Environmental Planning and Design for Rapid Transit Facilities

Edward C. Muse and Sean T. Stewart, Schimpeler-Corradino Associates, Kaiser Transit Group, Miami
Billy J. Sexton and Stephen R. Beard, Schimpeler-Corradino Associates, Louisville, Kentucky
Abbe Marner, Urban Mass Transportation Administration, U. S. Department of Transportation

The National Environmental Policy Act of 1969 and related environmental laws mandated certain environmental considerations for major federal actions. The principal tool for documenting these considerations was the environmental impact statement. This requirement, interpreted and implemented by each federal agency, has given environmental planning concerning federally funded public improvements, such as transit facilities, its scope. This paper discusses the environmental planning studies and methodologies involved in preparing an impact statement for rapid-transit projects under the Urban Mass Transportation Administration. Emphasis is given to major issues, including alternatives analysis, environmental-impact analysis, and analysis of parklands and historic properties. The primary considerations in each subject area and specific approaches to an analysis that would satisfy the requirements of the National Environmental Policy Act of 1969 and related environmental directives are examined. The Metropolitan Dade County Rail Rapid Transit System is used as an example.

The environmental impact statement (EIS) requirements stem from section 102 of the National Environmental Policy Act (NEPA) of 1969. This act mandates that each federal agency give full consideration to environmental impact as part of its decision-making process and identify and develop methods and procedures to carry out this mandate. To ensure that environmental considerations are an integral part of the federal decision-making process, section 102 requires that all federal agencies

> Include in every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible officials on (i) the environmental impact of the proposed action, (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented, (iii) alternatives to the proposed action, (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Due in part to the broad application for which section 102 was intended, interpretation of the procedural provisions of NEPA has differed from agency to agency. The Urban Mass Transportation Administration (UMTA) as a federal agency has interpreted NEPA's procedural provisions and promulgated guidelines for the EIS process for projects under its jurisdiction.

In addition to the NEPA-mandated planning and before approving any application for funding, UMTA is required by section 14 of the Urban Mass Transportation Act of 1964 to determine that "either no adverse environmental effect is likely to result from such a project, or there exists no feasible and prudent alternative to such effect and all reasonable steps have been taken to minimize such effects." Given these legislative requirements, the scope of this paper involves UMTA's approach to the EIS process. The specific focus concerns the environmental assessment methodologies used to satisfy the NEPA requirements for federal actions, in this case rail rapid transit. Environmental planning for the Dade County (Florida) Rail Rapid Transit Project is used in this paper to illustrate the central issues.

Rapid transit projects have a potentially great effect on an urban area and the natural environment because of their permanence and irreversibility. An EIS is required to enable UMTA (a) to ensure that environmental impacts are adequately considered when planning and designing not only the total project, but also the specific project elements, and (b) to ensure that the social, economic, and natural resource impacts of the project are considered relative to the alternatives available (1). Toward this end, UMTA has developed an EIS sample outline for use on rail projects that evolved from several environmental impact statements, including the Dade County Rail Rapid Transit Project. The Dade County impact statement, developed by Schimpeler-Corradino Associates working in a five-firm joint venture known as the Kaiser Transit Group, fulfilled UMTA's mandate under NEPA.

ALTERNATIVES ANALYSIS

One of the substantive requirements of NEPA is the analysis of alternatives, including the proposed action. Implementing this policy, the regulations of the Council on Environmental Quality (CEQ) for EIS preparation require that agencies explore and evaluate all reasonable alternatives. Environmental impact is intended to be a primary decision-making element. For any action, in this case a transportation improvement program, alternatives to a particular action must be considered. NEPA requires that the decision-making process by which a particular alternative is selected consider thoroughly environmental impacts of alternative actions, including that of no action (the null alternative). The impact statement must document the process by which the analyses have been conducted.

The alternatives-analysis process for the Dade County project was somewhat different from that currently required by UMTA. Prior to EIS development and during preliminary engineering, system alternatives were studied, developed, evaluated, and thoroughly documented in the Environmental Impact Analysis (EIA) for grant application. A complete summary of the alternatives analysis was prepared and included in the EIS. As established by UMTA's Major Urban Mass Transportation Investments Statement of Policy (Sept. 2, 1976), the EIS process now includes alternatives analyses.

Systemwide Selection Process

The first step in the preliminary engineering of Dade County's rapid transit system was the development of systemwide alternatives. Systemwide transportation alternatives were defined as those total transportation alternatives that were consistent with overall transportation goals and objectives and that provide feasible, regionwide solutions to the current and projected transportation needs of an area. These systemwide transpor-

tation alternatives were relatively general in nature, because it was intended that the feasible alternatives would be narrowed to a select set of alternatives before detailed data generation and alternatives analyses would occur.

The planning process used to generate the systemwide alternatives was an iterative one beginning with the early phases of system concept definition through the evaluation of alternative courses of action, to the development of the specific rapid transit alternatives. Evaluations were structured in order to provide a systematic analysis of the opportunities and consequences of each of the several system alternatives considered. The elements and steps used in the planning process fell into 10 general categories: state transportation goals and objectives; develop plan alternatives; define system elements, concepts, and relationships; develop evaluation process; develop evaluation data; develop system alternatives; evaluate alternatives; solicit public response; reassess; and prepare draft of the environmental impact analysis.

The systemwide alternatives presented in the Dade County EIS evolved as a result of investigating various alternative approaches and analyzing inputs from the citizens' participation program and local agencies. The planning was conducted at three levels. At the first level, alternative concepts were developed by the consultant and presented and discussed at 24 public forums. Comments and recommendations were received at each of the public discussions. Following the forums, seven citizens' panels, comprised of the officers of the forums within each panel, met and developed recommendations representing a consensus of the public and panel discussions. During this first level of analysis, 41 alternative concepts were considered. These included alternatives such as null, low capital-intensive alternatives, high capital-intensive alternatives, and combinations of each.

At the second level of analysis (sketch planning), 14 alternatives were identified as worthy of investigation. The process of identifying, defining, and culling the candidate systems alternatives involved the following primary task elements:

1. Preparation of a Miami urban system profile and environmental inventory that included the documentation of demographic, socioeconomic, political, and environmental data and an analysis of these data from the point of view of the influence on transit system design and impact of the proposed system concepts on the environment;
2. Study of existing and proposed land-use patterns and activity centers as developed by the Dade County Planning Department;
3. Visual inspection of candidate rapid transit corridors and routing possibilities throughout Dade County;
4. Preparation of aerial photo maps to allow the synthesis and development of corridor alternatives;
5. 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;
6. Performance of a general soils and utilities survey to establish any major utility relocation requirements and any geologic problem areas;
7. 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;
8. Preparation of preliminary service criteria and standards; and
9. Investigation of a wide range of vehicle technologies and the synthesis of specific operational concepts based on 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. The principal objective of the alternatives analysis effort was to investigate the consequences of implementing low to high capital-intensive systems such as nongrade separated transitways (bus, trolley, or trolley bus), grade-separated busways, and fixed-guideway grade-separated rapid transit.

Evaluation Criteria

The basic evaluation approach used included the following:

1. The establishment of a set of criteria and characteristics deemed appropriate and relevant to the measurement of the desirability of any system alternative,
2. 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
3. The qualitative and quantitative evaluation of each alternative system leading to the selection of a preferred alternative.

To provide a consistent and systematic framework for evaluating the transit alternatives, a set of evaluation criteria was developed. Table 1 indicates the criteria deemed appropriate and relevant. Seven major categories and the subfactors in each category were developed.

Table 1. Evaluation criteria.

Criterion	Weight: Subfactor	Weight: Major Factor
Service		1.54
Projected ridership	2.14	
Directness of service	0.68	
Residential accessibility	0.76	
Employment accessibility	1.00	
Special activity accessibility	0.42	
Urban planning		1.19
Conformance with existing land uses	0.72	
Compatibility with adopted plans and policies	1.53	
Urban design considerations (function, form, scale)	0.75	
Community disruption and displacement		0.91
Residential displacement	1.44	
Business displacement	1.11	
Special disruptions	0.45	
Environment		0.84
Air	1.29	
Noise	1.05	
Water, microclimate, vegetation, and wildlife	NR	
Visual and aesthetic	0.66	
Energy		0.63
Implementation energy	0.51	
Propulsion efficiency	1.03	
Energy savings due to diversion from automobiles	1.47	
System characteristics		0.77
Capacity increase potential (expandability)	0.68	
Network extension potential (extensibility)	0.60	
Safety from accidents	1.36	
Reliability	1.36	
Security		
Cost		1.12
Capital cost	0.74	
Annual operating and maintenance costs	1.26	

Note: NR = not reported.

The subweights show the relative importance of items within each major category. The generation of values or ratings for each criterion for each system alternative was a comprehensive process. This process involved a broad range of analytical techniques and professional judgments based on substantial experience and substantial exposure to and study of the Dade County urban area and transit-planning framework.

Development of the Service Network

The definition of system requirements at the first level and sketch-planning analysis at the second level led to the development of a service network (Figure 1). This development was based on the following:

1. The quantitative evaluation of the original 14 networks developed by the consultant;
2. The unification and quantitative evaluation of the corridor segments contained in all 41 networks developed by the consultant, the citizens' panels, and public agencies;
3. The independent evaluation and analysis of all 41 networks made by a subcommittee of the Transit Advisory Committee, comprised of county commissioners from Dade, Broward, and Palm Beach Counties; the presidents and vice presidents of the seven citizens' panels; appointed county officials; representatives of city, state, and federal agencies; and members of special interest groups; and
4. Conformance with the proposed 1985 Metropolitan Development Pattern of the Dade County Planning Department that shows corridors deemed suitable for mass transit improvements and activity centers within the county.

Figure 1. An illustration of the 1985 service network.

The process described in this section resulted in the development of a number of service corridors that appear to reflect the choice of the citizens' panels and technical, engineering, and planning personnel from the consultant and county organizations. In connecting these corridors 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 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.

Development of the Core System

The final product of the sketch-planning level of analysis was the core system. Numerous alternatives were developed at the first level of analysis; these were evaluated and the viable alternatives were combined during the second level of analysis to form the service network. Additional analyses were conducted to define that portion of the service network that would require grade-separated rapid rail service to meet the projected 1985 travel demands. The core system was defined as the minimum rapid transit network that would sustain an integrated system for the 1985 travel requirements of Dade County.

The extensive analysis of alternatives that led to the development of the service network has provided a basis for the establishment of various objectives that support the definition of the core system. These objectives fall into three categories and are described and discussed here:

1. Service and cost-effectiveness: (a) Accessibility—the core system should be within a 10-min feeder bus ride of 60 percent or more of the 1985 resident population of Dade County; (b) Modal split—the core system should achieve projected ridership of 20 percent or more of the 1985 home-based work trips (80 percent confidence level), plus 10 percent or more of the 1985 nonwork trips (80 percent confidence level); and (c) Radial corridor limitation—grade-separated rapid transit should not be extended to segments of the service network that are projected to carry less than 6000 passengers/h, peak load, peak direction (50 percent confidence level).
2. Engineering and network continuity considerations: (a) Operational viability and expandability—the core system must be operationally viable and capable of expansion to include the entire service network with minimum disruption; (b) Key link inclusion—the core-system network continuity and integrity must be maintained by the inclusion of key links between segments that may not otherwise meet core-system objectives; and (c) Current programs—the core system must include use of the I-95 busway currently under construction (since completed) by the Florida Department of Transportation.
3. Land use and development: (a) Activity center service and reinforcement—the core system should serve the county's principal major activity centers and should promote the reinforcement of such areas; and (b) Conformance with the support of other elements of 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.

Evaluation of Systemwide Alternatives

The third and final level of planning analysis during preliminary engineering involved detailed evaluations of both the core system and the null alternative. The approach

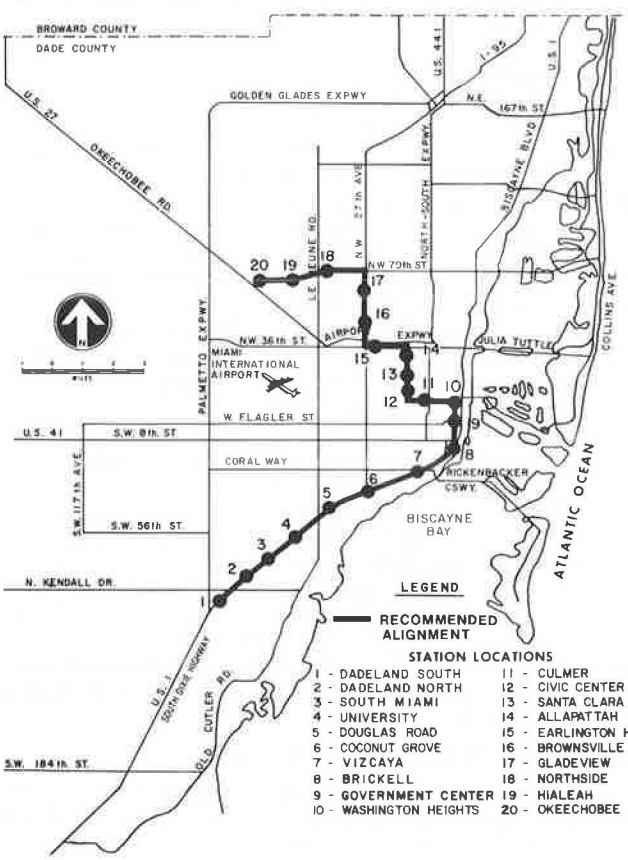
used in this section of the EIS was to provide a comparison between the early alternatives and the core system that was the end product of a long evaluation process. To allow a true comparison of the null, core, and selected systemwide alternatives, all alternatives were measured and judged equally. The details of the core and null alternatives were developed during the final level of planning analysis.

A discussion of a limited set of alternatives, in addition to the core and null alternatives, was presented in the EIS as a summary of the data prepared previously during preliminary engineering. The alternatives selected for presentation reflected the spectrum of alternatives analyzed. They included low- and high-cost allbus alternatives and low-, medium-, and high-cost alternatives containing varying levels of transitway and grade-separated (fixed-guideway and busway) service. A complete description of all alternatives analyzed was published in a separate document and made available to the public.

Stage 1 System

The end product of the preliminary engineering working within fiscal restraints was the definition of the stage 1 or initial-stage system (Figure 2). The route of the system begins in the vicinity of Dadeland, southwest of Miami, and follows northeasterly along the Florida East Coast Railway right-of-way, generally parallel to South Dixie Highway and the central business district of Miami, thence northerly to N. W. 79th Street, and then along N. W. 79th Street through Hialeah to the terminal at the Okeechobee Station, a distance of 32.8 km (20.5 miles). The system is to be a fixed-guideway, heavy rail system. Most of the system is elevated, i.e., 32 km (20 miles), although some sections will be at grade of 0.8 km (0.5 mile). A yard and shop site west of Hialeah and 20 stations are planned for the system. The stage 1 system provides maximum service for funds to be expended and can operate as a complete system or can be extended when additional funds become available, all within the service network. Figure 3 presents a conceptual flow diagram of the phase 2 alternatives-analysis process used to define the first construction increment.

Figure 2. Stage 1 rapid transit system with station locations.



ENVIRONMENTAL IMPACT ANALYSIS

Impact studies focus on the nature and extent to which the natural and human environments will change as a result of the proposed action. They are predicated on a knowledge of existing conditions in the study area—information that would be developed earlier in the EIS process. To determine the level of significance of each environmental impact, the analysis procedures involve comparative evaluation. Predicted environmental impacts are commonly compared to and evaluated on the basis of (a) future environmental quality with and without the proposed project and (b) conformance with adopted standards, plans, guidelines, regulations, and so forth. Probable impacts are usually time referenced, i.e., either short-term (construction) or long-term (operations and maintenance) impacts.

Opinions among professionals and citizens vary as to which issues should be included in an impact statement and how they should be evaluated. The issues discussed here are examples of impact assessments in the UMTA EIS process and are not intended as a complete listing. Issues vary with the type of system and geographic location.

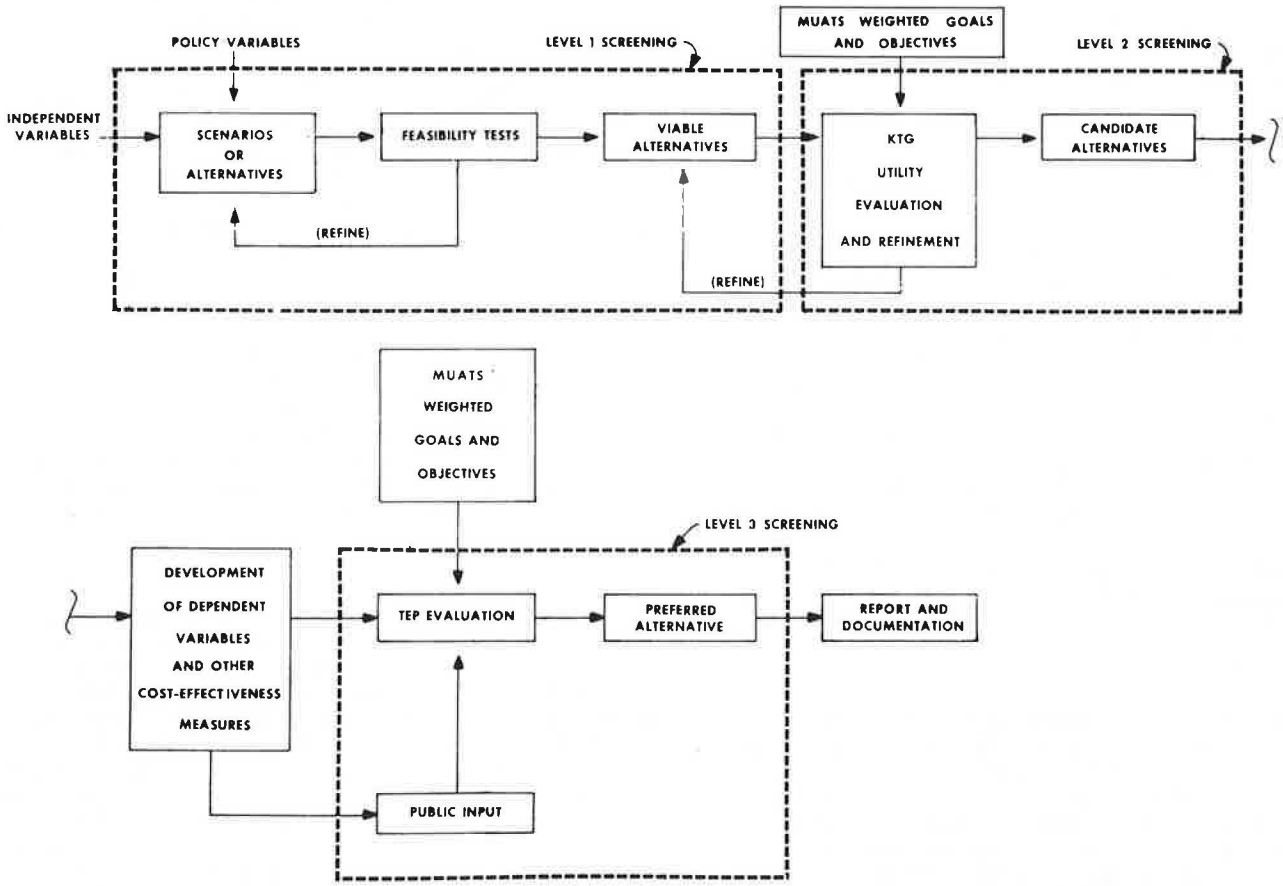
Land Use and Urban Development

The impact on land use and urban development in a study area as a result of the proposed project should focus on the relation of the transportation improvement to current and projected land-use trends and adopted plans and policies. Land-use impact analysis for Dade County's rapid transit system involved considering each project's influence on existing land-use patterns, compatibility with existing plans, and opportunities for new development. The influence on existing land use was presented by discussing what influence the transit system would have on countywide land-use trends, based on the experiences of other heavy rail systems. To determine the compatibility of the system with existing plans, the proposed project was evaluated in terms of how it would support and complement the Comprehensive Development Master Plan adopted by Dade County in 1975. Opportunities for new development were calculated based on the existing character of the land, the probable impact of the transit stations, and the land-use trends in the area.

One of the major issues of the Dade County project was the selection of the yard and shop site. Sites selected along the original proposed stage 1 system became impossible to construct because of strong objections by citizen groups and homeowners. A second study sought sites removed from the original line. Considerations were given to land availability, citizen satisfaction, operational characteristics, environmental impacts, cost to reach the site, patronage additions to the line extension, and other factors. After exhaustive studies, public meetings, consultations with UMTA, and special funding from the City of Hialeah, the 6.4-km (4-mile) extension through Hialeah to the yard and shop was selected and subsequently approved by UMTA.

Mitigation measures for land-use impacts involved a

Figure 3. Conceptual flow diagram of the phase 2 alternatives-analysis process.



discussion of the planning efforts to be undertaken to assist Dade County and the affected municipalities in maximizing the effectiveness of their land-use controls. The Station Area Design and Development (SADD) program, a planning program, was begun in September 1977 to examine in detail land-use planning issues in areas adjacent to and near the transit stations in order to maximize land use. Development would be subject to local control.

Air Quality

The probable air-quality impacts of project implementation are commonly predicted by application of one or more air-pollution-modeling techniques. Based on background data of the study region, models can be used to predict future air-pollutant concentrations for a region as well as specific sites.

To estimate concentrations of nonreactive pollutants (carbon monoxide) for highway traffic in the vicinity of the rapid transit alignment, the EPA HIWAY model was applied. In the analysis, 1- and 8-h average pollutant concentrations at six selected receptor sites along the stage 1 route were calculated. Receptor locations were in high-volume traffic areas. The results were then discussed in relation to Florida's 1- and 8-h carbon monoxide (CO) standards to ascertain the magnitude of impact.

Analysis of predicted CO concentrations also included parking lots for those proposed transit stations with parking facilities. For large-capacity parking facilities, this analysis will be continued in compliance with the Complex Air Source Rule of the Florida Department of Environmental Regulation.

To assess the impact of the rapid transit system with respect to the National Ambient Air Quality Standards and Florida's State Implementation Plan, hydrocarbon and nitrogen oxide emissions from 1970 to 2000, within and without the transit system, were estimated. Emission factors, reflecting the Clean Air Act Amendments of 1977, were calculated based on the EPA Mobile Source Emission Factor Model (January 1978). In addition to long-term impacts, the short-term impacts created by project construction were presented with a discussion of appropriate mitigating measures for the control of air, water, and noise pollution.

Water Quality and Hydrology

Adverse water quality and hydrologic impacts may occur from project implementation. As such, the EIS process requires a thorough analysis of the potential short- and long-term impacts on the water resources of the study area. Depending on the type of project and specific ecology of the locale, emphasis will vary as to the priority of water-quality issues.

Water-quality degradation is the most predominant environmental problem in Dade County because the county is almost entirely underlain by the Biscayne Aquifer at a shallow depth. This aquifer, the primary source of potable water for the county, has an extremely porous surface, allowing run-off pollutants to readily enter the subsurface and degrade water quality.

Analysis of short-term water-quality impacts of the Dade County project in the EIS involved discussion of the potential problems from construction activities. The probable impacts discussed were sedimentation, erosion, spillage of petroleum products, river and canal crossings,

dewatering, and water supply sources. In addition to determinations regarding the probable magnitude of each impact, analysis outlined relevant mitigation measures including retention basins for trapping sediment, temporary erosion-control techniques (grassing, mulching), and grouting to prevent water-table fluctuations during dewatering.

The major, long-term water-quality and hydrologic impacts analyzed in the impact statement were runoff pollution from the increased amount of impervious surface (parking lots), the spillage of petroleum products at various system facilities, and potential impacts to the Biscayne Aquifer from system operations and maintenance.

Each major and minor impact was evaluated in terms of the location and extent of the problem. Separate analyses included probable impacts as a result of system operations in station areas, along the guideway, and at the yard and shop site. The most in-depth analysis was performed concerning the yard and shop, due to the anticipated magnitude of the impact from the activities to occur there. For each water-quality impact delineated in the EIS, appropriate mitigation and control methodologies were presented, emphasizing nonpoint-source pollution-control options, appropriate facility location in relation to water resources, and water supply systems.

Noise Pollution

Implementation of a transportation improvement plan creates a new noise source in the urban environment that can adversely affect communities traversed by it. A noise-impact analysis is then an essential part of environmental planning for rapid transit facilities.

Numerous noise exposure schemes have been developed to evaluate noise from transportation sources and to provide a basis for determining noise-level design goals and acceptability criteria. The noise exposure scheme considered most applicable for rapid-transit environmental planning in Dade County was the maximum permissible single-event noise level. Train noise levels, because of their short duration, may appear acceptable on a calculated exposure-level basis, but due to possible large differences between maximum pass-by levels and average community ambient noise, train noise may be unacceptable. Single-event noise-level design goals avoid masking adverse noise impacts.

The noise impact on the urban environment is dependent on the land-use activities adjacent to the transit improvement. Noise-impact studies should relate predicted wayside levels along transit corridors to land uses traversed. Noise-level guidelines used for train operations in Dade County were those of the American Public Transit Association (APTA). These consider five general categories of community areas: low-density residential, average residential, high-density residential, commercial, and industrial or highway. They also set maximum single-event noise level design goals for each.

Analysis to determine noise impacts of the rapid transit system first involved classification of the land uses along the transit corridor into one of the area categories to set noise guidelines for each route segment. This was accomplished by plotting the transit alignment on aerial photographs and then classifying abutting land uses. Subsequently, overlays with the anticipated noise contours from system operations were added to the photographs. Adverse impacts were identified by comparing the land-use classifications with the anticipated pass-by noise levels. Where noise levels were determined to be in excess of APTA guidelines, sound barriers were recommended to attenuate noise to acceptable levels.

Noise-impact evaluations devoted particular attention to noise-sensitive land uses. Hospitals, schools, parks, libraries, and theaters, for example, are land uses whose activities could be disrupted by excessive noise.

Graphic presentation of noise contours was not included in the Dade County EIS because of the extremely large number of pages required to portray this feature at a meaningful scale. Sound-barrier locations and adverse noise-impacted structures were shown on line diagrams. In addition, a table was prepared to indicate noise impacts above 75 dB(A). Noise contours were available for inspection by anyone visiting the project office.

Socioeconomic Environment

A wide range of social and economic impacts results from transportation improvements. Impact statements should consider both the short-term (direct) and long-term (indirect) effects of project implementation. While relevant socioeconomic issues will vary from project to project depending on its nature, topics that meet impact statement requirements are summarized in this section.

Visual Impact

The nature and extent to which the visual landscape will be altered by a transit project deserves thorough study. Dade County's impact analysis used a rating scheme, developed by professionals in architecture and urban design, to gauge the probable visual effects of the rapid transit system. The process developed required (a) review of the preliminary engineering reports that indicated the design configuration of some of the principal elements of the system, (b) field observation of the transit corridor, (c) the development of typical situations that would occur along the system and the attempt to predict the visual impact of different configurations, and (d) a field survey applicable to typical situations and problem areas. Impacts were divided into eight categories exhibiting a range of impacts that may add to, or detract from, the use of nearby properties. The range of impact included situations in which the transit system would make a positive contribution to the environment or would replace existing negative features and improve the overall visual environment. The design included mitigating measures for situations of negative visual impact. Landscaping of the transit system was part of the design used to present a visually pleasing appearance.

Displacement Impact

A major socioeconomic impact of transit improvements is the displacement of residences and businesses. Environmental planning for rapid transit facilities should involve analysis of the affected residences and businesses and should delineate available mitigation measures.

The information collected and analyzed for the Dade County rapid transit system displacement impact included the number and location of residences and businesses to be displaced; an estimate of the percentage of minority families, low-income families, and elderly; and the median income of those displaced in each impact area. A frequent source of demographic information is the population census of the U.S. Bureau of the Census. However, depending on the date of the census and the level of accuracy required for impact analysis, such data can be inadequate. More recent data can often be obtained from local agencies involved in planning, economic development, housing, and so forth.

The displacement impact on an urban area is dependent on the magnitude of relocation and the ease with which those displaced can be relocated. As such, sources of

replacement housing should be evaluated. For EIS purposes, this evaluation should be of sufficient depth to uncover potential relocation problems. The Dade County EIS also evaluated relocation problems for commercial and industrial properties due to the magnitude of the business impacts.

Mitigating measures for displacement impact are those developed in accordance with the required project relocation plan. Impact statements should discuss those elements of the plan concerning available relocation assistance. The discussion of mitigating measures would delineate applicable federal, state, and local programs and policies for relocation assistance and the services and payments available through them. In addition, the mechanisms by which available assistance will be provided (i.e., relocation program and staff) should be presented.

Community Cohesion

Fixed-facility transit improvements, with appropriate design considerations, can minimize significant disruption of community cohesion and stability. The impact statement should assess the extent to which project implementation would cause neighborhoods to undergo socioeconomic change or create a barrier to existing activity patterns. Particularly important are station areas as the potential for development and redevelopment is strongest in these areas.

Minimal impacts to community cohesion and stability were anticipated in the Dade County EIS as the system will follow established transportation rights-of-way (railroad and highway) in most areas, and the system will be elevated over most of its length, allowing existing activity patterns to continue.

Access to Services and Facilities

The construction of transit improvements, the completed project, or both can affect accessibility to services and facilities. Construction-related effects would include the hindrance of access by such activities as temporary street closings and construction activities. Impacts of the completed project would involve the disruption or obstruction of existing movement patterns from increased traffic volumes in station areas, at-grade system facilities, and permanent street closings.

Dade County's rapid-transit system, almost entirely grade separated, is anticipated to have minimal overall adverse impacts on accessibility. Transit station areas, especially at those stations with large-capacity parking, are anticipated to experience slight impacts from increased traffic volumes, particularly during peak hours. Planning efforts, therefore, have been directed toward maintaining pedestrian and vehicular access through appropriate design considerations.

Safety and Security

This section of the impact statement should discuss those elements of system design, engineering, and operation that will provide for the safety and security of transit patrons. Safety criteria would include, among other provisions, station accidents, boarding and alighting accidents, onboard accidents, collisions, fires, structural failures, and construction accidents. Security criteria would discuss deterrence of criminality, detection of criminal activity, and limitation of injuries and losses due to criminal activity. The information presented in the impact statement should indicate how safety and security goals will be achieved. As delineated in the Dade County EIS, the goals for the project are to be accomplished by developing comprehensive safety and security plans.

Effect on Business Activity

The expenditures for a major transit project and their impact within the general business and industry sector of the study area should be investigated. Discussion would involve the multiplier effect on the regional economy from material, labor, and service purchases. The induced effects on business activity from project construction should be examined and mitigation measures noted.

Effect on Employment

Economic impact analysis of the project would reflect the project's effects on employment levels and employment distribution within the regional economy. The anticipated number of jobs lost from business dislocation and the predicted number of jobs created, both from project construction and operation, should be indicated. Employment distribution would be assessed in terms of how project implementation will reinforce or alter existing employment patterns. For the Dade County EIS, an estimate of employment impact was developed by locating the businesses to be displaced and estimating the number of employees for each business. Results were presented in terms of impact on each employment sector (retail, wholesale, service, manufacturing).

Property Tax Base Impacts

An estimate of the impact to the property tax base from the removal of land from the tax rolls for the system would be included in the economic analysis. For the Dade County EIS, tax displacement was derived by determining the total property value in each municipality and in unincorporated Dade County by adding the assessed value of all parcels to be taken by the rapid transit system. Residential property values were discounted to allow for Dade County's homestead exemption. The appropriate county or municipal tax rate was then applied to derive the tax assessment for residential and commercial property, which were then totaled to find the annual property tax revenue loss.

Discussion of mitigating measures would include the retrieval of revenue loss through various value-capture methods, such as the leasing of space for commercial uses within the project right-of-way and for redevelopment and development of station areas.

ANALYSIS OF PARKLANDS AND HISTORIC PROPERTIES

Section 4f of the U. S. Department of Transportation Act of 1966 mandates that the Secretary of Transportation shall not approve any project or program that requires the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance as determined by the federal, state, or local officials who have jurisdiction over them, or any land from a historic site of national, state, or local significance as so determined by such officials unless (a) there is no feasible and prudent alternative to the use of such land and (b) such program includes all possible planning to minimize harm to the section 4f land resulting from such use. In accordance with this legislation, if a project proposes to take or seriously impact park and recreation lands, a section 4f statement must be prepared that adequately addresses the stated preconditions for the use of such lands. Projects that impact, but do not take section 4f lands, do not usually

require such a statement. UMTA prefers to include a draft statement in the draft EIS and to include the final section 4f statement in the final EIS.

Briefly, statements related to section 4f lands should include the following information:

1. Description of land—type of area, location, size, activities, existing and planned facilities, use, vehicle and pedestrian access, ownership, and title restrictions;
2. Involvement of land—the location and extent of the land to be taken, whether the section 4f land acquisition will be temporary or permanent, the type of facilities that will be built there and on surrounding land, and detailed discussion of the impact of the project on the land;
3. Alternative locations that avoid the section 4f land—these should be discussed in sufficient detail to clearly support a judgment of not feasible or prudent; and
4. Mitigation measures to be used to minimize the impact of the project on section 4f lands.

The planning efforts for the Dade County transit system were directed at the avoidance of section 4f land acquisitions. Beginning in the early stages of system development, such lands were located within the study area, their significance determined by appropriate officials, and the potential impacts, if the land were to be taken, assessed. A statement of section 4f involvement was presented in the draft EIS relating to a proposed land taking for transit station parking at the Hialeah Station. However, subsequent architectural and engineering studies provided an alternative solution to the taking of such land, and a formal statement was not necessary in the final EIS.

Section 106 of the National Historic Preservation Act of 1966 requires that the federal agency with jurisdiction over a proposed federal or federally assisted project shall, prior to the approval of the expenditure of any federal funds on the project, take into account the effect of the project on any district, site, building, structure, or object listed on or eligible for the National Register of Historic Places. The act created the Advisory Council on Historic Preservation that promulgated procedures for the protection of historic and cultural properties to implement the act.

To comply with these requirements the impact assessment process must involve identification of all properties of historical, architectural, archeological, and cultural significance within the project impact area. Although National Register properties are easily identified by consulting the National Register and monthly supplements, eligible properties should be determined by applying the National Register criteria included in the latest advisory council procedures. Eligible properties must be determined in coordination with the state historic preservation officer (SHPO). If the eligibility of a particular property for inclusion in the National Register is questionable, the keeper of the National Register, U.S. Department of Interior, should be consulted for a determination of eligibility. UMTA attempts, in the draft EIS, to identify all National Register and eligible properties and to make a determination of effect for each property. Such determination is accomplished in consultation with the SHPO by applying the advisory council's criteria of effect. If the project will have any effect on National Register and eligible properties, the advisory council's criteria of adverse effect should be applied in consultation with the SHPO. Determinations of no adverse effect must be submitted to the advisory council for review with adequate supporting documentation. The advisory council review was accomplished simultaneously with the draft EIS circulation. The draft EIS documented that the advisory council's procedures had been followed. The close coordination between project planning with the SHPO and UMTA, along with the advisory council, made this process relatively easy.

In compliance with these requirements a survey was undertaken by the Dade County Historic Survey, Department of Parks and Recreation, to locate National Register and eligible properties within the rapid transit system impact area. One problem did develop when the historical and archeological survey team discovered a structure considered eligible for the National Register. This occurred during the draft EIS circulation period. Consequently, a consensus determination of eligibility, a 10-day process, was obtained from the advisory council. This was documented with a special report and later included in the final EIS.

CONCLUSION

The environmental planning issues discussed in this paper are considered major in the development of an EIS for rapid transit facilities under UMTA guidelines. The development of the Dade County EIS was very closely coordinated with UMTA. In effect, it was the result of a three-party effort by UMTA, the Dade County Office of Transportation Administration, and the consultant.

The basic scope of each issue and the impact methodologies presented serve to indicate one approach in fulfilling NEPA and related environmental law considerations for the planning of rapid transit facilities. Because of the nature of the project this EIS will be of benefit to other fixed-facility transit projects. The experiences gained should be helpful in assessing the impacts of similar projects, including downtown people movers.

REFERENCE

1. U.S. Department of Transportation, Office of the Secretary. Procedures for Considering Environmental Impacts. Federal Register, Vol. 39, No. 190, Sept. 30, 1974.

Publication of this paper sponsored by Committee on Social, Economic, and Environmental Factors.