FINAL REPORT

Cleveland Dual Hub Corridor Transitional Analysis

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EXECUTIVE SUMMARY

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- Selection of the Preferred Investment Strategy
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S.1 INTRODUCTION

The Dual Hub Corridor is focused around Euclid Avenue with University Circle representing one hub at the eastern end and Downtown Cleveland representing the other hub at the western end (Figure S-1). The Dual Hub Corridor is one of the oldest areas of Cleveland. Having undergone redevelopment a number of times, the corridor is once again in transition, as Cleveland solidifies its economic position in national and world markets. The City's growing legal and financial sectors have concentrated in the Downtown, and major medical and educational institutional activities are found throughout the corridor. Increasing economic activity has instigated significant actions by the community to improve the corridor infrastructure. Over the years, the Greater Cleveland Regional Transit Authority (GCRTA), as the major transit provider in the corridor, has been studying ways to improve transit services in the area.

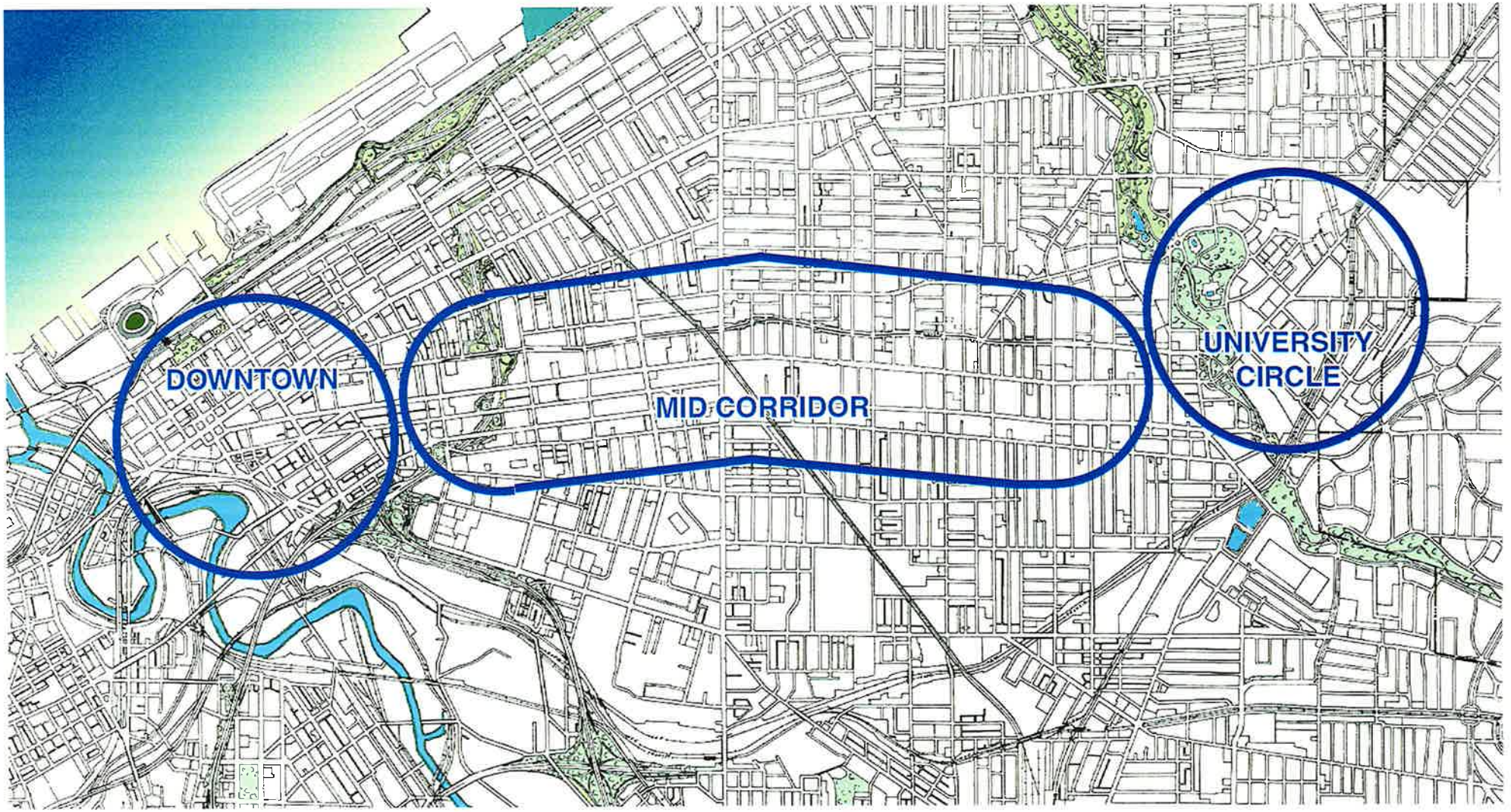
Focused attention on congestion and travel problems in the Dual Hub Corridor was initiated with the *Dual Hub Corridor Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS)* project undertaken in 1988. The AA/DEIS produced an evaluation of ways to improve public transportation between the Cleveland metropolitan area's two largest employment centers–Downtown Cleveland and University Circle. The following alternatives were evaluated:

- A **Null, or "Do Nothing," Alternative**, which included no actions to change the existing or planned transit system operated by the GCRTA;

- A **Transportation System Management (TSM) Alternative**, which included a package of lower cost improvements to upgrade existing bus and rail transit services; and

- Several **Rail Alternatives**, which included various schemes for relocating GCRTA's Red Line to serve the concentration of business and institutional development located along Euclid Avenue between Downtown Cleveland and University Circle.

Since preparation of the AA/DEIS, a new planning approach initiated by the Federal Transit Administration (FTA) permits potential federal grant recipients to identify, define, and adopt a locally Preferred Investment Strategy (PIS) without direct Federal supervision. Potential projects coming out of the regional comprehensive planning process are to be refined and evaluated at the local level. Implementation of this new framework for planning requires extensive, coordinated agency action and seeks to guide communities in developing "multimodal" solutions



CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure S-1

STUDY AREA

PLANNING SUBAREA SEGMENTS

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to regional mobility problems. Integrated environmental analyses must be conducted as well as modal trade-off analyses. Effective cooperation and coordination with the many diverse interest groups becomes vitally important during the evaluation of alternatives and development of a consensus plan, i.e., adoption of the PIS.

The work activities relating to the AA/DEIS narrowly focused on transit solutions. The Transitional Analysis, initiated in the Fall of 1993, focuses, in part, on updating the understanding of modal travel patterns in the Dual Hub Corridor and evaluating a subset of multimodal transportation solutions. This study also satisfies the Federal Major Investment Study (MIS) requirements.

This Final Report summarizes the results of the Transitional Analysis, particularly the evaluation of alternatives and the selection of a preferred investment strategy (PIS). The PIS will be advanced to preliminary engineering (PE) for more detailed definition, examination, and analysis. Physical, operating, environmental, and cost aspects of the PIS will be examined in detail during the PE phase. Detailed environmental studies, including identification of mitigation measures, will be fully documented during PE and preparation of the Environmental Impact Statement (EIS).

S.2 PURPOSE AND NEED

The Dual Hub Corridor encompasses the metropolitan area's two largest employment centers with businesses, institutions, and public agencies providing jobs for 160,000 people. Neighborhoods along the corridor are home to 83,000 people. In addition, a large number of visitors are attracted to many of Cleveland's most important religious, cultural, educational, medical, government, and social service institutions located in the corridor. Since the streetcar days of the early 1900's, the number of people riding public transportation on Euclid Avenue has been the highest of any street in the Greater Cleveland area.

Although both extensive rail and bus service are available between Downtown Cleveland and University Circle, 95 percent of the 128,000 daily transit trips in the Dual Hub Corridor in 1988 were served by GCRTA's bus transit system. This is mainly due to the existing high capacity Rapid Transit service providing only indirect service to the corridor's two hubs.

The need for transportation improvements is based on a number of factors. The existing street network, particularly in the downtown area, creates constraints on the amount of bus service that effectively can be provided during peak periods. A more efficient distribution system through Downtown Cleveland would also reduce automobile and bus traffic resulting in less traffic congestion and producing improvements in air quality. The existing Red Line service is underutilized, which adversely affects transit operating performance and efficiency. Because most transit riders use buses traveling on congested city streets, significant travel time savings are generally not realized by users of public transportation. The extensive bus service provided in the Dual Hub Corridor to meet the high demand for public transportation represents a significant portion of GCRTA's annual operating expenses. Relocating the existing Red Line service between Downtown and University Circle from the sparsely populated railroad corridor to Euclid Avenue would permit GCRTA to reallocate current expenditures for resource-intensive bus services.

In addition, the Red Line, which was constructed at minimal cost in a railroad corridor in the 1950's and 1960's, is distant from both residential and high density commercial activities. It, therefore, is not supportive of desirable land use patterns in the corridor and impedes regional

accessibility. A major investment in public transit will help to focus private development activities and promote the long-term economic and social viability of the corridor. The City of Cleveland and corridor organizations and institutions have been actively involved in identifying and defining alternatives evaluated during the AA/DEIS and as part of this Transitional Analysis. Proposed improvements in public transportation would contribute to the development potential of the area from Downtown Cleveland to University Circle. The opportunities would be enhanced for allowing higher densities of office, retail, residential, and institutional development in the corridor. Higher density development would improve the viability of public transportation by increasing its competitive position relative to the private automobile.

S.3 DESCRIPTION OF ALTERNATIVES

The alternatives examined in the AA/DEIS and others were reviewed when the Transitional Analysis was initiated. For the Transitional Analysis, a Null (do nothing) Alternative, a Bus/TSM Alternative, and several rail alternatives were evaluated. Each is summarized below. Chapter 3 provides further details about the alternatives considered.

S.3.1 Null Alternative

The Null Alternative is defined as including only "minimal changes" to existing bus and rail services provided by GCRTA. It essentially reflects planned, programmed, and committed improvements already adopted by GCRTA. As such, the Null Alternative is the baseline for all transit service alternatives defined within the context of the Transitional Analysis. The bus transit system will remain similar to today's system supplemented by short-range improvements defined in GCRTA's *Service Management Plan* (SMP) for implementation by 2000. Included in the SMP are five service development projects to enhance park-and-ride (P&R) opportunities.

S.3.2 Bus/TSM Alternative

The Bus/TSM Alternative encompasses a host of concepts and actions directed toward enhancing the effectiveness and efficiency of the community's existing transportation facilities and services. Therefore, the Bus/TSM Alternative, encompasses a package of relatively aggressive physical and operational improvements to upgrade existing bus and rail services, with particular emphasis on the Dual Hub Corridor and, especially, Euclid Avenue. The Bus/TSM Alternative defined for the Transitional Analysis includes a significantly lower level of investment in physical facilities than defined within the context of the AA/DEIS process. Although proposed improvements would demand less capital and operating resources than those associated with the rail alternatives, they still would require substantial funding commitments. Specific improvements to the bus and rail transit systems are included in all alternatives. The "package" of bus transit improvements defined for the Bus/TSM Alternative reflects the new service concepts identified in GCRTA's *Transit 2010 Long Range Plan*. Implementation of this package of services will require expanding the bus fleet of 768 vehicles established for the Null Alternative to 827 vehicles.

Both non-corridor and corridor improvements are planned under this alternative. Non-corridor improvements include: development of transit centers and P&R lots; improvements and modifications to existing bus routes; new Expressway Flyer service; and Community Circulator service. Within the corridor, service would be enhanced for select routes and major capital

improvements would be constructed along Euclid Avenue to improve bus travel times. Improvements and changes to the existing Red Line Rapid Transit service would principally take the form of station relocations; however, some facility improvements (e.g., structure and line modification or rehabilitation) would be undertaken, and some service changes would occur. Rapid Transit service on the Waterfront Line, an extension of the Blue and Green Lines, is also a part of this alternative.

S.3.3 Rail Transit Alternatives

Services and costs for rail alternatives considered within the framework of the Transitional Analysis range from extension of the Red Line to the Playhouse Square/CSU area to potential full integration of Red/Blue/Green Line Rapid Transit service on Euclid Avenue. Six distinct rail transit alternatives ultimately were defined for engineering and planning analyses. Four were established as defining the bounds of various options available for implementation in the Dual Hub Corridor and are summarized in this section.

All rail alternatives have several features in common. New rail transit service would be provided on a double track system with power provided from overhead wires as found elsewhere on GCRTA's rail network. Each alternative includes both at-grade and subway segments. Modifications to the GCRTA bus transit network would be implemented to take advantage of (1) additional, focused bus transit services and more efficient bus operations (i.e., synchronized signals) or (2) new rail transit facilities that provide accessibility by Rapid Transit service to new areas of the community. All rail transit alternatives include Blue/Green Line service to the Waterfront. No new maintenance and storage facilities would be required for any of the alternatives. Existing facilities are more than adequate because the existing Rapid Transit fleet is greater than needed for current and proposed operations. The four alternatives evaluated in this report are described below.

- **Alternative 3A - Downtown Red Line Extension** represents a means of providing additional Rapid Transit access to Downtown Cleveland. This alternative also would serve the function of a Downtown "distributor", by continuing east from Tower City Station and intercepting bus patrons arriving at the new CSU Transit Center on the express and flyer routes. Direct Rapid Transit service would be provided to the East 9th Street/Euclid Avenue office/commercial concentration, the Playhouse Square District, and CSU.

- **Alternative 3B - Downtown Rapid Transit Relocation Alternative** represents a means of providing full Rapid Transit access to Downtown Cleveland through the relocation of the existing Rapid Transit alignment from a point just east of East 30th Street to Tower City Station. Direct, through Rapid Transit service would be provided to the east downtown area (East 9th Street/Euclid Avenue commercial district; Playhouse Square District; CSU/Cleveland State Convocation Center) and the St. Vincent Quadrangle (St. Vincent Charity Hospital; Metro Campus of Cuyahoga Community College; and Main US Post office facility). All Red, Blue, and Green Line service would be routed along this new alignment. All Rapid Transit service would be discontinued on the N&W RR cut between East 30th Street and Tower City.

- **Alternative 4A - Huron/East 9th Subway/Euclid At-Grade/Euclid At-Grade** represents the relocation of all Red Line service to Euclid Avenue. Revenue service would be discontinued on the existing Red Line section from Tower City to Euclid Avenue/East 120th Street. All trains serving the Tower City/Windermere Route would use the new Euclid Avenue alignment.

- **Alternative 4D - Huron/East 9th Subway/Euclid At-Grade/East 107th At-Grade & Shaker Connector** represents a scheme to provide fully integrated regional Rapid Transit service with respect to the Dual Hub Corridor. This alternative (like the others) principally proposes relocation of the Red Line to serve Euclid Avenue, providing a direct link between Downtown and University Circle. However, regional accessibility would be enhanced through linkage with Blue and Green Line operations to Shaker Heights.

S.4 EVALUATION OF ALTERNATIVES

A comparative evaluation of alternatives with respect to ridership forecasts, capital cost estimates, operating and maintenance cost estimates, environmental impacts, and financial feasibility was conducted for the purpose of informing local, State, and Federal decisionmakers of the benefits, costs, and potential impacts of each alternative.

The goals and objectives adopted for the Transitional Analysis were the basis for defining criteria to be used in measuring the performance of each alternative. The degree to which an alternative satisfies the adopted goals and objectives indicates the potential for its acceptance by the community and the likelihood of its implementation. The decision at hand focused on the selection of a PIS. Selection of a PIS will permit GCRTA to continue the Federal project development process.

S.4.1 Decision Framework

The alternatives defined for the Transitional Analysis were reviewed first by an inter-agency staff level technical group. The evaluation process then involved the InterAgency Task Force established for the study. Feedback from the InterAgency Task Force was used as guidance with respect to the need to perform additional analyses, clarify study findings, or modify adopted conclusions. The study's findings and conclusions then were subject to review by various community interests and constituencies. During the course of this review, GCRTA conducted public meetings to present the findings and conclusions in this report and solicit feedback regarding the preferred alternative.

S.4.2 Transit Trips

Table S-1 presents the forecasts of "linked" trips for each alternative. Linked transit trips count all travel from the point of origin to the point of final destination as a single trip, whether or not a transfer occurs enroute. That is to say, the individual segments of a transit trip involving transfer are "linked" to reflect one complete trip. The number of linked trips provides an estimate of how many people use the system.

Table S-1 RIDERSHIP FORECASTS

Alternative	Null	TSM	3A	3B	4A	4D
Daily Linked Passenger Trips[1]	148,141	151,905	154,117	154,984	156,716	155,469

[1] Ridership estimates include programmed Blue/Green Line service on the waterfront extension.

S.4.3 Potential Economic Development Impacts

Direct economic effects in the corridor can be assessed by determining potential changes in the levels of economic activity relating to construction of the project and subsequent changes in land use and property development patterns. Table S-2 shows data that reveals the forecast economic development effects of the various alternatives.

Table S-2 ECONOMIC DEVELOPMENT IMPACTS

Performance Measure	Alternative[1]					
	Null	TSM	3A	3B	4A	4D
Daily Linked Work Trips[2]	78,207	80,545	81,075	81,333	81,896	81,217
Direct Expenditures[3]	Neg.*	$66,212	$253,897	$328,702	$443,689	$458,038
Total New Construction Jobs (Person Years)[4]	Neg.	251	992	1,281	1,738	1,792
New Commercial Development (Millions of Sq.Ft.)	3,780	3,930	4,190	4,285	5,435	5,345
New Residential Development (Units)	1,015	1,120	1,270	1,270	1,460	1,450

* Negligible.
1 The analysis assumes the baseline scenario only. The alternative development scenario evaluation is presented in the appendix.
2 Ridership estimates include programmed Blue/Green Line service on the Waterfront extension.
3 Direct outlays in local area (i.e., Corridor), region, and State during construction phase in $1,000s of 1994 dollars.
4 "Person years" represents any one person employed full-time at any job for one full year.

Long-Term Development Opportunities

Three measures were identified, investigated, and defined which reflect the opportunities to bring about the economic development potential described above. The opportunity for forming public/private partnerships to support project development was defined in a general manner for each alternative. The potential for direct, independent private sector participation in the development and financing of proposed improvements also was investigated. The third area of

concentration was opportunities for participation in project development by small and disadvantaged business firms. Qualitative conclusions relating to these three measures of economic development opportunity are discussed below.

Private/Public Partnership

Opportunities for private and public development actions essentially would be unchanged from today, if the Null or Bus/TSM Alternatives were implemented. However, with favorable economic conditions and supportive local land use policies, the rail alternatives can support higher densities of office, retail, and residential development. Such polices can be tied to efforts to promote private/public partnerships in the development of transportation services and facilities in the corridor. Opportunities would be greater for the Euclid Avenue Rapid Transit Alternatives because system services would affect a larger population, and there would be more stations. Rapid Transit stations present good opportunities for joint development and create a concentration of personal movements that can be favorable to business development in the vicinity of the station sites.

Private Sector Financial Participation

The Null Alternative would have a negligible impact on private sector participation in transportation because there would be no physical development actions. The Bus/TSM Alternative would produce minimal private sector participation because it focuses on enhancing current conditions rather than creating new opportunities. Limited joint development actions would be possible with implementation of one of the rail alternatives. This joint development could take the form of direct contributions to the construction of transit facilities (specifically stations) or assessments on adjacent property that benefits from the investment in and activity associated with transit facilities.

The administration of joint development planning and programming could produce a significant contribution to project costs. In addition, there would be tax benefits associated with the development of permanent, major rail transit facilities. The less ambitious Downtown Relocation Alternatives would have the potential to generate about $2.6 million in additional annual tax revenue, while the more extensive Euclid Avenue Rapid Transit Alternatives potentially would yield about $7.6 million in incremental tax benefits annually.

Small and Disadvantaged Firm Participation

Small and disadvantaged business firms (e.g., contractors, engineers, suppliers, etc.) are afforded the opportunity to participate in all GCRTA development projects through normal contracting and procurement procedures. This would be true for all alternatives under consideration. However, project development actions, such as those anticipated with the alternatives, would provide additional opportunities for these types of firms to offer and sell products and/or services to GCRTA or firms contracting with GCRTA to perform architectural, engineering, and construction work. The total capital cost of each alternative and the estimated new job potential was used to establish the potential magnitude of participation.

The Null Alternative would offer no additional potential for economic growth by small and disadvantaged firms, because no major expenditures over and above the level already planned or programmed are anticipated. The Bus/TSM Alternative does not represent a major capital outlay nor is it expected to stimulate a large number of new jobs. Therefore, this alternative

would be expected to have only a minimal positive impact on the economic activity of small and disadvantaged firms in the corridor and region. The opportunities for participation by small and disadvantaged firms would be from 3 to 4 times greater than the Bus/TSM Alternative with implementation of Alternative 3A. Opportunities under Alternative 3B would be about five times greater than the Bus/TSM Alternative. Positive economic benefits associated with the Euclid Avenue Rapid Transit Alternatives would be very similar, increasing the value of potential opportunities by 6 to 8 times that of the Bus/TSM Alternative. Alternative 4D would be slightly better than Alternative 4A, because it would involve greater capital investment.

S.4.4 Capital and Operating and Maintenance Costs

Cost is very important to any project. Therefore, it is important that the evaluation include the consideration of the costs of proposed transit improvements in the corridor against expected benefits and related impacts. Both short-term capital costs and long-term, continuing operating and maintenance (O&M) costs must be considered. Relating the costs with the benefits of the project, in terms of increased ridership and/or mobility improvements, reveals the cost-effectiveness of proposed alternatives.

There are numerous components to project cost for any particular alternative. The two basic or principal components of project cost are: capital construction costs (both total and annualized) and long-term and continuing annual O&M costs (Table S-3).

Table S-3 ESTIMATED PROJECT COSTS[1]

Performance Measure	Alternative[2]					
	Null	TSM	3A	3B	4A	4D
Total Capital Cost	–	$113,619	$365,028	$577,910	$675,948	$749,560
Annualized Capital Cost	–	$10,371	$31,302	$49,483	$57,532	$64,159
Annual O&M Cost	$183,054	$194,070	$199,294	$199,470	$198,780	$199,178

[1] 1,000s of 1994 Dollars.
[2] The analysis assumes the baseline scenario only. The alternative development scenario evaluation is presented in the appendix.

S.4.5 Cost-Effectiveness

Rather than attempt to measure all benefits of a major transit investment, FTA recommends using a few measures to assess a wide range of transportation and other benefits associated with a project. The direct benefits of a major transit investment are improvements in travel time and increases in transit ridership over that provided by the Bus/TSM Alternative. The comparison is made with the Bus/TSM Alternative because cost-effectiveness must include expenditure to gain a benefit, and the Null Alternative does not include a major capital expenditure. Other indirect benefits, such as improved mobility, reduced congestion, and less air pollution, are consequences of the travel time and ridership changes.

Accordingly, FTA has defined two cost-effectiveness indices. FTA's first index-- *Cost per User Benefits*-- uses travel time savings as the measure of a project's benefits, and the second index-- *Cost per New Transit Rider*-- uses new additional transit riders.[1] Under current procedures, FTA uses the Cost per New Transit Rider Index (which is easier to compute) to rate transit projects proposed for Federal funding assistance. However, the Cost per User Benefits Index is useful for gauging the direct travel benefits of a transportation improvement proposal relative to the funds required to build and operate the service. Therefore, the values for both types of indices have been calculated. The Cost per New Transit Rider index has also been calculated for only the Federal portion of the cost. In addition, a fourth index of cost-effectiveness was computed, the *O&M Cost per Rider*. The values for these indices are shown in Table S-4.

Table S-4 COST EFFECTIVENESS INDICES

Performance Measure	Alternative[1]					
	Null	TSM	3A	3B	4A	4D
Cost per User Benefits[2]	--	--	$20.78	$25.73	$16.67	$31.94
Total Cost per New Transit Rider[2]	--	--	$28.26	$40.97	$31.07	$49.51
Federal Cost per New Transit Rider[2]	--	--	$11.84	$18.92	$14.05	$23.30
O&M Cost per Rider ($/Linked Trip)	$4.30	$4.61	$4.52	$4.49	$4.44	$4.48

[1] The analysis assumes the baseline scenario only. The alternative development scenario is presented in the appendix.
[2] 1994 Dollars.

S.5 SELECTION OF PREFERRED INVESTMENT STRATEGY

The selection process for the PIS was initiated with public and agency review of the evaluation results and solicitation of comments. Following this review and comment period, the PIS was adopted by the GCRTA Board of Trustees. The decision of the GCRTA Board was based on the findings and conclusions arising from the evaluation of alternatives. The GCRTA Board then forwarded its decision to the Northeast Ohio Areawide Coordinating Agency, the regional planning body, for action. The NOACA considered the decision of the GCRTA Board and approved a resolution adopting the PIS, as required by the regulations issued by the FTA and FHWA for Statewide and Metropolitan Planning.

[1] Refer to Final Evaluation of Alternatives Methodology Report, pp. 5-8.

S.5.1 The Preferred Investment Strategy

The PIS selected for implementation by GCRTA and adopted by NOACA would provide for improvements to bus service both inside and outside the Dual Hub Corridor. Major capital improvements along Euclid Avenue would also be provided. In addition, Rapid transit service would be improved. An alternative development scenario to the PIS, which includes additional station development, is being considered by the GCRTA. The additional development would occur as a result of the implementation of the Empowerment Zone in the Mid Corridor subarea. An evaluation of this alternative is presented in the appendix. For purposes of this report, the PIS discusses the baseline scenario (without the additional development). This is being done to be consistent with Federal planning practice. A description of the physical and operational aspects of the PIS is provided below.

Physical Description

The Bus/TSM Alternative (or the PIS) represents a minimum action plan to improve transit service throughout the region. Outside the Dual Hub Corridor, non-rail transit centers and P&R facilities will be built. Within the Corridor, major capital improvements would take place along Euclid Avenue as a means to improve bus travel times. Computerized signal progression would be installed on Euclid Avenue between East 22nd Street (CSU) and East 118th Street. Therefore, buses operating on Euclid Avenue would realize travel time savings through efficient signal progression. Other improvements include new sidewalks, curb and gutter, paving, signs, and striping between Public Square and East 118th Streets. New bus shelters would be installed at twenty locations on both sides of Euclid Avenue.

The PIS includes and reflects Rapid Transit service on the Waterfront Line. The Waterfront Line would operate as an extension of the Blue and Green Lines. Certain physical improvements to the trackage and structures of the Rapid Transit system are also included in the PIS. In addition, four stations currently served by the Red Line would be relocated.

Operations Description

Implementation of the PIS would involve operational modifications and additions to the bus and rail transit systems both within and outside the Dual Hub Corridor. With regard to buses, non-corridor improvements include nine additional community circulators, in addition to the Lee-Harvard Community Circulator included in the Null Alternative. They will connect residential areas to transit centers and higher capacity main line bus and rail service.

Bus-to-rail/rail-to-bus transfers at existing Rapid Transit stations will be enhanced through bus route modifications. Several bus routes would be modified within the framework of the Transit 2010 Long Range Plan. Nine routes would be modified to serve new transit centers. In addition, six new express/flyer bus routes are proposed; these will operate on a 30 minute headway during the peak periods. Details regarding these routes and their locations may be referenced in the Operations Plan Report.

Within the Dual Hub Corridor, the Euclid Avenue express and flyer routes would continue to operate. Stops would occur only at major activity centers, such as Cleveland Clinic. The Cedar Routes (32CX, 32SX, & 32WX), which presently use Carnegie, will be routed to Euclid Avenue to take advantage of the signal progression.

Service on Route 6A (Euclid Avenue) will be improved in the A.M. and P.M. peak periods to compensate for the operating restrictions on express and flyer service. The combined service of Route 6A (Murray Hill/CWRU) and Route 6 (Windermere Station) will result in 5 minute local service along Euclid Avenue.

Red Line Rapid Transit service would remain routed in the same manner as today (i.e., Windermere-Tower City-Airport). The Red Line would operate on a 12 minute headway, during the A.M. and P.M. peak periods. Rapid Transit service would be provided via the proposed Waterfront Line which would operate as an extension of the Blue and Green Lines. Alternate Blue/Green Line trains would be routed through the Tower City Station to the Waterfront, during the peak periods. All Blue/Green Line trains would continue on to the Waterfront during the nonpeak periods. It is anticipated that nine rail vehicles must be purchased and added to the Blue/Green Line fleet to serve the Waterfront Line. This represents an expansion of the total rail fleet from 64 to 73 vehicles, including the Red Line Rapid Transit fleet. The acquisition of these vehicles would be accomplished within the framework of the Waterfront Line extension project.

S.5.2 Capital and Operating and Maintenance Costs

Capital and operating costs were estimated for the transit capital facilities and services to be provided within the definition of the PIS. The cost estimates reflect conceptual engineering and understanding of the principal structural and system elements. Additional design detail developed during Preliminary Engineering will provide a basis for refining the accuracy and reliability of cost estimates.

The estimated cost to construct required facilities and acquire necessary system control and operating equipment and vehicles for the PIS is approximately $114 million. The largest cost component would be for the purchase of buses, accounting for about $15 million in capital costs. The total cost of construction is estimated at approximately $43 million. Non-construction costs include the costs associated with right-of-way and lease agreements and engineering and management services. These costs are estimated to be approximately $23 million. In addition to these costs, the cost estimate includes $13 million in contingencies, $25 million for escalation, and $10 million in project reserves.

Operating and maintenance (O&M) costs for the PIS were estimated, using a disaggregate and resource build-up methodology, in accordance with Federal Transit Administration procedures for alternatives analysis and major investment studies. Total annual O&M costs for the PIS would be approximately $194 million. The bus transit system would account for about $138.14 million, or 71 percent of total operating costs of the PIS.

S.5.3 Project Financing Plan

A project financing plan was developed to support implementation of the PIS. The financial plan incorporates analyses performed during the evaluation of the selected alternative and subsequent review of funding availability and commitments. It identifies the revenue sources that can be tapped to cover the estimated capital and O&M costs and the commitments and assumptions associated with those sources.

Existing Revenue Sources

Several revenue sources are available to GCRTA for financing the capital development and continuing operations costs of the PIS. Existing revenue sources are identified in the following discussion, which includes critical assumptions regarding funds availability.

Operating revenues for the project would be derived from five sources:

- Fares - Fare revenue yield (fare revenue per hour of service) was assumed to grow at the rate of inflation adjusted every other year. To the extent fares inflate at a greater rate of inflation, there would be a loss of ridership. Conversely, fare growth that is less than the rate of inflation will result in some ridership gain. A fare elasticity of -0.30 was assumed for all transit services.

- FTA Section 9 Funds - Annual operating funds from this source are assumed to decline from the current level of $9.0 million to zero by fiscal year 1999.

- Advertising Revenues - Revenues were assumed to grow with ridership at the current rate of advertising revenue per passenger. As service and ridership grows, advertising revenues will also grow.

- GCRTA Sales Tax Revenue - Current GCRTA projections of tax revenues in 1995 are used as the baseline. Long-term projections assume sales tax revenue will grow at 5.0 percent per year. According to GCRTA's 1992 annual report, sales and use tax revenues grew at an average annual rate of 5.8 percent between 1983 and 1992. GCRTA bonds legally have the first lien on dedicated sales tax revenue. However, it is assumed the size of the debt would be within the constraints of sales tax revenues less operating subsidy requirements.

- State Operating Assistance - The current level of ODOT operating assistance was assumed to continue (with no inflation). ODOT elderly and disabled assistance was assumed to continue. The State fuel tax reimbursement was assumed to grow with the level of service and with inflation.

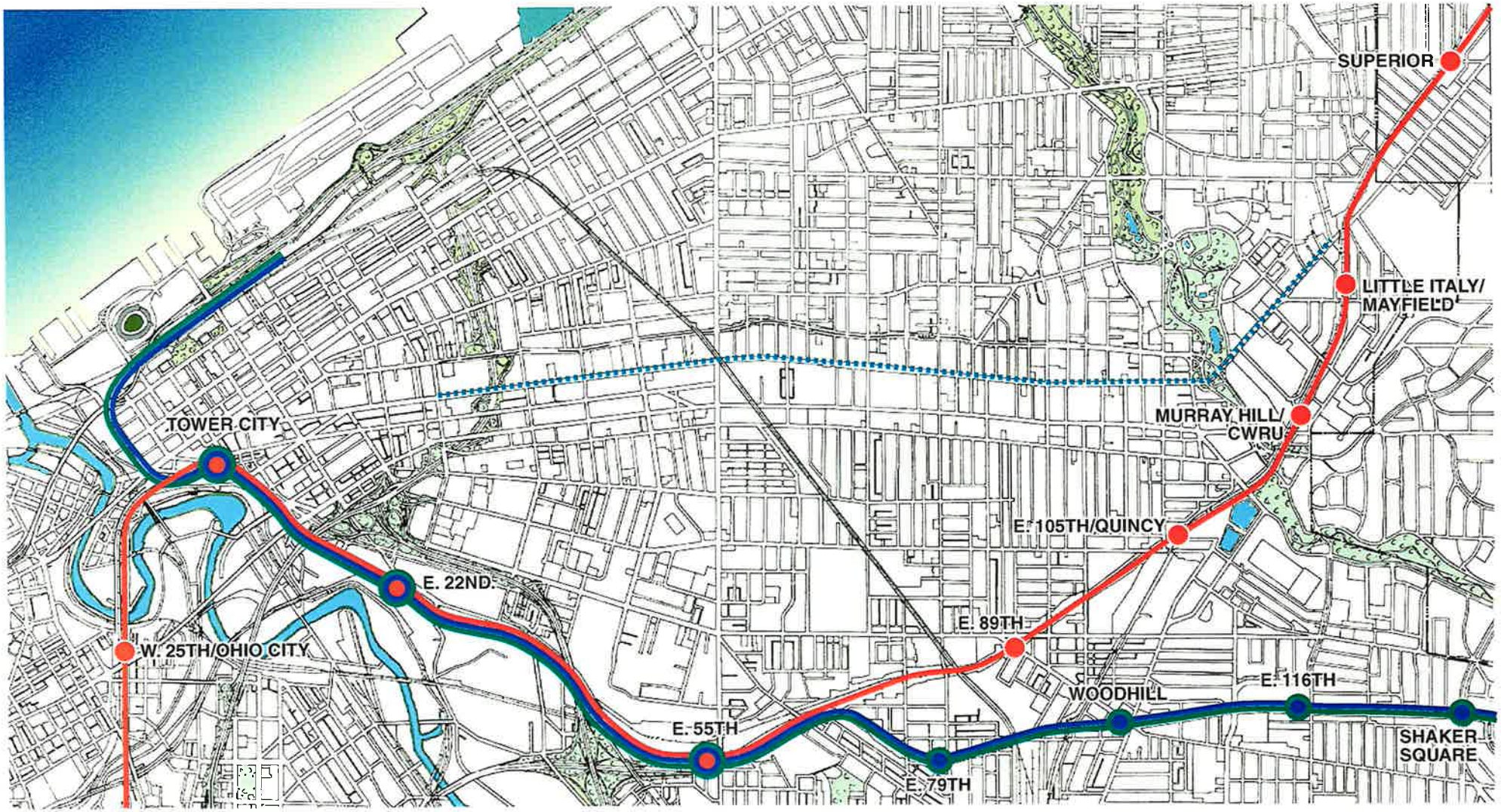
Revenues to construct the project would be derived from the following five sources:

- Section 3 New Starts (Rail) Discretionary Funding - This source was assumed to fund 50 percent of the capital cost. Funding for the project is considerably lower than the federal match for similar projects.

- Section 3 Bus Discretionary Funding - The current federal statutory maximum of 80 percent of the cost for buses and bus-related non-fixed guideway facilities was assumed to be available.

- FTA Section 9 Funds - The historic annual level of Section 9 capital funding is assumed to remain constant at $9.4 million per year and will not inflate.

- GCRTA Sales Tax - All of the proceeds from the one percent sales tax, less operating subsidy needs, would be available. The long term debt can be financed through a first lien on sales tax revenues. The Authority's bonded debt per capita has declined between



CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure S-2

PREFERRED INVESTMENT STRATEGY

RED LINE
BLUE LINE
GREEN LINE
DEDICATED BUS LANES
STATION

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1983 and 1992 from $30.07 to $16.55. Similarly, the ratio of bonded debt to assessed value has decreased from 0.33 percent in 1983 to 0.11 percent in 1992. However, the projected level of indebtedness for the PIS would exceed GCRTA's debt ceiling, but would still be within the Authority's statutory maximum debt limits.

- State Capital Grants - Ten percent of the first phase of the rapid transit project and zero percent of the second phase would be funded with state resources. In addition, ODOT resources are assumed to fund ten percent of bus purchases and other capital projects.

Financing Strategy

In a detailed assessment of financial feasibility, funding requirements for both the capital and O&M costs are compared to projected revenue from existing sources of funds and potential revenue from new funding sources. The indicator of financial feasibility for any given project, then, is the funding surplus or deficit that would result from construction and long-term operation. If a deficit is projected, additional revenue requirements and sources must be identified. The likelihood of success in securing additional, new revenue sources (e.g., referenda, local legislation, state legislation, etc.) must be identified to assess financial feasibility. Where existing and potential new sources of funds are not sufficient, the project is deemed to be financially infeasible.

The results of the financial analysis indicate that GCRTA will have the financial capacity to undertake the transit investment. To finance the Bus/TSM Alternative, bonds will need to be issued between 1995 and 2008 in order to undertake the Waterfront Light Rail Line and to maintain sufficient working capital until GCRTA can contain its operating costs. The amount of annual carry-forward resources from the sales tax appears and begins to grow in 2015. Prior to 2015, resources are primarily required to cover the cost of operations and, to a lesser extent, debt service and capital needs.

S.6 PROJECT IMPLEMENTATION

There are several steps to be completed from this point in order to advance the PIS for the Dual Hub Corridor. The Transitional Analysis, along with the AA/DEIS completed in 1993, satisfies the requirements for a major investment study. The outcome of an MIS is the selection of a preferred investment strategy for the corridor or area being studied. Selection of a PIS effectively satisfies the conclusion that further, more detailed, PE work is justified and necessary. The majority of technical issues differentiating the alternatives and affecting feasibility up to this point did not require the level of analysis associated with PE to form reasonable conclusions. Consequently, the Transitional Analysis necessarily leaves a number of technical issues unresolved, anticipating the potential for advancement into PE.

A capital grant application will be prepared by GCRTA and submitted to FTA. A copy of this Final Report will accompany the application. The grant application will request that FTA approve advancing the PIS into PE and grant funds for the next level of engineering efforts.

FTA approval of the grant application will permit GCRTA to initiate the preliminary engineering phase of the project development process, which will provide the framework for resolving outstanding issues. Specific attention will be given to refinement and finalization of the design of improvements along Euclid Avenue; station, transit center, and P&R lot location and design

issues; refined cost estimates and financial plan; and bus operations plans. Additionally, in compliance with the NOACA Resolution, the feasibility of extending the Waterfront Line to tie into the PIS alignment will be evaluated during PE.

The purpose of PE is to further refine the selected alternative so that detailed cost estimates can be prepared. PE takes the project approximately to the 30 percent level of design. With the more detailed cost estimates that come out of PE, a revised financial plan can be prepared. Additionally, comprehensive environmental impact assessments are conducted in order to identify potential adverse impacts and design appropriate mitigation measures.

At the end of PE, a decision will be made whether or not to proceed with final design and construction. The decision will be based upon the information produced in PE, especially the environmental impacts, the capital and O&M costs, and the financing plan. It is only after all involved parties have formally agreed to financial participation that the project can move ahead. Simultaneously with the PE work, GCRTA will prepare a Supplemental Draft Environmental Impact Statement (SDEIS), and a Final Environmental Impact Statement (FEIS). With the preparation and publication of the FEIS and certain other administrative actions on the part of FTA, GCRTA can proceed into the Final Engineering/Final Design and then Construction/Implementation phases of project development. A summary of the overall Project Implementation Schedule for the project is presented in Figure 7-1.

1.0 INTRODUCTION

1.0 INTRODUCTION

1.1 PROJECT BACKGROUND

The Dual Hub (Euclid Avenue) Corridor is one of the oldest areas of Cleveland (Figure 1-1). Consequently, it has undergone redevelopment a number of times, as the city expanded from a mercantile town in the 1800s to the modern, industrial city it is today. Large areas of the corridor were cleared in the 1960s as part of urban renewal programs to revitalize Downtown Cleveland office and housing markets and encourage further development of University Circle. Today, this corridor is once again in transition, as Cleveland solidifies its economic position in national and world markets. The City's growing legal and financial sectors have concentrated in the Downtown and major medical and educational institutional activities are found throughout the corridor.

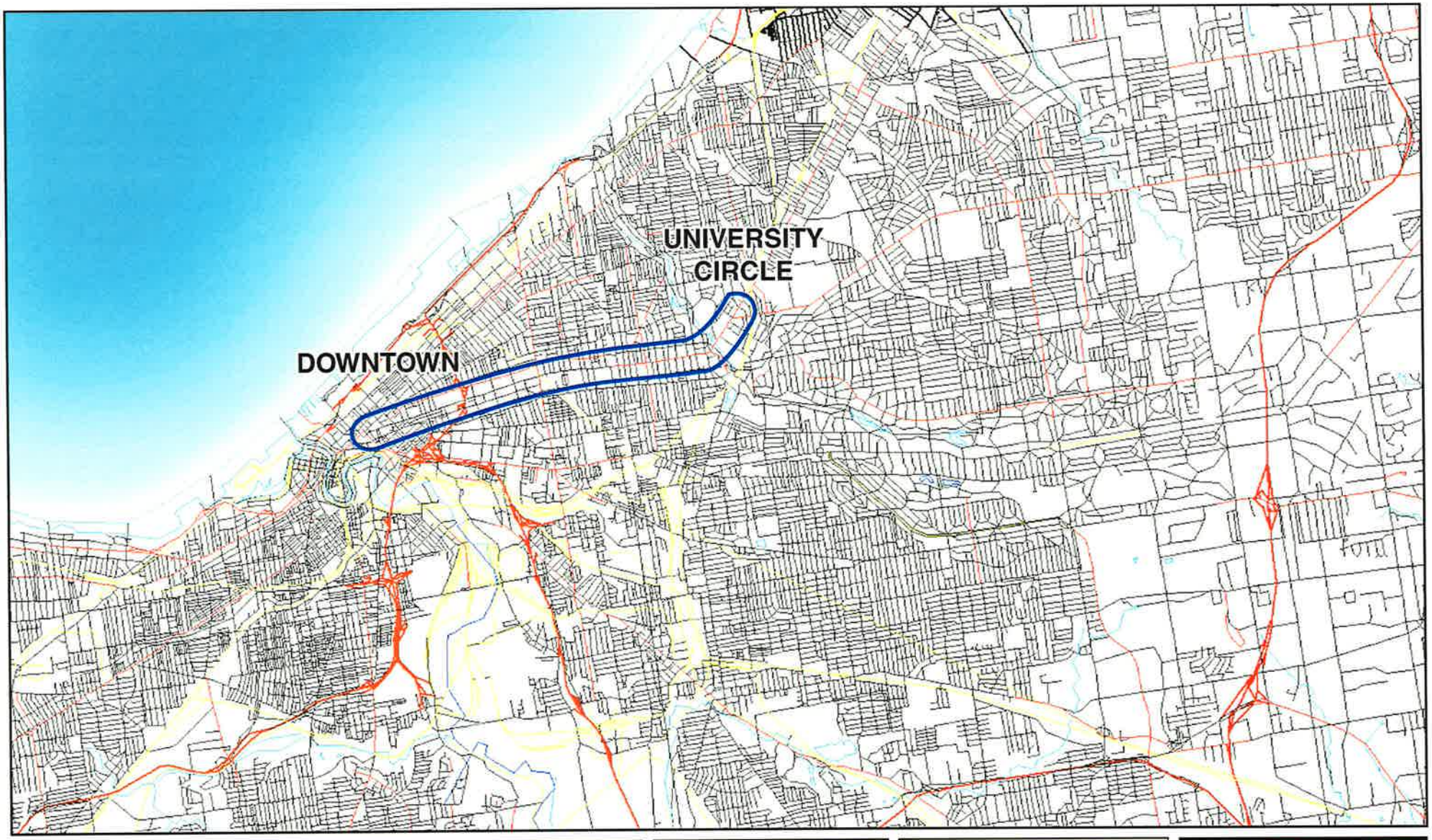
Increasing economic activity in the Dual Hub Corridor has instigated significant actions by the community to improve the corridor infrastructure. The Greater Cleveland Regional Transit Authority (GCRTA) is continually evaluating ways to improve transportation in it's service area. The GCRTA, as the major transit provider in the corridor has been studying ways to improve transit services for almost a decade. The paragraphs below provide a brief overview of the actions taken by GCRTA to implement transit improvements in the Dual Hub Corridor.

1.1.1 Description Of The Dual Hub Corridor

The Dual Hub Corridor is focused around Euclid Avenue with University Circle representing one hub at the eastern end and Downtown Cleveland representing the other hub at the western end. Commercial and institutional land uses and density of development in the Dual Hub Corridor varies greatly (Figure 1-2). The densely developed Downtown is dominated by commercial activity, including 21 million square feet of office space, 750,000-square feet of retail space, and two malls—the Avenue at Tower City Center adjacent to Public Square and the Galleria in the East 9th Street/Erieview District.

Just east of Downtown is the St. Vincent Quadrangle, a major center for educational, medical care, human services, and religious institutions serving the greater Cleveland area. Nineteen thousand employees work at area institutions and businesses and over 26,000 students attend classes in the area.

Another concentration of commercial land uses is located in the "Mid Corridor" area, between East 30th Street and East 84th Street. The Mid Corridor commercial concentration includes low density, lower cost office space between East 30th Street and East 55th Street, which serves as an extension of the Downtown office core. The Mid Corridor area accommodates county government offices, union halls, headquarters for smaller corporations, and professional firms. It contains large surface parking lots, viewed by the City as opportunities for additional office and retail development. The eastern portion of the Mid Corridor, between East 55th Street and East 84th Street, was once a combination of small manufacturing, retail, and residential uses. Today, this area is dominated by large tracts of vacant land and underutilized or unused buildings.



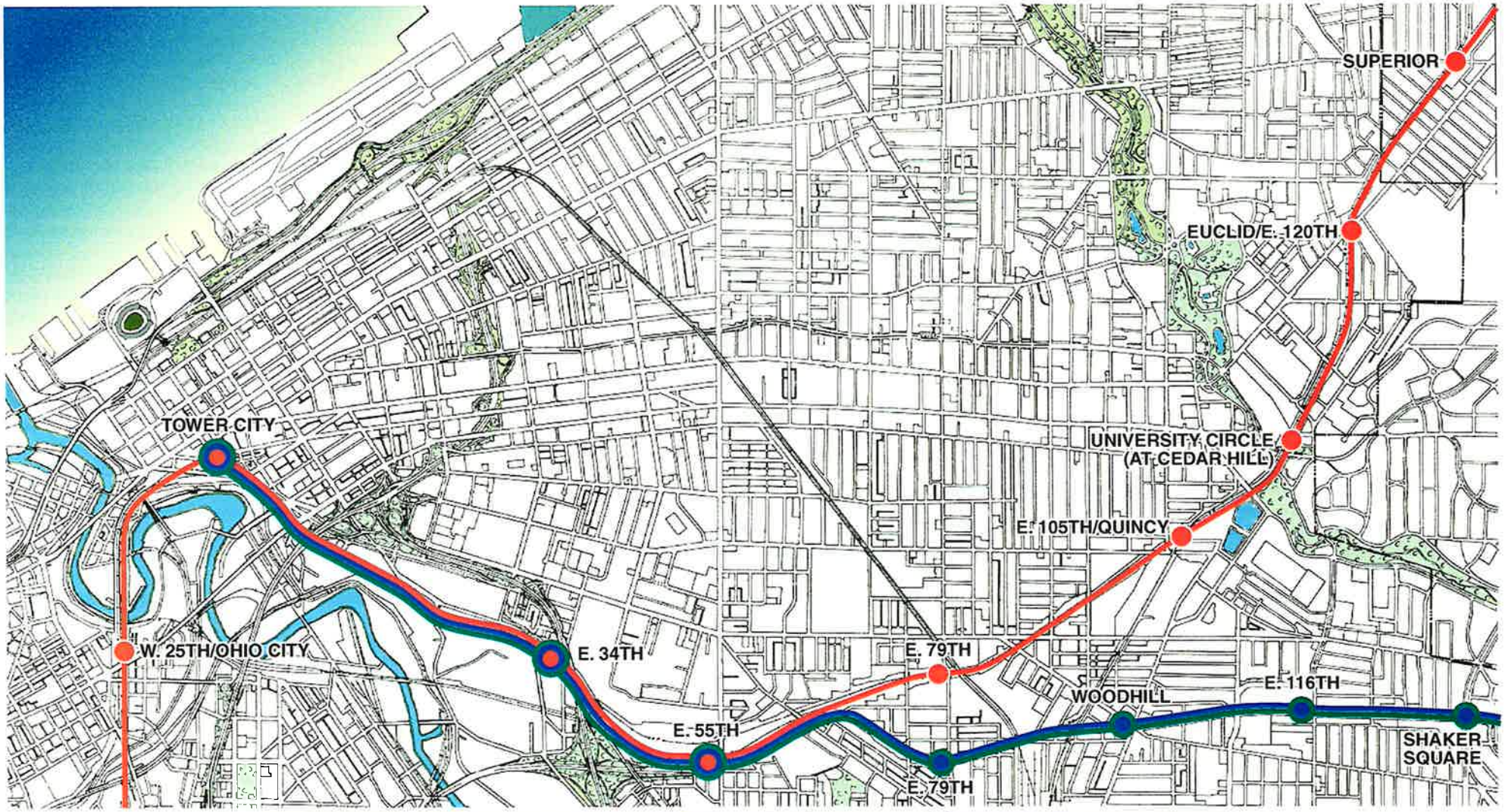
CLEVELAND
DUAL HUB
TRANSITIONAL
ANALYSIS STUDY

Figure 1-1
PROJECT VICINITY

STUDY
AREA

euclid
CONSULTANTS
A Joint Venture

RTA
GREATER CLEVELAND
REGIONAL TRANSIT AUTHORITY



CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 1-2

DUAL HUB CORRIDOR

RED LINE
BLUE LINE
GREEN LINE
STATION

euclid CONSULTANTS
A Joint Venture

RTA
GREATER CLEVELAND REGIONAL TRANSIT AUTHORITY

Some small neighborhood and convenience-type commercial activity remains scattered along Euclid and Cedar Avenues.

A third concentration of commercial activity is located in the University Circle area at the Euclid/Mayfield Triangle. A retail core of restaurants and small service enterprises attracts residents, students, and employees from the nearby educational institutions.

1.1.2 Alternatives For Transportation Improvements

Over the past fifteen years the study of various alternatives to improve public transportation and mobility in the Dual Hub Corridor has progressed through several phases. An explanation of the history and sequence of these efforts follows.

Dual Hub Corridor Alternatives Analysis/Draft Environmental Impact Statement

Focused attention on congestion and travel problems in the Dual Hub Corridor was initiated with the "Dual Hub Corridor Alternatives Analysis/Draft Environmental Impact Statement" (AA/DEIS) project undertaken in 1988.[1] The Dual Hub Corridor AA/DEIS was undertaken after results of the 1982 NOACA-GCRTA System Planning Study indicated that relocation of the portion of the Red Line rail service between Downtown Cleveland and University Circle would be an effective means of improving regional public transportation in the Downtown area as well as providing a higher level of service through the Dual Hub Corridor. The Dual Hub Corridor AA/DEIS project produced an evaluation of ways to improve public transportation between the Cleveland metropolitan area's two largest employment centers--Downtown Cleveland and University Circle. The following alternatives were evaluated:

- A **Null, or "Do Nothing," Alternative**, which included no actions to change the existing or planned transit system operated by the GCRTA;

- A **Transportation System Management (TSM) Alternative**, which included a package of lower cost improvements to upgrade existing bus and rail transit services; and

- Several **Rail Alternatives**, which included various schemes for relocating GCRTA's Red Line to serve the concentration of business and institutional development located along Euclid Avenue between Downtown Cleveland and University Circle.

The AA/DEIS provides descriptions of these alternatives and contains information relating to the impacts associated with each.

This new planning approach initiated by FTA permits potential grant recipients to identify, define, and adopt a locally preferred investment strategy (PIS) without direct Federal supervision. Potential projects coming out of the regional comprehensive planning process are to be refined and evaluated at the local level. Implementation of this new framework for planning requires extensive, coordinated agency action and seeks to guide communities in developing "multimodal" solutions to regional mobility problems, as contemplated under ISTEA. Integrated environmental

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1 Dual Hub Corridor Alternatives Analysis/Draft Environmental Impact Statement, U.S. Department of Transportation, Federal Transit Administration and City of Cleveland, Ohio, in association with Greater Cleveland Regional Transit Authority and Northeast Ohio Areawide Coordinating Agency, February, 1993.

analyses must be conducted as well as modal trade-off analyses. Effective cooperation and coordination with the many diverse interest groups becomes vitally important during the evaluation of alternatives and development of a consensus plan, i.e., adoption of the PIS.

In the same period GCRTA was preparing the AA/DEIS, the U.S. Congress passed and the President signed into law the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).[2] ISTEA has had major impact on the Federal project development process for major transportation investments. Key aspects of this landmark legislation are presented below.

Intermodal Surface Transportation Efficiency Act

ISTEA established new Federal policy regarding the development, evaluation, and implementation of solutions to transportation problems in the country's major metropolitan areas. FTA and FHWA promulgated Joint Planning Regulations in response to ISTEA.[3] Implementation of these regulations, "governing the development of statewide plans and programs," is intended to "ensure the adequacy of statewide and metropolitan (*emphasis added*) transportation planning and programming and the eligibility of metropolitan areas and State for Federal highway and transit funds."[4] The new regulations change the project development process for major transportation investment projects, especially transit projects being developed under the sponsorship of FTA. The new regulations establish a framework for performing "major investment (corridor or subarea) studies, [which] shall be undertaken to develop or refine the [local transportation] plan and lead to decisions by the MPO, in cooperation with participating agencies, on the design concept and scope of the investment."[5]

The Dual Hub Corridor AA/DEIS provides a detailed examination, comparison, and evaluation of transportation alternatives in accordance with a comprehensive set of factors. These factors included environmental impacts, ridership forecasts, capital cost, operating and maintenance cost, economic and cost-effectiveness considerations. The factors were defined to determine how well each alternative achieved regional transportation goals and objectives. Performance with respect to the regional transportation goals and objectives was expected to play a major role in the selection of the PIS at the conclusion of the study.

Transitional Analysis Study

The work activities relating to the Dual Hub Corridor AA/DEIS, narrowly focused on transit solutions. The "Transitional Analysis Study," in part, focuses on updating the understanding of modal travel patterns in the Dual Hub Corridor and evaluating a subset of multimodal transportation solutions. This study also satisfies the Federal Major Investment Study (MIS) requirements.

The Transitional Analysis Study was initiated in the Fall of 1993. The study also includes refinement of the alternatives carried through the AA/DEIS process and the conduct of related

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2 Public Law 102-240, 105 Statute 1914.

3 "Statewide Planning; Metropolitan Planning," Final Rules, 23 CFR Part 450, Federal Highway Administration (FHWA) and 49 CFR Part 613, Federal Transit Administration (FTA), **Federal Register**, Vol. 58, No. 207, Thursday, October 28, 1993, p. 58040.

4 Ibid.

5 Ibid.

planning and engineering studies needed to advance proposed transportation improvements to Preliminary Engineering (PE). This phase of the planning for transportation improvements in the Dual Hub Corridor was initiated in response to several concerns raised by the Federal Transit Administration (FTA) and the City of Cleveland. The FTA informed the GCRTA that revision and updating of the patronage forecast for the Dual Hub Corridor project would be necessary for continued Federal participation. The City of Cleveland is requiring that any transportation improvements in the Dual Hub Corridor be part of a carefully planned and executed program to involve the public in a consistent and meaningful manner. The City also expects the project to result in the development of job opportunities and training programs for people within the Dual Hub Corridor and the City in general.

1.2 PURPOSE OF THIS REPORT

This report summarizes the results of the Transitional Analysis, particularly the evaluation of alternatives and the selection of a preferred investment strategy (PIS). The evaluation concentrates on comparing the Null and TSM Alternatives with the top two candidate rail alternatives identified after public review of the Dual Hub Corridor AA/DEIS. Two new alternatives were defined and are included in this report. The two new alternatives are designed to provide direct Rapid Transit service to the eastern side of Downtown Cleveland.

The selection of the PIS included definition of the design concept and scope of the proposed investment. The PIS will be advanced to PE for more detailed definition, examination, and analysis. Physical, operating, environmental, and cost aspects of the PIS will be examined in detail during the PE phase. As noted above, detailed environmental studies, including the identification of mitigation measures, will be fully documented during Preliminary Engineering and preparation of the Environmental Impact Statement (EIS).

The six major components of the purpose and structure of this Final Report are outlined below.

- **Establish Purpose and Need for Project:** This report is intended to (1) provide adequate understanding of the purpose for a major investment in transportation improvements in the Dual Hub Corridor and (2) establish the need for proposed improvements. A summary of the project's purpose and need is provided in Chapter 2.

- **Description of Alternatives:** This report contains descriptions or definitions of the alternatives being considered. Alternatives being considered within the framework of this study include: a Null Alternative (i.e., no improvement action undertaken), a Transportation System Management (TSM) Alternative, and two Rail Transit Alternatives. Chapter 3 presents descriptions of these alternatives.

- **Evaluation of Alternatives:** This report provides the results of the evaluation of the transit improvement alternatives proposed for the Dual Hub Corridor. In Chapter 4, the evaluation process is outlined, existing conditions affected by the alternatives are summarized, potentially significant environmental impacts are noted, and other considerations weighing on the selection of a PIS are presented.

- **Comparative Analysis of Alternatives:** Chapter 5 presents a comparative analysis of the trade-offs among alternatives, focusing on similarities, differences, and affected interests. Community input and the evaluation of potential impacts is an important part of this project. Information from both of these sources will help ensure that significant social and environmental consequences are considered within an integrated decision-making process.

- **Selection of Preferred Investment Strategy:** This chapter (Chapter 6) summarizes the actions taken to select the PIS for the corridor. the steps necessary to approve a project for advancement to PE are documented.

- **Project Implementation:** The final chapter outlines the steps remaining to implement the PIS. A project schedule is provided.

2.0 PURPOSE AND NEED

2.0 PURPOSE AND NEED

The AA/DEIS provided a detailed discussion regarding the purpose and need for the Dual Hub Corridor transit improvements. The reader is referred to that document for reference. The discussion in this chapter of the Final Report will focus on the central issues surrounding the need for transportation improvements in the corridor.

2.1 SPECIFIC TRANSPORTATION PROBLEMS IN THE DUAL HUB CORRIDOR

The GCRTA operates a major publicly owned and financed mass transit system, which serves approximately 1.4 million people living in Cuyahoga County. In the Fiscal Year ending September, 1994, GCRTA provide transit service for approximately 207,000 riders (i.e., individual boardings) each weekday. The Rapid Transit system carried slightly more than 22,000 passengers, while the bus system carried about 185,000. GCRTA provides this service by operating a fleet of 641 buses on 87 routes and a fleet 54 rail vehicles on the Red, Blue, and Green Lines. Over 60 percent of the rail and bus boardings occur in a five mile corridor from Downtown Cleveland to University Circle, which is as the Dual Hub Corridor as defined in Chapter 1.

The Dual Hub Corridor encompasses the metropolitan area's two largest employment centers with businesses, institutions, and public agencies providing jobs for 160,000 people. Neighborhoods along the corridor are home to 83,000 people. In addition, a large number of visitors are attracted to many of Cleveland's most important religious, cultural, educational, medical, government, and social service institutions located in the corridor, including:

- the campuses of Cleveland State University (CSU) and Case Western Reserve University (CWRU);
- the Cleveland Clinic, University Hospitals, and five other major medical centers;
- the theaters in Playhouse Square and the Cleveland Play House;
- the Cleveland Orchestra's Severance Hall;
- the Cleveland Museum of Art; and
- many other museums and cultural facilities in University Circle.

Since the streetcar days of the early 1900's, the number of people riding public transportation on Euclid Avenue has been the highest of any street in the Greater Cleveland area.

In 1994, during the two hour morning rush period, more than 1.5 buses per minute traveled on Euclid Avenue in the peak (in-bound) direction. In addition, there is a significant demand for public transportation in both directions throughout the day, due to the presence of a variety non-work activities. Approximately 128,000 boardings occurred on bus routes in this corridor on a typical day in 1994. This all-day demand for public transportation is in marked contrast to a more typical "suburbs to city" oriented service that is used almost exclusively by rush hour commuters, traveling to and from the Downtown with limited demand for service at other times. In contrast, approximately 6,000 boardings occurred each weekday on the existing Red Line rail service between Downtown Cleveland's Tower City Station and the East 120th Station at University Circle.

A stable market for public transportation is well established in the corridor, even though surrounding neighborhoods have lost substantial numbers of residents in recent decades. This market is focused on the current distribution of businesses and institutions throughout the entire length of the corridor. In 1994, Downtown loop bus routes carried 16,000 riders each week day. Thousands of others used the Downtown portion of other bus routes that circulate through the central business district (CBD). Local and express bus routes on Euclid and Carnegie Avenues carried 54,000 riders. Buses operating on parallel streets attracted 11,000 riders, and feeder bus routes to and from the eastern suburbs brought 13,000 riders into the Dual Hub Corridor daily. Another 24,000 riders used crosstown buses, traveling through the corridor. By comparison, the entire Red Line carried only 20,600 riders daily and the Blue and Green Lines, serving Shaker Heights, attracted only 16,700 riders.

Although both extensive rail and bus service are available between Downtown Cleveland and University Circle, 95 percent of the 128,000 daily transit trips in the Dual Hub Corridor in 1988 were served by GCRTA's bus transit system. The existing high capacity Rapid Transit service, which provides only indirect service to the corridor's two hubs, is unattractive to transit riders for several reasons: (1) it is located in a railroad right-of-way that skirts the edges of Downtown Cleveland and University Circle; (2) it runs far south of the major businesses and institutions located in the corridor; and (3) there is no effective distribution through Downtown Cleveland for those using rail service, because there is only one Downtown station. The AA/DEIS identified numerous other factors that support the need for major transit improvements in the corridor. These factors are highlighted and discussed in the next section of this chapter.

2.2 THE NEED FOR TRANSPORTATION IMPROVEMENTS

The need for improvements generally is based on: (1) transit-limiting constraints of the existing street network; (2) underutilization of existing Red Line service, which adversely affects transit operating performance and efficiency; and (3) locational constraints associated with the existing Red Line route, which is not supportive of desirable land use patterns in the corridor and impedes regional accessibility. The AA/DEIS identified the following six reasons for pursuing the development and implementation of major transit improvements in the Dual Hub Corridor.

- **Physical Characteristics of the Greater Cleveland's Street and Highway Network:** Significant operational limitations are associated with the physical characteristics of Greater Cleveland's street and highway network, particularly in the Downtown area. Existing major highways and arterial streets concentrate vehicular traffic at a limited number of access points to Downtown Cleveland. To address recognized transportation inadequacies, GCRTA makes extensive use of buses to distribute people through the congested Downtown area and to meet the heavy travel demand throughout the entire corridor. However, the restrictive nature of the street pattern in the CBD, creates constraints on the amount of bus service that effectively can be provided during peak periods in which the greatest hourly public transit ridership occurs.

  East 9th Street is the only north-south street providing access from both the Inner Belt (Interstate 71/90) and Memorial Shoreway into the vicinity of Public Square, where traffic on Euclid Avenue, Superior Avenue, and Ontario Street converges. Because of the limited number of access points into Downtown from the regional highway network and traffic flow discontinuities created by two distinctly different intersecting street grids,

major traffic conflicts arise along East 9th Street. Historically, GCRTA has recognized the traffic congestion problem on East 9th Street and has not attempted to operated bus routes on it. Rather bus routes have been concentrated on Euclid Avenue, Superior Avenue, and Ontario Street to serve the concentration of commercial office and retail development along East 9th Street (north of Huron Road), around Public Square, and along Euclid Avenue (to East 17th Street).

- **Current System Operating Performance:** After years of declining transit ridership in Cuyahoga County, the GCRTA was formed in 1975 to improve the mobility of the region's residents and work force, particularly the transit dependent population. Unifying municipal and private transit systems and introducing a uniform fare structure halted the deterioration of transit service and immediately resulted in substantial increases in public transit usage. Ridership again declined during the recessions of 1981-82 and 1991. Inefficiencies in the current system lead to inferior operating performance.

  Built in the 1920s as part of a carefully planned urban environment that integrated public transportation with residential, retail, and community facilities, the Blue and Green Lines were boarded by approximately 16,700 passengers daily in 1994. The Red Line, which was constructed at minimal cost in a railroad corridor during the 1950s and 1960s, is distant from residential and high density commercial activities. The isolation of Red Line service is particularly severe in the portion east of Downtown between Tower City Station and the University Circle area. Red Line service in this segment passes far south of the major employment centers and institutions concentrated along Euclid Avenue. It runs instead through an area of abandoned industrial plants and railroad yards. This location is one of the primary reasons that GCRTA's rail ridership per track mile is the lowest in the United States despite heavy travel demands associated with the Dual Hub Corridor.

- **Efficiency:** The current system of bus and rail service is not efficient in serving most local residents or for using the GCRTA's resources for the maximum benefit of Greater Clevelanders. Because the majority of GCRTA's current service is by bus on city streets, significant travel time savings are generally not realized by users of public transportation. Providing extensive bus service in the Dual Hub Corridor to meet the high demand for public transportation represents a significant portion of GCRTA's annual operating expenses. Relocating the existing Red Line service between Downtown and University Circle from the sparsely populated railroad corridor to Euclid Avenue would permit GCRTA to reallocate current expenditures for resource-intensive (i.e., labor, equipment, and energy) bus services.

- **Environmental and Social Impacts:** Improved rail service would ensure that many of environmental and social benefits are realized. Particularly, a more efficient distribution system through Downtown Cleveland would reduce automobile and bus traffic. Alternatives under consideration for the most part would use existing public rights-of-way; therefore, residential, business, and institutional relocations would be minimized.

- **Equity:** With the improvements under consideration, the numerous institutions, activities, and employment opportunities in the corridor would become more accessible and attract greater numbers of people from all areas of Greater Cleveland. The

proposed rail improvements for the corridor, while located on the east side of Cleveland, also would provide better service for people living on the west side of Cleveland. Additional stations at East-9th Street/Euclid, Playhouse Square, and CSU would significantly improve distribution in the Downtown for patrons of the Red, Blue, and Green Lines. New stations in the Downtown, along Euclid Avenue, and in the University Circle area would provide more direct Rapid Transit service and reduce transit travel times to major regional activity centers, including: Downtown Cleveland offices and businesses, CSU, Cleveland Clinic, and the medical and academic institutions of University Circle. Rail transit accessibility would be enhanced throughout the region. Transit improvements under consideration in the Dual Hub Corridor would be designed to be free of barriers.

- **Local Development Potential:** A major investment in public transit will help to focus private development activities and promote the long-term economic and social viability of the corridor. The investment in rail transportation improvements would be coordinated with (1) careful planning to meet market demand and (2) specific actions, such as proper zoning, to support private development. Between 1980 and 1988, $1.3 billion was invested in the corridor; another $575 million worth of new construction was underway, and $1.8 billion was projected to be spent for new development by 1995. Development activity includes residential, retail, office, and institutional development in all areas of the corridor, from Downtown to the Midtown and Doan Center areas to University Circle and the surrounding neighborhoods. Nevertheless, even with this significant development activity, large tracts of vacant and underutilized land remain available for development.

  Many of the corridor's institutions (including CSU, Cleveland Clinic, University Hospitals, and CWRU) have prepared ambitious master plans in recent years to guide their growth into the next century. In addition, other civic and development organizations, such as St. Vincent Quadrangle, Nouvelle Espoir Development Corporation, MidTown Corridor Inc., Neighbors Organized for Action in Housing (NOAH) Inc., Hough Area Partners in Progress, New Cleveland 6, Inc., and University Circle, Inc., are acting as catalysts to encourage redevelopment of large areas of the corridor. The City of Cleveland recently updated its Downtown and Citywide land use plans to guide long range development in the corridor.

  The proposed transit improvements would be a key component of new development initiatives expected to be undertaken in the next twenty years. The City of Cleveland and corridor organizations and institutions have been actively involved in identifying and defining alternatives evaluated during the AA/DEIS and as part of this transitional analysis study. Proposed improvements in public transportation would contribute to the development potential of the area from Downtown Cleveland to University Circle. The opportunities would be enhanced for allowing higher densities of office, retail, residential, and institutional development in the Corridor. Higher density development would improve the viability of public transportation by increasing its competitive position relative to the private automobile.

3.0 DESCRIPTION OF ALTERNATIVES

3.0 DESCRIPTION OF ALTERNATIVES

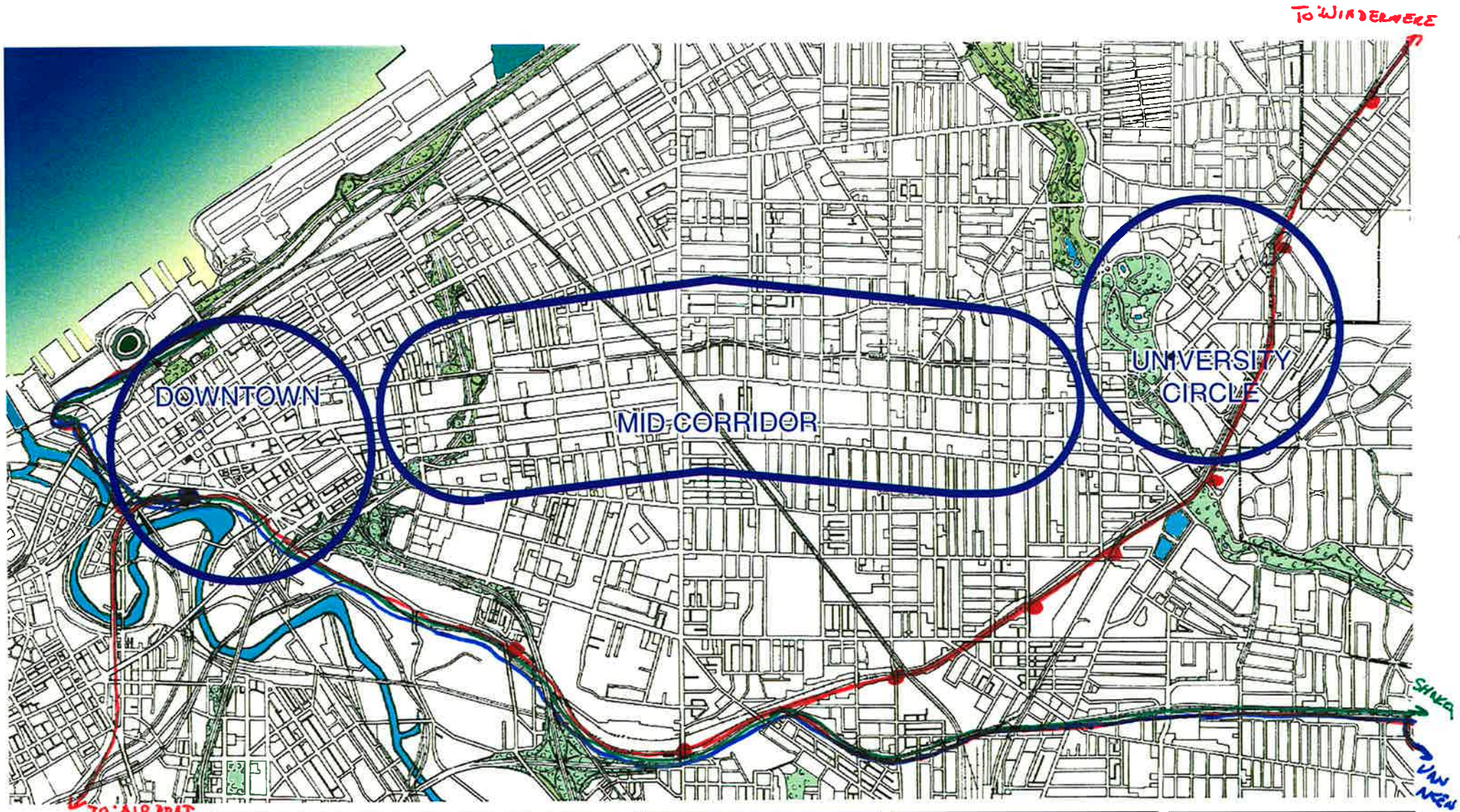
This chapter provides a description of the alternatives defined and evaluated during the course of the Transitional Analysis. Each alternative is described in terms of the physical characteristics of the facilities that would be built and the operational services that would be provided. The expected capital costs and operating and maintenance (O&M) costs associated with the alternatives also are presented. The first section summarizes the range of alternatives considered during GCRTA's studies to enhance transit services in the Dual Hub Corridor. This is followed by descriptions of the alternatives that were the focus of the Transitional Analysis. The alternatives described in this chapter include: the Null Alternative, the Transportation Systems Management (TSM) Alternative, two alternatives that would supplement Rapid Transit service in the Downtown only, and rail alternatives to provide direct service along Euclid Avenue. The alternatives are described in terms of the baseline scenario only to be consistent with Federal planning practice. Major characteristics of the alternative development scenario, assuming implementation of the Empowerment Zone, are presented in the appendix.

3.1 RANGE OF ALTERNATIVES CONSIDERED

The Dual Hub Corridor AA/DEIS was undertaken in 1984, as a joint effort of the City of Cleveland, GCRTA, and NOACA, to consider in further detail potential bus and rail improvements between Downtown Cleveland and University Circle. The study was conducted as part of the formal process for securing Federal funding. Two Scoping Meetings were held prior to initiating work on the DEIS in accordance with regulations of the FTA. An initial set of alternatives was presented at these meetings, and the social, economic, and environmental impact categories to be analyzed were discussed. Interested agencies and citizens attending the meeting were encouraged to comment on the alternatives and impact categories to be considered.

At both scoping meetings, potential opportunities for implementing bus and rail improvements, principally in relation to Euclid Avenue, were presented. The Transportation System Management (TSM) Alternative encompassed an aggressive package of low cost capital improvements, including an exclusive transitway for bus operations in the center of Euclid Avenue and improvements to existing rail facilities. The proposed transitway on Euclid Avenue was designed to minimize conflicts with automobile traffic that slows the large number of buses operating on this major arterial street. The TSM Alternative included improvements to existing Red Line Rapid Transit rail service through relocation or improvement of selected stations and line segments. The rail improvement alternatives included major capital investments in "fixed guideway" facilities in the corridor with stations about every mile along Euclid Avenue. New Red Line Rapid Transit service through the corridor was defined as being in addition to operations on the existing railroad cut.

The corridor, generally centered around Euclid Avenue, was separated into three subareas to facilitate operational planning (Figure 3-1). These subareas reflect the two "hubs" with Euclid Avenue as the primary travel link. The three subareas were defined as follows: "Downtown" - East side of the Cuyahoga River to East 17th Street; "Mid Corridor" - East 17th Street to East 107th Street; and "Circle" - East 107th Street to Cleveland City Limits. Potentially feasible routes in these subareas, which may be considered operational segments, were identified in the following manner:



CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 3-1
STUDY AREA

PLANNING SUBAREA SEGMENTS

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A Joint Venture

RTA
GREATER CLEVELAND REGIONAL TRANSIT AUTHORITY

- **Downtown Options:** Rockwell At-Grade, East 9th Subway, Superior Subway, and Waterfront Connection At-Grade (to the lakefront);

- **Mid Corridor Options:** Chester At-Grade, Euclid At-Grade, Chester Aerial, and Euclid Aerial; and

- **Circle Options:** East 107th At-Grade, Euclid At-Grade, Euclid Subway. and the Shaker Connector.

These various options were combined to create 12 full length alternatives from Downtown (Tower City) through University Circle to about East 120th Street. Several people at the meeting raised concerns about specific elements of the bus and rail improvements presented. All of these concerns were addressed within the scope of the alternatives as defined, although in many cases the details had not been finalized.

A final screening of alternatives was conducted following the Scoping Meetings to further refine those alternatives which would be subject to detailed engineering and planning evaluation. This refinement process included, but was not limited to: examining possibilities for more fully integrating the Tower City Station in Downtown Cleveland into all Downtown alignments; refining routes and station locations for all segments; and evaluating preliminary probable costs and environmental impacts. The Dual Hub Corridor Technical Advisory Committee in late 1986 recommended to the study's Steering Committee that further examination of rail alternatives for the Corridor be limited to combinations of the following operational segments:

- **Downtown Options:** Superior At-Grade, Superior Subway, and Huron/East 9th Subway;

- **Mid Corridor Options:** Chester At-Grade, Euclid At-Grade, and Chester/Euclid At-Grade; and

- **Circle Options:** East 107th At-Grade, Euclid At-Grade, and Shaker Connector.

Public review of capital costs, environmental impacts, and development potentials associated with alternatives formed from these operational segments was accomplished at a series of eight public meetings held between March and September, 1988. Concern was raised at these meetings about the need to make full use of the Tower City Station by defining a lower cost subway option. Therefore, a Euclid Subway segment was added to those being considered in Downtown. Subsequently, the Chester/Euclid At-Grade segment in the Mid Corridor was eliminated to reduce the number of full alternatives subjected to study.

These alternatives and others were reviewed when the Transitional Analysis was initiated. A Null Alternative was adopted that represented "... minimal changes in existing bus and rail service levels" over the next two decades.[3.1] A less aggressive TSM Alternative was defined than that adopted for the AA/DEIS, because the transitway concept "...proved to be counter-productive in handling additional and even existing bus volumes. Bus capacities at several downtown

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3.1 Operations Plan Report, Cleveland Dual Hub Corridor Study, prepared for Greater Cleveland RTA by Manuel Padron & Associates, September, 1994, p. 2.

intersections were exceeded."[3.2] Four rail alternatives became the focus of attention early in the Transitional Analysis Study. The alternatives were defined within the same framework of operational segments used for the AA/DEIS, but they reflected the range of possible service options potentially feasible for implementation in the corridor. A description of each of the alternatives adopted for the Transitional Analysis follows in subsequent sections of this chapter.

3.2 NULL (DO NOTHING) ALTERNATIVE

The Null Alternative, as cited above, is defined as including only "minimal changes" to existing bus and rail services provided by GCRTA (Figure 3-2). It essentially reflects planned, programmed, and committed improvements already adopted by GCRTA. As such, the Null Alternative is the baseline for all transit service alternatives defined within the context of the Transitional Analysis.

3.2.1 Bus Transit System

The bus transit system for the Null Alternative is defined as the existing transit network and those committed improvements identified in GCRTA's Fiscal Year 1994 Service Management Plan (SMP) and GCRTA's Long Range Plan (2010) for implementation by the year 2000. Since the definition of the Null Alternative, GCRTA has published a Fiscal Year 1995 update of the Service Management Plan. The projects from the Fiscal Year 1995 plan are summarized below:

- **Westlake Park-n-Ride Lot:** This facility will accommodate 550 vehicles. New freeway flyer service will operate on a 20 minute headway during the A.M. and P.M. peak periods providing direct service to Downtown Cleveland. During the midday, route 55X will be rerouted to serve the new facility. This lot is scheduled to open by December 1995.

- **Lee-Harvard Community Circulator:** This new neighborhood circulator service will link residents to shopping, medical, and transportation centers. It will operate Monday through Saturday on a 30 minute headway.

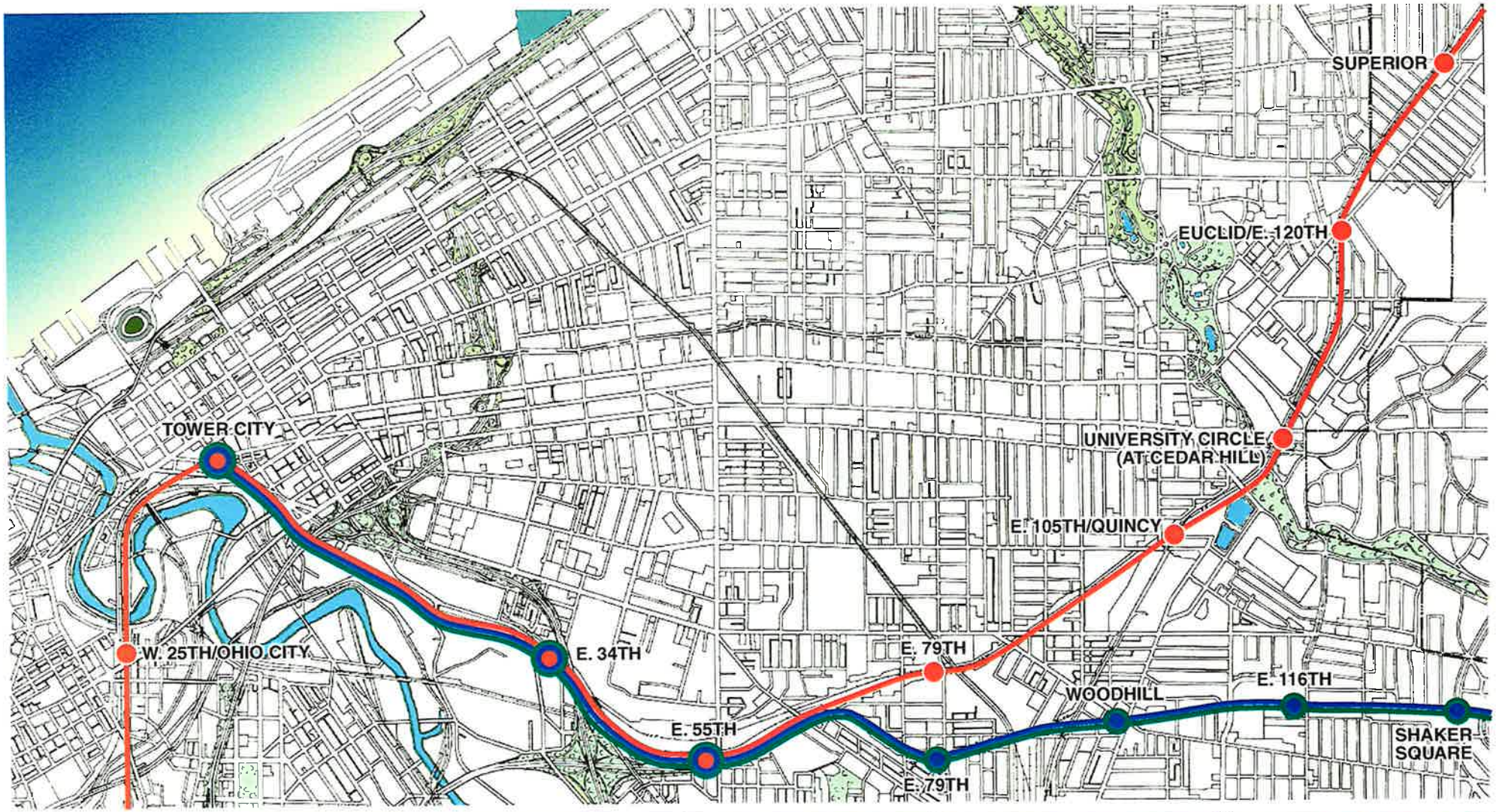
- **St. Clair-Superior Community Circulator:** This circulator service will operate within the St. Clair-Superior neighborhood of Cleveland and will link residents to major destination points within the community which may be difficult to reach without transferring using existing bus service.

- **Harvard District Garage:** This new operating district will reduce GCRTA's deadhead bus miles and hours. It is scheduled to open in January 1995. All Woodhill routes and service will be shifted to this district in order to accommodate the Hayden Garage closing.

- **Hayden Garage Rehabilitation:** The Hayden operating district garage will close for rehabilitation in February 1995. All routes and service will be shifted to the Woodhill Garage during the rehabilitation which is estimated to be completed by January 1997.

- **Great Northern Park-n-Ride Lot:** A 600-800 space regional park-n-ride lot is planned for the I-480-Great Northern Area. The lot will feature freeway flyer express service with

3.2 Ibid, p. 14.



CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 3-2

"NULL" (DO NOTHING) ALTERNATIVE

RED LINE
BLUE LINE
GREEN LINE
STATION

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20 minute headways during the A.M. and P.M. peak hours. Midday service will be provided by rerouting a current express route through to the lot at 30 minute headways. The project is scheduled for land acquisition in 1995 and design and construction in 1996. The facility may be ready for service in the spring of 1997.

- **Oakwood Park-n-Ride Lot:** A 400-600 space regional Park-n-Ride lot is planned for the I-480/I-271 area in Oakwood. Express Freeway flyer service will be provided at 20 minute headways during peak hours. Midday service will be provided at 30 minute intervals by modifying the routing of an existing bus route. The Park-n-Ride is planned for acquisition in 1995 with design and construction following in 1996. The lot could be ready for service in late 1996 or early 1997. The facility may also be linked to a potential commuter rail demonstration project serving the Akron-Cleveland commuter market.

- **CSU Transit Center:** A Transit Center to accommodate CSU students featuring a centralized and convenient bus service in a comfortable, secure indoor waiting area is in the land acquisition and architectural design phase. The Transit Center will centralize the 268 daily bus trips now serving the campus at one off-street transfer center. The project is scheduled for construction in 1996 and could be ready for service implementation at the end of 1996.

- **Westgate Transit Center:** A transit center is planned for the Westgate Mall area. This center will provide an enclosed waiting area with convenient off-street bus loop and transfer point for all routes now serving this bus suburban shopping mall. The project is scheduled for land acquisition in 1995. Design and construction will follow in 1996. The center may be open for implementation by the end of 1996.

- **Parmatown Transit Center:** The Parmatown regional shopping mall is served by six different bus routes. A transit center is planned to accommodate park-n-ride spaces, centralized bus service, and a comfortable enclosed waiting area for GCRTA passengers. The project is scheduled for land acquisition in 1995 with design and construction to follow in 1996. This facility should be operational in 1997.

3.2.2 Rail Transit System

The configuration and operation of GCRTA's rail transit system will remain unchanged within the definition of the Null Alternative. The definition of the Null Alternative for purposes of this study does not include the facilities or services of a "Waterfront" line, although GCRTA's Long Range Plan (2010) for implementation by the year 2000 includes the line. At the time of definition of the Null Alternative, a decision was made to exclude the "Waterfront" line from the Null Alternative because funding for the line was not assured at the time. Instead it was included in the TSM Alternative. However, since that time, the "Waterfront" line has been reprogrammed as a committed project.

3.3 BUS/TSM ALTERNATIVE

The Bus/TSM Alternative encompasses a host of concepts and actions directed toward enhancing the effectiveness and efficiency of a community's existing transportation facilities and services. Therefore, the Bus/TSM Alternative, encompasses a package of relatively aggressive physical and operational improvements to upgrade existing bus and rail services, with particular

emphasis on the Dual Hub Corridor and, especially, Euclid Avenue (Figure 3-3). The Bus/TSM Alternative defined for the Transitional Analysis includes a significantly lower level of investment in physical facilities than defined within the context of the AA/DEIS process. Although proposed improvements would demand less capital and operating resources than those associated with the rail alternatives, they still would require substantial funding commitments. Specific improvements to the bus and rail transit systems are included in all alternatives.

3.3.1 Bus Transit System

The bus network defined for the Bus/TSM Alternative builds from the "existing and committed" bus network established for the Null Alternative. Bus service improvements have been categorized as "non-corridor" and "corridor", because the Bus/TSM Alternative represents a minimum action plan to improve transit service throughout the region. The "package" of bus transit improvements defined for the Bus/TSM Alternative reflects the new service concepts identified in GCRTA's Transit 2010 Long Range Plan.[3.3] Implementation of this package of services will require expanding the bus fleet of 768 vehicles established for the Null Alternative to 827 vehicles.

Non-Corridor Improvements

The Transit 2010 Long Range Plan includes proposed bus service improvements outside the Dual Hub Corridor. A major component of the Bus/TSM Alternative's definition is implementation of these proposed non-corridor improvements, including: transit centers, P&R lots, and community circulator service. The Transit 2010 Long Range Plan calls for establishing better coordination between bus and rail services to improve the mobility of current users and attract new patrons. It also calls for establishing an integrated transit center/P&R service network throughout the GCRTA service area. Improvements to several bus routes are proposed as part of the transit center/P&R concept spelled out in the Transit 2010 Long Range Plan. New Expressway Flyer and Community Circulator service would be added, and select existing routes modified. A summary of these improvements is provided below; details may be referenced in the Operations Plan Report.

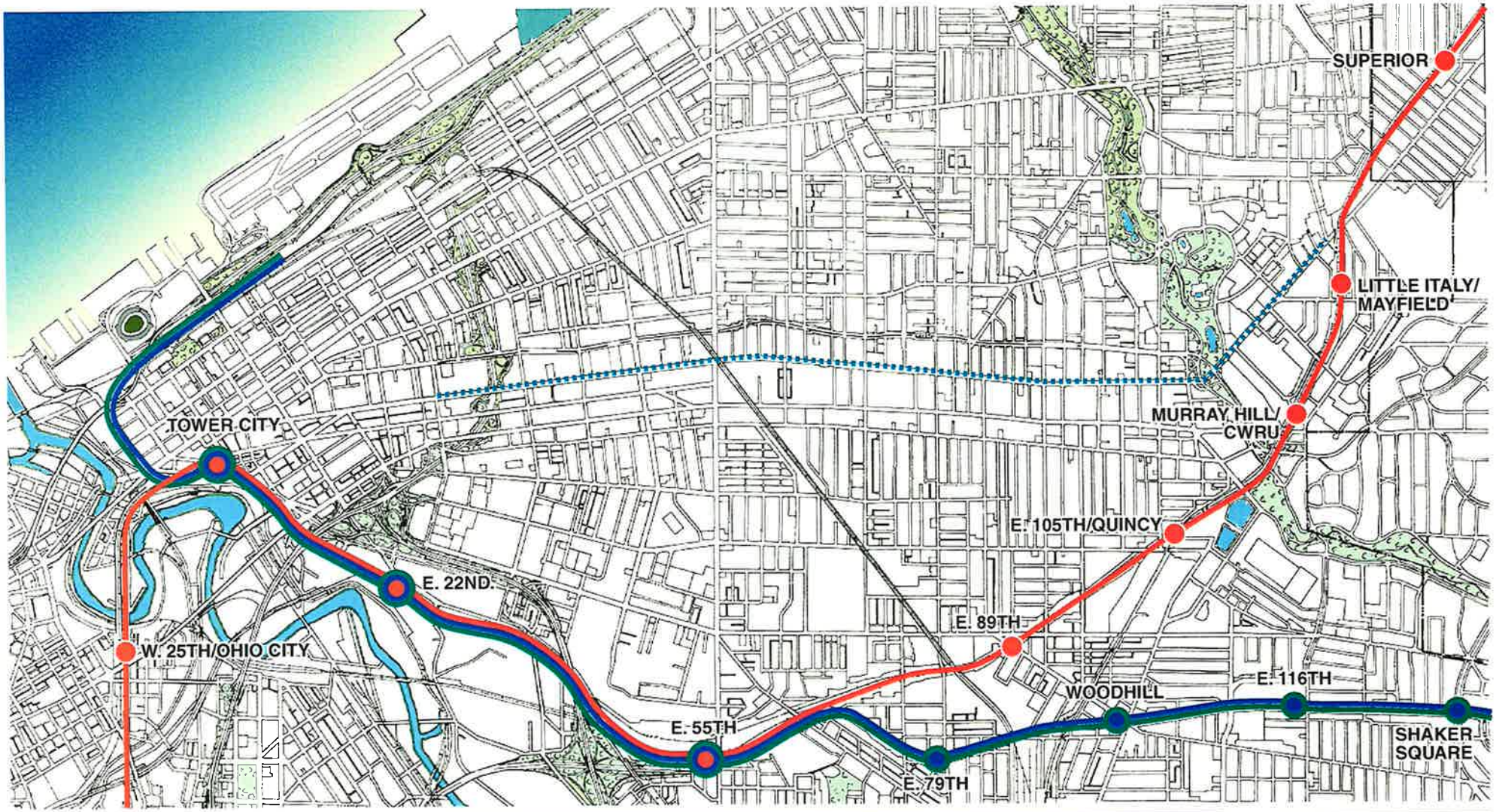
Community Circulators

Nine community circulators are contemplated for implementation, in addition to the Lee-Harvard Community Circulator included in the Null Alternative. Community circulators are proposed to serve:

- Euclid (C-2)
- St. Clair (C-3)
- University Circle (C-4)
- Slavic Village (C-5)
- Garfield/Maple Heights (C-6)
- Tremont (C-7)
- Kamms (C-8)
- Lakewood (C-9)
- Cleveland Heights (C-10)

Using smaller (30-foot) buses and operating with flexible or fixed routes and schedules, community circulators will connect residential areas to transit centers and higher capacity main line bus and rail service.

3.3 Transit 2010 Long Range Plan, GCRTA, April, 1993.



CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 3-3

"Bus/TSM" ALTERNATIVE

RED LINE
BLUE LINE
GREEN LINE
DEDICATED BUS LANES
STATION

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Transit Centers and P&R Facilities

Transit centers will be developed in one of two forms. Transit hubs will be located at the intersection of two or more routes, where patrons normally can transfer. Transit centers will be located where several routes converge. Transit centers may consist of indoor waiting areas with concessions and other amenities (e.g., telephones, restrooms, etc.). The main feature of the transit center concept will be buses serving several routes, with arrival/departure times within just a few minutes of each other. This "timed transfer" operating concept would eliminate lengthy waiting times for passengers.

P&R facilities will be developed in relation to the suburban bus network to permit "seamless" connections between modes of travel. Although primarily geared to serving the Downtown-oriented commuter trip, P&R facilities may be developed in conjunction with transit centers to link express bus or rail service with local bus routes or community circulators. Planned locations for non-rail transit centers and P&R facilities are listed below (some already are in operation).

Transit Centers	Park-and-Ride	Transit Center and P&R
- Westgate	- Brecksville	- I-90/Euclid
- Parmatown	- Sprague-Fair	- I-271/Wilson Mills
- 77/I-480		- Southeast US 422
- Randall Park		- I-480/I-271
- CSU		- I-77/Brecksville
		- Strongsville
		- I-480/North Olmsted
		- I-90/Westlake[3.4]

Rail Transfer Stations

Bus-to-rail/rail-to-bus transfers at existing Rapid Transit stations will be enhanced through bus route modifications. Several bus routes would be modified within the framework of the Transit 2010 Long Range Plan. The following routes would be modified to serve new transit centers:

9X - Mayfield
15F - Warrensville Heights Flyer
35F - West 25th/Broadview
73 - East 222nd/Highland
77F - Brecksville
87F - Westwood/I-90
94 - East 250th/Richmond
97F - Walton Hills
96F - Butternut/Hilliard

In addition, new express/flyer bus routes are proposed; these will operate on a 30 minute headway during the peak periods:

41F - Solon Express Flyer
107F - Wilson Mills
146F - Westlake Express Flyer
177F - Brecksville Express Flyer
186F - Sprague-Fair Express Flyer
197F - Broadway/Northfield Express Flyer

Details regarding these route and their locations may be referenced in the Operations Plan Report.

3.4 Operations Plan Report, p. 9.

Corridor Improvements

A high level of transit service already is provided in the Dual Hub Corridor, and significant improvements in transit service levels (i.e., headways) probably are not warranted. "However, the high bus volumes ... in particular, on Euclid Avenue, indicate that the Bus/TSM network should include capital improvements that will improve transit operations within the Corridor."[3.5] Therefore, the Bus/TSM Alternative includes service enhancements for select routes within the corridor and capital improvements along Euclid Avenue as a means to improve bus travel times.

Computerized signal progression would be installed on Euclid Avenue between East 22nd Street (CSU) and East 118th Street. This capital improvement project would entail the complete reconstruction of Euclid Avenue from building face to building face. Corridor improvements would include:

- Installation of new traffic signals at all signalized intersections;
- Running inter-connect cable between signalized intersections; and
- Controlling signal activity through a mainframe computer.

The result of this project would be new sidewalks, curb and gutter, paving, signs, and striping between Public Square and East 118th Streets. New bus shelters on both sides of Euclid Avenue would be installed at twenty locations between these two streets, along with new signage and other transit amenities.

The computer, installed to control traffic signals, would constantly monitor Euclid Avenue traffic. Signal phasing would be adjusted to best serve current traffic activity and travel conditions. Therefore, buses operating on Euclid Avenue would realize travel time savings through efficient signal progression. Computerized signal progression would not extend into the Downtown (i.e., west of East 22nd Street), because buses stop frequently and automobile and passenger volumes are heavy. No improvement in travel speeds could be gained from expenditures for computerized signal progression.

Euclid Avenue express and flyer routes (Monticello/Euclid Heights-7F; Mayfield-9X, 9BX, & 9F; Euclid-28X) would continue to operate. However, frequent stops for passenger boarding/alighting would result in buses operating "out-of-sync" with the phasing established through computerized signal progression. Therefore, all express and flyer routes would operate in a "limited stop/closed-door" service. Stops would occur only at major activity centers, such as Cleveland Clinic. The Cedar Routes (32CX, 32SX, & 32WX), which presently use Carnegie, will be routed to Euclid Avenue to take advantage of the signal progression.

Service on Route 6A (Euclid Avenue) will be improved in the A.M. and P.M. peak periods by reducing the headway from 18 minutes to 10 minutes. This will compensate for the operating restrictions on express and flyer service. The combined service of Route 6A (Murray Hill/CWRU) and Route 6 (Windermere Station) will result in 5 minute local service along Euclid Avenue.

3.5 Operations Plan Report, p.14.

3.3.2 Rail Transit System

The Bus/TSM Alternative also includes improvements and changes to the existing Red Line Rapid Transit service. These improvements principally would take the form of station relocations; however, some facility improvements (e.g., structure and line modification or rehabilitation) would be undertaken.

Service Changes

Red Line Service

Red Line Rapid Transit service would remain routed in the same manner as today (i.e., Windermere-Tower City-Airport). The Red Line would operate on a 12 minute headway, during the A.M. and P.M. peak periods. Midday service levels would be improved slightly. Four stations currently served by the Red Line would be relocated, as follows:

- The University Circle/Cedar Hill Station would be removed and a new Murray Hill/CWRU Station (Adelbert Road) would be constructed to replace it;
- The Euclid/East 120th Street Station would be removed and a new Little Italy/Mayfield Station (Mayfield Road) would be constructed to replace it;
- The East 79th Street Station would be removed and a new East 89th Street Station would be constructed to replace it; and
- The East 34th Street/Campus Station would be removed and a new East 22nd Street Station would be constructed to replace it.

Blue/Green Line Service

The Bus/TSM Alternative includes and reflects Rapid Transit service on the Waterfront Line. The Waterfront Line would operate as an extension of the Blue and Green Lines. Alternate Blue/Green Line trains would be routed through the Tower City Station to the Waterfront, during the peak periods. All Blue/Green Line trains would continue on to the Waterfront, during the nonpeak periods. It is anticipated that nine rail vehicles must be purchased and added to the Blue/Green Line fleet to serve the Waterfront Line. This represents an expansion of the total rail fleet from 64 to 73 vehicles, including the Red Line Rapid Transit fleet. The acquisition of these vehicles would be accomplished within the framework of the Waterfront Line extension project.

Physical Facility Improvements

Certain physical improvements to the trackage and structures of the Rapid Transit system are included in the definition of the Bus/TSM Alternative. Proposed improvements would enhance service operations and safety, but are not significant cost items. These include the relocation of Rapid Transit tracks west of the Hope Memorial Bridge to remove or improve a speed restricting, double reverse curve in the line.

3.4 RAIL TRANSIT ALTERNATIVES

Services and costs for rail alternatives considered within the framework of the Transitional Analysis range from extension of the Red Line to the Playhouse Square/CSU area to potential full integration of Red/Blue/Green Line Rapid Transit service on Euclid Avenue. Six distinct rail transit alternatives ultimately were defined for engineering and planning analyses. Four were established as defining the bounds of various options available for implementation in the Dual Hub Corridor.

3.4.1 Rail Alternatives Considered

Two distinct rail service schemes were evaluated. One scheme focused on providing Rapid Transit service to the eastern side of Downtown Cleveland. There is a major office concentration on the east side of Downtown along with the Playhouse Square District and the nearby St. Vincent Quadrangle. All are major trip attractors. The Downtown Rapid Transit Relocation concept was aimed at establishing GCRTA's Rapid Transit service to these areas by extending the Red Line or diverting its route in the Downtown area. The second scheme was oriented to providing fully integrated Rapid Transit service throughout the corridor, connecting Downtown with University Circle and points beyond. These service schemes were centered on Euclid Avenue and, therefore, referred to as the Euclid Avenue Rapid Transit Alternatives. Red Line service within the definition of the Euclid Avenue Rapid Transit Alternatives would be rerouted to Euclid Avenue. Red Line operations in the N&W RR cut would be discontinued.

Downtown Rapid Transit Relocation Alternatives

Two rail service concepts were advanced for consideration during the Transitional Analysis that represented attempts to define a lower cost way to provide Red Line service to the east side of Downtown, specifically the East 9th Street, Playhouse Square, and CSU activity centers. The first of these alternatives is referred to as the "Downtown Red Line Extension Alternative" (Alternative 3A). Alternative 3A would involve extending the Red Line east from Tower City Station to Euclid Avenue. This extension would add new Red Line subway stations at: Euclid/East 9th Street and Euclid/East 18th Street (Playhouse Square/CSU).

The second concept is referred to as the "Downtown Rapid Transit Relocation Alternative" (Alternative 3B). Alternative 3B would involve diversion of all GCRTA Rapid Transit service (i.e., Red, Blue, and Green Lines), currently operating in the N&W RR cut, over to Euclid Avenue only in the Downtown area. The new alignment would depart from Tower City Station, follow Euclid Avenue east to the Euclid/East 18th Street Station, then turn southeast, tying back into the current Rapid Transit route alignment at the N&W RR cut just west of East 34th Street.

These two Downtown rail alternatives focus Rapid Transit service improvements on the east side of Downtown Cleveland. Therefore, each incorporates significant TSM actions (e.g., shelters, new striping, new Red Line stations, and street improvements) along Euclid Avenue and in the Corridor. There also would be basic modifications and improvements to the existing Red/Blue/Green Line service scenarios.

Euclid Avenue Rapid Transit Alternatives

The routes of four Euclid Avenue rail alternatives were carried forward from the AA/DEIS with some modifications. Those routes had been determined after consideration of the different needs

of three distinct operational subareas (or segments) of the Dual Hub Corridor, as defined earlier. These rail alternatives identify varying opportunities for providing significantly improved transit service within the Dual Hub Corridor and, particularly to Euclid Avenue. These alternatives, by definition, include the proposal to provide LRT service in the median of Euclid Avenue. Certain improvements and modifications to the existing rail transit system, as contained within the definition of the Bus/TSM Alternative, are included in these alternatives. However, no significant enhancements of the bus transit system are contemplated. Therefore, the four rail alternatives brought forward from the AA/DEIS include essentially no TSM "Corridor" improvements aside from the rerouting of buses to improve connections with new rail transit service.

It was determined, during the course of the Transitional Analysis, that two rail alternatives could adequately represent the range of ridership, costs, and other impacts associated with major rail transit improvements in the corridor. Alternative 4A would provide new direct rail transit service along Euclid Avenue from Downtown to the east. Alternative 4B would provide new direct rail transit service along Euclid from Downtown to about East 107th, where the line would turn south to tie in with current Red Line service operating in the existing N&W RR cut. Alternative 4C would provide the same new direct rail transit service on Euclid Avenue, as specified for Alternative 4A. In addition, the Blue Line would be used to provide service via a Shaker Connector.[3.6] Alternative 4D would provide new direct rail transit service on Euclid Avenue, as specified for Alternative 4B. Alternative 4D, like Alternative 4C, also would provide Blue Line service along Euclid Avenue via the Shaker Connector.

Alternatives 4A and 4D were selected for full evaluation, because these two alternatives "bracket" the likely impacts of the four Euclid Avenue Rapid Transit Alternatives. Alternative 4A represents the minimum new Rapid Transit service for the region, and Alternative 4D represents the maximum new Rapid Transit service. Red Line service would be discontinued along the N&W RR between Downtown and University Circle, because it would compete with and be redundant to the Red/Blue Line service along Euclid Avenue and Green Line service along the N&W RR cut. This would be the case of all Euclid Avenue rail alternatives.

3.4.2 Common Elements of LRT Alternatives Selected for Evaluation

There are several physical and operational features or aspects that are common to all Euclid Avenue Rapid Transit Alternatives. These are summarized below.

- **Facility/Station Design:** New rail transit service would be provided on a double track system with power provided from overhead wires as found elsewhere on GCRTA's rail network. All stations would be able to accommodate three-car trains. Weather protection for transit users would be provided at all stations.

- **Operating and Fare Policies:** All alternatives will have associated with them certain modifications to the GCRTA bus transit network. These modifications will be implemented

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3.6 The Shaker Connector (to be discussed in a subsequent section) would link the existing Blue/Green Line to the rerouted Red Line at East 107th Street. Due to theoretic and practical limitations imposed by ridership forecasting models, the Blue Line was used to test the potential patronage impacts of the Shaker Connector. However, the actual operating configuration necessary, required, or desirable for making this an effective and efficient connection could include both the Blue and the Green Lines. Operational details associated with serving both the Shaker Connector and the existing Blue/Green Lines will be finalized during Preliminary Engineering and reported in the Draft Environmental Impact Statement.

to take advantage of (1) additional, focused bus transit services and more efficient bus operations (i.e., synchronized signals) or (2) new rail transit facilities that provide accessibility by Rapid Transit service to new areas of the community. Operational procedures and scheduling policies remain unchanged, as do fare policies. Detailed descriptions of proposed changes in the routing and scheduling of GCRTA bus and rail transit services are contained in the Operations Plan Report and the AA/DEIS.

- **Service to the Waterfront Line:** All rail transit alternatives include Blue/Green Line service to the Waterfront. The current proposal is for every other Blue/Green Line train to continue through Tower City Station during peak periods to serve this new Rapid Transit line.

- **Urban Design:** Urban Design Guidelines would be developed by the Cleveland City Planning Department. They would be developed according to the highest urban design standards possible, considering funding resources available and results of the Public Involvement Program. Rail facilities identified for all alternatives would be located to keep property takings to a minimum.

- **Noise and Vibration Attenuation:** Rail facilities (i.e., trackwork and switches) and vehicles would be designed to minimize groundborne and airborne noise and vibration.

- **Maintenance and Storage Facility Requirements:** No new maintenance and storage facilities would be required. Existing facilities are more than adequate, because the existing Rapid Transit fleet is greater than needed for current and proposed operations. The acquisition of new "dual boarding-height" boarding vehicles (as proposed for some of the rail alternatives) may require modifications or additions to the inventory of maintenance equipment or changes in space utilization patterns of existing facilities.

3.4.3 Definition of Rail Alternatives Evaluated

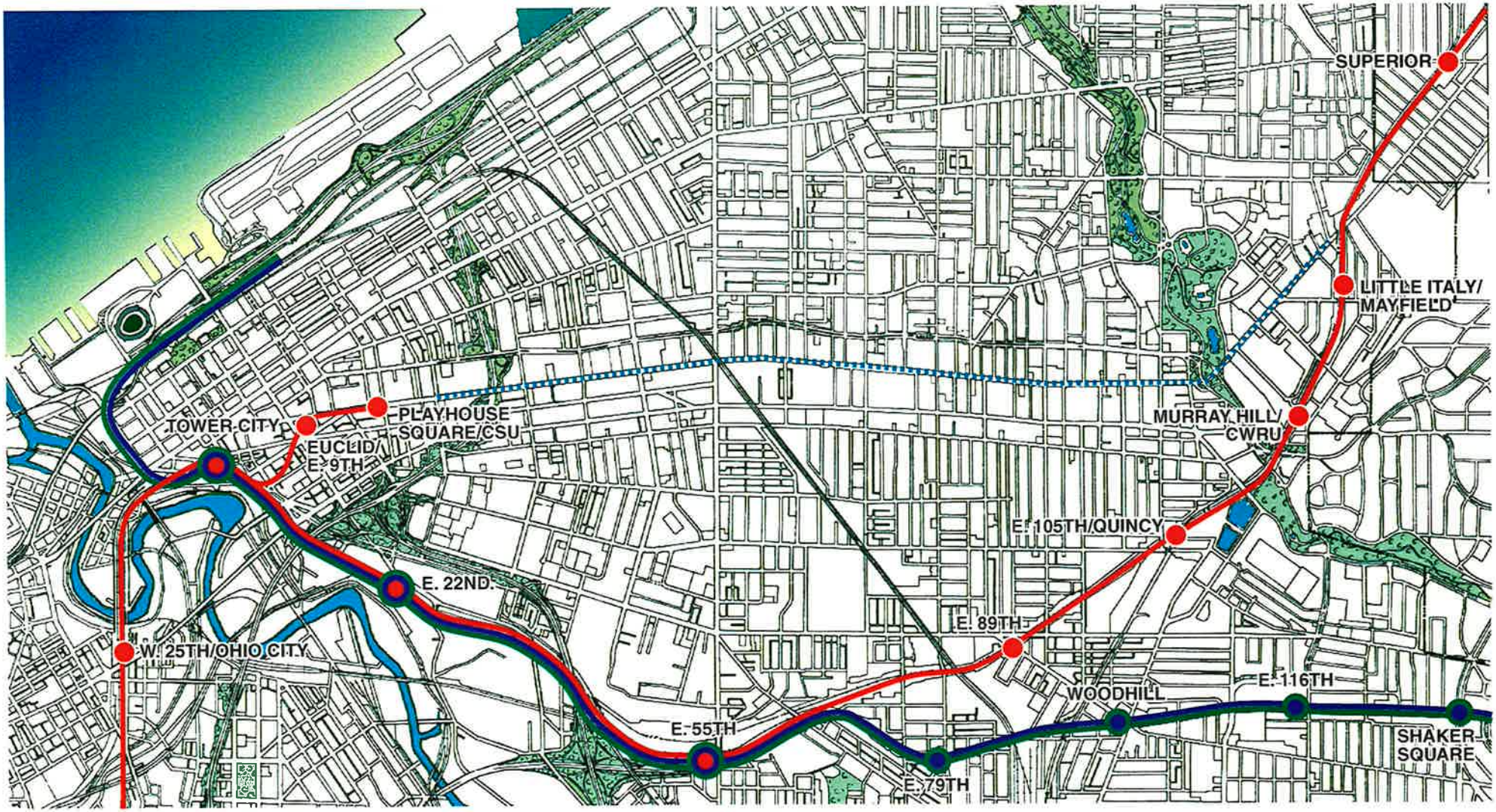
Descriptions of the four rail alternatives selected for evaluation within the framework of the Transitional Analysis are presented in the following sections. The physical features of each alternative are described as well as the service operation plans.

Alternative 3A - Downtown Red Line Extension

Alternative 3A (Figure 3-4) represents a means of providing additional Rapid Transit access to Downtown Cleveland. This alternative also would serve the function of a Downtown "distributor", by continuing east from Tower City Station and intercepting bus patrons arriving at the new CSU Transit Center on inbound express and flyer routes. Direct Rapid Transit service would be provided to the East 9th Street/Euclid Avenue office/commercial concentration, the Playhouse Square District, and CSU.

Operational Segment (Euclid Subway)

After coming off GCRTA's Cuyahoga Valley viaduct (from HIA), passing beneath the State Office Building, and serving Tower City Station, Red Line service would make use of blind headings already in place under Huron Road. The line would turn to the east and continue underground beneath Huron Road to East 4th Street, then curve northeast on a cross-lots alignment toward the intersection of East 9th Street and Euclid Avenue. A subway station would be located on this



CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 3-4

DOWNTOWN RED LINE EXTENSION ALTERNATIVE (3A)

RED LINE
BLUE LINE
GREEN LINE
DEDICATED BUS LANES
STATION

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cross-lots segment west of East 9th Street and south of Euclid Avenue. Continuing underground, the line would curve eastward within Euclid Avenue right-of-way.

The line would continue east along Euclid Avenue in a shallow subway to a point just east of East 17th Street, where it would curve south in a cross-lots alignment toward the intersection of East 18th Street and Prospect Avenue. A second subway station would be located on the cross-lots segment between East 17th and East 18th Streets. A pedestrian passageway would be constructed under Prospect Avenue to establish an all-weather connection between this station and the new CSU Transit Center.

Operating Plan

The operating plan for this alternative assumes that the Red Line operations would continue to serve the HIA/Tower City/Windermere route, as today. However, two separate and distinct route operations would be created, requiring a transfer at Tower City Station.

Rail Operating Plan

Red Line service from the west (Red Line West) would be extended along the new subway segment to serve the two new stations in the east Downtown area. Red Line trains from the west (HIA and Brookpark) would proceed through Tower City Station and be turned back at the new Playhouse Square/CSU Station. Red Line East trains would operate between Tower City and Windermere. Red Line East trains would not be able to use the new extension; they would continue to operate along the N&W RR alignment, being turned back at Tower City Station. A peak period headway of 6 minutes would be maintained east of Tower City along the new extension. The two new stations would be constructed with "high" platforms to accommodate the high boarding height of cars that currently make up the Red Line fleet. The rail operating plan would not require acquisition of additional rail vehicles, because the current fleet size is sufficient to provide service on the two Red Line routes. Blue/Green Line service would not be affected by operations on the new subway section.

Bus Operating Plan

Improved Downtown access would permit short-turning some bus routes at outlying rail stations. Bus route turnback, in effect, would create "feeder" service to the Rapid Transit system. Certain express and flyer bus routes on the west side would be modified to take advantage of the direct Red Line service to this area. West side express and flyer routes would be turned back at three Red Line stations: Brookpark (75F-North Olmsted, 64F-Olmsted Falls, & 96F-Butternut/Hilliard), Triskett (75X-North Olmsted), and West 117th/Madison (65F-Hilliard).

East side express and flyer patrons would make connections with the extended Red Line West service via the pedestrian passageway between the new Playhouse Square/CSU Station and the CSU Transit Center. The following express and flyer bus routes would be turned back at the CSU Transit Center on the east side of Downtown:

7F	Monticello/Euclid Heights
9X, BX, F	Mayfield
28X	Euclid
32CX, SX WX	Cedar Routes

Transferring bus patrons would use the Red Line West to complete their travel into Downtown. Computerized signal progression on Euclid Avenue, as defined for the Bus/TSM Alternative, would be installed to improve the travel times of Euclid Corridor express and flyer routes. The GCRTA bus fleet of 768 vehicles anticipated under the Null Alternative would be increased to 822 vehicles.

Alternative 3B - Downtown Rapid Transit Relocation Alternative

Alternative 3B (Figure 3-5) represents a means of providing full Rapid Transit access to Downtown Cleveland through the relocation of the existing Rapid Transit alignment from a point just east of East 30th Street to Tower City Station. Direct, through Rapid Transit service would be provided to:

- **East Downtown Area -**
  - East 9th Street/Euclid Avenue commercial district
  - Playhouse Square District
  - CSU/Cleveland State Convocation Center; and

- **St. Vincent Quadrangle -**
  - St. Vincent Charity Hospital
  - Metro Campus of Cuyahoga Community College (Tri-C)
  - Main U.S. Post Office facility.

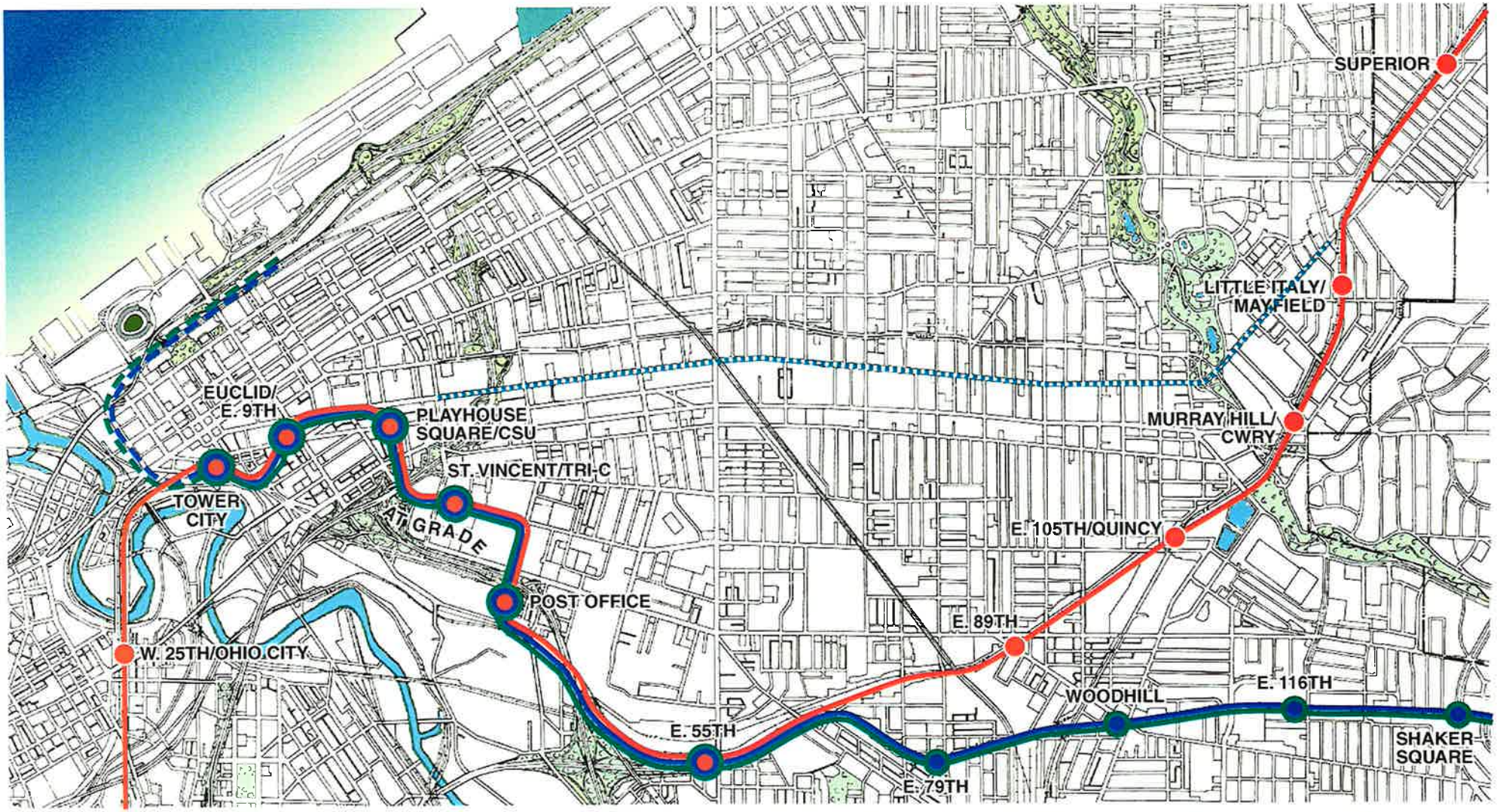
All Red, Blue, and Green Line service would be routed along this new alignment. All Rapid Transit service would be discontinued on the N&W RR cut between East 30th Street and Tower City.

Operational Segments

There would be two principal operational segments associated with Alternative 3B. The Downtown segment would be similar to Alternative 3A. Red Line service would be extended to the east of Tower City as a subway along the Huron/Euclid alignment. The second operational segment would connect the new subway extension to existing Rapid Transit service at the N&W RR cut via an at-grade, two-track rail guideway through the St. Vincent Quadrangle. Once at the N&W RR cut, Red, Blue, and Green Line service out to Windermere, Green, and Warrensville would be the same as today.

Downtown (Euclid Subway)

After coming off GCRTA's Cuyahoga Valley viaduct (from HIA), passing beneath the State Office Building, and serving Tower City Station, Red Line service would make use of blind headings already in place under Huron Road. The line would turn to the east and continue underground beneath Huron Road to East 4th Street, then curve northeast on a cross-lots alignment to the intersection of East 9th Street and Euclid Avenue. A subway station would be located on this cross-lots alignment just west of East 9th Street and south of Euclid Avenue. Continuing underground, the line would curve eastward on Euclid Avenue. The line would continue east on Euclid Avenue in a shallow subway to East 17th Street, where it would turn southeast on a cross-lots alignment to the intersection of East 18th Street and Prospect Avenue. A second subway station to serve the Playhouse Square/CSU area would be located on this cross-lots alignment, between East 17th and East 18th Streets.



CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 3-5

DOWNTOWN RAPID RELOCATION ALTERNATIVE (3B)

RAIL LINES
ALTERNATING (Blue & Green Lines)
DEDICATED BUS LANES
STATION

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Mid Corridor (Euclid/Pittsburgh At-Grade)

The Euclid/Pittsburgh At-Grade segment would connect the Euclid Subway to existing Rapid Transit service at the N&W RR cut south of Pittsburgh Avenue and east of East 30th Street. The shallow subway would transition south of the Playhouse Square/CSU Station by way of a retained cut aligned along the east side of East 18th Street. The alignment of this retained cut would require the use of East 18th Street right-of-way and the landscaped buffer on the western edge of the CSU Convocation Center site. East 18th Street would become a two-lane facility. This would be consistent with plans for East 18th Street to become the northbound element of a one-way pairing with East 17th Street extended to the south from Euclid Avenue. The new LRT line would be fully at-grade before crossing Carnegie Avenue.

The line would cross Carnegie Avenue, staying to the east side of East 18th Street and curving eastward under the Inner Belt (Interstate 71/90) This alignment would require removal of the Independent Towel Supply Company Building and, potentially, the U.S. Postal Workers Credit Union Building. Also, the east side of the Inner Belt overpass may need to be slightly modified to accommodate the two-track, at-grade LRT guideway. The line would continue at-grade east on the north side of westbound Community College Avenue to East 22nd Street. The line, still at-grade, would proceed diagonally through the East 22nd Street/Community College Avenue intersection, shifting to the middle of Community College Avenue. A station is proposed to be located in the center of Community College Avenue just west of East 24th Street in front of St. Vincent Charity Hospital (refer to Typical Euclid At-Grade Station included in the definition of Alternative 4A). This station would serve the hospital, Cuyahoga Community College (Tri-C), and numerous other social services in this redevelopment area.

The relocated Rapid Transit line would continue east in the center of Community College Avenue to a point just west of East 30th Street. At this point, the line would curve in a cross-lots alignment to the south, cutting through the northeast corner of the Tri-C campus to the center of East 30th Street. The line would continue south at-grade in the center of East 30th Street to Woodland Avenue. At Woodland Avenue, the line would shift to the west side of East 30th Street, crossing diagonally through the Woodland/East 30th Street intersection. The new at-grade Red Line alignment on the west side of East 30th Street would continue south, crossing Woodland Avenue, going under the Willow Freeway (Interstate 77), and crossing Orange Avenue. The west side of the Willow Freeway overpass would need to be widened to accommodate the two-track, at-grade rail guideway. A station would be located between Orange and Pittsburgh Avenues in the grassed buffer zone at the east end of the U.S. Post Office complex. South of this station, the new Rapid Transit alignment would cross Pittsburgh Avenue, curve to the east and drop down into the N&W RR cut south of Pittsburgh Avenue.

Operating Plan

This alternative would provide significant, enhanced accessibility to Downtown, particularly from the east. Red Line service for the west side would be extended to the Playhouse Square and CSU area. All Red, Blue, and Green Line service from the east side of Cleveland would be routed on to this new line serving the east side of Downtown and the St. Vincent Quadrangle area. Rapid Transit service to the east from Downtown would continue operating within the existing N&W RR cut to serve Windermere (Red Line) and Warrensville and Green (Blue and Green Lines, respectively).

Rail Operating Plan

All Red, Blue, and Green Line trains would operate over this new Downtown Rapid Transit alignment. Red Line service would be separated into two routes. "Red Line West" service, from HIA and the Brookpark area to Downtown, would be turned back at the new Playhouse Square/CSU Station (Euclid/East 18th Street). "Red Line East" service, between Tower City and Windermere, would be turned back at Tower City Station. Blue/Green Line trains also would operate to Tower City Station before turning back or continuing on to serve the Waterfront Line. As noted earlier, every other Blue/Green Line train would continue through to serve the Waterfront Line in the peak periods. The combined operation of the East/West Red Lines and the Blue/Green Lines would result in a 3 minute peak period headway between Tower City Station and the Playhouse Square/CSU Station.

The two new Downtown stations at East 9th Street and Playhouse Square/CSU would be constructed with "high" platforms; this would permit the existing Red Line fleet to serve the extended Red Line West subway route. Stations at St. Vincent/Tri-C and the U.S. Post Office would be standard "low" platform, at-grade stations. Such stations are typical of those now served by the Blue/Green Line. The requirement for both high and low platform boarding/alighting under this scenario would require Red Line East operations to serve existing and new subway stations with high platforms as well as the new at-grade stations with low platforms. Similarly, Blue/Green Line operations would be required to serve existing and new low platform stations as well as the new high platform stations. Thus, this operating scenario would include acquisition of a new fleet of 28 "dual boarding-height" cars to be used for both Red Line East and the Blue/Green Line operations. This acquisition would permit all Red Line cars to serve all stations. However, Blue/Green Line service to all stations would be limited to every other car. Detailed operating plans for integrated Rapid Transit service on this new alignment would be fully defined and tested during Preliminary Engineering.

Bus Operating Plan

The bus operating plan for Alternative 3B is the same as that defined for Alternative 3A.

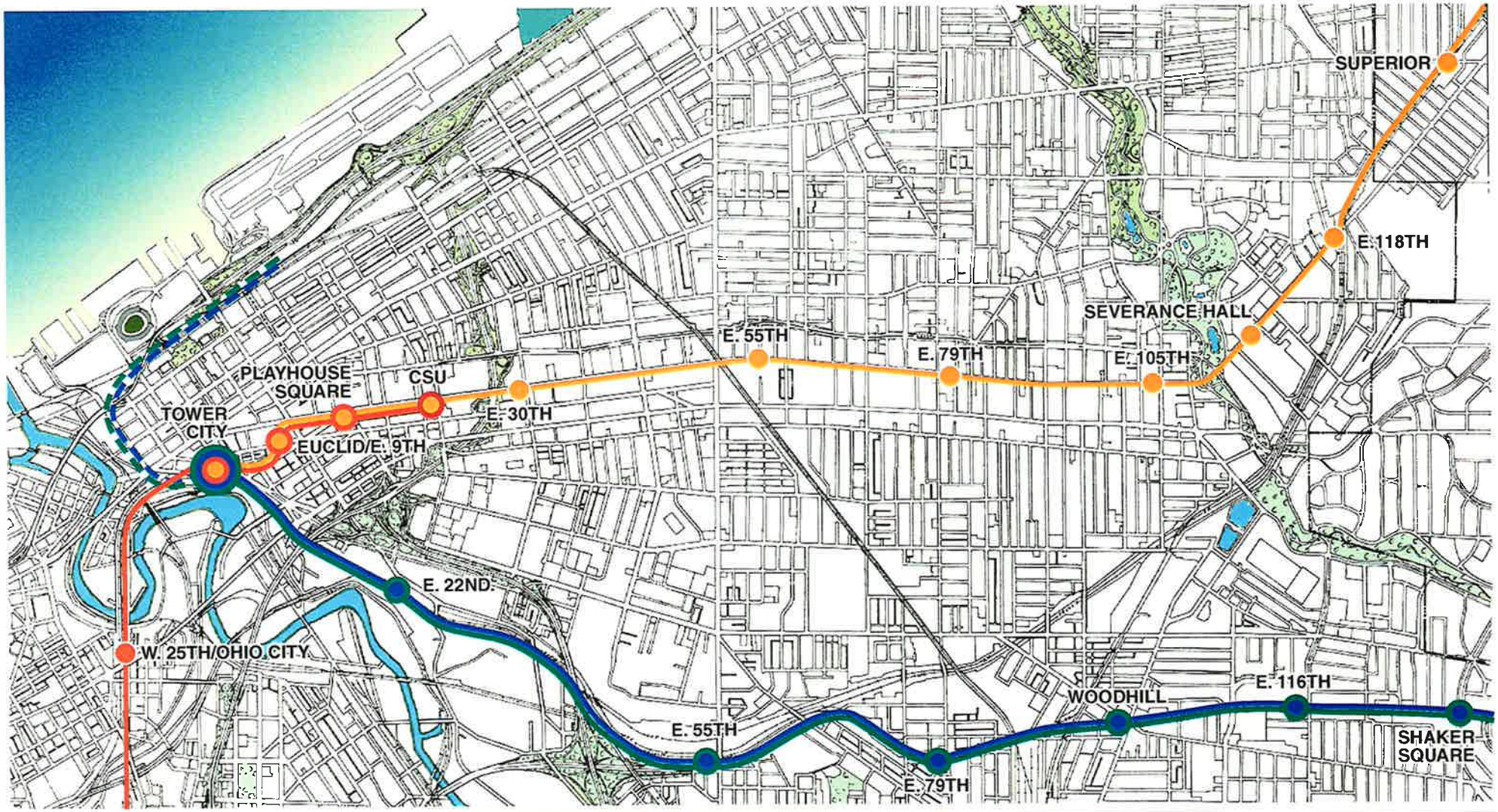
Alternative 4A - Huron/East 9th Subway/Euclid At-Grade/Euclid At-Grade

Alternative 4A represents the relocation of all Red Line service to Euclid Avenue. Revenue service would be discontinued on the existing Red Line section from Tower City to Euclid Avenue/East 120th Street. All trains serving the Tower City/Windermere Route would use the new Euclid Avenue alignment. The overall alignment of Alternative 4A, as defined for evaluation, is shown on Figure 3-6. A description (west to east) of the physical and operational aspects of this alternative is provided below.

Operational Segments

Downtown

After coming off GCRTA's Cuyahoga Valley viaduct from Hapkins International Airport(HIA), passing beneath the State Office Building, and serving Tower City Station, Red Line East/West service would make use of blind headings already in place under Huron Road. The new Red Line alignment would turn to the east and continue underground beneath Huron Road to East 4th Street. It then would curve northeast on a cross-lots alignment to the intersection of East 9th



CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 3-6

EUCLID AVENUE RAPID ALTERNATIVE 4A

RAIL LINES
EUCLID ALIGNMENT
ALTERNATING ROUTES
STATION

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Street and Euclid Avenue. A subway station would be located on this cross-lots alignment just west of East 9th Street and south of Euclid Avenue. Continuing in a shallow subway, the line would curve eastward on Euclid Avenue. A second subway station would be located in the Playhouse Square District between East 13th and East 14th Streets. The line would continued in the center of Euclid Avenue. A portal would be constructed in the center of Euclid Avenue between East 18th and East 19th Streets to effect the subway to at-grade transition.

Mid Corridor

The at-grade LRT guideway would continue east in the median of Euclid Avenue to East 21st Street. An at-grade station, serving CSU, would be located between East 21st and East 22nd Streets. The relocated Red Line would continue east along Euclid Avenue in an exclusive, at-grade median from East 24th Street to East 107th Street (Figure 3-7). The bridge over the Inner Belt and the Conrail bridge over Euclid Avenue at East 55th Street would be modified to accommodate the two track LRT guideway. At-grade stations would be located approximately one mile apart at: East 30th Street, East 55th Street, East 79th Street, and East 105th Street (Figure 3-8).

University Circle

The relocated Red Line would continue at-grade in the exclusive transit median on Euclid Avenue from East 107th Street to approximately East 120th Street. The line then would curve north in a cross-lots alignment and rise to connect with the existing Red Line rail service alignment in the N&W RR cut near the Cleveland City Limits. The existing Euclid Avenue rail overpass at East 120th Street would be modified to permit construction of the at-grade LRT tracks in the center of Euclid Avenue. An at-grade station is to be located on Euclid Avenue to serve Severance Hall. The existing East 120th Street Station would be replaced by an at-grade station in the LRT guideway near East 118th Street.

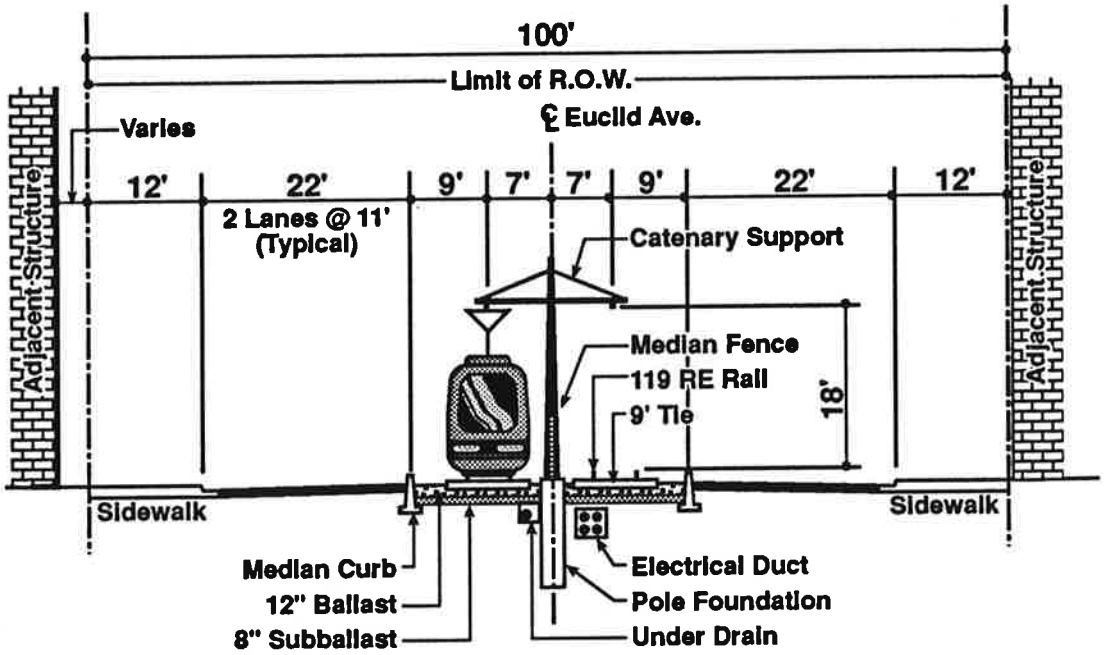
Operating Plan

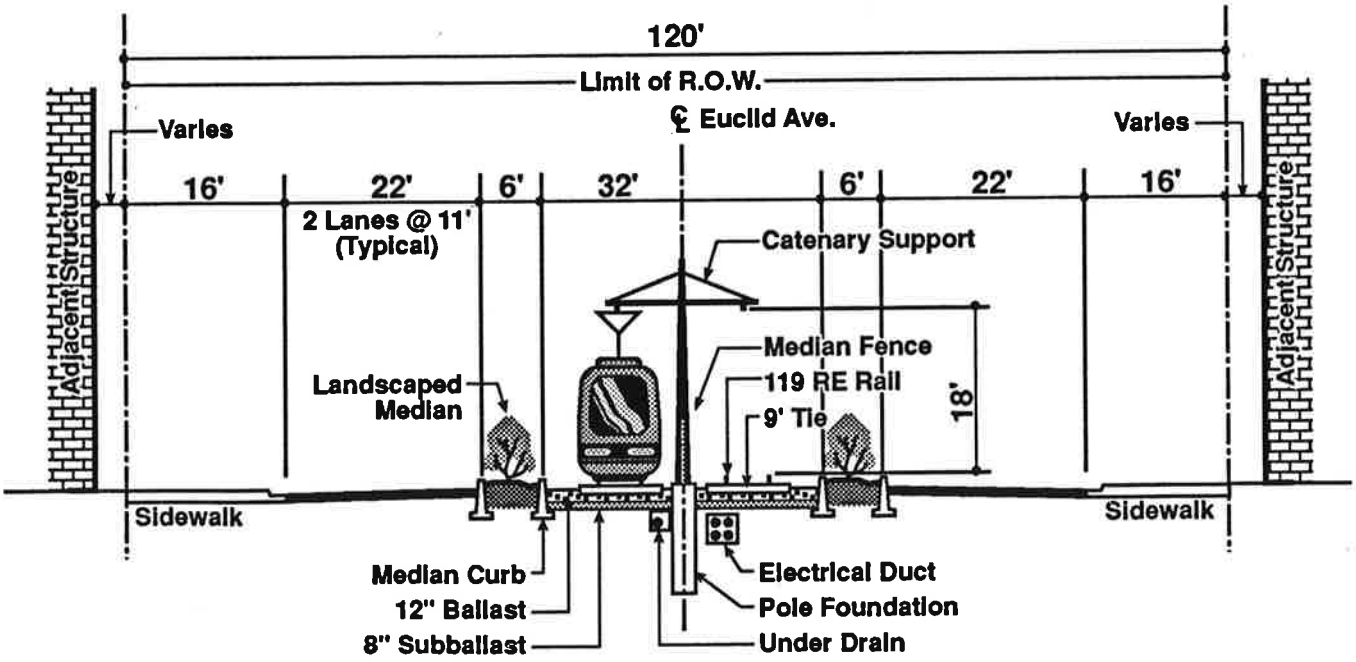
This alternative would provide LRT service along Euclid Avenue from Downtown Cleveland to the University Circle area. Service would continue to the east to Windermere. The rail and bus operating plans reflect decisions to "defer" select stations along Euclid Avenue, which were included in the original definition presented in the AA/DEIS and the subject of other evaluations.[3.7] This definition of the operating plan does not preclude development of these stations at a later date.

Rail Operating Plan

The rail operating plan for Alternative 4A eliminates Red Line service between the University Circle area and Tower City along the current route. Red Line trains would operate at 8 minute headways between Windermere and Tower City along the new Euclid Avenue alignment. Trains from the east would be turned back at the Tower City Station. Red Line service from HIA and the Brookpark area to Downtown would be turned back at the CSU Station. The combined operation of these two Red Line segments would result in a 3 minute peak period headway

3.7 Station Area Market Analysis, Revised Draft, September, 1994, and Station Area Profile, November, 1994, prepared for GCRTA by euclid Consultants, A Joint Venture.





CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 3-7
CROSS SECTON OF TWO TRACK, AT-GRADE LRT ON EUCLID AVE.

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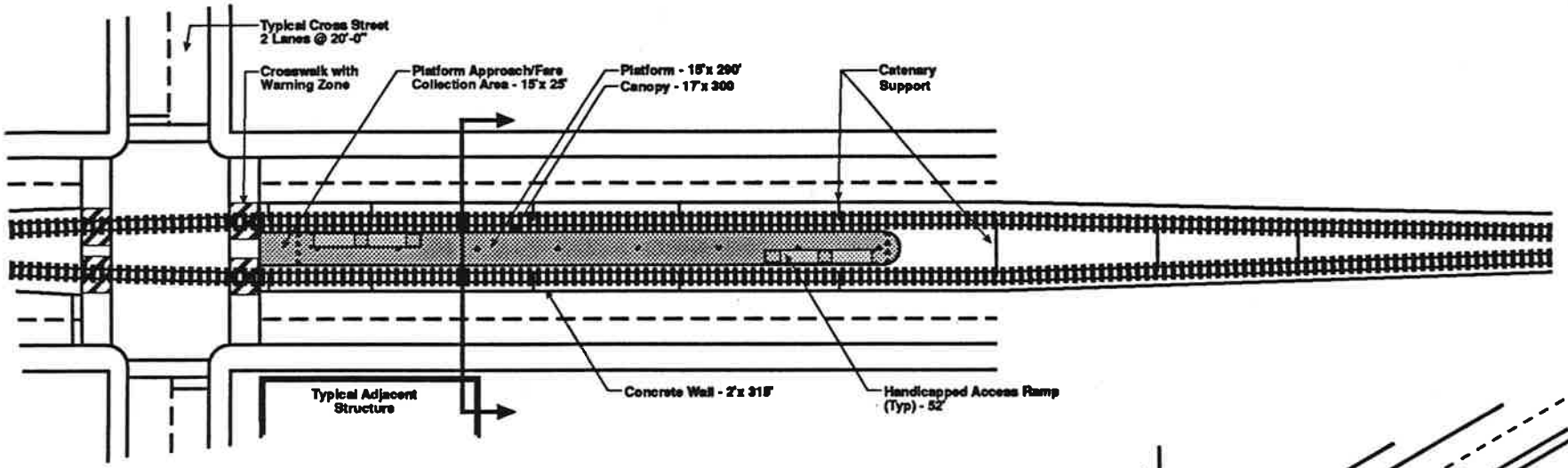
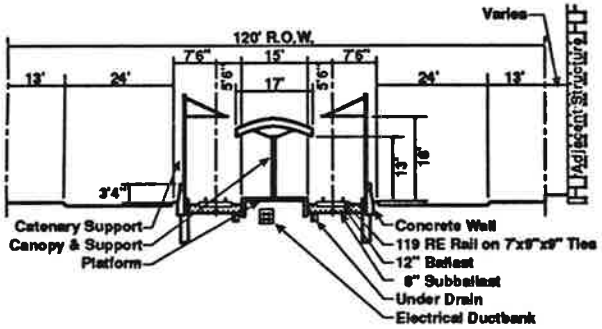
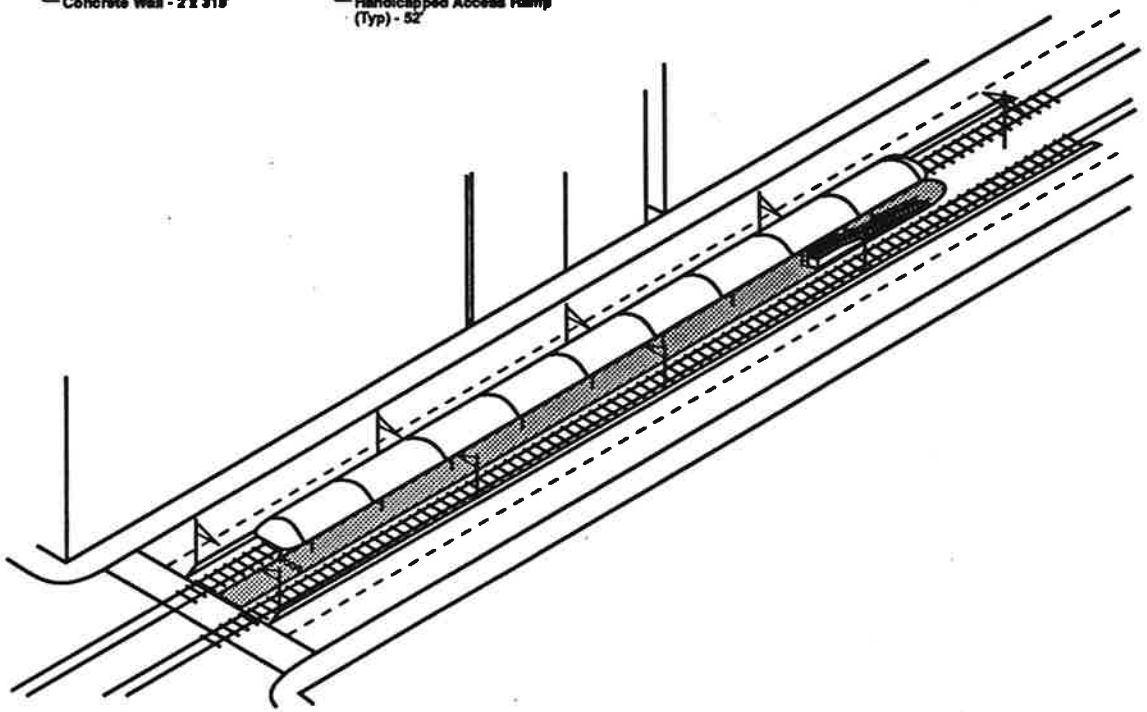
NOT TO SCALE

GREATER CLEVELAND REGIONAL TRANSIT AUTHORITY

Source: Dual Hub Corridor AA/DEIS







CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 3-8

TYPICAL AT GRADE, CENTER PLATFORM STATION ON EUCLID AVENUE

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NOT TO SCALE

GREATER CLEVELAND REGIONAL TRANSIT AUTHORITY

Source: Dual Hub Corridor AA/DEIS

between Tower City Station and the CSU Station. Blue and Green Line service would remain unchanged, continuing to operate along the N&W RR cut.

The existing fleet of Red Line cars could be used to provide service for HIA and the Brookpark area to these new stations. Therefore, the two new Downtown subway stations at East 9th Street and Playhouse Square (between East 13th and East 14th) and the CSU Station would be constructed with "high" platforms to accommodate existing Red Line cars that would serve the Red Line West route. However, at-grade LRT operations along Euclid Avenue's exclusive median guideway (east of East 22nd Street) would require "low" platform cars. A new fleet of cars, permitting high/low boarding, must be acquired to serve both the at-grade and subway stations on the Windermere-Tower City Red Line East route. This scenario contemplates the acquisition of 13 new dual boarding-height rail vehicles.

LRT trains on Euclid Avenue east of East 22nd Street would operate at-grade, i.e., at street level; rail operations would be contained within an exclusive median guideway in the public right-of-way. The number of lanes carrying through traffic would be maintained by eliminating parking and using the curb lanes for through traffic. Rail service would operate at posted speed limits for city streets.

Bus Operating Plan

"Improved rail accessibility to Downtown employment centers creates additional opportunities for turning buses back at outlying rail stations." Alternatives 3A and 3B include the concept that express and flyer service in the Dual Hub Corridor would be turned back at the new CSU Transit Center. The bus operating plan for Alternative 4A calls for buses providing these services to be turned back in the University Circle area at the Euclid/East 105th Red Line East Station. The bus transit services on the west side of Cleveland are turned back at either Brookpark, Triskett, or West 117th/Madison. Routes affected by implementing this alternative are:

Service Area	**Service Orientation**
Dual Hub Corridor	
6,6A - Euclid Avenue	Local
16,16A - East 55th Street	East 55th Rail Station Feeder
2 - East 79th Street	East 79th Rail Station Feeder
10 - East 105th Street	East 105th Rail Station Feeder
48,48A - Univ. Circle/E.131st	East 105th Rail Station Feeder
50 - Univ. Circle/E.116th	East 105th Rail Station Feeder
7F - Monticello/Euclid Hts.	East 105th Rail Station Feeder[3.8]*
9X,BX,F - Mayfield Road	East 105th Rail Station Feeder*
28X - Euclid Avenue	East 105th Rail Station Feeder*
32CX,SX,WX - Cedar Routes	East 105th Rail Station Feeder*
West Side	
65F - Hilliard	West 117th/Madison Red Line Station
75X - North Olmsted	Turned back at Triskett
75F - North Olmsted	Brookpark Rail Station Feeder
64F - Olmsted Falls	Brookpark Rail Station Feeder
96F - Butternut/Hilliard	Brookpark Rail Station Feeder

3.8 * Indicates routes turned back at CSU Transit Center.

Changes in bus operations would require the same number of additional buses as for Alternatives 3A and 3B. GCRTA would need to increase the bus fleet to 822 vehicles from the 768 vehicles required under the Null Alternative.

Alternative 4D - Huron/East 9th Subway/Euclid At-Grade/East 107th At-Grade & Shaker Connector

Alternative 4D represents a scheme to provide fully integrated regional Rapid Transit service with respect to the Dual Hub Corridor. This alternative (like the others) principally proposes relocation of the Red Line to serve Euclid Avenue, providing a direct link between Downtown and University Circle. However, regional accessibility would be enhanced through linkage with Blue and Green Line operations to Shaker Heights. The overall alignment of Alternative 4D, as defined for evaluation, is shown on Figure 3-9. A description (west to east) of the physical and operational aspects of this alternative is provided below.

Operational Segments

Downtown

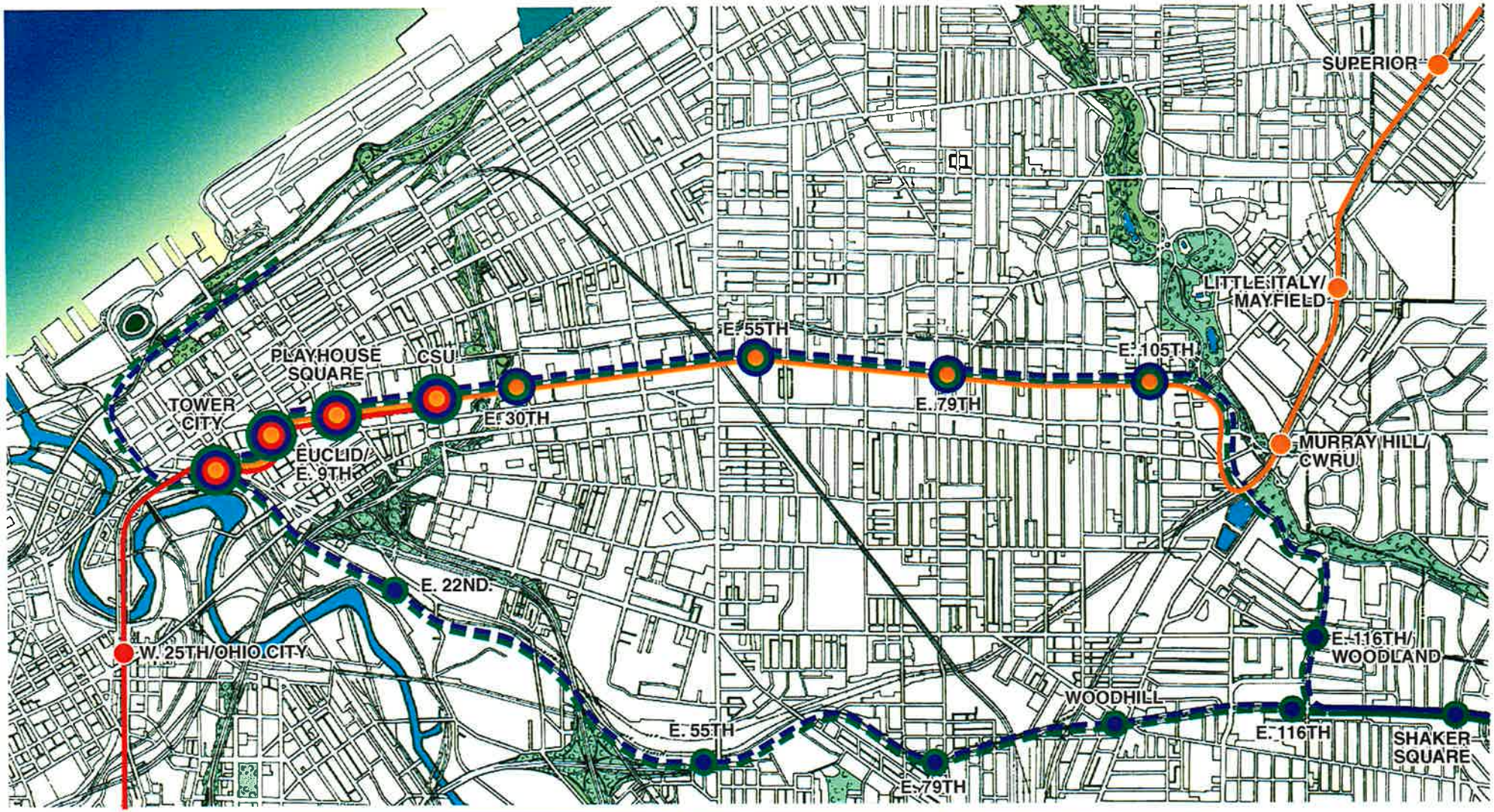
After coming off GCRTA's Cuyahoga Valley viaduct (from HIA), passing beneath the State Office Building, and serving Tower City Station, Red Line service would make use of blind headings already in place under Huron Road. The line would turn to the east and continue underground beneath Huron Road to East 4th Street, then curve northeast on a cross-lots alignment to the intersection of East 9th Street and Euclid Avenue. A subway station would be located on this cross-lots alignment just west of East 9th Street and south of Euclid Avenue. Continuing underground, the line would curve eastward on Euclid Avenue. Continuing in a shallow subway, the line would curve eastward on Euclid Avenue. A second subway station would be located in the Playhouse Square District between East 13th and East 14th Streets. The line would continue in the center of Euclid Avenue. A portal would be constructed in the center of Euclid Avenue between East 18th and East 19th Streets to effect the subway to at-grade transition.

Mid Corridor

The at-grade LRT guideway would continue east in the median of Euclid Avenue to East 21st Street. An at-grade station, serving CSU, would be located between East 21st and East 22nd Streets. The relocated Red Line would continue east along Euclid Avenue in an exclusive, at-grade median from East 24th Street to East 107th Street (refer to Figure 3-7). The bridge over the Inner Belt and the Conrail bridge over Euclid Avenue at East 55th Street would be modified to accommodate the two track LRT guideway. At-grade stations, as identified for Alternative 4A, would be located approximately one mile apart at: East 30th Street, East 55th Street, East 79th Street, and East 105th Street (refer to Figure 3-8).

University Circle

The University Circle operational subarea under Alternative 4D has been defined by two separate operating segments. One segment would provide service to the east from East 107th Street along the existing Red Line route within the N&W RR cut. The other segment would continue across the existing Red Line route and N&W RR to the south to serve the Woodland Hills and Fairhill neighborhoods and Shaker Heights.



CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 3-9

EUCLID AVENUE RAPID ALTERNATIVE 4D

RAIL LINES
EUCLID ALIGNMENT
ALTERNATING ROUTES
STATION

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Euclid Avenue: The relocated Red Line would remain at-grade in an exclusive median guideway in the Euclid Avenue ROW to East 107th Street. The guideway alignment would curve south at Stearns Road and continues along East 109th Street to Carnegie Avenue. At Carnegie Avenue, the line would proceed in a cross-lots alignment to the east side of Fairhill Road, then curve eastward on a short section of aerial structure over the railroad tracks, descending to join the existing Red Line rail service in the vicinity of the GCRTA overpass for Cedar Avenue. New Murray Hill/CWRU and Little Italy/Mayfield Stations would be constructed on the existing Red Line at Adelbert Road and Mayfield Road, respectively. These stations would replace existing Red Line stations at Cedar Avenue and East 120th Street.

Shaker Connector: A rail link would proceed south from the new Red Line alignment at Fairhill Road and the N&W RR tracks. This "Shaker Connector" would continue at street level on the eastern side of Fairhill Road to Martin Luther King, Jr. Drive, where it would curve south into an exclusive at-grade guideway constructed in the median (Figure 3-10). An at-grade, low platform station would be built in the center of Martin Luther King (MLK), Jr. Drive at Woodland Avenue. Continuing to Shaker Boulevard (Figure 3-11), the line would curve east and descend to join the existing tracks for the Blue/Green Lines in the median of this street.

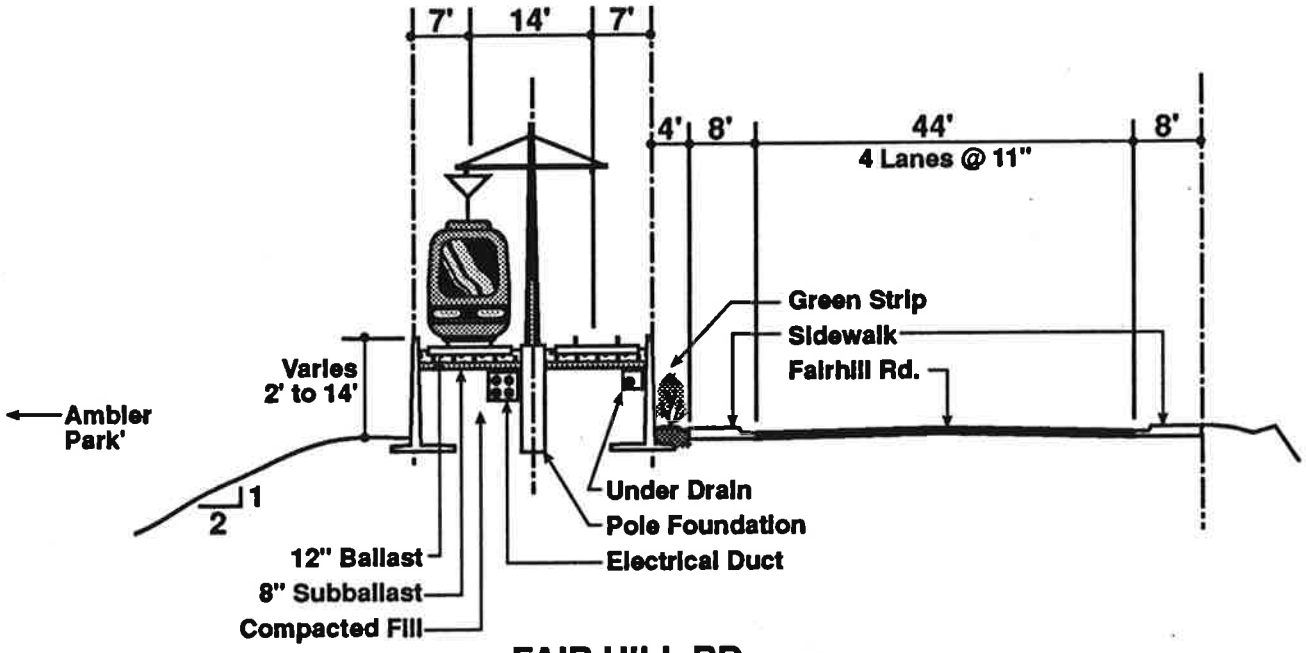
Operating Plan

This alternative would provide LRT service along Euclid Avenue from Downtown Cleveland to the University Circle area. Service would continue to the east to Windermere (Red Line) and to the south to Shaker Square and Warrensville (Blue/Green Line). The rail and bus operating plans reflect decisions to "defer" select stations along Euclid Avenue, which were included in the original definition presented in the AA/DEIS and other evaluations noted above. This evaluation does not preclude development of these stations at a later date.

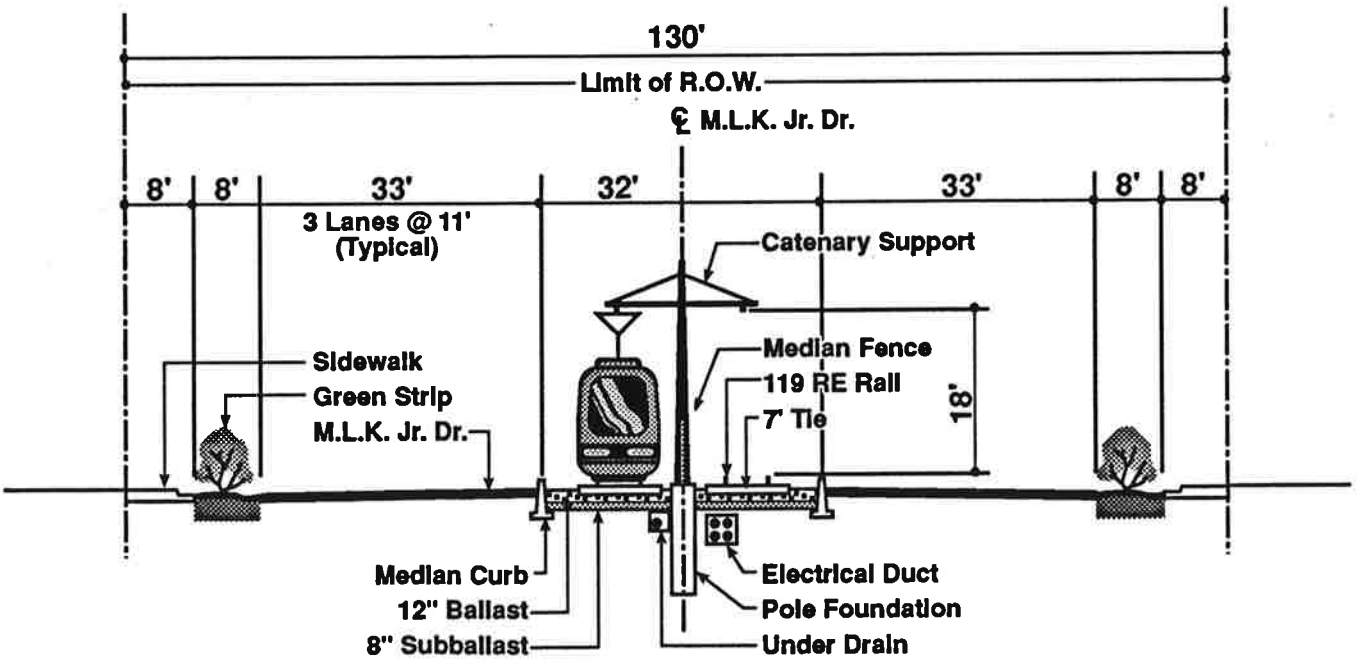
Rail Operating Plan

The rail operating plan for Alternative 4D, like that for Alternative 4A, eliminates Red Line service between the University Circle area and Tower City along the current N&W RR alignment. Red Line trains would operate at 8 minute headways between Windermere and Tower City along the new Euclid Avenue alignment. Red Line "East" trains would be turned back at the Tower City Station. Red Line "West" service, from HIA and the Brookpark area to Downtown, would be turned back at the CSU Station. The combined operation of these two Red Line segments would result in a 3 minute peak period headway between Tower City Station and the CSU Station.

Blue/Green Line service would continue to be provided along the existing N&W RR alignment. Due to limitations in the modeling/forecasting environment, ridership forecasts have been based on the assumption that only Blue Line trains would be routed along the Shaker Connector to provide regional service in the Euclid Corridor. However, it is perfectly feasible that every other Blue/Green train could be routed along the Shaker Connector, combining with the Red Line trains to serve the new Euclid Avenue route. Either operating scenario provides the same level of service. The underlying concept for Alternative 4D contemplates that both the Blue and Green Lines would serve the Euclid Corridor. Details regarding the operating and interconnection between the Red, Blue, and Green Lines, within the definition of this alternative, will be reexamined and finalized during Preliminary Engineering. This operating plan would result in a combined peak period operating headway of 4 minutes along Euclid Avenue west of University Circle. The combined peak period operating headway on the current Blue/Green Line west of East 116th Street (between Downtown and Shaker Heights) would be doubled to 8 minutes.



FAIR HILL RD.



MARTIN LUTHER KING JR. DR.

CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 3-10
EXCLUSIVE LRT GUIDEWAY AT FAIRHILL RD. & MARTIN LUTHER KING JR. DR.

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NOT TO SCALE

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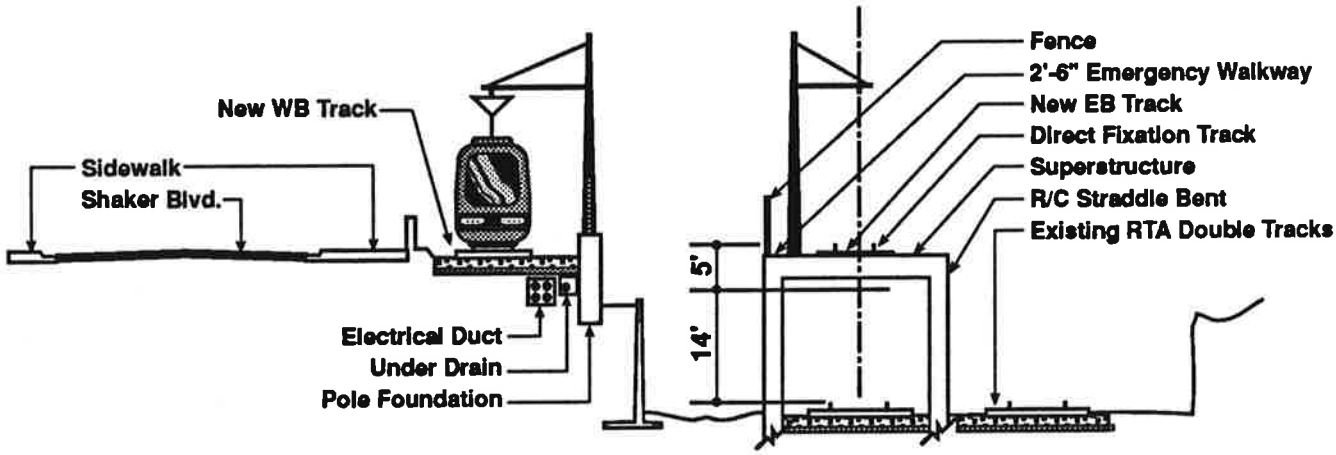
Source: Dual Hub Corridor AA/DEIS



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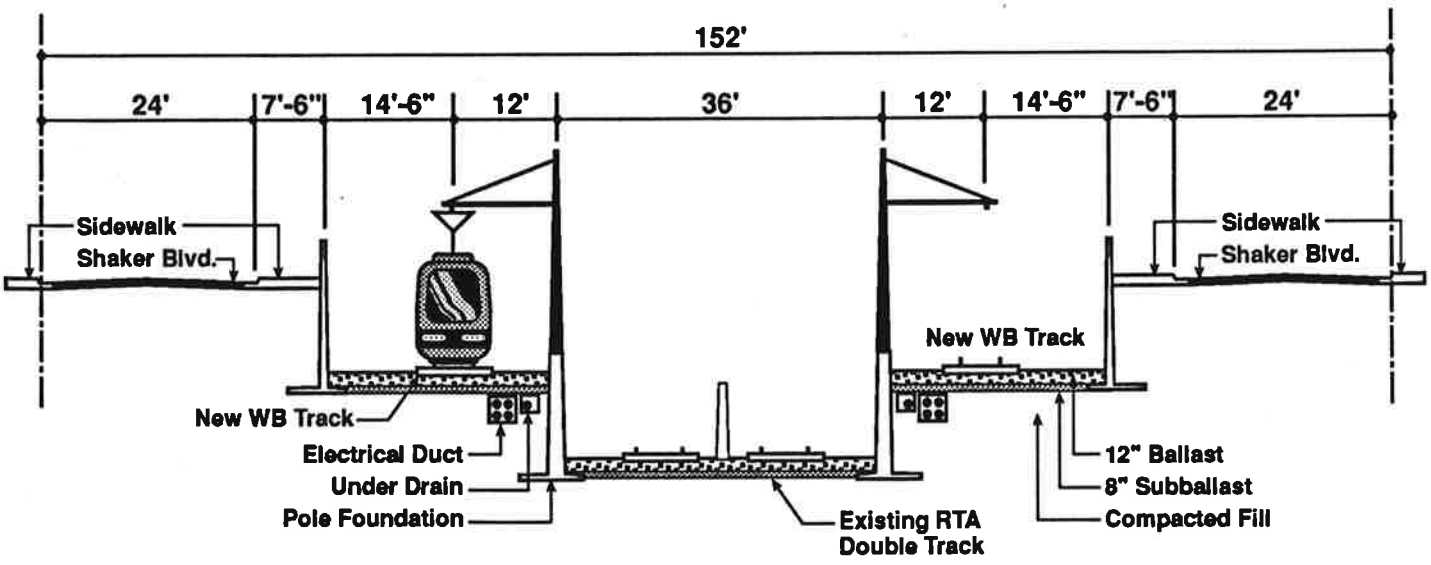

BELOW GRADE

CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 3-11
CROSS SECTION ALTERNATIVES AT SHAKER BLVD.

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NOT TO SCALE

GREATER CLEVELAND REGIONAL TRANSIT AUTHORITY

Source: Dual Hub Corridor AA/DEIS

The existing fleet of Red Line cars could be used to provide service from HIA and the Brookpark area to the new Downtown stations. Therefore, the two new Downtown subway stations at East 9th Street and Playhouse Square (between East 13th and East 14th) and the CSU Station would be constructed with "high" platforms to accommodate existing Red Line cars that would serve the Red Line West route. However, at-grade LRT operations along Euclid Avenue's exclusive median guideway (east of East 22nd Street) would require "low" platform cars. A new fleet of LRT cars, permitting high/low boarding, would be acquired to serve both the at-grade and subway stations on the Windermere-Tower City Red Line East route. This scenario contemplates the acquisition of 27 new dual boarding-height rail vehicles for disposition between the Red, Blue, and Green Line operations in accordance with the final operating plan.

Bus Operating Plan

The bus operating plan for Alternative 4D is the same as that identified for Alternative 4A, except that Routes 48,48A - University Circle/East 131st Street and Route 50 - University Circle/East 116th Street would serve as feeders for the East 116th/Fairhill Blue/Green Line Station in addition to the East 105th Red Line Station.

4.0 EVALUATION OF ALTERNATIVES

4.0 EVALUATION OF ALTERNATIVES

4.1 EVALUATION FRAMEWORK

The purpose of the evaluation of alternatives is to inform local, State, and Federal decisionmakers of the benefits, costs, and potential impacts of each alternative. The framework provided outlines measures used to explain, either quantitatively or qualitatively, the performance of each alternative relative to an approved set of goals and objectives. The following sections identify these goals and objectives and explain the decision framework adopted for the study. To be consistent with Federal planning practice, the evaluation performed throughout this chapter compares only the baseline scenario. Information on the alternative development scenario is included in the appendix.

4.1.1 Study Goals And Objectives

The Steering Committee of the Dual Hub Corridor AA/DEIS adopted several goals and objectives to aid in judging the extent to which the alternative transportation improvements address the concerns of the community, including the City of Cleveland, GCRTA, NOACA, private sector interests, and the general public. These goals were reviewed with initiation of the Transitional Analysis. The specific goals and objectives that constitute the framework for evaluating Dual Hub Corridor transit alternatives are:

- **GOAL: Improve Transportation Services**
  - Increase Public Transit Usage
  - Minimize Total Travel Time
  - Minimize Traffic Congestion
  - Enhance the Productivity of the Transit System
  - Improve the Mobility of the Transit Dependent and Access of that Population to Employment Centers and Community Resources
- **GOAL: Support Economic Development**
  - Improve Access to Existing Private and Public Physical Development
  - Encourage New Public and Private Physical Development
  - Encourage Private Financial Participation in Public Transportation Improvements
- **GOAL: Enhance the Social and Environmental Quality of the Community**
  - Minimize Neighborhood/Community Disruption
  - Reduce Aesthetic Intrusion
  - Minimize Adverse Impacts on Architectural and Historic Sites
    Improve Air Quality
  - Minimize Noise and Vibration Impacts
  - Improve Access of Greater Cleveland Residents to Medical, Educational, and Cultural Institutions and Resources

4.1.2 Decision Framework

The goals and objectives adopted for the Transitional Analysis are the basis for defining criteria to be used in measuring the performance of each alternative. The degree to which an alternative satisfies the adopted goals and objectives indicates the potential for its acceptance by the community and the likelihood of its implementation. The decision at hand is focused on the selection of a PIS. Numerous alternatives were evaluated in the AA/DEIS. That work was instrumental in reaching the alternatives defined in the previous chapter. Selection of a PIS will permit GCRTA to continue the Federal project development process. Assuming the PIS is one of the action alternatives, it, along with the Null and Bus/TSM Alternatives, will be carried forward into Preliminary Engineering and become the subject of a Supplemental DEIS and Final EIS.

The alternatives defined for the Transitional Analysis were reviewed first by an inter-agency staff level technical group. The evaluation process then involved the InterAgency Task Force established for the study. Feedback from the InterAgency Task Force was used as guidance with respect to the need to perform additional analyses, clarify study findings, or modify adopted conclusions. The study's findings and conclusions then were subject to review by various community interests and constituencies, including:

- GCRTA Citizen's Advisory Committee
- County Planning Commission
- City Planning Commission
- NOACA Technical Advisory Committee
- County Mayors and Managers
- GCRTA Board of Trustees
- NOACA Policy Board

During the course of this review, GCRTA conducted public meetings to present the findings and conclusions in this report and solicit feedback regarding the recommended alternative. A PIS will be identified in accordance with comments received at the Public Meetings and comments and recommendations from the community interests and constituencies identified above.

The purpose of this chapter is to provide a comparative evaluation of alternatives with respect to ridership forecasts, capital cost estimates, operating and maintenance cost estimates, environmental impacts, and financial feasibility. It is the intent of this chapter to provide data and information needed for the selection of a PIS to be studied in detail in Preliminary Engineering.

The next steps to be taken in the Federal transit project development process (outlined in Chapter 6) will depend on the PIS selected. The selection of the Bus/TSM Alternative likely would require a short-range implementation study, leading to construction of capital improvements and modification of existing GCRTA bus and rail operations to encourage new ridership. Should one of the LRT alternatives or the Bus/TSM Alternative be selected, funding for Preliminary Engineering would be sought from the FTA and preparation of the Final Environmental Impact Statement (FEIS) would be undertaken.

4.2 PROJECT EFFECTIVENESS - IMPROVE TRANSPORTATION SERVICES

The evaluation associated with the goal to ***Improve Transportation Services*** seeks to determine how well each alternative improves travel times and accessibility within the Dual Hub Corridor and to/from points outside the corridor. This section presents first a discussion of the existing transportation services in the corridor. This is followed by an evaluation of the effectiveness of each alternative in achieving the travel and mobility objectives.

4.2.1 Existing Transportation Services

General travel patterns and transportation conditions in the Dual Hub Corridor and in the Greater Cleveland region, which includes Cuyahoga County and portions of adjoining Geauga, Lake, Lorain, Medina, Portage, and Summit Counties, are highlighted in this section. Additional detail may be referenced in the AA/DEIS.

Streets and Highways

An extensive network of streets and highways provides access to the employment and activity centers in the Dual Hub Corridor from all areas of Greater Cleveland. Three interstate highways (I-90, I-71, I-77) provide direct access to the corridor in the vicinity of Downtown Cleveland. However, "no limited access highways serve the east side of Cleveland or the adjacent eastern suburbs of Cleveland Heights and Shaker Heights."[4.1] Instead four parallel streets-- Chester Avenue, Euclid Avenue, Carnegie Avenue, and Cedar Avenue-- serve the east/west travel pattern. These streets provide access to the corridor and its two intensely developed activity hubs-- Downtown Cleveland and University Circle.

The major highways and arterial streets concentrate vehicular traffic at a limited number of access points to Downtown Cleveland. Primary access from the northeastern, southern, and western portions of Cleveland and its suburbs is concentrated at five major points:

- **Inner Belt Interchanges** - providing access to I-71, I-77, and I-90.
  - Ontario Street
  - East 9th Street
  - East 14th Street; and

- **Memorial Shoreway Interchanges** - providing access to I-90 and western portions of Cleveland along the lake shore.
  - Lakeside Avenue (West 6th Street)
  - East 9th Street interchanges.

Once in Downtown Cleveland, traffic movement impedance and congestion results because of an awkward street pattern created by two intersecting street grids.

The focal point of the first street grid, established by the original survey for Cleveland in 1796, is the intersection of Ontario Street and Superior Avenue at Public Square. The second street grid was established at a later date, and it is positioned at an acute angle to the first. The

4.1 AA/DEIS, p. 3-20.

primary artery of the second street grid pattern, which has an east/west orientation, is Euclid Avenue. The other major east/west streets that comprise this grid terminate at various points in the CBD. The restrictive nature of Downtown access points and this intersecting street pattern in the Downtown creates significant congestion and constraints on the amount of bus service that can be provided during peak periods when the greatest hourly public transit ridership occurs.

Because of major changes in land elevation, the University Circle area serves as a funnel for traffic to and from Cleveland's eastern suburbs. Euclid Avenue provides access to East Cleveland; Mayfield Road and Cedar Glen serve Cleveland Heights; and the one-way pair of Fairhill Road and MLK, Jr. Drive provide access to Shaker Heights and Cleveland's southeastern neighborhoods. Euclid Avenue, in conjunction with Chester Avenue, Carnegie Avenue, and Cedar Avenue, carry approximately 75,000 vehicles daily between Downtown Cleveland and the eastern suburbs.

In general, traffic conditions on streets in the Dual Hub Corridor are projected to worsen by 2000, due to anticipated new public and private development. The efficiency of the streets and highways is expected to deteriorate from Level of Service (LOS) C or better in which traffic flow is stable to Level of Service D in which the flow of traffic is increasingly restricted. This deterioration is of particular concern in Downtown Cleveland and in University Circle. In both areas, street patterns do not allow traffic to be diverted to parallel streets, nor is it possible to increase the number of traffic lanes significantly to better accommodate increasing traffic.

Public Transportation

GCRTA provides public transportation services to the residents of Cuyahoga County on an extensive network of bus routes and on three rail lines.

Bus Transit Service

Bus service is available throughout Cuyahoga County on 118 routes with some 7,000 stops and covering 806 miles of streets. GCRTA provides three types of service through the operation of the bus transit system.

- **Downtown Loop Bus Routes:** Service on two downtown loops distribute passengers throughout Downtown office core and provide access to: the West Side Market, Burke Lakefront Airport, Memorial Shoreway municipal parking lots, St. Vincent Charity Hospital, and Tri-C.

- **Local Bus Routes:** Regular route services consists of radial routes which extend from Downtown Cleveland to the suburbs on major streets, and crosstown routes, which link radial routes at various intervals beyond the Downtown area. Typically, the 62 local bus routes operated by GCRTA have frequent stops to provide numerous points of access to activities along the routes.

- **Express and Flyer Bus Routes:** GCRTA operates 54 express and flyer services between Downtown Cleveland and its suburbs with a limited number of intermediate stops. This service is designed to carry significant numbers of people by providing a bus every 15 minutes or less during the peak morning and afternoon commuting periods.

Six of the local bus routes are operated with buses that have lifts for physically challenged patrons. Accessibility to bus service will expand in the future, as GCRTA continues implementing a policy calling for Community Responsive Transit (CRT) for elderly and disabled citizens. CRT provides prescheduled door-to-door travel service within 18 neighborhood areas in Cuyahoga County. Cross County Medical Service (CCMS) provides direct service to 13 hospitals and clinics.

Rail Transit "Rapid Transit" Service

GCRTA operates its "Rapid Transit" service on three rail lines, a heavy rail line– the Red Line– and two LRT lines– the Blue and Green Lines. GCRTA's Rapid Transit consists of 29.5 miles of double-track service to 44 stations. Three Red Line stations (Tower City Station, East 34th/Campus Station, and East 55th Station) are shared with the Blue and Green Lines.

- **Red Line:** The Red Line provides 19 miles of service between HIA and Brookpark on the west side through Tower City in Downtown Cleveland to Windermere in East Cleveland. Red Line service can be accessed at 18 stations. Red Line trains operate at five to six minute headways during the peak period. The operating headway is increased to 18 minutes during the midday and 20 minutes in the evening.

- **Blue/Green Lines:** The Blue Line is 9.3 miles long, serves 18 stations, and provides service to Warrensville Center Road along Van Aken Boulevard in Shaker Heights. The Green Line is 9.8 miles, also serves 18 stations, but provides service to Green Road along Shaker Boulevard. The Blue/Green Lines share four stations and three of these also are served by the Red Line. Service on the Blue and Green Lines is available every 10 minutes throughout the day.

Parking

In general, the supply of parking spaces in Downtown Cleveland is considered adequate to meet current demand. The zoning code of the City of Cleveland does not require the provision of parking with new development in the CBD. As a result, the supply of parking in Downtown Cleveland is determined by market forces and not mandated by municipal regulation. For the most part, off-street parking is available in garages in the center of the CBD and in peripheral surface lots. However, certain subareas, which have had significant amounts of new development in recent years ("Flats" entertainment district, Public Square, and CSU), do not have sufficient, convenient parking.

Travel Patterns

The AA/DEIS reported that approximately 6.0 million trips were made each day in the Greater Cleveland region in 1980, using private automobiles and public transportation for a variety of purposes. The report noted that "through 2000, the total number of trips made each day throughout the Greater Cleveland region and the purposes for this travel are expected to remain constant given the projected stability of the population and employment in the region." The most predictable of all trips, in terms of where people are travelling and at what time of day, are those related to work. The majority of the estimated 1.4 million daily work trips are concentrated during relatively short morning and afternoon "peak" periods. Therefore, they are an important factor in determining (1) the number of lanes on streets and highways needed to carry traffic efficiently and (2) the level of bus and rail service to be provided by public transportation.

Many of the region's residents make work trips to jobs in the same general vicinity as their residences. This fact reflects the desire of many people to live near where they work. It was reported in the AA/DEIS that 58 percent of all work trips begun in the eastern suburbs ended there; 46 percent of those in the southern suburbs followed the same pattern as did 61 percent of the work trips in the western suburbs. Seventy-one percent of work trips made by residents of the City of Cleveland ended in the City. However, the modeling of origins and destinations conducted for the AA/DEIS revealed that about one-third of all daily work trips (475,000) by people living in Cleveland's surrounding suburbs and the outlying counties were destined beyond their immediate areas. Approximately 186,000 (13%) of all daily work trips were related to employment in Downtown Cleveland. Another 122,000 (9%) daily work trips were destined for the many businesses and institutions in the corridor outside the Downtown. Thus, about 22 percent of all daily work trips in the region are destined for the Dual Hub Corridor.

Of the estimated 1.4 million trips made each day in 1985 for work purposes, 142,000, or 10 percent, occurred on public transportation. Sixty-one percent (87,000) of all work trips using public transportation were destined for Downtown Cleveland. The bus and rail service provided by GCRTA offers an important alternative means of access to the concentration of jobs in the CBD. There is no other similar focal point for work trips using public transportation, because businesses in the balance of the region are more widely dispersed.

In 1986, GCRTA and NOACA conducted a survey of riders using bus and rail service in the region to determine how public transportation was being used for non-work purposes. Approximately 69,000 trips, or about a third of the 211,000 trips made each day on public transportation in the Greater Cleveland region, were made for purposes other than work (e.g., shopping, recreation, school, etc.). The survey revealed that 36 percent of these non-work trips were made by people living on Cleveland's east side and in University Circle. It also showed that 32 percent of the trips made for purposes other than work were destined for Downtown Cleveland and another 29 percent were to locations on Cleveland's east side and in University Circle. This suggests the importance of the Dual Hub Corridor as more than just a place of work.

The government agencies and the educational, medical, cultural and social service institutions within it attract people throughout the day. Public transportation provided by GCRTA is an important means of access, particularly for residents of Cleveland's east side, the majority of whom have low incomes and limited access to other modes of transportation.

The average travel time on GCRTA's current bus and rail service is 42 minutes systemwide. Transfer opportunities between bus and rail service are limited, because rail stations do not provide direct access to many major activity centers in the Greater Cleveland region or in the Dual Hub Corridor. The Tower City Station, which is served by all three rail lines, is the only rail transit station in Downtown Cleveland, and it is located at the southwestern edge of the CBD. Numerous employment and shopping attractions are located near Tower City Station, including Tower City itself. However, Tower City Station is ¼ to ½ mile from the developing office concentration along East 9th Street and 1¼ miles from the CSU Campus.

4.2.2 Travel and Mobility Impacts

The adopted study goals and the policy considerations established by ISTEA serve as the basis for defining travel and mobility "effectiveness" criteria. These criteria measure the performance of an alternative in terms of travel time, system use, and accessibility. The following criteria have been identified as indicators of project effectiveness:

- Total Daily Systemwide Linked Passenger Trips
- Average In-Vehicle Travel Time (Minutes)
- Average Out-Of-Vehicle Travel Time (Minutes)
- Average Total Travel Time (Minutes)
- Average Trip Length (Miles)
- Fleet Required (Peak and Total)
- Regional Accessibility/Mobility
- Annual Operations and Maintenance (O&M) Cost per Boarding or Unlinked Trip
- Additional Annual O&M Cost per New Boarding
- Number of Intersections Affected
- Passengers per Revenue Hour
- Passengers per Revenue Mile
- Station Boardings
- Travel Time for Selected East/West Trips.

These criteria or measures of effectiveness have been employed to evaluate the Dual Hub Corridor alternatives and to ascertain how well each alternative "performs" relative to the others.

When compared to the Null Alternative, the Bus/TSM Alternative and rail alternatives would foster an increase in transit ridership. However, the overall average in-vehicle and out-of-vehicle travel time for transit users would change only slightly. The annual O&M cost per boarding resulting from implementing transit improvements would be higher than doing nothing (the Null Alternative), if the Bus/TSM Alternative and the less ambitious Downtown Relocation Alternatives were to be implemented. The Bus/TSM Alternative would stimulate 4.5 percent additional rail boardings in the Downtown. The four rail alternatives would produce increases in Downtown rail boardings ranging from 45 to almost 80 percent. Discussion of travel/transportation impacts associated with the alternatives considered are presented below.

Transportation System Impacts

Transportation system impacts generally are defined in terms of service supplied and service used or demanded. Transportation system supply measures provide an indication of the amount of service provided by each alternative. The principal measure selected to gauge system supply impacts is the fleet requirement associated with each alternative. Travel demand is defined as the initiation of person trips in response to the availability (or supply) of and mobility provided by various transportation modes. The measures used to evaluate travel demand impacts are based on the transit networks and operating assumptions defined for each alternative. Thus, the measures provide information on projected user response to a given set of assumptions regarding characteristics of the service provided by each alternative. Travel demand has been measured in terms of the number or trips taken and station boardings.

The data presented below summarizes the anticipated transportation supply and demand impacts of each alternative. The measures of travel demand, along with the system supply measures, are used for determining system performance, which is addressed in the next section.

Fleet Required

The peak vehicle requirement measure is the number of vehicles needed to provide transit service in the corridor and the region during the A.M. and P.M. peak periods. Peak vehicle requirement excludes extra vehicles on hand as spares or backup vehicles to those actually in

revenue service. Table 4-1 shows that the Bus/TSM Alternative would require a total of 689 buses and 61 rail vehicles during peak periods of travel. The LRT alternatives would not significantly reduce the number of buses required to operate during peak periods. Relative to the Bus/TSM Alternative, the peak rail vehicle requirement would be increased by four cars under Alternatives 3A, 3B and 4A. Alternative 4D would require only one additional car during the peak periods.

Table 4-1 FLEET REQUIREMENTS

Performance Measure	Alternative					
	Null	TSM	3A	3B	4A	4D
• Bus Transit						
- Peak	640	689	685	685	685	686
- Total	768	827	822	822	822	824
• Rail Transit						
- Peak	54	61	65	65	65	62
- Total	64	73	79	78	78	74

Overall, the alternatives being considered would require a 7 to 8 percent increase in the bus fleet over the Null Alternative and a 14 to 22 percent increase in the rail vehicle fleet. The LRT alternatives would require a slightly smaller bus fleet and more rail vehicles. Alternative 4D would have the smallest total transit fleet compared the other action alternatives.

Transit Trips

Both "linked" or "unlinked" transit trips were forecast for each alternative. The forecast of linked transit trips counts all travel from the point of origin to the point of final destination as a single trip, whether or not a transfer occurs enroute. That is to say, the individual segments of a transit trip involving transfer are "linked" to reflect one complete trip. Unlinked trips refers to each individual transit vehicle boarding whether by payment of fare or by transfer; thus, each segment of a person's trip remains "unlinked". The number of unlinked trips (or boardings) will always be greater than the number of linked trips.

The different measures of transit ridership provide information useful in evaluating the demand for proposed transportation system improvements. The number of linked trips provides an estimate of how many people use the system, while unlinked trips provides a measure of the number of persons using each route or mode within the system. Forecast total daily linked trips and boardings by station are shown in Table 4-2. Total linked transit trips range from 148,141 under the Null Alternative to 156,716 under Alternative 4A (Euclid Avenue). This represents an increase of up to 8,575 trips with the proposed transit improvements. The Bus/TSM Alternative would increase transit travel by about 3,800 trips over the Null Alternative. This represents a 2½ percent increase in total daily systemwide passenger trips. Expected ridership gains associated with implementing one of the rail alternatives would range from 4 to about 6 percent.

Alternative 3A would add about 2,200 transit trips over the Bus/TSM Alternative. This represent a four percent increase in total daily systemwide passenger trips when compared to the Null Alternative, 1.5 percent compared to the Bus/TSM Alternative. Full relocation of all Rapid Transit

Table 4-2 FORECAST TRANSIT BOARDINGS

Performance Measure	Alternative					
	Null	TSM	3A	3B	4A	4D
Daily Linked Passenger Trips[1]	148,141	151,905	154,117	154,984	156,716	155,469
Station Boardings						
University Circle						
• Euclid/E.120th	193	–	–	–	–	–
• Euclid/E.118th	–	–	–	–	187	–
• Little Italy/Mayfield	–	538	523	544	–	906
• Murray Hill/CWRU	–	533	446	477	–	436
• Severance Hall	–	–	–	–	1,493	–
• University Circle	460	–	–	–	–	–
Existing Red Line						
• E.105th/Quincy	261	315	236	289	–	–
• E.89th	–	132	126	158	–	–
• E.79th	129	–	–	–	–	–
• E.55th	229	365	362	342	361	292
• E.34th	349	–	–	–	–	
• E.22nd	–	704	264	–	137	64
Euclid Avenue/Downtown						
• Euclid/E.105th				–	858	1,089
• Euclid/E.79th	–	–	–	–	628	593
• Euclid/E.55th	–	–	–	–	523	506
• Euclid/E.30th	–	–	–	–	546	519
• CSU (E.22nd)	–	–	–	–	3,158	3,012
• Playhouse Sq/CSU (E.18th)	–	–	2,254	2,820	–	–
• Playhouse Sq (E.13/14th)	–	–	–	–	835	857
• Euclid/E.9th	–	–	3,970	6,330	6,233	6,426
• U.S. Post Office	–	–	–	136	–	–
• St. Vincent/Tri-C	–	–	–	633	–	–
• Tower City	8,112	8,506	8,086	3,562	5,251	4,518
Waterfront/West Cleveland						
• Superior/St. Clair	–	166	203	185	211	196
• Main Avenue	–	269	426	409	450	435
• W.3rd	–	58	23	19	25	27
• E.9th	–	258	174	114	184	217
• E.12th/14th	–	266	573	469	553	268
• Brookpark	1,469	1,766	2,017	2,005	2,026	2,007
• Airport (HIA)	470	531	448	456	454	440

[1] Ridership estimates include programmed Blue/Green Line service on the waterfront extension.

service through the east Downtown area, as proposed under Alternative 3B, would increase ridership an additional 867. The represents an improvement of 4.6 percent relative to the Null Alternative and two percent relative to the Bus/TSM Alternative.

The more ambitious Euclid Avenue Rapid Transit alternatives would increase ridership on the transit system five to six percent. Alternative 4A (Euclid Avenue) would improve upon the Bus/TSM Alternative by attracting about 2.3 times more trips– 8,575 v. 3,764 added trips when compared to the Null Alternative. The more extensive transit service proposed under Alternative 4D would attract about one percent fewer riders (1,247) than Alternative 4A. This still represents a five percent increase over the Null alternative.

Station Boardings

The number of station boardings differs significantly among alternatives. Table 4-2 shows boardings for stations directly affected by the alternatives and selected other stations (Waterfront Line, Brookpark, and HIA). The maximum number of boardings for this set of Rapid Transit stations (24,113) is expected to occur under Alternative 4A. The Null Alternative has the potential to attract less than 12,000 rail users to this same set of stations. Total rail ridership would only slightly increase to about 14,500 under the Bus/TSM Alternative. Up to 5,700 new rail users could be attracted to these stations by implementing the Downtown Rapid Transit Extension (Alternative 3A). Alternative 4D represents a 13 percent improvement over Alternative 3A, attracting almost 23,000 riders to the rail system daily. This still is about five percent shy of Alternative 4A.

Rail ridership in the University Circle would improve by 300 to 400 hundred percent should the Bus/TSM Alternative or one of the two less ambitious rail proposals for Downtown Rapid Transit Relocation be implemented. The two Euclid Avenue Rapid Transit alternatives would more than double the number of Rapid Transit users in this eastern hub of the corridor. The opposite would be true for the current set of stations served by the existing Red Line along the N&W RR cut between University Circle and Downtown. The Bus/TSM Alternative would increase the number of rail riders by more than 50 percent; however, the two Downtown Rapid Transit Relocation alternatives would only slightly increase rail ridership or reduce it along this route. The two Euclid Avenue Rapid Transit alternatives would significantly decrease rail boardings, principally because Red Line service on the route would be discontinued and patronage at the East 22nd Street Station would be sustained. It should be noted that the number of boardings at the East 55th Street Station would increase with all action alternatives despite the fact that Red Line service at this station would be eliminated under the two Euclid Avenue Rapid Transit alternatives.

Significant transit ridership effects between University Circle and Downtown are reflected by boardings at the proposed new Euclid Avenue Stations, the U.S. Post Office and St. Vincent Stations, and Playhouse/CSU station options. Over 3,000 daily boardings are forecast at the CSU (East 22nd Street) Station, when it is integrated with full Rapid Transit service along Euclid Avenue (Alternatives 4A and 4D). Travel demand associated with CSU also would be served by the Downtown Relocation Alternatives. The greatest number of boardings at the Playhouse Square/CSU Station (2,820) would be associated with Alternative 3B, which would include service through the area by all Rapid Transit lines. The Euclid/East 9th Street Station also would attract a significant number boardings under all alternatives, ranging from 3,970 for the Downtown Rapid Transit Extension (Alternative 3A) to 6,426 for the Euclid Avenue Rapid Transit with the Shaker Connector (Alternative 4D).

In all cases, boardings at Tower City Station would decrease significantly, particularly for those alternatives providing frequent service to the east (Alternatives 3B, 4A, and 4D). This reflects the latent travel demand for the major attractors in the eastern part of Downtown that is unmet by current rail transit services. The forecast boardings indicate that many rail patrons are destined for the East 9th Street and East 18th Street areas, because there are a high number of boardings for these stations coupled with a decrease at the Tower City Station.

There would be approximately 1,000 to 1,200 Waterfront Line boardings associated with the Bus/TSM Alternative and Alternatives 3B and 4D. In contrast to this, boardings on the Waterfront Line under Alternatives 3A and 4A would be about 1,400. All alternatives would have a positive

influence on rail boardings at the Brookpark Station. However, all except the Bus/TSM Alternative would have a negative influence on boardings at the Airport.

Trip Characteristics

System impacts also have been defined in terms of changes in the characteristics of transit trips. The factors selected for evaluation of alternatives reflect the desire to go farther in less time. The values for system performance measures are provided in Table 4-3.

Table 4-3 TRANSIT TRIP CHARACTERISTICS

Performance Measure	Alternative					
	Null	TSM	3A	3B	4A	4D
Average Trip Length (Miles)	11.6	11.4	11.4	11.4	11.5	11.4
Average In-Vehicle Travel Time (Minutes)	28.7	28.8	28.6	28.8	28.1	28.2
Average Out-Of-Vehicle Travel Time (Minutes)	23.0	22.6	22.5	22.4	22.4	22.6
Average Total Travel Time (Minutes)	51.6	51.3	51.1	51.3	50.5	50.7
Travel Time For Selected East/West Trips (Minutes)						
Red Line						
• Windermere > > Airport	46.73	46.12	50.12	49.13	46.62	48.58
• Windermere > > Tower City	20.78	20.17	20.17	23.18	16.67	18.63
• Windermere > > Waterfront	--	32.90	32.90	35.91	29.40	31.36
• Tower City > > Brookpark	23.37	23.37	23.37	23.37	23.37	23.37
• East 18th > > Brookpark	--	--	26.58	26.58	27.62	27.62
Blue Line						
• Warrensville > > Tower City						
- N&W RR Route	25.15	25.15	25.15	--	--	--
- Euclid Subway	--	--	--	28.43	25.15	28.32
• Warrensville > > Waterfront						
- N&W RR Route	--	33.88	33.88	37.17	33.88	--
- Euclid Subway	--	--	--	--	--	37.05
Green Line						
• Green > > Tower City						
- N&W RR Route	26.02	26.02	26.02	29.30	26.02	26.02
- Euclid Subway	--	--	--	--	--	--
• Green > > Waterfront						
- N&W RR Route	--	38.75	38.75	42.03	38.75	38.75
- Euclid Subway	--	--	--	--	--	--

Average Trip Length

The alternatives, as defined, reveal little difference in the average trip length. Table 4-3 shows that average trip length would vary by only two tenths of a mile.

Travel Time

Changes in travel time would be only slightly more significant. The average in-vehicle travel time under the Null Alternative has been forecast at 28.7 minutes; out-of-vehicle travel time would be 23.0. Thus, the average total travel time per trip for essentially the same system that is operating today would be 51.6 minutes.The lowest average total travel time (50.5 minutes) is forecast to occur under Alternative 4A. The rail alternatives would produce average total travel times (50.5 to 51.3) about the same or slightly greater than the Bus/TSM Alternative (51.3 minutes).

Table 4-3 shows the Bus/TSM Alternative would result in no significant changes in travel times for selected trips. A slight improvement in travel time would be associated with Red Line service from Windermere to Tower City and HIA, but it would be less than one minute. Rapid Transit service (Blue/Green Line) on the Waterfront Line is part of the Bus/TSM; this service is not associated with the Null Alternative, as defined for this study. Alternative 3A, like the Bus/TSM Alternative would slightly improve the current travel time between East Cleveland (Windermere) and Downtown (Tower City). However, travel time between Windermere and HIA would increase almost 4 minutes, because a transfer to Red Line West would be required at Tower City Station. On the plus side, this alternative and the other rail alternatives would provide direct access between Brookpark/HIA and the East 9th Street and East 18th Street (Playhouse Square and CSU) areas.

Alternative 3A would have no effect on Blue/Green Line service or routing. Alternative 3B would have a longer, more circuitous route (including street-running in the St. Vincent/Tri-C area) than the existing Red Line and serve two additional stations. This would result in a travel time increase of about 2½ minutes for the trip between Windermere and Downtown (Tower City Station), which would translate into an equivalent increase in the travel time to HIA. Similarly, travel times from Warrensville and Green would increase slightly more than 3 minutes, because all Rapid Transit trains would follow the new routing through east Downtown.

Alternative 4A would provide a more direct route between Windermere and Downtown destinations, including the Waterfront. Therefore, travel times would be reduced more than 4 minutes. The trip to HIA would be comparable to today, even though a transfer would be required between Red Line East and Red Line West. There would be no change in Blue/Green Line service or routing and, thus, travel time would remain the same as today. Alternative 4D also would provide improved travel times to Downtown destinations, although the improvement would be only about 1½ minutes. The new Red Line East route between Windermere and HIA would be longer than proposed for Alternative 4A and, therefore, take more time-- about 2 minutes). Rerouting of Blue Line service would add a little more than 3 minutes to the travel time between Shaker Heights and Downtown.

System Performance Impacts

System performance has been defined in terms of the impacts each alternative would be expected to have on travel opportunities. The factors selected reflect both positive and negative aspects of proposed transportation improvements. Two provide an evaluation of alternatives relative to accessibility and efficiency in travel or effectiveness of transportation services provided. The third is a measure of impact on the existing physical system of movements in the corridor. The values for system performance measures are provided in Table 4-4.

Table 4-4 SUMMARY SYSTEM PERFORMANCE IMPACTS

Performance Measure	Alternative					
	Null	TSM	3A	3B	4A	4D
Regional Accessibility/Mobility						
• % Share of Region's Jobs within 30 Minutes of Rapid Stations	7.07	7.07	7.78	7.79	8.24	8.15
• % Share of Region's Jobs within 45 Minutes of Rapid Stations	13.75	14.58	14.67	14.60	15.04	14.92
Annual O&M Cost per Boarding ($/Unlinked Trip)[1,2]	$3.07	$3.26	$3.18	$3.20	$3.09	$3.15
Additional Annual O&M Cost per New Boarding ($/Unlinked Trip)[1,2]	--	$9.80	$5.34	$6.08	$3.35	$4.62
Number of Intersections Affected	--	--	0	6	32	30

[1] Ridership estimates include programmed Blue/Green Line service on the waterfront extension.
[2] 1994 Dollars.

Regional Accessibility/Mobility

Improvements in mobility for residents in the corridor and region will enhance opportunities for economic and social interaction. The evaluation measures were selected to determine the potential benefits of proposed transportation improvements in the Dual Hub Corridor relates directly to employment opportunities. Table 4-4 shows the percent share of the region's jobs that would be within 30 and 45 minutes of travel by Rapid Transit service. This is the aggregate total number of jobs accessible from all Rapid Transit stations relative to the total number of jobs in the region. Seven percent of all jobs in the region would be within 30 minutes travel time by rail under the Null Alternative (which essentially reflects current levels of service). The share of regional jobs accessible by Rapid Transit service would increase to above eight percent with implementation of one of the Euclid Avenue Rapid Transit Alternatives. This share would increase to about 15 percent, assuming a longer acceptable travel time of 45 minutes compared to lest than 14 percent under the Null Alternative.

Operating and Maintenance Costs

All alternatives call for expansion of the bus and rail transit system operated by GCRTA. Expanding the transit services would result in higher operating and maintenance (O&M) costs. However, the performance of the system overall must be viewed in term of the cost-effectiveness of proposed improvements. Table 4-4 shows values for two measures of cost-effectiveness: "Annual O&M Cost per Boarding" and "Additional Annual O&M Cost per New Boarding." The former provides a measure of the total overall O&M cost for the complete system and, thus, reveals the productivity of operating dollars spent in terms of riders or passengers carried. The latter provides a measure of the effectiveness of adding to transit services, i.e., the productivity or number of new passengers associated with the specific increase in O&M costs for the new service.

As noted above, all alternatives would increase O&M costs, because transit service would be expanded in the corridor and the Greater Cleveland region. The greatest increase in O&M cost

per transit boarding over the Null Alternative would be associated with the Bus/TSM Alternative, because of more extensive bus operations. This cost would increase slightly more than 6 percent from $3.07 to $3.26 per boarding. The increase in O&M cost per boarding for the rail alternatives would be less, principally because rail operations have lower overall labor costs relative to the number of passengers carried. Alternative 4A would be the most cost-effective of the rail alternatives, adding only two cents to the O&M cost per boarding associated with the Null Alternative. The other rail alternatives would add 2½ to 4 percent to this indicator of cost-effectiveness, which is about one-half that of the Bus/TSM Alternative (about 7 percent).

The additional O&M cost associated with each new boarding generally is an indicator of the marginal cost of production, because it measures the change in cost relative to the change in passengers served. Thus, Table 4-4 shows that, under the Bus/TSM Alternative, GCRTA would expend $9.80 for each additional passenger over and above that served under the Null Alternative. The rail alternatives would be well below this figure. Again, the lowest cost alternative would be Alternative 4A, which would provide Red Line service on Euclid Avenue. The added cost per additional passenger for Alternative 4A is forecast to be $3.35, about one-third of anticipated with the Bus/TSM Alternative. The other three rail alternatives would be a few dollars higher. The least cost-effective rail alternative, Alternative 3B, would cost $6.08 for each additional passenger; this still is less than two-thirds of the Bus/TSM Alternative.

System Operating Impacts

Major transportation improvements would result in impacts to the functioning of the physical system of transportation services in place in the corridor and the region. The evaluation of alternatives, therefore, includes consideration of operational impacts on the local street system and public transit services.

Several aspects of the proposals for transportation improvements in the Dual Hub Corridor would have implications for traffic flow and circulation. The continued operation of Red Line Rapid Transit service on the current alignment, as under the Null and Bus/TSM Alternative, would not directly affect localized traffic operations. Relocation of the four Rapid Transit stations may create minor local impacts on traffic and circulation in the areas of the stations. However, these impacts would be manageable through proper planning of station siting and access points.

More serious impacts on local traffic flow and circulation would be associated with street-running LRT trains and at-grade stations in the median of roadways, as defined under three of the four rail alternatives. The potential impacts associated with the physical presence and operation of LRT trains was analyzed. As an indicator of these impacts, the number of intersections potentially impacted was determined (refer to Table 4-4). Alternative 3B has a short at-grade segment from just north of Carnegie on East 18th Street to the N&W RR cut at Pittsburgh. LRT operations on this segment potentially would impact six intersections. The Euclid Avenue rail alternatives would be roughly similar in impact. Alternative 4A, routed along Euclid Avenue through University Circle, potentially would affect two more intersections than Alternative 4D. Alternative 4D, east of East 107th Street, would operate mostly in the N&W RR cut.

Service Performance Impacts

Two service performance measures were defined to aid in evaluating Dual Hub Corridor transportation improvement alternatives. These two measures are indicators of the productivity of the service provided, i.e., the change in passengers resulting from a given change in the

amount of service supplied. Values for these two indicators are shown in Table 4-5 and discussed below.

Table 4-5 SERVICE PERFORMANCE IMPACTS

Performance Measure	Alternative					
	Null	TSM	3A	3B	4A	4D
Passengers per Revenue Hour[1]						
• Unlinked Bus Trips/Revenue Hour	37.40	33.32	34.04	34.04	33.76	33.97
• Unlinked Rail Trips/Train Hour	79.22	71.97	85.83	81.14	103.14	94.69
Passengers per Revenue Mile[1]						
• Unlinked Bus Trips/Revenue Mile	2.58	2.30	2.38	2.37	2.35	2.34
• Unlinked Rail Trips/Car Mile	2.10	2.32	2.79	2.64	3.75	3.47
[1] Ridership estimates include programmed Blue/Green Line service on the waterfront extension.						

Passengers Per Revenue Hour

All alternatives defined for this study result in fewer trips by bus per hour than would occur under the Null Alternative (Table 4-5). Generally, all alternatives produce the same result: unlinked bus trips per revenue hour would decrease 9 to 11 percent. This reflects the orientation of corridor transit service to the Rapid Transit system with bus feeder service accentuated over continuing Express, Flyer, and Linehaul bus transit service. Obviously, the Bus/TSM Alternative would not produce an increase in rail transit trips, because the focus of transportation improvements is on the bus system. This alternative actually is revealed to be counterproductive in that both bus and rail passengers transported per hour would decrease. Additional operations, due to expanded Express and Flyer service on Euclid Avenue and the added rail service on the Waterfront Line without significant ridership increases, would bring about this result.

In contrast, all rail alternatives balance the loss of productivity in the bus system with an increase in passengers transported per train hour of operation or service. A minimal improvement in rail trips per train hour (2.4 trips) would be gained with implementation of Alternative 3B. Alternative 3A, which would provide a rather limited extension of Red Line Rapid Transit service into the east Downtown area, is roughly comparable to the Downtown Relocation Alternative (Alternative 3B). A more substantial increase in service productivity would be attained with implementation of Alternative 4A, because it offers the most direct and concentrated service through the heart of the corridor. This alternative would increase the number of rail passengers transported per train hour to 103.14, representing an 30 percent increase over the Null alternative. Alternative 4D would be significantly better than the Downtown Relocation Alternatives, but the ridership to train hours of operation ratio would still be only 92 percent of that achieved under Alternative 4A.

Passengers Per Revenue Mile

All alternatives defined for this study would result in fewer trips per bus revenue mile than would occur under the Null Alternative (refer to Table 4-5). All alternatives would produce a decrease 8 to 11 percent in unlinked bus trips per revenue mile. The opposite is true with regard to unlinked rail passengers trips per car mile: all alternatives would be more productive than the

Null Alternative. The Bus/TSM Alternative would produce a slight increase (10.5 percent) in train loadings from 2.10 to 2.32 unlinked rail passenger trips per car mile of travel. As in the case of passengers per revenue hour, Alternative 4A would be the most productive, increasing the system load factor to 3.75 trips per car mile. This represents an improvement of almost 80 percent for the rail transit system operated by GCRTA. The improvement achieved with implementation of Alternative 4D (65 percent) would be more than twice that achieved under the two downtown improvement alternatives (33 and 26 percent for Alternatives 3A and 3B, respectively).

4.3 PROJECT EFFECTIVENESS - SUPPORT ECONOMIC DEVELOPMENT

The evaluation associated with the goal to ***Support Economic Development*** seeks to determine how well each alternative improves and encourages the opportunities for private and public development within the Dual Hub Corridor. This section presents first a discussion of the existing and potential development environment in the corridor and the Cleveland region. This is followed by an evaluation of the effectiveness of each alternative in achieving stated economic development objectives.

4.3.1 Affected Environment

The affected environment defined for evaluating effects and impacts on economic development potential essentially is the land use and development dynamics of the corridor and policies and actions that affect these dynamics. Land use and development dynamics are discussed below relative to the Greater Cleveland Region, the Dual Hub Corridor, and land use planning activities.

Greater Cleveland Region

The development of current land use patterns throughout Greater Cleveland has been significantly influenced by the location of major transportation routes (including waterways, highways, and railroads) traversing the region. The earliest commercial development occurred where the Cuyahoga River flows into Lake Erie. Today, the low lying areas along the Cuyahoga River, which primarily was an industrial areas, is being transformed into a major regional entertainment enclave. Downtown Cleveland to the east of the mouth of the Cuyahoga River is the region's largest office and retail core. Major industrial activity is concentrated along the numerous railroads and interstate highways that traverse Cuyahoga County. Smaller office and retail nodes have risen in recent decades in outlying suburbs along the outer belt freeways, particularly along I-271 in eastern Cuyahoga County and along I-480 stretching across its southern portion. University Circle is the region's principal concentration of institutional and cultural land uses, with four major medical centers, the CWRU Campus, and many museums and cultural facilities. Other institutional and retail uses are scattered along major arterial streets, including Euclid Avenue, that serve as boundaries for residential areas.

Approximately 870,000 people were employed in the Cleveland MSA in 1985 with 720,000 jobs in Cuyahoga County and 340,000 in the City of Cleveland. Employment in the Cleveland MSA peaked in 1979 with 918,000 jobs. During the national recession between 1979 and 1983, a net loss of 90,000 jobs occurred in the four-county region. Since 1983, the local economy has recovered, and over 70,000 net new jobs have been created. Through 2000, NOACA projects

this overall level of employment to remain stable at approximately 870,000 jobs. NOACA projects the loss in manufacturing employment to continue through 2000, but the loss should be fully offset by an increase in service jobs. This shift in employment will result in a concurrent shift in the types of occupations available. The number of blue collar positions, such as operators and laborers, will decline while opportunities for white collar and service workers, administrative support, professional and technical positions will increase.

There also have been dramatic shifts in the location of business activity in the Cleveland MSA. In 1947, 81 percent of the total metropolitan employment was located in the City of Cleveland. By 1982, only 37 percent of the area's jobs were located in the City. NOACA projects that this trend will continue through 2000, with over 40,000 jobs being relocated to the surrounding suburbs. Nevertheless, Downtown employment is expected to increase significantly in the next decade. Within the City of Cleveland, the dominant employment centers are, and will continue to be, the CBD and University Circle. In 1985, more than 110,000 jobs were located in Downtown Cleveland. NOACA expects Downtown employment to increase 8 percent to 124,000 by 2000. The 30,000 jobs at University Circle are expected to remain stable through 2000.

Dramatic shifts in where people choose to live within the metropolitan area began in the 1950s and continue to occur. The City of Cleveland had lost 40 percent of its population between 1950 and 1985. NOACA expects the population to stabilize or decline through 2000. Most people leaving the City moved to the surrounding suburbs in Cuyahoga County. However, the population of the suburbs peaked in 1970. NOACA projects continued decline in the suburbs through 2000. NOACA's projections indicate that surrounding rural counties will increase in population, continuing the outward expansion of the Cleveland MSA.

Dual Hub Corridor

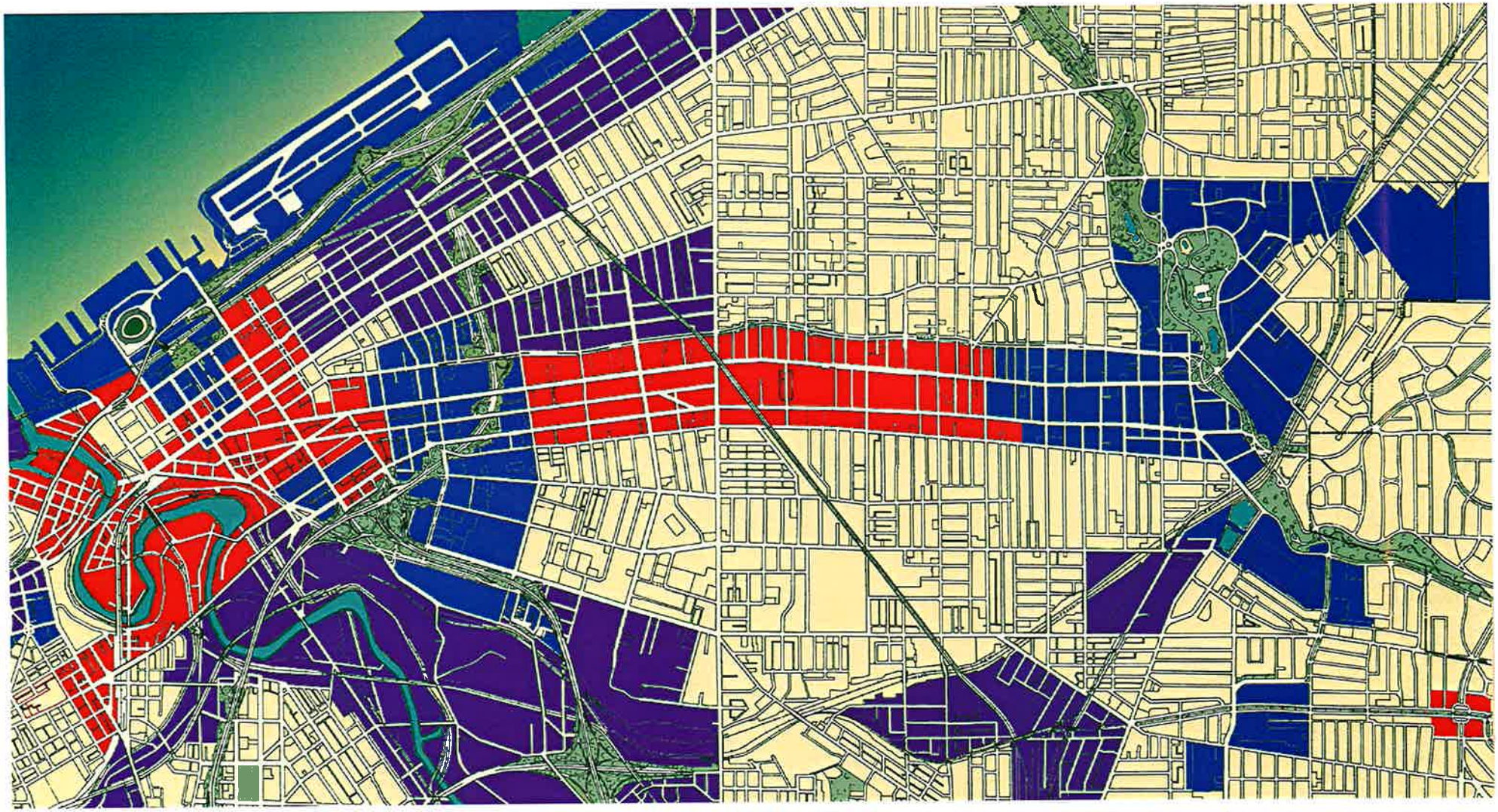
The Dual Hub Corridor is one of the oldest areas of Cleveland. It has undergone redevelopment a number of times as the City expanded from a mercantile town in the 1800s to an industrial city by the early 1900s. In the 1960s, large areas of the corridor were cleared as part of urban renewal programs aimed at revitalizing the Downtown office and housing markets and encouraging further development of University Circle. Today, this corridor once again is in transition, as Cleveland solidifies its position as a leading service center. The current land use dynamic is influenced in large part on the City's growing legal and financial sectors, which have concentrated in the Downtown and the medical and educational institutions found throughout the Dual Hub Corridor, particularly in University Circle. Existing land uses in the Dual Hub Corridor are shown in Figure 4-1.

Commercial Development

Commercial land uses and densities of development in the corridor vary greatly. The development patterns in the three principal subareas of the corridor are characterized below.

Downtown Cleveland

The Cleveland CBD is dominated by office and commercial activity. The Downtown includes a high-density office core of 21 million square feet of space. In 1988, the Downtown office vacancy rates were at 10 percent, and 2.6 million square feet of new office space was under construction. As those buildings were completed, the vacancy rates rose to over 20 percent by 1991.



CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 4-1
GENERALIZED LAND USE
Source: Dual Hub Corridor AA/DEIS

- Residential
- Commerical
- Institutional
- Industrial

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A Joint Venture

RTA
GREATER CLEVELAND REGIONAL TRANSIT AUTHORITY

However, excess office space is not considered a problem, given the Downtown's historic trend of absorbing space at the rate of 400,000 square feet annually.

Major retail development occurred in Downtown Cleveland in the 1980s. This development included:

- Growth of the new dining and entertainment district in the Flats along the Cuyahoga River;
- Renovation of the Halle Building in the Playhouse Square District, which added 40,000 square feet of new retail space;
- Construction of the 40,000 square foot BP America Atrium; and,
- The 183,000 square foot Galleria in the Erieview District (East 9th Street).

Another 350,000 square feet of retail space-- the "Avenue"-- became available with the opening of the Tower City complex, which include renovation of the Tower City Rapid Transit Station. Today, there is approximately 3 million square feet of retail space in the Downtown.

Mid Corridor

A second area of commercial uses is found from East 30th Street to East 84th Street in the Mid Corridor. This area includes low density, lower cost office space between East 30th Street and East 55th Street. This area is an extension of the Downtown office core and includes County government offices, union halls, and headquarters for smaller corporations and professional firms. Adequate commercial and retail services are substantially lacking for residents of the eastern portion of this area. The City is addressing this problem by assisting in the implementation and financing of private sector development. For example, a 100,000 square foot shopping center recently was constructed at East 79th Street and Euclid Avenue. The City views the large surface parking lots in this area as opportunities for additional office and retail development.

A combination of small manufacturing, community and neighborhood retail, and residential uses once occupied the eastern portion of the Mid Corridor from East 55th Street to East 84th Street. Today, it is dominated by large tracts of vacant land and unused or underutilized buildings. There are still some commercial uses in the area scattered along Euclid Avenue and Cedar Avenue.

University Circle

There is a third area of concentrated commercial land uses at the eastern end of the Dual Hub Corridor. The Euclid-Mayfield Triangle is situated in the University Circle area and attracts students, employees, and visitors of Case Western Reserve University as well as area residents. It is a commercial core of restaurants and small retail services occupying 40,000 square feet of commercial space.

Institutional Facilities

Institutional uses are concentrated in three locations within the corridor. A core of local government and Federal offices is concentrated around Cleveland's historic Mall in Downtown Cleveland north of Superior Avenue from Ontario Street to East 6th Street. A second institutional concentration is located east and southeast of the CBD. This area includes the CSU Campus, St. Vincent Charity Hospital, Tri-C, and numerous other smaller academic, social, and religious institutions. CSU, currently concentrated between Euclid Avenue and Chester Avenue, is expanding. Recent additions to the campus include athletic fields on Payne Avenue north of Chester Avenue and a the music and convocation center (arena) between Prospect Avenue and Carnegie Avenue south of Euclid Avenue.

The third major institutional concentration is University Circle– the eastern "Hub" of the corridor. University Circle is a highly developed area of institutional buildings in a park-like setting. Two major institutions in the University Circle, University Hospitals and CWRU, have master plans in place, calling for rebuilding or rehabilitation of existing facilities and construct of new buildings on underutilized land currently being used for parking. The Cleveland Clinic also has a master plan, which includes expansion of its facilities and actions to encourage related office and retail development on large tracts of land controlled by the Clinic.

Residential Development

There are small enclaves of residential land uses Downtown in the Warehouse District (on the east side of the Cuyahoga River) and in the East 12th Street area. These residential developments reflect the recent resurgence of interest in the Downtown as a total community. The AA/DEIS reports that 13 percent of the City's residents and 23 percent of its black community live in the residential neighborhoods in the corridor. A small portion of the corridor's residential population (less than 10%) resides in Downtown Cleveland.

Much larger and older residential areas are situated outside the Inner Belt north of Chester Avenue (Hough neighborhood), south of Cedar Avenue (Central and Fairfax neighborhoods), along the eastern and northern edge of University Circle (Little Italy and Wade Park neighborhoods, respectively), and along MLK, Jr. Drive (Woodland Hills and Fairwood neighborhoods). They also are the most distressed in Greater Cleveland in terms of population loss, unemployment, low income households, and housing demolition rates. These neighborhoods suffered substantial loss of population in the 1970s, and today they have large concentrations of young and elderly. The AA/DEIS reported that in 1985, 60 to 70 percent of the households had low to moderate incomes, 44 percent lived below the poverty level, and approximately 40 percent of the housing units have been razed.

Major public and privately supported community efforts have been undertaken in recent years to reverse the trends in corridor neighborhoods. The construction of new "market rate" housing has been accomplished in several areas of the corridor. Continued, strong public and private support will be necessary to reestablish viable neighborhoods through rehabilitation of early 1900s housing and the construction new housing attractive to middle class working families who now find the suburbs more desirable.

Land Use Planning

In Ohio, the adoption of development policies and land use plans and the establishment of zoning codes and design controls to regulate public and private development are the responsibility of municipal government. The City recently updated its General Land Use Plan and is implementing major changes in its Zoning Code. In general, City development policies seek to halt the loss of people and jobs from the center city to the surrounding suburbs by:

- Revitalizing the existing stock of housing and encouraging new housing construction;
- Consolidating scattered retail uses along older commercial strips to better serve neighborhoods; and
- Encouraging economic development through the expansion of Downtown Cleveland's office and retail core and enhancing business and institutional activity in the Dual Hub Corridor.

City planning has been conducted with extensive input from residents, community, and corporate interests. Master plans developed by major community institutions have been coordinated with the City's general planning effort to ensure that the long range plans of the private sector are compatible with public goals.

Two activities have been an integral part of this effort. Efforts to development of viable and efficient transit services in the corridor have been progressing for more than a decade. These efforts have been coordinated with the redefinition and rehabilitation of the roadway system, other infrastructure elements (e.g., water and sewer), and community facilities. All transportation improvements being considered for the Dual Hub Corridor are within the corporate limits of the City of Cleveland and supportive of the objectives identified above. It is anticipated that a Transit Overlay Zone will be established following selection of a PIS. This will encourage the highest and best use of the land along the route.

The second activity has been application for designation of the Mid Corridor area as an "Empowerment Zone." The Empowerment Zone concept is based on four principles for stimulating community development and redevelopment actions: economic opportunity; sustainable community development; community-based partnerships; and a strategic vision for change. The City of Cleveland formulated a comprehensive development strategy as part of its request to the Federal Department of Housing and Urban Development for Empowerment Zone designation. The strategy included significant employment generation along Euclid Avenue linked closely to transit improvements.

As a result of City efforts, HUD selected Cleveland's application for designation as a "Supplemental" Empowerment Zone. The designated Zone encompasses all of the Dual Hub Corridor Study Area from East 30th Street to approximately East 105th Street plus the Glenville area to the north. The designation of Supplemental Empowerment Zone, precludes the use of tax breaks to stimulate business development, but permits $90 million in funds to flow to the Zone from the Federal Economic Development Initiative (EDI) program. In addition to the specific funding award, the EDI program includes provisions for giving funding priority among existing Federal assistance programs so that between $3 and $4 billion will be made available to communities with Empowerment Zone designations.

4.3.2 Potential Economic Development Impacts

Direct economic effects in the corridor can be assessed by determining potential changes in the levels of economic activity relating to construction of the project and subsequent changes in land use and property development patterns. Table 4-6 shows data that reveals the forecast economic development effects of the various alternatives.

Table 4-6 ECONOMIC DEVELOPMENT IMPACTS

Performance Measure	Alternative[1]					
	Null	TSM	3A	3B	4A	4D
Daily Linked Work Trips[2]	78,207	80,545	81,075	81,333	81,896	81,217
Direct Expenditures[3]	Neg.*	$66,212	$253,897	$328,702	$443,689	$458,038
Total New Construction Jobs (Person Years)[4]	Neg.	251	992	1,281	1,738	1,792
New Commercial Development (Millions of Sq.Ft.)	3,780	3,930	4,190	4,285	5,435	5,345
New Residential Development (Units)	1,015	1,120	1,270	1,270	1,460	1,450

* Negligible.
1 The analysis assumes the baseline scenario only. The alternative development scenario is presented in the appendix.
2 Ridership estimates include programmed Blue/Green Line service on the Waterfront extension.
3 Direct outlays in local area (i.e., Corridor), region, and State during construction phase in $1,000s of 1994 dollars.
4 "Person years" represents any one person employed full-time at any job for one full year.

Work Trips Served By Transit

At the regional level the number of work trips served by the transit system provides a measure of the support for general economic activity. The number of work trips carried by the regional transit system under the various alternatives would not be significantly different. The number would vary according to the directness of travel. Thus, the rail alternatives would serve more work trips than the Bus/TSM Alternative, which focuses on improvements in the bus transit service. Alternative 4A would serve the greatest number of work trips-- almost 82,000 daily. However, this represents only 1.7 percent more than the Bus/TSM Alternative.

Construction-Related Activity

Clearly, all action alternatives will produce a benefit over the Null Alternative, which represents no concerted action to improve transportation beyond current expectations and directions. Also, it is clear that the more extensive the project, the larger will be the benefit. This would be no more apparent than in the area of construction expenditures and construction-related jobs.

Direct Expenditures During Construction

Expenditures associated with the Null Alternative would be limited to general maintenance and upgrading of existing facilities. Therefore, there would be no clear economic benefit generated from selection of this alternative beyond sustaining a viable element of the community's infrastructure. The Bus/TSM Alternative would involve significant enhancement of the physical operating environment of the bus system, including new paving, striping, and landscaping along Euclid Avenue and modern bus shelters. Table 4-6 shows that locally significant expenditures (i.e., direct purchase in project area, the region, and/or the State) during the life of the Bus/TSM development effort would amount to slightly more than $66 million.

The rail alternatives would involve considerably more development of physical facilities; therefore, the magnitude of locally significant expenditures would be much higher. Alternative 3A would generate about $254 million in local expenditures through the construction phase; this is almost four times greater than the Bus/TSM Alternative. Full relocation of the Rapid Transit system Downtown, as proposed under Alternative 3B, would result in local expenditures of about $329 million, which is five times the local expenditures associated with the Bus/TSM Alternative. The Euclid Avenue Rapid Transit Alternatives would generate between $440 and $460 million in locally significant expenditures. This represents a potential benefit seven times greater than that generated by the Bus/TSM Alternative.

Construction Jobs

Although construction-related jobs are "short-term"; construction spending and payroll represents a significant injection of money into the local economy. No construction jobs would be associated with the Null Alternative, because there would be no development of new physical facilities. The Bus/TSM Alternative, which would involve major reconstruction of Euclid Avenue, would produce an estimated 251 person years of work (i.e., one person year is equivalent to one full-time job for one year) during the period of construction. Table 4-6 indicates the rail construction projects would add significantly to this number.

The Downtown Rapid Transit Extension (Alternative 3B) would create nearly 1,000 person years of employment in the construction phase. Full relocation of the Rapid Transit system in the Downtown would add about 300 person years for the area's construction industry. The more ambitious Euclid Avenue Rapid Transit Alternatives would generate about seven times as many construction-related jobs (measured in person years) as those created by the Bus/TSM Alternative. Alternative 4D (Euclid Avenue with Shaker Connector), which represents the greatest amount of construction, would create about 40 percent more person years of construction employment than Alternative 3B.

Commercial/Residential Development Potential

A relatively small economic benefit would be gained by implementing the Bus/TSM Alternative (refer to Table 4-6). About four percent more commercial development and 10 percent more residential units would be expected compared to the Null Alternative. A significant additional benefit would be achieved with implementation of either one of the Downtown Relocation Alternatives, which include enhanced bus transit services along Euclid Avenue. The number of residential units would be expected to be 25 percent higher than with the Null Alternative. A smaller, though significant, added benefit (plus 11 to 13 percent) would be associated with the potential for commercial development. The Euclid Avenue Rapid Transit Alternatives would yield

the greatest benefit in both impacts areas, and Alternative 4A would produce a slightly higher benefit than Alternative 4D. Commercial development under Alternative 4A would be 44 percent greater than that expected under the Null Alternative; this compares to 41 percent for Alternative 4D. Alternative 4A, which would be expected to stimulate 44 percent more residential units, would have only a slight advantage over Alternative 4D, which would yield 43 percent more.

Long-Term Employment Potential

Development opportunities, when manifest in actual physical development, would result in long-term employment gains for the corridor and community (refer to Table 4-6). The development potential associated with the corridor at this time, assuming no transportation improvements are initiated (i.e., the Null Alternative) is expected to create an estimated 15,120 new jobs by 2010. Enhancement to the transportation infrastructure in the corridor would add to this potential through improved accessibility and mobility for residents of the corridor and region. Thus, the Bus/TSM Alternative potentially could add about 600 jobs (about 4 percent) to that now anticipated without transportation improvements.

The Downtown Rapid Transit Relocation Alternatives potentially would add 11 to 13 percent to the long-term jobs anticipated under the base situation established for the Null Alternative. Alternative 3A, the Downtown Rapid Transit Extension, potentially would add 1,640 to the 15,120 anticipated under the Null Alternative, resulting in 16,760 long-term jobs. Alternative 3B would be slightly more beneficial, creating about 17,140 long-term jobs. The potential development impacts of the Euclid Avenue Rapid Transit Alternatives is significantly greater than the Downtown Rapid Transit Relocation Alternatives. The extent of the system would be greater, and the accessibility afforded the region's residents would be much improved. Therefore, it has been estimated that long-term jobs potentially would be more than 40 percent higher than expected under the Null Alternative. Employment benefits would be slightly greater with implementation of Alternative 4A (21,740 jobs) than if Alternative 4D were to be implemented (21,380 jobs), because the alignment of the former would take advantage of prime development possibilities in the heart University Circle.

Long-Term Development Opportunities

Three measures were identified, investigated, and defined, which reflect the opportunities to bring about the economic development potential described above. The opportunity for forming public/private partnerships to support project development was defined in a general manner for each alternative. The potential for direct, independent private sector participation in the development and financing of proposed improvements also was investigated. The third area of concentration was opportunities for participation in project development by Small and Disadvantaged business firms. Qualitative conclusions relating to these three measures of economic development opportunity are discussed below.

Private/Public Partnership

Opportunities for private and public development actions essentially would be unchanged from today, if the Null or Bus/TSM Alternatives were implemented. However, with favorable economic conditions and supportive local land use policies (refer to Land Use Planning discussion above), the rail alternatives can support higher densities of office, retail, and residential development. Such polices can be tied to efforts to promote private/public partnerships in the development of transportation services and facilities in the corridor. Opportunities would be greater for the Euclid

Avenue Rapid Transit Alternatives, because system services would affect a larger population and there would be more stations. Rapid Transit stations present good opportunities for joint development and create a concentration of personal movements that can be favorable to business development in the vicinity of the station sites.

Private Sector Financial Participation

The Null Alternative would have a negligible impact on private sector participation in transportation, because there would be no physical development actions. The Bus/TSM Alternative would produce minimal private sector participation, because it focuses on enhancing current conditions rather than creating new opportunities. Limited joint development actions would be possible with implementation of one of the rail alternatives. This joint development could take the form of direct contributions to the construction of transit facilities (specifically stations) or assessments on adjacent property that benefits from the investment in and activity associated with transit facilities.

The administration of joint development planning and programming could produce a significant contribution to project costs. In addition, there would be tax benefits associated with the development of permanent, major rail transit facilities. The less ambitious Downtown Relocation Alternatives would have the potential to generate about $2.6 million in additional annual tax revenue, while the more extensive Euclid Avenue Rapid Transit Alternatives potentially would yield about $7.6 million in incremental tax benefits annually.

Small and Disadvantaged Firm Participation

Small and disadvantaged business firms (e.g., contractors, engineers, suppliers, etc.) are afforded the opportunity to participate in all GCRTA development projects through normal contracting and procurement procedures. This would be true for all alternatives under consideration. However, project development actions, such as those anticipated with the alternatives, would provide additional opportunities for these types of firms to offer and sell products and/or services to GCRTA or firms contracting with GCRTA to perform architectural, engineering, and construction work. The total capital cost of each alternative and the estimated new job potential was used to establish the potential magnitude of participation.

The Null Alternative would offer no additional potential for economic growth by small and disadvantaged firms, because no major expenditures over an above the level already planned or programmed are anticipated. The Bus/TSM Alternative does not represent a major capital outlay nor is it expected to stimulate a large number of new jobs. Therefore, this alternative would be expected to have only a minimal positive impact on the economic activity of small and disadvantaged firms in the corridor and region. The opportunities for participation by small and disadvantaged firms would be from 3 to 4 times greater than the Bus/TSM Alternative with implementation of Alternative 3A. Opportunities under Alternative 3B would be about five times greater than the Bus/TSM Alternative. Positive economic benefits associated with the Euclid Avenue Rapid Transit Alternatives would be very similar, increasing the value of potential opportunities by 6 to 8 times that of the Bus/TSM Alternative. Alternative 4D would be slightly better than Alternative 4A, because it would involve greater capital investment.

4.4 PROJECT EFFECTIVENESS - ENHANCE THE SOCIAL AND ENVIRONMENTAL QUALITY OF THE COMMUNITY

The evaluation associated with the goal to ***Enhance the Social and Environmental Quality of the Community*** seeks to determine how well each alternative (1) minimizes adverse impacts on the community that may be associated with implementation, and (2) improves the quality of life for residents of the Dual Hub Corridor and the Cleveland region. This section presents a discussion of the existing conditions for each area of concern in the corridor. This is followed by an evaluation of the effectiveness of each alternative in achieving the stated objectives.

4.4.1 Air Quality

The Dual Hub Corridor is located within the eight county Cleveland Air Quality Control Region (AQCR). Ambient air quality standards for six pollutants have been established by the State of Ohio and the Federal government: ozone (O_3), carbon monoxide (CO), nitrogen oxide (NO_x), lead (Pb), particulates, and sulfur dioxide (SO_2).

Affected Environment

The pollutants of principal concern for this evaluation are CO, HC, and NO_x– three pollutants which are closely related to transportation activity. The Dual Hub Corridor is situated in an urban environment which is considered marginally non-attainment with respect to ambient air quality standards from transportation-related sources. Current design values for both O_3 and CO are marginally above the standard.

The AA/DEIS states the "existing regional air quality is not expected to change significantly," because the residential population and local economy is projected to be stable through 2000. However, localized air quality problems could arise at specific locations as the result of the development of new facilities (e.g., transit centers, rail stations, P&R lots).

The AA/DEIS identified two intersections that potentially could be adversely impacted by additional traffic flows: East 9th Street/Euclid Avenue and Euclid Avenue/Mayfield-Ford Roads. Two criteria served as the basis for identifying these sensitive sites: (1) CO monitoring data existed which established a current problem site; or, (2) CO modeling results indicated a potential problem site.

Potential Impacts

Air quality impacts have been evaluated by assessing the changes in bus operations, which has a direct effect on diesel fuel emissions, and regional, annual emissions of three standard atmospheric pollutants associated with the transportation system.

Daily Vehicle-Miles Travelled by GCRTA Buses

Daily vehicle-miles traveled by GCRTA buses has been used as a surrogate measure for diesel emissions, which affect the opacity of the local ambient air quality. Daily bus vehicle-miles would be maximum under the Bus/TSM Alternative (approximately 78,000), because it focuses on major improvement to bus services in the corridor. Although bus operating efficiency would be enhanced (i.e., improved speeds, less traffic conflict, etc.), more buses would be operating;

hence, diesel emissions would be greatest under this alternative. Bus vehicle-miles associated with the rail alternatives also would be greater than the Null Alternative, because a more extensive feeder system would be established. However, greater emphasis on rail transit service development would result in fewer daily miles compared to the Bus/TSM Alternative. Daily bus vehicle-miles would be about 74,200 for the Downtown Rapid Transit Relocation Alternatives, representing a reduction of about five percent. The Euclid Avenue Rapid Transit Alternatives would reduce daily bus vehicle-miles still further. Alternative 4A would have the lowest estimated daily bus vehicle-miles at 73,013 (a reduction of 6.3 percent), while Alternative 4D would produce an estimated 73,308 miles.

Estimated Annual Pollutant Emissions

Potential regional air quality effects associated with implementation of the alternatives have been measured through estimates of the total annual emissions of CO, HC, and NO_x (Table 4-7). Total emissions were based on automobile and bus miles of travel, as projected by the patronage forecasting and modeling process.

Table 4-7 POTENTIAL AIR QUALITY IMPACTS

Performance Measure (Tons Per Year)*	Alternative					
	Null	TSM	3A	3B	4A	4D
Hydrocarbons (HC)	--	-6	-25	-29	-41	-33
Carbon Monoxide (CO)	--	-158	-310	-358	-469	-394
Nitrogen Oxides (NO_x)	--	40	5	3	-17	-5
* Change from Null Alternative.						

The estimated changes in the total annual emissions of three major pollutants relative to the Null Alternative are shown in Table 4-7. Clearly, the Euclid Avenue Rapid Transit alternatives would be most beneficial to regional air quality, and Alternative 4A would be the better of the two. Reductions of HC and CO pollutants are two to three times better, if one of the Downtown Relocation Alternatives were to be implemented rather than the Bus/TSM Alternative. Implementation of Alternative 4A would yield almost seven times more of a reduction in HC than that associated with the Bus/TSM alternative and the reduction in CO would three times greater. The two Euclid Avenue Rapid Transit Alternatives also would be the only alternatives to effect a reduction in NO_x. The Bus/TSM Alternative actually would bring about an increase in NO_x, because of the greatly increased bus operations.

4.4.2 Noise and Vibration

Ambient (or background) levels of noise and vibration vary throughout urban areas, depending on the nature of ongoing activities associated with certain types and densities of land use (e.g., residential, parks, institutions, industry, offices). A variety of land uses give form to the corridor, not the least of which are transportation facilities. This first section below identifies the noise and vibration levels present along the alternative routes for proposed public transit improvements.

The second section discusses potential impacts on ambient levels that may be associated with project implementation and operation. A discussion of applicable noise standards and guidelines is presented in the AA/DEIS.

Affected Ambient Noise and Vibration Environment

Noise

During preparation of the AA/DEIS, an environmental noise measurement program was undertaken to establish existing ambient noise levels in the corridor. Eight monitoring sites were selected to be representative of the various land uses. The sites were located in the vicinity of several potential noise sensitive land uses that could be affected by the rail improvements being considered. The AA/DEIS provides a map showing the location of the monitoring locations chosen for these measurements.[4.2] The results of noise measurements indicate existing noise levels in the corridor are generally high. Noise levels at most locations are characteristic of a commercial area or a high density residential area containing a mixture of residential and commercial uses.

Vibration

The AA/DEIS also contains a statistical analysis of the vibration velocity levels observed at the eight sites in the corridor. Vibration velocity levels were typical of commercial and residential areas with a moderate to high volume of local vehicular traffic. The typical maximum vibration velocity levels were below applicable criteria for groundborne vibration from transit train passbys except at two locations: East 17th Street/Euclid Avenue and on Chester Avenue between East 105th Street and East 107th Street. This indicates that existing sources produce vibration levels which are generally imperceptible except at these two locations, where the vibration was, at least, barely perceptible for approximately 6 seconds (in aggregate) over a 10 minute period.

Noise and Vibration Impacts

The potential for noise and vibration impacts was measured by the length of guideway in subway and at-grade (Table 4-8). Subway segments would create the potential for groundborne vibration

Table 4-8 POTENTIAL GROUNDBORNE VIBRATION AND AIRBORNE NOISE/VIBRATION IMPACTS

Performance Measure (Feet)	Alternative					
	Null	TSM	3A	3B	4A	4D
Length of Route Affected by Groundborne Vibration	None	None	5,450	6,400	8,600	8,600
Length of Route Affected by Airborne Noise/Vibration	None	None	None	7,500*	33,160	45,900*

* Excludes length of route along existing N&W RR cut.

4.2 Figure 3-8, Location of Noise and Vibration Measurement Sites, p. 3-44.

impacts, while the at-grade segments would have the potential for two types of impacts: vibration (groundborne and airborne), as well as airborne noise. This surrogate measure reveals the order of magnitude of potential impacts for evaluation purposes.

Potential Length of Route Affected by Groundborne Vibration

Potential vibration impacts principally would be associated with underground rail operations; therefore, no vibration impacts would occur with implementation of the Null or Bus/TSM Alternatives. Potential vibration impacts for the two Downtown Rapid Transit Relocation Alternatives would vary slightly, due to the proposed difference in the length of subway operations (5,450 and 6,400 feet, respectively). The potential for such impacts would greater under the Euclid Avenue Rapid Transit Alternatives, but both would have the same impact because each would have 8,600 feet of subway.

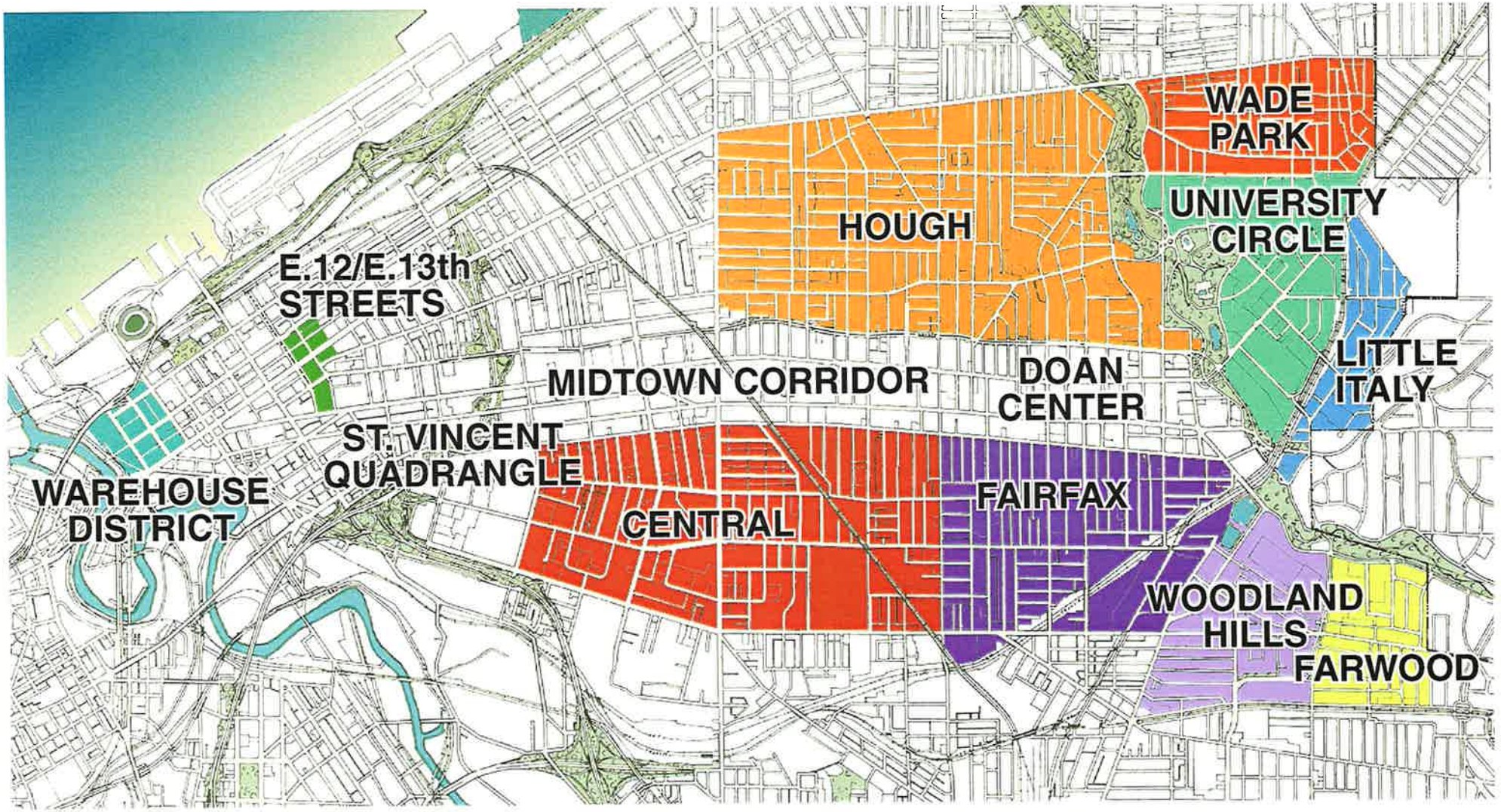
Potential Length of Route Affected by Airborne Noise/Vibration

Airborne noise/vibration impacts principally would be associated with at-grade bus and rail guideway operations. Bus operations already occur along every major thoroughfare in the corridor; therefore, no substantial, new noise/vibration impacts would occur with implementation of the Null or Bus/TSM Alternatives. Neither would there be notable impacts under the Downtown Rapid Transit Extension Alternative (3A), because new rail operations would be in subway. The Downtown Rapid Transit Relocation Alternative (3B) would have about 7,500 feet of at-grade LRT guideway running from the intersection of East 18th Street and Carnegie Avenue to the N&W RR cut. Operations on this guideway would subject adjacent properties to new noises, such as steel wheels running on steel rails and wheel squeal associated with trains turning corners and braking. Similar airborne noise/vibration effects would be associated with the Euclid Avenue Rapid Transit Alternatives, but the exposure to adjacent properties would be more extensive. Alternative 4A would result in 33,160 feet of fronting property to be expose to LRT operational noise. Alternative 4D would result in the exposure of 45,900 feet to this type of noise

4.4.3 Neighborhoods

As mentioned earlier, nine residential neighborhood areas are located within the Dual Hub corridor (Figure 4-2). The older neighborhoods east of the Inner Belt represent some of Cleveland's earliest settlement. The majority of the single family housing was built in the early 1900s. Each of the neighborhoods has a distinct identity and relationship to the corridor and the region. In general, the current residents of corridor neighborhoods are poor and predominantly Black. Primarily constructed of wood, maintenance on most of the houses has been deferred, and many of the units are in substantial disrepair. These neighborhoods also have large concentrations of public housing, including the City's oldest, the Cedar Estates. Many of these public housing units need major rehabilitation. Although several neighborhoods border existing Red Line rail service, the isolated location of Rapid Transit stations relative to major employment and activity centers in the corridor and throughout Greater Cleveland make it less desirable to use than the existing bus network.

The attempt in this study has been focused on ensuring the specific needs of the neighborhoods are addressed and the cohesion of social and economic activity strengthened. A brief summary of the characteristics of each neighborhood is presented in the following paragraphs. Potential effects on the integrity of the neighborhoods or community cohesion are presented in the following section.



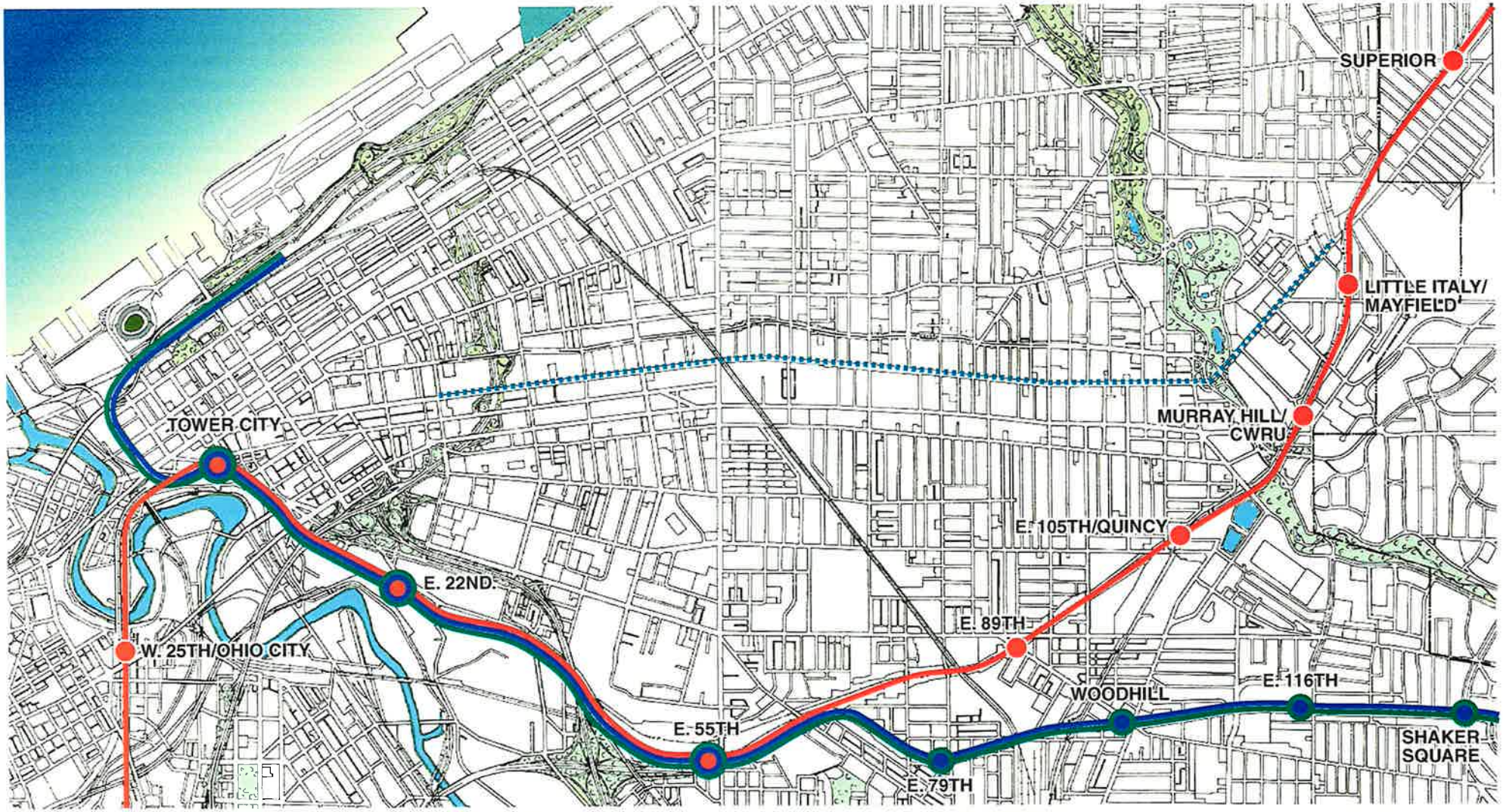
CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 4-2
NEIGHBORHOODS

Source: Dual Hub Corridor AA/DEIS

euclid CONSULTANTS
A Joint Venture

RTA
GREATER CLEVELAND REGIONAL TRANSIT AUTHORITY



CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 6-1

PREFERRED INVESTMENT STRATEGY

RED LINE
BLUE LINE
GREEN LINE
DEDICATED BUS LANES
STATION

euclid CONSULTANTS
A Joint Venture

RTA
GREATER CLEVELAND REGIONAL TRANSIT AUTHORITY

Affected Neighborhoods[4.3]

Downtown

The *Warehouse District* is Cleveland's newest residential area with almost 100 condominiums built since 1980. The Warehouse District appeals both to younger adults (25-40 years old) with few children and to older adults (over age 55). The average annual household income in this area is over $50,000. Retailers are attracted to this area to meet the needs of the District's residents and office workers. The City expects that more warehouses will be converted, and new housing will continue to be built. The City further expects that the population of this area will be about 1,200 persons by 2000.

Housing in the *Erieview District* of Downtown (East 12th/East 13th Streets) is in public and private high-rise apartment complexes. These complexes were built in the 1960s and 1970s as part of the Erieview urban renewal program. The AA/DEIS reported that nineteen hundred rental units housed about 2,700 people in 1985. The Erieview District residential units generally attract a population with characteristics similar to those of the Warehouse District. The City of Cleveland's long range plan for Downtown suggests the construction of additional housing in the Playhouse Square District and in the adjacent CSU District.

Mid Corridor

The *Central* neighborhood lies south of Cedar Avenue between East 30th Street and East 79th Street. The AA/DEIS reports that in 1985 over 90 percent of the 17,200 residents of the Central Neighborhood were Black, and 36 percent were under the age of 19. This neighborhood is one of the poorest in Greater Cleveland. The majority of the neighborhood's households are headed by women and almost one-half had incomes under $7,500. More than one-half of the housing (4,400) is in public housing, representing the largest concentration in Cuyahoga County. The majority of this public housing is in substantial disrepair as is the privately-owned housing.

The *Fairfax* neighborhood occupies the area south of Cedar Avenue and east of the Central neighborhood. It is a stable, older, black community. Many of Cleveland's major black institutions are located in Fairfax, including its churches and Karamu House. The neighborhood had a population of 11,900 people in 1985. The elderly population, which makes up about 1/5 of the neighborhood population, is heavily dependent on Social Security and pensions. This dependency is reflected in low average household income. The age and low income of Fairfax residents has contributed to the physical deterioration of the neighborhood's housing stock (principally built in the 1900s) as many homeowners are unable to afford the cost of maintaining the large frame houses. Community efforts in recent years, led by New Cleveland 6, Inc., have focused on helping owners to prevent the housing stock from further deterioration by providing loans and grants for housing rehabilitation.

The *Hough* neighborhood occupies a large portion of the northern Mid Corridor. It is a predominantly black neighborhood that had about 23,500 residents in 1985. The Hough neighborhood is relative stable, although it lost a substantial portion of its population and housing units in the 1970s and early 1980s. This neighborhood has the second highest

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[4.3] This discussion of neighborhoods characteristics was abstracted from the Section 3.3, AA/DEIS, pp. 3-25 through 3-31.

concentration of public housing (1,200 units) in Cuyahoga County. However, despite this, the rate of home ownership is moderate, and new residential developments are present today. Middle-income families have been attracted to Hough by recent neighborhood improvements, including 263 market-rate rental apartments at Lexington Village.

University Circle

The *Little Italy* neighborhood is located on the eastern edge of University Circle. The current Red Line Rapid Transit alignment along the N&W RR defines the western edge of this stable neighborhood with a strong community identity. Little Italy is a predominantly white neighborhood with over 5,000 residents living in households of average incomes. Little Italy is a Cleveland Landmark District in recognition of its unique character and historic roots. Its densely built, early 1900s housing stock has been well maintained over the years. Little Italy also has a thriving retail area serving neighborhood residents. The neighborhood also attracts people from throughout Greater Cleveland to its distinctive shops, restaurants, and artist studios. With only 12 acres of vacant land on scattered sites, there is little opportunity for new development.

The *Wade Park* neighborhood is located on the northern periphery of the institutional concentrations forming University Circle. Wade Park is a stable neighborhood of almost 6,000 predominantly black residents. Although 27 percent of the housing units in Wade Park were demolished between 1970 and 1980, the remaining housing is in good condition and home ownership is stable. The City expects the population of Wade Park to remain relatively constant with annual losses of less than one percent through 2000.

The *Woodland Hills* neighborhood is just east of the Fairfax neighborhood. It is bounded by Woodhill Road on the west, Baldwin Reservoir on the north, MLK, Jr. Drive on the east, and Shaker Boulevard on the south. This predominantly black neighborhood of 5,000 plus residents has a relatively high proportion (38% in 1985) of young people under the age of 19. Single family houses generally dominate the neighborhood, although seven hundred public housing units are concentrated in its southwestern quadrant. St. Luke's Hospital is located in the southeast quadrant.

The *Fairwood* neighborhood is to the east of the Woodland Hills neighborhood. Its western boundary is considered to be MLK, Jr. Drive. Approximately 5,000 Fairwood neighborhood residents live in households with incomes near the City average. This neighborhood has a very high concentration of elderly residents. It is a stable, well-maintained neighborhood with a mix of apartment buildings and one and two family homes. The Fairwood Association leads community efforts to revitalize commercial and retail activities that serve the neighborhood.

Neighborhood Impacts

Downtown

Most housing in the *Warehouse District* is located along its northern and western edges, 4 to 7 blocks from the Tower City Station at Terminal Tower and from the transit alternatives being considered for the Dual Hub Corridor. New housing has been built toward the southern portion of this District. Alternatives defined for evaluation in the context of the Transitional Analysis Study would not directly impact this neighborhood in either a negative or positive way. GCRTA bus service would remain available to all Downtown residents.

GCRTA bus service is available to residents of the *Erieview District*. The proposed station at East 9th Street would provide the nearest access to Rapid Transit service from this District. No direct impacts to the neighborhood are anticipated, beyond some "spillover" traffic congestion that may be associated with cut-and-cover construction of the Huron/East 9th/Euclid and Euclid Avenue Subway segments associated with all rail alternatives.

Mid Corridor

The *Central* neighborhood is between the existing Red Line, which is operated in the N&W RR cut, and the Euclid At-Grade alignment, which is part of Alternatives 4A and 4D. However, because of the distances to these routes, most residents of Central will continue to be best served by GCRTA bus service when using public transportation. The western edge of the neighborhood would gain some benefit from the at-grade alignment on East 30th Street and Community College Boulevard proposed under Alternative 3B.

The *Fairfax* neighborhood is positioned in a manner similar to the Central neighborhood with respect to Rapid Transit service on the Red Line and proposed service on Euclid Avenue. Therefore, most residents will continue to be best served by GCRTA bus service when using public transportation.

The *Hough* neighborhood is positioned in a manner similar to the Central and Fairfax neighborhoods with respect to Rapid Transit service on the Red Line and proposed service on Euclid Avenue. Therefore, most residents will continue to be best served by GCRTA bus service when using public transportation.

University Circle

Today, residents of *Little Italy* rely on bus service for public transportation. The existing Rapid Transit stations at Cedar Glen and at East 120th Street are rarely used by residents, because the stations are located at the outer edge of the neighborhood. These two stations would be relocated as part of the TSM Alternative and, therefore, all rail alternatives to better service this neighborhood, CWRU, and University Circle as a whole. These relocations would significantly improve the accessibility of Rapid Transit service for neighborhood residents.

Wade Park residents have ready access to GCRTA bus service. Red Line Rapid Transit at the Euclid/East 120th Street is only marginally convenient, being more than ½ mile from the core of the neighborhood. This station is proposed to be relocated to a site further to the south along the present Red Line alignment within the definition of the TSM Alternative. This relocation would occur also under the two Downtown rail alternatives (3A & 3B) and Alternative 4D. Thus, Red Line Rapid Transit service would be even more distant. Alternative 4A includes a new station near Severance Hall in University Circle (Euclid Avenue/Adelbert Road) to replace the two existing Red Line stations. Development of the proposed station at East 118th Street/Euclid Avenue has been deferred to a later date. Neither station would improve access to Red Line Rapid Transit for Wade Park neighborhood residents.

The *Woodland Hills* neighborhood currently is served by GCRTA buses. Rapid Transit service via the Blue/Green Lines is available at the southern edge of the neighborhood at the East 116th Street and Woodhill Road Stations. Red Line service at the East 105th Street Station is only marginally convenient for neighborhood residents. Alternative 4D would provide additional Rapid

Transit access at the east edge of the neighborhood via the Shaker Connector. A new Rapid Transit station would be located at Woodland Avenue and MLK, Jr. Drive (East 116th Street).

The *Fairwood* neighborhood currently is served by GCRTA buses. Rapid Transit service via the Blue/Green Lines is available at the southern edge of the neighborhood at the East 116th Street and Shaker Square Stations. Alternative 4D would improve access to Rapid Transit service, because it would include a new Rapid Transit station located on the Shaker Connector at Woodland Avenue and MLK, Jr. Drive (East 116th Street).

4.4.4 Architectural Sites

Direct impacts to significant architectural sites would not occur under any of the alternatives considered. However, indirect impacts potentially could occur through the alteration of the setting of the site/building. In most circumstances, the setting would be improved through the renewal of the streetscape, which is key to the quality and value of architectural facades.

Affected Environment

Generally, the Downtown and the area east of Downtown (Playhouse Square District and CSU) is considered to be an area of low to medium quality architecture. Some special aesthetic and design features are notable, particularly in relation to historic structure, as discussed in the next section. Euclid Avenue from the Downtown to University Circle presents a lower quality urban design environment; however, there are some unique and special sites. The western portion of the area labeled University Circle is a relatively high quality architectural environment with several older institutional structures surrounded by extensive parkland. The eastern portion of University Circle is a general commercial area of lower architectural quality.

Potential Impacts

No impacts to architectural sites would be associated with the Null Alternative, because no major capital improvements would be undertaken. However, it should be noted that, lacking capital investment in an improved transportation infrastructure, continued deterioration of the urban environment of the corridor should be expected. This effect certainly would have an effect on sensitive architectural sites. The Bus/TSM Alternative, on the other hand, would effect a general improvement in the corridor's urban design environment through reconstruction of the Euclid Avenue streetscape. This would be beneficial and supportive of the continued presence and quality condition of such sites. An increased number of buses would operate in the corridor, particularly on Euclid Avenue, which would result in a slight change in the general environmental setting. However, the improved streetscape and even slight stimulus to corridor development and economic activity would offset this effect through enhancement of the commercial and residential environments.

Potentially apparent effects on architectural sites would be associated with the development of "headhouses" for subway system ingress/egress in the Downtown segments of the rail alternatives. More apparent, impacts would be associated with the at-grade portions of the new Red Line alignment. Overhead catenary wires and supporting columns would be added to the

streetscape for the entire distance of the at-grade segments.[4.4] These features and appurtenances would permanently alter the vistas and traditional views along the routes followed. This effect would be minimized with implementation of Alternative 3B, because it would have the shortest at-grade segment. Conversely, this effect would be maximum with implementation of Alternative 4D, because it would have greatest length of at-grade guideway construction.

Both Euclid Avenue Rapid Transit Alternatives would have a visual and aesthetic impact on the existing urban space. Alternative 4A would alter the traditional setting of University Circle by introducing new vertical and horizontal visual elements into the park-like setting. Nevertheless, construction of the LRT guideway and stations would upgrade the existing streetscape and bring continuity to the urban setting through reconstruction of Euclid Avenue. Alternative 4D would displace the present median of MLK, Jr. Drive and position the LRT guideway and associated visual elements directly adjacent the open space of Ambler Park.

4.4.5 Historic Properties

The importance of the Dual Hub Corridor as a major travel route predates the founding of the City of Cleveland in 1796. Euclid Avenue, one of the major arteries which traverses the corridor, originally was an Indian trail along the south shore of Lake Erie. As late as 1825, Euclid Avenue was known as Buffalo Road, because it served as the principal trade route to that City from Buffalo, New York. Much of the early settlement of Cleveland occurred along this route. Thus, sites having potential archeological and historic significance are present in the Dual Hub Corridor.

Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, directs Federal agencies to take into account the effect of their undertakings on any district, site, building, structure or object which is included in or eligible for inclusion in the National Register of Historic Places (NRHP). Federal agencies must obtain the review and comment of the Advisory Council on Historic Preservation (ACHP) prior to the approval of undertakings which effect such properties. The ACHP, an independent agency created to advise the President and Congress on matters involving historic preservation, has established procedures for implementing Section 106. It is not necessary to invoke the Section 106 review process for this study. It is noted, because it was followed during preparation of the AA/DEIS from which the preponderance of information about historic properties presented herein has been taken.

The City of Cleveland has its own program for historic designation to help ensure the preservation of historic buildings and sites. Chapter 161 of the Codified Ordinance of the City of Cleveland established in 1971 an eleven member Cleveland Landmarks Commission. The responsibilities of this Commission include "safeguarding the heritage of the City by preserving sites and structures which reflect elements of the City's cultural, social, economic, political, or architectural history."[4.5] The ordinance empowers the Commission to designate landmarks and landmark districts and to issue or deny any Certificate of Appropriateness which would alter or demolish areas designated as such.

4.4 Refer to Figures 7, 8, 10, & 11 in Chapter 3. City of Cleveland's design guidelines, procedures, and approval process would be followed, reducing negative impacts and assuring attention to visual quality and adopted aesthetic standards.

4.5 AA/DEIS, p. 3-50.

Affected Environment

Potentially Affected Historic Buildings and Properties

Properties adjacent to any of the proposed alignments, including underground segments, were considered in the assessment of impacts on historic and archeological sites. Proposed alignments have been designed to utilize existing streets and rapid transit rights-of-way to the maximum extent feasible, and do so except for several very short segments. Therefore, adverse impacts on historic resources generally already have been minimized to a great extent. Information regarding historic properties, as reported in the AA/DEIS, has been the primary source for defining the affected environment.[4.6]

Significant buildings in the Dual Hub Corridor originally were inventoried in 1975-76 by staff representing the Ohio State Historic Preservation Office (SHPO) for the purpose of inclusion in the Ohio Historic Inventory. Most of the inventoried buildings still standing are either included or considered eligible for inclusion on the NRHP. Little change has occurred in the corridor since the inventory was conducted. Nevertheless, a second inventory was conducted in 1988, through a joint effort of the staff of the Cleveland Landmarks and the City Planning Commissions, to update the information gathered earlier.

A total of 43 NRHP buildings/properties are within the area of potential effects (APE), which defines the extent to which impacts from alternatives may be manifested. Sixty-three buildings/properties are considered to be eligible for inclusion on the NRHP. In addition, there are seven designated National Register Districts, which are wholly or in part within the APE. These Districts, in their entirety, incorporate 118 more buildings/properties. Designated Districts are: the Warehouse District, Terminal Tower Group, Public Square, The Mall, and Playhouse Square east of the Downtown; East 89th Street in the Mid Corridor; and Wade Park north of University Circle.

Designated Cleveland Landmarks are considered for the purpose of this report to be of National Register quality, and, in fact, many are listed on the NRHP. The AA/DEIS identified 41 Cleveland Landmarks and four Landmark Districts, which in there entirety contain an additional 515 buildings. The Landmark Districts include: the Warehouse and Playhouse Square District in the Downtown; Prospect Avenue District in the Mid Corridor; and Little Italy District on the east side of University Circle. It should be noted that some buildings in a Landmark District may not necessarily be of individual note, but all are subject to the same regulations as those of higher quality.

Potentially Affected Archaeological Sites

The Dual Hub Corridor has been the subject of a series of archaeological studies, because it is one of the earliest areas of Cuyahoga County to be settled and developed. Seven sites in the corridor were examined by staff of the Cleveland Museum of Natural History (CMNH). These sites are sensitive historic resources that can be easily damaged or destroyed; therefore, the precise location of such sites is subject to control.

[4.6] See AA/DEIS, pp. 3-49 through 3-51, Table 3-24, and Figures 3-9, 3-10, and 3-11.

Potential Impacts

Impacts to historic properties were determined using the compilation contained in the AA/DEIS.[4.7] Properties were identified in three categories: Cleveland Landmark, National Register Eligible, and National Register. For the Transitional Analysis a fourth category was designated to permit accounting for potentially historic properties adjacent to and within the St. Vincent Quadrangle. Table 4-9 presents a summary of the types of impacts expected on properties in these four categories.

Table 4-9 AFFECTED HISTORIC PROPERTIES

Performance Measure	Alternative					
	Null	TSM	3A	3B	4A	4D
Potentially Historic						
• No Effect	--	--	--	0	--	--
• Visual Impacts						
- Major	--	--	--	1	--	--
- Minor	--	--	--	5	--	--
• Property Taking						
- Major	--	--	--	0	--	--
- Minor	--	--	--	0	--	--
• Building Removal	--	--	--	1	--	--
Cleveland Landmark						
• No Effect	--	--	10	10	29	24
• Visual Impacts						
- Major	--	--	0	0	1	4
- Minor	--	--	0	0	6	6
• Property Taking						
- Major	--	--	0	0	0	1
- Minor	--	--	0	0	3	4
• Building Removal	--	--	0	0	0	1
National Register Eligible						
• No Effect	--	--	12	12	29	24
• Visual Impacts						
- Major	--	--	1	1	7	9
- Minor	--	--	0	0	9	9
• Property Taking						
- Major	--	--	0	0	1	1
- Minor	--	--	0	0	2	4
• Building Removal	--	--	0	0	6	7
National Register						
• No Effect	--	--	13	13	21	18
• Visual Impacts						
- Major	--	--	0	0	2	3
- Minor	--	--	0	0	4	4
• Property Taking						
- Major	--	--	0	0	0	1
- Minor	--	--	0	0	0	1
• Building Removal	--	--	0	0	0	0

4.7 See AA/DEIS, pp. 5-26 through 5-31 and Table 5-9.

No impacts would be associated with the Null and Bus/TSM Alternatives. Historic impacts under Alternative 3A would be limited to visual impacts on one property considered eligible for the National Register. This same property would be impacted by Alternative 3B, which also would result in visual impacts on six potentially historic properties and cause the razing/removal of one other – the Independent Towel Building. Alternative 4A potentially would affect 10 Cleveland Landmark properties; three properties would be taken. This alternative also would affect 25 properties eligible for the National Register and 6 listed on the National Register. Six of the properties considered eligible for the National Register would involve demolition and removal of the building. Alternative 4D potentially would affect 16 Cleveland Landmark properties; four properties would be taken. One building would be demolished and removed for construction of the LRT guideway. This alternative also would affect 30 properties eligible for the National Register and 9 listed on the National Register. Seven of the properties considered eligible for the National Register would involve demolition and removal of the building. Also, one archaeological site in an area east of Fairhill Road potentially could be affected by Alternative 4D. It should be noted, however, this site is the only one of the seven identified that has no intact cultural resources present.

4.4.6 Community Institutions

Affected Environment

Many of Greater Cleveland's most important cultural, religious, educational (including libraries), health care, government, and social services institutions are located in the Dual Hub Corridor. Many of these institutions are located in University Circle, which was planned as the City's institutional center in the 1880s. These important community institutions attract large numbers of visitors, employees, patrons, and students throughout each day. The affected environment with respect to community institutions was established to be all institutions within 1,500 feet of the proposed alternative alignments, including underground segments. A total of 160 community institutions were identified in the AA/DEIS as being located in the corridor, including: 38 government and social service institutions, 12 health care institutions, 26 educational and research institutions, 21 museums and libraries and 62 religious institutions.

Potential Impacts

The AA/DEIS divided community institutions into two categories for the purpose of (1) evaluating their significance to the residents of Greater Cleveland and (2) establishing the accessibility effects of various alternatives.[4.8] Community institutions were identified as major or minor traffic generators.

- **Major Traffic Generators:** These institutions attract 100,000 or more visitors or students annually, or 350 or more on an average weekday. Among these are the Cleveland Clinic, University Hospitals, the Cleveland Museum of Art, and the campuses of CSU and CWRU.

- **Minor Traffic Generators:** These institutions attract less than 100,000 visitors or students annually or less than 350 on an average weekday. These include many of the Dual Hub Corridor's elementary schools and churches.

[4.8] See AA/DEIS, pp. 5-31 through 5-36 and Table 5-12.

An evaluation then was conducted to determine whether the accessibility of a particular institution would be affected by the proposed transportation improvement. If there was a potential affect on accessibility, then the degree of access was assessed in terms of the estimate distance between rail transit service and the institution. If the institution would be within 750 feet of a rail station, then the proposal was concluded to have created "direct access." If the distance between institution and rail station was 750 to 1,500 feet, then "indirect access" would be achieved. The direct impact of relocation also was noted. The principal focus of the AA/DEIS assessment was the core of the Dual Hub Corridor-- Downtown, Euclid Avenue, and University Circle. Table 4-10 shows the potential accessibility effects of each alternative.

Table 4-10 MEDICAL, EDUCATIONAL, CULTURAL, RECREATIONAL, AND COMMUNITY INSTITUTIONS SERVED BY RAIL

Performance Measure	Alternative					
	Null	TSM	3A	3B	4A	4D
Institutions Generating Major Volumes of Traffic						
• No Effect	39	39	39	39	14	12
• Direct Access	2	2	3	8	15	17
• Indirect Access	2	2	1	1	14	14
• Relocate	0	0	0	0	0	0
Institutions Generating Major Volumes of Traffic						
• No Effect	109	109	106	101	34	33
• Direct Access	3	3	4	18	36	38
• Indirect Access	5	5	7	10	47	45
• Relocate	0	0	0	0	0	1

- **Null Alternative:** The Null Alternative would establish rail accessibility to 12 of the 160 community institutions identified as potentially affected by this proposal. Four major traffic generators in the corridor would become accessible; two of these would be directly accessible (i.e., within 750 feet of a rail station). No major community institutions would need to be relocated to accommodate this proposal. Eight minor traffic generators in the Corridor would become accessible; three of these would be directly accessible. No minor community institutions would need to be relocated to accommodate this proposal.

- **Bus/TSM Alternative:** The effect on accessibility to community institutions under the Bus/TSM Alternative would be the same as those identified for the Null Alternative.

- **Alternative 3A:** The Downtown Rapid Transit Extension Alternative would establish rail accessibility to 15 of the 160 community institutions identified as potentially affected by this proposal. Four major traffic generators in the corridor would become accessible; three of these would be directly accessible (i.e., within 750 feet of a rail station). No major community institutions would need to be relocated to accommodate this proposal. Eleven minor traffic generators in the corridor would become accessible;

four of these would be directly accessible. No minor community institutions would need to be relocated to accommodate this proposal.

- **Alternative 3B:** The Downtown Rapid Transit Relocation Alternative would establish rail accessibility to 37 of the 177 community institutions identified as potentially affected by this proposal. Nine major traffic generators in the corridor would become accessible; eight of these would be directly accessible (i.e., within 750 feet of a rail station). No major community institutions would need to be relocated to accommodate this proposal. Twenty-eight minor traffic generators in the corridor would become accessible; 18 of these would be directly accessible. No minor community institutions would need to be relocated to accommodate this proposal.

- **Alternative 4A:** The Euclid Avenue Rapid Transit Alternative would establish rail accessibility to 112 of the 160 community institutions identified as potentially affected by this proposal. Twenty-nine major traffic generators in the corridor would become accessible; 15 of these would be directly accessible (i.e., within 750 feet of a rail station). No major community institutions would need to be relocated to accommodate this proposal. Eighty-three minor traffic generators in the corridor would become accessible; 36 of these would be directly accessible. No minor community institutions would need to be relocated to accommodate this proposal.

- **Alternative 4D:** The Euclid Avenue Rapid Transit with Shaker Connector Alternative would establish rail accessibility to 114 of the 160 community institutions identified as potentially affected by this proposal. Thirty-one major traffic generators in the corridor would become accessible; 17 of these would be directly accessible (i.e., within 750 feet of a rail station). No major community institutions would need to be relocated to accommodate this proposal. Eighty-three minor traffic generators in the corridor would become accessible; 38 of these would be directly accessible. One minor community institution would need to be relocated to accommodate this proposal.

4.5 COST-EFFECTIVENESS/EQUITY/FINANCIAL FEASIBILITY

Cost is very important to any project. Therefore, it is important that the evaluation include the consideration of the costs of proposed transit improvements in the corridor against expected benefits and related impacts. Both short-term capital costs and long-term, continuing operating and maintenance (O&M) costs must be considered. Relating the costs with the benefits of the project, in terms of increased ridership and/or mobility improvements, reveals the cost-effectiveness of proposed alternatives. Finally, the ability to fund both the short- and long-term costs must be evaluated to determine whether the proposed actions are financially feasible.

4.5.1 Financial Feasibility

The category of financial feasibility is used to assess the impact of projected transit funding needs on existing and potential sources of funds. In a detailed assessment of financial feasibility, funding requirements for both the capital and O&M costs of each alternative are compared to projected revenue from existing sources of funds and potential revenue from new funding sources. The indicator of financial feasibility for any given alternative, then, is the funding surplus or deficit that would result from construction and long-term operation. If a deficit is projected,

additional revenue requirements and sources must be identified. The likelihood of success in securing additional, new revenue sources (e.g., referenda, local legislation, state legislation, etc.) must be identified to assess financial feasibility. Where existing and potential new sources of funds are not sufficient, the project is deemed to be financially infeasible.

Project Costs

There are numerous components to project cost for any particular alternative. The two basic or principal components of project cost are: capital construction costs (both total and annualized) and long-term, continuing annual O&M costs (Table 4-11).

Table 4-11 ESTIMATED PROJECT COSTS[1]

Performance Measure	Alternative[2]					
	Null	TSM	3A	3B	4A	4D
Total Capital Cost	--	$113,619	$365,028	$577,910	$675,948	$749,560
Annualized Capital Cost	--	$10,371	$31,302	$49,483	$57,532	$64,159
Annual O&M Cost	$183,054	$194,070	$199,294	$199,470	$198,780	$199,178

[1] 1,000s of 1994 Dollars.
[2] The analysis assumes the baseline scenario only. The alternative development scenario evaluation is presented in the appendix.

Capital Costs

The capital investment required to implement the alternatives, obviously, is a key effectiveness criteria. Property acquisition usually is a major component; however, all the proposed alternatives have been defined and design to take full advantage of public rights-of-way. Therefore, this cost would be a smaller than usual portion of total project cost for a major capital investment in transportation improvements. Critical cost components include: civil/structural work associated with facilities (e.g., HOV lanes, stations, transit centers); vehicles (bus and LRT); signalization and service equipment; and trackwork (LRT only).

There would be no capital costs associated with the Null Alternative, because no major physical facilities are proposed. The Bus/TSM Alternative would involve the reconstruction of Euclid Avenue and the purchase of additional buses. The capital costs of this proposal have been estimated to be just under $114 million. This would produce an annualized cost of approximately $10.4 million, which reflects the spreading of the cost burden over the useful life of the principal components of the project (e.g., trackwork, vehicles, structures, etc.).

Implementation of one of the rail alternatives would add substantially to anticipated capital costs for transportation improvements. The minimal rail proposal-- Alternative 3A, Downtown Rapid Transit Extension-- would cost about $365 million, which would translate into an annualized capital cost of about $31.3 million. Full relocation of all Rapid Transit service Downtown, as proposed under Alternative 3B, Downtown Rapid Transit Relocation, would add about

$213 million to the cost of the Downtown Rapid Transit Extension for a total capital cost of $578 million. This is five times greater than the cost associated with the Bus/TSM Alternative. Annualized capital costs would be just under $50 million.

The most ambitious rail proposal-- Alternative 4D, Euclid Avenue Rapid Transit with Shaker Connector-- would cost just under $750 million. This is more than six times the cost of the Bus/TSM Alternative. The annualized cost of this alternative would be about $64.2 million. Alternative 4A, Euclid Avenue Rapid Transit, which excludes the Shaker Connector, with a total estimated capital cost of $676 million would be about $74 million cheaper than Alternative 4D. The annualized capital cost of this alternative would be about $57.5 million.

Annual Operating and Maintenance Costs

Continuing costs, which affect financial feasibility, are associated with annual vehicle and facility O&M costs. The O&M costs of Local Bus service vary significantly from those associated with the Express or Flyer Bus service. And, O&M costs associated with Rapid Transit service differ widely from service provided by buses. Therefore, each alternative offers different combinations of costs, which results in variation in annual O&M costs. The 2010 O&M costs have been estimated in 1994 constant dollars for each of the alternatives.

The total year 2010 O&M costs for the Null Alternative have been estimated at approximately $183.1 million (refer to Table 4-11). Implementation of the Bus/TSM Alternative would increase annual O&M costs by slightly more than 6% to about $194.1 million. The most expensive rail alternative to operate would be Alternative 3B ($199.5 million), which would be about $5.4 million more than the Bus/TSM Alternative. O&M costs for the rail alternatives would be within $0.7 million of each other. The annual O&M cost of the proposed Downtown Rapid Transit Extension (Alternative 3A), estimated to be $199.3 million, would be $200,000 less than Alternative 3B. The annual O&M cost of Alternative 4D ($199.2 million) would be only slightly less ($100,000) than Alternative 3A. The least cost rail alternative would be Alternative 4A at $198.8 million annually, which is $700,000 less than Alternative 3B.

Farebox Recovery

Projections and assumptions associated with the Null Alternative indicate that 44 percent of GCRTA's operating revenue would come from the farebox in 2010. The Bus/TSM Alternative would reduce farebox coverage to about 41 percent. All of the rail alternatives would achieve a farebox coverage ratio of 42 percent.

4.5.2 Cost-Effectiveness

Rather than attempt to measure all benefits of a major transit investment, FTA recommends using a few measures to assess a wide range of transportation and other benefits associated with a project. The direct benefits of a major transit investment are improvements in travel time and increases in transit ridership over that provided by the Bus/TSM Alternative. The comparison is made with the Bus/TSM Alternative, because cost-effectiveness must include expenditure to gain a benefit and the Null Alternative does not include a major capital expenditure. Other indirect benefits, such as improved mobility, reduced congestion, and less air pollution, are consequences of the travel time and ridership changes.

Accordingly, FTA has defined two cost-effectiveness indices. FTA's first index– *Cost per User Benefits*– uses travel time savings as the measure of a project's benefits, and the second index-- *Cost per New Transit Rider*-- uses new additional transit riders.[4.9] Under current procedures, FTA uses the Cost per New Transit Rider Index (which is easier to compute) to rate transit projects proposed for Federal funding assistance. However, the Cost per User Benefits Index is useful for gauging the direct travel benefits of a transportation improvement proposal relative to the funds required to build and operate the service. Therefore, the values for both types of indices have been calculated. The Cost per New Transit Rider index has also been calculated for only the Federal portion of the cost. In addition, a fourth index of cost-effectiveness was computed, the *O&M Cost per Rider*. The values for these indices are shown in Table 4-12.

Table 4-12 COST EFFECTIVENESS INDICES

Performance Measure	Alternative[1]					
	Null	TSM	3A	3B	4A	4D
Cost per User Benefits[2]	--	--	$20.78	$25.73	$16.67	$31.94
Total Cost per New Transit Rider[2]	--	--	$28.26	$40.97	$31.07	$49.51
Federal Cost per New Transit Rider[2]	--	--	$11.84	$18.92	$14.05	$23.30
O&M Cost per Rider ($/Linked Trip)	$4.30	$4.61	$4.52	$4.49	$4.44	$4.48

[1] The analysis assumes the baseline scenario only. The alternative development scenario evaluation is presented in the appendix.
[2] 1994 Dollars.

Cost Per User Benefits Index

The Cost Per User Benefits Index is a ratio between (1) the incremental (i.e., added) cost of building and operating the proposed system of services and (2) the travel time saved by both "existing" and "new" riders as compared to the Bus/TSM Alternative. The resulting calculations of this index indicate Alternative 4A is the most cost-effective proposal; it offers the least added cost with the greatest increase in travel time savings ($16.67). Alternative 4D, which would add the Shaker Connector to Alternative 4A, is shown to be the least cost-effective. The value of the index for Alternative 4D is almost twice as large as that for Alternative 4A, meaning that Alternative 4D would provide the least benefit in terms of travel time savings while requiring the greatest added cost over the Bus/TSM Alternative. Alternative 3A would be the next best choice for implementation in terms of its potential cost-effectiveness. The index for Alternative 3A was calculated to be $20.78, which is about 25 percent greater than Alternative 4A. The index for Alternative 3B, calculate at $25.73, would more than 50 percent greater than Alternative 4A.

Cost Per New Transit Rider Index

[4.9] Refer to Final Evaluation of Alternatives Methodology Report, pp. 5-8.

The Cost Per New Rider Index is a ratio between (1) the incremental annual cost of building and operating an alternative less the value of travel time savings of existing riders and (2) the incremental transit riders attracted to that alternative. This ratio seeks to isolate the cost-effectiveness of proposed improvements strictly on the new riders attracted because of the improvements. There are two versions of the New Transit Rider Index. The "Total" New Transit Rider Index includes total annualized capital cost of the project, annual O&M costs, and estimated annual travel time savings, while the "Federal" New Transit Rider Index includes only the Federally-funded share of the project's annualized capital costs.

- **Total Cost Per New Rider Index:** The "Total" Cost Per New Transit Rider Index was computed for the alternatives being considered for the corridor. The resulting calculations of this index indicate Alternative 3A is the most cost-effective proposal at $28.26; it offers the least added cost with the greatest increase in new riders. Alternative 4D, which would combine Euclid Avenue and the Shaker Connector LRT segments, is shown to be the least cost-effective at $49.51. The value of the Total Cost Per New Transit Rider Index for Alternative 4D is about 75 percent greater than Alternative 3A, meaning that Alternative 4D would provide the least benefit in terms attracting new transit riders while requiring the greatest added cost over the Bus/TSM Alternative. Alternative 4A would be the next best choice for implementation in terms of its potential cost-effectiveness. The index for Alternative 4A was calculated to be $31.07, which is about 10 percent greater than Alternative 3A. The index for Alternative 3B, calculated at $40.97, would more than 45 percent greater than Alternative 3A.

  Comparing similar alignment and service proposals, the estimated value for this index for the Downtown Rapid Transit Relocation proposal (Alternative 3B) is 56 percent greater than the Downtown Rapid Transit Extension option (Alternative 3A). A similar differential exists between the Euclid Avenue Rapid Transit Alternatives. Alternative 4D, which includes the Shaker Connector, has an index value that is 59 percent greater than its counterpart Alternative 4A, which does not include the Shaker Connector.

- **Federal Cost Per New Rider Index:** The "Federal" Cost Per New Transit Rider Index was computed for the alternatives being considered for the corridor. The resulting calculations of this index produced the same result as discussed above for the Total Cost Per New Transit Rider Index. Alternative 3A would be the most cost-effective proposal at $11.84. Alternative 4D is shown to be the least cost-effective at $23.30, which is almost twice that of Alternative 3A. Thus, Alternative 4D would provide the least benefit in terms attracting new transit riders while requiring the greatest added cost over the Bus/TSM Alternative. Alternative 4A would be the next best choice for implementation in terms of its potential cost-effectiveness. The index for Alternative 4A was calculated to be $14.05, which is about 21 percent greater than Alternative 3A. The index for Alternative 3B, calculated at $18.92, would about 60 percent greater than Alternative 3A.

  Comparing similar alignment and service proposals, the estimated value for this index for the Downtown Rapid Transit Relocation proposal (Alternative 3B) is 60 percent greater than the Downtown Rapid Transit Extension option (Alternative 3A). A similar differential exists between the Euclid Avenue Rapid Transit Alternatives. Alternative 4D, which includes the Shaker Connector, has an index value that is 66 percent greater than its counterpart Alternative 4A, which does not include the Shaker Connector.

O&M Cost Per Rider

The O&M Cost Per Rider index provides a measure of the total, overall operational effectiveness of the transit system. This index relates the total annual O&M costs to operate all components of the transit system (i.e., bus and rail) to the total ridership on the system after implementation of the proposed improvement, where ridership is measured by "linked" trips. Because this index shows the relationship between costs and the whole system, comparison with the Null Alternative is appropriate.

The values for this index range from $4.30 for the Null Alternative to $4.61 for the Bus/TSM Alternative. This represents an increase of about seven percent over the Null Alternative's index. All rail alternatives would result in an increase in this index compared to the Null Alternative. The minimum increase in O&M cost per rider would be 14 cents for Alternative 4A. This increase would result in an value of $4.44, which is an increase over the Null Alternative of about 3.3 percent. The index value for Alternative 4D was calculated to be $4.48; this is 4 cents higher than Alternative 4A and represents an increase of 4.2 percent over the Null Alternative. The value for Alternative 3B is only slightly more– $4.49, which adds 19 cents to the Null Alternative's index or 4.4 percent. The index value for Alternative 3A is $4.52. This is eight cents more than Alternative 4A (1.8 percent), which is the rail alternative with the lowest index value, and 22 cents higher (5.1 percent) than the Null Alternative.

4.5.3 Equity Considerations

Equity considerations focus on the distribution of project effects or impacts across various segments of the population. Attention to the issue of equity seeks to determine whether any segment of the Region's population would be receiving a disproportionate share of benefits. Equity effects or impacts include: improved mobility, reduced travel times for transit users, reduced levels of congestion for auto users, and improved environmental quality in the region. Several of these aspects of the transportation improvements proposed for the corridor have been explicitly or implicitly recognized in previous sections. For the purposes of this evaluation, work trips served by transit were evaluated with respect to income levels. This evaluation category or measure reveals the degree to which proposed transit improvements are equitably distributed within the region.

Table 4-13 shows the number of work trips by persons in each of three income groups, as defined by the number of automobiles per household. This information was generated from the patronage forecasting process. In all cases, the number of work trips carried by the GCRTA's transit system would increase for all three categories of users. Likewise, Alternative 4A would produce the largest increase in work trips carried by transit for all three categories. The Bus/TSM Alternative would produce the greatest increase in the "Low-Income" (Zero Autos) category (3.20% or about 600 trips), although the relative increase for "Upper-Income" (2+ Autos) category would be very similar (3.16%) and almost 1,000 new work trips would be made by transit. The lowest improvement under the Bus/TSM Alternative (2.68%, 789 trips) would be associated with the "Middle-Income" (1 Auto) category.

The rail alternatives consistently demonstrate the ability to produce more new work trips than the Bus/TSM Alternative. The greatest actual and relative increase in work trips by rail would be in the Upper-Income category. Alternative 4A would increase work trips by transit the most of any alternative considered, and the number of work trips by persons in the Upper-Income category would increase about 1,500 trips (five percent). A 4.83 percent increase in work trips (1,422) by

Table 4-13 DAILY LINKED WORK TRIPS BY INCOME CATEGORY

Performance Measure	Alternative										
	Null	TSM	% Chg	3A	% Chg	3B	% Chg	4A	% Chg	4D	% Chg
Low-Income (Zero Autos)	18,635	19,231	3.20	19,243	3.26	19,303	3.58	19,393	4.10	19,278	3.50
Middle-Income (1 Auto)	29,439	30,228	2.68	30,381	3.20	30,443	3.41	30,861	4.83	30,568	3.84
Upper-Income (2+ Autos)	30,133	31,086	3.16	31,451	4.37	31,587	4.83	31,642	5.01	31,371	4.11
Percent Share of Total Work Trips											
Low-Income	23.83	23.88		23.74		23.73		23.68		23.74	
Middle-Income	37.64	37.53		37.47		37.94		37.68		37.64	
Upper-Income	38.53	38.59		38.79		38.83		38.64		38.62	

the Middle-Income category would be realized under Alternative 4A, but work trips in the Low-Income category would increase only 4.10 percent (758). Although the actual and relative increase in work trips would be less under the Alternative 4D for all categories, the apparent gap between benefits to the Low-Income category and the Middle- and Upper-Income categories would be reduced.

The Downtown Rapid Transit Relocation Alternatives show a different profile than the Euclid Avenue Rapid Transit Alternatives. Both Alternative 3A and 3B slightly favor the Low-Income category over the Middle-Income category (3.26% v. 3.20% and 3.58% v. 3.41%, respectively). The Upper-Income category shows the greatest increase for both alternatives, and the expected increases are higher than for Alternative 4D. In fact, Alternative 3B would produce greater increases in work trip patronage in the Lower- and Upper-Income categories than would Alternative 4D.

Table 4-13 also shows the distribution of work trips among the three categories for each alternative. Changes in the total distribution are very slight, but the values show that the Bus/TSM Alternative would increase the relative share of work trips attributable to the Low-Income category and the rail alternatives would reduce it. The share of work trips attributable to the Middle-Income category generally varies only slightly across the alternatives, with some showing a slight decrease and other a slight increase. The Upper-Income category shows an increase in the relative share of work trips across all alternatives.

5.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The analysis presented in this chapter identifies trade-offs among the No-Build, Bus/TSM, and four rail transit alternatives. Specific measures (absolute or relative) of the impacts of each alternative are related to specific measures (absolute or relative) of the impacts of every other alternative. A summary of findings to aid in decision-making is presented in matrix form in Appendix A. To be consistent with Federal planning practice, the evaluation performed throughout this chapter compares only the baseline scenario. Information on the alternative development scenario is included in Appendix B.

5.1 TRADE-OFFS AMONG ALTERNATIVES

The trade-offs analysis is undertaken to gain an understanding of the major differences among the alternatives being considered. It also is intended to reveal the degree to which each of the alternatives achieves the stated goals of this project. Measures of impacts have been expressed quantitatively whenever possible and compared on the basis of the incremental differences between them. For those impacts which are qualitative in nature, the differences between alternatives have been described in narrative form and the significance of the differences assessed.

The first consideration focuses on measures of specific impacts that are similar among alternatives. For example, all alternatives would have an impact on average travel time. This analysis focuses on order of magnitude differences between alternatives relative to a particular impact category. Where the extent or degree of impact between alternatives is significant, the size and nature of that difference has been presented. The second consideration focuses on the specific differences between alternatives, i.e., some impacts are not associated with all alternatives. Lastly, there is a discussion of the various interests that would be affected with implementation of the different alternatives.

5.1.1 Similarities Among Alternatives

The similarities among alternatives are highlighted below. Predicted or anticipated impacts have been divided into three categories:

- Those with similar but negligible values for all alternatives considered;
- Those with similar but significant values; and
- Those with diverse values.

Similarities Of Minor Consequence

- **Average Travel Time:** The Average Travel Time for all trips would not vary significantly among alternatives. Average In-Vehicle Travel Time, Average Out-Of-Vehicle time, and Average Total Travel Time would vary by less than a minute. Thus, no alternative would present a decided advantage.

- **Average Trip Length:** The Average Trip Length would vary by only two tenths of a mile among all alternatives.

- **Annual O&M Cost per Boarding ($/Unlinked Trip):** The Annual O&M Cost per Boarding would be just above $3.00 for all alternatives. The difference among alternatives are not substantial, because annual O&M costs are very large (about $200 million) and expected changes in ridership between alternatives are not. The lowest Annual O&M Cost per Boarding ($3.07) would be associated with the Null Alternative, because no major service changes are contemplated that would add to the annual O&M cost. Alternative 4A would have the next lowest Annual O&M Cost per Boarding at $3.09. This low figure results from the larger projected number of added passengers to absorb the additional service operations costs. The other three rail alternatives represent a significant jump in this category. The Annual O&M Cost per Boarding for the other rail alternatives would be 2 to 4 percent higher ($3.15-$3.20) than the Null Alternative. The Bus/TSM Alternative at $3.28 would be the most costly in this measure.

- **Daily Linked Work Trips:** Although all action alternatives would increase the number of work trips by transit, the differences between alternatives would not be significant. Daily Linked Work Trips with the Null Alternative would total slightly more than 78,000. The largest number of Daily Linked Work Trips (almost 82,000) would result with implementation of Alternative 4A. The relative difference between Alternative 4A and the Null Alternative is 4.5 percent.

- **Daily Vehicle-Miles Travelled by GCRTA Buses:** There would not be a significant change in the overall quantity of service provide by the bus transit system with any alternative being considered. There would be slightly less than 69,000 Daily Vehicle-Miles Travelled by GCRTA Buses for the Null Alternative. The Bus/TSM Alternative, which would rely on buses for the major part of the proposed transportation improvement, would increase this figure by almost 9,000 miles per day to 77,882. The less ambitious Downtown Rapid Transit Relocation Alternatives would result in fewer daily vehicle-miles of travel for buses (slightly more than 74,000) than the Bus/TSM Alternative. However, the Euclid Avenue Rapid Transit Alternatives would be even more effective in reducing bus miles travelled, while adding significant new service. Alternative 4A would require only 73,013 bus miles daily, which is the lowest of the action alternatives; Alternative 4D would be a little higher at 73,308 daily bus miles.

- **Air Quality Impacts:**

  Tons/Year of Hydrocarbons (HC) Generated would be significant between alternatives, but the total amount of reduction for any one alternative would not be regionally significant. The Bus/TSM Alternative would produce a reduction of about six tons compared to the Null Alternative. The largest reduction of about 41 tons would be associated with Alternative 4A, which is almost seven times greater than the reduction for the Bus/TSM Alternative. Alternative 4D would result in a reduction of about 33 tons, while Alternatives 3A and 3B would produce reductions of 25 and 29 tons, respectively.

  Tons/Year of Carbon Monoxide (CO) Generated would vary among alternatives, but the amount of the reduction of CO would not be significant for any one alternative. The

greatest reduction would occur with implementation of Alternative 4A, which would reduce CO by an estimated 469 tons. The reduction associated with the Bus/TSM Alternative (158 tons) would be about one-third that of Alternative 4A. The other three alternatives would result in reductions of similar magnitude: Alternative 3A - 310 tons; Alternative 3B - 358 tons; and Alternative 4D - 394 tons.

Tons/Year of Nitrogen Oxides (NO_x) Generated would increase with implementation of the Bus/TSM Alternative (plus 40 tons) and remain essentially unchanged with Alternatives 3A and 3B (plus 5 tons and plus 3 tons, respectively). Reductions in NO_x would be attained with implementation of the two Euclid Avenue Rapid Transit Alternatives. Alternative 4D would result in a reduction of 5 tons, while the greatest reduction of about 17 tons would occur with Alternative 4A.

- **Equity Considerations:** The evaluation measure defined for equity considerations identifies *Daily Linked Work Trips* for households of different income levels. The Bus/TSM Alternative would result in a slightly greater relative increase in *Daily Linked Work Trips* for low-income households, thus it would be more beneficial to the low-income households than to the middle- and upper-income households. This is not true of the rail alternatives. The values generated for this measure indicate the greatest relative increase in *Daily Linked Work Trips* with the rail alternatives would be associated with the upper-income group (2 or more automobiles). Generally, it can be concluded that as the emphasis on rail transit increases, the increase in trips associated with low-income households decreases relative to the middle- and upper-income households. Also, the more extensive the improvement, the greater the benefit to all groups.

- **Annual O&M Cost:** Annual O&M costs for the action alternatives would range from $199.5 million for Alternative 3B to $194.07 million for the Bus/TSM Alternative. This represents an increase over the Null Alternative of 9.0 and 6.0 percent, respectively. The relative difference in annual O&M costs among the action alternatives is less than 2.8 percent.

- **Farebox Recovery:** The share of O&M costs recovered through the farebox for the Null Alternative would be 44 percent. This would be slightly reduced with all of the action alternatives considered. The Bus/TSM Alternative would have a farebox recovery ratio of 41 percent, while all other alternatives would attain a ratio of 42 percent.

Similarities Of Major Consequence

- **Total Daily Systemwide Linked Passenger Trips:** Total Daily Systemwide Linked Passenger Trips would be increased almost six percent with implementation of Alternative 4A. This represents an increase of 8,575 in trips by all transit modes per day. The Bus/TSM Alternative would prove least beneficial in this category, increasing Total Daily Systemwide Linked Passenger Trips by only 2.5 percent. Increases in passenger trips for the three other alternatives considered would range between four and five percent. Alternative 3A would attract 5,976 additional trips (4.0%); Alternative 3B would attract 6,843 new trips (4.6%); and Alternative 4D would attract 7,328 new trips (5.0%).

- **Fleet Required:** The Fleet Required for each alternative is an important consideration, because vehicle costs are a large capital cost component and the size of the fleet is reflected in annual operating costs. All action alternatives would require an increase in the fleet assumed for the Null Alternative. The bus fleet would need to be increased by more than seven percent; the bus fleet size increase would be roughly similar for all action alternatives. The rail fleet would need to be increased by 14 to 23 percent. The rail fleet size increase would be greatest for Alternatives 3A, 3B, and 4A. The rail fleet size increase associated with the Bus/TSM Alternative and Alternative 4D would be 40 percent less.

- **Additional Annual O&M Cost per New Boarding ($/Unlinked Trip):** Variations in the Additional Annual O&M Cost per New Boarding are more noticeable than variances among alternatives relative to total annual O&M costs (as noted above). This measure uses the Null Alternative as the base for comparison, because it attempts to represent the benefit gained-- measured in term of new ridership-- relative to the cost to secure it. The Bus/TSM Alternative would have the greatest increase in annual O&M costs, because of the more extensive use of labor intensive bus transit services. This same alternative would have the lowest increase in ridership; therefore, it has the highest estimated Additional Annual O&M Cost per New Boarding of $9.80. The rail alternatives would be significantly below this value, depending on the combination of new services (i.e., bus or rail transit) and the forecast ridership increase. The estimated Additional Annual O&M Cost per New Boarding for Alternative 4A ($3.35) would be almost one-third that of the Bus/TSM Alternative. The value of this measure for the other Euclid Avenue Rapid Transit Alternative ($4.62), which includes the Shaker Connector (Alternative 4D), would be 47 percent of the Bus/TSM Alternative. But, this alternative's incremental O&M costs represent a 47 percent increase over Alternative 4A. The values for the Downtown Rapid Transit Relocation Alternatives also would be higher (59 and 82 percent greater than Alternative 4A for Alternative 3A and 3B, respectively), because the number of new riders attracted to the system would not be significant compared to the added O&M costs. Still, Alternative 3B would be only 62 percent of the Bus/TSM Alternative.

- **Passengers per Revenue Hour/Mile:** Differences in the measures of Passengers per Revenue Hour and Passengers per Revenue Mile (where passengers are measured as "unlinked trips") are important. They reveal most clearly the "trade-off" between the bus transit service and the rail transit service that is explicit with each alternative. Changes in these measures are evaluated with respect to the Null Alternative.

  Passengers per Revenue Hour for the bus and rail transit services would decrease with the Bus/TSM Alternative. Additional operations, due to expanded Express and Flyer service on Euclid Avenue and the added rail service on the Waterfront Line without significant ridership increases, would bring about this result. Unlinked Bus Trips/Revenue Hour would be 11 percent less than the Null Alternative; Unlinked Rail Trips/Train Hour would drop by nine percent. Bus transit travel uniformly would decrease nine to ten percent for all rail alternatives being considered. This reflects the orientation of corridor transit service to the Rapid Transit system with bus feeder service accentuated over continuing Express, Flyer, and Linehaul bus transit service. Travel by rail transit would increase, but there would be greater variation of change among the alternatives. Thus, Alternative 4A would produce 103.14 Unlinked Rail Trips/Train Hour, which would be an increase of 30 percent over the Null Alternative.

Alternative 3B would result in an insignificant increase in rail use, producing only 81.14 Unlinked Rail Trips/Train Hour compared to 79.22 for the Null Alternative. Alternative 3A would produce an increase of 8.3 percent in this measure to 85.83 Unlinked Rail Trips/Train Hour, while the other Euclid Avenue Rapid Transit Alternative (Alternative 4D, which includes the Shaker Connector) would increase rail transit travel by about 20 percent to 94.89 Unlinked Rail Trips/Train Hour.

Passengers per Revenue Mile for the bus transit services would decrease with the Bus/TSM Alternative; however, there would be an increase relative to rail transit service. Additional operations, due to expanded Express and Flyer service on Euclid Avenue without significant ridership increases, would bring about this result. *Unlinked Bus Trips/Revenue Mile* would be 11 percent less than the Null Alternative. Additional riders attracted to the rail system, including the new Waterfront Line, would raise *Unlinked Rail Trips/Car Mile* slightly (approximately 10%). Bus transit travel uniformly would decrease eight to nine percent for all rail alternatives being considered. This reflects the orientation of corridor transit service to the Rapid Transit system with bus feeder service accentuated over continuing Express, Flyer, and Linehaul bus transit service. Travel by rail transit would increase, but there would be greater variation of change among the alternatives. Thus, Alternative 4A would produce 3.75 *Unlinked Rail Trips/Car Mile*, which would be an increase of 79 percent (almost double) over the Null Alternative. Alternative 3B would result in a much less significant increase in rail use, producing only 2.64 *Unlinked Rail Trips/Car Mile* compared to 2.10 for the Null Alternative. Alternative 3A would produce an increase of 33 percent in this measure to 2.79 *Unlinked Rail Trips/Car Mile*, while the other Euclid Avenue Rapid Transit Alternative (Alternative 4D, which includes the Shaker Connector) would increase rail transit travel by about 65 percent to 3.47 *Unlinked Rail Trips/Car Mile*.

- **Travel Time For Selected East/West Trips:** The relocation or rerouting of Red Line service would result in significant changes in travel time for some trips. Travel time changes would be a function of the directness or circuity of the route of travel. A summary of expected effects on travel time for selected east/west trips is provided in Table 5-1.

  Red Line travel times for any of the selected trips would not be substantially altered with implementation of the Bus/TSM Alternative. A summary of travel time impacts follows.

  - *Alternative 3A* (Downtown Rapid Transit Extension), like the Bus/TSM Alternative, would not result in a significant travel time change between Windermere (East Cleveland) and the Tower City Station. However, travel time to the Airport (HIA) would be increased more than three minutes, because a transfer between the Red Line West and Red Line East routes would be required. Travel time for trips from West Cleveland (i.e., Brookpark and Airport) to Downtown would not be affected, nor would trips on the Blue and Green Lines.

  - *Alternative 3B*, which calls for relocation of all Rapid Transit service in the Downtown area, would produce significant travel time changes. Alternative 3B would add 2.4 minutes to Red Line travel between Windermere and the Tower City Station and the overall trip to the Airport. The increase travel time to Tower City would result from a longer, more circuitous route; additional time for the Airport

Table 5-1 TRAVEL TIME CHANGES FOR SELECTED EAST/WEST TRIPS (Minutes)

Origin >> Destination	Alternative					
	Null	TSM	3A	3B	4A	4D
Red Line						
• Windermere >> Airport	***46.73***	-.61	+3.39	+2.40	-.11	+1.85
• Windermere >> Tower City	***20.78***	-.61	-.61	+2.40	-4.11	-2.15
• Windermere >> Waterfront	–	***32.90***	NC	+3.01	-3.50	-1.54
• Tower City >> Brookpark	***23.37***	NC	NC	NC	NC	NC
• E.18th >> Brookpark	–	–	***26.58***	NC	+1.04	+1.04
Blue Line						
• Warrensville >> Tower City	***25.15***	NC	NC	+3.28	NC	+3.17
• Warrensville >> Waterfront	–	***33.88***	NC	+3.29	NC	+3.17
Green Line						
• Green Road >> Tower City	***26.02***	NC	NC	+3.28	NC	NC
• Green Road >> Waterfront	-	***38.75***	NC	+3.28	NC	NC

12.34 = Base Travel Time Value for Selected Trip.
– = No service provided or proposed.
NC = No Change.

trip would be associated with the need to transfer between the Red Line East and Red Line West route service. There would be no affect on trips from West Cleveland (i.e., Brookpark) to the Playhouse Square/CSU area (Euclid/East 18th Street). Compared to the Bus/TSM Alternative (which essentially reflects the Null condition), this Red Line relocation alternative would add about three minutes to the trip to the Waterfront. A travel time increase exceeding three minutes also would be associated with trips to Tower City Station and the Waterfront from Warrensville (Blue Line) and Green Road (Green Line).

- *Alternative 4A* would reduce travel time from Windermere to Tower City Station by more than four minutes. Travel time to the Waterfront would also be reduced (3.5 minutes). The added requirement to transfer between the Red Line East and Red Line West route service at Tower City Station would result in the Windermere to Airport trip being similar in time as for the Null Alternative. Travel time from Brookpark to East 18th Street (Playhouse Square/CSU Station) would be about one minute more than for Alternative 3A, which would be a direct extension of Red Line service. Otherwise, travel times between West Cleveland and the Tower City Station in Downtown would not be affected, neither would Blue and Green Line service to Downtown from Warrensville and Green Road, respectively.

- *Alternative 4D* would have a more circuitous route than Alternative 4A; therefore, travel time saved for the Windermere to Tower City trip would only be about two minutes compared to Alternative 4A. Therefore, the overall trip to the Airport would be greater than for the Null Alternative, because the travel time savings for the first leg of 2.15 minutes would not offset the time imposed by the required transfer between the Red Line East and Red Line West route service at Tower City Station. Travel time from Brookpark to East 18th Street (Playhouse Square/CSU Station) would be the same as for Alternative 4A, about one minute more than with Alternative 3A. Otherwise, travel times between West Cleveland and Tower City

Station in Downtown would not be affected. Travel time from Warrensville to Tower City and the Waterfront via the Blue Line would be increased slightly more than three minutes, due to rerouting of Blue Line service along the Shaker Connector to Euclid Avenue. Travel times on the Green Line from Green Road to Tower City Station in Downtown would not be affected.

- **New Commercial Development:** The assessment of development potential in the corridor, indicates an opportunity for about 3.8 million square feet of new development by 2010. The Bus/TSM Alternative, which would enhance transportation accessibility and mobility in the corridor through significant improvements in bus transit service, would increase the expected level of New Commercial Development only four percent. More extensive and permanent improvements associated with the rail alternatives would bring about larger increases in development opportunities. The two Downtown Rapid Transit Relocation Alternatives (3A and 3B) would increase the anticipated level of development by more than ten percent, yielding 4.2 and 4.3 million square feet of New Commercial Development, respectively. The Euclid Avenue Rapid Transit Alternatives would increase opportunities for New Commercial Development more significantly. Total New Commercial Development associated with Alternative 4A, which would serve the heart of University Circle along Euclid Avenue, would be slightly more than 5.4 million square feet. This represents a 44 percent increase over the Null Alternative. The Red Line alignment proposed with alternative 4D would remain outside the core area of University Circle, staying in the N&W RR cut. This alternative would increase development opportunities only 41 percent, yielding about 100,000 square feet less than Alternative 4D.

- **New Residential Development:** The pattern of New Residential Development would be roughly similar to the New Commercial Development. It has been determined that about 1,015 new residential units would be created with the Null Alternative. The Bus/TSM Alternative would create conditions conducive to the development of about 10 percent more units (1,120). The Downtown Rapid Transit Relocation Alternatives would be more stimulative in there effect, adding about 25 percent more units to the New Residential Development potential for a total of 1,270. New Residential Development for the Euclid Avenue Rapid Transit Alternatives would be 43 to 44 percent higher than the Null Alternative, resulting in an estimated 1,460 units under Alternative 4A and 1,450 units with Alternative 4D.

- **New Long-Term Jobs:** New Long-Term Jobs would be directly related to the level of New Commercial Development, as discussed above. Consequently, the Null Alternative would create an estimated 15,120 jobs; the Bus/TSM Alternative would bring about an increase of 4 percent in New Long-Term Jobs. The two Downtown Rapid Transit Relocation Alternatives (3A and 3B) would increase the anticipated number of New Long-Term Jobs by more than ten percent, yielding 16,760 jobs and 17,140 jobs, respectively. The Euclid Avenue Rapid Transit Alternatives would increase opportunities for New Long-Term Jobs more significantly. Alternative 4A, which would serve the heart of University Circle along Euclid Avenue, would create an estimated 21,740 New Long-Term Jobs. This represents a 44 percent increase over the Null Alternative. The Red Line alignment proposed for Alternative 4D would remain outside the core area of University Circle, staying in the N&W RR cut. This alternative would produce an estimated 21,380 New Long-Term Jobs, which would be 41 percent more than the Null Alternative.

Diverse Levels Of Impact

The impacts considered here are the impacts that are similar in nature and character, such as noise, but the magnitude of potential effects varies with each alternative.

- **Regional Accessibility/Mobility:** Regional accessibility/mobility is a function of the spatial distribution of transit services relative to the potential user population. Therefore, the impacts in this category are as diverse as the proposals themselves. The lowest level of regional accessibility/mobility would be achieved with the Null Alternative. The Bus/TSM Alternative and the two Downtown Rapid Transit Relocation Alternatives would be very similar in impact relative to improving regional accessibility/mobility. The percent share of the region's jobs within 30 minutes travel time by Rapid Transit service would be increased by nine to ten percent. The percent share of the region's jobs within 45 minutes travel time by Rapid Transit service would be increased by six to seven percent. The Euclid Avenue Rapid Transit Alternatives would improve the 30 minute access share by 15 to 16.5 percent (Alternatives 4D and 4A, respectively). Alternative 4A would have a distinct advantage by providing direct service to the heart of University Circle. The 45 minute access share for these two alternatives would be improved less dramatically– an 8.5% increase with Alternative 4D and a 9.5% increase with Alternative 4A.

- **Station Boardings:** Station boardings would vary greatly among the alternatives considered, as shown in Table 5-2 (refer also to the Evaluation Matrix). Total boardings for selected stations for the Null Alternative would be 11,672. The greatest number of boardings (24,113) would be attained with Alternative 4A, which would be more than twice that of the Null Alternative. Significant differences in rail boardings would occur in the University Circle, Mid Corridor, and Downtown subareas, which were defined for analysis purposes within the framework of the AA/DEIS and the Transitional Analysis. The ridership forecast also provided boarding information for other areas. The two other areas shown, Waterfront/West (i.e., the extended Blue/Green Line) and West Cleveland, would have significantly different boardings, but the order of magnitude of the differences is very much less than in the Corridor where new services are proposed.

  University Circle boardings would vary from 653 with the Null Alternative to 1,680 for Alternative 4A, which would provided direct LRT service along Euclid Avenue between East 107th and East 120th Streets. The number of boardings associated with the Bus/TSM Alternative, Alternative 3A, and Alternative 3B would in the neighborhood of 1,000 per day. Alternative 4D would have about 1,300 daily boardings in this subarea. This represents a 26 to 39 percent improvement over the Bus/TSM and Downtown Rapid Transit Relocation Alternatives, but this level of boardings would be 20 percent less than Alternative 4A.

  Mid Corridor boardings would be very different among alternatives, because the route of the Red Line would be substantially altered for each alternative considered (except the Null Alternative). Rail transit boardings in the Mid Corridor have been forecast to be 968 with the Null Alternative. The Bus/TSM Alternative would increase rail transit boardings by almost 60 percent to 1,536. The principal reason for the expected improvement relates to relocation of the East 34th Street Station to East 22nd Street and improved feeder bus service to other Red Line stations. Relocation of the East 34th

Table 5-2 DISTRIBUTION OF BOARDINGS BY AREA

Performance Measure	Alternative					
	Null	TSM	3A	3B	4A	4D
University Circle	653	1,071	969	1,021	1,680	1,344
Mid Corridor						
• N&W RR[1]	968	1,536	990	789	498	356
• Euclid Avenue	0	0	0	0	5,713	5,719
Downtown	8,112	8,508	14,310	13,481	12,319	11,801
Waterfront/West	0	1,017	1,401	1,196	1,423	1,143
West Cleveland[2]	1,939	2,297	2,465	2,461	2,480	2,447
TOTAL BOARDINGS	11,672	14,429	20,135	18,948	24,113	22,810

[1] Existing Red Line.
[2] Brookpark & Airport Stations.

Street Station to East 22nd Street would improve access to the CSU and Tri-C campuses, especially for persons living in West Cleveland. The same magnitude of increase in Mid Corridor boardings would not be realized with the two Downtown Rapid Transit Relocation Alternatives (which also include moving the East 34th Street Station), because direct service from West Cleveland would be provided via Red Line West to the Playhouse Square/CSU Station. It should be noted that the Playhouse Square/CSU Station located at Euclid/East 18th Street (in the Downtown subarea) would better serve the function of the new East 22nd Street Station, producing well over 2,000 daily boardings with both of these alternatives. Boardings in the Mid Corridor for Alternative 3A (990) would be similar to the Null Alternative, while boardings for Alternative 3B actually would be less (789). Clearly, the potential for Mid Corridor rail boardings would be greatly improved with direct service on Euclid Avenue. Thus, the Euclid Avenue Rapid Transit Alternatives would produce about 5,700 daily boardings between East 22nd Street and East 105th Street (University Circle). The greatest number of boardings (more than 3,000) would occur at the CSU station located in the vicinity of Euclid Avenue and East 22nd Street.

Downtown boardings would be of a similar order of magnitude for the Null and Bus/TSM Alternatives (8,112 and 8,508, respectively). Although the rail alternatives also are roughly comparable with only a 20 percent differential among them, there would be significant differences in the distribution of boardings Downtown. Table 5-3 shows the boardings for the Downtown Rapid Transit Stations. It is important to note that travel demand associated with CSU has a major influence on the use of the proposed rail transit configurations and, therefore, potential station boardings. Thus, Table 5-3 also shows the boardings for the proposed CSU Station in the vicinity of East 22nd Street. The Red Line Extension proposal (Alternative 3A) would provide direct access to the eastern part of Downtown. Over 6,000 daily boardings would be associated with the two new subway stations, while boardings at Tower City Station would remain about the same as for the Null Alternative. Full relocation of Rapid Transit service in

Table 5-3 DISTRIBUTION OF CBD/DOWNTOWN RAIL BOARDINGS

Station/Location	Alternative					
	Null	TSM	3A	3B	4A	4D
Tower City "Central Business District"	8,112	8,508	8,086	3,562	5,251	4,518
Euclid/East 9th "Office/Financial District"	0	0	3,970	6,330	6,233	6,426
Euclid/East 13th "Playhouse Square"	0	0	0	0	835	857
Euclid/East 18th "Playhouse Square/CSU"	0	0	2,254	2,820	0	0
Community College Blvd. "St. Vincent/Tri-C"	0	0	0	136	0	0
East 30th "U.S. Post Office"	0	0	0	633	0	0
Euclid/East 22nd "CSU" (Mid Corridor)	0	0	0		3,158	3,012

the Downtown (Alternative 3B) would result in a significant increase in boardings at the Euclid/East 9th Station (3,970 to 6,330) and a significant decrease at Tower City Station (8,086 to 3,562). Boardings at the Euclid/East 18th Station (Playhouse Square/CSU) also would increase by 25 percent. Thus, it can be seen that a large number of boardings at Tower City Station are persons from East Cleveland, who currently must go to Tower City and then travel by bus or foot to their final destination in the eastern part of the Downtown, including the CSU campus. Total Downtown boardings, however, would be slightly lower (6 percent), reflecting the more circuitous routing of Rapid Transit service. The number of boardings at the Euclid/East 9th Station with the two Euclid Avenue Alternatives (6,233 and 6,426 for 4A and 4D, respectively) would be similar to Alternative 3B. However, boardings at Tower City Station would be higher, though not as high as for the Null, Bus/TSM Alternative, and Alternative 3A. Daily boardings in the eastern part of the Downtown, when the CSU Station at Euclid/East 22nd is considered, would be close to 4,000 for both Euclid Avenue Rapid Transit Alternatives. Total Downtown/CSU boardings would be 15,477 for Alternative 4A, which is 8 percent more than Alternative 3A and almost twice that of the Null Alternative. Daily Downtown/CSU boardings associated with Alternative 4D, which includes the Shaker Connector, would be less than 15,000.

- **Direct Expenditures in Local Area, Region, and State During Construction Phase:** The level of expenditures would be a function of the size of the project undertaken. As such, direct expenditures associated with the Null Alternative would be negligible. On the other hand, direct expenditures associated with the rail alternatives would be a significant contribution to the economy. The more ambitious Euclid Avenue Rapid Transit Alternatives would contribute almost one-half billion dollars in direct expenditures. Whereas, the Bus/TSM Alternative, although it includes extensive

roadway improvements and equipment installation, would contribute less than $100 million. The other two rail alternatives would have more of an impact than the Bus/TSM Alternative. Alternative 3A would contribute about one-quarter billion (almost four times the Bus/TSM Alternative), while Alternative 3B would generate close to one-third of a billion dollars in direct local expenditures.

- **Total New Construction Jobs (Person Years):** Construction jobs, like direct expenditures, would be related directly to the size of the project. Thus, adoption of the Null Alternative would do nothing to increase short-term employment opportunities. Adoption of the Bus/TSM Alternative would create 251 short-term construction jobs. In contrast, Alternative 4D, which has an estimated capital cost of about $750 million, would have the potential to create almost eighteen hundred jobs (1,792), more than seven times the number expected to be created with the Bus/TSM Alternative. The number of jobs created with implementation of Alternative 4A would be very similar (1,738). Potential new construction jobs associated with Alternative 3A would be less than 60 percent of the Euclid Avenue Rapid Transit Alternatives. Full relocation of Rapid Transit services Downtown, with Alternative 3B, would create about thirteen hundred jobs (1,281), one-quarter less than the Euclid Avenue Rapid Transit Alternatives.

- **Potential Groundborne Noise and Vibration Impacts:** The greatest amount of these noise and vibration impacts would be associated with the Euclid Avenue Rapid Transit Alternatives. Alternative 4D would produce the most noise and vibration impacts, because it would have longer routing (45,900 feet) through areas not now impacted by rail operations. Alternative 3A would have the least amount of noise and vibration impacts among the rail alternatives, because it would be entirely underground. No significant vibration or noise impacts would be associated with the Null or Bus/TSM Alternatives.

- **Potential Airborne Noise/Vibration Impacts:** The Null and Bus/TSM Alternatives would result in no adverse, facility related impacts. Alternative 3A also would produce no significant long-term airborne noise/vibration impacts, because the project would be wholly underground. Short-term airborne noise/vibration impacts during construction would be expected. Excluding airborne noise/vibration effects associated with current Rapid Transit service in the N&W RR cut, full Downtown Rapid Transit Relocation would expose fronting properties along 7,500 feet of new alignment to the noise/vibration effects of streetrunning LRT vehicles. The exposure to potential airborne noise/vibration with implementation of the Euclid Avenue Rapid Transit Alternatives (4A and 4D) 4 to 6 times greater. With Alternative 4A, slightly more than 33,000 feet of fronting properties would be exposed to potential noise/vibration impacts from streetrunning LRT vehicles. Alternative 4D would increase this to about 46,000 feet.

- **Impacts on Architectural Sites:** The Null Alternative would not include physical, capital improvements; therefore, no direct impacts on architectural sites would occur. However, the lack of major investment in transportation and other improvements that would enhance access to the Corridor and mobility within the corridor could stifle maintenance and reinvestment in architectural sites, resulting in the further and continued deterioration. The Bus/TSM Alternative would provide a positive benefit to such sites through the reconstruction and renewal of Euclid Avenue. Although there

would be more bus operations on Euclid Avenue, the rejuvenation of the streetscape and provision of street furniture would create a favorable environment for maintenance and reinvestment. Few effects would result from implementing the Downtown Rapid Transit Extension Alternative (3A), although localized impacts would be associated with station access points and cut-and-cover construction methods. The Downtown Rapid Transit Relocation Alternative (3B) would include the development of street-running LRT service with associated overhead catenary and ancillary electrical transmission facilities. However, significant architectural sites would not be impacted by these new elements in the streetscape. More significant spatial and visual effects would be attendant with implementation of the Euclid Avenue Rapid Transit Alternatives. The development of LRT operations outside the Downtown (i.e., east of East 22nd Street) would permanently alter the environmental setting and streetscape of Euclid Avenue through the construction and installation of the overhead catenary, median guideway, stations, and ancillary facilities. In the case of Alternative 4D, Fairhill Road and MLK, Jr. Drive also would be affected.

- **Impacts on Historic Properties:** Impacts to historic properties would be very similar to those associated with architectural sites. Thus, the Null and Bus/TSM Alternatives would have no direct impacts, but the indirect effects stemming from neglect of the transportation system serving these properties could contribute to their deterioration and ultimate loss to the community. The greatest number of historic properties would be impacted by Alternative 4A, which is proposed to serve full length of Euclid Avenue. There are numerous historic properties along Euclid Avenue and University Circle represents a major concentration of such properties. Thus, Alternative 4D, which includes a route to the south and east of University Circle along the existing Red Line alignment in the N&W RR cut, would avoid these properties. The less ambitious Downtown Rapid Transit Relocation Alternatives principally would impact only those historic properties in the Downtown and Playhouse Square, and this impact would be limited to construction-related activities and small supporting facilities (e.g., headhouses). Alternative 3B would have some additional effect over Alternative 3A, because it would include an at-grade segment south of Euclid Avenue along East 18th Street.

- **Rail Service Impacts on Medical, Educational, Cultural, Recreational, and Community Institutions:** The Null Alternative includes some transit improvements currently anticipated for implementation in ongoing GCRTA planning and programming activities. These actions, however, would improve rail access only for a few institutions in the corridor. Although improvements to rail service and Rapid Transit accessibility would be associated with the Bus/TSM Alternative, like the Null Alternative, very few major institutions in the corridor would be benefited. The Downtown Rapid Transit Relocation Alternative (3B) would introduce direct Rapid Transit access to the southwest portion of the St. Vincent Quadrangle, where there are numerous social, health, and other institutions, including the St. Vincent Charity Hospital. Significant benefits would accrue to institutions in the corridor relative to Rapid Transit accessibility and mobility with implementation of the Euclid Avenue Rapid Transit Alternatives. Direct (within 750 feet) or indirect access (within 1,500 feet) would result for numerous institutions situated along or close to Euclid Avenue, Fairhill Road, and MLK, Jr. Drive. Twelve institutions would have direct or indirect access to Rapid Transit service for the Null Alternative; with Alternative 4A this number would be raised to 112. Alternative 4D would be slightly better, serving 114 institutions directly or indirectly.

- **Capital Funding Requirements:** The Null Alternative, being the "Base" for comparison would include only normal capital funding requirements associated with routine maintenance and upgrading of existing facilities, vehicles, and equipment. The Bus/TSM Alternative would require about $113.6 million to implement. The alternatives for developing major improvements to the Rapid Transit system would demand capital funding commitments 3 to almost 7 times greater. The Downtown Rapid Transit Extension (Alternative 3A) would require about $365 million to implement (3 times that of the Bus/TSM Alternative), while complete relocation of Rapid Transit service in the Downtown (Alternative 3B) would increase the capital funding need about 5 times to approximately $578 million. Full LRT service along Euclid Avenue would require only 17 percent more capital funds than Alternative 3B ($676 million); however, Alternative 4D would add $172 million or about 30 percent for a total capital funding requirement of approximately $750 million.

5.1.2 Difference Between Alternatives

- **Number of Intersections Affected:** Impacts on traffic operations would vary according to the character and type of facilities being developed/constructed. No major construction projects are anticipated with the Null Alternative; therefore, no significant impacts would impinge upon intersection operations in the Corridor. The Bus/TSM Alternative would involve major reconstruction of Euclid Avenue, but permanent changes to intersections or intersection movements are not contemplated. Alternative 3A involves the construction of a subway extension of the Red Line; consequent subway operations would not interfere with or alter intersection operations. The other three action alternatives include street-running, at-grade LRT operations, which have the potential to impact intersection operations. Six intersection potentially would be affected by Alternative 3B, which would operate through the St. vincent Quadrangle area. The Number of Intersections Affected by the Euclid Avenue Rapid Transit Alternatives would be five times greater– 32 intersections for Alternative 4A, and 30 intersections with Alternative 4D.

- **Opportunities for Private and Public Physical Development:** Development opportunities are supported best by permanent infrastructure improvements. The Null Alternatives would include no major improvements and, therefore, no specific opportunities would be created. Although the Bus/TSM Alternative would involve major reconstruction of Euclid Avenue, the bus transit service proposed to be provided would not be as permanent as the rail transit service proposed in the other action alternatives. Therefore, no specific opportunities have been identified. On the other hand, the system of services and facilities associated with rail transit can support higher densities of office, retail, and residential development with favorable economic conditions and supportive, local land use policies.

- **Opportunities for Private Sector Financial Participation:** Opportunities for Private Sector Financial Participation in community development actions are most definitively associated with permanent infrastructure improvements. The Null Alternatives would include no major improvements and, therefore, no specific opportunities would be created. Although the Bus/TSM Alternative would involve major reconstruction of Euclid Avenue, the bus transit service proposed and the facilities created to support it would only minimally stimulate private sector participation. On the other hand, it generally is recognized that the system of services and facilities associated with rail

transit opens opportunities for: limited, direct joint development; direct contributions to station facilities serving commercial and residential properties; and, special assessments on property benefited by the public investment in transportation improvements. Thus, the Downtown Rapid Transit Relocation Alternatives have the potential to generate approximately $2.6 million in incremental annual tax revenue over the Null Alternative. The Euclid Avenue Rapid Transit Alternatives, which involve more extensive investments throughout the corridor, potentially would generate approximately $7.6 million in additional annual tax revenue for the community.

- **Opportunities for Small and Disadvantaged Firms:** Many public agencies maintain policies that require a certain level of participation by small business firms and firms owned by women and/or minorities in most or all contracts let to the private sector. As such, it follows that Opportunities for Small and Disadvantaged Firms normally are greater in relation to larger projects with major funding commitments. Thus, the Null Alternative, which includes no such commitments, would provide opportunities only through the normal, day-to-day contracting and procurement practices of GCRTA. The same would be true for the Bus/TSM Alternative, although minimal opportunities would be created in association with the redevelopment of Euclid Avenue to facilitate more efficient bus operations. The rail alternatives would add to the opportunities available through the normal contracting and procurement activities of GCRTA.

- **Impacts on Neighborhoods:** The Null Alternative would result in no adverse, facility related impacts, but limitations on mobility and accessibility in the corridor potentially would adversely affect neighborhood stability and vitality in the long-term. The Bus/TSM Alternative would improve accessibility and mobility in the Little Italy and Fairfax neighborhoods through the relocation of the Euclid/East 120th Street and East 79th Street Rapid Transit Stations. Relocation of the University/Cedar Hill and East 34th Street Rapid Transit Stations would benefit the community of students, faculty, and visitors associated with the University Circle and Tri-C areas. The Downtown Rapid Transit Extension Alternative (3A) would include all these benefits and add direct access to the residential concentration in the Playhouse Square District. Alternative 3B would add to the benefits of the Bus/TSM Alternative and Alternative 3A by making Rapid Transit service more accessible to the multitude of residential housing units and institutions in the southwest portion of the St. Vincent Quadrangle. The two Euclid Avenue Rapid Transit Alternatives would create, through direct Rapid Transit service or feeder linkages to Rapid Transit stations, new opportunities for regional travel for residents of several neighborhoods. Depending on the one selected the following neighborhoods could be benefited: Downtown, Playhouse Square District, Hough, Central, Fairfax, Wade Park, Little Italy, Woodland Hills, Fairwood, Shaker Heights. In addition, Alternative 4D would create new direct Rapid Transit links between University Circle and Shaker Heights and between Shaker Heights and the core area Euclid Avenue via the Shaker Connector.

6.0 SELECTION OF PREFERRED INVESTMENT STRATEGY

6.0 SELECTION OF THE PREFERRED INVESTMENT STRATEGY

This chapter describes the process followed to select the Preferred Investment Strategy (PIS) for the Euclid Avenue Corridor and the results of that process. The description of the selection process includes a discussion of the decision framework and the course of events leading to the selection of the PIS by GCRTA and adoption of the PIS by the Northeast Ohio Areawide Coordinating Agency (NOACA) for incorporation into the Regional Transportation Plan and initiation of preliminary engineering. A description of the alternative selected as the PIS is also provided along with the plan for financing the PIS.

6.1 SELECTION PROCESS

The process for selection of the PIS is summarized in this section. It includes an overview of the discussion of the decision framework, meetings held for public review of the alternatives, and actions by the GCRTA and NOACA Boards through which the PIS was selected and then adopted for implementation.

6.1.1 Decision Framework

The decision framework established for this project was consistent with the requirements of the regulations issued by the FTA and Federal Highway Administration (FHWA) for Statewide and Metropolitan Planning. The regulations establish a process for communities to develop and evaluate "multimodal" solutions to regional mobility problems and select a PIS, sometimes called a locally preferred alternative (LPA). Implementation of this process for planning also requires extensive coordinated agency action. The planning and decision process must be coordinated with the Metropolitan Planning Organization (MPO, in this case, the MPO is NOACA) and other affected agencies (e.g., Ohio Department of Transportation, FHWA, FTA). In addition, integrated environmental analyses must be conducted as well as modal trade-off analyses. Thus, effective coordination with the many diverse interest groups becomes vitally important during evaluation of alternatives and development of a consensus plan, i.e., adoption of the PIS.

The selection process was initiated with public and agency review of the evaluation results and solicitation of comments. Following this review and comment period, the PIS was adopted by the GCRTA Board of Trustees. The decision of the GCRTA Board was based on the findings and conclusions arising from the evaluation of alternatives. The GCRTA Board then forwarded its decision to the Northeast Ohio Areawide Coordinating Agency, the regional planning body, for action. The NOACA Board considered the decision of the GCRTA Board and approved a resolution adopting the PIS, as required by the joint regulations.

6.1.2 Public Review/Involvement

Three public meetings were held for the purpose of informing affected agencies and interested citizens of the findings and conclusions arising from the evaluation of alternatives. The location and dates of the meetings are listed below:

- **Downtown Cleveland:** 11:00 a.m. to 2:00 p.m., Thursday, March 2, 1995, CSU Convocation Center, 2000 Prospect Avenue.

- **University City Neighborhood:** 5:30 to 8:30 p.m., Thursday, March 2, 1995, Martin Luther King Branch, Cleveland Public Library, 1962 Stokes Boulevard.

- **Old Brooklyn Neighborhood:** 6:30 to 8:30 p.m., Tuesday, March 7, 1995, City of Cleveland Estabrook Recreation Center, 4125 Fulton Road.

Notice of the meetings were mailed to a total of 1,100 persons using mailing lists provided by Midtown Corridor, Inc., St. Vincent Quadrangle, Inc., University Circle, Inc., and NOACA. The NOACA mailing list included the following groups:

- Air Quality Public Advisory Task Force
- NOACA Board Mailout Mailing List
- Cities, City Managers, Clerks, Council Members, County Planners, Mayors (Cuyahoga County)
- Citizens Participation Advisory Council
- Commuter Rail Technical Group
- Environmental Advisory Committee (EAC)
- EAC Air Quality
- NOACA employees and member organizations
- Media, i.e, newspapers, radio, and television
- Metropolitan Planning Organization list
- Transportation Advisory Committee/TAC mailout
- Transit agencies
- Section 16 agencies (variety of social service agencies)

All members of GCRTA's Citizens' Advisory Committee were notified, and another 200 postcards were hand-distributed at a major downtown public meeting sponsored by the American Institute of Architects, with the cooperation of the Cleveland Neighborhood Development Corporation and a new Gateway-area merchants' group. Another 64 additional persons whose names were supplied by Cleveland City Council members or City of Cleveland staff members received special information packets and a personal letter invitation.

At the meetings, the GCRTA Project Manager presented an overview of the study, its current status, and the alternatives studied and evaluation results. Attendees were informed that the GCRTA Board Planning and Development Committee had recommended Alternative 4A for approval by the full Board. The Board was now being asked to decide which, if any, of the alternatives studied merit further investigation by advancing the project to the preliminary engineering phase. Following the presentation, the meetings were opened to questions and comments by meeting attendees. The comments were recorded for the study files.

Where speakers stated preferences on the alternatives, almost all supported proceeding into preliminary engineering on an alternative that includes expanded rail service in part, or all of the Dual Hub Corridor. Of those who supported rail, the preference was for a full-length rail alternative along the corridor.

6.1.3 GCRTA Board Action

The results of the evaluation of the alternatives were reviewed by the GCRTA staff, and the recommendation of the staff was sent to the GCRTA Board of Trustees. The staff's recommendation was to pursue a phased implementation of Alternative 4A, with a downtown subway and Euclid Avenue busway as Phase I, and a Euclid Avenue at-grade light rail line as Phase II. The busway constructed in Phase II would be kept in service until completion of the light rail line in Phase II.

The recommendation of the staff was reviewed by the Planning and Development Committee of the Board and then sent to the full Board. On _____, the Board considered the staff's recommendation, the public comment, and the Committee's recommendation. After discussion, the Board adopted the Bus/TSM Alternative as the PIS for the Dual Hub Corridor. The Bus/TSM Alternative was selected because it was a more affordable solution than any of the rail alternatives and it still provides a number of transit benefits. The GCRTA Board then forwarded its decision to the NOACA for action. The PIS, as adopted, provides for the following:

- Improve certain bus service elements outside the Dual Hub Corridor including: transit centers, P&R lots, and community circulator service. Improvements and/or modifications to several bus routes would also be included.

- Enhance bus service within the Corridor and provide capital improvements along Euclid Avenue as a means to improve bus travel times.

- Increase Red Line Rapid Transit service levels during peak periods and midday. Relocate selected Eastside Red Line Stations to new locations.

- Construct the Waterfront Line as an extension of the Blue and Green Lines.

A copy of Resolution No. _____, by which the board adopted the alternative, is contained in the Appendix.

6.1.4 Northeast Ohio Areawide Coordinating Agency (NOACA) Action

Under the Statewide and Metropolitan Planning Regulations, NOACA, as the Metropolitan Planning Organization for Northeast Ohio, must adopt the PIS and include it in the Transportation Improvement Program, in order for the project to be advanced from the MIS phase to preliminary engineering. On _____, 1995, the NOACA Board acted on the GCRTA decision by adopting the Bus/TSM Alternative as the PIS. The Board's resolution adopting the alternative approves _____. A copy of Resolution No. _____, by which the board adopted the alternative is contained in the Appendix.

6.1.5 Rationale For the Decision

The selection of the Bus/TSM Alternative as the Preferred Investment Strategy was based on expected ridership increases, cost-effectiveness, affordability, availability of funding, and providing needed service to developments along Euclid Avenue. The results in these areas are presented earlier in this report.

The PIS includes and reflects Rapid Transit service on the Waterfront Line. The Waterfront Line would operate as an extension of the Blue and Green Lines. Certain physical improvements to the trackage and structures of the Rapid Transit system are also included in the PIS. Proposed improvements would enhance service operations and safety, but are not significant cost items. These include the relocation of Rapid Transit tracks west of the Hope Memorial Bridge to remove or improve a speed restricting, double reverse curve in the line. In addition, four stations currently served by the Red Line would be relocated as follows:

- The University Circle/Cedar Hill Station would be removed and a new Murray Hill/CWRU Station (Adelbert Road) would be constructed to replace it;
- The Euclid/East 120th Street Station would be removed and a new Little Italy/Mayfield Station (Mayfield Road) would be constructed to replace it;
- The East 79th Street Station would be removed and a new East 89th Street Station would be constructed to replace it; and
- The East 34th Street/Campus Station would be removed and a new East 22nd Street Station would be constructed to replace it.

6.2.2 Operations Description

Implementation of the PIS would involve operational modifications and additions to the bus and rail transit systems both within and outside the Dual Hub Corridor.

Bus Operating Plan

Non-corridor improvements include nine additional community circulators, in addition to the Lee-Harvard Community Circulator included in the Null Alternative. They will connect residential areas to transit centers and higher capacity main line bus and rail service. Community circulators are proposed to serve:

Euclid (C-2)
St. Clair (C-3)
University Circle (C-4)
Slavic Village (C-5)
Garfield/Maple Heights (C-6)
Tremont (C-7)
Kamms (C-8)
Lakewood (C-9)
Cleveland Heights (C-10)

Bus-to-rail/rail-to-bus transfers at existing Rapid Transit stations will be enhanced through bus route modifications. Several bus routes would be modified within the framework of the Transit 2010 Long Range Plan. The following routes would be modified to serve new transit centers:

9X - Mayfield
15F - Warrensville Heights Flyer
35F - West 25th/Broadview
73 - East 222nd/Highland
77F - Brecksville
87F - Westwood/I-90
94 - East 250th/Richmond
97F - Walton Hills
96F - Butternut/Hilliard

In addition, new express/flyer bus routes are proposed; these will operate on a 30 minute headway during the peak periods:

41F - Solon Express Flyer
107F - Wilson Mills
146F - Westlake Express Flyer
177F - Brecksville Express Flyer
186F - Sprague-Fair Express Flyer
197F - Broadway/Northfield Express Flyer

Details regarding these routes and their locations may be referenced in the Operations Plan Report.

Within the Dual Hub Corridor, the Euclid Avenue express and flyer routes (Monticello/Euclid Heights-7F; Mayfield-9X, 9BX, & 9F; Euclid-28X) would continue to operate. However, frequent stops for passenger boarding/alighting would result in buses operating "out-of-sync" with the phasing established through computerized signal progression. Therefore, all express and flyer routes would operate in a "limited stop/closed-door" service. Stops would occur only at major activity centers, such as Cleveland Clinic. The Cedar Routes (32CX, 32SX, & 32WX), which presently use Carnegie, will be routed to Euclid Avenue to take advantage of the signal progression.

Service on Route 6A (Euclid Avenue) will be improved in the A.M. and P.M. peak periods by reducing the headway from 18 minutes to 10 minutes. This will compensate for the operating restrictions on express and flyer service. The combined service of Route 6A (Murray Hill/CWRU) and Route 6 (Windermere Station) will result in 5 minute local service along Euclid Avenue.

Rail Operating Plan

Red Line Rapid Transit service would remain routed in the same manner as today (i.e., Windermere-Tower City-Airport). The Red Line would operate on a 12 minute headway, during the A.M. and P.M. peak periods.

The Bus/TSM Alternative includes and reflects Rapid Transit service on the Waterfront Line. The Waterfront Line would operate as an extension of the Blue and Green Lines. Alternate Blue/Green Line trains would be routed through the Tower City Station to the Waterfront, during the peak periods. All Blue/Green Line trains would continue on to the Waterfront during the nonpeak periods. It is anticipated that nine rail vehicles must be purchased and added to the Blue/Green Line fleet to serve the Waterfront Line. This represents an expansion of the total rail fleet from 64 to 73 vehicles, including the Red Line Rapid Transit fleet. The acquisition of these vehicles would be accomplished within the framework of the Waterfront Line extension project.

6.3 CAPITAL AND OPERATING COSTS

Capital and operating costs were estimated for the transit capital facilities and services to be provided within the definition of the PIS. Costs included construction of system elements, acquisition of equipment and vehicles, and operations and maintenance (O&M). The cost estimates reflect conceptual engineering and understanding of the principal structural and system elements. Additional design detail developed during Preliminary Engineering will provide a basis for refining the accuracy and reliability of cost estimates. Cost refinement also would be based on decisions made relating to facility requirements at transit center, P&R's, and stations. Station locations would be selected during Preliminary Engineering; this also would affect final cost estimates.

about $15 million in capital costs. The total cost of construction is estimated at approximately $43 million.

Non-construction costs include the costs associated with right-of-way and lease agreements and engineering and management services. These costs are estimated to be approximately $23 million. In addition to these costs, the cost estimate includes $13 million in contingencies, $25 million for escalation, and $10 million in project reserves, for a total capital cost of $113.619 million.

6.3.2 Operating and Maintenance Costs

Operating and maintenance (O&M) costs for the PIS were estimated, using a disaggregate and resource build-up methodology, in accordance with Federal Transit Administration procedures for alternatives analysis and major investment studies (Table 6-2).

Table 6-2 ESTIMATED O&M COST FOR THE PREFERRED INVESTMENT STRATEGY

Mode	Item	Number
Bus	Annual Unlinked Bus Pass. Trips	53,628,480
	Fixed Routes	102
	Peak Buses	689
	Annual Revenue Bus - Miles	23,364,600
	Annual Revenue Bus - Hours	1,609,700
	Service & Inspection Garages	4
	% CNG Powered Buses	100.00%
	Satellite Annual Bus - Miles	1,726,890
	Satellite Annual Bus - Hours	108,700
	Subtotal Bus O&M Cost	**$138.14**
Paratransit	Annual DR Revenue - Miles	699,729
	Annual DR Revenue - Hours	77,800
	Subtotal Paratransit O&M Cost	**$19.4**
Rail (HRT & LRT)	Annual Unlinked RT Pass. Trips	7,916,832
	Lines	3
	Peak Vehicles	61
	Annual Revenue Car - Miles	3,414,000
	Annual Revenue Train - Hours	110,000
	Route Miles	31.50
	Total Stations	53
	Service & Inspection Yards	1
	Subtotal Rail O&M Cost	**$36.55**
	TOTAL O&M COST	**$194.07**

The *O&M cost Methodology Report* (August 1994) describes the methodology used to develop the O&M cost model for GCRTA.

Total annual O&M costs for the PIS would be approximately $194 million. The bus transit system would account for about $138.14 million, or 71 percent of total operating costs of the PIS.

6.4 PROJECT FINANCING PLAN

A project financing plan was developed to support implementation of the PIS. The financial plan incorporates analyses performed during the evaluation of the selected alternative and subsequent review of funding availability and commitments. This section provides a general description of the revenue sources that can be tapped to cover the estimated capital and O&M costs and the commitments and assumptions associated with those sources. For more detailed information refer to the *Financial Analysis Results Report* (May 1995).

6.4.1 Project Sources and Uses of Funds

The major assumptions used in forecasting the costs and revenues supporting implementation of the PIS are summarized below.

Projected Project Expenditures

The following application of capital and O&M funds would be associated with the PIS:

- Bus Capital Program - including expenditures for new buses.
- System Development - including expenditures for transit facilities and Euclid Avenue improvements, planning, design, construction management, agency oversight, and capitalized start-up costs.
- Operations and Maintenance Expense - including fleet operations and facilities;
- Financing Costs - including debt issuance expenses and contributions to a debt service fund.

Existing Revenue Sources

Several revenue sources are available to GCRTA for financing the capital development and continuing operations costs of the PIS. Existing revenue sources are identified in the following discussion, which includes critical assumptions regarding funds availability.

Operating Revenues

Operating revenues for the project would be derived from five sources:

- Fares - Fare revenue yield (fare revenue per hour of service) was assumed to grow at the rate of inflation adjusted every other year. To the extent fares inflate at a greater rate of inflation, there would be a loss of ridership. Conversely, fare growth that is less than the rate of inflation will result in some ridership gain. A fare elasticity of -0.30 was assumed for all transit services.
- FTA Section 9 Funds - Annual operating funds from this source are assumed to decline from the current level of $9.0 million to zero by fiscal year 1999.

- Advertising Revenues - Revenues were assumed to grow with ridership at the current rate of advertising revenue per passenger. As service and ridership grows, advertising revenues will also grow.

- GCRTA Sales Tax Revenue - Current GCRTA projections of tax revenues in 1995 are used as the baseline. Long-term projections assume sales tax revenue will grow at 5.0 percent per year. According to GCRTA's 1992 annual report, sales and use tax revenues grew at an average annual rate of 5.8 percent between 1983 and 1992. GCRTA bonds legally have the first lien on dedicated sales tax revenue. However, it is assumed the size of the debt would be within the constraints of sales tax revenues less operating subsidy requirements.

- State Operating Assistance - The current level of ODOT operating assistance was assumed to continue (with no inflation). ODOT elderly and disabled assistance was assumed to continue. The State fuel tax reimbursement was assumed to grow with the level of service and with inflation.

Capital Development Revenues

Revenues to construct the project would be derived from the following five sources:

- Section 3 New Starts (Rail) Discretionary Funding - This source was assumed to fund 50 percent of the capital cost. This funding is considerably lower than the federal match for similar projects. This lower level of reliance on Federal funding, demonstrating local commitment to the Dual Hub project, will increase the likelihood that the project will be favorably considered by FTA and the Congress for funding.

- Section 3 Bus Discretionary Funding - The current federal statutory maximum of 80 percent of the cost for buses and bus-related non-fixed guideway facilities was assumed to be available.

- FTA Section 9 Funds - The historic annual level of Section 9 capital funding is assumed to remain constant at $9.4 million per year and will not inflate.

- GCRTA Sales Tax - All of the proceeds from the one percent sales tax, less operating subsidy needs, would be available. The long term debt can be financed through a first lien on sales tax revenues. The challenge in developing a feasible financial plan is to manage the level of debt service and operating subsidy so that the funds available to service the debt are greater than the minimum acceptable debt service coverage ratio. The minimum acceptable coverage ratio is 1.25 given the limited level of engineering design for the transit alternatives. The Authority's bonded debt per capita has declined between 1983 and 1992 from $30.07 to $16.55. Similarly, the ratio of bonded debt to assessed value has decreased from 0.33 percent in 1983 to 0.11 percent in 1992. However, the projected level of indebtedness for the PIS would exceed GCRTA's debt ceiling, but would still be within the Authority's statutory maximum debt limits.

- State Capital Grants - Ten percent of the transit project would be funded with state resources. In addition, ODOT resources are assumed to fund ten percent of bus purchases and other capital projects.

6.4.2 Financing Strategy

In a detailed assessment of financial feasibility, funding requirements for both the capital and O&M costs are compared to projected revenue from existing sources of funds and potential revenue from new funding sources. The indicator of financial feasibility for any given project, then, is the funding surplus or deficit that would result from construction and long-term operation. If a deficit is projected, additional revenue requirements and sources must be identified. The likelihood of success in securing additional, new revenue sources (e.g., referenda, local legislation, state legislation, etc.) must be identified to assess financial feasibility. Where existing and potential new sources of funds are not sufficient, the project is deemed to be financially infeasible.

Table 6-3 identifies the total capital and operating funding sources and uses for all transit projects that the GCRTA is committed to implementing over the 30-year period 1994-2023. The plan includes the PIS and other additional investments for projects such as the continuation of infrastructure renewal and construction of the Waterfront light rail system (Refer to Schedule K in Appendix B of the *Financial Analysis Results Report* for more detail). The financing plan shows a net cash flow of $818 million. Base line assumptions for preparing the plan include the following:

• Inflation	4.0% per year
• Construction costs	3.8% per year
• GCRTA share	40%
• Sales tax revenue growth	5.0% per year
• Bond term/interest rate	20 year/6.6%
• Operating revenue growth	4.0% per year
• Unit operating cost growth	3.0% per year
• Service growth	3.2% in 1997 15.2% by 2006

The results of the financial analysis indicate that GCRTA will have the financial capacity to undertake the transit investment. To finance the Bus/TSM Alternative, bonds will need to be issued between 1995 and 2008 in order to undertake the Waterfront Light Rail Line and to maintain sufficient working capital until GCRTA can contain its operating costs. The amount of annual carry-forward resources from the sales tax appears and begins to grow in 2015. Prior to 2015, resources are primarily required to cover the cost of operations and, to a lesser extent, debt service and capital needs.

Strategies are available to construct the PIS assuming a financially constrained future. Overall, these initiatives would achieve lower operating cost increases and greater fare revenues and contribute to an acceptable debt service coverage ratio. These strategies include:

- Increase the attractiveness of existing transit services - These actions include additional park-and-ride lots, passenger facilities, and other physical amenities that enhance the competitiveness of GCRTA's services as well as more effective marketing strategies.

- Constrain the rate of service growth - GCRTA could slow down the growth in local, express, and circulator bus service. Increased bus service results in a greater drain on tax revenues that would otherwise be available to support the capital program.

Table 6-3 SOURCES & USES OF FUNDS (millions of year-of-expenditure dollars)

SOURCES OF FUNDS		**$ (1994-2023)**
Capital Sources		
Federal Grants:		
Sec. 3 Dual Hub	50%	$42.1
Sec. 3 Buses	80%	550.3
Sec. 3 Other Projects	80%	466.8
Sec. 9 Bus Capital	80%	305.8
ODOT Grants:		
Dual Hub	10%	8.4
Other Rail Extensions	10%	20.0
Buses	10%	107.0
Other Projects	10%	58.3
Dedicated Tax		1,507.6
Financing Program - Bond Proceeds		173.0
Total Capital Sources		$3,250.5
Operating Sources		
Fares		$2,924.4
Advertising Revenue		60.1
Other Operating Revenue		53.3
Section 9 Assistance		35.7
State Assistance		180.8
State Elderly & Disabled		17.9
State Fuel Tax Reimbursement		171.0
Interest Income		217.8
Dedicated Tax for Operations		6,095.5
Total Operating Sources		$9,756.4
Total Sources of Cash		$13,007.2
USES OF FUNDS		
Capital Uses		
100% GCRTA-Funded Capital Program		
Routine Capital		$175.7
Asset Maintenance		112.2
Capital Program		
Rail System (Non Leasable)		346.9
Bus System (Non Leasable)		370.8
Leasable (Vehicles Only)		1,070.2
Financing		
Principal		146.5
Interest		193.7
Debt Issuance		2.4
Debt Service Reserve Fund		14.4
Total Capital Uses		$2,432.8
Operating Uses		
Bus		$6,485.7
Demand Response		868.3
Rail (including Rail Extensions)		2,402.4
Total Operating Uses		$9,756.4
Total Uses of Funds		$12,189.2
NET CASH FLOW		$818.0

- Increase fare yield per revenue vehicle hour - This can be achieved through a combination of fare increases, service optimization, and more effective marketing. The financial analysis considers the adverse ridership impacts of fare growth above the rate of inflation.

- Contain operating costs - This can be achieved through privatization/competitive contracting of services, use of part time labor, automation, efficiency enhancing capital projects, and process re-engineering. However, the projection already assumes aggressive (and historically achievable) cost containment.

7.0 PROJECT IMPLEMENTATION

7.0 PROJECT IMPLEMENTATION

There are several steps to be completed from this point in order to advance the PIS for the Dual Hub Corridor. This chapter summarizes those steps and presents a schedule for implementation of the selected project.

7.1 NEXT STEPS

The Federal project development process includes the following steps:

- System Planning;
- Major Investment Study;
- Preliminary Engineering;
- Final Design; and
- Construction.

System Planning involves the regional planning efforts that result in the selection of a corridor having the need for major mobility improvements. For the Dual Hub Corridor, system planning was completed several years ago.

The Transitional Analysis, along with the AA/DEIS completed in 1993, satisfies the requirements for a major investment study. The outcome of an MIS is the selection of a preferred investment strategy for the corridor or area being studied. For the Dual Hub Corridor, the PIS is the Bus/TSM Alternative. This alternative calls for improvements of bus service and transit facilities outside the corridor; enhancement of bus service within the Dual Hub Corridor and major capital improvements along Euclid Avenue as a means to improve bus travel times; computerized signalization along Euclid Avenue; increase of Red Line Rapid Transit service levels and relocation of selected Eastside Red Line Stations; and construction of the Waterfront Line as an extension of the Blue and Green Lines. The next step is preliminary engineering.

7.1.1 Preliminary Engineering (PE)

The Transitional Analysis has been undertaken to determine if any of the "action" alternatives (Bus/TSM and rail alternatives) are sufficiently promising to warrant PE and, eventually, final design and construction. Selection of a PIS effectively satisfies the conclusion that further, more detailed, PE work is justified and necessary. The majority of technical issues differentiating the alternatives and affecting feasibility up to this point did not require the level of analysis associated with PE to form reasonable conclusions. Consequently, the Transitional Analysis necessarily leaves a number of technical issues unresolved, anticipating the potential for advancement into PE.

A capital grant application will be prepared by GCRTA and submitted to FTA. A copy of this Final Report will accompany the application. The grant application will request that FTA approve advancing the PIS into PE and grant funds for the next level of engineering efforts.

FTA approval of the grant application will permit GCRTA to initiate the preliminary engineering phase of the project development process, which will provide the framework for resolving outstanding issues. Specific attention will be given to refinement and finalization of the design of improvements along Euclid Avenue, station, transit center, and P&R lot location and design issues, refined cost estimates and financial plan, and bus operations plans. Additionally, in compliance with the NOACA Resolution, the feasibility of extending the Waterfront Line to tie into the PIS alignment will be evaluated during PE.

The purpose of PE is to further refine the selected alternative so that detailed cost estimates can be prepared. PE takes the project approximately to the 30 percent level of design. With the more detailed cost estimates that come out of PE, a revised financial plan can be prepared. Additionally, comprehensive environmental impact assessments are conducted in order to identify potential adverse impacts and design appropriate mitigation measures.

At the end of PE, a decision will be made whether or not to proceed with final design and construction. The decision will be based upon the information produced in PE, especially the environmental impacts, the capital and O&M costs, and the financing plan. It is only after all involved parties have formally agreed to financial participation that the project can move ahead.

7.1.2 Environmental Impact Statement

Simultaneously with the PE work, GCRTA will prepare a Supplemental Draft Environmental Impact Statement (SDEIS), and a Final Environmental Impact Statement (FEIS). A DEIS was prepared in 1993 as a component of the AA/DEIS process that preceded the Transitional Analysis. Because of the changes that have been made to the alternatives since the publication of that document it will be necessary to prepare a SDEIS. This document will "supplement" the information on the alternatives,

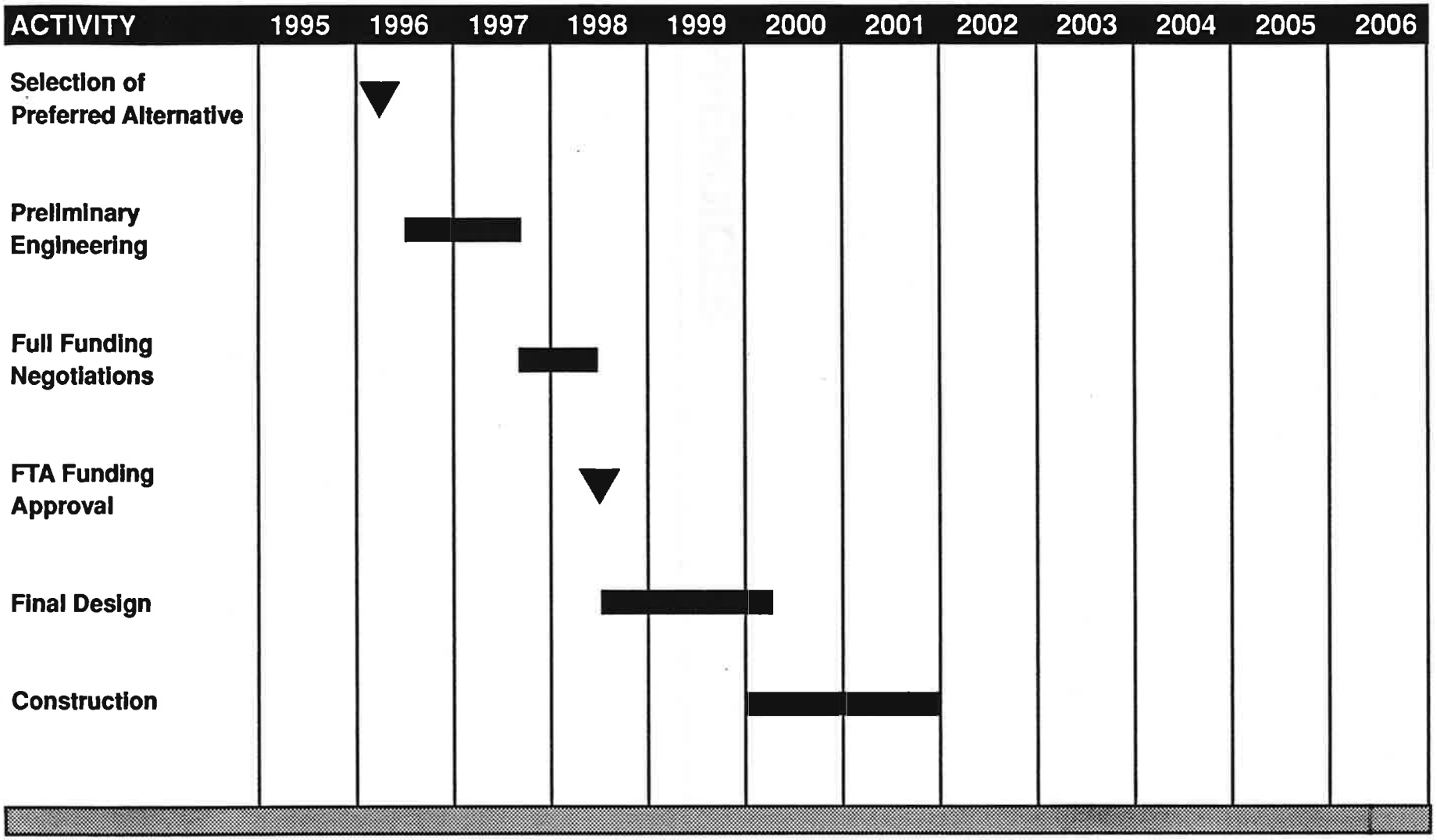
It is during PE, also, that the FEIS will be prepared. The FEIS will be assembled from information relating to all areas of technical analysis. Implementation of the LPA will be evaluated against doing nothing (i.e., the "Null Alternative"). The FEIS will flow directly from the AA/DEIS and this Final Report, providing a detailed description of the LPA, alternatives considered, the affected environment, expected impacts, and mitigation measures. It will include Memoranda of Agreement or Understanding specifying necessary mitigation measures and assuring their implementation.

The draft of the FEIS will be circulated for public examination, review, and comment. Specific coordination will be maintained with all affected government agencies during this review process. Review of the draft FEIS will be followed by revisions, as necessary to respond to comments received from agencies and the interested public. With the preparation and publication of the FEIS and certain other administrative actions on the part of FTA, GCRTA can proceed into the Final Engineering/Final Design and then Construction/Implementation phases of project development.

7.2 SCHEDULE

As described in the previous sections, continued development of transit service in the Dual Hub Corridor requires completion of PE, preparation of Federal environmental documents, Final Engineering and Design, and then construction. A summary of the overall Project Implementation Schedule for the project is outlined in Figure 7-1.

With selection of the PIS, GCRTA has prepared the way for initiation of the Preliminary Engineering phase of the project, during which the Draft and Final EISs would be prepared. PE is expected to commence in mid-1996. The Final Design phase would be completed in early 2000 followed by the initiation of construction in the same year. Construction would be completed by the end of 2001.



CLEVELAND DUAL HUB TRANSITIONAL ANALYSIS STUDY

Figure 7-1
PROJECT SCHEDULE
Preliminary Engineering, Final Design and Construction

euclid CONSULTANTS A Joint Venture

NOT TO SCALE

GREATER CLEVELAND REGIONAL TRANSIT AUTHORITY

Source: GCRTA 2-27-95

EVALUATION CATEGORY/MEASURE[1]	ALTERNATIVE					
	Null	Bus/TSM	Downtown Rapid Relocation		Euclid Avenue Rapid	
			Alternative 3A	Alternative 3B	Alternative 4A	Alternative 4D
EFFECTIVENESS (GOAL ACHIEVEMENT)						
GOAL: IMPROVE TRANSPORTATION SERVICES **Objectives: Increase Transit Usage** **Minimize Total Travel Time** **Minimize Traffic Congestion** **Enhance the Productivity of the Transit System** **Improve Mobility of the Transit Dependent and Access of that Population to Employment Centers and Community Resources**						
▪ Total Daily Systemwide Linked Passenger Trips[2]	148,141	151,905	154,117	154,984	156,716	155,469
▪ Fleet Required • Peak/Total Bus • Peak/Total Rail	640/768 54/64	689/827 61/73	685/822 65/79	685/822 65/78	685/822 65/78	686/824 62/74
▪ Annual O&M Cost per Boarding ($/Unlinked Trip)[2,3]	$3.07	$3.26	$3.18	$3.20	$3.09	$3.15
▪ Additional Annual O&M Cost per New Boarding ($/Unlinked Trip)[2,3]	–* * Not Applicable	$9.80	$5.34	$6.06	$3.35	$4.62
▪ Number of Intersections Affected	–	–	0	6	32	30
▪ Passengers per Revenue Hour–Bus/Rail (Unlinked Trips)[2]	37.40/79.22	33.32/71.97	34.04/85.83	34.04/81.14	33.76/103.14	33.97/94.69
▪ Passengers per Revenue Mile–Bus/Rail (Unlinked Trips)[2]	2.58/2.10	2.30/2.32	2.38/2.79	2.37/2.64	2.35/3.75	2.34/3.47
▪ Total Station Boardings[2] West Cleveland (Airport/Brookpark to Tower City) Waterfront (Tower City to E.12th/E.14th) Downtown (Tower City to Euclid/E.22nd) Mid Corridor (Euclid/E.22nd to Euclid/E.107th University Circle (Euclid/E.107th to Euclid/E.120th)	 1,939 0 8,112 968 653	 2,297 1,017 8,508 1,536 1,071	 2,465 1,401 14,310 990 969	 2,461 1,196 13,841 789 1,021	 2,480 1,423 12,319 6,211 1,680	 2,447 1,143 11,801 6,075 1,344

EVALUATION CATEGORY/MEASURE[1]	ALTERNATIVE					
	Null	Bus/TSM	Downtown Rapid Relocation		Euclid Avenue Rapid	
			Alternative 3A	Alternative 3B	Alternative 4A	Alternative 4D
EFFECTIVENESS (GOAL ACHIEVEMENT)						
GOAL: IMPROVE TRANSPORTATION SERVICES **Objectives: Increase Transit Usage** **Minimize Total Travel Time** **Minimize Traffic Congestion** **Enhance the Productivity of the Transit System** **Improve Mobility of the Transit Dependent and Access of that Population to Employment Centers and Community Resources**						
▪ Total Daily Systemwide Linked Passenger Trips[2]	160,561	164,557	168,967	169,948	172,742	171,415
▪ Fleet Required • Peak/Total Bus • Peak/Total Rail	744/893 54/64	783/940 61/70	776/932 66/79	784/941 65/78	785/942 65/78	786/944 62/74
▪ Annual O&M Cost per Boarding ($/Unlinked Trip)[2,3]	$3.02	$3.20	$3.07	$3.10	$2.91	$2.91
▪ Additional Annual O&M Cost per New Boarding ($/Unlinked Trip)[2,3]	–*	$9.42	$3.96	$4.61	$2.57	$3.40
▪ Number of Intersections Affected	–	–	0	6	32	30
▪ Passengers per Revenue Hour–Bus/Rail (Unlinked Trips)[2]	37.55/85.67	33.95/77.90	35.09/94.47	35.04/89.24	34.75/115.82	34.43/108.16
▪ Passengers per Revenue Mile–Bus/Rail (Unlinked Trips)[2]	2.62/2.27	2.34/2.51	2.45/3.07	2.44/2.91	2.43/4.22	2.41/3.89
▪ Total Station Boardings[2] West Cleveland (Airport/Brookpark to Tower City) Waterfront (Tower City to E.12th/E.14th) Downtown (Tower City to Euclid/E.22nd) Mid Corridor (Euclid/E.22nd to Euclid/E.107th University Circle (Euclid/E.107th to Euclid/E.120th)	 4,224 0 17,892 2,010 1,475	 4,991 2,178 18,703 1,730 2,442	 5,394 3,000 32,078 2,112 2,225	 8,385 2,583 30,321 1,666 2,351	 5,455 3,090 27,121 15,234 3,909	 5.385 2,495 25,957 14,907 3,157

* Not Applicable

EVALUATION CATEGORY/MEASURE[1]	ALTERNATIVE					
	Null	Bus/TSM	Downtown Rapid Relocation		Euclid Avenue Rapid	
			Alternative 3A	Alternative 3B	Alternative 4A	Alternative 4D
COST EFFECTIVENESS						
▪ Cost per User Benefits Index[3]	–	–	$17.67	$23.00	$14.92	$27.66
▪ Total Cost per New Transit Rider Index[3]	–	–	$13.45	$23.58	$18.51	$26.06
▪ Federal Cost per New Transit Rider Index[3]	–	–	$5.32	$10.88	$8.42	$12.36
▪ O&M Cost per Rider ($/Linked Trip)	$4.22	$4.51	$4.33	$4.32	$4.24	$4.28
EQUITY CONSIDERATIONS						
▪ Daily Linked Work Trips from Low-Income Households (i.e., Zero Autos)	19,558	20,173	20,434	20,495	20,637	20,519
▪ Daily Linked Work Trips from Middle-Income Households (i.e., 1 Autos)	31,631	32,469	33,161	33,230	33,813	33,506
▪ Daily Linked Work Trips from Upper-Income Households (i.e., 2 or More Autos)	32,844	33,876	34,789	34,962	35,186	34,881
FINANCIAL FEASIBILITY						
▪ Total Capital Cost (1,000s)[3]	–	$162,934	$412,598	$629,842	$728,319	$801,492
▪ Annualized Capital Cost (1,000s)[3]	–	$16,580	$37,236	$56,021	$64,125	$70,698
▪ Annual O&M Cost (1,000s)[3]	$194,974	$213,606	$210,611	$211,400	$211,013	$211,491
▪ Capital Funding Requirements • Net Present Value[5] • Bonds Required[5] • Section 3 Funds Required[5] • Minimum Bond Coverage[6]	 $615 $0 $1,171 –	 $678 $25 $1,226 –	 $830 $75 $1,340 .66	 $962 $125 $1,439 .33	 $1,071 $141 $1,480 .31	 $1,061 $160 $1,512 .29
▪ Percent of O&M Covered by Farebox	.45	.42	.43	.43	.44	.44