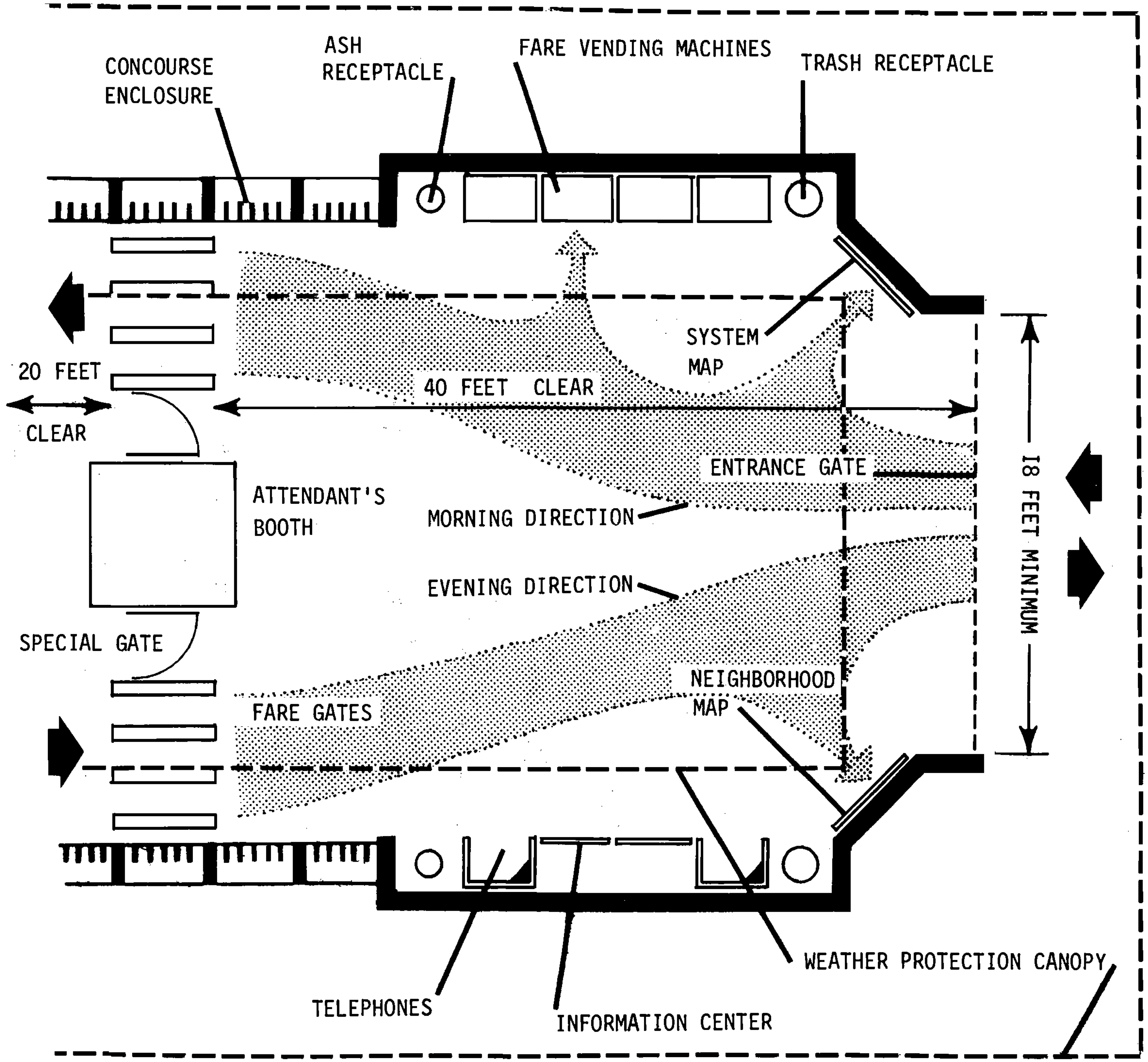


FIGURE 42
STATION ENTRANCE—TYPICAL LAYOUT

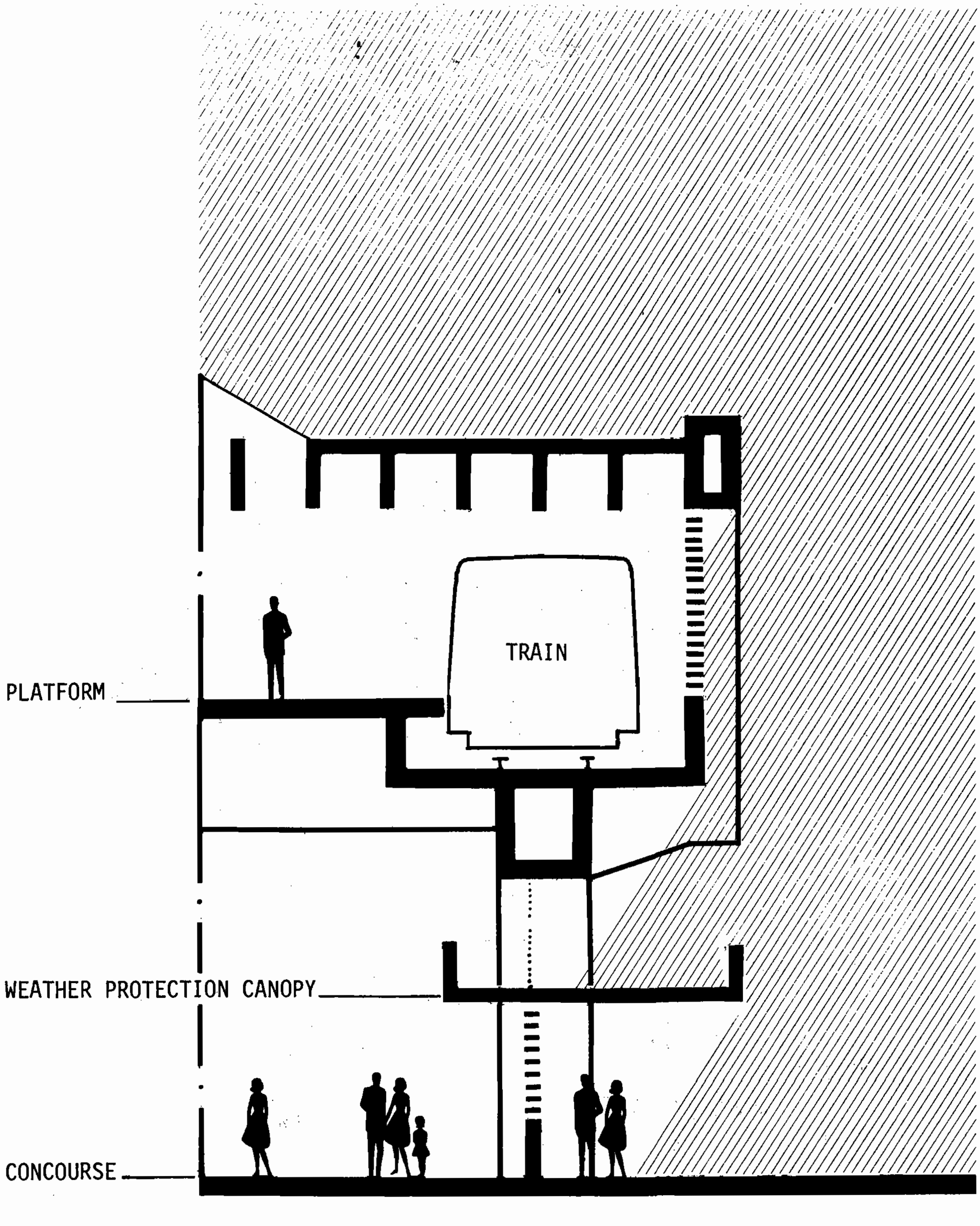


FIGURE 43
SECTION—WEATHER PROTECTION CANOPY

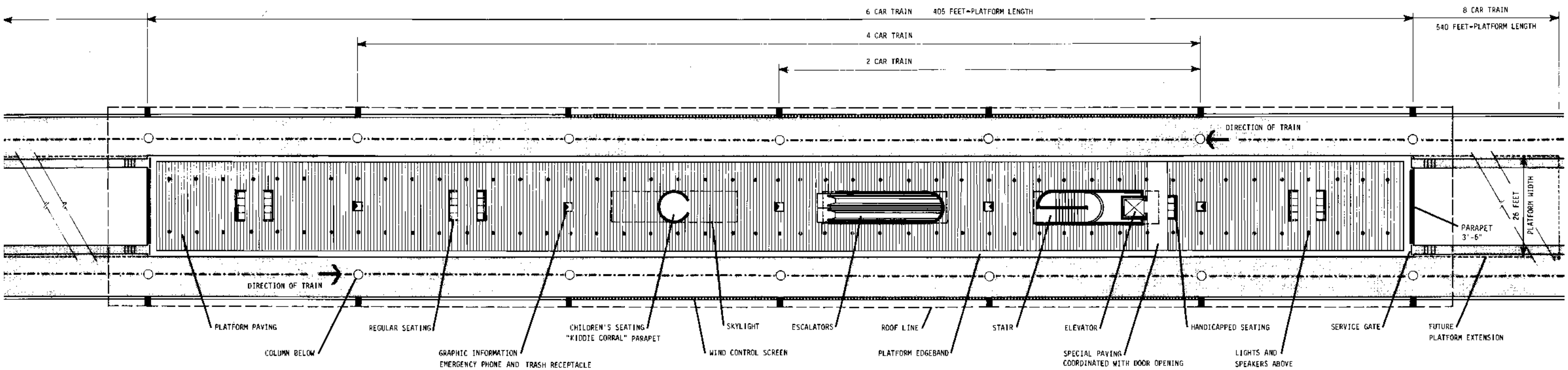


FIGURE 44
AERIAL CENTER PLATFORM—TYPICAL LAYOUT

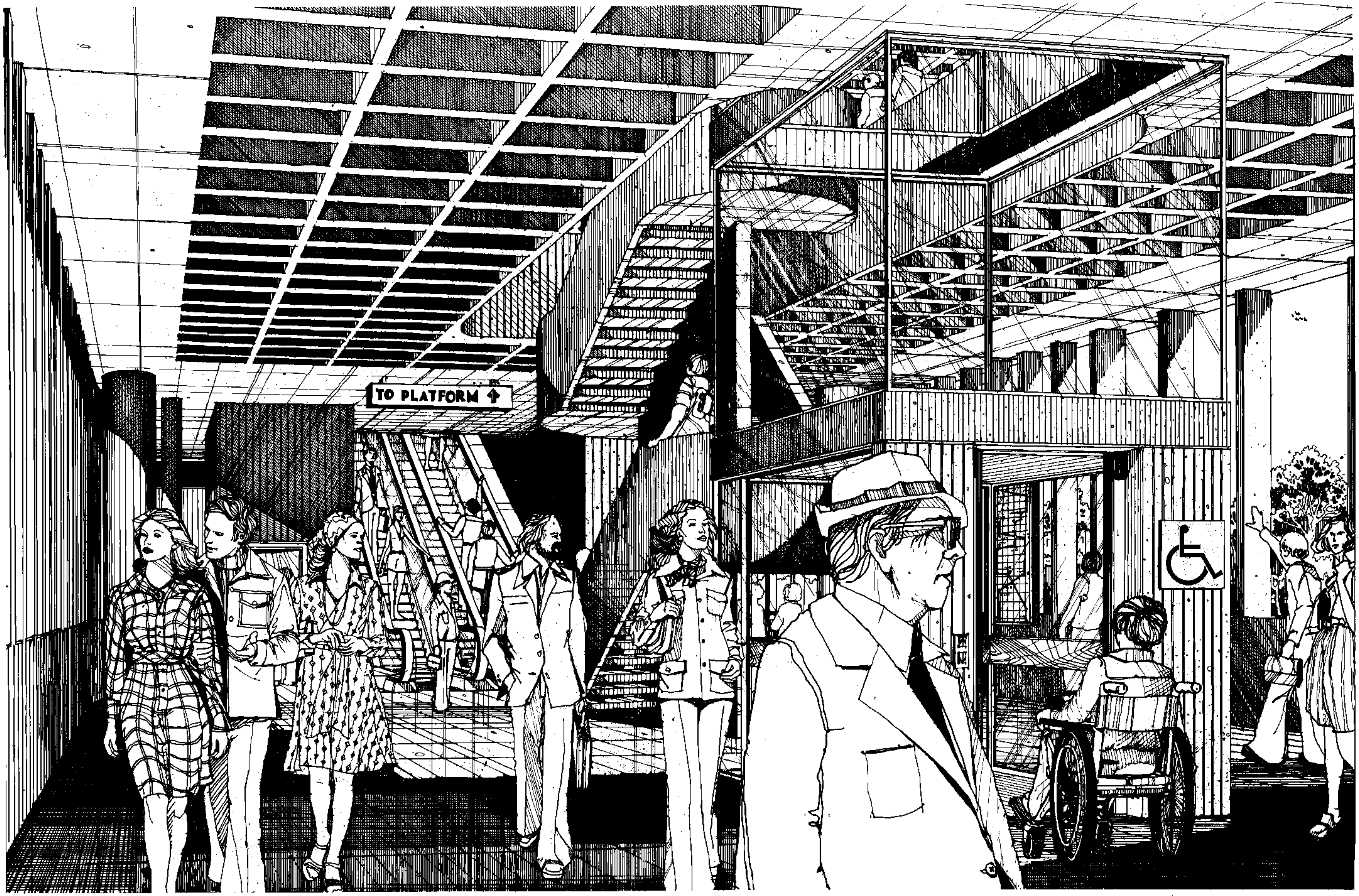


FIGURE 45
CONCOURSE AT GRADE

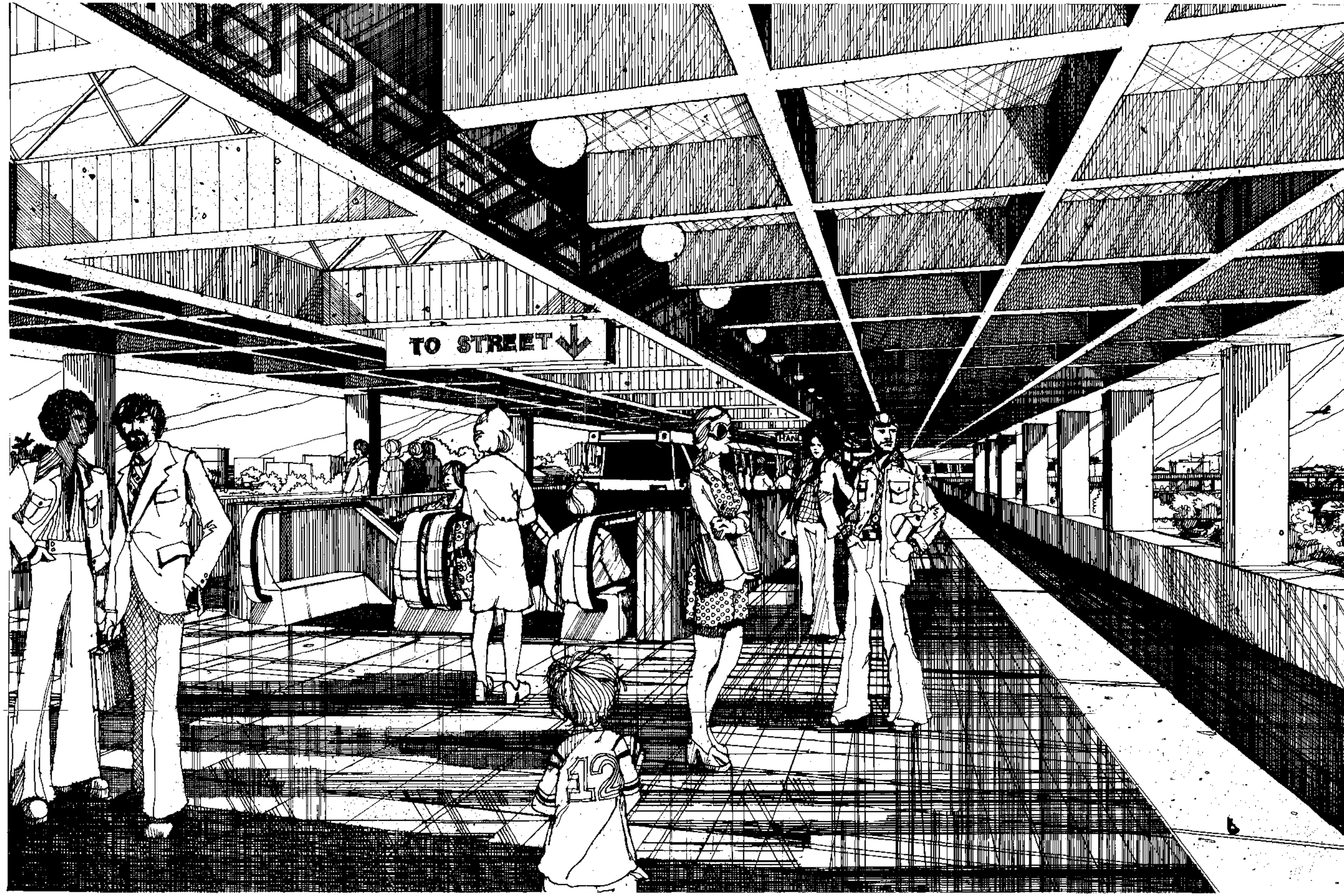


FIGURE 46
AERIAL CENTER PLATFORM

e. Site Development

While stations perform the same function, station sites must be responsive to variations in size, shape and configuration, different functional requirements, and existing and future plans of the community. It is therefore highly desirable to establish for all sites a systematic framework of aesthetics, basic standardization and continuity in design. Basic goals of convenience and safety for arriving and departing patrons must always be met.

Since all travel modes ultimately become pedestrian for entry into the station, a priority for vehicular access has been established in order of convenience to the most riders. They are:

- Bus loading and unloading
- Kiss-and-Ride (morning drop-off and evening pick-up).
- Park-and-Ride (including bicycles and motor scooters).

Other key elements considered basic to the design of station sites are:

- A single identifiable entrance into the site
- One way traffic providing linear flow-through circulation
- Separation of traffic modes
- The safe and convenient channelization of pedestrians toward the entrance.

It is important that a transit station be as much a part of a total urban design as any other development in an area. A careful study must be made of any master plans, urban renewal plans and specific future projects in the influence area for a particular station for any useful information that may influence site development. A conscious environmental concern must be exercised to assure proper integration of site facilities within the physical structure of a community.

Pedestrian Access is available to all stations from the public right-of-way. The pedestrian entering from the street or from the site values convenience and time over almost everything else and must be permitted as direct and as safe an approach as possible. Other than physical barriers such as a railroad or an at-grade station, the traffic volumes at most stations do not require absolute separation between pedestrians and vehicles.

Buses will have prime access adjacent to, through or terminating at the station thus reducing the transfer penalties in travel time and inconvenience. Saw-toothed loading bays which require considerable shorter lineal space than parallel bays will allow buses to arrive and depart at random without having to back up or wait for the bus in front to move out. Each bay can be designated for a special bus route, thus the passenger always knows at which bay to wait. Coordinated with each bay provisions for comfort will include bench seating and shelter. Wherever possible the aerial structure itself will provide the necessary weather protection.

Kiss-and-Ride is a term used for special areas of short term parking which are available for spouse-driven and taxi passengers which rank second in access priority. Close proximity to the entrance with good visibility for quick access and egress is mandatory.

Park-and-Ride areas are provided at most stations outside of the hig density downtown areas. The amount of parking space at a particular station will depend upon the traffic potential, the ability of the street system to feed the station, and availability of land. If additional parking is required in the future, multi-decked parking structures can be built on the existing site without acquiring additional property.

Parking aisles, laid out parallel to the direction of pedestrian traffic, are separated with wide, shaded walkways leading toward the station.

Elderly and Handicapped access facilities will include parking spaces in both Kiss-and-Ride and Park-and-Ride areas as close to the primary access points as possible. It is intended that all station sites be made accessible to and functional for the physically handicapped. Special attention will be given to ramps, curb-cuts, walkways, signage and lighting to make this possible.

Lighting of exterior spaces will make the pedestrian and driver aware of the organization of the site thus providing a natural lead-in to the station entrance. Parking areas will utilize a minimum number of poles located in the perimeter landscaping of the lot away from the entrance. This arrangement along with a selection of highly controllable light fixtures will avoid light spillage and glare into the surrounding neighborhood. Rows of warm clear sparkling globes in scale with the human figure will define major pedestrian walkways. Roadway and Kiss-and-Ride areas will feature special designs to prevent glare.

Landscaping plays a great part in the impact of a system on both the neighborhood and the rider in different ways. Careful preservation of vistas from the train may be as important as planting trees to screen and humanize a parking lot. Landscaping serves to ensure the harmonious integration of the transit facilities (both functionally and aesthetically) into the planned development of the areas in which they are located.

The route traverses districts varying widely in landscape quality, from the natural beauty of waterways and countryside to areas of intensive urban development. It is intended to integrate each section of the route as directly and simply as possible into the surrounding environs. The transitway is to be designed as a well-modulated viewing frame for the passengers, providing evolving sequences of pleasant views from the vehicles and agreeable prospects of the transit route and structures from the adjacent neighborhoods.

The purpose of landscaping parking areas is to protect and preserve the appearance, character and value of the surrounding neighborhoods. "Good neighbor" screen walls, earth mounding and massed plantings are examples of how this is achieved. Shaded pedestrian ways and places are essential to intercept the hot afternoon sun.

Stations serve as community gateways and focal points. They should be given landscape development in keeping with the quality of the station architecture and also in keeping with the unique character of each site. Here the use of a more refined landscape material would be fitting, such as specimen plants of larger initial size.

The concept for the linear park is to treat the area under the rapid transit guideway structure as a continuous meandering path for pedestrian walks and bikeways. The pathways, periodically developed for sitting areas, play lots and places of assembly, serve to tie together areas of the surrounding community and provide linkage with adjacent public and social activities along the edge of the transit line. The aerial structure will remain the dominant visual element, but the landscaped and special activity areas should provide a transition to the neighborhood and to a human scale.

FIGURE 47
PROTOTYPE SITE PLAN

SITE CONDITION A

This site condition is typically located in or immediately adjacent to the Miami CBD. No on-site parking will be provided and there will be limited "kiss and ride" facilities. The walk mode is expected to serve as the dominant type of access with support from feeder buses.

SITE CONDITION B

This site condition is typically located in lower density residential areas, or areas with expected heavy auto mode access. Auto mode of access will predominate with primary support from feeder bus (fixed route or demand responsive). Walking trips will be limited in number, including only those residents within one-quarter to one-half of a mile of a station.

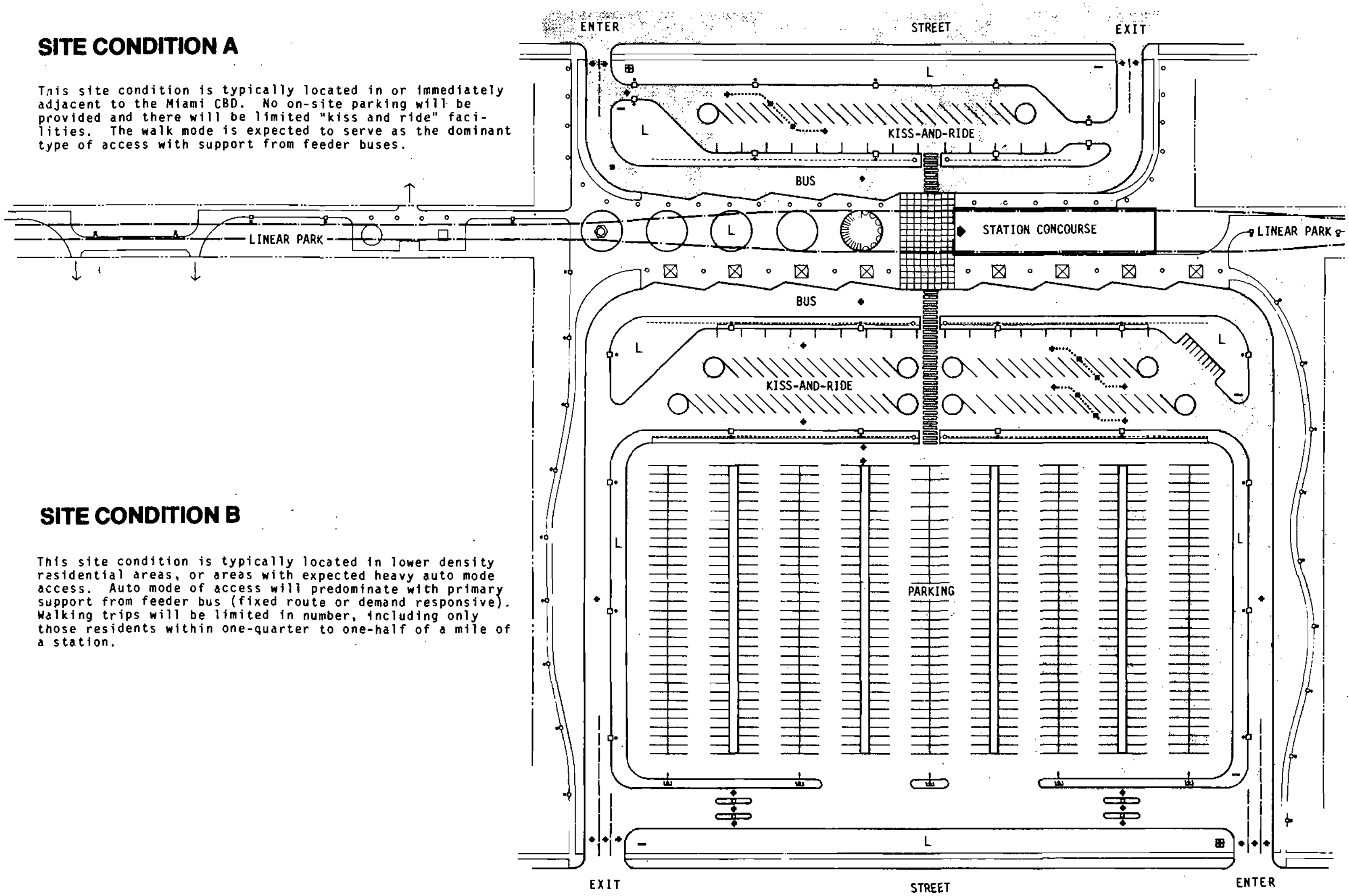


FIGURE 48
SITE PLAN LEGEND

System Symbol Sign

Primary Pedestrian Walk Light Fixture

Secondary Pedestrian Walk Light Fixture

Roadway Light Fixture

Parking Lot Light Fixture

Site Signage

Bus Shelter

Pedestrian Crosswalk

Pedestrian Barrier

Parking Lot Control Gates

Handicapped Spaces

Parking Spaces

Bicycles

Kiss-and-Ride (morning)

Kiss-and-Ride (evening)

Bus Bay

Aerial Guideway

Property Line

Traffic Direction

Landscaping

Seating

Statue

To Community Activity

Motorcycles

FIGURE 49
LANDSCAPING PLAN

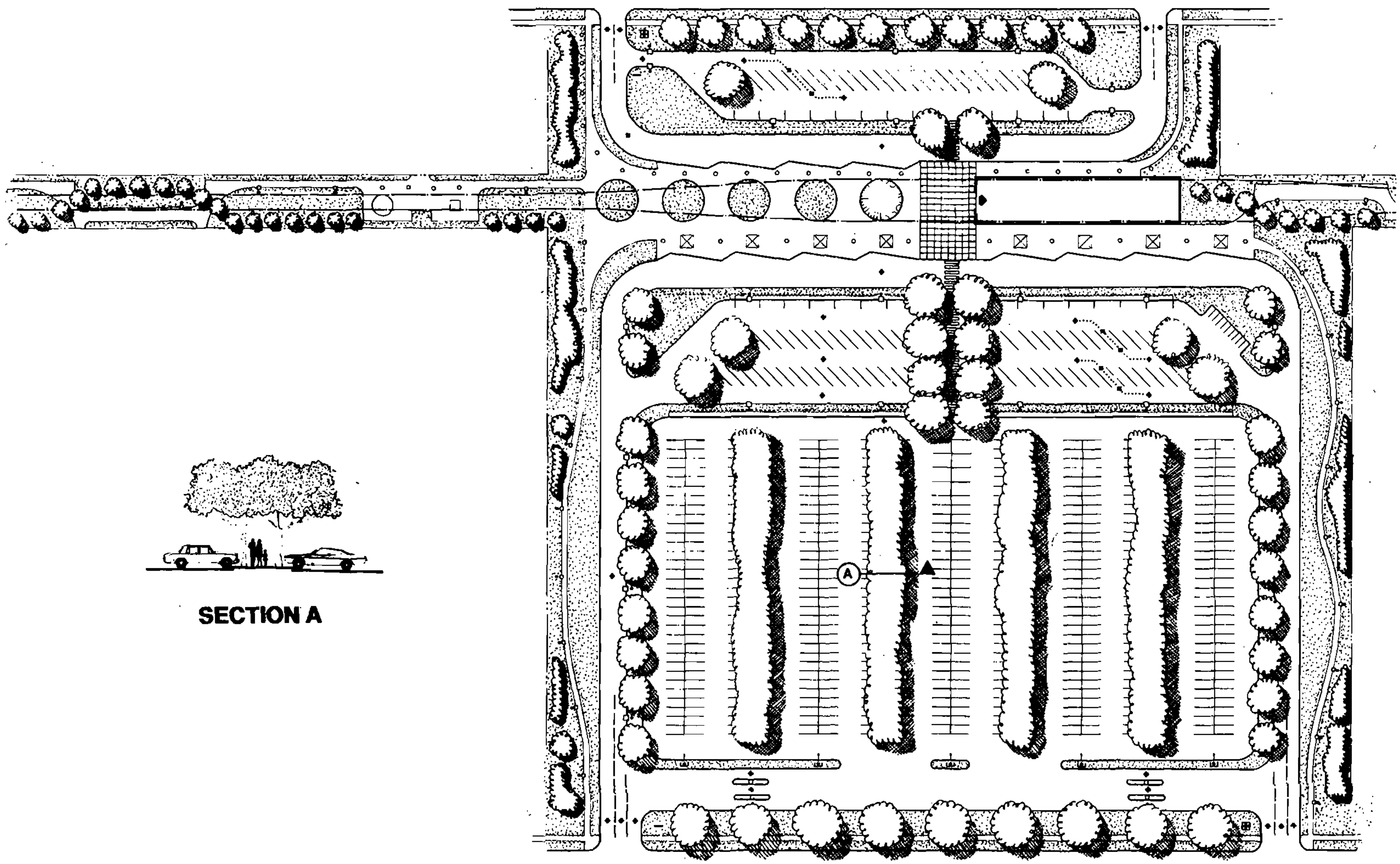
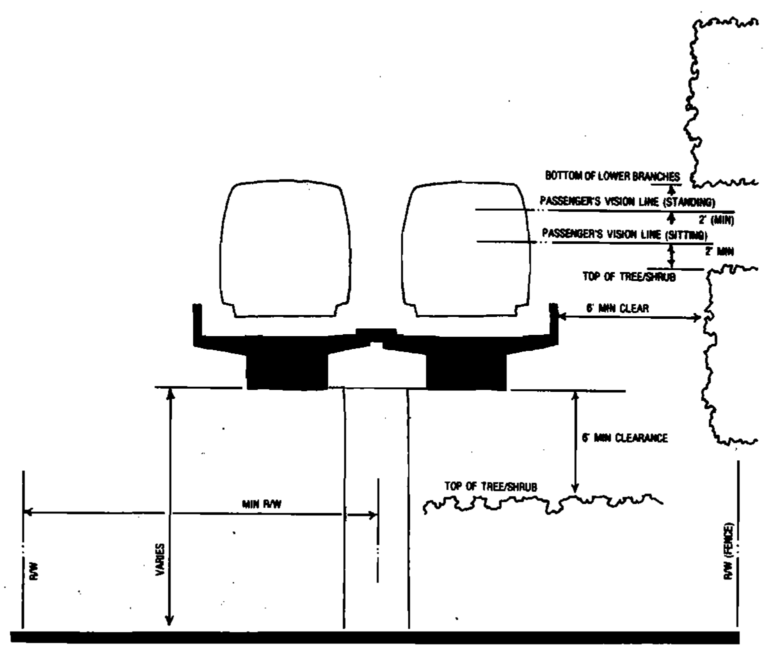
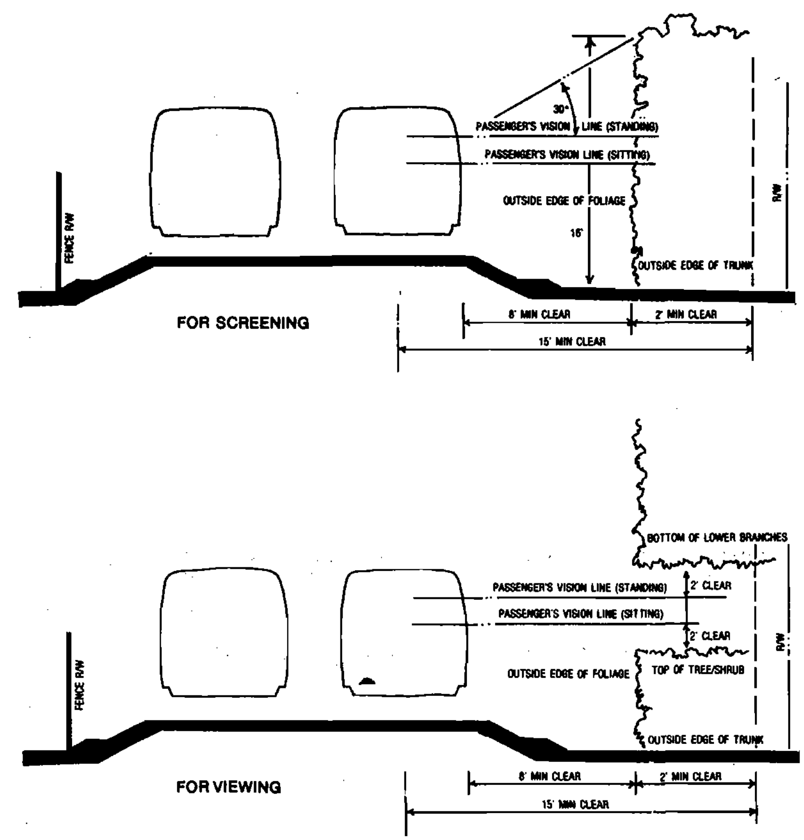


FIGURE 50
LANDSCAPE SECTIONS

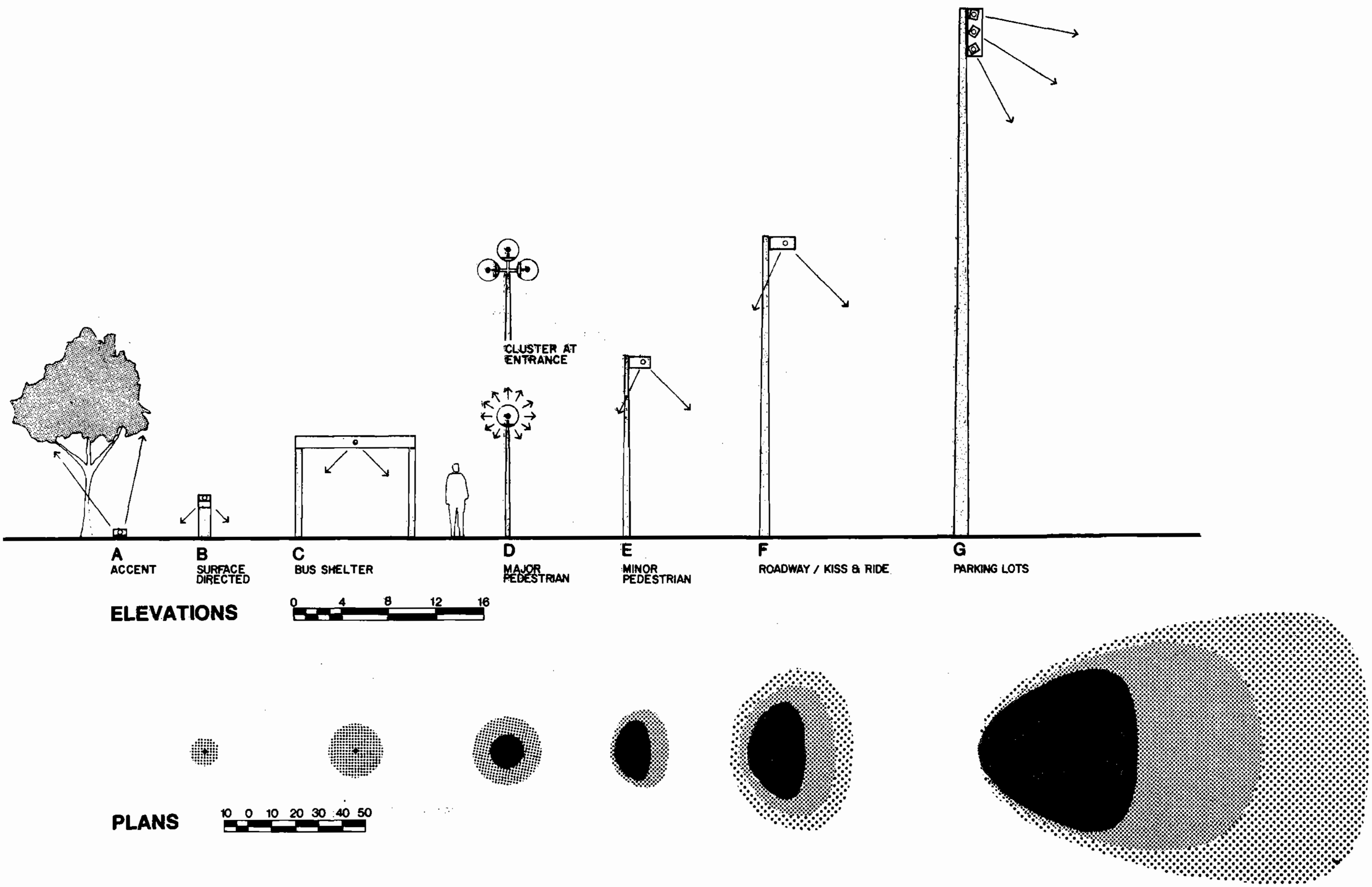


ELEVATED SECTION



AT-GRADE SECTION

FIGURE 51
SITE LIGHTING FIXTURES



3. Vehicles

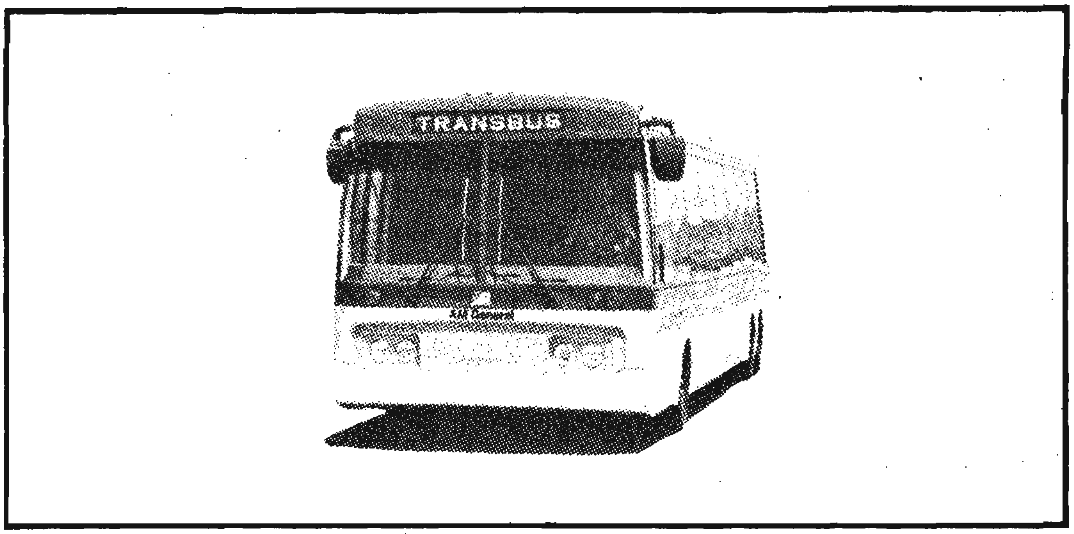
The bus and rail vehicles for operation on the core system are the Transbus type vehicle and the conventional steel-wheeled rapid transit vehicle.

Figure 52 shows prototype Transbus vehicles constructed by AM General, General Motors and Rohr for the Urban Mass Transportation Administration of the U. S. Department of Transportation. Typical dimensions of the Transbus are 40' length, 8'-10" to 10'-4" height, and 8'-6" width. The empty weight of the vehicle is in the 26,000 to 28,000 lb. range. Seated capacity is 45 passengers and the Transbus features equipment to allow easy entry and exit by handicapped persons in wheelchairs. Transbus prototypes include both diesel and gas turbine powered units, are capable of speeds up to 70 mph and provide higher acceleration rates (2.2 mph/second) than conventional city buses. These performance features together with the many improved passenger comfort, convenience, and safety factors, make the Transbus a most suitable vehicle for high speed operation on the busway and lower speed neighborhood operations for collection and distribution. Specific convenience, comfort, safety, environmental, and handicapped service improvements incorporated in the Transbus specification include:

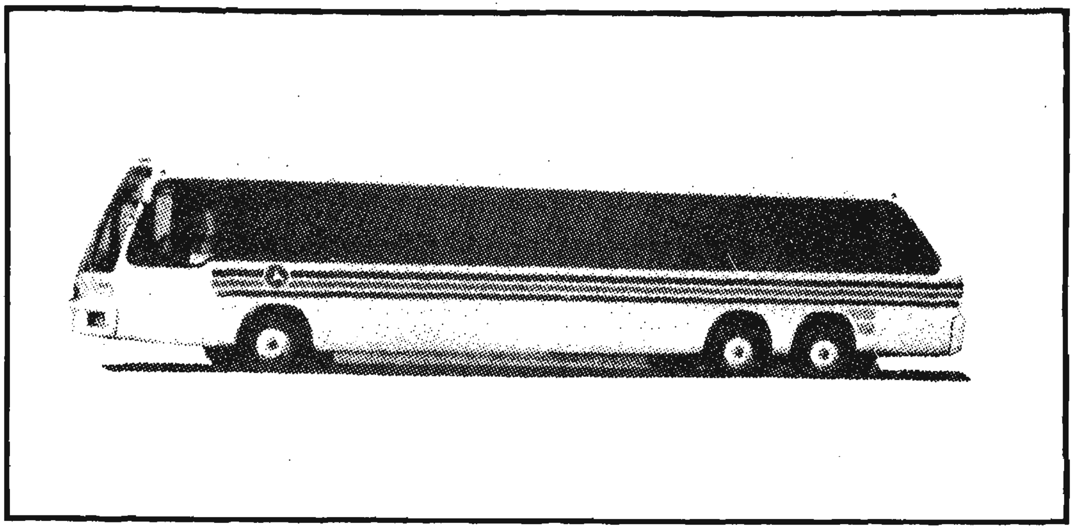
- Increased door width (40" versus 27" on standard bus)
- Noise levels reduced to a maximum of 75 dBA under all operating conditions and at all passenger locations, from a current maximum of 85 dBA.
- Air conditioning is standard equipment
- Seat width increased (18" per passenger versus 16" on standard bus)
- Window area increased versus standard bus
- Floor height reduced
- Improved crashworthiness and interior safety design
- Improved emission controls
- Accommodation of individuals in wheelchairs through advanced lift and ramp designs built into bus to provide "level" boarding by wheelchair.

FIGURE 52

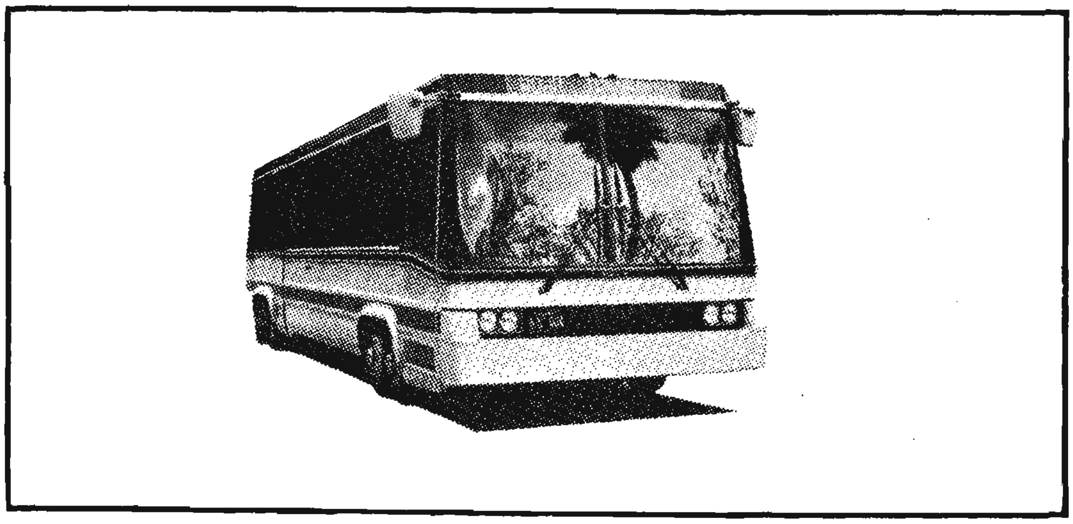
TRANSBUS PROTOTYPES



AM GENERAL TRANSBUS



GMC TRANSBUS



ROHR TRANSBUS

Initial dimensions and system requirements for the rail vehicle are shown in Table 15.

The vehicle used for preliminary design and costing purposes is 67'-6" long, 10' wide and 10'6" high. This size is arbitrary to the extent that an optimization of vehicle dimensions can only be effectively performed during the final design process. The dimensions may thus be adjusted in the final design process in order to most economically satisfy the functional requirements and/or to conform with new industry and government standards or vehicle designs from other metropolitan areas. Consistent with the initial dimensions, the vehicle has a seating capacity of 66 persons and is designed to carry a full load of 130 passengers during peak hours. Capacity beyond 130 passengers is feasible up to a crush load of 240 persons, however comfort and space standards would not be met with capacities beyond 130 persons.

Each vehicle has three bi-parting doors per side with large windows in between. This door arrangement has the capacity to accommodate the anticipated passenger flow and is appropriate to the urban rapid transit system nature of the core system. As shown in Figure 53 the seating arrangement allows easy access and egress and leaves door vestibule areas clear. Figure 54 shows an artist's impression of the interior of the vehicle and illustrates the comfortable upholstered seats, convenient stanchions and hand holds, and clean spacious interior design. Complete environmental control of the passenger space will assure passenger comfort, and materials used in the interior will be fire-resistant for passenger safety. Passenger safety and security is further provided for by on-board emergency control devices and communications equipment, and by a load balancing system that maintains the vehicle floor level with the station platform under all normal vehicle load conditions.

The vehicle equipment and body structure will be designed to limit interior noise levels to 72 dBA with a train traveling at 60 mph on an elevated structure. Exterior noise levels will be closely controlled through the vehicle design (particularly in the area of wheels and wheel/rail dynamics) and the track design. In addition to continuously welded steel rails and resilient tie pads, many track sections will include acoustic side barriers so as to limit radiated noise levels to the objectives established in section V-A-8 of the 'Environmental Impact Analysis', June 1975.

The vehicles run over standard gauge steel rails picking up electric power from a third rail which parallels, to one side, the running rails. Each vehicle is powered by four nominal 175 horsepower D.C. motors controlled by a solid state, chopper controller. Other motor/controller combinations should be considered during final design. However, for purposes of this preliminary engineering program the chosen combination is supported by an abundance of cost and performance data needed for both the vehicle and the operating cost estimates. The propulsion control circuitry is such that the motors act as generators during vehicle braking to provide electric braking effort. This energy generated by the motors can, in some schemes, be used by other system loads. However, for purposes of this program the braking energy is assumed to be converted to heat in braking resistors on the vehicle (dynamic braking). The dynamic braking scheme is used to supplement friction brakes, thus increasing brake shoe life.

TABLE 15

INITIAL VEHICLE DIMENSION DATA AND SYSTEM REQUIREMENTS*

Car length over coupler faces	:	67' 6"
Car width maximum	:	10' 0"
Car height (Max. from top of rail)	:	10' 6"
Empty weight	:	70,000 Lb.
Truck centers	:	46' 0"
Doors - Number of openings	:	3 per side
- Opening size	:	54"
- Type	:	Biparting
Wheel centers	:	7' 0"
Seated capacity	:	66 Passengers
Normal full capacity	:	130 Passengers
Crush capacity	:	240 Passengers
Maximum car weight (crush)	:	106,000 Lb.
Weight per passenger	:	150 Lb.
Wheel gauge	:	4' 7 11/16" (AAR Std.)
Wheel size (new)	:	28" diameter
Maximum Train Length (initial)	:	6
Maximum Train Length (ultimate)	:	8
Rail Gauge (tangent)	:	4' 8¼"
Minimum Mainline Curve Radius	:	500' (Horizontal-Circular)
Maximum Mainline Grade	:	4%
Turnouts - Yards	:	No. 6 (259' R)
-Mainline	:	No. 15 (1721' R)
Initial Design Maximum Line Haul Capacity	:	15,000 Passengers per hour at 3 minute train headway
Ultimate Design Maximum Line Haul Capacity	:	30,000 Passengers per hour at 2 minute headway

*Subject To Revision

FIGURE 53
RAIL VEHICLE FLOOR PLAN AND ELEVATION

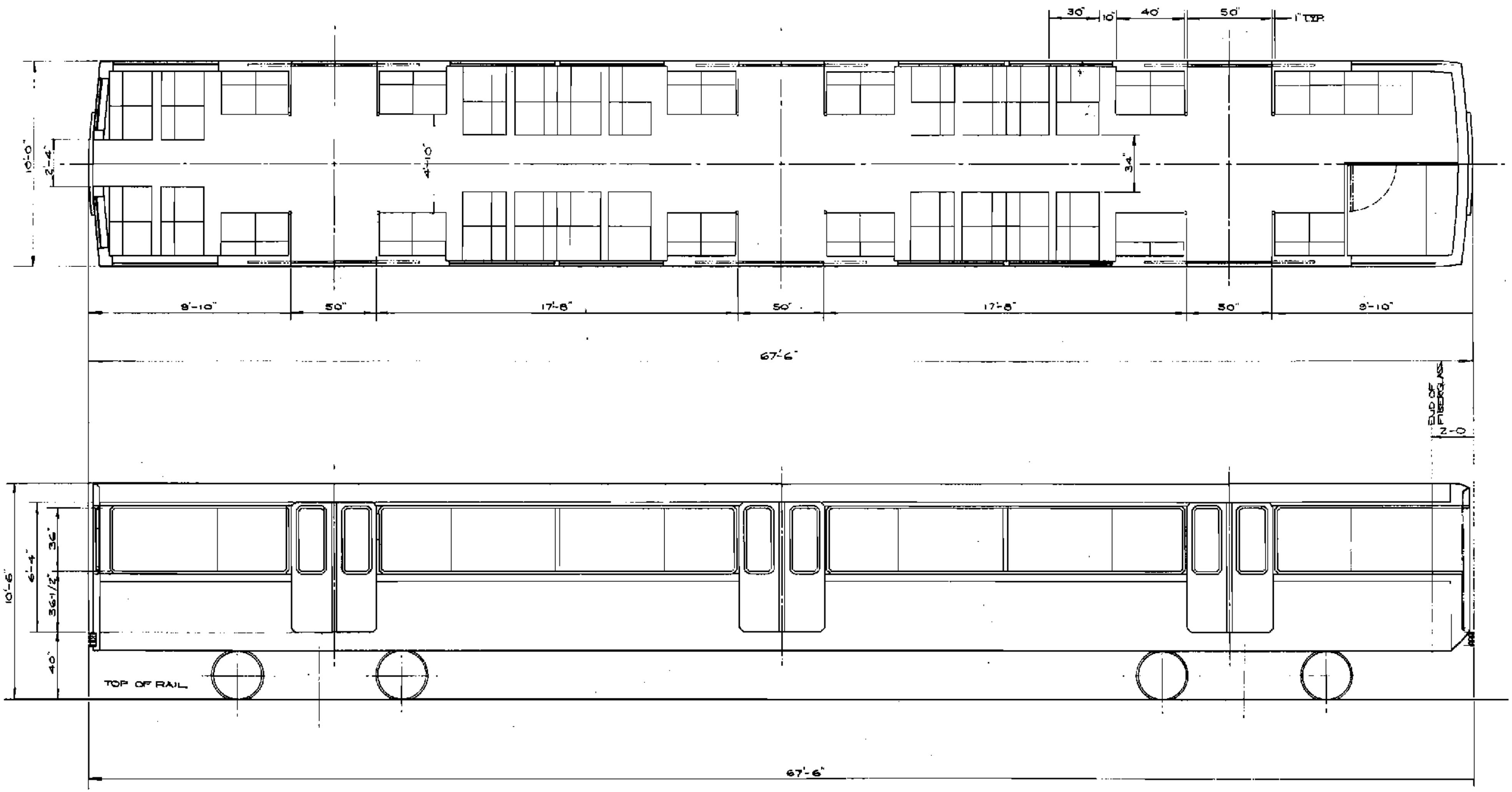


FIGURE 54
RAIL VEHICLE INTERIOR VIEW

The trains as now described are capable of operating at speeds up to 70 miles per hour. Although the average schedule speeds on the various corridors of the core system are in the range of 25 to 36 mph, the 70 mph top speed is reached and sustained frequently enough to be justified. The trains will accelerate at an initial rate of 2.8 mph/second and will brake at an average rate of 2.7 mph/second. Jerk rates (rates of change of acceleration or braking levels) will be controlled to 2.0 mph/second^2. These performance figures will be achieved regardless of the vehicle passenger load. Lateral or vertical accelerations caused by trains operating in horizontal or vertical curves will be limited to comfortable levels by appropriate track system design and route alignment and profile design.

Train size has to be adjusted to economically meet passenger demand levels over the day (see subsection V-B). From an operations point of view it is desirable and economical to operate trains made up of identical "units", which can be separated or joined to reduce or increase train size. The determination of the "unit" size is based upon a number of factors among which are off peak passenger demand requirements, vehicle equipment location and cost considerations, and reliability considerations. For the core system, a 2-car "unit" size has been tentatively established, and this "unit" is called a married-pair. A married pair is thus the minimum size train and consists of two cars semi-permanetly joined together and sharing specific equipment items. Figure 55 shows a graphic impression of a married pair train at an elevated station on the core system.

An important vehicle design consideration for the Dade County vehicle is that of stability under high wind loads. The area is susceptible to hurricane winds ranging from 75 mph to over 125 mph. Under hurricane conditions, operations will cease, but the vehicle must be designed so as to eliminate the possibility of overturning. To provide vehicle stability under wind conditions in excess of 75 mph, special operating procedures will be required and special features may be incorporated into the vehicle design. These features, such as tie-down devices, will be considered during the final design process.

The overall design of the vehicle will make use of a large number of standard off-the-shelf subsystems including motors, air conditioning units, brake systems, etc. Thus the vehicle will basically be a standard high performance rapid transit car clothed in an exterior customized for the Dade County area. In this manner, the reliability and cost advantages of existing vehicle subsystems are attained, while still providing a vehicle appearance appropriate to this area. In the final design process, close attention should be given to modern equipment innovations (particularly as such relate to power consumption reduction) with the objective of incorporating such items when reliability and cost goals can be maintained.

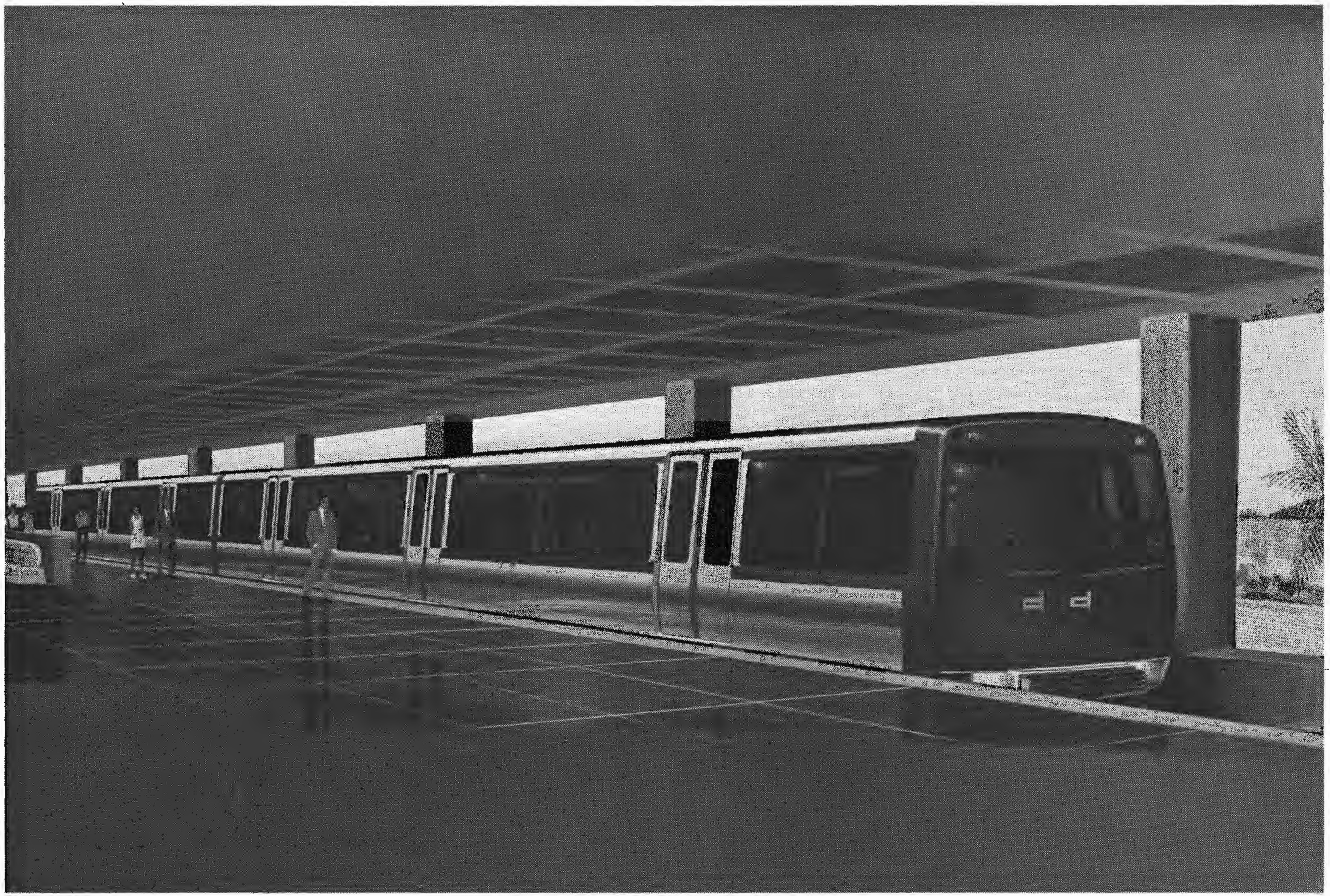
It is provisionally recommended (subject to detailed study in the final design process) that a member of the operating agencies' personnel be placed aboard each and every train. This recommendation is based upon the requirement for rapid recovery from failure conditions imposed by the reliability service criteria contained in Milestone 1. Placing an attendant aboard each train should allow the rapid diagnosis and possible correction of many minor failure conditions which, without an attendant, could cause substantial delays in system operation. This desirable operational approach can only be obtained at substantial annual cost, which will tend to increase every year. Once the decision to place an attendant aboard each train has been made however, other benefits, which of themselves might not be sufficient to justify an attendant, can accrue. These include the potential psychological benefits to passengers, the presence of the attendant during emergencies, the use of the attendant as a voice communications interface and filter between passengers and central control, the use of the attendant to manually operate the train in the storage yard area, the use of the attendant to override the automatic train control system and stop the train in the event of an object or person being on the track (the train may not be stopped in time to prevent the object or person from being struck, but may reduce any damage or injury caused), and the use of the attendant to receive distress indications from passengers on the train. The attendant may also be used to hold train doors open at stations at which unexpected high passenger volumes are experienced. The attendant does not, however, have any normal functions related to the operation of trains on the main line. These functions, for safety reasons, are handled by an automatic system.

4. Storage and Maintenance Facilities

General Maintenance and Operations Requirements. The operation of the rail system portion of the core system will require approximately 310 vehicle units operating over 48 route miles of trackage during peak hours. To achieve the reliability service criteria and safety criteria established in Milestones 1 and 6 respectively, a comprehensive program of scheduled and preventive maintenance will be required. This maintenance program must cover all system elements including vehicles, power equipment, electronic equipment, tracks and structures and other miscellaneous support equipment. In addition, specific facilities must be provided for the operational requirements of storage, servicing, cleaning, dispatching, testing and size (or consist) changing of trains. These functions are necessary to provide the passenger carrying capacity in an efficient, clean, safe and reliable manner consistent with the expected passenger demand at different times of the day. To achieve these maintenance and operations functions, facilities for the maintenance and storage of vehicles, and for the maintenance of all other equipment and systems, must be provided at various locations adjacent to the core system or convenient to the core system.

Operation and Maintenance Facility Locations. Based upon the system criteria and upon work performed in Milestone 5, rail vehicle storage and maintenance facilities are planned for three separate locations. In addition, as described later in this subsection, certain other maintenance facilities will be required, but these need not be

FIGURE 55
TRAIN EXTERIOR VIEW



adjacent to the rail rapid transit system route. Further, operation of the I-95 Busway will require bus garage facilities which probably cannot be accommodated within the existing MTA facility at NW 32 Avenue/ NW 31st Street.

The rail system operations and maintenance facility locations are shown schematically on Figure 56, and include the following facilities:

- Cutler Ridge Area

  Storage and Marshalling Yard
  Maintenance Operations Building and Equipment
  Component Repair Facility
  Test Track
  Maintenance-of-Way Facility

- Airport Area

  Storage and Marshalling Yard
  Maintenance Operations Building and Equipment

- Hialeah Area

  Storage and Marshalling Yard
  Maintenance Operations Building and Equipment
  Test Track (optional)

- NW 62nd Street Area

  Maintenance-of-Way Facility
  On line storage facility (temporary - Stage I only)

- NW 7th Street Area

  Central Control and Administration Building
  Maintenance-of-Way Facility.

Functional Description of Storage and Marshalling Yard. Yard functions include:

- Vehicle Cleaning
- Vehicle Washing
- Undercar blowdown
- Minor repairs and servicing, and simple operational checks on vehicles
- Train confidence checks
- Material storage
- Receipt, dispatch, and storage of trains, and change of train consists.

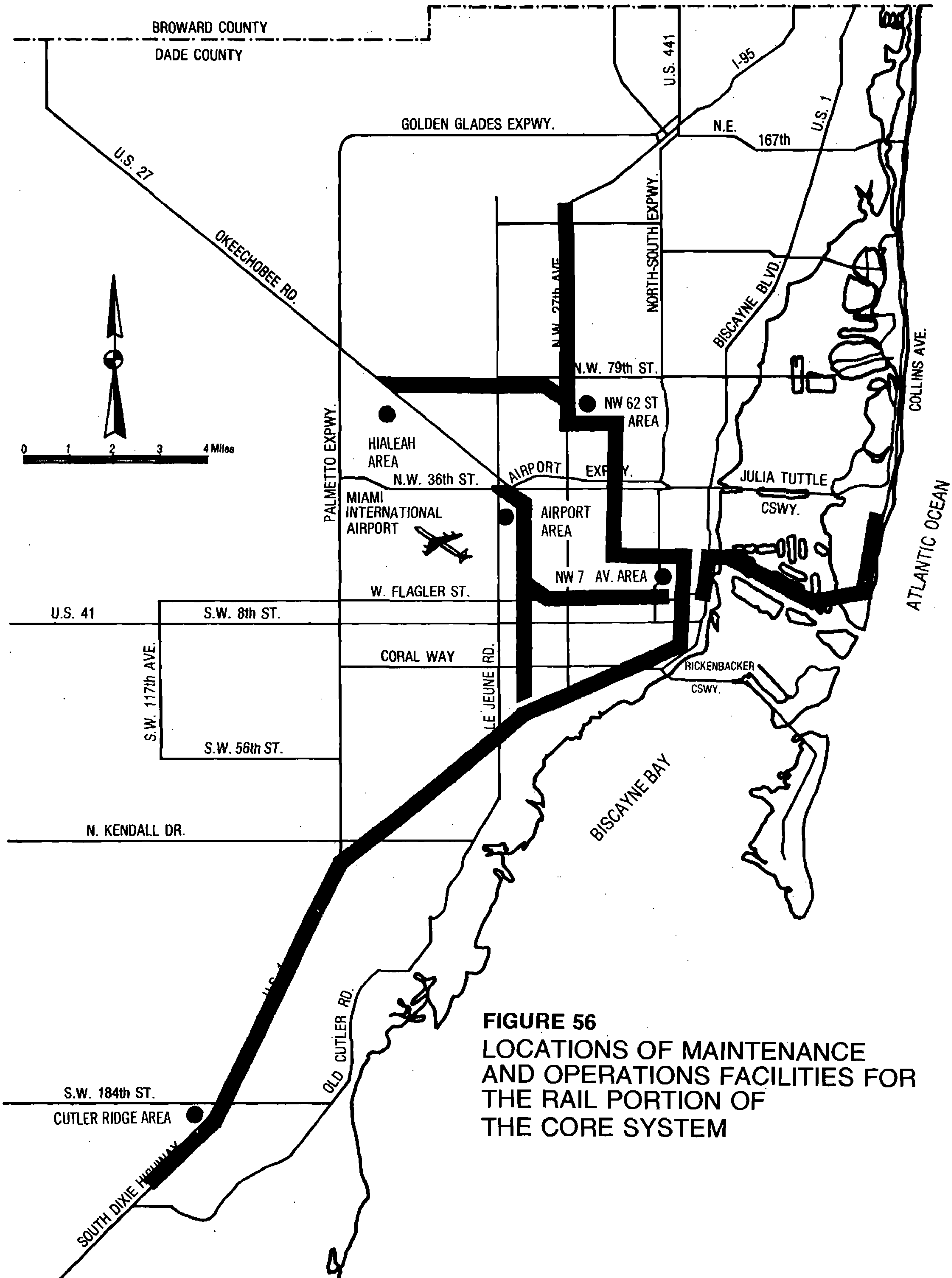


FIGURE 56
LOCATIONS OF MAINTENANCE AND OPERATIONS FACILITIES FOR THE RAIL PORTION OF THE CORE SYSTEM

A typical storage yard layout includes track connections to the main line, yard leads, train storage tracks, transfer tracks, wash tracks, operations building access tracks, special maintenance equipment storage tracks, and various other support facility requirements. Typical daily operation includes varying both the number and size of trains in operation on the mainline so as to meet peak and off-peak patronage levels. Normally, all trains are returned to the marshalling yard for overnight storage. Figure 57 shows a flow diagram for routine train movement sequence through the yard. A key feature of any storage yard is the location at which "handover" of a train from yard operations to mainline operations occurs. This location is called a transfer track or transfer zone. On this track, inbound trains which have arrived at that point under the automatic control of the mainline are stopped and switched to manual control for movement in the yard area. Outbound trains go through the reverse process at the transfer zone and also undergo a train confidence check at this area before being dispatched into revenue service.

Functional Description of Maintenance Operations Shop. The maintenance plan for the rail portion of the core system involves the concept of a single type of on-line maintenance facility called an Operations Shop. The Operations Shop performs a variety of functions on vehicles brought directly into the facility, including:

- All major inspections and servicing
- Lubrication
- Scheduled periodic maintenance
- Unscheduled repairs
- Component changes
- Modifications
- Wheel grinding and turning
- Acceptance testing
- Storage of routine material and parts
- Response to trouble associated with vehicles on the main line.

The Operations Shop is designed to handle all the functions of a traditional service and inspection shop plus some of the functions of a traditional main repair shop. It is a self-sufficient facility in that all vehicle maintenance including wheel turning, major modifications, minor accident repair, and extensive scheduled inspections can be carried out. The Operations Shop is designed for car movement through the facility in a planned manner, normally in one direction. Quick and easy access to car underfloor equipment is provided for with pits, and the work flow is concentrated on the many routine tasks required to place a car in operational readiness in the shortest possible time.

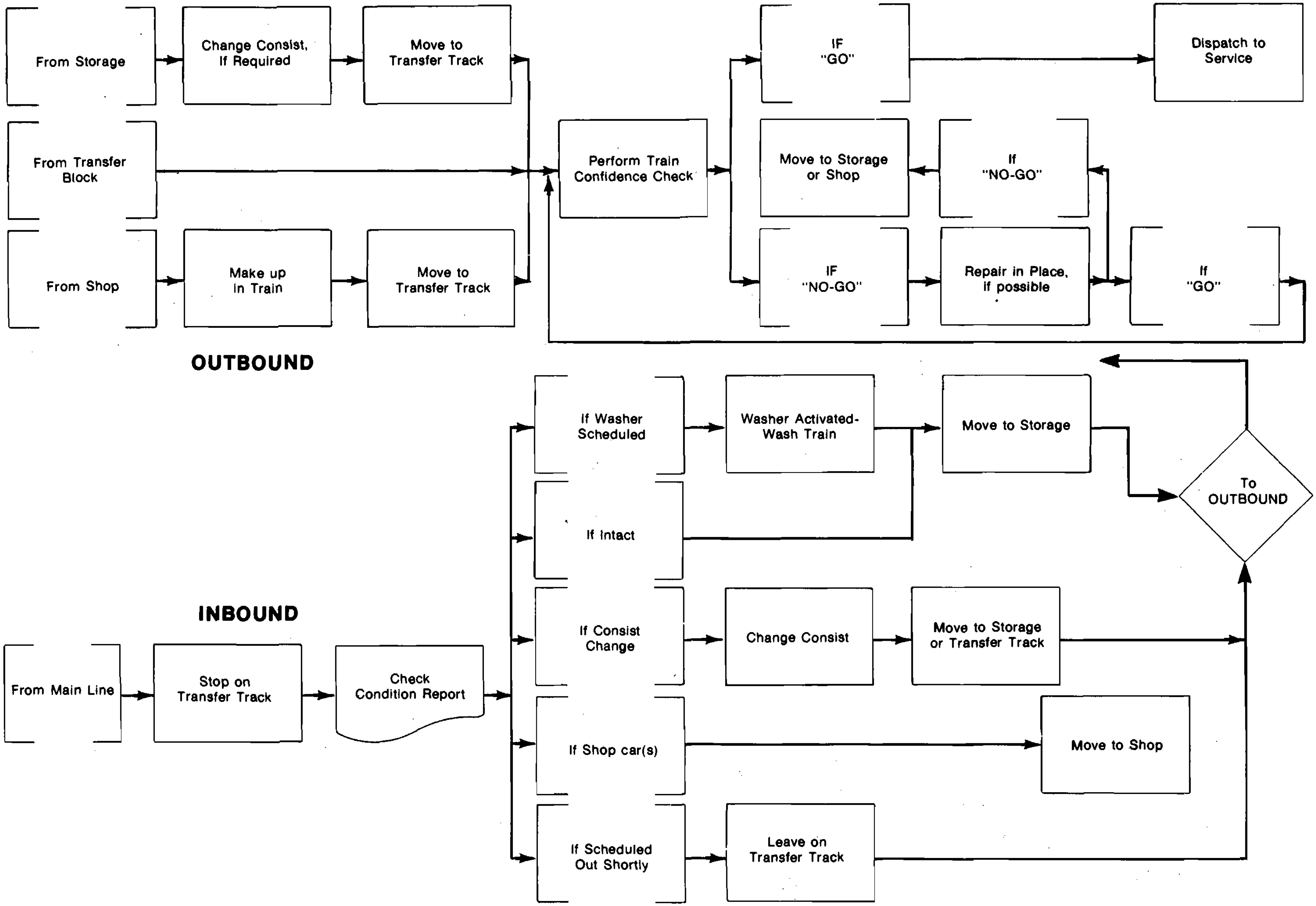


FIGURE 57
FLOW DIAGRAM OF ROUTINE TRAIN MOVEMENT SEQUENCE THROUGH YARD

The effective, efficient and economical functioning of an Operations Shop relies on failure diagnosis, troubleshooting and repair at the replaceable module, component or assembly level, up to and including vehicle trucks. Good units, components or modules from stock are used to replace the defective items. No attempt is made to repair the defective item at the Operations Shop; that is the function of a separate facility, the Component Repair Facility. This specialization of maintenance functions allows the Operations Shop to concentrate on its prime objective, to return vehicles to operational use as quickly as possible.

Functional Description of Component Repair Facility. The Component Repair Facility accomplishes all secondary level maintenance for the system. Tasks performed at such a facility include:

- Receipt, inspection and storage of parts
- Repair, overhaul, and test of parts, components, modules, etc., including failure analysis
- Distribution of new and repaired components to Operations Shops
- Component disposal and warranty decisions.

The Component Repair Facility can be likened to a commercial service shop that specializes in repairing, rebuilding and testing products for their customers. The customers in this instance are the Operating Shops and Wayside Maintenance Shops. Because the facility is set up to perform as a separate maintenance element and because it provides service to all other organization elements of the system, duplicate facilities and personnel functions can be avoided. The facility can be located without regard for space for transit vehicles and does not therefore necessarily have to be part of the yard and shop complex. However, where the building is located in a yard area, a rail connection to yard tracks is provided for major repair of wrecked vehicles.

Functional Description of Maintenance-of-Way Facility. While most wayside maintenance is accomplished at the site of the equipment being maintained, a facility is required for wayside maintenance personnel and for storage of parts, and special track areas are required for storage of tracked wayside maintenance equipment. Wayside maintenance covers all items of equipment other than tracked vehicles, and provides maintenance services for all plant and equipment used in track structures, in station areas, in the electrification system, the train control and communications system, landscaping, fencing, and other support systems. In a similar fashion to the Operations Shop, it is the objective of the Maintenance-of-Way organization to restore equipment to service as rapidly as possible. Further, the Maintenance-of-Way facility will rectify problems by replacing discrete modules, components or assemblies, and will then ship defective units to the Component Repair Facility for failure analysis and repair. Maintenance-of-Way personnel normally access the work location by over the road motor truck equipment.

Cutler Ridge Yard and Shops. Figure 58 shows a plan layout of the Cutler Ridge Yard and Shops. As can be seen, this area encompasses all four of the facilities functionally described above, and will provide complete maintenance services for Stage I of the core system rail network.

Test Track. Modern rapid transit vehicle equipment has reached a level of complexity that demands not only the most thorough maintenance program, but also an extensive and specific test procedure for new vehicles and for vehicles returning to service after major overhaul. To provide a complete test of vehicular equipment the test track should:

- be long enough for a complete acceleration run, plus some time at maximum speed, plus a complete deceleration run. Added to this must be about one half mile of coast distance in the event of some brake malfunction or problem;

- have direct access to a yard lead without a grade crossing of any main line;

- be equipped with automatic train control equipment and any other signalling equipment used on the main line; and

- have a means of retardation at its extreme end.

Because of the staged nature of the core system, and possible future expansion of the core system, new vehicles will be acquired for revenue service for many years after the system starts operation. This fact, together with the requirement for high speed testing of vehicles being put back into service after overhaul, makes a separate independent test track a mandatory requirement. This track should be used only for testing purposes and should not become a section of main line at any point in time. The core system test track will run approximately three miles north from the Cutler Ridge Yard area, will be located on the east side of the transit structure and thus be adjacent to South Dixie Highway for most of its length.

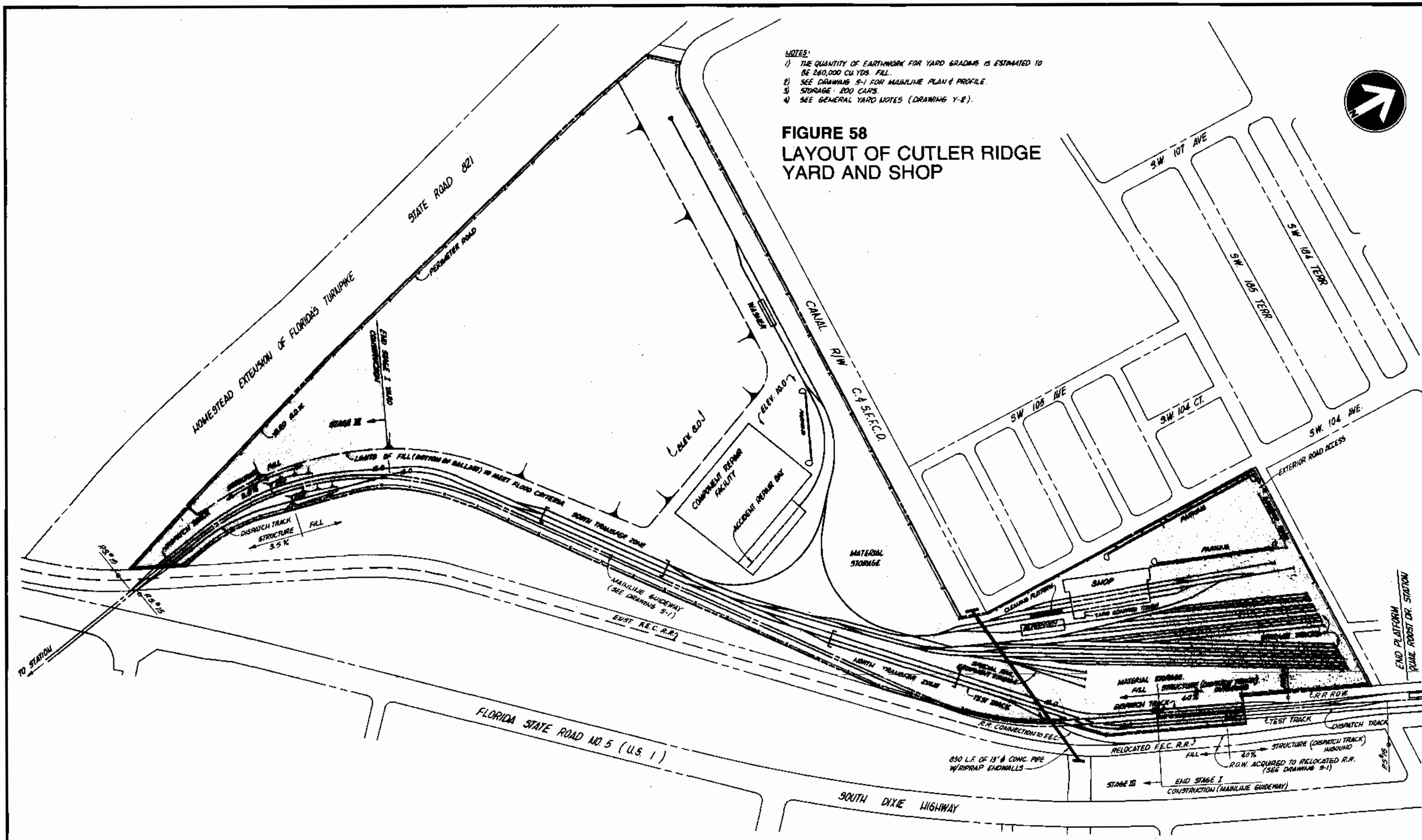


FIGURE 58
LAYOUT OF CUTLER RIDGE YARD AND SHOP

5. Other Subsystems

Operation of the rail portion of the rapid transit system will involve a number of subsystems to control the trains, to provide communications, to power the trains, stations and other facilities, and to collect fares.

a. Train Control and Communications

In Milestone 2 of the preliminary engineering program, the following criterion was established:

"• Normal vehicle control functions will be completely automated. A train will normally operate continuously in revenue service without manual intervention. Manual control of each vehicle will be provided for non-normal and storage area operations."

The basis for this criterion was the fact that substantial evidence exists that human operator error is the cause of many accidents on U. S. railroads and transit systems, and thus, automation of the vehicle control functions becomes desirable from a safety viewpoint. This criterion, together with many safety and security criteria established in Milestone 6, formed the basis of the preliminary design of the train control and communications operating subsystem. This subsystem consists of three major elements, the train control system, the data communications and supervisory control system, and the voice and video communications system.

The Train Control System. This system includes four major subsystems. These are

(1) Automatic Train Protection
(2) Automatic Train Operation
(3) Line Supervision
(4) Manual/Auto Yard Operation

(1) The Automatic Train Protection (ATP) system provides the basic safety assurance for train movements on the mainline. This system automatically prevents rear-end, head-on and sideswipe collisions due to conflicting train movements, prevents damage or collision by assuring that track switches are not moved ahead of or under trains, and prevents damage or collision by preventing trains from traveling at speeds beyond track civil speed limits. The ATP system provides for 1) continuous wayside detection of trains, 2) safe spacing between trains as governed by the maximum required stopping distances (plus safety margins) of following trains, 3) route interlocking to align and lock protected routes wherever trains may converge or have conflicting movements, 4) operating speed restrictions by limiting the speed of trains to predetermined speed profiles, 5) transmission of

speed commands from the wayside to each train, 6) prevention of train rollback (movement in reverse direction to that permitted), and 7) prevention of train movement when any door in a stopped train is not closed or locked, or stopping of a moving train in which any door is detected as not being closed or locked.

To achieve the functions listed above, the entire mainline portion of the system will be divided into fixed geographic zones called blocks. Train detection will be continuous within the confines of each block through the use of a track circuit which is shunted by the wheels/axle of a train. The ATP system utilizes vital circuits and relays for which all known failure modes will result in more restrictive (and thus safe) operating conditions. The ATP system will be responsible for any action necessary to provide safe operating conditions regardless of any failures in central control computers or other equipment.

(2) The Automatic Train Operation (ATO) system performs the basic operating control functions, but is entirely subordinate to the ATP system. Thus if the ATO system attempts a train movement which is in violation of ATP requirements, then the ATP system overrides the ATO system and no potentially unsafe conditions can occur. The ATO system does not therefore require vital equipment but does require highly reliable equipment. The Automatic Train Operation System provides for 1) regulation of train speeds within the limit imposed by the ATP, 2) precise stopping of trains at each passenger station, 3) control of train movement with regards to speed, acceleration, deceleration and jerk taking into account the effects of grade and all time delays and lags within the train control system, 4) generation and interpretation of vehicle door open and close commands, 5) regulation of train dwell times, performance levels, and headway spacing, 6) release of trains between the mainline and yards, 7) train reversal in specially designated track zones, and 8) generation of destination message logic.

(3) The Line Supervision system will provide for the following supervisory functions, 1) dispatch of trains from terminal points according to the daily operating schedule, 2) normal routing of trains, 3) monitoring of train performance via a train tracking program, 4) alarming and recording of abnormal conditions associated with the train control, electrification, and other vital systems, 5) hold and release of trains from central or local control points, 6) station run through provisions, 7) maintenance of inventory data, vehicle mileage data, vehicle maintenance data and 8) vehicle equipment safety monitoring which will signal major and minor alarms to the train attendant.

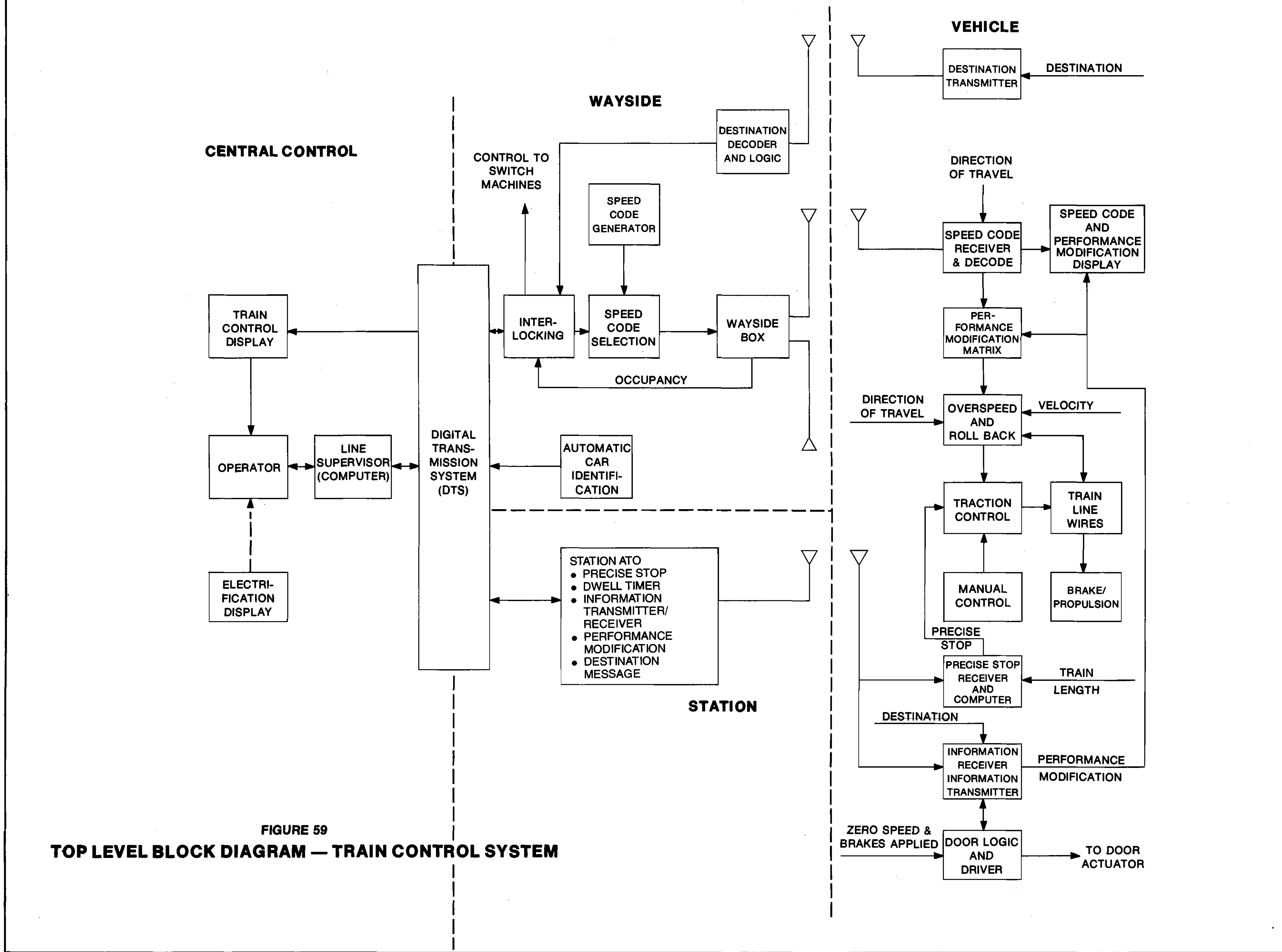
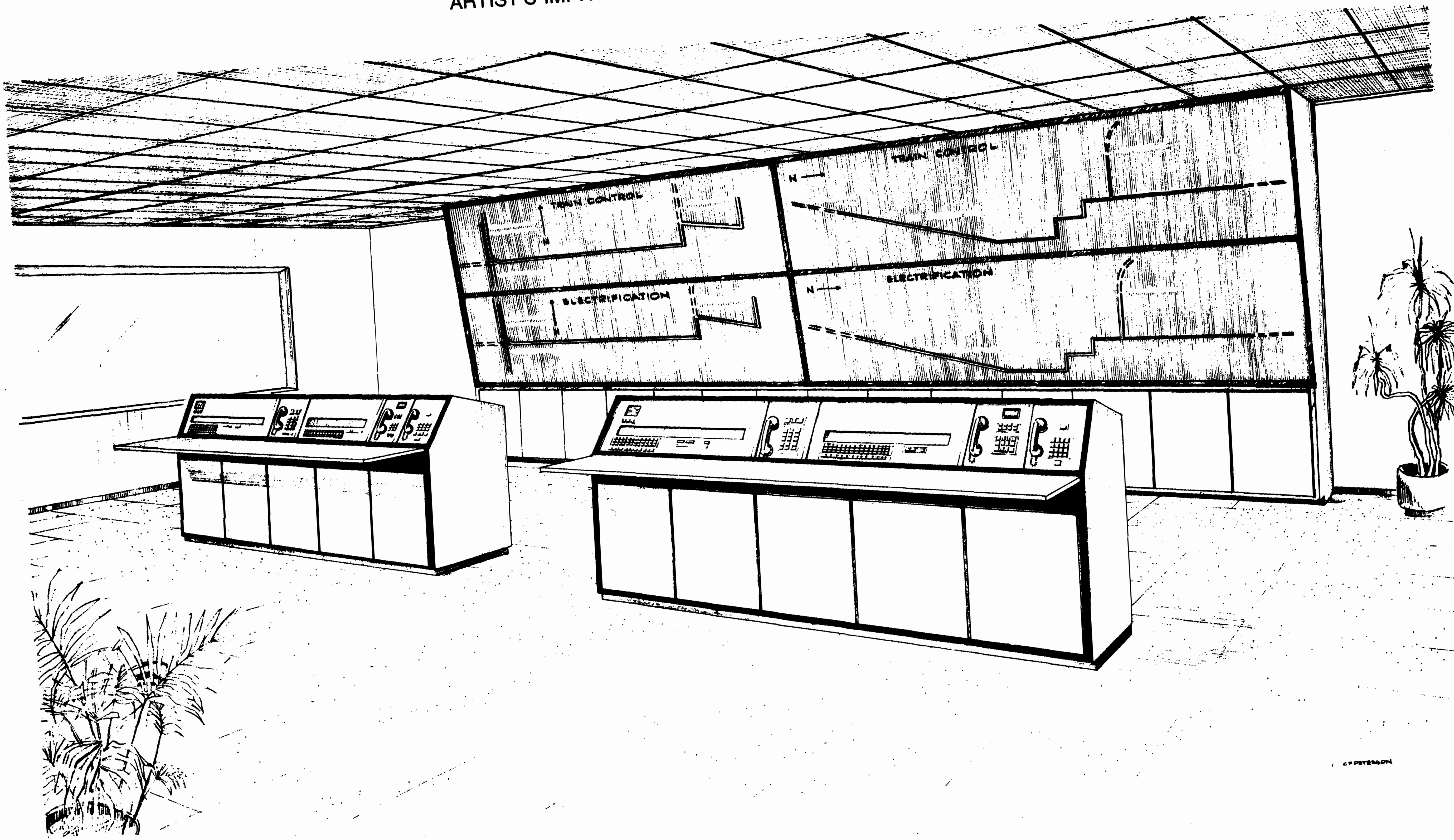


FIGURE 59

TOP LEVEL BLOCK DIAGRAM — TRAIN CONTROL SYSTEM

FIGURE 60

ARTIST'S IMPRESSION OF CENTRAL CONTROL ROOM



(4) The Manual/Auto Yard Operation system will control trains and vehicle movements within the confines of the yard area. The yard control system will be designed for manual operations with route selection controlled from the yard control tower and train control performed by the train attendant under complete manual control. Signalling will be provided via wayside signal equipment. Reception of trains from the mainline will be at the yard transfer zone. Manual control of the vehicle will also be possible on the mainline at restricted speed under the responsible control of the train attendant.

The various train control functions described above will be performed by a variety of electrical and electronic equipment located on the vehicles, on the track wayside, at passenger station areas, at yard areas, and at a central control point. Figure 59 shows a top level block diagram of the train control system, and indicates how the various elements of the system are linked together to perform the required functions. Many of the line supervision functions will originate at the Central Control Facility. Here, central control consoles and system displays will be used to provide graphic information of the status of train operations and the electrification system. Remote control of train movements and of substation circuit breakers will be achieved by manual input of appropriate instructions at the control consoles by the system supervisors. (See Figure 60 for an artist's impression of the core system Central Control room). The consoles will also contain voice communication equipment (radio, public address, and telephone) to facilitate effective control of communication channels.

The train control system will be designed to allow automatic operation of trains around a section of track out of service. Such reverse direction and single track operations would require manual set up of routes by central control or by local line supervision at the appropriate train control equipment room at a passenger station.

Data Communications and Supervisory Control System. As described later in this section, the electrification system provides power to the trains and stations of the rail portion of the core system via substations located at various points along the routes. In a similar fashion, train control equipment is also located at various passenger stations along the route. These facilities will normally be unattended, and are designed to be controlled and monitored from a remote location, (the Central Control area). The data transmission system provides the required link between the remote facility and each of the substations and train control equipment rooms. A digital data transmission system for train control and electric substation supervision will be required to transmit supervisory controls to the remote power substations and train control locations and to receive status indications from those locations as well as alarm indications from fire, high water, and other detectors.

Voice and Video Communications System. Figure 61 shows a top level block diagram of the Voice and Video Communications System for the rail portion of the core system. The preliminary design of these systems has been based on criteria established in Milestones 1, 2 and 6 of the preliminary engineering program, and provides for all necessary voice and television communications systems to assure passenger security and safety and to allow efficient operation of the core system. The following functional elements make up the Voice and Video Communications System:

(a) Two-way voice communications between Central Control and each train attendant's area

(b) One-way voice communications from Central Control to each station platform

(c) One-way voice communication from each station attendant's booth to platforms at that station

(d) One-way voice communication from the train attendant's area to each car of that train

(e) One-way voice communication from Central Control to each car of each train

(f) Two-way voice communications between various fixed locations including station attendants' booths, equipment rooms, substations, track wayside areas, maintenance areas, Central Control, administrative areas, and fire and police authorities

(g) Two-way communication between the station platform and the attendant's booth at that station

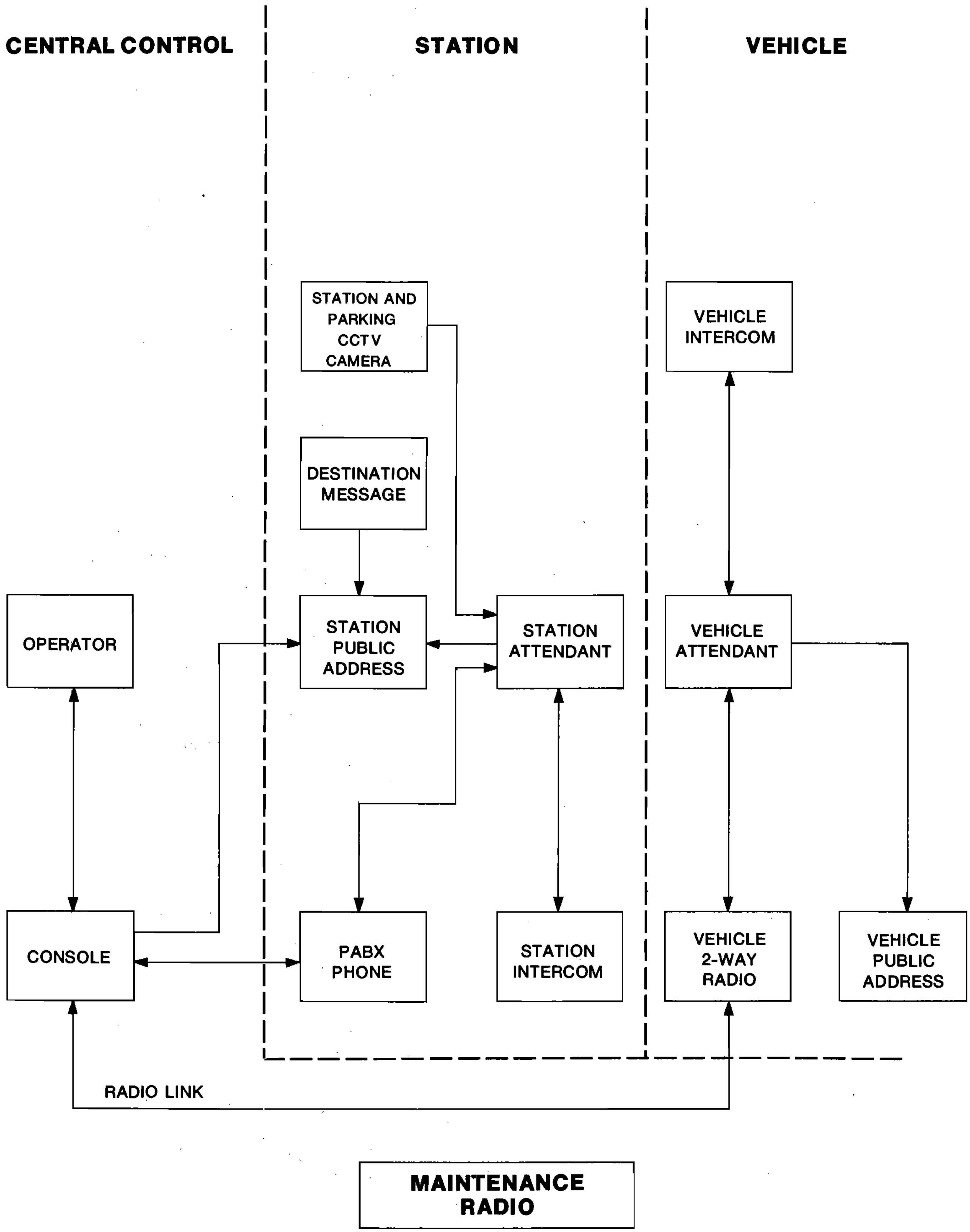
(h) Two-way communication between the train attendant's area and each car of that train

(j) Two-way voice communication between a fixed maintenance base and Central Control and roving maintenance equipment and personnel

(k) One-way video communication from various fixed points within station facilities and in station parking areas to the station attendant's booth in that station.

The various functions listed above are combined to form a number of distinct, but operationally integrated, communications subsystems. Functions (a), (d) and (e) will be provided by a UHF radio system coupled with an on-board train public address system. The system will function in such a way that personnel at Central Control have the capability to make public announcements both selectively to a combination of trains or to all trains at once. Central control will also have the capability to engage in semi-private conversation

FIGURE 61
TOP LEVEL BLOCK DIAGRAM
VOICE AND VIDEO COMMUNICATIONS SYSTEM



with the vehicle operator. The system will, in addition, provide the means by which the train attendant can signal Central Control, requesting assistance. This signal will not interfere with previously initiated calls, but will be displayed at Central Control. Channel control will be exercised at central control by a licensed operator (as required by FCC regulations). The train attendant may also independently use the train public address system to make station name announcements or other announcements.

Functions (b) and (c) will be provided by a public address system wired from Central Control and from the station attendant's booth to loudspeakers in each station area. Central Control will be able to selectively address any station or combinations of stations at one time. The attendant will have access to the public address system for that particular station and may override messages from Central Control with locally important announcements. The system will accommodate pre-recorded messages or tones which can be activated by imminent train arrival or departure and can include destination announcements.

Function (f) will be achieved by a private automatic branch telephone exchange (PABX). This system will use four digit dialing to allow normal phone connection between the various fixed locations around the system. It is recommended that the system be independent of the Bell System but have provision for connection to the Bell System for certain of the telephone instruments used. In addition, the system will include a hot line between each station attendant's booth and a fire/police desk at Central Control and/or fire/Police authorities closest to the particular station site.

Function (g) is provided by a local intercom system at each station, and allows passengers to signal the station attendant's booth and talk to the station attendant from points remote from the booth. Function (h) is a similar local intercom system aboard each train, and provides a voice communications link between passengers in each vehicle and the attendant located at the front of the train. These systems have been included as a result of security criteria developed in Milestone 6.

Function (j) is achieved by a separate radio system used for maintenance purposes only. Over the road trucks operated by transit maintenance personnel will include mobile radio units, and maintenance personnel will have access to walkie-talkie type units to be used at wayside track locations.

A television system will be provided at each station area to perform the functions required by item (k). This closed circuit system will include cameras mounted in tamperproof enclosures on station platforms, in concourse areas out of sight of the station attendant, in parking areas, and in certain other station areas where warranted for security purposes. Monitors will be located in the station attendant's booth and sequential switching and video tape recording equipment will be provided at certain stations.

b. Electrification System

General Requirements. Electric power for propulsion and auxiliary equipment aboard trains, for station equipment, and for maintenance and control facility equipment, will be conditioned and distributed by the electrification system. This system will supply power for the rail portion of the core system and will be designed to provide sufficient power levels for continuous operation of maximum length trains on minimum headways. The system will incorporate substantial duplication of essential equipment elements. This duplication is necessary to insure continuity of power supply under many equipment failure conditions.

Primary Power Supply. The area in which the core system is located is served by a single utility company, Florida Power and Light Co. On the basis of brief preliminary discussions with technical staff of the utility, it was assumed that two 13.2 kv, 3 phase A.C. primary feeders from independent bus sources would be made available at each and every transit system substation. In the final design process an examination and analysis of the applicable power rate structures should be undertaken to determine whether separate primary feeds and metering at each substation is more economical than a reduced number of feeds and meter points with necessary primary cabling provided by the transit property owner. Further, complete coordination with Florida Power and Light Co. will be necessary to insure that the transient loads of train operations do not cause undesirable voltage fluctuations to other users.

Substations. The train equipment will be designed to operate from a nominal 700 volt D.C. power supply. To convert the incoming 13,200 volt 3 phase A.C. power to 700 volt D.C. power, rectifier substations will be required. The rectifier substations will be located at various points around the core system as shown schematically in Figure 62. The spacing between substations is determined by electrical loads, voltage drops and other electrical effects and characteristics. The maximum propulsion power demand normally occurs while a train is accelerating out of a station area, and therefore substations should be located at or near passenger stations so as to minimize voltage drops in feeder cables and, more importantly, in the wayside power rail system. The substation unit consists of a number of items of equipment some of which are housed within an enclosed building and others of which are located outdoors in a fenced or walled area. Substations can be located directly beneath the track structures or at convenient points adjacent to the line or station such as the corner of station parking areas, and will be accessible by road truck equipment.

The propulsion substation also provides a power circuit for operations and domestic power loads in the station area. These loads include power for escalators, elevators, lighting, fare collection and train control and communications equipment and other minor

COMBINATION CODE	PASSENGER STATION SERVICE – 480/277V. CAPACITY – KVA	PROPULSION SUBSTATION DUAL SERVICE – 13.2KV: BACK-UP AUXILARY OR SHOP – KVA	PROPULSION POWER RECTIFIER UNITS – KW: 1985	2000
1	1 – 150	1 – 150	2 – 2000	2 – 2000
2	1 – 150	1 – 150	2 – 2000	3 – 2000
3	1 – 225	1 – 225	2 – 2000	3 – 2000
4	—	2 – 500	2 – 2000	2 – 2000
5	1 – 150 (OR 208/120V)	—	—	—

NOTE: PROPULSION SUBSTATIONS ARE LOCATED AT PASSENGER STATIONS OR MSF

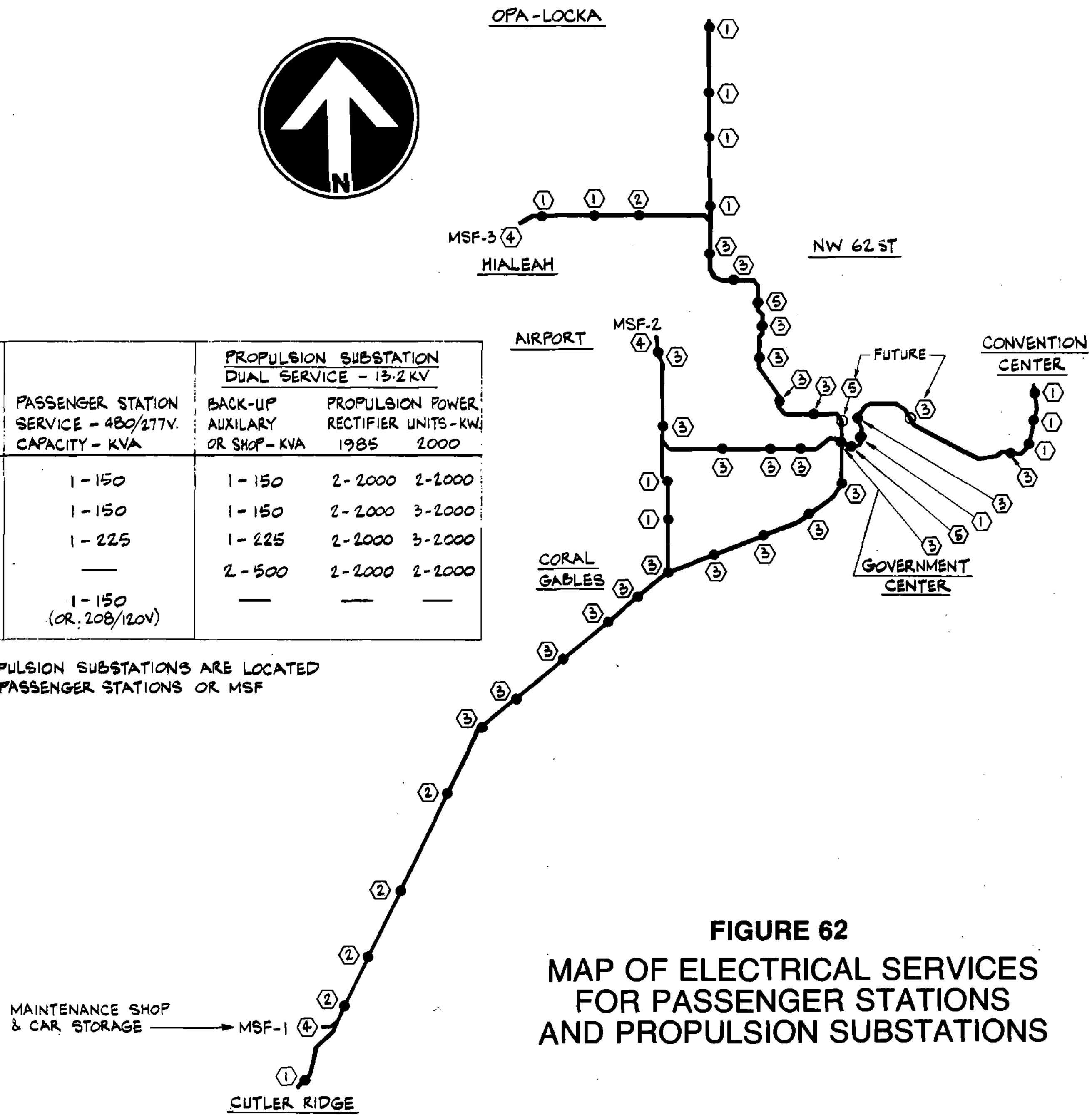


FIGURE 62

MAP OF ELECTRICAL SERVICES FOR PASSENGER STATIONS AND PROPULSION SUBSTATIONS

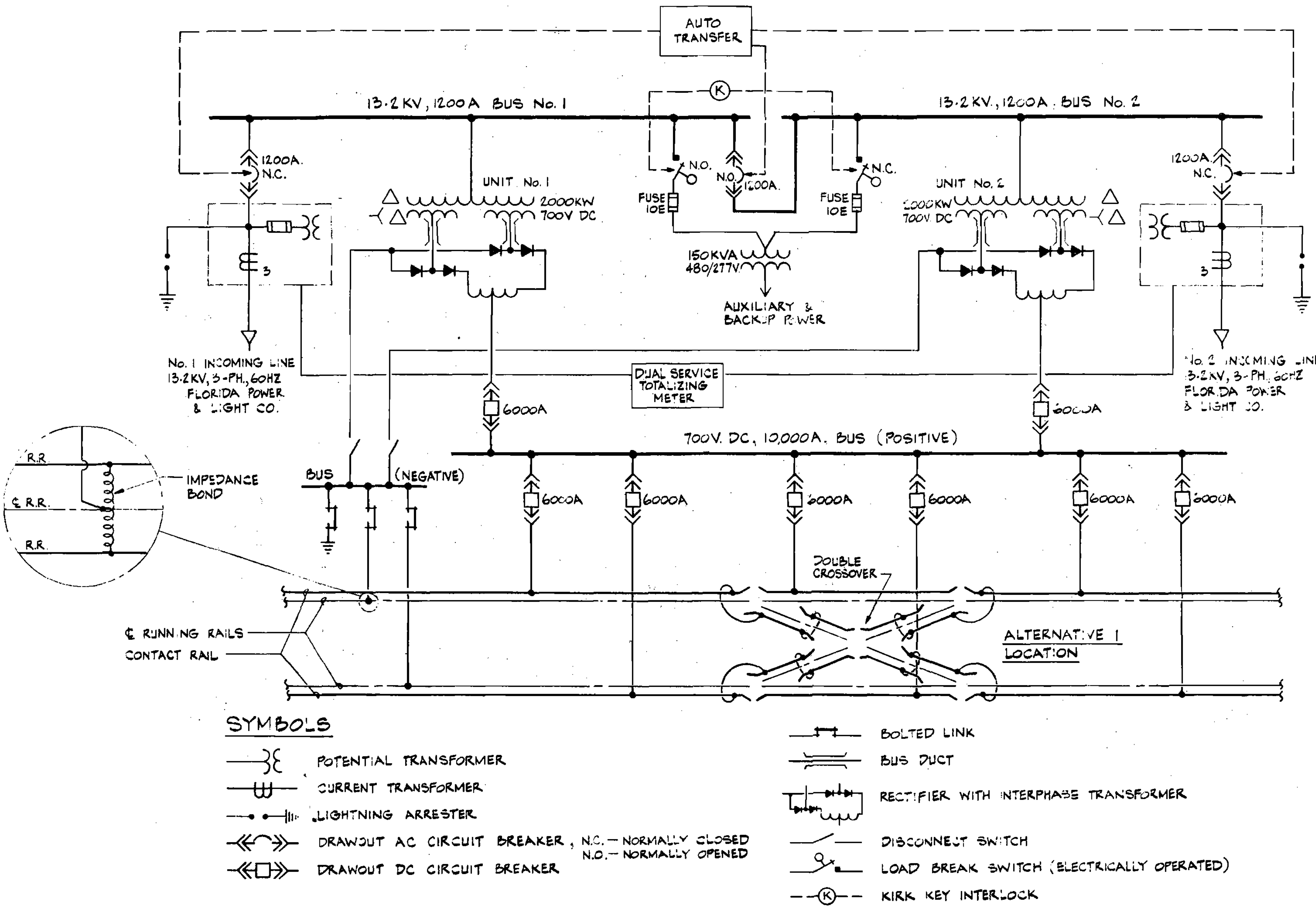
loads. Certain of these power requirements are of a critical nature which must not be interrupted by any utility supply failure, and battery equipment is provided for this supply.

Secondary Feeders and Power Rail System. Power is collected by vehicles through the use of a car mounted shoe which slides along the surface of a wayside mounted power rail. The power rail is energized with 700 volts D.C. and is supplied from the propulsion substations through secondary feeder cables. These secondary feeders will be provided by using multiples of 2000 MCM aluminum conductor with standard stranding. Extra flexible conductor will be used to terminate these feeders and to make final connections to the power rail on the track. The power rail itself will be a composite structure in which a steel contact surface (for good wearing properties) is combined with a high conductivity aluminum alloy structural member. A 5000 ampere rating rail will be used and this will be sufficient for the ultimate operation of trains on the core system. Special expansion joints in the rail will be necessary to allow for thermal expansion and rail anchor points. The rail is supported on post type semi-porcelain insulators and is protected by a continuous cover which prevents accidental contact with the energized rail. The low potential negative return path for the Direct Current propulsion power circuit is provided by the two steel running rails.

Sectionalization Scheme. In order to allow flexibility in train operations, and the ability to maintain some service while maintaining or repairing track sections, the power rail system is divided or sectionalized. Figure 63 shows a typical sectionalization scheme at a station area which includes an adjacent double crossover in the track. By such provisions, the power can be shut off individual track sections while still allowing train operations on nearby track sections. The sectionalization scheme will also include gaps between the ends of power rails fed from adjacent propulsion substations. However, electrical connection between these rails will be made through a normally closed circuit breaker at a gap tie station, so that any voltage differences between power rail sections are equalized.

Special Requirements. Because of potential flooding during hurricanes, special attention will be paid to the type, location, and elevation of all substations and electrical equipment. Also, the final design program for the electrification system should pay special attention to corrosion problems. The design of the system should ensure that track voltage drops are not excessive (cross-bonding should be used), and that running rails, impedance bonds, negative feeders, crossovers, and turnback rails are well insulated from ground. Measures should also be undertaken to minimize the effects of residual stray currents on transit structures.

FIGURE 63
SINGLE LINE DIAGRAM OF ELECTRICAL CONNECTIONS AT TYPICAL PROPULSION SUBSTATION



c. Fare Collection System

Because fare structures and policies for the core system have not yet been finally established, two separate but similar fare collection system preliminary designs have been prepared. The two systems examined were basically,

(1) a flat fare system using tokens, and
(2) a zoned fare system using tickets.

It has been assumed that free transfer will be available between surface bus and core system vehicles, with time being the only control on the use of transfers. Provisions will be made in either system for handling senior citizens and handicapped persons at no more than half the normal fare during off-peak hours. As detailed in Milestone 7, stations will be designed with a "free" area and a "paid" area with entry/exit gates forming the boundary between the two areas.

Flat Fare System. This type of fare collection system is one of the most simple barrier types available, and generally combines relatively low initial cost with reliability. The system utilizes a token or bus to rail transfer as its basic value element, and the value element can be purchased for the same price for a trip of any length. A token or a bus to rail transfer ticket will allow a single person entry through the milkstool type tripod gates. Tokens can be purchased at vending machines which will also dispense change. Bus to rail transfer tickets will only be dispensed by drivers of buses which serve core system stations. The gate captures both tokens and bus to rail transfer tickets and thus those wishing to use a surface bus at the other end of the core system trip will have to obtain a transfer ticket in the "paid" area of their exit station. Existing surface bus fare collection equipment and transfer tickets could remain unchanged. The bus to rail transfer ticket will be encoded (either by punch-hole, magnetic, or other methods) with the date & time and the gate will deny access to anyone attempting to use an expired transfer. No multiple trip, weekly or monthly passes would be issued to the traveling public. It would be anticipated that employees and certain special interest groups would be issued passes, with senior citizens' passes valid only in off-peak hours. Tokens could also be sold at off premises locations such as banks, system offices, and possibly retail outlets.

Zoned Fare System. This type of system is similar in fare structure to the existing MTA system, but requires more complex equipment. Fares would be charged on a graduated basis, that is, they are related to the distance traveled. To avoid the involvement of personnel in the fare collection process, single trip tickets will be sold by vending machines at each station. Passengers then enter through ticket-operated fare gates at each station in order to reach the platform area. At their destination, passengers then exit through the ticket-operated fare gate in order to leave the station. To pass through a gate in the entry direction will simply require a ticket of any value. To pass through a gate in the exit direction will require a ticket with enough value for the trip taken. Tickets with insufficient value will not permit exit and the passenger will be directed to the station agent, who will handle the excess fare using a farebox and the gate adjacent to the agent's booth.

For regular travelers, weekly and monthly passes will be available that permit unlimited trips to be taken within the limits of time and distance specified. Weekly passes valid for the same incremental fare steps as for single trip tickets will be sold. Travel beyond the valid distance will be permitted upon payment at exit of the normal incremental fare for the extra distance traveled. Monthly passes will have no such distance limitations and will permit unlimited trips to be taken over the entire MTA bus and rail network. For senior citizens and the handicapped, tickets will be sold at half-fare (or less) for use only in off-peak hours. These reduced-rate tickets will not be available at stations.

Transfer ticket issuing machines will be located in the paid areas of stations that have facilities to transfer to bus. Passengers requiring a transfer will simply push a button to obtain a free transfer. The transfer will be printed with station name, time, and date of issue. Upon boarding the bus the passenger hands the transfer to the driver. Any additional fare payment for the transfer privilege (if any) or the incremental fare for traveling to additional fare stages, will be paid in the farebox upon boarding the bus. The transfer will contain printed portions to represent various fare stages. For the minimum transfer privilege, the transfer will be retained by the driver. For additional distances, the driver will return a portion of the original transfer showing the incremental fare that has been deposited in the farebox.

The recommended rapid transit system has been described in this section of the report in terms of criteria for its development and design, the principal characteristics of the system as a whole, and the numerous structural and operational facilities needed. It is obvious that during the course of final design changes will be made in some of the concepts, criteria and designs as more detailed studies are carried out.

The system as defined in preliminary form in this report is considered to meet the needs of Dade County. A discussion of the costs of the system as so defined is contained in the following section.

VI. COST ESTIMATES

A. CAPITAL COSTS & CONSTRUCTION PLANNING

One of the primary objectives of this preliminary engineering program has been to develop reliable estimates of construction cost to be used in establishing capital costs. The investigations and studies conducted for the preliminary design of facilities and systems were carried to sufficient depth and detail to permit careful analysis of construction methods and techniques most feasible for this project. Preliminary drawings and outline specifications were prepared and used as the basis for quantity take-off/pricing of materials and equipment, and for construction planning.

1. Construction Planning

The most favorable sequence of construction, contract size and content, construction schedule and construction methods were the objectives of the planning work. Consideration was given to needs for minimum disruption of public services during construction, for maintenance of an approximately level engineering and construction activity without high peaks, for division of the total project into appropriate construction contracts scheduled to minimize physical interference among contractors and permit early completion of operational segments of the system, and for the general need for efficiency and economy of construction.

a. Sequence of Construction

The sequence of corridor segments to permit an orderly development of the system has been discussed previously in the Staging Plan and Schedule. This section identifies the segments of the core system which could be built to permit the system to be operationally usable by segments. The staging plan has taken into consideration the necessary construction sequences of transit facilities to suit system development. The size, complexity and interrelated features of this system demand a sophisticated method for developing and controlling the work schedule from start to finish. Scheduling would consider control methodology such as the Critical Path Method (CPM) set up for use on a computer. Basic divisions or phases of this schedule would include field surveys and investigation, right-of-way acquisition, final design, preparation of contract documents, construction, and acceptance testing for equipment and operational systems. The computer program to be used would provide time scheduling, manpower, and cash flow requirements for both design and construction phases of the program.

b. Contract Size and Content

The total project would be divided into contract packages of various sizes, large enough for efficient operations but small enough to create bidding competition. Plans could be made to call for bids on these packages singly or in combinations of two or more, depending upon type of work involved. This method will permit a greater number of local contractors to participate in this program, and additionally, will interest large specialty contractors from other areas to participate, thus encouraging greater competition. Certain types of work involving complete operating systems such as the automatic train control system, would be planned as single contract packages with the option of purchasing some of the major equipment on one or more supply contracts, to obtain the most economical costs, and the undivided responsibility for the satisfactory performance of the system.

Scheduling of construction activities would generally follow the staging plan schedule of previous Section V. The rapid transit program is one requiring large amounts of work to be performed at one time but is within the capabilities of the area's construction industry and design profession. It appears that Stage I could be completed within six years, and remaining Stages II and III within ten years of initial activities to meet program objectives. Stage I facilities could be completed by the end of 1981 if program activities were to follow the schedule of development for rapid transit facilities shown in Figure 30, Section V. System operation would commence after suitable check-out and break-in period.

c. Construction Methods

The aerial guideway and busway structures and stations will be the major components since aerial configuration of these facilities is predominantly used throughout the system. The construction of these facilities will have a major impact on the community and the general public during the construction period. The design of these facilities has been carefully analyzed to achieve the established design objectives with minimum disruption to the community during construction. Construction planning also takes into consideration subsurface conditions, interference with existing utilities, and interference with and disruption of existing surface improvements and their use.

The construction requirements for aerial way structures involve measures which provide efficiency in cost and time of construction, offer favorable structural and aesthetic features, and create the least disruption to the community during construction. Precast/prestressed concrete girders, commonly used in the South Florida area, meet these requirements satisfactorily. Steel girders, though less commonly used, would be given consideration on an alternate basis in design and at the time of bidding.

2. Capital Cost Basis

The construction of a rapid transit system involves not only unique construction elements, but also large quantities of repetitive items whose costs are influenced by subsurface conditions and location of existing utilities and structures. These factors have been considered in a detailed manner which accounts for estimating materials, equipment, labor, and construction plants and equipment separately, in order to properly reflect varying site conditions and construction methods. Definitions of the system elements are contained in the following discussion for pricing of fixed guideway and busway transit facilities.

Way & Structures - Estimates cover aerial, embankment and at grade structures, covering costs for demolition, utility relocation and maintenance, earthwork, foundations, columns, aerial superstructure, trackwork, emergency walkways, acoustic barriers, and surface restoration. Miscellaneous structures account for modifications to other facilities such as railroad relocations and expressway modifications.

Stations - Estimates consist of costs for station structures, including pedestrian passageways to adjacent facilities; architectural finishes; lighting and other electrical equipment; mechanical equipment, including escalators and elevators; station graphics and miscellaneous furnishings. Also included are all of the costs of the through guideway structure as defined under way and structures. Parking lots include site demolition, utility relocation and maintenance, earthwork, paving, structures (if required), striping, fencing, drainage facilities, lighting, signs and surface restoration.

Yards and Shops - Estimates cover site demolition, utility relocation and maintenance, earthwork, storage and access tracks, operation shop buildings and component repair facility with equipment, vehicle cleaning/blowdown/wash facilities, paving, fencing, drainage, lighting, landscaping, signs and surface restoration. Non-revenue vehicles, equipment and facilities for maintenance of the way and general yard use are included.

Landscaping - Costs for landscaping are estimated for areas along the transit right-of-way, in the station area and parking lots. (Landscaping costs at the yards and the administration facilities are included with those elements).

Fare Collection - Costs are based upon a zoned fare automatically regulated system and include purchase and installation of exit and entry gates, ticket vending machines, money vaults, transfer vending machines, initial ticket supply, money carts, money sorters, armored trucks and various miscellaneous items.

Propulsion Power - Includes estimates of equipment and facilities for vehicle propulsion power and station and other equipment auxiliary power, from supply points through the distribution and transformation facilities, and including the power rail along the track and in the yards.

Train Control - Estimates comprise contract costs for design, manufacture, installation and testing of equipment to operate the trains and control train movement, including wayside track circuits, station logic and control, route interlocking equipment, central supervisory control equipment and console, yard control equipment and necessary cabling, accessories and data transmission equipment.

Voice and Video Communications - Estimates comprise system costs for the purchase and installation of radio, telephone, public address, intercoms, and television systems with appropriate interconnecting cables and equipment.

System Testing - Costs are generally an allowance for on-site testing of the vehicles and their propulsion and control systems by the contractors responsible for the performance of these items. Costs of system testing are included under the items being tested.

Administration Facilities - Costs cover site demolition, utility relocation and maintenance, earthwork, structures complete including architectural, mechanical and electrical facilities and the required furnishings. Also included are costs for yard paving, fencing, drainage, lighting, landscaping, signs and surface restoration. The central control station is also included.

Test Track - Estimates cover items associated with way and structures, propulsion power, vehicle control and voice and video. The test track is planned to be adjacent to and constructed as part of the main line structure. The costs of the test track have been determined assuming a separate single track structure.

Right-of-Way - An assessment has been made for the cost of acquiring land and/or easements required for the system route, stations, parking lots, yards and shops, administration facilities and the test track.

Vehicles - Estimates comprise contract costs for design, manufacture, delivery and on-site testing for the entire vehicle and on-board components.

Spares - Included are the cost of purchase and delivery of all spare components for the transit system. Concrete ties, running rail, third rail, fare collection devices, vehicle trucks, etc. are included.

Engineering and Management - Costs cover work performed by a general engineering consultant and a general construction consultant and include all of their subcontractors.

Specific services include surveying programs; subsurface investigations and reports; design for construction contracts; design services for the procured fare collection, vehicle control, electrification, and vehicle systems; design services for right-of-way acquisition; design services during construction; construction management services; and project management services such as contract writing and pre-award services.

Contingency - An allowance of 20% on basic construction/equipment estimates is made for unevaluated, undefined or unknown items or conditions. It is a function of the level of design furnished, the internal compatibility between the various elements and the estimating techniques used.

Escalation - Based on current and historical trends, it is anticipated that wages and prices will continue to increase along with other cost factors such as taxes, interest rates, working conditions, and regulations. It is necessary to provide for increases to the 1975 prices used to develop the basic estimate of costs. The projection of this cost increase over a long term construction project is a complex task and can only be based on past experience and careful consideration of future anticipated trends as related to cost items. An allowance has been made in the Table for the Capital Cost Program, for an amount based on a declining scale of escalation consisting of 15% in 1975, 10% in 1976-77, 8% in 1978, and 7% thereafter. These rates represent the best assessment of the consultants' estimating experience.

Uncertainties in the nation's economy make it difficult to project capital costs at predictable rates of escalation. The section following the capital cost program presents an analysis of effects of escalation differing from those used to estimate the transit program costs.

Exclusions - A number of items have not been included which require input or direction from external sources, consisting of items such as: utility relocation expenses borne by agencies/companies as required by preemptive regulations, preliminary engineering, and working capital.

3. Capital Cost Program

The cost estimates for the capital cost program of the core system network are summarized in two parts for presentation in this report, as shown on the following tables 16 and 17. The cost data is shown on the basis of 1975 prices at the time of this estimate including those cost elements as delineated by the tables, but excludes escalation. The effects of escalation for implementing the system are discussed in detail by Section 4 following. The impact of escalation will be variable by the uncertain nature and schedule of Stages II and III brought about by local issues and community concerns, funding restraints, and the difficulty in projecting long range escalation patterns.

Table 16 following shows capital cost estimates for Stage I of the core system network which includes generally the North-South Corridor fixed guideway system and the I-95 Busway extension. The cost items do not show separation in detail for the I-95 Busway, but it is estimated that the busway extension and facilities will cost about $65,500,000 including bus equipment and right-of-way, but excluding escalation.

TABLE 16

ESTIMATE OF CAPITAL COSTS

STAGE I — CORE SYSTEM

(In thousands of dollars)

1.	Way and Structures	$155,918
2.	Stations	81,939
3.	Yards and Shops	13,373
4.	Landscaping	6,461
5.	Fare Collection	5,862
6.	Electification	43,930
7.	Automatic Train Control	18,524
8.	Voice and Video Cornm.	4,533
9.	Administration Facility	3,000
10.	Test Track Facility	10,034
	Subtotal Construction	$343,574
11.	Engineering and Management	52,775
12.	Vehicles	101,662
13.	Spares	3,977
	Subtotal	$501,988
14.	Contingency	100,398
	Subtotal	$602,386
15.	Right-of-Way and Relocation	73,040
	Total - 1975 basis	$675,426
16.	Escalation on Capital Costs	287,284
17.	County Project Management	6,000
18.	County Pre-Operational Expense	10,000
19.	Stage I Total-Escalated	$978,710

TABLE 17

ESTIMATE OF CAPITAL COSTS

TOTAL CORE SYSTEM NETWORK BY STAGES

(In Thousands of Dollars)

CAPITAL COST ITEMS	SYSTEM STAGING STAGE I	STAGE II	STAGE III	TOTAL
1. Way and Structures	155,918	71,658	103,831	331,407
2. Stations	81,939	40,712	44,925	167,576
3. Yards and Shops	13,373	7,663	10,529	31,565
4. Landscaping	6,461	3,404	2,868	12,733
5. Fare Collection	5,862	2,854	2,867	11,583
6. Electrification	43,930	18,815	27,198	89,943
7. Automatic Train Control	18,524	12,100	11,300	41,924
8. Voice & Video	4,533	3,270	3,370	11,173
9. Administration Facility	3,000	500	500	4,000
10. Test Track Facility	10,034	—	—	10,034
Subtotal Construction	343,574	160,976	207,388	711,938
11. Engineering & Management	52,775	17,983	24,642	95,400
12. Vehicles	101,662	35,381	35,311	172,354
13. Spares	3,977	2,091	2,354	8,422
Subtotal	501,988	216,431	269,695	988,114
14. Contingency	100,398	43,286	53,939	197,623
Subtotal	602,386	259,717	332,634	1,185,737
15. Right-of-way/Relocation	73,040	75,640	21,490	170,170
Capital Costs - 1975 Basis	675,426	335,357	345,124	1,355,907
16. County Project Management	6,000	3,700	3,200	12,900
17. County Pre-Operational Expense	10,000	12,250	10,000	32,250
Program Total	$691,426	$351,307	$358,324	$1,401,057

Table 17 shows the capital cost estimate of facilities for the total core system network. Costs for the total core system network exclude escalation due to uncertainties in the schedule of implementation, and in the definition of facilities for Stages II and III requiring resolution of local issues.

4. Capital Cost Effects from Escalation

Table 16, preceding, showed the estimated capital cost of Stage I of the project in 1975 dollars with an allowance for escalation based on the best assessment of rates from experience. The following Table 18 shows the effects on this cost of applying varying escalation rates over the period of construction shown in the staging plan in Figure 30 of Section V-B-5. Escalation is calculated by compounding the assumed escalation rates for future years to the time of construction or procurement of each element of system. Therefore, those elements which are not constructed or procured for several years or which have long construction or manufacturing periods are most affected by escalation. As an example, with an assumed escalation rate of 10% compounded annually, the cost of an object will double in less than eight years.

The figures shown in Table 18 indicate that the cost of Stage I may increase from $220 million (33%) to $350 million (53%) above the 1975 estimate depending on the actual rate of escalation experienced in the future. In the previous discussion on capital cost items, the consultants' projection of escalation rates for construction during 1975 would be approximately 15% but it would decline to about 10% in 1976 and 1977, to 8% in 1978 and to 7% for 1979 and 1980. On this basis the escalation would be approximately equal during this time period to the flat 10% rate. With these assumed rates the escalated cost of Stage I capital improvements would total approximately $962.5 million.

TABLE 18

EFFECT OF ESCALATION ON STAGE I CAPITAL COSTS

Basis	Stage I Cost In Thousands of Dollars
Estimated cost, 1975 dollars	$ 675,426
Escalated at 8% annually to 1980-81	896,430
Escalated at 10% annually to 1980-81	962,710
Escalated at 12% annually to 1980-81	1,030,990

The effect of escalation is illustrated graphically in Figure 64 which shows the annual cash flow required to implement Stage I of the project and the total cumulative cost at varying rates of escalation.

Delay in starting the project will also result in higher cost due to escalation. Figure 65 shows how the estimated capital cost of Stage I of the core system would increase if the start of the project is delayed by one to five years. The figure also shows how this increase would vary depending on the rate of escalation. The base point for the graph is the estimated cost of Stage I in 1975 dollars.

The portion of the curve to the left of this point shows the estimated cost in current year dollars had the project been started prior to 1975, based on past escalation rates. The portion of the curve to the right of the 1975 base point shows how the current estimated cost will increase if the project start is delayed.

FIGURE 64

EFFECT OF ESCALATION ON PROJECT COST

STAGE I CORE SYSTEM

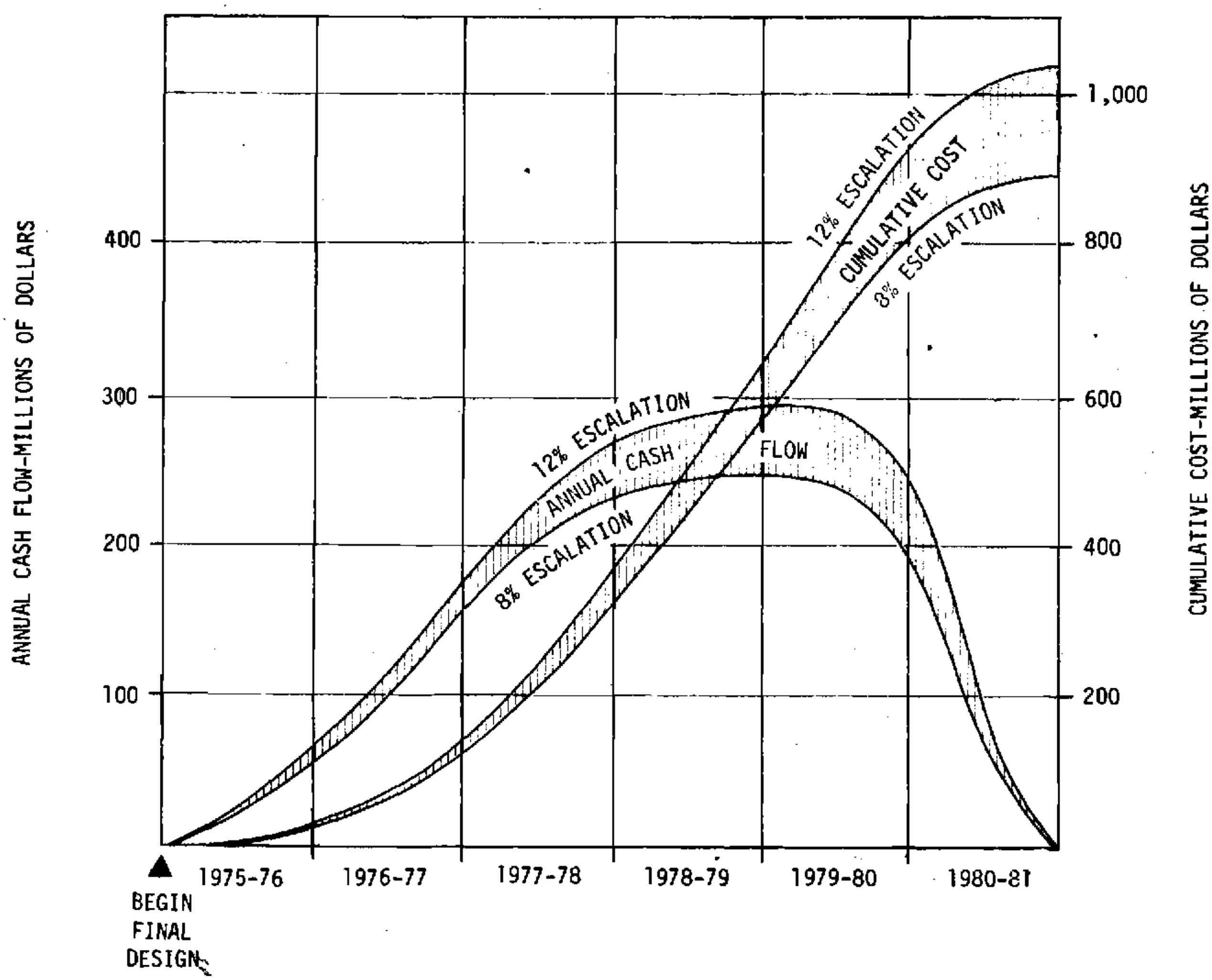
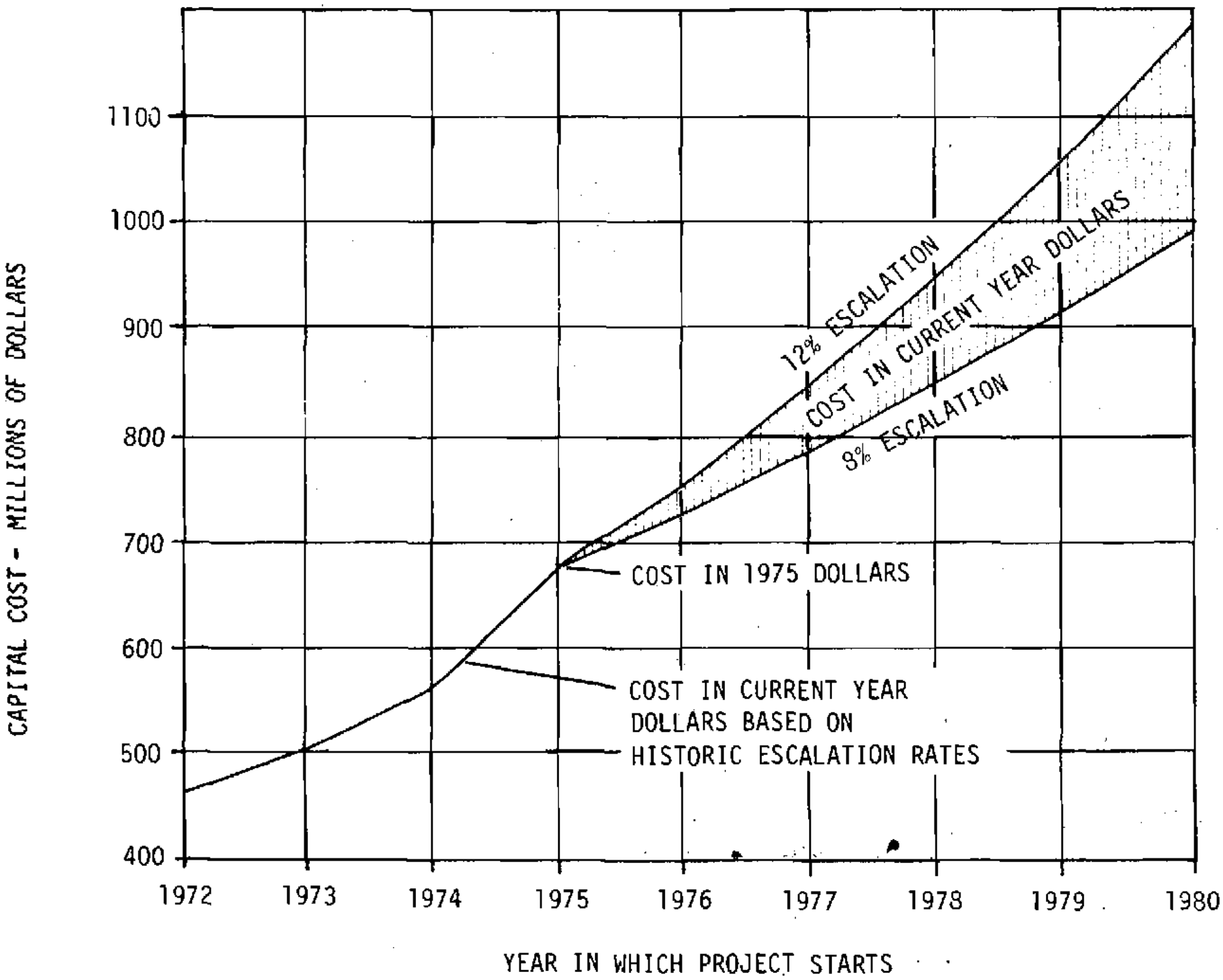


FIGURE 65

EFFECT OF DELAY IN STARTING PROJECT

STAGE I CORE SYSTEM



B. OPERATING COSTS

This section provides operating cost estimates for the Stage I of the core system and the complete core system. Operating costs are recurring costs which are normally estimated on an annual basis. Operating costs cover all labor, material, and other expenses required to clean, operate, maintain, and manage the rapid transit system and keep the system in first class operational condition. Operating costs do not include any amortization or depreciation of capital cost items.

Basic Assumptions. The operating cost estimates are based upon a set of data and certain key assumptions. The data and assumptions include:

- The physical characteristics and system operations of the core system as described previously in this report.
- Established rapid transit and bus system practices.
- Working rules, conditions, labor rates, and employee benefit rates as established by the current agreement between the Transport Workers Union of America, Local 291, AFL-CIO and Metropolitan Dade County.
- Salary levels based on general salary levels in the transit industry and commensurate with authority and responsibility levels.
- Current materials expenses.
- Contingency allowances as judged appropriate for the estimating accuracy and potential unknowns of each operating cost category.
- Other specific assumptions contained in each cost category.
- Revenue operation for 250 weekdays and 115 weekend/holiday days per year.

I-95 Busway Operating Costs. Operating costs for bus operations on the I-95 Busway portion of the core system have been estimated on a cost per bus hour approach utilizing current MTA experience with express bus operations, and extrapolating service to levels as required to satisfy projected ridership and as described in a previous section. The estimates assume that the bus fleet maintenance requirements can be accommodated within existing or proposed MTA facilities. The costs also allow for an attendant at each busway station during operating periods.

Rail System Operating Costs. To derive costs for rail service initiated in the core system, a more detailed operating cost estimation technique has been used. This technique involves an estimation of manpower requirements, labor rates (including all fringe benefits), material expenses, power costs, and other expenses, on a cost category, work area, or semi-departmental basis. These categories are as follows:

(a) Power Cost (Demand and Energy) - costs are based upon the system power consumption for vehicles with passengers, and auxiliary power costs for stations, yards, maintenance areas, etc. The rate schedule used to develop 1985 operating costs in 1975 dollars is Florida Power and Light Company's schedule GS (dated January 28, 1975 with a further fuel adjustment allowance of $6 per 1000 KW HR.), based on transit substations with separate feeds from the utility company and separate metering. The overall unit cost for operation of the rail system (energy and demand) based upon this schedule, is approximately $0.026 per KW HR (1975 $).

(b) Train Operations - cost includes labor costs for central control operating personnel (supervisors, schedulers, and dispatchers), and train attendants.

(c) Station Operations - includes attendants, custodians (cleaners) and cleaning materials and supplies. All stations are assumed to have one station attendant on duty at all times except for Government Center (four attendants) and U. S. 1/Douglas Road (two attendants). Supervision labor is also allowed for.

(d) Tracks/Structures/Wayside Equipment Maintenance - includes supervisors, foremen, technicians, and laborers for trackwork, structures, mechanical/electrical/fare collection equipment, and train control system. Materials and subcontracted expense cover rail and rail fastenings replacement, escalator and elevator maintenance, computer systems maintenance, and other miscellaneous expense items.

(e) Yard Operations - includes labor for supervisors, yardmasters, dispatchers, and other yard labor categories.

(f) Operations Shop-Vehicle Maintenance - includes shop labor/materials expense and cleaning/washing/inspection. Materials for car cleaning/washing, and shop operations are also included.

(g) Component Repair Shop - includes shop labor, and replacement parts used for the entire system (it is assumed after warranty expirations). Shop cleaning and consumable materials are also included, as well as motor truck repairs and operating expenses for all system road vehicles.

(h) Fare Collection System Operation - includes labor for ticket distributors, accounting clerks, money collectors, revenue security guards, money sorters, and supervisors. Materials expenses include tickets, transfers, and other miscellaneous items.

(i) Security - includes labor for security guards, watchmen, and roving security officers.

(j) Liability and Property Insurance - covers premiums for liability and property insurance, estimated on a per-passenger trip basis using current MTA statistics as a guide.

(k) General and Administrative Staff and Expenses - covers managerial, accounting, payroll, public relations, personnel services, legal, clerical, and general secretarial labor. Materials expenses cover general office supplies and overhead.

Annual Operational Data and Costs

Operational data was generated and costs were compiled with the use of a computer program to simulate system operation and apply cost factors. Two levels of system operation were determined, based on the system staging plan described previously. Table 19 summarizes data and costs for the Stage I level (I-95 Busway and 23 mile North-South Corridor railway) and the more extensive level (I-95 Busway and 48 mile railway network). An index cost is estimated (in Table 19) at $0.51 per busway passenger trip, at $0.21 per railway passenger trip and a system composite cost of $0.26 per passenger trip. The composite cost includes considerable transfers of patrons between systems which would not be reflected in equivalent revenue from ridership volume projections.(1)

Escalation Effects on Operational Costs

Operational costs shown previously have been determined on the basis of 1975 wage and price levels to relate costs to present experience. Projection of present-day costs to the 1985 full-system operations involves speculation on economy trends as discussed in the Capital Cost section. In view of the uncertainties for wage, fuel, power and supply prices, an analysis has been made with three levels of escalation to compare effects on operational requirements of the total core system. These comparisons are made in Table 20. An assessment of the cost factors for labor and fuel reflects that the high escalation category extends recent wage/fuel spirals while the moderate rate reflects present slow-down trends. The low rate category reflects annual labor rate escalation below present labor wage negotiations, and precludes repetition of recent step increases in fuel/power costs.

Stage I core system first-year operational costs, escalated to a 1985 basis on a medium rate assumption are estimated at $43.398 million, consisting of busway costs of $18.298 million and railway costs of $25.100 million.

Cost estimates established herein have been provided in appropriate sections of the capital grant applications submitted by Dade County for federal funding of the project. Capital and operating costs covered in this section reflect the investment of community resources and the anticipated annual expenditures to provide the level of service perceived for Dade County. Modifications to system facilities may be necessary to accommodate funding restraints and schedules. The Staging Plan for the core system network provides for adjustments in the implementation of capital improvements and level of service in resulting operations. Further modifications may be possible in system designs and operations to effect adjustments in the initial facility requirements.

(1) Refer to Appendix 3, Section G for an operating cost and revenue analysis.

TABLE 19

OPERATIONAL DATA AND COST ESTIMATES

STAGE I AND TOTAL CORE SYSTEM

Operational Data/Cost	STAGE I SYSTEM		
	Busway	Rail	Total
Annual Travel (Vehicle Miles x 1000)	13,778	14,590	
Annual O & M Cost Estimate ($1975 x 1000)	$11,860	$16,700	$28,560
	TOTAL CORE SYSTEM		
	Busway	Rail	Total
Annual Travel (Vehicle Miles x 1000)	13,778	26,905	
Annual Passenger Mode Trips (Mean Values x 1000)	23,200	142,600	165,800
Annual O & M Cost Estimate ($1975 x 1000)	$11,860	$30,673	$42,533
O & M Cost/Vehicle Mile ($1975)	$0.861	$1.14	
O & M Cost/Passenger Mode Trips[1] (Mean Value-$1975)	$0.51	$0.21	$0.26

TABLE 20

EFFECTS OF ESCALATION ON OPERATING COSTS

Assumed Annual Rates for
Escalation Categories Are As Follows:

	HIGH	MEDIUM	LOW
Bus Operation	12%	8%	5%
Rail (Labor/Material/Power)	12-9-6%	9-7-5%	6-5-4%

Escalation Effects Operational Costs	Total Core System — 1985 Basis BUSWAY	RAIL	TOTAL
HIGH ESCALATION	$36,835	$81,537	$118,372
MEDIUM ESCALATION	25,605	64,779	90,384
LOW ESCALATION	19,320	51,490	70,810

VII. CONCLUSIONS

The results of the preliminary engineering program, conducted over a span of more than 18 months and including detailed environmental studies, preliminary engineering and design and an intensive citizen participation program, lead to the following major conclusions:

- The recommended transit system is the optimum solution to meeting Dade County's transportation requirements
- The plan and all of its supporting activities have advanced to the point that final design and construction can proceed rapidly and smoothly
- The recommended plan should be implemented without delay.

These conclusions are based upon consideration of the following significant factors:

- Achievement of the objectives of the County and of the federal government
- The need for improvement in the transportation system of the County
- Comparison of the proposed system with other alternatives
- Flexibility of the plan as proposed in the staging plan for the core system
- Adequacy of the data base on which the plan and future stages are based
- The comprehensive and transportation planning which has been accomplished, and the capabilities of the planning process to support ongoing phases of the program.

A. ACHIEVEMENT OF OBJECTIVES

Section IV of this report presented a comparative evaluation of alternative transit systems to demonstrate the merit of the recommended system as compared with other possible options. In absolute terms, the effectiveness of the proposed system may only be measured by the degree to which it meets established objectives. The objectives of the preliminary engineering program and the transportation objectives of Dade County and of the federal government have been set forth in the introduction to this report. Synthesized, their major elements can be expressed in terms of the following five factors:

- Transit use relative to automobile use (modal split).
- Accessibility of transit.
- Support of land use and development plans and transportation plans.
- Environmental considerations, including energy conservation.
- Public support.

No numerical values have been assigned to the various objectives, and therefore it is not possible to determine if the proposed system meets, exceeds or falls short of the objectives. The evaluation in Section IV indicated that it achieves higher ratings in most of the characteristics making up the objectives than any of the alternatives considered, and therefore, unless it actually exceeds the objectives, which is highly unlikely, it appears to come the closest to achieving them.

The following discussion summarizes the achievements of the proposed transit system in terms of the five objective factors.

1. <u>Transit Use</u>

In Dade County today more than 10 million vehicle-miles, or approximately 12 million passenger-miles, are traveled daily by automobile. The present surface bus operation carries only about 185,000 passengers daily, approximately five per cent of the total vehicular trips made per day. To significantly increase transit use differentially with respect to the automobile requires dramatic improvements in levels and quality of service of the transit system. These needed improvements include faster travel times; safe and comfortable journeys; convenient and frequent service; and a generally pleasant travel experience. All of these features are an intrinsic part of the proposed transit system as it has been developed in the preliminary engineering program. Operations analysis shows that in peak periods, travel on the rapid transit system will be faster than corresponding trips by automobile. In the off-peak periods, the rapid transit system will be far faster than surface transit. Headways on the rapid transit system will range from three to twelve minutes in peak and off-peak periods, respectively, considerably more frequent service than on existing transit. As a result (because the patronage forecasting models used in the program are responsive to improvements in service levels) total transit ridership after implementation of the proposed system in 1985 is projected to be 724,000 per day at the 50% confidence level, an increase of 290%. Even if only the 80% confidence value of 446,000 trips were to be achieved, the increase would still be significant at 141%.

An important feature of the projected ridership on the proposed system is that the rapid transit will capture a great number of the longer trips now made predominantly by automobile. The average trip length on the core system is projected to be slightly over five miles, as compared with an average bus trip of less than two miles. Projections are that the implementation of the transit system will result in a reduction of from 800,000 to 3,000,000 automobile vehicle-miles traveled daily, depending on the assumptions used. Considering that all of the County's limited access highways and major arterials are operating at well over their design capacity, with volume to capacity ratios as high as 227%,(1) this reduction in automobile travel is significant. Further, the transit system will accommodate a great number of the peak hour trips, which are the cause of most of the current traffic congestion.

2. Accessibility

A measure of the degree to which the transit system achieves the goals of providing mobility and opportunity to the transit dependent, disadvantaged and handicapped, as well as better service to the public at large, is its accessibility to residences, to places of employment, to activity centers and to essential services. Estimates of accessibility indicate that core system stations will be within a 10-minute feeder bus ride of 988,000 residents (58%) and within a 5 minute walking distance of 251,000 jobs. The system will also serve, within a five minute walk, approximately 66 special activity centers, defined as major commercial, cultural, educational, medical, governmental or recreational facilities. Of these, approximately 16 are hospitals and medical clinics.

Service to transit dependents and the disadvantaged was a paramount consideration in the development of the core system. Special care was taken to route the system through the central city, the Model City area, South Miami Beach and Little Havana, which are concentrations of people in these categories. In one specific case, a segment of the north corridor evaluated in Milestone 5 rated higher in terms of the evaluation characteristics than an alternative segment which would penetrate the center of Model City. The decision was put to the residents of the area who selected the lower rated segment because of improved accessibility to transit dependents.

3. Support of Land Use and Development Plans and Transportation Plans

The County's Comprehensive Development Master Plan (CDMP) had been developed in essentially its final form at the time of initiation of the preliminary engineering program, and was adopted officially prior to completion of the program. This plan, which provides for controlled growth to limit urban sprawl, conserve essential natural resources, permit provision of necessary services and reinforce development of activity centers, was a major guide in development of the proposed transit system.(2) Land use and development opportunities were the subjects of special studies comprising a major portion of the program. As a result, the proposed system makes use of major transportation arteries as delineated in the CDMP and provides excellent service to a great number of the activity centers designated in the plan.

(1) Refer to Appendix 3, Section F for further details.
(2) Refer to Appendix 3, Section B for further details.

The transit system itself is a significant factor in achieving the goals of the CDMP because it has the capability both of serving developed areas and of inducing and influencing development. By establishing high accessibility movement corridors, it provides the opportunity to control the overall direction of growth as well as the nature of development. Accessibility is provided to employment, shopping, living accommodations and activity centers in areas that are planned for such activities, thus preserving other areas that otherwise would have been under more extreme development pressures.

The system also has the potential for creating pressures leading to the redevelopment and revitalization of many areas where such action is needed. Especially important from this point of view are portions of the downtown area where such redevelopment would strengthen the now weak CBD. Portions of the north and west corridors would also benefit from such action.

Some examples of service to activity centers in support of the CDMP are:

- The southern terminus of the south corridor has been located between and adjacent to the South Dade Government Center and the Cutler Ridge Shopping Center. The former is a new, subregional complex which will bring government services nearer to the people. The latter is designated as a regional level center in the CDMP.

- The system passes directly through the Civic Center, a complex of County and State office buildings and a major concentration of public and private hospitals and other medical facilities. The Civic Center is one of the largest employment centers in the County. Service to this large area is proposed to be provided by surface circulation facilities tying into the main transit station.

- The system directly serves two campuses of the Miami-Dade Community College and the University of Miami, with stations located immediately adjacent to these facilities.

- A proposed multi-modal transportation center east of the airport will be served by the system, providing a direct in-station interface with AMTRAK, an airport area people mover system and other public transportation.

- Major expansion plans of the Miami Beach Convention Center have been coordinated with transit service at the north end of the Miami Beach route.

- The largest public project related to the proposed system will be the new downtown Government Center, expected to eventually comprise more than 1,200,000 square feet of office space. This is the hub of the transit system -- a transfer station accommodating both the north-south and east-west corridors of fixed guideway transit as well as the southern terminus of the I-95 busway.

In addition to the Comprehensive Development Master Plan, the Miami Urban Area Transportation Study plan had a significant impact on development of the transit system. This plan, as modified by the curtailment of six controversial expressways in accordance with public desires, is highly transit intensive, emphasizing the use of public transit relative to automobile use. It is, in fact, this plan which gave impetus to the entire series of transit planning studies between 1969 and 1975. The fact that the proposed transit system is completely in harmony with and supportive of the MUATS plans is shown by the following resolution passed on July 8th, 1975, by the MUATS Technical Planning Committee:

"WHEREAS, the Dade County Rapid Transit Preliminary Engineering Program has been carried out under the auspices of the Miami Urban Area Transportation Study organization as evidenced in the MUATS Unified Work Programs for the fiscal years 1973-74 through 1975-76; and

WHEREAS, the MUATS Technical Planning Committee is the arm of the aforesaid organization charged with the responsibility of formulating the area-wide transportation plans for the review and approval of the MUATS Policy Committee; and

WHEREAS, the Dade County Manager's Office (Office of Transportation Coordinator) responsible for the subject MUATS activity, has adequately completed all elements of the Rapid Transit Preliminary Engineering Program outlined in the aforesaid MUATS Unified Work Programs; and

WHEREAS, the Technical Planning Committee reviewed in overall the products of the Dade County Rapid Transit Engineering Program at a special meeting called for this exclusive purpose on July 8, 1975;

BE IT THEREFORE RESOLVED that the Miami Urban Area Transportation Study Technical Planning Committee approves the following as the Technical Planning Committee's position on the Dade County Rapid Transit Preliminary Engineering Program and recommends the adoption of the same by the Miami Urban Area Transportation Study Policy Committee:

(1) The Rapid Transit Preliminary Engineering Program has produced a product consistent with the 3-C planning process and is acceptable as an element of the MUATS.

(2) The proposed "Core System" recommended by the preliminary engineering program be included as a part of the approved network for the MUATS 2000 plan update.

(3) The proposed "Stage I" of the core system be approved for final design and engineering.

(4) The proposed "Stage II" and "Stage III" of the core system be accepted in principle and as a basis for further and continuing study and evaluation."

4. Environmental Considerations

As described in detail in the environmental impact analysis, the transit system will have both adverse and favorable impacts on the environment. On an absolute basis the principal adverse impacts, as the system has been designed for Dade County, are related to disruption and dislocation, visual intrusion and noise. The principal favorable impact is caused by improvement in air quality. In a related area of concern, transit can also result in conservation of energy. On a relative basis, transit should have less of an adverse impact than alternative methods of meeting similar mobility objectives. At an average automobile occupancy rate of 1.3 persons per vehicle, a single lane of highway can carry approximately 2,500 persons per hour. At an occupancy rate of four per car, capacity would increase proportionally to about 8,000 per hour. A single track of a transit line, on the other hand, can carry as many as 32,000 per hour, or the equivalent of four to ten lanes of automobile traffic. It is readily apparent therefore, that highways would cause far greater disruption and dislocation than a transit system of the same capacity.

Visual intrusion depends somewhat upon the size of the intruding structures. Broad highways, even at grade, can intrude on the environment and divide neighborhoods more than a well-designed two track aerial transit structure. Visual intrusion also depends largely upon the quality of design, and transit stations can be blended with the surroundings in a manner which makes them an asset instead of a liability.

All modern transportation facilities cause some noise intrusion, and transit systems are no exception. Studies show, however, that electrically powered transit trains are not as noisy as diesel buses or trucks. With careful design and provision of noise suppression devices, a transit system should result in less noise impact than highway systems.

In the area of air quality, the transit system will result in a decrease in pollutants generally because of the reduction in automobile travel. Automobile emissions cause about 80 per cent of the air pollution loads in the County today and the reduction in vehicle-miles traveled is estimated to result in from three to fifteen per cent reduction in pollutant emissions.

Substantial savings in fuel energy will accrue from implementation of the transit system, deriving from the diversion of travelers from private automobiles to the more energy-efficient electrically powered vehicles. It has been estimated that if only 25 per cent of the transit patrons are persons diverted from automobile use, a net saving of about 65,000 gallons of automobile fuel will accrue daily. This is the equivalent of 296 million kilowatt hours per year of electricity produced by a generating plant. As an indication of the magnitude of this saving, it would constitute about 85 per cent of the total energy required to operate the fixed guideway transit system.

5. Public Support

One of the primary objectives of the public involvement program described in Section III-C, in addition to informing the public and involving it in the planning and decision making process, was to attempt to gain public support for the project. Public support had, of course, already been demonstrated in the earlier stages by the overwhelming majority by which the Decade of Progress bond issue referendum was passed in November 1972, authorizing issuance of $132.5 million in bonds for the local share of the cost of the transit system. A basic premise in the development of the public involvement program was that an informed public, one which was well aware of the issues involved and which had actively participated in the project planning, was essential to the maintenance of public support.

In the course of the hundreds of public meetings, presentations and discussions, there could be no question as to the level of knowledge of transit issues which had been developed among a sizable segment of the population. These citizens did not agree with all of the recommendations made by the consultants, nor with all of the decisions made by the County Commission, but by far the overwhelming majority were fully in support of the total concept. In the later stages of the program some opposition to the project as a whole was manifested, but it was quite apparent that the opponents constituted only a small percentage of the total public. An indication of the public support of the project can be gotten from an analysis of the final public hearings conducted at four locations on June 16, 1975. Although previous experience shows that the public hearings on any project are frequently dominated by opponents of the project, the record of the hearings on the transit improvement program shows that of the people appearing at the hearings 60 per cent spoke in favor of the project, 30 per cent were opposed and 10 per cent did not indicate either support or opposition.

B. NEED FOR TRANSPORTATION IMPROVEMENT

With a current population of about 1,450,000, the demand for transportation in the County at present is approximately 3.6 million person trips per day. Of the total weekday vehicular trips, only about 5 percent are made by public transit. Of these transit trips, about 81 percent are made by persons who have no alternative means of transportation. Only 19%, therefore, use public transit as a matter of choice.

With a projected increase in population in 1985 to 1,736,000, it is estimated that the travel demand will increase to about five and a half million person trips per day. At the present time almost all of the major arterial highways and expressways are operating at well beyond their design capacity. To accommodate the anticipated future demand, therefore, it would be necessary either to significantly expand the highway network or to divert a large number of trips to public transit. Although some major expansions to the arterial highway system are planned, six of the previously proposed nine new expressways in the County have been deleted from the transportation program because of public demand. Since the improved arterial network alone cannot meet the increasing demand, the only alternative is to divert a large number of trips to public transit. To do this will require a significantly improved public transportation system.

C. COMPARISON OF PROPOSED SYSTEM WITH ALTERNATIVES

Section IV of this report described in detail the comparative analysis of alternative transit systems that were conceived to meet the transportation requirements. It was the conclusion of these analyses that the recommended transit system is the optimum solution to the transportation problem.

Not discussed in detail in Section IV, although considered in the analysis, were some additional implications related to the practicality of attempting to rely solely upon surface bus public transit rather than on the higher capacity rapid transit alternatives.

The current MTA bus operation employs about 512 buses and carries about 180,000 passengers per day. The null option considered in the alternatives analysis, consisting of the implementation of planned short range bus improvement programs, would increase capacity to about 317,000 trips per day at a capital cost of $17 million. It has been estimated that to increase the capacity of an all-bus transit operation to equal the daily ridership potential of the recommended system would require a fleet of some 2,200 buses costing, at present day prices, at least $120 million, not including a considerable outlay for additional bus storage, maintenance and administrative facilities. The County has estimated the annual operating costs of such a fleet as about $150 million (1975 $), as compared to estimated operating costs of the core system plus supporting services of $42 million. The latter system would of course require local and feeder bus service which would result in total operating costs approximately two-thirds that of the all-bus fleet. More important than costs, however, is the impact that a 2,200-bus fleet would have on the already congested streets and highways of the County. Although detailed studies have not been made, it is the opinion of the consultants that the road network, particularly in the downtown Miami area and other major activity centers, could not support such an operation.

D. FLEXIBILITY OF THE PLAN - SYSTEM STAGING

As discussed in Section V, implementation of a regional transit system is a long-range process involving several levels of development. At the first level is the service network designed to serve transit needs beyond the year 2000. The second level is the core system which provides the rapid transit system to serve transit needs in and after 1985. The third level deals with a staged implementation of the core system to meet priority demands, and the fourth level consists of shorter-range transit improvements to meet immediate needs.

In staging the implementation of the core system at the third level of development, consideration was given to the priority of transit needs, to availability of funding and ability to place construction contracts, and to the definitiveness of transit planning. The key factor is to stage development so that the first increment is a usable and well defined segment, operationally viable within itself, and to extend this core element incrementally until the necessary coverage is attained.

This process has several advantages: it provides for the highest priority needs first; it spreads the capital expenditures to accommodate funding availability and the ability of the area to sustain the construction workload and disruption; and it provides the flexibility needed to ensure the resolution of all community issues.

Stage I of the recommended plan provides a usable segment covering the corridors of greatest transit demand. Its routes and facility locations are well defined and non-controversial. The following Stages II and III involve some areas where all local community issues have not been finally resolved. The staging concept, however, provides ample time for resolution of all of these issues and for adjustments in the final plan prior to the scheduled implementation of the later stages.

E. ADEQUACY OF DATA BASE

In the course of the numerous planning activities described in Section II and particularly of the preliminary engineering program, vast amounts of data have been collected, organized and analyzed. These data cover a wide range of subjects, including information on physical, demographic, environmental, socio-economic, political and technical matters which are essential to the performance of final design and construction. The information at hand will provide a smooth, rapid and orderly transition from preliminary engineering to final design without the need for additional study. In addition to such hard data, the citizen participation program has provided a clear insight into the desires of the people of the County relative to transit, which will be invaluable as the program moves from the regional planning scale to the local scale where the details of design will be of greater importance.

F. PLANNING ACCOMPLISHMENTS AND CAPABILITIES

County-wide comprehensive and transportation planning since 1964 have resulted in the development and subsequent refinement of a mature set of land use, development and transportation plans as a base for the next step toward realization of the plans' objectives and goals. The unique position of Dade County in having the power to perform both comprehensive and transportation planning and to implement these plans ensures the ability of the County to carry on a continued program of transportation development compatible with and supporting land use and development plans. Further, the planning structure that has been established (the Planning Department, the Planning Advisory Board, MUATS and the Office of Transportation Administration) and the procedures for close coordination of all planning efforts likewise ensure the capability of maintaining planning flexibility to adjust to changing conditions in the future. Although the preliminary engineering plans for rapid transit in Dade County have been completed, the planning process continuous to examine other short and long range aspects of the transportation problem, both local and regional.

In summary, the preliminary engineering planning and design are now complete. The transportation improvement program is ready to move into the next phase of final design and implementation. Both the demand for transportation improvement and the monetary costs of delay due to inflation indicate the need for early implementation.

APPENDIX 1

MEMBERS OF THE TRANSIT ADVISORY COMMITTEE, ITS STANDING AND SELECT COMMITTEES, THE PUBLIC OFFICIALS COORDINATING COUNCIL AND OFFICERS OF PUBLIC FORUMS.

TRANSIT ADVISORY COMMITTEE

Hon. Beverly Phillips, Chairperson, Commissioner, Dade County
Hon. Stephen P. Clark, Mayor, Dade County
Hon. Neal Adams, Commissioner, Dade County
Hon. Harry P. Cain, Commissioner, Dade County
Hon. Sidney Levin, Commissioner, Dade County
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Hon. James F. Redford, Jr., Commissioner, Dade County
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Hon. J. W. Stevens, Commissioner, Broward County
R. Ray Goode, County Manager
Melvin J. Adams, Director, Housing and Urban Development
Alf Barth, Chief Architect
Nikki Beare, Commission on Status of Women
Alan Bialkowski, Citizen Panel Representative
Seth Bramson, Citizen Panel Representative
Glenn Allen Buff, Citizen Panel Representative
Douglas Campion, U.M.T.A.
Dennis Carter, Assistant County Manager
Andrew P. Crouch, Asst. City Manager, Miami
John Dexter, Citizen Panel Representative
Dr. Marvin Dunn, Citizen Panel Representative
William K. Fowler, Florida D.O.T.
Roger Gordon, Citizen Panel Representative
Steven Gordon, Citizen Panel Representative
Richard L. Greenup, Florida D.O.T.
George Hepburn, Citizen Panel Representative
Ellis Hollums, Director, Public Works
Richard H. Judy, Director, Aviation
Duke Kimbrough, Florida D.O.T.
Murray Kirschner, Citizen Panel Representative
Dewey Knight, Assistant County Manager
Edward Levinson, Citizen Panel Representative
James Levis, Citizen Panel Representative
William N. Lofroos, Florida D.O.T.
Russ Marchner, Dade League of Cities
Houston Miller, Broward County Department of Transportation
I. H. Milton, Director, Model Cities Program
Alex McNeil, U.M.T.A.
Colin Morrissey, Director, Environmental Resources Mgmt.
Barry Peterson, South Florida Regional Planning Council
John Pippin, Palm Beach County Transit Authority
David J. Reynolds, Executive Secretary, MTA
Harry Russell, Employment of Handicapped Committee

Eugene L. Simm, Director, Traffic and Transportation
Ben C. Simpson, Florida D.O.T.
Charles Stone, Citizen Panel Representative
Orrie Strubinger, Citizen Panel Representative
Joseph A. Turturici, Planning Advisory Board
Reginald R. Walters, Director, Planning
Hiram Walker, U.M.T.A.
W. W. Wilson, Broward County Planning Council
Sara Weitzel, League of Women Voters
Wayne Whisler, Citizen Panel Representative
Isaac Withers, Community Action Agency

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George Hepburn
Silvia Huber
J. A. Ojeda, Jr.
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APPENDIX 2

DELIVERABLE ITEMS PRESCRIBED BY PROFESSIONAL SERVICES AGREEMENT

INTRODUCTORY TASK

1. Policy statements on key transit issues which have been identified and resolved and which will be used to guide the conduct of the study.

2. A revised scope of services reflecting changes indicated by review with the Transit Advisory Committee and the Public Roster.

3. A revised PERT schedule consistent with 2. above.

4. A revised Task Manpower Allocation Matrix showing manhours allocated to each task.

ENVIRONMENTAL ANALYSIS

TASK E-1

1. A written summary report of the existing community services, institutional frameworks and preliminary community objectives and citizens attitudes.

2. Composite graphic illustrations showing present land uses and densities, significant development features; landmarks and historic features and natural amenities.

3. A listing of environmental criteria against which environmental effects can be measured.

TASK E-2

1. Maps showing influence zones around Rapid Transit System corridors and stations.

2. A listing of probable environmental impacts of the Rapid Transit System and a graphic representation of environmental constraints.

3. Plans showing recommended general land use plans and regulatory changes around each corridor and within designated "influence zones" of stations.

TASK E-3

1. Plans showing areas of conflict, alternative corridor and station locations to avoid areas of conflict, and the recommended configuration.

2. Plans showing alternative land uses to avoid conflict with the Rapid Transit System.

3. A summary report presenting relative const indices for alternatives, identifying socio-economic opportunities, describing alternative transportation plans and recommending Rapid Transit System configuration.

TASK E-4

1. A listing of criteria used in selection of influence zones for prototype stations.

2. Plans showing recommended land uses and urban designs for prototype stations.

3. A summary report recommending zoning changes to reflect recommended land use plans.

TASK E-5

1. A milestone report on development policy and land use planning.

2. A milestone report on relocation policy, a plan, and standards and procedures.

TASK E-6

1. A report of the findings of Tasks E-1, 2 and 3 providing an evaluation of environmental impacts.

2. An environmental analysis.

PRELIMINARY ENGINEERING AND DESIGN

TASK D-1

1. An interim report identifying physical problem areas and the needs for collector-feeder-distribution systems, outlining the rationale for alternatives and summarizing public reacton.

2. Conceptual drawings on aerial base maps showing alternative horizontal and vertical alignments, right-of-way requirements and facility locations.

TASK D-2

1. Updated transit patronage estimates.

TASK D-3

1. Manuals of Service and performance criteria for the Rapid Transit System.

2. A milestone report on concepts and criteria.

TASK D-4

1. A milestone report describing the vehicle technologies evaluated and the recommended technology.

TASK D-5

1. A milestone report describing the system safety program for the project, safety criteria and the outline system safety program for final design and implementation.

TASK D-6

1. A milestone report describing the security and surveillance program and measures to be taken to protect the public from annoyance, harassment or crime.

TASK D-7

1. Plan and profile drawings of the entire route of the Rapid Transit System.
2. Drawings of typical and special structures and facilities.
3. Plans for the storage and maintenance areas.
4. Guide specifications for construction contracts.
5. Guide specifications for procurement contracts.
6. Recommendations as to scopes of contract packages.
7. Plans for the train control and communications system.
8. Functional specifications for mini-systems.
9. A listing of right-of-way acquisition requirements.
10. A milestone report on route alignment.

TASK D-8

1. Outline drawings of stations, station access and architectural features.
2. Architectural renderings of selected stations and shape.
3. Models of selected stations (deleted).
4. A model of the Rapid Transit System (deleted).

5. A milestone report on architectural design.

TASK D-9

1. An operations plan showing levels of service, numbers of vehicles required and operating schedules.

TASK D-10

1. Capital cost estimates for fixed facilities, operating subsystems, rights-of-way and relocations.
2. Estimates of operating costs.
3. Estimates of costs for final design and construction management.
4. A milestone report on the final Rapid Transit System concept.

PUBLIC INVOLVEMENT PROGRAM

TASK P-1

1. A report describing the organizational structure for citizen participation for the duration of the Transit Improvement Program.
2. A Public Roster of neighborhoods, communities, organizations and opinion leaders.
3. Initial reports to the Public Roster describing the project and the public involvement program.
4. Monthly transit newsletters.

TASK P-2

None except as reflected in deliverable items of other tasks.

TASK P-3

1. Monthly progress reports.
2. Milestone reports as described for other tasks.

CONCLUDING TASK

1. A scope of work for final design and implementation.
2. A schedule for final design and implementation, including scheduled expenditures for the Rapid Transit System.
3. A draft final project report.

4. Support materials for public hearings.

5. Recommendations to the County for changes in the draft final report to reflect results of the public hearings.

6. A final project report.

7. A summary project report (deleted).

8. Camera-ready copy for the final report and summary report (summary report deleted).

APPENDIX 3

This Appendix contains a letter with attachments from the Metropolitan Dade County Transportation Coordinator to Mr. Charles H. Graves, Director of the Planning Assistance Division of the Urban Mass Transportation Administration. The letter transmits supplemental material expanding upon or clarifying material contained in the Draft Final Project Report, as a follow-up to a meeting between Dade County, federal and state representatives in Washington on October 3, 1975.

METROPOLITAN DADE COUNTY • FLORIDA

911 COURTHOUSE
MIAMI, FLORIDA 33130
TEL: 377-5311

OFFICE OF COUNTY MANAGER

Mr. Charles H. Graves
Director Planning Assistance Division
Office of Transit Planning
Urban Mass Transportation Administration
Room 9314-E - Nassif Building
400 Seventh Street, S.W.
Washington, D.C. 20590

Dear Mr. Graves:

This is a follow up on our meeting with the UMTA staff on October 3, 1975. We appreciated the thorough, point-by-point analysis of the Metropolitan Dade County Transit Improvement Program which was carried out by UMTA at the meeting. The material attached to this letter responds to the points which we discussed during the meeting. This material will be included in the Final Project Report after receipt of UMTA comments on the draft of this Report.

We have organized this material, which is essentially summary data drawn from prior submittals, into seven enclosures:

A. Summary of Comparative Analyses of Alternative Vehicle Technologies within Corridors of Core System (copies of this document were distributed to all participants in the October 3 meeting).

B. Interrelationship of the Metropolitan Dade County Comprehensive Development Master Plan with the Transportation Improvement Program.

C. Recapitulation and Summary of the Comparison of Alternative 3 with Alternative 22.

D. Present Value Analysis of the Projected Transit System.

E. Summary of the Analysis of Yards and Shops Alternatives, and their Impacts on Stage I.

F. Metropolitan Dade County's Highway Lane/Capacity Data - Summary.

G. Operating Costs and Revenue Analysis.

Additional to the issues covered in the Enclosures, we believe the discussions of October 3 essentially reconciled for the present stage of development of our program the questions raised regarding the subject of projected operating deficits. The Board of County Commissioners has not as yet had conducted the exhaustive and detailed fare structure and cost-revenue studies which are needed prior to a decision by the Commission within the next year addressing what levels and sources of funding for operations of the transit system should be established. These studies have been programmed for performance concurrent with performance of design, in order to contribute to the final scoping of the transit development project to fix a proper economic balance for the project's operations.

The projections at Enclosure G reflect an assumption for continuing the present fare structure through 1979-80 and projecting three alternative rates thereafter, as a method of approximating the magnitude of deficits in a preliminary manner. More precise information and data on these preliminary projections will be forthcoming later as Stage I data, particularly, is further refined.

The present value analyses which you requested at the October 3 meeting are now contained at Enclosure D. These have been developed utilizing a specially designed computer program which has been run at the 4%, 7% and 10% discount rate levels for each of the leading seven alternatives (giving a total of 21 computer print-outs attached). You can appreciate that a series of assumptions were necessary to project these data to the year 2020, and it is believed that through the several informal discussions of last week with your staff suitable common understandings as to these assumptions have been arrived at. Enclosure D summarizes both the assumptions used, and results obtained.

We look forward to continuing to work with UMTA regarding this program. If any further material is needed, please advise us.

Sincerely,

John A. Dyer
Transportation Coordinator

JAD:ir

Enclosures: A through G (A/s)

cc: Mr. Douglas R. Campion

Summary of
Comparative Analyses
of
Alternative Vehicle Technologies
within Corridors of Core System

Contents

Enclosure A

July 1975

1. INTRODUCTION

In Milestone 1, 14 alternative transit networks were examined in detail. (See pp. VIII-1 through VIII-35 of Draft Milestone Report 1). Each of these alternative networks included two major features:

- The system operational concept for each of the corridors, and

- The geographic corridors that made up the rapid transit network.

The operational concept was defined as a general operating mode for the transit system within each corridor. A corridor was defined as a broad geographic band (approximately 4,000 feet wide) following a general directional flow connecting major sources of transit trips. A corridor may contain a number of alternative route alignments. A network was defined as a collection of connected corridors.

In addition, 27 other geographic networks were formulated without the application of specific operational concepts, for a total of 41 alternatives.

These networks were developed to meet, in varying degrees, the established transit objectives and criteria, and also to determine whether low capital-intensive operational concepts might be used effectively on certain corridors. (See pp. IV-1 through IV-6 and VI-12 through VI-22 of Draft Milestone Report 1).

2. OPERATIONAL CONCEPTS/TECHNOLOGY OPTIONS

Three basic operational concepts were contemplated for the transit system and were used in various ways in each of the 14 original alternative networks. These operational concepts were:

(1) Grade Separated fixed guideway system

(2) Grade separated bus system

(3) Non-grade separated transitway

A grade separated fixed guideway system consisted of electrically powered vehicles, single or in trains, mechanically guided along a fixed track or guideway, and operating on exlcusive rights-of-way completely separated from any other transportation systems.

A grade separated bus system consisted of buses driven along an exclusive roadway completely separated from any other transportation systems. The I-95 busway system, which could be adapted from the demonstration program currently under construction in Dade County, is an example of this operational concept.

A non-grade separated transitway consisted of transit vehicles, either mechanically guided (Light Rail) or operator-guided (bus) along a track or roadway which, at various points along its length, crossed at the same grade other roads, streets or highways. Examples of this type of operational concept include the current "Blue Dash" bus service on contra-flow lanes on South Dixie Highway, the use of bus systems on reserved lanes of a highway, and transit streets for the exclusive use of buses, trolley buses or light rail cars. Traffic signals at the crossings would be used for this concept and the traffic signals would be designed to give the transit vehicle precedence at any such crossing.

Under similar station location and route characteristics, the first two operational concepts will achieve similar average corridor travel speeds of between 30 and 40 mph. Express service contemplated for certain corridors using operational concept (2) may achieve average speeds up to 45 mph. Operational concept (3) will generally operate at between 15 mph and 25 mph average speed and is thus approximately half as fast as (1) and (2).

A total of four combined operational concept/technology options were thus used and these were:

- non-grade separated, bus --------------NGS(B)
- non-grade separated, (light rail) -----NGS(T)
- grade separated, bus ----------------- GS(B)
- grade separated, fixed guideway ------- GS(F)

3. ALTERNATIVE NETWORKS

Formulation of the alternatives was based on a synthesis of previous studies, the Miami urban profile, and consideration of various transit determinats which included land use, population and employment distribution, travel patterns, demand levels, the needs of transit dependents, and factors relating to the environment. More specifically, the process of identification, definition and synthesis of the candidate system alternatives involved the following primary task elements:

- preparation of a Miami urban system profile and environmental inventory which included the documentation of demographic, socioeconomic, political, and environmental data and an analysis of these data from the point of view of influence on transit system design and impact of the proposed system concepts on the environment;

- study of existing and proposed land use patterns and activity centers as developed by the Dade County Planning Department and delineated in the Comprehensive Development Master Plan for Dade County (as subsequently approved by the Board of County Commissioners);

- visual inspection of candidate rapid transit corridors and routing possibilities throughout the County;

- preparation of aerial photo maps to allow the synthesis and development of corridor alternatives;

- identification of physical and engineering problem areas such as the Miami River and bay crossings, aerial structure intrusion into sensitive community areas, and existing major structural facilities;

- conduct of general soils and utilities surveys to establish any major utility relocation requirements and any geologic problem areas;

- comprehensive review of existing and projected travel demands, volumes, and characteristics, including investigation of the characteristics of users and potential users of transit services and modal choice behavior patterns;

- preparation of preliminary service criteria and standards; and

- investigation of a wide range of vehicle technologies and the synthesis of specific operational concepts based upon the application of candidate general technology types in various operating modes.

Corridor segments, station locations, alignments, and general operational concepts comprised the major elements of the various system alternatives. Patronage estimates for the alternatives were developed using "sketch planning" techniques. These estimates were made in the following context:

- the elimination from previous area plans of the majority of new expressway construction (see p. 7 of Draft Final Project Report);

- perceived costs of private vehicle operation substantially higher relative to the costs (price) of transit usage;

- significantly greater levels of general traffic congestion in key travel corridors than had been assumed in previous analyses;

- controls on parking in downtown Miami and development of outlying fringe parking facilities designed for "park-and-ride" commuter service; and,

- the implementation of land development policies consistent with activity forecasts and the Comprehensive Development Master Plan.

In synthesizing the networks, six principal corridors and a number of other minor corridors emerged. The principal corridors were as follows:

South Corridor:	Cutler Ridge Area to Downtown Miami Area via FEC Railroad Corridor
I-95 Corridor:	Golden Glades Interchange Area to NW 36th St. Area via I-95 Expressway corridor
North Corridor:	Various alternatives were considered - please see Table 1.
West Corridor:	NW 42nd Avenue Area to Downtown Miami Area via Flagler Street Corridor.
East Corridor:	Downtown Miami Area to South Miami Beach Area via MacArthur Causeway Corridor
Miami Beach Corridor:	Miami Beach Convention Center Area to Sunny Isles Area via Collins Avenue Corridor.

The 14 alternative networks to which operational concepts were applied were presented on pages VIII-6 through VIII-32 of Draft Milestone Report 1 and included a series of network maps with accompanying data. The alternatives were numbered from 0 (zero) to 10. Several alternatives had minor variations and were designated as secondary with the letter "A". The maps, Figures 1 through 14, are attached and show the geographic location of the network corridors and reflect the details of the system operational concept. Table 1 shows a summary of the operational concept and vehicle system utilized on each corridor for each of the fourteen alternatives and for the null option and core system. As can be seen from Table 1, all four operational concept/technology options were examined in the South, North and Miami Beach Corridors. Three of the four options were examined in the East and West Corridors, however the non-grade separated light rail system was not examined in these corridors because its application was deemed infeasible in the West Corridor (provision of an at-grade right-of-way in the Flagler Street area would be very disruptive) and the necessity for continuity of east-west service dictated that the East Corridor would have the same operational concept/technology as the West Corridor. The I-95 Corridor options were restricted to grade separated ones due to the nature of the corridor and the current transportation improvement work being conducted (I-95 Demonstration Program).

TABLE 1

ALTERNATIVE NETWORKS, OPERATIONAL CONCEPT/TECHNOLOGY OPTIONS BY CORRIDOR

NGS(B) = Non-Grade Separated - Bus
NGS(T) = Non-Grade Separated - Light Rail
GS(B) = Grade Separated - Bus
GS(F) = Grade Separated - Fixed Guideway (Rubber Tire or Steel Wheel)

	CORRIDOR					
ALTERNATIVE NETWORK	SOUTH	NORTH	I-95	WEST	EAST	MIAMI BEACH
0	NGS(B)	NGS(B)[1,5,12]	GS(B)[2]	NGS(B)[13]	NGS(B)	NGS(B)
1	NGS(B)	NGS(B)[1,5]	GS(B)[2]	GS(F)	GS(F)	NGS(B)
1A	NGS(T)	NGS(B)[5]/GS(F)[3]	GS(B)[2]	GS(F)	GS(F)	NGS(B)
2	NGS(T)	NGS(T)[1,4]	GS(B)[2]	GS(B)	GS(B)[11]	NGS(B)
2A	NGS(T)	NGS(T)[4]/GS(F)[3]	GS(B)[2]	GS(F)	GS(F)	NGS(T)
3	NGS(B)	GS(F)[5]/NGS(B)[1]	GS(B)[2]	GS(F)[14]	GS(F)	NGS(B)
3A	NGS(T)	GS(F)[3,5]	GS(B)[2]	GS(F)[14]	GS(F)	NGS(B)
4	NGS(B)	GS(F)[7]/NGS(B)[1]	GS(F)[6]	GS(F)	GS(F)	NGS(B)
4A	NGS(B)	GS(B)[3,7]	GS(B)[6]	GS(B)	GS(B)	NGS(B)
5	NGS(T)	GS(F)[3,7]	GS(F)[8]	GS(F)	GS(F)	NGS(B)
6	NGS(T)	GS(F)[1]	GS(B)[2]	GS(F)[13]	GS(F)	NGS(B)
7	NGS(T)	GS(F)[7]/NGS(T)[1]	GS(F)[8]	GS(F)	GS(F)	GS(F)
8	GS(F)[15]	GS(F)[3,7]	GS(F)[8]	GS(F)	GS(F)	GS(F)
10	GS(B)[15]	GS(B)[7]/NGS(B)[1]	GS(B)[8]	GS(B)	GS(B)	GS(B)
NULL	NGS(B)[9]	-	GS(B)[10]	-	-	-
CORE	GS(F)	GS(F)[1]	GS(B)	GS(F)	GS(F)	NGS(B)

NOTES:
1 Includes FEC Corridor in Hialeah
2 Golden Glades to NW 36th St. only, then NGS(B) to Downtown
3 Extension of West Corridor along Okeechobee Road - Hialeah
4 Biscayne Boulevard Corrido
5 Flagler to NW 36th Street on NW 12th Avenue
6 From NW 62nd Street Northward
7 Flagler to NW 62nd Street on NW 12th Avenue
8 NW 62nd Street to NW 119th Street then to Interama Site
9 From I-95 to SW 72nd Street Only
10 From Golden Glades to NW 36th Street only
11 Includes mixed traffic operation on McArthur Causeway
12 Includes U.S. 1 to NW 36th Street on Le Jeune/Douglas Corridor
13 Includes I-95 to LeJeune Road on NW 36th Street
14 Includes U.S. 1 to Flagler Street on LeJeune/Douglas Corridor
15 Connects to Downtown via LeJeune/Douglas and West Corridors

4. ANALYSIS OF OPERATIONAL CONCEPT/TECHNOLOGY OPTIONS BY MAJOR CORRIDOR

The examination of the 14 alternative networks included sketch planning patronage analyses of the various operational concept/technology options in place on various corridor of various of the networks, as indicated by Table 1. (See pp. V-9 through V-23 of Draft Milestone Report 1). To provide appropriate inputs for the patronage model, each operational concept/technology option was applied in a manner which utilized the best attributes of that mode, generally within the constraints of the service criteria previously established. As a result, station location, departure frequency, operating route and average travel speed parameters were developed for the particular operational concept/technology option in the particular corridor, and were used in the UTPS program package. For example, on the South Corridor, the non-grade separated bus option was designed to operate on the FEC right-of-way parallel to South Dixie Highway using traffic signal preemption at the many grade crossings along the corridor. The bus system was set up to operate on a zoned basis. That is, a bus line would provide local service to an area adjacent to the corridor, would then enter the corridor and run express to the downtown area. In this way average speeds along the corridor would be maintained at fairly high levels (in the 25 mph to 35 mph range). This type of service is most favorable to commuter type journeys and less favorable for journeys within the corridor. The non-grade separated light rail option in the same corridor also operated on the FEC right-of-way with traffic signal preemption at the many grade crossings. It was designed to offer a scheduled line haul service along the corridor and was estimated to achieve an average speed of about 25 mph. The grade separated fixed guideway system was designed to operate in a conventional rapid transit system manner and achieved an average speed of 32 mph. The grade separated bus option again used a zoned service and achieved operating speeds of 39 mph on the South Corridor. All options used similar peak hour departure frequencies (3 to 6 minute rante) on each operating route.

The basic results of this work are summarized below for each corridor:

4.1 South Corridor

The non-grade separated bus option was examined in alternatives 0 and 3, the non-grade separated light rail option was examined in alternatives 3A and 6, the grade separated fixed guideway option was examined in alternative 8 and the grade separated bus option in alternative 10. The estimated peak hour patronage (mean value) for the operational concept/technology option in alternatives 3, 3A, 6 and 10 exceeded the practical maximum capacity for the option in question. In effect, the demand for transit in the South Corridor appeared to be sufficiently strong to swamp any new non-grade separated system or any new grade separated bus system. As a point of reference the following maximum practical and sustainable passenger carrying capacities were estimated for the various operational concept/technology options in all corridors:

Operational Concept/Technology	Practical Maximum One-Way Passenger Carrying Capacity Per Lane or Track
Non-grade separeted, bus	8,000 pass/hour
Non-grade separated light rail	8,000 pass/hour
I-95 Exlcusive Busway	12,000 pass/hour
Grade separated, bus	12,000 pass/hour
Grade separated, fixed guideway (light rail)	12,000 pass/hour
Grade separated, fixed guideway (multi-car)	25,000 pass/hour

Estimated peak hour one-way maximum passenger capacities (see page V-29 of Draft Milestone Report 1) were developed by using a 12% peak hour peak direction factor (i.e., peak hour peak direction travel volumes at the peak load points on a corridor were assumed to be 12% of the total daily two-way volumes through such points). Later data established that a 14% factor would be more appropriate -- see page IV-8 of Draft Milestone Report 8. Based upon mean or expected passenger patronage figures, peak hour one-way passenger movements through the peak load point in the South Corridor in 1985 were as follows:

Alternative 0	5,700	passengers per hour
1	15,200	" " "
3A	12,300	" " "
6	14,900	" " "
8	13,500	" " "
10	9,900	" " "

Thus it was determined that for a system meeting the goals and objectives of the county as reflected in the service criteria, only a grade separated fixed guideway system could carry the demand in the South Corridor.

4.2 I-95 Corridor

The I-95 Corridor essentially consists of the median of the expressway which is currently being paved as part of a bus and carpool demonstration program. As a result, only grade separated facilities were considered for use in this corridor, and such facilities would utilize the new median lanes. Primary consideration as an alternative operational concept/technology was given to the grade separated bus option, as such would require minimum additional investment in the corridor as compared to a fixed guideway system. Also, the lack of accessibility to and space for passenger stations in the expressway median, strongly favored the bus technology operating in a local collection mode in areas adjacent to the corridor and then running express along the corridor to the downtown area. The grade separated bus option was examined in alternatives 0, 1, 1A, 2, 2A, 3, 3A, 4A, 6, 10, Null and Core. The grade separated fixed guideway alternative was only examined for a portion of the corridor in alternatives 4, 5, 7 and 8. In the sketch planning patronage estimation work carried out for alternative 1 (one of the first networks analyzed), peak hour one way passenger movements on the I-95 corridor were estimated at 16,000 passengers per hour (based on the 12% factor and expected patronage values). Thus it was again determined that demand in the north area would swamp the grade separated bus system. As a result it was determined that at least one other corridor would be required in the north area (see North Corridor discussion in next section), so as to spread the demand between the I-95 Corridor and the North Corridor, and thus match demand to the capacity capability of a grade separated bus facility in the median of I-95.

4.3 North Corridor

Unlike the South Corridor, the geographic location and extent of the North Corridor was subject to substantial variation in the 14 network analyses. In many elements of the North Corridor all four operational concept/technology options were tested using appropriate operating parameters for the particular corridor and mode option. However, in portions of the finally selected corridor only a grade separated fixed guideway or bus system was analyzed (see alternatives 6 and 10 respectively). For alternative 6, the peak link peak hour one way volume was estimated at 16,100 passengers per hour, and for alternative 10, 16,500 passengers per hour. In the latter case, the volume would exceed the capability of the grade separated bus option and thus a grade separated fixed guideway mode was deemed necessary for capacity reasons and also for continuity with the South Corridor.

4.4 West and East Corridors

As previously mentioned, three operational concept/technology types were analyzed for the West and East Corridors. As before, each mode was applied in the most appropriate manner. The non-grade separated bus option was used in alternative 0, the grade separated bus option in alternatives 2, 4A and 10, and the grade separated fixed guideway option in alternatives 1, 1A, 2A, 3, 3A, 4, 5, 6, 7,and 8. In each case on the East Corridor, the peak hour patronage figures generated were within the capability of the mode. The mean value peak hour one way figures for 1985 at the peak load point of the East Corridor were:

Alternative 0	3,400 passengers per hour
1	6,000 " " "
3A	8,000 " " "
6	11,700 " " "
8	6,600 " " "
10	6,800 " " "

For the West Corridor, network configuration differences caused substantial patronage level differences. For example, both alternatives 8 and 10 funneled all South Corridor to/from Downtown patronage through the West Corridor. As a result, these two alternatives had peak hour peak direction movements of 17,300 and 22,100 passengers per hour (alternatives 8 and 10 respectively) at the peak load point in the West Corridor. The latter figure far exceeds the practical maximum capacity of the grade separated bus option used in alternative 10. The other alternatives generated patronage estimates capable of being carried by the operational concept/ technology used.

4.5 Miami Beach Corridor

This corridor was tested with all four operational concept/technology options each being applied in the most appropriate manner. The non-grade separated bus option was used for alternative 0, 1, 1A, 2, 3, 3A, 4, 4A, 5, and 6, the non-grade separated light rail was used for alternative 2A, the grade separated fixed guideway option for alternatives 7 and 8, and the grade separated bus option for alternative 10. Peak hour peak direction passenger patronage (1985 mean values) ranged from 750 per hour for alternative 0 to 3,800 for alternative 6. On this basis, the use of a grade separated mode in Miami Beach Corridor was deemed unjustified.

Thus the operational concept/technology alternatives were tested on a corridor by corridor basis and the feasible options determined for each corridor.

5. VEHICLE TECHNOLOGY SELECTION

In Draft Milestone Report 2, candidate vehicle systems were identified for application on each of the corridors. Public input was solicited (see Table 2) on the choice of vehicle technology for each corridor with the choice being limited to those operational concepts/technologies found to be feasible through the Milestone 1 analysis summarized above. The input received from the Citizens Participation Program is shown in Table 3. As a result of the Milestone 1 and 2 analyses, conclusions were reached as to the operational concept to be employed on the various elements of the transit network. The bus vehicle technology type was selected for the non-grade separated portion of the network and confirmed for the I-95 grade separated corridor. For the other grade separated portions of the network a fixed guideway type was selected with a choice between rubber tired vehicles and steel wheeled vehicles left for final determination after detailed route profile and alignment studies in Milestone 5. In Milestone 5, (see sections X and XI-C in Draft Milestone Report 5) the selection of the bus technology for the non-grade separated elements of the network was confirmed, and the steel wheeled train system was selected for the grade separated route elements.

TABLE 2

MILESTONE 2 PRESENTATION OF DATA - "VEHICLE TECHNOLOGY"

CITIZEN INPUT FORM

DISTRICT________________________

PRESIDENT ____________________

SIGNED____________________

DATE __________

CANDIDATE TECHNOLOGIES	CORE SYSTEM CORRIDORS					
	NORTH-SOUTH	EAST-WEST	SOUTHWEST	WEST	I-95	MIAMI BEACH
	Opa-Locka, Civic Center, CBD, Dadeland, Cutler Ridge	Miami Beach, CBD, Airport, Hialeah, Coral Gables	Dadeland, S.W. 110th Ave.	Flagler/LeJeune, Palmetto Expressway		
B1 STEEL WHEEL TRAIN			Nongrade-Separated Corridor. Technology Type Does Not Apply.	Nongrade-Separated Corridor. Technology Type Does Not Apply.	Bus Technology Previously Selected.	Nongrade-Separated Corridor. Technology Type Does Not Apply.
B2 TROLLEY CAR					Bus Technology Previously Selected.	
D1 RUBBER TIRED TRAIN			Nongrade-Separated Corridor. Technology Type Does Not Apply.	Nongrade-Separated Corridor. Technology Type Does Not Apply.	Bus Technology Previously Selected.	Nongrade-Separated Corridor. Technology Type Does Not Apply.
F3 BUS					✓	
F4 TROLLEY BUS					Bus Technology Previously Selected.	

TABLE 3

CITIZEN INPUTS — SUMMARY OF ALL SEVEN DISTRICTS

DATE ________

CANDIDATE TECHNOLOGIES	CORE SYSTEM CORRIDORS: NORTH-SOUTH	EAST-WEST	SOUTHWEST	WEST	I-95	MIAMI BEACH
	Opa-Locka, Civic Center, CBD, Dadeland, Cutler Ridge	Miami Beach, CBD, Airport, Hialeah, Coral Gables	Dadeland, S.W. 110th Ave.	Flagler/LeJeune, Palmetto Expressway		
B1 STEEL WHEEL TRAIN	**1, 3, 4,** 6	**1, 3, 4,** 6	Nongrade-Separated Corridor. Technology Type Does Not Apply.	Nongrade-Separated Corridor. Technology Type Does Not Apply.	Bus Technology Previously Selected.	Nongrade-Separated Corridor. Technology Type Does Not Apply.
B2 TROLLEY CAR			**2,**	**2,**	Bus Technology Previously Selected.	
D1 RUBBER TIRED TRAIN	**1, 2, 4, 5, 6, 7,[4]**	**1, 2, 4, 5, 6, 7,[4]**	Nongrade-Separated Corridor. Technology Type Does Not Apply.	Nongrade-Separated Corridor. Technology Type Does Not Apply.	Bus Technology Previously Selected. 2[3]	Nongrade-Separated Corridor. Technology Type Does Not Apply.
F3 BUS	6	6	**1, 3, 4, 5,[2] 6, 7,** 2	**1, 3, 4, 5,[2] 6, 7,** 2	✓	**1, 3, 4, 5,[2] 6, 7,**
F4 TROLLEY BUS			3	3	Bus Technology Previously Selected.	**2,** 3

Notes: The bold figures in the first line of each box show the district numbers for those districts that had a majority preference for the given technology in the given corridor.

The light figures in the second line of each box show the district numbers for those districts that had a minority preference for the given technology in the given corridor.

The Cross County Corridor is not shown, as this corridor would require a vehicle system compatible with the I-95 busway. It is recommended that this corridor and the I-95 busway utilize the Transbus.

1. Preference for D technology only, not necessarily D-1 technology category.

2. Preference for "adequate bus," not necessarily F-3 technology category.

3. Suggested that a rubber-tired train should be considered for operation in I-95 Corridor.

4. Stated that Montreal Metro type system should be used contingent upon such being manufactured in the United States.

The Transbus type vehicle was recommended for the busways for the following reasons:

- the Transbus type vehicle can meet 1985 line haul passenger carrying capacity requirements for the I-95 Busway and non-grade separated corridors;

- citizen participation program inputs indicated a strong preference for this technology;

- operating and maintenance considerations made the choice of one technology for all non-grade separated corridors most desirable;

- the Transbus type vehicle could be integrated with the existing bus fleet operations and could utilize common storage and maintenance facilities;

- the Transbus type vehicle represented the most modern, safe, comfortable and convenient bus yet produced for urban transit application in the United States. The Transbus type vehicle was also designed to meet the most stringent noise and air pollution limitations ever imposed on a city bus; and,

- the use of non-fixed guideway equipment allowed maximum flexibility for route changes and expansion and for providing neighborhood circulation service and lower capacity line haul service with one vehicle, thus reducing transfers and improving core system access.

The steel-wheeled train system was recommended for the following reasons:

- 1985 line haul passenger carrying capacity requirements were within the capability of this technology. The capacity of the steel wheeled system was further judged to be satisfactory in accommodating substantial increases that can be anticipated for the year 2000 and beyond;

- outside the downtown area, none of the routes which could (due to profile and alignment limitations) be used by only the rubber-tired vehicle system, were deemed of sufficient importance and merit to warrant selection of that vehicle technology for the entire system;

- differences in ramp structure lengths attributable to different maximum grades (4% vs. 8%) used by the two technologies were, in overall cost terms, not judged of sufficient significance to disqualify the steel wheeled system;

- additional disruptions and displacements caused by the steel wheeled vehicle system, due to profile and alignment differences, were estimated to be less than 5% more than those caused by the rubber tired system for the recommended route profile and alignment. This difference was not considered significant in the context of the total rapid transit system program;

- the use of 4% maximum grades does not constrain the elevation of any stations (including downtown stations) above that required for normal clearances;

- over a route profile and alignment that can be traversed by either a steel wheeled or rubber tired vehicle technology, and assuming vehicles of equal performance, weight, and size per passenger carried, the steel wheel system will have a lower power consumption;

- the steel wheel system has a much longer history of proven operational experience than does the rubber tired system;

- operational and maintenance considerations made the choice of one technology for all corridors desirable;

- The cost of implementing either technology type was considered equal within the error associated with a preliminary cost estimate; and,

- future expansion of the core system and possible future vehicle technologies made the use of a less restrictive (larger curve radio, lower grades) route profile and alignment desirable. Also, the higher speed capability of the steel wheeled system would be advantageous in the context of a possible regional system in future years.

6. ALTERNATIVES ANALYSIS STATUS

After completion of Milestone 8, the Final System Plan, the Environmental Impact Analysis, and four public hearings on both, the Metropolitan Dade County Commission adopted on July 16, 1975, Stage I of the Core System as the first usable segment of the Transit Improvement Program. The vehicle technology adopted was the grade separated, steel-wheeled train system. The remaining segments of the core system were accepted only for further study and analysis. Obviously, this study will require careful alternative analyses of corridors as well as vehicle technologies within corridors. Those tasks will have to be a major part of the next stage activities, and can be expected to be a considerable refinement of the work done to date.

ALTERNATIVE 0

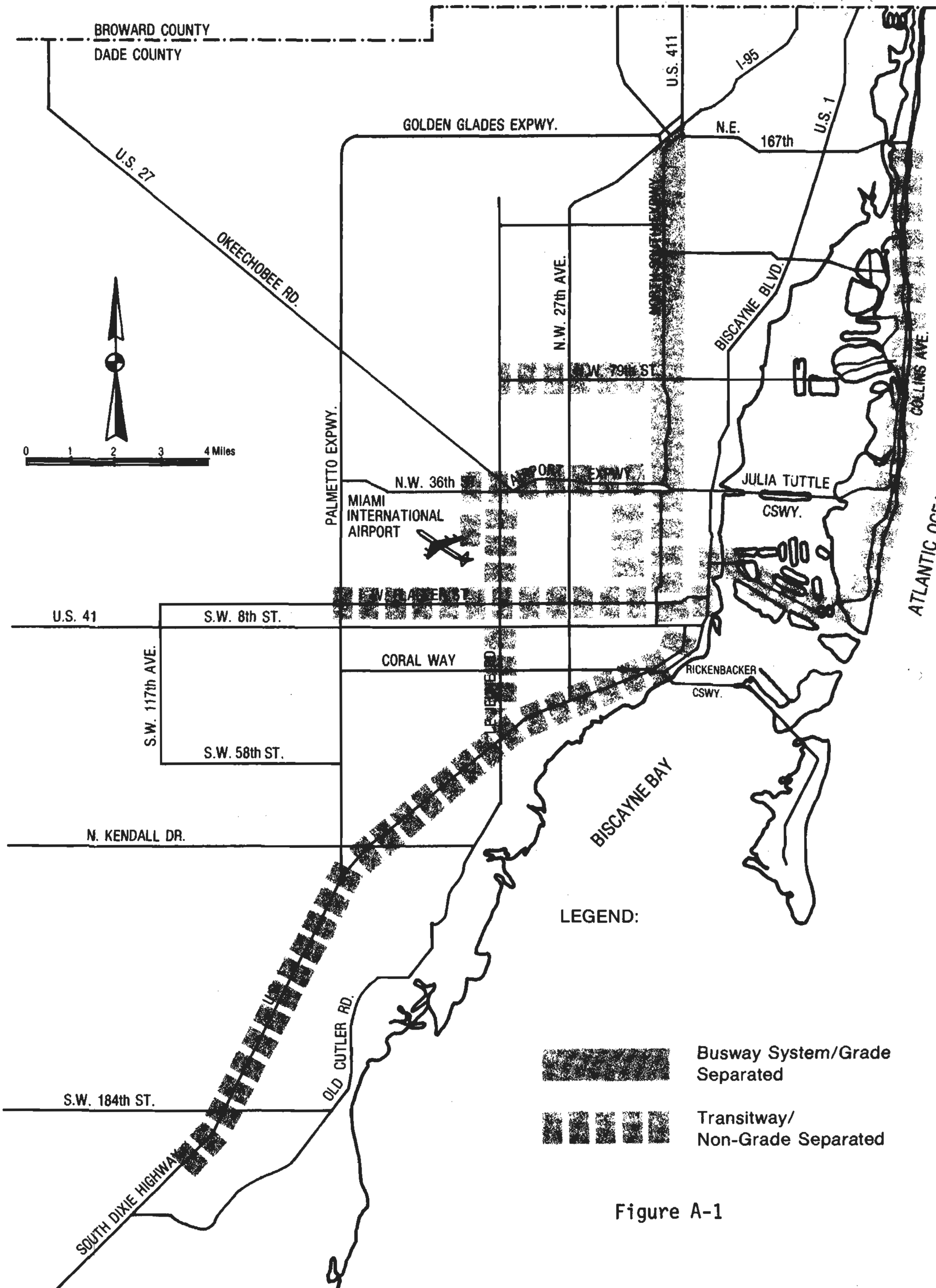


Figure A-1

ALTERNATIVE 1

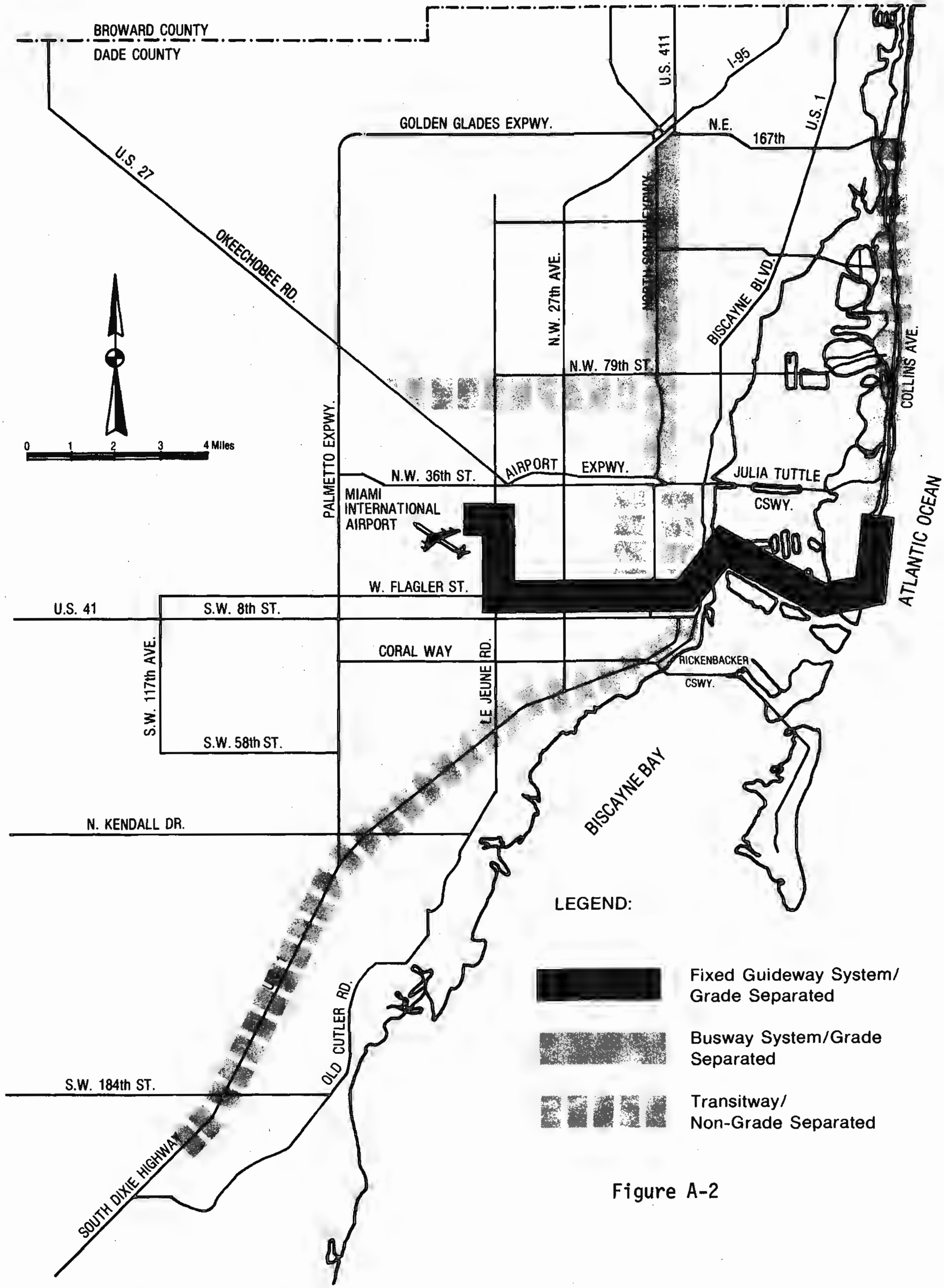


Figure A-2

ALTERNATIVE 1A

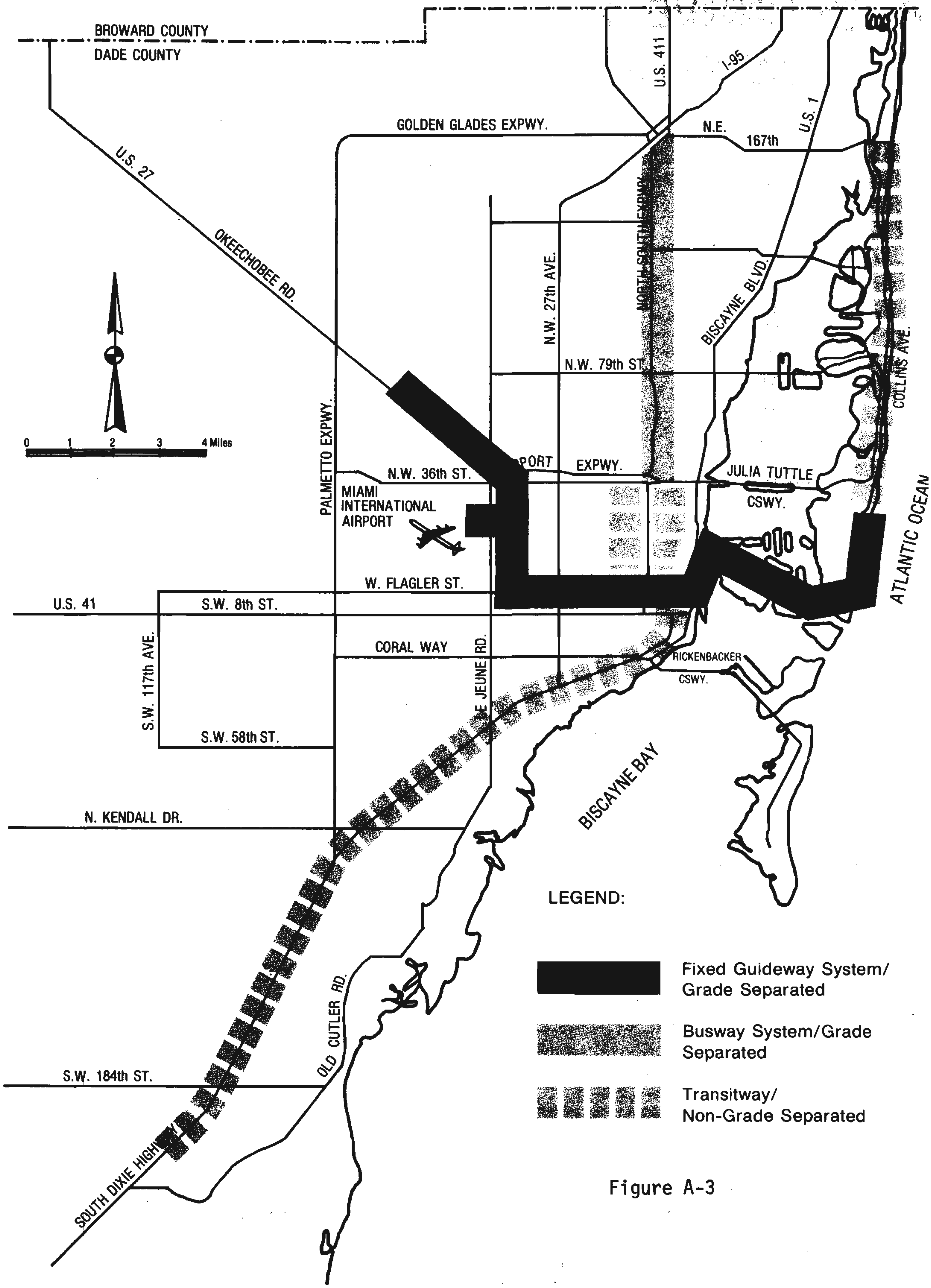


Figure A-3

ALTERNATIVE 2

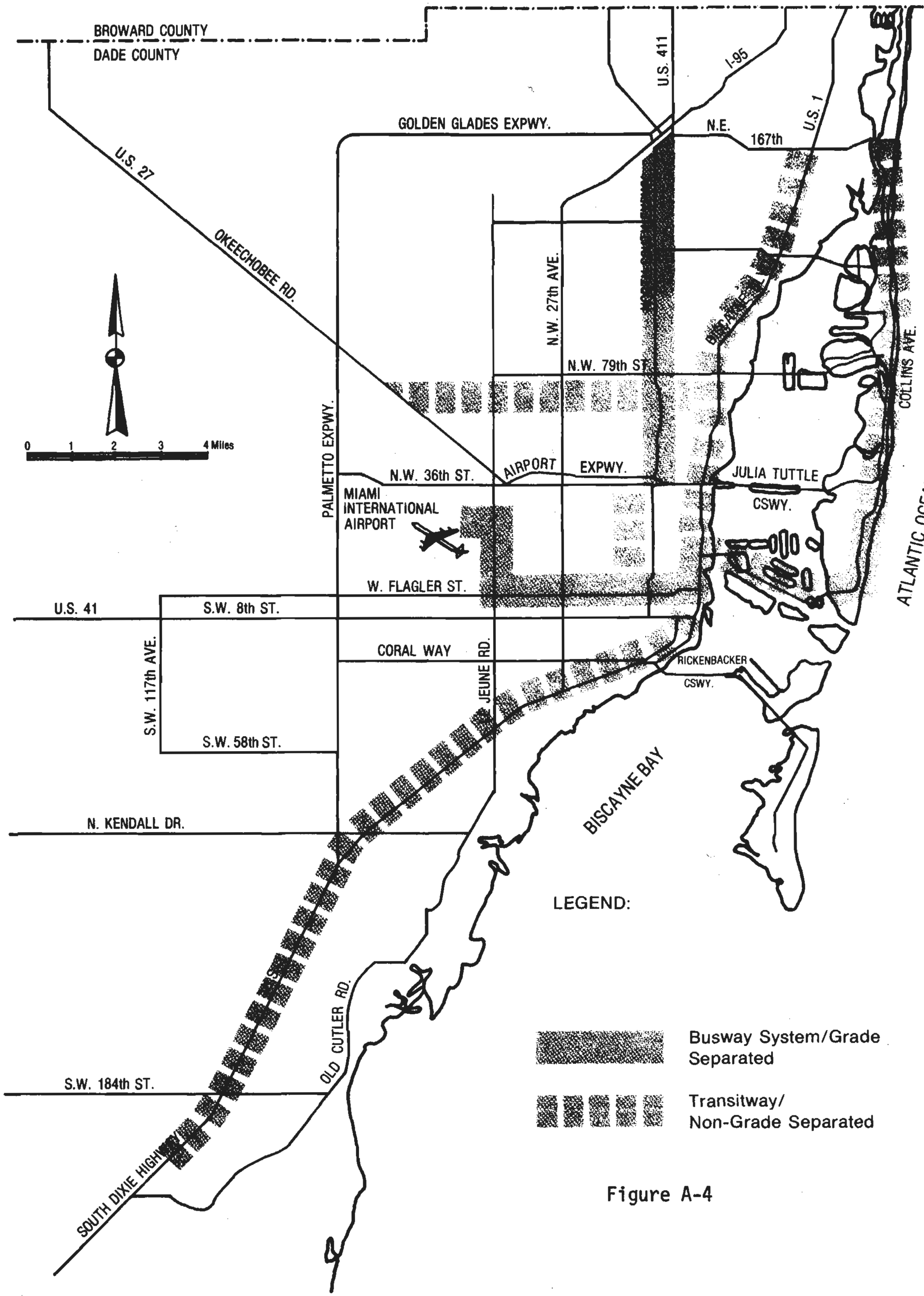


Figure A-4

ALTERNATIVE 2A

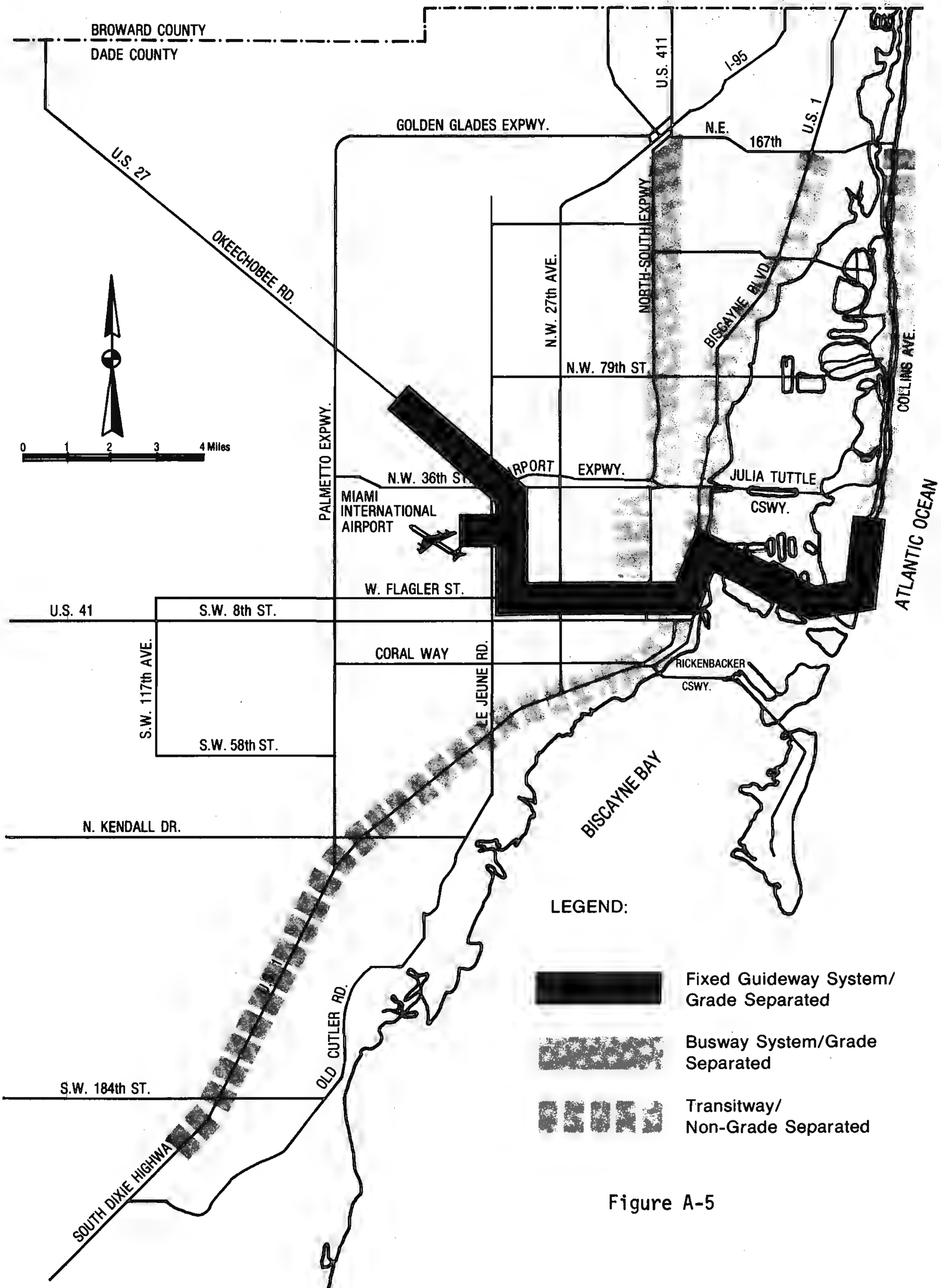


Figure A-5

ALTERNATIVE 3

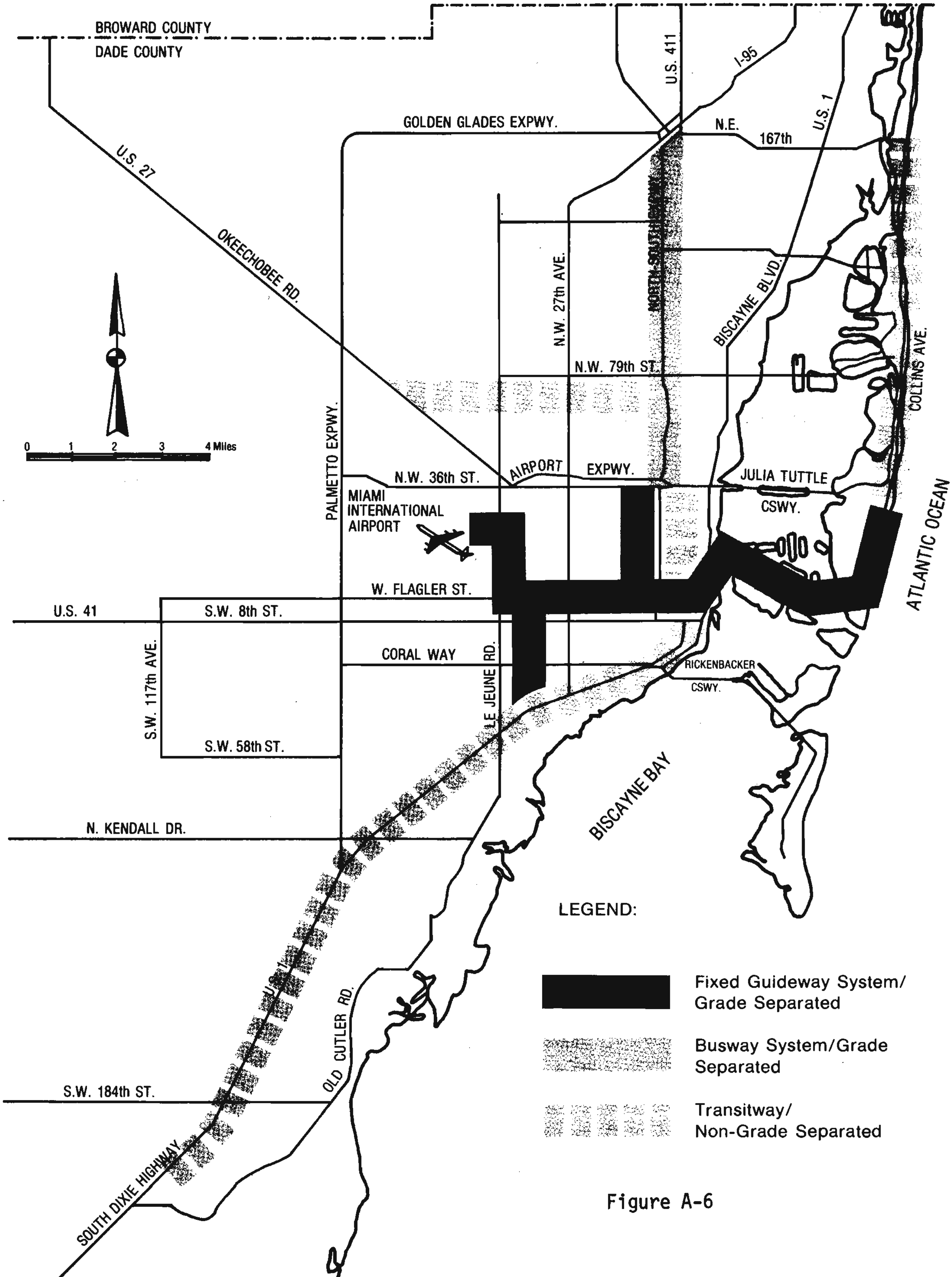


Figure A-6

ALTERNATIVE 3A

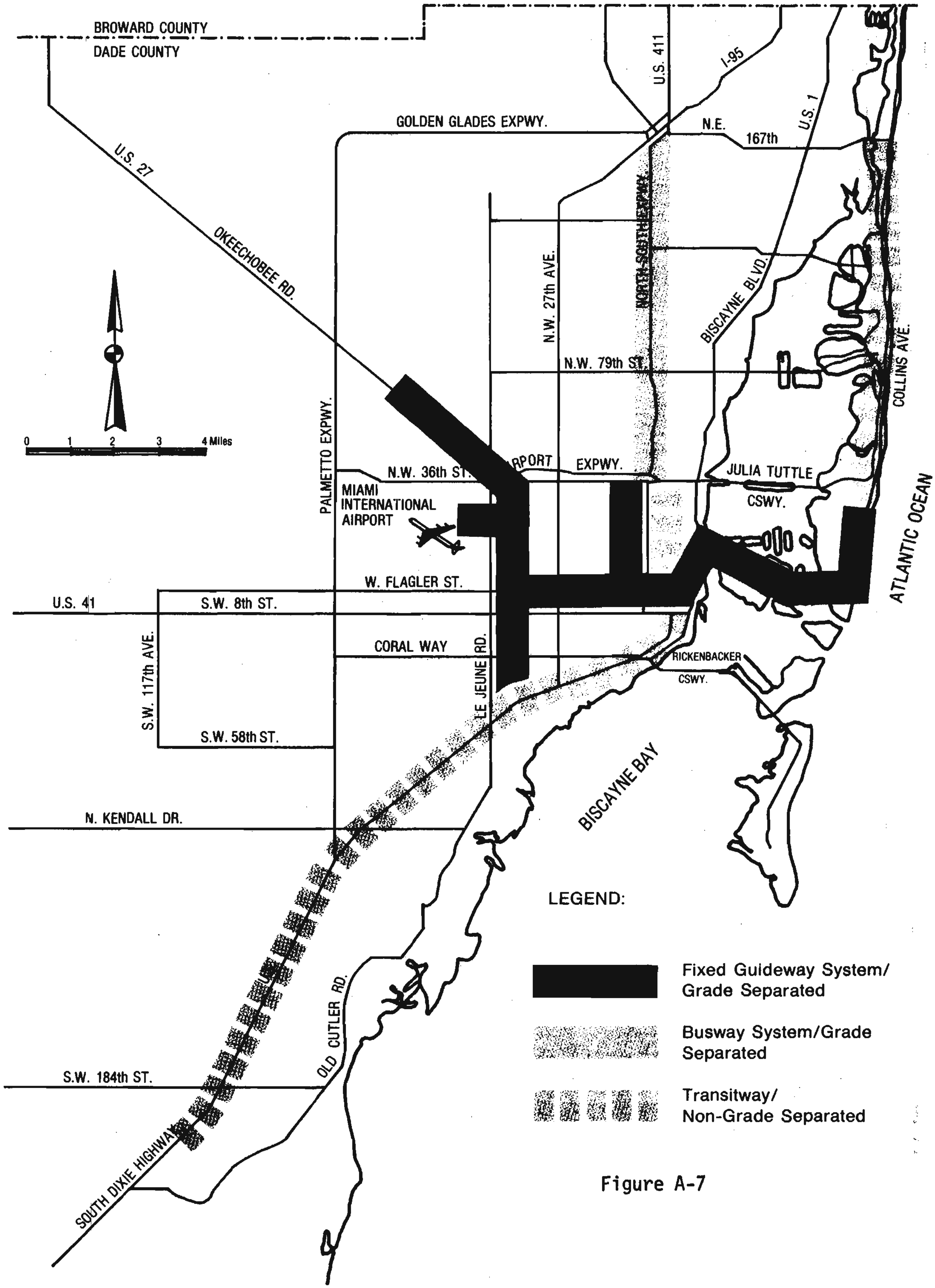


Figure A-7

ALTERNATIVE 4

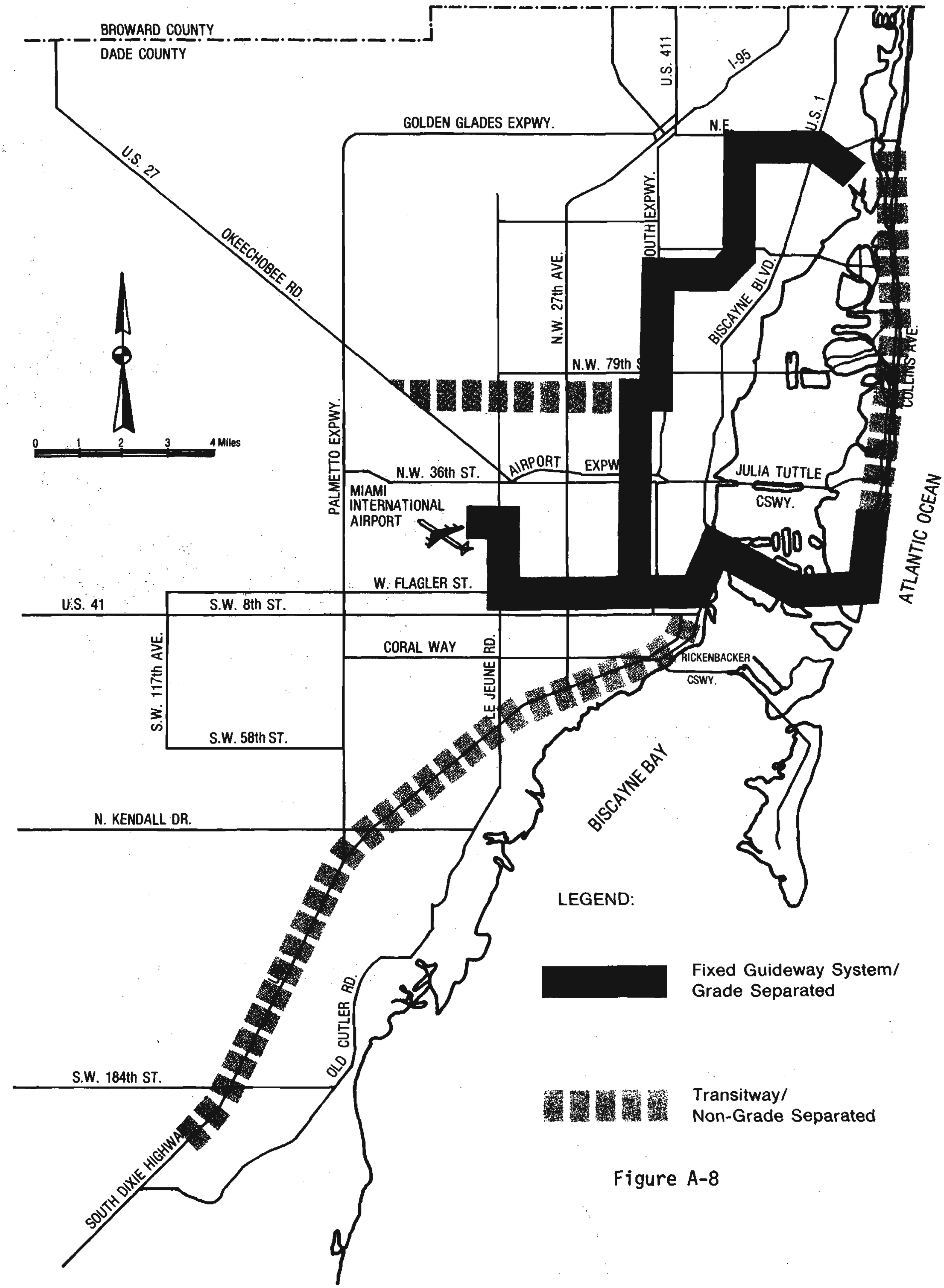


Figure A-8

ALTERNATIVE 4A

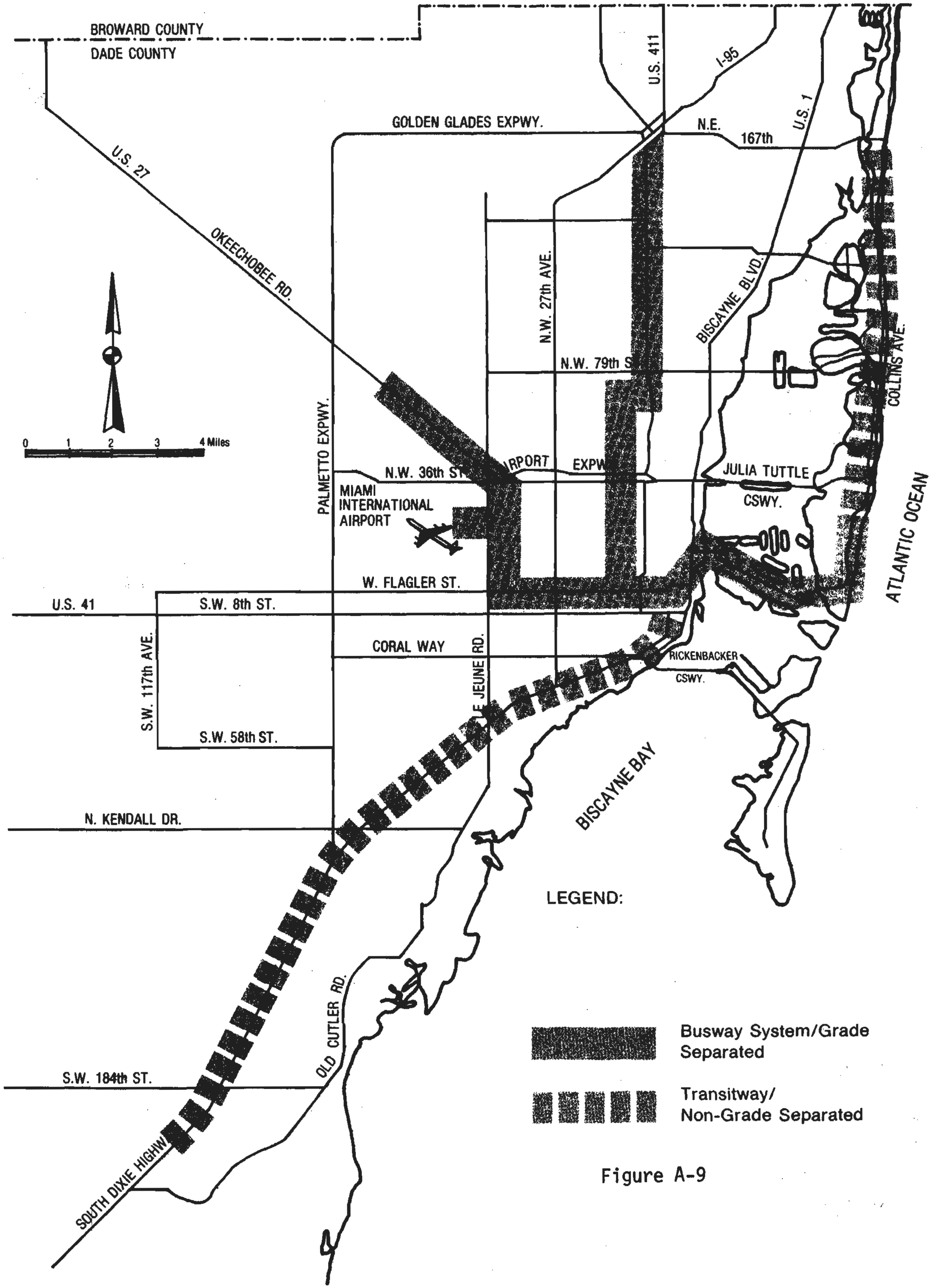


Figure A-9

ALTERNATIVE 5

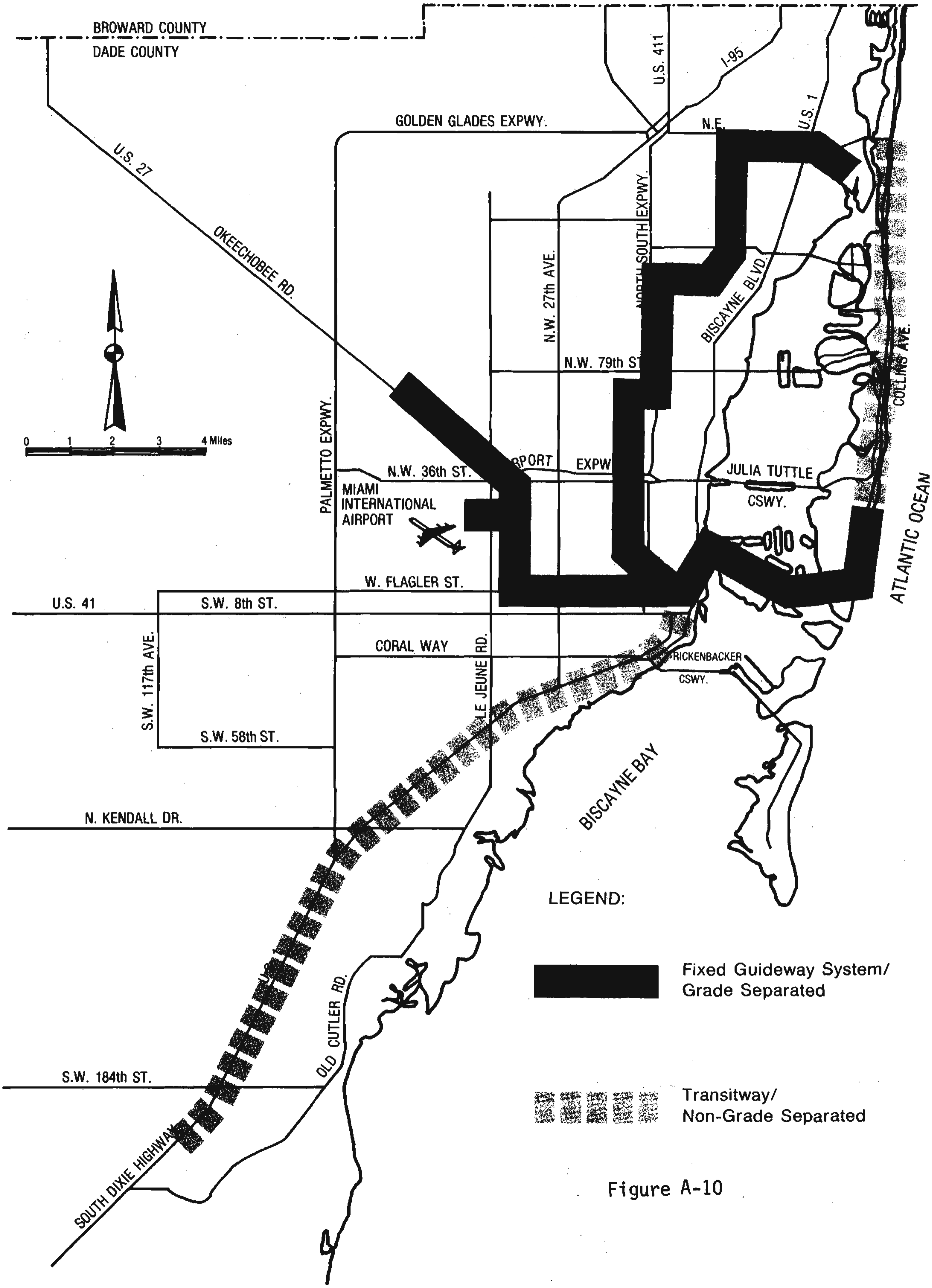


Figure A-10

ALTERNATIVE 6

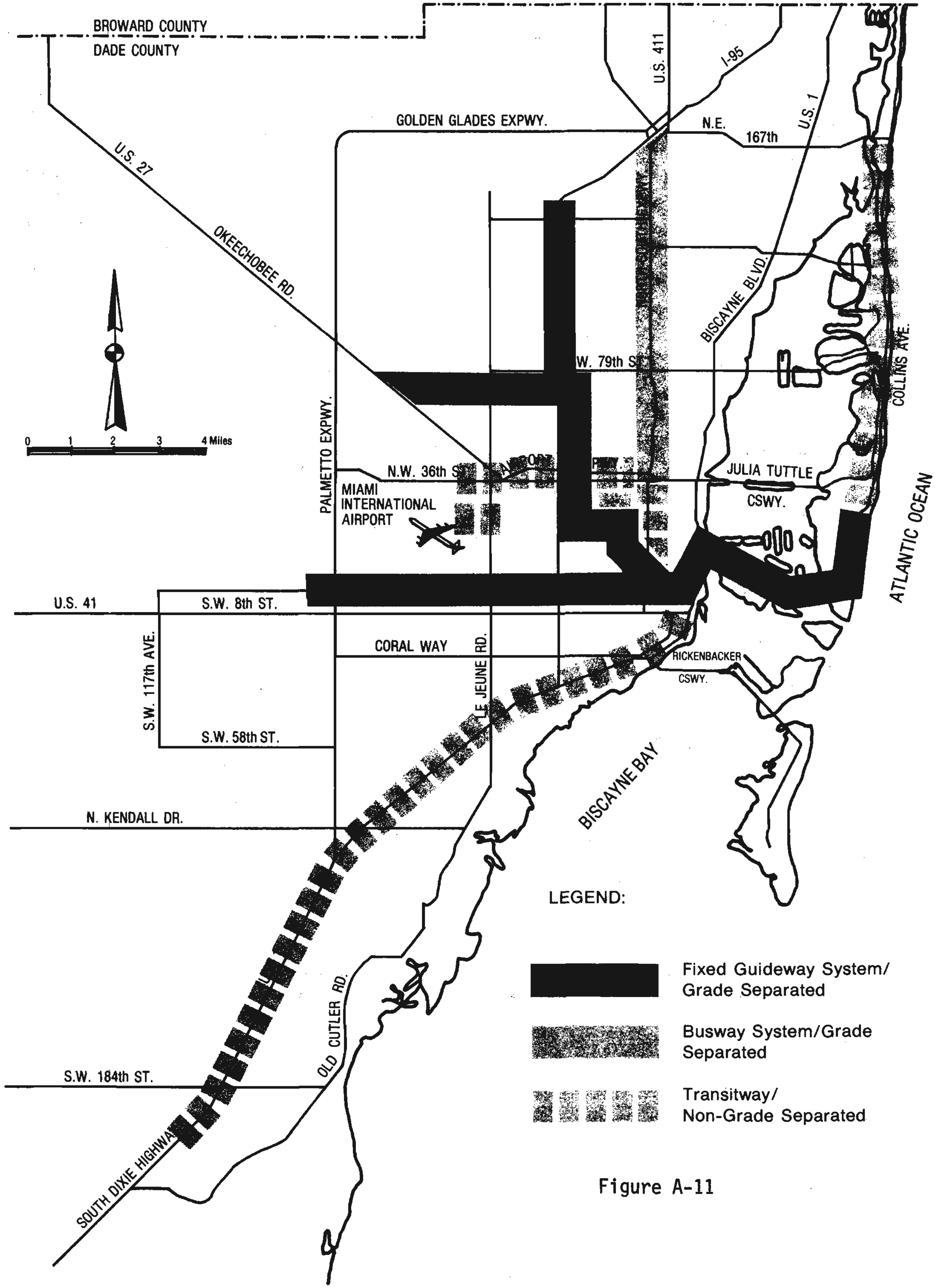


Figure A-11

ALTERNATIVE 7

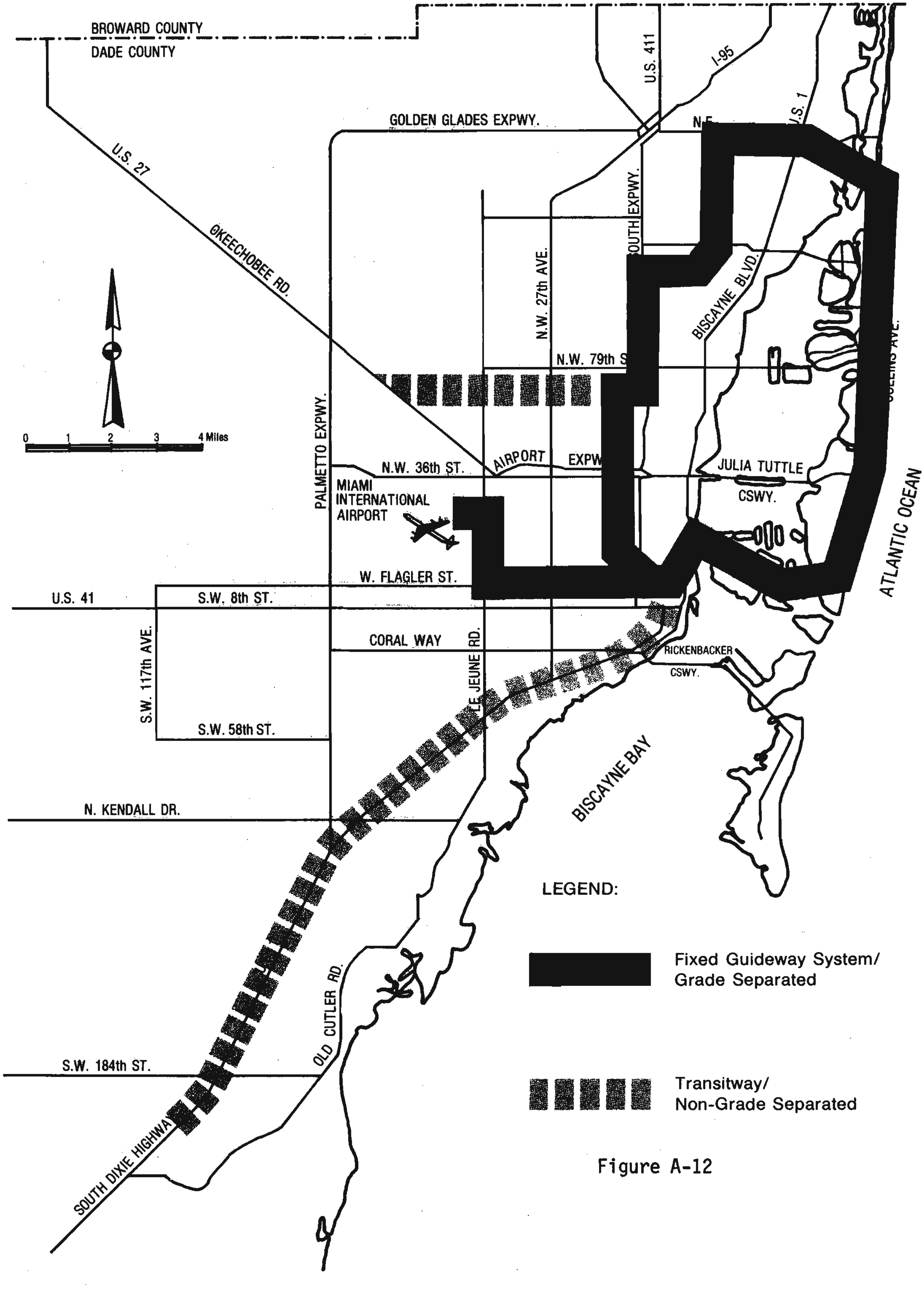


Figure A-12

ALTERNATIVE 8

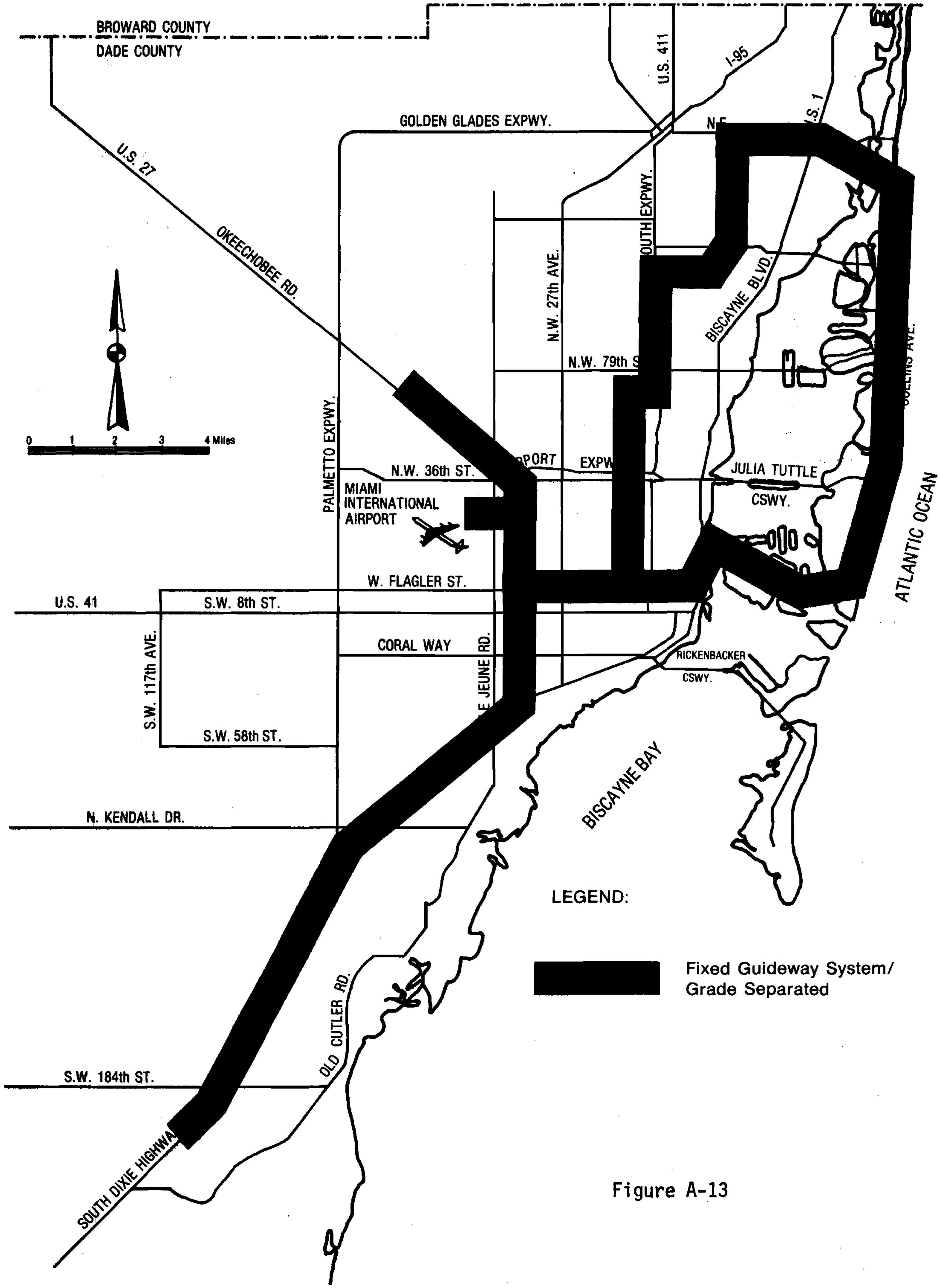


Figure A-13

ALTERNATIVE 10

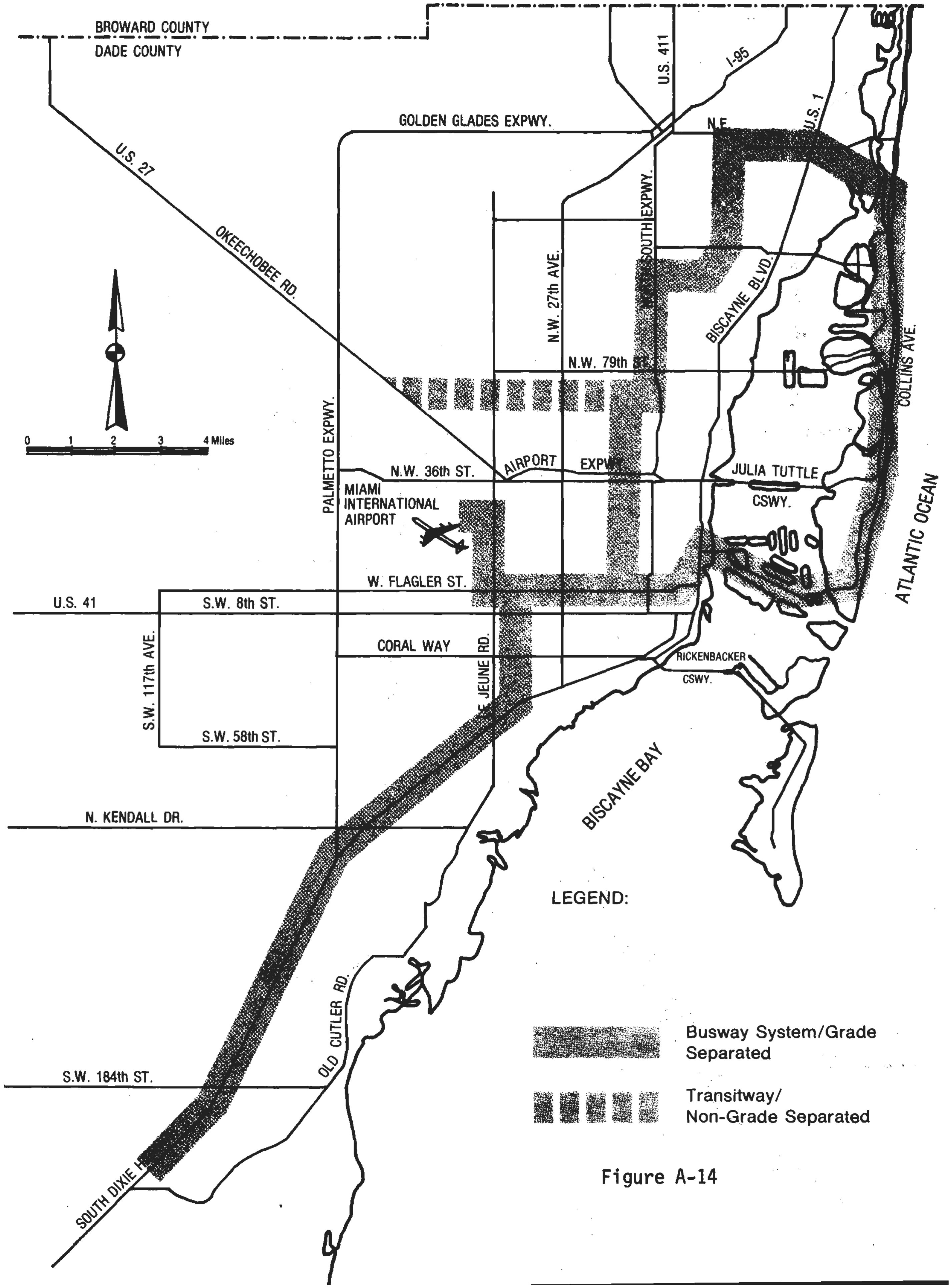


Figure A-14

INTERRELATIONSHIP OF THE METROPOLITAN DADE COUNTY COMPREHENSIVE DEVELOPMENT MASTER PLAN WITH THE TRANSPORTATION IMPROVEMENT PROGRAM

Metropolitan Dade County adopted a 1985 and 2000 Comprehensive Development Master Plan (CDMP) on March 31, 1975 to help guide all the long-range planning activities of the County. This plan has three parts covering the broad spectrum of long-range public planning endeavors. The first part, Metropolitan Development Policies, consists of 250 policy statements covering all phases of County planning activities. These statements and the other two parts of the CDMP, are discussed in detail in Milestone 1, "General System Concept & Criteria". In addition, input from this element of the CDMP influenced the "Environmental Impact Analysis" (EIA) in evaluating the project, as well a influencing parts of Milestone 3, "Development and Land Use Policy", and Milestone 8, "Final System Plan". The second part of the CDMP, the Environmental Protection Guide, sets the basis for many of the constraints confronting the Transit Improvement Program and is described in several Milestone reports including the EIA and Milestone 5, "Route Alignment and Station Location". The third part of the CDMP, the Metropolitan Development Guide, is crucial in understanding several other Milestone documents. It provides the basis for all demographic projections and the 1985 transit/highway network, as well as the long-range land use development concepts used throughout the study. Essentially, the CDMP emphasizes transit as a major part of the transportation element, both in terms of Policies and the Metropolitan Development Guide.

The three elements of the Metropolitan Dade County CDMP are presently being used as the policy and data sources for the Miami Urban Area Transportation Study (MUATS) 2000 Update. Thus, the CDMP is the basis for coordinating public policies, long-range environmental constraints and adopted development procedures into a comprehensive urban development guidance system. The public and political adoption of this plan and its procedures is a requisite to transit and transportation planning for the Miami Urban Area.

The CDMP which is Metropolitan Dade County's adopted plan, stresses the importance of "activity centers" as the focal points of various community activities within the region. The over two dozen centers vary from each other in size and function, however, all are linked together through a comprehensive transportation network. The road and transit concept is designed to satisfy the transportation needs of these centers and the population and employment concentrations they contain. The proposed 1985 Transit Improvement Program would link 17 of the 26 proposed centers together.

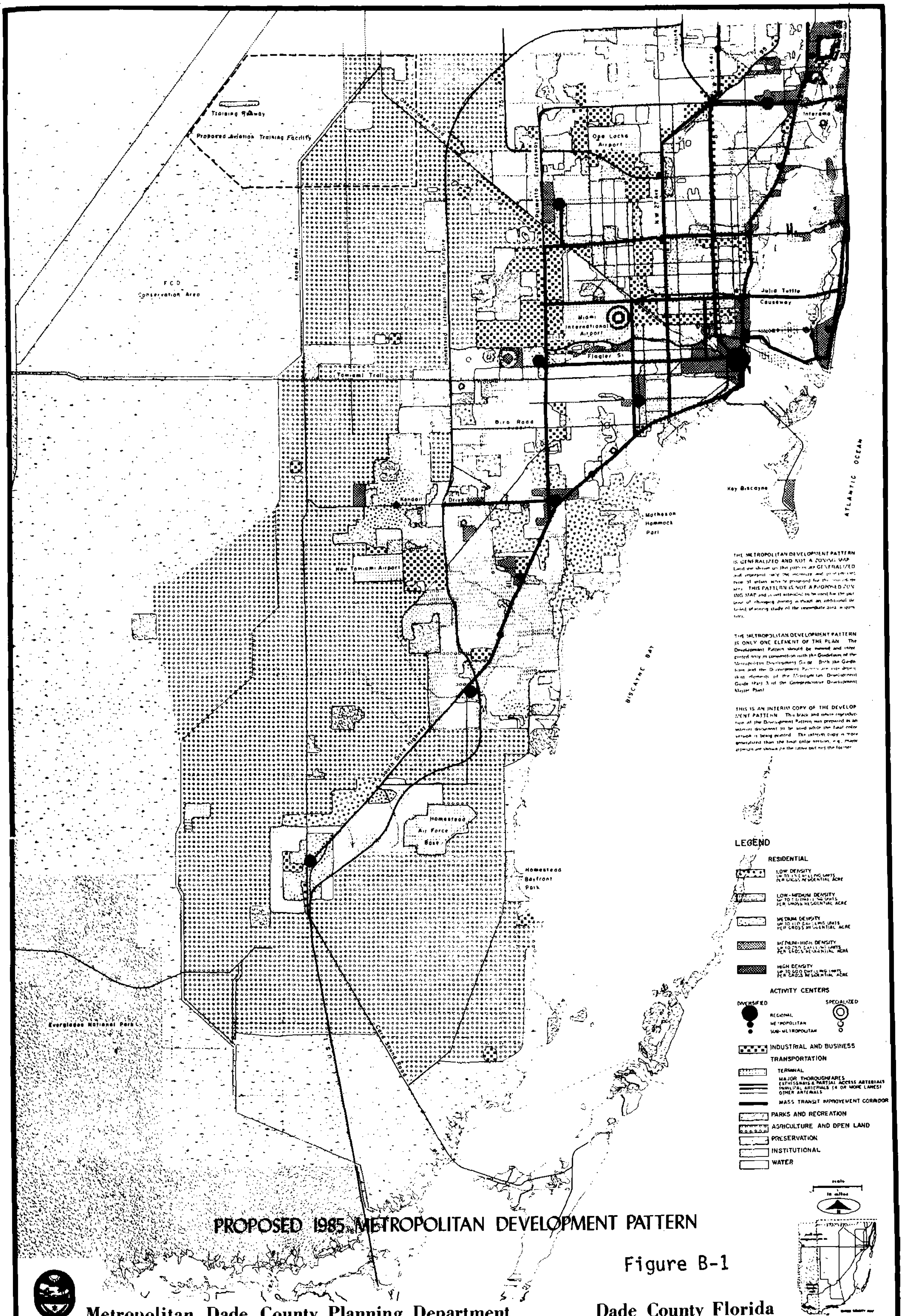
The activity center concept is an extension of the traditional development pattern in the Miami urban area. Urban development is concentrated along the area's eastern coastline, including the Biscayne Bay islands. Development is constrained from westward growth due to the water supply and the necessity for public control of the water recharge areas, the national park lands, and expensive site preparation costs in the Everglades area. Thus population densities are concentrated in already developed areas, or in new sites along the eastern coastline of Dade County based on CDMP forecasts. The transportation system for this urban development pattern has limited the role of new expressways in developed areas, while emphasizng transit's abilities in high demand, high density corridors.

The largest concentration of activities is in the Central Miami area. This concentration includes the County's only regional level activity center as well as two sub-metropolitan centers, and one specialized center in a four square mile area. The Miami CBD as Dade County's regional center and the adjacent Civic Center, a specialized center, will have over 120,000 jobs by 1985, with adjacent centers on Brickell Avenue and Biscayne Boulevard bringing central Miami's employment level to over 200,000 jobs by 1985. Other activity centers, such as Coral Gables, Miami International Airport, and the Miami Beach Business District will continue to be large scale activity centers as they are today. (See Figure B-1). All of these centers would be directly served by the fixed guideway transit system as proposed in the Transit Improvement Program.

The projected population growth for Dade County in the CDMP is based upon the trends of the 1960's and very early 1970's. The total is estimated at 1,735,000 residents for 1985, and 2,050,000 for the year 2000. Tourists account for an additional 10% increase in population for transportation planning. The population estimates will be reviewed during 1976 to see if earlier projections are still viable in light of the large building boom of the 1970-73 period which added over 125,000 housing units in Dade County.

The County has the power to implement this plan due to its charter. Metropolitan Dade County is one of the nation's few regional governments, with unique abilities to coordinate and implement programs for an entire urban area. The County's Metropolitan Charter, initiated in 1957 gives the County overall responsibility for the region's transportation, water, sewer, health care, land use standards, environmental and long-range planning activities. The responsibility for delivering other urban functions such as police, fire, sanitation, recreation and renewal programs are solely the County's responsibility in unincorporated areas, and may be turned over to Metropolitan Dade County by municipalities at their discretion.

The County seeks to use its powers to implement the CDMP as an instrument in regulating the cost and availability of services to its residents, as well as to insure the survival of South Florida's uniquely balanced ecological systems. The County's responsibility to provide water, sewer, transportation and recreational facilities as well as social services for expanding urban population is dependent upon the policies and growth concepts established in the CDMP. The cost of providing these services now is over 500 million dollars annually, and is increasing at a rate faster than other municipal functions. The transportation element of the CDMP, which depends upon transit linkages among the activity centers, becomes the key to shaping the desired urban development pattern, thus allowing a more cost-efficient and equitable distribution of these services than would occur if growth were not so guided. Efforts to deliver all these services in future years without a transit system would add more than 100 million dollars annually to the total cost of service delivery.



PROPOSED 1985 METROPOLITAN DEVELOPMENT PATTERN

Figure B-1

Metropolitan Dade County Planning Department

Dade County Florida

TABLE B-1

CROSS REFERENCE SHEET

Comprehensive Development Master Plan/Transit Improvement Program

Transit Improvement Program Report \ Comprehensive Development Master Plan Element	Part I Metropolitan Development Policies	Part II Environmental Protection Guide	Part III Metropolitan Development Guide
Milestone 1: General System Concepts and Criteria	Sections IV, V	Section VII	Sections II, III, V, VII, IX, X
Milestone 2: Vehicle Technology			Section IV
Milestone 3: Development and Land Use Policy	Sections IV, V		Sections III, IV
Milestone 5: Final Route Alignment		Section VIII	Sections III, VI VII, VIII, IX
Milestone 7: Architectural and Urban Design			Part 2 - All Sections
Milestone 8: Final System Concept			Sections III, IV, V
Final Project Report	Section I		Sections II, IV, VII
Environmental Impact Analysis (E.I.A.) (including revisions)	Section IV	Sections III, V	Sections III, IV, V

RECAPITULATION AND SUMMARY OF THE

COMPARISON OF ALTERNATIVE 3 WITH ALTERNATIVE 22

In the studies leading to the Core System, Alternative 22, in Milestone 5, 14 alternative transit networks embodying different operational concepts were originally formulated for evaluation to arrive at an optimum system. Alternative 3, together with Alternatives 3A and 6, scored well in the qualitative and quantitative evaluations. Alternative 3 made use of the I-95 busway corridor. The east-west corridor from the Miami Airport to Miami Beach, the Miami Beach corridor, the South Dixie Highway/FEC corridor and the Douglas Road corridor, with a short branch to the Civic Center and a busway to Hialeah. Because earlier planning studies had indicated that the Airport-Miami Beach corridor would have high ridership, this corridor, together with Douglas Road and the Civic Center branch was designated to be served by a grade-separated fixed guideway system. Non-grade separated transitways were provided for the South Dixie, Miami Beach and Hialeah corridors. The latter two corridors were conceived to make use of exclusive bus lanes, while light rail operating at grade on the railroad right-of-way was envisioned for South Dixie.

Evaluation of the alternatives showed that Alternative 3 had excellent service characteristics, particularly ridership and accessibility to residences, employment and special activities. Directness of service was only fair, reflecting substantial transfer requirements between the diverse modes. Ratings under the urban planning category were poor to fair. A significant but not unreasonable amount of residential displacement would be required, primarily in the east-west corridor, and business displacement was quite high. The alternative ranked in the medium range in environmental factors generally, although the absence of an elevated fixed guideway in the south corridor caused it to rate fairly well in visual/aesthetic impact. Ratings for energy factors were quite high when compared with other alternatives having grade-separated guideways.

In terms of capital cost, Alternative 3 was by far the least expensive of all alternatives except the null and low cost all-bus options, while operating costs were somewhat higher than those for other high performance options.

Analysis of the system characteristics, specifically expandability, or the potential for increased passenger-carrying capacity, revealed the significant weakness of Alternative 3.

Ridership modeling studies had indicated that Alternative 3 would develop one of the highest riderships of all the alternatives. This together with its relatively low capital cost, made it appear to be an outstanding choice. The forecasting model, however, contained no restraints on system capacity. Along a given route, and with other variables being essentially equal, travel time -- a function of vehicle speed -- was the primary determinant of ridership. With the assignment of relatively high average travel speeds to the south corridor and the I-95 corridor, riderships were generated which exceeded restrained capacity of at-grade light-rail service or busways in these corridors. Thus, while the travel demand and the high levels of service caused projections of high ridership, the operational concepts on these corridors could not cope with the demand.

Enclosure C

If the purpose of the development and analysis of alternatives had been simply to postulate a number of alternatives and to select the best from among these alternatives, Alternative 3 (or 3A or 6, which exhibited similar characteristics) might have been selected, with the understanding that it could not actually meet the demand but would still prove viable up to the limits of its capacity. This would require acceptance of the fact that the system would have to be supplemented with ohter means to meet the substantial but unfulfilled demand, and would not accomplish the goals and policies of the Comprehensive Development Master Plan.

Such was not the purpose of the alternatives formulation, however. Rather it was to develop and test various alternatives to identify those features which could best be combined to develop the optimum system.

Analysis of Alternatives 3, 3A and 6 indicated that their general corridor alignments were the best of all the alternatives but that their weaknesses lay in their technologies which did not permit satisfaction of travel demand. Correction of these weaknesses resulted in the development of the recommended core system (Alternative 22). In the north corridor, with the technology already established by the investment of substantial capital in the I-95 busway, the solution was to provide a second corridor to satisfy the demand. Additional benefits resulted from this solution: (1) Direct service to the Civic Center, a major employment and activity center, and to the Model Cities Area, the most highly transit dependent area of the County, would be provided; (2) direct service would be provided to Hialeah, Dade County's second largest city; and (3) a route would be initiated which could eventually link up with the fastest developing portion of Broward County to the north.

In the south corridor there are no suitable alternative corridors to the South Dixie/FEC corridor, even for supplementary special and express bus service. The solution, therefore, was to upgrade the service on the existing corridor by substituting grade separated rapid transit for the at-grade light rail system to provide required capacity ranges.

Whereas earlier planning studies had indicated that the east-west corridor would be the most intensive, subsequent ridership studies showed that the South Dixie corridor has by far the greatest demand of any, a demand which can be met only by fixed guideway rapid transit. It is this fact also which led to selection of this corridor as the first stage of the transit system.

Upgrading of Alternatives 3, 3A and 6 to eliminate their major deficiencies thus resulted in Alternative 22, the proposed core system.

PRESENT VALUE ANALYSIS

Each of the alternatives evaluated in the EIA has been subjected to a present value analysis at a variety of discount rates. In order to arrive at annual costs for each year between the present and 2020, certain assumptions and modifications regarding the cost data in the evalumatrix were made. These assumptions and modifications are described below. The 1975 dollar values for operating and capital costs are presented in the computer printout pages appended to this exhibit.

General. At UMTA's instructions all capital costs between the present and the year 2020 were developed and included in the analysis. The year of 2020 is 35 years beyond the initial startup date of 1985. Since incremental development stages have not been analysed for each alternative, the common assumption was made that surface bus (and I-95 Busway) only would be operating prior to 1985 under each alternative. That is, the 1975 to 1984 transit system is identical under each alternative, and only its capital cost (not operating cost) was included in the analysis. Starting in 1985 each system was presumed to be fully operational and present value analysis of further operating and capital costs was conducted.

1985 Operating Costs. The last line of the evaluation matrix identifies the operating cost associated with each alternative. Footnote 18 to the matrix notes that "all figures include $22 million for operation of the existing MTA Bus Fleet." While this $22 million was adequate for the 400+ bus fleet operated by MTA in 1974, it does not reflect existing and currently programmed improvements to the bus network. Under current plans, the MTA fleet size will reach 800 buses in the early 1980's. Operating costs for the surface bus system within each alternative have been increased by $21.4 to $23.5 million to reflect this increase.

Annual Operating Costs. Fleet size was increased in accordance with increasing population rates and therefore annual operating costs had to be increased to reflect additional bus miles operated each year. This rate of increase in operating costs was taken to be 8/10 of the rate of increase in population to reflect that 80% of MTA's current costs will vary with miles operated while 20% of the costs are fixed regardless of the amount of miles operated. Every 7th year, this increase was adjusted to indicate major purchases of vehicles which increased fleet size, but decreased miles operated per bus. In a similar fashion, operating costs for fixed rail facilities increased at 6/10 of the increase in population reflecting a smaller variation in total operating cost with the amount of car miles operated. It is important to note that the increases in annual operating costs shown on the printout pages reflect actual $1975 increases caused by increased vehicle miles operated and are in no way indicative of inflation rates or increasing costs of operation due to inflaction.

Initial Capital Costs. 1975 $ capital costs shown in the period 1975 to 1984 are initial capital costs for each alternative plus a constant $64 million projected to increase the surface bus system to 800 buses in 1975-1980. In

Enclosure D

each instance the project capital costs shown on the next to last line of the evaluation matrix were distributed over the years 1980-1984 inclusive by the proportions 10%, 20%, 30%, 30%, 10% consecutively. The year 1980 capital figures are complicated by the addition of the last $7.9 million of surface bus purchases to the 10% of project costs. The 1984 capital figures are complicated by the addition of $28 million of bus replacement costs described below.

Equipment Increase and Replacement Costs. To simplify calculations, it was assumed that bus fleet increases and replacement would occur only once every seven years. One half of the existing fleet would be replaced at that time and the additional buses (required by population increases since the previous purchase) would also be acquired. The surface bus fleet replacements and additions account for $221 million of capital cost in each alternative. Rapid transit vehicles are not replaced during the project period, however, population increases do necessitate the purchase of additional rail vehicles to saisfy demand. These rail vehicle purchases were presumed to occur in the years 1995, 2005, and 2020. Again, all costs for original capital investment and equipment replacement are expressed in 1975 dollars.

The following Table summarizes other major assumptions made in the analysis.

TABLE D-1
PRESENT VALUE ANALYSIS INITIAL ASSUMPTIONS

Population Increase — 1.34% per year 1985-2000; 0.90% per year 2000-2020

Operating Cost (1975 dollars)

Surface Bus:	$1.40/vehicle mile
Core System Bus:	$1.15/vehicle mile
Rapid Transit Vehicle:	$1.30/vehicle mile

Capital Cost (1975 dollars)

Surface Bus:	$ 70,000/vehicle
Core System Bus:	$ 73,500/vehicle
Rapid Transit Vehicle:	$483,000/vehicle

Base System (common to all alternatives): 800 buses
1985 Operating Cost: $44.8 million
1975-1980 Capital Cost: $64 million

(Increments beyond Base System)

Alternative	1985 Vehicle Miles		1985 Vehicles	
	Bus x 10^6	Fixed Guideway x 10^6	Bus	Fixed Guideway
Null	3.478	-	172	-
0	14.248	-	360	-
10	25.217	-	720	-
3	20.696	6.846	550	140
3a/6	8.824	16.681	274	389
8	-	20.567	-	516
22	8.933	15.759	133	320

Present Value Analysis. After operating and capital costs for each year for each alternative were developed, present value discounting for the period 1975 to 2020 was conducted. Discount rates of 4%, 7%, and 10% were considered. The total present value of the operating and capital costs over the entire period is summarized for each alternative in Table D-2.

TABLE D-2
TOTAL 1975 PRESENT VALUE OF ALTERNATIVES
1975-2020

Alternative	Discount Rate 4%	7%	10%
Null	$ 926,989,824	$ 506,807,040	$ 307,600,384
0	1,161,668,350	637,176,320	387,178,752
10	1,799,335,940	1,082,887,680	717,193,056
3	1,723,322,880	1,009,808,130	653,008,896
3a/6	1,868,459,780	1,132,772,100	754,767,104
8	2,116,531,970	1,356,558,590	945,731,568
22	1,960,640,770	1,216,182,530	825,857,792

A useful comparison and somewhat an indicator of cost effectiveness would be the present value per passenger trip for trips made in the period 1985 to 2020 on the various alternatives. This calculation is presented in Table D-3 for each of the various discount rates.

TABLE D-3
TOTAL PRESENT VALUE COST PER TOTAL PASSENGER TRIPS (1985-2020)

Alternative	4%	7%	10%
Null	21.1 ¢	11.5 ¢	7.0 ¢
0	21.6	11.8	7.2
10	17.7	10.6	7.0
3	15.5	9.1	5.9
3a/6	16.7	10.2	6.8
8	20.9	13.4	9.3
22	16.9	10.5	7.1

Examination of these figures leads to the conclusion that either alternative 3 or 3a/6 is the least expensive per trip. However, each of these alternatives has significant links with trip volumes beyond the capacity of the identified modes for those links. Therefore additional capital costs need to be added to arrive at a solution which is feasible from a capacity point of view. This is precisely the process which was used to develop alternative 22 which can now be seen from the table to be the most cost-effective (in terms of total present value costs per rider) among the feasible alternatives.

A large number of other non-monetary factors were taken into consideration in arriving at the Alternative 22 network. None of these has been mentioned in the foregoing analysis. However, consideration of the "best" or most appropriate cannot be properly made without examination of these other factors. See the alternatives analysis presented in the EIA for identification and evaluation of these factors.

COMPUTER PRINT-OUTS

(In the submittals to UMTA on October 15, a computer print-out was inserted at this point in Enclosure D which reflected the results of the computer runs on each of seven alternatives at the 4%, 7% and 10% discount rates, or 21 print-outs. Due to its bulk, this document is not reproduced in quantity but is available for review at the Office of Transportation Administration at Dade County if desired by addressees of this copy of the correspondence to UMTA.)

SUMMARY OF THE ANALYSIS OF YARD AND SHOP

ALTERNATIVES, AND THEIR IMPACT ON STAGE I

Ten potential locations for storage yard and maintenance facilities were considered during the course of the study. These are depicted on Figure E-1. The basic requirements for these facilities are described in the Final Project Report pages 192 to 203 and in somewhat greater detail in Chapter 9 of the Manual of Service and Design Criteria.

A rigorous numerical ranking of the potential locations against evaluation criteria was not performed. This step was omitted because of obvious substantial differences in quality among the condidate sites. The recommended locations were presented to the Citizen Participation Program without alternatives except that Alternative 7 was considered in lieu of Location C.

Criteria used in the evaluation included size, operational compatibility, land use compatibility, likelihood of public acceptance, environmental impact and cost of land. Table E-1 presents a summary of the various factors which were deemed significant in arriving at the final recommendations. Locations A, and C are acceptable in regard to all factors considered.

Location B, which was also recommended, is only barely acceptable with regard to size of site and is likely to be of relatively high Land cost. This site was included because of the necessity to locate proper facilities on the East-West line. It is desireable because of the operational difficulties which would result from storing trains for this line on North-South line locations.

Alternative one is located West of N.W. 27th Avenue adjacent to the site of the Miami-Dade Community College's North Campus. The Comprehensive Development Master Plan (CDMP) for Dade County calls for a high intensity activity center immediately north of the community college and this would necessitate that the location of site 1 be approximately ½ mile West of the Rapid Transit Alignment. Although the site itself is programmed for industrial use, access trancks to the site would pass through the activity center. In other respec-s the site is basically the same as Location A and offers no substantial advantages.

Alternative two has received serious attention even though it is not located directly on any of the Core System Routes. This site is located on a virtually abandoned yard of the Florida East Coast (FEC) Railway north of the Miami CBD. A 1½ mile spur from the State I route would be required for development of this site. The site size is adequate, although not as large as two of the three recommended locations. Land use is currently industrial, however, the CDMP programs an activity center on that location. This fact coupled with the operational difficulties involved caused rejection of the alternative.

Alternative three is located in an area halfway between Downtown and the Civic Center. The area has been partially cleared through urban renewal efforts but several multiple family units still remain. An inner city elementary school is located either on the site or immediately adjacent, depending on the configuration analyzed. Intensive urban development is identified in the CDMP. Primarily on disruption considerations, the Master Plan, and operational incompatibility, the alternative was rejected.

Enclosure E

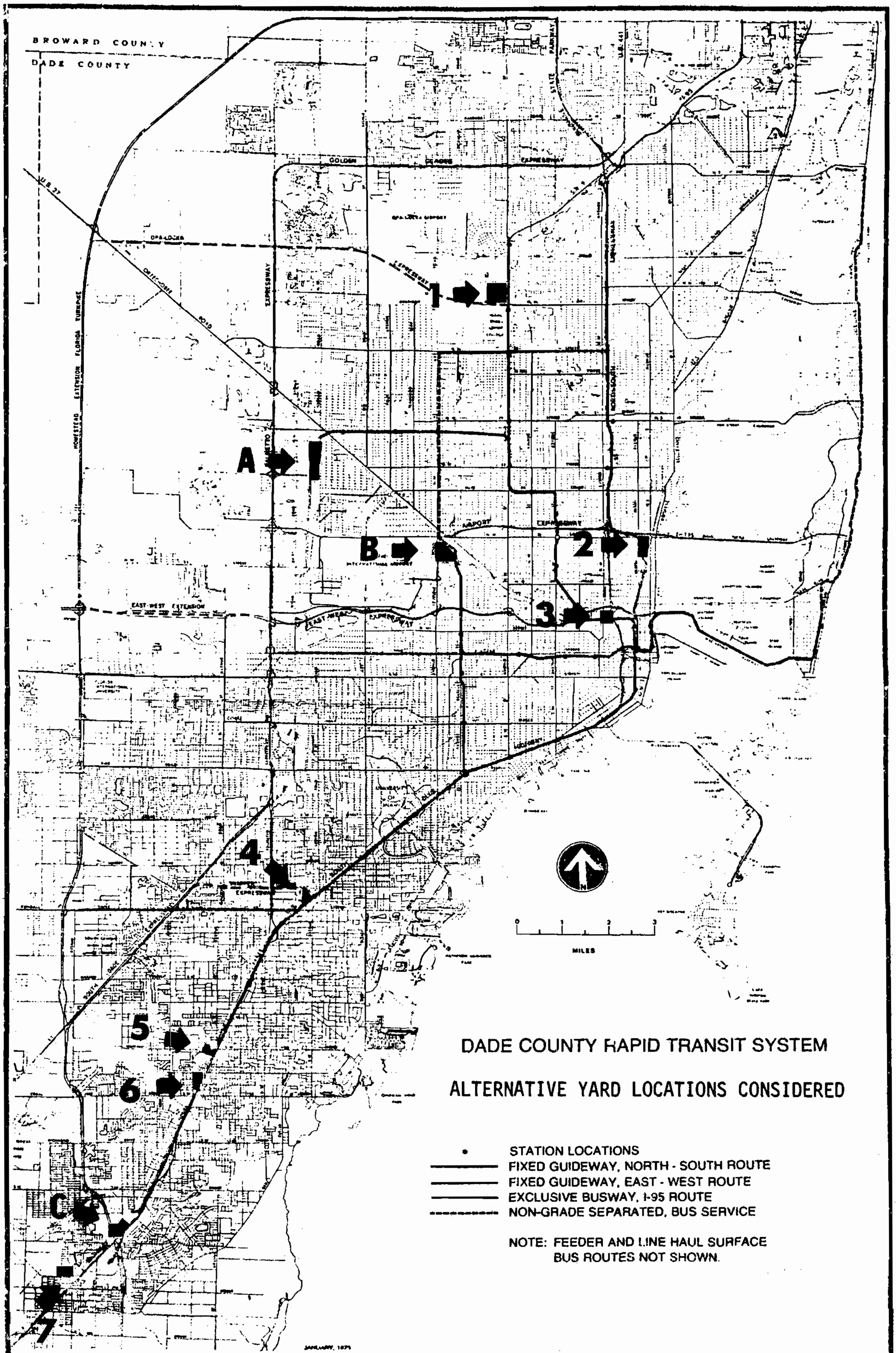

BROWARD COUNTY
DADE COUNTY
GOLDEN GLADES EXPRESSWAY
OPA-LOCKA EXPRESSWAY
U.S. 27
OKEECHOBEE ROAD
HOMESTEAD EXTENSION FLORIDA TURNPIKE
PALMETTO EXPRESSWAY
NORTH-SOUTH EXPRESSWAY
AIRPORT EXPRESSWAY
EAST-WEST EXTENSION
EAST-WEST EXPRESSWAY
SOUTH DADE EXPRESSWAY
1
2
3
4
5
6
7
A
B
C
MILES
DADE COUNTY RAPID TRANSIT SYSTEM
ALTERNATIVE YARD LOCATIONS CONSIDERED
STATION LOCATIONS
FIXED GUIDEWAY, NORTH - SOUTH ROUTE
FIXED GUIDEWAY, EAST - WEST ROUTE
EXCLUSIVE BUSWAY, I-95 ROUTE
NON-GRADE SEPARATED, BUS SERVICE
NOTE: FEEDER AND LINE HAUL SURFACE BUS ROUTES NOT SHOWN.

TABLE E-1

COMPARISON OF

ALTERNATIVE YARD LOCATION

YARD LOCATIONS	SIZE	OPERATIONAL COMPATIBILITY	LAND USE COMPATIBILITY	PUBLIC ACCEPTANCE	ENVIRONMENTAL IMPACT	COST OF LAND	COMMENTS
1.	Good	Good	Fair	Good	Good	Good	Compares with A
2.	Fair	Poor	Good	Good	Good	Fair	Not on line
3.	Fair	Poor	Poor	Poor	Poor	Poor	Much Disruption
4.	Poor	Fair	Fair	Poor	Fair	Poor	Unlikely public acceptance
5.	Poor	Good	Poor	Poor	Poor	Poor	Incompatible land use
6.	Fair	Good	Poor	Poor	Fair	Poor	Incompatible land use
7.	Good	Good	Good	Fair	Good	Good	Compares with C
A.	Good	Good	Good	Good	Good	Good	Selected
B.	Fair	Good	Good	Good	Good	Fair	Selected
C.	Good	Good	Good	Good	Good	Good	Selected

Alternative four is located in a triangle of land bounded by South Dixie Highway, the FEC Railroad, and the proposed Snapper Creek Expressway. The track is immediately adjacent to the Dadeland Activity Center (CDMP), an area containing a regional shopping center surrounded by apartments and condominiums. Although the natural buffers surrounding the site would tend to mitigate adverse environmental effects, this problem is still serious because of the passage of Snapper Creek through the site. Very restricted land area and high cost of land also were factors weighing against selection of this alternative.

Alternative five is located West of South Dixie Highway at Howard Drive (S.W. 136th Street). This area is programed for a sub-metropolitan activity center, and construction work on a shopping center began after initial consideration was made. Because of this work the site is no longer considered a possibility for yard location.

Alternative six is approximately ½ mile South-West of Alternative five and is also located on South Dixie Highway. The site itself is surrounded by single family hones and the CDMP calls for the site to be developed at higher densities. The desireable South Dixie Highway frontage is further enhanced by the location of a Rapid Transit Station at S.W. 144th Street. The primary reasons for rejecting the site area thus incompatible land use, unlikelihood of securing public acceptance, and the relatively high cost of the land involved.

Alternative seven was initially found to be nearly the same as Location C in terms of the criteria considered. It was therefore submitted to the Community Involvement Program during the Milestone 5 deliberations. The results of this process are described in that Milestone, and the result was a recommendation in favor of Location C.

Staging for the Core System was developed after yard locations were established, and the necessity to include a storage yard and maintenance facility in Stage I definitely influenced its length. One suggestion will receive further attention in the future for an alternative Stage I configuration. The southern end of Stage I could be located at some point south of Dadeland. Either the S.W. 112th Street Station or the S.W.144th Street Station are considered potential Stage I terminals. Yard access to this system would then be obtained by construction of the line between the Station at N.W. 27th Avenue (and N.W. 67th Street) and the recommended yard Location A. Depending on the exact location of the southern terminus, this alternative might result in a slightly shorter initial stage.

A COMPARISON OF
METROPOLITAN DADE COUNTY'S
HIGHWAY/LAND CAPACITY DATA

Several studies have analyzed and endeavored to quantify the hidden costs of the car. These include air pollution, energy consumption, congestion, consumption of land, noise and water pollution, accidents, and the exclusion of the poor and other nondrivers from access to transportation. One variable of particular interest is the freeway capacity miles per capita. The following table presents this data.

TABLE F-1 Freeway Capacity Miles Per Capita*

Atlanta	N/A	Milwaukee	.31
Baltimore	.38	Minneapolis	.33
Boston	.43	Newark	N/A
Buffalo	.29	New Orleans	.15
Chicago	.29	New York	.31
Cleveland	.40	Philadelphia	.35
Dallas	1.13	Phoenix	.19
Denver	.32	Pittsburgh	.47
Detroit	.27	Portland	.22
Houston	.75	St. Louis	.39
Indianapolis	.70	San Diego	.60
Kansas City	.57	San Fransisco	.48
Los Angeles	.38	San Jose	N/A
Miami	.16	Seattle	.39

*Defined as the capacity of each mile of single freeway lane divided by the total population.

Source: Preliminary data from the 1974 National Transportation Study and 1970 Census of Population. Municipal Performance Report, Council on Municipal Performance, 1975.

Table F-1 demonstrates that rapid population growth in the late 1960's and geographical location on the periphery of the Interstate Highway System have combined to place Miami in the next to last position on the amount of freeway space available to its populace. Miami's .16 freeway capacity miles per capita is more than only that of New Orleans. Even a doubling of the existing mileage would not bring Dade up to the national average of .41 freeway capacity miles per capita.

This inadequate freeway system (Figure F-1) is naturally overcrowded and currently in many locations operating under unsafe consitions. Table F-2 shows vehicle and capacity conditions for main thoroughfares in Dade County. The worst conditions all occur on the freeway network within the urbanized area. Figure F-2 shows the volume/capacity analysis of the 1985 highway network. As can be seen from the chart these overcrowded conditions are expected to continue into the forseeable future. Figure F-3 shows 1974 locations of high accident occurance in Dade County. The freeway network itself can be seen to be a major source of problems in this regard.

Within the perspective of this congested freeway picture, a network of express buses on the highway system was considered during the synthesis of alternatives prior to Milestone 1. In this synthesis work (see pages 39, 41, and 42 of the Draft Final Project Report.), all expressways in Dade County were analyzed as to the feasibility of provision of bus only landes and the geographic locations of the expressway corridors as such relate to 1985 travel demand. From this work it was concluded that only the I-95 Expressway Corridor was both feasible (from a two lane provision point of view) and useful (from a service and travel demand point of view). Thus a pure exclusive "Bus on Freeway" alternative was not generated for the analysis.

Bus routes do currently operate on segments of the Palmetto, Airport, and Dolphin expressways in mixed mode. It is found that the congested characteristics of these expressways preclude time savings along these routes which are substantial enough to generate significant increases in area wide transit useage levels. Nonetheless new expressways in Dade County are being constructed from designs especially compatible with transit service. The newly opened South Dade Expressway, in particular, incorporates specially designed bus stations and Park-and-Ride lots for use in express commuter service.

In summary, despite insufficient and overcongested expressways, the bus on freeway type of transit improvement has been given particular attention in Dade County. Where physically feasible and useful, it is proposed that expclusive bus lanes be implemented. Where traffic is sufficiently light to allow mixed mode operations, non-exclusive use of the freeway network will be enhanced through the use of the Park-and-Ride lots and wayside bus stations. Unfortunately however, the majority of Dade's freeway network within the urbanized area is too overcrowded to develop adequate mixed mode routes and too much physically restricted to allow for exclusive lane designs.

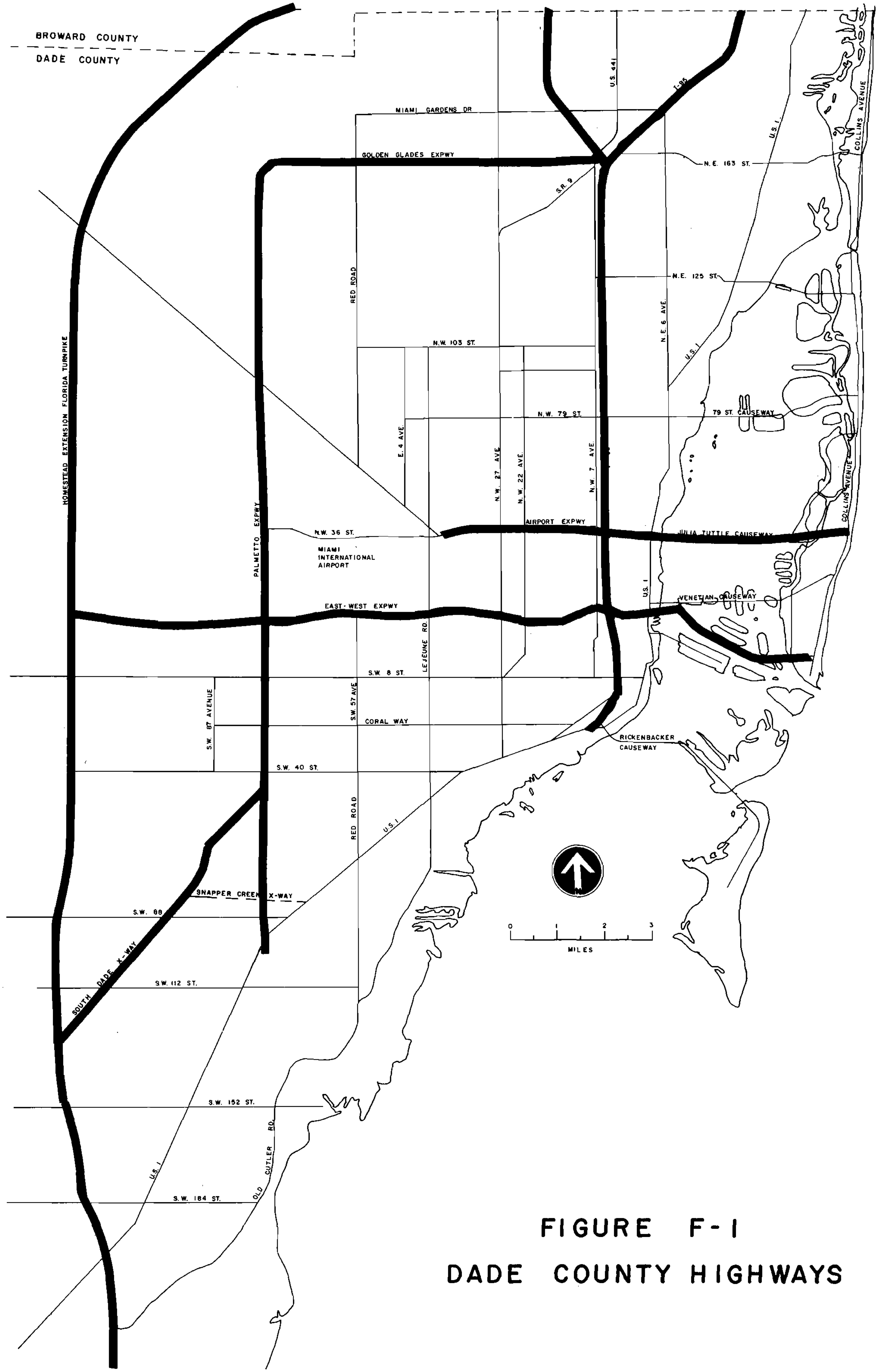
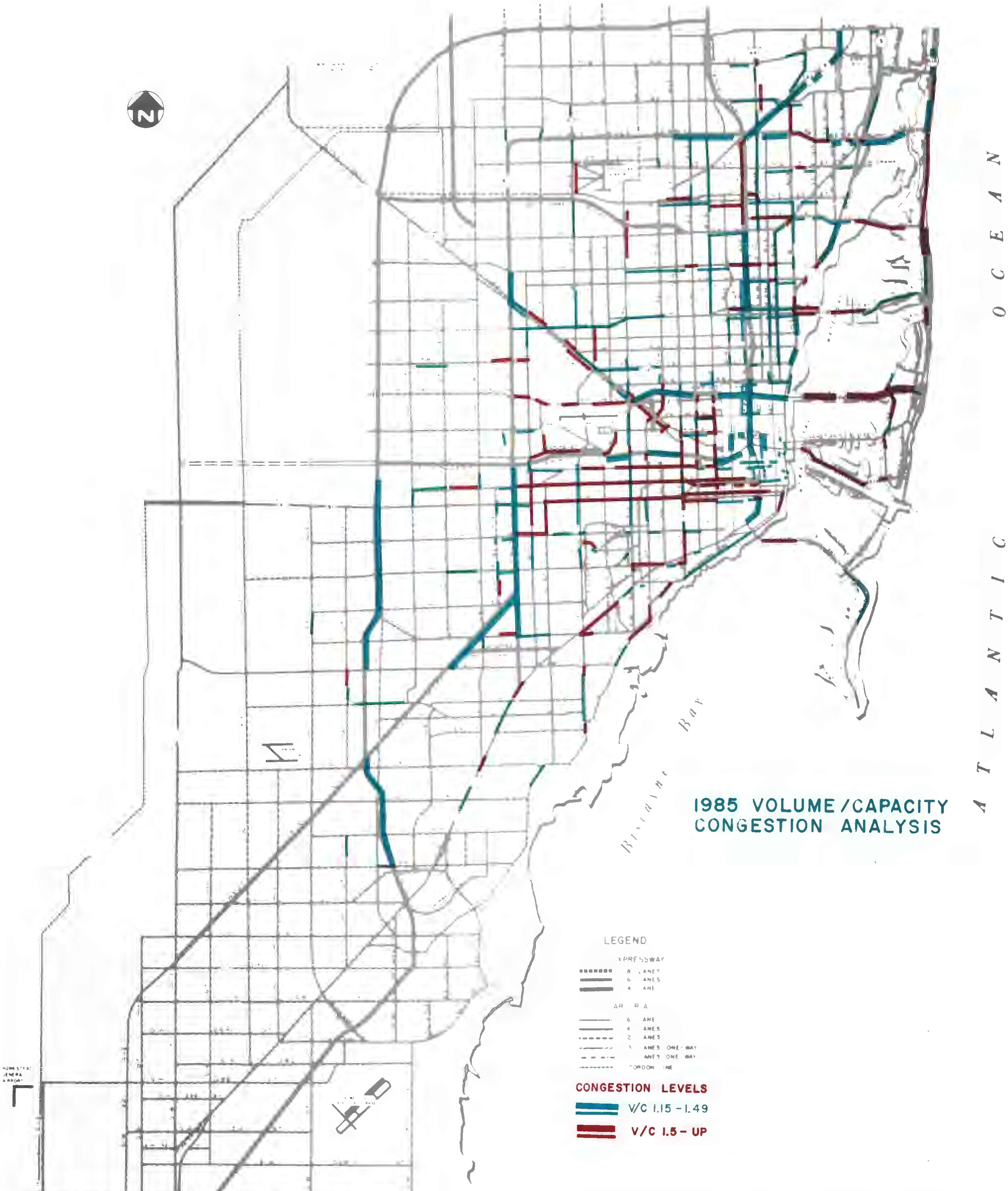
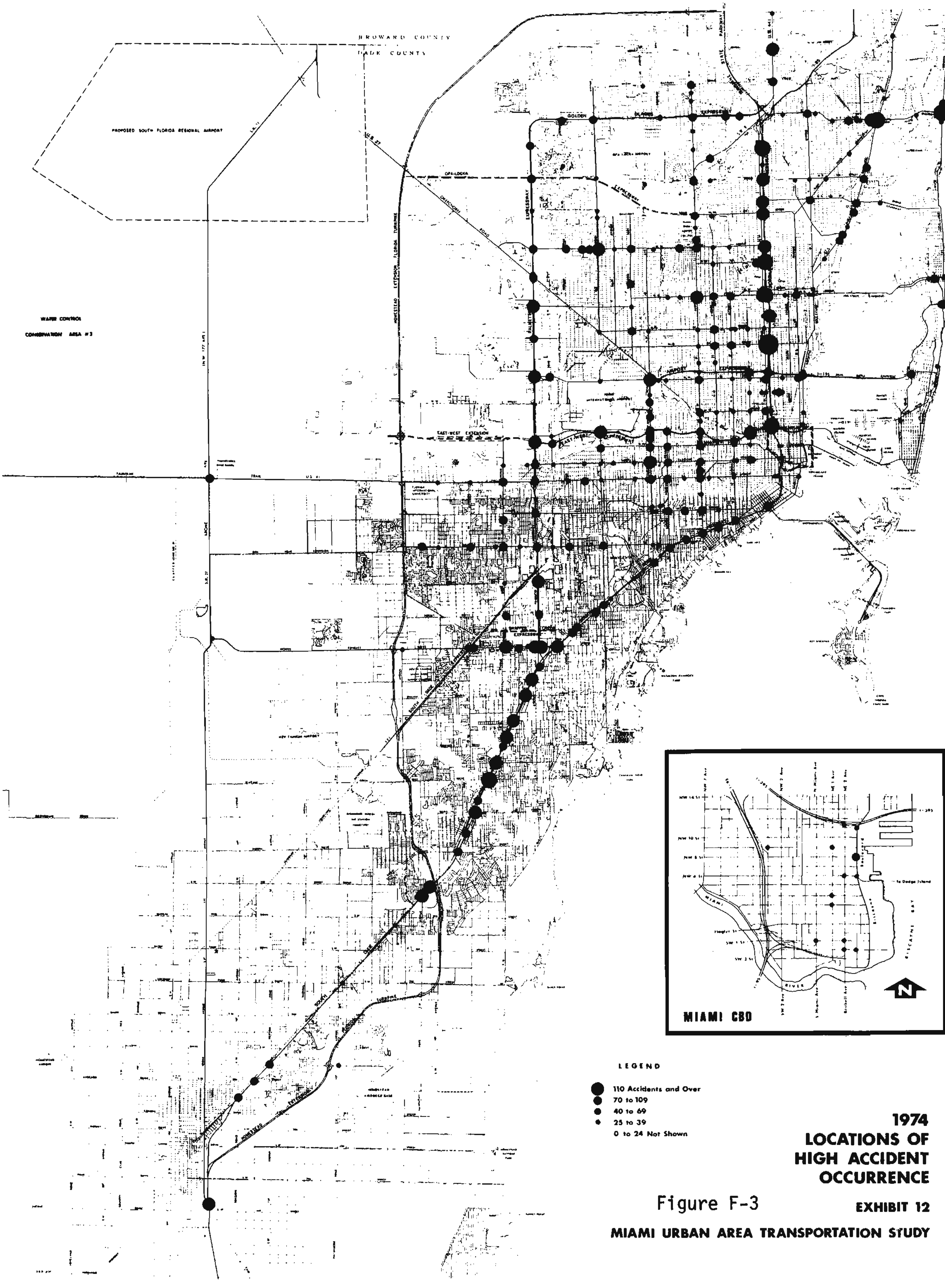


FIGURE F-1
DADE COUNTY HIGHWAYS



1985 TEST NETWORK WITH CONTROVERSIAL EXPRESSWAYS REMOVED

MIAMI URBAN AREA TRANSPORTATION STUDY



1974
LOCATIONS OF HIGH ACCIDENT OCCURRENCE

Figure F-3

EXHIBIT 12

MIAMI URBAN AREA TRANSPORTATION STUDY

TABLE F-2

EXISTING TRAFFIC CONDITIONS
(1974)
AVERAGE DAILY TRAFFIC (ADT)

CONGESTION MAP REFERENCE	ADT VEHICLES	ADT CAPACITY
I-95	182,000	96,000
Palmetto Expressway	101,900	48,000
Dolphin Expressway	N/A	48,000
Airport Expressway	68,700	48,000
I-95 (Julia Tuttle Causeway)	63,300	36,000
MacArthur Causeway	40,400	30,000
Florida Turnpike	22,900	24,000
Florida Turnpike Extension	N/A	24,000
Golden Glades Expressway	71,000	36,000
U.S. 1 - Biscayne Blvd.	34,200	24,000
U.S. 1 - South Dixie Highway	58,100	30.000
N.E. 163 Street	43,600	30,000
N.E. 135 Street	30,900	24,000
Coral Way (S.W. 22 Street)	31,300	24,000
Kendall Drive (S.W. 88 Street)	43,400	30,000
LeJeune Road (N.W. 42 Avenue)	78,100	36,000
Collins Avenue (Fla. A1A)	41,000	30,000
Flagler Street	30,800	30,000
N.W. 36 Street	34,400	36,000
S.W. 8 Street	32,800	30,000

EXPLANATORY NOTES:

Highest Volumes recorded/artery capacity at peak point.
Service at Level C.

PRINTED MAP OF 1985 TEST NETWORK WITH

CONTROVERSIAL EXPRESSWAYS REMOVED - ALTERNATE A

1985 VOLUME/CAPACITY CONGESTION ANALYSIS

(At this point in Exhibit F, a printed map of the Miami Urban Area Transportation Study map indicated above was inserted in Exhibit F and Furnished to UMTA. This was not available in quantity for distribution with the other copies of this correspondence but can be reviewed, if desired, at the Office of Transportation Administration of Dade County.)

OPERATING COSTS & REVENUE ANALYSIS
(Thousands of 1975 Dollars)

Year	Operating Costs			Revenues			Projected Deficit (Surplus)		
	Local Bus	Rapid Rail & Busways	Total	Sched. A.	Sched. B.	Sched. C.	Sched. A.	Sched. B.	Sched. C.
1975-76	30,700	---	30,700	15,350	---	---	15,350	---	---
1976-77	35,880	---	35,880	17,940	---	---	17,940	---	---
1977-78	44,520	---	44.520	22,260	---	---	22,260	---	---
1978-79	48,000	---	48,000	24,000	---	---	24,000	---	---
1979-80	48,000	---	48,000	24,000	---	---	24,000	---	---
1980-81	48,000	28,560	76,560	54,596	75,745	60,779	21,964	815	15,781
1981-82	48,000	28,560	76,560	54,596	75,745	60,779	21,964	815	15,781
1982-83	48,000	35,047	83,047	67,384	92,480	75,248	15,663	(9,433)	7,799
1983-84	48,000	35,047	83,047	67,384	92,480	75,248	15,663	(9,433)	7,799
1984-85	48,000	42,533	90,533	79,353	108,543	89,283	11,180	(18,010)	1,250

Fare Schedules:

Sched. A: 30¢ base fare + 10¢ zone fare; RT and special bus 40¢; local bus 30¢.
Sched. B: 50¢ flat fare, all transit.
Sched. C: 50¢ rapid transit; 30¢ base + 10¢ zone-bus.

NOTES =

1. 1975-1980 costs and revenues are for all-bus operation with numbers of buses increasing from 512 in 1975 to 800 in 1978-80.
2. Stage I of rapid transit becomes operational in 1980-81; Stage II in 1982-83; Stage III in 1984-85.
3. Revenues for rapid transit portion of transit system calculated for 1984-85 from ridership projections for total core system multiplied by assumed fare schedules. Revenues for Stage I and II interpolated from total system ridership.
4. Schedule A is essentially current MTA fare structures. Schedules B and C not considered for all-bus operation 1975-1980.

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