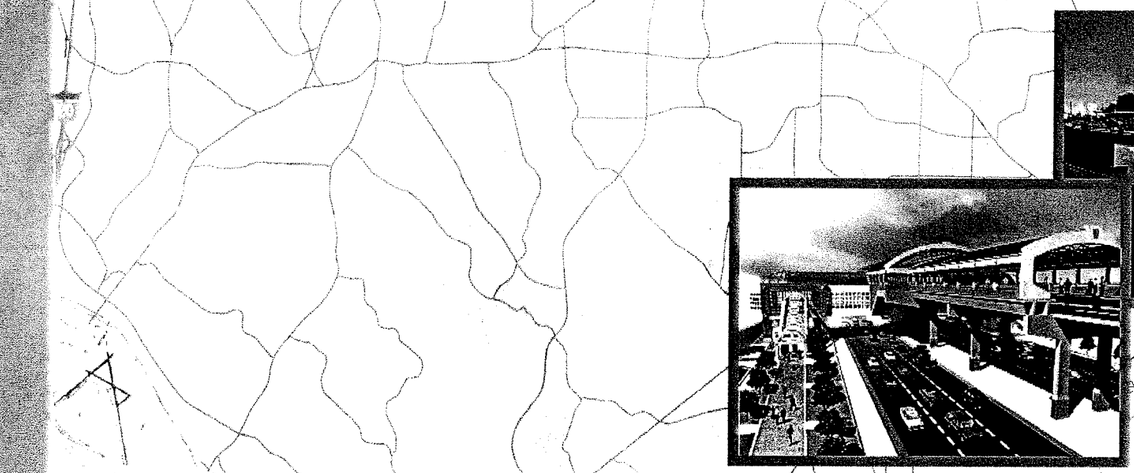

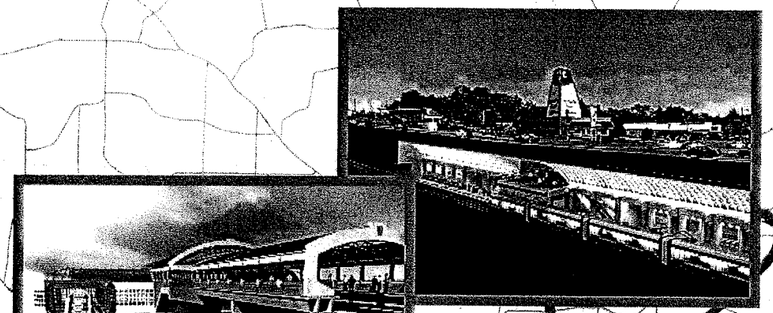

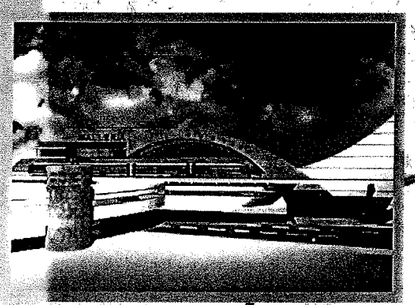

Barrett Parkway
Transfer Station

Town Center Area Circulator

Chastain Road /
I-575 Transfer
Station

Town
Center
Mall

Town Center Mall
Transfer Station

Central Maintenance
and Storage Facility

Trunkline

Cobb Parkway

Cumberland Circulator

Windy Ridge Parkway /
Herodian Way
Transfer Station

Cumberland
Mall

Fulton County

Cumberland Boulevard
Transfer Station

MARTA Arts Center Station

Transit Implementation Study

Northwest Corridor Light Rail Transit System
Atlanta, Georgia

Final Report – Volume 1

Submitted to

Cobb County Department of Transportation
Cumberland Community Improvement District
Town Center Area Community Improvement District

Submitted by

Bechtel Infrastructure Corporation
Mayes, Sudderth & Etheredge, Inc.

February 2001

EXECUTIVE SUMMARY

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This *Transit Implementation Study* comprises a comprehensive 20-month investigation into the need for, and reaffirmation of, a proposed light rail transit system for the northwest corridor of the Atlanta Region, serving both Fulton and Cobb counties. This Final Report documents the work prepared in each of the Study's Work Elements, the work presented in three interim reports, as well as work presented by the consulting team at the regular monthly meetings of the Study's Steering Committee.

The Study was performed by an integrated architectural, engineering, and planning consultant team of Bechtel Infrastructure Corporation, an international engineering and construction company headquartered in San Francisco, California; and Mayes, Sudderth & Etheredge, Inc. (MSE), a Southeastern architectural and engineering company headquartered in Marietta, Georgia. The Bechtel/MSE Team was assisted by CobbRides, the Cumberland Transportation Management Association (TMA), and the Burruss Institute of Kennesaw State University.

This section presents the background for the Study and summarizes the structure of this Final Report.

1.1 BACKGROUND

Cobb Pkwy and South Marietta Pkwy

The Atlanta Region has experienced extraordinary growth since 1990, and this trend is expected to continue, with an anticipated 78 percent increase in population by 2025. As the population and employment centers have spread outward, significant efforts by regional, countywide, and community agencies have focused on the planning strategies necessary to assure orderly growth and improve transportation, air quality, and quality of life in the area. These efforts include:

- **The Regional Transportation Plan (RTP).** The Atlanta Regional Commission (ARC), as the designated metropolitan planning organization for the Atlanta Region, maintains a comprehensive transportation planning process, develops transportation strategies for the Region, sets priorities on project funding, and coordinates the ongoing process with the federal, state, and local government agencies. The Regional Transportation Plan (RTP) development process is a primary activity of the ARC, and is a planning requirement to assure the Atlanta Region's share of federal funding for transportation and air quality improvement programs.
- **The Draft Cobb County Comprehensive Transportation Plan (DCCCTP).** The Cobb County Board of Commissioners authorized several studies, culminating in the submittal of the DCCCTP in January 1999. This plan included a general definition of a light rail transit system for Cobb County that was submitted to the ARC for inclusion in the RTP.
- **The *Transit Implementation Study.*** This Study was commissioned by the Cumberland Community Improvement District (CID) and the Town Center Area CID. It builds on the DCCCTP and significantly advances and refines concepts for a fixed guideway transit system in the Cobb Parkway/I-75 North Corridor, as described in detail within this Final Report.

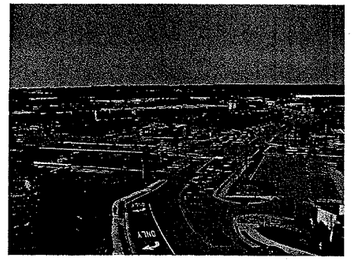
1.1.1 Study Sponsors

1.1.1.1 Cumberland CID and Town Center Area CID

In the Spring of 1999, the Cumberland CID and the Town Center Area CID joined together to move forward on the transit system concepts identified in the DCCCTP. These sponsors entered into an agreement with the Bechtel/MSE Team to perform the *Transit Implementation Study* as the first in a series of steps to implement a fixed guideway transit system. This system, referred to throughout this Final Report as the Northwest Corridor Light Rail Transit (LRT) System, would originate in the Town Center area, extend southward through the Cumberland Mall/Galleria area, across the Chattahoochee River, and onward to its southern terminus at the Metropolitan Atlanta Rapid Transit Authority (MARTA) Arts Center Station in Midtown Atlanta. This system would include two light rail transit circulators within the Cumberland and Town Center Area CIDs, as well as a branch line through the central business district the city of Marietta.

Cumberland CID

The Study followed a carefully defined work program, and has been guided via monthly meetings with a Steering Committee comprised of the Director of the Department of Transportation for Cobb County and key appointed members of the Cumberland and Town Center Area CID Boards, as well as staff from CobbRides for the Town Center Area CID, the Cumberland Transportation Management Association (TMA), and the Cobb County Department of Transportation (CCDOT). This group worked closely with the consultant staff to produce this Final Report.


Town Center Area CID, Barrett Parkway

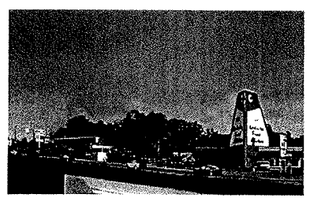
In addition, a significant number of coordination meetings were held with the major landholders and developers in the Region, to fully understand and address their transportation needs, as well as to fit the physical requirements of the system into the community as successfully as possible. These meetings were productive and have enabled the results of this Study to enjoy a preliminary acceptance from the major business interests who will be affected by its implementation.

1.1.1.2 City of Marietta

In February of 2000, the City of Marietta and the Downtown Marietta Development Authority entered into a supplemental agreement with the Bechtel/MSE Team, to study a potential branch line that would provide light rail transit service to the central business district of Marietta. This work was entered into with the agreement of the Study's primary sponsors, the Cumberland and Town Center Area CIDs. This additional work has been coordinated with the various elements of the overall Study – the patronage forecasting, conceptual engineering design, and operations planning. The Marietta Branch report is presented in Section 12 of this Final Report.

1.1.2 Study Goals, Objectives, and Scope

The *Transit Implementation Study* has proceeded according to stated goals, objectives, and scope that initially encompassed five work elements.


The "Big Chicken" – Cobb Parkway and Roswell Road

The goals of the Study are to identify and plan a system to:

- Relieve traffic congestion on I-75, on Cobb Parkway, and at major intersections within the Cobb Parkway Corridor.

- Improve air quality in Cobb County and the Atlanta Region.
- Foster and accommodate employment growth in the Cumberland and Town Center Area CIDs.
- Strengthen the regional transportation network.
- Coordinate the development of the new transit system with the Atlanta Region's and Cobb County's land use and comprehensive development plans.
- Minimize the impacts of these transportation improvements on the surrounding environment.

Specific objectives of the Study were to:

- Develop a conceptual engineering solution for a light rail Trunkline within the Cobb Parkway corridor with provisions for its continuation to the Metropolitan Atlanta Rapid Transit Authority (MARTA) Arts Center Station in Midtown Atlanta.
- Develop conceptual engineering solutions for rail circulators in the Cumberland and Town Center Area CIDs, with passenger interchange provisions with the Trunkline.
- Develop a conceptual alignment design for a branch line from the Trunkline through the Marietta central business district.
- Prepare transit system demand forecasts and a transportation impact analysis for the proposed transit system.
- Prepare economic, financial, and environmental assessments of the proposed system.
- Prepare a recommended initial project and implementation strategies for its execution.

The scope of work comprised five initial work elements; two additional elements were also performed. These elements included:

1. Information gathering and data collection
2. Preliminary forecast of transit demand and evaluation of alternatives.
3. Conceptual engineering
4. Economic, financial and environmental assessments
5. Development of the Final Report
6. At the request of the Steering Committee, development of system phasing options
7. Also at the request of the Steering Committee, development of strategic implementation planning

The Study workflow diagram shown in Figure 1-1 illustrates how work progressed through the initial work elements, their relationship with each other, and their corresponding reports.

Interim reports were presented for Work Elements 1, 2, and 3. The Work Element 4 report is included in this Final Report.

1.1.3 Study Constraints

The primary sponsors of this Study are the Cumberland and Town Center Area CIDs. Given the sponsors' jurisdictional limitations with regard to funding, the Team's scope of work, overall, was necessarily constrained to the geographic boundaries of the two CIDs and the Cobb Parkway corridor that connects them (within Cobb County).

However, with a clear understanding that the Northwest Corridor Light Rail Transit System must be an integral component of the Atlanta Region's transportation network, the overall planning and transportation modeling work undertaken as part of this *Transit Implementation Study* was extended into Fulton County and the requisite transfer connection to the MARTA heavy rail transit system at the Arts Center Station. Specifically, the transportation modeling work addresses (is inclusive of) the entire proposed Trunkline, from the Town Center Area CID, south through the Cumberland CID, to

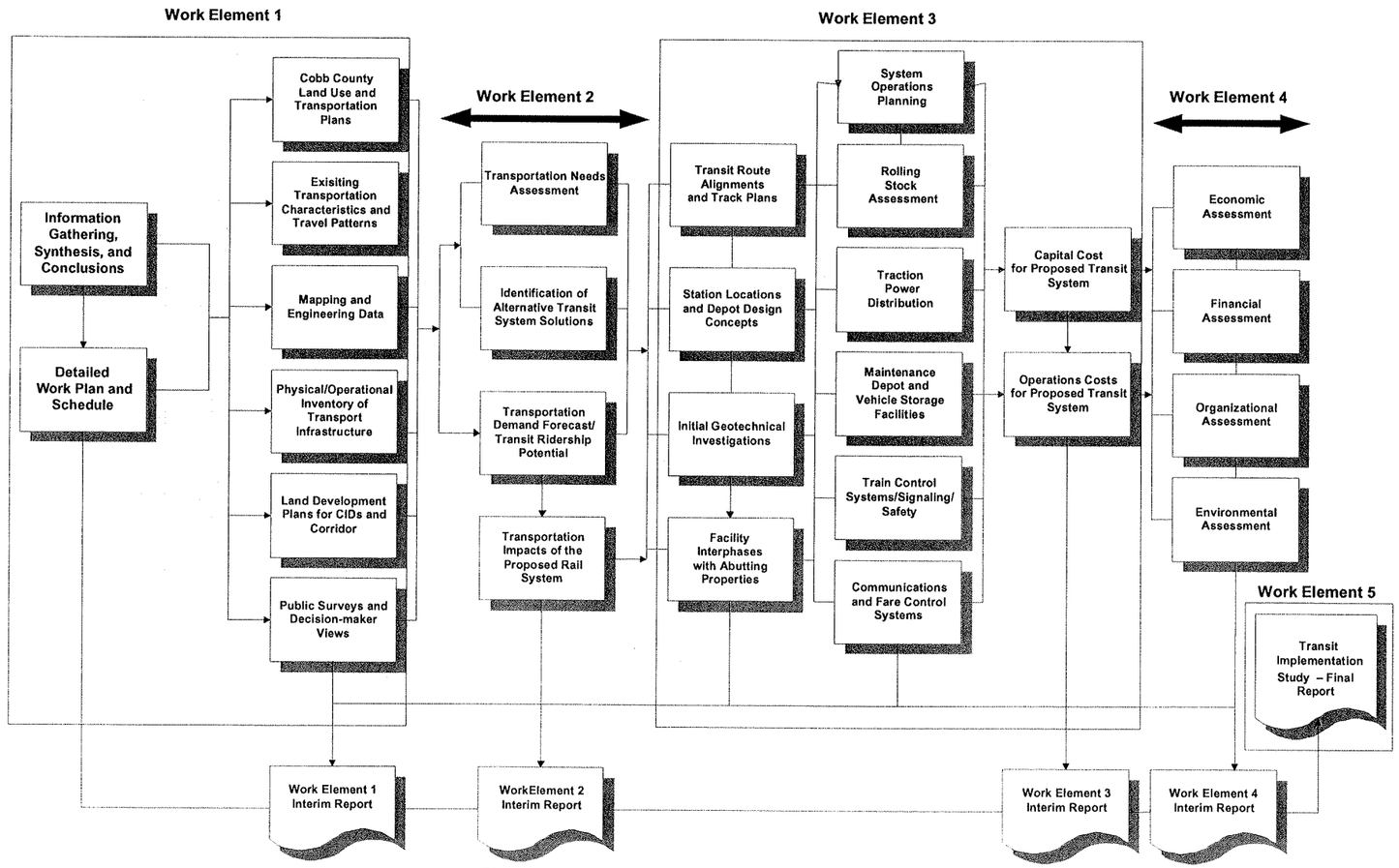


Figure 1-1 Transit Implementation Study Initial Work Flow

the MARTA Arts Center Station in Midtown Atlanta. Patronage forecasting results are presented within this Final Report, inclusive of the Trunkline stations in Cobb and Fulton counties. The anticipated patronage of the Circulators and the Marietta Branch is also predicated upon a full implementation of the Northwest Corridor Light Rail Transit System from the Town Center Area, through Cumberland and Marietta, to Midtown Atlanta, which is referred to throughout this report as the Ultimate System.

The Bechtel/MSE Team was constrained, however, in terms of their conceptual engineering design work. The Trunkline, CID Circulators, and Marietta Branch alignment and vertical profile design work is constrained to that which is within Cobb County, north of the Chattahoochee River, as graphically presented in Volume II of this Final Report. On the other hand, the operations planning text addresses an implementation of a phased build-out of the envisioned Ultimate System. Similarly, the cost estimating work, as presented within Section 9 of this Final Report, addresses the full build-out of this system within both Cobb and Fulton counties.

1.1.4 Geographic Context

Three levels of study area were considered: 1) the Atlanta Region, 2) Cobb County as a whole, and 3) the specific transit corridor linking the Cumberland and Town Center Area CIDs, extending south to the Midtown Atlanta district, as shown in Figure 1-2.

Three perspectives underlie the overall Study planning framework:

- On a regional scale, the proposed transit system would link northern suburban areas in the Cobb Parkway/I-75 Corridor with Midtown and the Atlanta CBD, while also linking key employment districts within Cobb County. This is one of the most congested corridors in the Atlanta Region.
- On a countywide scale, the proposed transit system would provide for expansion of local bus routes to a countywide service plan, which would feed stations along the north-south rail service within the Cobb Parkway/I-75 Corridor.
- Within the corridor itself, the proposed LRT system would provide quick, easy access to the highest-density housing, retail, and employment centers located within the Cumberland and Town Center Area CIDs, and the Marietta central business district (CBD).

1.1.5 Planning Context

This Study began with a thorough review of transportation studies and recommendations made as part of previous regional and countywide planning efforts, discussed in the following subsections.

1.1.5.1 Original Transit System Concepts for Cobb County

The DCCCTP, begun in late 1996, resulted in the proposal of a long-range transportation system plan that shifted the focus from increasing highway capacity to developing a multimodal transportation system, with increased emphasis on public transportation.

The DCCCTP provides a comprehensive inventory of:

- Existing transportation conditions
- A forecast of future conditions under alternative transportation concept plans
- An evaluation of alternative plans for transportation improvements over the next twenty years
- Preliminary costing of specific transportation projects.

Most importantly, the DCCCTP provided the initial conceptual definition of a transit system for Cobb County, including rail transit, express and local buses, and park-and-ride facilities.

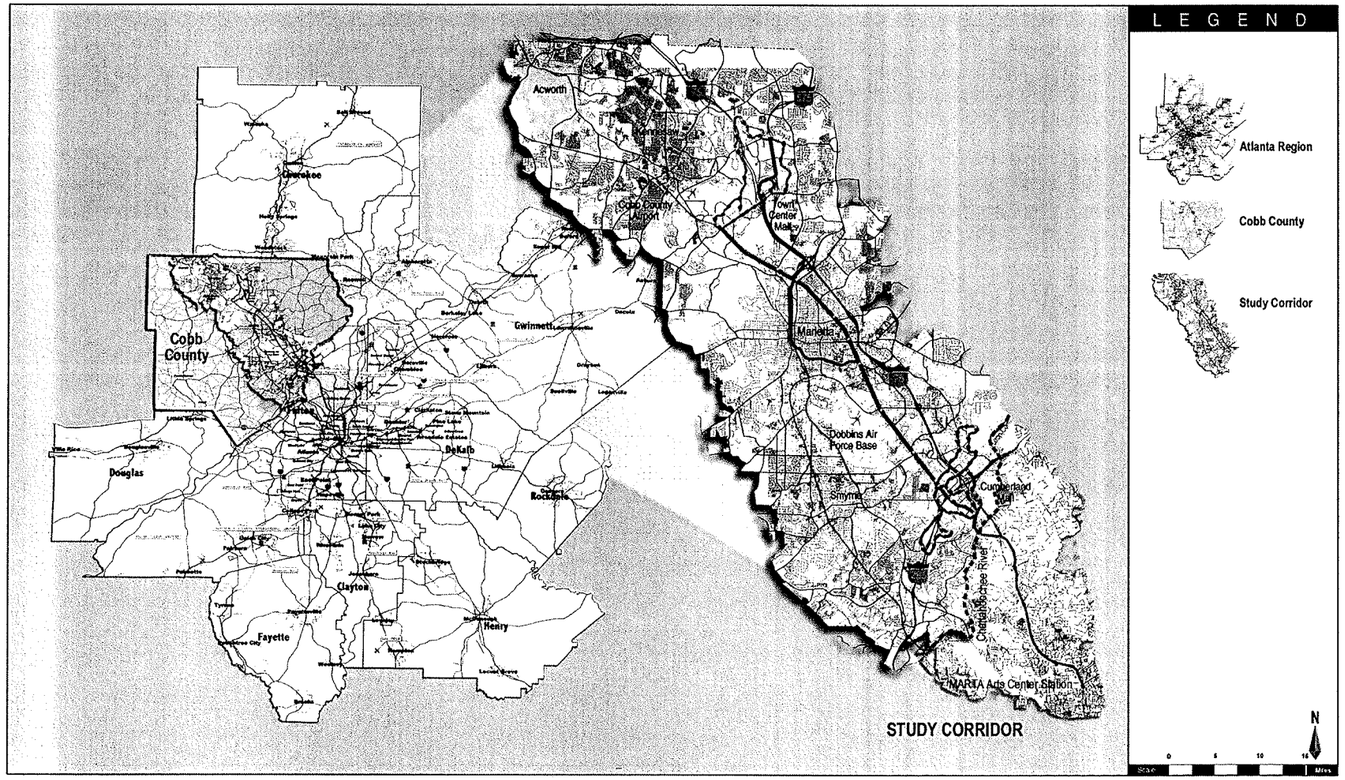


Figure 1-2 Study Area Context, showing the Atlanta Region, Cobb County, and the Study Corridor

The transit system concept identified in the DCCCTP included:

- **A Trunkline.** A light rail service extending from Town Center Mall to the Cumberland Mall/Galleria area, generally running along the Cobb Parkway corridor, with frequent station spacing in Cobb County.
- **Two Fixed Guideway Transit (FGT) Circulators.** Rail circulators serving the Cumberland and Town Center Area CIDs
- **Expanded Countywide Express and Local Bus System.** This system would directly feed the proposed Trunkline light rail service and the two area circulators.

This transit system concept, along with other transportation improvements identified in the DCCCTP, was submitted by Cobb County to ARC, for inclusion in the RTP update. The DCCCTP study work, being the most current set of recommendations for Cobb County, was used as a starting point for this *Transit Implementation Study*. This Study builds upon and expands these earlier findings, resulting in the comprehensive transit system recommendations contained within this Final Report. These recommendations include an expanded transit system coverage area and number of stations.

1.1.5.2 Role of the Atlanta Regional Transportation Plan (RTP) Update

The RTP comprises a comprehensive assessment of regional transportation needs and a transportation investment program to meet the Atlanta Region's transportation and air quality goals over the next twenty-five years. Table 1-1 lists the RTP goals and objectives. Projects identified in the RTP form the foundations of the RTP investment plan, which advances 5-year implementation programs. The RTP is updated on an ongoing basis.

The RTP includes recommendations for the implementation of a light rail system in the northwest corridor of the Atlanta Region, extending from Fulton County into and throughout Cobb County, as part of its regional planning needs assessment. The RTP also provides for funding to take that system from the concept stage through the next stages of project implementation.

Table 1-1
Regional Transportation Plan Goals and Objectives

RTP Goal		Objective
1	Accessibility and mobility for people and goods	Develop intermodal passenger connections and equalize accessibility
		Implement transit/land use changes to support transit/pedestrian development
		Increase the accessibility and mobility options available to people and for freight
		Enhance the integration and connectivity of the transportation system across and between modes for people and freight
2	Attain regional air quality goals	Meet air quality attainment target for NOX = 224
		Meet air quality attainment target for VOC = 132
		Protect and enhance the environment, promote energy conservation and improve quality of life
3	Improve and maintain system performance and system preservation	Improve connections between truck, rail and air freight facilities
		Promote efficient system management and operation
		Emphasize the preservation of the existing transportation system
		Promote energy conservation
4	Protect and improve the environment and the quality of life	Preserve historic resources
		Minimize community and environmental impacts
		Create incentives and regional policies to promote livable cities
		Protect and enhance the environment, promote energy conservation and improve the quality of life
		Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity and efficiency
		Increase the safety and security of the transportation system for motorized and non-motorized users
		Improve connectivity between low income and minority populations and major employment and activity centers
		Improve social and environmental equity for all the Region's citizens

Source: *Draft Regional Transportation Plan*, prepared by Atlanta Regional Commission, dated January 2000, pg. 1-3

For Cobb County, the RTP calls for the following actions:

- Implementation of a generally defined light rail line providing service between the MARTA Arts Center Station in Midtown Atlanta and the Cumberland Mall/Galleria area, by the year 2010
- Implementation of a rail circulator within the Cumberland Mall/Galleria area by the year 2010
- Continuation of the light rail line from the Cumberland Mall/Galleria area northward in the Cobb Parkway corridor to the city of Marietta by the year 2015
- Continuation of the light rail line from the city of Marietta to the Town Center Mall area by the year 2020
- Expansion of the local and express bus services in the northwest corridor

Periodic Updates

ARC, as the designated metropolitan planning organization for the Atlanta Region, must prepare a Transportation Improvement Program (TIP) at least every 3 years in order for agencies to authorize the use of federal transportation funds in the Region. The projects included in the TIP are taken from the RTP. Both the RTP and TIP in the Atlanta Region must demonstrate conformance to the air quality standards in the State Implementation Plan (SIP), before adoption by ARC.

In 1985, 1990, and 1994, Cobb County voters passed sales tax referenda that allowed the County to implement TIP projects.

Atlanta Regional Transportation Plan, Forecast Year 2025

ARC adopted the *Transportation Solutions for a New Century Document Set* on March 22, 2000. The set contained the following: 2025 Regional Transportation Plan (RTP); 2001-2003 Transportation Improvement Plan (TIP); Conformity Determination Report – 2025 RTP/ 2001-2003 TIP; Public Comments & Responses, Addenda; Project Listing and Justification; and Model Documentation & Output.

The development of the RTP was guided by ARC's *VISION 2020* planning effort. The RTP development was also guided by federal transportation planning, including the Transportation Efficiency Act

for the 21st Century (TEA-21).[1] A major focus of the development of the RTP and the TIP was insuring that the plan would bring the Region into conformity for air quality.

The RTP and TIP provide a dramatic shift in the Region's transportation investment policy toward the development of additional transit facilities. The RTP includes a total investment of $36 billion over 25 years, with 55 percent of those funds for transit projects, including the light rail transit system in the Region's northwest corridor, serving Fulton and Cobb counties. Less than 5 percent of the funds in the RTP are dedicated for new roadway construction. The RTP also provides for the construction of 212 new HOV lane miles in the Region, as well as expansion of regional bicycle and pedestrian systems. The TIP provides a $1.9 billion investment over three years, with 40 percent of the funds for transit projects. According to the ARC, this will be the first TIP since 1995 that meets the mobile emissions budget for the Region.

1.1.5.3 Other Planning Studies and Findings

Numerous studies performed prior to the DCCCTP and the RTP are also relevant, in varying degrees, to the current effort. The following are abstracts of three recent studies that specifically considered rail service in Cobb County.

Multi-modal Strategic Plan for Public Transportation in Cobb County

This Study was completed in September 1994, for Cobb County, by Parsons Brinckerhoff Quade & Douglas, Inc., in association with Mayes, Sudderth & Etheredge, Inc. and others. The stated Study goal was "...to develop a plan for a long range (year 2010) multi-modal public transportation system, located wholly or partially within Cobb County, that is consistent with or an enhancement of the Cobb County Comprehensive Land Use Plan and the Atlanta Regional Transportation Plan and which will best serve the future public transportation needs of the people and businesses of Cobb County." The Final Report consists of seven working papers leading to a set of recommendations. The plan included a rail transit line in the Cobb Parkway/I-75 Corridor connecting Acworth with Atlanta, with two right-of-way alternatives south of the Canton Road Connector.

Georgia Department of Transportation Commuter Rail Plan

Completed in August 1995 by LS Transit Systems, Inc. (now SYSTRA USA Inc.) for the Georgia Department of Transportation, the objective of this Study was "...to determine whether commuter rail could be an effective way of enhancing the mobility of the entire Metropolitan North Georgia region." The conclusion reached was affirmative, provided that a selected number of corridors are used that run through the heart of the Atlanta Region. The Study's Final Report proposed a two-phase development of a 322-mile network of six commuter rail lines, to be operated by push-pull trains of bi-level coaches propelled by diesel-electric locomotives. A commuter rail line through Cobb County to Canton via the CSX Transportation's main line to Chattanooga (the State-owned Western and Atlantic Railroad) and Georgia Northeastern Railroad (formerly part of the Louisville and Nashville Railroad) was proposed as part of the Phase 2 development. This line would have stations in Cobb County at Sandy Springs Road, in downtown Marietta, and at the Cumberland Boulevard Bus Transfer Center adjacent to the Cumberland Mall. The Study also considered a commuter rail line to Cartersville in Bartow County, which would have continued north from Marietta along the Western & Atlantic (W&A) Railroad. This route, along a railroad that carries very heavy and increasingly dense CSX freight train movements, was not included in the two-phase commuter rail plan.

Georgia Department of Transportation Intercity Rail Plan

Completed in March 1997, by LS Transit Systems, Inc., for the Georgia Department of Transportation, the objective of this Study was to assess the potential for rail passenger trips for distances of greater than 60 miles in Georgia and adjacent states. The Study considered a rail passenger service passing through Cobb County to connect Atlanta with Chattanooga, Tennessee via either the CSX-operated Western and Atlantic Railroad or the Norfolk Southern Railway; neither of these routings was included in the plan's final recommendations.

1.2 CONTENTS OF THIS FINAL REPORT

This Final Report is submitted in four volumes: an Executive Summary; Volume I, which contains the report's narrative text; Volume II, which contains the conceptual architectural and engineering drawings; and Volume III, which contains supporting appendices.

Following this Introduction, Volume I continues as follows:

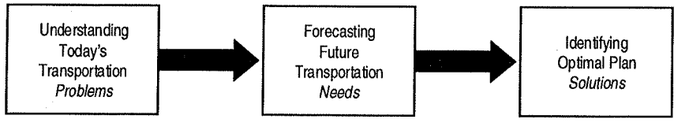
- **Section 2, Existing and Future Conditions in Cobb County.** Presents the population, employment, and traffic demand generators that frame the purpose of and need for the proposed transit system.
- **Section 3, Rail System Configuration.** Describes the development of the proposed transit system to meet specified functional objectives and performance criteria.
- **Section 4, Transit Alternatives Analysis Patronage Forecasts, and Impacts.** Presents the results of transit patronage forecasts and transportation impact analysis, resulting from the detailed transportation modeling work conducted in concert with the ARC and the Cobb County Department of Transportation.
- **Section 5, Performance Criteria, System Parameters, and Vehicle Technology.** Describes the detailed performance criteria, system parameters, and vehicle technology considerations.
- **Section 6, Systems Component Characteristics.** Presents the proposed traction electrification system; train control and signal system; communication, uninterruptible power supply, and environmental control systems; AC power; and fare collection.
- **Section 7, Station Concepts.** Describes the aspects and issues to be considered in the design of transit stations, as well as their intermodal transfer site requirements; also lists the Trunkline and Circulator stations, designating each by specific design type.
- **Section 8, System Operations and Performance Characteristics.** Presents the transit system's operations and performance characteristics; includes important recommendations regarding the rolling stock fleet requirements and the operations assessment, which impact the system's capital and operating costs.
- **Section 9, Cost Estimates.** Presents the capital cost estimates, including the development of quantities, pricing basis, assumptions, exclusions and cost summaries. It also presents preliminary estimates of operating and maintenance costs, which are to be refined in the next steps of implementation.

[1] *Draft Regional Transportation Plan*, prepared by Atlanta Regional Commission, dated January 2000

- **Section 10, Economic, Financial, and Environmental Assessments.** Presents an assessment of the Northwest Corridor's economic context, a preliminary outlook in regard to the financing of the proposed light rail transit system's capital and operating costs, as well as a preliminary assessment of the environmental and cultural resource impacts anticipated with the implementation of the proposed system.
- **Section 11, Phasing Options and Recommendations.** Includes a presentation of various construction phasing alternatives in response to anticipated project funding constraints. This section presents a Preferred Initial Project with its associated patronage projections, operational considerations, and capital and operating costs.
- **Section 12, Service to the City of Marietta.** Presents the results of an evaluation of extending light rail transit service to the central business district of the city of Marietta and identifies alternative conceptual alignments, patronage forecasts, capital cost estimates, and an operations plan.
- **Section 13, Strategic Implementation Plan.** Presents a discussion of the key issues the Georgia Regional Transportation Authority (GRTA) will need to address early in the process of implementing the Northwest Corridor LRT System. Included topics are the federal process for the development of fixed guideway transit systems, program management strategies, stakeholder strategies, project delivery strategies, and financing strategies.

Population and employment, both significant drivers of the need for a transit system, have grown dramatically over the past decade in the Atlanta Region and in Cobb County. That growth is expected to continue, placing increasing pressure on highways that have experienced traffic volume increases resulting in failure conditions during morning and afternoon peak periods.

This Study examines population and employment characteristics, as well as travel demand patterns within Cobb County and the Atlanta Region, and has followed the logic of a traditional comprehensive transportation planning assessment.



The three perspectives examined in this Study were the Atlanta Region; Cobb County; and the primary corridor, including the Cumberland and Town Center Area Community Improvement Districts (CIDs), as shown in Figure 1-2.

2.1 POPULATION AND EMPLOYMENT CHARACTERISTICS

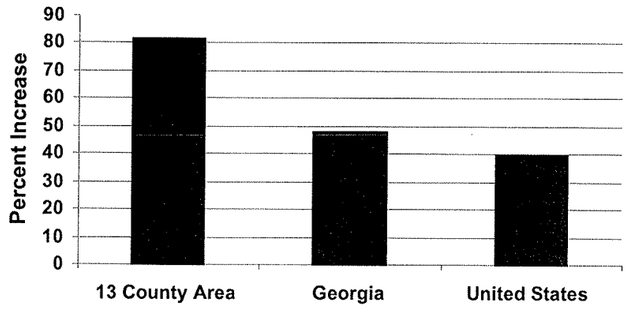
The Atlanta Regional Commission (ARC) develops population and employment projections for the Region, the counties, and sub-areas of the counties. As part of this Study, a detailed land use inventory of the Cumberland and Town Center areas of the County was performed by the Bechtel/MSE Team, and the results were used to generate more site-specific population and employment data. The land use inventory indicated that the ARC forecasts underestimated the existing and future population and employment in the Cumberland and Town Center areas. The following are used for analysis:

- Analysis of the Regional growth patterns for the Study uses the ARC projections.
- Analysis of the growth patterns in Cobb County considers both the ARC forecasts and the results of the land use inventory.
- Analysis of growth patterns within the Cumberland and Town Center areas uses results of the land use inventory.

The ARC continually updates their population and employment forecasts. The forecasts used in the analysis of the regional growth patterns were taken from the ARC's *Draft Regional Transportation Plan* (RTP), dated January 2000. The forecasts used to analyze the growth within Cobb County were taken from the detailed socioeconomic data files provided by ARC in November 1999 for use in the transportation modeling and patronage forecast work. It should be noted that, although there are very slight variations in the total employment and population in Cobb County between the ARC and the Study data sets (year 2000 population varies from 542,070 to 542,292; and the current employment varies from 287,526 to 287,562) these variations are considered insignificant in the analysis and indicate the same base to project future growth.

2.1.1 Regional Growth Patterns

The Atlanta Region has experienced extraordinary population growth over the past 40 years and is now the eleventh-most-populated urban area in the United States.[1] The population has increased by 2 million since 1960, including an increase of 1.3 million since 1980. According to the Regional Transportation Plan (RTP) projections, the Region will continue to experience extraordinary growth, in both population and employment, from a base year of 1990 to 2025. According to the RTP, the 1990 population for the 13-county non-attainment area (do not meet U.S. Environmental Protection Agency National Ambient Air Quality Standards for ozone) was 2.7 million people. By 2025, it is projected to increase by 2.2 million, to 4.8 million people – an 81 percent increase from 1990. The rate of population growth in the Region far exceeds that for the state of Georgia and the U.S., during this period, as illustrated below.



Source: *Draft Regional Transportation Plan*, Atlanta Regional Commission, January 2000, pg. 2-3

Projected Percentage of Population Growth, 1990 – 2025

Table 2-1 shows the ARC forecast of population growth between 2000 and 2025 for the counties within the Region. The greatest absolute increases – approximately 60 percent of the total – occur in Fulton, DeKalb, Gwinnett, and Cobb Counties, which, by 2025, will contain approximately 68 percent of the Region's population.

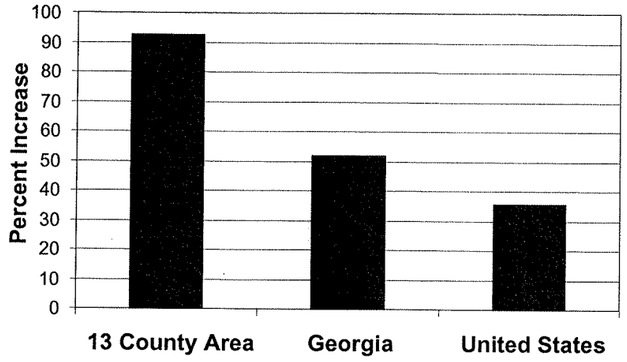
Table 2-1
Projected Population Growth by Area, 2000 – 2025

Area	2000 Population	2025 Population	Change 2000-2025	% Change
Cherokee	132,260	216,407	84,147	63.6%
Clayton	209,298	260,313	51,015	24.4%
Cobb	542,070	711,944	169,874	31.3%
DeKalb	593,213	831,954	238,741	40.2%
Douglas	96,274	169,252	72,978	75.8%
Fayette	91,740	160,135	68,395	74.6%
Fulton	756,988	1,027,954	270,966	35.8%
Gwinnett	527,923	720,919	192,996	36.6%
Henry	113,459	210,741	97,282	85.7%
Rockdale	71,373	129,353	57,980	81.2%
Coweta, Forsyth, and Paulding	231,802	374,627	142,825	61.6%
Totals*	**3,366,400**	**4,813,600**	**1,447,200**	**43.0%**

* Columns may not add due to rounding
Source: *Draft Regional Transportation Plan*, prepared by Atlanta Regional Commission, dated January 2000, pg. 2-4

The Atlanta Region's employment growth is expected to track population growth, but at a slightly higher rate. RTP projections put 1990 to 2025 employment growth for the Region far above comparable levels for the state of Georgia and the U.S. as a whole. Employment growth in the Region is 77 percent higher than the state and 155 percent higher than the country during this period.

[1] Pg. 2-2, *Draft Regional Transportation Plan (RTP)*, prepared by the Atlanta Regional Commission, January 2000.



Projected Percentage of Employment Growth, 1990 – 2025

Source: *Draft Regional Transportation Plan*, Atlanta Regional Commission, dated January 2000, pg. 2-4

The Draft RTP forecast employment growth between 2000 and 2025 for the counties within the Region (see Table 2-2). The greatest absolute increases in employment within the Region will occur in Fulton and Cobb Counties. These two counties will account for approximately one-half (49.3 percent) of the employment growth in the Region.

Table 2-2
Projected Employment Growth by Area, 2000-2025

County	2000 Employment	2025 Employment	Change 2000 – 2025	% Change
Cherokee	35,169	82,051	46,882	133.3%
Clayton	126,134	161,912	35,778	28.4%
Cobb	287,526	420,512	132,986	46.3%
DeKalb	343,763	431,566	87,803	25.5%
Douglas	34,950	62,800	27,850	79.7%
Fayette	34,637	53,840	19,203	55.4%
Fulton	673,429	968,757	295,328	43.9%
Gwinnett	274,245	385,658	111,413	40.6%
Henry	32,843	61,681	28,838	87.8%
Rockdale	38,646	61,725	23,079	59.7%
Coweta, Forsyth, and Paulding	89,744	150,994	59,106	65.9%
Totals	**1,971,086**	**2,841,496**	**868,266**	**44.1%**

* Columns may not add due to rounding

Source: *Draft Regional Transportation Plan*, Atlanta Regional Commission, January 2000, pg. 2-6

2.1.2 ARC Projections of Growth in Cobb County

Like the Region, Cobb County has experienced tremendous growth over the last several decades. The County's population has increased from 114,174 in 1960[2] to 542,070 in the year 2000, including a population increase of 94,325 since 1990. Table 2-3 shows the population growth in the County since 1950.

Currently, the County population accounts for 16.1 percent of the total population of the 13-county non-attainment area. Based on the ARC projections shown in Table 2-3, the population in Cobb County will increase by 169,874 to 711,944 by 2025. This increase accounts for approximately 11.7 percent of the growth in the 13-County non-attainment area. As a result, the County will contain a smaller percentage (14.7 percent) of the Region's population in 2025.

Historically, the population was centered around small cities within the County. The largest of the cities was Marietta, while other cities like Acworth, Austell, Kennesaw, Powder Springs, and Smyrna served as local centers. As the County began to grow as a suburb of metropolitan Atlanta in the 1970s and 1980s, the largest population growth occurred in other areas of the County, such as East Cobb. Based on the ARC figures, 27 percent of the population in the County currently lives in the East Cobb area, and 14 percent of the population lives in Marietta. Combined, these two areas contain 41 percent of the County's current population. The projections show that West Cobb and South Cobb contain 12 percent of the population each, and Smyrna contains 10 percent; these three areas total 34 percent of the County's current population. The remaining 25 percent of the population is spread through the various other areas. Currently, only 6 percent of the County's population lives in the Cumberland area, and only 1 percent lives in the Town Center area. Table 2-4 shows the current population figures for the sub-areas of the County.

The ARC projects that the growth patterns in the County will begin to change in the next 25 years. The growth rates in Cumberland, East Cobb, and Marietta will slow significantly. The West Cobb, South Cobb, and Smyrna areas will continue their current growth rate, and the Austell, Powder Springs, Acworth, and Town Center areas will experience increased growth. Based on the ARC projections, the East Cobb and Marietta areas will contain only 36 percent of the County's population. The West Cobb, South Cobb, and Smyrna areas will contain 38 percent of the population, and the remaining areas of the County will contain 26 percent of the population. In 2025, the Cumberland area will contain only 5 percent of the County's population and the Town Center area will contain 2 percent of the County's population. Table 2-4 shows the rates of growth and 2025 population projected by ARC for the various sub-areas of the County. A comparison of the current and future population densities within the County is shown in Figure 2-1.

2 Pg. 2, *Cobb County Comprehensive Plan: A Policy Guide 1995-2015*, adopted October 22, 1996

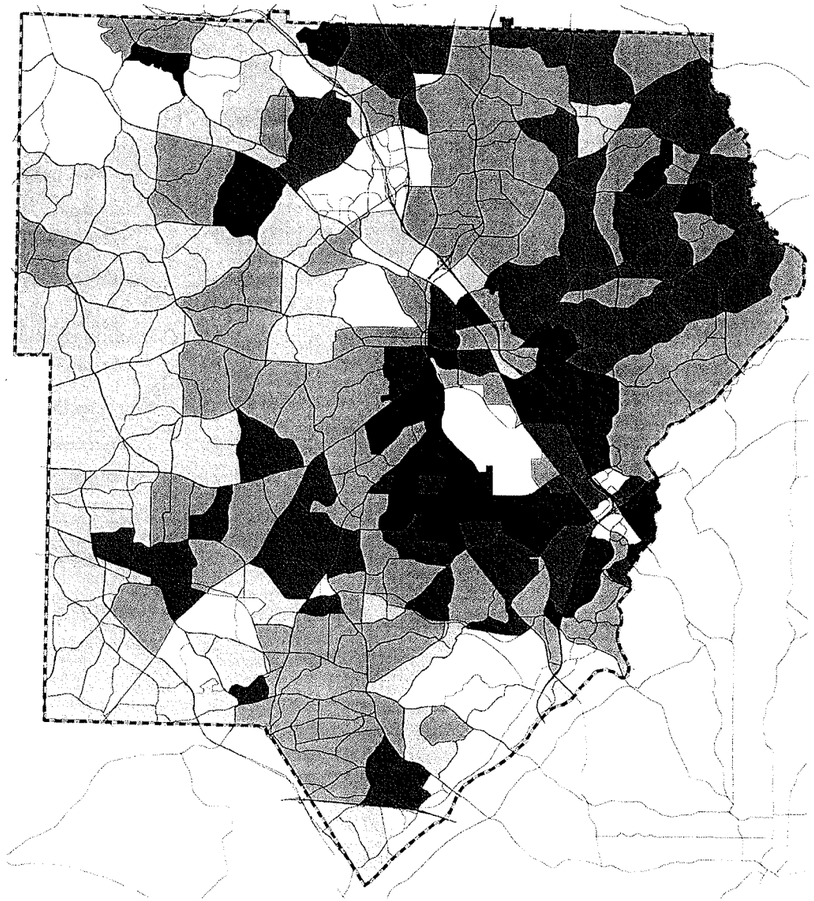
Table 2-3
Population Growth in Cobb County Since 1950

Year	Population
1950	61,830
1960	114,174
1970	196,793
1980	297,718
1990	447,745
2000	542,070
2025	711,944

Source for population data for 1950-1990: *Cobb County Comprehensive Plan: A Policy Guide 1995 –2015*, adopted October 22, 1996, pg. 2. Source for population data for 2000 -2025: *Draft Regional Transportation Plan*, prepared by Atlanta Regional Commission, dated January 2000, pg. 2-4

Table 2-4
ARC Population Projections in Cobb County

Sub-Area	2000 Population	% of 2000 Population	2025 Population	% of 2025 Population	Annual % Change 2000 – 2025
Marietta	77,578	14%	93,824	13%	0.76%
Smyrna	55,135	10%	77,700	11%	1.38%
South Cobb	64,416	12%	93,197	13%	1.49%
Austell	16,230	3%	33,092	5%	2.89%
Powder Springs	22,495	4%	39,945	6%	2.32%
West Cobb	66,700	12%	96,331	14%	1.48%
Acworth	12,673	2%	22,226	3%	2.27%
Kennesaw	37,103	7%	44,330	6%	0.71%
Town Center	7,570	1%	12,742	2%	2.10%
East Cobb	147,709	27%	162,080	23%	0.37%
Cumberland	34,684	6%	35,791	5%	0.13%
Cobb Subtotal	542,292	100%	711,258	100%	1.09%



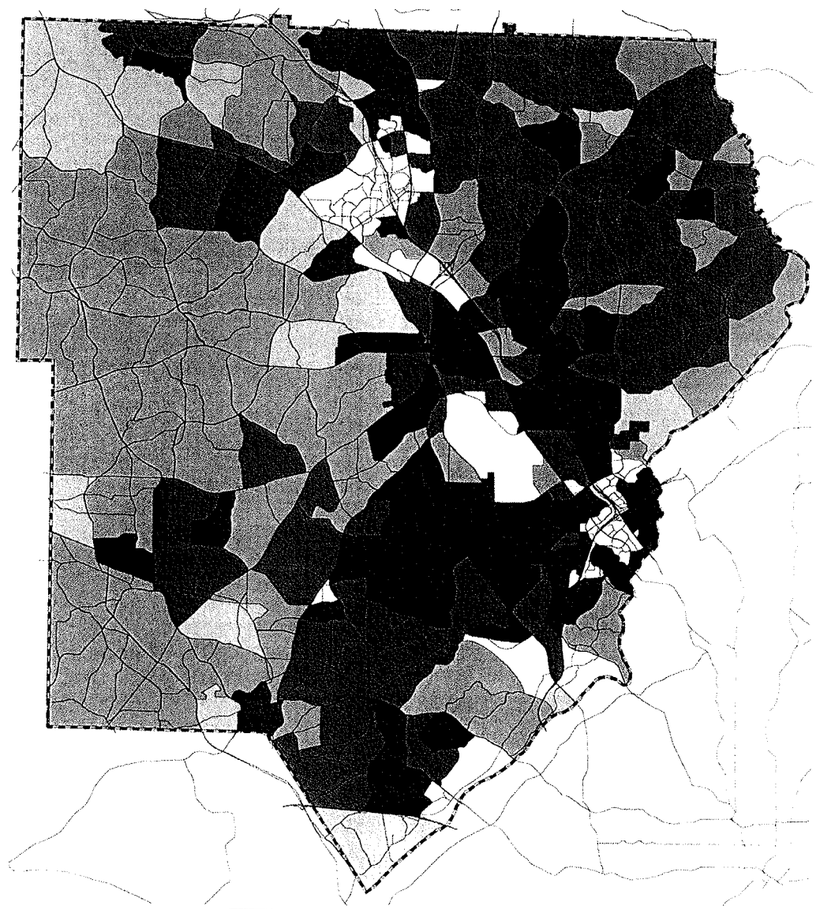


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FIGURE 2-1 POPULATION DENSITY IN COBB COUNTY, 2000 AND 2025

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In addition to the increase in population, Cobb County has experienced tremendous growth in employment over the last several decades. The number of jobs in the County has grown from 74,567 in 1970[3], to 287,526 in 2000. Table 2-5 summarizes the increase in employment in the County since 1970. The County currently accounts for approximately 15 percent of the total employment in the 13-county nonattainment area. The ARC projects that the employment within the County will increase by 132,986 to 420,512 by 2025. This growth accounts for approximately 15 percent of the employment growth in the Region. As a result, the percentage of the Region's jobs located in Cobb County will remain at approximately 15 percent.

Table 2-5
Employment Growth in Cobb County Since 1970

Year	Employment
1970	74,567
1980	122,385
1990	249,699
2000	287,526
2025	420,512

Source for employment data for 1970-1990: *Cobb County Comprehensive Plan: A Policy Guide 1995-2015*, adopted October 22, 1996, pg. 17. Source for employment data for 2000 -2025: *Draft Regional Transportation Plan*, prepared by Atlanta Regional Commission, dated January 2000, pg. 2-6

The population-to-employment ratio in the County is currently 1.88/1.0, while the ratio for the Region is 1.73/1.0. As discussed in the previous paragraphs, the employment in the County will grow at a faster rate than the population over the next 25 years. In 2025, the projected population-to-employment ratio in the County will drop to 1.69/1.0, while the ratio for the Region will remain fairly constant at 1.71/1.0. This indicates that a higher percentage of the County's residents will be employed in the County, thereby reducing the percentage of residents that will be commuting outside of the County to work. In addition, the ratio is a strong indicator that the County will be importing more workers from the neighboring Counties in the future.

Historically, the employment in the County has been centered around the cities. In the 1970s, the Cumberland area began to emerge as a major office and retail employment center in the County and Region. In the 1990s, the Town Center area also began to emerge as a major office and retail employment center in the County and Region. Based on the ARC figures, 27 percent of the employment in the County is currently located in the Marietta area, and 24 percent of the employment is located in the Cumberland area. Therefore, these two areas contain about half (51 percent) of the total employment in the County. The only other sub-area of the County that contains more than 10 percent of the County's employment is East Cobb (13 percent). According to the ARC, the Town Center area currently contains 8 percent of the employment.

The ARC projects that the Cumberland area will contain a lower percentage (19 percent) of the County's employment in 2025. The projections also show a slight reduction in the percentage of the employment located in Marietta (25 percent). Slight increases in employment are projected for the Town Center area (9 percent) and for some of the other sub-areas of the County.

Table 2-6 shows the year 2000 ARC employment figures and projections for the year 2025, for the various sub-areas of the County. Employment density comparisons for 2000 and 2025 are shown in Figure 2-2.

Table 2-6
ARC Employment Projections in Cobb County

Sub-Area	2000 Employment	% of 2000 Employment	2025 Employment	% of 2025 Employment	Annual % Change 2000-2025
Marietta	78,632	27%	105,282	25%	1.17%
Smyrna	26,511	9%	39,694	9%	1.63%
South Cobb	22,872	8%	34,047	8%	1.60%
Austell	3,439	1%	7,874	2%	3.37%
Powder Springs	3,886	1%	8,641	2%	3.25%
West Cobb	8,788	3%	21,188	5%	3.58%
Acworth	5,518	2%	14,492	3%	3.94%
Kennesaw	9,596	3%	14,860	4%	1.76%
Town Center	23,474	8%	38,753	9%	2.03%
East Cobb	37,154	13%	56,721	13%	1.71%
Cumberland	67,692	24%	79,005	19%	0.62%
Total	**287,562**	**100%**	**420,558**	**100%**	**1.53%**

As stated in the beginning of this section, the ARC projections for the Cumberland and Town Center areas are not consistent with the development patterns realized in the County. As a result, a detailed land use inventory was performed by the Bechtel/MSE Team, to determine the current and future development potential of both the Cumberland and Town Center areas. A brief discussion of this inventory and the ensuing projections follows below.

2.1.3 Projected Growth in the Community Improvement Districts

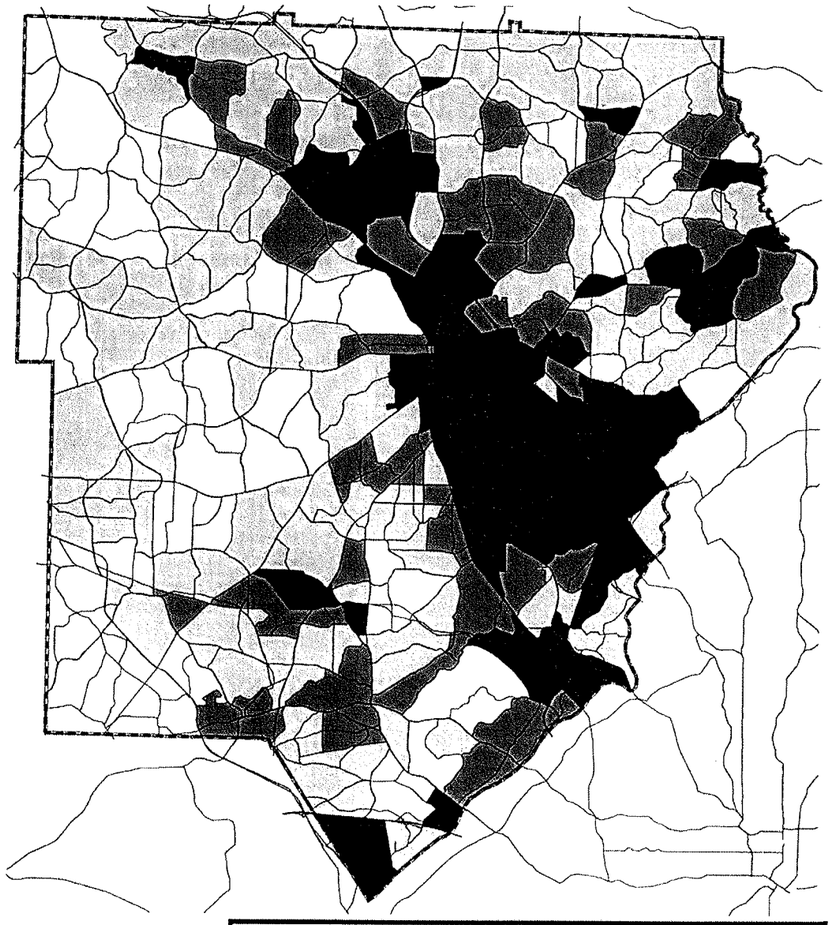
The Cumberland and Town Center Area CIDs comprise the major activity centers in the Study corridor. Both of these CIDs contain substantial existing development and will continue to grow. They serve as major employment and retail centers for Cobb County and the entire Atlanta Region.

2.1.3.1 Land Use Inventory

As part of this Study, a detailed land use inventory was performed for both the Cumberland and Town Center areas. The purpose of the inventory was to identify the existing and future levels of development in the two areas. The development information was then used to develop more site specific population and employment projections for these areas.

The inventory of the existing development, conducted by the Bechtel/MSE Team, entailed surveying existing property owners, researching available tax records, researching real estate industry resources, and performing extensive field surveys. The information on the future development was obtained from interviews with existing property owners and developers, and researching the Cobb County Comprehensive Plan and Zoning Map. The population and employment estimates did not assume any efforts to densify the development in the transit corridor, nor any efforts to redevelop existing properties with low-intensity uses. Future comprehensive plans in the County will need to consider transit-supportive policies, including possible densification of the transit corridor. The transit project will also increase the potential for redevelopment of existing low-intensity developments, including older strip mall developments in the area. Appendix A-1 includes the results of the land use inventory, as well as a detailed discussion of the methodology used in developing the inventory.

[3] Pg. 17, *Cobb County Comprehensive Plan: A Policy Guide 1995-2015*, adopted October 22, 1996



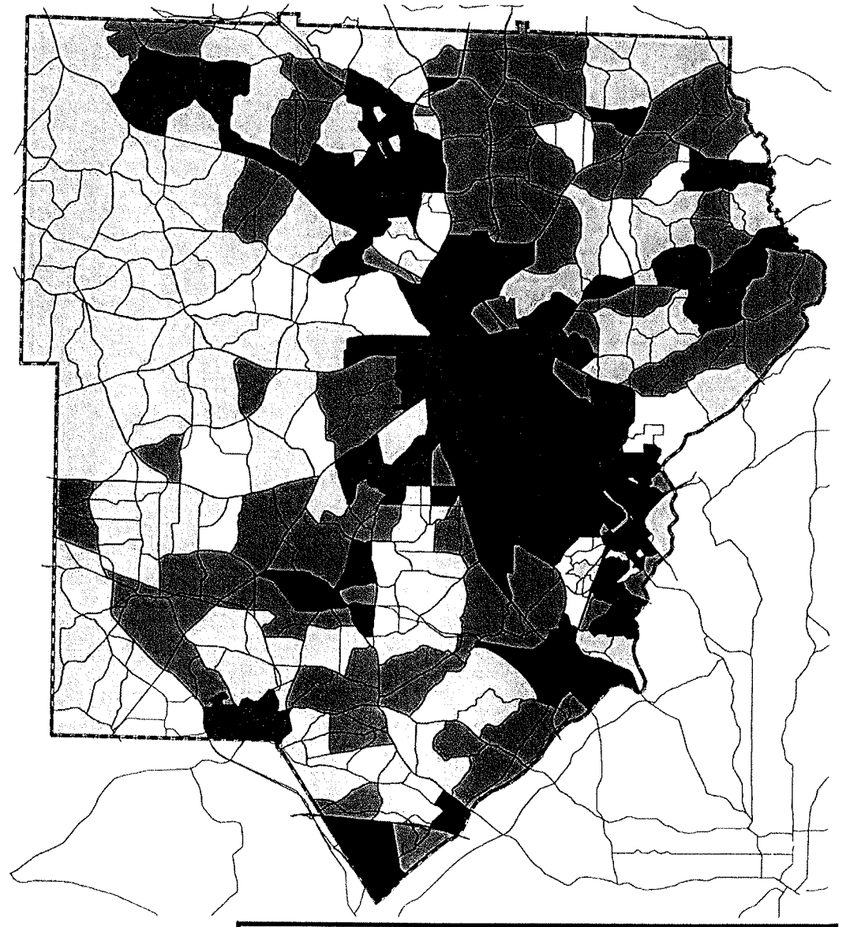


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FIGURE 2-2 EMPLOYMENT DENSITY IN COBB COUNTY, 2000 AND 2025

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When compared with the ARC data, the results of the land use inventory show similar existing population levels, but greater future population levels in the Cumberland and Town Center areas. The results also show significantly greater existing and future employment in the two areas. Table 2-7 provides a comparison of the existing and future population and employment projections derived from the land use inventory, and the ARC projections.

2.1.3.2 The Cumberland CID

The Cumberland CID contains several high-density office developments, including Wildwood, Interstate North, Circle 75, Overlook, and Home Depot. In addition, the area contains the Cumberland Mall and Galleria retail developments and the Galleria Convention Center. Current developments include 3.5 million square feet of retail space, 17.9 million square feet of office space, and 14,400 residential units.

As shown on Table 2-7, the results of the land use inventory show the employment in the Cumberland area nearly doubling – from 70,565 to 140,138 between 2000 and 2025. The inventory results also show a 36 percent increase in population over that same time period.

A complete listing of the retail, office, and residential developments in the Cumberland CID is provided in Appendix A1. Estimates of the number of employees, daily patrons, and/or residents are included in the table. Figure 2-3 shows the locations of the largest developments in the Cumberland CID.

Table 2-7
Comparison of ARC and Land Use Inventory Employment and Population Projections for Cumberland and Town Center

Area	Employment			Population		
	ARC Forecast	CCTIS LU Inventory	Difference	ARC Forecast	CCTIS LU Inventory	Difference
	Year 2000					
Cumberland	67,692	70,565	2,873	34,684	33,759	(925)
Town Center	23,474	32,815	9,341	7,570	8,408	838
	Year 2025					
Cumberland	79,005	140,138	61,133	35,791	45,846	10,055
Town Center	38,753	55,582	16,829	12,742	15,874	3,132

2.1.3.3 The Town Center Area CID

The Town Center Area CID contains a mix of retail, office, and residential developments. It also contains the campus of Kennesaw State University. The major retail developments in the area include the Town Center Mall. Other developments include 4.8 million square feet of retail space, 4.1 million square feet of office space, 2.3 million square feet of industrial space, and 3,500 residential units.

As shown on Table 2-7, the results of the land use inventory show the employment in the Town Center area increasing by nearly 70 percent – from 32,815 to 55,582 between 2000 and 2025. The inventory results also show an 89 percent increase in population over that same time period. A complete listing of the largest developments in the Town Center Area is provided in Appendix A1. In addition, the table includes estimates of the number of daily patrons, employees, students, or residents in the developments. Figure 2-4 shows the locations of the largest developments on a Town Center Area CID map.

2.1.3.4 Land Use Inventory and Future Growth Projections

Based on the results of the land use inventory, the future development patterns in Cobb County will vary from those projected in the current ARC forecasts. The results of the land use inventory should be made available to ARC for their use when preparing future forecasts for the County and Region. The difference in the population estimates is relatively small compared to the total population projected for the County. The population increases in Cumberland and Town Center may not result in an increase in the total projected population in the County, but may simply involve a redistribution of the projected population among the various sub-areas of the County. For instance, the population in the Cumberland and Town Center areas may be underestimated, and the population projected in West Cobb, Acworth and other sub-areas may be overestimated in the current ARC forecasts.

The increase in employment in the Cumberland and Town Center areas is significant and may indicate that the total employment projected for the County is underestimated. The increase may also indicate that the projected employment in the County must be redistributed among the various sub-areas. It is likely that a combination of both, an increase in the total population projected for the County, and a redistribution of the employment among the various sub-areas in the County is required to address the discrepancies.

2.2 TRANSPORTATION AND TRAFFIC CHARACTERISTICS

The roadway network within the Study area experiences chronic high levels of congestion, according to several recent studies regarding the existing and forecast levels of congestion in the area. The travel patterns within the Study area are dominated by:

- The north-south travel along I-75, I-575, and Cobb Parkway; east-west travel along I-285
- The circulation within the Cumberland and Town Center Area major activity centers

2.2.1 I-75 Corridor

The I-75 Corridor includes the following arteries:

- I-75 is the primary north-south corridor in Cobb County and in the adjacent counties. I-75 varies from 6 to 14 lanes in the county.
- I-575 is a 4-lane highway that branches off I-75 north of Bells Ferry Road. This highway serves East Cobb County and Cherokee County to the north.
- Cobb Parkway is a major north-south artery located west of I-75, extending from Bartow County in the north, to Fulton County in the south. Cobb Parkway is typically two lanes in each direction, separated by a center turn lane, or a median with left and right turning lanes.
- I-285 is the primary east-west corridor within Cobb County and allows access to the Cumberland CID and major points throughout the Atlanta Region.

These roadways experience significant congestion during peak travel times. The performance levels of these roadway segments were evaluated in the Draft Cobb County Comprehensive Transportation Plan (DCCCTP).

Tables 2-8 and 2-9 illustrate projected traffic patterns into and out of Cobb County for 2020, based on the recent DCCCTP (December 1999).

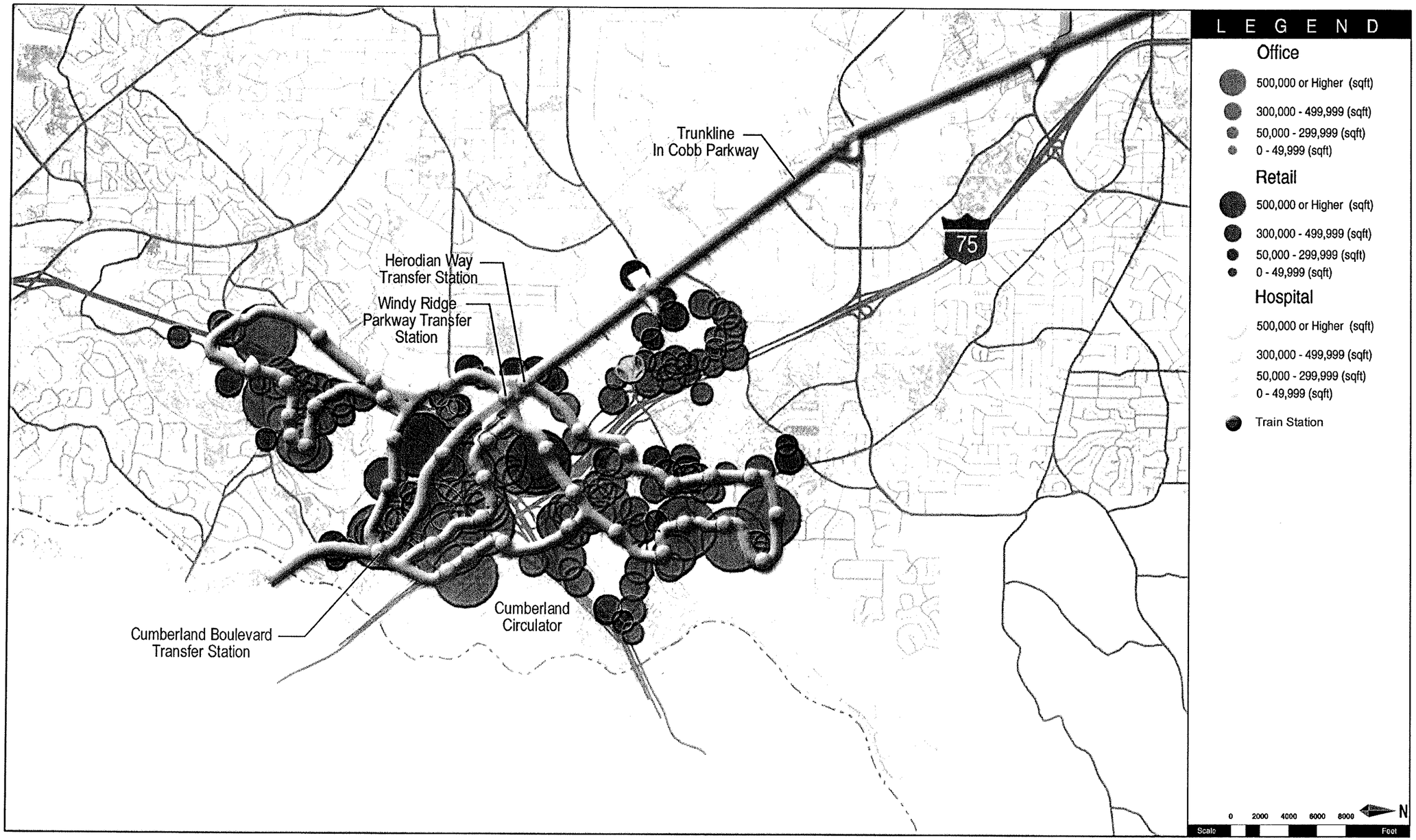

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FIGURE 2-3 CUMBERLAND AREA, EXISTING MAJOR TRAVEL DEMAND GENERATORS

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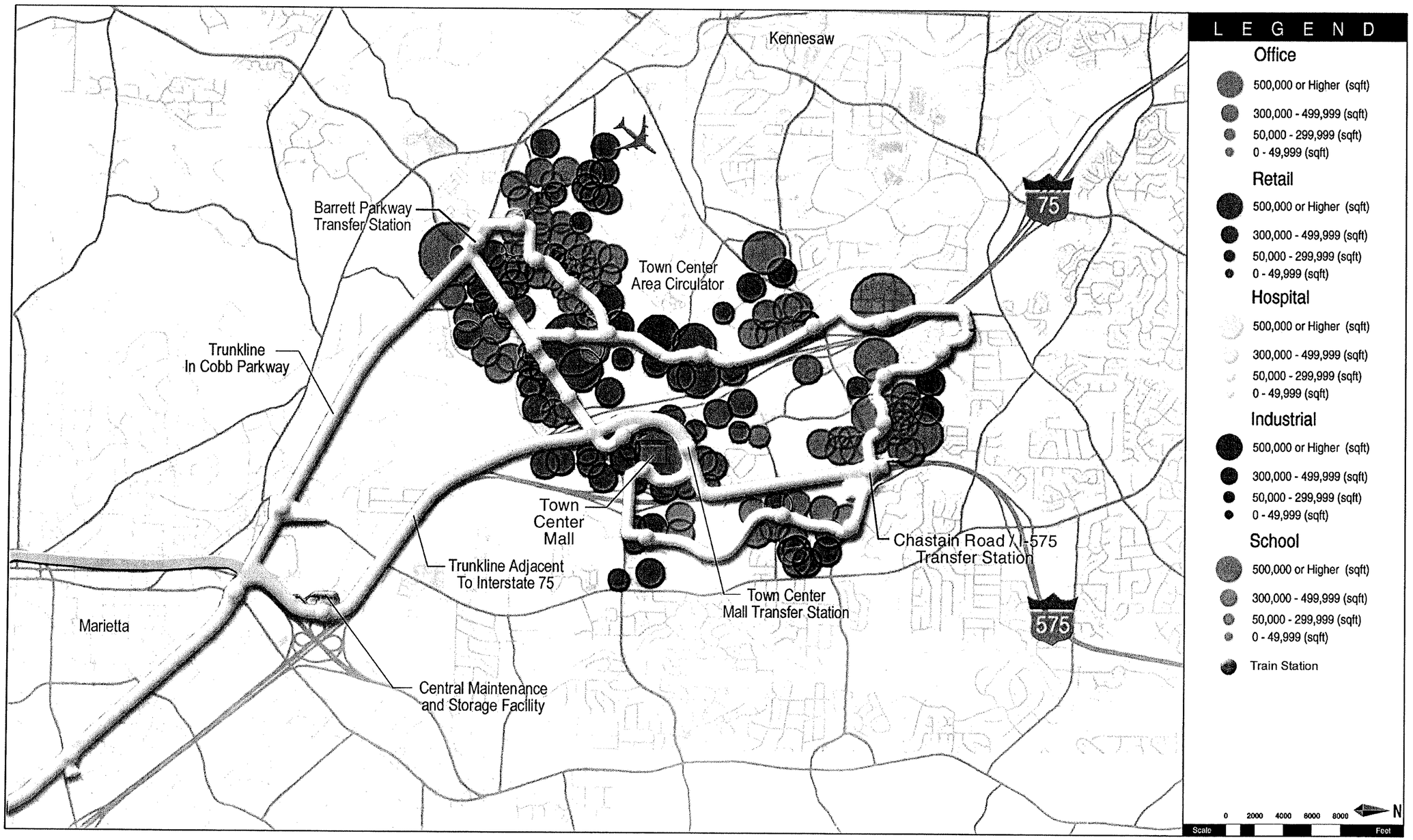

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FIGURE 2-4 TOWN CENTER AREA, EXISTING MAJOR TRAVEL DEMAND GENERATORS

Transit Implementation Study

Table 2-8
Origin of Daily Trips Coming to Cobb County, Year 2020

Origin County	Work Trips		Nonwork Trips		Total Trips	
	Trips	% of Total	Trips	% of Total	Trips	% of Total
Fulton	71,468	30	205,343	48	276,811	41
Cherokee	38,415	16	84,165	20	122,580	18
DeKalb	29,804	12	40,517	10	70,321	11
Paulding	25,013	10	32,205	8	57,218	9
Douglas	19,106	8	24,598	6	43,704	7
Gwinnett	18,016	7	15,375	4	33,391	5
Other	39,981	17	23,457	6	63,438	10
Total	**241,803**	**100**	**425,660**	**100**	**667,463**	**100**
% Share	36%		64%		100%	

Source: *Draft Cobb County Comprehensive Transportation Plan*, Cobb County DOT, December 1999.

Table 2-9
Destination of Daily Trips Leaving Cobb County, Year 2020

Destination County	Work Trips		Nonwork Trips		Total Trips	
	Trips	% of Total	Trips	% of Total	Trips	% of Total
Fulton	124,046	69	169,014	46	293,060	53
DeKalb	30,748	17	32,933	9	63,681	12
Gwinnett	19,461	11	8,610	2	28,071	5
Cherokee	2,050	1	75,392	20	77,442	14
Other	3,110	2	83,966	23	87,076	16
Total	**179,415**	**100**	**369,915**	**100**	**549,327**	**100**
% Share	33%		67%		100%	

Source: *Draft Cobb County Comprehensive Transportation Plan*, Cobb County DOT, December 1999.

Table 2-10 summarizes traffic condition ratings at major traffic bottlenecks on Cobb County highways, based on 1995 traffic volumes. However, traffic volumes on these corridor highways have increased about 7 percent each year between 1995 and 2000; consequently, these highways now exhibit failure conditions during both the morning and afternoon peak periods of congestion.

Table 2-10
Major Traffic Bottlenecks

Congested Segments	Planning Rating
I-75 – North of Chattahoochee River	Failure
I-575 – Cherokee County to I-75	Marginal
I-285 – Throughout Cobb County	Marginal
Cobb Parkway – Throughout Cobb County	Marginal to Failure

Source: *Draft Cobb County Comprehensive Transportation Plan*, Cobb County Department of Transportation, and December 1999.

2.2.2 Cumberland CID

The Cumberland CID, with substantial office and retail development as well as residential development, serves as a major employment center in Cobb County and the Atlanta Region. The area is intersected by I-75 in a north-south direction and I-285 in an east-west direction. The area is further served by multiple arteries in both the north-south and east-west directions.

The *Cumberland-Galleria Sub-Area Existing Conditions Report* stated that 17 of the 40 (43 percent) major roadway segments have traffic volumes that approach or exceed the capacity of the segment based on 1995 traffic volumes. The report further stated that 36 of the 69 (52 percent) signalized intersections within the area operated with major or excessive delays and were classified as marginal or failing.

Table 2-11 lists major area roadways that were considered deficient.

Table 2-11
Summary of Roadway Deficiencies – Cumberland CID

Roadway	From	To	Rating
I-75	Chattahoochee River	I-285	Failure
I-75	I-285	Windy Hill Road	Failure
Cobb Parkway	I-285	Windy Hill Road	Failure
I-285	Paces Ferry Road	Cobb Parkway	Failure
I-285	I-75	Powers Ferry Road	Failure
Delk Road	I-75	Powers Ferry Road	Failure
Windy Hill Road	Village Parkway	Cobb Parkway	Failure
Paces Ferry Road	I-285	Paces Ferry Road	Failure
Powers Ferry Road	Windy Hill Road	Terrell Mill Road	Marginal
1-75	Windy Hill Road	Delk Road	Marginal
Akers Mill Road	Professional Parkway	Power Ferry Road	Marginal
Cobb Parkway	Windy Hill Road	Delk Road	Marginal
I-285	South Cobb Drive	Atlanta Road	Marginal
I-285	Atlanta Road	Paces Ferry Road	Marginal
I-285	Cobb Parkway	I-75	Marginal
South Cobb Drive	Church Road	Cooper Lake Road	Marginal
Windy Hill Road	Cobb Parkway	I-75	Marginal

2.2.3 Town Center Area CID

The Town Center Area CID contains a mix of retail, office, and residential development. The area has experienced tremendous growth in the recent past, which should continue for the foreseeable future. Both I-75 and I-575 serve the area in the north-south direction. In addition, Chastain Road and Barrett Parkway serve as the major east-west thoroughfares in the area. The traffic congestion in this area was studied as part of the *Town Center Sub-Area Existing Conditions Report*. Table 2-12 summarizes the roadway segments that were reported to operate deficiently based on 1995 traffic volumes.

2.2.4 Environmental Compliance Issues

The Federal Clean Air Act Amendments (CAAA) of 1990 mandate that states must meet federal clean air standards to continue to be eligible for federal transportation program funding. Areas not meeting one or more National Ambient Air Quality Standards (NAAQS) were ranked according to the severity of their air pollution problems. Based on recent ARC reporting, thirteen counties in the Atlanta Region were classified as serious ozone nonattainment areas, for not meeting federal air quality standards.[4] These counties include: Cherokee, Clayton, Cobb, DeKalb, Douglas, Fayette, Fulton, Gwinnett, Henry, Rockdale, Forsyth, Coweta, and Paulding counties.

The Atlanta Region ozone problem results from the chemical reaction of nitrogen oxide (NOx) with reactive volatile organic compounds (VOCs) in the presence of abundant sunlight. In 1990, the Georgia Environmental Protection Division (EPD) developed a baseline inventory of VOC and NOx for the 13-county area, which recorded the proportional contributions to the ozone problem by mobile and stationary-point sources. The inventory showed that mobile sources (light-duty vehicles and heavy-duty trucks) contributed 58 percent of the VOCs and 56 percent of the NOx emissions.

The report also identified several intersections in the Town Center Area CID that were classified as operating at a marginal or failure level.

Table 2-12
Summary of Roadway Deficiencies – Town Center Area

Roadway Segment	From	To	Rating
Barrett Parkway	I-75	Roberts Court/Busbee Parkway	Failure
Barrett Parkway	Barrett Lakes Boulevard	I-75	Failure
Chastain Road	I-75	Busbee Parkway	Failure
Chastain Road	Frey Road	I-75	Failure
Frey Road	Chastain Road	Shiloh Road	Failure
George Busbee Parkway	Big Shanty Road	Chastain Road	Failure
Barrett Parkway	I-575	Bells Ferry Road	Marginal
Barrett Parkway	North Cobb Parkway	Barrett Lakes Road	Marginal
Barrett Parkway	Roberts Court/ Busbee Parkway	I-575	Marginal
George Busbee Parkway	Barrett Parkway	Big Shanty Road	Marginal
I-575	I-75	Barrett Parkway	Marginal
I-575	Bells Ferry Road	Cherokee County Line	Marginal
I-575	Chastain Road	Bells Ferry Road	Marginal
I-575	Barrett Parkway	Chastain Road	Marginal
I-75	Barrett Parkway	Chastain Road	Marginal
I-75	Chastain Road	Wade Green Road	Marginal
I-75	Canton Road	I-575	Marginal
I-75	I-575	Barrett Pkwy	Marginal
McCollum Parkway	North Cobb Parkway	Old 41 Highway	Marginal
McCollum Parkway	Old 41 Highway	Duncan Road	Marginal
North Cobb Parkway (US 41)	Old 41 Highway	McCollum Parkway	Marginal
North Cobb Parkway (US 41)	Barrett Parkway	Old 41 Highway	Marginal
North Cobb Parkway (US 41)	Bells Ferry Road	Barrett Parkway	Marginal
Old 41 Highway	North Cobb Parkway	McCollum Parkway	Marginal

2.2.5 Mode Share and Auto Occupancy

The *Cobb County Model Documentation* report includes an analysis of existing travel by mode, in the County and the Region. The findings show that Cobb County accounts for 2.1 million person trips per day, which amounts to 21 percent of the daily trips in the Atlanta Region. Less than 1/3 of 1 percent of the Cobb County trips are made using public transit. By comparison, approximately 2.4 percent of the trips in the Region were made using public transit.

The analysis also shows a very low vehicle-occupancy rate (1.21 persons/vehicle) for Cobb County trips. Table 2-13 summarizes the daily travel characteristics for the County and the Region.

Table 2-13
Cobb County and Atlanta Region
Daily Travel Characteristics, 1995

Trip Category	Cobb County	Atlanta Region	Cobb County Percent of Total
Total Person Trips	2,123,100	10,080,900	21.0
Total Auto Trips	1,756,000	8,253,000	21.1
Total Auto Person Trips	2,116,600	9,835,000	21.5
Auto Percent Mode Share	99.6%	97.5%	-
Average Vehicle Occupancy	1.21	1.19	-
Total Transit Trips	6,842	245,841	-
Transit Percent Mode Share	0.3%	2.4%	-

Source: *Cobb County Model Documentation and Users Manual,* prepared for Cobb County Department of Transportation, by Post, Buckley, Schuh & Jernigan, Inc., December 1997.

2.2.6 Cobb Community Transit

The summaries of traffic conditions in the Cumberland and Town Center Area CIDs reveal that chronic congestion during peak periods is occurring on a daily basis. Traffic bottleneck conditions along key roadway segments, and over-capacity conditions at most signalized intersections, create widespread delays and contribute to the regional air quality problem.

[4] Atlanta Regional Commission, Transportation Planning Fact Book, December 1998.

Cobb Community Transit (CCT) currently provides a limited local bus, express bus, and paratransit system. The system includes 13 local and two express routes. The existing fleet includes 53 fixed route buses and 15 paratransit vans. Table 2-14 summarizes the key performance characteristics of the CCT system.

Table 2-14
Existing Characteristics of Cobb Community Transit

System Characteristics	Base Year 2000 Existing CCT System Performance
Transit Ridership (Weekday) Total Bus	10,109
Transit Ridership (Annual Unlinked Passenger Trips) Total Bus	2,833,034
Weekday Revenue Hours Local/Express Bus	389.1
Transit Vehicle Fleet Size Local/Express Bus	53
Annual Vehicle Revenue Miles Local/Express Bus	1,781,315
Costs Per Vehicle Revenue Miles Local/Express Bus	$3.11
Costs Per Vehicle Revenue Hours Local/Express Bus	$49.86
Unlinked Passenger Trips Per Vehicle Revenue Hours Local/Express Bus	$25.48

Source: *Draft Cobb County Comprehensive Transportation Plan*, Cobb County Department of Transportation, and December 1999.

Currently, CCT provides connections to the MARTA system along four local routes and two express routes. Three local bus routes and the two express bus routes stop at MARTA stations in downtown Atlanta. The fourth local bus route stops at the MARTA Dunwoody Station. Table 2-15 lists the links from CCT to MARTA facilities.

ARC has under way a number of Transportation Demand Management (TDM) programs and actions that may benefit regional air quality by reducing vehicle trips and emissions. These programs include carpooling, transit, bike, and pedestrian facilities, alternative work arrangements, and telecommuting. Furthermore, the updated RTP emphasizes a balanced transportation network to eliminate bottlenecks and inefficiencies in the transportation system, increase transit mode share, and minimize vehicle trips.

The adopted RTP includes a concept light rail transit system in the Region's northwest corridor, serving Fulton and Cobb counties, as a proposed project for funding. This system is envisioned to address chronic congestion in the Cobb Parkway/I-75 north corridor within Cobb County and to the north in Cherokee County. The project is expected to directly benefit the ozone problem in the counties directly served by it and the Region overall.

Table 2-15
CCT Service to MARTA Facilities

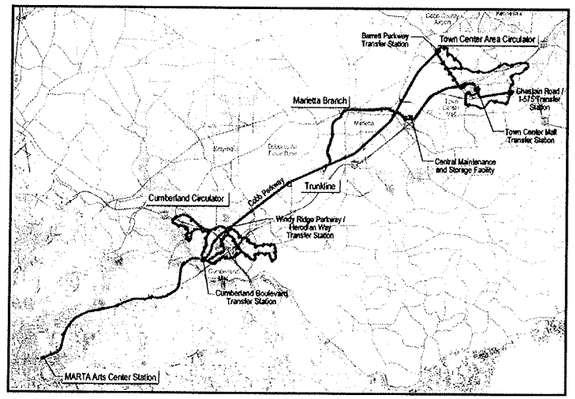
CCT Bus Routes	MARTA Facilities Connecting
Express Route 100	MARTA Civic Center MARTA Peachtree Center MARTA Five Points
Express Route 101	MARTA Civic Center MARTA Peachtree Center MARTA Five Points
Local Route 10	MARTA Arts Center
Local Route 10A	MARTA Arts Center MARTA Civic Center MARTA Peachtree Center MARTA Five Points
Local Route 10B	MARTA Arts Center MARTA Civic Center MARTA Peachtree Center MARTA Five Points
Local Route 60	MARTA Dunwoody Station
Local Route 70	MARTA H.E. Holmes Station

This proposed light rail transit system conforms to ARC RTP policy direction.

This section summarizes the original concept, describes the field investigations that led to modifications of the concept, presents objectives and criteria for the various elements of the system, and describes the proposed Ultimate System.

The proposed Northwest Corridor Light Rail Transit System consists of:

- The Trunkline – from the Town Center area, southward in Cobb Parkway, to the Cumberland Mall/Galleria area, to its terminus at the Metropolitan Atlanta Rapid Transit Authority (MARTA) Arts Center Station in Midtown Atlanta
- The Cumberland Circulator – looping throughout the "Platinum Triangle" area
- The Town Center Area Circulator – looping from the Town Center Mall through Kennesaw State University and back along heavily congested Barrett Parkway
- A Marietta Branch line – providing service to the central business district of the city of Marietta, as presented in Section 12 of this Final Report



The proposed Ultimate System (shown above) is based on the original concept set forth in the Draft Cobb County Comprehensive Transportation Plan (illustrated in Figure 3-1). Modifications and refinements were driven by:

- Identification of the fixed guideway system objectives and performance criteria
- Comprehensive field investigations by the Team
- Extensive discussion and coordination with and input from the Cobb County Department of Transportation (CCDOT), the Cumberland and Town Center Area Community Improvement Districts, and other major stakeholders in the northwest corridor

3.1 ORIGINAL CONCEPT

The proposed light rail transit system had as its genesis elements of a comprehensive transportation plan, the DCCCTP, developed by several consulting firms for CCDOT. This report was submitted to CCDOT in January of 1999. In addition to numerous highway-related projects, the DCCCTP included conceptual proposals for three public transportation projects using fixed guideway technology, which are illustrated in Figure 3-1, Original Concept. They are summarized in the following paragraphs:

- **Cumberland/Galleria to Town Center Area Transit Connector.** A trunkline located primarily along Cobb Parkway (one of the main arterial north-south roadways running through Cobb County), it would have linked the two circulators. This trunkline, identified by Cobb County as the Transit Connector (TC), would at some future date have been extended south into neighboring Fulton County, to terminate in Midtown Atlanta at the MARTA Arts Center Station. The TC would have been approximately 10.7 miles in length, and served ten stations – eight located where the TC intersected major east-west roadways, two at interchanges with the CAC, and one at an interchange with the TCAC.
- **Cumberland/Galleria Area Circulator (CAC).** Located in southeastern Cobb County near the intersection of I-75 and I-285, the CAC focused on the Cumberland Mall and the Galleria/ Convention Centre development. It would have served 15 stations and had a length of approximately 7.1 miles.
- **Town Center Area Circulator (TCAC).** Located in Kennesaw in north central Cobb County near the intersection of I-75 and I-575, the TCAC focused on the Town Center shopping mall. This circulator would have served 11 stations and had a length of approximately 6.2 miles.

In addition to these proposed fixed guideway transit lines, Cobb County's bus system – Cobb Community Transit (CCT) – would have been greatly expanded to serve as a local feeder system, and Park-and-Ride facilities were envisioned at key locations. Both of these elements of the DCCCTP would have complemented the fixed guideway lines and enhanced their effectiveness as an alternative to the near-total dependence upon the automobile for mobility within Cobb County and to/from Fulton County.

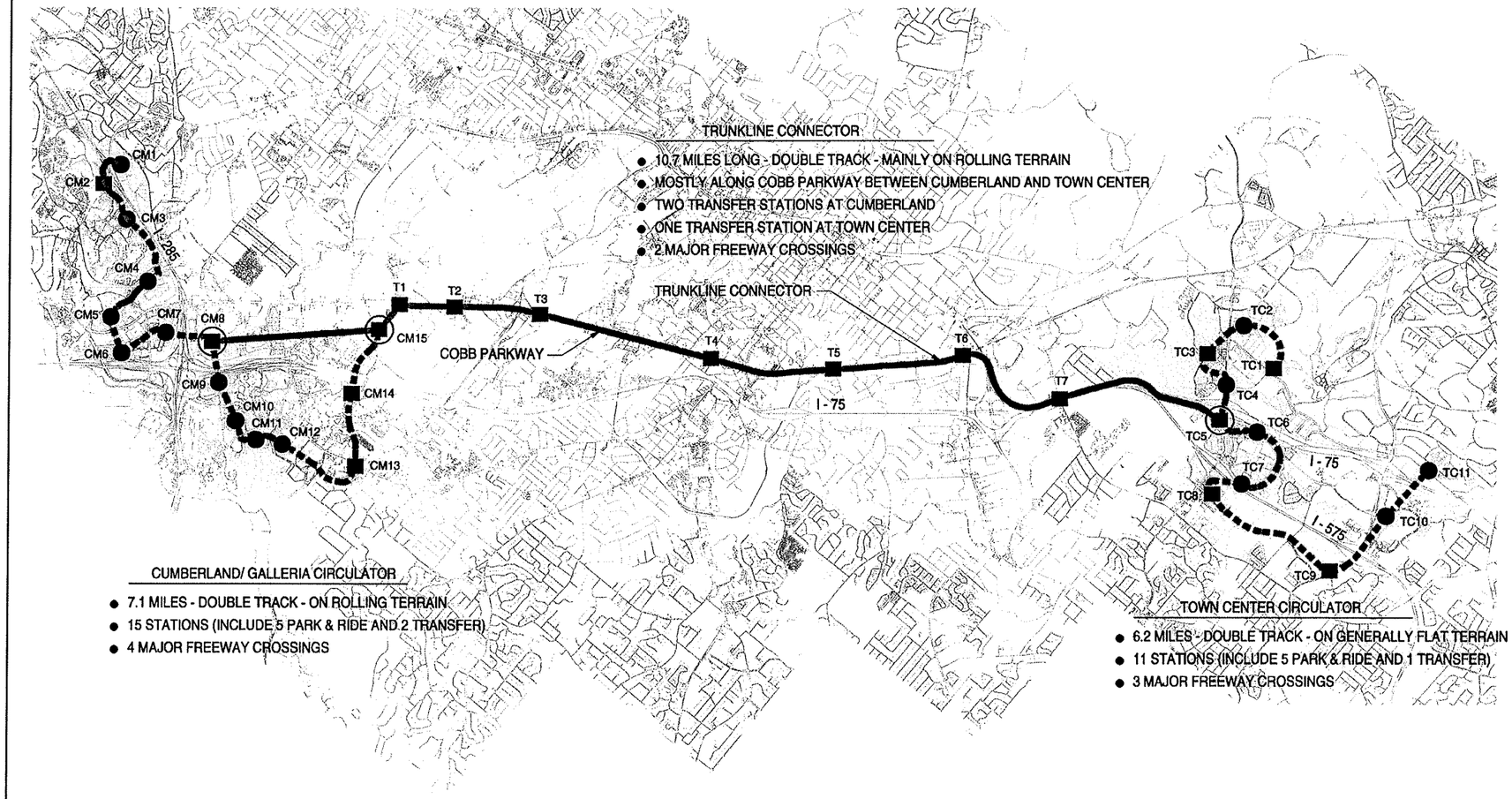
3.2 ENGINEERING FIELD INVESTIGATIONS

Numerous field investigations were conducted along the alignment originally proposed in the DCCCTP for the Transit Connector (TC), primarily along by Cobb Parkway, as well as the alignments proposed for the two circulators (CAC and TCAC). Field investigations were also conducted to examine adjacent corridors and areas in search of preferable alternatives. The results of these investigations are summarized in the following subsections.

3.2.1 Cobb Parkway Trunkline

The following engineering observations resulted from field investigations for the Trunkline:

- Cobb Parkway is the logical corridor for the Trunkline, to serve areas with ridership-generating activity centers on both sides of its alignment. To the greatest extent possible, other than in the immediate vicinity of the Town Center Area CID, a Trunkline alignment closely following I-75 should be avoided in order to maximize its tributary area and its redevelopment potential.
- Major east-west arterials – Chastain Road, Barrett Parkway, Canton Road/SR 5, North Marietta Parkway/120 Loop, Roswell Road/Route 120, South Marietta Parkway/120 Loop, Delk Road, Windy Hill Road, Herodian Way, and Windy Ridge Parkway– will act as important highway feeders to the Trunkline if stations are located in close proximity to their intersections with Cobb Parkway.
- Cobb Parkway is lined with low-density commercial and residential development that has adequate parking but difficult access due to congestion during peak periods, particularly at intersections with east-west arterial roadways.
- For the Trunkline to be successful as a tool to relieve congestion in the Cobb Parkway/I-75 Corridor park/ride lots and bus transfer facilities are essential at most stations, to provide passengers with convenient and time-competitive access.
- Rolling terrain along Cobb Parkway precludes the use of an aerial guideway throughout the entire Trunkline alignment. The character of the roadway would require inordinately high, unsightly aerial structures between intersections with major east-west arterials, to allow the Trunkline to pass over these roadways and still maintain reasonable grades for the fixed guideway transit system.



NOTE: This Is The Original Concept As Presented Within The Draft Cobb County Comprehensive Transportation Plan - January 1999.

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FIGURE 3-1 ORIGINAL CONCEPT

Transit Implementation Study

- The median of Cobb Parkway must be widened to accommodate either at-grade or elevated structures for the line to be built in the Cobb Parkway median, which was determined as its preferable location.
- The side-of-road alignment options – whether double-track guideway on one side of Cobb Parkway or single-track guideway on both sides of the roadway – would require extensive aerial structures to retain motor vehicular and pedestrian access to properties fronting on Cobb Parkway. Side-of-road Trunkline alignments along Cobb Parkway were determined to be a more intrusive, less balanced, more costly alternative and were not further investigated.
- The use of the high voltage power line right-of-way between Terrell Mill Road and Windy Hill Road on the east side of Cobb Parkway, as shown in the original proposal, is impractical. It requires very costly construction due to the presence of overhead high voltage power line and poles, and creates an unnecessary jog in the alignment of the light rail transit line.

3.2.2 Cumberland Circulator

Engineering observations resulting from field investigations for the Cumberland Circulator include:

- The Cumberland CID has many high-rise office buildings in scattered locations, with extensive parking. It has numerous other commercial activity centers, such as shopping malls and restaurants, and some fairly dense residential communities.
- Congestion on arterial roadways within the CID, especially at intersections of north-south and east-west arterials (e.g., West Paces Ferry Road and I-285 or Terrell Mill Road and Powers Ferry Road), is severe during a.m. and p.m. peak periods. Powers Ferry Road and Windy Hill Road also have considerable congestion at lunchtime.
- Rolling terrain, steep hills, narrow street rights-of-way, and existing development patterns combine to create a challenge for inserting a circulator within the Cumberland CID.
- The Cumberland Circulator should be grade-separated where physically and economically possible, to be free of potential delays from motor vehicle traffic congestion. It also must maintain frequency and speed high enough to attract riders, although frequent station stops are needed to provide acceptable walking access to and from activity center origins and destinations.
- The Overlook/Mt. Wilkinson area would not be well served by the originally proposed alignment (along Cumberland Parkway with a station at its intersection with Mt. Wilkinson Drive).
- The original proposed alignment of the Circulator along Terrell Mill Road (connecting with Wildwood North area with an interchange to the Trunkline east of Cobb Parkway in the vicinity of the Wal-Mart shopping center) does not appear to have potential as a major passenger generator. The Georgia Memorial Park, a major cemetery directly west of the intersection of Terrell Mill Road with Cobb Parkway, also would preclude future consideration of a western extension to this end of the Circulator. A routing via Interstate North Parkway and Herodian Way between Powers Ferry Road and Cobb Parkway appears to be more attractive from the perspective of ridership-generating activity centers.
- The joint use of the Columbia gas pipeline right-of-way from Circle 75 Parkway to Wildwood South (indicated in the maps), which accompanied the original proposal, is not desirable from either a constructibility or maintainability standpoint. An alignment along Windy Ridge Parkway between Circle 75 Parkway/I-75 and Powers Ferry Road, appears to be more attractive from the standpoints of constructibility, maintainability, and ridership-generating activity centers.

3.2.3 Town Center Area Circulator

The following engineering observations resulted from field investigations for the Town Center Area Circulator:

- The major land uses in the Town Center Area CID are shopping centers, restaurants, and low-rise office parks.
- Kennesaw State University, in both its main campus and auxiliary location along Chastain Road, has the potential to generate many passengers for both the Town Center Area Circulator and the Trunkline.
- Traffic flows along Barrett Parkway and Chastain Road, as well as on secondary roads within the CID, are heavy throughout the day.
- The Town Center Area CID Transportation Management Association reports severe traffic congestion during holiday periods, as a result of insufficient parking at shopping centers.
- The Town Center Mall is reported to have approximately 6,200 parking spaces, yet employs almost that number of people during holidays, which creates competition among shoppers and store employees for parking space. Busing store employees to and from remote parking sites is less than effective because of traffic congestion.
- Remote park-and-ride lots at Circulator stations could intercept auto traffic to relieve parking space shortages and congestion, especially at holiday periods.
- The Town Center Area CID has gentle terrain and is predominately flat, easing problems of inserting the proposed Circulator in its built-up areas.
- The west side of the CID, along Barrett Lakes Boulevard, was not served by the original County alignment. This area seems to be building up rapidly and to have development potential that would be influenced favorably if it were served by the Circulator. The result would be that the TCAC, when viewed on a map, would be reconfigured as a loop instead of the backwards C, as originally proposed.

3.3 FUNCTIONAL OBJECTIVES

Having carefully evaluated the alignments originally proposed in the DCCCTP for the Transit Connector (TC) and the two circulators (CAC and TCAC), the Bechtel/MSE Team then established the functional objectives necessary to guide the development of a recommended light rail transit system.

3.3.1 Functional Objectives of the Trunkline

The functional objectives of the Trunkline are to:

- Provide fast, convenient, and comfortable rapid transit service to and between the Cumberland CID and the Town Center Area CID, and southward to the MARTA Arts Center Station in Midtown Atlanta.
- Intercept vehicular traffic at strategically located stations, with park-and-ride and bus transfer facilities, to provide convenient access between origins and destinations.
- Reduce vehicular traffic on I-75, Cobb Parkway, and other roads, thus improving traffic flow and air quality in the Region.
- Support desired growth patterns for additional commercial and residential development along the entire Trunkline Corridor.

3.3.2 Functional Objectives of the CID Circulators

The functional objectives of the CID Circulators are to:

- Reduce traffic throughout the CIDs to promote a safer and cleaner environment

- Promote the safe and fast movement of people between commercial, educational, employment, and residential centers within the CIDs
- Facilitate the movement of people between major activity centers within the CIDs and to/from the Trunkline
- Support desired growth patterns for additional commercial and residential development throughout the CIDs

3.3.3 Functional Objectives of the Marietta Branch

The functional objectives of the Marietta Branch are to:

- Reduce traffic throughout the city of Marietta to promote a safer and cleaner environment
- Promote the safe and fast movement of people between commercial, educational, employment, and residential centers within the city of Marietta
- Facilitate the movement of people between major activity centers within the city of Marietta and to/from locations served by the Trunkline and the Circulators
- Support desired growth patterns for additional commercial and residential development throughout the city of Marietta

3.4 AESTHETIC OBJECTIVES

In addition to establishing functional objectives for the light rail transit system, it is important to establish basic aesthetic objectives to guide the system's design and act in concert with the comprehensive master plans for Cobb and Fulton counties.

It will be important to establish a systemwide design approach for the entire light rail transit system – one that reflects the region's natural attributes in its design and aesthetic appearance. It is vital that the system be perceived as a series of like components, designed as an aesthetically unified system, conforming to a commonality of function. As such, it will establish a strong architectural and engineering identity, taking its place among the most significant transit systems in the United States, while fostering increased civic pride throughout the region.

In addition to enhancing the aesthetic appeal of the system to patrons, this systemwide design approach will also enhance the functional clarity of the system and its stations. Repetition of functional relationships and elements will yield similar experiential patterns, so that all patrons – everyday riders, newcomers, elderly or disabled – will feel confident in their ability to use the system without confusion, in both comfort and safety.

The system's successful aesthetic "fit" into each of its urban/suburban environments is also extremely important, with station proportions and architectural finish materials selected with restraint, to lessen or preclude the system's visual impact.

Specific aesthetic objectives should include:

- Provide a strong, yet appropriate systemwide visual identity, placing it among the most significant and attractive transit systems in the U.S.
- Present a unified assembly of like components and materials; designed as a linear system.
- Integrate with the region's natural attributes; lessen or preclude disruptive or intrusive visual impact.
- Reflect the highest state-of-the-art in transit design and technology.
- Provide visual clarity of the system's functionality, with similar experiential patterns throughout, so that all patrons can use the system easily, in comfort, security, and safety.
- Fit the project into its context; i.e., avoid disruptive or intrusive visual impact via judicious use of scale, simplicity, and clarity of line.
- Use landscape design elements and arrangements to soften the system's impact, enable scale transitions while framing desirable views and vistas, and to screen undesirable views.
- Design exterior lighting, both that emanating from the stations as well as that utilized throughout the station sites, to minimize intrusion into the surrounding neighborhoods.
- Give particular care to attenuation of noise created by the operation of the light rail vehicles, especially in sensitive areas such as near hospitals, to preclude any negative impact.

3.5 PERFORMANCE CRITERIA

The following subsections summarize essential and desirable performance characteristics for the Trunkline, the two Circulators and the Marietta Branch.

3.5.1 Performance Criteria for the Trunkline

Essential performance characteristics include:

- Completely grade-separated and segregated system
- Automatic Train Protection (ATP) and Automatic Train Control (ATC) to ensure maximum safety
- Service frequency comparable with similar suburban rail transit systems at not more than 8.0 minutes during peak periods, 15 minutes during off-peak periods and 30 minutes during early morning/late evening and weekend periods
- Vehicle and station compatibility with the Americans with Disabilities Act (ADA) requirements
- Adequate park-and-ride, kiss-and-ride, bus transfer, pedestrian access, and circulation facilities at stations
- Intersection with each of the Circulators at two common stations, at least, where transfers can take place

Desirable performance characteristics for the Trunkline:

- System technology compatible with that of the Circulators
- Automatic Train Operation (ATO) under the supervision of a train driver with full speed manual control available whenever necessary
- Average spacing of stations at approximately 1.5 miles apart
- Average speed of at least 35 mph
- Maximum vehicle speed capability of at least 70 mph
- Maximum civil design speed capability of at least 80 mph utilized as design criteria for the construction of fixed facilities such as trackways, elevated guideways and tunnels

Section 5 presents a more detailed discussion of the system's performance criteria, system parameters, and proposed vehicle technology.

3.5.2 Performance Criteria for the Circulators

Essential performance characteristics include:

- Frequent service at not more than 6.0 minutes during peak periods, 10 minutes during off-peak periods, and 15 minutes during early morning/late evening and weekend periods
- Vehicle and station conformance to Americans with Disabilities Act (ADA) requirements

- Average spacing of stations at approximately 0.5 miles apart
- Convenient, direct transfers at the Trunkline interchange stations

Desirable performance characteristics for the CID Circulators:

- Grade-separated and segregated from vehicular traffic and pedestrians where physically possible and economically justifiable
- Dedicated right-of way for Circulator operation only with grade crossings at cross streets
- Compatible technology with the Trunkline to allow common use of a central maintenance and storage facility
- Average speed of 20 mph
- Maximum civil and vehicle design speed of 50 mph, utilized as design criteria for fixed facilities

3.5.3 Performance Criteria for the Marietta Branch

Essential performance characteristics include:

- Frequent service at not more than 8.0 minutes during peak periods, 15 minutes during off-peak periods and 30 minutes during early morning/late evening and weekend periods
- Vehicle and station conformance to Americans with Disabilities Act (ADA) requirements
- Average spacing of stations at approximately 0.5 miles apart
- Through service with the Trunkline permitting convenient, direct transfers to both Circulators at the Trunkline interchange stations
- Light rail vehicles capable of operation on both the Trunkline and the Marietta Branch meeting all performance criteria for Trunkline service

Desirable performance characteristics for the Marietta Branch:

- Full grade-separation and segregation from vehicular traffic and pedestrians only where a level interface between the LRT line and heavily traveled highways and arterial roadways would be unsatisfactory from a traffic engineering perspective
- Dedicated right-of way for Marietta Branch operation only with grade crossings at cross streets where physically possible and economically justified
- Use of reserved lanes or mixed traffic lanes in local streets in the city of Marietta, where this would facilitate insertion of the LRT line into the urban fabric and bring greater benefits to the community than other solutions
- Compatible technology with the Trunkline to allow common use of a central maintenance and storage facility
- Average speed of 25 mph
- Maximum civil and vehicle design speed of 50 mph, utilized as design criteria for fixed facilities

3.6 BASIC CIVIL DESIGN CRITERIA

Basic design criteria were developed in accordance with the following objectives: safety, vehicle stability, passenger riding comfort, and good quality. Criteria for various aspects of the light rail transit system are summarized below.

Trackwork
- Track gauge: 4 ft., 8 ½ in. (standard gauge)
- Rail: 115 lb. Continuously welded
- Turnouts: No. 6 (minimum)
  Turnouts shall not be located on vertical curves. Turnouts may be located on horizontal curves without super-elevation.

Track Structures
- For aerial structures, tunnels, and within maintenance buildings: ballast-less slab track with direct rail fixation system
- For storage yards and other reserved right-of-way areas: ballasted track using standard U.S. rails laid on concrete or creosoted wooden sleepers (crossties)

Civil Structures
- Aerial structures should be of concrete construction with a minimum deck slab width of 28 feet for double-track structures and 15 feet for single-track structures.
- Underground structures should be of cut-and-cover concrete construction, with a minimum width of 28 feet for double track structures and 18 feet for single-track structures. The minimum height of underground structures should be 14 feet from top of rail to bottom of roof slab.

Stations
- Stations should be located on level tangent track wherever possible, with constant gradients up to 200 feet from each end of the platform.

Table 3-1 lists a comparison of Trunkline and Circulator/Marietta Branch criteria.

3.7 CRITERIA FOR LOCATING STATIONS

The locations of the Trunkline, Circulator and Marietta Branch stations are particularly important to the successful performance of the proposed light rail transit system. However, station spacing is also key – if station-to-station distances are too short, the cost of the system will be excessive, the average speed of trains will be lower, and power consumption will be higher.

Table 3-1
Basic Civil Design Criteria – Trunkline, Circulators, and Marietta Branch

Criterion	Trunkline	Circulator/Marietta Branch
Track Gauge	Standard 4' 8½"	Standard 4' 8½"
Track Spacing	14' 0" on tangent. Increased with certain curvatures.	14' 0" on tangent. Increased with certain curvatures.
Super-Elevation	7" absolute maximum. Varies with speed, curvature, and unbalance.	Same as Trunkline
Grade	8% on tangent. Decreased with horizontal curves 0% at stations	10% on tangent. Decreased with horizontal curves 0% at stations
Tangents	100% minimum between curves. Vary with speed	(No limit)
Horizontal Circular Curves	150' minimum radius. Varies with speed and super-elevation limitations Length of horizontal curve is 3x speed. 100' absolute minimum	100' minimum radius. Varies with speed and super-elevation limitations Length of horizontal curve is 3x speed. 82' absolute minimum
Spiral Transition	100' absolute minimum. Varies with speed and super-elevation	100' minimum where required
Vertical Curves - - Crest and Sag	100' absolute minimum. Varies with speed and rate of grade change	Same as Trunkline
Constant Grade	100' minimum. Varies with speed	Same as Trunkline
Horizontal Clearance	7'-0" minimum on tangent with walkway Increased on curves	Same as Trunkline
Vertical Clearance	18' 0" with catenary above ground 15'0" with catenary in tunnels	22' 0" with catenary at grade crossings or in street lanes 18' 0" with catenary elsewhere
Platform Length	270' – 360'	100'
Platform Width	12' side; 30' center minimum	10' side; 25' center minimum

The spacing of stations on the Trunkline must reflect a balance between desirable points for passenger access, reasonable minimization of access time, and the minimization of overall travel times.

For the Circulators and the Marietta Branch, local access within the CIDs and the central business district of Marietta becomes of key importance and the balance swings to shorter distances between

stations. It is intended that the majority of passengers using the Circulators and the Marietta Branch will walk to and from the stations on those elements of the light rail transit system.

3.7.1 Criteria for Locating Trunkline Stations

Criteria guiding location decisions for Trunkline stations include:

- Average spacing of approximately 1.5 miles apart
- Locations in prime regional and community nodes of activity
- Locations to support desired patterns of regional and community growth and development
- Locations to maximize transit patronage and patronage growth potential
- Locations to be coordinated with and supportive of the region's transportation networks, both existing and planned, and the surrounding vehicular circulation networks
- Locations to be selected to minimize any negative impact to their immediate environments and to maximize benefits to the community
- Opportunities for joint development activities to be a consideration, with placements that may encourage the creation of public-private partnerships affecting the planning, design, and financing of the transportation improvements

3.7.2 Criteria for Locating Circulator Stations

Criteria guiding location decisions for Circulator stations include:

- Average spacing of approximately 0.5 mile or less
- Locations at prime CID nodes of activity
- Locations to support desired patterns of CID growth and development
- Locations to maximize light rail transit system usage within and between the CIDs and locations served by the Trunkline and the Marietta Branch
- Locations to be coordinated with and supportive of internal vehicular and pedestrian circulation networks, both existing and planned, within the CIDs
- Locations selected to minimize any negative impact to their immediate environments and maximize benefits to the community
- Opportunities for joint development activities to be a consideration, with placements that may encourage the creation of public-private partnerships affecting the planning, design, and financing of the transportation improvements

3.7.3 Criteria for Locating Marietta Branch Stations

Criteria guiding location decisions for Marietta Branch stations include:

- Average spacing of approximately 0.5 mile or less
- Locations at prime nodes of activity within the city of Marietta
- Locations to support desired patterns of growth, development and regeneration within the city of Marietta
- Locations to maximize light rail transit system usage within the city of Marietta and between the Marietta central business district and locations served by the Trunkline and the two Circulators.
- Locations to be coordinated with and supportive of internal vehicular and pedestrian circulation networks, both existing and planned, within the city of Marietta
- Locations to be selected to minimize the impact to their immediate environments
- Opportunities for joint development activities to be a consideration, with placements that may encourage the creation of public-private partnerships affecting the planning, design, and financing of the transportation improvements (if this approach is judged to be in the overall interest of the City of Marietta and its residents)

3.8 CONFIGURATION CHARACTERISTICS

In order to achieve the functional objectives of the light rail transit system (see Subsection 3.3) and meet the essential performance criteria (see Subsection 3.5), the recommended system configuration will require the following characteristics.

3.8.1 Configuration Technology

The basic configuration of the Trunkline, the two Circulators and the Marietta Branch will include a double-track fixed guideway system, on-line stations and electrically powered trains using an external source of power. This is a conventional, well-proven approach, and avoids the operational complexities and development risks associated with other configurations.

A double-track guideway will be used for all main line segments of the Trunkline and the Marietta Branch to allow high-frequency service in both directions of travel. Although the basic approach for the two Circulators will be the same, the routing of the Circulators may lend themselves to single-track uni-directional or bi-directional operation in certain locations, particularly in the initial deployment, or phasing, of the system.

The off-line station concept is sometimes presented as an attractive option because express trains can overtake local trains at such locations. However, neither the Trunkline nor the Circulators nor the Marietta Branch appear to warrant special provisions for the operation of express trains.

The use of electric power from remote generating sources within Cobb County is responsive to the RTP objective of alleviating current air quality problems, and is fully consistent with the provision of a contemporary light rail transit system.

3.8.2 Grade Separation

In order to meet the performance criteria for the Trunkline, complete separation of the Trunkline from surface traffic will be required. Thus all streets and roads will be grade-separated from the Trunkline, and the movement of trains will in no way be impeded by surface traffic. This means that Trunkline sections, whether on the surface (at-grade), elevated, or underground, will be separate and protected from other non-transit facilities.

For the Circulators and the Marietta Branch, grade-level street crossings will be allowed at selected locations. In addition, street running in reserved lanes will be used where appropriate. Where the Marietta Branch is concerned, depending upon which alignment alternative is chosen from several possible alternatives, it may be desirable to locate the LRT tracks in mixed-traffic lanes along Campbell Hill Street or one or more streets in the Marietta central business district.

3.8.3 Maximum Grade and Minimum Horizontal Curve Radius

For the Trunkline and the Marietta Branch, a maximum grade of 5 percent and a minimum horizontal curve radius of 100 feet have been established (82 feet being permissible on trackage within city streets and on non-revenue trackage), based on the topography of the routes, average schedule speed requirements, rolling stock configuration and power consumption considerations. In accordance with the common practice of light rail transit systems (as distinct from heavy rail transit systems), the maximum allowable grade can be increased to an absolute maximum of 8 percent in difficult terrain where the costs of constructing to a less demanding criteria would be prohibitive. Continuation of the Trunkline to the MARTA Arts

Center Station in Midtown Atlanta, depending upon the route profile south of the Cumberland Mall/Galleria Station, may employ a main line grade of 8 percent for a distance of approximately 2,500 feet along Cobb Parkway between the Cumberland Boulevard Transfer Station and the Chattahoochee River. In that case, speed restrictions and additional signal equipment providing for positive all-weather train separation will be required in this area to ensure safe and reliable operations.

To meet the requirements of the Circulator routes, a desirable maximum grade of 8 percent, with an absolute maximum grade of 10 percent, and a minimum horizontal curve radius of 82 feet have been established.

3.8.4 Route Flexibility

The Trunkline and Marietta Branch route configuration requires that main line branching be readily accomplished. However, there does not appear to be a need for looping, as trains can simply be reversed at the ends of the route.

For the Circulators, both branching and looping will be required, particularly to facilitate the phased growth of the routes. This makes a symmetric vehicle/guideway interface advantageous for the Circulators.

3.8.5 Station Platform Length

To facilitate the vehicle technology identified in Section 5, nominal station platform lengths have been established. These lengths are 270 feet and 360 feet, respectively, for the Trunkline and 100 feet for the two Circulators and the Marietta Branch. Initial platform and station design would make specific allowance for subsequent lengthening of the Trunkline station platform, from 270 feet to 360 feet to permit longer trains to be operated in the future, should this be required by unforeseen growth in peak-period ridership.

3.9 PROPOSED ULTIMATE SYSTEM

The ultimate configuration of the Northwest Corridor Light Rail Transit System consists of a Trunkline approximately 28 miles in length, originating in the Town Center area, traversing along Cobb Parkway to the Cumberland Mall/Galleria area, and continuing to its terminus at the MARTA Arts Center Station in Midtown Atlanta. It also consists of two light rail transit Circulators – one approximately 14 miles in length in the Cumberland Mall/Galleria area, and the other approximately 11 miles in length in the Town Center area. A branch line providing light rail transit service to the Marietta central business district, as described in Section 12 of this Final Report, is also included in the proposed Ultimate System.

The proposed Ultimate System is a double-track fixed guideway, using on-line stations. Trains will be electrically powered, using an external source of power. It is recommended that the Trunkline be fully grade-separated; however, the Circulators and the Marietta Branch will operate at grade in certain areas. The ultimate network is illustrated in Figure 3-2. Plans and profiles, as well as cross sections, are provided in Volume II of this document; station concepts are discussed in Section 7 of this volume, and are also presented in drawing form in Volume II.

The proposed Ultimate System will include a total of 95 stations. Given the Study constraints as explained in Subsection 1.1.3 of this Final Report, the conceptual engineering work presented herein addresses 90 of those stations, as listed in Table 3-2. Five (5) additional Trunkline stations have been assumed in Fulton County in compliance with the conceptual alignment and station location recommendation s set forth by the ARC in the Regional Transportation Plan (RTP)

Table 3-2
Summary of Stations in Cobb County

Element	Elevated	At Grade	Underground	Total
Trunkline	6	2	5	13
Cumberland Circulator	27	7	3	37
Town Center Area Circulator	12	10	1	23
Marietta Branch	2	15	0	17
Total	**47**	**34**	**9**	**90**

3.9.1 The Trunkline.

The Trunkline configuration is shown in Figure 3-3 and the Trunkline stations are listed in Table 3-3 (page 13). A number of alignment alternatives for the placement of the Trunkline along Cobb Parkway were studied, as presented in Appendix 2. The resulting Trunkline location is generally described as follows: it originates at the Chastain Road/I-575 Transfer Station and runs south in the median of I-575, turning westward in a tunnel to the Town Center Mall Transfer Station. It continues in tunnel under Barrett Parkway, coming to grade along the west side of I-75 southward to the Canton Road Connector/SR 5, where it turns west running alongside the roadway where operating connections are provided to access the Central Maintenance and Storage Facility.

The Trunkline, in elevated configuration, then turns south into the Cobb Parkway alignment, where it is joined by the Barrett Parkway extension of the Trunkline (that extension of the Trunkline originates at the intersection of Cobb Parkway and Barrett Parkway, is approximately 3 miles long, and is located in the median of Cobb Parkway. It traverses southward across Bells Ferry Road and connects with the main line of the Trunkline south of Old Canton Road.).

The Trunkline then continues southward in the median of Cobb Parkway in three major design configurations: at-grade trackage, on elevated guideway, and in cut-and-cover tunnel. It crosses over I-285 into the Cumberland Mall/Galleria area, passes under Akers Mill Road, portaling north of Cumberland Boulevard and ascends onto elevated guideway structure traversing the escarpment down to and across the Chattahoochee River into Fulton County, and continues southward to the MARTA Arts Center Station in Midtown Atlanta.

The light rail transit alignment south of the river has not been studied as part of this work scope as explained in Subsection 1.1.3. Its Fulton County length of 10.5 miles, with 5 stations, has been adopted within this Final Report in compliance with the information set forth by the ARC in Regional Transportation Plan.

The Trunkline is approximately 28 miles long, 10.5 miles in Fulton County and 17.5 miles in Cobb County, including the 3-mile Barrett Parkway extension. As explained herein, the Trunkline is proposed to be fully grade-separated. There are 18 Trunkline stations, 5 in Fulton County and 13 in Cobb County. Three transfer stations between the Trunkline and the Cumberland Circulator and three transfer stations between the Trunkline the Town Center Area Circulator are planned. A branch line, as indicated on Figure 3.2, is to be included, providing light rail transit service to the central business district of the city of Marietta.

Finally, Figure 3.3 includes a potential nineteenth Trunkline station, labeled Multimodal Transfer Station, located adjacent to the Old Canton Road and the Georgia Northern Railroad tracks. Provisions would be made for the construction of this Trunkline station if the envisioned commuter railroad service from Canton is implemented, to accommodate passengers wishing to transfer to the Trunkline at that location.

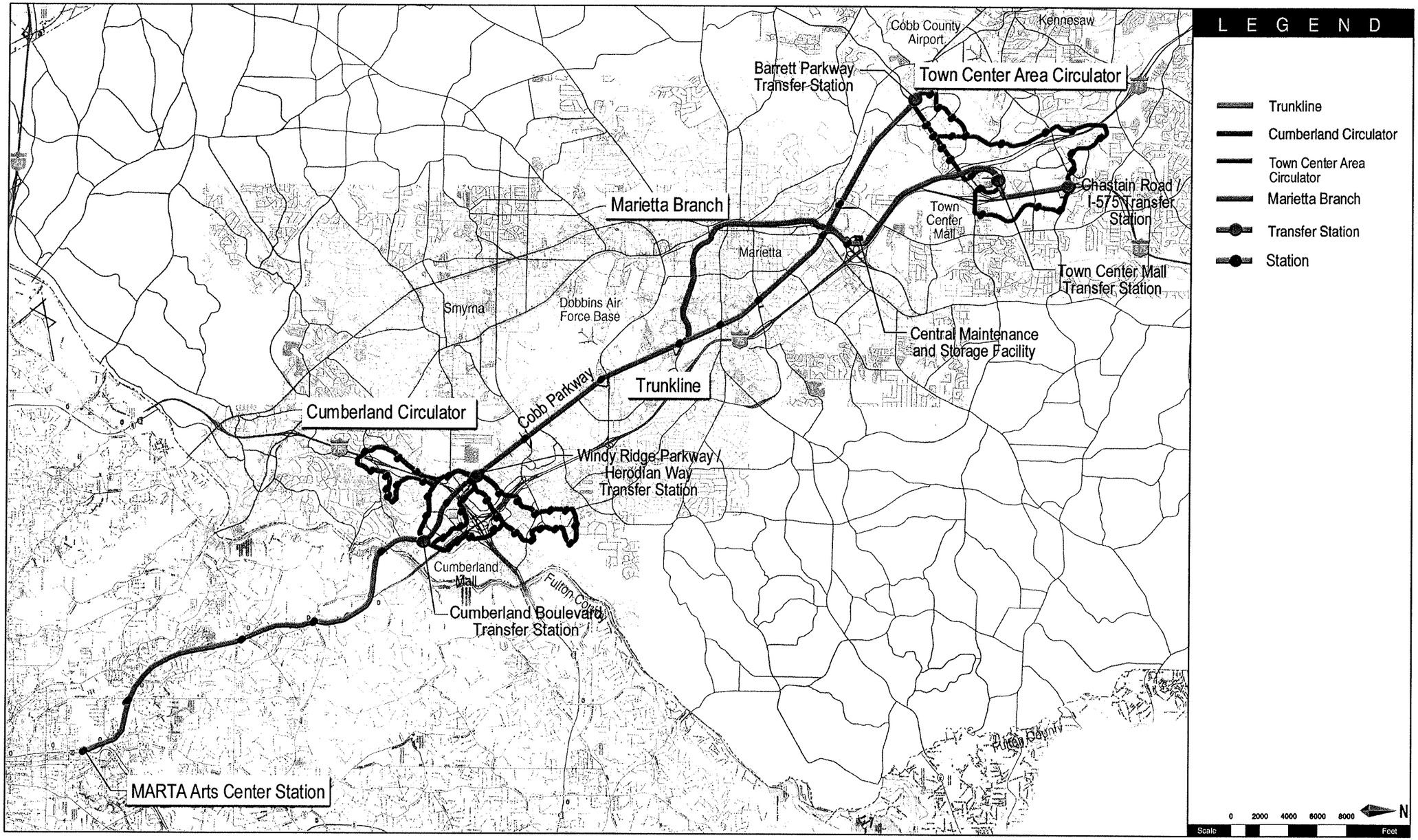

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FIGURE 3-2 PROPOSED ULTIMATE SYSTEM

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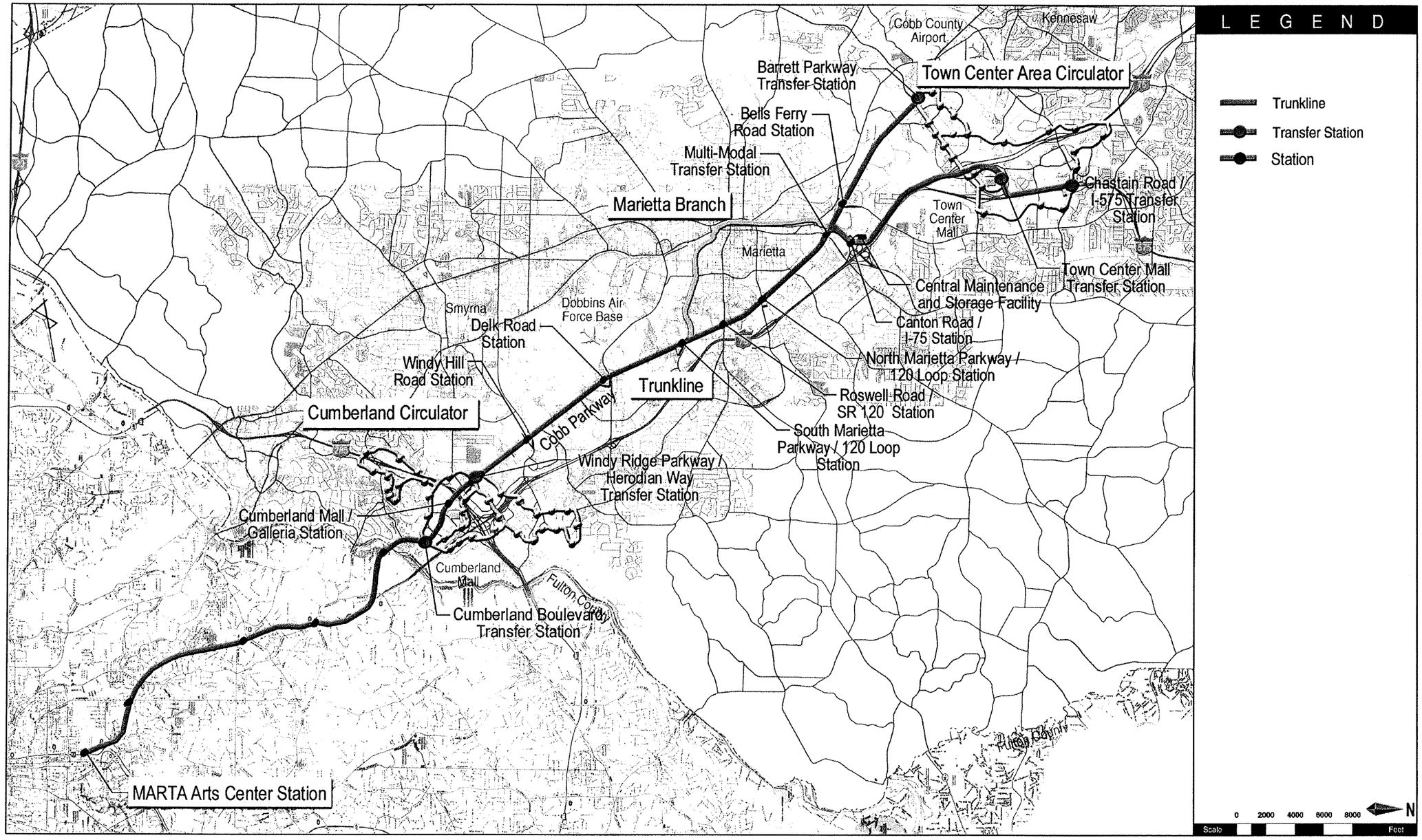

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FIGURE 3-3 TRUNKLINE

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The typical cross-sections shown in Volume II are used in the planning for Trunkline construction, except in the following locations, where special construction is necessary:

- Between the Cumberland Mall/Galleria Station and the Spring Road/Circle North intersection with Cobb Parkway, the Trunkline passes over I-285 at an elevation much higher than the profile of Cobb Parkway requiring special bridge design and construction. Aesthetics should be a prime consideration in this area.
- The turn in the alignment of the main line near the Canton Road Connector/SR 5 intersection (from Cobb Parkway to the east beside the Canton Road Connector/SR 5) is about 3,000 feet long and is in the form of a flyover that passes over Cobb Parkway and the Barrett Parkway branch of the Trunkline, then over the Canton Road Connector/SR 5, and descends to grade near the Central Maintenance and Storage Facility. Generally, it is higher than a standard elevated structure and requires special design.
- The tunnels under I-75 near the I-75/I-575 interchange, and the tunnel under the southbound roadway of I-575 east of the Town Center Mall.

Tail/pocket tracks are provided at the ends of the Trunkline, to provide for train turnaround and storage, and allow for its future extension.

Major reconstruction and modification of Cobb Parkway is required due to planned highway improvements; these can be designed and staged to include construction of the Trunkline. All of this work will need to be coordinated with the Georgia Department of Transportation, the CCDOT, and local municipal and utility agencies.

Table 3-3
Trunkline Stations in Cobb County

Station Name	No.	Stationing	Distance to Next Station Feet	Vertical Position	Platform Type	Station In Roadway Median
Main Trunkline						
Begin Tail Track		99,760	240			
Cumberland Blvd Transfer Station	TL-1	100,000	4,265	Elevated	Side	Yes
Cumberland Mall / Galleria Station	TL-2	104,265	3,525	Elevated	Side	Yes
Windy Ridge Pkwy / Herodian Way Transfer Station	TL-3	107,790	5,970	Underground	2 Center	Under
Windy Hill Road Station	TL-4	113,760	8,175	Underground	Side	Under
Delk Road Station	TL-5	121,935	8,020	Elevated	Side	Yes
South Marietta Pkwy / 120 Loop Station	TL-6	129,955	4,155	Elevated	Side	Yes
Roswell Road / SR 120 Station	TL-7	134,110	4,190	Underground	Side	Under
North Marietta Pkwy / 120 Loop Station	TL-8	138,300	12,000	Underground	Side	Under
Canton Rd / I-75 Station	TL-9	150,300	16,035	At Grade	Side	No
Town Center Mall Transfer Station	TL-10	166,335	7,450	Underground	Center	No
Chastain Road/ I-575 Transfer Station	TL-11	173,785	680	At Grade in I-575 Median	Center	Yes
End Tail Track		174,465				
Length = 74,705 = 14.15 miles						
Extension along Cobb Parkway northward to Barrett Parkway						
Turnout from Main Trunkline		3,000	4,660			
Bells Ferry Road Station	TL-12	7,660	11,510	Elevated	Side	Yes
Barrett Pkwy Transfer Station	TL-13	19,170	680	Elevated	Center	Yes
End Tail Track		19,850				
Length = 16,850 = 3.19 miles						
Total Length of Trunkline in Cobb County = 91,555 = 17.34 miles						

Note #1: As explained in Subsection 1.1.3, Study Constraints, the Bechtel/MSE Study Team did not conduct conceptual engineering studies for the segment of the Trunkline in Fulton County. The information contained within the ARC's Regional Transportation Plan was adopted for the purposes of this Study. That information proposes five (5) Trunkline stations in Fulton County as follows: Atlanta Road, Moores Mill Road, Howell Mill Road, Atlantic Steel, and the Arts Center Transfer station in Midtown Atlanta, which enables passenger transfer between the Trunkline and MARTA. That information also sets forth a Trunkline route length of 10.5 miles in Fulton County. Therefore, this Final Report envisions a Trunkline of approximately 28 total miles in length, with 18 stations.

Note #2: Figure 3.3 includes a potential nineteenth Trunkline station, labeled Multi-Modal Transfer Station located adjacent to the Old Canton Road and the Georgia Northern Railroad line. Provisions would be made in the design of the Trunkline to enable the construction of this Trunkline station if the envisioned commuter railroad service is implemented, to accommodate passenger wishing to transfer to the Trunkline at this location.

3.9.2 The Cumberland Circulator.

The Cumberland Circulator is shown in Figure 3-4; stations are detailed in Table 3-4. It comprises the following three main parts:

- **The Central Loop**, a closed loop encircling the I-75/I-285 interchange, is about 4.4 miles long and includes 11 passenger stations. Starting at the Cumberland Boulevard Transfer Station and, moving counterclockwise, it runs in the median of Cumberland Boulevard, crosses I-75, passes through the Overton area, then under I-285. It runs along Interstate North Circle until it turns to the west along Windy Ridge Parkway, crossing I-75 to Cobb Parkway, where it connects with the Trunkline at the Windy Ridge Parkway/Herodian Way Transfer Station. From there, it continues south along Cumberland Boulevard, crosses I-285 to the Cumberland Mall/CCT Transfer Station, and then continues south and east to the Cumberland Boulevard Transfer Station.
- **The Home Depot Loop**, the southern wing of the Cumberland Circulator, is about 3.9 miles long, with 10 passenger stations. It starts at a junction with the Central Loop and runs west along Spring Hill Road to the Home Depot office complex near West Paces Ferry Road. It crosses under West Paces Ferry Road, then over I-285 and turns east along Cumberland Parkway to the Overlook area. It loops through the Overlook area, then back to Cumberland Parkway, and merges with the Central Loop north of the Cumberland Mall/CCT Transfer Station.
- **The Wildwood Loop**, the northern wing of the Cumberland Circulator, is about 4.5 miles with 12 stations. It starts at Windy Ridge Parkway/Interstate North Circle intersection and runs northeast along Windy Ridge Parkway and Windy Hill Parkway, through the Wildwood area, then turns back southerly along Powers Ferry Road, then west along Interstate North Parkway, crossing over I-75 to Cobb Parkway where it connects with the Trunkline at the Windy Ridge Parkway/Herodian Way Transfer Station. From that point, it continues a short distance along Herodian Way and connects with the Central Loop.

In addition to the above, the Galleria Link connects the southern arc of the Central Loop with its northern arc along an alignment located west of I-75. It is about 1.5 miles long, with four stations. The Galleria Link starts at a junction with the Central Loop east of the Cumberland Boulevard Transfer Station, runs along the Cobb Galleria Parkway, loops around the Galleria Mall, crosses I-285, and connects with the Central Loop at Windy Ridge Parkway a short distance east of the Windy Ridge Parkway/Herodian Way Transfer Station and Cobb Parkway.

Typical guideway sections (see Volume II) are generally applicable to the Cumberland Circulator. However, the five freeway overpass structures require special consideration, due to above-standard heights and long spans.

3.9.3 The Town Center Area Circulator.

This Circulator serves the Town Center Mall and the Town Center Area CID. The Main Loop is about 11 miles long and includes 22 passenger stations. The Barrett Lakes Connector is 0.6 mile long with one intermediate station. The Town Center Circulator is shown in Figure 3-5; stations are detailed in Table 3-5.

The Main Loop starts at the Barrett Parkway Transfer Station and runs east above the median of Barrett Parkway until it crosses over I-75. Then it turns to the north, circles around the Town Center Mall, and returns to Barrett Parkway just west of I-575. After crossing over I-575 on Barrett Parkway, it turns to the north along Chastain Meadows Parkway, then west into Chastain Road to the Chastain Road/I-575 Transfer Station. From this point, it continues west along Chastain Road, Town Park Lane, George Busbee Parkway and Town Green Boulevard to Frey Road where it turns south. Along Frey Road, it passes under I-75 to Kennesaw State University (KSU) and crosses Chastain Road west of I-75. It continues south along Barrett Lakes Boulevard to Cobb Place Boulevard where it turns west to Roberts Boulevard, north to Vaughn Road, west to Cobb Parkway and then south to the Barrett Parkway Transfer Station.

The Barrett Lakes Connector is a short cut along Barrett Lakes Boulevard that links Cobb Place Boulevard with Barrett Parkway, permitting a direct train service to be operated between KSU and the Town Center Mall Transfer Station.

Typical guideway sections (see Volume II) are generally applicable to the Town Center Area Circulator. However, at the Barrett Parkway crossings of I-75 and I-575, the line requires special consideration in treating the existing structures.

3.9.4 The Marietta Branch

Please refer to Section 12, where four potential alignment configurations for the Marietta Branch are presented and evaluated.

3.9.5 The Central Maintenance and Storage Facility

The Central Maintenance and Storage Facility is shown conceptually on drawing no. TL-18 in Volume II. It is situated on a 40± acre site located at the west side of the Canton Road Connector/SR 5 near I-75. The facility is comprised of two components:

- **The Service Building**. The building will be fully equipped to provide inspection, maintenance, and repair for all the Trunkline, Marietta Branch and Circulator vehicles, as well as rail-borne maintenance equipment such as an overhead line car and a ballast tamper.
- **The Storage Yard**. The storage yard will be designed to meet the Ultimate System storage requirements as described in Section 8 but constructed in stages as size of the vehicle fleet increases in conjunction with expansion of the light rail transit system. Equipment and supplies for the infrastructure maintenance operations will be located in this facility.

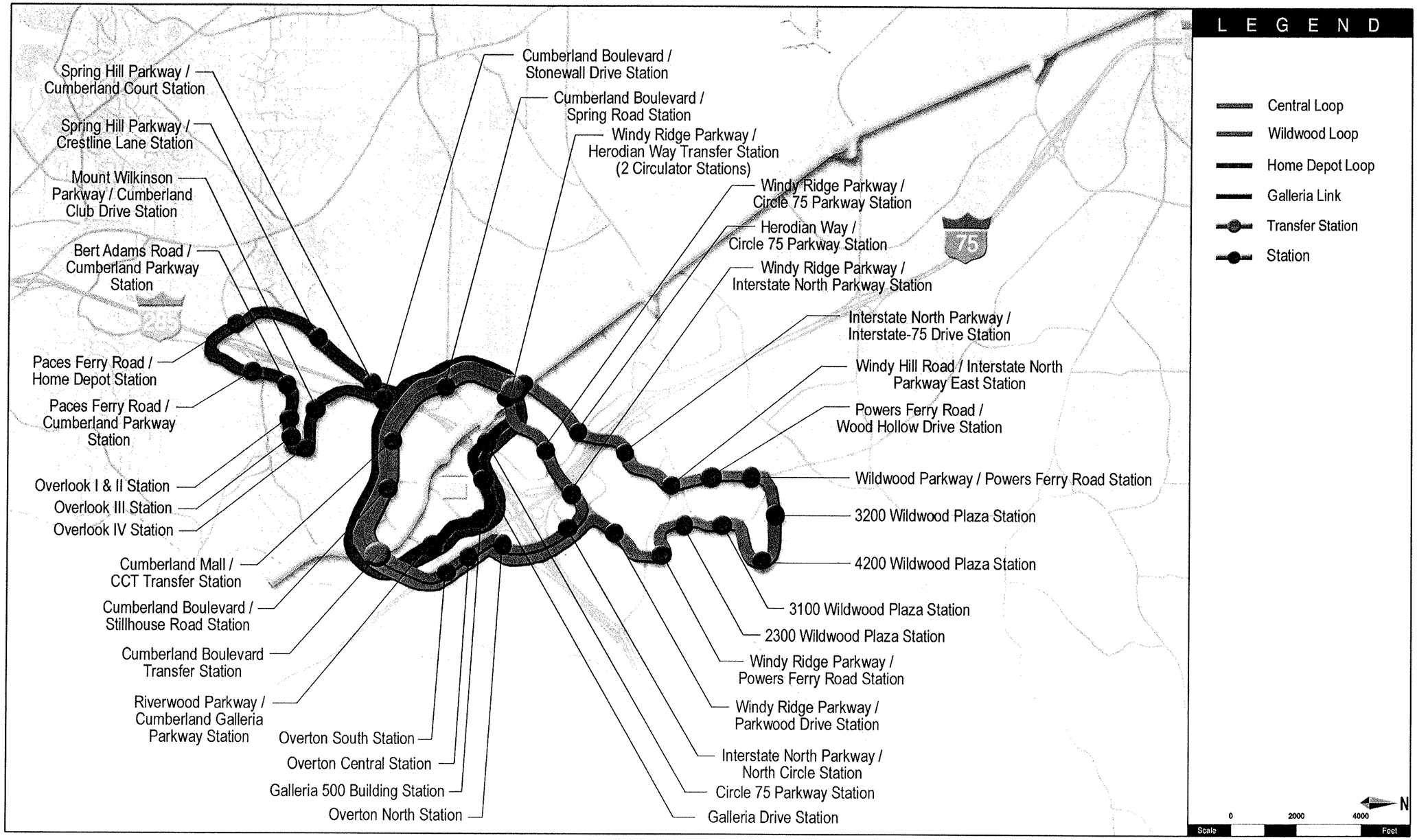

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FIGURE 3-4 CUMBERLAND CIRCULATOR

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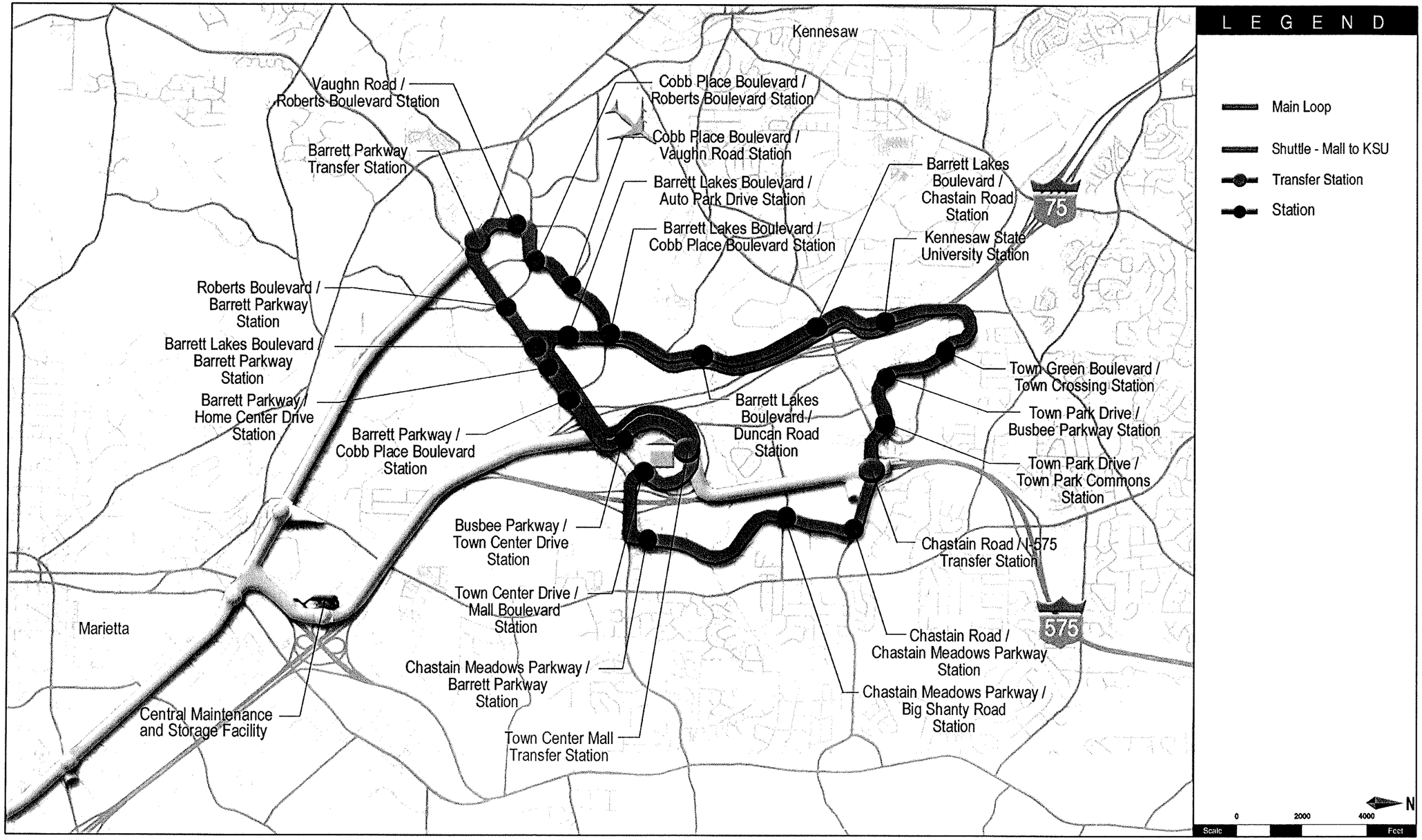

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FIGURE 3-5 TOWN CENTER AREA CIRCULATOR

Transit Implementation Study

Table 3-4
Cumberland Circulator Stations

Station Name	No.	Stationing	Distance to Next Station Ft	Vertical Position	Platform Type	Station in Roadway Median
Central Loop						
Cumberland Blvd Transfer Station	CC-11	0	2,770	Elevated	Center	Yes
Overton South Station	CC-12	2,770	935	Elevated	Side	No
Overton Central Station	CC-13	3,705	1,415	Elevated	Side	No
Overton North Station	CC-14	5,120	2,725	Elevated	Side	No
Interstate North Pkwy / North Circle Station	CC-15	7,845	1,625	Elevated	Side	Yes
Windy Ridge Pkwy / Interstate North Pkwy. Station	CC-16	9,470	1,825	Elevated	Side	Yes
Windy Ridge Pkwy / Circle 75 Pkwy Station	CC-106	11,295	2,485	Elevated	Side	Yes
Windy Ridge Pkwy Transfer Station	CC-105	13,780	2,490	Underground	Side	Under
Cumberland Blvd / Spring Rd Station	CC-29	16,270	2,790	Elevated	Side	Yes
Cumberland Mall / CCT Transfer Station	CC-9	19,060	1,730	Elevated	2 Center	No
Cumberland Blvd / Stillhouse Rd Station	CC-10	20,790	2,485	Elevated	Side	Yes
To Cumberland Blvd Transfer Station	CC-11	23,275				
Length = 23,275 = 4.41 miles						
Home Depot Loop						
From Central Loop		0	2,015			
Spring Hill Pkwy / Cumberland Court Station	CC-30	2,015	2,475	At Grade	Side	Yes
Spring Hill Pkwy / Crestline Lane Station	CC-31	4,490	3,375	At Grade	Side	Yes
Paces Ferry Rd / Home Depot Station	CC-1	7,865	3,115	Underground	Center	Under
Paces Ferry Rd / Cumberland Pkwy Station	CC-2	10,980	1,320	Elevated	Side	Yes
Bert Adams Rd / Cumberland Pkwy Station	CC-3	12,300	1,290	At Grade	Side	Yes
Overlook I & II Station	CC-4	13,590	750	Elevated	Center	No
Overlook III Station	CC-5	14,340	825	Elevated	Center	No
Overlook IV Station	CC-6	15,165	1,630	Elevated	Center	No
Mt. Wilkinson Pkwy / Cumberland Club Dr Station	CC-7	16,795	2,580	Elevated	Center	No
Cumberland Blvd / Stone Wall Dr Station	CC-8	19,375	1,205	Elevated	Side	No
To Central Loop		20,580				
Length = 20,580 = 3.90 miles						
Wildwood Loop						
From Central Loop		0	1,395			
Windy Ridge Pkwy / Parkwood Dr Station	CC-17	1,395	2,100	At Grade	Side – Split	Yes
Windy Ridge Pkwy / Powers Ferry Rd Station	CC-18	3,495	1,665	Elevated	Center	No
2300 Wildwood Plaza Station	CC-19	5,160	1,435	At Grade	Center	No
3100 Wildwood Plaza Station	CC-20	6,595	2,175	At Grade	Center	No
4200 Wildwood Plaza Station	CC-21	8,770	1,955	At Grade	Center	No
3200 Wildwood Plaza Station	CC-22	10,765	1,910	Elevated	Side	Yes
Wildwood Pkwy / Powers Ferry Rd Station	CC-23	12,675	1,425	Elevated	Side	Yes
Powers Ferry Rd / Wood Hollow D. Station	CC-24	14,100	1,355	Elevated	Side	Yes
Windy Hill Rd / Interstate North Pkwy East Station	CC-25	15,455	2,200	Elevated	Center	No
Interstate North Pkwy / Interstate 75 D. Station	CC-26	17,655	1,950	Elevated	Side	Yes
Herodian Way / Circle 75 Pkwy Station	CC-27	19,605	2,580	Elevated	Side	Yes
Herodian Way Transfer Station	CC-28	22,185	1,360	Underground	Side	Under
To Central Loop		23,545				
Length = 23,505 = 4.45 miles						
Galleria Link						
From Central Loop		0	1,445			
Riverwood Pkwy / Cumberland Galleria Pkwy Station	CC-101	1445	1,965	Elevated	Side	Yes
Galleria 500 Building Station	CC-102	3410	1,660	Elevated	Center	No
Galleria Drive Station	CC-103	5070	1,545	Elevated	Center	No
Circle 75 Pkwy Station	CC-104	6615	1,290	Elevated	Side	No
To Central Loop		7905				
Length = 75,265 = 1.49 miles						
Total Length = 14.25 miles						

Table 3-5
Town Center Area CID Circulator Stations

Station Name	No.	Stationing	Distance to Next Station, Ft	Vertical Position	Platform Type	Station in Roadway Median
Main Loop						
Beginning of Town Center Loop		0	550			
Barrett Pkwy Transfer Station	TC-1	550	2,710	Elevated	Center	Yes
Roberts Blvd / Barrett Pkwy Station	TC-2	3,260	1,735	Elevated	Side	Yes
Barrett Lakes Blvd / Barrett Pkwy Station	TC-3	4,995	805	Elevated	Side	Yes
Barrett Parkway/Home Center Drive Station	TC-4	5,800	1,350	Elevated	Side	Yes
Barrett Pkwy / Cobb Place Blvd Station	TC-5	7,150	2,935	Elevated	Side	Yes
Busbee Pkwy / Town Center Dr Station	TC-6	10,085	2,805	Elevated	Side	Yes
Town Center Mall Transfer Station	TC-7	12,890	2,775	Underground	Center	No
Town Center Dr / Mall Blvd Station	TC-8	15,665	3,190	Elevated	Side	Yes
Chastain Meadows Pkwy / Barrett Pkwy Station	TC-9	18,855	5,565	Elevated	Center	Yes
Chastain Meadows Pkwy / Big Shanty Rd Station	TC-10	24,420	2,675	At Grade	Side - Split	Yes
Chastain Rd / Chastain Meadows Pkwy Station	TC-11	27,095	2,145	At Grade	Side	No
Chastain Rd / I-575 Transfer Station	TC-12	29,240	1,950	Elevated	Center	No
Town Park Dr / Town Park Common Station	TC-13	31,190	1,820	At Grade	Side - Split	Yes
Town Park Dr / Busbee Pkwy Station	TC-14	33,010	2,360	At Grade	Side - Split	Yes
Town Green Blvd / Town Crossing Station	TC-15	35,370	5,340	At Grade	Side - Split	Yes
Kennesaw State University Station	TC-16	40,710	2,335	At Grade	Side	No
Barrett Lakes Blvd / Chastain Rd Station	TC-17	43,045	4,300	Elevated	Side	Yes
Barrett Lakes Blvd / Duncan Rd Station	TC-18	47,345	3,465	At Grade	Side	Yes
Barrett Lakes Blvd / Cobb Place Blvd Station	TC-19	50,810	2,340	At Grade	Side	No
Cobb Place Blvd / Vaughn Rd Station	TC-20	53,150	1,445	At Grade	Side - Split	Yes
Cobb Place Blvd / Roberts Blvd Station	TC-21	54,595	1,825	Elevated	Side	Yes
Vaughn Rd / Roberts Blvd Station	TC-22	56,420	1,170	Elevated	Side	Yes
Barrett Parkway Transfer Station	TC-1	57,590		Elevated	Center	Yes
Length = 57,590 = 10.91 miles						
Barrett Lakes Connector						
Turnout from Main Loop		0	1,570			
Barrett Lakes Boulevard / Auto Park Drive	TC-23	1,570	1,685	At Grade	Side	Yes
Connection to Main Loop		3,255				
Length = 3,255 = 0.62 miles						
Total Length = 60,845 = 11.52 miles						

At this stage of the analysis, the following service characteristics appear desirable:

- **Trunkline.** The civil design of the transit guideway and the performance characteristics of the recommended interurban type light rail vehicles will enable maximum speeds of 70 mph with the intention of achieving an average speed of 35 mph, including intermediate station stops. The system will be designed to accommodate train headways as frequent as every 2 minutes; however, the anticipated peak hour boardings for the Trunkline will be accommodated with train frequencies of 4 minutes.
- **Circulators.** The civil design of the Circulator guideways and the performance characteristics of the recommended urban type light rail vehicles will enable maximum speeds of 50 mph, with the intention of achieving an average speed of 20 mph including intermediate station stops. The systems will be designed to accommodate train headways as frequent as every 2 minutes in areas where more than one Circulator service will operate on the same trackage; however, the anticipated peak-hour boardings in areas where only one Circulator service will operate can be accommodated with train frequencies of 6 minutes on each service.

The physical properties of the light rail transit system are summarized in Table 3-6.

Table 3-6
Physical Properties of the Northwest Corridor LRT System within Cobb County

System Element/ Characteristics	Trunkline		Cumberland Circulator		Town Center Area Circulator	
	Distance	Percentage	Distance	Percentage	Distance	Percentage
Length in Miles	17.34	100.00	14.25	100.00	11.52	100.00
At Grade	3.98	22.95	2.55	17.89	6.28	54.51
Retained Fill	2.81	16.21	0.68	4.77	0.28	2.43
Retained Cut	0.93	5.36	0.62	4.35	0.14	1.22
Open Cut	0.87	5.02	-0-	N/A	-0-	N/A
Elevated Structure	6.30	36.33	10.07	70.67	4.35	37.76
Cut-and-Cover Tunnel	2.27	13.09	0.33	2.32	0.47	4.08
Bored Tunnel	0.18	1.04	-0-	N/A	-0-	N/A
Number of Stations	13		37		23	
Average Distance Between Stations	1.35 Miles		0.40 Miles		0.52 Miles	
Length of Station Platforms - Initial	270 Feet		100 Feet		100 Feet	
Length of Station Platforms - Future	360 Feet		100 Feet		100 Feet	
Width of Station Platforms - Center	30 Feet		27.5 Feet		27.5 Feet	
Width of Station Platforms - Side	12 Feet		10 Feet		10 Feet	
Maximum Grade - Desired	5%		8%		8%	
Maximum Grade - Difficult Terrain	8%		10%		10%	
Minimum Curve Radius - Desired	150 Feet		100 Feet		100 Feet	
Minimum Curve Radius - Absolute	100 Feet		82 Feet		82 Feet	
Traction Power	750 Volts DC		750 Volts DC		750 Volts DC	
Track Gauge	4 Feet, 8 1/2 Inches		4 Feet, 8 1/2 Inches		4 Feet, 8 1/2 Inches	

Patronage forecasts and regional and local transportation impacts have been developed for three alternative transit systems, with particular emphasis on the proposed Northwest Corridor Light Rail Transit (LRT) System. This information is presented within the framework of the guidance provided by the Federal Transit Administration (FTA) for fixed guideway transit studies; definition of Build, Transportation System Management (TSM), and No-Build Alternatives; and the transportation model used to develop forecasts.

The following analysis addresses the fixed guideway transit corridor presented in Section 3, connecting the Town Center Area and Cumberland CIDs within Cobb County, with service south into Fulton County, including the corridor from Cumberland south to the Metropolitan Atlanta Rapid Transit Authority (MARTA) Arts Center Station. The inclusion of service to Fulton County is essential to the viability of forecasting transit patronage for the proposed Ultimate System.

4.1 FEDERAL TRANSIT ADMINISTRATION GUIDANCE

The Study was conducted with the intention of preparing for federal funding eligibility. Although the current RTP calls for this project to be funded using federal flexed funds from highways, particular attention is paid to the "New Starts[1]" funding program and specific systems planning requirements mandated by the FTA. At this stage in this process, it is felt important to take all necessary steps to qualify for the New Starts funding program as well as flexible federal funding, for maximum flexibility. The Study compares the Build Alternative with two other, less capital-intensive future alternatives, the TSM and No-Build alternatives. Each of these alternatives represents potential investments in Cobb County and regional transit systems; each is defined in a format consistent with the direction and definitions provided by the FTA.

The definition of the alternatives and the technical methods used to forecast results is considered a "Pre-Alternatives Analysis" for the portion of the transit system and corridor which is within Cobb County. The intent is to further refine the alternatives during the next step of the project's implementation. The formal federal "Alternatives Analysis" will be conducted for the entire project corridor, from Arts Center to Town Center.

The FTA has established an evolving process for assisting local agencies in evaluating projects that may become eligible for Major Transit Capital Investments (New Starts)[2]. The project evaluation criteria include two categories:

- Project Justification
- Local Financial Commitment

This Section contains information relevant to the project justification criteria. Section 10 of this report addresses the local financial commitment criteria.

4.1.1 Goals and Objectives for Transportation Improvements

This Study has evolved from a comprehensive local transportation planning process. First, the Draft Cobb County Comprehensive Transportation Plan evaluated the proposed transit system projects and recommended their inclusion in the Regional Transportation Plan (RTP) Update developed by the Atlanta Regional Commission (ARC). As part of the RTP update, the Cobb County transit projects were further evaluated against the goals, objectives, and performance measures of the entire Regional Transportation Plan. As part of the Cobb Parkway/I-75 corridor area, the proposed Trunkline LRT system and Cumberland Circulator were found to meet the regional transportation goals, objectives, and specified performance measures.

The evaluation now takes the next step in project development by beginning to apply the federal evaluation criteria to prepare the Study for the project's justification and to meet local financial commitment criteria.

4.1.2 Project Justification Criteria

For evaluation, the FTA New Starts program requires project justification criteria and data worksheets for specified evaluation measures summarized in Table 4-1. In order to prepare these project evaluation worksheets, the evaluation must be based on a comparison of a defined Build Alternative with two other baselines, namely the TSM and No-Build Alternatives.

Table 4-1
FTA New Starts Information Guidance
Evaluation Measures for New Start Projects

Reporting Item
General
Project Description Worksheet
Project Maps
Certification of Technical Assumptions
Mobility Improvements
Travel Time Savings Worksheet
Low Income Households Served Worksheet
Environmental Benefits
Change in Criteria Pollutant and Precursor Emissions Worksheet
Change in Criteria Pollutant and Precursor Emissions Supplemental Worksheet
Change in Greenhouse Gas Emissions Worksheet
Change in Regional Energy Consumption Worksheet
Current Regional Air Quality Designation
Operating Efficiencies
Change in Operating Cost per Passenger Mile Worksheet
Cost Effectiveness
Incremental Cost per Incremental Passenger Worksheet
Incremental Cost per Incremental Passenger Supplemental Worksheet
Other Factors
Other Factors, as appropriate
Transit Supportive Existing Land Use and Future Patterns
Land Use Documentation and Supporting Information
Quantitative Land Use Data Worksheet
Additional Supporting Documentation
Local Financial Commitment
Project Finance Worksheet
Additional Supporting Documentation

[1] Federal Transit Administration, Technical Guidance on Section 5309 New Starts Criteria, July 2000.

2 Federal Transit Administration. Federal Register: December 7, 2000 (Volume 65, Number 236) Federal Register Notice Pages, 76863-76884, Major Capital Investment Projects, Final Rule.]

The FTA requirements for the Study alternatives are[3]:

- Assume identical highway and transit networks outside the corridor for the No-Build, the TSM, and the Build Alternatives, for the travel demand forecasts
- Define the Build Alternative as the project for which FTA New Starts funding is sought
- Develop ridership forecasts for the New Starts project that are based on the same set of growth forecasts and land use assumptions that are used for the No-Build and TSM alternatives
- Allocate the population and employment growth on the basis of locally-adopted land use plans
- Analyze all of the Alternatives within the same basic policy setting, (i.e., use the same model assumptions, parameters, and inputs for all alternatives, except for changes in the transportation network or other data that are directly attributable to each alternative.)
- Report the New Starts criteria and specific measures only for the Section 5309 New Starts transit investment and not for the complete build alternative.

Applying these FTA guidelines, the Team defined the three alternatives, developed ridership forecasts based on regional growth plans, analyzed the results using consistent methods, and prepared the results presented in this Final Report.

4.1.3 Organizing Technical Data

The forecasts and data in this Study comprise a beginning database of technical information necessary to complete the FTA project justification and local financial commitment worksheets. The information also feeds a number of other Study objectives, including physical planning, conceptual engineering, revenue forecasting, technology assessment, and operations planning.

4.1.4 Meeting Federal Requirements

The technical information in this Study, while extensive, is incomplete until study of the portion of the proposed light rail transit system from the south Cobb County line (the Chattahoochee River) to the Arts Center in midtown Atlanta is completed to the same level of detail. The Build, TSM, and No-Build Alternatives, as prepared in this Study, will offer a starting point for completion of the whole corridor assessment, during the formal Alternatives Analysis to follow in the next steps of implementation.

4.2 STUDY ALTERNATIVES

A series of meetings was held in November 1999, with participation of the consultants and staff from Cobb County Department of Transportation, and Cobb Community Transit. The Team evaluated basic assumptions, transit network and service features, and other issues related to defining three transit system alternatives. The Build and TSM Alternatives and the ongoing conceptual engineering for the fixed guideway system were influenced significantly by work prepared for the recent Draft Cobb County Comprehensive Transportation Plan. The three alternatives – the Build, TSM, and No-Build Alternatives, are discussed in the following subsections.

4.2.1 Transit System Assumptions – Build Alternative

Within Cobb County, the Build Alternative is the closest match to the RTP, but with some differences in the stations, alignments, and service frequency. The Build Alternative represents an Ultimate System of high-investment transit facilities and services, comprised of light rail transit, buses, and park-and-ride facilities. It is consistent with the multi-modal focus implicit in the RTP and with recent Cobb County comprehensive transportation planning.

As input to the Build Alternative, the Bechtel/MSE Team prepared preliminary functional objectives and performance characteristics for fixed guideway systems for Cobb County (see Section 3), each of which, to the extent possible, were addressed in the preparation of the model representation of the Build Alternative, depicted in Figure 4-1.

The Build Alternative represents the planned future transit systems:

- **The Regional Transportation System.** The Build Alternative and all other alternatives considered in this Study represent future transportation systems as proposed in the RTP. The Build Alternative includes expansion of HOV lanes throughout the region, and along the entire length of I-75 in Cobb County; development of a mature rail network including MARTA extensions, commuter rail, and LRT systems; expansion of bus service throughout the region and to suburban counties; and expansion of park-and-ride facilities and transfer stations.
- **Northwest Corridor LRT System.** The Build Alternative includes a Trunkline light rail transit system, as proposed in the RTP, with differences in alignment, stations, service frequency, and technology. In addition, there would be two fixed-guideway circulators: the Cumberland Circulator and the Town Center Area Circulator (the RTP plans for the Cumberland Circulator by year 2010). The Build Alternative is, however, based on the RTP proposed transit system, with the Trunkline serving the travel market from the Town Center Area south to the MARTA Arts Center Station in Midtown Atlanta. The two area circulators would have transfer stations at key stations along the Trunkline LRT system, and would be served by bus transit services.
- **Express Bus System.** The Build Alternative reduces the RTP's express bus system. Given the high investment in the proposed Trunkline fixed guideway system, express buses running along I-75 using the planned HOV lanes to downtown Atlanta would be replaced by the Trunkline light rail transit service, which would provide a higher level of frequency and reduces travel time to Midtown Atlanta. However, two express bus services in the corridor would be maintained in the Build Alternative; a Cherokee County express bus service to the north terminal station at Chastain Road; and express bus service serving the east-west corridor connecting Lawrenceville to Marietta. This east-west corridor is currently under separate study for consideration of future light rail transit service. However, since it is not included in the RTP, an express bus service is assumed in the Build Alternative.
- **Local Bus System.** The Build Alternative provides for a countywide expansion of the Cobb Community Transit System, with service to virtually all population and employment areas in the County, and along all major travel corridors. The expanded countywide bus system would link east-west service, with planned transfer stations along the north south Trunkline light rail transit system. If the local bus service were customized to provide a high and accessible level of service, a portion of the travel market would use the bus service for access to the connecting rail service.
- **Park-and-Ride/Multimodal Stations.** The Build Alternative would provide park-and-ride (PNR) and multimodal station transfer facilities. The PNR facilities would be located throughout the County, at major highway intersections and key city locations. The multimodal stations would be located at stations along the Trunkline.

[3] Technical Guidance on Section 5309, page 31, July 2000.

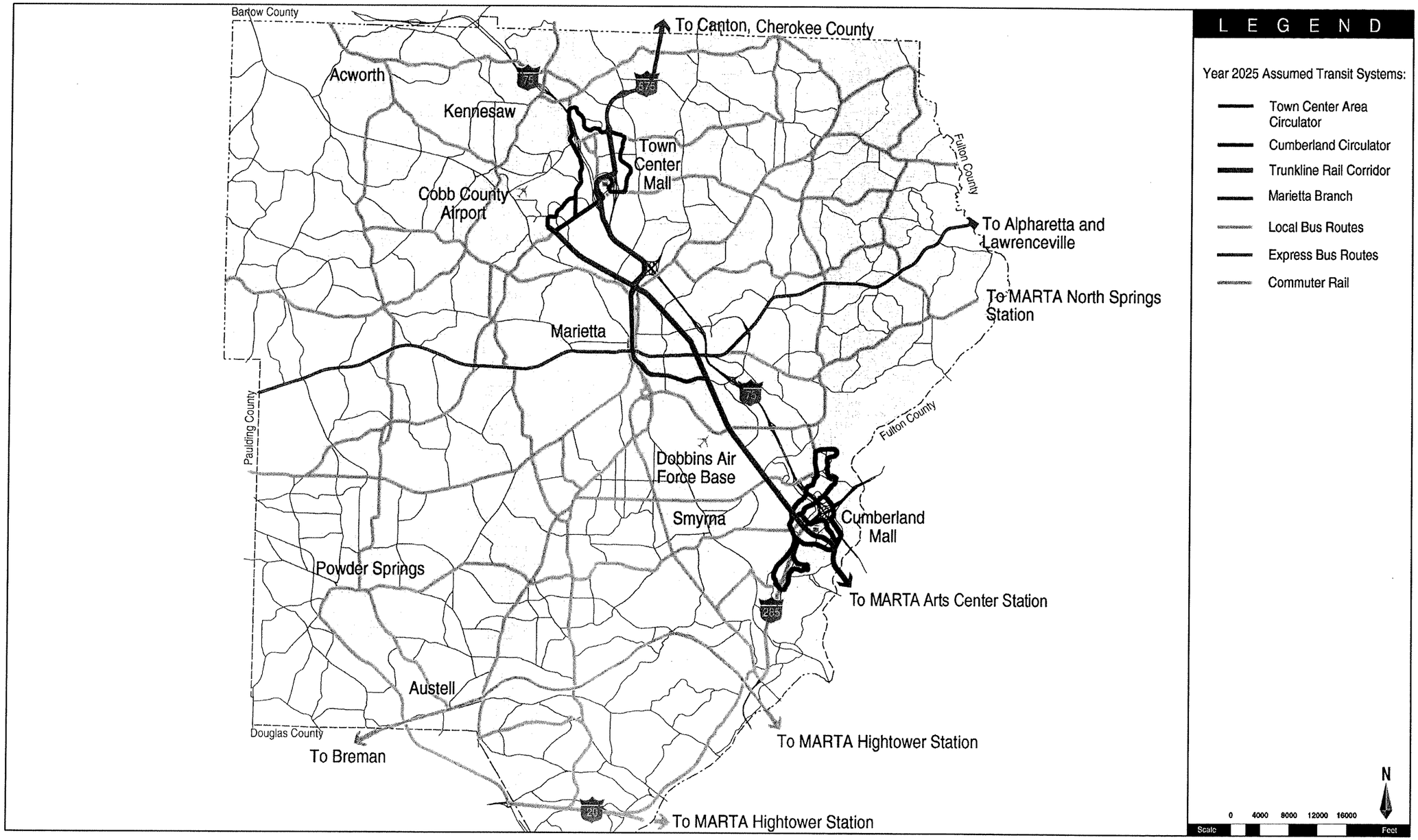

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FIGURE 4-1 BUILD ALTERNATIVE FOR COBB COUNTY

Transit Implementation Study

4.2.2 Transit System Assumptions – TSM Alternative

The TSM Alternative is a midlevel investment transit system and is less capital-intensive than the Build Alternative. It replaces the Build Alternative's proposed light rail transit system along the Cobb Parkway corridor with express buses and park-and-ride facilities. The TSM Alternative is basically like the Build Alternative, except that it omits the fixed guideway systems and expands the express bus service.

The TSM Alternative depicted in Figure 4-2 within Cobb County, represents the following planned future transit systems:

- **The Regional Transportation System.** The TSM Alternative outside Cobb County is the same as described above for the Build Alternative.
- **Northwest Corridor LRT System.** The TSM Alternative has no fixed guideway transit systems along the Cobb Parkway corridor between the Town Center and Arts Center, and no fixed guideway transit system within the Cumberland and Town Center Area CIDs.
- **Express Bus System.** The TSM Alternative replaces the proposed fixed guideway rail system in the Build Alternative with Express buses running along I-75, taking advantage of the planned HOV lanes to downtown and Midtown Atlanta. Express bus services include a Cherokee County express bus service to the Town Center Mall area, with a connecting service to Atlanta. Express bus service is also provided linking the Marietta Transfer Center and the Cumberland Transfer Center with Midtown Atlanta. As with the Build Alternative, the TSM Alternative has express bus service connecting Marietta and Lawrenceville.
- **Local Bus System**. The TSM Alternative is identical to that described under the Build Alternative, however, linking the express bus service rather than the fixed guideway service.
- **Park-and-Ride/Multimodal Stations.** The TSM Alternative is identical to the Build Alternative, linking the express bus service rather than the fixed guideway service.

4.2.3 Transit System Assumptions – No-Build Alternative

The No-Build Alternative is a low-level investment transit system, relying mostly on expansion of the current Cobb Community Transit bus service. The No-Build Alternative is much less capital-intensive than that proposed for Cobb County in the RTP.

Some corridor studies assume, in the No-Build Alternative, that the existing transit system will continue in the future. For this Study, however, the No-Build Alternative expands on the current CCT service in order to accommodate projected growth in population and employment in Cobb County.

The No-Build Alternative depicted in Figure 4-3 within Cobb County, represents the following planned future transit systems:

- **The Regional Transportation System.** The No-Build Alternative outside Cobb County is the same as described above for the Build Alternative.
- **Northwest Corridor LRT System.** The No-Build Alternative assumes no fixed-guideway transit systems in Cobb County and no fixed-guideway transit systems within the Cumberland and Town Center Area CIDs.
- **Express Bus System.** The No-Build Alternative replaces the proposed fixed guideway transit system in the Build Alternative with express bus service. Existing express bus service, running along I-75, would take advantage of the planned HOV lanes to downtown and Midtown Atlanta. The express routes would also extend new Cobb County direct service and connections to MARTA stations at Six Flags, North Springs, Arts Center and Dunwoody. Express bus services also include a Cherokee County express bus service to the Town Center Mall area, with a connecting service to Atlanta. Express bus service is also provided, linking the Marietta Transfer Center, the Cumberland Transfer Center, and Midtown Atlanta.
- **Local Bus System.** This is considered a strategic expansion of the current CCT bus system. New express and local service is added to reinforce the basic CCT system. In contrast to the local system proposed for the Build and TSM Alternatives, the No-Build Alternative provides direct service to locations outside the County (rather than transfers to a high frequency north-south corridor service provided by rail or express buses). Within the County, new local service remains oriented to connections to/from the existing Marietta Bus Transfer Center and the Cumberland Bus Transfer Center.
- **Park-and-Ride/Multimodal Stations.** The No-Build Alternative adds no new PNR or Multimodal Station facilities, but expands the current facilities to accommodate more bus transfer activity.

4.2.4 Summary Comparison of Study Alternatives

Table 4-2 summarizes the three Study alternatives.

The Build Alternative would provide the highest level of service frequency and capacity in the highly congested Cobb Parkway and I-75 north-south travel corridors. The local bus system serving countywide and connecting services to the Northwest Corridor LRT System assumed in the Build Alternative, and connecting to Express Bus services in the I-75 corridor in the TSM Alternative, is identical. Also, the number of new PNR facilities is identical between the Build and TSM Alternatives.

In the No-Build Alternative, there is significant difference in the transit systems for Cobb County, in terms of routes, markets served, capacity and frequency of service. The No-Build Alternative represents a strategic expansion of existing bus service to serve markets with a high potential number of transit users (based on current trends in travel demand).

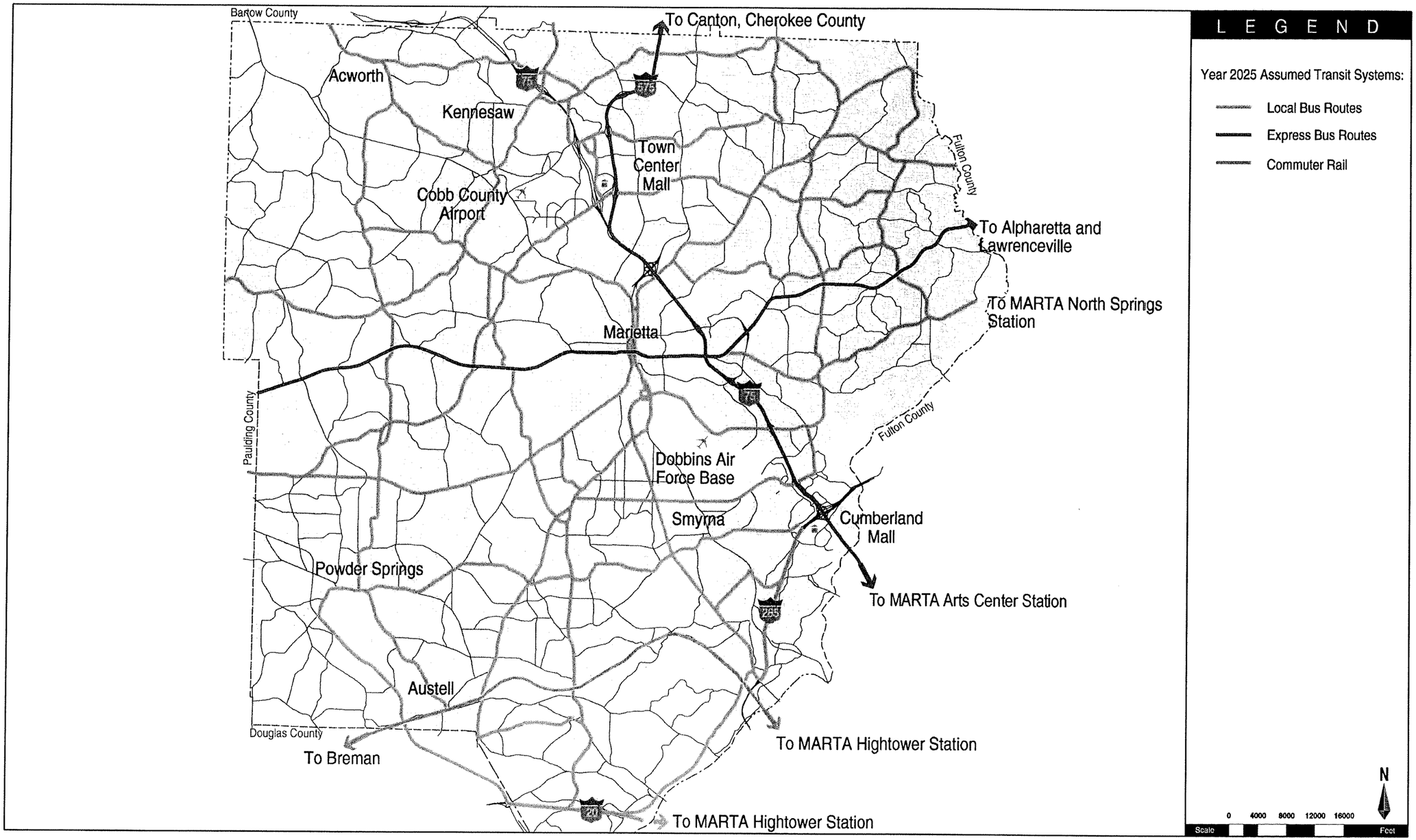

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FIGURE 4-2 TSM ALTERNATIVE FOR COBB COUNTY

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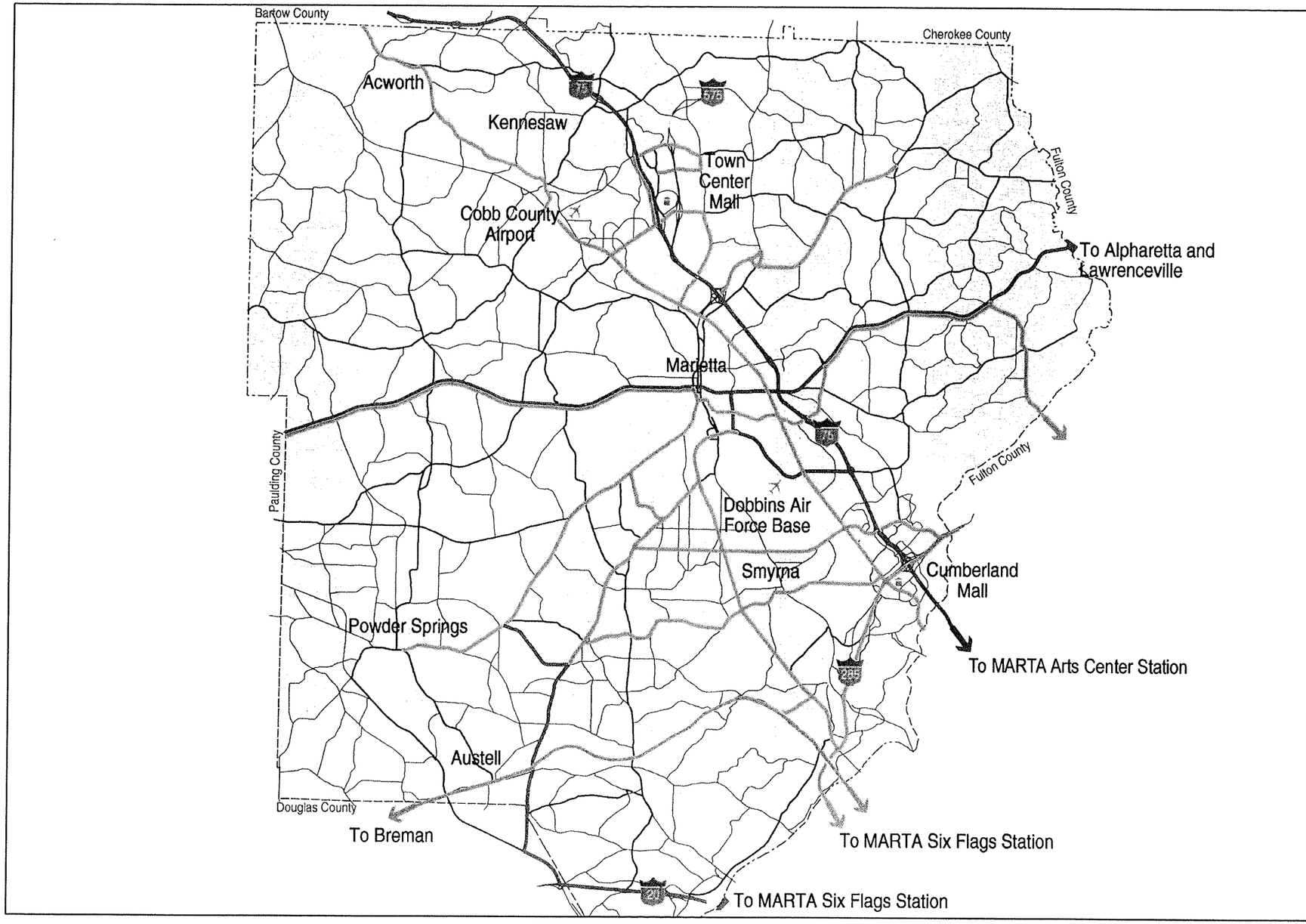

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FIGURE 4-3 NO BUILD ALTERNATIVE FOR COBB COUNTY

Transit Implementation Study

Table 4-2
Summary Comparison of Study Alternatives

System Elements	Build Alternative	TSM Alternative	No-Build Alternative
Regional Transportation Network Outside Cobb County	▪ Same in all Three Alternatives ▪ RTP network of highway, HOV lanes, Commuter and Heavy Rail, Light Rail and bus system expansion	▪ Same in all Three Alternatives ▪ RTP network of highway, HOV lanes, Commuter and Heavy Rail, Light Rail and bus system expansion	▪ Same in all Three Alternatives ▪ RTP network of highway, HOV lanes, Commuter and Heavy Rail, Light Rail, and bus system expansion
New Fixed Guideway Transit Systems serving Cobb County	▪ Trunkline Light Rail Transit system extending two branches from Chastain Road/I-575 and Barrett Parkway to Arts Center, Atlanta with 18 stations, 27.30 miles in length, providing two 8- minute service frequency, yielding a 4- minute service (15 Trains per hour) from North Marietta Parkway/Loop 120 to Arts Center, Atlanta ▪ Cumberland Circulator – 37 stations and 14.25 miles in length, at 6-minute service frequencies in peak periods; 7.5 to 15 minutes at other times ▪ Town Center Circulator – 23 stations and 11.52 miles in length, at 6-minute service frequencies in peak periods; 7.5 to 15 minutes at other times	▪ No Fixed Guideway Transit Systems assumed for Cobb County	▪ No Fixed Guideway Transit Systems assumed for Cobb County
Express Bus Services Serving Cobb County	▪ Two (2) Express Bus services: North-South service connecting Cobb County to Cherokee County, and East-West service connecting from West Cobb to Lawrenceville in Glint County ▪ Service with 12 to 30 minute frequency	▪ Four (4) bi-directional Express Bus connecting services: including Build Alternative services, plus I-75 service from Town Center to Arts Center, and connecting service from Marietta and Cumberland Transfer Centers, to Mid-Town Atlanta ▪ Service with 12 to 30 minute frequency	▪ Ten (10) directional peak period market-specific and connecting services, including connections to MARTA at Arts Center, North Springs, Six Flags, and Dunwoody stations, with transfer stations at Marietta and Cumberland Transit Centers ▪ Service with 15 to 30 minute frequency
Local Bus Services in Cobb County	▪ Nineteen (19) Local Bus lines extending service countywide and serving all major population and employment areas ▪ Service oriented to feed Trunkline rail stations with 15 to 30 minute frequency	▪ Nineteen (19) Local Bus lines extending service countywide and serving all major population and employment areas ▪ Service with 15 to 30 minute frequency	▪ Nine (9) local bus lines with 15 to 30 minute frequency ▪ Eight (8) new local bus lines with 15 to 30 minute frequency
Park-and-Ride and Multimodal Station Facilities in Cobb County	▪ Eight (8) new PNR facilities away from Northwest LRT System corridor ▪ Multimodal and PNR facilities at virtually all 17 Trunkline rail stations	▪ Eight (8) new PNR facilities away from Trunkline Rail and fixed guideway corridor (same locations as in the Build Alternative).	▪ No new PNR facilities, retains existing Marietta and Cumberland Bus Transit Centers.

4.3 STUDY FORECASTING METHODOLOGY

The preparation of travel demand forecasts using the Cobb County Transportation Model (CCTM) involved extensive cooperation and coordination between the ARC staff, the Cobb County Department of Transportation staff, and the Bechtel/MSE Team. The results are considered the most reliable to date for the proposed Northwest Corridor LRT System.

4.3.1 Description of Cobb County Transportation Model (CCTM)

The CCTM was created as part of the Draft Cobb County Comprehensive Transportation Plan, conducted between 1998 and 1999. The CCTM was used to prepare travel demand forecasts for the proposed Cobb County transportation improvements, and these forecasts are the beginning point of reference in this Study.

The CCTM is based on the ARC regional model and applied to Cobb County with increased emphasis on local transportation issues. In the travel demand-modeling vernacular, the CCTM is considered a "focused" version of the ARC model.

Both the ARC model and the CCTM divide the Region and County into geographic areas called Transportation Analysis Zones (TAZ). In the CCTM used for this Study, the number of TAZs within Cobb County is significantly greater than in the ARC model. This allows for better detailing of the network of roadways and transit services within Cobb County. As a result, the CCTM is used for transportation system and project planning, addressing transportation infrastructure within Cobb County.

The modeling steps and inputs used in the application of the CCTM are basically similar to those used in the ARC application. The Cobb County staff coordinated with ARC concerning technical modeling issues, ensuring that inputs and results of the models are generally consistent.

The use of the CCTM to develop travel demand and transit patronage forecasts for this Study is consistent with FTA requirements. Additional information regarding use of the CCTM in this study is provided in Appendices A-1 and A-3. Information on FTA evaluation measures is provided in Appendix A-4.

4.3.2 Consistency with ARC and RTP Forecasts

Preparation of the CCTM for application to this Study occurred in parallel with the ARC's work on the Regional Transportation Plan (RTP) update. Therefore, the following efforts were made to assure consistency in network assumptions, modeling inputs, and procedures:

1. The ARC model representation of the regional network outside of Cobb County is identical to the CCTM model network in the Build, TSM, and No-Build Alternatives.
2. Socio-economic forecasts for the CCTM year 2025 are derived from the RTP projections.
3. Other model input parameters and procedures are consistent.

Important input parameters for the CCTM include fare matrices, transit path-building parameters, network speeds, and percent of zone within walking access to transit. These inputs directly affect the mode choice model results.

Appendix 3 contains a more detailed discussion of the transportation modeling techniques used for this Study.

4.3.3 Socioeconomic Forecasts, Year 2025

In early November 1999, ARC provided the Team with year 2025 demographic projections based on ARC's regional demographic model. The demographic projection model takes into account the future transportation network as one input in a "top-down" allocation of regional growth. The projections take into account the areas of the region that will have a functional transportation system and reasonable accessibility to activity centers share an advantage and will grow faster than other areas lacking these conditions. The results of the ARC demographic model are projections of population, households and employment by category for all transportation analysis zones in the Atlanta Region.

The data received from ARC was distributed within Cobb County from the ARC zones to the more detailed CCTM zones. Then three sets of travel demand forecasts were prepared, using the socio-economic projections as follows:

1. The RTP 2025 socioeconomic projections were used directly for a set of year 2025 travel demand forecasts (see the Work Element 2 report).

2. Based on a land use and development inventory within the Cumberland and Town Center Area CIDs, the Team prepared a revised set of year 2025 socioeconomic projections (see Section 2). These were used to forecast the final set of year 2025 travel demand forecasts for the project alternatives. The revised year 2025 socioeconomic projections were allocated to further detailed-CCTM zones.

These socioeconomic projections are a primary input to each travel demand forecast.

4.3.4 Network Coding for Study Alternatives

The transportation modeling involved extensive network preparation of the three Study alternatives. Within the transportation modeling software capabilities, each alternative network was "coded" to reflect the transit service characteristics: drive and walk access connectivity, transfer stations, and objective travel times. Each alternative started from the same background regional transit networks and only varied within Cobb County, as previously explained.

Also for each alternative, the same regional and local highway network was used as an input to each transit forecast.

4.3.5 Post-Processing Study Results

The analysis of the travel demand forecasts includes an effort to "post-process" the forecast outputs. The basic outputs of a travel demand forecast include mode specific trip-tables, travel time and distance matrices, and "loaded" networks indicating the number of vehicles and transit riders on each segment of the transportation network.

The post-processing includes peak and weekday summaries, district level summaries of transit trips and mode share, systemwide and selected-link outputs, and summaries of the highway system. These results are presented below.

4.3.6 Presentation of the CCTM Results

The results of applying the CCTM to the Build, TSM, and No-Build transportation alternatives are presented in the following order:

- Cobb County and corridor transit patronage
- Systemwide transit patronage forecasts
- Systemwide and corridor roadway forecasts
- Transportation impacts

4.4 COBB COUNTY AND CORRIDOR TRANSIT PATRONAGE SUMMARY

This Section presents transit patronage for the Cobb County area and corridor, including weekday and peak period transit boarding on transit lines, station access and parking demand at transit stations, transfers at transit stations, and select link analysis for Trunkline rail segments.

4.4.1 Comparative Forecast Results

The Team prepared a number of alternative patronage forecasts used in preparing the NW Corridor LRT System components. These forecasts are used in the analysis of the three planning alternatives discussed in this section, input to the systems operations presented in Section 8, input to the capital and operating costs presented in Section 9, and the analysis of phasing options as presented in Section 11.

All Study forecasts are based on adjusted Cobb County year 2025 socioeconomic growth projections of population, household distribution, and employment, as discussed in Section 2. These are not the official ARC-approved regional growth projections; rather, they are adjusted to include growth potential not in the ARC projections, derived from a detailed inventory of existing and future land use plans within the Cumberland and Town Center Area CIDs. Meetings have been held with ARC and Cobb County planners to review these Study adjusted growth projections and to discuss the process for integrating this new information into the next RTP update and regional growth projection to be prepared by ARC.

An evaluation was prepared comparing the ARC and Study growth projection's impact on transit patronage forecast results, using the Ultimate System network, which is the Build Alternative as described above and presented in the analysis below.

Table 4-3 presents the results of comparing these forecasts, showing weekday transit boarding on the planned LRT systems within Cobb County, for the Ultimate System, using ARC growth projection and the Study adjusted growth projection, both for year 2025. The table also includes for information purpose, the official RTP forecast prepared by ARC, which can be described as only a partial representation of these same LRT components as refined in this Study.

Table 4-3
Comparative Study Forecasts
Weekday Transit Boardings, Year 2025

	Weekday Boarding			
	Trunkline	Cumberland Circulator	Town Center Circulator	Total
Study Forecasts				
Ultimate System, ARC Projected 2025 Growth & Distribution within Cobb County	61,300	29,000	10,100	100,400
Ultimate System, Study Adjusted 2025 Growth & Distribution within Cobb County	77,000	57,100	16,000	150,100
% Increase Using Study Adjusted Growth over ARC Growth within Cobb County	20%	49%	37%	33%
ARC Forecast				
Regional Transportation Plan, ARC Projected 2025 Growth & Distribution within Cobb County	52,300	18,800		71,100

Note: Transit Boarding Volumes rounded to nearest 100.

The comparative patronage forecast results indicate the following:

- Overall the adjusted growth projections used in this Study for the Ultimate System, would yield 33 percent more transit patronage combined for the Trunkline, Cumberland and Town Center Circulators, than forecasts using the ARC growth projection. The results would vary across the LRT system components, showing the Trunkline (20%), Cumberland Circulator (49%) and Town Center Circulator (37%), with different increases in patronage, under the Study year 2025 growth projection.
- These patronage results correspond to the Study adjustments made to year 2025 growth projections, generally representing a shift from other areas within Cobb County and increase of growth within the Cumberland and Town Center CIDs. The resulting increase in patronage under the Study adjusted year 2025 growth projection within Cobb County, for the circulators and Trunkline is significant; and represent what is considered in this Study, a sound basis for development of the system requirements.
- The weekday patronage forecasts for the Trunkline, Cumberland and Town Center Circulators, under *both* Study forecasts using the ARC and study adjusted projection of year 2025 growth, indicate patronage levels supporting the viability of each of these LRT system components. Under the Ultimate System and the Study projection of year 2025 growth, forecast weekday boarding on the Trunkline (77,000), the Cumberland Circulator (57,100) and the Town Center Circulator (16,000), combine to more than 150,000 weekday boarding.
- Applying these higher forecasts, the system components for the Ultimate System as presented throughout this report are scaled appropriately. In this way, the Study makes extensive use of the detailed land use inventory and of planned projects within the two CIDs, particularly those within close proximity to the planned LRT stations. The technical guidance provided by the Federal Transit Administration for development of LRT systems, places considerable value on the integration of land development and transit systems planning.
- The RTP forecast prepared by ARC shows comparative year 2025 patronage for the Trunkline and Cumberland Circulator. Since the RTP excluded the Town Center Area Circulator, and represented a more limited Trunkline and Cumberland Circulator in terms of number of stations and services as compared to the Ultimate System, the patronage forecasts result in significantly lower patronage. Nevertheless, the results for the RTP forecast also suggest the viability of both the Trunkline and Cumberland Circulator LRT systems.

In summary, the patronage forecasts presented below and used in this Study are considered a subsequent refinement of the Northwest Corridor LRT System elements, evolving from the definition used in the RTP to more focused system elements identified in this Study and detailed adjustments to the year 2025 growth projections. Both of these refinements may be recommended to ARC to incorporate into the next update of the RTP.

The following subsections present detailed patronage results of the forecast for the Ultimate System (Build Alternative), the TSM, and No Build Alternatives. Each of these forecasts is based on using the adjusted year 2025 growth projections within Cobb County, as described in Section 2.

4.4.2 Transit Boarding by Cobb County Lines

The number of transit boardings by station are a measure of transit patronage potential that deals specifically with station and line loading service levels. These forecasts provide the most understandable level of transit patronage and are used in the comparison of alternatives and as inputs to physical and operations planning. Since only the Build Alternative includes the Trunkline, Town Center Area, and Cumberland Circulators, more information is provided for station boarding under the Build Alternative. However, information on weekday and peak bus boarding is compared across the three Study alternatives.

Table 4-4 compares weekday, A.M. peak period, and A.M. peak hour transit boarding forecasts under the Build Alternative. Experience in transit planning shows that most people make their modal choice – use transit or drive – based on the trip they make in the morning. Therefore, these peak A.M. forecasts are used as input to the analysis of peak load point in the operations service planning, presented in Section 8.

Table 4-4
Build Alternative, Comparison of
Weekday and A.M. Peak Period Transit Boardings, Year 2025

System Element	Existing Weekday CCT Service	Year 2025 Weekday	Year 2025 A.M. Peak Period*	Year 2025 Peak Directional Load
Local/Express Bus	10,000	81,200	14,200	620
Trunkline	–	77,000	15,800	4,700
Cumberland Circulator	–	57,100	11,300	2,200
Town Center Area Circulator	–	16,000	2,900	550
Total	**10,000**	**231,300**	**44,200**	**N/A**

* Peak period represents 2 hour A.M. period

Table 4-5 summarizes weekday and peak period transit boarding for the Trunkline LRT system, for the 18 stations in the Build Alternative, representing the Ultimate System. Along the Trunkline system, 13 stations would be located within Cobb County. The remaining stations would be located in Fulton County, at locations consistent with the ARC Regional Transportation Plan. Transfer stations are assumed between the Trunkline rail service, and the Cumberland and Town Center Area Circulators, at several transfer points within each CID.

Year 2025 patronage forecasts for the Trunkline indicate:

- The Trunkline shows significant weekday patronage potential at almost all stations along the planned system.
- A total of 77,000 weekday station boardings are forecast for Trunkline stations, ranging from a low of 500 (Bells Ferry Road Station) to a high of 12,000 (Cumberland Boulevard Transfer Station).
- The MARTA Arts Center Transfer Station, the southern most terminal station for the Trunkline service, is a major destination station for transit trips generated along the Trunkline system, with 21,000 weekday boardings, mostly in the P.M. peak commute period.
- The A.M. peak period represents 15,800 boarding, or 21 percent, that would occur during a two-hour morning peak period. It is expected that during a morning three-hour peak (6 to 9 A.M.), about 30 percent of weekday patronage would occur. Taken together with the afternoon peak period, the combined peaks represent about 60 percent of weekday patronage on the Trunkline system. This indicates that work commute trips are a high proportion of transit trips.
- Significant station transfer activity would occur at six multi-modal transfer stations: Barrett Parkway, Chastain Road/I-575, Town Center Mall, Windy Ridge Parkway/Herodian Way, Cumberland Boulevard and the MARTA Arts Center Transfer Station.

Table 4-5
Build Alternative (Ultimate System) –
Trunkline Station Boardings, Year 2025

Station	Weekday Boarding	A.M. Peak Period Boarding*
Cobb County		
Barrett Parkway Transfer Station**	2,200	400
Bells Ferry Road Station	500	100
Chastain Road/I-575 Transfer Station**	2,700	800
Town Center Mall Transfer Station**	1,800	400
Canton Road/I-75 Station	4,300	1,300
North Marietta Pkwy/120 Loop Station	1,300	400
Roswell Road/SR 120 Station	4,300	1,300
S. Marietta Pkwy/120 Loop Station	2,200	400
Delk Road Station	700	200
Windy Hill Road Station	1,500	400
Windy Ridge Pkwy/Herodian Way Transfer Station***	8,400	800
Cumberland Mall/Galleria Station	3,500	700
Cumberland Blvd Transfer Station***	12,000	1,500
Fulton County		
Atlanta Road Station	700	300
Moores Mill Road Station	4,000	1,200
Howell Mill Road Station	3,500	700
Atlantic Steel Station	2,100	400
MARTA Arts Center Station	21,300	4,500
Total	**77,000**	**15,800**

* Peak period represents 2-hour A.M. period
** Transfer station with the Town Center Circulator
*** Transfer station with Cumberland Circulator

Table 4-6 summarizes weekday and peak period boarding for the Cumberland Circulator, for all 37 stations assumed under the Build Alternative. Transfers to the Trunkline would occur at the Cumberland Boulevard Transfer Station and the Windy Ridge Parkway/Herodian Way Transfer Stations.

Year 2025 patronage forecasts for the Cumberland Circulator indicate:

- Significant demand is forecast for the Cumberland Circulator, with 57,100 weekday transit boarding, and more than 1,000 boardings at 18 of 37 stations.
- The three Cumberland Circulator transfer stations with the Trunkline yield the highest number of weekday boardings. The two northern Circulator transfer stations at the intersection of Windy Ridge Parkway and Herodian Way with Cobb Parkway show 8,500 weekday boardings; the southern Circulator transfer station at Cumberland Boulevard and Cobb Parkway has 11,000 weekday boardings. These results indicate that a high number of transit-linked trips would use both the Trunkline and the Cumberland Circulator.
- The Cumberland Mall/CCT bus station shows a significant demand with a forecast of 6,200 weekday boardings. This includes transfers from connecting buses assumed under the Build Alternative.
- During the A.M. peak period, 11,300 boardings, or 20 percent, would occur during a two-hour morning peak period. During a morning three-hour peak (6 to 9 A.M.), about 25 percent of weekday patronage would occur. Taken together with the afternoon peak period, the combined peaks represent about 50 percent of weekday patronage on the Cumberland Circulator system. As compared to the Trunkline with a 60 percent peak share, this shows that the Cumberland Circulator would more equally serve peak work commute travel, and off-peak non-work travel.
- Weekday boardings at 10 of the 37 stations fall in the forecast range of 100 to 500 passengers.

Table 4-6
Build Alternative (Ultimate System) –
Cumberland Circulator Station Boardings, Year 2025

Station	Weekday Boardings	A.M. Peak Period Boarding
Cumberland Mall/CCT Transfer Station	6,200	1,800
Cumberland Blvd/Stillhouse Road Station	2,700	100
Cumberland Blvd Transfer Station*	11,000	3,200
Overton South Station	900	25
Overton Central Station	1,000	200
Overton North Station	1,600	200
Interstate North Parkway/North Circle Station	600	25
Windy Ridge Pkwy/Interstate North Pkwy Station	1,300	200
Windy Ridge Pkwy/Parkwood Drive Station	700	50
Windy Ridge Pkwy/Powers Ferry Road Station	800	50
2300 Wildwood Plaza Station	1,300	50
3100 Wildwood Plaza Station	800	40
4200 Wildwood Plaza Station	200	20
3200 Wildwood Plaza Station	2,500	500
Wildwood Pkwy/Powers Ferry Road Station	1,200	100
Powers Ferry Rd/Wood Hollow Drive Station	1,600	100
Windy Hill Rd/Interstate North Parkway East Station	200	20
Interstate North Parkway/I-75 Drive Station	1,300	50
Herodian Way/Circle 75 Parkway Station	800	200
Windy Ridge Parkway/Herodian Way Transfer Station **	8,500	2,700
Cumberland Blvd/Spring Road Station	1,500	300
Riverwood Pkwy/Cumberland Galleria Parkway Station	500	20
Galleria 500 Building Station	100	20
Galleria Drive Station	200	20
Circle 75 Parkway Station	400	20
Windy Ridge Pkwy/Parkwood Drive Station	1,200	50
Spring Hill Pkwy/Cumberland Court Station	300	100
Spring Hill Pkwy/Crestline Lane Station	400	150
Paces Ferry Road/Home Depot Station	2,500	100
Paces Ferry Road/Cumberland Parkway Station	1,000	300
Bert Adams Road/Cumberland Parkway Station	100	20
Overlook I & II Station	1,200	50
Overlook III Station	300	20
Overlook IV Station	900	250
Mt. Wilkinson Pkwy/Cumberland Club Drive Station	1,000	200
Cumberland Blvd/Stone Wall Drive	300	50
Totals	**57,100**	**11,300**

* Transfer Station with the Trunkline
** Windy Ridge Parkway/Herodian Way Transfer Station represented as combined station in transportation model. Planned as 2 separate nearby stations in study.

Table 4-7 summarizes weekday and peak period boardings for the Town Center Area Circulator, for all 23 stations in the Build Alternative. Transfers to the Trunkline would occur at Chastain Road/I-575, Town Center Mall, and Barrett Parkway Transfer Stations.

Year 2025 patronage forecasts for the Town Center Area Circulator indicate:

- Moderate demand is forecast for the Town Center Area Circulator, with 16,000 weekday transit boardings, and more than 1,000 boardings at only 4 of 23 planned stations.
- The three Town Center Area Circulator transfer stations with the Trunkline yield the highest number of weekday boardings. The north transfer station at Chastain Road/ I-575 shows a forecast 2,700 weekday boardings; the transfer station at Town Center Mall yields 1,250 weekday boardings; and the Barrett Parkway Transfer station shows a forecast 2,450 weekday boardings. Similar to the Cumberland Circulator, these results indicate that a high number of transit-linked trips would use both the Trunkline and the Town Center Area Circulator.
- During the A.M. peak period, 2,900 boardings, or 18 percent, would occur during the two-hour morning peak period. During a morning three-hour peak (6 to 9 A.M.), about 25 percent of weekday patronage would occur. Taken together with the afternoon peak period, the combined peaks represent about 50 percent of weekday patronage on the Town Center Area Circulator. As compared to the Trunkline with a 60 percent peak share, this shows that the Town Center Area Circulator, similar to the Cumberland Circulator, would more equally serve peak work commute travel and off-peak non-work travel.
- Weekday boardings in many of the stations falls in the forecast range of 100 to 500 passengers. During the Alternatives Analysis, evaluation and refinement of the patronage forecasts will evaluate the specific characteristics of these stations and may call for consolidating or eliminating some of these stations.

Table 4-7
Build Alternative – Town Center Area Circulator
Station Boardings, Year 2025

Station	Weekday Boardings	Peak Period Boardings
Barrett Parkway Transfer Station*	2,450	700
Vaughn Rd/Roberts Blvd Station	300	10
Cobb Place Blvd/Roberts Blvd Station	300	10
Cobb Place Blvd/Vaughn Road Station	750	20
Barrett Lakes Blvd/Cobb Place Blvd Station	300	10
Barrett Lakes Blvd/Auto Park Drive Station **	NA	NA
Barrett Lakes Blvd/Duncan Road Station	400	10
Barrett Lakes Blvd/Chastain Road Station	300	10
Kennesaw State University Station	900	250
Town Green Blvd/Town Crossing Station	1,700	500
Town Park Dr/Busbee Parkway Station	350	30
Town Park Dr/Town Park Common Station	820	30
Chastain Rd/I-575 Transfer Station *	2,700	660
Chastain Rd/Chastain Meadows Parkway	800	30
Chastain Meadows Pkwy/Big Shanty Rd Station	360	30
Chastain Meadows Pkwy/Barrett Parkway Station	300	40
Town Center/Mall Blvd Station	120	10
Town Center Mall Transfer Station *	1,250	300
Busbee Pkwy/Town Center Drive Station	150	10
Barrett Pkwy/Cobb Place Boulevard Station	200	10
Greers Chapel Road Station	350	110
Barrett Lakes Blvd/Barrett Parkway Station	350	20
Roberts Blvd/Barrett Parkway Station	850	100
Totals	**16,000**	**2,900**

* Transfer Station with the Trunkline
** No forecast was prepared for this station

Bus transit boarding forecasts for the three Study alternatives are shown in Table 4-8. The local and express bus services vary (see Section 4.2). Although the Build and TSM Alternatives would provide similar countywide local bus service coverage, under the TSM Alternative, the LRT systems are replaced by local and express bus routes. The No-Build Alternative provides for an expansion of existing Cobb Community Transit bus routes – adding express bus service connections to Atlanta, the Perimeter area and various MARTA rail stations; and expanding local services, connecting cities within Cobb County not currently served.

Table 4-8
Comparison of Alternatives,
Cobb County Bus Transit Boardings, Year 2025

Cobb County Routes	Build Alternative		TSM Alternative		No-Build Alternative	
	Weekday Boardings	A.M. Peak Boardings*	Weekday Boardings	A.M. Peak Boardings*	Weekday Boardings	A.M. Peak Boardings*
Local Routes	62,900	10,800	78,000	13,300	39,100	6,700
Express Routes	18,300	3,400	13,200	2,500	23,500	4,600
Total	**81,200**	**14,200**	**91,200**	**15,700**	**62,600**	**11,300**

* Peak period represents 2 hour A.M. period

Year 2025 patronage forecasts for bus transit across the Study alternatives reveal these findings:

- The TSM Alternative would generate the greatest number of weekday bus boardings, about 10,000 above the Build Alternative. These replace some, but not all, of the transit-linked trips served by the Trunkline and Circulator light rail transit systems, under the Build Alternative.
- Bus transit boardings under the Build and TSM Alternatives would essentially serve the same travel markets within Cobb County, providing countywide coverage and service to the dense employment areas within the two CIDs.
- The No-Build Alternative local bus patronage is forecast to be significantly less than for both the Build and No-Build Alternatives, since it lacks the countywide coverage provided in the other alternatives. The service is more oriented to the regional network.
- The No-Build Alternative shows the highest level of patronage on the express bus services. Since this Alternative expands on the existing CCT system, adding market-specific new express services, it shows the potential to increase express bus patronage from about 5,500 per weekday today, to more than 23,000 in year 2025.

The transit patronage results for the local and express bus services gives transit planners insight into how best to integrate the proposed LRT systems with local and express bus services, which can feed and supplement these systems.

4.4.3 Mode of Access at Trunkline Stations

The transportation impact analysis to be considered during the upcoming Alternative Analysis will carefully evaluate the access and parking demand directly related to park-and-ride facilities at stations along the Trunkline. The assumptions and forecast results will be input to planning and development of facilities at each station, so as to encourage use of the transit system and minimize traffic impacts.

Table 4-9 is considered a preliminary forecast of the percentage and share of total weekday forecast demand at each Trunkline station by mode of access. This information is being carefully studied and compared against other transit systems in the Region and nationally.

The station demand forecasts show that for the Trunkline, the largest share of weekday users would transfer to/from other rail (38 percent); this includes transfers from the Cumberland and Town Center Area Circulators in Cobb County, and the MARTA Arts Center Station in Fulton County. Considering only the stations within Cobb County, rail transfers would represent a slightly lower share (26 percent).

Both overall and within Cobb County, direct-walk access represents the next largest share (27 percent) of weekday transit users at Trunkline stations. Bus transit transfers would comprise a significant share, both overall (21 percent), and for stations within Cobb County (27 percent). Drive access mode would represent another significant share both overall (14 percent), and within Cobb County (20 percent).

Although the forecasts do not differentiate between park-and-ride access and kiss-and-ride access, they suggest that between 9,000 and 10,000 parking spaces may be required for the Trunkline to accommodate parking demand. During the Alternatives Analysis, revised forecasts should focus on verifying the overall drive access demand to stations along the Trunkline by share of long-term parking and drop-off users. Detailed studies will be required to determine station access requirement by mode as an important input to preliminary design of each station.

Table 4-9
Build Alternative (Ultimate System),
Station Mode of Access at Trunkline Stations, Year 2025

	Weekday Boarding	Access Mode/Transfer			
		Walk	Bus	Drive	Rail
Barrett Parkway Transfer Station **		20%	38%	22%	20%
	2,200	435	831	492	442
Bells Ferry Road Station		60%	35%	5%	0%
	500	302	174	23	-
Chastain Road/I-575 Transfer Station **		5%	59%	10%	25%
	2,700	140	1,605	283	672
Town Center Mall Transfer Station **		30%	26%	31%	13%
	1,800	546	463	559	232
Canton Road/I-75 Station		17%	55%	28%	0%
	4,300	719	2,386	1,195	-
North Marietta Pkwy/120 Loop Station		98%	0%	2%	
	1,300	1,268	-	32	-
Roswell Road/SR 120 Station		25%	69%	6%	0%
	4,300	1,066	2,977	257	-
S. Marietta Pkwy/120 Loop Station		88%	0%	12%	0%
	2,200	1,927	-	273	-
Delk Road Station		34%	8%	58%	0%
	700	237	58	404	-
Windy Hill Road Station		36%	59%	5%	0%
	1,500	536	886	78	-
Windy Ridge Pkwy/Herodian Way Transfer Station		27%	3%	26%	44%
	8,400	2,255	229	2,225	3,691
Cumberland Mall/Galleria Station		19%	81.2%	0%	0%
	3,500	659	2,841	-	-
Cumberland Blvd/Cobb Pkwy Station		18%	0%	26%	56%
	12,000	2,141	-	3,120	6,739
Atlanta Road Station		0%	0%	100%	0%
	700	-	-	700	-
Moores Mill Road Station		53%	42.1%	5%	0%
	4,000	2,101	1,683	216	-
Howell Mill Road Station		84%	4.0%	12%	0%
	3,500	2,928	140	432	-
Atlantic Steel Station		92%	0%	8%	0%
	2,100	1,923	-	177	-
Atlanta Arts Center Station		9%	9.6%	0%	82%
	21,300	1,838	2,045	-	17,417
Total	**77,000**	**21,023**	**16,317**	**10,468**	**29,192**
		27%	21%	14%	38%
Cobb County Stations Subtotal	45,400	12,233	12,449	8,943	11,776
		27%	27%	20%	26%

4.4.4 Rail to Rail Transfers

As indicated in Table 4-9, a high degree of rail-to-rail transfer activity is forecast between the Trunkline and the Cumberland and Town Center Area Circulators within Cobb County, as well as between the Trunkline and other transit services within Fulton County at the southern terminus of the planned Northwest Corridor LRT System at the MARTA Arts Center Station in Midtown Atlanta. As expected, the number and percentage of rail-to-rail transfers is greater the further south along the corridor, as more connecting services are available.

The forecast rail-to-rail transfer activity is an important measurement used in the design of each station. Station platforms and other facilities are designed to accommodate peak demand at each transfer station. *These forecasts are considered preliminary, as with the mode of access results, to be refined in subsequent studies as key input to the preliminary engineering of each transfer station.*

4.4.5 Select Link Analysis, Trunkline Segments

A transit "select link analysis" is an important transportation-planning tool to determine the origin and destination of transit ridership forecast at different locations along the proposed transit networks. Summaries were prepared for each of the 11 Planning Districts within Cobb County, as illustrated in Figure 4-4. Table 4-10 summarizes the select link analysis prepared for the Study. Three segments were identified along the Trunkline system.

The select link analysis reveals that the Trunkline system would serve a different share of the travel market at different points in the corridor. It is important to note that patronage on the Trunkline generally builds along the system from north to south, or in order from Select Link 1 to 3.

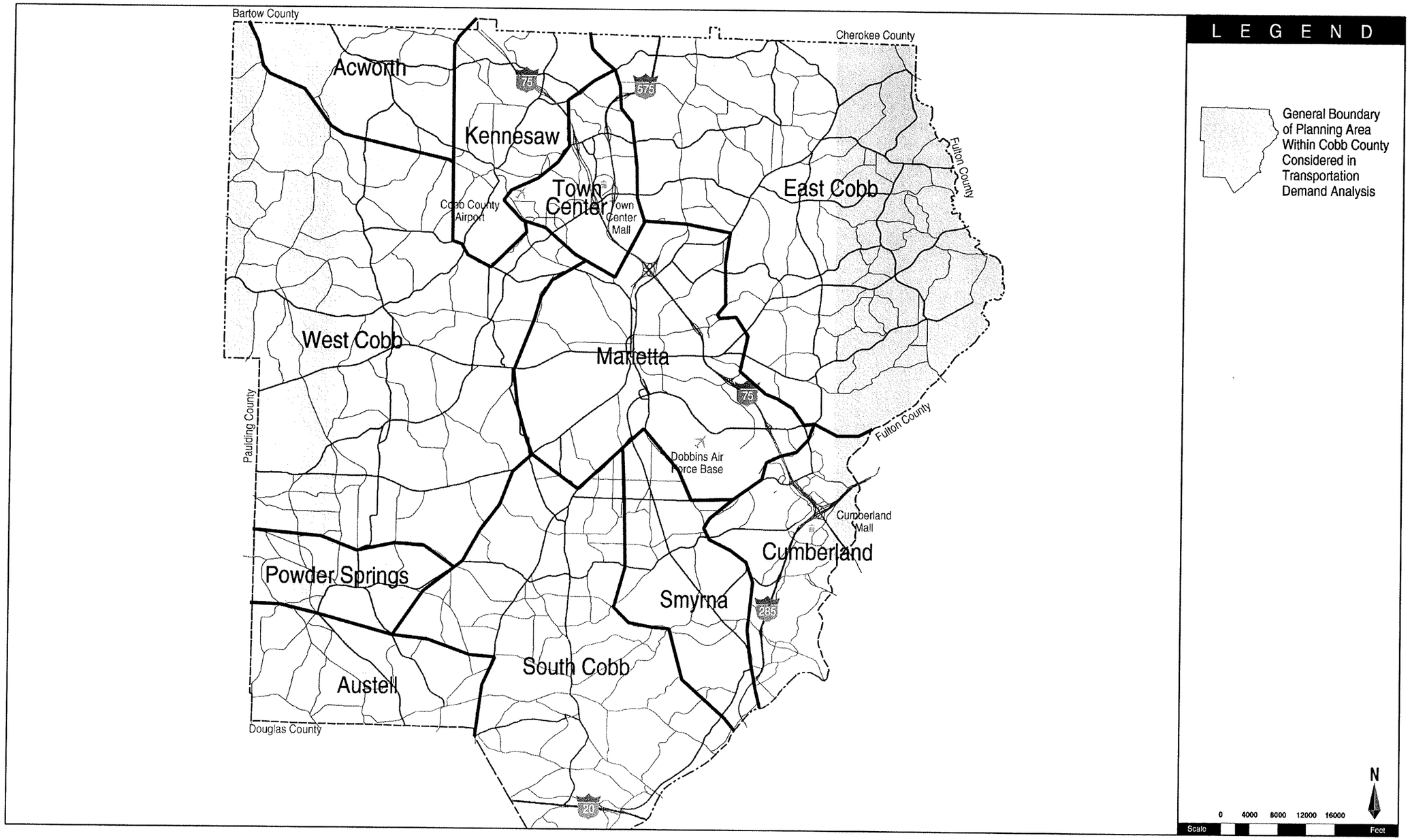
The select link analysis results indicate the following:

- At Select Link 1, the north segment of the Trunkline south of the Town Center Mall Transfer Station, a significant share of total transit riders would begin their trip in Cherokee County (42%). Significant patronage would be generated by East Cobb (24%) and the Town Center (21%). Acworth (4%) and Kennesaw (9%) would also contribute transit patronage in this part of the system.
- At Select Link 2, the middle segment south of the Delk Road Station, nearly half the transit riders would begin their trip in Marietta (47%). As a percent of total transit patronage at this point, the share of trips from Cherokee County (10%), East Cobb (14%), and Town Center (12%) would continue to be significant.
- Select Link 3, the south segment between the Atlantic Steel Station and the Arts Center Station and the peak load point of the Trunkline, would have the greatest mixture of trip origins. The Cumberland (20%) and Marietta (17%) districts would generate the highest share of Cobb County patrons at this location. Significant ridership would also have origins in Smyrna (8%) and East Cobb (7%). Fulton County (28%) would also generate a significant share of patronage at this location, resulting from the four stations between Cobb County and the terminal Arts Center Station.

In summary, the results of the select link analysis reveal that the Trunkline would serve many travel markets within the corridor. Of the total weekday patronage, about 72 percent at the peak load point would have trip origins in Cobb County. This indicates that the Trunkline would predominantly serve Cobb County residents and workers.

Table 4-10
Build Alternative –
Select Link Analysis Transit Patronage, Year 2025

Select Link Locations and Direction	District % Share of Trip Origins at Select Link	
Select Link 1 (north segment) Transit patronage traveling southbound, departing from Town Center Mall Transfer Station, traveling towards Canton Road/I-75 Station	Cherokee County	42%
	East Cobb	24%
	Town Center	21%
	Kennesaw	9%
	Acworth	4%
Select Link 2 (middle segment) Transit patronage traveling southbound, departing from Delk Road Station, traveling toward Windy Ridge Parkway/Herodian Way Transfer Station	Marietta	47%
	East Cobb	14%
	Town Center	12%
	Cherokee County	10%
	West Cobb	8%
	Kennesaw	5%
	Acworth	3%
	Other	3%
Select Link 3 (south segment) Transit patronage traveling southbound, departing from Atlantic Steel Station, traveling toward Arts Center Station	Fulton County	28%
	Cumberland	20%
	Marietta	17%
	Smyrna	8%
	East Cobb	7%
	Town Center	4%
	West Cobb	4%
	Cherokee County	4%
	South Cobb	3%
	Kennesaw	2%
	Acworth	1%



Bechtel Infrastructure Corporation

MSG Atlanta, GA / Little Rock, AR / Lexington, KY / St. Marys, GA / Myrtle Beach, SC

FIGURE 4-4 STUDY PLANNING DISTRICTS

Transit Implementation Study

4.5 SYSTEMWIDE TRANSIT PATRONAGE SUMMARY

Systemwide transit patronage summaries are commonly used transit measures. The three Study alternatives are compared for each of these measures.

4.5.1 Transit-Linked Trips

Transit-linked trips are a key measure of transit patronage, expressed in terms of the number of total trips between origin and destination in which at least one leg is by transit. A transit-linked trip can include more than one boarding on the trip. The CCTM generates six different transit trip tables representing walk and drive access modes, stratified for three basic trip purposes: home base work, home base non-work, and non-home base. (Additional information on the CCTM model is provided in Appendix 3.)

Table 4-11 compares the year 2025 transit-linked trips for the entire region for the Study alternatives with the ARC-RTP results for the years 2000 and 2025. As the transportation network in each alternative varies only in Cobb County, the difference between the Build, the TSM, and the No-Build Alternatives, represents transit-linked trips generated by Cobb County transit services.

Results from transit-linked trips reveal the following:

- Weekday transit-linked trips under the Build Alternative compare closely with the RTP for year 2025. The differences are not considered significant; and overall, they indicate consistency between the Study and the RTP forecasts.
- Over the next 25 years, weekday transit-linked trips are forecast to increase at an average annual growth rate of 2.58 percent, 2.09 percent, and 1.86 percent for the Build, TSM and No-Build Alternatives respectively.
- There would be 59,700 more weekday transit-linked trips under the Build Alternative than under the TSM Alternative, and about 86,500 more than under the No-Build Alternative. The difference between the Build and TSM Alternative is attributable to transit trips on the Trunkline and the Cumberland and Town Center Area Circulators.

Table 4-11
Atlanta Region Forecast Weekday Transit-Linked Trips

	Year 2000 ARC - RTP	Year 2025 ARC – RTP	Year 2025 CCTIS* Build Alternative	Year 2025 CCTIS* TSM Alternative	Year 2025 CCTIS No-Build Alternative
Walk to Transit (home base work)	141,329	266,194	266,919	239,138	228,591
	50.1%	49.5%	50.0%	50.5%	51.1%
Drive to Transit (home base work)	30,491	68,898	72,075	62,204	57,346
	10.8%	12.8%	13.5%	13.1%	12.8%
Walk to Transit (home base non-work)	71,090	120,856	110,021	99,591	93,316
	25.2%	22.5%	20.6%	21.0%	20.9%
Drive to Transit (home base non-work)	7,232	14,673	25,169	22,199	19,824
	2.6%	2.7%	4.7%	4.7%	4.4%
Walk to Transit (non-home base)	28,324	59,755	50,995	43,157	41,293
	10.0%	11.1%	9.6%	9.1%	9.2%
Drive to Transit (non-home based)	3,686	7,161	8,233	7,446	6,669
	1.5%	1.3%	1.5%	1.6%	1.5%
Total Atlanta Region	282,152	537,537	533,412	473,699	446,986
	100%	100%	100%	100%	100%
Net Increase 2000 to 2025		291,696	287,571	227,858	201,145
Average Annual Transit Use Growth Rate 2000 to 2025		2.61%	2.58%	2.09%	1.86%

* *Transit Implementation Study* Definition

- The percentage of drive- and walk-access transit-linked trips varies only slightly across the three Study alternatives. For the Build Alternative, 50 percent of weekday transit-linked trips are made for a walk-to-transit, home-base-work purpose; and 13.5 percent of weekday transit-linked trips are for a drive-to-transit, home-base-work purpose. Together, the home-base-work purpose represents 63.5 percent of weekday transit-linked trips. This compares to a 1995[4] estimate that shows about 57 percent of weekday transit-linked trips were made for a home-base-work purpose.
- The number of home-base-work trips in the 2025 network show a significant increase in drive-to-transit home-base-work trips, increasing from about 30,500 in year 2000 (ARC, RTP) to more than 68,800 under the Build Alternative in year 2025. These home-base-work purpose trips occur during the most congested travel times. This increase would result from improved accessibility of the regional transit network, household and employment growth, and improved driving access to stations in the most congested corridors.
- The home-based-work walk-to-transit trips are also forecast to increase from 141,300 (ARC, RTP) in year 2000 to more than 266,900 under the Build Alternative in year 2025. This category of transit usage includes direct walk access to bus and rail transit services, including bus to rail transfers.
- For home-base non-work and non-home base transit-linked trips, drive access trips will also increase, although not as significantly as for home-base-work trips. Most of these non-work trips occur during off-peak hours, and some during afternoon peak.

Additional information on transit-linked trips within Cobb County districts is provided in the next section.

4.5.2 Transit Mode Share

The mode choice sub-model compares the relative travel time and accessibility of highway versus transit networks to predict the share of each zone-to-zone trip that potentially is made by transit.

Travel by transit as a percentage of total travel by all modes is an important measure of the effectiveness of the proposed transit systems in the Build Alternative. Transit mode share is important to examine on an area or "district" (combination of TAZ) basis, as well as for the entire region. For the Region, the Atlanta Regional Commission seeks a transit mode share goal of 10 percent for all weekday home-base-work trips. No specific transit mode share goals are set for home base non-work and non-home base purposes.

As indicated in Section 2, transit mode share in Cobb County is well below 1 percent of total trips by all travel modes. The transit systems

[4] Draft Cobb County Comprehensive Transportation Plan, January 1999.

in the Build Alternative seek to significantly increase the share of weekday trips taken by transit, particularly in the north-south corridor serving the CIDs.

Tables 4-12 and Table 4-13 present year 2025 transit mode share for weekday and home-base-work transit-linked trips, respectively, both summarizing transit patronage forecasts for the Atlanta Region and for Cobb County districts.

Figure 4-4 showed the boundaries of the eleven Cobb County districts.

The transit mode share results are as follows:

- As a percent of total weekday trips for the Atlanta Region (see Table 4-12), transit mode share is forecast to range from 3.2 percent under the Build Alternative, to 3.0 and 2.8 percent under the TSM and No-Build Alternatives, respectively. These are percentages of more than 15.8 million total weekday trips forecast to occur in the Atlanta Region in year 2025.
- For the Region, about 533,400 weekday transit linked-trips would occur under the Build Alternative; of these, 111,300 or 21 percent of the Region's transit trips would be generated by residents or workers in Cobb County. Under the TSM Alternative, without the light rail transit system in Cobb County, about 63,510 or 13 percent of the Region's transit trips would be generated by residents or workers in Cobb County. Furthermore, with the No-Build Alternative's expansion of the existing bus system in Cobb County, about 43,900 or 10 percent of the Region's weekday transit trips would be generated by residents and workers in Cobb County. Thus the light rail transit system would increase both the County's number and regional share of trips by transit.

Table 4-12
Weekday Transit-Linked Trips and Mode Share for Region and Cobb County Districts, Year 2025

		Build Alternative		TSM Alternative		No-Build Alternative	
District	Location	Transit-Linked Trips	% Transit	Transit-Linked Trips	% Transit	Transit-Linked Trips	% Transit
1	**Marietta**	**14,573**	**3.6%**	**6,394**	**1.6%**	**9,510**	**2.4%**
2	Smyrna	5,567	2.5%	4,547	2.0%	3,046	1.4%
3	South Cobb	4,805	1.9%	4,467	1.8%	1,769	0.7%
4	Austell	518	0.8%	533	0.8%	227	0.3%
5	Powder Springs	437	0.5%	441	0.5%	36	0.0%
6	West Cobb	2,560	1.1%	1,418	0.6%	266	0.1%
7	Acworth	1,074	1.4%	1,100	1.4%	215	0.3%
8	Kennesaw	836	0.8%	958	0.8%	292	0.3%
9	**Town Center**	**16,747**	**6.5%**	**9,244**	**3.6%**	**6,423**	**2.5%**
10	East Cobb	4,639	1.2%	4,498	1.1%	845	0.2%
11	**Cumberland**	**59,554**	**12.0%**	**29,549**	**6.0%**	**21,316**	**4.3%**
	Total Atlanta Region	533,412	3.2%	473,735	3.0%	447,039	2.8%
	Total Cobb County	**111,310**	**3.4%**	**63,149**	**2.4%**	**43,945**	**1.7%**
Cobb County as % of Atlanta Region Transit Trips		**21%**		**13%**		**10%**	

- For weekday transit-linked trips under the Build Alternative, transit mode share for 2025 ranges from a low of less than 1 percent for the Powder Springs and Austell districts, to highs of 6.5 and 12 percent, in the Town Center and Cumberland districts, respectively. The Cumberland district, with the highest employment and residential densities in the corridor, shows excellent potential and would benefit from the Cumberland Circulator stations and ease of transferability to the Trunkline system.
- For the Atlanta Region, transit mode share under the Build Alternative nearly meets the ARC objective of 10 percent for all home-base-work trips, showing a 9.7 percent forecast mode share for the Region (see Table 4-13). These trips occur during the heaviest periods of traffic congestion during the morning and afternoon commute. The TSM and No-Build Alternatives yield lower transit mode share for home-base-work trips showing 8.6 and 8.2 percent, respectively for the Region.
- Cobb County as a whole shows a forecast transit mode share of 11.8 percent for home-base-work trips under the Build Alternative. For the TSM and No-Build Alternatives, transit mode share in Cobb County is forecast significantly lower at 6.3 percent and 4.5 percent, respectively. The higher transit mode share for home-base-work trips under the Build Alternative indicates that the proposed transit system would net a significant share of work commuters, reducing vehicular traffic within and outside the County.
- For home-base-work trips during the peak roadway congestion, transit mode shares in Cobb County districts show significant potential under the Build Alternative. Again, the Town Center Area and Cumberland, as suburban business and commercial districts can potentially capture transit patronage. The Town Center Area is forecast to capture 13.6 percent and the Cumberland district a 24.5 percent transit mode share. Other districts with relatively high transit mode share for home-base-work trips are Marietta (7.3 percent) and Smyrna (5.1 percent).

In summary, the north-south corridor serving the Cumberland and Town Center areas would yield the highest transit patronage, resulting from dense development and the competitive travel times of transit service under the Build Alternative. These results make a strong case for concentrating further development in the Cumberland and Town Center districts, and implementing high quality transit services.

Both Marietta and Smyrna districts also show good transit mode share potential. The greatest potential is shown under the Build Alternative, whereby both of these areas would be served directly and indirectly by the light rail transit system and connecting bus transit services. Transit mode shares for areas currently not served by Cobb Community Transit services, including West Cobb, East Cobb, Austell, and Acworth, generally show rather limited patronage potential in year 2025, under all alternatives. Transit mode share potential in these areas depends on the ability to penetrate into neighborhoods with transit service that competes with the private automobile.

Table 4-13
Home-Based-Work (Commute Period) Transit-Linked Trips and Mode Share for Region and Cobb County Districts, Year 2025

		Build Alternative		TSM Alternative		No-Build Alternative	
District	Location	Transit-Linked Trips	% Transit	Transit-Linked Trips	% Transit	Transit-Linked Trips	% Transit
1	**Marietta**	**8,123**	**7.3%**	**3,562**	**3.3%**	**4,860**	**4.5%**
2	Smyrna	2,187	5.1%	**1,710**	3.9%	1,061	2.5%
3	South Cobb	1,557	4.3%	**1,446**	3.8%	573	1.5%
4	Austell	156	1.9%	**159**	1.7%	82	0.9%
5	Powder Springs	95	1.1%	**108**	1.1%	5	0.0%
6	West Cobb	957	3.5%	**376**	1.4%	19	0.4%
7	Acworth	422	2.7%	**454**	2.8%	81	0.5%
8	Kennesaw	298	2.2%	**318**	1.8%	122	0.7%
9	**Town Center**	**9,383**	**13.6%**	**5,056**	**7.8%**	**3,288**	**5.1%**
10	East Cobb	1,441	2.4%	**1,370**	2.3%	358	0.6%
11	**Cumberland**	**41,589**	**24.5%**	**20,094**	**12.8%**	**14,176**	**9.1%**
	Total Atlanta Region	338,994	9.7%	**301,342**	8.6%	285,937	8.2%
	Total Cobb County	**66,208**	**11.8%**	**34,653**	**6.3%**	**24,725**	**4.5%**
Cobb County as % of Atlanta Region Transit Trips		**20%**		**11%**		**9%**	

4.5.3 Transit Boarding (Unlinked Transit Trips)

A transit boarding, also called "Unlinked Transit Trip," is a measure of the number of transit services entered for each origin to destination transit-linked trip. Boarding is the use of a transit station-to-station or stop-to-stop service. The number of transit boardings is used in the computation of the number of transfers, transfer rate per transit-linked trips, and revenue forecasts for any specific fare policy.

Table 4-14 shows the existing and forecast year 2025 weekday transit boardings for the Atlanta Region and Cobb County across the Study alternatives. The forecasts indicate that the Build Alternative, both for the Atlanta Region and Cobb County, far exceeds the TSM and No-Build alternatives in attracting transit patrons. Under the Build Alternative, year 2025 weekday transit boardings is forecast at 945,900 for the Atlanta Region, of which 231,200 or 24.4 percent would be generated on Northwest Corridor transit systems. In contrast, the TSM and No-Build Alternatives would generate 786,100 and 744,600 weekday transit boardings in the Region; and, 91,200 and 62,600 weekday transit boardings on Northwest Corridor transit systems, respectively.

As a percentage of the Build Alternative, the TSM and No-Build Alternatives for the Region would generate 17 and 21 percent less transit patronage potential. For Cobb County, as a percentage of the Build Alternative, the TSM and No-Build Alternatives would generate 61 and 73 percent less patronage.

As a percentage of the Atlanta Region transit boardings or unlinked transit trips, Cobb County's share would grow from under 2 percent today to over 24 percent in 2025, under the Build Alternative.

Table 4-14
Weekday Transit Boardings – Atlanta Region and Cobb County

	Year 2000 Existing	Year 2025 Build Alternative	Year 2025 TSM Alternative	Year 2025 No-Build Alternative
Atlanta Region				
Total Weekday Transit Boardings	544,000	945,900	786,100	744,600
% less than Build Alternative	-	-	17%	21%
Cobb County				
Total Weekday Transit Boardings	10,000	231,200	91,200	62,600
% Less than Build Alternative	-	-	61%	73%
Cobb County % Share of Atlanta Region's Weekday Boardings	1.8%	24.4%	11.6%	8.4%

Table 4-15 is a further summary of transit boarding forecast results for Cobb County assumed transit systems across the Study alternatives. It shows that the significant difference in weekday boardings for the Build Alternative, versus the TSM and No-Build alternatives, would be generated on the Trunkline and Circulator systems.

Table 4-15
Weekday Transit Boardings for Cobb County System Elements

System Element	Year 2000 Existing	Year 2025 Build Alternative	Year 2025 TSM Alternative	Year 2025 No Build Alternative
Local/Express Bus	10,000	81,200	91,200	62,600
Trunkline		77,000		
Cumberland Circulator*		57,100		
Town Center Circulator*		16,000		
Total	**10,000**	**231,300**	**91,200**	**62,600**
Net Increase in Boardings Under Build Alternative, Versus TSM and No-Build Alternatives			140,100	168,700

Note: Trunkline Rail Forecast represents patronage on the entire service Town Center to Arts Center in Midtown Atlanta

Under the Build Alternative, the number of local and express bus weekday boardings would be about 10,000 less than under the TSM Alternative, with essentially the same bus service network. However, under the Build Alternative, this is more than offset with forecast patronage of 77,000 on the Trunkline, 57,100 on the Cumberland Circulator, and 16,000 on the Town Center Area Circulator. Although a portion of those boardings on the rail transit systems are linked-transit trips, which include both a bus and rail boardings, many are also transit trips directly served by walk- and drive-access to the planned rail stations. Information on systemwide transfers is presented in the next section.

In summary, transit boarding results indicate a robust patronage potential by the year 2025 for the Northwest Corridor LRT System and other transit systems serving Cobb County. These trips would serve both local and regional travel and help reduce congestion and air pollution.

4.5.4 Systemwide Transfer Rate

The number of systemwide transfers is a measure of transit convenience, or the extent to which transit services directly serve origin to destination travel demand. Generally speaking, one or more transfers occur for each transit-linked trip, and a transfer rate is computed by dividing the number of transit-linked trips by the number of transit boardings. Since wait-time resulting from transfers is commonly cited as a major disadvantage to using transit, one objective of transit system planning is to minimize the systemwide transfer rate.

Table 4-16 summarizes the systemwide transfer rate forecast. The transfer rate forecast for the Build Alternative shows that for the Region, about 56 percent of transit users require a transfer; and that within Cobb County, about 48 percent of transit users require a transfer per transit-linked trip. This suggests that the planned transit system within Cobb County would effectively serve transit-linked trips under the Build Alternative.

By comparison, the transit transfer rates for the TSM and No-Build Alternatives for the Region are 60 percent, or slightly less effective than under the Build Alternative. However, considering Cobb County only, the TSM and No-Build Alternatives show significantly less effective transit transfer rates with 69 and 70 percent, respectively.

These results clearly show that the Build Alternative is most effective at minimizing transit transfers in the Region and specifically within Cobb County where the Alternatives differ.

Table 4-16
Comparison Forecast Weekday Transit Transfer Rate, Year 2025

	Year 2025 Build Alternative	Year 2025 TSM Alternative	Year 2025 No-Build Alternative
Atlanta Region	56%	60%	60%
Cobb County	48%	69%	70%

4.5.5 Transit Walk Access Market

The Cobb County and ARC travel demand models provide forecasts based on a key input that gauges the propensity of the population to walk to a transit stop or station. This input is referred to as the "transit walk access market." It is a computation made for each of the Cobb County and regional transportation analysis zones (TAZ), for each alternative based on the assumed transit systems. The criteria for the transit walk access market is the percentage of each zone that is within 0.4 miles walking distance to a transit bus stop or rail station.

Figure 4-5 shows Cobb County population and employment, and Table 4-17 shows the percentage of each that lies within the transit walk access market. These measures show that the Build Alternative provides the best transit-walk accessibility for both population and employment. Generally, the percent of population within the transit walk access market is much lower than the percent of employment within the walk access market. This reflects the transit system's focus on serving the highest density employment areas within each CID and generally along the Cobb Parkway/I-75 corridor.

The percentage of population within the transit walk access market for Cobb County ranges from 45 percent for the Build Alternative, to 41 percent for the TSM Alternative, to 30 percent for the No-Build Alternative. The higher figures for the Build and TSM Alternatives result from the countywide transit system serving all major corridors, as shown in Section 4.2. Under the Build Alternative, more than 323,000 people would be close to a bus stop or light rail transit.

The percentage of employment within the transit walk access market ranges from 62 percent for the Build Alternative, to 52 and 53 percent respectively for the TSM and No Build Alternatives. The Build Alternative would provide better direct accessibility to major employment centers and building within both CIDs through design of the two Circulators. Under the Build Alternative, about 258,700 people would be close to a bus stop or LRT station.

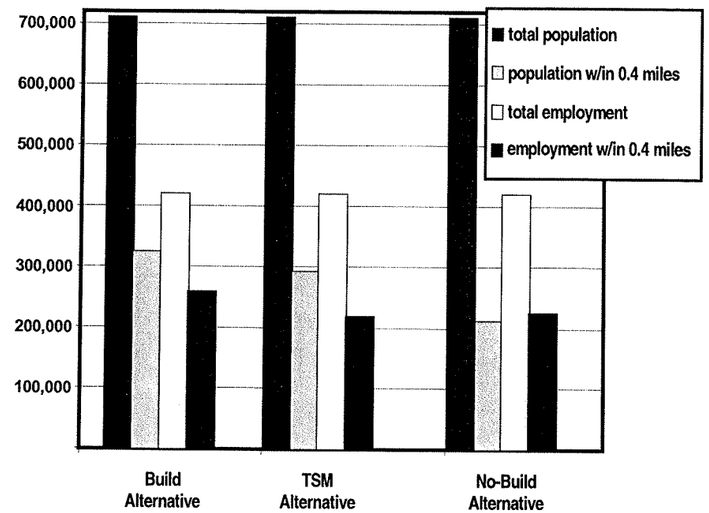


Figure 4-5 Cobb County Projected Population, Employment, and Share Located Within 0.4 Miles of Transit Service, Year 2025

Table 4-17
Cobb County – Share of Population and Employment Within Transit Walk Access Market, Year 2025

	Year 2025 Build Alternative	Year 2025 TSM Alternative	Year 2025 No-Build Alternative
Total Population	711,300	711,300	711,300
Population Within 0.4 Miles	323,400	291,800	211,500
Percent of Population Within Transit Walk Access Market	45%	41%	30%
Total Employment	420,600	420,600	420,600
Employment Within 0.4 Miles	258,700	218,600	225,000
Percent of Employment Within Transit Walk Access Market	62%	52%	53%

4.6 SYSTEMWIDE AND CORRIDOR ROADWAY FORECASTS

The transportation demand forecasts include summaries of highway traffic volumes for all roadways and systems within the Atlanta Region. These indicate the net benefits and impacts that the transit system improvements would have on regional vehicular traffic demand. The results in this Section include vehicle-miles-traveled (VMT) and cut-line volume summaries.

4.6.1 Regional Vehicle Travel Summary – Vehicle Miles of Travel

The travel demand forecast VMT is a common measure of overall weekday transportation demand. Forecasts are compared for the three Study alternatives. Table 4-18 is a summary of the forecast year 2025 weekday VMT across all Atlanta Region roadways, summarized by functional roadway classification. Table 4-19 is a summary of the net increment of additional VMT for the TSM and No-Build Alternatives over the Build Alternatives.

The Build Alternative would reduce regional weekday VMT as compared against the TSM and No-Build Alternatives. On a regional scale the overall reduction is about 292,000 (0.2%) vehicle miles compared to the TSM Alternative, and about 438,000 vehicle miles (0.3%) as compared to the No-Build Alternative.

Although the percent change in VMT is small between the Build Alternative on the one hand and the TSM and No-Build Alternatives on the other hand, the absolute reduction in VMT will result in appreciable improvement in air quality in the Region and corridor.

Table 4-18
Forecast Weekday Vehicle-Miles Traveled, Year 2025

	Build Alternative	TSM Alternative	No-Build Alternative
Freeway	61,160,580	61,248,396	61,279,565
Expressway	590,383	585,442	588,431
HOV	1,464,747	1,489,541	1,494,023
Freeway Ramps	3,347,527	3,355,324	3,365,209
Principal Arterial	15,202,090	15,244,771	15,248,787
Major Arterial	16,876,410	16,892,859	16,952,121
Minor Arterial	20,541,660	20,589,756	20,611,076
One-Way Roadways	174,147	174,909	175,553
Principal Collectors	17,064,500	17,104,858	17,094,568
Major Collectors	600,833	606,346	612,647
Minor Collectors	428,254	433,335	437,295
Local	16,193,930	16,214,262	16,224,254
Total	**153,645,061**	**153,939,803**	**154,083,528**

Table 4-19
Weekday VMT Reduction under Build Alternative Compared to TSM and No-Build Alternatives, Year 2025

	TSM Alternative	No-Build Alternative
Freeway	87,816	118,985
Expressway	(4,941)	(1,952)
HOV	24,794	29,276
Freeway Ramps	7,797	17,682
Principal Arterial	42,681	46,697
Major Arterial	16,449	75,711
Minor Arterial	48,096	69,416
One-Way Roadways	762	1,406
Principal Collectors	40,358	30,068
Major Collectors	5,513	11,814
Minor Collectors	5,081	9,041
Local	20,332	30,324
Total	**294,742**	**438,467**

4.6.2 Cut-Line Traffic Volumes

A "Cut-line Analysis" was performed to look more closely at the forecast change in Cobb County weekday traffic volumes. Figure 4-6 shows the cut-line locations. Table 4-20 summarizes the traffic volume crossing all roadways at different locations within the County for the Build Alternative, and the "net change" or additional traffic volume under the TSM and No-Build Alternatives.

The cut-line summaries indicate that the Build Alternative would reduce weekday vehicular traffic volumes in many areas of the County. The forecast reduction in weekday traffic volumes on the roadway system, although modest, shows positive benefits to air quality and travel time in Cobb County.

Important highlights of the Cut-Line Analysis include the following:

- The Cumberland Cordon would show the largest reduction in weekday vehicular traffic volumes under the Build Alternative, with 14,600 and 16,400 less than the TSM and No-Build Alternatives respectively.
- The Marietta Cordon also shows significant reduction in weekday vehicular traffic volume under the Build Alternative, with 12,500 and 12,900 less than the TSM and No-Build Alternatives respectively.
- The Cobb County Cordon also shows reduction in weekday vehicular traffic volume under the Build Alternative, with 7,900 and 20,500 less than the TSM and No-Build Alternatives respectively.
- The Town Center shows reduction in weekday vehicular traffic volumes under the Build Alternative, with 6,800 and 5,800 less than the TSM and No-Build Alternatives respectively.

In comparing the three alternatives, it is important to keep in mind that each of these three alternatives includes a major increase in transit services in Cobb County (see Section 4.2). Therefore, much of the significant difference is located along the Cobb Parkway/I-75 corridor. This corridor shows benefits under the Build Alternative concentrated within the Cumberland, Town Center, and City of Marietta districts. These are the districts served best by the north-south Trunkline and the Cumberland and Town Center Area Circulators

Table 4-20
Cut-Line Analysis Weekday Traffic Volume Forecasts, Year 2025

Map Reference	Cut-line Description	Build Alternative	TSM Alternative	No-Build Alternative
		Total	Net Increase*	Net Increase*
	All east-west roadways:			
1-1	West Cobb	757,720	1,369	4,917
2-2	West of I-75	672,781	9,533	10,042
3-3	East of I-75	725,770	7,068	9,342
4-4	East Cobb	224,918	1,913	3,589
	All north-south roadways:		-	-
5-5	North of Town Center	334,058	3,064	3,025
6-6	North of North Loop	541,039	5,733	7,889
7-7	South of Delk Road	641,337	8,867	6,078
8-8	South Cobb	517,960	(20)	1,886
10-10	Bartow-Cherokee County	353,245	1,118	4,070
	All crossing roadways:		-	-
9-9	**Cobb County Cordon**	**2,405,307**	**7,900**	**20,528**
11-11	Fulton County Line	1,515,756	5,626	13,112
12-12	Douglas County Line	379,653	487	2,276
13-13	Paulding County Line	156,653	691	1,110
14-14	**Cumberland Cordon**	**1,356,124**	**14,555**	**16,388**
15-15	**Town Center Cordon**	**728,345**	**6,780**	**5,788**
16-16	**Marietta Cordon**	**1,091,669**	**12,543**	**12,868**

* Net Increase is weekday traffic volume over the Build Alternative across Cut-line

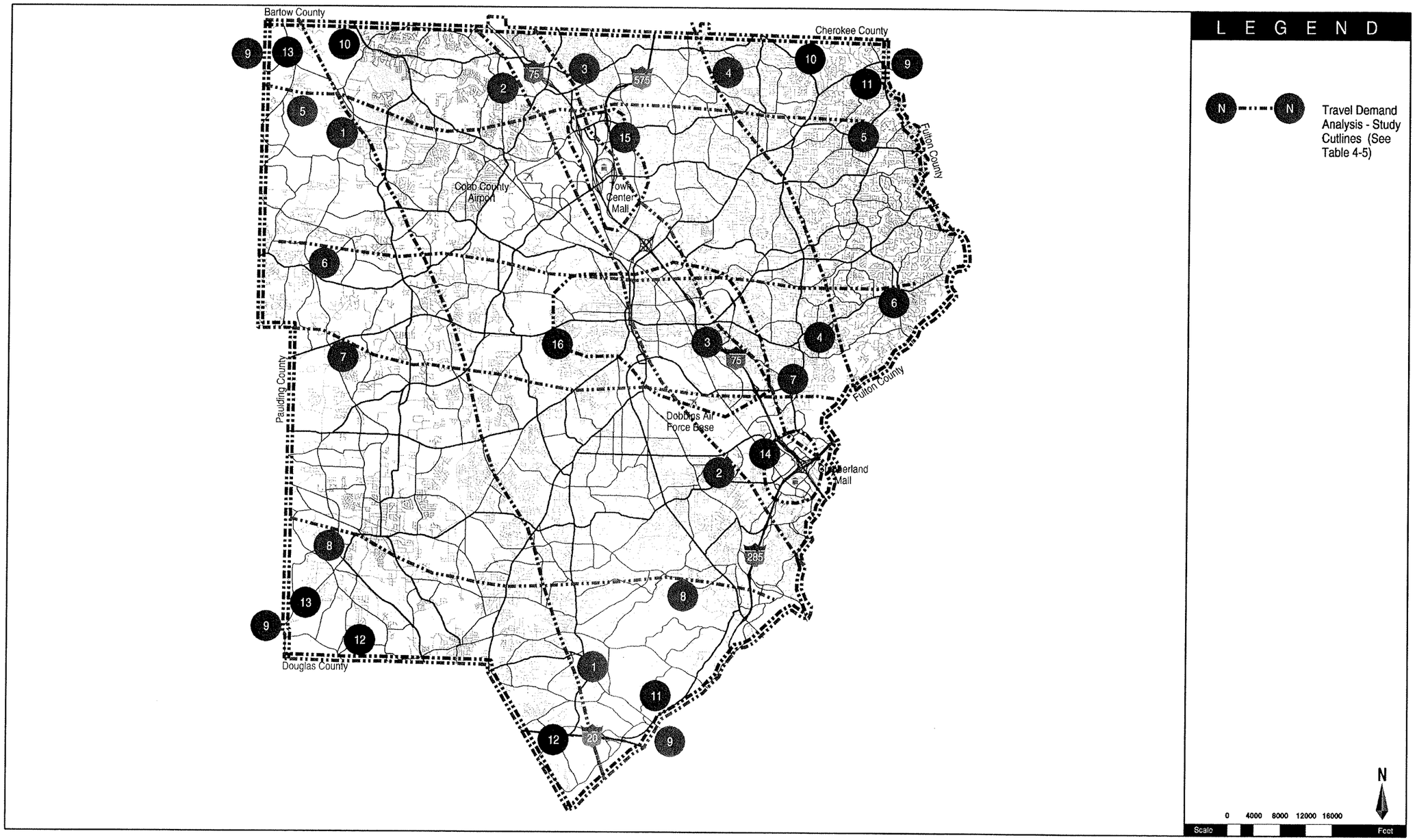


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FIGURE 4-6 TRANSPORTATION ANALYSIS CUTLINE LOCATIONS

Transit Implementation Study

4.7 TRANSPORTATION IMPACTS

This Section presents a preliminary summary of the benefits and other impacts resulting from the Build Alternative. Transportation benefits include improved transit service coverage, travel time savings, transit accessibility to low income households, and the opportunity to coordinate land use and development plans through the stimulus of the transit system. Other transportation impacts may include alignment and station area dislocation, and station area traffic.

A more thorough documentation of the benefits and other impacts of the proposed Northwest Corridor LRT System will be provided in the subsequent Alternatives Analysis Study. The discussions below introduce the key issues to be elaborated upon. Discussions concerning some of the other potential transportation impacts of the proposed project are provided in Section 12.

Transit service coverage, travel time savings and transit accessibility to low- to moderate-income households are key mobility benefits that would result from implementation of the proposed transit systems under the Build Alternative.

4.7.1 Transit Service Coverage

The Build Alternative would expand transit service coverage throughout the County and provide accessibility to high frequency service in the Cobb Parkway/I-75 corridor serving the Cumberland and Town Center Area CIDs.

Under the Build Alternative, approximately 45 percent of the population and about 62 percent of the employment would be within walking distance of transit service (see Section 4.5.5, Table 4-17). Under the TSM Alternative, with the same countywide bus transit service, about 41 percent of the population and about 52 percent of the employment would be within walking distance.

The Build Alternative would expand the availability of transit service to the largest share of the population and employment in Cobb County. The expansion of transit service coverage would directly benefit the County in meeting transportation demand in a manner directly consistent with the RTP and the air quality conformity program.

4.7.2 Travel Time Savings

A standard FTA required evaluation in an Alternatives Analysis is to compare how transit travel times improve across the Study Alternatives. The Build Alternative would show a significant benefit in transit travel time between key travel origin and destination zones within the County and Region. To evaluate the benefits in transit travel time savings, the Build Alternative is compared against the TSM and No-Build Alternatives.

Table 4-21 summarizes transit travel times between key locations within Cobb County and Atlanta. The transportation model forecasts both walk and drive access to transit, and travel time results are shown for both types of transit trips.

Table 4-21
Transit Travel Times, Year 2025

Selected Door-to-Door Interchanges (Origin to Destination)	Transit Travel Times (Minutes)					
	Build Alternative		TSM Alternative		No-Build Alternative	
	Walk Access	Drive Access	Walk Access	Drive Access	Walk Access	Drive Access
Town Center Mall to Cumberland	24.1	24.9	75.7	57.0	73.2	64.4
Town Center Mall to Central Marietta	28.6	16.5	41.2	16.5	38.3	16.5
Town Center Mall to Atlanta Arts Center	38.6	39.4	74.7	65.1	101.3	85.6
Town Center Mall to Atlanta CBD	45.2	46.0	80.0	70.4	96.7	79.0
Cumberland to Town Center Mall	24.1	23.9	75.7	52.6	80.2	79.0
Cumberland to Central Marietta	28.7	17.4	46.5	18.8	46.9	18.8
Cumberland to Atlanta Arts Center	24.2	27.3	54.9	46.3	33.5	41.1
Cumberland to Atlanta CBD	30.8	33.9	58.2	49.6	30.9	36.5
Central Marietta to Town Center	28.6	12.9	41.2	13.7	38.3	30.0
Central Marietta to Cumberland	28.7	18.3	46.5	18.8	46.9	18.8
Central Marietta to Atlanta Arts Center	43.2	32.8	87.9	69.7	75.0	51.9
Central Marietta to Atlanta CBD	49.8	39.4	91.2	73.0	70.4	47.3

The Build Alternative would provide a transit travel time competitive with the automobile in the Cobb Parkway/I-75 corridor linking the Cumberland and Town Center Area CIDs, and points south in Mid-Town and Central Atlanta. The Build Alternative would significantly improve transit travel times as compared to the TSM and No-Build Alternatives. For example, the average walk access transit trip in year 2025, from the Town Center Mall to the MARTA Arts Center station is forecast to take about 39 minutes under the Build Alternative, about 75 minutes under the TSM Alternative, and about 101 minutes under the No-Build Alternative.

These initial results indicate the direct benefit in the Cobb Parkway/I-75 corridor that would result from the Northwest Corridor LRT System. Travel times within the County between the Town Center Area CID and the Cumberland CID, between each of these centers and Midtown Atlanta would be significantly improved and would attract a significant transit ridership. The Trunkline light rail service would maintain these travel times, since the system would be completely grade-separated. However, if any portion of the Trunkline were not grade-separated, these travel times would no longer be achievable.

Transit travel times between these important locations would be impaired under the TSM and No-Build Alternatives, since buses would travel on the roadway system under highly congested conditions.

4.7.3 Low-Income Households Served

All three Study alternatives would provide an expanded transit service, with improved access to transit for low- to moderate-income households. Table 4-22 is a summary showing that the Build Alternative would provide service within walking access to transit for about 49 percent of the low- to moderate-income households in Cobb County in year 2025. By comparison, under the TSM and No-Build Alternatives transit service would be available within walking distance to transit for about 35 to 36 percent of low- to moderate-income households.

Given definition of low- to moderate-income households based on the demographic projections used in the model, the Build Alternative would clearly provide a benefit for these households providing access to jobs and activities throughout the County and Region. The FTA criteria for project justification will emphasize documentation of these results.

Table 4-22
Low- to Moderate-Income Households Served, Year 2025

	Build Alternative	TSM Alternative	No-Build Alternative
Low-Moderate Income Households Walk Accessible to Transit – Cobb County	75,716	53,191	54,687
Low-Moderate Income Households* in Cobb County	153,747	153,747	153,747
Total Cobb County Households	296,924	296,924	296,924
% Low-Moderate Income Households which are Walk Accessible to Transit in Cobb County	49%	35%	36%

* Low- to Moderate-Income households defined by income quartile distribution includes income ARC defined lowest two levels of household categories.

4.7.4 Reduction in Vehicle Miles Traveled

The Build Alternative as compared against the TSM and No Build Alternatives, would show a reduction in weekday VMT and traffic congestion in the County, Atlanta Region, and across key travel corridors as presented in Sections 4.6.1 and 4.6.2. The most significant reduction would benefit overall mobility and air quality in the Cobb Parkway/I-75 corridor, and within and between the Cumberland and Town Center CIDs.

4.7.5 Station Access Traffic

The travel demand forecasts show that stations along the Trunkline LRT system would generate significant drive access demand (see Section 4.4.3). In most cases, station access traffic would comprise traffic already traveling along the arterial roadways and freeways, rather than new traffic demand. Site specific traffic impacts would occur at the access and egress to the stations. Mitigation measures to handle the traffic demand at stations may include new traffic signals, access roadways, and other roadway improvements. These improvements would be approved by the local Public Works agencies and would be considered part of the project cost.

4.7.6 Park-and-Ride Facilities

At each Trunkline station, secure and adequate park-and-ride facilities should be developed that allow for efficient parking, drop-off and pick-up zones, and bus transfer facilities. Section 4.4.3 indicates a preliminary forecast of drive access demand at each Trunkline station. These park-and-ride facilities must minimize impacts on adjacent land use. In general, the development of these park-and-ride facilities are considered an impact of the proposed transit system, and require minimal visual, noise, traffic and other associated impacts. The mitigation measures would be considered part of the project cost.

4.7.7 Traffic Signal Systems

The change in traffic demand patterns around the Trunkline stations and the Cumberland and Town Center Area Circulator stations may require modifications to the area's traffic signal coordination. Often updates to signal hardware and computer software is required to serve the change in traffic patterns and to provide good access to stations.

The trend in traffic signal systems is toward area-wide computerized traffic management programs that optimize traffic flow throughout the roadway systems. These systems could ideally be re-oriented to provide efficient access and egress to the LRT stations so as to minimize travel times and encourage the use of the rail service.

4.7.8 Roadway Modifications

The fully grade-separated alignment of the Trunkline will require modifications to roadways and site access driveways. Any changes that would be required to these roadways or driveways, would be part of the project mitigation that would be negotiated amongst property owners, city public works officials, and the implementation agency.

Changes to circulation patterns resulting from modifications in roadways would seek to improve traffic flow in each area. Traffic signal system modification would be integrated into these improvements on an area-wide basis.

4.8 TRANSIT-SUPPORTIVE EXISTING LAND USE AND FUTURE PATTERNS

The existing CCT local and express bus services are oriented to link transfer points in the city of Marietta, the Town Center Area CID and the Cumberland CID, and places outside Cobb County in the city of Atlanta. The county transfer stations allow passengers to transfer to connecting bus lines oriented to providing service to major employment and activity centers. The CCT bus service is therefore a service plan to meet the major travel demands of the existing land use.

An important and significant benefit of the proposed Cobb County transportation improvements is the opportunity to integrate planning for the Northwest Corridor LRT System with new development plans. Already, physical planning for the fixed guideway alignment and stations is being established in close coordination with land use plans and project development within each of the Community Improvement Districts.

Significant development and redevelopment opportunities will also arise along the Trunkline and, particularly, at each of the Trunkline stations. A natural densification of development at and adjacent to the Trunkline stations would be the subject of newly created, fully coordinated station area development plans created with the cooperation of GRTA and the respective jurisdictions having purview over the planning and zoning requirements at each station.

4.8.1 Land Use Plan Documentation

A comprehensive database has been established for the Study, to enumerate the existing and planned land use and new development potential within the Cumberland and Town Center Area CIDs. The database is direct input to the final transit patronage forecasts and for identifying the best locations for stations along the fixed-guideway systems. Figures 2-2 and 2-3, previously provided in Section 2, illustrate the inventory of existing land use in each CID resulting from the development of the database. Appendix 1 provides a complete listing of the land use database.

Over the Study duration, the Bechtel/MSE Team has been actively working with county planners and developers in the Study area to identify planned new land use, based on project plans. The Team has met with many developers active in the CIDs and is working to identify the benefits of integrating the fixed guideway transit systems into their specific plans. In general, the development community is welcoming the development of the transit system and indicated a strong willingness to modify plans toward these objectives.

This integration of land use and transit system development is a primary categorical benefit of the proposed projects. A clear documentation of direct results will be important to project justification during the formal Alternatives Analysis to follow.

4.8.2 Coordination with the Atlanta Regional Commission and Other Agencies Concerning Transportation Forecast Results

The travel demand and transit patronage forecasts prepared in the Study have utilized a Cobb County version of the ARC regional transportation model with enhanced detail within Cobb County as described in earlier in Section 4.3 and in Appendix 3. The development of the model and key socio-economic forecasts based on the land use database, establishes a refined basis for use in local and regional planning, and in the next phase of implementation of the study recommendations.

Ultimately, the transit patronage forecasts using this model will be vital in the determination of a locally preferred alternative (LPA), project justification evaluations and financial planning. Assuming the project seeks federal funding for design and construction, the FTA will closely scrutinize the methods and results of the travel demand and patronage forecasts used to justify the need for the Northwest Corridor LRT Project.

Particular effort was made through numerous formal and informal meetings with the ARC, GRTA, GDOT and CCDOT planning staff to review the project and the patronage forecasts prepared as part of the Study. The team conducted a review of the study generated transportation model forecasts with ARC, sharing information and comparing study modeling procedures and results, to recent forecasts prepared by ARC for the Regional Transportation Plan. Issues discussed, included: study revisions to the socio-economic data based on the land use and development data; highway and transit network assumptions; transit walk access and transfer station methods; trip distribution; transit assignment procedures; and patronage detailed results. These meetings have benefited the modeling techniques and results, and the environmental benefits analysis presented in this final report.

The overall objective of these meetings has helped to identify a consensus set of travel demand modeling policies and techniques, and inputs to the regional land use models, to apply in the next steps of the Northwest Corridor LRT Project implementation. That next step is the formal "Alternatives Analysis" whereby the FTA will actively guide the forecasting procedures, with expectation of local technical consistency on those procedures.

The material presented within this section results in the recommendation of generic light rail vehicle types for the Northwest Corridor Light Rail Transit (LRT) System. This is done with the understanding that the Regional Transportation Plan for the Atlanta Metropolitan Region designates the use of light rail transit technology for use within this corridor. This determination results from numerous transportation studies that have been undertaken in this corridor, the most recent of which are described in Section 1.

With this determination in mind, the Bechtel/MSE Team felt that it would be beneficial to the entire Study effort to present in a global, then project-specific sense, the overall performance criteria and system parameters that should be taken into consideration in the selection of vehicle technologies for the Trunkline, the Marietta Branch, and the Circulators. Comparative system parameters and characteristics are summarized and presented later in this section, as well as a summary evaluation of generic vehicle technologies. The conclusion of this section reaffirms the light rail transit technology determination in the Regional Transportation Plan (RTP) and presents generic descriptions of the light rail vehicle types recommended for the Northwest Corridor Light Rail Transit System.

Definition of Light Rail Transit

Throughout this Final Report, as well as within this section, the term light rail transit (LRT) is used extensively. In various meetings in which members of the Team have participated, there has been some misunderstanding as to what this term actually means. The Team, therefore, presents the following definition of light rail transit in hopes of clarifying this key term.

Light rail transit is that which is based upon steel-wheel-on-steel rail technology, i.e., using vehicles guided by flanged wheels, is electrically powered using either overhead contact wire, underground conduit and/or third rail for current distribution, and most importantly, is capable of running in shared lanes with motor vehicle traffic as well as in areas of pedestrian circulation. In addition, LRT practice tends to allow steeper gradients and tighter radius curves to be introduced into the alignment although this is not a requirement.

Modern LRT technology is derived from street railway or tramway and interurban electric railway applications typical of the late 1880s through the mid 1900s. In contrast, rapid transit or metros, often referred to as heavy rail transit, typically blend street railway and standard railroad technology to develop a hybrid which is not capable of operation in shared lanes which is the defining differential between light rail transit and heavy rapid transit applications. It is noted that issues of grade separation, design speed of the alignment, and balancing speed of the vehicle is not relevant to the definition of light rail transit.

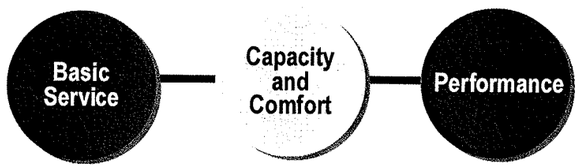
Performance parameters and vehicle technology recommendations were arrived at by first identifying a set of performance objectives and criteria for light rail transit in the Northwest Corridor; next, establishing an initial set of system parameters/characteristics; and, then, identifying the physical and functional aspects required to deliver that performance criteria.

These initial system parameters were used to evaluate alternative vehicle technologies and the selection of generic vehicle technologies for the Northwest Corridor.

5.1 DETAILED PERFORMANCE CRITERIA

The major areas addressed in the development of performance objectives and criteria include:

- **Basic Service.** Trip time (access time, waiting time, travel time, transfer time), departure frequency, system operating hours, and trip convenience



- **Capacity and Comfort.** Line passenger-carrying capacity, passenger comfort (weather protection, ventilation and temperature/humidity control, lighting, vehicle ride quality, vehicle seats, seat space, and interior layout, vehicle seat-to-standee ratios, noise and acoustics, and scenic experience), Americans with Disabilities Act (ADA) facilities
- **Performance.** Reliability, safety, security

Each of these areas is discussed in the following subsections.

5.1.1 Basic Service

Basic service includes trip time, departure frequency, system operating hours, and trip convenience.

5.1.1.1 Trip Time

Trip time is a fundamental performance parameter for the transit system. For rapid transit to be effective, total trip times should be comparable with or shorter than times on other modes (auto, bus, bicycle, and vanpool), particularly in peak travel hours.

The total trip time is comprised of: access time + waiting time + line travel time + transfer time. The implications of each of these times must be considered, since each may play a part in determining the transit system routes and station locations.

Access time is the time required for a person to get from his/her point of origin to a transit system, and from the system to his/her destination (on foot, via bicycle, taxicab, limousine, bus, private automobile, motorcycle, a special access system, or any combination of these modes). To achieve a very low access time (less than 2 minutes) would require an extensive transit network and a great number of transit stations. This would increase construction costs and lower transit vehicle speeds, but could provide good access for a large number of users. A high access time (over 20 minutes) would require fewer but larger stations, increase surface traffic congestion in certain areas, and could impose a severe restraint on other trip time components, to keep the total trip time within a desired range.

Waiting time is the time spent waiting for a train once the passenger has reached a station. Waiting time depends on the departure frequency (the average time interval between the departure of one train and the departure of the next). In calculating waiting times, it is normally assumed that every person riding the transit system will be required, on the average, to wait half the time between trains before he/she leaves the station. Very high departure frequencies (i.e., average waiting time less than 30 seconds) would require a great number of vehicles, complex stations, and complex control systems. Very low departure frequencies (greater than 30 minutes) would greatly impair the transit system. Finally, departure frequencies can be varied at different times of day, which can affect total trip times.

Line travel time is the time the passenger spends riding the transit system, including the dwell time spent stopped at intermediate stations. The average running speed of the system may be determined

by an analysis of route profile and alignment, station spacing, equipment configuration, power and technology, and signal and communication system technology. In addition, the service characteristics of passenger comfort impose restraints on acceleration, braking, and other ride-quality-factors that may limit the average running speed. High average running speeds (greater than 40 mph) would require relatively long station spacings and high-power equipment, while low average speeds (less than15 mph) would greatly increase total trip times.

Transfer time is the time required for a passenger to transfer from one route of the network to another. For passengers with origins or destinations within Cobb County, for example, transfers would occur between the Trunkline, the Marietta Branch, and the Circulators, or for passengers with origins or destinations in Fulton County, transfers would occur between the Trunkline and the Metropolitan Atlanta Rapid Transit Authority (MARTA) system at the Arts Center Station in Midtown Atlanta. Transfer time is a function both of the physical nature of the interchange (the distance between the ends of the transfer trip and the transportation mode that links the two points), and of the waiting time. High transfer times (over 10 minutes) may impose restraints on other trip time components that make it difficult to keep the total trip time within the desired range.

Total trip time. When the four components of total trip time are properly balanced, the transit system can perform well, in both a practical and an economic sense. The components of total trip time can only be specified in terms of a desirable maximum for a given geographic area and, as previously stated, are set by the desire to improve on automobile travel and existing transit system travel times for equivalent journeys during the peak hours.

The recommended criteria for the proposed Northwest Corridor Light Rail Transit (LRT) System peak-hour total trip time, in terms of desirable maximum average, are as follows.

From any point within Cobb County:

- To the MARTA Arts Center Station in Midtown Atlanta (average 20-minute vehicle trip to the transit station plus an average 30-minute trip to Midtown Atlanta): 50 minutes
- To any point within the Town Center Area CID or Cumberland CID (average 20-minute vehicle trip to the transit station plus an average 15-minute train trip to destinations within the CIDs): 35 minutes

The access time goal would allow the following access distances for the access travel modes shown:

Walking, at 3 ft/sec:	1,800 feet (0.34 miles)
Bus, at 15 ft/sec (10.2 mph):	9,000 feet (1.70 miles)
Auto, at 25 ft/sec (17 mph):	15,000 feet (2.85 miles)

5.1.1.2 Departure Frequency

Departure frequency relates both to trip time, and to the average passenger's perception of delays. Various studies have shown that passengers perceive waiting time as two-to-three times longer per minute than line travel time, e.g., 5 minutes of waiting time may seem equivalent to 10 to 15 minutes of travel time. This means that it is important to reduce waiting time to a practical and economical minimum.

Furthermore, when departures are sufficiently frequent, passengers know that if the train they are trying to board is full, another train will be along shortly; therefore, they do not need to struggle to jam themselves onto a full train. This helps to decrease the station stop time and avoids delaying the other passengers on the train and on the following trains.

Another departure frequency consideration is related to station size and platform length: With frequent train departures (e.g., every 4 minutes), shorter-length trains can carry the same number of passengers as longer trains operating less frequently. Thus, a high departure frequency can help to reduce overall station size.

The recommended criteria for departure frequency are as follows:

- **The Trunkline.** Desirable peak hour departure frequency will be 15 units per hour (a train every 4 minutes). Departure frequencies at other times of the day will vary, but should be no less than four units per hour (a train every 15 minutes).

- **The Circulators and the Marietta Branch.** Departure frequencies will be at or above the values for the Trunkline.

5.1.1.3 System Operating Hours

The hours that the transit system is in operation will be a key concern to many potential users. If the system shuts down too early in the evening or opens too late in the morning, residents and visitors who prefer to use the system for work, shopping, or recreation trips may be limited in their ability to do so. Balancing this requirement is the practical need to shut down the system or reduce service to low levels for part of each day, to allow scheduled, preventive, and unscheduled maintenance to be performed on the system facilities and vehicles and to reduce operating costs.

The maintenance time is particularly important for the safety and reliability of the system.

The recommended criterion for operating hours is:

- Normal operating hours will be 20 hours per day, 365 days a year.

5.1.1.4 Trip Convenience

Trip convenience is a function of the passenger's ease of use and ease of movement throughout the entire system. It is a function of (1) the quality of movement information, directional information and other information displayed to the passenger; (2) the amount of information a passenger requires to use the transit system; and (3) the amount of time and motion expended by the passenger during his/her total trip. For example, a transit system that incorporates a high departure frequency from all stations will not require a user to carry or consult a timetable; one that incorporates a limited number of transfers for even the longest trip will disturb the rider less; one that incorporates simple, well laid out, well-signed stations and transfer facilities will be easier to use.

The recommended criterion for trip convenience is as follows:

- Trip convenience is of major importance and will be given specific attention in the design of all elements of the system.

5.1.2 Capacity and Comfort

Capacity and comfort includes line passenger-carrying capacity, passenger comfort, and facilities for persons with special needs.

5.1.2.1 Line Passenger-Carrying Capacity

The line passenger-carrying capacity for the peak-day and peak-hour periods is the primary service characteristic of transit systems. The transit ridership studies undertaken in this and subsequent studies will

establish a range for these parameters for the initial year, a design year, and for the Ultimate System.

If passenger-carrying capacity goals are set too high, the investment in facilities and equipment may be higher than necessary, and a financial burden may be placed on the community with no attendant benefits. If passenger-carrying capacity goals are set too low, the system may quickly become overcrowded, resulting in deterioration of trip convenience and passenger comfort levels (i.e., crowded stations and vehicles), and could result in the need for potentially expensive and disruptive "add-on" construction programs.

The recommended criterion for line passenger-carrying capacity is:

- Line passenger-carrying capacity for the peak periods for the initial year will be designed to exceed ridership projections by a reasonable margin. Specific provision will be made in the system configuration for expansion of passenger-carrying capacity to meet the design year and ultimate requirements with minimum system disruption and reasonable additional expense. The following performance objectives will apply:

Line Passengers/Peak Hour/Direction

	Trunkline	Marietta Branch	Circulators
Initial Year	6,000	1,300	1,500
Design Year (2025)	9,000	3,000	3,000
Ultimate	18,000	6,000	7,200

5.1.2.2 Passenger Comfort

To compete effectively with other transportation modes and to become integrated in a balanced transportation network for the County and Region, the light rail transit system must provide not only reasonable trip times, but also a comfortable, quiet, and pleasurable trip experience. The following elements affect passenger comfort and have, therefore, been classified as performance characteristics.

Weather Protection. Protection from the weather in public areas of all facilities and vehicles is a prime influence on passenger comfort and convenience.

The recommended criterion for weather protection is as follows:

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

Ventilation and Temperature/Humidity Control. Air flow, temperature, and humidity conditions in public areas of all facilities and vehicles will directly affect the comfort of passengers.

The recommended criteria for ventilation and temperature/humidity control are as follows:

- Complete control of air flow, temperature, and humidity conditions within all vehicles, to provide comfort under all normal climatic and environmental conditions
- Ventilation in all covered and enclosed public facilities
- Shaded areas for pedestrian access around all stations

Lighting. Lighting design in public areas of all facilities (including stations, transfer facilities, and parking lots) and vehicles will affect the comfort, convenience and security of passengers. It is the means by which space is perceived, color is controlled, and atmosphere and mood are established.

The recommended criterion for lighting is as follows:

- Lighting levels will be established (by accepted standards) to provide for comfort, safety, security and amenity of the users. Lighting will be glare-free and orderly, using long-life, low power consumption, high-lumen lamps whenever possible. Emergency lighting will be provided to allow persons to exit the transit system and facilities when prolonged primary power outages occur.

Vehicle Ride Quality. Vehicle ride quality is an important factor in the passenger's perception of trip comfort and convenience. Ride quality may be defined in terms of acceleration rates, deceleration rates, jerk rates, and vibration characteristics. Poor ride quality would cause physical discomfort for passengers, particularly those who are standing. In contrast, good ride quality enhances the attractiveness of public transportation services.

The recommended criterion for vehicle ride quality is as follows:

- Vehicles will provide a ride quality equivalent to that of a modern inter-city train on operating on a well-maintained railroad and superior to that of a modern inter-city bus on a modern interstate highway.

Vehicle Seats, Seat Space, and Interior Layout. The size, design, and configuration characteristics of vehicle seats directly affect passenger comfort, particularly on longer journeys. Further, the layout of the vehicle interior and the relationship of seats to one another can affect the passenger's psychological perception of the journey. Balancing the desire to provide wide roomy individual seats are the requirements for (1) rapid movement of persons in and out of vehicles at stations, (2) maximum use of vehicle interior space to achieve a high passenger capacity and thus limit station size for peak hour traffic, and (3) the need for easily cleaned and maintained seats of vandal-proof materials. Thus, the goal for vehicle seat space and interior configuration is a balance between the space objectives and the practical requirements of operation and maintenance.

The recommended criterion for vehicle seats, seat space, and interior layout is:

- The system's vehicles will include the provision of comfortable passenger seats, of durable vandal-proof materials, in a configuration that will allow efficient use of vehicle interior space and rapid vehicle loading and unloading.

Vehicle Seat-To-Standee Ratios. It would be most desirable to provide every person using a transit vehicle with a seat regardless of the time of day at which the person is travelling. However, because the ratio between the number of peak-hour travelers and the number of off- peak-hour travelers may be in the range of 10 or 20 to 1, it becomes extremely uneconomical to provide all peak-hour passengers with a seat. This is because of the following factors:

- Seated persons take up between 50 and 100 percent more floor space than standing persons.
- The areas used in a transit vehicle to allow access to the seats must be clear floor areas that can only be used by standing passengers.
- The rapid loading and unloading necessary to reduce station stop time requires open floor areas around the door locations in the vehicles.

These factors effectively restrict the seated capacity of a vehicle to between one half and one quarter of the total capacity. Thus, in a hypothetical corridor that would require 10 vehicles to carry every person seated in an off-peak hour, perhaps 100 to 200 vehicles would be required to carry the peak-hour rush with every person seated. If, however, for every seated person there were two standing persons, then only 33 to 66 vehicles would be required to carry the rush hour load. The cost of purchasing, operating, and maintaining these extra vehicles to give every person a seat can be a substantial economic burden on the community.

A further consideration is that passengers making longer journeys will normally get a seat in the peak hour, for part or their entire journey. This is because those making longer journeys will normally get on the vehicle first (thereby getting a seat) or will be able to get a seat vacated by someone else as the vehicle stops at stations along its journey.

The recommended criterion for vehicle seat-to-standee ratios is as follows:

- In peak hour periods, Trunkline and Marietta Branch vehicles will be designed for a seat-to-standee ratio not exceeding 2 to 3, and Circulator vehicles will be designed for a seat-to-standee ratio not exceeding 1 to 3. In off-peak-hour periods, sufficient vehicle capacity will be operated on the system to provide all normally expected passengers with a seat.

Noise and Acoustics. Noise or unwanted sound can interfere with speech and cause irritation, annoyance, physical discomfort and even actual physical damage to the ear. Noises that are intermittent, shrill, excessively loud, or that contain a concentration of energy in pure tones or narrow bands are among the most irritating and annoying.

The recommended criterion for noise and acoustics is as follows:

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

Scenic Experience. Based on current alignment and profile studies, it is anticipated that a substantial portion of each line will incorporate elevated guideway structures. Thus, a passenger aboard a vehicle would view areas of Cobb and Fulton counties adjacent to the alignment of the Northwest Corridor LRT System from a moving vantage point. Daytime and nighttime viewing may provide scenic views and vistas of significant extent and quality. Elevated station structures may provide equivalent opportunities in some areas.

The recommended criterion for scenic experience is:

- The Northwest Corridor LRT System will take full advantage of available scenic views and vistas by appropriate vehicle window design and configuration (for seated and standing passengers), by appropriate guideway design, and by appropriate station orientation and design.

5.1.2.3 Facilities for Persons with Special Needs

A significant percentage of the Atlanta Metropolitan Region's residents are classified as elderly and handicapped persons – people having chronic conditions that limit their mobility so that they need another person's aid or a mechanical aid to move around outdoors. The types of disability can be classified as follows: nonambulatory, semi-ambulatory, visual (sight), and aural (hearing). There are also disabilities associated with coordination and aging. Each disability type may require different techniques to improve the disabled person's mobility.

A 1970 amendment to Section 16 of the Urban Mass Transportation Act of 1964 declared "...the national policy that elderly and handicapped persons have the same right as other persons to utilize mass transportation facilities and services." In many cases, this represents a population segment most in need of public transit. The national policy has been further strengthened by the Americans with Disabilities Act (ADA).

The recommended criterion for providing facilities through the Northwest Corridor LRT System for persons with special needs is:

- First, identify the transit needs and experiences of the elderly and the handicapped, and identify any problems they may have encountered on public transit. The system design will then make specific provisions for the reduction and, possibly, the elimination of operating barriers on all facilities and equipment that impede the mobility of the elderly and handicapped, thereby improving their social and economic opportunities. Full ADA compliance is required throughout the LRT system.

5.1.3 Performance

The following subsections discuss individual performance criteria.

5.1.3.1 Reliability

One of the most important service characteristics of the LRT system will be reliability. If the transit system can be relied upon, with a high degree of confidence, to regularly and consistently provide all passengers with an uninterrupted, smooth, on-time journey, then substantial community support for the cost of rapid transit can be expected. However, the provision of highly reliable equipment must be balanced against the cost of that equipment. It may, in the long run, be more economical to procure equipment slightly less reliable, but which can be more easily maintained and repaired. So, in the design of facilities and equipment, reliability must be considered both in terms of mean time between failures and mean time to restore service.

The recommended criterion for reliability is:

- The system will be designed to achieve a reliability expressed in terms of the probability of any passenger completing a trip within 10 minutes of the scheduled time on any given day. The recommended probability is not less than 97.5 percent.

5.1.3.2 Safety

Passenger safety is the most important performance characteristic.

The recommended criterion for safety is:

- The safety of passenger and operating personnel, and the safety of equipment and facilities, will be of paramount concern in the system design. Specific and continual attention will be paid to the safety aspects of all system elements.

5.1.3.3 Security

Personal security is the second most important performance characteristic. In this context, security is defined as freedom from the

fear of personal attack and freedom from any anxieties related to use of the transit facility. Communication and surveillance equipment, security and operating personnel, and station facility/design are all-important aspects of crime deterrence. However, the economic penalties of some deterrence methods must be carefully evaluated against the potential benefits. It must be recognized that crime is a social problem that permeates almost all aspects of modern life, including urban transportation. System design and operation can attempt to deter crime, but cannot prevent it altogether.

The recommended criterion for security is:

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

5.2 SYSTEM PARAMETERS/CHARACTERISTICS

The system parameters/characteristics are, in effect, the functional and physical methods by which the performance criteria are achieved. Table 5-1 shows a summary listing of the parameters/characteristics initially established for the Northwest Corridor LRT System. The application of such parameters/ characteristics must be tempered by the local physical conditions, the level of community resources, and by an application of reasonable and relatively near-term solutions to the community's transportation needs.

5.2.1 Configuration

The ultimate network of the Trunkline, the Marietta Branch, and the two Circulators is shown in Section 3, Figure 3-2, which includes route alignments, station locations, and the functional interchanges between each element of the Northwest Corridor LRT System.

The basic configuration of the Trunkline, the Marietta Branch, and the Circulators will include a double-track fixed guideway system, on-line stations, and electrically powered trains whose source of power is external. This is a conventional, well-proven approach, and avoids the operational complexities and development risks associated with other configurations.

A double track guideway would be used for all mainline segments of the Trunkline and the Marietta Branch to allow high-frequency service in both directions of travel. Although the basic approach for the Circulators would be the same, the routing of the Circulators may lend themselves to single-track uni-directional or bi-directional operation in certain locations, particularly in the initial deployment or phasing, of the system.

The off-line station concept can be attractive, because express trains can theoretically overtake local trains at such locations. Current judgement is that neither the Trunkline nor the Marietta Branch nor the Circulators warrant the provision of express trains. Additionally, the unproven nature of the control systems required for off-line stations with close-headway train operations would introduce an unacceptable level of risk.

A principal objective of the Northwest Corridor LRT System is the alleviation of current air quality problems. The use of electric power from remote generating sources within Cobb and Fulton counties responds to these problems, and can also be used in a contemporary transit system.

5.2.2 Grade Separation

As indicated the information presented in Section 3, the Trunkline will be completely separated from surface traffic. Thus all streets and roads will be grade-separated from the Trunkline, and movement of trains will in no way be impeded by surface traffic. This means that Trunkline sections, whether on the surface (at-grade), elevated or underground, will be separate and protected from non-transit facilities. This feature of the Trunkline is of particular importance along Cobb Parkway, where intersections with east-west roads are subject to chronic gridlock conditions during peak periods.

The majority of the Marietta Branch alignment as indicated in Section 12 will be located either in at-grade protected right-of-way or in mixed traffic conditions within the streets in the vicinity of the Marietta Square. Overpasses for the Marietta Branch will be utilized at select locations to separate the LRT line from surface vehicular traffic.

For the Circulators, grade-level street crossings will be incorporated at selected locations. In addition, street-level running in protected rights-of-way will be used where appropriate.

5.2.3 Maximum Train Speed

Consistent with the performance objectives and criteria, Trunkline, Marietta Branch, and Circulators maximum train speeds of 70 mph, 40 mph, and 50 mph, respectively, will be appropriate. The principal influences on practical upper limits on train speeds are station-to-station spacing, constraints on acceleration and braking imposed by passenger comfort limits, and equipment sizing and power consumption.

5.2.4 Average Train Speed

Average train speed is determined by the same factors mentioned in 5.2.3, but with the additional consideration of the time that trains are stopped in stations (station dwell time). Allowing 30 seconds for Trunkline stations, 20 seconds for Marietta Branch stations, and 15 seconds for Circulator stations, should allow an average speed of 35 mph, 25 mph, and 20 mph respectively for the three elements. These average speeds are required to meet the established performance criteria.

5.2.5 Operating Frequency/Train Configuration/Peak Capacity

To meet the performance objectives and criteria, these system parameters/characteristics have been developed on the basis of *initial, design year*, and *ultimate* requirements. Departure frequency (the time between trains), has been established as a performance criterion, and the values established here are consistent with the criteria cited in Subsection 5.1.1.2 and the capabilities of modern automatic train control systems. The train configuration has been established generically, using typical vehicle internal configurations and passenger space and seat-to-standee ratios established in the performance criteria. The train configuration is designed to deliver the peak passenger-carrying capacity characteristics (as expressed in terms of passengers-per-peak-hour per direction), as established in Subsection 5.1.2.1.

Table 5-1
Summary System Parameters/Characteristics

Parameters and Characteristics by System Elements	Trunkline	Marietta Branch	Circulators
Function	Regional Transit Line	Downtown Access for Regional Transit Line	Circulation Within CIDs Access to/from Trunkline
Configuration	Double Track Fixed Guideway On Line Stations Electrically Powered	Double Track Fixed Guideway On Line Stations Electrically Powered	Double Track Fixed Guideway On Line Stations Electrically Powered
Grade Separation	Full (Rights of Way in Roadway Medians, Tunnels and Underpasses, Elevated Structures and Overpasses – No At-Grade Crossings with Intersecting Streets)	Limited (Primarily In-Street with Mixed Traffic Lanes or Side-of-Road Rights-of-Way with At-Grade Crossings of Intersecting Streets; Overpasses at Selected Locations)	Full or Partial (Largely on Elevated Structures with Stations; Some Sections on Private Rights of-Way with At-Grade Crossings of Intersecting Streets)
Maximum Train Speed	70 mph	45 mph (Roadway Speed Limits Apply in Mixed Traffic Lanes)	50 mph
Average Train Speed (Commercial or Schedule Speed)	35 mph (incl. 30 sec. station dwell times)	25 mph (incl. 20 sec. station dwell times); 15 mph (incl. 20 sec. station dwell times) in mixed traffic lanes.	20 mph (incl. 15 sec. station dwell times)
Initial Operating Frequency Initial Train Configuration Initial Peak Hour/Peak Direction Capacity	4 minutes 2 – 90/100 ft. cars @ 200 pax/car 6,000 pax/hour	8 minutes 1 – 90/100 ft. car @ 200 pax/car 1,500 pax/hour	4 minutes 1 – 50 ft. car @90 pax/car 1350 pax/hour
Design Year Operating Frequency Design Year Train Configuration Design Year Peak Hour/Peak Direction Capacity.	4 minutes 3 – 90/100 ft. cars @ 200 pax/car 9,000 pax/hour	4 minutes 1 – 90/100 ft. car @ 200 pax/car 3,000 pax/hour	2 minutes 1 – 50 ft. car @120 pax/car 3,600 pax/hour
Ultimate Operating Frequency Ultimate Train Configuration Ultimate Peak Hr./Peak Dir. Cap.	2 minutes 3 – 90/100 ft. cars @ 200 pax/car 18,000 pax/hour	4 minutes 2 – 90/100 ft. cars @ 200 pax/car 6,000 pax/hour	2 minutes 2 – 50ft. cars @ 120pax/car 7,200 pax/hour
Maximum Grade	8 % (5% Desirable)	8 % (5% Desirable)	10% (8% Desirable)
Minimum Horizontal Curve Radius	100 ft. (150 ft. Desirable)	100 ft. (300 ft. Desirable)	82 ft. (100 ft. Desirable)
Route Flexibility	Branching and Merging	Branching and Merging	Branching, Merging and Looping
Station Platform Length – Initial Design Year Ultimate	270 feet nominal 270 feet nominal 360 feet nominal	100 feet nominal 100 feet nominal 100 feet nominal	100 feet nominal 100 feet nominal 100 feet nominal
Degree of Automation	Automatic Train Protection (ATP) and Automatic Train Control (ATC) Mandatory; Automated Train Operation (ATO) Optional	Automatic Train Protection (ATP) and Automatic Train Control (ATC) Mandatory on Overpasses; Line-of-Sight Operation in Mixed Traffic Lanes and Side-of-Road Trackage	Fully Automated* or Automatic Train Protection (ATP) and Automatic Train Control (ATC) Mandatory on Elevated Structures and in Tunnels; Line-of-Sight Operation on Roadway Median and Side-of-Road Trackage
Train/Station Staffing	Train Drivers/Station Attendants	Train Drivers/Unattended Stations with Roving Security	Train Drivers/Unattended Stations with Roving Security
Maintenance Compatibility (Trunkline/Marietta Branch/Circulators)	Preferable – Not Mandatory	Mandatory	Preferable – Not Mandatory
Phasing and Extensions	Yes	Yes	Yes
Proven Safety Record	Paramount	Paramount	Paramount
Proven Operations	5 Years Operating	5 Years Operating	5 Years Operating
Procurement Flexibility	Complete	Complete	Complete (Proprietary Technology Allowed Only with Future Procurement Conditions)

* See text Section 5.3.0 for Special Note

5.2.6 Maximum Grade and Minimum Horizontal Curve Radius

For the portion of the Trunkline within Cobb County, a maximum grade of 5 percent and a minimum horizontal curve radius of 150 feet, or greater being desirable, have been established based upon the topography of the route, the average train speed requirement, equipment configuration, and power consumption considerations. Continuation of the Trunkline to the MARTA Arts Center Station in Midtown Atlanta, depending upon the route profile and alignment south of Cumberland Boulevard, may employ a mainline grade of 8 percent for a distance not to exceed 2,500 feet; in this case, speed restrictions and signal equipment providing for positive all-weather train separation will be required in this area to ensure safe and reliable operations.

To meet the requirements of the Circulator routes, a maximum grade of 10 percent and a minimum horizontal curve radius of 82 feet (100 feet or greater being desirable) have been established for the Circulators.

5.2.7 Route Flexibility

The route configuration of the Trunkline requires that main line branching be readily accomplished. However, there does not appear to be a need for looping, as trains can simply be reversed at the ends of the route. For the Circulators, both branching and looping will be required, particularly to facilitate the phased growth of the routes. This makes a symmetric vehicle/guideway interface advantageous for the Circulators.

5.2.8 Station Platform Length

To facilitate the train configuration identified in 5.2.5 above, nominal station platform lengths for *initial, design year and ultimate* conditions have been established. For the Trunkline these lengths are 270 feet, 270 feet, and 360 feet respectively; for the Marietta Branch, and the two Circulators, the lengths are 100 feet, 100 feet, and 100 feet. Initial platform and station design would allow for subsequent lengthening of platforms to accommodate longer trains should this prove desirable as future ridership growth occurs.

5.2.9 Degree of Automation

The degree to which the system will be automated depends upon a wide range of economic, institutional and public acceptance factors. A paper prepared by the UITP International Metropolitan Railways Committee entitled "A Better Quality Service at the Lowest Cost – Driverless Metros" and published in January 1997, stresses the service advantages of full automation, and clearly identifies the trend towards full automation and driverless operation of metro systems. The fully automated approach, while possible to implement on the Trunkline, is not appropriate for the Marietta Branch or the Circulators because of their at-grade operations on private rights-of-way with level crossings and, in case the Marietta Branch, in mixed traffic in the streets of downtown Marietta; manual control under line-of-sight operating rules is mandatory under these circumstances. On balance, manually controlled trains using more conventional train control/signaling technology is the better choice for the Northwest Corridor LRT System because it provides for greater flexibility with alignment options.

The Trunkline, being fully grade-separated and the system element with the highest operating speeds, should be protected with Automatic Train Protection (ATP) and Automatic Train Control (ATC); Automatic Train Operation (ATO) while optional is not mandatory. The Marietta Branch should have ATP including Automatic Train Stop (ATS) on overpasses and elevated structures only; the remainder of its alignment should be designed for line-of-sight operations with "train ahead" warning signals in any areas where train drivers may encounter visual obstructions. The Circulators (both the Cumberland and Town Center Area Circulators) should have train control/signaling protection similar to that of the Marietta Branch, including installation on all elevated structures and in tunnels or underpasses.

Modern rail transit systems rely heavily on the automation of many functions, particularly train supervision, fare collection, communications, and power system control. Such automation has been introduced for reliability, safety, and cost reasons. Further, certain functions have become so complex that human operators cannot perform them adequately in the real time available, so automatic equipment has become necessary. There is substantial evidence that human operator error is the cause of many accidents on rail transit and railroad systems around the world, thus automation of train control functions has become virtually mandatory from a safety viewpoint. At the same time, it must be recognized that accidents resulting in passenger injuries may occur on fully automated transit systems, as the result of programming error, software corruption, or ill-advised intervention by supervisory personnel.

For the Trunkline, complete automation of train protection functions (those functions that relate to keeping trains separated from one another under all conditions) is required, with partial automation of train control and train operation functions. The same approach should be taken for the Marietta Branch, and the Circulators, except that manual control of train movement will be necessary for non-grade-separated areas.

For other systems and equipment (for the Trunkline, the Marietta Branch, and the two Circulators), automation should follow established and proven state-of-the-art standards for equipment operation.

5.2.10 Train/Station Staffing

Automation and system staffing can be closely related, but staff may be required for safety, security, or failure recovery reasons even on fully automated systems (the fully automated driverless Docklands Light Railway in London nevertheless employs on-board train attendants for passenger security and to be able to operate trains manually when difficulties arise). Many issues must be balanced in determining staffing requirements, but service to passengers (particularly passengers with disabilities), safety, security, institutional constraints, and cost (capital, operating and maintenance) are chief among them.

For the Trunkline, both train drivers and station attendants are potentially warranted, due to the passenger levels expected. For the Marietta Branch and the Circulators, which will require manually driven trains, unattended stations would be feasible with roving passenger assistance and security personnel.

5.2.11 Maintenance Compatibility

A unique consideration for the Northwest Corridor LRT System is the desire for commonality between the Trunkline, Marietta Branch, and Circulator equipment, to allow for the common use of a central maintenance and vehicle storage facility. In effect, this would require that vehicles used on the Circulators be able to traverse the Trunkline (and possibly vice-versa, depending on the location of the maintenance and storage site). If the operating agency elects not to carry passengers on such trips, it may also involve "dead heading" (movement of trains without passengers in an out-of-service mode) from and to the maintenance and storage site. The significant benefit would be the need for only a single, larger maintenance and storage site, where all maintenance functions and equipment storage would

be consolidated. Although not mandatory, a central maintenance and vehicle storage facility is judged to be a desirable and preferable feature for the Northwest Corridor LRT System.

5.2.12 Phasing and Extensions

The Trunkline should be constructed as a complete facility from Town Center Area to the MARTA Arts Center Station in Midtown Atlanta. This would avoid the very significant impacts on Cobb County travel patterns and mobility, which would result if only a partial transit system were constructed. It is also recommended that the Marietta Branch be added to the Trunkline as soon as the requisite funding becomes available.

However, it may be necessary for the Circulators to be implemented in an initial form with subsequent extensions. This phasing is a critical requirement that will allow a rational and feasible investment plan and a system evolution that will both serve and shape the growth of the two CIDs.

5.2.13 Proven Safety Record

In keeping with the safety requirement established in the performance criteria, the parameters and characteristics of the system must adhere to proven safety principles and they must demonstrate long-term safety performance. This applies equally to the Trunkline, the Marietta Branch, and the two Circulators.

5.2.14 Proven Operations

The system parameters and characteristics must be consistent with those of light rail transit systems that have been in satisfactory operating service for a period of at least five years. Development of the Northwest Corridor LRT System should not be subject to the vagaries and uncertainties of a research and development program, but should be based on facilities, systems, and operating practices that have a history of successful implementation in North America, Europe or other developed countries. This applies equally to the Trunkline, the Marietta Branch, and the two Circulators.

5.2.15 Procurement Flexibility

Complete procurement flexibility is an important consideration for the Trunkline, the Marietta Branch and the Circulators. Use of a proprietary technology or system can pose procurement problems. This is particularly true of a vehicle/control system, which has special nonstandard characteristics, dimensions or functions and is unique to a single vendor. These problems center not so much on the initial procurement of the technology or system, but rather on subsequent procurements when a transit line is expanded or extended, or where significant renovation of hardware and software becomes necessary. Under these conditions, the Owner becomes captive to the original vendor, who is then in a position to charge unreasonable rates for equipment and services. At the other extreme, the original vendor may have gone out of business, leaving the Owner with technology that cannot be renewed or extended. In the real world of system-level procurement, there are techniques for mitigating these issues; however these techniques make the initial procurement more complex and require long-term commitments from vendors, which may be difficult or expensive to obtain. For complete procurement flexibility, suppliers must meet certain basic standards for compatibility, so that subsequent procurements can also be achieved in a fully competitive environment.

5.3 GENERIC VEHICLE TECHNOLOGY SOLUTIONS

5.3.1 Vehicle System Types and Technologies

Transit vehicle system types and technologies have traditionally been described in a number of ways, with little coordination or commonality among the descriptions. Typical descriptive methods rely on:

- The vehicle ground support and/or guidance and/or propulsion method
- The vehicle manufacturer's proprietary or system name
- Popular, generally used terms describing the overall function and appearance of the vehicle system
- The passenger carrying capacity of the vehicle system.

Ground Support/Guidance/Propulsion. These three functions are normally integrated. The most common form is the classic steel wheel on steel rail, with adhesion between the wheel and rail relied upon for propulsion and braking. However, rubber tired vehicles, air cushion vehicles, linear motor driven vehicles, air driven vehicles, magnetic levitation (MagLev) vehicles, and cable hauled vehicles have all been used in various urban-passenger-carrying forms.

Proprietary or System Name. Many manufacturers or originators of proprietary systems use names as a unique descriptor. Examples include VAL, POMA, Aeromovel, Sky Train, Alweg, etc.

5.3.2 Evaluated Vehicle Technologies

The following three generic vehicle technology types were evaluated by the Bechtel/MSE Team for use on the Trunkline, the Marietta Branch, and/or Circulators:

- *Steel wheel/steel rail systems* using flanged steel wheels riding on steel rails for guidance and support. Figures 5-1 and 5-2 illustrate this technology.
- *Rubber-tired systems (non monorail)* using vehicles with pneumatic tires riding on concrete or steel running surfaces, with lateral guidance obtained through the interaction of smaller wheels running against longitudinal guidance surfaces. Figure 5-3 illustrates this technology.
- *Supported or suspended monorail systems* using vehicles that ride on, or hang from, a single concrete or steel structure, and that employ laterally mounted wheels that run against longitudinal guidance surfaces and also "capture" the vehicle to the support structure. Figure 5-4 illustrates this technology.

Another example of the steel wheel/steel rail system, shown as Figure 5-2, is the Rouen (France) Metrobus System Light Rail Vehicle by Alstom. First developed for Grenoble, LRVs of this type also operate in Paris. Grass track is employed extensively on new French LRT systems as part of efforts to make their 'insertion into the urban fabric as unobtrusive as possible.

5.3.3 Vehicle Technology Evaluation

Table 5-2 shows a matrix illustrating the evaluation of how well each of the three potential technologies meets the performance criteria and the resulting system parameters and characteristics. A simple scoring system has been established as follows:

- Score of 3, fully meets evaluation factor requirements
- Score of 2, partially meets evaluation factor requirements
- Score of 1, minimally meets evaluation factor requirements
- Score of 0, does not meet evaluation factor requirements.

Figure 5-1 Steel Wheel/Steel Rail – Croydon Tramlink by Bombardier

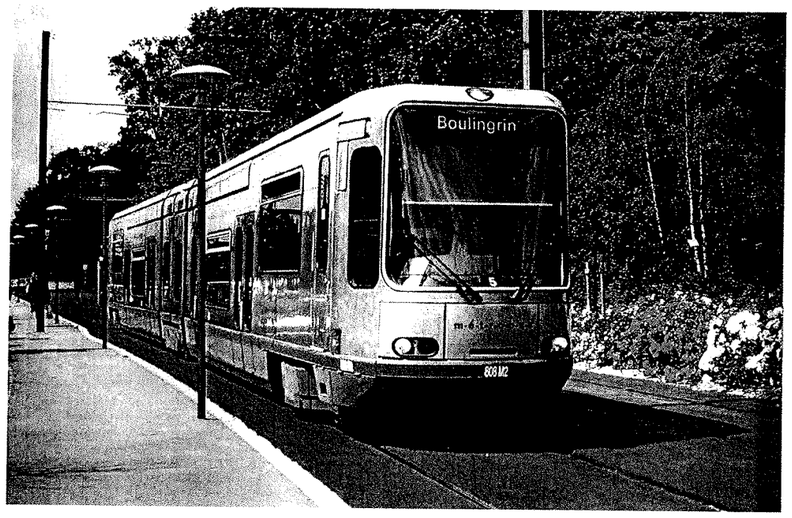


Figure 5-2 Steel Wheel/Steel Rail – Rouen (France) Metrobus System Light Rail Vehicle by Alstom.

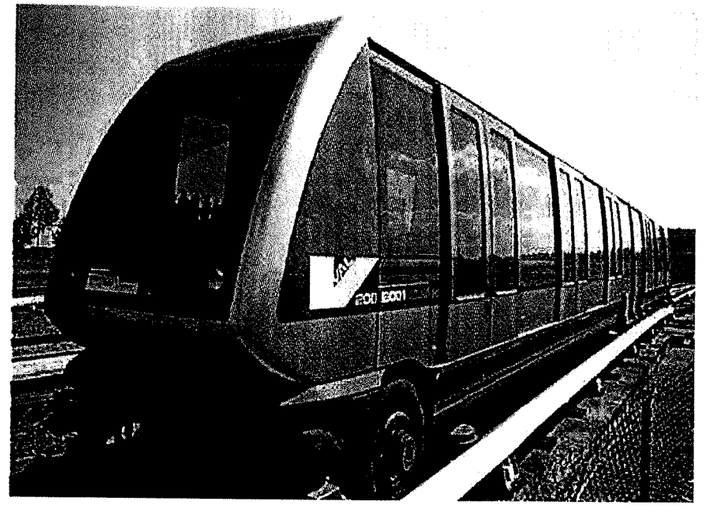


Figure 5-3 Rubber-Tired (Non-Monorail) – Matra/Siemens VAL (Lille, France)

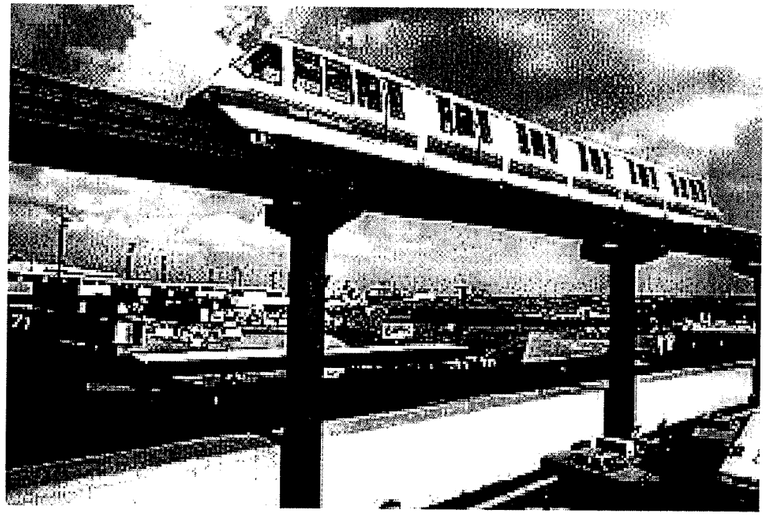


Figure 5-4 Supported or Suspended Monorail Systems Adtranz Van Roll Type III

Table 5-2
Summary Evaluation of Candidate Vehicle Technologies

Notes GS = Fully Grade Separated Partial GS = Includes at-grade street crossings and street running in protected right-of-way.	Trunkline				Circulators				
	Factor	Score			Factor	Score			
		Steel/ Wheel/Steel Rail (GS)	Rubber-Tired (Non-Monorail (GS)	Monorail (GS)		Steel Wheel/ Steel Rail (Partial GS)	Steel Wheel/ Steel Rail (GS)	Rubber-Tired (Non-Monorail) (GS)	Monorail (GS)
Function	Regional Transit Line	3	3	3	Circulation Within CIDs and Access to/from Trunkline	3	3	3	3
Configuration	Double Track Fixed Guideway, On-Line Stations, Elec. Powered	3	3	3	Double Track Fixed Guideway, On-Line Stations, Elec. Powered	3	3	3	3
Grade Separation	Full	Not Scored			Partial	Not Scored			
Maximum Operating Train Speed	70 mph	3	1	1	50 mph	3	3	3	3
Average Train Speed	35 mph (inc. 30 sec. station dwell times)	3	2	2	20 mph (inc. 20 sec. station dwell times)	2	3	3	3
Initial Operating Frequency Initial Train Configuration Initial Peak Hr./Peak Dir. Cap.	4 minutes 2 – 90-ft. cars @ 200 pax/car 6,000	3	3	3	6/2 minutes 1 – 50-ft. car @ 120 pax/car 1,500	3	3	3	3
Design Year Operating Frequency Design Year Train Configuration Design Year Peak Hr./Peak Dir. Cap.	4 minutes 3 – 90-ft. cars @ 200 pax/car 9,000	3	3	3	6/2 minutes 1 – 50-ft. car @120 pax/car 3,000	3	3	3	3
Ultimate Operating Frequency Ultimate Train Configuration Ultimate Peak Hr./Peak Dir. Cap.	3 minutes 3 – 90-ft. cars @ 200 pax/car 12,000	3	3	3	6/2 minutes 2 – 50-ft. cars@120 pax/car 4,500	3	3	3	3
Maximum Grade	5% (8%)	2(1)	3	3	10%	1	1	3	2
Minimum Horizontal Curve Radius	150 ft.	3	3	1	82 ft.	3	3	3	2
Route Flexibility	Branching	3	2	1	Branching/Looping	3	3	2	1
Station Platform Length – Initial Design Year Ultimate	270 feet nominal 270 feet nominal 360 feet nominal	Not Scored			100 feet nominal 100 feet nominal 100 feet nominal	Not Scored			
Degree of Automation	ATP, Partial ATC/ATO	Not Scored			ATP, Partial ATO/ATC	Not Scored			
Train/Station Staffing	Train/Station Attendants	Not Scored			Train Attendants/Roving Security	Not Scored			
Maintenance Compatibility (Trunkline/Circulators)	Desirable – Not Mandatory	Not Scored			Desirable - Not Mandatory	Not Scored			
Phasing and Extensions	No	3	3	3	Yes	3	3	2	1
Proven Safety Record	Paramount	3	3	2	Paramount	2	3	3	2
Proven Operations	5 Years Operating	3	3	3	5 Years Operating	3	3	3	3
Procurement Flexibility	Complete	3	0	0	Complete	3	2	2	1
Total Score		**41**	**35**	**31**		**38**	**39**	**39**	**33**

Each evaluation factor has been given equal weight, and each technology has been evaluated for the Trunkline, the Marietta Branch, and for the Circulators. For purposes of the evaluation, each of the potential technologies for the Trunkline, the Marietta Branch and the Circulators is represented by a current vehicle type, as described below. These representations are for evaluation purposes only and should not be considered as the only vehicle systems that may satisfactorily meet the requirements of the Northwest Corridor LRT System.

Trunkline and Marietta Branch, Representative Vehicles

- Steel Wheel/Steel Rail
  - Kawasaki SEPTA City Division LRV (Philadelphia, Pennsylvania)
  - Bombardier Croydon Tramlink LRV (London, England)
  - Siemens MetroLink LRV (St. Louis, Missouri)
- Rubber Tired (Non-monorail)
  - Matra/Siemens VAL (Lille, France)
- Monorail
  - Hitachi Alweg Haneda Monorail (Japan)

Circulator Representative Vehicles

- Steel Wheel/Steel Rail
  - Breda Muni Metro-2 LRV (San Francisco, California)
  - Bombardier/UTDC Canadian LRV (Toronto, Canada)
- Rubber Tired (Non Monorail)
  - Adtranz C100 People Mover (Miami, Florida DPM)
- Monorail
  - Adtranz Van Roll Type III (Newark New Jersey Airport)

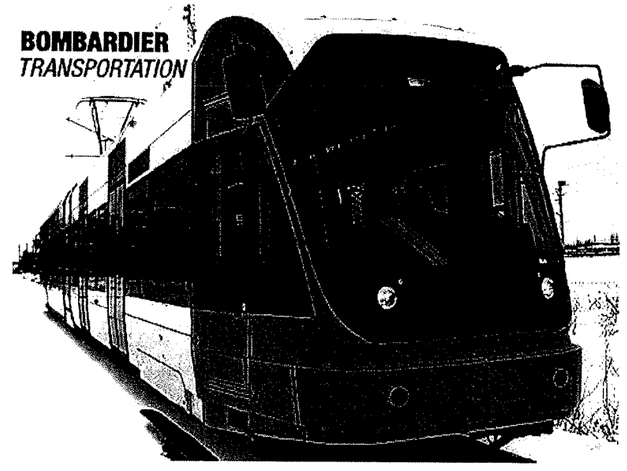
Capital costs and operating and maintenance costs are not directly included in the above evaluation. This is because, at the level of detail commensurate with this *Transit Implementation Study*, the basic cost levels will be set by the performance criteria and the resulting system parameters and characteristics, and not by the vehicle technology.

5.3.4 Vehicle Technology Recommendations

Trunkline. On the basis of this evaluation, the steel wheel/steel rail technology appears to be the most suitable for Trunkline application. Principal problems associated with the rubber tired (non-monorail) technology center on the limited top speed of existing systems, the comparative complexity of switching (compared to steel wheel/steel rail), and the proprietary nature of the systems. Principal deficiencies with the monorail technology again center on the maximum speed (the top speed of the Hitachi Alweg monorail in Tokyo is approximately 60 mph), the comparative complexity of switching compared to both steel wheel/steel rail and rubber tired (non-monorail) systems, the comparative difficulty of achieving emergency evacuation measures, and the proprietary nature of the systems.

The type of vehicle recommended for the Trunkline would be an interurban type LRV with a range of 90 to 100 feet long with two car-body sections and two articulated joints. These vehicles would have 68 transverse seats (plus 2 wheel chair positions) and be able to comfortably stand up to 132 passengers for a peak load of 200 passengers. Maximum design speed would be 80 mph although maximum operating speed would be limited to 70 mph. These Trunkline LRVs would have a nominal acceleration rate of 3.0 miles per hour per second (mphps) and be capable of achieving 70 mph within 60 seconds on level tangent track. The Trunkline LRVs would be equipped with pantographs for power collection from the overhead catenary system (OCS).

Marietta Branch. With the use of at-grade street crossings and in-street running mixed–traffic conditions, the steel wheel/steel rail LRT technology becomes the only viable solution. The performance characteristics of the Marietta Branch LRVs would match those of the Trunkline LRVs in every respect. They would also be equipped with raising and lowering steps (similar to those used on the LRVs of the San Francisco Municipal Railway – MUNI Metro) permitting passengers to board or alight from either high level or low level platforms. The Marietta Branch would also be equipped with a small number of replica interurban cars that would provide a vintage trolley car shuttle service along the Branch as more fully explained in Section 13. The Marietta Branch LRVs would be equipped with pantographs for power collection from the overhead catenary system (OCS); the replica interurban cars would be equipped with either trolley poles or pantographs for power collection from the overhead catenary system (OCS).



Circulators. With the use of at-grade street crossings and street running in a protected right-of-way, the steel wheel/steel rail becomes the only viable solution.

The type of vehicle recommended for the Circulators would be an urban type LRV approximately 50 feet long with a rigid carbody. These LRVs would set 44 passengers (with provisions for 2 wheelchairs) and be able to comfortably stand 76 passengers, providing a total capacity of 120 passengers. Maximum design speed would be 50 mph, although their maximum operating speed would be limited to 40 mph on the Circulators (but not while operating on the Trunkline on trips to and from the Central Maintenance Facility). Circulator LRVs would have a nominal acceleration rate of 3.0 mphps and be capable of achieving 40 mph within 20 seconds on level tangent track.

The Circulator LRVs would be equipped with pantographs for power collection from the OCS.

5.3.4.1 Rolling Stock Fleet Size Requirements

The rolling stock requirements for the Ultimate System are presented in Sections 8. The rolling stock requirements for the Preferred Initial Project are presented in Section 11, and the rolling stock requirements for adding service to the city of Marietta are presented in Section 12.

In the identification of systems components for the Northwest Corridor Light Rail Transit System, careful attention has been given to the objective of alleviating air quality problems. The use of electric power from remote generating sources within Cobb County is responsive to both air quality and operational objectives. Therefore, the configuration will include electrically powered trains using an external source of power. The systems characteristics and requirements are discussed in the following subsections. As the patronage forecasts are characteristic of light rail transit (LRT) systems, experience of comparable LRT systems in North America and abroad provides guidance to the selection of systems technologies.

6.1 TRACTION ELECTRIFICATION SYSTEM

The necessity of operating the Cumberland and Town Center Area Circulators along various at-grade segments of trackage, including at-grade street crossings and in-street operations, coupled with the mixed-traffic operating conditions along the Marietta Branch, dictates that traction and auxiliary power be delivered to the light rail vehicles (LRVs) via an overhead catenary system (OCS) or trolley wire system. Fleet compatibility, as well as the use of the Trunkline by the Circulator LRVs (to access the Central Maintenance and Storage Facility) and the Marietta Branch LRVs operating through passenger service to terminals located on the Trunkline also dictate the adoption of an overhead catenary system for the Trunkline. The traction electrification system (TES) will, therefore, provide electrical power to the vehicles by means of the traction power supply system (TPSS) via an overhead catenary system for the entire Northwest Corridor LRT System.

The TPSS consists of traction power substations and direct current (DC) feeder cables in underground duct banks, which connect the substation to the overhead distribution system. The substations will be located at various points along the route of the LRT system. Substations will be connected to the distribution networks of the local electric power utility or company or companies and will include all the equipment necessary to transform and rectify the alternating current (AC) 3-phase 60 Hertz voltage supplied by the utilities to 750Volts DC for use as the LRT system's electrification voltage.

According to the Georgia Power Company, the major public utility serving Cobb County, the available primary distribution voltage in some locations is 20kV, while in others it is 25kV. However, Georgia Power Company informed the Bechtel/MSE Team that the public utility is ready to provide power at the most convenient voltage to the system.

The proposed TES system will be based on drawing high-voltage, commercial frequency 20kV or 25kV 3-phase, 60-cycle power from the Georgia Power Company and rectifying it to 750VDC for distribution along the LRT system's lines through feeder cables.

The TPSS configuration will be of the multiple-feed type, with electrical continuity between substations through the overhead catenary system for the Trunkline, the Marietta Branch and for the Circulators. On the Trunkline, the Marietta Branch and the Circulators, the light rail vehicles will collect power from the OCS or trolley contact wire by means of pantographs. The return of the power to the substations will be via the running rails (the track).

Power will also be required for passenger stations, maintenance and shop facilities, storage yards, and transit system auxiliaries (signals and communications) along the route.

6.1.1 TES Ratings, Location, and System Description

The TES will consist of 1,500kW rated traction power substations distributed as follows: 12 substations along the main line of the Trunkline, 4 substations along the Barrett Parkway branch of the Trunkline; 3 substations along the Marietta Branch, 15 substations along the two Circulators, and one 1,000kW substation for the maintenance facility and storage yard, for a total of 32 traction power substations within Cobb County. Further refinement and analysis will be necessary during the engineering and design stage in order to optimize the system's overall cost and performance.

Spacing between substations will not exceed 1.5 miles to avoid the voltage dropping below the minimum level required to operate the light rail vehicles.

The optimum number and capacity of the substations will be calculated during Preliminary Engineering. Their final locations and optimum size will be refined, based on the track gradients, track speed limits, frequency of service, system acceleration curves, passenger loading, passenger station locations, TPSS locations, and station dwell times, as well as the electrical and mechanical characteristics of the trains.

Each substation will be capable of supplying the load cycle in accordance with NEMA and ANSI applicable standards. Substation equipment will be capable of sustaining overload twice a day, in AM and PM peak periods; the traction power system will be capable of full operation with one substation out of commission; and the system will maintain voltages supplied to the LRVs above 525 Volts DC under all load conditions.

6.1.2 Traction Power Equipment

The traction power system comprises the equipment from the interface point(s) with the power utility, the distribution system, and negative return impedance bonds or track. The equipment list includes: AC cables, AC switchgear assemblies, transformer/rectifier units, DC switchgear assemblies, busbars, positive and negative cables, negative return and drainage assemblies, substation buildings, foundations, grounding systems, protective systems, auxiliary power supply systems, ventilation systems, batteries and chargers, fire detection and intrusion systems, lightning arrestors, annunciation and control systems, metering equipment, and provision for supervisory control equipment. The electrical equipment may be housed in metal prefabricated buildings constructed off-site, or installed in buildings or rooms constructed on the site. Typically, traction power substations are located at station sites in conjunction with the requisite ancillary spaces serving each station.

Each substation will have one incoming line from the utility, AC switchgear with metering and protective devices, a transformer-rectifier unit, two DC feeder breakers, one 150kVA auxiliary transformer for supplying service power, and provision for a second transformer-rectifier unit and DC breakers on Trunkline substations.

6.1.2.1 Substation Incoming Service

Georgia Power Company will supply the substation incoming primary power. Preferred primary nominal voltage is 13.8 kV, 3-phase, 3-wire, 60 Hz. The substations will be connected by overhead lines or underground cables to the utility's 3-phase distribution network. The feeder rating will permit the substations to supply the specified load cycle and short circuits without exceeding the allowable equipment temperatures.

6.1.2.2 AC Switchgear

The AC switchgear assembly will provide the means to deliver, control, and measure the substation power requirements. The assembly will be housed in dead-front enclosures containing

AC drawout vacuum circuit breakers, relaying, and metering equipment. A power monitor with digital readout is recommended for each traction power substation, to monitor and display amperes per phase, AC volts (line-to-line and line-to-ground), and kW. The output of the monitor will be suitable for connection to Supervisory Control and Data Acquisition (SCADA) using an RS-232 interface or other appropriate interface.

6.1.2.3 Rectifier Transformer

The rectifier transformer will be dry-type, self-cooled, with primary voltage to be consistent with utility supply, and equipped with appropriate taps. The transformer/rectifier unit will be designed so that the maximum overall regulation is not greater than 6% ± 0.5% between 1% rated load and 450% rated load. The rectifier will be state of the art twelve-pulse rectifier.

6.1.2.4 DC Switchgear

The DC switchgear assembly consists of the positive switch, negative switch, rectifier, buswork, controls, and DC circuit breakers. It will form a lineup of dead-front metal enclosed switchgear built to ANSI C37.20.2 "IEEE Standard for Metal Clad and Station Type Cubicle Switchgear." The positive and negative switch and rectifier cubicles will be constructed to ANSI C37.20.3 "IEEE Standard for Metal Enclosed Switchgear." The DC circuit breakers will be high speed, stored energy, draw-out, single-pole units and will have bottom feeder cable entry. DC protective devices and relays will protect the overhead distribution system and feeder cables, and provide back up for the transit vehicle protective devices.

6.1.3 Traction Power Contact.

Traction and auxiliary power will be delivered to LRVs and replica vintage trolley cars operating on the Trunkline, the Marietta Branch, and the two Circulators via an overhead catenary distribution system (OCS).

The OCS and equipment must be designed to be as visually unobtrusive as possible. Specifically, main line railroad type compound catenary systems (such as used by Amtrak between Washington, D.C and Boston, Massachusetts on its Northeast Corridor) will not be employed on any part of the Northwest Corridor LRT System.

For the most part, the LRT system will be equipped with a constant-tension simple catenary system. Overhead contact rails may be used in tunnels or other locations where vertical clearances are restricted. Fixed-termination trolley wire with span wires will be used in conjunction with lamp posts or building fronts where trackage is located in city streets or other sensitive areas, to make the contact wire system as unobtrusive as possible. Trolley wire also will be used in lieu of catenary within the Central Maintenance and Storage Facility and on selected portions of the Circulators, if it is less expensive than the standard OCS installation.

The OCS consists of all equipment between the interface with the DC traction power supply equipment and the vehicle pantograph. The equipment will include foundations, poles, feeders, system conductors, support system for the catenary, insulation system, cantilevers, bridge arms, hangers, jumpers, terminations, tensioning devices, sectioning equipment, disconnect switches, and all other necessary equipment.

Within the mechanical and structural design constraints, the system structures and associated equipment will be lightweight and will use visually unobtrusive fittings. The messenger and contact wires will be double-insulated, with each level of insulation compatible with the system insulation class.

The contact wire for the OCS will be set at the following height above the top of the surface of the running rails:

- Along protected rights-of-way: 15 feet minimum, 22 feet maximum
- Along street alignments: 18 feet minimum, 22 feet maximum

The OCS will be sectionalized to enable electrical protective relays to disconnect faulted sections of the distribution system, to allow planned maintenance to be performed, and to achieve operational flexibility during system emergencies (such as fires in buildings along the line).

Sectionalizing at substations will be performed by means of insulated overlaps. Where overlaps cannot be located adjacent to the substations, section insulators will be used. The section insulators will also be used for sectionalizing at or near turnouts at specific locations, such as junctions between lines.

The primary connection and isolation of the system sections will be performed by the substation feeder circuit breakers. At locations along the route, connections and isolation of the system sections will be accomplished by disconnect switches.

Based on the magnitude of load, overload, and short circuit currents, a comprehensive protective scheme will be designed to protect the substation equipment and the overhead line equipment as well as to provide back-up for vehicle-borne protective devices.

All protective relays will be high quality utility-type draw-out devices enclosed in rustproof, dust proof, high-impact cases with integral test switches. The protective relays will be self-reset and will have seal-in, hand-reset targets indicating relay operation. The relays will be arranged to be visible, accessible for maintenance, and logically grouped, with devices having related functions located in proximity to each other.

6.1.4 Substation Low Voltage Auxiliary Power

The voltage requirement for auxiliary equipment varies with location: 120/240V, 1-phase or 208Y/120V, 3-phase, as appropriate.

Low voltage auxiliary AC components will include the auxiliary power transformer and AC panel boards (Panel PI and PDI) for the traction power battery charger as well as substation auxiliary AC equipment including lighting, convenience receptacles, and HVAC. Panel P1 will be a main breaker branch circuit panel board dedicated to feeding substation loads exclusively. Panel PD1 will be a distribution panel adequately sized to power non-substation "hotel" loads. PD1 will feed other panel boards or large feeder loads, and will not feed branch circuits (e.g. sprinkler controllers or traffic signals), either inside or outside of the substation.

Substation AC auxiliary power will be used for large "hotel" loads, which may include signal systems, communications systems, station platforms, transit facilities, parking lot lighting, or other branch circuit panel boards that feed external loads, where appropriate.

In addition, each substation will be furnished a DC control voltage distribution panel board. The DC panel board will supply all substation control power loads at 125 Volts DC.

6.1.5 Grounding

Each traction power substation will be provided with three independent grounding systems, isolated and insulated from each other – an AC ground mat, a DC ground mat, and a utility ground rod. The AC ground mat will be designed to protect personnel from step and touch potentials that may arise under substation fault conditions, and to meet the requirements of the National Electrical Code. The DC ground mat will be designed to ground the negative bus through a diode and monitor ground return currents through a shunt. The utility ground rod will be adequate for grounding the utility neutral or cable shielding, and will maintain separation between the utility ground and the ground mats.

The design of the AC mat will use IEEE 80, IEEE 142, and IEEE Transactions on Power Apparatus and Systems, Vol. PAS-103, No. 11, November 1984, as guidelines. It will be designed so that the step and touch potentials at the rated short-circuit current do not exceed the recommended safety limits of IEEE 80, when all the above guidelines are considered. The average body weight of 110 lb. will be used in calculating the tolerable step and touch potentials. The AC ground mat may be partially located under the substation building slab, and extend a minimum of 10 feet beyond the limits of the substation foundation in all directions. The AC mat shall also be used to solidly ground auxiliary power transformer neutrals, building and door frames, and AC switchgear.

The DC ground mat will measure a minimum of 10 feet by 10 feet, and be physically isolated from other grounds by at least 25 feet. The DC mat will be connected to the negative bus through a diode by a single insulated cable, as part of the low resistance grounding scheme for DC switchgear protection. The DC traction return circuit and protective relay grounds shall be kept separate from other grounds.

The ground mats will be constructed of an assembly of bare copper conductors and ground rods, exothermically welded together. All grounding connections shall carry the rated short circuit current. The ground mat conductors shall be totally encased in native soil. A layer of coarse, clean crushed gravel, free of fines, will be placed over the soil, with a layer of "filter fabric" placed between the soil and the gravel to prevent contamination of the gravel from the soil. The surface layer (over the gravel) may be asphalt, masonry, concrete, or soil. If the surface layer is loose material, such as soil, a layer of filter fabric shall be placed over the gravel to prevent contamination of the gravel from the surface material.

The utility ground rod shall be located approximately 50 feet from other system grounds, and connected by an insulated cable to an electrically isolated lug in the utility incoming section of the switchgear. The utility neutral and incoming cable shields will be isolated from the AC and DC ground mats to prevent the flow of DC stray currents onto the electric utilities grounding system.

The DC traction power substation equipment enclosures shall be low-resistance-grounded to the DC ground mat.

Ground mats will be tested at the time of construction, by the *fall of potential* method described in IEEE 81, and again when the substation is put into service. The resistance of the AC mat shall be less than 5 ohms to ground, the DC mat less than 10 ohms to ground, and the utility rod less than 15 ohms to ground. The resistances between the AC and DC mat, and utility rod and AC and DC mat will be tested by attaching a current source between the mats or rod under test, measuring the voltage, and computing the resistance. The resistance between the mats, or the mats and the utility rod shall be greater than 5 ohms.

Cathodic protection and stray current containment measures also will be provided as part of the design of the Traction Electrification System.

6.2 TRAIN CONTROL AND SIGNAL SYSTEMS

Train control and signal systems for the Trunkline, the Marietta Branch and the two Circulators are discussed in the following subsections.

6.2.1 Trunkline

For the Trunkline operations, fail-safe Automatic Train Control (ATC) is recommended. The ATC system will incorporate train on-board signaling using a distance-to-go fixed block system. The ATC will comprise an Automatic Train Protection (ATP) sub-system, a limited Automatic Train Operation (ATO) sub-system capability, and an Automatic Line Supervision (ALS) sub-system or a Total Traffic Control (TTC) sub-system.

Automatic Train Control (ATC). The ATC will be capable of safely controlling all trains on the main line at all speeds from zero speed to the operating speed of 70 mph. The ATC will be capable of safely controlling train operations with sustained headways of 2 minutes, with headway capability to be adjusted to meet demand in future years.

The system will provide for recovery from minor delays, using built-in regulation capabilities.

In the case of degraded train operations due to track repairs or unplanned incidents, train operations will continue to be controlled by ATC. Full speed manually-controlled operations (subject only to the maximum allowable speed normally authorized for each signal block and the ATP system) will be permitted.

Automatic Train Operation (ATO). The limited level of ATO envisioned for the Trunkline is typified by that employed on the Lindenwold High Speed Line of the Port Authority Transit Corporation (PATCO) connecting Lindenwold and other Southern New Jersey communities with Philadelphia, Pennsylvania; more inclusive installations, such as those employed on the San Francisco Bay Area Rapid Transit District (BART) specifically are not envisioned. Main line train operations will be performed by ATO, with a train driver onboard. Full speed manually controlled train operations will be permitted when required by weather conditions or other circumstances, subject to Automatic Train Protection (ATP). Door opening and closing function will be manually controlled by the train driver. Off-main line and depot operations will not be controlled by ATO. Train movements in the depot will be limited to a maximum speed of 12 mph and will be controlled by a 2-aspect multicolored light signal and dead end signal system.

ATO will control the following on-board train capabilities:

- Departure
- Automatic train driving between stations
- Precision stops at stations
- Speed control, coast control, zero speed monitoring

Automatic Train Protection (ATP). Service brake and emergency brake applications will be subject to the automatic train protection system.

Main line crossovers will be controlled by micro-processor controlled signals and will be subject to the ATP system.

Signal System. The signal system will function within the following context:

- **Train Driver** – One on each train for safety, manual operation when required, and controlling of door opening and closing. Operation in the depot will be manual
- **Maximum Operating Speed** – 70 mph
- **Minimum Service Interval** – 2 minutes
- **Dwell Time** – 15 to 30 seconds at each station; controlled by train driver.

Train operations will be controlled by fixed-block signaling, with continuous track-to-train transmission. Continuous on-board speed supervision will be provided with ATP. The ATP/ATO sub-systems will be based on the "Distance-to-Go" principle, with on-board intelligent processing equipment.

It is recommended that train detection use audio frequency track circuits on the main line and high-voltage impulse track circuits in the depot. The transmission system interface will use short cable loops approximately 40 feet long to inject the signals into the rails. For the intermittent system, the loop interfaces will only be installed at selected discrete locations.

The ATO will allow precision stopping in stations. It will provide operational and route control from the Central Control Room (CCR) with timetable and headway regulation. The signaling system will also provide for local control.

The signal system will allow unidirectional running at service headways and bi-directional single-line operation from crossover to crossover at longer headways. The route interlocking will use a computer-based interlocking system with decentralized control processors for controlling the input/output signal equipment. Point machines will be electrically controlled.

The CCR will contain signal system workstations for operators and a large mimic display panel. There will be a train movement interface to the passenger information and train radio systems. The system will provide automatic fault reporting. A local control facility will be located at the depot.

The ATP system will monitor the ATO system to ensure that trains maintain a safe separation, by regulating train speed and maintaining safe braking distances.

Interface between the train operation and the signals will be provided by the Automatic Train Supervision System (ATSS) and Automatic Train Regulation (ATR) System, communicating to the train through the signal system. The ATSS will monitor the signals data and train operation and communicate this information to the train operators. The ATR will ensure that a given level of traffic is achieved. These functions will be available at the central control room; the ATSS will also be available locally.

6.2.2 Circulators and Marietta Branch

In cases where the tracks are located in roadway medians, side-of-the-road reservations, curb lanes, or in mixed traffic, the signal system will be based on line-of-sight operations, without speed or occupied-block protection. However, at level grade crossings of intersecting streets and at other locations where LRT train movements and other vehicular traffic movements may conflict, distinctive signals governing LRT train movements will be provided.

To protect against conflicting train movements, interlocking signals will be provided at junctions on exclusive rights-of-way, especially those located in underpasses where the vision of train drivers will be restricted. Block signals will be provided on aerial structures; at other locations where a train driver's line-of-sight may be impaired by curvature, gradients, or obstructions; and where high operating speeds will be possible. Both interlocking signals and block signals will have their stop indications enforced by electronic or magnetic trip stops. Circulator and Marietta Branch trains will be driver-operated in both grade-separated territory and in-street operations.

6.2.3 Systems Common to Trunkline and Circulators

6.2.3.1 Headway Criteria for Signal system Design

The signal system will be designed to permit trains to follow one another with safety at 2-minute headways.

6.2.3.2 Automatic Train Protection

The ATP system will be designed to accommodate specific minimum train headways and will comprise track circuits and signals that convey safety directives to a train driver concerning conditions in a track section. The manner in which these components will be deployed is described in the following paragraphs.

The Trunkline will be equipped (depending upon the state-of-the-art of service-proven signaling equipment at the time of project implementation) either with a communications-based train control (CBTC) system or with a fixed block signal system using audio frequency track circuits. With either technology, allowable speeds or stop commands will be displayed in the lead cabs of all trains operating on the Trunkline (including Circulator LRVs traveling to and from the Central Maintenance and Storage Facility). Train drivers will be required to respect cab signal speed commands; failure to do so will result in automatic brake applications that will bring trains to an immediate stop.

Within track segments with block signals, the location of trains will be detected by the track circuits, which also will define the type of indication displayed by each wayside signal.

The use of 3-aspect color light signals mounted on pedestal boxes or affixed to underpass walls is recommended. These signals would display the following commands or indications:

- **Clear (Green)** – Proceed within authorized track speed
- **Caution (Amber)** – Proceed with caution, prepared to stop in advance of next block signal
- **Stop and Proceed (Red)** – Stop and proceed at speed not to exceed 12 miles per hour, while prepared to stop 30 feet short of a train ahead

Occupancy of a block by a train will cause the signal at the entrance to that block to display a STOP command (red) to following trains, and the signal at the entrance to the following (second) block to display a CAUTION command (amber).

A CLEAR signal (green) would be displayed by a wayside signal located at the entrance to a block only when both the block it protects and the second block ahead are not occupied by a train.

6.2.3.3 Wayside Signals

Intermediate wayside signals will be located along exclusive rights-of-way, including at the beginning of ramps descending into underpasses, to maintain safe operating conditions.

6.2.3.4 Signals at Stations on Exclusive Rights-of-Way

Signals located on exclusive rights-of-way will be achieved by installation of 3-aspect color light ATP signals mounted on pedestal boxes located at the departure end of the platforms.

6.2.3.5 Automatic Train Stop (ATS)

Along the Trunkline, the home signals at interlocking plants and block signals along reserved rights of way will be equipped with an Automatic Train Stop (ATS) system and the required wayside mounting hardware. ATS transponders will be installed 30 feet in advance of the insulated joint controlling the associated signal. Within track switch turnouts at interlocking plants, traction-power-return bonds and impedance bonds will be provided to prevent false tripping of the ATS system that would result in unwarranted emergency brake applications of trains.

An ATS System comprised of both wayside and train-mounted equipment is proposed for the Circulators and the Marietta Branch.

6.2.3.6 Interlockings

An interlocking is a discrete zone of track circuits incorporating a switch or switches and home signals that control train movements over those switches. Interlockings are not envisioned at the several junctions located at city street intersections and major crossroads, where distinctive signals governing train movements will be provided to avoid conflicts with vehicular and pedestrian traffic and other train movements. Interlockings will be provided at track intersections in grade-separated territories of the LRT system.

6.2.3.7 Switch and Signal Operation and Control

Movements across interlocking blocks are not permitted unless all switches in the route selected are correctly aligned and locked. Movement through the limits of an interlocking will be permitted when no conflicting movements have been requested.

The track switches and signals are controllable under a variety of modes, which include automatic train-to-wayside communications (TWC) equipment and a local control using the Local Control Panel (LCP). Routes through interlocking plants can be cleared and cancelled, as long as the interlocking is not in the LCP mode. Local control will be provided through the use of LCP located in the CCR.

6.2.3.8 Local Control Panel (LCP)

The LCP permits routes to be aligned and selected by supervisory or signal maintenance forces at a specific location. Crossovers and single turnouts can be operated without the need to clear a signal. Once the switches are aligned properly, signals can be requested, providing that no conflicting routes have previously been requested. All of the safety features present in remote operation are also present in the LCP.

Control of Interlocking Plants

An interlocking plant of an LRT system is usually controlled via the Train-to-Wayside (TWC) system, using both wayside and car borne equipment. The preferred technology is the Philips VETAG technology widely employed on tramway and LRT systems in Europe and North America. Routes through the interlocking plant are initiated by a radio message received by a wayside installed interrogator. The interrogator interprets the data in the message and requests the appropriate route. A signal requested in this manner will clear the departing signal in the normal direction of traffic only. A route cancellation button also will be provided on the wayside at the location of each interlocking signal governing the entrance to a route.

Train-to-Wayside Communications (TWC) Equipment

The equipment is a single wire loop mounted between the rails, 16 feet long from end to end when installed on main line track. On track installed in paving, the TWC loop will be buried, but it may be left exposed when installed on exclusive and protected rights-of-way. The TWC also will interrogate trains approaching diverging routes at interlocking plants and non-interlocked junctions to ascertain their destination, cause the preferred route to be set as soon as it is safe to do so, then cause a "proceed" signal to be displayed.

Home Signals at Interlocking Plants

Multi-aspect color interlocking home signals, which simultaneously display safety commands and describe the route aligned, will be provided at all locations with interlockings. The indications of interlocking home signals will be distinct from those of 3-aspect block signals.

Although other aspect combinations could be chosen to reflect local preferences, the Bechtel/MSE Team suggests the following:

- **Stop and Stay (Double Red)**
- **Clear/Diverge to Left (Double Yellow)**
- **Clear/Diverge to Right (Yellow Over Green)**
- **Clear/Proceed Straight (Double Green)**

When the track circuit beyond the diverging turnout or track crossing is occupied by another train, the interlocking system will not display a *Clear* route. The operating rules of the transit system must state that *Clear* indications of interlocking signals govern only the block immediately ahead and train drivers must be prepared to stop their trains 30 feet in advance of the next ATP block signal if necessary.

Route Alignment Indicators at Non-Interlocked Junctions

Route alignment indicators will be installed at non-interlocked junctions located in city streets (regardless of whether the track is located in medians or in mixed traffic lanes). These indicators will provide information to train drivers, describing the alignment of track switches and alerting them when the sequencing of the traffic light system (governing all vehicular movements through an intersection) permits a requested train movement through the TWC system. The Train route alignment indications will be distinct from traffic light signal indications to avoid confusion to motorists. They also will be distinct from the command aspects of interlocking home signals, to remind train drivers that LRT train movements in this area of the system are not protected by ATS equipment. Although other route alignment indications could be chosen to reflect local preferences, the Bechtel/MSE Team suggests use of the following LRT-only aspects widely used in Europe and North America:

- **Stop and Stay** (Three white lights displayed horizontally)
- **Left Turn Permitted** (Five white lights displayed in an angle 45 degrees to the left of vertical)
- **Right Turn Permitted** (Five white lights displayed in an angle 45 degrees to the right of vertical)
- **Straight Movement Permitted** (Five white lights displayed vertically). The use of five white lights for each indication is recommended to allow understandable route indications to be displayed, pending replacement of a burned out lamp (which will be replaced on a priority basis).

Lighting Circuitry

Home signals will be lit continuously and provided with light-out-relay (LOR) protection to prevent display of a more permissive aspect than intended (because of a burnt-out lamp or broken wire).

Switch Machines

Electrically powered switch machines will be installed at all track switches, including those controlled by interlocking plants. In addition to being electrically powered, in the event of power failure, all switch machines will be capable of being operated manually.

Where a station platform is located at a terminal, at the approach to a grade-level crossing with a street, or at other selected locations, provisions will be made for display of departure signals, to improve the regularity and commercial speed of the LRT system. These provisions will enable train drivers to press a push-button located on the control desk in the cab and initiate a message through the TWC system, calling for display of a wayside signal permitting the train to proceed. Normally, the P light-out-relay (LOR) *Proceed* signal governing LRT movements at intersections will be displayed in conjunction with the display of traffic signals prohibiting left turns or movements across the path of the LRT train by motorists and pedestrians. The *Proceed* or *Stop and Stay* indications displayed to train drivers at such locations will be the same as those discussed above.

6.3 TRAIN CONTROL – COMMUNICATION SYSTEM

A reliable telecommunications system will be provided, with due consideration given both to safety of passengers and staff and to the functional and operational requirements of the system.

6.3.1 Supervisory Control and Data Acquisition (SCADA)

A supervisory control and data acquisition (SCADA) system will be provided for centralized monitoring and control of many functions on the transit system. These functions will include, but are not limited to the traction power system and fire/intrusion systems. The SCADA system will be monitored from the Central Control Room, using communication via telephone dial-up modem links. Microprocessor-based dispatching systems may be explored for possible application.

6.3.2 Telephone Communications

The telecommunications network will be capable of transmitting voice, data, and video and provide reliable service over the distances encountered, in the volumes and level of clarity necessary to safely and reliably operate the system.

Recommended telecommunications facilities are listed below.

Main Transmission System	■ Main transmission line ■ Line for video transmission
Facilities for Operations Management	■ Digital switch ■ General and public phones ■ Station facilities ■ CCTV ■ Fare collection (optional)
Facilities for Train Operations	■ Dispatch telephone ■ Direct telephone ■ Train radio system ■ Video transmission system
Facilities for Passenger Services	■ Broadcasting ■ Train destination equipment ■ Electronic clock
Facilities for Maintenance	■ Wayside telephone ■ Talk-back radio ■ Portable radio
Facilities for Car Depot	■ All related facilities for car depot

It is recommended that telecommunications be provided approximately in accordance with the following plan:

- Each passenger station will have facilities for the local management and the control and safety monitoring of passengers and staff. Communication facilities will be provided for the operation of the LRT system, which will include the facilities for operational, service, and maintenance staff. The passenger control and communications system will comprise a number of subsystems that provide a means of operating the system and assist with passenger management, monitoring, and safety control. The communications system will provide passengers with train arrival and departure information.
- Station telecommunications facilities for management of the system and the control and safety monitoring of passengers will include:
  - Public address system
  - Passenger talk-back units
  - Train destination equipment
  - Passenger information system
  - Closed circuit television system
  - Radio systems
  - Telephone systems

  These facilities will be controlled and monitored from a Central Control Room; however, local control will be provided in selected stations.
- In addition to the station communication facilities, other telecommunications subsystems will be provided to give dedicated support to operations and maintenance staff. These subsystems will comprise:
  - Radio for mobile staff and for Central Control Center to train communications
  - Administrative telephone communications
  - Lineside telephones/talk-back systems
  - Dispatcher telephones
  - Depot communications

6.3.3 Rooms, Shelters and Tunnels

This section covers systems that are unique in application to station rooms, signal or communication shelters, and tunnels and/or underpasses.

6.3.3.1 Fire and Intrusion Systems

Fire and intrusion systems will be provided in any enclosed areas, such as rooms or shelters, where any vital or valuable equipment resides. These systems will be controlled by local fire/intrusion panels, and will also communicate with the central control room via SCADA to provide alarms and remote monitoring of these systems.

6.3.3.2 Tunnel Emergency Telephones (Blue Light Telephones)

For any underground track, emergency telephones will be provided at maximum intervals of 100 feet wherever the length of tunnels exceeds 300 feet. International practice dictates that the location of each emergency telephone will be identified by constantly illuminated blue lights visible from the trackway.

6.4 UNINTERRUPTIBLE POWER SUPPLIES (UPS)

Redundant and independent AC utilities will be available through the use of power transfer switches to enable continuous operation of the SCADA, fire/intrusion system, and emergency lights in the event of an Area Power Outage.

6.5 ENVIRONMENTAL CONTROL SYSTEMS

Large enclosed areas where passengers or personnel congregate, such as underground stations, need centrally controlled environmental control systems. In any underground stations and/or tunnels, appropriate ventilation systems must be provided, including emergency response capability monitored and controlled from the CCR.

Small enclosed areas containing electronic equipment, such as communications/signal shelters or station rooms, will be provided with simple local environmental controls, such as thermostat-controlled air conditioning units, fans or heaters.

6.6 AC POWER (120V AC, SINGLE PHASE)

Two redundant and independent AC power utility connections will be provided at the Central Maintenance and Storage Facility and all terminal stations. Power transfer switches will be used to provide the power.

All elements of the LRT system will be required to meet the applicable safety codes and regulations of the USDOT, FTA, State of Georgia, and Cobb and Fulton counties. In the absence of specific codified requirements, international best practice (IBP) will be followed. Consideration will be given to the various guidelines and recommendations of the American Public Transportation Association (APTA) and the National Fire Protection Association (NFPA).

6.7 FARE COLLECTION SYSTEM

There are essentially four basic fare collection concepts currently in use on modern transit systems: the barrier system, using stored-ride or stored-value cards and automated readers; the manual ticket sales and inspection system; on-board vehicle ticket sales system; and the self-service "proof-of-payment" system.

Each fare collection system is discussed below, together with an evaluation of each.

6.7.1 Barrier System

The modern barrier system provides automatic fare collection barriers at entrances and exits to the 'paid' area within a station. The main advantage of this system is that it provides good revenue control; it also is a valuable source of information regarding trip characteristics of the transit system. The main disadvantages are the requirements to provide and maintain expensive equipment (gates or turnstiles with card readers) and the need to segregate station areas into paid and unpaid areas.

6.7.2 Manual Ticket Sales and Inspection

Manual ticket sales and inspection systems are usually configured with manned ticket barriers. They have the advantage of avoiding the major investment and ongoing maintenance requirements of barrier-based automatic fare collection systems; they also require less space at stations. Their major disadvantage is that they are extremely labor-intensive, usually requiring at least two employees at every station during all hours of operation. Manual sales and inspection of tickets at stations is not recommended for use on the transit system. The relatively high requirements for staffing make this system particularly unattractive for the two Circulators and the Marietta Branch, which have a high ratio of stations to track miles.

6.7.3 On-Board Fare Collection

On-board vehicle fare collection – in which each passenger files past the train driver or a conductor upon entering or exiting the vehicle to pay their fare – is seldom employed on new LRT systems. Although it reduces investment in fare collection equipment and avoids demand for considerable space at stations, this system has a major negative impact on commercial (schedule) speeds. It lengthens station dwell times significantly, which results in longer travel times that depress ridership. It also requires more rolling stock to operate at the same service frequency.

This system is not recommended for use on the Trunkline, the Marietta Branch through service, or the two Circulators. It may be suitable, however, for use on the Marietta Vintage Trolley Car Service as discussed in Section 12.

6.7.4 Proof of Payment Fare Collection

The proof-of-payment system requires that patrons purchase tickets, usually from machines in station areas, and board trains without any preboarding ticket inspection. Roving ticket inspectors are employed to randomly verify that travelling passengers are in possession of a ticket. Passengers who are unable to produce a ticket upon demand are typically charged for a ticket and are subject to a penalty fare and/or fine.

This method was developed in Europe (notably in Germany) about 30 years ago, for use on existing transit systems. It has been implemented successfully on numerous recently built systems serving European, North American, Australian, and Asian cities. Its advantage, compared to the barrier system, is that it requires substantially less investment in equipment and virtually eliminates ticket barrier maintenance. Maintenance of ticket vending equipment is still required. It does, however, require the employment of roving ticket inspectors to assure that passengers have valid tickets.

When properly designed and implemented, fare evasion experience under this system has been comparable to, or less than, that of barrier systems. Compared to manual ticket sales and inspection, a proof-of-payment fare collection is far less labor-intensive and more economical to operate. The proof-of-payment system does not adversely impact station dwell times, thereby permitting commercial speeds to be the same as the speeds for systems that employ barriers.

The proof-of-payment fare collection system also lends itself better (than a barrier-based system) to allowing pedestrians to use Trunkline stations located along Cobb Parkway as de facto footbridges or underpasses. Given the width of Cobb Parkway and its very high volume of vehicular traffic, this feature will be a side benefit to the communities served, that can be expected to improve pedestrian safety in locations that are widely acknowledged to be dangerous.

6.7.5 Fare Collection System Recommendations

For the Northwest Corridor LRT System, it is recommended that either a barrier system or a proof-of-payment fare collection system be adopted. The choice between the two requires consideration of how effective a proof-of-payment fare collection system would be in the Atlanta Metropolitan Region, using what is essentially a random inspection system backed by the courts for enforcement. The factors affecting that decision are almost all local, and should be considered in concert with the operators of the system, the political and business leaders of the community, as well as local representatives of public sector organizations.

This section of the Final Report describes the numerous issues that must be taken into consideration in the design of the stations along the Northwest Corridor Light Rail Transit System as well as the sites where intermodal transfer of transit patrons will be accommodated. This section concludes with descriptive lists of the 13 Trunkline stations in Cobb County and the 60 Circulator stations. The stations and their locations along the Marietta Branch are discussed separately within Section 12.

7.1 STATION SITE DESIGN

A number of issues influence effective station site design, such as site size, development considerations, parking, access modes, accommodations for non-drivers, signage, landscaping, and lighting.

These issues, along with applicable municipal and county design standards and regulations, will ultimately be set forth in a *Station Site Design Criteria Manual* established for the use of each station site's final designer, to guide station site design quality and a standardized design approach.

7.1.1 Site Size

The site sizes for the stations will be determined by the functional requirements for their use.

Trunkline stations will act as nodes of modal interface, used intensively by buses, car-pooling vans, taxi cabs, personal vehicles, bicyclists, and pedestrians; the majority of patrons using the Trunkline stations will access/egress the site via some form of vehicle. Therefore, the Trunkline station sites will be sizeable.

Circulator stations, on the other hand, will be accessed and egressed mostly by pedestrians. Therefore, the Circulator station sites will be much smaller and will, in many cases, occupy little more than the footprint of the station structure.

7.1.2 Development Considerations

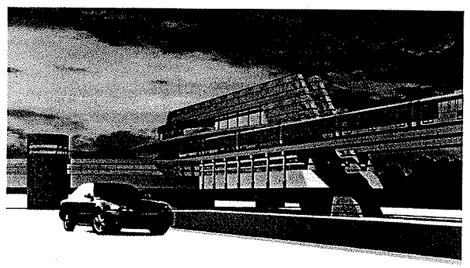
Trunkline stations, being intermodal, will form significant nodes of community activity, serving as catalysts for increasing density of adjacent development and, in many cases, initiating a revitalization of their environs. As such, site layouts should reflect consideration of the potential for future air-rights joint development of the transit-agency-owned property, possibly in the form of public – private partnerships.

Since, at many stations, vehicular and pedestrian activities will be accommodated mostly at the ground level, air-rights developments could be added above these station site areas at a later time. Such developments could provide recurring revenue to the transit agency, through the long term leasing of their air-rights; therefore, initial site design should accommodate future joint development considerations.

7.1.3 Parking Considerations

Trunkline stations will generally require additional adjacent land, to accommodate the numerous intermodal transfer and storage functions described below.

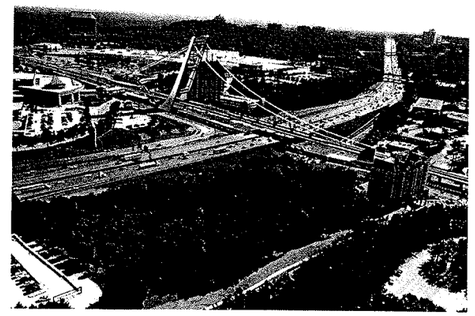
Given the size of Trunkline station sites, some of them accommodating as many as 1,000 long-term parking spaces, great care must be taken to assure that they are designed to successfully "fit" into their neighborhoods and into the urban/suburban fabric of the region. From a design standpoint, the Trunkline station sites must be clearly recognizable as inviting, high-quality, integral parts of the overall system, and must not be confused with the many existing internal vehicular circulation areas and parking lots along Cobb Parkway and other major roadways. Design will be in accordance with the applicable municipal and county design standards and regulations governing the design and construction of parking areas (the minimum sizes of parking spaces, basic vehicular and pedestrian circulation requirements, landscaping, screening, and perimeter buffering recommendations, and provisions addressing the needs of the mobility-impaired).



Circulator stations will not be expected to have additional site areas. Although there will be some curbside drop-off/pick-up by buses, carpooling vans, taxis, and private vehicles, in addition to the pedestrian access and egress, these modal transfer movements will be accommodated in the public right-of-way alongside public roadways, which obviates the need for additional land acquisition at Circulator stations.

7.1.4 Safety

Safety and efficiency of vehicular and pedestrian circulation within the Trunkline station sites is of paramount importance. These factors are key to making the sites user-friendly and, in turn, attracting ridership to the system.



7.1.5 Access Mode Priorities and Accommodations

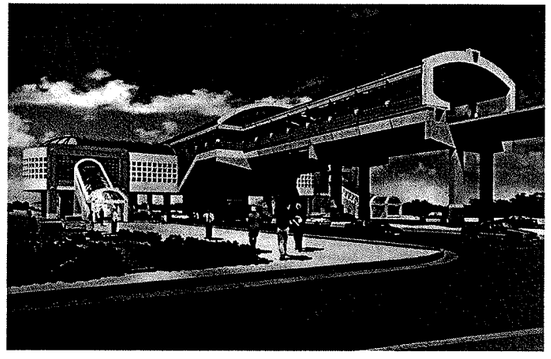
The accepted practice in transit site planning is to establish a hierarchy for the modes of access to be accommodated.

- The highest priority is usually given to feeder buses – to promote their use as a means of accessing the stations – by providing bus stalls as close to the station entrance(s) as possible.
- The second priority is given to the kiss-and-ride patrons – patrons who are driven to or from the station and are dropped-off/picked-up close to the station entrance(s), thus requiring only short term parking spaces. These spaces will be located on the station site a bit further away from the station entrance(s), requiring a little longer walking time.
- The third priority is assigned to the park-and-ride patron, who requires a space in which to park a car for an extended period of time. Park-and-ride patrons will have the farthest walk to the station entrance(s), albeit a relatively short distance when compared to similar walking requirements at large commercial malls. Although park-and-ride facilities require the most space per patron, they have proven to be an essential ingredient in transit patron accommodation.

In some cases, parking structures will be necessary to provide an adequate amount of park-and-ride spaces. The design of these structures will vary based on site constraints and the number of parking spaces to be accommodated. Care must be exercised in the design of these structures, since their impact can be significant to the ground level circulation of both vehicles and pedestrians (which such structures tend to interrupt) and to the surrounding community. The more successful structured parking facilities at transit stations are those that have been integrated into mixed-use facilities; such facilities offer transit patrons additional conveniences and present a more architecturally appropriate image to the community. The construction of such mixed-use facilities can result from public-private partnerships, as explained above, in the discussion of joint development opportunities on transit agency owned station sites.

7.1.6 Accommodations for Non-Drivers

Patrons who walk or bicycle to the stations must be accommodated in the safest and most inviting manner possible. These individuals are the transit system's most "environmentally responsible" patrons, and they require the least of the station site, in terms of walkway/roadway paved surfaces and dedicated land area. The station site walkways, their connectivity to the existing pedestrian networks in the surrounding communities, their safe and non-circuitous design, and their accommodation of the needs of the mobility-impaired are extremely important. Pedestrian and bicycle design standards and guidelines for the station sites will reduce, to the maximum extent possible, conflicting movement patterns between pedestrians/ bicyclists and motorized vehicles circulating within the station sites.



7.1.7 Directional and Informational Signage

Convenient use of each station site will depend on the appropriate placement and design of graphic signage, both throughout the site and at the station entrance(s). Decision points should be properly signed, particularly those that indicate the vehicular entranceways/exitways from the adjacent roadways into the station site. Transit patrons will rely heavily on the directional and informational graphic signage, within each station site and throughout the transit system, to consistently guide and reinforce their movement patterns.

7.1.8 Landscaping

In addition to providing a softening and beauty to the sites, landscaping can be used to reinforce movement patterns, to prevent conflicting circulation (vehicular and pedestrian), and to emphasize view corridors for functional and aesthetic purposes. Landscaping design can help to achieve scale transitions from the larger architectural elements of the station and trackway structures, frame views, or screen elements. Well-designed landscaping will be key to achieving the successful fit of the station into its neighborhood.

7.1.9 Site Lighting Design

Lighting is critical to the perception of transit station sites as being safe and inviting places, as well as for their safe and secure use. Lighting will be designed to guide and assist the safe movement of both vehicular and pedestrian circulation throughout, and to enhance the aesthetic quality of the station facilities and landscape materials.

At the same time, the lighting will be designed to assure minimal impact of the light on the surrounding community, i.e. use of appropriate lighting intensities, cut-off angles to prevent light intrusion, and proper screening of light.

7.2 STATION DESIGN

Various issues influence effective station design, ranging from aesthetic to functional to operational. The issues addressed herein will ultimately be expanded upon in a *Station Design Criteria Manual*, for the use of each station's final designer, to assure that transit patrons will be provided a consistent experience, with appropriate levels of safety, space provision, patron facilities, and positive station ambience in all of the stations. The design criteria will enable achievement of these objectives in a cost-effective manner, while including planned capacity for future growth.

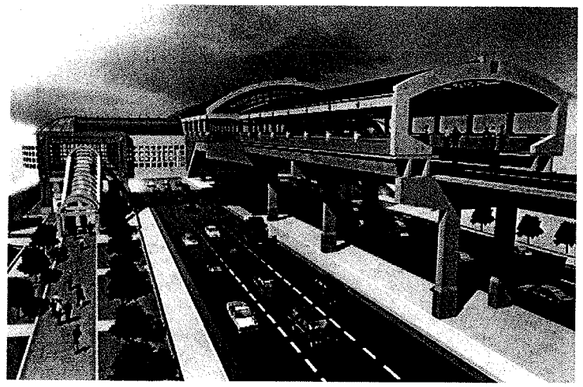
Table 7-1 summarizes the types of stations proposed; they are discussed in the following subsections, along with the issues guiding their design. Conceptual designs of typical stations are presented in Volume II of this document, coded per Station Design type as indicated within Table 7-1.

Table 7-1 Station Types

Station Type	Station Type Code	Number of Stations		
		Trunkline	Cumberland Circulator	Town Center Area Circulator
Transfer Station – Elevated Center Platform Circulator Station above an Elevated Side Platform Trunkline Station	T1	1 (at Cumberland Boulevard, platform types: B1 / **B3)**	1 (at Cumberland Boulevard Transfer Station, platform types: **B1** / B3)	
Transfer Station – Underground Side Platform Circulator Stations below an Underground Double Center Platform Trunkline Station	T2	1 (at Windy Ridge Parkway / Herodian Way, platform types: 2A1's / **A2)**	2 (at Windy Ridge Parkway / Herodian Way , platform types: **2A1's** / A2)	
Transfer Station – Two Adjacent Underground Center Platforms, Trunkline Utilizing Inner Tracks, Circulator Utilizing Outer Tracks	T3	1 Town Center Mall Transfer Station: A2 / **A2**		1 (at Town Center Mall, platform types: **A2** / A2)
Transfer Station – Elevated Center Platform Circulator Station above an At-Grade Center Platform Trunkline Station	T4	1 (at Chastain Road/ I-575, platform types: B2 / **C1**		1 (at Chastain Road/ I-575 , platform types: **B2** / C1)
Transfer Station – Elevated Center Platform Circulator Station below an Elevated Center Platform Trunkline Station	T5	1 (at Barrett Parkway, platform types: B1 / **B1)**		1 (at Barrett Parkway, platform types: **B1** / B1)
Underground Side Platform	A1	3		
Underground Center Platform	A2		1	
Elevated Center Platform Station in Roadway Median	B1			1
Elevated Center Platform Station NOT in Roadway Median	B2		9	
Elevated Side Platform Station in Roadway Median	B3	4	12	9
Elevated Side Platform Station NOT in Roadway Median	B4		5	
At-Grade Center Platform Station in Roadway Median	C1			
At-Grade Center Platform Station NOT in Roadway Median	C2		3	
At-Grade Side Platform Station in Roadway Median	C3		4	7
At-Grade Side Platform Station NOT in Roadway Median	C4	1		3
Total Number of Stations		**13**	**37**	**23**

Note: For the five transfer stations, the **bold** station type designation with each of the three columns indicates the station type for that column. Example: type B1/B3 in the T1 Trunkline column indicates an interchange station comprised of a B1 Circulator station type and a B3 Trunkline station type.

7.2.1 Overview of Station Types



The recommended Trunkline configuration includes 13 stations in Cobb County – five transfer stations (where patrons can transfer to the Circulators), three additional underground stations, four elevated stations in and above the median of Cobb Parkway, and one at-grade station.

The two Circulators include 60 stations, 37 in the Cumberland CID and 23 in the Town Center Area CID.

- The Cumberland Circulator has three transfer stations (two underground at the Windy Ridge Parkway/Herodian Way Transfer Station, and one elevated at Cumberland Boulevard) for interchange with the Trunkline, one underground station, 26 elevated stations, and seven at-grade stations.
- The Town Center Area Circulator has three transfer stations (one underground and two elevated) for interchange with the Trunkline, ten elevated stations, and ten at-grade stations.

Architectural concept drawings, including plans, sections, and elevations of these various types of stations, are included in Volume II. The stations have been assigned "Station Type Codes" such as T1, A1, or B1 etc. as indicated in Table 7-1, Station Types, on the previous page. These codes are used to designate the recommended design configuration for each of the stations in the lists contained at the end of this section.

7.2.2 Aesthetic Objectives

As stated in Section 3.4, it is essential that a systemwide design approach be undertaken for all of the stations. The design guidelines and requirements set forth in the *Station Design Criteria Manual* will establish standardized design configurations, material usage, and assemblies for all of the stations, to achieve an aesthetically unified transit system. It is vitally important that the transit system and its stations be perceived as a series of like components, designed as a totality, and not as a disparate collection of dissimilar designs and materials.

The successful "fit" of the stations into their urban/suburban built environments is another extremely important aesthetic objective. Purposeful aesthetic strategies will be developed for each station, to lessen or actually preclude their intrusive visual impact. An architectural design approach will be developed whose simplicity and clarity of line will not compete visually with adjacent, more architecturally significant building designs.

As part of a concerted effort to enhance the functional clarity of all stations, levels of repetition of station functional relationships and elements will be established, to produce similar experiential patterns for all patrons throughout system. These functional patterns, coupled with visual, spatial and aesthetic continuities, will aid not only the everyday patron, but also newcomers and the many elderly and mobility-impaired individuals who will depend on the system every day. These similar functional relationships and aesthetic commonalties will help transit patrons avoid confusion, maintain a clear concept of self-in-place, and use the system in greater comfort, security, and safety.

7.2.3 Basic Station Design Considerations

The *Station Design Criteria Manual* will establish the basic principles to be followed in the laying out of station facilities: the space planning guidelines both for the public areas of the stations and for the nonpublic areas (i.e., equipment spaces and those utilized by station operating staff) as well as guidelines for the accommodation of emergency evacuation of the stations.

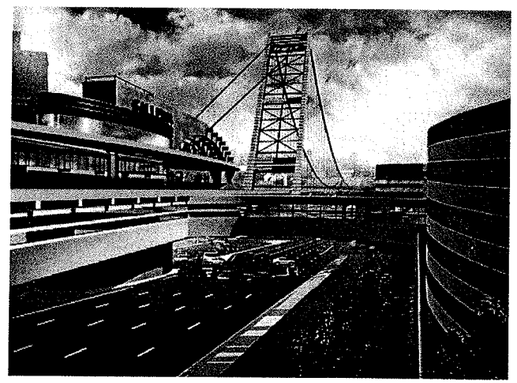
Basic station space-planning principles will provide for the following, during normal operating conditions:

- Avoidance of congestion, enabling a free flow of transit patrons
- Reasonable levels of comfort in the station waiting areas
- Right hand orientation for movement patterns
- Capability of the public areas to successfully absorb surges in demand and greater densities of patrons due to train service disruption.

In principle, that which is considered most economically optimal should determine the space within the stations provided for transit patrons.

The conceptual station designs presented in Volume II include numerous station types that are located within medians of roadways. A guiding principle in their design is that, when possible, the stations will include a concourse level that also functions as a pedestrian overpass or underpass. For example, because Cobb Parkway is so wide and so heavily used by vehicles, it is extremely difficult for pedestrians to cross. Therefore, the Trunkline stations have been conceptualized to accommodate pedestrian movements across the Parkway via stairways, escalators, and elevators. Similarly, many of the Circulator stations, (e.g., those in the median of Barrett Parkway in the Town Center Area), have also been designed to accommodate the movements of both transit patrons and pedestrians needing to cross busy thoroughfares. The accommodation of such pedestrian movements helps to knit the stations and transit system into their neighborhood contexts, and is an excellent way to attract new patrons to the system.

An example of this type of connectivity is the architectural concept for the Cumberland Mall/Galleria Trunkline station. At present, a pedestrian bridge spans Cobb Parkway, connecting the Cumberland Mall to the Cobb Galleria Convention Centre and the Galleria shopping arcade. Although the placement of the Trunkline station will necessitate the removal of that pedestrian bridge, the station's concourse has been designed to enable the same pedestrian crossing movements over Cobb Parkway, thereby bringing an even greater vitality to that station and its environs.



The stations will be designed to have an open and spacious feel, while providing protection from inclement weather. They should offer the best possible sight lines throughout and should maximize the use of natural light. Long passageways, possible hiding places and dead ends must be avoided. Circulation routes should be direct and obvious, and travel distances should be kept to a minimum and designed free of obstructions and constrictions. The pedestrian flow-through capacities of any area of a station, must be equal to the combined capacities of all routes feeding into it. Finally, all stations must be fully accessible to the mobility impaired, as required by the *Americans with Disabilities Act (ADA).* Specific criteria and design guidelines will be detailed in the *Station Design Criteria Manual* to achieve these objectives.

7.2.4 Station Concourse Design Considerations

The concourse is a walkway level that is generally included within a station whose trackage is either elevated or below ground in a subway configuration. The concourse level is accessed and egressed by stairway, escalator, and/or elevator; from the ground level up to the station concourse, from the ground level down to the station concourse, and in some cases – such as station type B2 – directly into the ground level concourse.

Concourse levels will be included in the transfer stations (Types T1 through T5), in the underground stations (A1 and A2), at the elevated stations in roadway medians (B1 and B3), and at the ground level of the elevated stations which are not in roadway medians (B2). Conversely, there will be no concourse levels within elevated side platform stations that are not in roadway medians (B4), nor will there be any concourses in the at-grade platform stations (C1 through C4).

The station concourse level should be thought of as a combination queuing area and pedestrian thoroughfare, providing patrons with the opportunity, time, and space to assess where they are and what they need to do without obstructing other pedestrian through flows.

Essentially, the *Station Design Criteria Manual* will set forth the space planning guidelines required for:

1. Orientation time
2. Decision/action time
3. Queuing time

As an example, minimum queuing distances will be established at the upper and lower landings of stairways and escalators, at elevator landings, on both sides of the fare collection array, and at fare vending machines.

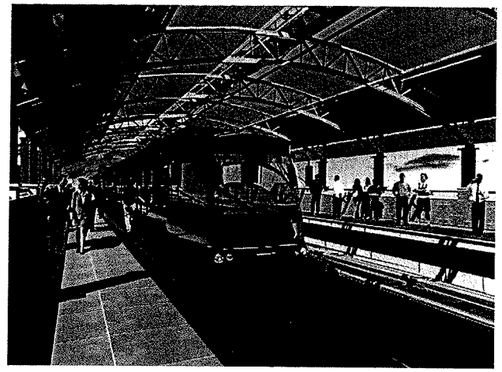
One of the key functions of station concourse levels is to provide space for the sale and collection of transit fares. There are many different approaches to this issue, ranging from automated and manned ticket sales facilities within the station concourse, to arrays of fare collection machines through which passengers must pass after inserting or swiping their tickets, to "proof of payment" scenarios where fare collection machines are not necessary. It is at the station concourse level where the basic line of distinction is established between the unpaid station zone and the paid station zone. A line of demarcation is established within each station concourse, past (or inside) which all patrons must be able to show proof of payment or a pass.

Finally, station control facilities are located at the concourse level. In some cases, these facilities include an office for station staff charged with operating the station and attending to the needs of the transit patrons. Depending upon the number of patrons using each of the stations, these offices may be manned during all hours of station operation, or during the peak hours only. At stations with low levels of patronage, the control functions may be accomplished remotely via closed circuit television and patron assistance telephones.

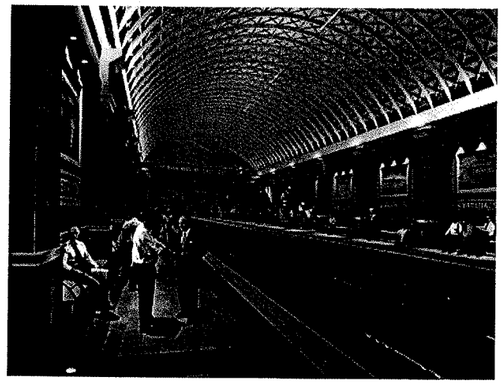
7.2.5 Station Platform Design Considerations

The platform level is where the transit patrons board or alight from the trains, as well as wait for the next train to arrive. There are basically two types of station platform arrangements used in the conceptual station designs for the Trunkline and the Circulator stations: a center platform station configured as an island between the inbound and outbound tracks, and a side platform station that consists of two separate platforms that flank the inbound and outbound tracks running side by side. Both types are recommended, as presented in Table 7-1, Station Types, and as shown in the lists at the end of this section.

Numerous factors influenced the platform concept designs, including operational considerations, cost, constructibility considerations, site-specific constraints regarding station access, and the safe and efficient movement of transit patrons.



The platforms are, in most cases, accessed from the concourse level – either up or down via stairways, escalators, and elevators. This is the case at the transfer stations (Types T1 through T5), at the underground stations (A1 and A2), at the elevated stations in roadway medians (B1 and B3), and the elevated stations that are not in roadway medians (B2). Conversely, for those stations not having concourse levels – for elevated side-platform stations that are not in the roadway medians (B4) and for at-grade platform stations (C1 through C4) – their platforms will be accessed directly from the ground level.



The sizing of station platforms is one of the most important aspects of successful station design. Although the length of each platform is, in most cases, based on the length of the train plus some minimum "overrun" distance, careful study must be made of the recommended platform widths, both center and side platforms. The Trunkline station platforms will be 270 feet long, incorporating provisions for future expansion to 360 feet. The Circulator station platforms will be 100 feet long.

The width of station platforms has a more direct and immediate effect on platform crowding than does the length; therefore, the

determination of platform widths, which will depend on projected patronage and operational considerations, must be carefully addressed. The *Station Design Criteria Manual* will offer various guidelines and formulas to determine the width of the station platforms.

Station platforms will be designed to promote convenient access, egress, and circulation. The arrangement of the stairways, escalators, and elevators on the station platforms will be placed so that patrons will be distributed and collected evenly along their length. They will also be arranged to minimize conflict between boarding and alighting patrons.

Good sight lines along and across the platforms are key to the safe and effective design of station platforms – all patrons must be able to easily see the arrival and departure of trains. Construction of elements that interrupt sight lines (e.g. signs, kiosks, other structures) along platforms must be kept to a minimum.

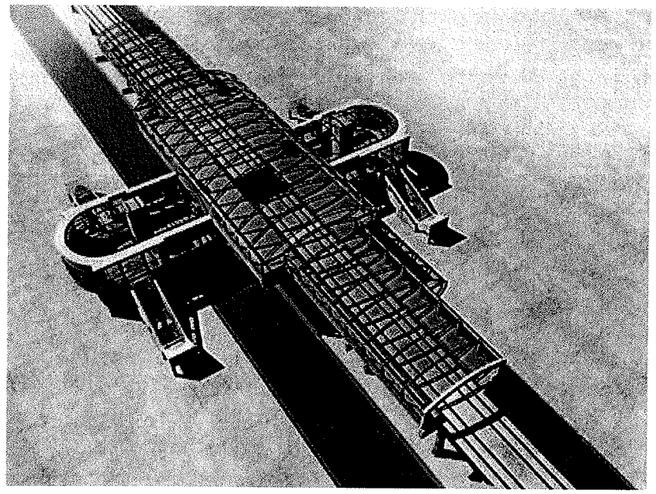
The design of the platform edge is critically important to the ease of train access/egress and to the safety of all patrons, particularly the mobility-limited and patrons with sight disabilities. It is recommended that level and adjacent access from the platform to the trains be achieved at all stations. Further, the *Station Design Criteria Manual* will establish a standardized platform edge design that will be identical for all stations, specifying the width, material, color, and tactile requirements.

7.2.6 Horizontal and Vertical Circulation Guidelines

The *Station Design Criteria Manual* will set forth guidelines and criteria governing the horizontal and vertical movements of patrons within each of the stations. Successful station design arrangements minimize the extent to which both types of movement.

Horizontal movement through stations should be on level surfaces, with the number of level changes kept to an absolute minimum. In principle, with the exception of the more complex transfer stations (Types T1 through T5), there should only be three levels in each station: the ground level or station entrance level, the concourse level, and the platform level. In some cases, such as the Type B2 and C1 through C4 Circulator stations, there are only two station levels: the ground level or station entrance level, and the platform level. Each level shall maintain a constant "step-free" elevation, constructed of slip-resistant materials, to aid the ease of movement of all patrons, particularly the mobility-impaired. The requirements of the *Americans with Disabilities Act* will be outlined and referenced in the *Station Design Criteria Manual.*

Efficient and safe horizontal movement throughout the stations will also be aided by an open and spacious design, which, in turn will enable excellent sight lines. Long horizontal passageways are to be avoided, while the circulation routes should be as direct and obvious as possible without heavy reliance on directional signage. The vertical clearance or headroom to overhead levels or structures



should be no less that 10 feet, and should be greater, when possible, since spaces perceived as being "compressed" have been proven to impact the flow and capacity of horizontal movement.

Vertical movement between levels in transit stations is achieved with ramps, stairways, escalators and elevators. The conceptual Trunkline station designs use combinations of stairways, escalators and elevators to achieve vertical movement between levels. The conceptual designs for the Circulator stations utilize only stairways and elevators, because the capital and operating expense of escalators is not justified given their anticipated patronage levels.

Ramps are most often encountered in the older transit systems, installed retroactively to meet the needs of the mobility impaired. In new transit systems, ramps internal to stations can and should be avoided. They negatively impact the flow and capacity of station areas and are uncomfortable for all patrons, particularly the mobility-impaired. However, ramps such as the traditional "curb cut" could be used inside the station sites to achieve minor changes in level, such as from roadway surfaces to the sidewalk levels.

Stairways are the preferred and most universal means of achieving vertical level change. They are multi-directional, cost-effective to construct, require little maintenance, are always available for use, and efficiently carry medium capacities of patrons. For vertical distances of 15 feet or less, stairways should be used instead of escalators.

Escalators are the most expensive means of achieving vertical level change. However, they are capable of higher capacities than stairways, and move transit patrons in greater comfort. Escalators are single-directional; expensive to install, operate, and maintain; require down-time for maintenance; and are uncomfortable to use as stairways when non-operational. They should only be used to achieve vertical transitions in excess of 15 feet.

Elevators have come into use in transit stations during the last forty years or so, as a result of the nationwide standards established governing the mobility requirements of the physically impaired. Transit systems throughout the world have long used elevators – most notably the London Underground – to achieve significant vertical transitions from subway stations located quite far below ground level. Today, all new U.S. transit systems use elevators between the major station levels, mainly to accommodate disabled patrons. They are multi-directional, meet the travel demands of nearly all patrons, and require far less space than either stairways or escalators. However, they are expensive to install, operate, and maintain (though less expensive to operate than escalators); require down-time for maintenance; and are limited in carrying capacity.

The *Station Design Criteria Manual* will include guidelines for the proper design and location of each of these elements. It will contain formulas for determining the capacity of stairways and escalators, and recommendations as to how many of each should be incorporated in the station's design. Similar guidelines will be included for station elevators, such as the desirability of using flow-through elevators (those with two doorways per level) and the need to place them in conspicuous locations so they are immediately available for the benefit of all patrons on a self-service basis.

7.2.7 Station Space Planning for Staff Accommodation and Ancillary Facilities

In addition to the public areas utilized by transit patrons in each of the stations, there are numerous spaces that must also be provided to facilitate the operation of the stations and the transit system. In general, the Trunkline stations, given their utilization by significantly higher patronage volumes, will require more extensive staffing and ancillary support. Similarly, underground stations recommended for both the Trunkline and Circulators will require more extensive electrical and mechanical facilities, thus more ancillary rooms.

The *Station Design Criteria Manual* will include a listing of every space required for the operation of each station. It will provide criteria for the sizing and location of each space as well as a detailed explanation of the functional requirements for each. Examples of such operations-related spaces include ticket offices and their related storage facilities, station control rooms, administrative offices, staff rest/break rooms, staff locker and toilet facilities, etc.

Numerous ancillary rooms will also be listed in the *Station Design Criteria Manual*. Similarly, their sizing and location criteria will be stated, as will detailed explanations for their functional requirements. Examples of such rooms will include mechanical and electrical rooms, escalator and elevator equipment rooms, switchgear rooms, communications equipment rooms, cleaners' rooms and their associated storage rooms, etc.

7.2.8 Station Control and Emergency Evacuation

All stations will be equipped with public address systems and closed circuit television monitoring. Each high-patronage station (mostly along the Trunkline) will include a Station Control Room at the concourse level, from which public address announcements will be made, and in which the CCTV cameras will be monitored. Certain station control rooms will also monitor other stations whose size and patronage do not merit the inclusion of such a facility.

Help-point facilities (similar to "push-to-talk" intercoms) will be provided in all stations at both the concourse and platform levels. These help-point facilities will be connected to and monitored by the station control room staff. Patrons could use them to obtain information, summon assistance, sound an alarm, and be monitored while waiting. These facilities will be located throughout the system's stations in a standardized manner, in the same relative positions on the stations' concourses and platforms, so that patrons can readily find them. The *Station Design Criteria Manual* will designate the locations of the station control rooms, designate the respective station groupings to be monitored remotely, and identify the functional requirements and location criteria for the station help-points.

Emergency evacuations of transit stations require patrons to be cleared to a place of safety within 6 minutes. Where possible, the emergency evacuation routes should be the same as those used in normal, everyday station operations. This will be more cost effective than constructing separate emergency exiting routes, and, more importantly, patrons will evacuate the stations more quickly if they are familiar with these routes. In principle, patrons should be able to clear the immediate vicinity of a fire in 4 minutes and reach a place safe from smoke or toxic fumes within 6 minutes (including the initial 4 minutes).

Two evacuation scenarios are traditionally used for station planning: the train-on-fire scenario ensures that a large number of people can be safely evacuated; and the station-on-fire scenario ensures that the station configuration can still enable timely evacuation if the largest evacuation route is blocked. Both evacuation scenarios represent worst-case situations in which patrons cannot be evacuated by train.

Proper planning for emergency evacuation is a critical aspect of transit station design. The international standard governing fire protection requirements for transit systems is the *NFPA 130 Standard for Fixed Guideway Transit Systems*, published by the National Fire Protection Association. The *Station Design Criteria Manual* will designate this standard as fully applicable to the system, and will provide further detailed guidelines for the specific designs of each of the stations.

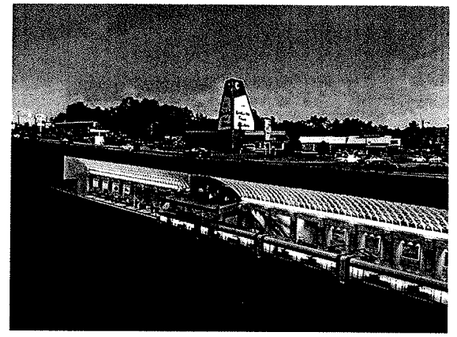
7.2.9 Station Environment – Graphic Signage, Lighting and Color, and Acoustics

Although directional and informational signage is always an integral part of transit station design, there is a correlation between the functional clarity of a station's design and the amount of signage that is required to assist the patrons traversing through it. As previously discussed, repetition of station functional relationships and elements will be established to yield similar experiential patterns for all patrons throughout the system. These unified functional patterns, along with the visual, spatial, and aesthetic continuities throughout the stations, will help the everyday patron, newcomers, and the elderly and mobility-impaired to avoid disorientation. When this is accomplished, graphic directional signage can be reduced in quantity and message content, and can be used more as reinforcement of patrons having made the correct decision.

Graphic signage will be designed and implemented on a systemwide basis and governed by a *Graphic Standards Manual* that will be utilized by the final designers of each station. The manual will establish the format, content, and location criteria for all signage used within the stations, both public and staff areas, and throughout the station sites. The full scope of the *Graphics Standards Manual* will include all signing, both directional and informational, other forms of visual patron information such as touch-screen monitors, audible patron information, and tactile patron information.

Station lighting design also plays a key role in the success of transit station design. It is key to the safe and secure use of each station and will be used to guide and assist the movement of patrons through each of the station areas. Lighting design is critical to the perception of the stations as safe places, and also enhances the aesthetic quality of the station facilities. Station lighting design will also be designed on a systemwide basis, as determined by the requirements and guidelines presented in the *Station Design Criteria Manual*.

Visually impaired patrons require higher lighting levels than usual. The applicable standards, such as those of the *Americans with Disabilities Act*, will be followed, as will various transit-station-specific recommendations that will be established in the *Station Design Criteria Manual*. Examples will include more intense lighting requirements along the platform edge, at stairway and escalator landings, at elevator landings, at key decision points, and at equipment utilized by the patrons such as fare vending and collecting equipment.



The use of color in the stations must also be carefully considered. Lighter colors reflect greater levels of light and in so doing, establish a more comfortable ambience within the stations. In contrast, darker colors absorb light, thereby requiring more energy use to achieve specified minimum lighting levels. Contrasting colors are most often utilized to aid patrons, particularly those with sight disabilities, and to warn them of potential hazards. Further, color use refers not only to those colors that are applied such as paint finishes and stains, but also to the natural colors of materials such as granite and marble, ceramic tile and paver units, stainless steel, concrete etc.

Color and light go hand-in-hand, and play a significant role in determining comfort levels for all patrons and the ambience of the stations. The *Station Design Criteria Manual* will address this issue by establishing palettes of acceptable materials and colors for use within the stations on a systemwide basis.

The acoustic quality of the stations must be such that the public address system will function well, because the public address system is the primary means of notifying patrons of the need to evacuate a station. A properly designed transit station takes into consideration the acoustical quality of the various levels in the selection of finish materials. Ceiling surfaces are especially important; ceiling heights are often a significant factor, since reverberation can occur in compressed spaces, resulting in annoyance to the patrons. Acoustical design is a highly technical and sophisticated science, experts in that field will be used as integral members of the station final design teams.

7.2.10 Potential Additional Facilities to be Contained within Stations

In general, light rail transit systems such as the one being recommended in this Final Report, provide a significant social benefit to the community at-large, not just to those who will use it regularly. Depending upon various policy decisions that will be made by the operating agency, that social benefit could be expanded to include additional uses within the stations, for the benefit of both the riding public and the operating property.

Specifically, many transit systems around the world include commercial and retailing facilities at various stations, including automated bank teller machines, forms of advertising, tourist information (both staffed and automated), public toilets, and vending machines. These types of facilities increase the utility of transit stations and should be given serious consideration. Income could be gained from them on a regular basis, which would help to offset the operating costs of the transit system.

If these types of facilities are included in the system's stations, specific design criteria will be established to ensure that these facilities will be constructed and located within the stations so that they will not negatively impact station safety, emergency evacuation, patron movement under normal operating conditions, the clarity of directional and informational signage, and the overall ambience of the station itself.

Table 7-2
Trunkline Station Locations in Cobb County

Station Name	No.	Stationing	Distance to Next Station, Feet	Vertical Position	Platform Type	Station In Roadway Median	Station Type	Remarks
Main Trunkline								
Begin Tail Track		99,760	240					
Cumberland Blvd Transfer Station	TL-1	100,000	4,265	Elevated	Side	Yes	T1 B1/**B3**	Transfer. Elevated center platform Circulator station above an elevated side platform Trunkline station. No Trunkline tailtrack beyond.
Cumb. Mall / Galleria Station	TL-2	104,265	3,525	Elevated	Side	Yes	B3	
Windy Ridge Pkwy / Herodian Way Transfer Station	TL-3	107,790	5,970	Underground	2 Center	Under	T2 2A1's/ **A2**	Transfer. Underground side platform Circulator stations below underground double center platform Trunkline station. 1020 at-grade parking spaces.
Windy Hill Road Station	TL-4	113,760	8,175	Underground	Side	Under	A1	940 at-grade parking spaces.
Delk Road Station	TL-5	121,935	8,020	Elevated	Side	Yes	B3	800 at-grade parking spaces.
South Marietta Pkwy / 120 Loop Station	TL-6	129,955	4,155	Elevated	Side	Yes	B3	620 at-grade parking spaces.
Roswell Road / SR 120 Station	TL-7	134,110	4,190	Underground	Side	Under	A1	
North Marietta Parkway / 120 Loop Station	TL-8	138,300	12,000	Underground	Side	Under	A1	400 at-grade parking spaces.
Canton Rd / I-75 Station	TL-9	150,300	16,035	At Grade	Side	No	C4	500 at-grade parking spaces.
Town Center Mall Transfer Station	TL-10	166,335	7,450	Underground	Center	No	T3 A2 / **A2**	Transfer. Two adjacent underground center platforms, Trunkline utilizing inner tracks, Circulator utilizing outer tracks.
Chastain Road / I-575 Transfer Station	TL-11	173,785	680	At Grade in I-575 Median	Center	Yes	T4 B2/**C1**	Transfer. Elevated center platform Circulator station above at-grade center platform Trunkline station. 2500 parking spaces in structure. 500 ft. Trunkline tail track beyond.
End Tail Track		174,465						
Length = 74,705 = 14.15 Miles								
Extension along Cobb Parkway Northward to Barrett Parkway								
Turnout from Main Trunkline		3,000	4,660					Min Trunkline Sta. 57000
Bells Ferry Road Station	TL-12	7,660	11,510	Elevated	Side	Yes	B3	1040 at-grade parking spaces.
Barrett Pkwy Transfer Station	TL-13	19,170	680	Elevated	Center	Yes	T5 B1/**B1**	Transfer. Elevated center platform Circulator station below elevated center platform Trunkline station. 520 at-grade parking spaces. 500 ft. Trunkline tail track beyond.
End Tail Track		19,850						
Length = 16,850 = 3.19 Miles								
Total Length of Trunkline = 91,555 = 17.34 Miles								

Note #1:
As explained in subsection 1.1.3, Study Constraints, the Bechtel/MSE Team did not conduct conceptual engineering studies for the segment of the Trunkline in Fulton County. The information contained within the ARC' Regional Transportation Plan was adopted for the purposes of this Study. That information proposes five (5) Trunkline stations in Fulton County as follows: Atlanta Road, Moores Mill Road, Howell Mill Road, Atlantic Steel, and the Arts Center Transfer station in Midtown Atlanta, which enables passenger transfer between the Trunkline and MARTA. That information also sets forth a Trunkline route length of 10.5 miles in Fulton County. Therefore, this final report envisions a Trunkline of approximately 27.5 total miles in length, with 18 stations.

Note #2:
Figure 3.3 includes a potential nineteenth Trunkline station, labeled Multi-Modal Transfer Station located adjacent to the Old Canton Road and the Georgia Northern Railroad line. Provisions would be made in the design of the Trunkline to enable the construction of this Trunkline station if the envisioned commuter rail service is implemented, to accommodate passenger transfer to the Trunkline.

Table 7-3 Cumberland Circulator Stations

Station Name	No.	Stationing	Distance to Next Station, Ft	Vertical Position	Platform Type	Station in Roadway Median	Station Type	Remarks
Central Loop								
Cumberland Blvd Transfer Station	CC-11	0	2,770	Elevated	Center	Yes	T1 **B1**/B3	Transfer. Elevated center platform circulator station above an elevated side platform Trunkline station.
Overton South Station	CC-12	2,770	935	Elevated	Side	No	B4	Concourse above Platform
Overton Central Station	CC-13	3,705	1,415	Elevated	Side	No	B4	Concourse above Platform
Overton North Station	CC-14	5,120	2,725	Elevated	Side	No	B4	Concourse above Platform
Interstate North Pkwy North Circle Station	CC-15	7,845	1,625	Elevated	Side	Yes	B3	
Windy Ridge Pkwy/Interstate North Pkwy Station	CC-16	9,470	1,825	Elevated	Side	Yes	B3	
Windy Ridge Pkwy / Circle 75 Pkwy Station	CC-106	11,295	2,485	Elevated	Side	Yes	B3	
Windy Ridge Pkwy Transfer Station	CC-105	13,780	2,490	Underground	Side	Under	T2 **A1**/A2	Transfer. Underground side platform circulator station below underground double center platform Trunkline station. 1020 at-grade parking spaces.
Cumberland Blvd / Spring Rd Station	CC-29	16,270	2,790	Elevated	Side	Yes	B3	
Cumberland Mall/CCT Transfer Station	CC-9	19,060	1,730	Elevated	2 Center	No	B2	CCT Bus Transfer. Two adjacent elevated center platforms; Inner Loop utilizing inner tracks, Outer Loop the outer tracks.
Cumberland Blvd / Stillhouse Rd Station	CC-10	20,790	2,485	Elevated	Side	Yes	B3	
To Cumberland Blvd Transfer Station		23,275						
		Length =	**23,275 = 4.41 Miles**					
Home Depot Loop								
From Central Loop		0	2,015					
Spring Hill Pkwy / Cumberland Court Station	CC-30	2,015	2,475	At Grade	Side	Yes	C3	
Spring Hill Pkwy/Crestline Lane Station	CC-31	4,490	3,375	At Grade	Side	Yes	C3	
Paces Ferry Rd / Home Depot Station	CC-1	7,865	3,115	Underground	Center	Under	A2	
Paces Ferry Rd/ Cumberland Pkwy	CC-2	10,980	1,320	Elevated	Side	Yes	B3	250 at-grade parking spaces.
Bert Adams Rd/Cumberland Pkwy	CC-3	12,300	1,290	At Grade	Side	Yes	C3	
Overlook I & II Station	CC-4	13,590	750	Elevated	Center	No	B2	
Overlook III Station	CC-5	14,340	825	Elevated	Center	No	B2	
Overlook IV Station	CC-6	15,165	1,630	Elevated	Center	No	B2	
Mt. Wilkinson Pkwy/ Cumberland Club Dr Station	CC-7	16,795	2,580	Elevated	Center	No	B2	
Cumberland Blvd / Stone Wall Dr Station	CC-8	19,375	1,205	Elevated	Side	No	B4	
To Central Loop		20,580						
		Length =	**20,580 = 3.90 Miles**					

Station Name	No.	Stationing	Distance to Next Station, Ft	Vertical Position	Platform Type	Station in Roadway Median	Station Type	Remarks
Wildwood Loop								
From Central Loop		0	1,395					
Windy Ridge Pkwy / Parkwood Dr Station	17	1,395	2,100	At Grade	Side - Split	Yes	C3	
Windy Ridge Pkwy / Powers Ferry Rd Station	18	3,495	1,665	Elevated	Center	No	B2	
2300 Wildwood Plaza Station	19	5,160	1,435	At Grade	Center	No	C2	
3100 Wildwood Plaza Station	20	6,595	2,175	At Grade	Center	No	C2	
4200 Wildwood Plaza Station	21	8,770	1,955	At Grade	Center	No	C2	
3200 Wildwood Plaza Station	22	10,725	1,910	Elevated	Side	Yes	B3	
Wildwood Pkwy / Powers Ferry Rd Station	23	12,635	1,425	Elevated	Side	Yes	B3	
Powers Ferry Rd / Wood Hollow Dr Station	24	14,060	1,355	Elevated	Side	Yes	B3	
Windy Hill Rd. / Interstate North Pkwy East Station	25	15,415	2,200	Elevated	Center	No	B2	
Interstate North Pkwy / Interstate 75 Dr Station	26	17,615	1,950	Elevated	Side	Yes	B3	
Herodian Way / Circle 75 Pkwy Station	27	19,565	2,580	Elevated	Side	Yes	B3	
Herodian Way Transfer Station	28	22,145	1,360	Underground	Side	Under	T2 **A1**/A2	Transfer. Underground side platform circulator station below underground double center platform Trunkline station. 1020 at-grade parking spaces.
To Central Loop		23,505						
		Length =	**23,505 = 4.45 Miles**					
Galleria Link								
From Central Loop		0	1,445					
Riverwood Pkwy / Cumberland Galleria Pkwy Station	101	1,445	1,965	Elevated	Side	Yes	B3	
Galleria 500 Building Station	102	3,410	1,660	Elevated	Center	No	B2	
Galleria Drive Station	103	5,070	1,545	Elevated	Center	No	B2	
Circle 75 Pkwy Station	104	6,615	1,290	Elevated	Side	No	B4	
To Central Loop		7,905						
		Length =	**7,905 = 1.49 Miles**					
		Total Length =	**75,265 = 14.25 Miles**					

Table 7-4 Town Center Area Circulator Station Locations

Station Name	No.	Stationing	Distance to Next Station, Ft	Vertical Position	Platform Type	Station in Roadway Median	Station Type	Remarks
Main Loop								
Beginning of Town Center Loop		0	550					
Barrett Pkwy Transfer Station	TC-1	550	2,710	Elevated	Center	Yes	T5 **B1**/B1	Transfer. Elevated center platform circulator station below elevated center platform Trunkline station. 520 at-grade parking spaces.
Roberts Blvd/Barrett Pkwy Station	TC-2	3,260	1,735	Elevated	Side	Yes	B3	
Barrett Lakes Blvd/Barrett Pkwy Station	TC-3	4,995	805	Elevated	Side	Yes	B3	
Barrett Parkway/Home Center Drive Station	TC-4	5,800	1,350	Elevated	Side	Yes	B3	
Barrett Pkwy / Cobb Place Blvd Station	TC-5	7,150	2,935	Elevated	Side	Yes	B3	
Busbee Pkwy / Town Center Dr Station	TC-6	10,085	2,805	Elevated	Side	Yes	B3	
Town Center Mall Transfer Station	TC-7	12,890	2,775	Underground	Center	No	T3 **A2**/A2	Transfer. Two adjacent underground center platforms, Trunkline using inner tracks, circulator using outer tracks.
Town Center Dr/Mall Blvd Station	TC-8	15,665	3,190	Elevated	Side	Yes	B3	
Chastain Meadows Pkwy / Barrett Pkwy Station	TC-9	18,855	5,565	Elevated	Center	Yes	B1	
Chastain Meadows Pkwy / Big Shanty Rd Station	TC-10	24,420	2,675	At Grade	Side - Split	Yes	C3	
Chastain Rd / Chastain Meadows Pkwy Station	TC-11	27,095	2,145	At Grade	Side	No	C4	
Chastain Road/ I-575 Transfer Station	TC-12	29,240	1,950	Elevated	Center	No	T4 **B2**/C1	Transfer. Elevated center platform circulator station above at-grade center platform Trunkline station. 2500 parking spaces in structure.
Town Park Dr / Town Park Comm. Station	TC-13	31,190	1,820	At Grade	Side - Split	Yes	C3	
Town Park Dr / Busbee Pkwy Station	TC-14	33,010	2,360	At Grade	Side - Split	Yes	C3	
Town Green Blvd / Town Crossing Station	TC-15	35,370	5,340	At Grade	Side - Split	Yes	C3	
Kennesaw State University Station	TC-16	40,710	2,335	At Grade	Side	No	C4	
Barrett Lakes Blvd / Chastain Rd Station	TC-17	43,045	4,300	Elevated	Side	Yes	B3	
Barrett Lakes Blvd / Duncan Rd. Station	TC-18	47,345	3,465	At Grade	Side	Yes	C3	
Barrett Lakes Blvd / Cobb Place Blvd Station	TC-19	50,810	2,340	At Grade	Side	No	C4	
Cobb Place Blvd / Vaughn Rd Station	TC-20	53,150	1,445	At Grade	Side - Split	Yes	C3	
Cobb Place Blvd / Roberts Blvd Station	TC-21	54,595	1,825	Elevated	Side	Yes	B3	
Vaughn Rd / Roberts Blvd Station	TC-22	56,420	1,170	Elevated	Side	Yes	B3	
Barrett Pkwy Transfer Station	TC-1	57,590						
		Length =	**57,590**	**= 10.91 Miles**				
				Barrett Lakes Connector				
Turnout from Main Loop		0	1,570					
Barrett Lakes Boulevard / Auto Park Drive Station	23	1,570	1,685	At Grade	Side	Yes	C3	
Connection to Main Loop		3,255						
		Length =	**3,255**	**= 0.62 Miles**				
		Total Length =	**60,845**	**= 11.52 Miles**				

The conceptual Systems Operations Plan prepared for the Northwest Corridor Light Rail Transit (LRT) System, and presented in this section, represents the implementation of the Ultimate System. Later, in Section 11, phasing options and a Preferred Initial Project are described in terms of operating plans and other characteristics.

Daily, peak period, and peak load point/peak direction passenger volumes have been forecast, using the Cobb County Transportation Model. The maximum volume on the Trunkline past the peak load point is forecast as less than 5,000 passengers during the peak hour. This level of demand is well within the capability of state-of-the-art light rail transit technology operating on a grade-separated alignment. Significantly lower peak-hour demands are forecast for the two CID Circulators; they are also within the range normally experienced with light rail transit. Depending upon a policy decision relating to the percentage of passengers to be offered seats during the peak hour, between 103 and 131 light rail vehicles (LRVs) of the types described in this Final Report will be required to operate the system at its full build-out stage, the proposed Ultimate System. In addition, a Central Maintenance and Storage Facility designed to accommodate a fleet of this size, plus maintenance-of-way vehicles, will be required.

A conceptual System Operations Plan is recommended, using light rail technology to serve the demand forecast identified in Section 4 of this Final Report. The System Operations Plan is based on the technical assumptions regarding systems elements, desired service characteristics, and rolling stock design that have been recommended to meet the specific needs identified in this Study.

8.1 SYSTEM ELEMENTS

As indicated in Section 3, the proposed Northwest Corridor LRT System consists of the Trunkline, the Marietta Branch, the Cumberland Circulator, and the Town Center Area Circulator. Each of the elements is described here in more detail.

8.1.1 The Trunkline

In its Ultimate System configuration, the Trunkline will extend south from two terminals located in Kennesaw – one at Chastain Road and I-575, the other at Barrett Parkway and Cobb Parkway – through Cobb and Fulton counties for approximately 28 miles, to the Metropolitan Atlanta Rapid Transit Authority (MARTA) Arts Center Station in Midtown Atlanta.

Within Cobb County, its main line will be 14.15 miles long and will be located in the median of I-575 to the Town Center Mall, continue via private right-of-way adjacent to I-75 and the Canton Road Connector/SR 5 to Cobb Parkway, and then follow Cobb Parkway south through Marietta and Cumberland to Cumberland Boulevard. A branch 3.19 miles long will begin at Barrett Parkway and run south along Cobb Parkway to the vicinity of the Canton Road Connector/SR 5, where it would merge with the line from Chastain Road/I-575. The combined length (within Cobb County) of the main line and the Barrett Parkway branch would be 17.34 miles.

Table 8-1
Ultimate System Trunkline – List of Stations and Distances

No.	Station Name	Distance to Next Station (Feet)	Cumulative Distance from Chastain Road/ I-575 (Feet)	Cumulative Distance from Barrett Parkway (Feet)
TL-13	Barrett Pkwy Transfer Station	11,510	N/A	0
TL-12	Bells Ferry Road Station	11,860	N/A	11,510
TL-11	Chastain Road, Interstate-575 Transfer Station	7,450	0	N/A
TL-10	Town Center Mall Transfer Station	16,035	7,450	N/A
TL-9	Canton Road/Interstate-75 Station	12,000	23,485	N/A
TL-8	North Marietta Pkwy/120 Loop Station	4,190	35,485	23,370
TL-7	Roswell Road/SR 120 Station	4,155	39,675	27,560
TL-6	South Marietta Pkwy/120 Loop Station	8,020	43,830	31,715
TL-5	Delk Road Station	8,175	51,850	39,735
TL-4	Windy Hill Road Station	5,970	60,025	47,910
TL-3	Windy Ridge Pkwy/Herodian Way Transfer Station	3,525	65,995	53,880
TL-2	Cumberland Mall/Galleria Station	4,265	69,520	57,405
TL-1	Cumberland Boulevard Transfer Station	55,440	73,785	61,670
FC	Arts Center Station, Midtown Atlanta	Terminal	**129,225**	**117,110**
Totals in Feet (Including Route Overlaps)		**246,365**	**129,225**	**117,110**
Totals in Miles (Including Route Overlaps)		**46.66**	**24.48**	**22.18**
Number of Stations Served in Cobb County (Including Route Overlaps)		**31**	**16**	**15**
Totals in Feet from Cobb County Terminals (Not Including Route Overlaps or End-of-Line Trackage)		**145,395**	**129,225**	**16,170**
Totals in Miles from Cobb County Terminals (Not Including Route Overlaps or End-of-Line Trackage)		**27.54**	**22.48**	**3.06**
Number of Stations Served in Cobb County (Not Including Route Overlaps)		**13**	**11**	**2**

In accordance with the RTP, the continuation of the Trunkline south to Arts Center in Midtown Atlanta, almost all of which would be in Fulton County, is assumed to have a route length of 10.5 miles and five stations. Thirteen stations are proposed within Cobb County for the Trunkline: eleven on the Chastain Road/I-575 portion of the main line and two on the Barrett Parkway branch, as shown on Table 8-1.

The train services provided on the Chastain Road/I-575 and Barrett Parkway/Cobb Parkway branches of the Trunkline would operate over a common portion of the Trunkline extending approximately 8.64 miles south from Canton Road Junction, located approximately 1.39 miles north of the North Marietta Parkway/120 Loop Station, to the Cumberland Boulevard Transfer Station.

Although not part of the current conceptual engineering effort, the Trunkline would be designed to run southeast from Cumberland Boulevard and Cobb Parkway to the MARTA Arts Center Station in Midtown Atlanta. Provisions would also be made for a possible Marietta Branch from the Trunkline at South Marietta Parkway/120 Loop, through the Marietta central business district, which would rejoin the Trunkline in the vicinity of the Canton Road/I-75 Station. As discussed in Section 12 - Service to the City of Marietta, there also is a potential in Cumberland for connecting the Trunkline to an East-West LRT line located in the Interstate 285 Corridor and providing through service from Marietta to Perimeter Center and Lawrenceville. Future extensions northeast from Chastain Road and I-575 towards Canton, the seat of Cherokee County, and northwest from Barrett Parkway and Cobb Parkway towards Acworth and Cartersville, the seat of Bartow County, also are possibilities.

Transfer connections between the Trunkline and the Cumberland Circulator would be provided at the Cumberland Boulevard Transfer Station and at the Windy Ridge Parkway/Herodian Way Transfer Station. Transfer connections between the Trunkline and the Town Center Area Circulator would be provided at the Town Center Mall Transfer Station, the Chastain Road/I-575 Transfer Station and the Barrett Parkway Transfer Station.

This Systems Operations Plan is presented in expanded form in Section 12, to reflect the addition of service on the Marietta Branch.

Table 8-2 contains estimates of the travel times (rounded to the nearest 15 seconds) that passengers will experience between Trunkline stations located within Cobb County and on trips to and from the Arts Center Station in Midtown Atlanta.

Figure 8-1 illustrates the train services that would operate on the Trunkline when the Ultimate System configuration is achieved, as well as the potential for future expansion of the System east into Fulton County, northeast into Cherokee County, and northwest into Bartow County.

A schematic track plan for the portion of the Trunkline between its two northern terminals, the Chastain Road/ I-575 Transfer Station and Barrett Parkway Transfer Station, as proposed in this conceptual engineering effort, is shown on Figure 8-2.

Table 8-2
Travel Times Between Trunkline Stations

Station Name	Chastain Road/ I-575 Transfer Station	Town Center Mall Transfer Station	Canton Road/ I-75 Station	Barrett Parkway Transfer Station	Bells Ferry Road Station	North Marietta Parkway/ 120 Loop Station	Roswell Road/ SR 120 Station	South Marietta Parkway/ 120 Loop Station	Delk Road Station	Windy Hill Road Station	Windy Ridge Parkway/ Herodian Way Transfer Station	Cumberland Mall/ Galleria Station	Cumberland Boulevard Transfer Station	Arts Center Station, Midtown Atlanta
Chastain Road/I-75 Transfer Station		2m, 30s	7m, 45s	TCAC	Transfer	11m, 45s	13m, 00s	14m, 15s	16m, 45s	19m, 30s	21m, 30s	22m, 45s	24m, 00s	42m, 00s
Town Center Mall Transfer Station	2m, 30s		5m, 15s	TCAC	Transfer	9m, 15s	10m, 30s	11m, 45s	14m, 15s	17m, 00s	19m, 00s	20m, 15s	21m, 30s	39m, 30s
Canton Road/I-75 Station	7m, 45s	5m, 15s		Transfer	Transfer	4m, 00s	5m, 15s	6m, 30s	9m, 00s	11m, 45s	13m, 45s	15m, 00s	16m, 15s	34m, 15s
Barrett Parkway Transfer Station	TCAC	TCAC	Transfer		3m, 45s	7m, 45s	9m, 00s	10m, 15s	12m, 45s	15m, 30s	17m, 30s	18m, 45s	20m, 00s	38m, 00s
Bells Ferry Road Station	Transfer	Transfer	Transfer	3m, 45s		4m, 00s	5m, 15s	6m, 30s	9m, 00s	11m, 45s	13m, 45s	15m, 00s	16m, 15s	34m, 15s
North Marietta Parkway/ 120 Loop Station	11m, 45s	9m, 15s	4m, 00s	7m, 45s	4m, 00s		1m, 15s	2m, 30s	5m, 00s	7m, 45s	9m, 45s	11m, 00s	12m, 15s	30m, 15s
Roswell Road/SR 120 Station	13m, 00s	10m, 30s	5m, 15s	9m, 00s	5m, 15s	1m, 15s		1m, 15s	3m, 45s	6m, 30s	8m, 30s	9m, 45s	11m, 00s	29m, 00s
South Marietta Parkway/120 Loop Station	14m, 15s	11m, 45s	6m, 30s	10m, 15s	6m, 30s	2m, 30s	1m, 15s		2m, 30s	5m, 15s	7m, 15s	8m, 30s	9m, 45s	27m, 45s
Delk Road Station	16m, 45s	14m, 15s	9m, 00s	12m, 45s	9m, 00s	5m, 00s	3m, 45s	2m, 30s		2m, 45s	4m, 45s	6m, 00s	7m, 15s	25m, 15s
Windy Hill Road Station	19m, 30s	17m, 00s	11m, 45s	15m, 30s	11m, 45s	7m, 45s	6m, 30s	5m, 15s	2m, 45s		2m, 00s	3m, 15s	4m, 30s	22m, 30s
Windy Ridge Parkway/ Herodian Way Transfer Station	21m, 30s	19m, 00s	13m, 45s	17m, 30s	13m, 45s	9m, 45s	8m, 30s	7m, 15s	4m, 45s	2m, 00s		1m, 15s	2m, 30s	20m, 30s
Cumberland Mall/Galleria Station	22m, 45s	20m, 15s	15m, 00s	18m, 45s	15m, 00s	11m, 00s	9m, 45s	8m, 30s	6m, 00s	3m, 15s	1m, 15s		1m, 15s	22m, 30s
Cumberland Boulevard Transfer Station	24m, 00s	21m, 30s	16m, 15s	20m, 00s	16m, 15s	12m, 15s	11m, 00s	9m, 45s	7m, 15s	4m, 30s	2m, 30s	1m, 15s		18m, 00s
Arts Center Station, Midtown Atlanta	42m, 00s	39m, 30s	34m, 15s	38m, 00s	34m, 15s	30m, 15s	29m, 00s	27m, 45s	25m, 15s	22m, 30s	20m, 30s	19m, 15s	18m, 00s	

Legend: Travel times between stations shown in minutes (m) and seconds (s) rounded to the nearest 15 seconds. Terminal to terminal travel times based upon 35 miles per hour average speed; average speed between stations varies depending upon distance and other factors.
Transfer = Passengers must transfer between Trunkline and Town Center Area Circulator trains or between TL1 and TI2 Trunkline trains to reach this station.
TCAC = Town Center Area Circulator provides direct route between these stations.

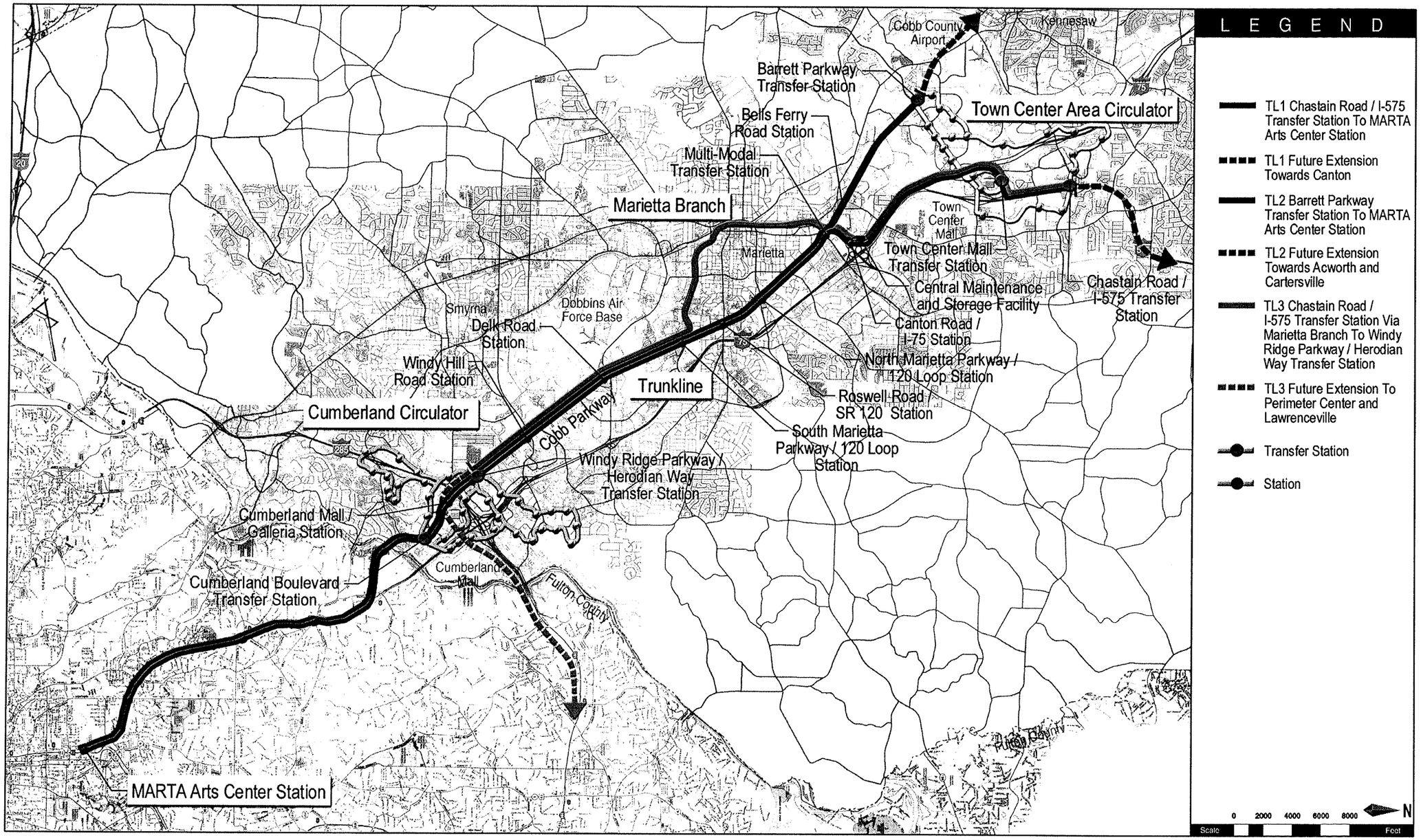


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FIGURE 8-1 ULTIMATE SYSTEM TRUNKLINE ROUTE MAP

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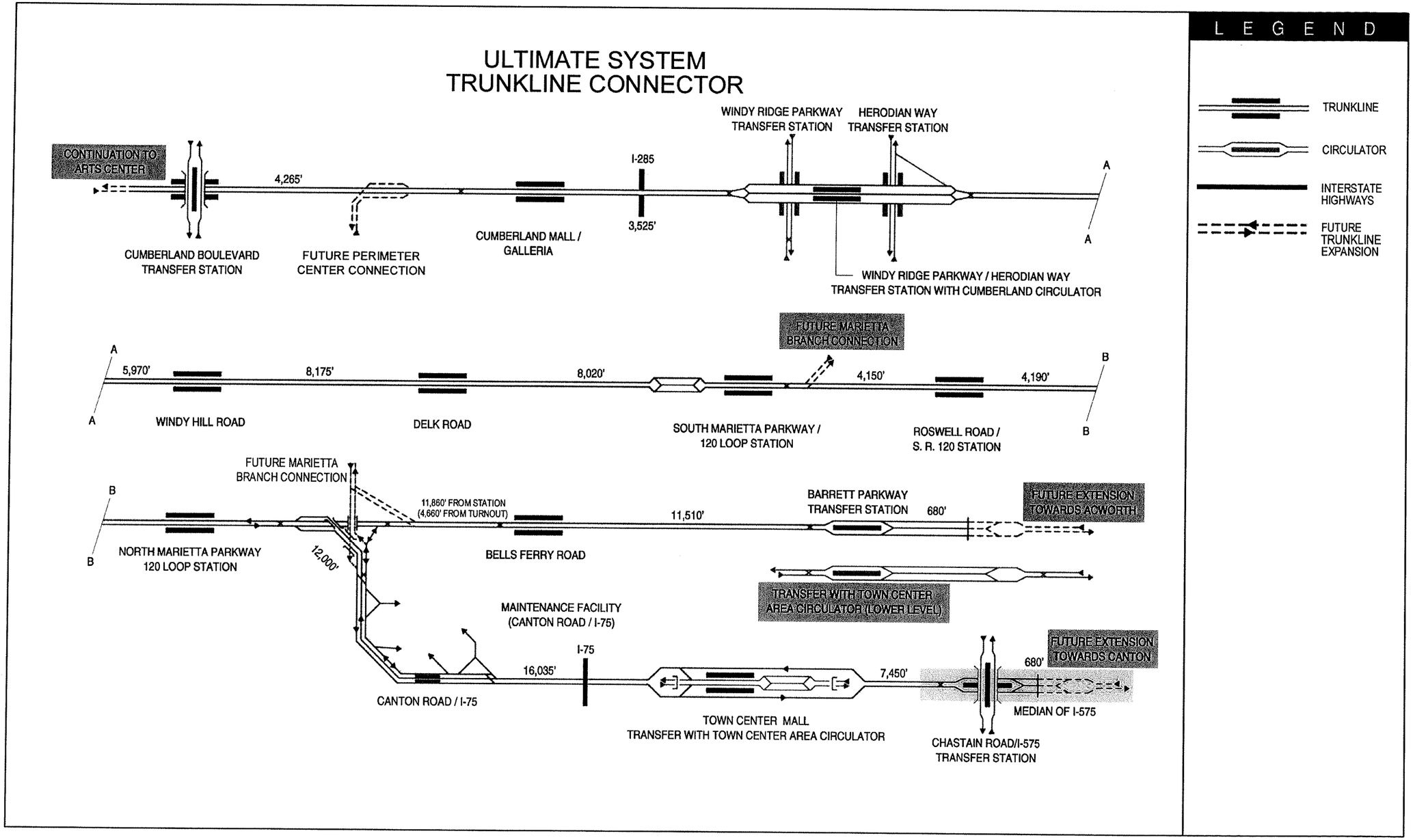

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FIGURE 8-2 TRACK PLAN TRUNKLINE CUMBERLAND BLVD. TO CHASTAIN ROAD/I-575 & BARRETT/COBB PARKWAYS

Transit Implementation Study

8.1.2 The Cumberland Circulator

The Cumberland Circulator would be 14.25 miles long and have 37 stations serving the densely developed Cumberland CID. It would feed the Trunkline at three locations and consist of a Central Loop and three segments that would branch from, then rejoin the Central Loop.

The four line segments that would make up this Circulator are:

- **The Central Loop.** This loop would form a complete circle, 4.41 miles long, and serve 11 stations. It would begin at the Cumberland Boulevard Transfer Station and continue east along Cumberland Boulevard and across I-75 to serve the planned Overton Development in the southeast quadrant of the I-75 and I-285 interchange, then pass under I-285 and enter Interstate North Parkway, turn west onto Windy Ridge Parkway and continue west to the Windy Ridge Parkway/Herodian Way Transfer Station and follow Cumberland Boulevard southwest past Spring Road, bridge over I-285 to the Cumberland Mall/CCT Transfer Station, and then continue southeast along Cumberland Boulevard to return to the Cumberland Boulevard Transfer Station.

- **The Wildwood Loop**. This loop would be 4.45 miles long and serve 12 stations. It would branch east from the Central Loop at Interstate North Parkway and Windy Ridge Parkway, cross over Powers Ferry Road, traverse the Wildwood Office Park along Windy Ridge Parkway, Windy Hill Parkway, and Wildwood Parkway to its intersection with Powers Ferry Road, follow Powers Ferry Road south to Interstate North Parkway East, follow the latter and then Interstate North Parkway to its intersection with I-75 Drive, bridge over I-75 on an extension of Herodian Way and follow the latter to the Windy Ridge Parkway/Herodian Way Transfer Station, after which it would rejoin the Central Loop west of Cobb Parkway in the vicinity of the former intersection of Herodian Way and Cumberland Boulevard.

- **The Home Depot Loop**. This loop would be 3.9 miles long and serve 10 stations. It would branch from the Central Loop southwest of the Spring Road Station, cross over the CSX railroad, descend and follow Spring Hill Road southwest to the Home Depot Support Center, pass under West Paces Ferry Road and bridge over I-285, turn north and follow Cumberland Parkway to Bert Adams Drive, traverse the Overlook Office Park, and return to Cumberland Parkway via Mount Davidson Parkway, continue north between Cumberland Parkway and I-285, cross over the CSX railroad and rejoin the Central Loop at the intersection of Cumberland Boulevard and Cumberland Parkway, immediately west of the Cumberland Mall/CCT Transfer Station.

- **The Galleria Link**. The link would be 1.49 miles long and have four stations, serving the densely developed area between I-75 and Cobb Parkway. It would branch from the Central Loop east of the Cumberland Boulevard Transfer Station at the intersection of Cumberland Boulevard and Cumberland Galleria Parkway, follow the latter north to the vicinity of its intersection with Akers Mill Road, then curve behind the Galleria Plaza buildings to Galleria Drive, and bridge over I-285 to Circle 75 North. It would rejoin the Central Loop east of the Windy Ridge Parkway/Herodian Way Transfer Station.

At full build-out under the Ultimate System, it is anticipated that the four line segments described above would be operated as three train services or routes: Route A – Central Loop, Route B – Wildwood/Herodian Way Loop, and Route C – Galleria/Home Depot Loop.

Table 8-3 shows the sequence, location, and distances between the proposed stations for each of the three proposed routes.

Cumberland Circulator trains serving Route A – Central Loop, Route B – Wildwood/Herodian Way Loop, and Route C – Galleria/Home Depot Loop would operate over common trackage of the Central Loop for 19,090 feet or 3.62 miles.

As indicated above, the Cumberland Circulator would be approximately 14.25 miles long when full build-out under the Ultimate System is achieved. It should be noted, however, that it would be possible to construct the Cumberland Circulator in stages, each consisting of a logical operable segment. In particular, build-out could commence with the Central Loop forming a viable Minimum Operable Segment (MOS) that would be expanded as development occurs and as funding becomes available. Section 11 of this volume presents a recommended initial phasing plan for the Cumberland Circulator.

Figure 8-3 illustrates the three LRT services that would operate on the Cumberland Circulator when the Ultimate System is achieved.

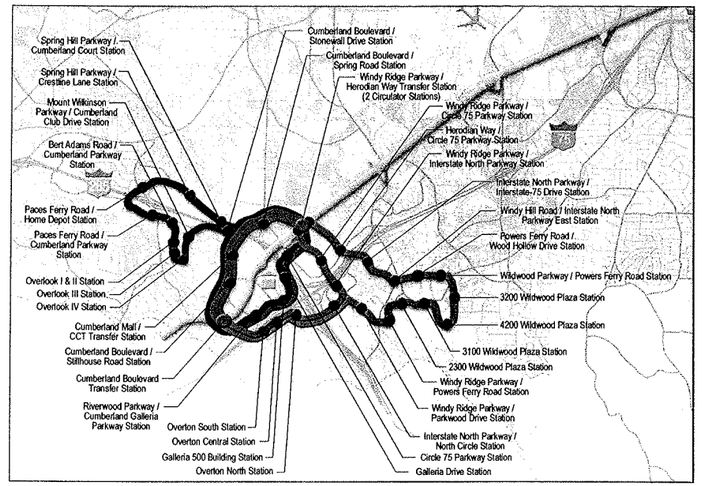


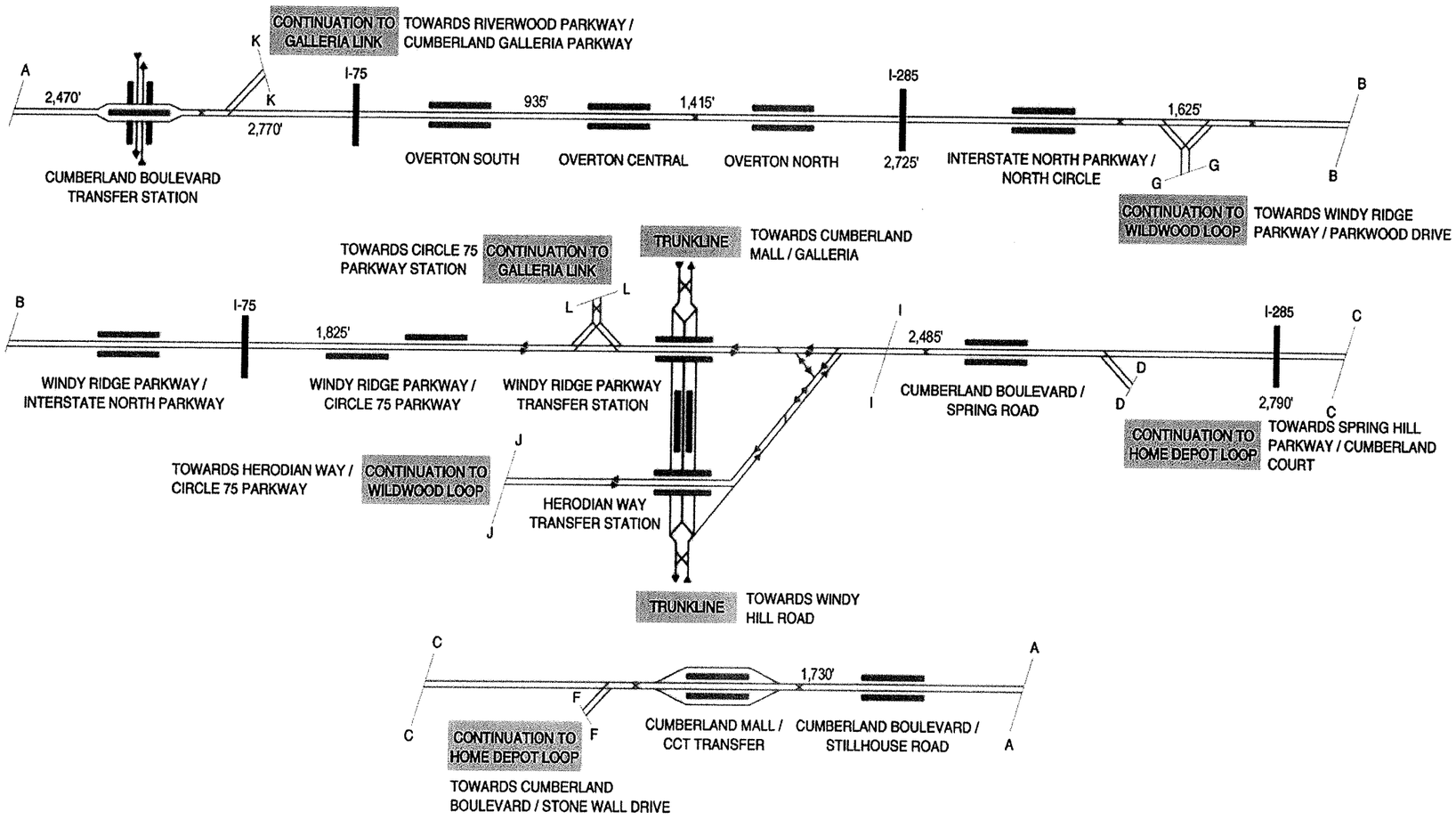
Figure 8-3 Cumberland Circulator LRT Services

The proposed track plan schematic for the Cumberland Circulator is shown in Figure 8-4.

Table 8-3
Cumberland Circulator – List of Stations and Distances

No.	Station Name	Distance from Last Station (Feet)	Route A Central Loop Cumulative Distance (Feet)	Route B Wildwood/ Herodian Way Loop Cumulative Distance (Feet)	Route C Galleria/ Home Depot Loop Cumulative Distance (Feet)
CC-11	Cumberland Blvd Transfer	0	0	0	0
CC-12	Overton South	2,770	2,770	2,770	N/A
CC-13	Overton Central	935	3,705	3,705	N/A
CC-14	Overton North	1,415	5,120	5,120	N/A
CC-15	Interstate North Pkwy/North Circle	2,725	7,845	7,845	N/A
CC-16	Windy Ridge Pkwy/ Interstate North	1,625	9,470	N/A	N/A
CC-106	Windy Ridge Pkwy/Circle 75 Pkwy	1,825	11,295	N/A	N/A
CC-105	Windy Ridge Pkwy Transfer (via Central Loop)	2,485	13,780	N/A	N/A
CC-29	Cumberland Blvd/Spring Rd (via Central Loop)	2,490	16,270	N/A	N/A
CC-9	Cumberland Mall/CCT Transfer (via Central Loop)	2,790	19,060	N/A	N/A
CC-17	Windy Ridge Pkwy/Parkwood Drive	2,140	N/A	9,985	N/A
CC-18	Windy Ridge Pkwy/ Powers Ferry Rd	2,100	N/A	12,085	N/A
CC-19	2300 Wildwood Plaza	1,665	N/A	13,750	N/A
CC-20	3100 Wildwood Plaza	1,435	N/A	15,185	N/A
CC-21	4200 Wildwood Plaza	2,175	N/A	17,360	N/A
CC-22	3300 Wildwood Plaza	1,955	N/A	19,315	N/A
CC-23	Wildwood Pkwy/Powers Ferry Rd	1,910	N/A	21,225	N/A
CC-24	Powers Ferry Rd/Wood Hollow Dr	1,425	N/A	22,650	N/A
CC-25	Windy Hill Rd/Interstate North Pkwy East	1,355	N/A	24,005	N/A
CC-26	Interstate North Pkwy/Interstate 75 Dr	2,200	N/A	26,205	N/A
CC-27	Herodian Way/Circle 75 Pkwy	1,950	N/A	28,155	N/A
CC-28	Herodian Way Transfer	2,580	N/A	30,735	N/A
CC-29	Cumberland Blvd/Spring Rd (from Herodian Way Transfer Station)	2,900	N/A	33,635	N/A
CC-9	Cumberland Mall/CCT Transfer (Wildwood Loop)	2,790	N/A	36,425	N/A
CC-101	Riverwood Pkwy/Cumberland Galleria Pkwy	2,255	N/A	N/A	2,255
CC-102	Galleria 500 Building	1,965	N/A	N/A	4,220
CC-103	Galleria Drive	1,660	N/A	N/A	5,880
CC-104	Circle 75 Pkwy	1,545	N/A	N/A	7,425
CC-105	Windy Ridge Pkwy Transfer (via Galleria Link)	2,106	N/A	N/A	9,531
CC-30	Spring Hill Pkwy/Cumberland Court	2,741	N/A	N/A	12,272
CC-31	Spring Hill Pkwy/Crestline Lane	2,475	N/A	N/A	14,747
CC-1	Paces Ferry Rd/Home Depot Support Center	3,375	N/A	N/A	18,122
CC-2	Paces Ferry Road/Cumberland Parkway	3,115	N/A	N/A	21,237
CC-3	Bert Adams Rd/Cumberland Pkwy	1,320	N/A	N/A	22,557
CC-4	Overlook I & II	1,290	N/A	N/A	23,847
CC-5	Overlook III	750	N/A	N/A	24,597
CC-6	Pinnacle/Overlook IV	825	N/A	N/A	25,422
CC-7	Mt. Davidson Pkwy/ Cumberland Club Dr	1,630	N/A	N/A	27,052
CC-8	Cumberland Pkwy/Stone Wall Dr	2,580	N/A	N/A	29,632
CC-9	Cumberland Mall/CCT Transfer (Home Depot Loop)	2,088	N/A	N/A	31,720
CC-10	Cumberland Blvd/Stillhouse Rd	1,730	20,790	38,155	33,450
CC-11	Cumberland Blvd Transfer Station	2,485	23,275	40,640	35,935
Totals in Feet (Including Route Overlaps)		**99,850**	**23,275**	**40,640**	**35,935**
Route Totals in Miles (Including Route Overlaps)		**18.91**	**4.41**	**7.70**	**6.81**
Number of Stations Served En Route (Inc. Route Overlaps)		**49**	**11**	**20**	**18**
Totals in Feet (Not Including Route Overlaps)		**75,265**	**23,275**	**23,505**	**28,485**
Totals in Miles (Not Including Route Overlaps)		**14.25**	**4.41**	**4.45**	**5.39**
Number of Stations Served (Not Including Route Overlaps)		**37**	**11**	**12**	**14**

ULTIMATE SYSTEM
CUMBERLAND CIRCULATOR - CENTRAL LOOP



LEGEND

- TRUNKLINE
- CIRCULATORS
- INTERSTATE HIGHWAYS

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FIGURE 8-4 TRACK PLAN CUMBERLAND CIRCULATOR CENTRAL LOOP - SHEET 1 OF 3

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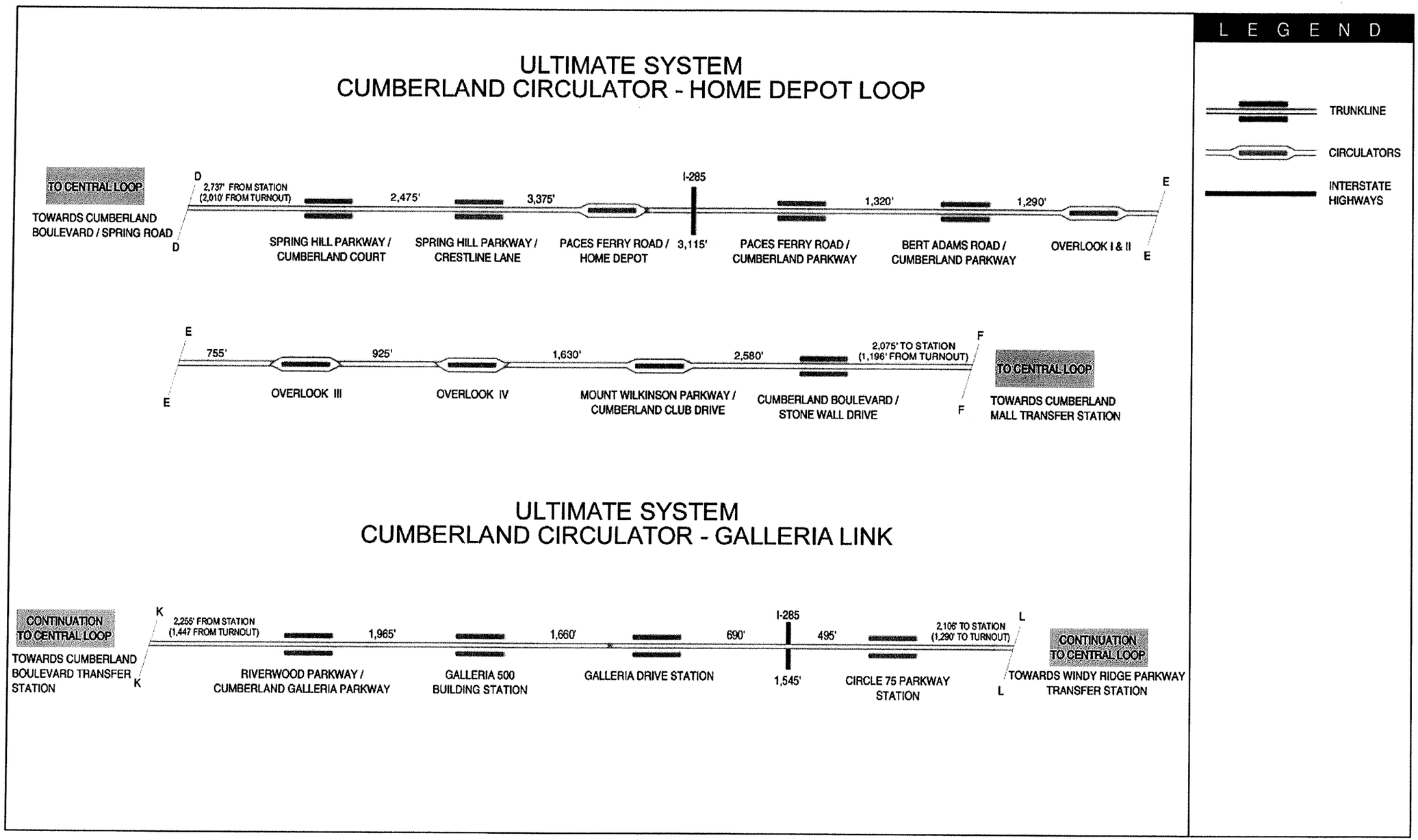

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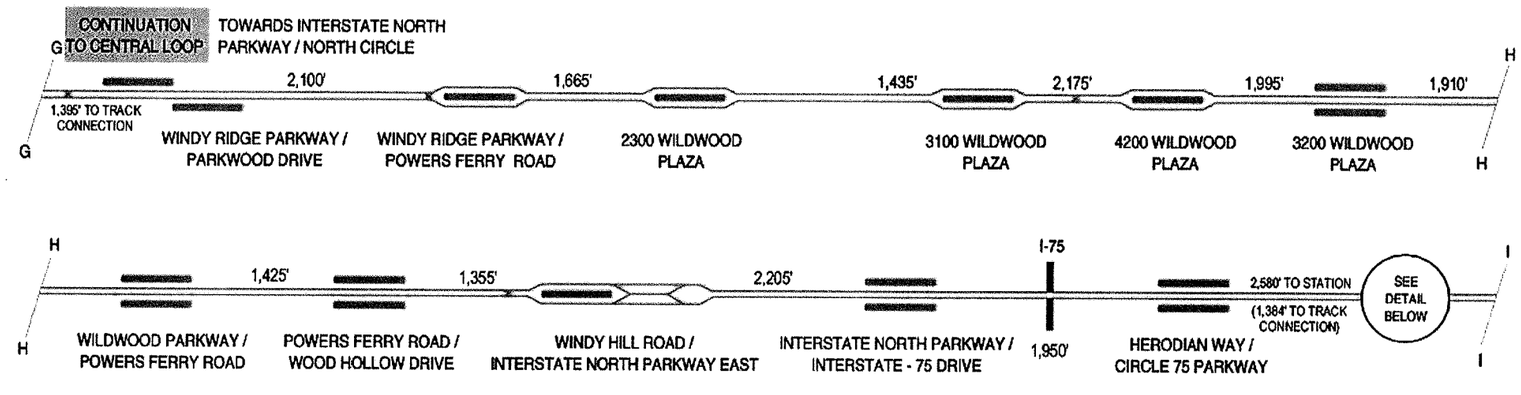
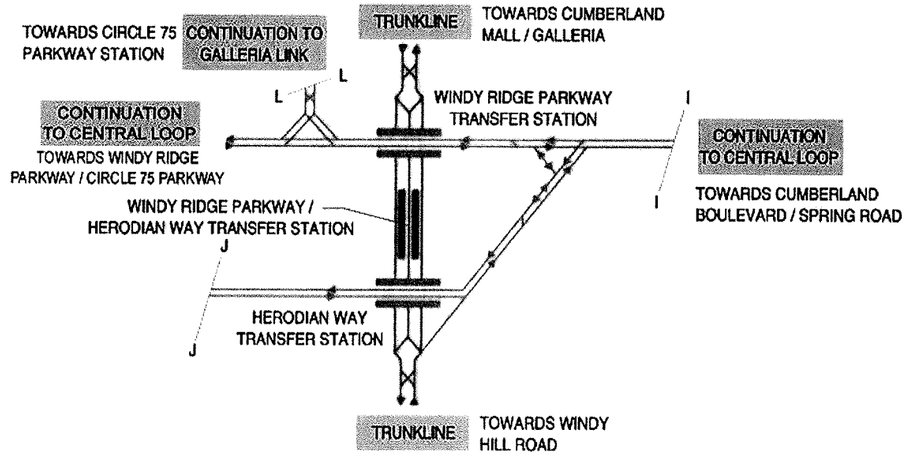
FIGURE 8-4 TRACK PLAN CUMBERLAND CIRCULATOR HOME DEPOT & GALLERIA LINK - SHEET 2 OF 3

Transit Implementation Study

ULTIMATE SYSTEM
CUMBERLAND CIRCULATOR - WILDWOOD LOOP





LEGEND

- TRUNKLINE
- CIRCULATORS
- INTERSTATE HIGHWAYS

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FIGURE 8-4 TRACK PLAN CUMBERLAND CIRCULATOR WILDWOOD LOOP - SHEET 3 OF 3

Transit Implementation Study

8.1.3 The Town Center Area Circulator

This Circulator will serve the Town Center Area CID, located in Kennesaw, and connect with the Trunkline at three locations. It would be configured as a loop, 10.91 miles long, connecting the intersection of Barrett Parkway and Cobb Parkway with the commercial developments along Barrett Parkway, the Town Center Mall, Chastain Meadows Parkway, Chastain Road, Town Park, Kennesaw State University, and Barrett Lakes Boulevard, and returning via Cobb Place Boulevard to its origin at Barrett Parkway and Cobb Parkway. A 0.62-mile long Barrett Lakes Connector is proposed along Barrett Lakes Boulevard, between Cobb Place Boulevard and Barrett Parkway, to facilitate the operation of a Kennesaw State University/Town Center Mall Transfer Station Line providing reduced travel time between those stations and more frequent service along the most heavily congested area of Barrett Parkway. At full build-out under the Ultimate System, the Main Loop and the Barrett Lakes Connector would have a combined length of 11.52 miles and serve 23 stations.

At full build-out under the Ultimate System, it is anticipated that the Town Center Area Circulator would be operated as two train services or routes. These would be:

- Route D – Main Loop
- Route E – Kennesaw State University/Town Center Mall Line

Table 8-4 shows the sequence, location and distances between the proposed stations for each of the two proposed routes of the Town Center Area Circulator.

The Main Loop and Kennesaw State University/Town Center Mall Transfer Station Line via the Barrett Lakes Connector would operate over a common portion of the Town Center Area Circulator, approximately 3.41 miles long.

Transfer connections between the Town Center Area Circulator and the Trunkline would be provided at the Barrett Parkway Transfer Station, the Town Center Mall Transfer Station and the Chastain Road/I-575 Transfer Station.

Table 8-4
Town Center Area Circulator – List of Stations and Distances

No.	Name	Distance from Last Station (Feet)	Route D Main Loop Cumulative Distance (Feet)	Route E KSU / Town Center Mall Line Cumulative Distance (Feet)
TC-1	Barrett Pkwy Transfer Station	0	0	N/A
TC-2	Roberts Blvd/Barrett Pkwy Station	2,710	2,710	N/A
TC-3	Barrett Lakes Blvd/Barrett Pkwy Station	1,735	4,445	N/A
TC-4	Home Center Dr/Barrett Pkwy Station	805	5,250	N/A
TC-5	Barrett Pkwy/Cobb Place Blvd Station	1,350	6,600	N/A
TC-6	Busbee Pkwy/Town Center Dr Station	2,935	9,535	N/A
TC-7	Town Center Mall Transfer Station	2,805	12,340	N/A
TC-8	Town Center Dr/Mall Blvd Station	2,775	15,115	N/A
TC-9	Chastain Meadows Pkwy/Barrett Pkwy Station	3,190	18,305	N/A
TC-10	Chastain Meadows Pkwy/Big Shanty Rd Station	5,565	23,870	N/A
TC-11	Chastain Rd/Chastain Meadows Pkwy Station	2,675	26,545	N/A
TC-12	Chastain Rd/I-575 Transfer Station	2,145	28,690	N/A
TC-13	Town Park Dr/Town Park Commons Station	1,950	30,640	N/A
TC-14	Town Park Dr/Busbee Pkwy Station	1,820	32,460	N/A
TC-15	Town Green Blvd/Town Crossing Station	2,360	34,820	N/A
TC-16	Kennesaw State University Station	5,340	40,160	0
TC-17	Barrett Lakes Blvd/Chastain Rd Station	2,335	42,495	2,335
TC-18	Barrett Lakes Blvd/Duncan Rd Station	4,300	46,795	6,635
TC-19	Barrett Lakes Blvd/Cobb Place Blvd Station	3,465	50,260	N/A
TC-20	Cobb Place Blvd/Vaughan Dr Station	2,340	52,600	N/A
TC-21	Cobb Place Blvd/Roberts Blvd Station	1,445	54,045	N/A
TC-22	Vaughan Dr/Roberts Blvd	1,825	55,870	N/A
TC-1	Barrett Pkwy Transfer Station	1,700	57,570	N/A
TC-23	Barrett Lakes Blvd/Auto Park Dr Station	4,814	N/A	11,449
TC-3	Barrett Lakes Blvd/Barrett Pkwy Station	1,640	N/A	13,089
TC-4	Home Center Dr/Barrett Pkwy Station	805	N/A	13,894
TC-5	Barrett Pkwy/Cobb Place Blvd Station	1,350	N/A	15,244
TC-6	Busbee Pkwy/Town Center Dr Station	2,935	N/A	18,179
TC-7	Town Center Mall Transfer Station	2,805	N/A	20,984
Totals in Feet (Including Route Overlaps)		**78,554**	**57,570**	**20,984**
Totals in Miles (Including Route Overlaps)		**14.88**	**10.90**	**3.97**
Number of Stations Served (Including Route Overlaps)		**31**	**22**	**9**
Totals in Feet (Not Including Route Overlaps)		**60,845**	**57,590**	**3,255**
Totals of Miles (Not Including Route Overlaps)		**11.52**	**10.91**	**0.62**
Number of Stations Served (Not Including Route Overlaps)		**23**	**22**	**1**

The Town Center Area CID Circulator would be 11.52 miles long at full build-out under the Ultimate System. It should be noted, however, that it would be possible to build this CID Circulator in several stages, each consisting of a logical operable segment. Section 11 presents a recommended initial phasing plan for the Town Center Area Circulator.

Figure 8-5 below illustrates the two LRT services that would operate on the Town Center Area Circulator when the Ultimate System is achieved.

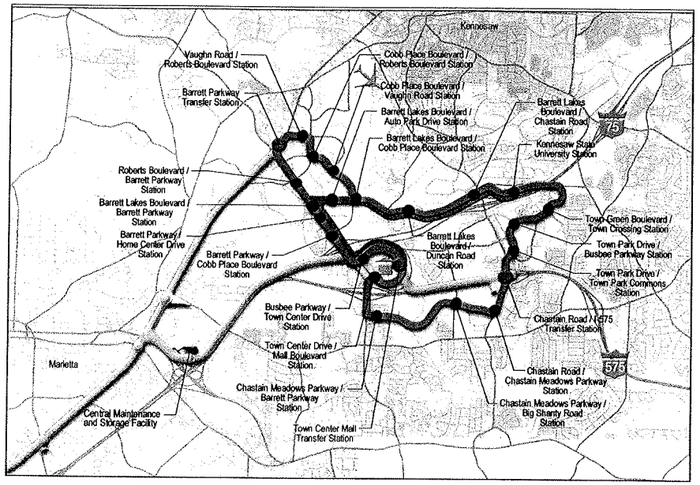
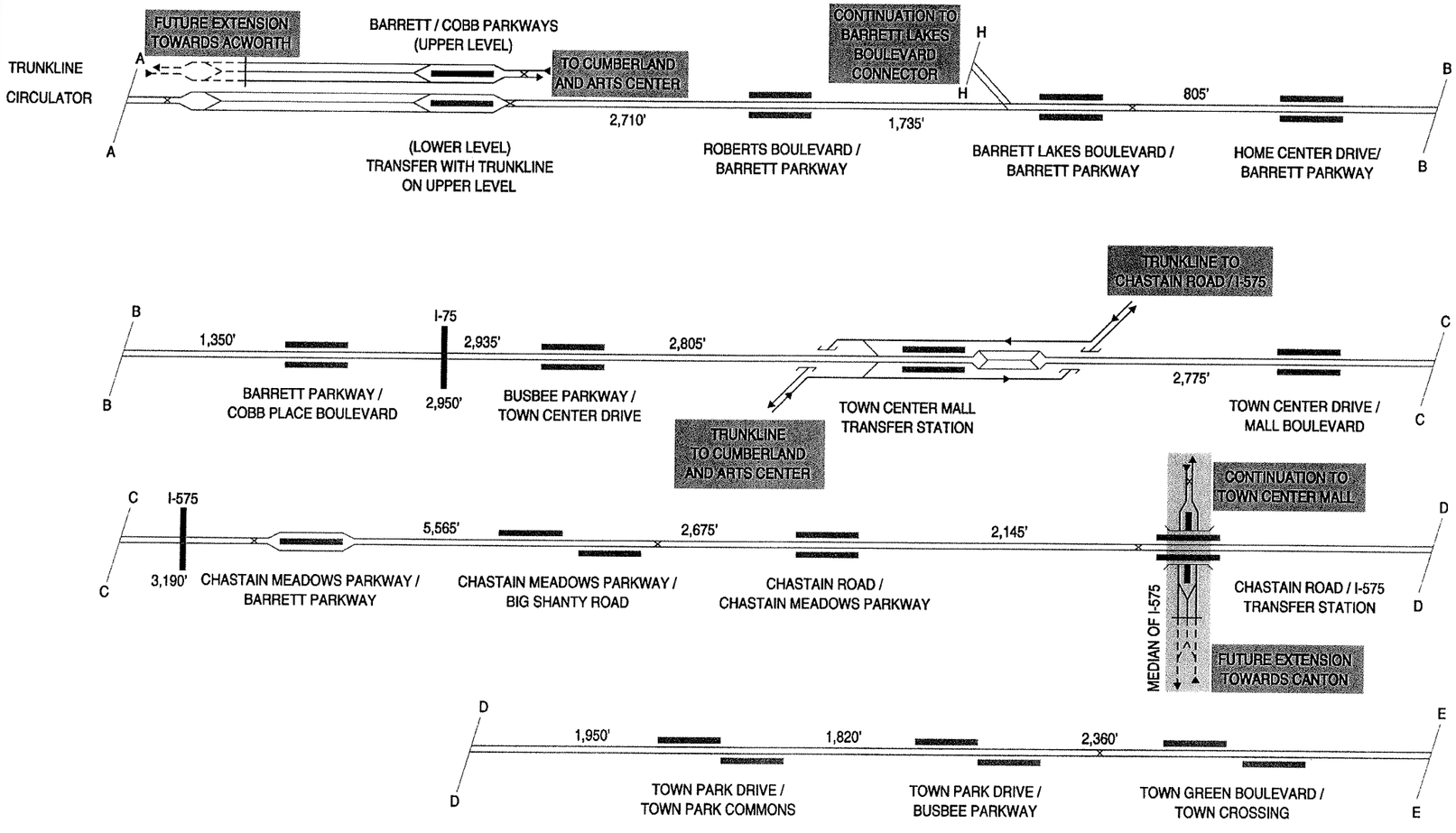


Figure 8-5 Town Center Area Circulator LRT Services

The proposed schematic track plan for the Town Center Area Circulator is shown in Figure 8-6.

ULTIMATE SYSTEM
TOWN CENTER AREA CIRCULATOR - MAIN LOOP



LEGEND

- TRUNKLINE
- CIRCULATORS
- INTERSTATE HIGHWAYS

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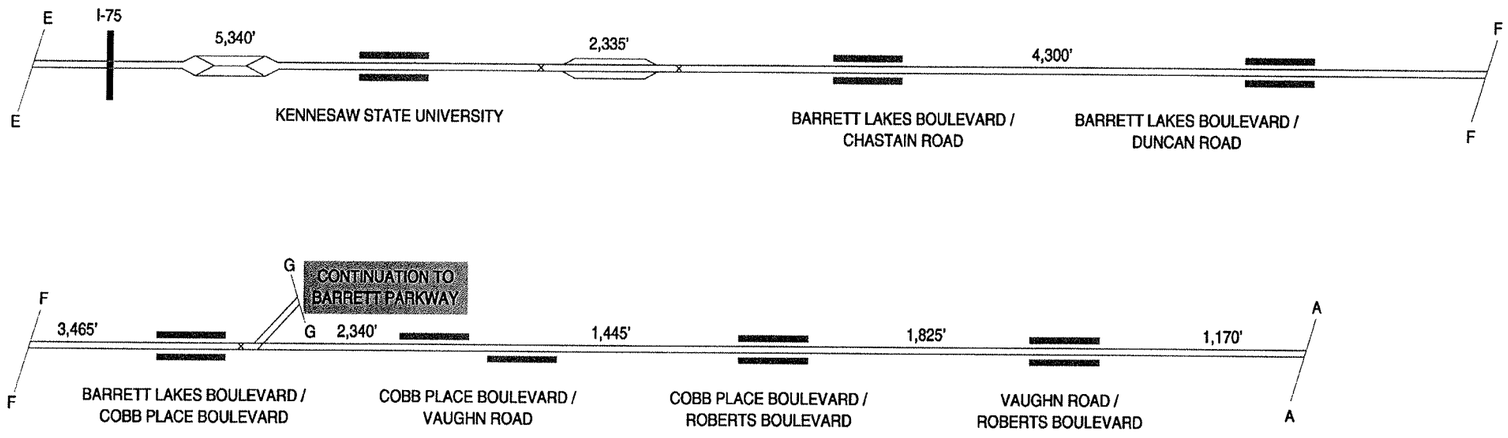
FIGURE 8-6 TRACK PLAN TOWN CENTER AREA CIRCULATOR MAIN LOOP - SHEET 1 OF 2

Transit Implementation Study

ULTIMATE SYSTEM
TOWN CENTER AREA CIRCULATOR - MAIN LOOP



LEGEND

- TRUNKLINE
- CIRCULATORS
- INTERSTATE HIGHWAYS

ULTIMATE SYSTEM
TOWN CENTER AREA CIRCULATOR - BARRETT LAKES CONNECTOR

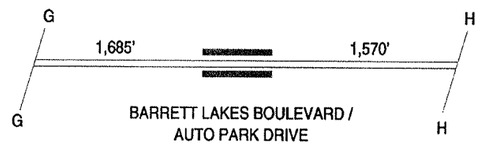


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FIGURE 8-6 TRACK PLAN TOWN CENTER AREA CIRCULATOR MAIN LOOP & BARRETT LAKES BLVD. SHORT CUT - SHEET 2 OF 2

Transit Implementation Study

8.2 DESIRED SERVICE CHARACTERISTICS

The following basic assumptions were made concerning service characteristics deemed desirable for the Northwest Corridor LRT System:

- **Trunkline.** Civil design and rolling stock performance characteristics to provide a commercial speed (schedule speed, including intermediate station stops) of 35 miles per hour (mph) between terminals at the Chastain Road/I-575 Transfer Station, the Barrett Parkway Transfer Station, and the Cumberland Boulevard Transfer Station. Pending confirmation in future studies, these characteristics are believed appropriate for the Trunkline continuation south to Arts Center, Atlanta.
- **Cumberland and Town Center Area Circulators.** Civil design and rolling stock performance characteristics to provide a commercial speed of 20 mph over the full length of each CID Circulator route.
- **Common Technology**. The Trunkline and the two Circulators will employ a common guidance technology and compatible traction power distribution and train control systems. This will permit a central maintenance and storage facility to serve the entire system.

8.3 DESIRED ROLLING STOCK CHARACTERISTICS

This conceptual System Operations Plan assumes that the rolling stock fleet of the Northwest Corridor LRT System will be composed of two types of LRVs, each reflecting performance and passenger-carrying capacity appropriate to the different functional requirements of the Trunkline and the two Circulators. To the greatest extent possible, the two types of vehicles would be of a modular design, using common components, such as carbody sections, articulation joints, trucks, air brake equipment, air conditioning units, etc.; their differences would be in areas such as overall length, traction motor size, gear ratio, seating arrangements, etc.

Specific features of each type of vehicle assumed are as follows:

- **Trunkline.** Interurban type LRVs with a range of 90-to-100 feet long, with two carbody sections and two articulated joints. Their interiors would be equipped with high-back transverse seats and overhead luggage racks to provide LRT passengers with a level of comfort and convenience commensurate with the length and type of their journeys. These vehicles would have 68 transverse seats (plus 2 wheelchair positions) and be able to comfortably stand up to 132 passengers (at the international comfort standard of 4 passengers per square meter) or a peak load capacity of 200 passengers. Maximum design speed would be 80 mph, although maximum operating speed would be limited to 70 mph. Trunkline LRVs would have a nominal acceleration rate of 3.0 mphps and be capable of achieving 70 mph within 60 seconds on level tangent track.

photo: Siemens Dueway/ABB

Interurban type LRV used in Karlsruhe, Germany on its extensive network of regional LRT lines.

photo: Siemens Dueway/ABB

The interior of the Karlsruhe LRVs have been designed to allow for excellent natural light.

- **Circulators**. Urban type LRVs approximately 50 feet long with a rigid carbody. The LRVs would seat 44 passengers in transit-type seating (with provisions for two wheelchairs) and be able to comfortably stand 76 passengers (at the international comfort standard of 4 passengers per square meter), providing a total capacity of 120 passengers. Maximum design speed would be 50 mph, although maximum operating speed would be limited to 40 mph. Circulator LRVs would have nominal acceleration rates of 3.0 mphps, and be capable of achieving 40 mph within 20 seconds on level tangent track.

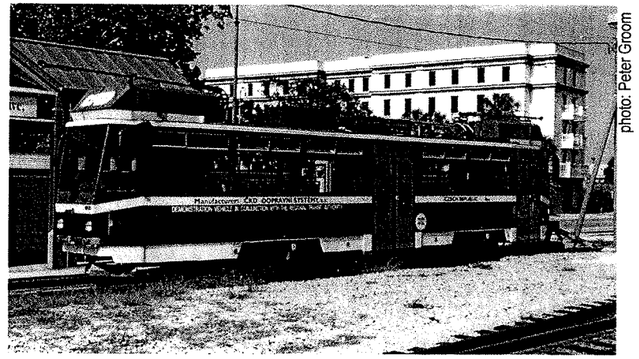


photo: Peter Groom

CKD Tatra (Czech Republic) demonstrator air conditioned urban type LRV using American PCC car technology car in test service in New Orleans, Louisiana

photo: Peter Groom

Interior of CKD Tatra demonstrator urban type LRV being tested in New Orleans, Louisiana

8.4 DEVELOPMENT OF THE OPERATIONS PLAN FOR THE ULTIMATE SYSTEM

To achieve a clear understanding of the complete operational requirements of the Trunkline and their influence on the design of the System as a whole, the Bechtel/MSE Team was obliged to develop a conceptualized completion of the Trunkline over its full extent from its two terminals in Kennesaw to Midtown Atlanta, as well as those of the Cumberland Circulator and the Town Center Area Circulator. This effort took into full account the detailed conceptual engineering performed for the Cobb County portion of the Trunkline and supplemented it with assumptions related to the Fulton County portion that are consistent with the Regional Transportation Plan (RTP) developed by the Atlanta Regional Commission.

It is anticipated that, when full build-out occurs (the Ultimate System), the train services shown in Table 8-5 will be operated on the three elements of the system.

8.5 DAYS AND HOURS OF OPERATION

The frequency of service, or intervals between trains, is customarily referred to as headways. Given the train capacities listed above, headways are chosen to meet the ridership demands at the peak load point of the most heavily traveled link and direction of travel on a particular route. The detailed data that would permit tailoring the train schedules to a fine-grained profile of ridership demand is not available at this time. Therefore, it is assumed that headways will be based on public policy decisions, including a high level of service frequency to encourage usage of the system.

For the purposes of this Study, the following assumptions about headway policies are made, to determine train service frequencies:

- A train will consist of one vehicle, or two or more coupled vehicles operating as one unit.
- A train every 2 minutes will be the minimum allowable headway on any portion of a line (Trunkline or Circulators) where two or more train services share common track.
- A train every 30 minutes will be the maximum headway on any portion of a line (Trunkline or Circulators).

Table 8-5 Train Services of the Ultimate System

Line	Route	From	To	Length (Miles)	Stations
Trunkline	TL1	Chastain Boulevard/ I-575 Transfer Station	Arts Center Station, Midtown Atlanta	22.48	16
Trunkline	TL2	Barrett Parkway Transfer Station	Arts Center Station, Midtown Atlanta	22.18	15
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station		4.41	11
Cumberland Circulator	B	Wildwood/Herodian Way Loop from Cumberland Blvd Transfer Station to Overton, Wildwood, Herodian Way Transfer Station, CCT Transfer Station and Cumberland Blvd Transfer Station		7.70	20
Cumberland Circulator	C	Galleria/Home Depot Loop from Cumberland Blvd Transfer Station to Galleria, Windy Ridge Pkwy Transfer Station, Home Depot, Overlook, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station		6.81	18
Town Center Area Circulator	D	Main Loop from Barrett Pkwy Transfer Station to Town Center Mall Transfer Station, Chastain Meadows and Barrett Pkwys, Chastain Road and I-575 Transfer Station, KSU and Barrett Parkway Transfer Station		10.90	22
Town Center Area Circulator	E	Kennesaw State University / Town Center Mall Transfer Station Line via Barrett Lakes Connector		3.97	9

- Headways will be set at intervals divisible into the hour, resulting in clock-face train schedules for a line or route, i.e., trains every 2, 2.5, 3, 4, 5, 6, 7.5, 10, 15, 20, or 30 minutes.
- Headways during peak hours on normal business days (Mondays through Fridays, from 7.00 to 9:00 AM and from 4:00 to 6.00 PM), will be every 4 minutes on the Trunkline (every 8 minutes on each branch) and every 6 minutes on each route of the Cumberland Circulator and the Town Center Area Circulator.
- Headways during off-peak, mid-day and early evening periods on normal business days (Mondays through Fridays) and on Saturdays, Sundays, and major holidays will be a maximum of 10 minutes on the Trunkline (20 minutes on each branch) and a maximum of 10 minutes on each Circulator route.
- Headways during early morning and late evening periods will not exceed 15 minutes on the Trunkline (30 minutes on each branch) and 15 minutes on each Circulator route.
- Timed transfer points will be established at stations where the Trunkline and the two Circulators intersect, whenever the Trunkline is operated at headways of 10 minutes or longer, i.e. Circulator trains will be scheduled to arrive and depart from these stations sufficiently in advance of or after a Trunkline train to permit connecting passengers to make convenient transfers between the services.

It is proposed that transit service be operated seven days per week, every week and month of the year. The hours of operation will be approximately as follows.

Days	Hours
Mondays through Fridays	5:00 AM to 1:00 AM
Saturdays	5:00 AM to 1:00 AM
Sundays and Major Holidays	7:00 AM to 12:00 Midnight

Additional service will be operated for special events such as baseball and football games.

The following service levels are proposed:

Mondays through Fridays

Periods of Operation	Trunkline Main Line	Trunkline Branches	Circulators
5:00 AM to 6:00 AM	Every 15 minutes	Every 30 minutes	Every 15 minutes
6:00 AM to 7:00 AM	Every 7.5 minutes	Every 15 minutes	Every 7.5 minutes
7:00 AM to 9:00 AM	Every 4.0 minutes	Every 8.0 minutes	Every 6.0 minutes
9:00 AM to 4:00 PM	Every 7.5 minutes	Every 15 minutes	Every 7.5 minutes
4:00 PM to 6:00 PM	Every 4.0 minutes	Every 8.0 minutes	Every 6.0 minutes
6:00 PM to 9:00PM	Every 10 minutes	Every 20 minutes	Every 10 minutes
9:00 PM to 1:00 AM	Every 15 minutes	Every 30 minutes	Every 15 minutes

Saturdays

Periods of Operation	Trunkline Main Line	Trunkline Branches	Circulators
5:00 AM to 9:00 AM	Every 15 minutes	Every 30 minutes	Every 7.5 minutes
9:00 AM to 9:00 PM	Every 7.5 minutes	Every 15 minutes	Every 7.5 minutes
9:00 PM to 1:00 AM	Every 15 minutes	Every 30 minutes	Every 15 minutes

Sundays and Major Holidays

Periods of Operation	Trunkline Main Line	Trunkline Branches	Circulators
7:00 AM to 9:00 AM	Every 15 minutes	Every 30 minutes	Every 15 minutes
9:00 AM to 9:00 PM	Every 10 minutes	Every 20 minutes	Every 10 minutes
9:00 PM to Midnight	Every 15 minutes	Every 30 minutes	Every 15 minutes

8.6 ONE-WAY DISTANCES AND RUNNING TIMES

Using the terminal-to-terminal distances listed in Section 8.1 and the performance requirements assumption of 35 mph average speed for the Trunkline and 20 mph average speed for the Circulators, both one-way and round trip running times were estimated for each route of the system.

While the conceptual engineering for the Fulton County portion of the Trunkline was not within the scope of this Study, it appears that its length will be in the range of 8.5 to 10.5 miles, depending on whether a direct or indirect route is chosen. For this operations planning exercise, the greater distance has been used, to be both conservative and consistent with the RTP. Continuing to assume an average schedule speed of 35 mph (which is consistent with the assumptions of the RTP) and the longer distance of an indirect routing, the one-way running time for the portion of the Trunkline located within Fulton County would be approximately 16.5 minutes. These estimates are added to the calculations of one-way and round trip running times for the Cobb County portion of the Trunkline to establish probable running times for the Ultimate System.

The one-way running times anticipated for the Ultimate System would be as shown in Table 8-6.

Table 8-6
Anticipated One-Way Running Times

Line	Route	Description	Length (Miles)	Average Speed	Running Time
Trunkline	TL1	Trunkline from Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	24.48	35 mph	42 min
Trunkline	TL2	Trunkline from Barrett Pkwy Transfer Station to Arts Center Station, Midtown Atlanta	22.18	35 mph	38 min
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	4.41	20 mph	14 min
Cumberland Circulator	B	Wildwood/Herodian Way Loop from Cumberland Blvd Transfer Station to Overton, Wildwood, Herodian Way Transfer Station, CCT Transfer Station and Cumberland Blvd Transfer Station	7.70	20 mph	24 min
Cumberland Circulator	C	Galleria/Home Depot Loop from Cumberland Blvd Transfer Station to Galleria, Windy Ridge Pkwy Transfer Station, Home Depot, Overlook, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	6.81	20 mph	21 min
Town Center Area Circulator	D	Main Loop from Barrett Pkwy Transfer Station to Town Center Mall Transfer Station, Chastain Meadows and Barrett Pkwys, Chastain Road and I-575 Transfer Station, KSU and Barrett Parkway Transfer Station	10.90	20 mph	33 min
Town Center Area Circulator	E	Kennesaw State University / Town Center Mall Transfer Station Line via Barrett Lakes Connector	3.97	20 mph	12 min

Note: Running Time estimates in minutes and seconds have been adjusted upwards to the next minute

8.7 ROUND TRIP OR LOOP CIRCUIT RUNNING TIMES, TERMINAL LAYOVERS AND CYCLE TIMES

Round trip or loop circuit running times for the system elements were developed based on the following assumptions and methodology:

- **Trunkline.** Cycle times for each Trunkline route are the sums of twice the one-way running time (i.e., the round trip running time) plus a terminal layover allowance of at least four minutes at each end of a route. Cycle times for Trunkline train services are also required to be divisible by four in order to conform to the assumption made in the transportation modeling work presented in Section 4 of this volume, that Trunkline trains will operate at 4-minute headways during the peak hours.
- **Cumberland Circulator.** Cycle times are based on the loop circuit running times or twice the one-way running time (whichever is appropriate) plus a layover allowance of at least two minutes or 10 % of the running time, whichever is greater. The layover occurs when a train returns to its point of origin or arrives at an end of line terminal. When, under the Ultimate System, full build-out of the Cumberland Circulator is achieved, the cycle times of each of its three routes must be divisible by six (during peak periods) to conform to line capacity limitation of minimum headways of 2 minutes on common trackage on which two or more services will operate.
- **Town Center Area Circulator.** Cycle times are based on circuit running times or twice the one-way running times (whichever is appropriate) plus a layover allowance of at least 2 minutes or 10 % of the running time, whichever is greater. The layover occurs when a train returns to its point of origin or arrives at an end of line terminal. The cycle times for each of its routes must be divisible by six (during peak periods), as the ultimate configuration of the Town Center Area CID Circulator will result in two routes operating over common trackage.

Table 8-7 shows the anticipated round trip or loop circuit running times, terminal layovers, and cycle times for the Ultimate System.

Table 8-7
Round Trip and Cycle Times for Ultimate System

Line	Route	Description	Round Trip or Circuit Running Times	Terminal Layovers	Cycle Times
Trunkline	TL1	Trunkline from Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	84 min	12 min	96 min
Trunkline	TL2	Trunkline from Barrett Pkwy Transfer Station to Arts Center Station, Midtown Atlanta	76 min	12 min	88 min
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	14 min	4 min	18 min (Each Direction)
Cumberland Circulator	B	Wildwood/Herodian Way Loop from Cumberland Blvd Transfer Station to Overton, Wildwood, Herodian Way Transfer Station, CCT Transfer Station and Cumberland Blvd Transfer Station	24 min	6 min	30 min (Each Direction)
Cumberland Circulator	C	Galleria/Home Depot Loop from Cumberland Blvd Transfer Station to Galleria, Windy Ridge Pkwy Transfer Station, Home Depot, Overlook, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	21 min	3 min	24 min (Each Direction)
Town Center Area Circulator	D	Main Loop from Barrett Pkwy Transfer Station to Town Center Mall Transfer Station, Chastain Meadows and Barrett Pkwys, Chastain Road and I-575 Transfer Station, KSU and Barrett Parkway Transfer Station	33 min	3 min	36 min (Each Direction)
Town Center Area Circulator	E	Kennesaw State University / Town Center Mall Transfer Station Line via Barrett Lakes Connector	24 min	6 min	30 min

8.8 RUNS REQUIRED FOR PEAK-PERIOD SERVICE ON ULTIMATE SYSTEM

A run is defined as the number of train sets (regardless of length) required to maintain scheduled service on a route during the peak hours. The number of runs required is calculated by dividing the headway (scheduled interval between trains) into the cycle time for the route. Since bi-directional operations are anticipated for the loop routes of the Circulators, the number of runs required is double that calculated by dividing the peak-hour headway into the cycle times.

Based on the assumptions concerning peak-period headways and cycle times stated above, the number of runs required for each route of the Ultimate System are as shown in Table 8-8.

Table 8-8
Number of Runs of the Routes of the Ultimate System

Line	Route	Description	Cycle Times	Peak Hour Headways	Runs Required
Trunkline	TL1	Trunkline from Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	96 min	8 min	12
Trunkline	TL2	Trunkline from Barrett Pkwy Transfer Station to Arts Center Station, Midtown Atlanta	88 min	8 min	11
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	18 min (Each Direction)	6 min	6
Cumberland Circulator	B	Wildwood/Herodian Way Loop from Cumberland Blvd Transfer Station to Overton, Wildwood, Herodian Way Transfer Station, CCT Transfer Station and Cumberland Blvd Transfer Station	30 min (Each Direction)	6 min	10
Cumberland Circulator	C	Galleria/Home Depot Loop from Cumberland Blvd Transfer Station to Galleria, Windy Ridge Pkwy Transfer Station, Home Depot, Overlook, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	24 min (Each Direction)	6 min	8
Town Center Area Circulator	D	Main Loop from Barrett Pkwy Transfer Station to Town Center Mall Transfer Station, Chastain Meadows and Barrett Pkwys, Chastain Rd. and I-575 Transfer Station, KSU and Barrett Parkway Transfer Station	36 min (Each Direction)	6 min	12
Town Center Area Circulator	E	Kennesaw State University / Town Center Mall Transfer Station Line via Barrett Lakes Connector	30 min	6 min	5
Total Peak Period Runs					**64**

Note: In the case of looping routes, the number of runs required is twice that of the cycle, as runs must be scheduled for both clockwise and counterclockwise service.

8.9 PASSENGER CARRYING CAPACITY OF TRUNKLINE AND CIRCULATORS

The passenger-carrying capacity of the Trunkline and each of the two Circulators – stated in seats and total capacity per hour, as measured in each direction past the peak load point, at varying service frequencies (headways) – is summarized in Table 8-9.

Table 8-9
Passenger Carrying Capacities Per Hour Per Direction

Headway	Trains Per Hour	Trunkline			Circulators	
		One Car	Two Cars	Three Cars	One Car	Two Cars
2.0 min	30	6,000	12,000	18,000	3,600	7,200
2.5 min	24	4,800	9,600	14,400	2,880	5,760
3.0 min	20	4,000	8,000	12,000	2,400	4,800
4.0 min	15	3,000	6,000	9,000	1,800	3,600
5.0 min	12	2,400	4,800	7,200	1,440	2,880
6.0 min	10	2,000	4,000	6,000	1,200	2,400
7.5 min	8	1,600	3,200	4,800	960	1,920
10 min	6	1,200	2,400	3,600	720	1,440
15 min	4	800	1,600	2,400	480	960
20 min	3	600	1,200	1,800	360	720
30 min	2	400	800	1,200	240	480

The line capacities per direction, calculated above, assume a 34 percent/66 percent ratio of seated to standing passengers for the interurban type LRVs proposed for the Trunkline, i.e., 68 seated passengers and 132 standees in each car at its full capacity of 200 passengers. Similarly, a 37 percent/63 percent ratio of seated passengers to standees is assumed for the urban type LRVs proposed for the Circulators, i.e. 44 seated passengers and 76 standees in each car at its full capacity of 120 passengers. This is a worst-case scenario; in actual practice, the acceptable ratio of seated to standing passengers is a policy decision, having bearing on the amount of capital investment and operating costs required for the system.

8.10 CORRELATION OF SERVICE PROVIDED TO DEMAND PAST PEAK LOAD POINTS

The Cobb County Transportation Model has been used to estimate peak period demands for the proposed system. This model is particularly sensitive to frequency of service, i.e. headways, and the assumption concerning walk-access distance to stations, i.e. within 0.4 mile, quarter mile, etc. A series of model runs were made with varying headways and walk-access distance assumptions. Results indicate the daily, 2-hour period, and peak hour/peak direction volumes past peak load points for the Trunkline and the two Circulators, as shown in Table 8-10.

Table 8-10
Peak Load Points

System Element/ Demand Forecasts	Trunkline	Cumberland Circulator	Town Center Area Circulator
Daily	76,970	57,080	16,020
Two Hour Peak	15,815	11,290	2,865
One Hour Peak	9,490	6,770	1,720
Peak Load Point	4,660	2,255	550

8.11 MINIMUM CAR REQUIREMENTS TO SATISFY DEMAND AT PEAK LOAD POINTS

Peak period car service requirements are calculated using the highest passenger volumes past the peak load point in the peak direction predicted by the model and assuming the headways stated in Section 8.5, Days and Hours of Operation, with the variable being train length. Assuming the seated to standee passenger ratios discussed above, this methodology yields the operating requirements shown in Table 8-11.

8.12 MAXIMUM CAR REQUIREMENTS TO SATISFY DEMAND AT PEAK LOAD POINTS

Given the suburban nature of Cobb County and the widespread use of automobiles and sports utility vehicles for personal travel needs for trips within the County and to/from Atlanta, it is probable that a policy to provide seats to as many people as possible will be needed to attract high volumes of passengers to the System. Implementation of this policy will increase the peak period car service requirements needed to transport the passenger volumes predicted by the model past the peak hour/peak direction load point. In contrast with the minimum car requirements calculated above, a policy to maximize the number of seats offered to peak period passengers, under the same headway assumptions, will result in an increase in the number of Trunkline vehicles, as shown in Table 8-12.

Table 8-11
Minimum Operating Requirements at Peak Load Points

System Element	Demand at Peak Load Point	Capacity at Peak Load Point	Runs (Not TPH)	Train Length	Cars In Service
Trunkline	4,660	6,000	23	2	46
Cumberland Circulator	2,255	3,600	24	1	24
Town Center Area Circulator	550	2,400	17	1	17
Total Runs and Cars In Service During Peak Periods			64	N/A	87

Table 8-12
Maximum Operating Requirements at Peak Load Points

System Element	Demand at Peak Load Point	Seats Available at Peak Load Point	Runs (Not TPH)	Train Length	Cars In Service
Trunkline	4,660	3,060	23	3	69
Cumberland CID Circulator	2,255	1,320	24	1	24
Town Center Area CID Circulator	550	880	17	1	17
Total Runs and Cars in Peak Period Service			64	N/A	110

8.13 ROLLING STOCK FLEET SIZE REQUIREMENTS FOR THE ULTIMATE SYSTEM

The total rolling stock requirements for both the minimum-cars-in-service and maximum-cars-in-service scenarios are shown in Table 8-13.

Table 8-13
Total Rolling Stock Requirements

System Element	Minimum No. LRVs In Service		Maximum No. LRVs In Service	
	Interurban	Urban	Interurban	Urban
Trunkline	46	N/A	69	N/A
Cumberland Circulator	N/A	24	N/A	24
Town Center Area Circulator	N/A	17	N/A	17
Scheduled Service Requirement	46	41	69	41
Operating Spares	4	1	6	1
Operating Requirement	50	41	75	42
Maintenance Spares (12%)	6	5	9	5
Total Rolling Stock Fleet	**56**	**47**	**84**	**47**

For planning purposes relating to the portion of the Ultimate System located within Cobb County, a rolling stock fleet consisting of at least 56 interurban type LRVs designed for use on the Trunkline and 47 urban type LRVs designed for use on the two Circulators should be assumed, if operations are based on 4-minute peak period headways. If a policy decision is made to maximize the number of seats offered to passengers using the Trunkline during peak hours, the number of interurban type LRVs required for the Trunkline would increase to 84. In addition, a Central Maintenance and Storage facility designed to accommodate an ultimate fleet of at least 103 LRVs, plus maintenance-of-way equipment, will be needed to accommodate the requirements of the Ultimate System.

8.14 OPERATIONS ASSESSMENT CONCLUSION

Daily, peak period, and peak load point/peak direction passenger volumes forecast by the Cobb County Transportation Model for the Northwest Corridor LRT System can be accommodated comfortably with the capacity provided by state-of-the-art light rail transit technology. Depending on policy decisions relating to the frequency of peak period service and the percentage of passengers to be offered

seats during the peak hour, between 103 and 131 LRVs of the types described in this Final Report will be required to operate the system at its full build-out under the Ultimate System. In addition, a central maintenance and storage facility designed to accommodate a rolling stock fleet of this size, plus maintenance of way equipment, will be required.

The Trunkline has certain physical characteristics somewhat similar to those commonly associated in the United States with a heavy rail rapid system – a fully grade-separated alignment with stations designed with high level platform stations. In fact, several North American cities (Calgary and Edmonton, Alberta, Canada; San Francisco, California; Los Angeles, California; St. Louis, Missouri; Philadelphia, Pennsylvania; and Guadalajara, Monterrey, and Mexico City, Mexico) have light rail transit systems that are either substantially or fully grade-separated and which are operated by fleets of LRVs designed to serve stations with high level platforms. Similar LRT applications exist in several Asian and European cities.

It should be recognized that full grade separation of the Trunkline along Cobb Parkway is required to achieve the schedule speed of at least 35 mph, established as a basic system objective. If the alignment were to be at grade with level crossings with intersecting streets, safety considerations (for motorists, pedestrians, transit passengers, and transit employees) would require reduction of the maximum allowable speed from 70 mph to the highway speed limit of 45 mph in that section of Cobb Parkway.

The Bechtel/MSE Team estimates that lowering the speed limit for Trunkline trains by 25 mph would reduce the average schedule speed by at least 12.5 mph, more likely by 15.0 mph, along the at-grade portion of the alignment. In addition, even if traffic light preemption were permitted, trains would be subject to delays at intersections blocked from passage by cross-traffic during the chronic gridlock conditions that prevail along Cobb Parkway in peak periods.

For example, the placing of approximately 8.5 miles of the Trunkline alignment between the Canton Road Connector/SR5 and Cumberland Boulevard, at grade in the median of Cobb Parkway would result in an increase in the one-way running time of at least 11 minutes (from approximately 14.5 minutes to 25.5 minutes) in that area. Consequently, passengers riding TL1 trains for the 24.5-mile trip from the Chastain Road/I-575 Transfer Station to the Arts Center Station in Midtown Atlanta would have their journeys lengthened from 42 minutes to 53 minutes. At the same time, the average speed of their trips would decline from 35 mph to 27.7 mph, well below the design criteria established as a basic system objective.

Similarly, the 22.2-mile trip on a TL2 train from the Barrett Parkway Transfer Station to the Arts Center Station in Midtown Atlanta would be increased from 38 minutes to 49 minutes as a result of placing the Trunkline alignment at grade along chronically-congested Cobb Parkway. In this case, the average speed of TL2 trains would be reduced from 35 mph to 27.2 mph, again well below the project goal.

Increases of this magnitude in the one-way running time of the Trunkline would severely reduce its competitiveness, both in peak and off-peak periods, vis-à-vis automobiles operating on parallel interstate highways I-75 and I-575, where speed limits are in the 55 mph to 65 mph range and, due to common-place violations, average driving speeds are customarily higher. Without question, eliminating the fully grade-separated character of the Trunkline would adversely impact its ridership levels and revenue-generating capability, as well as those of the remainder of the Northwest Corridor LRT System. As a direct consequence, revision of this System Operations Plan would be required to reassess the frequency of train services to be operated on the Trunkline, and, perhaps, on the Circulators. Ripple effects would extend to reducing the LRV fleet, downsizing the Central Maintenance and Storage Facility, decreasing its Operations and Maintenance Costs and, in all probability, significantly increasing the operating deficit of the Northwest Corridor LRT System as a whole.

Accordingly, the Systems Operations Plan presented in this section, and the Capital Cost and Operations and Maintenance Cost projections contained in Sections 9 and 11 (based in part on the conclusions of this section), are valid only if the alignment of the Trunkline remains in a fully grade-separated configuration; otherwise the work of this Final Report must be revisited. In summary, in the judgment of the Bechtel/MSE Team, retaining the fully grade-separated character of the Trunkline is essential to the success of the Northwest Corridor LRT System as a whole.

This section of the Final Report presents the capital cost estimates and the operating and maintenance cost estimates for the Northwest Corridor Light Rail Transit System. As explained in Subsection 1.1.3 Study Constraints, the conceptual engineering work for the proposed system was undertaken only for the portion of the system that is contained within Cobb County. Therefore, the quantity-based cost estimating activities were limited to Cobb County and an allowance was included for the portion of the system located in Fulton County, as explained further in this section.

A number of key qualifications must be taken into consideration when referencing this cost estimate data:

- All costs are estimated at the first quarter of year 2000. These costs are not "year of expenditure" costs. Escalation of project costs through the completion of construction will need to be factored into the capital cost of the system as will the remainder of the items set forth in Subsection 9.1.6 Exclusions. Similarly, escalation to "year of expenditure" must be factored into the system operating and maintenance costs presented herein.
- The costs presented in this section of the Final Report are for the proposed Ultimate System; the Trunkline from the Town Center Area through Cumberland to the MARTA Arts Center Station in Midtown Atlanta, plus the costs for the light rail transit Circulators in the Cumberland and Town Center areas.
- The costs for the Marietta Branch are presented separately in Section 12.
- The costs of the potential project phasing scenarios are presented separately in Section 11.

9.1 CAPITAL COST ESTIMATES

The capital cost estimates for the proposed Ultimate System include furnishing of all labor, equipment, materials, and services required to construct the system as described in this Final Report.

9.1.1 Scope of Capital Cost Estimates

The estimates cover the following main project elements:

- Trunkline
- Trunkline LRV Fleet
- Cumberland Circulator
- Town Center Area Circulator
- Circulator LRV Fleets
- Maintenance and Storage Facilities

9.1.2 Documents Used

The estimate is based on the following drawings:

- Alignment plans and profiles (See Volume II)
- Drawings of typical alignment sections (See Volume II)
- Drawings of typical stations (See Volume II)
- Track schematic diagrams (See Section 8)

9.1.3 Quantity Development

Quantities for this estimate have been developed from the above drawings and sketches and are based on the following:

- **Route length quantities** for guideways, by configuration
- **Number of stations by type** (see Table 7-2). Using the architectural drawings, quantity takeoffs have been performed for the following station types:
  - Trunkline: A1, B3, and C4
  - Circulators: B2, B3, and C3
- **Trackwork quantities** (tracks on ballast or direct fixation track) are based on guideway quantities.
- **Special trackwork items** are based on schematic track plans.
- **Systems quantities** are based on track length or number of stations.
- **Maintenance and Storage Facility** quantities were developed based on project concepts and considering data from other projects with similar fleet size.
- **Allowance for number of vehicles** (56 interurban type LRVs for the Trunkline Fleet; 47 urban type LRVs for the Circulator Fleet) is based on the preliminary System Operations Plan presented in Section 8 (34 interurban type LRVs are attributed to the Cobb County portion of the Trunkline and included in this estimate; the remaining 22 interurban type LRVs are attributed to the $900 million allowance for the Fulton County portion of the Trunkline)

9.1.4 Pricing Basis

All costs are estimated at the first quarter 2000 pricing level. Unit rates in the estimate include contractor's direct and indirect costs, and mark-ups. Pricing is based on the following:

- **Guideway costs** are based on typical cross-sections to arrive at the cost per linear foot for each type of trackway structure.
- **Station costs** have been developed by pricing the quantities developed for the six quantified stations listed above. The remaining stations have been priced by making approximate adjustments to those six stations. Vertical circulation equipment is included in the station costs. Station Control Rooms are provided for the Trunkline stations only.
- **Trackwork pricing** is based on unit rates from other transit systems for tracks on ballast, direct fixation tracks, and special trackwork.
- **Systems costs,** including traction power, train control, communications, station communications and SCADA, and fare collection systems, are based on cost data from other transit systems with similar features.
- **Central Maintenance and Storage Facility cost** was developed by pricing the conceptual quantities, using prices from similar facilities.
- **Transit vehicle costs** are based on an allowance of $3,000,000 each for Trunkline vehicles, and $1,500,000 each for Circulator vehicles.
- **Fulton County costs** have been accounted for with a $900 million allowance for total project cost as included in the Regional Transportation Plan.

9.1.4.1 General Conditions (of Construction)

A 10 percent allowance has been made for mobilization/ demobilization and various items not covered by unit rates.

9.1.4.2 Engineering and Management

The following percentage of construction cost allowances are included in the estimate:

- Engineering 10%
- Construction Management 8%
- Project Management 6%
- Environmental Engineering/Mitigation 1%

9.1.4.3 Project Contingencies

A contingency allowance of 25 percent has been included in the estimate. Contingency is an allowance to compensate for the level and quality of information available at the time the estimate is prepared. As estimates are prepared during preliminary and final engineering, the contingency will be reduced appropriately.

9.1.4.4 Owner's (Georgia Regional Transportation Authority) Costs

The following percentage allowances are included:

- Owner's (GRTA) management and administration 4 %
- Utilities (By agreement between Georgia Regional Transportation Authority [GRTA], Cobb County, the City of Marietta, and the utility companies for gas, power, and communications, a majority of the utility work is expected to be performed by the utility companies. The project, through GRTA, Cobb County, and the City of Marietta, will reimburse these costs.) 3%
- Pre-revenue start-up and testing 1.1%
- Owner (GRTA) Controlled Insurance program (OCIP) 3%

9.1.5 Assumptions

The following assumptions have been made for this estimate:

- Conventional contracting practices will be employed.
- GRTA will provide an OCIP.
- Support of existing utilities (sewers, water, gas, power, communication), new utilities (drainage, sewer and water) and temporary electrical power and other temporary utility costs) will be by the construction contractors.
- Agreements between GRTA, Cobb County, and the utility companies for gas, power, and communications will generally result in advance relocations (before the main construction) of these items by the utility companies. The cost will be included in GRTA's project costs.

9.1.6 Exclusions

Exclusions to the estimate include the following:

- GRTA administration facilities
- Supplies and spare parts
- Escalation
- Financing and interest during construction

9.1.7 Cost Summaries

Cost summaries are presented in the following five tables:

- Table 9-1 Project Cost Summary
- Table 9-2 Trunkline Cost Summary – Cobb County Portion
- Table 9-3 Cumberland Circulator Cost Summary
- Table 9-4 Town Center Area Circulator Cost Summary
- Table 9-5 Central Maintenance and Storage Facility Cost Summary

Unit Cost Abbreviations Used:

RM Route Mile
EA Each
TF Track Foot
LS Lump Sum

Table 9-1
Project Cost Summary
Ultimate System (to Arts Center)

Description	Total Cost $
Trunkline and Stations	1,519,500,000
Trunkline Fleet (34 @ $3,000,000 ea.)	102,000,000
Total Cumberland Circulator	954,000,000
Total Town Center Area Circulator	588,500,000
Circulator Fleet (47 @ $1,500,000 ea.)	70,500,000
Central Maintenance and Storage Facility	159,200,000
Total Project	**3,393,700,000**
Right of Way Allowance*	250,000,000
Total – Ultimate System Cobb County	3,643,700,000
Fulton County Project Allowance**	900,000,000
Total – Ultimate System Cobb and Fulton Counties* **	**4,543,700,000**

* In the absence of the Preliminary Engineering work that will take place during the ensuing project phases, it has not been possible to determine the actual right-of-way requirements for the light rail transit system. Therefore, at this early stage of the project, the Bechtel/MSE Team has established an all-inclusive indicative allowance for the project right-of-way at $250,000,000, inclusive of property costs, relocation, legal assistance, and other related costs.

** As explained within subsection 1.1.3 Study Constraints, the conceptual engineering work for the proposed system was undertaken only for the portion of the light rail transit system contained within Cobb County. Therefore, in the absence of the data necessary to enable quantity-based estimating, the Team has accepted and included herein, as an allowance, the $900,000,000 Trunkline project cost included in the Regional Transportation Plan for the segment within Fulton County. Reaffirmation or modification of this project cost will take place in subsequent phases of the work with the completion of the requisite engineering design work.

*** The cost of the Marietta Branch would be in addition to this amount. Utilizing an average cost of $220 million, as presented in Section 12 for the Branch, would bring the total cost for the Ultimate System to $4,763,700,000

Table 9-2
Trunkline Cost Summary
Cobb County Portion

Description	Quantity	Unit	Unit $	Total Cost
General Conditions (of Construction)	10%	%		$79,600,000
Guideway	17.34	RM	19,036,141	$330,000,000
Stations	13	EA	19,515,385	$253,700,000
Parking	8,340	Stall	5,791	$48,300,000
Total Systems	186,644	TF	878	$163,800,000
Total Construction				$875,400,000
Engineering and Management				
Engineering	10%	%		$85,700,000
Construction Management	8%	%		$70,000,000
Project Management	6%	%		$52,500,000
Environmental Engineering and Mitigation	1%	%		$8,800,000
Total Engineering and Management	25%	%		$218,800,00
Sub Total Project Cost				$1,094,200,000
Project Contingencies	25%	%		$273,600,000
Sub Total Project Cost				$1,367,800,000
Owner's Costs				
Owner's Management and Administration	4%	%		$54,700,000
Utilities by Owner	3%	%		$41,000,000
Revenue Start up and Testing	1.1%	%		$15,000,000
OCIP	3%	%		$41,000,000
Total Owner's Costs				$151,700,000
Total Trunkline and Stations				**$1,519,500,000**

Table 9-3
Cumberland Circulator Cost Summary

Description	Quantity	Unit	Unit $	Total Cost
General Conditions (of Construction)	10%	%		$50,000,000
Guideway	14.25	RM	17,354,389	$247,300,000
Stations	37	EA	2,808,108	$103,900,000
Parking	250	Stall	3,200	$800,000
Total Systems	152,056	TF	970	$147,500,000
Total Construction				$549,500,000
Engineering and Management				
Engineering	10%	%		$55,000,000
Construction Management	8%	%		$44,000,000
Project Management	6%	%		$33,000,000
Environmental Engineering and Mitigation	1%	%		$5,500,000
Total Engineering and Management	25%	%		$137,500,000
Sub Total Project Cost				$687,000,000
Project Contingencies	25%	%		$171,700,000
Sub Total Project Cost				$858,700,000
Owner's Costs				
Owner's Management and Administration	4%	%		$34,300,000
Utilities by Owner	3%	%		$25,800,000
Revenue Start up and Testing	1.1%	%		$9,400,000
OCIP	3%	%		$25,800,000
Total Owner's Costs				$95,300,000
Total Cumberland Circulator				**$954,000,000**

Table 9-4
Town Center Area Circulator Cost Summary

Description	Quantity	Unit	Unit $	Total Cost
General Conditions (of Construction)	10%	%		$30,800,000
Guideway	11.52	RM	12,357,373	$142,400,000
Stations	23	EA	2,360,870	$54,300,000
Systems	121,688	TF	915	$111,400,000
Total Construction				$338,900,000
Engineering and Management				
Engineering	10%	%		$33,900,000
Construction Management	8%	%		$27,100,000
Project Management	6%	%		$20,400,000
Environmental Engineering and Mitigation	1%	%		$3,400,000
Total Engineering and Management	25%	%		$84,800,000
Sub Total Project Cost				$423,700,000
Project Contingencies	25%	%		$105,900,000
Sub Total Project Cost				$529,600,000
Owner's Costs				
Owner's Management and Administration	4%	%		$21,200,000
Utilities by Owner	3%	%		$15,900,000
Revenue Start up and Testing	1.1%	%		$5,900,000
OCIP	3%	%		$15,900,000
Total Owner's Costs				$58,900,000
Total Town Center Area Circulator				$588,500,000

Table 9-5
Central Maintenance and Storage Facility Cost Summary

Description	Quantity	Unit	Unit $	Total Cost
General Conditions (of Construction)	10%	%		$8,600,000
Maintenance Facility	119	Vehicles	678,151	$80,700,000
Maintenance of Way Equipment				$5,000,000
Total Construction				$94,300,000
Engineering and Management				
Engineering	10%	%		$9,400,000
Construction Management	8%	%		$7,500,000
Project Management	6%	%		$5,700,000
Environmental Engineering and Mitigation	1%	%		$900,000
Total Engineering and Management	25%	%		$23,500,000
Sub Total Project Cost				$117,800,000
Project Contingencies	25%	%		$29,500,000
Sub Total Project Cost				$147,300,000
Owner's Costs				
Owner's Management and Administration	4%	%		$5,900,000
Revenue Start up & Testing	1.1%	%		$1,600,000
OCIP	3%	%		$4,400,000
Total Owner's Costs				$11,900,000
Total Maintenance and Storage Facilities				**$159,200,000**

Note: The Central Maintenance and Storage Facility has been sized to accommodate the fleet requirements of the Ultimate System plus the fleet requirements anticipated for the Marietta Branch; specifically, the Trunkline from Town Center to the MARTA Arts Center Station in Midtown Atlanta and the full build-out of the Marietta Branch and the Cumberland and Town Center Area Circulators.

The Operations Control Center is included.

9.2 O & M COST ESTIMATES

Elements of the O & M estimating process are discussed in the following subsections and summarized in Tables 9-6 through 9-13.

9.2.1 Scope of Operating and Maintenance Cost Estimates

The Ultimate System, as defined herein, includes the Trunkline configuration between the Chastain Road/I-575 Transfer Station and the MARTA Arts Center Station in Midtown Atlanta, plus the Trunkline extension along Cobb Parkway to the Barrett Parkway Transfer Station. It also includes the ultimate configuration of the Cumberland and Town Center Area Circulators, all as depicted in Figure 3-2. The O & M costs for the Marietta Branch are presented separately in Section 12. This section presents the data used to prepare this preliminary forecast of O & M costs.

O & M costs normally comprise the following elements:

- Management and administration
- Fare collection and handling
- Transportation
- Light rail vehicle maintenance
- Maintenance of way, including stations and parking facilities
- System security
- Utilities

At this stage of conceptual planning, operating and maintenance costs are based on the average cost per forecast revenue-vehicle-mile, using O & M cost experience of similar U.S. transit systems and the forecast revenue-vehicle-miles based on the System Operations Plan presented in Section 8.

9.2.2 Development of Unit Costs

O & M costs per revenue-vehicle-mile were guided by data from industry experience in the U.S. It is assumed that one organization will be set up to operate the entire system, including the Trunkline, the Marietta Branch, and the two Circulators. The Trunkline (and the through service of the Marietta Branch) will be served by large, interurban type light rail vehicles, operating in 2-car and 1-car trains; the two Circulators will use smaller urban type LRVs that are operated at a high level of frequency in 1-car trains, and will require a proportionately greater number of train drivers per passenger carried. Another consideration in using industry-wide experience is the labor wage differential between the East and West Coasts of the U.S., on the one hand, and those in the Southeast U.S. on the other.

Table 9-6 presents O & M cost characteristics for a number of fully grade-separated heavy rail transit systems in the U.S. From an operating standpoint, it is envisioned that the Trunkline, notwithstanding its use of interurban type LRVs, would exhibit characteristics similar to these systems and, thus, its O & M costs would be similar to these experiences (excluded from this list are very old systems that require heavy maintenance expenses, such as New York, Chicago, and Boston). O & M costs for the selected systems were escalated to year 2000 levels. It is assumed that 80 percent of the O & M costs are labor and are, therefore, subject to the labor cost adjustment between Cobb County (Atlanta Region) and various other parts of the country. The adjusted average O & M cost per revenue-vehicle-mile, as used in the forecast at the year 2000 level, is $6.50.

For estimating O & M cost for the Circulators, we have been guided by the experience of selected light rail transit systems in the U.S. A process similar to that explained for the heavy rail system is adopted here and presented in Table 9-7. The resulting adjusted average O & M cost per revenue-vehicle-mile, at year 2000 level, is $8.80.

9.2.3 Forecast of Revenue-Vehicle-Miles

Tables 9-8 to 9-12 present the operating framework and calculations necessary to estimate the revenue-vehicle-miles for each leg of the Trunkline and the two Circulator systems for year 2025 operation, based on the System Operating Plan presented in Section 8.

Specifically, Tables 9-8 to 9-10 provide forecasts of number of trains per line and per time periods, and calculates number of revenue-vehicle-miles for typical weekdays, Saturdays, and Sundays and major holidays, respectively. Table 9-11 summarizes the revenue-vehicle-miles for each type of day, while Table 9-12 summarizes the same information on an annual basis (for the year 2025) as well as for the entire system. For the Trunkline, total annual revenue-vehicle-miles for the year 2025 amount to about 3.16 million; for the two Circulator systems, this number is about 3.45 million for the same year.

9.2.4 Ultimate System O & M Cost Forecasts

The annual O&M Ultimate System cost for the year 2025 operation is forecast to be $50.90 million (year 2000 $), as shown in Table 9-13.

Trunkline O & M

Applying the adjusted average O & M cost per revenue-vehicle-mile for fully grade-separated heavy rail rapid transit systems of $6.50 to the 2025 annual revenue-vehicle-miles for the Trunkline (approximately 3.16 million), results in operating and maintenance costs of $20.55 million (year 2000 $).

Circulator O & M

Applying the adjusted average O & M cost per revenue-vehicle-mile for light rail transit systems of $8.80 to the total annual revenue-vehicle-miles for the two Circulators (about 3.45 million), results in a year 2025 O & M cost for the Circulators of $30.35 million (year 2000 $).

Marietta Branch O & M

The Marietta Branch O & M costs are presented separately, in Section 12. The average O & M cost per revenue-vehicle-mile for the Marietta Branch service is based upon composites of those estimated for the Trunkline and the Circulators.

Table 9-6
Operating Expenses Per Revenue-Vehicle-Mile – Grade Separated Heavy Rail Transit Systems for Representative U.S. Cities

Transit System	Annual Actual Revenue-Vehicle-Miles (1000)	Total Operating and Maintenance Expenses (1,000) – 1998	Total Operating Cost/ Revenue-Vehicle-Mile ($/Mile) – 1998	Total Operating Cost/ Revenue-Vehicle-Mile ($/Mile) – 2000	Labor Cost Adjustment Factor	Adjusted Operating Cost/ Revenue-Vehicle-Mile ($/Mile) – 2000
San Francisco – BART	55,270	$289,729	$5.24	$5.55	$0.60	$3.78
Washington Metro	44,788	$367,189	$8.20	$8.69	$0.88	$7.86
Miami-Dade Transit	6,072	$49,247	$8.11	$8.60	$1.10	$9.28
Atlanta – MARTA	22,177	$96,745	$4.36	$4.62	$1.00	$4.62
Baltimore – MTA	4,229	$33,813	$7.99	$8.47	$0.95	$8.13
Philadelphia – PATCO	3,954	$26,486	$6.70	$7.10	$0.65	$5.11
Philadelphia – SEPTA	14,440	$125,994	$8.73	$9.25	$0.65	$6.66
Average						**$6.50**

Assumptions:
1. Inflation rate between 1998 and 2000 at 6 percent
2. 80 percent of O & M costs are labor
3. Labor cost adjustment factor derived from the 2000 edition of Means Building Construction Cost Data

Source: Federal Transit Administration 1998 National Transit Database and Bechtel.

Table 9-7
Operating Expenses Per Revenue-Vehicle-Mile – Light Rail Transit Systems for Representative U.S. Cities

LRT System	Annual Actual Revenue-Vehicle-Miles (1000)	Total Operating and Maintenance Expenses (1000) – 1998	Total Operating Cost/ Revenue-Vehicle-Mile ($/Mile) – 1998	Total Operating Cost/ Revenue-Vehicle-Mile ($/Mile) – 2000	Labor Cost Adjustment Factor	Adjusted Operating Cost/ Revenue-Vehicle-Mile ($/Mile) – 2000
Los Angeles County MTA	4,532	$51,440	$11.35	$12.03	$0.76	$9.14
Sacramento – Regional Transp.	1,858	$14,806	$7.97	$8.45	$0.76	$6.42
San Diego Trolley	6,192	$26,494	$4.28	$4.54	$0.80	$3.63
San Jose VTA	2,079	$26,238	$12.62	$13.38	$0.76	$10.17
Denver – RTD	680	$8,018	$11.78	$12.49	$0.94	$11.89
Baltimore – MTA	2,404	$23,001	$9.57	$10.14	$0.95	$9.74
St. Louis – Bi-State Development Agency	2,574	$19,229	$7.47	$7.92	$0.74	$6.27
Portland – Tri-Met	1,711	$22,255	$13.01	$13.79	$0.75	$11.03
Dallas – DART	2,603	$27,699	$10.64	$11.28	$0.95	$10.83
Average						**$8.80**

Assumptions:
1. Inflation rate between 1998 and 2000 at 6 percent
2. 80 percent of O & M costs are labor

Source: Federal Transit Administration 1998 National Transit Database and Bechtel.

Table 9-8
Daily Revenue-Vehicle-Miles
Ultimate System – Weekdays, Year 2025

Route	Operating Subsystem/Line	Distance In Miles	5 – 6 am	6 – 7 am	7 – 9 am	9 am – 4 pm	4 – 6 pm	6 – 9 pm	9 pm – 1 am	Total Vehicle-Miles
			Number of trains per hour							
TL1	Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	24.5	2	4	7.5	4	7.5	3	2	5,439
TL2	Barrett Parkway Transfer Station to Arts Center Station, Midtown Atlanta	22.2	2	4	7.5	4	7.5	3	2	4,928
	Total Trunkline									**10,367**
A	Cumberland Central Loop	4.4	4	7.5	10	7.5	10	6	4	1,373
B	Cumberland Wildwood/Herodian Way Loop	7.7	4	7.5	10	7.5	10	6	4	2,402
C	Cumberland Galleria/Home Depot Loop	6.8	4	7.5	10	7.5	10	6	4	2,122
D	Town Center Main Loop	10.9	4	7.5	10	7.5	10	6	4	3,401
E	Town Center Kennesaw State University/Town Center Mall Line	4.0	4	7.5	10	7.5	10	6	4	1,248
	Total Circulators									**10,546**
	Total System									**20,913**

Note: 7.5 trains per hour (60 minutes/8 tph) represents a frequency of service of every 8 minutes, or 8 trains per 64 minutes

Table 9-9
Daily Revenue-Vehicle-Miles
Ultimate System – Saturdays, Year 2025

Route	Operating Subsystem/Line	Distance Miles	5 – 9 am	9 am – 9 pm	9 pm – 1 am	Total Vehicle-Miles
			Number of trains per hour			
TL1	Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	24.5	2	4	2	3,136
TL2	Barrett Parkway Transfer Station to Arts Center Station, Midtown Atlanta	22.2	2	4	2	2,842
	Total Trunkline					**5,978**
A	Cumberland Central Loop	4.4	4	7.5	4	1,074
B	Cumberland Wildwood/Herodian Way Loop	7.7	4	7.5	4	1,879
C	Cumberland Galleria/Home Depot Loop	6.8	4	7.5	4	1,660
D	Town Center Main Loop	10.9	4	7.5	4	2,660
E	Town Center KSU/ Town Center Mall Line	4.0	4	7.5	4	976
	Total Circulators					**8,249**
	Total System					**14,227**

Note: 7.5 trains per hour (60 minutes/8 tph) represents a frequency of service of every 8 minutes, or 8 trains per 64 minutes

Table 9-10
Daily Revenue-Vehicle-Miles
Ultimate System – Sundays and Major Holidays, Year 2025

Route	Operating Subsystem/Line	Distance Miles	7 – 9 am	9 am – 9 pm	9 pm – midnight	Total Vehicle-Miles
			Number of trains per hour			
TL1	Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	24.5	2	3	2	2,254
TL2	Barrett Parkway Transfer Station to Arts Center Station, Midtown Atlanta	22.2	2	3	2	2,042
	Total Trunkline					**4,296**
A	Cumberland Central Loop	4.4	4	6	4	810
B	Cumberland Wildwood/ Herodian Way Loop	7.7	4	6	4	1,417
C	Cumberland Galleria/ Home Depot Loop	6.8	4	6	4	1,251
D	Town Center Main Loop	10.9	4	6	4	2,006
E	Town Center KSU/Town Center Mall Line	4.0	4	6	4	736
	Total Circulators					**6,220**
	Total					**10,516**

Note: 7.5 trains per hour (60 minutes/8 tph) represents a frequency of service of every 8 minutes, or 8 trains per 64 minutes

Table 9-11
Daily Revenue-Vehicle-Miles by Type of Day
Ultimate System, Year 2025

Operating Subsystem/Line	Weekday Vehicle-Miles	Saturday Vehicle-Miles	Sunday/Holiday Vehicle-Miles
Total Trunkline	10,367	5,978	4,296
Total Circulators	10,546	8,249	6,220
Grand Totals for System	**20,913**	**14,227**	**10,516**

Table 9-12
Annual Revenue-Vehicle-Miles by Type of Day
Ultimate System, Year 2025

Operating Subsystem/Line	Weekday Vehicle-Miles	Saturday Vehicle-Miles	Sunday/Holiday Vehicle-Miles	Total Vehicle-Miles
Total Trunkline	2,571,016	310,856	279,240	3,161,112
Total Circulators	2,615,408	428,948	404,300	3,448,656
Grand Totals for System	**5,186,424**	**739,804**	**683,540**	**6,609,768**

Notes: 248 weekdays per annum
52 Saturdays per annum
65 Sundays and major holidays per annum

Table 9-13
Annual O & M Cost for the Ultimate System, Year 2025

Operating Subsystem/Line	O & M Cost/ Revenue-Vehicle-Mile	Transit System Revenue-Vehicle-Miles	Annual O & M Cost (Year 2000 $Millions)
Total Trunkline	$6.50	3,161,112	20.55
Total Circulators	$8.80	3,448,656	30.35
Grand Totals for the Ultimate System		**6,609,768**	**$50.90**

This section presents the economic, financial, and environmental assessment of implementing the Northwest Corridor Light Rail Transit System. As explained within Subsection 1.1.3, Study Constraints, given the jurisdictional limitations of the *Transit Implementation Study* sponsors, the Cumberland and Town Center Area CIDs, much of the Bechtel/MSE Team's scope of work was necessarily constrained to the geographic boundaries of the two CIDs and the Cobb Parkway corridor that connects them. Therefore, the economic, financial, and environmental assessment data presented within this section of the Final Report is limited to the geographic boundaries of Cobb County.

10.1 ECONOMIC ASSESSMENT

Cobb County has a strong, diversified economy with a current total estimated employment of approximately 290,000. Both large companies and successful small businesses drive the County's economy. Major national firms are represented in the County, as are a growing number of international businesses.

The County experienced diversified growth in employment during the 1980s, which continued through the 1990s. Employment within the County has grown by over 135 percent since 1980. Services, retail, and wholesale trade substantially increased their share of employment during this period, while reliance on manufacturing decreased. As of 1998, no individual sector accounted for more than 26 percent of the County's total employment. This diversity has helped keep the rate of unemployment in the County consistently below the regional and national averages. The 1999 unemployment rate in the County was 2.6 percent, compared to the Atlanta Region's rate of 3.1 percent, and the national rate of 4 percent. For the period between 1980 and 1999, the average unemployment rate for the County was 4 percent, while the Region's was 4.9 percent, and the nation's was 6.5 percent. The County is recognized nationally for its pro-business environment, a product of careful planning, cooperation with other governments, and progressive leadership.

All of Cobb County's economic indicators are very high. Compound Annual Growth Rates (CAGR) for the period 1990 to 1999 for a number of key indicators are shown in Table 10-1.

Of all Georgia counties, Cobb County ranked first (highest) in 1998 auto registration, second in 1997 adjusted gross income (only Fulton County was higher), and second in 1998 net property and utility digest (second again to Fulton). The Georgia Department of Revenue's Master Economic Index for 1999 ranks Cobb second overall (again behind only Fulton).

By any measure, Cobb County has outstanding economic vital signs commensurate with undertaking a major transit development such as the Northwest Corridor LRT System. This healthy economic outlook materially enhances the prospects for successfully funding the proposed project.

Table 10-1
Compound Annual Growth Rates (CAGR)
Period 1990 – 1999

	1990 – 1999 CAGR
Population	2.7%
Per Capita Income	4.0%
Median Household Effective Buying Income	3.8%
Single Family Residences	
Permits	7.5%
Value	8.8%
Commercial, Industrial	
Permits	4.4%
Value	8.4%
Financial Institutions Deposits	3.9%

The introduction of the Northwest Corridor LRT System is expected to result in significant economic benefits to the County in general and to the Cumberland and Town Center Area CIDs, in particular. Following is a qualitative listing of such impacts:

- Potential increase in retail sales especially along the rail transit routes and around stations.
- Reduction in automobile congestion levels, especially during peak periods, resulting in potential time savings to system users.
- Reduction in automobile accidents, due to reduced vehicular congestion as well as reduced vehicle-pedestrian conflict.
- Reduction in vehicle-miles of travel and positive impacts on auto emission levels.
- Increase in land values, especially around transit stations.
- National (and potentially international) recognition of the CIDs and positive impacts on tourism in the area.
- Promoting the development of additional commercial establishments, office buildings, housing, and educational facilities, due to improved accessibility as well as expedient transit connection to Atlanta's Midtown and the Metropolitan Atlanta Rapid Transit Authority (MARTA) rail transit system.
- Fast and reliable connections between various facilities and activity centers throughout the CIDs.
- Use of the system for promotional advertising.
- Increase in the tax base of the County and of the CIDs.
- Improved connections of Kennesaw State University and Southern Polytechnic State University with various establishments in the CIDs as well as in Atlanta.

Many of these impacts, particularly those related to transportation impacts, have been quantified and are presented later in this section, as well as in Section 4 of this report.

The development of the transit system will have a significant impact on the land use and employment growth patterns in the Region, the County, and within the CIDs. The presence of the system will make the County even more attractive to businesses that are considering locating in the Atlanta Region, will permit more dense development and redevelopment in the areas around transit stations, and will allow the transit corridor to become a focus for future growth, thereby allowing less dense development in other areas of the County.

As detailed in Section 2 of this Study, the CID areas will continue to experience tremendous employment growth. Projected from our land use inventory, the future development levels in the areas around each of the Circulator stations will be very high (based on the existing master plans of developers and the future land use plan for the County). It is likely that the development around the stations will include more mixed-use and residential than currently reflected in the land use inventory; however, the inventory provides a strong indicator for the development potential of the areas.

10.2 FINANCIAL ASSESSMENT

This section represents a preliminary assessment of the outlook for financing the proposed Northwest Corridor LRT System. The intent is to indicate the magnitude of the funding effort required.

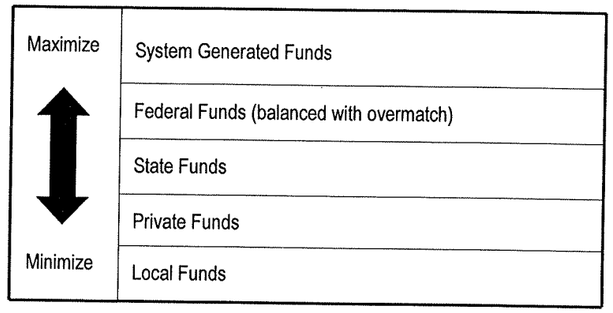
Accordingly, this section discusses the requirements for developing a financial plan, the financial options available to meet capital and operating requirements, and success factors for obtaining FTA funding.

A financial plan for the system is not presented herein, as it would be premature at the present time; therefore, nothing in this section is intended to recommend any specific funding sources at this point.

10.2.1 Financial Principles

As the project evolves toward the development of a formal financial plan, it will be useful for the Northwest Corridor LRT System to subscribe to identified financial principles as a way of defining issues and guiding future development of financial strategies.
The following are offered as a starting point for that discussion:

- Lowest possible capital and operating costs consistent with a contemporary facility meeting the transportation needs of the corridor until at least 2025.
- Earliest practical deployment and project completion.
- Funding strategy to be acceptable to the public, CID members, developers, and retail trade establishments.
- Funding priorities to be as follows:
  - Financial plans should both maximize likelihood of award of federal funds (through overmatch, and demonstrated strength of capital and operating plans) while at the same time developing a financially sound, viable plan from the standpoint of Cobb and Fulton Counties and the sponsoring and operating agencies. While these two perspectives are not necessarily incompatible, neither are they automatically complementary.
  - The project should demonstrate a high return on investment in terms of transportation benefits and contribution to regional planning objectives.



10.2.2 Financial Plan Requirements

Generally, a project of this type faces two types of external financial planning hurdles:

- It is unlikely that a project of this scale can be constructed without significant Federal financial assistance. Securing this Federal funding requires that specified financial planning requirements be met.
- It is likely that substantial funds will have to be borrowed from some source. Although some borrowing may come from public sources – the Georgia Regional Transportation Authority (GRTA), the State, or Federal sources – it remains probable that additional borrowing will be necessary from the municipal bond market for tax-exempt bonds or possibly from the commercial bond market at taxable rates for any vendor or turnkey manager financing. Therefore, bond market requirements need to be taken into account.

Overcoming both hurdles depends on the essential soundness of the financial scheme.

10.2.2.1 FTA Financial Plan Requirements[1]

Sound financial planning helps to ensure the financial health of transit agencies and the quality of service that they are able to provide. A continually updated financial plan is the centerpiece of sound capital investment planning for any transit agency. The financial plan documents the recent financial history of the transit agency, describes its current financial health, documents projected costs and revenues, and demonstrates the reasonableness of key assumptions underlying these projections.

Section 3(a)(2)(a) of the Federal Transit Act states that "No grant or loan shall be provided under this section unless the Secretary determines that the applicant has or will have the legal, financial, and technical capacity to carry out the proposed project." Consequently, the Federal Transit Administration (FTA) has specific responsibilities to promote careful financial planning by state and local transportation agencies that receive FTA funds.

Sound financial planning and the FTA requirements share two key principals. First, the general content of the financial plan should remain the same throughout the planning and project development process. The financial health of an organization and the financial feasibility of specific projects are established by comparable information on costs, revenues, funding sources, and financing mechanisms. Second, the details of the financial information will change as projects advance through planning and development. Project cost estimates become more reliable as the project scope is defined in detail and funding strategies become more certain as funds are committed to the proposed project.

The FTA framework is geared to describe the overall financial condition of a transit agency, include realistic financial projections, and incorporate the increasingly detailed financial information available to projects in later stages of development.

FTA's assessment of financial plans requires consistent and comparable financial plans from project sponsors. To help project sponsors provide a complete and well-organized financial submission, FTA requires project sponsors to produce financial submissions that adhere to the outline below. The documentation provided by project sponsors to support their financial plans should be developed as part of the planning and project development process (systems planning, alternatives analysis, preliminary engineering, Environmental Impact Statement, final design, and construction).

[1] "Federal Transit Administration, *Draft Technical Guidance on Section 5309 New Starts Criteria,* July 2000, and; Federal Transit Administration, *Major Capital Investment Projects; Final Rule,*49 CFR Part 611, *Federal Register,* December 7, 2000, pp. 76864ff."

FTA Financial Plan Outline
1) Introduction a) Description of Project Sponsor and Funding Partners b) Description of the Project c) Summary of the Financial Plan
2) Capital Plan a) Proposed Project Capital Plan b) Agency-Wide Capital Plan
3) Operating Plan a) Operating Revenues b) Operating and Maintenance Costs c) Agency-Wide Operating Plan
4) Cash Flow Analysis a) Twenty-Year Cash Flow Projection b) Financial Evaluation
5) Appendix (Reference Supporting Documentation) A. Summary of Regional Economic Forecasts B. Summary of Financial Condition of Project Sponsor C. Summary of Bus and Rail Fleet Management Plans

A brief discussion of FTA Financial Plan elements follows.

1) Introduction. The financial plan begins with a description of the project sponsor (GRTA) and major funding partners. It discusses the project sponsor's and partners capability to fund the construction and operation of the proposed project. The introduction then describes the proposed project, explains the purpose and need for the project and how this project fulfills the project sponsor's objectives. The introduction then describes the strategy to provide the local share of project funding. It concludes with a summary of the projected financial position of the project sponsor and the ability of the sponsor to fund planned capital improvements and continue to operate and maintain the existing transit system.

2) Capital Plan. The first component of the financial plan is the capital plan, which documents the sponsor's capital spending plans and funding sources, and describes in detail the strategy to fund the construction of the proposed project. The capital plan is composed of two elements: the capital plan for the proposed project and the sponsor's 20-year capital plan. The project sponsor first develops the capital plan for the project, then inserts the project into the sponsor-wide capital plan. The capital plan documentation confirms the stability, reliability, and availability of all capital funding sources and describes the sponsor's capital spending plans 20 years into the future.

3) Operating Plan. The project sponsor supplies an operating plan to document how it intends to fund and operate the proposed project. The operating plan presents 20 years of projected system operating revenues and O&M costs to demonstrate the capability of the sponsor to operate and maintain the proposed project.

Projections of operating costs, ridership, and fares for the proposed project are often estimated as part of the Alternatives Analysis effort and refined in the DEIS/FEIS. The values reported for ridership and service levels will be consistent with the forecasts documented in the MPO's constrained long-range plan.

4) Cash Flow Analysis. The overall objective of project sponsor financial plans is to demonstrate that the entity has the financial resources to successfully construct the proposed project while adequately operating, maintaining, and recapitalizing the planned transit system. The cash flow statement combines the results of the capital plan and the operating plan to summarize the year-by-year financial condition of the project sponsor throughout the 20-year analysis period.

Cash flow analysis is a valuable tool for project planning. Its application permits project sponsors to develop and test funding strategies, test alternative assumptions, and conduct risk analysis as part of the sponsor's continuing financial planning activities.

The cash flow projection can be structured in several possible formats. The cash flow statements are structured in a way that reflects the sponsor's restrictions on operating and capital funds. Many sponsors have restrictions on the use of cash balances such as debt retirement, contractual obligations, lease deposits, uninsured losses or reserve accounts for specific projects. If a sponsor is subject to any of these restrictions, balances in these restricted accounts are identified in the cash flow statement and not included as "available" cash.

5) Appendix. Many components of the financial plan require additional documentation to support the assumptions and forecasts in the plan. The financial plan summarizes, in an appendix, the results of the critical external analyses that directly support the financial plan. The critical analyses include the regional economic forecasts, the financial condition of the sponsor, and the fleet management plans.

The following documents should be available in support of the financial plan:

- Past three years' audited financial statements
- Commitment letters, contracts, agreements, legislative referendums, joint development agreements, or other documents evidencing commitment of funds
- Latest bonding prospectus
- Rail vehicle and bus fleet management plans
- Regional economic forecast documentation
- Description of innovative financing techniques (e.g., innovative funding sources or financing techniques to be used to support the project or to be implemented as part of a larger system-wide program)
- Correspondence or other documentation indicating local source's "intent to commit" if no formal commitment or programming of local funding is yet in place
- Regional Long Range Transportation Plan (RTP)
- Regional Transportation Improvement Program (TIP)
- Major Investment Study (MIS) or Alternatives Analysis (AA) and Environmental Impact Statement (DEIS or FEIS)
- Project finance plans or project management plans for each major project
- Latest Project Management Oversight Contractor (PMOC) monthly or spot report
- Most recent strategic plan or budget
- While generally consistent with the foregoing, FTA's requirements for New Start funding contain additional requirements relating to the proportion of proposed New Start funding relative to other funding and provides sample reporting templates to ensure consistency of reporting from one applicant to the next. It is not expected that adoption of the final regulation on Major Investment Projects by FTA on December 7, 2000 will materially change the financial planning requirements as contained in the earlier draft guidance (which remains pending adoption) because most issues were in other areas.

10.2.2.2 *Capital Market Considerations – Risk Assessment and Credit Factors*[2]

From the perspective of the capital markets, project risk takes on different characteristics during three main phases of activity: project development and pre-construction, construction, and operation. These activity phases are briefly described below, followed by a discussion of information required to analyze credit risk.

Development/Pre-Construction Risks

Inherent in the development/pre-construction period is a varied group of risks with probabilities that are quite difficult to estimate. These risks can significantly alter the timeline for a project. Typical pre-construction risks include acquiring the right-of-way or obtaining access to public property; securing state, local, and federal permits (environmental and construction); achieving requisite institutional coordination; and obtaining significant support from the various stakeholder groups or communities affected by the project. If stakeholder support is not forthcoming, the project is unlikely to proceed; costs invested up to that point are usually not recoverable.

For transit projects, perhaps the biggest unknowns during development are environmental approvals (including legal and regulatory changes) and right-of-way acquisition. These two factors can delay the scheduled start and completion of the project and have the potential to cause significant cost overruns and impede the project's ability to procure financing.

Construction Risks

The construction period brings different risks, including the question of whether the project will be completed on schedule and at the indicated cost. The risk of completion delays and other cost overruns influences the financial structure of the project because financing is much more accessible after completion of construction. The construction team's experience on similar projects and ability to meet financial obligations is critical to executing the contract and delivering a project as guaranteed.

The contract format is important in dealing with and assigning risk, particularly since the projects tend to use a turnkey development approach, such as design-build or build-operate-transfer. If franchise or license agreements are involved, the degree of market exclusivity is important. When the contractor, through a design-build or design-build-operate contract structure, shoulders construction risk, risks borne by the debtor are minimized, thus support a better credit rating.

Various contractual arrangements among the parties involved have been developed to deal with the substantial risks posed by the construction phase. One usual way to mitigate construction risk is through a fixed-price fixed-completion date construction contract, including carefully drawn provisions related to change orders and completion delays. In addition, even with a fixed-price or not-to-exceed contract, the availability of contingency funds to cover cost overruns, project delays, or other risks, adds protection for the lenders and benefits the overall credit rating of the project.

Operational Risks

The ability of a project to service its debt depends on the uninterrupted, cost-effective operation of the facility or mechanism for delivering the product or service, and, therefore, the revenue stream. The operational phase includes risks related to traffic forecasts, revenue projections, and operating costs. Provisions for routine maintenance and major maintenance or overhaul of the facilities are an important part of the operational phase. Credit analysts examine who is responsible for operations, terms of operation and maintenance contracts, and the experience of the operator with similar facilities.

Operations and maintenance of facilities involving advanced technologies is a particular concern. Lenders and rating agencies need assurance that new systems will be properly maintained and operated whether by the public sector, private sector, or both.

Information Requirements to Support an Investment-Grade Rating

Bond rating agencies become involved during a project's development phase or once the project is fully developed and ready to go to market. By getting involved early, rating agencies can better evaluate the project's supporting data and agreements as they evolve. This involvement provides an opportunity to review the project's credit strengths and weaknesses and to inform project sponsors about what steps or changes would be beneficial to improve the credit quality of the project before formally soliciting the rating on the debt issue. With a preliminary review, rating agencies may be asked to provide a preliminary opinion on the rating that the project might receive either as currently structured or assuming the project incorporates the rating agency's advice on how to strengthen the credit.

Nationally recognized rating agencies typically require extensive information for their assessment of the credit quality of a project. This information falls into four categories:

- Contractual documents for the construction and operation of the project (including all environmental and construction permits needed)
- Financing documents (e.g., trust indenture, bond insurance, or letters of credit)
- Regional and local economic trends and data pertinent to the project, such as employment levels, economic diversity, income levels, and assessment of the public support (general and local/state levels)
- Independent reports and analyses that support the project economics such as traffic and revenue forecasts and an independent engineer's feasibility report

The availability of all the information required enables the analysts to conduct a thorough review and assign an appropriate credit rating. To the extent that key information is not available, analysts may not be able to assign a rating or may assign a conditional rating subject to the project meeting certain thresholds. It is not unusual for the rating agencies to undertake an initial review of a project and assign a preliminary rating opinion letter at the request of the project sponsors. The preliminary rating is often requested to assist a project sponsor in identifying what further steps must be taken or what revisions in the various contractual elements are required to secure an investment-grade rating (i.e., BBB or higher).

10.2.3 Funding and Financing Options

Discussion of specific funding options is tentative at this early stage in the evolution of the project, while engineering options are still fluid. No useful purpose would be served by precipitating a debate over any requirements for new taxes or fees until sufficient information is available to properly weigh the benefits in conjunction with the costs. Further, the current atmosphere in Atlanta remains sensitive, following the recent debates pursuant to adoption of the ARC 2025 Plan and lifting of Federal clean air sanctions. Certainly, it is not appropriate at this time to commence debating the relative merits of this project versus others in competition for limited funding.

[2] Federal Transit Administration, *Major Capital Investment Projects; Final Rule,* 49 CFR Part 611, *Federal Register,* December 7, 2000, pp. 76864ff."

It is important that dialogue concerning how the project is to be paid for begin to move forward. This is a complex subject that will take time for the project leadership to digest and understand. If there is to be a subsequent buy-in by community, developer, and retail stakeholders, they also must begin to digest information providing at least a sense of the scale of the financial undertaking involved.

10.2.3.1 Funding Options[3]

A fairly exhaustive analysis of funding and financing options available in the U.S. has been undertaken and is presented in some detail in Appendix 5 of this Final Report. The appendix presents a menu of summary descriptions concerning the financial mechanisms theoretically available to support the Northwest Corridor LRT System. Many of these could be applied to either capital construction or operating subsidies. However, some of the federal grant programs apply generally only to capital programs. In this regard, eligible expenses include things like preventative maintenance and lease payments, so that some "operating" expenses can be made eligible for "capital" funding.

Table 10-2 presents a summary listing of funding options. It is organized into four categories of funds: System-Generated, Federal, State, and Local. Under System-Generated and Local funds, a distinction is made between Public funds and Private funds.

A useful distinction in these funding sources is between "funding" (primary streams of revenues for direct application to expense or to support various leveraging schemes) and "financing" (which manipulate primary revenue streams in a way to make funds available when needed or to reduce the costs of borrowing). For example, in the case of 30-year bonds issued against revenues from a tax dedicated to transit use, the revenue stream from the tax pledged as security for the bonds would be the "funding" and the bond proceeds, which concentrate the 30-year tax revenues into (say) four years to meet construction expense, would be the "financing."

While this distinction is not always clear-cut, it is useful to keep in mind. Many of the current so-called "innovative financing" techniques—while valuable in their own right, require underlying revenue streams to support them. The first and most difficult task facing a new transit undertaking is to establish a solid *funding* base.

A discussion of key options follows.

Table 10-2
Summary of Funding Options

= Most significant sources of new funding that do not require some underlying revenue stream (and are thus considered financing).

	System-Generated	Federal	State	Local
Public	▪ Fares ▪ Transit entity imposed taxes – Sales tax – Gas tax – Rental vehicle tax ▪ Excess of State subsidy for capital ▪ Fare surcharge for capital ▪ Transit entity bonds ▪ COPs & Pickle lease-based bonds ▪ Air rights ▪ Leasing ROW ▪ Station concessions ▪ Parking strategies ▪ Advertising ▪ Interest income ▪ Other System-Generated Revenue	▪ New Starts funding (§5309) ▪ Urban Formula (§5307) ▪ Flexible Funds (Highway/ CMAQ) (could be GARVEE enhanced) ▪ Earmarked Project ▪ Pay lease with federal funds ▪ Capital cost of contracting (contract operator's costs becomes capital cost) ▪ Flexible federal match – Credit for donated ROW – Toll credit – Credit for acquired lands – Delayed federal match – Program level match ▪ Multiple use facility funds ▪ Metropolitan Planning ▪ Minor federal funding program ▪ TIFIA ▪ Pledge future apportionments to pay off bonds (GARVEE) ▪ Advance construction	▪ GRTA Funding ▪ Grants (bond-based or GRF) ▪ Ongoing program and funding entitlements ▪ Central equipment agency ▪ State infrastructure banks ▪ State revolving loan fund ▪ Reimbursable loans	▪ Dedicated City/ County Revenues – Dedicated tax – Continuing GRF commitment ▪ Tax increment financing (can be TIFIA enhanced) ▪ Local community partnerships ▪ Negotiated investment (public agencies) ▪ Transit station construction by local governments ▪ Land banking ▪ Development of transit villages
Private	▪ Contractor concessions in consideration for PM/CM award – Fee deferral – Equity contribution – Credit Enhancements – Arrange short-term financing ▪ Cross border lease ▪ Lease w/ Maintenance (maintenance becomes capital cost) ▪ Cost Reduction – Vendor price discounts in return for proprietary equipment, long-term maintenance contract, etc. – Turnkey financing – Super Turnkey financing – Commodity swaps – Incentive, penalty contracts – Progress payments			▪ Benefit assessment districts ▪ Public-Private partnerships – Asset sales/privatization – Contracting for services – Construction/operating arrangements ▪ Joint development (especially TIFIA or GRTA enhanced) ▪ Value capture strategies ▪ 63-20Corporations ▪ Real Estate Related Strategies – Density bonus – Developer extractions – Development rights – Impact fees – Incentive zoning – Transfer of development rights – Access agreements ▪ Advertising rights ▪ Cost sharing ▪ Real estate oriented revenues ▪ Assessments and fees ▪ Negotiated investment (private agencies) ▪ Private donations ▪ Merchant subsidies ▪ Transit station construction by private entities

[3] See Appendix 5 – Funding and Financing Options.

System-Generated

System-generated funding is internal to the system. The most significant sources are as follows.

Fares

Transit fares are typically used in the US to offset only operating expenses and then, only a portion of these expenses. The percentage of operating expense recovered from fare proceeds is generally referred to as the "recovery ratio." In some cases, this percentage is fixed, either by enabling legislation or governing board policy, in the effort to require periodic fare increases designed to keep pace with expense inflation or to force cost cutting. In other cases, it is treated as a floating indicator, reflecting the results of other elements of a transit entity's fare policy. It is to be expected that the recovery ratio will increase somewhat over the first 5 to 10 years of operating a new system, as ridership ramps up to steady state.

Typically, the maximum fare charged for a linked trip (inclusive of all transfers) will be constrained by fares charged on other transit systems. In the case of the Northwest Corridor LRT System, for example, fares for the proposed transit system will be compared with the MARTA fare (currently $1.75). In addition, fare revenues are affected by things such as:

- Structure of the fare (e.g., flat fare versus distance-based fare, which charges more for a further distance traveled, or different fares for peak and off-peak rides).
- Amount of fare avoidance tolerated. Depending on ticketing, transfer, and enforcement policy, some transit properties lose as much as 10 percent of potential fare revenue through avoidance.
- Transfer policy. The way transfers from one system element to another (e.g., MARTA to Trunkline, Trunkline to Circulator, Trunkline/Circulator to local bus) are handled and enforced has a significant impact on fare revenues.
- Number and amounts of discounted fares. Typically, students, elderly, transit employees, law enforcement personnel, and possibly others are given reduced fare tickets. In some instances, the transit entity is reimbursed for the costs of such discounts mandated by some other jurisdiction, e.g., student and elderly discounts mandated by state law.

  In addition, the price of multiple ride tickets is discounted to encourage ridership, e.g., weekly, 10-ride, monthly passes, etc.

Transit Entity-Imposed Taxes

Many transit entities have taxes and other revenue streams dedicated to transit use. Some have bonding authority based on these revenue streams. In the large transit properties of the US, 86 percent of such dedicated revenues for capital programs comes from sales taxes. Little comes from property or motor vehicle related levies (some used tax on rental vehicles). The balance comes from miscellaneous sources.

Contractor Fee Concessions in Consideration for PM/CM Award

It is not unusual for candidates for project management (PM) and/or construction management (CM) contracts to offer various financial incentives to their selection. The most common are the following:

- **Fee Deferral.** The contractor offers to defer its fee (but not usually direct expense) during initial stages of the project, to advance project mobilization and reduce the sponsor's financial requirements until federal and non-federal grants and other funding is in place. In some instances, this deferral is offset by "success fees" at attainment of certain milestones or by some "sweat equity" position in private development of project assets.
- **Credit Enhancements.** The contractor may offer to purchase credit enhancements to assist the project sponsor in borrowing bridge funds necessary to advance the project until longer-term funding is in place or revenue streams from developments begin to produce.
- **Arrange Short-Term-Financing.** The contractor may completely arrange short-term financing required to advance the project until longer-term funding and financing is on line.
- **Equity Contribution.** In some rare instances, the contractor may enter into a public-private partnership with the sponsor and contribute equity funding to the undertaking.

Federal

Key federal funding mechanisms are discussed below.

New Starts

Up to 80 percent of capital costs of fixed guideway projects such as the proposed Northwest Corridor LRT System are eligible for New Starts funding. FTA awards limited amounts of Federal funds competitively. Maximum overmatch (increased non-federal share so as to reduce federal portion below 80 percent) is one FTA selection criteria. Generally, these funds are not available for operating expenses unless they have been capitalized, e.g., preventative maintenance or lease payments.

Urban Formula

In addition, FTA funds are available under a complex formula to states and regions and can be used for up to 80 percent of project capital costs. Such funds can be used to support Alternatives Analysis. Generally, these funds are not available for operating expenses unless they have been capitalized, e.g., preventative maintenance, lease payments, or capital cost of contracting.

Flexible Funds

A variety of highway funds and air quality funds can be reprogrammed to transit projects.

Flexible funding categories are those programs authorized under the Federal-aid highway program that are permitted to be used for either transit or highway projects. The funds may be used for any non-operating purpose eligible under the FTA Urbanized Area Formula Program (49 U.S.C. Section 5307), the Elderly and Persons with Disabilities Program (49 U.S.C. Section 5310) and the Nonurbanized Area Formula Program (49 U.S.C. Section 5311) (including preventive maintenance). Flexible fund programs include the Surface Transportation Program (STP), Donor State Bonus, Interstate Maintenance, Bridge Replacement and Rehabilitation, National Highway System, Substitute Highway, and the Congestion Mitigation and Air Quality Improvement (CMAQ) programs. Although these FHWA programs have intermodal flexibility, it is important to note that there are both programmatic and distributive limitations on the use of at least some portions of some programs. (As examples, 10 percent of Surface Transportation Program (STP) funds are set aside for safety projects, and there are funds in some programs available only to rural, and only to urbanized areas.)

The provisions of Title 23, U.S.Code, regarding the non-federal share apply to Title 23 funds used for transit projects. Thus, flexible funds transferred to FTA require the same non-federal matching share that such funds would have had if used for highway purposes and administered by the FHWA.

CMAQ funds are available for operating assistance at the 80 percent Federal share, but such availability is limited to the introduction of new transit services and for up to a 3-year period only.

Decisions concerning the eligibility of projects for flexible funding will be made at the regional or MPO level. In this regard, the current ARC Regional Plan assumes operating subsidies for the first 3 years of the Northwest Corridor LRT System will be met jointly by CMAQ funds and flexible funds for preventative maintenance. Thereafter, 25 percent of those costs (for preventive maintenance) will be paid

from flexed highway funds. Further, it is assumed that 80 percent of the capital costs for this project will be met by using funds flexed from highways at 80 percent federal, 20 percent non-federal matching ratio. Because these funds flow into the Atlanta Region on a formula rather than a discretionary basis, overmatch is not a consideration.

Earmarked Projects
It is possible for substantial project funding to be earmarked by Congress, independent of the FTA process. In recent years, the use of this approach for large projects has decreased somewhat in favor of smaller awards for study, the initial phases of projects, or larger awards embedded in the FTA process, e.g., New Starts. There is always a concentration of this sort of funding activity in connection with the political log-rolling that accompanies periodic re-authorization of the highway and transit legislation every five years, e.g., TEA-21. Because this re-authorization will occur prior to the start of construction on the Northwest Corridor LRT System, this option should be kept in mind as a possibility.

Credit for Donated Right-of-Way
Under certain conditions, the fair market value of land donated for project right-of-way can be treated as a "soft-match" against federal funds. Typically, the value of such donated funds is added to the "hard" project costs, the federal/non-federal share calculated, and then the donated value subtracted from the non-federal share. Tax considerations may apply to the company donating the land.

It is possible for an "80 percent" federal project to have significantly less than 20 percent non-federal cash. For example, the St. Louis Light Rail Project was constructed with no out-of-pocket local funding, due to donation of the EADS Bridge across the Mississippi River for the rail crossing.

State

Important state funding mechanisms include the following.

Georgia Regional Transportation Authority
Although limited to regional application to date, the Georgia Regional Transportation Authority (GRTA) is considered to be, and views itself as, a State agency.

Largely untested as yet, the GRTA has broad powers to:

- Issue revenue bonds and other notes and financial instruments on its own or through Georgia Environmental Facilities Authority (GEFA).
- Issue bonds secured by a pool of obligations issued by local governments when proceeds of the local government obligations are applied to projects of GRTA.
- Issue guaranteed revenue bonds, backed by an appropriated debt service reserve set aside at the state level. Such bonds would be repaid by project revenue streams in the first instance.
- Generate revenue streams from special taxing districts activated by the legislation creating GRTA. However, the mechanism for activating this key funding source remains unclear at the present time.

Proceeds from the above can be used for loans, grants, or extension of credit in support of projects and leases.

Grants
State Government funding, for both operating and capital, is typically derived from General Revenue Fund (GRF) (pay-as-you-go or bonded) or dedicated Transportation/Transit Funds. It can be single grants or a continuing program. Use of some motor-vehicle-related funds blended with other state funds is fairly common, e.g., motor vehicle excise tax, sales tax on motor fuel, or state sales tax. Lottery was sometimes used in the past. State Infrastructure Banks can loan revolving funds and guarantee/enhance transit project borrowings.

On-Going Program and Funding Entitlements
Many states have on-going transit subsidy programs. These can be funding entitlements (as in the case of Chicago, where 3/32 of the State Sales Tax collected in the Regional Transit Authority's area is distributed by formula among agencies). Or, the programs can be topical, most commonly to "reimburse" the transit property for things like reduced fares for students, elderly, or the disabled.

Local

Key local funding options are as follows.

Dedicated City/County Revenues
It is relatively common for local governmental entities (primarily cities and counties) with general taxing authority to either earmark specific tax revenues for transit purposes or to make a continuing appropriation of funds for such purposes. Sales tax is commonly used for this purpose.

For purposes of borrowing against such revenue streams, it is important that the funds be dedicated to project purposes in such a way as to avoid an appropriations risk, which could periodically interfere with debt service repayment during each budget cycle.

Tax Increment Financing
This is the issuance of bonds that are paid off with the higher property taxes that result from the appreciation of real estate near the project and its stations. Tax Increment Financing (TIF) is used as a joint development or value capture technique, and is also called a TIF district.

Benefit Assessment Districts (including CIDs)
Within a geographic area, an assessment is levied on the properties, and the resulting revenues are earmarked for a specific use. Frequently, the district is drawn around a transit station or segment of a transit system. The tax is justified on grounds that real estate near a transit station and/or transit system segment will appreciate in value and so the system is entitled to this tax appreciation. Benefit Assessment Districts are used as a value-capture technique, and are also called Special Assessment Districts or Transportation Development Districts. The current Cumberland and Town Center Area CIDs are examples of this approach.

Public-Private Partnerships
Public-private partnerships (PPPs) are arrangements between government and private sector entities for the purpose of providing public infrastructure, community facilities, and related services including transit. Such partnerships are characterized by sharing of investment, risk, responsibility, and reward among the partners. The reasons for such partnerships vary but generally involve the financing, design, construction, operation, and maintenance of such facilities and services.

The underlying logic for establishing partnerships is that both the public and the private sector have unique characteristics that provide them with advantages in specific aspects of service or project delivery. The most successful partnership arrangements draw on the strengths of both the public and private sector to establish complementary relationships.

The roles and responsibilities of the partners vary from project to project. For example, in some projects, the private partner will have significant involvement in all aspects of service delivery, in others, only a minor role.

While the roles and responsibilities of the private and public partners may differ on individual servicing initiatives, the overall role and responsibilities of government do not change. Public-private partnership is one of a number of ways of delivering public infrastructure and related services. It is not a substitute for strong and effective governance and decision-making by government. In all cases, government remains responsible and accountable for delivering services and projects in a manner that protects and furthers the public interest.

Only one form of public-private partnership, known as Build-Own-Operate (BOO) can be described as coming close to privatization. All other forms require an ongoing partnership between the private and public sectors. Even Build-Own-Operate projects involve a form of partnership in that the public sector can place conditions and regulations on the private partner. One of the key reasons for considering public-private partnerships is the ability to introduce competition in the provisions of local government services, either between private firms or between the private and public sectors. Full privatization merely transforms a public monopoly to a private monopoly such that the benefits of public-private partnerships are not realized.

The principle reasons for local government becoming involved in public-private partnerships are to benefit from increased efficiency, shorter implementation time, greater innovation, and ultimately better value in the delivery of services brought about by increased competition. The ability to finance a project so that debt is "off book" should not be the prime motivation for entering into a public-private partnership in that local government and the ultimate users of service are still responsible for servicing the debt in one way or another. The emphasis should be on structuring creative and cost-effective ways of delivering services, not on creative accounting.

Joint Development

Joint development is an effort by a public agency and a private developer to undertake a construction project. Joint developments are usually a voluntary joining of governmental entities with private for-profit organizations to undertake mutually beneficial development in connection with public infrastructure. A joint development agreement generally contains formal legally binding language between a public entity and a private individual. Projects may also be initiated through a co-development. A co-development is an informal working arrangement in which the public agency and the private developer work together to complete their individual projects in a mutually beneficial way. The co-developers usually attempt to site and coordinate their projects based on a non-binding legal agreement.

Value Capture Strategies

Value capture strategies involve use of the increased property, rental, occupancy, density, and other values created by the new transit facility to pay for construction or operations subsidy.

These strategies include TIF strategies, designed to dedicate increased tax revenues resulting from transit improvement to servicing construction bonds.

Recent Federal programs such as TIFIA and State Infrastructure Banks that guarantee such borrowings, substantially enhance the value of this approach. GRTA funds could serve the same purpose.

Funding options for the implementation of the first phase of the Northwest Corridor LRT System are discussed in Section 11.

10.2.3.2 Analysis of 2001 New Starts Success/Failure Factors

Because much of the financial planning effort is directed at securing an award of federal funds, it is instructive to look at the way in which successful candidates for New Start Funding have combined these funding options into financial plans. Also, it is instructive to look at the deficiencies identified in those transit properties which did not yet achieve an FTA rating high enough to be funded.

Refer to Section 6 within the Appendices volume of this Final Report for information regarding Federal New Starts Funding 2001: Summary Ranking that contains three separate sorts of the Spring 2001 New Start FTA Project Evaluations: [4]

- *Primary Sort*: Overall Financial Rating; *Secondary Sort*: Total Capital Cost
- *Primary Sort*: Total Capital Cost
- *Primary Sort*: New Start Share of total project cost; *Secondary Sort:* Overall Financial Rating

It is interesting to note from these data that, at $4.5 billion, the Northwest Corridor LRT System would be more expensive than any other New Start project now approaching funding. Only the New York Long Island Rail Road East Side Access Project at $4.4 billion comes close to costing as much. Miami's East-West Multimodal Corridor at $2 billion, and Orange County's Centerline Rail Corridor at $2 billion, are the only other projects costing $2.0 billion or more.

More detailed information was developed for projects meeting the following criteria:

- Successful Projects:
  - Projects with a High Overall Finance Rating
  - Projects with Capital Costs greater than $475 million and a Medium-High Overall Finance Rating
  - Projects with Capital Costs greater than $475 million and a Medium Overall Finance Rating
- Unsuccessful Projects:
  - Projects with a Capital Cost greater than $475 million and a Low Overall Finance Rating

[4] For Base data see: *Annual Report on New Starts Proposed Allocations of Funds for Fiscal Year 2001* (Report of the Secretary of Transportation to the United States Congress Pursuant to 49 U.S.C. 5309(o)(1)) at http://www.fta.dot.gov/library/policy/ns/ns2000/2000nsr.htm

As illustrated below, these criteria identified 11 "successful" projects, and 3 "unsuccessful" projects for further analysis. Details concerning each of these projects, their capital financial plan, their operating financial plan, and the apparent principles of success or failure are presented in Section 7 of the Appendices volume, FTA New Starts Success/Failure Factors.

Successful	Unsuccessful
■ Portland	■ Miami (EastWest)
■ Orange County	■ Miami (North)
■ Seattle	■ Norfolk
■ Denver	
■ Austin	
■ Minneapolis	
■ San Francisco	
■ NY East Side Access	
■ New Jersey	
■ Las Vegas	
■ San Juan	

Key elements of the "successful" and "unsuccessful" projects appear to have been as follows. In this regard, it should be noted that while overmatch does not appear to have been a determining factor with respect to these projects, FTA has made it clear that its importance will increase in future project selection.

Successful	Unsuccessful
■ Good fundamentals Regional consensus	■ Funding which has failed in adoption or otherwise not in place
■ Dedicated revenue streams	■ Poor financial record of the sponsoring agency and/or uncertain financial outlook
■ Funding commitments in place Good financial condition/capacity of sponsoring agency	
■ Financial capability to absorb any cost overruns	
■ Successful financial history and track record of implementing previous projects	
■ Innovative financing may be used, but is not a centerpiece	
■ Overmatch not overriding	

10.2.4 Organizational Considerations

The current presumption is that GRTA will undertake the role of project sponsor, possibly utilizing some purchase of service arrangement for operations and maintenance.

From a financial standpoint, this will present dual challenges since the agency will be largely untested financially and operationally. Consequently, if the federal government and the municipal bond markets are to be persuaded to invest in an undertaking of this magnitude – arguably one of the largest transit projects in the United States – considerable care will have to be exercised in structuring this agency. The confidence of the current state government in GRTA and the substantial statutory empowerments granted to it will help considerably. However, consideration should also be given to the following:

- **Access to Experienced Staff.** It will help substantially if GRTA directly employs or retains staff on an out-sourced basis with substantial experience in financing large transit construction projects and operating and maintaining such projects after they are complete.
- **Strategic Financial Plan.** From the outset, GRTA should proceed with development and implementation of a strategic financial plan that lays out its fiscal roadmap with clarity. This plan should be developed with care, using state-of-the-art and innovative financing techniques.
- **Early Establishment of Dedicated Revenue Streams.** Although significant borrowings and debt service may not be required for several years, depending on soft match provisions, it is critical to establish a firm financial base for future actions. If legislation is required, it will take time to enact. New tax levies may have to be tested in litigation. This revenue stream should be structured from the outset for bondability. Impediments such as appropriations risk should be identified and systematically eliminated.
- **Rating Agency Relationships.** GRTA should employ or retain personnel experienced with the financial community and the bond rating agencies so that early relationships can be established. This will assist in guiding the early development of the agency to avoid future impediments.
- **Early Issuance of Debt.** GRTA should deliberately look for opportunities to issue debt on favorable terms early in its existence, both to gain experience and begin establishing a credit rating and history.
- **Oversight vs. Operating.** An early decision needs to be taken whether GRTA will limit its role to oversight, managing actual operations through purchase of service agreements, or whether it will undertake a direct operating role. Once this decision is taken, deliberate steps should be taken to develop the organization in a way that inspires confidence to successfully manage major transit and financial projects.
- **Inclusionary Consensus Building.** Ability to attract federal financial participation requires a regional consensus that GRTA has the confidence of the other transportation community participants to progress the undertaking. Further, it must be clear to all concerned that this can be done in such a way as not endanger existing operations of other transportation services.

10.3 ENVIRONMENTAL AND CULTURAL RESOURCE IMPACTS

As a part of this Study, an environmental and cultural resource screening was conducted to identify major constraints to the proposed light rail system. Known constraints that prohibit a specific route or location for project facilities are listed in the following sections of this report. Major environmental impacts are also addressed. Screening was not performed to the level of effort and detail required by the National Environmental Protection Act (NEPA) for an Environmental Impact Statement (EIS) or an Environmental Assessment (EA). However, the research performed for this Study will serve as preliminary work for the EIS or EA prepared during the later phases of the project.

The following sections identify issues, impacts, and constraints for each environmental or cultural resource. Each section includes a brief discussion of the issue, information gathered to date, regulatory issues, possible impacts for both construction and operation phases, and potential mitigation.

10.3.1 Traffic Circulation, Congestion, and Roadway Capacity

Rapid growth in Cobb County has resulted in significant traffic congestion and delays, especially along arterial highways and collector roads adjacent to the proposed system. The proposed transit system will decrease congestion within the densely developed commercial areas of the CIDs and throughout the proposed rail corridor.

Overall Impact

The travel demand model shows that the proposed transit system will result in a reduction of 438,500 vehicle-miles-traveled (VMT) per day on the region's roadways. (For a complete analysis of the VMT for each alternative analyzed, see Section 4, Tables 4-18 and 4-19).

As part of the travel demand forecasting efforts, "cut-line" analyses were performed for several subareas in the County, calculating the total traffic volume crossing all roadways entering and leaving a defined area. The cut-line analysis shows that the project will not only reduce traffic volumes throughout the County, but will also reduce the daily traffic volume entering and leaving the Cumberland area by about 16,400, and the Town Center Area by about 5,800. Please see Subsection 4.6.2 for a discussion of these cut-line traffic volume analyses.

In addition, the Circulators will reduce the volume of traffic within the Cumberland and Town Center Area CIDs by enabling people already in the CIDs to travel by Circulator instead of using their cars – when going to meetings, running errands, and going to lunch. This further reduction in traffic volume within the CIDs is not reflected in the cut-line analysis.

Localized Impacts

While the proposed system will result in an overall reduction in traffic volumes and congestion, traffic may increase in the immediate areas of the stations, possibly necessitating roadway and intersection improvements to maintain acceptable levels of service. The proposed system will be grade-separated in congested areas to eliminate any service impacts associated with the mixing of vehicular and train movements.

The system is proposed to operate at grade in some areas. At these locations, a signal control system will allow preemption for the train. Due to the proposed median location of the railway, automobiles travelling along Cobb Parkway may in some locations be limited to making left turns at major intersections only. This will result in changes to the current travel pattern along Cobb Parkway.

Construction Impacts

Construction will result in temporary impacts to traffic that can be carefully mitigated, through the development of efficient construction sequencing and traffic control and detour plans. Construction impacts are generally the result of detours, routing traffic away from the construction sites. Interruptions in traffic circulation can be expected:

- Where construction activities take place within public rights-of-way and easements along collector and local roads parallel to or intersected by the transit system.
- At driveways and access roads to commercial businesses where traffic must be rerouted.
- Along roadways in the vicinity of the construction operations, due to the transportation of material and equipment to construction sites.

10.3.2 Air Quality

The Environmental Protection Agency has established National Ambient Air Quality Standards (NAAQS) for six criteria pollutants, sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), particulate matter (PM), oxides of nitrogen (NO_x), and lead (Pb). Areas not meeting one or more NAAQS are ranked according to the severity of their air pollution problems. The 13 counties in the Atlanta Region were classified as a serious ozone nonattainment area, for not meeting the federal air quality standard for ozone.

The Atlanta Region ozone problem results from the chemical reaction of nitrogen oxide (NO_x) with reactive volatile organic compounds (VOCs) in the presence of an abundance of sunlight. In 1990, the Georgia Environmental Protection Division developed a baseline inventory of VOC and NO_x for the 13-county area. The inventory recorded the proportional contributions to the ozone problem by mobile and stationary point sources. The inventory shows that mobile sources (light-duty vehicles and heavy-duty trucks) contributed 58 percent of the VOCs and 56 percent of the NO_x in the emissions inventory.

On March 22, 2000, the Atlanta Regional Commission (ARC) adopted the *2025 Regional Transportation Plan* (RTP). A primary objective of the plan is to program transportation improvements that will result in a reduction in mobile source emissions sufficient to allow the region to satisfy all of the NAAQS. The State Implementation Plan (SIP) established mobile source emission budgets for the region of 224 tons per day (tpd) of NOx and 132 tpd of VOCs. The ARC prepared a *Conformity Determination Report* as part of the RTP to demonstrate that the programmed transportation improvements will result in the reduction in emissions necessary to meet these standards. The *Conformity Determination Report* included the results of the ARCs efforts to model the air quality in the region upon completion of the projects listed in the RTP. According to the ARC, the NOx emissions are forecast to decline from 264 tpd in 2000 to 152 tpd in 2025, and the VOC emissions are forecast to decline from 162 tpd in 2000 to 99 tpd in 2025.

In order to evaluate the impact of this project on the air quality conformity issues in the Atlanta Region, an analysis was performed to determine the reduction in NOx, VOC, and CO resulting from the development of this project. The analysis quantified the impact of the project on the mobile source emissions in the region in the year 2025 using the methodology set forth in the Federal Transit Administration (FTA) Section 5309 New Starts criteria.

In general, the analysis applied emissions factors for NOx, VOC, and CO to the total number of vehicle-miles-traveled (VMT) in the region, as determined from the travel demand model for the "Build" and "No-Build" alternatives. The total emissions from each alternative were compared to determine the reduction in emissions resulting from the development of the project. The emission factors used in the analysis were provided to the Team by the ARC. These factors were determined by ARC using the USEPA MOBILE5b emissions factor model, with additional off-model credits calculated in accordance with EPA guidelines. The emission factors vary significantly with variations in the speed of travel. As a result, the VMT in each alternative was broken down into nine speed ranges and emission factors were used for each range of speed. In addition, separate factors were used for light-duty gas vehicles and heavy-duty diesel vehicles. The total emissions for each alternative were calculated by summing the values calculated for each speed range and vehicle classification. Table 10-3 shows the comparison of the emissions generated in the various alternatives:

Table 10-3
Results of Air Quality Analysis

Pollutant	Total Emissions Build Alternative		Total Emissions No-Build Alternative		Reduction in Emissions if Project is Developed	
	(tons/day)	(tons/year)	(tons/day)	(tons/year)	(tons/day)	(tons/year)
NOx	168.58	48,888	169.06	49,027	0.48	139
VOC	91.07	26,410	91.33	26,486	0.26	75
CO	635.18	184,202	636.99	184,727	1.81	525

Annual Emissions were calculated by multiplying weekday values by a factor of 290.

The analysis suggests that the operation of the proposed system will reduce mobile source pollution in Cobb County and the entire region. There may be an increase in localized concentrations of some criteria pollutants in the immediate area of the transit stations, as a result of increased traffic. However, any increase in localized pollutant concentrations is not expected to violate any NAAQS.

Overall, adverse impacts on air quality as a result of construction are expected to be temporary and insignificant. Use of construction equipment and interrupted traffic patterns along impaired roadways may temporarily increase local levels of CO, NOx, and VOC. PM emissions may temporarily rise, due to soil disturbance. However, it is not expected that air quality permits will be required for the construction of the transit system. Construction activities will normally take place at different times during daylight hours and generally not at the same place for extended periods of time, thus generation of additional air pollutants is expected to be intermittent, localized, and of short duration. To reduce impacts from PM resulting from construction operations, sometimes referred to as fugitive dust, the contractor may be required to spray exposed soil with water and to wash trucks leaving the construction sites. Properly covering trucks transporting soil to and from the construction site can also minimize fugitive dust. It may be necessary to decrease traffic on unpaved roads and sweep paved roads adjacent to the construction sites to avoid re-suspension of PM.

10.3.3 Hydrology and Water Quality

The proposed transit system traverses the following three watersheds in Cobb County:

- Middle-Chattahoochee-Lake Harding
- Upper Chattahoochee
- Etowah

The greatest potential impact to water quality during construction is from soil erosion and siltation. Water quality will be protected during construction by developing and maintaining a soil erosion control plan in conformance with the Cobb County Soil Sedimentation and Erosion Control Ordinance. Adverse impacts on ground water due to either construction or operation are expected to be minimal. There is expected to be minimal, if any impact on the quality of surface waters in Cobb County, due to operation of the transit system. Upon completion of the project, some hydrologic impact may occur, due to runoff from parking facilities. However, design of all facilities will incorporate stormwater management facilities to attenuate runoff and maintain water quality. Because all water supply intakes are located well outside the project corridor, it is unlikely that public water supply will be affected during either construction or operation of the project.

10.3.4 Noise and Vibration

Construction Noise and Vibration

During construction, noise and vibration impacts are unavoidable, but are generally short-term, arising from machinery or procedures such as pile driving or rock blasting. Construction noises will be kept to a minimum and must follow local noise criteria and ordinances.

The best possible and most economical technologies will be used to control noise and vibration impacts. Temporary noise barriers may be used at sensitive areas and operations can often be scheduled for times that will not conflict with noise-sensitive areas. To reduce impacts from vibration on structures near the construction sites, it may be necessary to monitor and record vibrations during construction operations such as pile-driving or rock-blasting. In addition, the potential impacts due to vibration may affect the selection of equipment and construction methods used in some areas.

Operation Noise and Vibration

There will be noise and vibration associated with normal operations of the system, especially in areas immediately surrounding stations. Operational noise is generally associated with: speed of train, type of track support (aerial or at-grade), number of cars in the train, frequency of trains, and the distance of the receiver from the facility.

Ground-borne noise and vibration can occur from the operation of underground portions of the alignment (from train wheels traversing the steel rails, which is transmitted through the ground to the foundations of buildings). To properly predict these impacts, further research will be conducted during the engineering phases of the project to determine soil and building characteristics near underground alignment locations. Proper design and location of the transit facilities will ensure that operational vibration impacts on buildings and structures adjacent to the transit line are kept to a minimum. In addition, site-specific measures such as sound barriers can be used to mitigate impacts in sensitive areas. Noise impact due to traction power substations along the route may be reduced by locating these substations in predominately commercial/industrial areas.

The conceptual design of the Northwest Corridor LRT System locates the central maintenance and storage facility in a predominately industrial area, because repairs and daily maintenance of trains are normally performed during non-operating hours (generally between 1 am and 5 am). By locating the central maintenance and storage facility in an industrial area, the offsite impacts of these operations will be minimized.

10.3.5 Public Services and Utilities

The proposed transit system is generally located in densely developed commercial areas where utility systems are extensive and equally dense in their locations. Utilities will have to be relocated if found to be in conflict with construction of the transit system. Further research during design phases of the project will be necessary to determine the extent of utility conflicts and to identify all utilities that must be relocated or protected during construction.

10.3.6 Historic and Cultural Resources (Parklands/Cemetery/ Open Space)

Historic resources in Cobb County stem from its Native American, Civil War, industrial, and commercial heritage. The National Register of Historic Places and the Cobb County Local Register list historic and archaeological sites worthy of preservation. In addition to the sites listed in the historic registers, the many community and family cemeteries in the County are considered valuable historic, archaeological, and architectural resources worthy of preservation. Included in the base mapping for this Study are maps showing locations of historic sites, original city limits and dates of incorporation, and cemeteries within the project corridor. This information is based on a review of available mapping. A more detailed historic, archaeological, and cultural resource survey will be completed as part of the EIS/EA phase of the work.

As shown on Figure 10-1, no known historic, cultural, or archaeological sites, including cemeteries, will be directly impacted by the project. Two potential areas of conflict are shown on a Civil War map in Darlene R. Roth's *Architecture, Archaeology, and Landscapes: Resources for Historic Preservation in Unincorporated Cobb County, Georgia*. Potential conflicts may occur near the intersection of Barrett Parkway and Cobb Parkway, south of the intersection of I-75 and I-575, and the intersection of Bells Ferry Road and Cobb Parkway. Detailed research of these areas shall be conducted in the following phases of the project to ensure that no

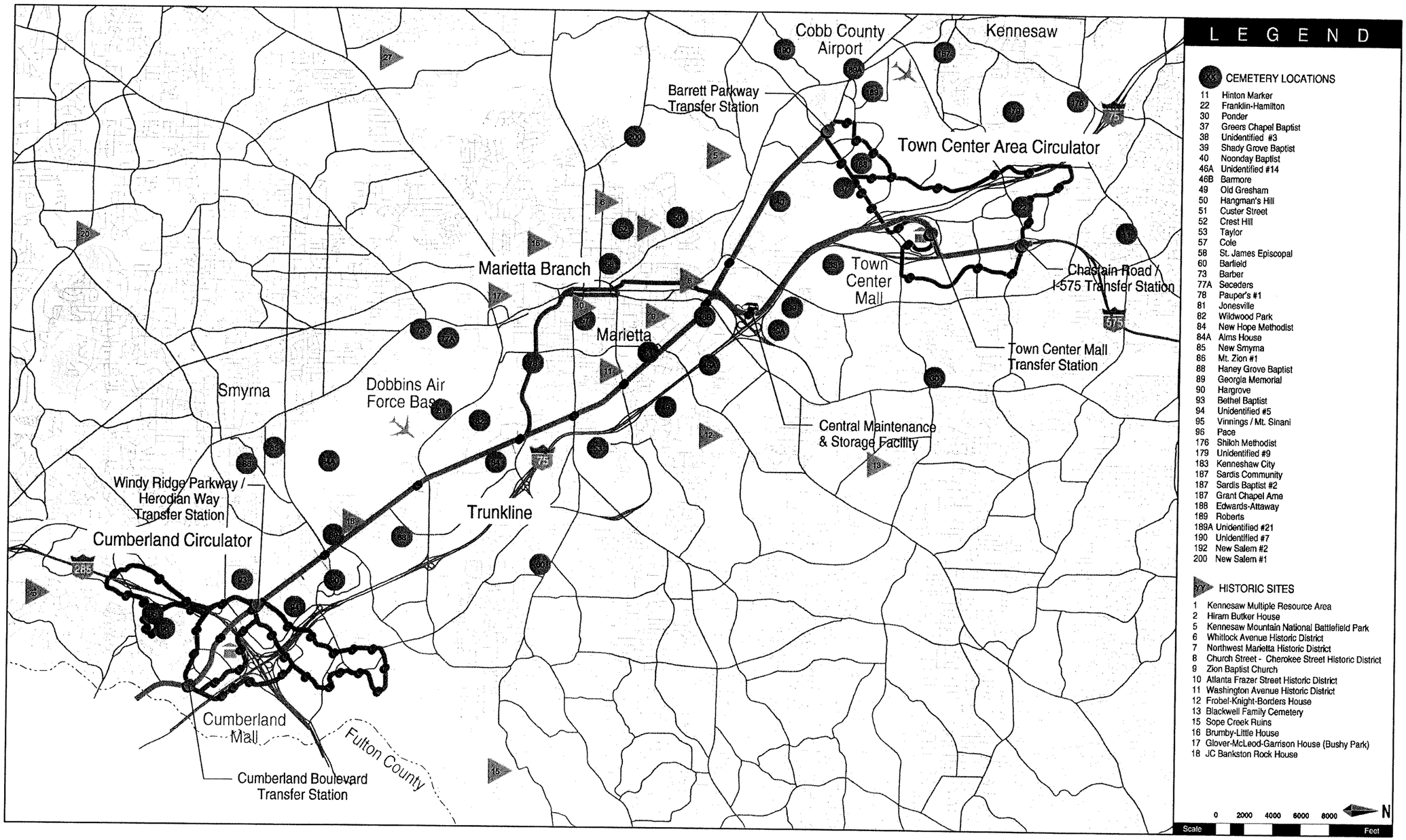


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FIGURE 10-1 HISTORIC SITES AND CULTURAL RESOURCES

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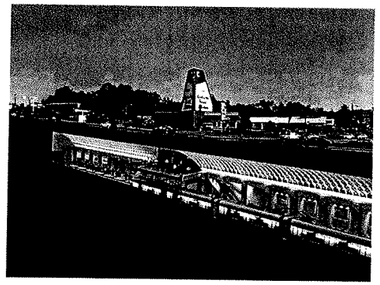
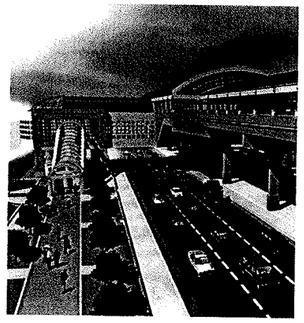
destruction of Civil War earthworks or any other historic and archaeological resources takes place. Georgia Memorial Park Cemetery, on Cobb Parkway at Windy Hill Road, is the burial ground closest to the proposed alignment. Because the trackway is located in the highway median, no adverse impacts on the cemetery are expected. If evidence of objects associated with historic or archaeological sites is encountered during the construction of the system, the requisite agencies will be contacted and construction will be postponed or halted in that particular area.

10.3.7 Visual Quality and Aesthetics

The transit system should blend with its surroundings, and not stand out or draw excessive attention. For the Trunkline, the surroundings are generally Cobb Parkway, and along I-75, and I-575. Although the Trunkline will pass through the area of Town Center Mall, it is currently proposed to be underground in this section. The majority of the Circulators will be located in densely developed commercial areas and generally not in residential areas. Some visual impacts may occur due to the elevated and at-grade portions of the transit line. Particular attention must be paid to transit lines in sensitive areas, such as the Wildwood area and at Kennesaw State University. Through careful architectural, engineering, and landscape design, the visual impact of the project can be buffered. In areas where the





system will be integrated into existing and proposed developments, the design must be coordinated with the existing development and future development plans. Please refer to Subsections 3.4 and 7.2.2 for further information on this important subject.

10.3.8 Geology, Soils, and Seismicity

Known geological and geotechnical information is provided in the Report of Initial Geotechnical and Geologic Assessment, prepared by NOVA Engineering and Environmental, Inc., and included in Section 8 of the Appendices volume of this Final Report.

The report divides the project into the following sections:

- The Southern portion, including the Cumberland Circulator and extending north to Herodian Way, falls within the Brevard Fault Zone. Excavation and removal of rock may be difficult and costly in this area, due to dense soils, partially weathered rock, and auger refusal materials. In certain areas, the soil quality may make excavation more laborious, increasing normal excavation costs.
- The Central portion, roughly the project area between Herodian Way and the North 120 Loop, is located over the Powers Ferry Formation. The nature of the soil in this region is typical for the Atlanta area, and tends to pose impacts on excavation similar to other construction projects in the area.
- The Northern portion, above the North 120 Loop and including the Town Center Circulator, is located over the Laura Lake Mafic Complex, where rock formations may be more vertically continuous and laterally extensive than those in the southern and central portions. Because the rock is high in quality, it allows for more rapid removal and is often appropriate for use as aggregate after processing.

Because the majority of the transit line is located on previously developed land, it is likely that previously placed fill will be encountered. Fill materials may have been placed according to standards. However, if there are areas with undocumented fill that is "debris-laden" and unsuitable for development, they will require excavation and replacement of the unsuitable soil. Further analysis and field investigations will be performed during the engineering and construction phases of the project, to reduce potential impacts.

10.3.9 Sensitive Soils and Steep Slopes

Soil types are considered sensitive to development if they typically occur in areas that are classified as wetlands, floodplains or steep slopes. To minimize the impact of construction and development on sensitive areas, erosion and sediment control measures shall be taken in accordance with the Cobb County Soil Sedimentation and Erosion Control Ordinance. Sensitive soils are also protected under the Cobb County Flood Damage Prevention Ordinance.

Soil sensitivity is determined from examination of texture, organic matter content, structure, permeability, and degree of slope. These factors influence soil erosion and establish natural limitations for development.

Steep slopes, with slopes in excess of 10 percent, are considered sensitive because they are sensitive to erosion. The Soil Sedimentation and Erosion Control Ordinance provides measures that will be taken to reduce erosion on steep slopes during both construction and operation. Figure 10-2 shows the location of sensitive soils and steep slopes within the project area. A considerable portion of the Cumberland Circulator will be developed in areas of steep slopes, and must be designed and constructed to limit the potential for soil erosion in these areas. Adverse impacts associated with erosion may be reduced by controlling vegetation clearing and exposure time on steep slopes. It may be necessary to divert or slow runoff from construction sites to avoid siltation.

10.3.10 Hazardous Material Sites

Since the proposed transit system is generally located within public rights-of-way, little or no impacts from hazardous waste are expected. Information from the Environmental Protection Agency (EPA) and the Georgia Environmental Protection Division (GAEPD) databases show that, to the best of their knowledge, the proposed alignment will not come in contact with any past or present hazardous waste sites.

Under the Resource Conservation and Recovery Act (RCRA), a distinction is made between "municipal solid waste" and "hazardous waste." The EPA considers any solid, liquid, or gas that poses a threat to human life, human health, or the environment when improperly stored, transported, treated, or disposed. A waste is considered to be a hazard if it is ignitable, corrosive, reactive, or toxic. Hazardous waste generators fall into one of three categories. A "Large Quantity Generator" produces 2,220 pounds or more of hazardous waste per month. A "Small Quantity Generator" produces between 220 pounds and 2,200 pounds per month. A "Conditionally Exempt Small Quantity Generator" generates 220 pounds of hazardous waste or less per month. A search of the EPA's Resource Conservation and Recovery Information System (RCRIS) resulted in over 600 facilities associated with the generation or handling of hazardous waste in Cobb County. Thirty-two facilities are located along the proposed transit system route. The majority of these facilities are classified as "Small Quantity Generators." The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), or Superfund, may be enforced to compel property owners to remediate contamination that occurred during or before their association with the property.

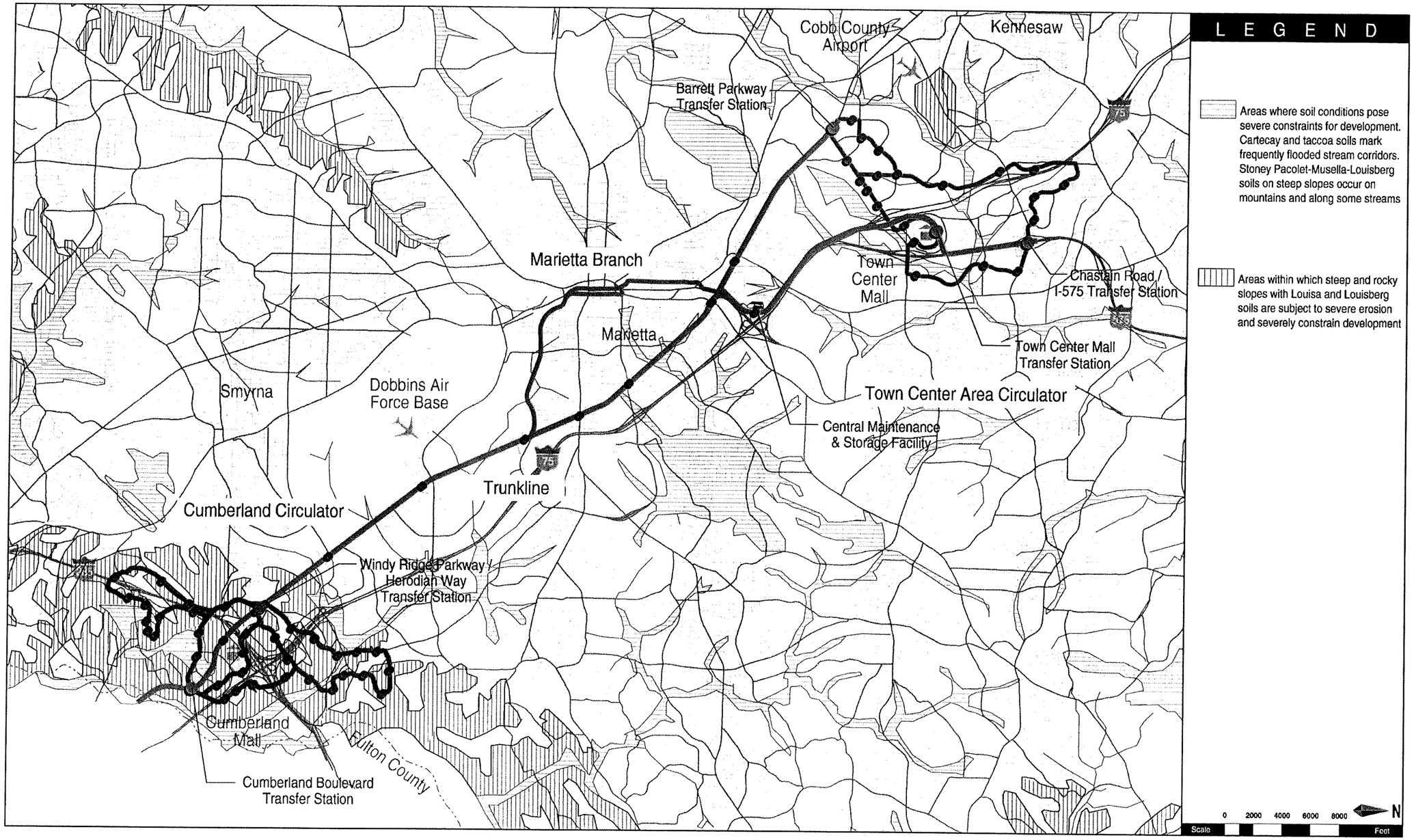


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FIGURE 10-2 SOILS SENSITIVE TO DEVELOPMENT

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A search of the EPA's Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database resulted in a total of nine Superfund sites in Cobb County, none of which will be disturbed by the proposed transit system.

In a search of the EPA's Superfund Archive database, 32 sites within Cobb County were identified. Classification of Archive status "indicates that to the best of EPA's knowledge, Superfund has completed its assessment of a site and has determined that no further steps will be taken to list that site on the National Priorities List (NPL) of sites that pose a large risk to public health and the environment and possibly qualify for Superfund money. Of the 32 sites listed in Cobb County, none were within the project corridor.

A search of the EPA's Toxic Release Inventory database generated 43 results for Cobb County. Based on this search, the proposed transit system will not encounter any of the 43 Release sites. A similar search was conducted on the GAEPD Hazardous Site Index database. Seventeen sites were listed for Cobb County, none of which will be disturbed by the proposed transit system alignment.

Environmental site assessments should be performed prior to acquisition of any property, be it public or private. The American Society of Testing and Materials (ASTM) has published Standard Practices for Environmental Site Assessment that will be followed when assessing property before purchase.

10.3.11 Safety Conditions

Potential impacts of this project on human safety fall into three areas: temporary impacts during construction, passenger safety, and the safety of people accessing and in and around the stations. Through the Occupational Safety and Health Act (OSHA), work place safety is ensured to a certain level of care. As a result, transit workers can expect a safe work environment. Passenger safety will be a primary criteria in the design of the stations, trackways, operation plans, and in the selection of transit vehicles and equipment. Design measures will be taken to ensure pedestrians reach their vehicles or destinations easily and safely, using conceptual design features such as elevated walkways in high traffic areas and providing pedestrian access from either side of the roadway to all stations located in the median. Additional pedestrian access improvements may be necessary at intersections to ensure the safety of pedestrians traveling to the station areas.

10.3.12 Protected Buffer Area of Mountain and River Corridors

Cobb County has mountains and rivers that are protected by federal, state, and local regulations. The Chattahoochee National Recreation Area and the Kennesaw Mountain National Battlefield Park are maintained and protected by the federal government as national parklands, but are outside the proposed project area.

The Chattahoochee River corridor is protected by the Georgia Mountain and River Corridor Act of 1991 and the Metropolitan River Protection Act (MRPA). The Georgia Mountain Corridor Act requires the maintenance of a 100-foot natural vegetative buffer from the mean bank of the river. Further, the MRPA requires a 2,000-foot protection corridor around the river and its impoundments in the metropolitan area. A portion of the Trunkline and Cumberland Circulator will encroach upon this buffer. All land-disturbing activities and developments within the protection corridor must be reviewed by the ARC and the Cobb County Community Development Department; each development is required to show consistency with the Corridor Plan and must be approved by the County Board of Commissioners. The MRPA requires the maintenance of a 50-foot undisturbed natural buffer along the riverbank, a 35-foot buffer along tributary streams, a 150-foot buffer along the river, and also limits the amount of land disturbance and impervious area allowed in the remainder of the protection corridor. In addition, Cobb County has adopted the Chattahoochee River Tributary Buffer Ordinance, which protects stream tributaries outside the 2,000-foot corridor. The 1999 Cobb County Stream Buffers map shows that the proposed transit system will cross approximately 20 streams, most of which are located in and around the Town Center Circulator. The design and construction of the project must satisfy the requirements of all relevant stream buffer and protection ordinances.

10.3.13 Endangered and Threatened Species

Because the proposed transit system is generally located in developed rights-of-way, the potential for the disturbance of the habitats of threatened and endangered species is limited. The Georgia Department of Natural Resources National Heritage Inventory Program has prepared a list of plant species, animal species, and habitats that are considered threatened and endangered and need to be protected. The inventory has identified several locations within the County as significant natural areas. Of the areas identified, the Chattahoochee River is located nearest to the proposed transit system. The inventory also identifies nine plant species and one fish specie as rare or imperiled. The inventory does not provide specific locations where these species have been identified. The Cobb County Comprehensive Plan: A Policy Guide 1995-2015, amended December 8, 1998, provides a description of each of the species and general locations within the County where they have been identified. Additional detailed research and field investigation must be performed during later phases of the project to identify any impact to endangered or threatened species, or their habitats. If impacts are recognized, the project design will be altered to mitigate adverse impacts on endangered or threatened species.

10.3.14 Floodplains

Floodplains are considered to be flat areas of land, adjacent to streams, that provide storage of floodwaters and channel flows and retain silt. Floodplains are identified and mapped by the Federal Emergency Management Agency (FEMA), based on the 100-year flood elevation in the stream or river. The addition of fill material in the floodplain may cause a rise in the water level and result in the flooding of previously dry land. The Cobb County Flood Damage Protection Ordinance regulates development within the floodplain.

Floodplains located within the project corridor are shown on Figure 10-3. The proposed system crosses several areas designated as floodplains; steps must be taken to ensure that there will be minimal impact to floodplains. The transit system must be designed in accordance with applicable County, State, and Federal regulations, to prevent any negative impact to the floodplains.

10.4.15 Wetlands

Wetlands are typically found in floodplains and adjacent to permanent bodies of water, such as lakes, ponds, and streams. Wetlands are protected because they serve as natural filters to protect water quality in both groundwater and adjacent surface waters, provide natural storage to mitigate flood hazards, and provide the natural habitat for a wide variety of both plant and animal life. Under Section 404 of the Federal Clean Water Act, wetlands are included in the definition of navigable waters, which are regulated by the Army Corps of Engineers. If there is a need to disturb areas considered wetlands, a permit must be issued by the Army Corps of Engineers. If a permit is granted to disturb or destroy wetlands, additional wetlands must be created elsewhere to compensate for the loss.

The United States Department of the Interior has prepared the National Wetland Inventory (NWI) maps that identify wetlands in areas based on the vegetation, hydrology, and geography visible from aerial photography. The wetlands identified on the NWI maps in the project area are shown on Figure 10-3. The Trunkline will cross an area that is identified as significant wetlands near the junction of I-75 and I-575.

The greatest potential impacts to wetlands will occur during and immediately following construction. The hydrology in and around construction sites may be temporarily altered as a result of construction. Compliance with the Soil Sedimentation and Erosion Control Ordinance will reduce undesirable impacts to the wetlands during construction. Steps, such as elevating the trackways, will be taken during design to ensure minimal impact to the wetlands during system operation.

10.4 OVERALL ASSESSMENT

There are many potential benefits to be achieved through the implementation of the Northwest Corridor LRT System, both within Cobb County and throughout the Region. Table 10-4 provides a representative summary of these benefits as they respond to the objectives of the Regional Transportation Plan (RTP) goals.

Table 10-4
Objective-Related Benefits of Proposed Northwest Corridor Light Rail Transit System

Objective	*Within Cobb County*	To Region
Serving County and Regional Travel Demand Needs	▪ Reduce peak congestion ▪ Less travel time between major activity centers ▪ Transit made available to choice markets ▪ Offset need for roadway expansion	▪ Link County to Midtown Atlanta ▪ Diversion of auto users to transit users, reduces traffic congestion ▪ Less travel time to center during peak travel conditions
Supporting Existing and Future Land Use	▪ Permit planned growth to occur in CIDs ▪ Reduce bottleneck conditions within CIDs ▪ Allow for strategic densification ▪ Integration of transit/pedestrian oriented development	▪ Allow Cobb County to absorb share of regional growth ▪ Reduce sprawl to other areas within region ▪ Help solidify Cobb CIDs as functioning business centers, important in hierarchy of regional development
Environmental Benefits to Regional Air Quality	▪ Reduction in auto trips within County ▪ Support regional air quality goals	▪ Integration with regional transit systems, reduces auto trips throughout region
Transportation Efficiency and Equity	▪ Transit service made available to minority and transit dependent populations ▪ Directly links job sites within County	▪ Link to job sites and populations within region by expanded transit services ▪ Part of balanced multi-modal transportation system
Growth and Quality of Life Factors	▪ Balanced transportation system creates opportunity for sustainable communities ▪ Pedestrian and transit oriented development shown to create healthy and prosperous environments	▪ Opportunity for regional growth absorption with minimal detrimental effects of sprawl

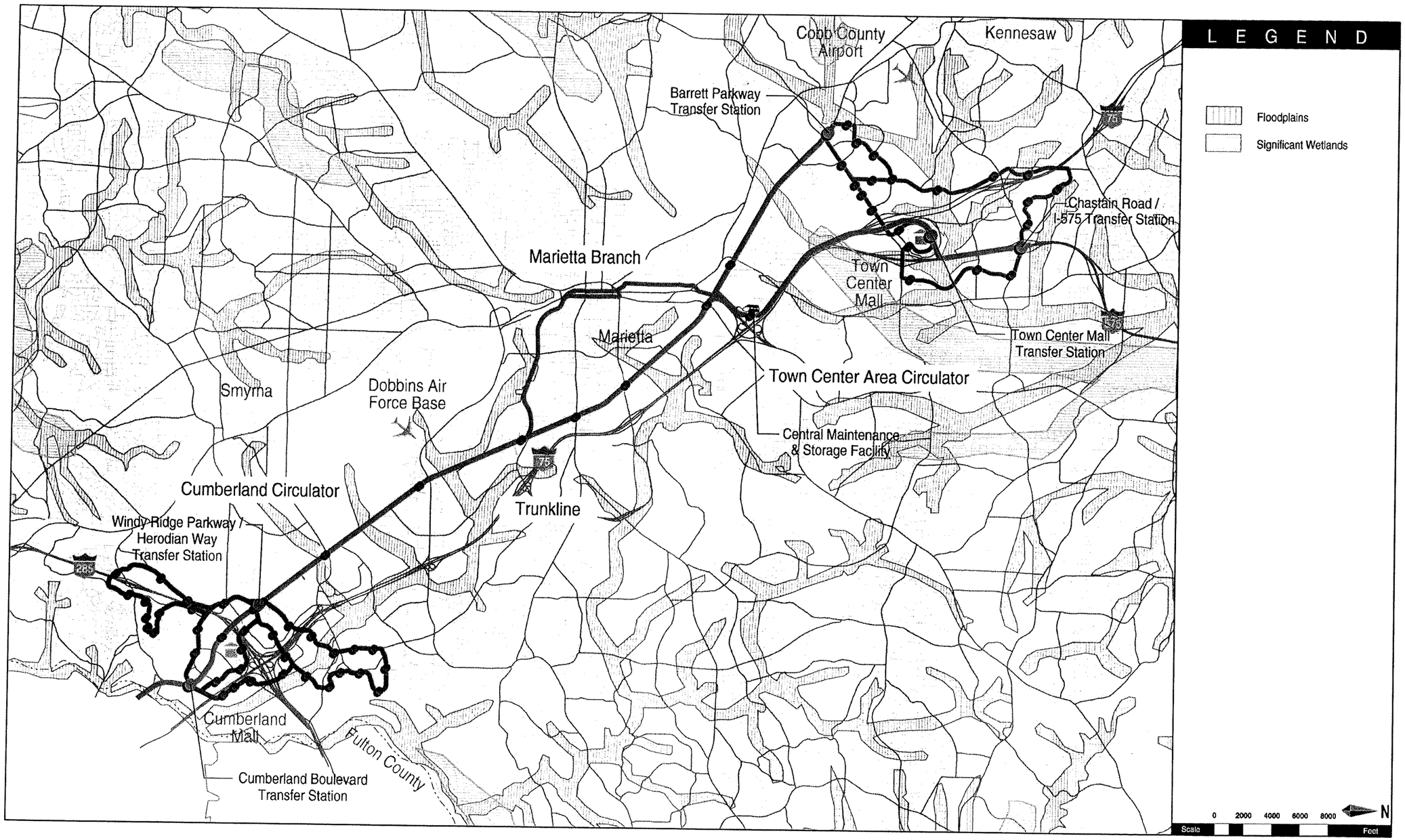

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FIGURE 10-3 WETLANDS

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In addition to work called for in the initial Scope of Services undertaken by the Bechtel/MSE Team, this section addresses issues that the Study's Steering Committee requested the Team to address during the course of the work. Specifically, this section addresses various project phasing scenarios related to the potential levels of anticipated project funding. These scenarios are formulated within the context of the proposed Ultimate System (described in Section 3), which includes the Trunkline, the Marietta Branch, the Cumberland Circulator, and the Town Center Area Circulator.

With an understanding among the members of the Steering Committee and the Team that a light rail transit system of the magnitude and cost of the proposed Ultimate System would, in all likelihood, be constructed in a series of phases over a period of years, the Team was requested to address the following three basic, initial project phasing scenarios:

- **Constrained Initial Project**
- **Preferred Initial Project**
- **Cobb County Only Project**

The Team was requested to perform the following additional task work for each of the three alternatives:

- Define each scenario's configuration and extent
- Conduct transportation modeling and planning analysis work for each
- Summarize the operational considerations for each
- Determine each scenario's environmental benefits
- Present the capital costs and the O & M costs for each

11.1 CONFIGURATION AND EXTENT OF INITIAL PHASING SCENARIOS

The three initial project phasing scenarios are described in the following subsections.

11.1.1 Constrained Initial Project Description

As a base case, the Team was requested to describe a project scenario constrained by a maximum cost of $2.0 billion, using first-quarter year 2000 pricing levels. That funding level is currently shown within the Regional Transportation Plan (RTP) as the amount projected for a three-phase development of the Northwest Corridor Light Rail Transit (LRT) System consisting of a Trunkline and a Cumberland Circulator in the Cumberland Mall/Galleria area, both of which would use compatible and non-proprietary technology.

The Constrained Initial Project is described as follows, and is graphically depicted in Figure 11-1.

- Implementation of the Trunkline in Cobb County from the Canton Road/I-75 Station and the Central Maintenance and Storage Facility southward in the median of Cobb Parkway to the Cumberland Mall/Galleria area continuing across the Chattahoochee River. This segment of the Trunkline consists of approximately 9.7 miles of route length, includes nine stations, and would be budgeted at $900 million. It should be noted that the Constrained

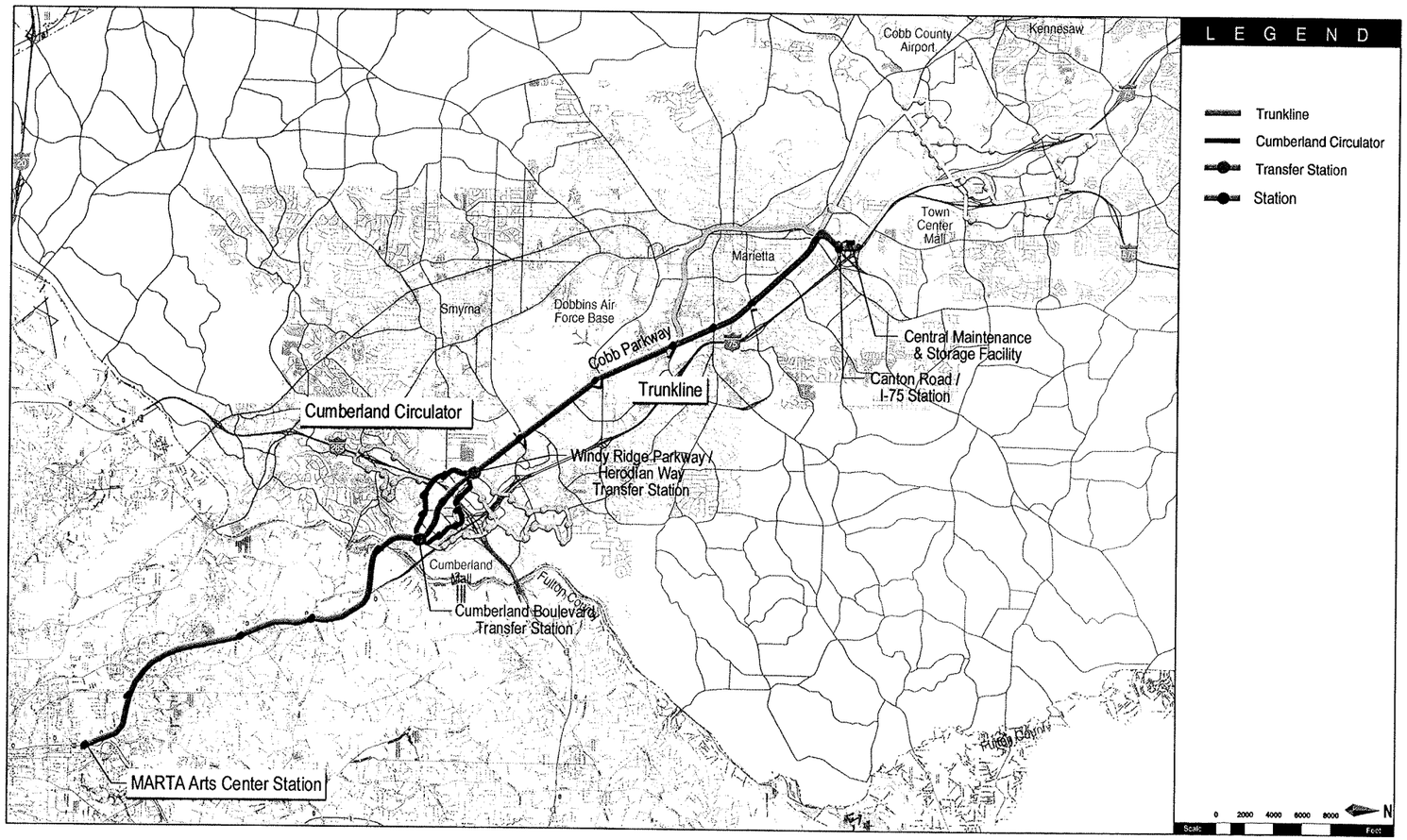

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FIGURE 11-1 CONSTRAINED INITIAL PROJECT

Transit Implementation Study

Initial Project does not reach the Town Center Area; its northern terminus is at the Canton Road/I-75 Station.

- Implementation of the Trunkline in Fulton County from the Chattahoochee River southward in the Cobb Parkway and I-75 Expressway corridors to Midtown Atlanta where passenger transfer would take place between the Northwest Corridor LRT System and the Metropolitan Atlanta Rapid Transit Authority (MARTA) heavy rail rapid transit system at the Arts Center Station. This segment of the Trunkline would consist of approximately 10.5 miles of route length and five stations. The construction cost of this segment is budgeted within the RTP to be approximately $900 million.
- Implementation of 2.81 route miles of the Cumberland Circulator, consisting of the western half of the Central Loop and the Galleria Link, together forming an Inner Loop with nine stations. It would have two interchange stations with the Trunkline, one at the Cumberland Boulevard Transfer Station and the other at the Windy Ridge Parkway/Herodian Way Transfer Station. However, the Inner Loop would serve only the two western quadrants of the I-75/I-285 interchange. This factor would limit its usefulness as an alternative to motor vehicles for trips within the Cumberland area. The construction cost of this initial segment would be budgeted at $200 million.
- An initial phase of the Central Maintenance and Storage Facility located to the northwest of the Canton Road/I-75 interchange, with a total gross area of 40 acres.

It is important to state that the construction of 20.2 miles of Trunkline with fourteen stations plus 2.81 miles of Cumberland Circulator with nine stations, as described within the conceptual engineering drawings contained within Volume II of this Final Report, will be difficult to achieve within the constrained budget of $2.0 billion. The Bechtel/MSE Team endeavored to include Trunkline service from the Canton Road/I-75 Station and the Central Maintenance and Storage Facility to Midtown Atlanta plus an operationally viable initial phase of the Cumberland Circulator in the Constrained Initial Project. However, it should be pointed out that modifications to the envisioned design of both the Trunkline and the Cumberland Circulator may be required to achieve the constrained budget amount of $2.0 billion.

11.1.2 Preferred Initial Project Description

The Study's Steering Committee, in its request for additional services, also requested the Team to recommend an initial project that would better satisfy the following criteria and requirements:

1. Adequately serve the mobility needs of Cobb County residents and businesses
2. Relieve traffic congestion on the I-75 corridor through Cobb County and between Cobb County and Atlanta's downtown districts
3. Serve the mobility needs of both the Cumberland and the Town Center Area CIDs through initiating reasonable, operable first-phase Circulator segments in both the Cumberland Mall/Galleria and the Town Center areas
4. Effectively reduce the vehicle-miles traveled within the Atlanta Region in general, and Cobb County in particular
5. Target a project cost within perceived affordable funding levels through available and innovative sources of funding

Guided by the above, the Team identified a Preferred Initial Project, described as follows and as graphically depicted in Figures 11-2, 11-3, and 11-4.

- Implementation of the Trunkline in Cobb County from the Chastain Road/I-575 Transfer Station southward in the median of I-575 then turning westward into the Town Center Mall, to the Transfer Station adjacent to the Mall, looping around the Mall and continuing southward crossing under Barrett Parkway and traversing along the I-75 expressway until it reaches the Canton Road Connector, where it turns westward along the northern edge of the Connector, incorporating track connections to the Central Maintenance and Storage Facility. From there, the Trunkline continues to Cobb Parkway, turns southward into the median of the Parkway, and continues the length of the Parkway to the Cumberland Mall/Galleria area, and then southward to the Chattahoochee River. This segment of the Trunkline consists of 14.15 miles of route length and eleven stations. It should be noted that the Preferred Initial Project does not include the Trunkline branch from the Barrett Parkway Transfer Station southward in the median of Cobb Parkway joining the main Trunkline south of the Canton Road Connector. That segment is 3.19 miles long and contains two stations.
- Implementation of the Trunkline in Fulton County from the Chattahoochee River southward in the Cobb Parkway and then the I-75 Expressway corridors to Midtown Atlanta where passenger transfer would take place between the Northwest Corridor LRT System and the MARTA heavy rail rapid transit system at the Arts Center Station. This segment of the Trunkline would consist of approximately 10.5 miles of route length and five stations. The construction cost of this segment is budgeted within the RTP to be approximately $900 million.

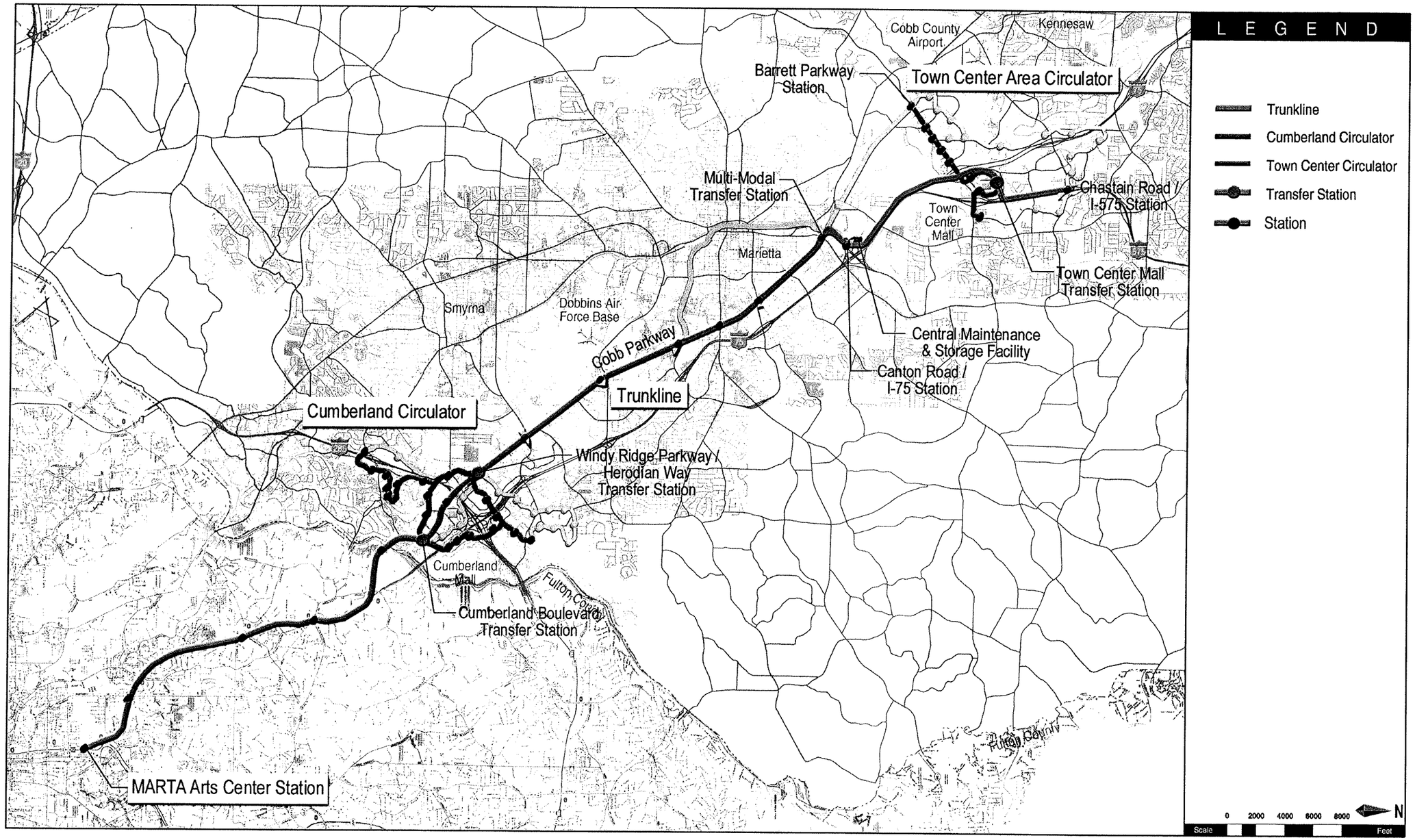

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FIGURE 11-2 PREFERRED INITIAL PROJECT

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- Implementation of an initial operating segment of the Cumberland Circulator, consisting of 7.58 miles of route length and 21 stations, described as follows:
  - The Central Loop, consisting of 4.41 miles of route length and 11 stations. This segment of the initial Cumberland Circulator would provide service to the four quadrants of the I-75/I-285 interchange as well as two interchange stations with the Trunkline, the Cumberland Boulevard Transfer Station, and the Windy Ridge Parkway/Herodian Way Transfer Station.
  - A westward branch from the Central Loop, through the Overlook area to the Home Depot corporate complex, consisting of 2.48 miles of route length and eight stations. This branch would diverge from the Central Loop north of the Cumberland Mall/CCT Transfer Station, traverse through the Overlook area and terminate at the Paces Ferry Road/Home Depot Station.
  - An eastward branch from the Central Loop along Windy Ridge Parkway to the Wildwood Office Park, consisting of 0.69 miles of route length and two stations. This branch would diverge from the Central Loop north of the Interstate North Parkway/North Circle Station, proceed along Windy Ridge Parkway, across Powers Ferry Road into the Wildwood development, where it would terminate at the Windy Ridge Parkway/Powers Ferry Road Station.

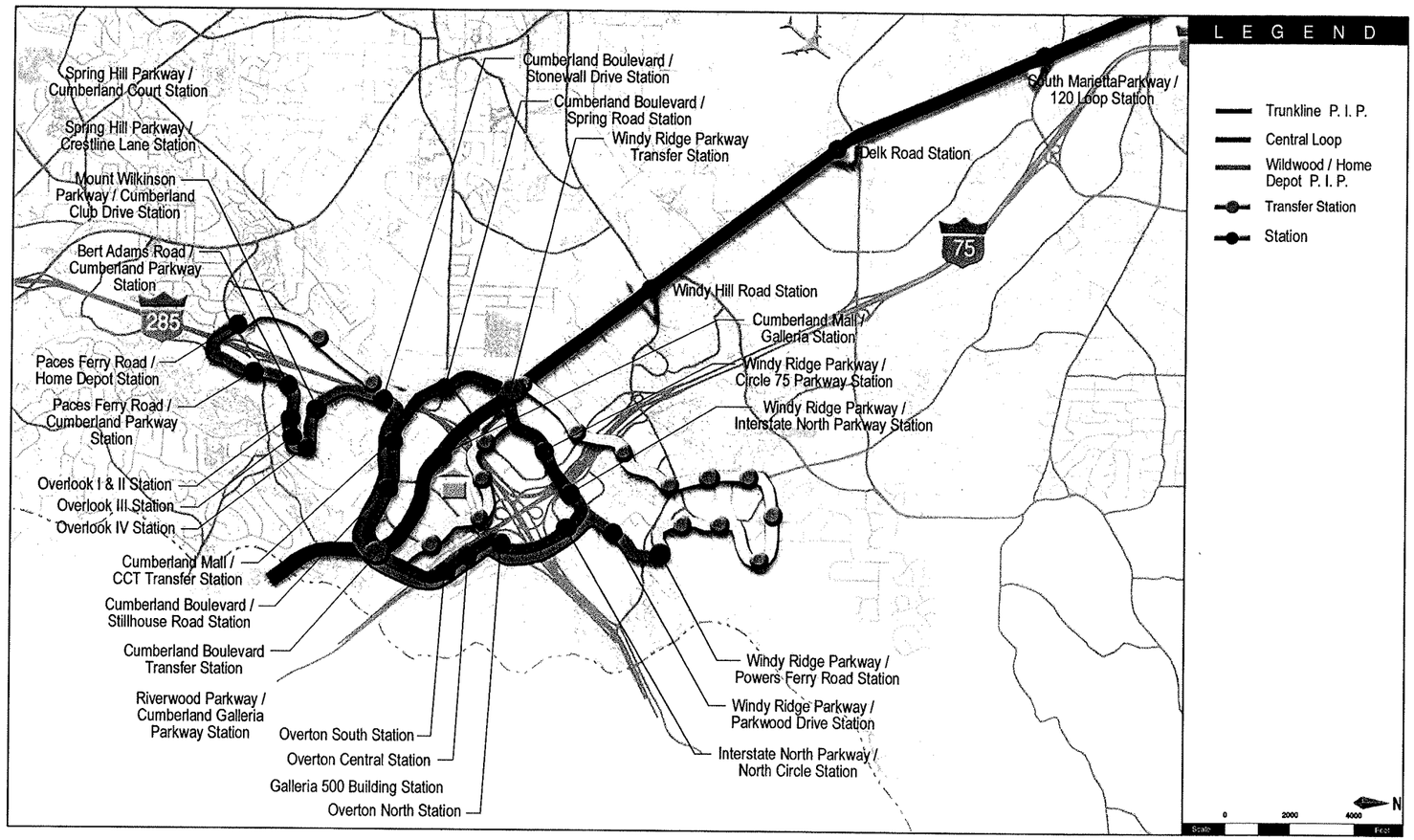

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FIGURE 11-3 CUMBERLAND CIRCULATOR PREFERRED INITIAL PROJECT

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- Implementation of an initial operating segment of the Town Center Area Circulator, consisting of 3.66 miles of route length and nine stations, described as follows:
  - The initial segment of the Town Center Area Circulator would originate at the Barrett Parkway Station and traverse eastward above the median of Barrett Parkway to the Town Center Mall, where it would circle the mall and return to Barrett Parkway, continuing eastward to Chastain Meadows Parkway, where it would turn northward to its terminus at the Chastain Meadows Parkway/ Barrett Parkway Station. This initial segment of the Town Center Area Circulator provides one point of interchange with the Trunkline, at the Town Center Mall Transfer Station.
- An initial phase of the Central Maintenance and Storage Facility located to the northwest of the Canton Road and I-75 Interchange, with a total gross area of approximately 40 acres.

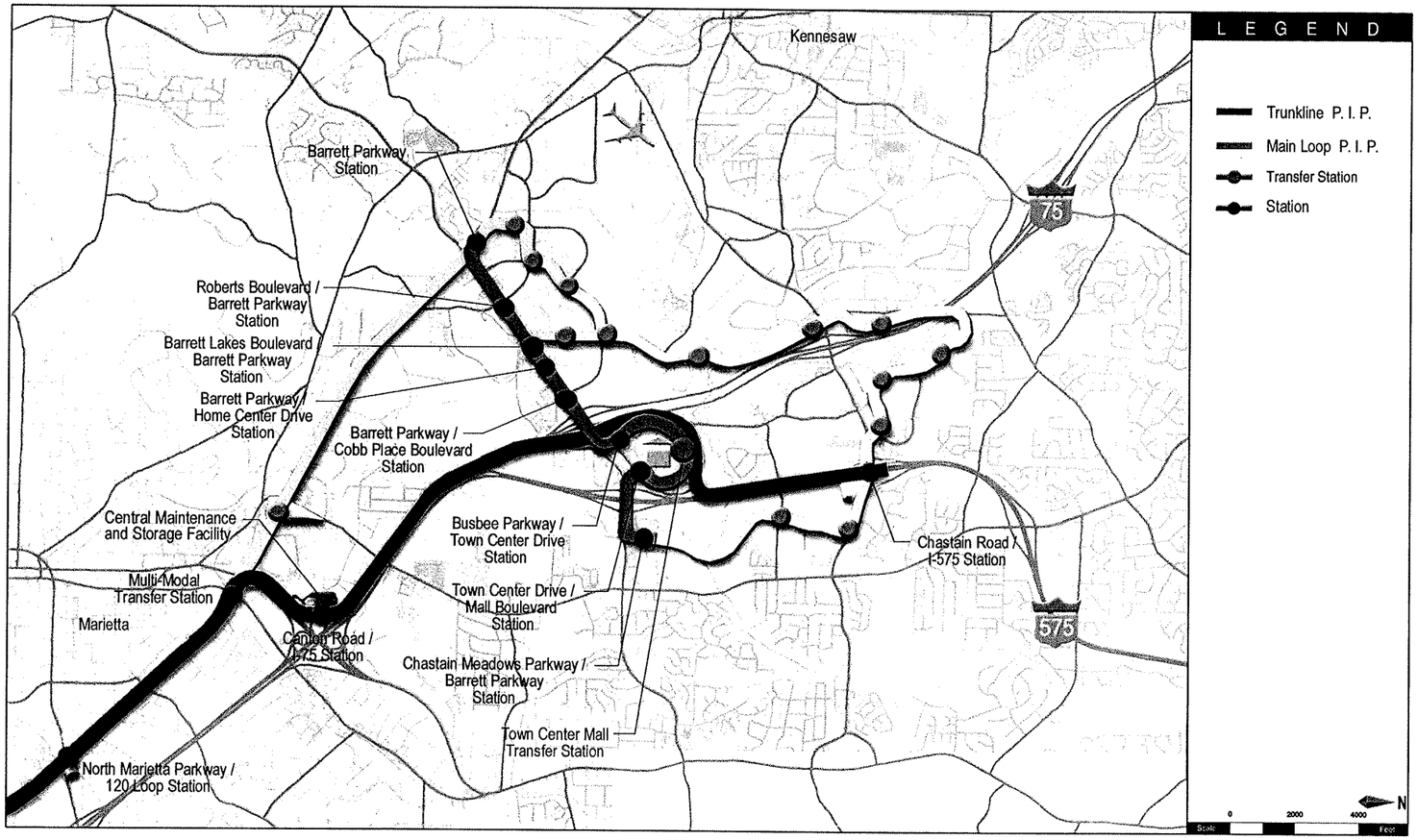

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FIGURE 11-4 TOWN CENTER AREA CIRCULATOR PREFERRED INITIAL PROJECT

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11.1.3 Cobb County Only Project Description

Various discussions took place between the Steering Committee and the Bechtel/MSE Team during the course of the Study, regarding the possibility of initiating revenue service in Cobb County prior to the opening of the Fulton County segment. It is logical to assume, given the detailed work products presented within this Final Report for the segments of the system within Cobb County, that the design and construction of those segments could possibly be advanced earlier than the Fulton County segment.

The Steering Committee, therefore, requested that the Final Report also address the patronage levels that could be anticipated if the Cobb County segments of the Preferred Initial Project commenced early revenue service operation. The Study Team was also requested to address the associated operational considerations, the environmental benefits, and the related operating and maintenance costs for those Cobb County segments.

The **Cobb County Only Project** is described as follows and as graphically depicted in Figure 11-5.

- Implementation of the Trunkline from the Chastain Road/ I-575 Station southward through the Town Center Mall, along the I-75 Expressway to the Canton Road Connector, west to Cobb Parkway, where the Trunkline would turn southward in the median of the Parkway and continue southward to the Cumberland Mall/Galleria area to its temporary terminus at the Cumberland Boulevard Transfer Station. This segment of the Trunkline is 14.15 miles in length and includes eleven stations.
- Implementation of an initial operating segment of the Cumberland Circulator consisting of 7.58 miles of route length and 21 stations described as follows and as depicted in Figure 11-3.
  - The Central Loop, consisting of 4.41 miles of route length and 11 stations
  - A westward branch from the Central Loop through the Overlook area to the home Depot corporate complex, consisting of 2.48 miles of route length and eight stations
  - An eastward branch from the Central Loop along Windy Ridge Parkway to the Wildwood office park, consisting of 0.69 miles of route length and two stations
- Implementation of an initial operating segment of the Town Center Area Circulator, consisting of 3.66 miles of route length and nine stations, as depicted in Figure 11-4.
- Implementation of an initial phase of the Central Maintenance and Storage Facility located to the northwest of the Canton Road/I-75 interchange, with a total gross area of 40 acres.

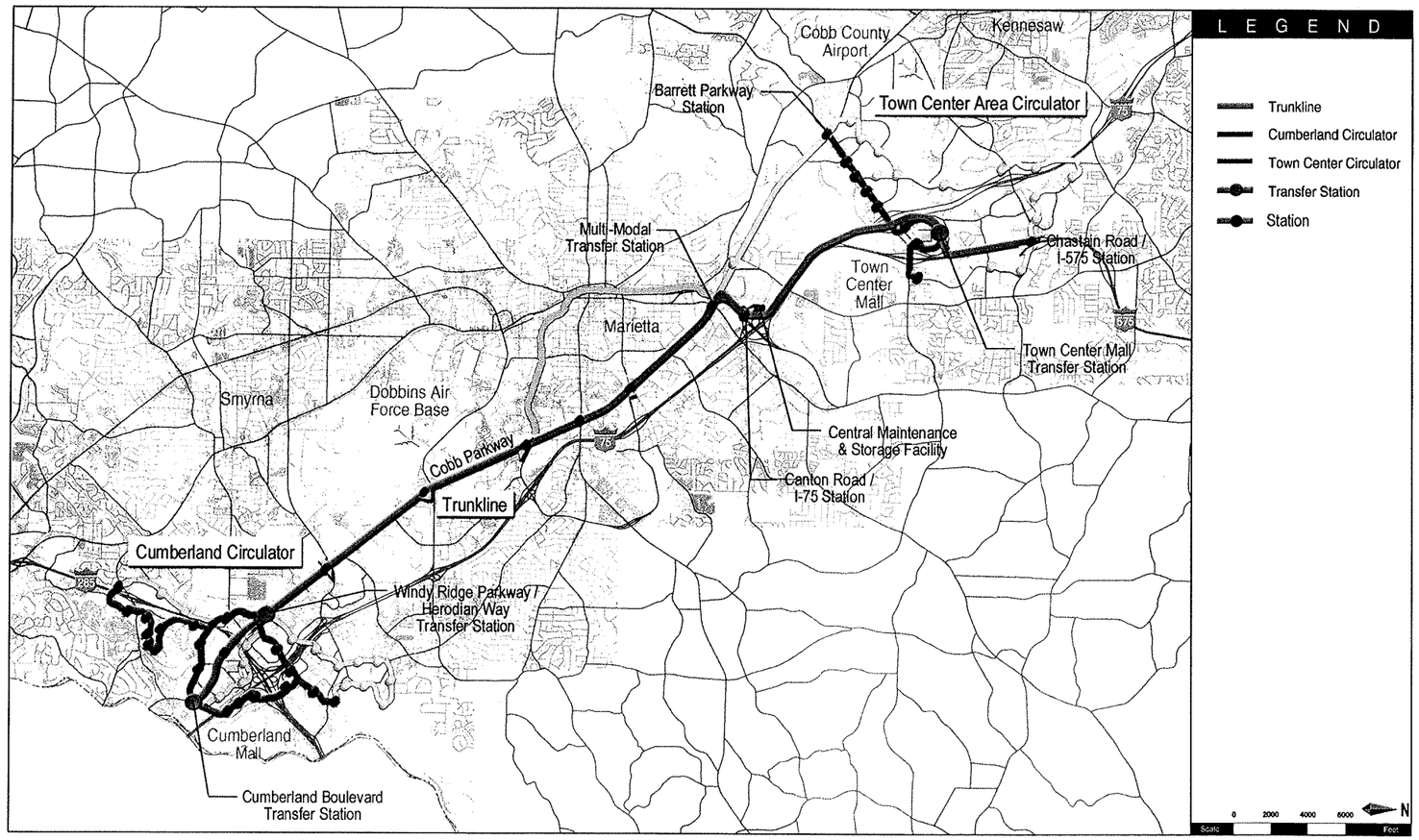

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FIGURE 11-5 COBB COUNTY ONLY PROJECT

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11.2 TRANSPORTATION MODELING AND PLANNING ANALYSIS

Transit patronage forecasts were prepared and evaluated for the three potential phasing scenarios described in Subsection 11.1. Each of the phasing scenarios was developed within the context of the Ultimate System as described in Section 3, and within the overall context of the patronage forecast data presented in Section 4 of this Final Report. The three phasing scenarios evaluated include:

- The Constrained Initial Project (2010)
- The Preferred Initial Project (2010)
- The Cobb County Only Project (2010)

In addition, the Steering Committee requested that the Study Team also include a transit patronage evaluation of the Trunkline without the Circulators, to document the importance of the Circulators as feeders to the Trunkline. The Team was requested to present this patronage forecast data in the context of the full buildout of the Ultimate System – specifically, an implementation of the Ultimate Trunkline without either of the two Ultimate Circulators. The additional scenario evaluated was, therefore:

- Ultimate System – Trunkline Only (2025)

The patronage forecasts for these phasing alternatives are summarized in Table 11-1 and indicate the following:

- **The Constrained Initial Project (2010).** Transit patronage under this scenario would yield 26,800 weekday transit boardings, representing about 18 percent of the year 2025 forecast patronage under the Ultimate System, as presented in Section 4. The weekday forecast results show 18,500 for the Trunkline, and 8,300 for the scaled down Cumberland Circulator. The viability of the Circulator and perhaps of the Trunkline system would be in question in the initial 2010 timeframe, based on the forecast levels of patronage under this scenario.
- **Preferred Initial Project (2010).** Expanding the system, in terms of stations and service coverage under this scenario, yields significantly improved transit patronage compared to the Constrained Initial Project scenario. Transit patronage under this scenario would yield 46,500 weekday transit boardings, representing about 31 per cent of the year 2025 forecast patronage under the Ultimate System. The weekday forecast results show 23,400 for the Trunkline, 20,500 for the initial phase of the Cumberland Circulator, and 2,600 for the initial phase of the Town Center Area Circulator. Of the three (year 2010) patronage scenarios evaluated for the phasing alternatives, the Preferred Initial Project showed the best results by far in terms of patronage.
- **Cobb County Only Project (2010).** Patronage under this scenario provides an indication of the patronage levels that could be expected with an initial (2010) operation of the Cobb County segments of the Preferred Initial Project. It also provides an evaluation of the importance of the Trunkline linkage south to the MARTA station in Midtown Atlanta, in the phased development of the Ultimate System. Transit patronage under this scenario would be slightly greater than under the Constrained Initial Project. Weekday transit boardings show 9,800 for the Trunkline (limited to service within Cobb County), 19,700 for the initial phase of the Cumberland Circulator, and 2,400 for the initial phase of the Town Center Area Circulator. Total weekday transit patronage under this scenario would yield 31,900 transit boardings, representing about 21 per cent of the year 2025 forecast patronage under the Ultimate System. These results indicate that more than acceptable patronage can be anticipated on the Cobb County segments should they be opened for revenue service previous to the completion of the Fulton County segment to Midtown Atlanta.
- **Ultimate System – Trunkline Only (2025).** This scenario, from a transit patronage standpoint, provides an insight as to the important role of the two CID area Circulators. Weekday transit patronage under this scenario would yield 56,500 weekday transit boardings on the Trunkline only system, in year 2025, or about 38 percent of the full Ultimate System ridership level of 150,100 weekday boardings. In other words, the transit system would serve about 62 percent fewer transit users than forecast assuming the full system of the Trunkline, Cumberland and Town Center Area Circulators, as detailed previously.

These phasing alternatives are considered unique versions of the project in terms of how the FTA would evaluate alternatives for implementation. The insights gained are helpful in formulating and streamlining alternatives to be studied during the next stage, the federal Alternatives Analysis process.

Table 11-1
Transit Patronage Forecasts for Project Phasing Alternatives, Weekday Boardings, Northwest Corridor LRT System

Phasing Alternative	Trunkline	Cumberland Circulator	Town Center Circulator	Total	% of Ultimate System Forecast
Constrained Initial Project (2010)	18,500	8,300	—	26,800	18%
Preferred Initial Project (2010)	23,400	20,500	2,600	46,500	31%
Cobb County Only Project (2010)	9,800	19,700	2,400	31,900	21%
Ultimate System, Trunkline Only (2025)	56,500	—	—	56,500	38%
Ultimate System (2025)	77,000	57,100	16,000	150,100	

11.3 OPERATIONAL ANALYSIS

The operational analyses for each of three phasing options, as stand-alone scenarios, are presented in the following subsections.

The analyses summarize system elements; one-way running times; round trip or loop circuit running times, terminal layovers, and cycle times; runs required for peak-period service, correlation of service provided and demand past peak load points; operating requirements at peak load points; seats provided at peak load points, and total rolling stock requirements.

11.3.1 Operational Analysis for the Constrained Initial Project

This subsection describes the train services to be operated during an initial development stage of the Northwest Corridor LRT System, referred to as the Constrained Initial Project.

The operating plan for the Constrained Initial Project is patterned after the assumptions and desired service characteristics for the Ultimate System, as presented in detail in Section 8 of this Final Report.

11.3.1.1 System Elements – Constrained Initial Project

It is anticipated that in this stage of development, the train services will be operated on two elements of the Northwest Corridor LRT System, as summarized in Table 11-2.

Table 11-2
Constrained Initial Project Service

Line	Route	From	To	Length (Miles)	Stations
Trunkline	TL1	Canton Road/I-75 Station	Arts Center Station, Midtown Atlanta	20.03	14
Cumberland Circulator	A/C	Central Loop from Cumberland Blvd Transfer Station to Galleria 500 Building, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station		2.81	9

11.3.1.2 One-Way Distances and Running Times – Constrained Initial Project

It is anticipated that one-way running times would be as shown in Table 11-3, during operation of the Constrained Initial Project.

Table 11-3
Anticipated One-Way Running Times – Constrained Initial Project

Line	Route	Description	Length (Miles)	Average Speed	Running Time
Trunkline	TL1	Trunkline from Canton Road/I-75 Station to Arts Center Station, Midtown Atlanta	20.03	35 mph	35 min
Cumberland Circulator	A/C	Central Loop from Cumberland Blvd Transfer Station to Galleria 500 Building, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	2.81	20 mph	9 min

11.3.1.3 Round Trip or Loop Circuit Running Times, Terminal Layovers, and Cycle Times – Constrained Initial Project

It is anticipated that round trip or loop circuit running times, terminal layovers, and cycle times would be as shown in Table 11-4.

Table 11-4
Round-Trip and Cycle Times – Constrained Initial Project

Line	Route	Description	Round Trip or Circuit Running Times	Terminal Layovers	Cycle Times
Trunkline	TL1	Trunkline from Canton Road/I-75 Station to Arts Center Station, Midtown Atlanta	70 min	8 min	78 min
Cumberland Circulator	A/C	Central Loop from Cumberland Blvd Transfer Station to Galleria 500 Building, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	9 min	3 min	12 min (each direction)

11.3.1.4 Runs Required for Peak-Period Service – Constrained Initial Project

Based on the assumptions concerning peak-period headways and cycle times, the number of runs required for each route of the Constrained Initial Project would be as listed in Table 11-5.

Table 11-5
Runs Required for Peak-Period Service – Constrained Initial Project

Line	Route	Description	Cycle Times	Peak Hour Headways	Runs Required
Trunkline	TL1	Trunkline from Canton Road/I-75 Station to Arts Center Station, Midtown Atlanta	78 min	6	13
Cumberland Circulator	A/C	Central Loop from Cumberland Blvd Transfer Station to Galleria 500 Building, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	12 min (each direction)	6	4
Total Peak Period Runs on Northwest Corridor LRT System					17

11.3.1.5 Correlation of Service Provided and Demand Past Peak Load Points – Constrained Initial Project in the Year 2010

The results of the Cobb County Transportation Model (see Section 4) have been adjusted by the Bechtel/MSE Team to estimate peak period demands for the Constrained Initial Project in 2010 (assumed to be the first year of revenue service operations of the System). Table 11-6 presents the ridership levels projected for 2010 and the demand past peak load points upon project start-up.

Table 11-6
Passenger Demand Past Peak Load Points – Constrained Initial Project, Year 2010

System Elements/ Demand Forecasts	Trunkline	Cumberland Circulator
Daily	18,500	8,300
Two Hour Peak	3,800	1,640
One Hour Peak	2,280	995
Peak Load Point	1,120	315

Peak period car service requirements for the Constrained Initial Project are calculated using the highest passenger volumes past the peak load point in the peak direction and assuming the headways stated in Table 11-5. This method yields the operating requirements shown in Table 11-7.

Table 11-7
Operating Requirements at Peak Load Points – Constrained Initial Project, Year 2010

System Element	Demand at Peak Load Point	Capacity at Peak Load Point	Runs (Not TPH)	Train Length (Cars)	Cars In Service
Trunkline	1,120	4,000	13	2	26
Cumberland Circulator	315	2,400	6	1	6
Total Runs and Cars in Service During Peak Periods			**19**	**N/A**	**32**

Note: Capacity at Peak Load Points is given in Table 8-4 Passenger Carrying Capacities Per Hour Per Direction of Section 8.

Given the suburban nature of Cobb County and the widespread use of automobiles, sports utility vehicles, and trucks for personal travel needs within the county and to/from Atlanta, it is probable that a policy to provide seats to as many people as possible will be needed to attract high volumes of passengers to the Northwest Corridor LRT System. This is particularly likely during its Constrained Initial Project stage, when potential passengers must be weaned away from their current modes of travel by superior public transportation services. Table 11-8 presents a comparison of the demand at peak load points and the number of seats to be provided past the peak load points at the headways stated in Table 11.5.

Table 11-8
Seats Provided at Peak Load Points – Constrained Initial Project, Year 2010

System Element	Demand at Peak Load Point	Seats Available at Peak Load Point	Runs (Not TPH)	Train Length (Cars)	Cars In Service
Trunkline	1,120	1,360	13	2	26
Cumberland Circulator	315	880	6	1	6
Total Runs and Cars in Peak Period Service			**19**	**N/A**	**32**

11.3.1.6 Total Rolling Stock Requirements – Constrained Initial Project

The rolling stock requirements are as listed in Table 11-9.

Table 11-9
Total Rolling Stock Requirements – Constrained Initial Project

Cobb County LRT System Element	No. LRVs In Service	
	Interurban	Urban
Trunkline	26	N/A
Cumberland Circulator	N/A	6
Scheduled Service Requirement	26	6
Operating Spares	2	1
Operating Requirement	28	7
Maintenance Spares (12%)	4	1
Total Rolling Stock Fleet	**32**	**8**

For planning of the Constrained Initial Project, the following minimum rolling stock fleet should be assumed, if operations are based on 6-minute peak period headways: at least 32 interurban type LRVs designed for use on the Trunkline and 8 urban type LRVs designed for use on the Circulators (both types of vehicles as described in this report). In addition, planning should include a central maintenance and storage facility, designed to accommodate an ultimate fleet of at least 119 LRVs plus maintenance-of-way equipment.

11.3.2 Operational Analysis for the Preferred Initial Project

This subsection describes the train services to be operated during an initial development stage of the Northwest Corridor LRT System, referred to as the Preferred Initial Project.

The operating plan for the Preferred Initial Project is patterned after the assumptions and desired service characteristics for the Ultimate System, as presented in detail in Section 8 of this Final Report.

11.3.2.1 System Elements of the Preferred Initial Project

It is anticipated that in its Preferred Initial Project stage of development, the train services will be operated on three elements of the Northwest Corridor LRT System as summarized in Table 11-10.

Table 11-10
Preferred Initial Project Service

Line	Route	From	To	Length (Miles)	Stations
Trunkline	TL1	Chastain Road/ I-575 Transfer Station	Arts Center Station, Midtown Atlanta	24.54	16
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station		4.41	11
Cumberland Circulator	B/C	Wildwood/Home Depot Loop from Windy Ridge Pkwy and Powers Ferry Rd to Overton, Cumberland Blvd Transfer Station, Cumberland Mall/ CCT Transfer Station, Overlook and Paces Ferry Road/Home Depot Support Center Station		6.00	17
Town Center Area Circulator	D	Main Loop from Barrett Pkwy Transfer Station to Town Center Mall Transfer Station and Chastain Meadows and Barrett Pkwys		3.47	9

11.3.2.2 One-Way Distances and Running Times – Preferred Initial Project

It is anticipated that one-way running times would be as shown in Table 11-11, during operation of the Preferred Initial Project.

Table 11-11
Anticipated One-Way Running Times – Preferred Initial Project

Line	Route	Description	Length (Miles)	Average Speed	Running Time
Trunkline	TL1	Trunkline from Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	24.54	35 mph	42 min
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	4.41	20 mph	14 min
Cumberland Circulator	B/C	Wildwood/Home Depot Line from Windy Ridge Pkwy and Powers Ferry Rd to Overton, Cumberland Blvd Transfer Station, Cumberland Mall/ CCT Transfer Station, Overlook and Paces Ferry Road/Home Depot Support Center Station	6.00	20 mph	18 min
Town Center Area Circulator	D	Main Loop from Barrett Pkwy Transfer Station to Town Center Mall Transfer Station and Chastain Meadows and Barrett Pkwys	3.47	20 mph	11 min

11.3.2.3 Round Trip or Loop Circuit Running Times, Terminal Layovers, and Cycle Times – Preferred Initial Project

It is anticipated that round trip or loop circuit running times, terminal layovers, and cycle times would be as shown in Table 11-12.

Table 11-12
Round-Trip and Cycle Times – Preferred Initial Project

Line	Route	Description	Round Trip or Circuit Running Times	Terminal Layovers	Cycle Times
Trunkline	TL1	Trunkline from Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	84 min	6 min	90 min
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	14 min	4 min	18 min (each direction)
Cumberland Circulator	B/C	Wildwood/Home Depot Line from Windy Ridge Pkwy and Powers Ferry Rd to Overton, Cumberland Blvd Transfer Station, Cumberland Mall/ CCT Transfer Station, Overlook and Paces Ferry Road/Home Depot Support Center Station	36 min	6 min	42 min
Town Center Area Circulator	D	Main Loop from Barrett Pkwy Transfer Station to Town Center Mall Transfer Station and Chastain Meadows and Barrett Pkwys	22 min	8 min	30 min

11.3.2.4 Runs Required for Peak-Period Service – Preferred Initial Project

Based on the assumptions concerning peak-period headways and cycle times, the number of runs required for each route of the Preferred Initial Project would be as listed in Table 11-13.

Table 11-13
Runs Required for Peak-Period Service – Preferred Initial Project

Line	Route	Description	Cycle Times	Peak Hour Headways	Runs Required
Trunkline	TL1	Trunkline from Arts Center Station, Midtown Atlanta, to Chastain Road/I-575 Transfer Station	90 min	6	15
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	18 min (each direction)	6	6
Cumberland Circulator	B/C	Wildwood/Home Depot Line from Windy Ridge Pkwy and Powers Ferry Rd to Overton, Cumberland Blvd Transfer Station, Cumberland Mall/ CCT Transfer Station, Overlook and Paces Ferry Road/Home Depot Support Center Station	42 min	6	7
Town Center Area Circulator	D	Main Loop from Barrett Pkwy Transfer Station to Town Center Mall Transfer Station and Chastain Meadows and Barrett Pkwys	30 min	6	5
Total Peak Period Runs on Northwest Corridor LRT System					**33**

11.3.2.5 Correlation of Service Provided and Demand Past Peak Load Points – Preferred Initial Project in the Year 2010

The results of the Cobb County Transportation Model, presented in Section 4, have been adjusted by the Bechtel/MSE Team to estimate peak period demands for the proposed Preferred Initial Project in 2010, assumed to be the first year of revenue service operations of the System. Table 11-14 presents the ridership levels projected for 2010 and the demand past peak load points upon project start-up.

Table 11-14
Passenger Demand Past Peak Load Points – Preferred Initial Project, Year 2010

System Elements/ Demand Forecasts	Trunkline	Cumberland Circulator	Town Center Area Circulator
Daily	23,385	20,515	2,575
Two Hour Peak	4,805	4,055	460
One Hour Peak	2,880	2,460	275
Peak Load Point	1,415	780	90

Peak period car service requirements are calculated using the highest passenger volumes past the peak load point in the peak direction and assuming the headways stated in Table 11-13. This method yields the operating requirements shown in Table 11-15.

Table 11-15
Operating Requirements at Peak Load Points – Preferred Initial Project, Year 2010

System Element	Demand at Peak Load Point	Capacity at Peak Load Point	Runs (Not TPH)	Train Length (Cars)	Cars In Service
Trunkline	1,415	4,000	15	2	30
Cumberland Circulator	780	2,400	13	1	13
Town Center Area Circulator	90	1,200	5	1	5
Total Runs and Cars in Service During Peak Periods			**33**	**N/A**	**48**

Note: Capacity at Peak Load Points is given in Table 8-4 Passenger Carrying Capacities Per Hour Per Direction of Section 8.

Given the suburban nature of Cobb County and the widespread use of automobiles, sports utility vehicles, and trucks for personal travel needs within the county and to/from Atlanta, it is probable that a policy to provide seats to as many people as possible will be needed to attract high volumes of passengers to the Northwest Corridor LRT System, particularly during its Preferred Initial Project stage when potential passengers must be weaned away from their current modes of travel by superior public transportation services. Table 11-16 presents a comparison of the demand at peak load points and the number of seats to be provided past the peak load points at the headways stated in Table 11-13.

Table 11-16
Seats Provided at Peak Load Points – Preferred Initial Project, Year 2010

System Element	Demand at Peak Load Point	Seats Available at Peak Load Point	Runs (Not TPH)	Train Length (Cars)	Cars In Service
Trunkline	1,415	1,360	15	2	30
Cumberland Circulator	780	880	13	1	13
Town Center Area Circulator	90	440	5	1	5
Total Runs and Cars in Peak Period Service			**33**	**N/A**	**48**

11.3.2.6 Rolling Stock Fleet Size Requirements – Preferred Initial Project

The rolling stock requirements for the Preferred Initial Project are as listed in Table 11-17.

Table 11-17
Total Rolling Stock Requirements –
Preferred Initial Project

Cobb County LRT System Element	No. LRVs In Service	
	Interurban	Urban
Trunkline	30	N/A
Cumberland Circulator	N/A	13
Town Center Area Circulator	N/A	5
Scheduled Service Requirement	30	18
Operating Spares	2	2
Operating Requirement	32	20
Maintenance Spares (12%)	4	3
Total Rolling Stock Fleet	**36**	**23**

For planning purposes relating to the Preferred Initial Project, the following minimum rolling stock fleet should be assumed, if operations are based on 6-minute peak period headways: at least 36 interurban type LRVs designed for use on the Trunkline and 23 urban type LRVs designed for use on the two Circulators (both types of vehicles as described in this report). In addition, planning should include a central maintenance and storage facility, designed to accommodate an ultimate fleet of at least 119 LRVs plus maintenance-of-way equipment.

11.3.3 Operational Analysis for the Cobb County Only Project

This subsection describes the train services to be operated during an initial development stage of the Northwest Corridor LRT System, referred to as the Cobb County Only Project.

The operating plan for the Cobb County Only Project is patterned after the assumptions and desired service characteristics for the Ultimate System, as presented in detail in Section 8 of this Final Report.

11.3.3.1 System Elements – Cobb County Only Project

It is anticipated that in this stage of development, the following train services will be operated on three elements of the Northwest Corridor LRT System, as summarized in Table 11-18.

Table 11-18
Cobb County Only Project Service

Line	Route	From	To	Length (Miles)	Stations
Trunkline	TL1	Chastain Road/ I-575 Transfer Station	Cumberland Boulevard Transfer Station	13.97	11
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station		4.41	11
Cumberland Circulator	B/C	Wildwood/Home Depot Loop from Windy Ridge Pkwy and Powers Ferry Rd to Overton, Cumberland Blvd Transfer Station, Cumberland Mall/ CCT Transfer Station, Overlook and Paces Ferry Road/Home Depot Support Center Station		6.00	17
Town Center Area Circulator	D	Main Loop from Barrett Pkwy Transfer Station to Town Center Mall Transfer Station and Chastain Meadows and Barrett Pkwys		3.47	9

11.3.3.2 One-Way Distances and Running Times – Cobb County Only Project

It is anticipated that one-way running times would be as shown in Table 11-19, during operation of the Cobb County Only Project.

Table 11-19
Anticipated One-Way Running Times – Cobb County Only Project

Line	Route	Description	Length (Miles)	Average Speed	Running Time
Trunkline	TL1	Trunkline from Chastain Road/I-575 Transfer Station to Cumberland Boulevard Transfer Station	13.97	35 mph	24 min
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	4.41	20 mph	14 min
Cumberland Circulator	B/C	Wildwood/Home Depot Line from Windy Ridge Pkwy and Powers Ferry Rd to Overton, Cumberland Blvd Transfer Station, Cumberland Mall/ CCT Transfer Station, Overlook and Paces Ferry Road/Home Depot Support Center Station	6.00	20 mph	18 min
Town Center Area Circulator	D	Main Loop from Barrett Pkwy Transfer Station to Town Center Mall Transfer Station and Chastain Meadows and Barrett Pkwys	3.47	20 mph	11 min

11.3.3.3 Round Trip or Loop Circuit Running Times, Terminal Layovers, and Cycle Times – Cobb County Only Project

It is anticipated that round trip or loop circuit running times, terminal layovers, and cycle times would be as shown in Table 11-20.

Table 11-20
Round-Trip and Cycle Times – Cobb County Only Project

Line	Route	Description	Round Trip or Circuit Running Times	Terminal Layovers	Cycle Times
Trunkline	TL1	Trunkline from Chastain Road/I-575 Transfer Station to Cumberland Boulevard Transfer Station	48 min	6 min	54 min
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	14 min	4 min	18 min (each direction)
Cumberland Circulator	B/C	Wildwood/Home Depot Line from Windy Ridge Pkwy and Powers Ferry Rd to Overton, Cumberland Blvd Transfer Station, Cumberland Mall/ CCT Transfer Station, Overlook and Paces Ferry Road/Home Depot Support Center Station	36 min	6 min	42 min
Town Center Area Circulator	D	Main Loop from Barrett Pkwy Transfer Station to Town Center Mall Transfer Station and Chastain Meadows and Barrett Pkwys	22 min	8 min	30 min

11.3.3.4 Runs Required for Peak-Period Service – Cobb County Only Project

Based on the assumptions concerning peak-period headways and cycle times, the number of runs required for each route of the Cobb County Only Project are as listed in Table 11-21.

Table 11-21
Runs Required for Peak-Period Service – Cobb County Only Project

Line	Route	Description	Cycle Times	Peak Hour Headways	Runs Required
Trunkline	TL1	Trunkline from Chastain Road/I-575 Transfer Station to Cumberland Boulevard Transfer Station	54 min	6	9
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	18 min (each direction)	6	6
Cumberland Circulator	B/C	Wildwood/Home Depot Line from Windy Ridge Pkwy and Powers Ferry Rd to Overton, Cumberland Blvd Transfer Station, Cumberland Mall/ CCT Transfer Station, Overlook and Paces Ferry Road/Home Depot Support Center Station	42 min	6	7
Town Center Area Circulator	D	Main Loop from Barrett Pkwy Transfer Station to Town Center Mall Transfer Station and Chastain Meadows and Barrett Pkwys	30 min	6	5
Total Peak Period Runs on Northwest Corridor LRT System					**27**

11.3.3.5 Correlation of Service Provided and Demand Past Peak Load Points – Cobb County Only Project in the Year 2010

The results of the Cobb County Transportation Model, presented in Section 4, have been adjusted by the Bechtel/MSE Team to estimate peak period demands for the proposed Cobb County Only Project in 2010, assumed to be the first year of revenue service operations of the Northwest Corridor LRT System. Table 11-22 presents the ridership levels projected for 2010 and the demand past peak load points upon project start-up.

Table 11-22
Passenger Demand Past Peak Load Points – Cobb County Only Project, Year 2010

System Elements/ Demand Forecasts	Trunkline	Cumberland Circulator	Town Center Area Circulator
Daily	9,800	19,700	2,400
Two Hour Peak	2,015	3,895	430
One Hour Peak	1,215	2,365	260
Peak Load Point	595	750	85

Peak period car service requirements for the Cobb County Only Project are calculated using the highest passenger volumes past the peak load point in the peak direction and assuming the headways stated in Table 11-21. This method yields the operating requirements shown in Table 11-23.

Table 11-23
Operating Requirements at Peak Load Points – Cobb County Only Project, Year 2010

System Element	Demand at Peak Load Point	Capacity at Peak Load Point	Runs (Not TPH)	Train Length (Cars)	Cars In Service
Trunkline	595	2,000	9	1	9
Cumberland Circulator	810	2,400	13	1	13
Town Center Area Circulator	90	1,200	5	1	5
Total Runs and Cars in Peak Period Service			**27**	**N/A**	**27**

Note: Capacity at Peak Load Points is given in Table 8-4 Passenger Carrying Capacities Per Hour Per Direction of Section 8.

Given the suburban nature of Cobb County and the widespread use of automobiles, sports utility vehicles, and trucks for personal travel needs within the county, it is probable that a policy to provide seats to as many people as possible will be needed to attract high volumes of passengers to the Northwest Corridor LRT System, particularly during its early stage, when potential passengers must be weaned away from their current modes of travel by superior public transportation services. Table 11-24 presents a comparison of the demand at peak load points and the number of seats to be provided past the peak load points located within Cobb County at the headways stated in Table 11-21.

Table 11-24
Seats Provided at Peak Load Points – Cobb County Only Project, Year 2010

System Element	Demand at Peak Load Point	Seats Available at Peak Load Point	Runs (Not TPH)	Train Length (Cars)	Cars In Service
Trunkline	595	1,360	9	1	9
Cumberland Circulator	750	880	13	1	13
Town Center Area Circulator	85	440	5	1	5
Total Runs and Cars in Peak Period Service			**27**	**N/A**	**27**

11.3.3.6 Rolling Stock Fleet Size Requirements – Cobb County Only Project

The rolling stock requirements for the Cobb County Only Project are as listed in Table 11-25.

Table 11-25
Total Rolling Stock Requirements –
Cobb County Only Project

Cobb County LRT System Element	No. LRVs In Service	
	Interurban	Urban
Trunkline	9	N/A
Cumberland Circulator	N/A	13
Town Center Area Circulator	N/A	5
Scheduled Service Requirement	9	18
Operating Spares	1	2
Operating Requirement	10	20
Maintenance Spares (12%)	2	3
Total Rolling Stock Fleet	**12**	**23**

For planning purposes relating to the Cobb County Only Project, the following minimum rolling stock fleet should be assumed, if operations are based on 6-minute peak period headways: at least 12 interurban type LRVs designed for use on the Trunkline and 12 urban type LRVs designed for use on the two Circulators (both types of vehicles as described in this report).

As an alternative, a uniform fleet of 36 interurban type LRVs could be acquired initially, for the Cobb County Only Project, and operated on both the Trunkline and the two Circulators. This would allow purchase of the 23 urban type LRVs required for the two Circulators to be deferred until completion of the Trunkline to Arts Center Station in Midtown Atlanta (as described in the Preferred Initial Project scenario).

In addition, planning should include a central maintenance and storage facility, designed to accommodate an ultimate fleet of at least 119 LRVs plus maintenance-of-way equipment.

11.4 ENVIRONMENTAL BENEFITS ANALYSIS

This section evaluates the regional and local environmental benefits derived from the various alternatives defined in this section. The analysis focuses on the traffic congestion and air quality benefits associated with each alternative. *To accurately compare the benefits derived from each alternative, a common model year of 2025 was used in the analysis. This model year does not coincide with the projected implementation year of 2010, presented elsewhere in this section. As a result, it must be clarified that the full benefits shown as resulting from these alternatives will not be realized immediately upon implementation in 2010.*

11.4.1 Traffic Congestion Analysis

As discussed in Subsection 2.2, rapid growth in Cobb County has resulted in significant traffic congestion and delays, especially along arterial highways and collector roads adjacent to the proposed system. The proposed transit system will decrease congestion within the densely commercial areas of the CIDs and throughout the proposed rail corridor.

The travel demand model results for each of the evaluated scenarios will result in a reduction in the number of vehicle-miles-traveled (VMT) per day on the region's roadways. Table 11-26 details the VMT savings resulting from each of the scenarios. As shown in the table, the development of the Ultimate System will result in a 439,128 reduction in VMT on the region's highways. The Preferred Initial Project Alternative would realize 54 percent of the benefit realized from the development of the Ultimate System. The Cobb County Only Project will realize 34 percent of that benefit, while the Constrained Initial Project will realize 28 percent of the benefit.

Table 11-26
Analysis of Vehicle-Miles-Traveled (VMT)
Savings for Various Alternatives, Year 2025 Basis

Alternative	Total VMT	Reduction in VMT-Savings from No-Build	Benefits as % of Ultimate-System Savings
Ultimate System	153,644,400	439,128	100%
Constrained Initial Project	153,961,300	122,228	28%
Preferred Initial Project	153,844,900	238,628	54%
Cobb County Only Project	153,436,419	147,109	34%

As part of the travel demand forecasting efforts, cut-line analyses were performed for several sub-areas in the County, calculating the total traffic volume crossing all roadways entering and leaving a defined area. The cut-line analysis provides insight into the impact each scenario will have on the levels of traffic in different areas of the County. Based on the results of this analysis, the greatest benefit would be realized from the Ultimate System, followed by the Preferred Initial Project, Cobb County Only Project, and the Constrained Initial Project. Subsection 4.6.2 discusses the cut-line analysis, and Figure 4-6 shows the locations of each cut-line.

It is important to note that travel patterns within the County vary for each scenario. In the Preferred Initial Project and Constrained Initial Project, some of the cut-lines experienced a greater volume of traffic than experienced in the No Build Alternative. The net increase in traffic volumes crossing these cut-lines is most likely the result of two factors: an increase in traffic volume caused by people driving to access the transit system; and a reduction in the number of trips that could be served by transit due to the reduced size of the Circulators proposed in these scenarios. The results of the cut-line analysis are presented in Table 11-27.

The proposed LRT system will further reduce traffic volumes within the Cumberland and Town Center Area CIDs by enabling people already in the CIDs to travel by Circulator instead of using their cars when going to meetings, running errands, and going to lunch. This further reduction in traffic volume within the CIDs will vary for each scenario based on the extent of the Circulators provided in each scenario, and is not reflected in the cut-line analysis.

Table 11-27
Analysis of Various Scenarios
Traffic Volume Cutline Analysis

Map Reference	Cutline Description	Daily Traffic Volume No-Build Alternative	Daily Traffic Volume Ultimate System	Reduction in Traffic Volume (No Build to Ultimate System)	Benefit as a % of Ultimate System Benefit			
					Ultimate System	Preferred Initial Project	Constrained Initial Project	Cobb County Only Project
	All East-West Roadways							
1	West Cobb	762,637	757,720	-4,917	100%	53%	26%	32%
2	West of I-75	682,823	672,781	-10,042	100%	55%	0%	9%
3	East of I-75	735,112	725,770	-9,342	100%	72%	88%	82%
4	East Cobb	228,507	224,918	-3,589	100%	36%	-104%	3%
	All North-South Roadways							
5	North of Town Center	337,083	334,058	-3,025	100%	35%	16%	35%
6	North of North Loop	548,928	541,039	-7,889	100%	24%	53%	35%
7	South of Delk Road	647,415	641,337	-6,078	100%	-19%	-32%	-59%
8	South Cobb	519,846	517,960	-1,886	100%	-71%	-22%	-59%
10	Bartow-Cherokee County	357,315	353,245	-4,070	100%	46%	26%	43%
	All Crossing Roadways							
9	Cobb County Cordon	2,425,835	2,405,307	-20,528	100%	56%	41%	57%
11	Fulton County Line	1,528,868	1,515,756	-13,112	100%	64%	51%	76%
12	Douglas County Line	381,929	379,653	-2,276	100%	61%	36%	-1%
13	Paulding County Line	157,763	156,653	-1,110	100%	39%	55%	26%
14	Cumberland Cordon	1,372,512	1,356,124	-16,388	100%	72%	53%	85%
15	Town Center Cordon	734,133	728,345	-5,788	100%	-4%	-42%	-64%
16	Marietta Cordon	1,104,537	1,091,669	-12,868	100%	20%	-10%	-1%

Note: 1. A negative % indicates that the traffic volume crossing that cut-line will increase over the traffic experienced in the No Build Alternative
2. The above analysis is preliminary in nature; numbers will be further refined through additional analysis

11.4.2 Air Quality

As detailed in Section 2.2.4, the 13 counties in the Atlanta Region are classified as a serious ozone nonattainment area by the Environmental Protection Agency (EPA), for not meeting the federal air quality standard for ozone.

The Atlanta Region ozone problem results from the chemical reaction of nitrogen oxide (NOx) with reactive volatile organic compounds (VOCs) in the presence of an abundance of sunlight. The impact of the various scenarios on air quality was analyzed by comparing the reduction in NOx, VOC, and CO resulting from the development of each project scenario. The reduction in emissions associated with each was determined for the year 2025 using the methodology set forth in the Federal Transit Administration (FTA) Section 5309 New Starts criteria.

In general, the analysis applied emissions factors for NOx, VOC, and CO to the total number of vehicle-miles-traveled (VMT) in the region, as determined from the travel demand model for each scenario. The total emissions from the scenarios were compared to evaluate the benefits associated with each scenario. The emission factors used in the analysis were provided to the Team by the ARC. These factors were determined by ARC using the USEPA MOBILE5b emissions factor model, with additional off-model credits calculated in accordance with EPA guidelines. The emission factors vary significantly with variations in the speed of travel. As a result, the VMT in each scenario was broken down into nine speed ranges and emission factors were used for each range of speed. In addition, separate factors were used for light-duty gas vehicles and heavy-duty diesel vehicles. The total emissions for each scenario was calculated by summing the values calculated for each speed range and vehicle classification.

Table 11-28 shows the comparison of the emissions generated in the various scenarios. As indicated in the table, the greatest air quality benefit will result from the development of the Ultimate System. The Preferred Initial System has the greatest benefit of the remaining scenarios, followed by the Cobb County Only Project and the Constrained Initial Project.

Table 11-28
Analysis of Air Quality Benefits for Various Scenarios

Scenario	Total Emissions (tons/day)	Reduction in Emissions from No-Build (tons/day)	Benefit as % of Ultimate System Savings (%)
VOC Emissions Reductions			
Ultimate System	91.07	0.26	100%
Constrained Initial Project	91.31	0.02	8%
Preferred Initial Project	91.23	0.10	38%
Cobb County Only Project	91.28	0.05	19%
CO Emissions Reductions			
Ultimate System	635.18	1.81	100%
Constrained Initial Project	636.94	0.05	3%
Preferred Initial Project	636.33	0.66	36%
Cobb County Only Project	636.20	0.29	16%
NOx Emissions Reductions			
Ultimate System	168.58	0.48	100%
Constrained Initial Project	168.89	0.17	35%
Preferred Initial Project	168.73	0.33	69%
Cobb County Only Project	168.84	0.22	46%

11.5 COST ESTIMATES

This subsection presents the capital cost estimates and the operating and maintenance cost estimates for the three project phasing scenarios evaluated within this section of the Final Report. The quantity-based cost estimating activities were guided by the same procedures and qualifications as those followed for the Ultimate System (presented at the beginning of Section 9).

A key qualification that must be taken into consideration when referencing this cost estimate data is that all costs are estimated at the first quarter of year 2000. These costs are not "year of expenditure" costs. Escalation of project costs through completion of construction will need to be factored into the capital cost of the system. Similarly, escalation to 'year of expenditure" must be factored into the system operating and maintenance costs presented herein.

11.5.1 Capital Cost Estimate

The capital cost estimates for the proposed project scenarios include the furnishing of all labor, equipment, materials, and services required to construct each project scenario (refer to Subsection 9.1 for description of the procedures and qualifications used by the Team in the development of the capital cost estimates).

11.5.1.1 Exclusions

Exclusions to the estimate include:

- Georgia Regional Transportation Authority (GRTA) administration facilities
- Supplies and spare parts
- Escalation
- Financing and interest during construction

11.5.1.2 Cost Summaries

The capital costs of the three project scenarios are:

- **Constrained Initial Project** $2,000,000,000
- **Preferred Initial Project** $3,490,900,000
- **Cobb County Only Project** $2,560,900,000

Costs for the Preferred Initial Project are presented in five tables:

Table 11-29 – Project Cost Summary
Table 11-30 – Trunkline Cost Summary – Cobb County Portion
Table 11-31 – Cumberland Circulator Cost Summary
Table 11-32 – Town Center Area Circulator Cost Summery
Table 11-33 – Central Maintenance and Storage Facility Cost Summary

Unit cost abbreviations used are:

RM Route Mile
EA Each
TF Track Foot
LS Lump Sum

Table 11–29
Project Cost Summary
Preferred Initial Project to Arts Center, Atlanta

Description	Total Cost $ *(Rounded)*
Trunkline and Stations	$1,343,700,000
Trunkline Fleet (22 vehicles @ $3,000,000 each)*	$66,000,000
Cumberland Circulator	$543,500,000
Town Center Area Circulator	$288,500,000
Circulator Fleet (23 vehicles @ $1,500,000 each)	$34,500,000
Maintenance and Storage	$114,700,000
Total Cobb County without Right-of-Way	**$2,390,900,000**
Right-of-Way Allowance**	200,000,000
Fulton County Project Allowance***	$900,000,000
Total Preferred Initial Project	**$3,490,900,000**

* A Trunkline fleet of 36 interurban-type light rail vehicles will be required to operate the Preferred Initial Project, of which 22 are included in this estimate and 14 are attributed to the Fulton County project allowance.

** In the absence of the Preliminary Engineering work that will take place during the ensuing project phases, it has not been possible to determine the actual right-of-way requirements for the light rail transit system. Therefore, at this early stage of the project, the Bechtel/MSE Team has established an all-inclusive indicative allowance for the project right-of-way at $200,000,000, inclusive of property costs, relocation, legal assistance, and other related costs.

*** As explained within Subsection 1.1.3 Study Constraints, the conceptual engineering work for the proposed system was undertaken only for the portion of the light rail transit system contained within Cobb County. Therefore, in absence of the data necessary to enable quantity-based estimating, the Bechtel/MSE Team has accepted and included herein, as an allowance, the $900,000,000 Trunkline project cost included in the Regional Transportation Plan for the segment within Fulton County. Reaffirmation or modification of this project cost will take place in subsequent phases of the work with the completion of the requisite engineering design work.

Table 11-30
Trunkline Cost Summary
Preferred Initial Project – Cobb County Portion

Description	Quantity	Unit	Unit $	Total Cost $ *(Rounded)*
General Conditions (of Construction)	10%	%		70,400,000
Guideways	14.15	RM	20,911,660	295,900,000
Stations	11	EA	21,054,545	231,600,000
Parking	6,780	Stall	6,401	43,400,000
Systems	150,828	TF	880	132,700,000
Total Construction				774,000,000
Engineering, CM &PM				
Engineering	10%	%		77,400,000
Construction Management	8%	%		61,900,000
Project Management	6%	%		46,400,000
Environmental Engineering and Mitigation	1%	%		7,700,000
Total Engineering, CM & PM	25%	%		193,400,000
Subtotal Project Cost				967,400,000
Project Contingencies	25%	%		241,900,000
Subtotal Project Cost, including contingencies				1,209,400,000
Owner's Costs				
Owner's Management &Admin	4%	%		48,400,000
Utilities By Owner	3%	%		36,300,000
Revenue Start Up & Testing	1.1%	%		13,300,000
OCIP	3%	%		36,300,000
Total Owner's Costs				134,300,000
Total Trunkline within Cobb County	**14.15**			**1,343,700,000**

Table 11-31
Cumberland Circulator Cost Summary
Preferred Initial Project

Description	Quantity	Unit	Unit $	Total Cost $ *(Rounded)*
General Conditions (of Construction)	10%	%		28,500,000
Guideways	7.58	RM	18,377,308	139,300,000
Stations	21	EA	2,985,714	62,700,000
Parking	250	Stall	3,200	800,000
Systems	81,484	TF	1,004	81,800,000
Total Construction				313,100,000
Engineering, CM & PM				
Engineering	10%	%		31,300,000
Construction Management	8%	%		25,000,000
Project Management	6%	%		18,800,000
Environmental Engineering and Mitigation	1%	%		3,100,000
Total Engineering, CM & PM	25%	%		78,200,000
Subtotal Project Cost				391,300,000
Project Contingencies	25%	%		97,800,000
Subtotal Project Cost, including Contingencies				489,100,000
Owner's Costs				
Owner's Management & Admin	4%	%		19,600,000
Utilities By Owner	3%	%		14,700,000
Revenue Start Up & Testing	1.1%	%		5,400,000
OCIP	3%	%		14,700,000
Total Owner's Costs				54,400,000
Total Cumberland Circulator	**7.58**			**$543,500,000**

Table 11-32
Town Center Area Circulator Cost Summary
Preferred Initial Project

Description	Quantity	Unit	Unit $	Total Cost $ *(Rounded)*
General Conditions (of Construction):	10%	%		15,100,000
Guideways	3.66	RM	22,503,573	82,300,000
Stations	9	EA	3,444,444	31,000,000
Systems	38,620	TF	976	37,700,000
Total Construction				166,100,000
Engineering, CM & PM:				
Engineering	10%	%		16,600,000
Construction Management	8%	%		13,300,000
Project Management	6%	%		10,000,000
Environmental Engineering and Mitigation	1%	%		1,700,000
Total Engineering, CM & PM	25%	%		41,600,000
Subtotal Project Cost				207,700,000
Project Contingencies	25%	%		51,900,000
Subtotal Project Cost, including Contingencies				259,600,000
Owner's Costs:				
Owner's Management and Admin	4%	%		10,400,000
Utilities By Owner	3%	%		7,800,000
Revenue Start Up and Testing	1.1%	%		2,900,000
OCIP	3%	%		7,800,000
Total Owner's Costs				28,900,000
Total Town Center Area Circulator	**3.66**			**$288,500,000**

Table 11-33
Central Maintenance and Storage Facility Cost Summary
Preferred Initial Project

Description	Quantity	Unit	Unit $	*Total Cost $* (Rounded)
General Conditions (of Construction):	10%	%		6,200,000
Maintenance Facility	58	Vehicles	977,586	56,700,000
Maintenance of Way Equipment				5,000,000
Total Construction				67,900,000
Engineering, CM & PM:				
Engineering	10%	%		6,800,000
Construction Management	8%	%		5,400,000
Project Management	6%	%		4,100,000
Environmental Engineering and Mitigation	1%	%		700,000
Total Engineering, CM & PM	25%	%		17,000,000
Sub Total Project Cost				84,900,000
Project Contingencies	25%	%		21,200,000
Subtotal Project Cost, including Contingencies				106,100,000
Owner's Costs:				
Owner's Management and Administration	4%	%		4,200,000
Revenue Start up and Testing	1.1%	%		1,200,000
OCIP	3%	%		3,200,000
Total Owner's Costs				8,600,000
Total Central Maintenance and Storage Facility				**114,700,000**

Note: Includes the Operations Control Center

11.5.2 Operating and Maintenance (O & M) Cost Estimate

Elements of the O & M estimating process are discussed in the following subsections and summarized in Tables 11-34 to 11-51.

As described in Section 9, O & M costs normally comprise the following elements:

- Management and administration
- Fare collection and handling
- Transportation
- Light rail vehicle maintenance
- Maintenance of way, including stations and parking facilities
- System security
- Utilities

At this stage of conceptual planning, O & M costs for all scenarios are based on the average cost per forecast revenue-vehicle-mile, using O & M cost experience of similar U.S. transit systems and the forecast revenue-vehicle-miles based on the System Operations Plan presented earlier in this Section.

Development of Unit Costs
For all three scenarios, O & M costs per revenue-vehicle-mile were guided by data from industry experience in the U.S. as described in Section 9. For the Trunkline, the average O & M cost per revenue-vehicle-mile, as used in the forecast at the year 2000 level, is $6.50. For the Circulator(s), it is $8.80.

11.5.2.1 O & M for Constrained Initial Project

Scope of O & M Cost Estimates

The Constrained Initial Project, as defined herein, includes the Trunkline configuration between the Canton Road/I-75 Transfer Station and the MARTA Arts Center Station in Midtown Atlanta, as well as an initial configuration of the Cumberland Circulator, as depicted in Figure 11-1.

Forecast of Revenue-Vehicle-Miles

Tables 11-34 to 11-39 present the operating framework and calculations necessary to forecast the revenue-vehicle-miles for each leg of the Trunkline and the Circulator for year 2010 operation, based on the System Operating Plan presented in this section, and the O & M unit costs methodology described in Section 9.

Specifically, Tables 11-34 to 11-36 provide forecasts of the number of trains per line and per time periods, and calculates the number of revenue-vehicle-miles for typical weekdays, Saturdays, and Sundays and major holidays, respectively. Table 11-37 summarizes the revenue-vehicle-miles for each type of day, while Table 11-38 summarizes the same information on an annual basis for the entire system. Total annual revenue-vehicle-miles for the year 2010 amount to approximately 2,102,000 for the Trunkline and about 239,000 for the Cumberland Circulator.

Forecast of O & M Cost for the Constrained Initial Project

As shown in Table 11-39, the annual O & M cost for the Constrained Initial Project in the year 2010 is forecast to be $15.76 million (year 2000 $).

Trunkline O & M
Applying the adjusted average O & M cost per revenue-vehicle-mile for fully grade-separated heavy rail rapid transit systems of $6.50, to the 2010 annual revenue-vehicle-miles for the Trunkline (approximately 2,102,000), results in operating and maintenance costs of $13.66 million (year 2000 $).

Circulator O & M
Applying the adjusted average light rail transit system O & M cost per revenue-vehicle-mile of $8.80 to the total annual revenue-vehicle-miles for the Cumberland Circulator (about 239,000) results in a year 2010 O & M cost for the Circulator of $2.10 million (year 2000 $).

Table 11-34
Daily Revenue-Vehicle-Miles
Constrained Initial Project – Weekdays, Year 2010

Route	Operating Subsystem/Line	Distance In Miles	5 – 6 am	6 – 7 am	7 – 9 am	9 am – 4 pm	4 – 6 pm	6 – 9 pm	9 pm – 1 am	Total Vehicle-Miles
			Number of Trains per Hour							
TL1	Canton Road/I-75 Station to Arts Center Station, Midtown Atlanta	20.0	4	6	10	6	10	6	4	6,640
	Total Trunkline									**6,640**
A/C	Cumberland Inner Loop	2.8	4	6	10	6	10	6	4	706
	Total Circulator									**706**
	Total System									**7,346**

Note: 7.5 trains per hour (60 minutes/8 tph) represents a headway or frequency of service of every 8 minutes, or 8 trains per 64 minutes

Table 11-35
Daily Revenue-Vehicle-Miles
Constrained Initial Project – Saturdays, Year 2010

Route	Operating Subsystem/Line	Distance Miles	5 – 9 am	9 am – 9 pm	9 pm – 1 am	Total Vehicle-Miles
			Number of Trains per Hour			
TL1	Canton Road/I-75 Station to Arts Center Station, Midtown Atlanta	20.0	4	6	4	4,160
	Total Trunkline					**4,160**
A	Cumberland Inner Loop	2.8	4	6	4	582
	Total Circulator					**582**
	Total System					**4,742**

Note: 7.5 trains per hour (60 minutes/8 tph) represents a headway or frequency of service of every 8 minutes, or 8 trains per 64 minutes

Table 11-36
Daily Revenue Vehicle-Miles Year 2010
Constrained Initial Project – Sundays and Major Holidays

Route	Operating Subsystem/Line	Distance Miles	7 – 9 am	9 am – 9 pm	9 pm – midnight	Total Vehicle-Miles
			Number of trains per hour			
TL1	Canton Road/I-75 Station to Arts Center Station, Midtown Atlanta	20.0	4	6	4	3,680
	Total Trunkline					**3,680**
A/C	Cumberland Inner Loop	2.8	4	6	4	515
	Total Circulator					**515**
	Total					**4,195**

Note: 7.5 trains per hour (60 minutes/8 tph) represents a frequency of service of every 8 minutes, or 8 trains per 64 minutes

Table 11-37
Daily Revenue-Vehicle-Miles by Type of Day
Constrained Initial Project, Year 2010

Operating Subsystem/Line	Weekday Vehicle-Miles	Saturday Vehicle-Miles	Sunday/Holiday Vehicle-Miles
Total Trunkline	6,640	4,160	3,680
Total Circulator	706	582	515
Totals for System	**7,346**	**4,742**	**4,195**

Table 11-38
Annual Revenue-Vehicle-Miles by Type of Day
Constrained Initial Project, Year 2010

Operating Subsystem/Line	Weekday Vehicle-Miles	Saturday Vehicle-Miles	Sunday/Holiday Vehicle-Miles	Total Vehicle-Miles
Total Trunkline	1,646,720	216,320	239,200	2,102,240
Total Circulator	175,088	30,264	33,475	238,827
Totals for System	**1,821,808**	**246,584**	**272,675**	**2,341,067**

Notes: 248 weekdays per annum
52 Saturdays per annum
65 Sundays and major holidays per annum

Table 11-39
Annual O & M Cost
Constrained Initial Project, Year 2010

Operating Subsystem/Line	O & M Cost/ Revenue-Vehicle-Mile	Transit System Revenue-Vehicle-Miles	Annual O & M Cost (Year 2000 $Millions)
Total Trunkline	$6.50	2,102,240	13.66
Total Circulator	$8.80	238,827	2.10
Grand Total for the Constrained Initial Project		**2,268,184**	**15.76**

11.5.2.2 O & M for Preferred Initial Project

Scope of O & M Cost Estimates

The Preferred Initial Project, as defined herein, includes the Trunkline configuration between the Chastain Road/I-575 Transfer Station and the MARTA Arts Center Station in Midtown Atlanta. It also includes initial configurations of the Cumberland and Town Center Area Circulators, all as depicted in Figures 11-2 to 11-4.

Forecast of Revenue-Vehicle-Miles

Tables 11-40 to 11-45 present the operating framework and calculations necessary to forecast the revenue-vehicle-miles for each leg of the Trunkline and the two Circulator systems for year 2010 operation, based on the System Operating Plan presented in this section, and the O & M unit costs methodology described in Section 9.

Specifically, Tables 11-40 to 11-42 provide forecasts of the number of trains per line and per time periods, and calculates the number of revenue-vehicle-miles for typical weekdays, Saturdays, and Sundays and major holidays, respectively. Table 11-43 summarizes the revenue-vehicle-miles for each type of day, and Table 11-44 summarizes the same information on an annual basis for the entire system. Total annual revenue-vehicle-miles for the year 2010 amount to approximately 2,575,000 for the Trunkline and about 1,160,000 for the two Circulator systems.

Forecast of O & M Costs for the Preferred Initial Project

The annual O & M cost for the Preferred Initial Project in the year 2010 is forecast to be $26.95 million (year 2000 $), as shown in Table 11-45.

Trunkline O & M

Applying the adjusted average O & M cost per revenue-vehicle-mile of $6.50 for fully grade-separated heavy rail rapid transit systems to the 2010 annual revenue-vehicle-miles for the Trunkline (approximately 2,575,000), results in operating and maintenance costs of $16.74 million (year 2000 $).

Circulators O & M

Applying the adjusted average O & M cost per revenue-vehicle-mile of $8.80 for light rail transit systems to the total annual revenue-vehicle-miles for the two Circulators (about 1,160,000) results in a year 2010 O & M cost for the Circulators of $10.21 million (year 2000 $).

Table 11-40
Daily Revenue-Vehicle-Miles
Preferred Initial Project – Weekdays, Year 2010

Route	Operating Subsystem/Line	Distance In Miles	5 – 6 am	6 – 7 am	7 – 9 am	9 am – 4 pm	4 – 6 pm	6 – 9 pm	9 pm – 1 am	Total Vehicle-Miles
			Number of Trains per Hour							
TL1	Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	24.5	4	6	10	6	10	6	4	8,134
	Total Trunkline									**8,134**
A	Cumberland Central Loop	4.4	4	6	10	6	10	6	4	1,109
B/C	Cumberland Wildwood/Home Depot Loop	5.7	4	6	10	6	10	6	4	1,436
D	Town Center Area Main Loop	3.5	4	6	10	6	10	6	4	882
	Total Circulators									**3,427**
	Total System									**11,561**

Note: 7.5 trains per hour (60 minutes/8 tph) represents a headway or frequency of service of every 8 minutes, or 8 trains per 64 minutes

Table 11-41
Daily Revenue-Vehicle-Miles
Preferred Initial Project – Saturdays, Year 2010

Route	Operating Subsystem/Line	Distance Miles	5 – 9 am	9 am – 9 pm	9 pm – 1 am	Total Vehicle-Miles
			Number of Trains per Hour			
TL1	Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	24.5	4	6	4	5,096
	Total Trunkline					**5,096**
A	Cumberland Central Loop	4.4	4	6	4	915
B/C	Cumberland Wildwood/Home Depot Loop	5.7	4	6	4	1,186
D	Town Center Area Main Loop	3.5	4	6	4	728
	Total Circulators					**2,829**
	Total System					**7,925**

Note: 7.5 trains per hour (60 minutes/8 tph) represents a headway or frequency of service of every 8 minutes, or 8 trains per 64 minutes

Table 11-42
Daily Revenue-Vehicle-Miles Year 2010
Preferred Initial Project – Sundays and Major Holidays

Route	Operating Subsystem/Line	Distance Miles	7 – 9 am	9 am – 9 pm	9 pm – midnight	Total Vehicle-Miles
			Number of Trains per Hour			
TL1	Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	24.5	4	6	4	4,508
	Total Trunkline					**4,508**
A	Cumberland Central Loop	4.4	4	6	4	810
B/C	Cumberland Wildwood/Home Depot Loop	5.7	4	6	4	1,049
D	Town Center Area Main Loop	3.5	4	6	4	644
	Total Circulators					**2,503**
	Total					**7,011**

Note: 7.5 trains per hour (60 minutes/8 tph) represents a headway or frequency of service of every 8 minutes, or 8 trains per 64 minutes

Table 11-43
Daily Revenue-Vehicle-Miles by Type of Day
Preferred Initial Project, Year 2010

Operating Subsystem/Line	Weekday Vehicle-Miles	Saturday Vehicle-Miles	Sunday/Holiday Vehicle-Miles
Total Trunkline	8,134	5,096	4,508
Total Circulators	3,427	2,829	2,503
Totals for System	**11,561**	**7,925**	**7,011**

Table 11-44
Annual Revenue-Vehicle-Miles by Type of Day
Preferred Initial Project, Year 2010

Operating Subsystem/Line	Weekday Vehicle-Miles	Saturday Vehicle-Miles	Sunday/Holiday Vehicle-Miles	Total Vehicle-Miles
Total Trunkline	2,017,232	264,992	293,020	2,575,244
Total Circulators	849,946	147,108	162,695	1,159,749
Totals for System	**2,867,178**	**412,100**	**455,715**	**3,734,993**

Notes: 248 weekdays per annum
52 Saturdays per annum
65 Sundays and major holidays per annum

Table 11-45
Annual O & M Cost
Preferred Initial Project, Year 2010

Operating Subsystem/Line	O & M Cost/ Revenue-Vehicle-Mile	Transit System Revenue-Vehicle-Miles	Annual O & M Cost (Year 2000 $Millions)
Total Trunkline	$6.50	2,575,244	16.74
Total Circulators	$8.80	1,159,749	10.21
Grand Total for the Preferred Initial Project		**3,734,993**	**26.95**

11.5.2.3 O & M for Cobb County Only Project

Scope of O & M Cost Estimates

The Cobb County Only Project, as defined herein, includes the Trunkline configuration between the Chastain Road/I-575 Transfer Station and the Cumberland Boulevard Transfer Station. It also includes initial configurations of the Cumberland and Town Center Area Circulators, as depicted in Figure 11-5.

Forecast of Revenue-Vehicle-Miles

Tables 11-46 to 11-51 present the operating framework and calculations necessary to forecast the revenue-vehicle-miles for each leg of the Trunkline and the two Circulator systems for year 2010 operation, based on the System Operating Plan presented in this Section, and the O & M unit costs described in Section 9.

Specifically, Tables 11-46 to 11-48 provide forecasts of the number of trains per line and per time periods, and calculates the number of revenue-vehicle-miles for typical weekdays, Saturdays, and Sundays and major holidays, respectively. Table 11-49 summarizes the revenue-vehicle-miles for each type of day, while Table 11-50 summarizes the same information on an annual basis for the entire system. Total annual revenue-vehicle-miles for the year 2010 amount to approximately 1,194,000 for the Trunkline, and about 1,160,000 the two Circulator systems.

Forecast of O & M Cost for the Cobb County Only Project

The annual O & M cost for the Cobb County Only Project in the year 2010 is forecast to be $17.97 million (year 2000 $), as shown in Table 11-51.

Trunkline O & M

Applying the adjusted average O & M cost per revenue-vehicle-mile of $6.50 for fully grade-separated heavy rail rapid transit systems to the 2010 annual revenue-vehicle-miles for the Trunkline of approximately 1,194,000, results in operating and maintenance costs of $7.76 million (year 2000 $).

Circulator O & M

Applying the adjusted average O & M cost per revenue-vehicle-mile of $8.80 for light rail transit systems to the total annual revenue-vehicle-miles for the two Circulators of about 1,160,000, results in a year 2010 O & M cost for the Circulators of $10.21 million (year 2000 $).

Table 11-46
Daily Revenue-Vehicle-Miles
Cobb County Only Project – Weekdays, Year 2010

Route	Operating Subsystem/Line	Distance In Miles	5 – 6 am	6 – 7 am	7 – 9 am	9 am – 4 pm	4 – 6 pm	6 – 9 pm	9 pm – 1 am	Total Vehicle-Miles
			Number of Trains per Hour							
TL1	Chastain Road/I-575 Transfer Station to Cumberland Boulevard Transfer Station	14.0	4	6	10	6	10	6	4	3,528
	Total Trunkline									**3,528**
A	Cumberland Central Loop	4.4	4	6	10	6	10	6	4	1,109
B/C	Cumberland Wildwood/Home Depot Loop	5.7	4	6	10	6	10	6	4	1,436
D	Town Center Area Main Loop	3.5	4	6	10	6	10	6	4	882
	Total Circulators									**3,427**
	Total System									**6,955**

Note: 7.5 trains per hour (60 minutes/8 tph) represents a headway or frequency of service of every 8 minutes, or 8 trains per 64 minutes

Table 11-47
Daily Revenue-Vehicle-Miles
Cobb County Only Project – Saturdays, Year 2010

Route	Operating Subsystem/Line	Distance Miles	5 – 9 am	9 am – 9 pm	9 pm – 1 am	Total Vehicle-Miles
			Number of Trains per Hour			
TL1	Chastain Road/I-575 Transfer Station to Cumberland Boulevard Transfer Station	14.0	4	6	4	2,912
	Total Trunkline					**2,912**
A	Cumberland Central Loop	4.4	4	6	4	915
B/C	Cumberland Wildwood/Home Depot Loop	5.7	4	6	4	1,186
D	Town Center Area Main Loop	3.5	4	6	4	728
	Total Circulators					**2,829**
	Total System					**5,741**

Note: 7.5 trains per hour (60 minutes/8 tph) represents a headway or frequency of service of every 8 minutes, or 8 trains per 64 minutes

Table 11-48
Daily Revenue-Vehicle-Miles Year 2010
Cobb County Only Project – Sundays and Major Holidays

Route	Operating Subsystem/Line	Distance Miles	7 – 9 am	9 am – 9 pm	9 pm – midnight	Total Vehicle-Miles
			Number of trains per hour			
TL1	Chastain Road/I-575 Transfer Station to Cumberland Boulevard Transfer Station	14.0	4	6	4	2,576
Total Trunkline						**2,576**
A	Cumberland Central Loop	4.4	4	6	4	810
B/C	Cumberland Wildwood/Home Depot Loop	5.7	4	6	4	1,049
D	Town Center Area Main Loop	3.5	4	6	4	644
Total Circulators						**2,503**
Total						**5,079**

Note: 7.5 trains per hour (60 minutes/8 tph) represents a headway or frequency of service of every 8 minutes, or 8 trains per 64 minutes

Table 11-49
Daily Revenue-Vehicle-Miles by Type of Day
Cobb County Only Project, Year 2010

Operating Subsystem/Line	Weekday Vehicle-Miles	Saturday Vehicle-Miles	Sunday/Holiday Vehicle-Miles
Total Trunkline	3,528	2,912	2,576
Total Circulators	3,427	2,829	2,503
Totals for System	**6,955**	**5,741**	**5,079**

Table 11-50
Annual Revenue-Vehicle-Miles by Type of Day
Cobb County Only Project, Year 2010

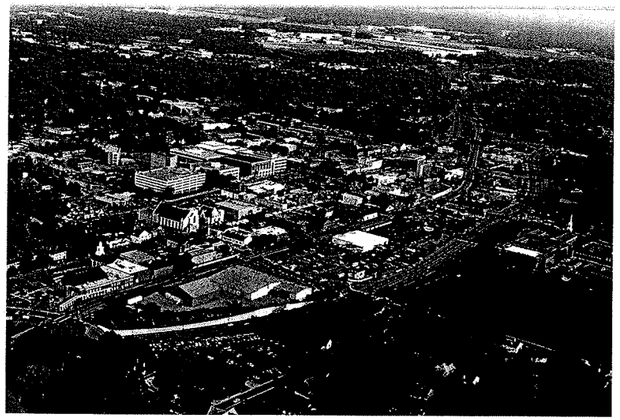
Operating Subsystem/Line	Weekday Vehicle-Miles	Saturday Vehicle-Miles	Sunday/Holiday Vehicle-Miles	Total Vehicle-Miles
Total Trunkline	874,944	151,424	167,440	1,193,808
Total Circulators	849,896	147,108	162,695	1,159,699
Totals for System	**1,724,840**	**298,532**	**330,135**	**2,353,507**

Notes: 248 weekdays per annum
52 Saturdays per annum
65 Sundays and major holidays per annum

Table 11-51
Annual O & M Cost
Cobb County Only Project, Year 2010

Operating Subsystem/Line	O & M Cost/ Revenue-Vehicle-Mile	Transit System Revenue-Vehicle-Miles	Annual O & M Cost (Year 2000 $Millions)
Total Trunkline	$6.50	1,193,808	7.76
Total Circulators	$8.80	1,159,699	10.21
Grand Total for the Cobb County Only Project		**2,353,507**	**17.97**

The city of Marietta is the county seat of Cobb County, with a population of 77,600 and an employment base of 78,600 jobs. The medium-sized historic central business district (CBD) includes approximately 1,800,000 square feet of office space. The proposed Northwest Corridor Light Rail Transit System's Trunkline, located in the median of Cobb Parkway, falls within the Marietta city limits for approximately 7 miles – from Windy Hill Road to Bells Ferry Road. However, as proposed, the Trunkline would not provide service to Marietta Square and the CBD.



For that reason, the City of Marietta, the Downtown Marietta Development Authority, and several large landholders within the CBD entered into a supplemental contract with the Bechtel/MSE Team in February of 2000 to study a potential Marietta Branch that would be routed from the Trunkline, through the central business district of Marietta, and back to the Trunkline north of the city. That agreement called for the Bechtel/MSE Team to propose a feasible routing, develop projected ridership forecasts for the branch, provide a generalized operations plan for the branch in concert with the Trunkline, present estimates of the Branch's capital and operating costs, and develop a suitable vehicle technology recommendation.

During ensuing meetings with city officials (both elected and staff) and local businessmen with interests in the CBD, the request was made that the Bechtel/MSE Team not limit their study to a single routing, but rather, propose a number of alternatives that could address various expressed concerns, and identify the advantages and disadvantages of each for further consideration. In coordination with the key stakeholders, four alternatives were decided upon. Each is described below and depicted in drawings in Volume II of this Final Report.

This presentation of potential alternative alignments is the first step in a comprehensive study process that will ultimately be sponsored and directed by public agencies such as the Georgia Regional Transportation Authority (GRTA) and the Federal Transit Administration (FTA). Further detailed alignment and station location studies will be conducted with the full participation of the public sector, local business leaders, and the City's elected officials. This will take place as part of a formal planning process, whose purpose will be to incorporate the input and concerns of all who may be affected by this significant capital improvement within Marietta, thereby resulting in the selection of a Locally Preferred Alternative (LPA). As a result of that process, the LPA will, in all probability, represent a combination of the numerous design considerations set forth in the four proposed conceptual alignment alternatives presented in the following Subsection 12.1.

12.1 PROPOSED CONCEPTUAL ALIGNMENTS

Looking south to north, all of the four alternatives begin immediately north of the South Marietta Parkway/120 Loop Trunkline Station and rejoin the Trunkline near the Canton Road/I-75 Station. The four alternative alignments are shown on Drawing MB-OA at the end of this section.

12.1.1 Alternative 1 – The Church and Cherokee Streets Alignment

Alternative 1 is 4.38 miles long, with 17 stations. Characteristics are shown schematically in Figure 12-1, summarized at the end of this subsection, and depicted in Drawings MB-01, MB-02, and MB-03 in Volume II.

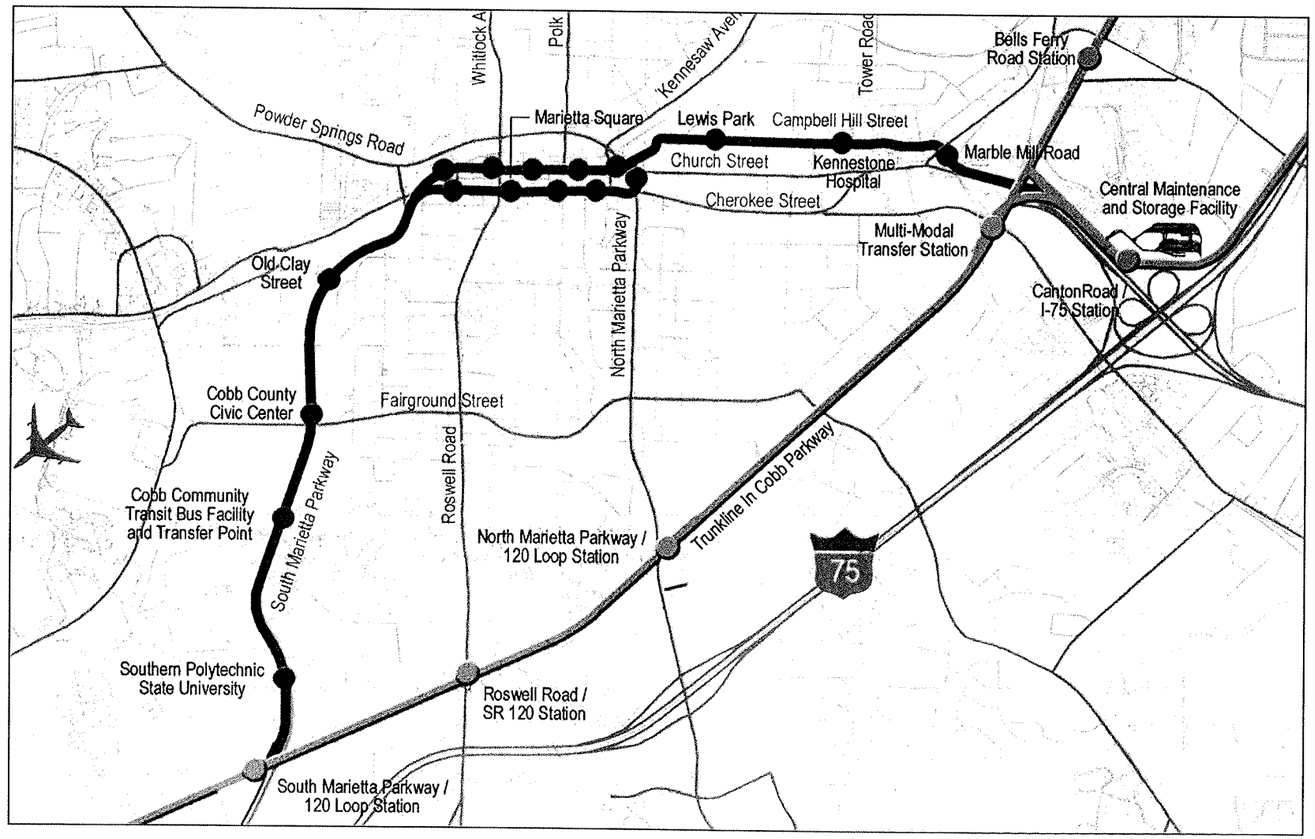


Figure 12-1 Marietta Branch Alternative 1

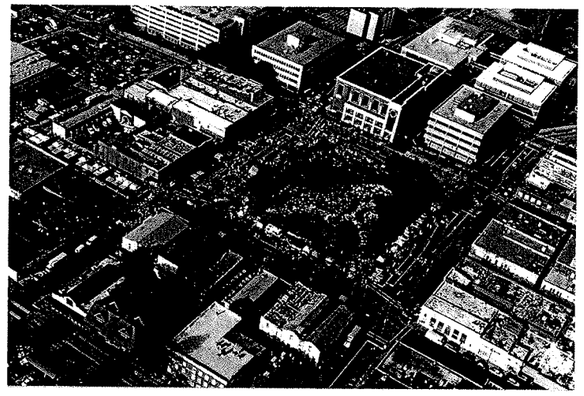
Alternative 1 begins immediately north of the South Marietta Parkway/120 Loop Trunkline Station, as an elevated double-track line. It turns northwesterly along South Marietta Parkway on a descending, double-track ramp that is located along the south side of the Parkway (in a roadway and rail right-of-way that has been expanded by approximately 35 feet to the south) crossing vehicular traffic only at intersecting streets. These intersections would be equipped with crossing protection and would, in some cases, employ signal preemption devices.

A station would be located close to the Southern Polytechnic State University entrance driveways. The light rail transit alignment would continue at-grade, northwesterly alongside South Marietta Parkway to the Cobb Community Transit bus maintenance and transfer facility, where an at-grade side platform station would be provided. The alignment would then continue across Fairground Street to the Cobb County Civic Center, where the next at-grade side platform station would be located. The alignment would then continue at-grade along the Parkway's south side, across Old Clay Street, where the next at-grade side platform station would be placed. The tracks would then ascend onto an elevated structure to cross over South Marietta Parkway.

Once across the Parkway, the two tracks would diverge as they came to grade – one track going northbound up Atlanta Street and Cherokee Street (the direction of one-way vehicular traffic), and the other going southbound down Church Street and Powder Springs Street (also the same direction as one-way vehicular traffic).

Northbound Track Divergence

At this point, the northbound transit vehicles would begin mixed-traffic operation, using the same roadway lanes as the vehicular traffic, which is similar to numerous successful LRT operations in the United States and Europe. As the rail alignment traverses northward, station stops would be provided just south of Waverly Way, at Marietta Square, midway between Dobbs and Lemon Streets and midway between Forest Avenue and Blackwell Lane. These four station stops would be single at-grade platforms, carefully sited and coordinated with the existing sidewalks along Atlanta and Cherokee Streets. North of Blackwell Lane, the track would ascend onto an elevated structure adjacent to the County Police facility to pass over both Cherokee Street and North Marietta Parkway. An additional station stop would be provided in the triangular-shaped City-owned property north of the Parkway between Cherokee and Church Streets. The elevated single-track structure would continue beyond that station, crossing over Church Street, where it would rejoin the southbound track in an elevated double-track structure above the parking lot of the Brumby Loft Apartment complex, for continuation northbound to the Trunkline west of the Canton Road/I-75 Trunkline Station.



Marietta Square

Southbound Track Divergence

In a southbound direction from Brumby Loft Apartment complex, the elevated southbound track would diverge from this junction above the loft apartment parking lot. It would continue across North Marietta Parkway and onto one of the parking lots of the First Presbyterian Church, where a single-platform station stop would be provided, either on retained fill or in an elevated configuration. The southbound track would then pass over Kennesaw Avenue, descend to grade in the Church Street right-of-way, and resume mixed-traffic operation. As the rail alignment traverses southward along Church Street and Powder Springs Street, four station stops would be provided: just south of Ardis Street, midway between Hansell Street and North Park Square Street, midway between South Park Square Street and Anderson Street, and between Waverly Way and Waterman Street. South of the Waterman Street Station, the trackage would ascend onto a retained fill, then elevated structure to pass over Atlanta Street and converge with the northbound track to pass over South Marietta Parkway on an elevated double-track structure.

The placement of the southbound track in Church Street at Marietta Square requires careful consideration, because traffic turning right onto Whitlock Avenue is frequently blocked for periods of time by CSX freight trains, causing backups. If the waiting right-turn vehicles block the LRT vehicles, these frequent traffic back-ups could impact the southbound schedule of the transit line. A potential solution would be to replace the parking along the outside western edge of Marietta Square with a right-turn-only lane, while placing the transit track in the westerly through lane. Certainly, the design of the vehicular and rail movements through this side of Marietta Square will require special consideration.

Double-Track Alignment

From above the Brumby Loft Apartment parking lot, the elevated double track structure would descend to grade along Brumby Street into the Campbell Hill Street right-of-way, where bi-directional mixed-traffic operation would take place. A station stop would be placed midway between Sessions Street and Hillside Avenue, adjacent to Lewis Park (the City's park and recreational facility) with the next station located adjacent to the Kennestone Hospital complex on Campbell Hill Street south of South Medical Drive. The street-running double trackage would continue past the hospital, through the Tower Road intersection continuing at-grade across the Church Street Extension, a crossing gate protected intersection, to the northernmost Marietta Branch station at Marble Mill Road in an at-grade side platform configuration.

The trackage would then ascend onto a retained fill double-track structure in a northerly direction paralleling the Canton Road Connector, passing over Cobb Parkway and the Trunkline extension to Cobb and Barrett Parkways. The elevated double-track structure would then rejoin the Trunkline service to/from Town Center Mall and the terminal station at Chastain Road/I-575. This connection to the Trunkline would take place southwest of the Canton Road/I-75 Trunkline Station.

Characteristics Summary – Alternative 1			
Total Length Point to Point:			**4.38 miles**
Trackage – Miles			
	At-Grade	Elevated	Total
Double-Track	2.54	1.02	3.56
Single-Track	1.17	0.55	1.72
Total:	3.71	1.57	5.28
Total Number of Stations:			**17**
Double-Track Stations:			
At-Grade Side Platform			7
Single-Track Stations:			
At-Grade Single Side Platform			8
Elevated or Retained Fill Single Side Platform			2

12.1.2 Alternative 2 – The CSX Railroad Joint-Use Alignment

Alternative 2 is 4.68 miles long and provides 13 stations. Characteristics are shown schematically in Figure 12-2, summarized at the end of this subsection, and depicted in Drawings MB-04, MB-05, and MB-06 in Volume II.

Alternative 2 begins immediately north of the South Marietta Parkway/120 Loop Trunkline Station. The branch's conceptual configuration and alignment is identical to Alternative 1 from the divergence from the Trunkline to just after it passes over South Marietta Parkway near Atlanta Street. However, instead of diverging on the east side of Atlanta Street, Alternative 2 maintains an elevated double-track configuration over Atlanta Street, descends to grade and commences a parallel alignment with the CSX Railroad south of Waverly Way. An at-grade side platform station would be located south of Waverly Way.

As this transit branch joins the CSX Railroad alignment south of Waverly Way, it would be necessary to relocate the CSX double-track configuration a minimum of fifty feet to the west. That shift would be accomplished from south of Waverly Way to somewhat north of the Brumby Loft Apartment complex, where greater right-of-way width becomes available for the branch.

If the railroad were to be relocated to the west, the Bechtel/MSE Team would also recommend that engineering studies be conducted to address the potential for grade-separating the affected cross streets: Waverly Way, Whitlock Avenue, Mill Street, Polk Street, and Kennesaw Avenue. The study work could consider modifications to the CSX Railroad's rail profile as well as overpass/underpass structures at each of these cross streets. The objective of this work would then be not only to accommodate the new transit branch, but also to improve vehicular circulation and safety within the CBD.

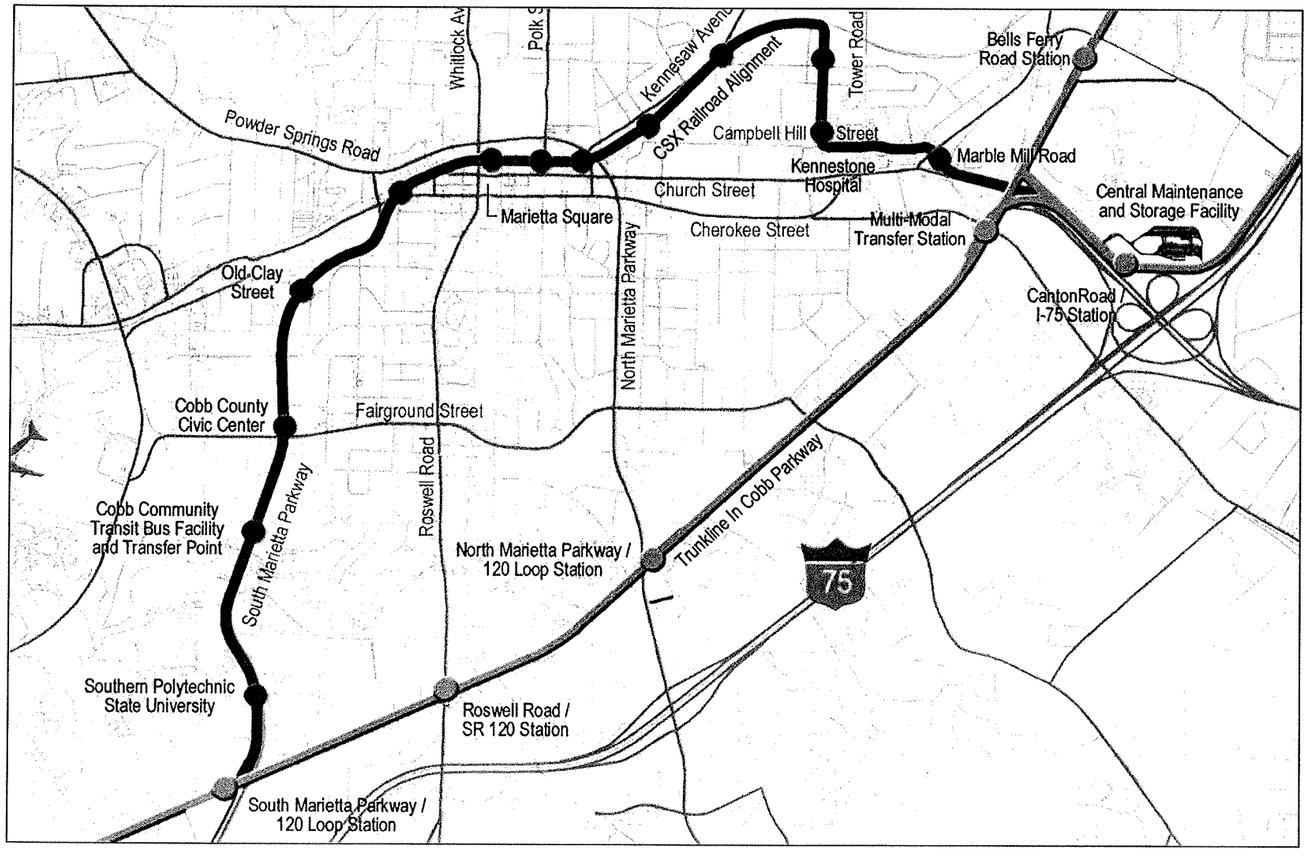


Figure 12-2 Marietta Branch Alternative 2

CSX Railroad Alignment through the city of Marietta

It should be pointed out that the Federal Railroad Administration (FRA) has a program through which they provide funding for the grade separating of problematic crossings along railroad lines. Given the intensity of the CSX freight service through the city, coupled with the crowded vehicular surface traffic conditions of these city streets, it may be possible to obtain FRA funding assistance with the movement of and grade separation of these tracks. If acceptable to the City and the CSX Railroad, the CSX tracks and the LRT tracks could be placed on a common viaduct through the city enabling all surface vehicles to pass below both the CSX freight trains and the proposed LRT service. This would enable uninterrupted LRT service through the city's business district while significantly improving the movement of surface traffic in the city.

With the CSX Railroad relocated to the west, the Marietta Branch alignment would continue northward, at-grade, on the east side of the CSX Railroad trackage. Station stops would be located midway between Whitlock Avenue and Mill Street – at the Marietta Visitor Center (the former Marietta Railroad Station), just south of Polk Street, and south of the North Marietta Parkway crossing (adjacent to and behind the First Presbyterian Church). Given the need to construct an additional double-track bridge across North Marietta Parkway to accommodate the westerly-relocated CSX Railroad tracks, it is presumed that the transit branch would use the current CSX Railroad bridge to cross over the Parkway.

Once over the Parkway, the alignment would continue at-grade, east of the CSX Railroad trackage, with two additional station stops. One would be adjacent to the intersection of Campbell Hill Street and North Sessions Street, and the second would be just north of the Roselane Street crossing of the CSX trackage, where Kennesaw Avenue diverges in a westerly direction.

The Marietta Branch alignment would continue at-grade, paralleling the CSX Railroad trackage to just north of Jordan Street. Here, the line would diverge from the CSX and head due east parallel to Jordan Street, crossing over Roselane Street and North Avenue, and passing the large hospital parking structure to its south. An at-grade side platform station would be placed near the intersection of Jordan Street and Roselane Street; the next at-grade side platform station would be located within the existing parking lot immediately east of Kennestone Hospital. The alignment would then turn northward into Campbell Hill Street and commence bi-directional mixed-traffic operation toward and across Tower Road.

From that point northward, to the rejoining with the Trunkline southwest of the Canton Road/I-75 Trunkline Station, the Marietta Branch's conceptual configuration and alignment is identical to Alternative 1, described in Subsection 12.1.1.

Characteristics Summary – Alternative 2			
Total Length Point to Point:			**4.68 miles**
Trackage – Miles			
	At-Grade	Elevated	Total
Double-Track	3.57	1.11	4.68
Single-Track			
Total:	3.57	1.11	4.68
Total Number of Stations:			**13**
All Double Track Stations:			
At-Grade Side Platform			13

12.1.3 Alternative 3 – The Church and Waddell Streets Alignment

Alternative 3 is 4.46 miles long and provides 16 stations. Characteristics are shown schematically in Figure 12-3, summarized at the end of this subsection, and depicted in Drawings MB-07, MB-08, and MB-09 in Volume II.

Alternative 3 begins immediately north of the South Marietta Parkway/120 Loop Trunkline Station. The Marietta Branch's conceptual configuration and alignment is identical to Alternative 1 until just after it passes over South Marietta Parkway near Atlanta Street. There, instead of diverging into the rights-of-way of Atlanta Street and Powder Springs Street as does Alternative 1, Alternative 3 diverges into the rights-of-way of Waddell Street and Powder Springs Street.

Once across the Parkway, the two elevated tracks would diverge as they came to grade – one track taking northbound transit service up Waddell Street (in bi-directional mixed-traffic conditions) and Cherokee Street (same direction as one-way vehicular traffic) and the other track taking southbound service down Church Street and Powder Springs Street (same direction as one-way vehicular traffic).

Northbound Track Divergence

At this point, the northbound transit vehicles would begin mixed-traffic operation, using the same roadway lanes as the vehicular traffic. As the rail alignment traverses northward along Waddell Street and then onto Cherokee Street, station stops would be provided just south of Green Street, midway between Washington Avenue and Lawrence Street, and within the at-grade parking lot alongside Cherokee Street between Lemon Street and Forest Avenue. These three station stops would be single at-grade platforms, carefully sited and coordinated with the existing sidewalks along Waddell Street. The transition of the single-track alignment from Waddell Street to Cherokee Street would take place in an "S-curve" configuration north of Lemon Street, through the surface level parking lot adjacent to Cherokee Street.

North of Blackwell Lane, the single-track would ascend onto an elevated structure adjacent to the County Police facility, to pass over both Cherokee Street and North Marietta Parkway. From this point northward, the Alternative 3 Marietta Branch conceptual configuration and alignment is identical to Alternative 1 all the way northward through the Kennestone Hospital complex to its rejoining

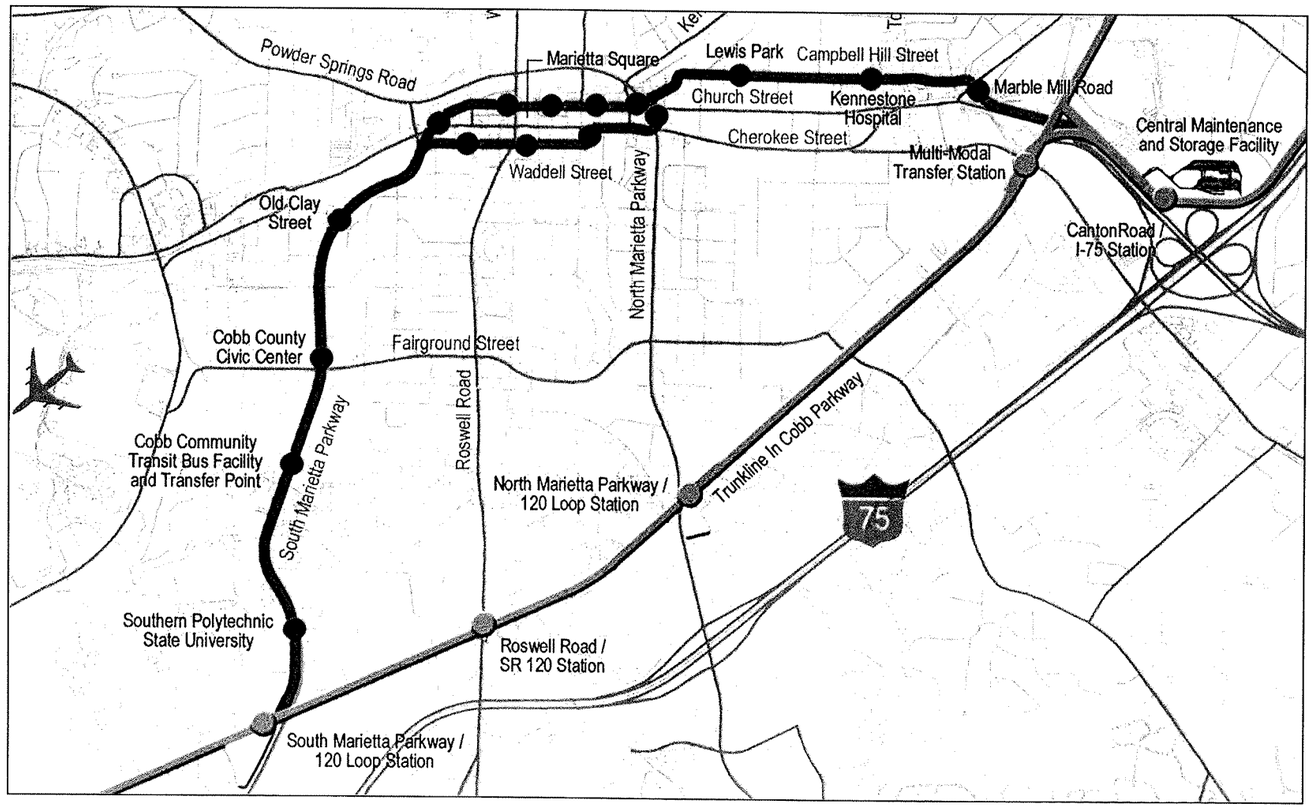


Figure 12-3 Marietta Branch Alternative 3

with the Trunkline east of the Canton Road/I-75 Trunkline Station (see Subsection 12.1.1)

Southbound Track Divergence

In the southbound direction from the Brumby Loft Apartment parking lot, where the elevated double track structure diverges, the line's conceptual configuration and alignment along Church Street and Powder Springs Street is identical to those of Alternative 1.

Characteristics Summary – Alternative 3			
Total Length Point to Point:			**4.46 miles**
Trackage – Miles			
	At-Grade	Elevated	Total
Double-Track	2.54	0.98	3.52
Single-Track	1.21	0.58	1.79
Total:	3.75	1.56	5.31
Total Number of Stations:			**16**
Double Track Stations:			
At-Grade Side Platform			7
Single-track Stations:			
At-Grade Single Side Platform			7
Elevated or Retained Fill Single Side Platform			2

12.1.4 Alternative 4 – The Church and Alexander/Lawrence Streets Alignment

Alternative 4 is 4.56 miles long and provides 18 stations. Characteristics are shown schematically in Figure 12-4, summarized at the end of this subsection, and depicted in Drawings MB-10, MB-11, and MB-12 in Volume II.

Alternative 4 begins immediately north of the South Marietta Parkway/120 Loop Trunkline Station. Its conceptual configuration and alignment is identical to Alternative 1 until just beyond the station at Old Clay Street, where the Branch's alignment would ascend on an elevated double track structure to cross over South Marietta Parkway. Once across the Parkway, the double-track alignment would descend into the right-of-way of Alexander Street. At this point the transit vehicles would begin bi-directional mixed-traffic operation, utilizing the same roadway lanes as the vehicular traffic. As the rail alignment traverses northward along Alexander Street, two at-grade side platform stations would be provided, one mid-way between Frasier and Waterman Streets, and the other adjacent to the Cobb County Public Library (central library and headquarters), on the south side of Roswell Street. The double-track at-grade rail alignment would continue northward across Roswell Street to Lawrence Street, where it would turn left in a westerly direction. An at-grade side platform station would be provided in Lawrence Street adjacent to the U.S. Post Office.

Northbound Track Divergence

The Branch's alignment would continue westerly to Waddell Street, where it would again turn north in the Waddell Street alignment and include a station located midway between Hansell and Dobbs Streets. As the rail alignment traverses northward along Waddell Street and onto Cherokee Street, an additional station stop would be provided within the at-grade parking lot alongside Cherokee Street, between Lemon Street and Forest Avenue.

The transition of the single-track alignment from Waddell Street to Cherokee Street would take place in an "S-curve" configuration north of Lemon Street, through the surface level parking lot adjacent to Cherokee Street, to a station located between Forest Avenue and Blackwell Lane.

North of Blackwell Lane, the single track would ascend onto an elevated structure adjacent to the County Police facility, to pass over both Cherokee Street and North Marietta Parkway. From this point northward, the Alternative 4 Marietta Branch conceptual configuration and alignment is identical to Alternative 1, all the way northward through the Kennestone Hospital complex to its rejoining with the Trunkline southwest of the Canton Road/I-75 Trunkline Station (see Subsection 12.1.1).

Southbound Track Divergence

In the opposite direction, southbound from the Brumby Loft Apartment parking lot, where the elevated double track structure diverges, Alternative 4's southbound configuration and alignment along Church Street are identical to that for Alternative 1, until it reaches Marietta Square.

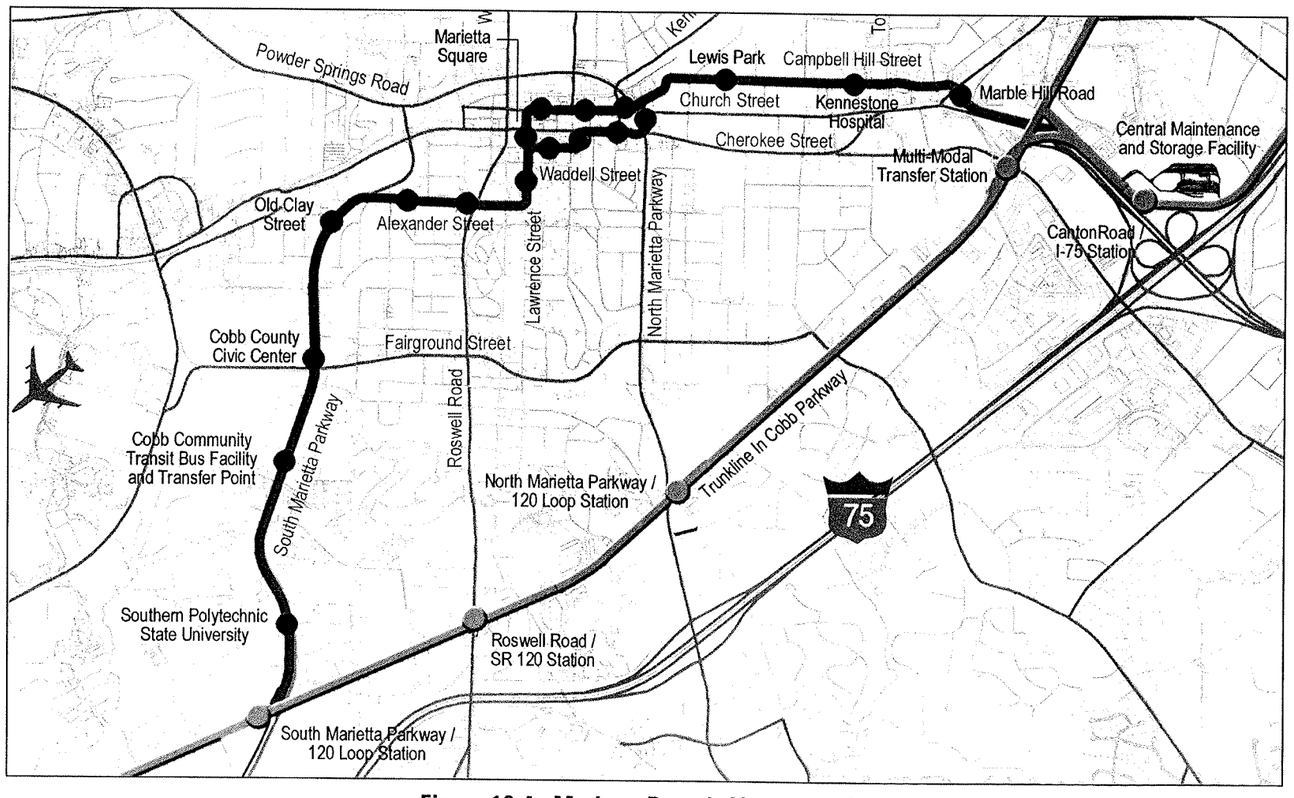


Figure 12-4 Marietta Branch Alternative 4

Just beyond the station located between Hansell Street and North Park Square Street, immediately north of Marietta Square, the single-track at-grade alignment would turn left in an easterly direction onto North Park Square Street. This difficult turn would require a full stop of all vehicular traffic (in all directions); in addition, both traffic signalization and stopping distances from the intersection would require redesign in order to accommodate this rail vehicle turning movement. The Branch would continue in an easterly direction across Cherokee Street to Lawrence Street, and further across Waddell Street, where the southbound track would converge with the northbound track in Lawrence Street. A single side platform station would be provided along the single-track alignment between Cherokee and Waddell Streets. The continuation of the southbound alignment along Lawrence Street, onto Alexander Street and further across South Marietta Parkway would be as described earlier in this subsection.

Characteristics Summary – Alternative 4			
Total Length Point to Point:			**4.56 miles**
Trackage – Miles			
	At-Grade	Elevated	Total
Double-Track	2.84	1.17	4.01
Single-Track	0.80	0.29	1.09
Total:	3.64	1.46	5.10
Total Number of Stations:			**18**
Double Track Stations:			
At-Grade Side Platform			9
Elevated or Retained Fill Center Platform			1
Single-track Stations:			
At-Grade Single Side Platform			6
Elevated or Retained Fill Single Side Platform			2

12.2 ADVANTAGES AND DISADVANTAGES OF THE FOUR ALTERNATIVES

When the City of Marietta requested that the Bechtel/MSE Team present a number of potential alternative transit alignments through the City, it was determined that the Team should not recommend any one alternative. The Team would evaluate advantages and disadvantages, offer technical and subjective judgements, and draw cost comparisons, with the understanding that the ultimate selection of a specific rail alignment through the City will be greatly influenced by the public policy direction established by the elected City officials and community and business leaders, as well as the citizens at large.

Each alternative has its advantages, and each has elements that may work in combination with those of other alternatives. Further detailed study could result in a combination of elements such as:

- Follow Alternative 1 along South Marietta Parkway, over North Marietta Parkway and past the Brumby Loft Apartments on their east side, but then, instead of continuing northward on Campbell Hill Street, the transit rail alignment could shift westerly, and parallel the CSX Railroad northward as described in Alternative 2. It is believed that this could be accomplished without relocating the CSX Railroad.
- Follow Alternative 2 along South Marietta Parkway, over North Marietta Parkway and past the Brumby Loft Apartments on their west side, but then, instead of continuing to follow the CSX Railroad alignment northward, the transit alignment could shift easterly into the Campbell Hill Street right-of-way and proceed northward as in Alternative 1.

To assist in the evaluation of alternatives, information and general observations regarding the advantages and disadvantages of each of the four alternatives are presented in the following subsections. The observations address only those segments of the alternative Branch alignments that vary from one alternative to the other; the alignment common to all four alternatives (along South Marietta Parkway) is not discussed.

12.2.1 Alternative 1 – The Church and Cherokee Streets Alignment

Ridership Convenience – Patron Catchment

Alternative 1 provides excellent convenience to the city's CBD and Marietta Square, with its balanced routing of LRT trains northbound on Atlanta Street/Cherokee Street and southbound on Church Street/Powder Springs Street. This alternative provides concentrated service both to the CBD and to residential origins and destinations primarily north of North Marietta Parkway, both east and west of Campbell Hill Street.

Operational Considerations

From South Marietta Parkway, through the CBD, across North Marietta Parkway through the Kennestone Hospital complex, Alternative 1 calls for the operation of the transit vehicles in street rights-of-way and thus, mixed-traffic conditions. In heavy traffic conditions, the schedule of the train service can be negatively impacted, as is also the case with both Alternatives 3 and 4. Only Alternative 2, with much of its at-grade alignment running parallel to the CSX Railroad trackage (thus not in mixed-traffic conditions), can be expected to provide more timely service resulting from the separation of much of its alignment from street traffic.

Impact to Vehicular Traffic

Joint use of Atlanta Street/Cherokee Street, Church Street/Powder Springs Street, and Campbell Hill Street by both the transit vehicles and regular street traffic will place both forms of transportation in the same public rights-of-way. Each mode will be required to make way for the others' movements and stops, and each will cause delays. This, in turn, will necessitate signalization modifications and improvements to accommodate the joint use. However, this type of mixed-traffic operation (transit vehicles, trams and/or trolley cars, and regular street traffic) has widespread historical precedent and there are hundreds of current successful examples in the U.S. and in Europe that are quite similar to Alternative 1.

Acquisition of Land

Very little land acquisition is foreseen for Alternative 1. The exact requirements would be determined during the Preliminary Engineering work. Examples of conditions where land may need to be acquired would include the widening of a street to accommodate the rail trackage (possibly Campbell Hill Street), or the acquisition of small areas to enable the construction of elevated track structures passing over South Marietta Parkway or North Marietta Parkway.

Impact to Public Parking at Street Level

The key consideration here is the street level parking along the east side of Atlanta Street/Cherokee Street, and the parking along the west side of Church Street/Powder Springs Street. The recommended placement of the tracks in these street rights-of-way would either be along the far right, necessitating the removal of the parking spaces along those sections of the above noted streets, or the tracks could be placed in the right vehicular travel lane, immediately to the left of the parking lane. The disadvantage of this arrangement is obviously the conflicts that would be created between the transit vehicles and street traffic pulling into or out of the curbside parking.

These placements in either of the two right lanes are recommended, given the loading and unloading requirements of the transit vehicles as well as the need to accommodate the faster traffic in the left through lanes. A combination of both conditions could ultimately be

recommended. In all probability, however, considerable impact to street level parking on the subject streets between South Marietta Parkway and North Marietta Parkway can be expected.

12.2.2 Alternative 2 – The CSX Railroad Joint-Use Alignment

Ridership Convenience – Patron Catchment

Alternative 2 provides good service to the city's CBD and Marietta Square; however, with its westerly orientation, convenience to the City and County court and office facilities along Cherokee and Waddell Streets is not quite as good as the other three alternatives. Similar to Alternative 1, it does not provide convenient service to the residential neighborhoods southeast of the CBD, nor does it serve the residential areas along Campbell Hill Street, Church Street and Cherokee Street very well. However, Alternative 2 does provide better service to the residential areas along Roselane Street and Kennesaw Avenue as far as slightly north of Jordan Street.

This alternative provides a more westerly concentration of service to the city's CBD, while providing service to residential origins and destinations primarily northwest of North Marietta Parkway.

Operational Considerations

Alternative 2 has much of its at-grade alignment running parallel to the CSX Railroad trackage and not in mixed-traffic conditions. Because of the separation of much of its alignment from street traffic, this alternative can be expected to provide more timely service. In this regard, Alternative 2 is superior to the other three alternatives.

Impact to Vehicular Traffic

Of the four alternatives, Alternative 2 would have the least impact on surface vehicular traffic. With the exception of crossing movements, the Alternative 2 rail alignment would be separated from surface vehicular traffic from the point of its divergence from the Trunkline just north of the South Marietta Parkway/120 Loop Station, all the way to its convergence into the Campbell Hill Street right-of-way adjacent to Kennestone Hospital.

Acquisition of Land

In order to implement this alternative, the CSX Railroad trackage would need to be relocated westward by a minimum of fifty feet from south of Waverly Way to somewhat north of the Brumby Loft Apartment complex. Therefore, the acquisition of the required land to accommodate both the CSX Railroad trackage and the two tracks for the Marietta Branch is a significant factor. Such relocation would require the full cooperation of the CSX Railroad.

Impact to Public Parking at Street Level

Of the four alternatives, Alternative 2 would have the least impact to street level public parking; its implementation would require the removal of very few parking spaces.

12.2.3 Alternative 3 – The Church and Waddell Streets Alignment

Ridership Convenience – Patron Catchment

Alternative 3 provides excellent convenience to the city's CBD and Marietta Square, with its balanced routing of LRT trains northbound on Waddell Street/Cherokee Street and southbound on Church Street/Powder Springs Street. This alternative is quite similar to Alternative 1, but its routing along Waddell Street provides somewhat better convenience to patrons living and working both along and west of Waddell Street. Those employed in the various City and County court and office buildings would benefit particularly, and there would be only a slight resulting loss of convenience for those along Cherokee Street.

Alternative 3 would provide concentrated service to the city's CBD and would provide somewhat better convenience to residents south of Roswell Street and east of Waddell Street than would Alternative 1. Alternative 3 provides the same level of service to residential origins and destinations north of North Marietta Parkway (both east and west of Campbell Hill Street), as does Alternative 1.

Operational Considerations

From South Marietta Parkway, through the central business district, across North Marietta Parkway through the Kennestone Hospital complex, Alternative 3 calls for the operation of the transit vehicles in street rights-of-way and thus, mixed-traffic conditions. In conditions of heavy traffic, the schedule of the train service can therefore be negatively impacted, as is also the case with both Alternatives 1 and 4. Only Alternative 2, with much of its at-grade alignment running parallel to the CSX Railroad trackage and thus not in mixed-traffic conditions, can be expected to provide more timely service resulting from the separation of much of its alignment from street traffic.

Impact to Vehicular Traffic

Joint use of Waddell Street/Cherokee Street, Church Street/Powder Springs Street, and Campbell Hill Street by both the transit vehicles and regular street traffic places both forms of transportation in the same public rights-of-way. Each mode will be required to make way for the others' movements and stops, each will cause delays, and signalization modifications and improvements to accommodate this joint use will need to be implemented. It has also been suggested that the use of Waddell Street might be modified if a rail alignment were to be included within that street. Waddell Street could potentially be restricted to the use of rail vehicles, emergency vehicles, buses and taxis, at least in the segment north of Roswell Street, in order to improve the operational conditions for the single-track, northbound transit vehicles.

Acquisition of Land

Very little land acquisition is foreseen for Alternative 3. The exact requirements would be determined during the Preliminary Engineering work. Examples of conditions where land may need to be acquired would be for the widening of a street to accommodate the light rail transit trackage (possibly along Campbell Hill Street) as the rail alignment traverses through the "S-curve" north of Lemon Street from Waddell Street into Cherokee Street, or for the acquisition of small areas to enable the construction of elevated track structures passing over South Marietta Parkway or North Marietta Parkway.

Impact to Public Parking at Street Level

The key consideration here is the street level parking along the west side of Church Street/Powder Springs Street. The recommended placement of the tracks in the street right-of-way would either be along the far right, necessitating the removal of the parking spaces along those sections of the street, or the tracks could be placed in the right vehicular travel lane, immediately to the left of the parking lane. The disadvantage of this arrangement is obviously the conflicts that would be created between the transit vehicles and street traffic pulling into or out of the curbside parking.

There would be no impact to street level parking along the northbound single-trackage because parking is not permitted along Waddell Street or along the segment of Cherokee Street north of Forest Avenue.

12.2.4 Alternative 4 – The Church and Alexander/Lawrence Streets Alignment

Ridership Convenience – Patron Catchment

Alternative 4 provides a reduced level of service to the City's CBD and Marietta Square, when compared to the other three alternatives. However, it provides far greater convenience to the residential neighborhoods east and west of Alexander Street, plus adjacent access to two key community facilities: the Cobb County Public Library (Central Library and Headquarters), and the U.S. Post Office on Lawrence Street. It should also be pointed out that Alternative 4 provides greater convenience for the residents along Washington Avenue, and Lawrence, Fort, and Lemon Streets in the neighborhoods east of the U.S. Post Office.

Alternative 4 would provide reduced service to the sector of the City's CBD located south of South Park Square Street. However, Alternative 4 would probably provide the best service to transit dependent neighborhoods east and west of Alexander Street, and north of Washington Avenue east of the U.S. Post Office. Similar to Alternatives 1 and 3, this alternative also provides good service to residential origins and destinations north of North Marietta Parkway, both east and west of Campbell Hill Street.

Operational Considerations

Through the CBD from South Marietta Parkway to North Marietta Parkway and along Campbell Hill Street through the Kennestone Hospital complex, Alternative 4 calls for the operation of the transit vehicles in street rights-of-way and mixed-traffic conditions. In heavy traffic conditions, the schedule of the train service can be negatively impacted, as is also the case with both Alternatives 1 and 3. Only Alternative 2, with much of its at-grade alignment running parallel to the CSX Railroad trackage, where it is separated from street traffic, can be expected to provide more timely service.

Impact to Vehicular Traffic

Joint use of Alexander Street/Lawrence Street/Waddell Street/Cherokee Street, Church Street/Powder Springs Street, and Campbell Hill Street by both the transit vehicles and regular street traffic will place both forms of transportation in the same public rights-of-way. Each mode will be required to make way for the others' movements and stops and each will cause delays, necessitating modifications and improvements to accommodate joint use. However, Alexander Street is not a heavily used street, so the impact of mixed-traffic would be less, and Lawrence Street is quite wide and also less traveled. The incorporation of a rail alignment into Lawrence Street in a mixed-traffic bi-directional configuration would have, in the Team's opinion, only moderate impact on traffic.

Acquisition of Land

Very little land acquisition is foreseen for Alternative 4. The exact requirements would be determined during the Preliminary Engineering work. Examples of conditions for which land may need to be acquired would include the widening of a street to accommodate the light rail transit trackage (possibly Alexander Street), or the acquisition of small areas to enable the construction of elevated track structures passing over South Marietta Parkway or North Marietta Parkway.

Impact to Public Parking at Street Level

The key consideration is the street level parking along the west side of Church Street, south to North Park Square Street. The recommended placement of the tracks in this street right-of-way would either be along the far right, necessitating the removal of the parking spaces along the street, or in the right vehicular travel lane, immediately to the left of the parking lane. The disadvantage of this arrangement is the conflicts that would be created between the transit vehicles and street traffic pulling into or out of the curbside parking.

However, minimal impact is foreseen to the limited parking along Alexander Street, Lawrence Street, and Waddell Street. Of the four alternatives, only Alternative 2 has less impact to street level parking along its alignment.

12.3 PATRONAGE FORECAST

The Cobb County Transportation Model (CCTM), documented in Section 4 and Appendix 3, was applied to develop a representative forecast of potential transit patronage for LRT branch service to the city of Marietta.

The following assumptions were used:

- A general alignment and approximate station locations were assumed for the four study alternatives. The line would operate as a "through" service beginning at the Chastain Road/I-575 Station, continuing south and branching from the Trunkline to serve stations within the city of Marietta, including Marietta Square, and rejoining the Trunkline to continue south to Windy Ridge Parkway/Herodian Way Transfer Station.
- Connecting transit services were based on transit systems identified under the Build/Ultimate System Alternative (described in Section 4). These include the full LRT system comprising the Trunkline extending from Chastain/I-575 and Barrett Parkway to the MARTA Arts Center Station in Atlanta, and the complete Cumberland and Town Center Area Circulators (described in Section 3).
- The vintage trolley car service described in Subsection 12.4 was not included as a connecting transit service.
- Growth was based on year 2025 adjusted socioeconomic projections of population, households, and employment (documented in Section 2). These projections are based on a detailed inventory of existing and planned land use within the two CIDs and modest shifting of some ARC projected growth from other areas in Cobb County to within the CIDs.

These forecast results for the Marietta Branch service are only a first step in assessing the patronage potential for LRT service. More detailed evaluation of service options and connecting bus services within the city of Marietta should be performed in the future, including consideration of potential connecting regional LRT service currently under study for the Marietta-Lawrenceville corridor.

Table 12-1 presents a summary of the patronage forecasts for LRT service to the city of Marietta. The data shows weekday transit boarding for year 2025 for the Ultimate System with and without LRT service through the center of the city of Marietta.

Patronage forecasts indicate that, on a weekday, about 6,900 riders would use the Marietta Branch service. About 1,200, or about 18 percent, of these trips would occur during the A.M. 2-hour peak period.

These forecasts also indicate that the Marietta Branch, given that it serves some of the same Trunkline stations, would attract some passenger trips forecast on the Trunkline without service to the center of the city of Marietta. Other new passenger trips would be generated by the greater connectivity of the Northwest Corridor LRT System as a whole. Therefore, the net increase in overall transit patronage, combined on these systems, is approximately 8,700 weekday riders with the addition of the Marietta Branch service.

To some extent, these patronage forecasts can be compared to forecasts for a new 5-mile extension to the LRT system in the city of Portland Oregon, which is expected to yield an additional 7,500 weekday riders in year 2020. The Portland Airport Max Project would serve an expanding international airport and new development in stations near the airport.

The patronage potential of the Marietta Branch service may be significantly higher with refined land use assumptions, station locations, fare assumptions, connecting bus service, park-and-ride, and other factors. It is recommended that, during the formal Alternatives Analysis, the Marietta Branch service be included in the analysis for further refinement of the patronage forecast.

Table 12-1
Weekday Transit Boarding for Ultimate System without Marietta Branch Service and with Marietta Branch Service, Year 2025

LRT Service	Ultimate System without Marietta Branch	Ultimate System with Marietta Branch
Weekday		
Marietta Branch	-	**6,870**
Trunkline	76,970	79,120
Cumberland Circulator	57,080	57,375
Town Center Area Circulator	16,020	16,120
Total	**150,070**	**159,485**
A.M. Peak (2-hour)		
Marietta Branch	-	**1,230**
Trunkline	15,815	16,255
Cumberland Circulator	11,210	11,475
Town Center Area Circulator	2,865	2,880
Total	**29,890**	**31,840**

As may be observed above in Table 12-1, addition of the Marietta Branch will increase the overall ridership of the to the Northwest Corridor LRT System as a whole due to the greater connectivity that it will bring to the system. In particular, the Marietta Branch will add to the ridership of the Trunkline and the Cumberland Circulator as passengers take advantage of new transfer options in order to connect potential trip ends. In summary, in addition to attracting almost 6,900 riders on the Marietta Branch, per se, its inclusion in the network will generate approximately 2,150 new riders to the Trunkline as well. In the absence of the Marietta Branch, the vast majority of these new riders would probably be driving their automobiles or not making the trips at all.

12.4 OPERATIONS PLAN AND TECHNOLOGY CONSIDERATIONS

This is a conceptual operations plan for a Marietta Branch that diverges from the Trunkline, loops through the central business district of the city of Marietta and then rejoins the Trunkline. Its purpose is to identify the type of transit service that would be provided on the Marietta Branch; the proposed frequency of service and the latter's adequacy to accommodate projected peak-hour ridership demands; the type and quantity of rolling stock required to operate the services proposed; and the implications of the proposed operating plan with respect to the basic transit system discussed in the main body of this Final Report. Inevitably, in order to be comprehensive and based upon sound logic, this section must readdress and re-examine some of the operational assumptions, conceptual designs, and technology selection issues discussed previously in this report. Nevertheless, the goal of this section is to deliver an operations plan and technology recommendation for the proposed Marietta Branch that is fully compatible with that presented elsewhere in this Final Report.

Of necessity, the development of this operations plan and technology selection recommendation had to take into account the fact that a light rail transit line between Marietta and Lawrenceville is being studied under the auspices of the Atlanta Regional Commission concurrently with this *Transit Implementation Study*. For the purposes of this Final Report, it is assumed that the ARC will direct their study team to proceed into Phase II of the work scope utilizing Alternative D as the preferred alignment. Conceptually, that LRT project's alignment would diverge from the Trunkline in Cumberland and continue east within the I-285 corridor via the Perimeter Center to Lawrenceville. Preliminary results from the Marietta to Lawrenceville Study indicate that there is sufficient demand in the I-285 corridor to warrant serious consideration of an LRT service with a Marietta Square-Cumberland Mall/Galleria-Perimeter Center-Lawrenceville routing. This possibility is of strong interest to the City of Marietta and, therefore, has been developed as a conceptually practical expansion of a Northwest Corridor LRT Trunkline branch serving the central business district of Marietta.

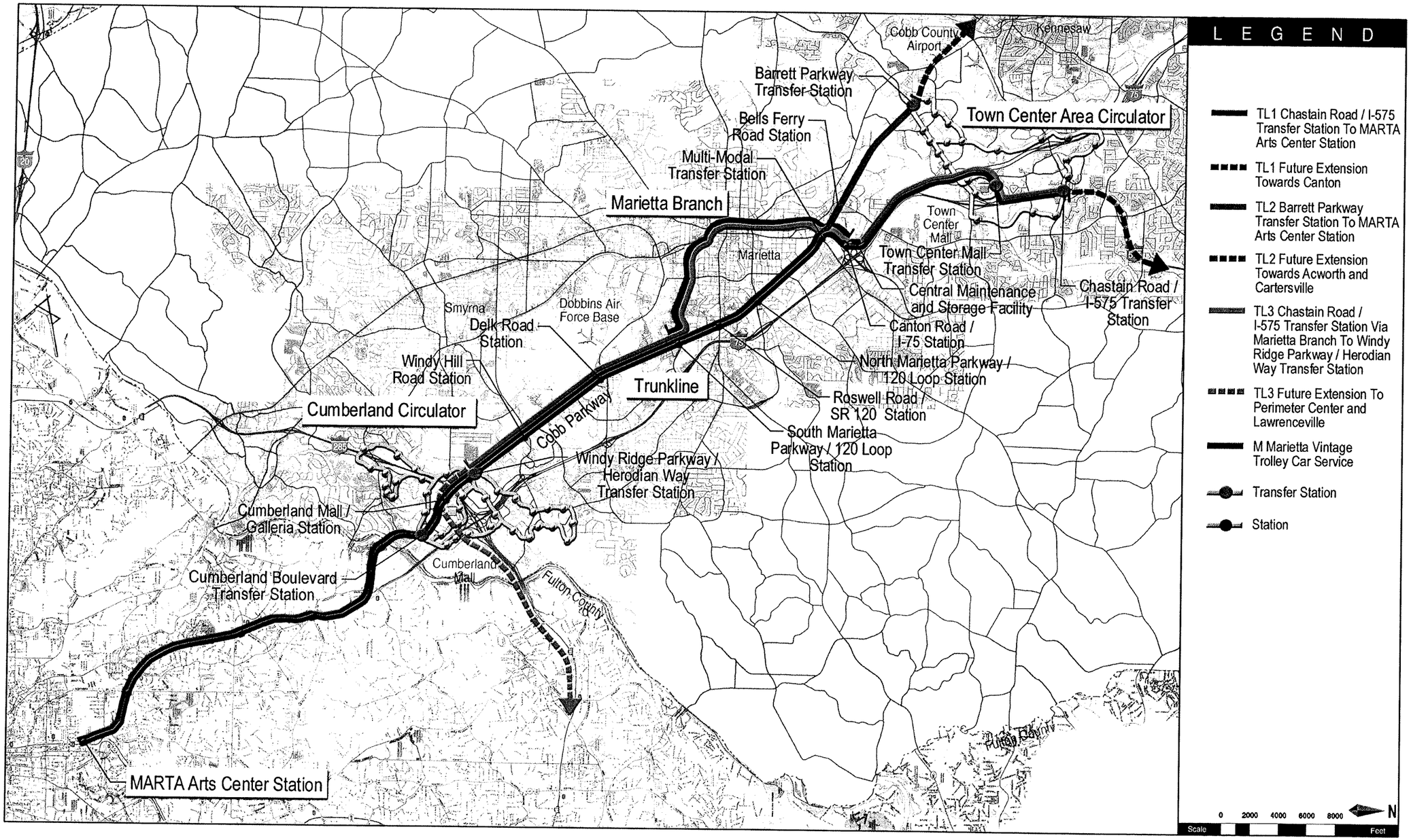
The operations plan for the Marietta Branch assumes that it will be operated as two services, described as follows:

- **Trunkline Route TL3**, beginning at the Chastain Road/I-575 Transfer Station and continuing via the Town Center Mall, Canton Road/I-75, Kennestone Hospital, Marietta Square, Cobb County Civic Center, Southern Polytechnic State University and South Marietta Parkway/120 Loop Stations to an interim southern terminal at the Windy Ridge Parkway/ Herodian Way Transfer Station (including intermediate stations or stops on both the Marietta Branch and the Trunkline). Upon completion of a connection between the Trunkline and the Marietta to Lawrenceville LRT Line in the vicinity of Cobb Parkway and Akers Mill Road, the TL3 service would be extended to serve the Cumberland Mall/Galleria, Perimeter Mall and Lawrenceville Stations (plus intermediate stations not presently identified).
- **Marietta Vintage Trolley Car Service (Route M),** beginning at the Canton Road/I-75 Station of the Trunkline, diverging onto the Marietta Branch to serve all intermediate stops (including Kennestone Hospital, Marietta Square, Cobb County Civic Center, and Southern Polytechnic State University) and then rejoining the Trunkline to terminate at its South Marietta Parkway/120 Loop Station. The proposed vintage trolley car service would be operated as an overlay to the TL3 service, perhaps with its hours of operation restricted to mid-day and weekend or holiday periods when additional local passenger-carrying capacity may be required if the introduction of LRT service to downtown Marietta stimulates further commercial and cultural reinvigoration of the historic commercial and governmental center of Cobb County.

The train services that would operate on the Trunkline and the Marietta Branch when the Ultimate System configuration is achieved are shown in Figure 12-5. That figure also illustrates the potential for future expansion of the Northwest Corridor LRT System east into Fulton County, northeast into Cherokee County and northwest into Bartow County.

A schematic track plan for the Marietta Branch is shown in Figure 12-6.

In summary, the operations plan for the Marietta Branch establishes a requirement for expanding the Trunkline fleet of interurban type LRVs by 10 cars of the type described in this report (subject to further augmentation upon completion of the Marietta to Lawrenceville LRT Line) and six replica Georgia Railway and Power



Bechtel Infrastructure Corporation

MSE Mayes, Sudderth, & Etheredge Inc.
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St. Marys, GA / Myrtle Beach, SC

FIGURE 12-5 ULTIMATE SYSTEM TRUNKLINE AND MARIETTA BRANCH ROUTE MAP

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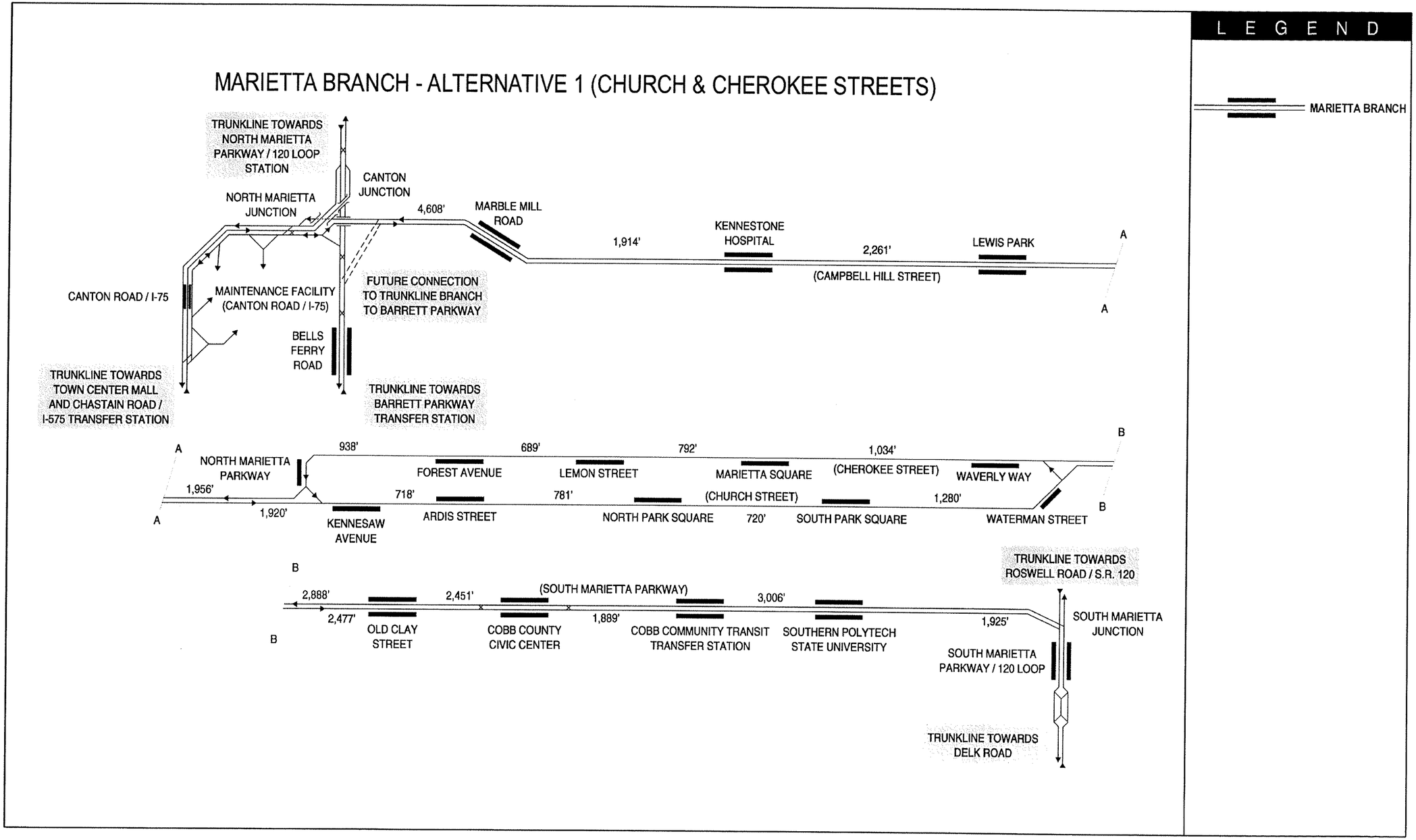

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FIGURE 12-6 MARIETTA BRANCH - ALTERNATIVE 1

Transit Implementation Study

Company interurban cars for use on the Marietta Vintage Trolley Car Service. As with the rest of the Trunkline fleet and the urban type LRVs required for the Cumberland and Town Center Area Circulators, the rolling stock required for the Marietta Branch will be maintained and stored overnight at the central maintenance and storage facility located immediately north of the Canton Road/I-75 Station.

12.4.1 Patronage Forecasts and Operations Plan Development

A conceptual system operations plan has been developed for a fixed guideway transit system using light rail transit technology, referred to as the Northwest Corridor Light Rail Transit (LRT) System, to serve the demand forecast identified in Section 4 and Section 12.3 of this Final Report. The System Operations Plan is based on technical assumptions regarding systems elements, desired service characteristics, and rolling stock designs that have been selected to meet the specific needs of the entire LRT System.

As part of this effort, new daily, peak period, and peak load point/peak direction passenger volumes for the Northwest Corridor LRT System (including the Marietta Branch) have been developed, using the Cobb County Transportation Model. The daily volume on the Marietta Branch is forecast at approximately 6,900 passengers per day; the maximum load past the peak load point is forecast at about 740 passengers during the peak hour. This demand forecast was based on a modeling assumption that the Marietta Branch would be served by a through service that would begin (in the northbound direction) at the Windy Ridge Parkway/Herodian Way Transfer Station in Cumberland, follow the Trunkline north to its South Marietta Parkway/120 Loop Station, then diverge to the west along South Marietta Parkway/120 Loop to serve stations at Southern Polytechnic State University, CCT Transfer and the Cobb County Civic Center, continue through the Marietta Square area, turn north to serve Kennestone Hospital, and rejoin the Trunkline south of its Canton Road/I-75 Station. After rejoining the Trunkline, it would continue north via the Town Center Mall Transfer Station to the Chastain Road/I-575 Transfer Station, where it would terminate.

Accordingly, for the development of this operations plan, the assumption was made that a seamless through service will be operated between the Trunkline and the Marietta Branch. It does not, however, attempt to make adjustments for increases in the ridership forecasts that might develop at Trunkline stations as a result of more frequent service being provided nor on what the effects would be on overall ridership on the Northwest Corridor LRT System induced through connectivity factors if its services were to be coordinated with those of the proposed Marietta to Lawrenceville Line extending from Cumberland to Perimeter Center and Lawrenceville.

12.4.2 Marietta Branch Configuration Adopted for Operations Plan Development

The Marietta Branch would diverge (in the northbound direction) from the Trunkline north of its South Marietta Parkway/120 Loop Station and rejoin the Trunkline south of its Canton Road Connector/I-75 Station. Several possible alignments through the City of Marietta are discussed within Subsection 12.1, none of which are assumed to have been chosen as the preferred alignment at this juncture. Nevertheless, in order to develop this operations plan, it was necessary to select one of them as its tentative basis.

Because of its relative simplicity and without any preference or ranking intended, Alternative 1 (mixed traffic running through the center of Marietta along Church and Cherokee Streets), was selected to be the basis upon which the operations plan would be developed.

Alternative 1 would begin with a flat junction with the Trunkline (called South Marietta Junction on the Marietta Branch Track Plan Schematic), would continue west along the south side of South Marietta Parkway to the vicinity of Alexander Street; would rise onto an elevated structure to pass over South Marietta Parkway and descend on its north side and split into parallel one-way alignments in Cherokee Street (northbound) and Church Street (southbound) in mixed traffic lanes; would rise again onto elevated structures to fly over North Marietta Parkway and Church Street (northbound track only); pass to the east side of the Brumby Loft apartment complex; would traverse Campbell Hill Street bi-directionally in mixed traffic lanes, stopping en route at Kennestone Hospital; would cross Marble Mill Road and the Church Street Extension; would ascend onto a retained fill and then pass over Cobb Parkway on a bridge and terminate at a grade-separated junction with the Trunkline (called North Marietta Junction on the Marietta Branch Track Plan Schematic) located immediately northeast of the Canton Road Connector/Cobb Parkway overpass and interchange ramps.

Northbound, Alternative 1 would be 4.46 miles long and serve 12 stations or stops, seven of which it would share with southbound trains. Southbound, Alternative 1 would be 4.38 miles long and serve 12 stations, five of which would be located along Church Street and be served only by southbound trains.

12.4.3 Stations Served by the Marietta Branch Trunkline TL3 and Marietta Vintage Trolley Car Services

In the initial stages of operation of the Northwest Corridor LRT System (prior to completion of the Marietta to Lawrenceville LRT Line), the stations on the Trunkline and the Marietta Branch to be served by the TL3 light rail transit service and the Marietta Vintage Trolley Car Service, are listed in Table 12-2.

As a result of the provision of through one-seat service, passengers using the Marietta Branch (TL3) trains who wish to transfer to or from Trunkline (TL1 and TL2) trains using the main line services via the Roswell Street Station (The Big Chicken), would be able to do so at the South Marietta Parkway, Delk Road, or Windy Hill Road Stations, or at the Windy Ridge Parkway/Herodian Way Transfer Station. At the latter station, Marietta Branch passengers also would be able to transfer directly to each of the three Cumberland Circulator services that would be operated as part of the Ultimate System (to Route A – Central Loop, Route B – Cumberland Mall/Wildwood/Herodian Way Loop or Route C – Galleria Link/Home Depot Loop). Similarly, the provision of through one-seat LRT service would permit passengers to make direct transfer connections at the Town Center Mall Transfer and the Chastain Road/I-575 Transfer Stations between the Marietta Branch (TL3) service and both of the Town Center Area Circulator services that would be operated as part of the Ultimate System (Route D –Main Loop and Route E – Kennesaw State University/Town Center Mall Transfer Station Line).

12.4.4 Desired Service Characteristics for the Marietta Branch

The following basic assumptions were made concerning service characteristics deemed desirable for a Marietta Branch of the Northwest Corridor LRT System:

- **Marietta Branch (TL3) LRT Service**. Civil design and rolling stock performance characteristics to provide a commercial speed (schedule speed including intermediate station stops) as follows:
  - 35 miles per hour (mph) along the Trunkline between terminals at the Windy Ridge Parkway/Herodian Way Transfer Station and South Marietta Junction (located immediately north of the South Marietta Parkway/120 Loop Station) and again between the Marble Mill Road Station and the Chastain Road/I-575 Transfer Station (including Trunkline trackage north of North Marietta Junction).

Table 12-2
Marietta Branch – List of Stations Served and Distances by Service

Marietta Branch Through LRT and Vintage Trolley Car Services			Cumulative for Through LRT Service	Cumulative for Vintage Trolley Car Service
Station No.	Station Name	Distance from Last Station (Feet)	Cumberland Area to Town Center Area (Feet)	Within City of Marietta (Feet)
TL-3	Windy Ridge Pkwy/Herodian Way Transfer Station	0	0	N/A
TL-4	Windy Hill Road Station	5,950	5,950	N/A
TL-5	Delk Road Station	8,220	14,170	N/A
TL-6	South Marietta Pkwy/120 Loop Station	8,000	22,170	0
MB-1	Southern Polytechnic State University Station	1,925	24,095	1,925
MB-2	Cobb Community Transit Transfer Station	3,006	27,101	4,931
MB-3	Cobb County Civic Center Station	1,889	28,990	6,820
MB-4	Old Clay Street Station	2,451	21,441	9,271
MB-5/13	Waverly Way/Waterman Street Stations	2,888	34,329	12,159
MB-6/14	Marietta Square/South Park Square Stations	1,034	35,363	13,193
MB-7/15	Lemon Street/North Park Square Stations	792	36,155	13,985
MB-8/16	Forest Ave/Ardis Street Stations	689	36,844	14,674
MB-9/17	North Marietta Pkwy/ Kennesaw Avenue Stations	938	37,782	15,612
MB-10	Lewis Park Station	1,956	39,738	17,568
MB-11	Kennestone Hospital Station	2,261	41,999	19,829
MB-12	Marble Mill Road Station	1,914	43,913	21,743
TL-9	Canton Road/I-75 Station	4,608	48,521	26,351
TL-10	Town Center Mall Transfer Station	17,565	66,086	N/A
TL-11	Chastain Road, I-575 Transfer Station	7,610	73,696	N/A
Totals in Feet – Northbound Direction (Including Overlap with Trunkline)		**N/A**	**73,696**	**26,351**
Totals in Miles – Northbound Direction (Including Overlap with Trunkline)		**N/A**	**13.95**	**4.99**
Number of Stations Served in Each Direction, (Including Overlap with Trunkline)		**N/A**	**19**	**14**
Totals in Feet – Northbound Direction – (Marietta Branch Only – Junction to Junction)		**N/A**	**23,127**	**23,127**
Totals in Miles – Marietta Branch Only – Junction to Junction)		**N/A**	**4.38**	**4.38**
Number of Stations Served in Each Direction (Marietta Branch Only – Junction to Junction)		**N/A**	**12**	**12**

- 25 mph along the reserved track alignment primarily on the south side of South Marietta Parkway/ 120 Loop between the South Marietta Parkway/120 Loop Station and the Waverly Way/Waterman Street Station.
- 15 mph between the Waverly Way/ Waterman Street and Marble Mill Road Stations, where the Marietta Branch alignment would be located primarily in Church, Cherokee, and along Campbell Hill streets, where the LRT trains would share mixed traffic lanes with other road users including automobiles, motorcycles and trucks.

► **Marietta Vintage Trolley Car Service**. Civil design and rolling stock performance characteristics to provide a commercial speed (schedule speed including intermediate station stops) of:

- 35 mph on grade-separated Trunkline trackage between the Marble Mill Road Station and the Canton Road/I-75 Station (including Trunkline trackage north of North Marietta Junction).
- 25 mph along the reserved track alignment primarily on the south side of South Marietta Parkway/120 Loop between the South Marietta Parkway/120 Loop Station and the Waverly Way/Waterman Street Station.
- 15 mph between the Waverly Way/Waterman Street and Marble Mill Road Stations, where the alignment would be located primarily in Church, Cherokee, and Campbell Hill streets, where the LRT trains would share mixed-traffic lanes with other road users, including automobiles, motorcycles, and trucks.

A 2-car Marietta-bound train at the Carmichael stop, March 1, 1944, led by car 482, the "George W. Adair." *S.D. Maguire Photo, Bill Volkmer Collection*

► **Common Technology.** As an adjunct to the Trunkline, the Marietta Branch will employ a common guidance technology with the remainder of the System, as well as compatible traction power distribution and train control systems. Light rail vehicles (LRVs) assigned to the through service (TL3) must be designed for operation on both of these elements of the Northwest Corridor LRT System. Similarly, the replica Georgia Railway and Power Company interurban cars acquired for the Marietta Vintage Trolley Car Service must be capable of sharing the Marietta Branch trackage with the LRVs in revenue service and operating over Trunkline trackage to and from the central maintenance and storage facility to be located adjacent to the Canton Road/I-75 Station. Adherence to this criteria will permit all of the rolling stock of the Northwest Corridor LRT System to be maintained and stored overnight in one location, permitting significant economies compared to providing separate facilities for each element of the system (Trunkline, Cumberland Circulator, Town Center Area Circulator, and Marietta Branch).

12.4.5 Rolling Stock Performance Requirements and General Characteristics

The operations plan for the Ultimate System including the Marietta Branch assumes that its rolling stock fleet will consist of four types of vehicles, three types of modern light rail vehicles (LRVs) and replicas of interurban cars that once served Marietta.

12.4.5.1 Light Rail Vehicles

The three types of light rail vehicles would have performance and passenger carrying capacities appropriate to the different functional requirements of the Trunkline, the Marietta Branch and the two Circulators. To the greatest extent possible, the three types of vehicles would be of a modular design, using common components (such as carbody sections, articulation joints, trucks, air brake equipment, air conditioning units); their differences would be in areas such as overall length, traction motor size, gear ratio, seating arrangements, etc.

Specific features of the three types of conventional vehicles assumed are as follows:

► **Trunkline**. Interurban type LRVs with a range of 90 to 100 feet long with two carbody sections and two articulated joints. These vehicles would have 68 transverse seats (plus 2 wheelchair positions) and be able to comfortably stand up to

132 passengers (at the international comfort standard of 4 passengers per square meter) or a peak load capacity of 200 passengers. Maximum design speed would be 80 mph although maximum operating speed would be limited to 70 mph. Trunkline LRVs would have a nominal acceleration rate of 3.0 miles per hour per second (mphps) and be capable of achieving 70 mph within 60 seconds on level tangent track.

- **Marietta Branch**. A variation of the Trunkline interurban type LRVs would be acquired for Marietta Branch service. These cars would be equipped with raising and lowering steps (similar to those used on LRVs of the San Francisco Municipal Railway) permitting passengers to board and alight from either high level or low level platforms. The performance characteristics of the Marietta Branch LRVs would match those of the Trunkline interurban LRVs in every respect; they also would be suitable for through service running via the Marietta to Lawrenceville LRT Line to Perimeter Center and Lawrenceville.
  - As an alternative to equipping a small number of interurban type LRVs with raising and lowering steps for service on the Marietta Branch, the procurement of a uniform fleet of interurban LRVs would provide greater flexibility for schedule service coverage and maintenance at moderate incremental cost. However, the procurement and ownership costs of maintaining two types of interurban LRVs may not be burdensome if the Marietta Branch service is combined with a Marietta-to-Lawrenceville LRT line (through service to and from the Perimeter Center and Lawrenceville).
  - A second alternative would be to design and construct all Trunkline stations with low-level platforms and acquire a uniform fleet of low-floor interurban cars that could be used interchangeably on the Trunkline and the Marietta Branch (and, in all probability, on a Marietta-Perimeter Center-Lawrenceville LRT service).
- **Circulators.** Urban type LRVs approximately 50 feet long with a rigid carbody. The LRVs would seat 44 passengers (with provisions for two wheelchairs) and be able to comfortably stand 76 passengers (at the international comfort standard of 4 passengers per square meter), providing a total capacity of 120 passengers. Maximum design speed would be 50 mph; maximum operating speed would be limited to 40 mph in most areas. Circulator LRVs would have nominal acceleration rates of 3.0 mph per second (mphps) and be capable of achieving 40 mph within 20 seconds on level tangent track.

The Croydon Tramlink LRV shown below is representative of the type of conventional light rail vehicle suitable for service on the Trunkline, Marietta Branch, and the Circulators.

Croydon Tramlink Light Rail Vehicle. *Photo by Bombardier*

12.4.5.2 *Marietta Branch Vintage Trolley Cars.*

In addition to the requirement for three types of conventional LRVs and their desired characteristics as presented immediately above, this operations plan anticipates that a small number of replica interurban cars will be acquired to permit a vintage trolley car service to be operated on the Marietta Branch between the South Marietta Parkway/120 Loop and Canton Road/I-75 Stations of the Trunkline via the Marietta Square area. Several replica trolley cars could be constructed with car bodies that closely match the appearance of the interurban cars operated by the Georgia Railway and Power Company (predecessor of the Georgia Power Company) on its Atlanta-to-Marietta interurban line, abandoned in 1947. These cars would be acquired from a manufacturer of replica electric railway rolling stock.

In recent years, several orders have been placed at favorable prices with the three U.S.-based companies that construct replica trolley cars. Using new car bodies and new or recycled propulsion and braking equipment acquired domestically or abroad, these firms have produced or are currently building replica trolley cars for Little Rock, Arkansas; Lowell, Massachusetts; Portland, Oregon; Galveston, Texas; Denver, Colorado; Tampa, Florida; and San Pedro, California. Conventional trolley cars of designs 75 to over 100 years old and streamlined PCC cars dating from the 1940s also have been rebuilt for use on existing streetcar lines or newly built vintage trolley car services in Boston, Massachusetts; Dallas, Texas; Kenosha, Wisconsin; Memphis, Tennessee; New Orleans, Louisiana, and San Francisco and San Jose, California; Seattle, Washington; and Toronto, Ontario, Canada.

For the purposes of this report, it is worth noting that the GOMACO Trolley Company of Ida Grove, Iowa has acquired a large stock of trucks, motors, controls, air brake equipment and other components based upon American designs common in the 1920s from the transit system serving Milan, Italy. GOMACO, which has been the major producer of replica trolley cars for the U.S. market, can be considered as a prime source of supply of rolling stock suitable for use on a Marietta Vintage Trolley Car Service.

The photograph at right shows the Georgia Railway and Power Company interurban trolley car that would serve as the basis for the design of the proposed replica vintage trolley cars.

Georgia Railway and Power Company interurban car 488, the "A. Stephens Clay," at Marietta Square in January 1941. Six years later, on the evening of January 31, 1947, this car made the last trip on the 18-mile long Atlanta Northern interurban electric railway.
Frank E. Butts photo from Bill Volkmer Collection

12.4.6 Northwest Corridor LRT System Train Services Including Marietta Branch

Train services routed via the Marietta Branch are superimposed over those proposed for the Northwest Corridor LRT System Ultimate System. The operations plan overlays these services in a manner that is fully compatible with the Trunkline services as described in Section 8. It also will permit the future implementation of a through service from Town Center, Marietta, and Cumberland to Perimeter

Center and Lawrenceville via an East-West LRT Line in the Interstate 285 Corridor.

It is anticipated that, at full build-out – including the Marietta Branch, the train services shown on the following page, in Table 12-3, will be operated on the three elements of the Northwest Corridor Light Rail Transit System.

12.4.7 Days and Hours of Operation for the Northwest Corridor LRT System

The frequencies of service, or intervals between trains, are customarily referred to as headways. Given the train capacities listed above, headways are chosen to meet the ridership demands at the peak load point of the most heavily traveled link and direction of travel on a particular route. The detailed data that would permit tailoring the train schedules to a fine-grained profile of ridership demand is not available at this time. Therefore, it is assumed that headways will be based upon public policy decisions including a high level of service frequency in order to encourage usage of the Northwest Corridor Light Rail Transit System.

For the purposes of this study, the following assumptions about headways policy were made, to determine train service frequencies:

- A train will consist of one vehicle or two or more coupled vehicles operating as one unit.
- A train every 2 minutes will be the minimum allowable headway on any portion of a line (Trunkline, Marietta Branch, or Circulators) where two or more train services share common trackage.
- A train every 30 minutes will be the maximum headway on any portion of a line (Trunkline, Marietta Branch, or Circulators).
- Headways will be set at intervals divisible into the hour resulting in clock-face train schedules for a line or route, i.e., trains every 2, 2.5, 3, 4, 5, 6, 7.5, 10, 15, 20, or 30 minutes.
- Headways during peak hours (8:00 to 9:00 A.M. and 4:00 to 5:00 P.M.) on normal business days (Mondays through Fridays), will be every 4 minutes on the Trunkline (every 8 minutes on each branch), every 8 minutes on the Marietta Branch, and every 6 minutes on each route of the Cumberland Circulator and the Town Center Area Circulator.

Table 12-3
Train Services of Ultimate System including the Marietta Branch

Line	Route	From	To	Length (Miles)	Stations
Trunkline	TL1	Chastain Road/ I-575 Transfer Station	Arts Center Station, Midtown Atlanta	24.48	16
Trunkline	TL2	Barrett Parkway Transfer Station	Arts Center Station, Midtown Atlanta	22.18	15
Marietta Branch/ Trunkline	TL3	Windy Ridge Pkwy/ Herodian Way Transfer Station	Chastain Road/ I-575 Transfer Station	13.95	19
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station		4.41	11
Cumberland Circulator	B	Wildwood/Herodian Way Loop from Cumberland Blvd Transfer Station to Overton, Wildwood, Herodian Way Transfer Station, CCT Transfer Station and Cumberland Blvd Transfer Station		8.0	20
Cumberland Circulator	C	Galleria/Home Depot Loop from Cumberland Blvd Transfer Station to Galleria, Windy Ridge Pkwy Transfer Station, Home Depot, Overlook, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station		6.98	19
Town Center Area Circulator	D	Main Loop from Barrett Parkway Transfer Station to Town Center Mall Transfer Station, Chastain Meadows and Barrett Parkways, Chastain Road and I-575 Transfer Station, KSU and Barrett Parkway Transfer Station		10.91	22
Town Center Area Circulator	E	Kennesaw State University / Town Center Mall Transfer Station Line via Barrett Lakes Connector		3.98	9
Marietta Vintage Trolley Car Service	M	Marietta Branch from South Marietta Parkway/120 Loop Station to Canton Road/I-75 Station via Marietta Square		4.99	12

- Headways during off-peak, mid-day, and early evening periods on normal business days (Mondays through Fridays) and on Saturdays, Sundays and major holidays will be set at a maximum of 10 minutes on the Trunkline (20 minutes on each branch), a maximum 20 minutes on the Marietta Branch, and a maximum of 10 minutes on each Circulator route.
- Headways during early morning and late evening periods will not exceed 15 minutes on the Trunkline (30 minutes on each branch), 30 minutes on the Marietta Branch, and 15 minutes on each Circulator route.
- Headways of the Marietta Vintage Trolley Car Service (when operated) will be compatible with those of the Marietta Branch LRT Service. Depending upon demand for service, headways will range between 8 and 30 minutes.
- Timed transfers will be established at stations where the Trunkline and the two Circulators intersect whenever the Trunkline and/or the Marietta Branch services are operated at headways of 10 minutes or longer, i.e., Circulator trains will be scheduled to arrive and depart from these stations sufficiently in advance or after a Trunkline or Marietta Branch train to permit connecting passengers to make convenient transfers between the services.

It is proposed that Northwest Corridor LRT service, including the Marietta Branch, be operated seven days per week, every week and month of the year. The hours of operation will be approximately:

Mondays through Fridays:	5:00 AM to 1:00 AM
Saturdays:	5:00 AM to 1:00 AM
Sundays and Major Holidays:	7:00 AM to 12:00 Midnight

Additional service will be operated for special events, such as baseball and football games.

Based on the above, the following service levels are proposed for the Northwest Corridor Light Rail Transit System with inclusion of the Marietta Branch:

Mondays through Fridays

Periods of Operation	Trunkline Main Line	Trunkline Branch	Marietta Branch	Circulators
5:00 AM – 6:00 AM	Every 15 min	Every 30 min	Every 30 min	Every 15 min
6:00 AM – 7:00 AM	Every 7.5 min	Every 15 min	Every 15 min	Every 7.5 min
7:00 AM – 9.00 AM	Every 4.0 min	Every 8.0 min	Every 8.0 min	Every 6.0 min
9:00 AM – 4:00 PM	Every 7.5 min	Every 15 min	Every 15 min	Every 7.5 min
4:00 PM – 6:00 PM	Every 4.0 min	Every 8.0 min	Every 8.0 min	Every 6.0 min
6:00 PM – 9:00PM	Every 10 min	Every 20 min	Every 20 min	Every 10 min
9:00 PM – 1:00 AM	Every 15 min	Every 30 min	Every 30 min	Every 15 min

Saturdays

Periods of Operation	Trunkline Main Line	Trunkline Branch	Marietta Branch	Circulators
5:00 AM – 7:00 AM	Every 15 min	Every 30 min	Every 30 min	Every 15 min
7:00 AM – 9:00 PM	Every 10 min	Every 20 min	Every 20 min	Every 10 min
9:00 PM – 1:00 AM	Every 15 min	Every 30 min	Every 30 min	Every 15 min

Sundays and Major Holidays

Periods of Operation	Trunkline Main Line	Trunkline Branch	Marietta Branch	Circulators
7:00 AM – 9:00 AM	Every 15 min	Every 30 min	Every 30 min	Every 15 min
9:00 AM – 9:00 PM	Every 10 min	Every 20 min	Every 20 min	Every 10 min
9:00 PM – Midnight	Every 15 min	Every 30 min	Every 30 min	Every 15 min

12.4.8 One-Way Distances and Running Times for Marietta Branch Services

Using the terminal-to-terminal distances listed in Table 12-2 (Marietta Branch – List of Stations Served and Distances by Service) and the performance goals stated in Section 12.4.4 (Desired Service Characteristics for the Marietta Branch), one-way running times were estimated for the two services of the Northwest Corridor LRT System that would operate via the Marietta Branch, and are shown in Table 12-4.

Table 12-4
One-Way Distances and Running Times – Marietta Branch
(Services TL3 and M)

From	To	Length (Miles)	Average Speed	Time Required	Cumulative Time
Windy Ridge Pkwy/ Herodian Way Transfer Station	South Marietta Pkwy/120 Loop Station	4.20	35 mph	7.20 min	7.20 min
South Marietta Pkwy/ 120 Loop Station	Southern Polytechnic State University Station	0.36	25 mph	0.87 min	8.07 min
Southern Polytechnic State University Station	Waverly Place/ Waterman Street Station	1.94	25 mph	4.66 min	12.73 min
Waverly Place/ Waterman Street Station	Kennestone Hospital Station	1.45	15 mph	5.80 min	18.53 min
Kennestone Hospital Station	Marble Mill Road Station	0.36	15 mph	1.44 min	19.97 min
Marble Mill Road Station	Canton Road/ I-75 Station	0.87	25 mph	2.09 min	22.06 min
Canton Road/ I-75 Station	Chastain Road/ I-575 Transfer Station	4.77	35 mph	8.18 min	30.24 min
Totals		**13.95**	**N/A**	**30.24 min**	**say 31 min**

12.4.9 One-Way Running Times for the Ultimate System Including the Marietta Branch

Table 12-5 shows anticipated one-way running times during operation of the Ultimate System, including the Marietta Branch.

Table 12-5
One-Way Running Times
Ultimate System with Marietta Branch

Line	Route	Description	Length (Miles)	Average Speed	One-Way Running Time
Trunkline	TL1	Trunkline from Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	22.48	35 mph	42 min
Trunkline	TL2	Trunkline from Barrett Pkwy Transfer Station to Arts Center Station, Midtown Atlanta	22.18	35 mph	38 min
Marietta Branch	TL3	Through service from Windy Ridge Pkwy/ Herodian Way Transfer Station to Chastain Road/I-575 Transfer Station	13.95	27 mph	31 min
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	4.41	20 mph	14 min
Cumberland Circulator	B	Wildwood/Herodian Way Loop from Cumberland Blvd Transfer Station to Overton, Wildwood, Herodian Way Transfer Station, CCT Transfer Station and Cumberland Blvd Transfer Station	8.11	20 mph	25 min
Cumberland Circulator	C	Galleria/Home Depot Loop from Cumberland Blvd Transfer Station to Galleria, Windy Ridge Pkwy Transfer Station, Home Depot, Overlook, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	6.79	20 mph	21 min
Town Center Area Circulator	D	Main Loop from Barrett Pkwy Transfer Station to Town Center Mall Transfer Station, Chastain Meadows and Barrett Parkways, Chastain Road and I-575 Transfer Station, KSU and Barrett Parkway Transfer Station	10.91	20 mph	33 min
Town Center Area Circulator	E	Kennesaw State University / Town Center Mall Transfer Station Line via Barrett Lakes Connector	4.02	20 mph	13 min
Marietta Vintage Trolley Car Service	M	Marietta Branch from South Marietta Parkway/120 Loop Station to Canton Road/I-75 Station via Marietta Square	4.99	20 mph	15 min

Note: Running Time estimates in minutes and seconds have been adjusted upwards to the next full minute.

12.4.10 Round Trip or Loop Circuit Running Times, Terminal Layovers and Cycle Times for the Northwest Corridor LRT System Including the Marietta Branch

The cycle time for each Trunkline and Marietta Branch route is the sum of twice the one-way running time (i.e., the round trip running time) plus a terminal layover allowance of at least four minutes at each end of the route. Cycle times for Trunkline train services are also required to be divisible by four in order to conform to the assumption made in the Transportation Planning Model that Trunkline trains will operate at four-minute headways during the peak hours.

In the case of the Marietta Vintage Trolley Car Service, cycle times are based on twice the one way running time plus a terminal layover allowance of at least three minutes at each end of its route. Inasmuch as it will operate on common trackage along with Marietta Branch with the through Trunkline/Marietta Branch LRT Service, the cycle times for the Marietta Vintage Trolley Car Service must be divisible by the same integer as that of the TL3 service any time that both are operating in order to assure compatibility between the schedules of the two services.

It is anticipated that round trip or loop circuit running times, terminal layovers, and minimum cycle times for the Ultimate System including the Marietta Branch would be as shown in Table 12-6.

Table 12-6
Cycle Times for the Ultimate System including the Marietta Branch

Line	Route	Description	Round Trip or Circuit Running Times	Terminal Layovers	Minimum Cycle Times
Trunkline	TL1	Trunkline from Chastain Road/ I-575 Transfer Station to Arts Center Station, Midtown Atlanta	84 min (42 min one-way)	12 min	96 min
Trunkline	TL2	Trunkline from Barrett Pkwy Transfer Station to Arts Center Station, Midtown Atlanta	76 min (38 min one-way)	12 min	88 min
Marietta Branch	TL3	Through service from Windy Ridge Pkwy/ Herodian Way Transfer Station to Chastain Road/I-575 Transfer Station	62 min (31 min one-way)	10 min	72 min
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Parkway Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	14 min (circuit)	4 min	18 min (in each direction)
Cumberland Circulator	B	Wildwood/Herodian Way Loop from Cumberland Blvd Transfer Station to Overton, Wildwood, Herodian Way Transfer Station, CCT Transfer Station and Cumberland Blvd Transfer Station	25 min (circuit)	5 min	30 min (in each direction)
Cumberland Circulator	C	Galleria/Home Depot Loop from Cumberland Blvd Transfer Station to Galleria, Windy Ridge Parkway Transfer Station, Home Depot, Overlook, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	21 min (circuit)	3 min	24 min (in each direction)
Town Center Area Circulator	D	Main Loop from Barrett Pkwy Transfer Station to Town Center Mall Transfer Station, Chastain Meadows and Barrett Parkways, Chastain Road / I-575 Transfer Station, KSU and Barrett Parkway Transfer Station	33 min (circuit)	3 min	36 min (in each direction)
Town Center Area Circulator	E	Kennesaw State University/ Town Center Mall Transfer Station Line via Barrett Lakes Connector	24 min (12 min one-way)	6 min	30 min
Marietta Vintage Trolley Car Service	M	Marietta Branch from South Marietta Parkway/120 Loop Station to Canton Road/I-75 Station via Marietta Square	30 min (15 min one-way)	10 min	40 min

12.4.11 Runs Required for Peak-Period Service on the Northwest Corridor LRT System including the Marietta Branch

Runs are defined as the number of train sets (regardless of length) required to maintain scheduled service on a route during the peak hours. The number of runs required is calculated by dividing the headway (scheduled interval between trains) into the cycle time for the route. In the case of the loop routes of the Circulators, since bi-directional operations are anticipated, the number of runs required is double that calculated by dividing the peak hour headway into the cycle times.

Based on the assumptions concerning peak-period headways and cycle times stated above, the number of runs required for each route of the Ultimate System including the Marietta Branch are as shown in Table 12-7.

12.4.12 Passenger-Carrying Capacity of the Trunkline, Marietta Branch, and Circulators

The passenger-carrying capacity of the Trunkline, the Marietta Branch, and each of the two Circulators, stated in total capacity per hour, as measured in each direction past the peak load point, at varying service frequencies (headways) and train lengths (number of cars) is estimated as shown in Table 12-8.

The line capacities per direction, as calculated, assume a 34 percent/ 66 percent ratio of seated to standing passengers for the interurban type LRVs proposed for use on the Trunkline and the Marietta Branch, i.e., 68 seated passengers and 132 standing passengers in each car at its full capacity of 200 passengers. Similarly, a 37 percent/63 percent ratio of seated passengers to standing passengers is assumed for the urban type LRVs proposed for the Circulators, i.e., 44 seated passengers and 76 standing passengers in each car at its full capacity of 120 passengers. This is a worst case scenario; in actual practice the acceptable ratio of seated to standing passengers is a policy decision having bearing on the amount of capital investment and operating costs required for the Northwest Corridor Light Rail Transit System.

Table 12-7
Peak Period Runs Required for the Ultimate System, including the Marietta Branch

Line	Route	Description	Cycle Times	Peak Hour Headways	Runs Required
Trunkline	TL1	Trunkline from Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	96 min	8 min	12
Trunkline	TL2	Trunkline from Barrett Pkwy Transfer Station to Arts Center Station, Midtown Atlanta	88 min	8 min	11
Marietta Branch	TL3	Through service from Windy Ridge Pkwy/ Herodian Way Transfer Station to Chastain Road/I-575 Transfer Station	72 min	8 min	9
Cumberland Circulator	A	Central Loop from Cumberland Blvd Transfer Station to Overton, Windy Ridge Pkwy Transfer Station, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	18 min (in each direction)	6 min	6
Cumberland Circulator	B	Wildwood/Herodian Way Loop from Cumberland Blvd Transfer Station to Overton, Wildwood, Herodian Way Transfer Station, CCT Transfer Station and Cumberland Blvd Transfer Station	30 min (in each direction)	6 min	10
Cumberland Circulator	C	Galleria/Home Depot Loop from Cumberland Blvd Transfer Station to Galleria, Windy Ridge Pkwy Transfer Station, Home Depot, Overlook, Cumberland Mall/CCT Transfer Station and Cumberland Blvd Transfer Station	24 min (in each direction)	6 min	8
Town Center Area Circulator	D	Main Loop from Barrett Pkwy Transfer Station to Town Center Mall Transfer Station, Chastain Meadows and Barrett Pkwys, Chastain Road/ I-575 Transfer Station, KSU and Barrett Parkway Transfer Station	36 min (in each direction)	6 min	12
Town Center Area Circulator	E	Kennesaw State University / Town Center Mall Transfer Station Line via Barrett Lakes Blvd Connector	30 min	6 min	5
Marietta Vintage Trolley Car Service	M	Marietta Branch from South Marietta Parkway/120 Loop Station to Canton Road/I-75 Station via Marietta Square	40 min	8 min	5
Total Peak Period Runs on Northwest Corridor LRT System					**78**

Note: In the case of looping routes, the number of runs required is twice that of the cycle inasmuch as runs must be scheduled for both clockwise and counter-clockwise service.

Table 12-8
Passenger-Carrying Capacity of the Trunkline, Marietta Branch, and Circulators

Passenger Carrying Capacities Per Hour Per Direction						
		Trunkline/Marietta Branch Trains			Circulator Trains	
Headway	Trains Per Hour	One Car	Two Cars	Three Cars	One Car	Two Cars
2.0 min	30	6,000	12,000	18,000	3,600	7,200
2.5 min	24	4,800	9,600	14,400	2,880	5,760
3.0 min	20	4,000	8,000	12,000	2,400	4,800
4.0 min	15	3,000	6,000	9,000	1,800	3,600
5.0 min	12	2,400	4,800	7,200	1,440	2,880
6.0 min	10	2,000	4,000	6,000	1,200	2,400
7.5 min	8	1,600	3,200	4,800	960	1,920
8.0 min	7.5	1,500	3,000	4,500	900	1,800
10 min	6	1,200	2,400	3,600	720	1,440
15 min	4	800	1,600	2,400	480	960
20 min	3	600	1,200	1,800	360	720
30 min	2	400	800	1,200	240	480

Note: It is assumed that Marietta Branch trains will be limited to one car because of their operation within mixed traffic lanes of streets in the Marietta central business district. In addition, the capacity of the replica interurban cars to be used on the Marietta Vintage Trolley Car Service is estimated to be approximately 90 passengers (52 seated and 38 standing)

12.4.13 Demand Past Peak Load Points

The Cobb County Transportation Model (CCTM) has been used to estimate peak period demands for the proposed Northwest Corridor LRT System including the Marietta Branch. It is noted that the model is particularly sensitive to frequency of service, i.e., headways, and the assumption concerning walk access distance to stations, i.e., within 0.4 mile, quarter mile, etc. A series of model runs were made with varying headways and walk access distance assumptions. Results indicate the daily, two-hour period and peak hour/peak direction volumes past peak load points for the Trunkline, the Marietta Branch and the two Circulators, shown in Table 12-9.

Table 12-9
Demand Past Peak Load Points

System Element/ Demand Forecasts	Trunkline	Marietta Branch	Cumberland Circulator	Town Center Area Circulator
Daily	79,120	6,870	57,375	16,120
Two Hour Peak	16,255	1,230	11,475	2,880
One Hour Peak	9,755	740	6,885	1,730
Peak Load Point	4,790	240	2,270	555

12.4.14 Rolling Stock Requirements to Satisfy Demand at Peak Load Points

12.4.14.1 Minimum Car Requirements to Satisfy Demand at Peak Load Points

Peak period car service requirements are calculated using the highest passenger volumes past the peak load point in the peak direction predicted by the model and then assuming the headways stated above in Section 12.4.7, Days and Hours of Operation for the Northwest Corridor LRT System, with the variable being train length. This methodology yields the car requirements shown in Table 12-10, assuming the seated to standee passenger ratios discussed in Subsection 12.4.12.

Table 12-10
Minimum Car Requirements at Peak Load Points

System Element	Peak Hour Demand at Peak Load Point	Capacity at Peak Load Point	Runs (Not TPH)	Train Length	Cars In Service
Trunkline	4,790	6,000	23	2	46
Marietta Branch LRT Service	240	1,500	9	1	9
Marietta Vintage Trolley Car Service	not estimated	675	5	1	5
Cumberland Circulator	2,270	3,600	24	1	24
Town Center Area Circulator	555	2,400	17	1	17
Total Runs and Cars In Service During Peak Periods			**78**	**N/A**	**101**

12.4.14.2 *Maximum Car Requirements to Satisfy Demand at Peak Load Points*

Given the suburban nature of Cobb County and the widespread use of automobiles and sports utility vehicles for personal travel needs for trips within the County and to/from Atlanta, it is probable that a policy to provide seats to as many people as possible will be needed to attract high volumes of passengers to the Northwest Corridor LRT System. Implementation of this policy will increase the peak period car service requirements needed to transport the passenger volumes predicted by the model past the peak hour/peak direction load point. In contrast with the minimum car requirements calculated above, a policy to maximize the number of seats offered to peak period passengers could result in the following car requirements under the same headway assumptions, as shown in Table 12-11.

Table 12-11
Maximum Car Requirements to Satisfy Demand at Peak Load Points

Northwest Corridor LRT System Element	Peak Hour Demand at Peak Load Point	Seats Available at Peak Load Point	Runs (Not TPH)	Train Length	Cars In Service
Trunkline	4,790	3,060	23	3	69
Marietta Branch LRT Service	240	480	9	1	9
Marietta Vintage Trolley Car Service	Not Estimated	390	5	1	5
Cumberland Circulator	2,270	1,320	24	1	24
Town Center Area Circulator	555	880	17	1	17
Total Runs and Cars in Peak Period Service			**78**	**N/A**	**124**

12.4.15 Rolling Stock Fleet Size Requirements for the Ultimate System including the Marietta Branch

12.4.15.1 *Minimum Requirements Assuming Reasonable Standing Loads on Trunkline*

The total rolling stock requirements for the minimum cars in service, assuming an operating scenario involving reasonable standing loads on Trunkline trains, are shown in Table 12-12.

Table 12-12
Minimum Fleet Size, Reasonable Standing Loads on the Trunkline

Northwest Corridor LRT System Element	Minimum Number of LRVs and Replica Cars In Service			
	Interurban (High Level Platform Doors)	Modified Interurban (Moveable High/Low Steps)	Replica Trolley Cars (Georgia Railway & Power Co.)	Urban (High Level Platform Doors)
Trunkline	46	N/A	N/A	N/A
Marietta Branch LRT Service	N/A	9	N/A	N/A
Marietta Vintage Trolley Car Service	N/A	N/A	5	N/A
Cumberland Circulator	N/A	N/A	N/A	24
Town Center Area Circulator	N/A	N/A	N/A	17
Scheduled Service Requirement (subtotal)	46	9	N/A	41
Operating Spares	4	0	0	1
Operating Requirement (subtotal)	50	9	5	42
Maintenance Spares (12%)	6	1	1	5
Total LRVs and Replica Trolley Cars by Type	**56**	**10**	**6**	**47**

For planning purposes, assuming 4-minute peak period headways on the Trunkline and a policy accepting a reasonable number of standing passengers at the peak load points, a rolling stock fleet consisting of at least 56 interurban type LRVs designed for use on the Trunkline, 10 interurban type LRVs designed for use on the Marietta Branch equipped with raising and lowering steps, and 47 urban type LRVs designed for use on the two Circulators (all types of rolling stock as described in this report) will be required to operate the Northwest Corridor LRT System.

As discussed above, six replica interurban cars would also be required to operate the proposed Marietta Vintage Trolley Car Service. Most likely, the ten additional cars required for the Marietta Branch would be acquired in conjunction with construction of the Marietta-to-Lawrenceville LRT Line connecting Cumberland with the Perimeter Center and Lawrenceville. In addition, a central maintenance and storage facility designed to accommodate a rolling stock fleet of at least 119 LRVs and replica trolley cars, plus maintenance-of-way equipment, will be required under the "reasonable standing loads" scenario.

12.4.15.2 *Maximum Requirements Assuming Minimal Standing Loads on the Trunkline*

The total rolling stock requirements for the maximum number of cars in service, assuming an operating scenario involving minimal standing loads on Trunkline trains, are shown in Table 12-13.

If a policy decision is made to maximize the number of seats offered to passengers using the Trunkline and the Marietta Branch during peak hours, the number of interurban type LRVs required for the portion of the Trunkline located within Cobb County and the Marietta Branch would increase to 94. In addition, a central maintenance and storage facility designed to accommodate an ultimate fleet of as many as 147 LRVs and replica trolley cars, plus maintenance-of-way equipment, will be required to operate the Northwest Corridor LRT System under the "maximum seats" scenario.

As discussed above, six replica interurban cars would also be required to operate the proposed Marietta Vintage Trolley Car Service. Most likely, the ten additional cars required for the Marietta Branch would be acquired in conjunction with construction of the Marietta-to-Lawrenceville LRT Line connecting Cumberland with the Perimeter Center and Lawrenceville.

Table 12-13
Maximum Fleet Size, Minimal Standing Loads on the Trunkline

Northwest Corridor LRT System Element	Maximum Number of LRVs and Replica Cars In Service			
	Interurban (High Level Platform Doors)	Modified Interurban (Moveable High/Low Steps)	Replica Trolley Cars (Georgia Railway & Power Co.)	Urban (High Level Platform Doors)
Trunkline	69	N/A	N/A	N/A
Marietta Branch LRT Service	N/A	9	N/A	N/A
Marietta Vintage Trolley Car Service	N/A	N/A	5	N/A
Cumberland Circulator	N/A	N/A	N/A	24
Town Center Area Circulator	N/A	N/A	N/A	17
Scheduled Service Requirement (subtotal)	69	9	N/A	41
Operating Spares	6	0	0	1
Operating Requirement (subtotal)	75	9	5	42
Maintenance Spares (12%)	9	1	1	5
Total LRVs and Replica Trolley Cars by Type	**84**	**10**	**6**	**47**

12.4.16 Trunkline Alignment and Other Technology Considerations Related to Inclusion of the Marietta Branch into the Northwest Corridor LRT System

The inclusion of the Marietta Branch in the Northwest Corridor Light Rail Transit System raises alignment and technological issues which, upon further consideration during Alternatives Analysis and/or the Preliminary Engineering Phase of the Project, may result in the configuration of Trunkline station platforms being revised. These issues revolve around the fact that the Trunkline, as presented in this Final Report, has characteristics somewhat similar to those commonly associated in the United States with a heavy rail rapid transit system, namely a fully grade-separated alignment with stations designed with high level platform stations.

Several North American cities (Calgary and Edmonton, Alberta, Canada; San Francisco, California; Los Angeles, California; St. Louis, Missouri; Philadelphia, Pennsylvania; and Guadalajara, Monterrey, and Mexico City, Mexico) have LRT systems that are either substantially or fully grade-separated and are operated by fleets of LRVs designed to serve stations with high level platforms. Similar LRT applications exist in several Asian and European cities.

12.4.16.1 Full Grade Separation of the Trunkline

It should be recognized that full grade separation of the Trunkline along Cobb Parkway is required to achieve the schedule speed of at least 35 mph, established as a basic system objective. If the alignment were to be at grade with level crossings with intersecting streets, safety considerations (for motorists, pedestrians, transit passengers, and transit employees) would require reduction of the maximum allowable speed from 70 mph to the highway speed limit of 45 mph in that section of Cobb Parkway.

The Bechtel/MSE Team estimates that lowering the speed limit for Trunkline trains by 25 mph would reduce the average schedule speed by at least 12.5 mph, more likely by 15.0 mph, along the at-grade portion of the alignment. In addition, even if traffic light preemption were permitted, trains would be subject to delays at intersections blocked from passage by cross-traffic during the chronic gridlock conditions that prevail along Cobb Parkway in peak periods.

For example, the placing of approximately 8.5 miles of the Trunkline alignment between Cumberland Boulevard and the Canton Road Connector/SR5, at grade in the median of Cobb Parkway would result in an increase in the one-way running time of at least 11 minutes (from approximately 14.5 minutes to 25.5 minutes) in that area. Consequently, passengers riding TL1 trains for the 24.5-mile trip from the Chastain Road/I-575 Transfer Station to the Arts Center Station in Midtown Atlanta would have their journeys lengthened from 42 minutes to 53 minutes. At the same time, the average speed of their trips would decline from 35 mph to 27.7 mph, well below the design criteria established as a basic system objective.

Similarly, the 14.0-mile trip on a TL3 train from the Chastain Road/ I-575 Transfer Station to the Windy Ridge Parkway/Herodian Way Transfer Station (via the Marietta Branch) would be increased from 31 minutes to 37 minutes as a direct result of placing the Trunkline at grade along chronically-congested Cobb Parkway (average trains would be reduced from 27.10 mph to 22.70 miles per hour). While both average speeds are below the system goal of 35 mph, the Marietta Branch train services should be looked at as the equivalent of a circulator service connecting with the Trunkline but providing a one-vehicle ride to and from several Trunkline stations located within Cobb Country. As discussed in Sections 5 and 8, the average speed for Circulator service is 20 mph.

Many passengers using the Marietta Branch trains (either the TL3 through service or the Marietta Vintage Trolley Car Service) who are bound for or coming from the Cumberland Mall/Galleria Station, the Cumberland Boulevard Transfer Station, or stations in Fulton County, notably Arts Center, will transfer to or from TL1 or TL2 trains at one of the four stations between South Marietta Parkway/120 Loop and the Windy Hill Parkway/Herodian Way Transfer Station. These passengers, expected to be a major portion of those using Marietta Branch trains, would have their journeys lengthened.

For example, a passenger boarding a TL3 train at Marietta Square and then changing to a TL1 or TL2 train at the Windy Ridge Parkway/Herodian Way Transfer Station to continue onwards to the MARTA Arts Center Station in Midtown Atlanta or vice versa, would have his or her 20.5-mile trip increased from 42 minutes to 50 minutes, including a two-minute transfer connection in either direction. In this example, the passenger's average journey speed would be reduced from 29.29 mph to 24.60 mph. As noted above, the Marietta Branch should be viewed as the equivalent of a Circulator connecting with Trunkline trains operating to and from Atlanta. In this example, while both of these average speeds are below the 35 mph goal established as a basic system objective, an at-grade alignment serves only to widen the gap and decrease the competitiveness of both the Trunkline and the Marietta Branch vis-à-vis motor vehicle alternatives.

Travel time increases of this magnitude would severely limit the competitiveness of the Trunkline and the Marietta Branch, as well as the Circulators and Cobb Community Transit (CCT) feeder buses during peak, off-peak, and weekend/holiday periods vis-à-vis motor vehicles operating on parallel Interstate highways I-75 and I-575, where speed limits are in a 55 mph to 65 mph range, and, due to commonplace violations, average driving speeds are customarily higher. Without question, eliminating the fully grade-separated characteristic of the Trunkline would adversely impact its ridership levels and those of the remainder of the Northwest Corridor LRT System including the Marietta Branch. In summary, the Bechtel/MSE Team believes that retaining the fully grade-separated characteristic of the Trunkline is essential to the System as a whole.

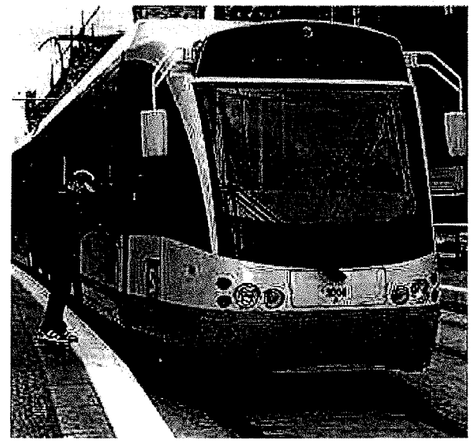
12.4.16.2 Other Technical Considerations

The Marietta Branch has an at-grade alignment with level crossings at intersecting streets along South Marietta Parkway and, in one area or another of all of its alternatives, portions of the alignment in roadway lanes involving mixed traffic operation. This mandates traction power distribution through an overhead catenary system (OCS) or trolley wires and encourages the use of low level platforms at its stations as well. In the annals of electric railway industry in North America, dichotomies such as those presented here have been most often (but not in every case) resolved by resorting to the technological solution involving the least complication. Numerous precedents suggest that, if the Marietta Branch is included in the Northwest Corridor LRT System, the technological decisions establishing the high platform configuration of the Trunkline and Circulators should be re-examined.

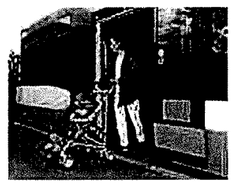
- **Station Design**. Using OCS or trolley wire will permit all Trunkline, Marietta Branch, and Circulator stations to be designed and constructed with low level platforms (instead of high level platforms as presently contemplated). This change could result in reductions in initial capital investment. It also would reduce the visual bulk of the stations, particularly those located on elevated structures along Cobb Parkway or at grade, such as the Canton Road/I-75 Station.
- **Passenger Access to LRVs/ADA Compliance**. The use of low level platforms at Trunkline, Marietta Branch, and Circulator stations, made practical and safe by the universal adoption of OCS as the method of traction power distribution for the Northwest Corridor LRT System, opens up the opportunity to acquire a uniform fleet (50 to 70 percent) of low-floor type interurban LRVs for use on the Trunkline, the Marietta Branch, and the Marietta-to-Lawrenceville LRT Line. Adoption of low floor rolling stock for all elements of the System would allow stepless entry to and exit from LRVs at all of its stations, thereby complying with the provisions of the Americans with Disabilities Act (ADA) and benefiting the travelling public in general, including parents with children in strollers, passengers with luggage, bicyclists using public transit, etc.
- **Traction Power Distribution**. The use of OCS or trolley wire, while compatible with high level platforms, would permit low level platforms to be used on all elements of the System including the Marietta Branch. Due to safety considerations, this option would not be available on any part of the System equipped with third rail traction power distribution. However, it would be desirable to minimize any negative visual impact resulting from OCS or trolley wire installations. This can be achieved by using tapered cylindrical poles that also serve as street lighting poles in sensitive areas, such as where the Trunkline will be located in the median of Cobb Parkway and along South Marietta Parkway/120 Loop where the Marietta Branch will be in a side-of-the-road reservation. The use of OCS avoids the need for high cyclone fences topped with barbed wire (such as those along the Georgia 400 Toll Road) to protect trackage located in the median of Cobb Parkway from trespassers. While safety fencing will be required along its rights-of-way because of the comparatively high speeds at which Trunkline trains would operate, the type of fencing required for an OCS-equipped electric railway would be less obtrusive than that required if the line were equipped for third rail traction power distribution.

It also is worth noting that low floor light rail vehicles (LFLRVs) with top speed capabilities in excess of 55 mph (88 kilometers per hour) are in use currently in the London Borough of Croydon, England; Jersey City/Bayonne, New Jersey; and Portland, Oregon. Houston, Texas is in the process of acquiring LFLRVs with a top speed capability of 65 mph (105 kph) for its Starter LRT Line. LFLRVs with a top speed capability in excess of 62 mph (100 kph) also have been in service for several years in Europe, notably in Germany and France.

Typical car used on the new interurban line (opened in October 1997) that connects Saarbrucken (Saarland), Germany with Sarreguemines (Alsace), France. *Bombardier Transportation*



Low floor vehicles provide ease of boarding. *Bombardier Transportation*



Therefore, the conclusion of this Study is that service-proven propulsion, braking and guidance components exist on an on-the-self basis that would permit the utilization of articulated interurban type LFLRVs with a top speed of 80 mph (128 kph) on the Trunkline and the Marietta Branch and urban type LFLRVs with a top speed of 50 mph (70 to 80 kph) on the Cumberland and Town Center Area Circulators.

12.4.17 Operations Assessment of Inclusion of Marietta Branch in the Northwest Corridor Light Rail Transit System

Daily, peak period, and peak load point/peak direction passenger volumes forecast by the Cobb County Transportation Model for the Northwest Corridor Light Rail Transit System, with inclusion of the Marietta Branch, can be accommodated comfortably by the capacity provided by state-of-the-art light rail transit technology. Depending on policy decisions relating to the frequency of peak period service and the percentage of passengers to be offered seats during the peak hour, between 119 and 147 LRVs and replica trolley cars of the types described in this report will be required to operate the system at its full build-out stage. Also required will be a central maintenance and storage facility designed to accommodate a rolling stock fleet of this size, plus maintenance-of-way equipment.

As the Northwest Corridor LRT System expands to its Ultimate System configuration, including branches of the Trunkline terminating at both the Chastain Road/I-575 Transfer Station and the Barrett Parkway Transfer Station, it would be necessary to acquire ten interurban type LRVs for Marietta Branch service within Cobb County; whether these additional cars would be 'charged' to the Marietta Branch or to the separate LRT project in the East-West I-285 Corridor would be a matter of accounting convenience and/or a future public policy decision.

A through Town Center-Marietta Square-Cumberland-Perimeter Mall-Lawrenceville LRT service could be developed by connecting the Trunkline to an East-West LRT line south of the Cumberland Mall/Galleria Station. This Study has taken that possibility into account by making provisions for a grade-separated junction in the vicinity of Akers Mill Road and Cobb Parkway as illustrated on Figure 12-5, Marietta Branch Schematic Track Plan.

12.5 COST ESTIMATES

This subsection presents the capital cost estimates and the operating and maintenance (O & M) cost estimates for the Marietta Branch. The quantity-based cost estimating activities were guided by the same procedures and qualifications followed for the Ultimate System.

A key qualification that must be taken into consideration when referencing this cost estimate data is that all costs are estimated at the first quarter of year 2000. These costs are not "year of expenditure" costs. Escalation of project costs through the completion of construction will need to be factored into the capital cost of the Marietta Branch, as will the remainder of the items set forth in Subsection 12.5.1.6 Exclusions. Similarly, escalation to "year of expenditure" must be factored into the branch's O & M costs.

12.5.1 Capital Cost Estimates

The capital cost estimates for the proposed Marietta Branch alternatives include the furnishing of all labor, equipment, materials, and services required to construct the branch as described herein.

12.5.1.1 Scope of Capital Cost Estimates

The estimates cover the following main project elements:

- Marietta Branch guideway and stations
- Marietta Branch LRV Fleet
- Marietta Branch Replica Vintage Trolley Cars

12.5.1.2 Documents Used

The estimate is based on the following drawings:

- Alignment plans included in Volume II
- Typical station sketches provided in Volume II
- Track schematic diagrams included in this section

12.5.1.3 Quantity Development

Quantities for this estimate have been developed from the above drawings and sketches and are based on the following:

- **Route length quantities** for guideways, by configuration
- **Number of stations by type** (see characteristics summaries).
- **Trackwork quantities** (tracks on ballast or direct fixation track), based on guideway quantities.
- **Special trackwork items,** based on the schematic track plan.
- **Systems quantities,** based on track length and number of stations.
- **Number of vehicles** (10 interurban type LRVs for the Marietta Branch and 6 Replica Vintage Trolley Cars), based on the preliminary Marietta Branch Operations Plan presented in Subsection 12.4.

12.5.1.4 Pricing Basis

All costs are estimated at the first-quarter 2000 pricing level. Unit rates in the estimate include contractor's direct and indirect costs, and mark-ups. Pricing is based on the following:

- **Guideway** costs are based on typical cross-sections, to arrive at the cost per linear foot for each type of trackway structure.
- **Station** costs have been developed based upon sketches and typical station designs developed for the Circulators (same platform length – 100') modified to low level platform configurations.
- **Trackwork** pricing is based on unit rates from other transit systems for tracks on ballast, direct fixation tracks, and special trackwork.
- **Systems** costs, including traction power, train control, communications, and fare collection systems, are based on cost data from other transit systems with similar features.
- **Central Maintenance and Storage Facility Cost**. No incremental cost was attributed to the Marietta Branch, although its LRVs and Replica Vintage Trolley Cars would be maintained and stored at that facility. The costs of that facility are included in the costs of the Ultimate System.
- **Transit vehicle** costs are based on an allowance of $3,200,000 each for the interurban LRVs and $1,200,000 each for the Replica Vintage Trolley Cars.

General Conditions (of Construction)

A 10 percent allowance has been made for mobilization/ demobilization and various items not covered by unit rates.

Engineering and Management

The following percentage of construction cost allowances are included in the estimate:

Engineering	10%
Construction Management	8%
Project Management	6%
Environmental Engineering/Mitigation	1%

Project Contingencies

A contingency and Owner's reserve allowance of 25 percent has been included in the estimate. Contingency is an allowance to compensate for the level and quality of information available at the time the estimate is prepared. As estimates are prepared during preliminary and final engineering, the contingency will be reduced appropriately.

Owner's (Georgia Regional Transportation Authority) Costs

The following percentage allowances are included:

Owner's (GRTA) management and administration	4 %
Utilities (By agreement between GRTA, Cobb County, the City of Marietta, and the utility companies for gas, power, and communications, a majority of the utility work is expected to be performed by the utility companies. The project, through GRTA, Cobb County, and the City of Marietta, will reimburse these costs.)	3%
Pre-revenue operations and startup	1.1%
Owner (GRTA) Controlled Insurance Program (OCIP)	3%

Assumptions

The following assumptions have been made for this estimate:

- Conventional contracting practices will be employed.
- GRTA will provide an OCIP.
- Support of existing utilities (sewers, water, gas, power, communication), new utilities (drainage, sewer and water) and temporary electrical power and other temporary utility costs) will be by the construction contractors.
- Agreements between GRTA, Cobb County, the City of Marietta, and the utility companies for gas, power and communications will generally result in advance relocations (before the main construction) of these items by the utility companies. The cost will be included in GRTA's project costs.

Exclusions

Exclusions to the estimate include the following:

- GRTA administration facilities
- Right-of-way costs
- Supplies and spare parts
- Escalation
- Financing and interest during construction

Cost Summaries

Cost summaries are presented in the following tables:

- **Table 12-16** Marietta Branch Cost Summary, Alternative 1
- **Table 12-17** Marietta Branch Cost Summary, Alternative 2
- **Table 12-18** Marietta Branch Cost Summary, Alternative 3
- **Table 12-19** Marietta Branch Cost Summary, Alternative 4

Unit Cost Abbreviations Used:

RM	Route Mile
EA	Each
TF	Track Foot
LS	Lump Sum

Table 12-16
Marietta Branch Cost Summary – Alternative 1

Description	Quantity	Unit	Unit $	Cost
General Conditions (of Construction)	10%	%		9,700,000
Guideway	5.28	RM	8,503,727	44,900,000
Stations	17	EA	558,824	9,500,000
Total Systems	46,676	TF	917	42,800,000
Total Construction				106,900,000
Engineering and Management				
Engineering	10%	%		10,700,000
Construction Management	8%	%		8,600,000
Project Management	6%	%		6,400,000
Environmental Engineering & Mitigation	1%	%		1,100,000
Total Engineering and Management	25%	%		26,800,000
Sub Total Project Cost				133,700,000
Project Contingencies	25%	%		33,400,000
Sub Total Project Cost				167,100,000
Owner's Costs				
Owner's Management and Administration	4%	%		6,700,000
Utilities by Owner	3%	%		5,000,000
Pre-revenue Operations and Startup	1.1%	%		1,800,000
OCIP	3%	%		5,000,000
Total Owner's Costs				18,500,000
Total Guideway and Stations				185,600,000
Rolling Stock, Modified Interurban LRVs	10	EA	3,200,000	32,000,000
Rolling Stock, Replica Vintage Trolleys Cars	6	EA	1,200,000	7,200,000
Total Alternative 1				**224,800,000**

Table 12-17
Marietta Branch Cost Summary – Alternative 2

Description	Quantity	Unit	Unit $	Cost
General Conditions (of Construction)	10%	%		8,800,000
Guideway	4.68	RM	7,734,855	36,200,000
Stations	13	EA	538,462	7,000,000
Total Systems	49,422	TF	915	45,200,000
Total Construction				97,200,000
Engineering and Management				
Engineering	10%	%		9,700,000
Construction Management	8%	%		7,800,000
Project Management	6%	%		5,800,000
Environmental Engineering & Mitigation	1%	%		1,000,000
Total Engineering and Management	25%	%		24,300,000
Sub Total Project Cost				121,500,000
Project Contingencies	25%	%		30,400,000
Sub Total Project Cost				151,900,000
Owner's Costs				
Owner's Management and Administration	4%	%		6,100,000
Utilities by Owner	3%	%		4,600,000
Pre-revenue Operations and Startup	1.1%	%		1,700,000
OCIP	3%	%		4,600,000
Total Owner's Costs				17,000,000
Total Guideway and Stations				168,900,000
Rolling Stock, Modified Interurban LRVs	10	EA	3,200,000	32,000,000
Rolling Stock, Replica Vintage Trolley Cars	6	EA	1,200,000	7,200,000
Total Alternative 2				**208,100,000**

The Alternative 2 estimate assumes the railroad relocation will be at grade. It is expected that the heavy use and number of grade crossings will result in pressure to grade-separate the relocated tracks. Separate funding may be available for grade separation from the Federal Railroad Administration (FRA). It is to be noted that Alternative 2 will require more right-of-way purchase (now excluded) than the other three alternatives. **Although Alternative 2 appears to be the low-cost alternative, when right-of-way and grade separation are added, this may no longer be the case.**

Table 12-18
Marietta Branch Cost Summary – Alternative 3

Description	Quantity	Unit	Unit $	Cost
General Conditions (of Construction)	10%	%		9,000,000
Guideway	5.31	RM	7,118,796	37,800,000
Stations	16	EA	568,750	9,100,000
Total Systems	46,621	TF	929	43,300,000
Total Construction				99,200,000
Engineering and Management				
Engineering	10%	%		9,900,000
Construction Management	8%	%		7,900,000
Project Management	6%	%		6,000,000
Environmental Engineering & Mitigation	1%	%		1,000,000
Total Engineering and Management	25%	%		24,800,000
Sub Total Project Cost				124,000,000
Project Contingencies	25%	%		31,000,000
Sub Total Project Cost				155,000,000
Owner's Costs				
Owner's Management and Administration	4%	%		6,200,000
Utilities by Owner	3%	%		4,700,000
Pre-revenue Operations and Startup	1.1%	%		1,700,000
OCIP	3%	%		4,700,000
Total Owner's Costs				17,300,000
Total Guideway and Stations				172,300,000
Rolling Stock, Modified Interurban LRVs	10	EA	3,200,000	32,000,000
Rolling Stock, Replica Vintage Trolley Cars	6	EA	1,200,000	7,200,000
Total Alternative 3				**211,500,000**

Table 12-19
Marietta Branch Cost Summary – Alternative 4

Description	Quantity	Unit	Unit $	Cost
General Conditions (of Construction)	10%	%		9,800,000
Guideway	5.10	RM	7,862,687	40,100,000
Stations	18	EA	700,000	12,600,000
Total Systems	48,101	TF	938	45,100,000
Total Construction				107,600,000
Engineering and Management				
Engineering	10%	%		10,800,000
Construction Management	8%	%		8,600,000
Project Management	6%	%		6,500,000
Environmental Engineering & Mitigation	1%	%		1,100,000
Total Engineering and Management	25%	%		27,000,000
Sub Total Project Cost				134,600,000
Project Contingencies	25%	%		33,600,000
Sub Total Project Cost				168,200,000
Owner's Costs				
Owner's Management and Administration	4%	%		6,600,000
Utilities by Owner	3%	%		5,000,000
Pre-revenue Operations and Startup	1.1%	%		1,800,000
OCIP	3%	%		5,000,000
Total Owner's Costs				18,500,000
Total Guideway and Stations				186,700,000
Rolling Stock, Modified Interurban LRVs	10	EA	3,200,000	32,000,000
Rolling Stock, Replica Vintage Trolley Cars	6	EA	1,200,000	7,200,000
Total Alternative 4				**225,900,000**

12.5.2 Operating and Maintenance (O & M) Cost Estimates

Elements of the O & M estimating process are discussed in the following subsections and summarized in Tables 12-20 through 12-27.

12.5.2.1 Scope of O & M Cost Estimates

The Ultimate System, as defined herein, includes the Trunkline configuration between the Chastain Road/I-575 Transfer Station and the MARTA Arts Center Station in Midtown Atlanta, plus the Trunkline extension along Cobb Parkway to the Barrett Parkway Transfer Station, as well as the Marietta Branch. It also includes the ultimate configuration of the Cumberland and Town Center Area Circulators, all as depicted in Figure 3-2. This section presents the data used to prepare this preliminary forecast of O & M costs, including the Marietta Branch Through Service and the Marietta Vintage Trolley Car Service are presented in this section.

O & M costs normally encompass the following elements:

- Management and administration
- Fare collection and handling
- Transportation
- Light rail vehicle maintenance
- Maintenance of way, including stations and parking facilities
- System security
- Utilities

At this stage of conceptual planning, operating and maintenance costs are based on the average cost per forecast revenue-vehicle-mile, using O & M cost experience of similar U.S. transit systems and the forecast revenue-vehicle-miles based on the System Operations Plan presented in Section 12.4.

12.5.2.2 Development of Unit Costs

O & M costs per revenue-vehicle-mile were guided by data from industry experience in the U.S. It is assumed that one organization will be set up to operate the entire system, including the Trunkline, the two Circulators, and the Marietta Branch. The Trunkline (and the through service of the Marietta Branch) will be served by large, interurban type light rail vehicles, operating in two-car and single-car trains; the two Circulators will use smaller, urban type LRVs that are operated at a high level of frequency in single-car trains and will require a proportionately greater number of train drivers per passenger carried. Another consideration in using industry-wide experience is the labor wage differential between the East and West Coasts of the U.S., on the one hand, and those in the Southeast U.S. on the other.

Table 12-20 presents O & M cost characteristics for a number of fully grade-separated heavy rail rapid transit systems in the U.S. From an operating standpoint, it is envisioned that the Trunkline, notwithstanding its use of interurban type LRVs, would exhibit characteristics similar to these systems and, thus, its O & M costs would be similar to these experiences (excluded from this list are very old systems that require heavy maintenance expenses, such as New York, Chicago, and Boston). O & M costs for the selected systems were escalated to year 2000 levels. It is assumed that 80 percent of the O & M costs are labor and are, therefore, subject to the labor cost adjustment between Cobb County (Atlanta Region) and various other parts of the country. The adjusted average O & M cost per revenue-vehicle-mile for the Trunkline, as used in the forecast at the year 2000 level, is $6.50.

For estimating O & M cost for the Circulators, and the Marietta Vintage Trolley Car Service, we have been guided by the experience of selected light rail transit systems in the U.S. A process similar to that explained for the Trunkline is adopted here and presented in Table 12-21. The resulting adjusted average O & M cost per revenue-vehicle-mile, at year 2000 level, is $8.80.

For estimating O & M cost for the Marietta Branch Through Service, a proportioned value for the Trunkline and Circulator O & M cost per revenue-vehicle-mile was developed based on the length of service along the Trunkline and along the streets of Marietta.

12.5.2.3 Forecast of Revenue-Vehicle-Miles

Tables 12-22 to 12-26 present the operating framework and calculations necessary to estimate the revenue-vehicle-miles for each leg of the Trunkline, the Marietta Branch, and the two Circulator systems for year 2025 operation, based on the System Operating Plan presented in Section 12.4.

Specifically, Tables 12-22 to 12-24 provide forecasts of the number of trains per line and per time periods, and calculates the number of revenue-vehicle-miles for typical weekdays, Saturdays, and Sundays and major holidays, respectively. Table 12-25 summarizes the revenue-vehicle-miles for each type of day, while Table 12-26 summarizes the same information on an annual basis (for the year 2025) as well as for the entire system. Total annual revenue-vehicle-miles for the year 2025 amount to approximately:

- Trunkline – 3.64 million
- Two Circulator systems – 3.45 million
- The Marietta Branch – 0.48 million

12.5.2.4 Ultimate System O & M Cost Forecasts

The annual O & M cost for the Ultimate System, including the Marietta Branch, is forecast to be $58.21 million (2000$) for the year 2025 operation, as shown in Table 12-27.

Trunkline O & M

Applying the adjusted average O & M cost per revenue-vehicle-mile for fully grade-separated heavy rail rapid transit systems, of $6.50, to the 2025 annual revenue-vehicle-miles for the Trunkline (approximately 3.64 million), results in operating and maintenance costs of $23.64 million (year 2000 $). This amount includes $3.09 million for the portion of the Marietta Branch Through Service that would operate over the Trunkline and directly serve seven of its stations.

Circulator O & M

Applying the adjusted average O & M cost per revenue-vehicle-mile for light rail transit systems, of $8.80, to the total annual revenue-vehicle-miles for the two Circulators (about 3.45 million), results in a year 2025 O & M cost for the Circulators of $30.35 million (year 2000 $).

Marietta Branch O & M

The O & M cost per revenue-vehicle-mile for the Marietta Branch Through Service is based on a composite of those estimated for the Trunkline and the Circulators. The total annual revenue-vehicle-miles forecast to be operated between the Canton Road/I-75 and the South Marietta Parkway/120 Loop has been allocated to the Marietta Branch. Applying the $8.80 per-revenue-vehicle-mile cost for LRT systems to the annual revenue-vehicle-miles forecast (about 259,000) results in a year 2025 O & M cost of $2.28 million (year 2000$).

Table 12-22
Daily Revenue Vehicle-Miles – Ultimate System including Marietta Branch – Weekdays, Year 2025

Route	Operating Subsystem/Line	Distance In Miles	5 – 6 am	6 – 7 am	7 – 9 am	9 am – 4 pm	4 – 6 pm	6 – 9 pm	9 pm – 1 am	Total Vehicle-Miles
			Number of Trains per Hour							
TL1	Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	24.5	2	4	7.5	4	7.5	3	2	5,439
TL2	Barrett Parkway Transfer Station to Arts Center Station, Midtown Atlanta	22.2	2	4	7.5	4	7.5	3	2	4,928
TL3	Chastain Road/I-575 Transfer Station to Windy Ridge Parkway/Herodian Way Transfer Station (Trunkline Portion)	9.0	2	4	7.5	4	7.5	3	2	1,458
	Total Trunkline									**11,825**
A	Cumberland Circulator Central Loop	4.4	4	7.5	10	7.5	10	6	4	1,373
B	Cumberland Circulator Wildwood/Herodian Way Loop	7.7	4	7.5	10	7.5	10	6	4	2,402
C	Cumberland Circulator Galleria/ Home Depot Loop	6.8	4	7.5	10	7.5	10	6	4	2,122
D	Town Center Area Circulator Main Loop	10.9	4	7.5	10	7.5	10	6	4	3,401
E	Kennesaw State University/Town Center Mall Line	4.0	4	7.5	10	7.5	10	6	4	1,248
	Total Circulators									**10,546**
TL3	Chastain Road/I-575 Transfer Station to Windy Ridge Parkway/Herodian Way Transfer Station (Marietta Branch Portion)	4.9	2	4	7.5	4	7.5	3	2	794
M	Marietta Vintage Trolley Car Service	4.9	–	4	7.5	4	7.5	3	–	696
	Total Marietta Branch									**1,490**
	Total System									**23,861**

Note: 7.5 trains per hour (60 minutes/8 tph) represents a headway or frequency of service of every 8 minutes, or 8 trains per 64 minutes

Table 12-23
Daily Revenue Vehicle-Miles – Ultimate System including Marietta Branch – Saturdays, Year 2025

Route	Operating Subsystem/Line	Distance Miles	5 – 9 am	9 am – 9 pm	9 pm – 1 am	Total Vehicle-Miles
			Number of Trains per Hour			
TL1	Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	24.5	2	4	2	3,136
TL2	Barrett Parkway Transfer Station to Arts Center Station, Midtown Atlanta	22.2	2	4	2	2,842
TL3	Chastain Road/I-575 Transfer Station to Windy Ridge Parkway/Herodian Way Transfer Station (Trunkline Portion)	9.0	2	4	2	1,152
	Total Trunkline					**7,130**
A	Cumberland Circulator Central Loop	4.4	4	7.5	4	1,074
B	Cumberland Circulator Wildwood/Herodian Way Loop	7.7	4	7.5	4	1,879
C	Cumberland Circulator Galleria/ Home Depot Loop	6.8	4	7.5	4	1,660
D	Town Center Area Circulator Main Loop	10.9	4	7.5	4	2,660
E	Kennesaw State University/Town Center Mall Line	4.0	4	7.5	4	976
	Total Circulators					**8,249**
TL3	Chastain Road/I-575 Transfer Station to Windy Ridge Parkway/Herodian Way Transfer Station (Marietta Branch Portion)	4.9	2	4	2	627
M	Marietta Vintage Trolley Car Service	4.9	–	4	–	470
	Total Marietta Branch					**1,097**
	Total System					**16,476**

Note: 7.5 trains per hour (60 minutes/8 tph) represents a headway or frequency of service of every 8 minutes, or 8 trains per 64 minutes

Table 12-24
Daily Revenue Vehicle-Miles – Ultimate System with Marietta Branch Sundays and Major Holidays, Year 2025

Route	Operating Subsystem/Line	Distance Miles	7 – 9 am	9 am – 9 pm	9 pm – midnight	Total Vehicle-Miles
			Number of Trains per Hour			
TL1	Chastain Road/I-575 Transfer Station to Arts Center Station, Midtown Atlanta	24.5	2	3	2	2,254
TL2	Barrett Parkway Transfer Station to Arts Center Station, Midtown Atlanta	22.2	2	3	2	2,042
TL3	Chastain Road/I-575 Transfer Station to Windy Ridge Parkway/Herodian Way Transfer Station (Trunkline Portion)	9.0	2	3	2	828
	Total Trunkline					**5,124**
A	Cumberland Circulator Central Loop	4.4	4	6	4	870
B	Cumberland Circulator Wildwood/Herodian Way Loop	7.7	4	6	4	1,417
C	Cumberland Circulator Galleria/ Home Depot Loop	6.8	4	6	4	1,251
D	Town Center Area Circulator Main Loop	10.9	4	6	4	2,006
E	Kennesaw State University/Town Center Mall Line	4.0	4	6	4	736
	Total Circulators					**6,220**
TL3	Chastain Road/I-575 Transfer Station to Windy Ridge Parkway/Herodian Way Transfer Station (Marietta Branch Portion)	4.9	2	3	4	451
M	Marietta Vintage Trolley Car Service	4.9	–	3	–	353
	Total Marietta Branch					**804**
	Total					**12,148**

Note: 7.5 trains per hour (60 minutes/8 tph) represents a headway or frequency of service of every 8 minutes, or 8 trains per 64 minutes

Table 12-25
Daily Revenue Vehicle-Miles by Type of Day
Ultimate System with Marietta Branch, Year 2025

Operating Subsystem/Line	Weekday Vehicle-Miles	Saturday Vehicle-Miles	Sunday/Holiday Vehicle-Miles
Trunkline	**11,825**	**7,130**	**5,124**
Circulators	**10,546**	**8,249**	**6,220**
Marietta Branch Through Service	794	627	451
Marietta Vintage Trolley Car Service	696	470	353
Total Marietta Branch	**1,490**	**1,097**	**804**
Total Ultimate System including Marietta Branch	**23,861**	**16,476**	**12,148**

Table 12-26
Annual Revenue Vehicle-Miles by Type of Day
Ultimate System with Marietta Branch, Year 2025

Operating Subsystem/Line	Weekday Vehicle-Miles	Saturday Vehicle-Miles	Sunday/Holiday Vehicle-Miles	Total Vehicle-Miles
Total Trunkline	**2,932,600**	**370,760**	**333,060**	**3,636,420**
Total Circulators	**2,615,408**	**428,948**	**404,300**	**3,448,656**
Marietta Branch Through Service	196,912	32,604	29,315	258,831
Marietta Vintage Trolley Car Service	172,608	24,440	22,945	219,993
Total Marietta Branch	**369,520**	**57,044**	**52,260**	**478,824**
Total Ultimate System including Marietta Branch	**5,917,528**	**856,752**	**789,620**	**7,563,900**

Notes: 248 weekdays per annum
52 Saturdays per annum
65 Sundays and major holidays per annum

Table 12-27
Annual O & M Cost for the Ultimate System, including Marietta Branch, Year 2025

Operating Subsystem/Line	O & M Cost/ Revenue-Vehicle Mile	Transit System Revenue-Vehicle-Miles	Annual O & M Cost (Year 2000 $Millions)
Trunkline	**$6.50**	**3,636,420**	**23.64**
Circulators	**$8.80**	**3,448,656**	**30.35**
Marietta Branch Through Service	$8.80	258,831	2.28
Marietta Vintage Trolley Car Service	$8.80	219,993	1.94
Total Marietta Branch		**478,824**	**$4.22**
Grand Total for the Ultimate System including Marietta Branch		**7,563,900**	**$58.21**

This section of the *Transit Implementation Study* Final Report outlines some key issues that the Georgia Regional Transportation Authority (GRTA) will need to address very early in the process of implementing the Northwest Corridor Light Rail Transit (LRT) System. These include:

- The federal process for development of fixed guideway transit systems
- Program management strategies
- Stakeholder strategies
- Project delivery strategies
- Financing strategies

At this early stage in development of the Northwest Corridor Light Rail Transit System, these issues have not been resolved into a definitive Strategic Implementation Plan. However, key considerations in the resolution of the issues are presented below.

13.1 THE FEDERAL PROCESS FOR DEVELOPMENT OF FIXED GUIDEWAY TRANSIT SYSTEMS

A major objective of the *Transit Implementation Study* is to establish a solid technical information basis that can be built upon to perform additional planning and engineering work necessary to meet eligibility requirements for federal funding support.

13.1.1 FTA Project Planning and Development Process

Figure 13-1 shows the major steps in the FTA Project Planning and Development Process, assuming Federal New Starts participation. While this process could theoretically be streamlined by using only federal flexible funds from highways, as currently included in the adopted Regional Transportation Plan (RTP), it is felt that the best strategy will be to qualify the project for full federal financial participation, so that no options are later foreclosed.

Following this Study, the proposed project will proceed into the first stage, a formal "Alternatives Analysis" – a straightforward, but detailed examination of Study alternatives, a public involvement process, and a thorough documentation of project benefits and costs. The Alternatives Analysis completes the system's planning stage, resulting in the formulation of a "locally preferred alternative" (LPA). Upon formal FTA evaluation and approval, the project is then advanced into the next stage: Preliminary Engineering (PE).

During PE, the design concepts are prepared to a level of detailed design (approximately 30 percent completion) necessary to evaluate the project costs and impacts, as the NEPA environmental clearance process is also completed during this phase. The results of the PE stage include a Record of Decision/Finding of No Significant Impacts (FONSI), preliminary engineering designs, and a detailed financial plan for the project. FTA evaluation and approval is made before the project can advance into the next stage: Final Design.

During Final Design, the project is made ready to secure a "Full Funding Grant Agreement" from the federal government upon completion of Final Design, commitment of non-federal funding and the preparation of construction plans.

Construction is the final stage of the federal project development process. Final design activities, land acquisition, vehicle procurement, and startup activities are completed during the construction stage.

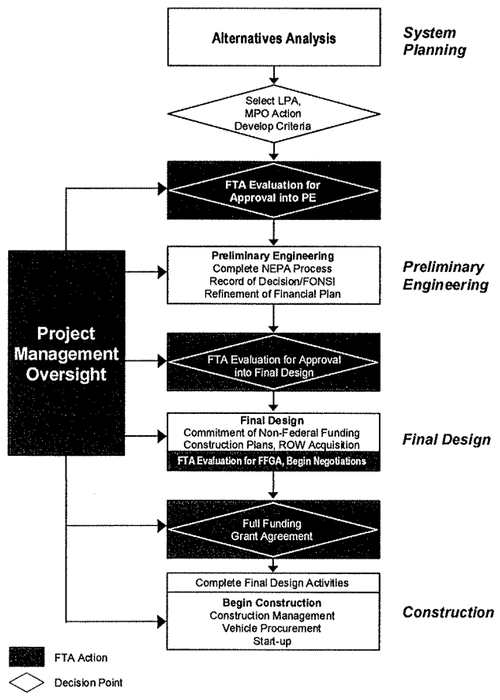


Figure 13-1 FTA Project Planning and Development Process

The Strategic Implementation Plan for the Northwest Corridor LRT System will be based on this FTA process.

13.1.2 Identification of Land Use Strategies

The FTA requires local agencies to develop supportive documentation and quantitative data to assess the "transit-supportive existing land use and future patterns of proposed new starts projects."[1] The land use assessment focuses on six factors that the FTA uses to measure how the project contributes to the integration of land use patterns and how effectively the transit system serves existing and future development.

The six factors used to measure the degree of transit supportive land use include:

- Existing Land Use
- Containment of Sprawl
- Transit Supportive Corridor Policies
- Supportive Zoning Regulations Near Transit Stations
- Tools to Implement Land Use Policies
- Performance of Land Use Policies

The Team made significant progress on these transit-supportive land use issues, recognizing their importance to FTA and to the functionality of the proposed LRT system. Many meetings were held with corridor stakeholders, including state, regional, and county agencies; the FTA; developers within both the Cumberland and Town Center Area CIDs; other consultants; the Georgia Institute of Technology; Kennesaw State University; Transportation Management Associations in both CIDs; and the Study's Steering Committee.

Through these efforts, the Team accomplished a significant amount of work that addresses the FTA land use issues, including:

- Development of a comprehensive land use database quantifying existing and planned land use for both the Cumberland and Town Center Area CIDs. This database is described in Section 2 and detailed in Appendix 1. This database was used to produce the Study patronage forecasts.

[1] Technical Guidance on Section 5309 New Starts Criteria, July 2000, page 69.

- Productive meetings were held with the ARC staff responsible for the regional growth projections, to review the database and to discuss how the updated data can be incorporated into the next regional growth forecasts. This would achieve conformity between the Study projection of growth and the official regional forecast. County planners said this was a major accomplishment, given their past concerns over regional growth projections for the corridor.
- The team held numerous meetings with developers in both the Cumberland and Town Center Area CIDs, describing the concept LRT system for the Trunkline, the Marietta Branch, and the Circulators. These discussions focused on how development plans for new or expanded projects might be revised to incorporate details of the LRT system in terms of station areas, density and orientation of buildings, and other factors. Generally, the team found the development community very receptive to the project and willing to work together in achieving transit supportive land use.

Land use accomplishments are initiatives that should be continued and expanded upon in developing and meeting the FTA criteria. In particular, proactive work with the development community may highlight this project as exemplary of what FTA is seeking to achieve in terms of integrated land use and transit system development.

Furthermore, efforts are needed to modify existing zoning policies to specifically allow for transit oriented development. Workshops and focused discussions should be conducted with county officials and staff, addressing what transit-oriented development is and how it best fits within the corridor in coordination with the transit systems.

13.2 PROGRAM MANAGEMENT STRATEGIES

One of the first things GRTA will need to do, to assure an orderly and effective implementation of the Northwest Corridor LRT System, is to establish a competent program management organization. Following are some of the key issues to be considered in determining a program management strategy.

13.2.1 Is Program Management Necessary?

The management demands of large-scale capital projects involving integrated design, procurement, and construction are characterized by their magnitude and complexity:

- They involve a wide variety of participants from both the public and private sectors, including national and local government agencies, design contractors, construction contractors, suppliers, lenders and community and public interest groups
- They cost hundreds of millions or billions of dollars
- They involve tens of thousands of workers
- They involve dozens of design contractors, materials and equipment suppliers and construction contractors

The purpose of project management is to achieve the Owner's objectives with respect to:

- Cost control
- Schedule control
- Quality control
- Risk management

The process of project management involves the core processes of project planning, management of design, and management of construction and is illustrated in Figure 13-2.

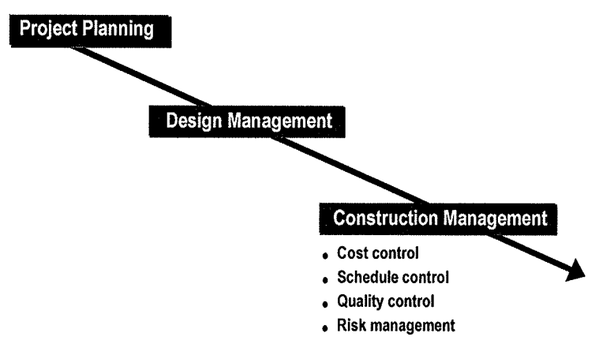


Figure 13-2 The Project Management Process

The basic organization concept for program management is illustrated in Figure 13-3. In this figure, the following functional distinctions are made:

- **Ownership.** Regardless of the role the Owner plays in the management of a project, it has an inescapable responsibility for certain functions as Owner. In general, these involve:
  - Providing guidance and oversight to the program management organization
  - Providing interfaces with government, outside organizations and the public
  - Providing and being accountable for the program's financial resources
  - Ultimately, providing for operations and maintenance of the completed facility
- **Program Manager, Cost and Schedule Control, and Quality Assurance.** The program manager, cost and schedule control, and quality assurance staff provide for the overall general management of the program to implement the Owner's objectives and policies. The program management organization:
  - Translates the Owner's objectives and policies into programs for implementation by execution contractors (design contractors; vendors and suppliers of Owner-provided materials, equipment and services; and construction contractors)
  - Provides an overall program control system, including program scope definition and implementation plan, contract packaging plan, milestone schedules, and cost estimates
  - Coordinates among the functions of engineering, procurement and construction
- **Design Management.** Design management involves the coordination and quality control of the design contractors, including assuring that the Owner's objectives and policies are incorporated into the designs. Considering the complex interrelationships among design elements and the sensitive balance between installed capital cost and operating and maintenance considerations, this is a particularly important function in most major programs.
- **Procurement.** Procurement includes contracting for design and construction services, and purchase and delivery of Owner-provided materials, equipment and services. Procurement also provides the commercial expertise for contract formation and administration.
- **Construction Management.** Construction management involves the coordination and quality control of the construction contractors, including assuring that the Owner's objectives and policies are brought into physical reality, construction claims are minimized, and all required documentation for operations and maintenance is delivered.

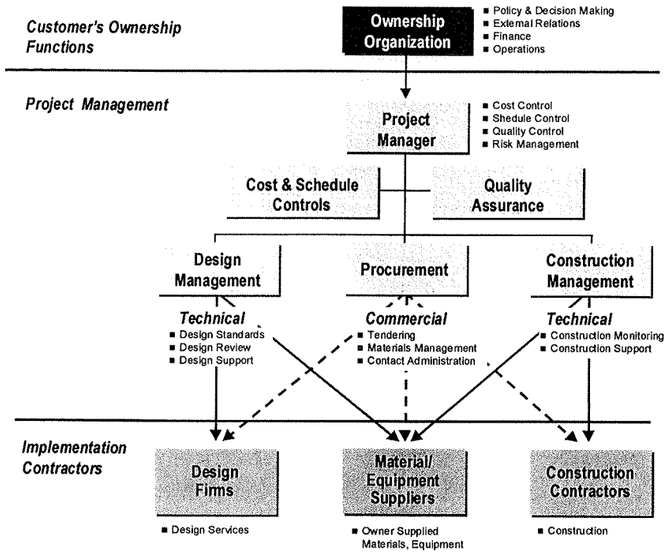


Figure 13-3 Program Management Organization Concept

13.2.2 How Big Should a Program Management Organization Be?

The size and functions of a program management organization will be determined by:

- The size, complexity, and geographic distribution of the work to be done
- The contracting strategy chosen
- The importance the Owner places on cost, schedule and quality control
- The Owner's attitude toward risk management.

Each function that is provided in a Program Management organization is designed to provide tangible benefits. Although benefits relate to productivity, improved schedule, and quality, they ultimately translate as cost savings and are identified as such.

Table 13-1 provides a list of program management functions and the benefits they provide.

Table 13-1
Functions of Program Management and their Benefits

Function	Cost-Savings Benefit
Quality Assurance/Quality Control - to assure designs, materials and construction meet the Owner's standards	Avoids rework and/or later excessive maintenance expense
Procurement - professional contracting and contract administration for design and construction services and Owner-supplied materials and equipment	Lower prices and avoiding disputes and claims
Design Review - to assure designs meet the Owner's standards and design firms maintain schedule	Avoids rework of design or construction work, avoids schedule delays
Design Support - to help design firms meet the Owner's standards and maintain schedule, on an as needed basis	Provides assistance to design firms to obtain resources necessary to meet program objectives; avoids rework of design or construction work or schedule delays
Materials Management - to assure the quality, economical and dependable delivery, and controlled distribution of purchased materials and equipment	Avoids rework and/or later maintenance expense due to inadequate quality, unnecessary expense and/or delays in delivery of purchased materials and equipment, and expense due to loss, vandalism or theft
Construction Progress Monitoring - to assure that construction contractors are maintaining schedules, faithfully following approved designs, and meeting Owner's standards	Avoids rework of construction or schedule delays
Construction Support - to help construction contractors meet the Owner's standards and maintain schedule, on an as needed basis	Provides assistance to contractors to obtain resources necessary to meet program objectives; avoids rework of construction work or schedule delays
Safety - to implement accident prevention programs	Reduces insurance cost
Security - to implement jobsite security programs	Avoids expense due to loss, vandalism, theft, or trespassing
Value Engineering - a professionally applied, function-oriented, systematic team approach used to analyze and improve value in a product, facility design, system or service	Identifies unnecessary program costs, reduces costs, and achieves the maximum benefit from every dollar spent.
Constructibility Analyses - construction specialists, cost estimators, schedulers, and engineers determine general construction feasibility of concept and construction planning to minimize the program critical path and constructed cost	Recommends modifications to design elements for cost or schedule improvements; considers practical construction aspects, such as contractor capabilities, logistics, cost and availability of labor, materials, and construction equipment
Operations & Maintenance Analyses - integrates O&M requirements into the planning and design processes	Improves efficiency of operations and maintenance, improves safety, and maximizes any revenue-generating potential
Public/Community Relations - to determine and assess public opinion toward the program and develop means of achieving community understanding and positive attitude	Anticipates and avoids adverse public opinion and serious opposition that could result in schedule delays and cost increases
Information/Automation Management - development and implementation of standards for communications and deliverables from all participants	Improves efficiency of communications, information transfer to operations, and efficiency of operations and maintenance; reduces document management costs
Finance & Accounting - drawdown of loans as needed, timely payment to suppliers, and hedging foreign exchange exposures	Reduced interest expense, reduced friction with suppliers, and reduced foreign exchange exposure

The leverage over program performance available from program management is enormous. Program management costs vary, depending on the scale and complexity of the program and the program management services provided. The investment in program management services can be readily recovered in overall program cost and schedule savings. This principle is demonstrated by the Santa Clara County Highway Improvement Program, as shown in Figure 13-4.

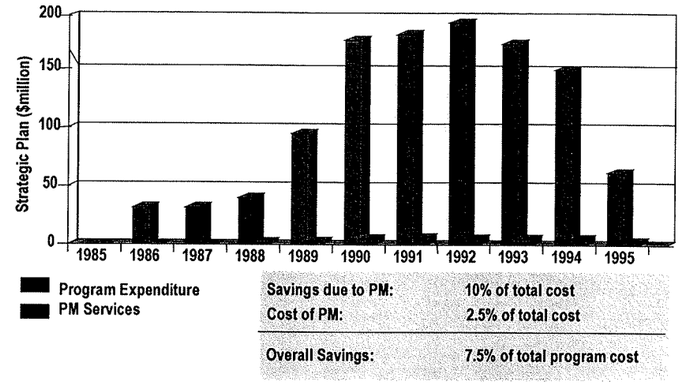


Figure 13-4 Santa Clara County Highway Improvement Program Management Value

13.2.3 What Are Contracted Program Management Services?

A program management contractor is a seamless extension of the Owner's resources, augmenting its staff to extend its capabilities to the degree desired to meet the Owner's objectives for control and risk avoidance.

The program management contractor will provide experienced, qualified professionals to inform and advise the Owner with regard to the planning and execution of its program and to direct implementation of the Owner's decisions.

The program management contractor, as agent for the Owner, assists the Owner in preparation of bid packages for design and construction services and procurement of Owner-provided materials and equipment, assists in the process of bid evaluation and award, and assists in the administration of services and purchase contracts.

The Owner and the program management contractor (together with whatever other consultants the Owner may wish to include) form the program management team.

13.2.4 Who Should Perform Program Management?

There is a wide range of approaches available for management of major design and construction programs. All of them are feasible, in that each can be effective in controlling program schedule, cost, and quality with the appropriate staffing and tools.

The approach most suitable for a particular Owner and program is determined by a number of factors, such as:

- **Owner's Program Management Expertise.** The extent to which the Owner has the experienced senior program management professionals and systems necessary to manage a program of this type, complexity and magnitude.
- **Owner's Desire for Participation.** The degree to which the Owner wants to be involved in the day-to-day work and decision-making of the program.
- **Owner's Desire for Checks and Balances.** The degree to which the Owner wants to have the program organization generate and resolve different points of view.
- **Owner's Willingness to Staff and Demobilize.** The degree to which the Owner is willing to recruit, hire, train and replace turnover in the Owner's program staff, and eventually demobilize the Owner's program staff not required for future work.
- **Owner's Objectives.** Program management is a strategy for managing the critical issues and priorities of a major program. Accordingly, policies, procedures and organization must be tailored to the specific critical issues and priorities of each program.

Many times, an owner will elect to use the services of a program management contractor rather than incur the inconvenience, cost, and risk associated with recruiting, training, and destaffing its own program management staff. This is chosen primarily for programs that are "one-off" due to their size or nature.

At the same time, owners often want to control certain design and other decisions to ensure that their objectives and policies are properly incorporated into their program.

A number of ways have been developed to enable owners to control the decisions they consider important, without having to staff large program management organizations. These tend to be referred to as Integrated Program Management Organizations.

Examples of alternative approaches to program management, which demonstrate the range of options available to owners, are shown in Figures 13-5, 13-6, and 13-7:

- Figure 13-5, One Contractor Provides All Program Management. In this alternative, a professional firm with a proven record of successful management of major transit projects provides overall program management, including design management, procurement, and construction management services as required and as appropriate within the context of state, municipal, and county regulations and procedures. The program management contractor would be overseen by a small in-house GRTA program management cadre.

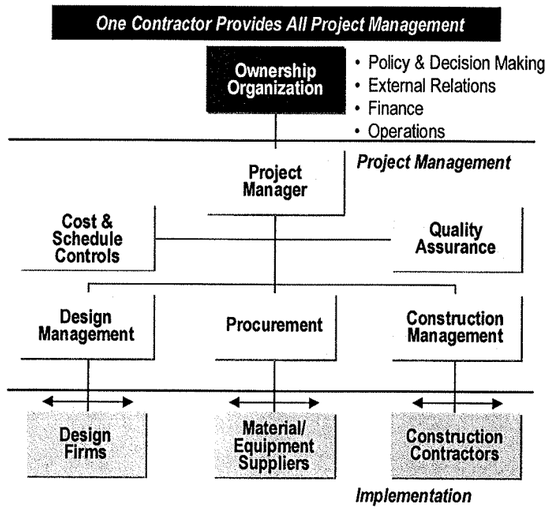


Figure 13-5 Alternative Approaches to Program Management – One Contractor Provides All Program Management

- Figure 13-6, Integrated Program Management Organization. In this alternative, which can take a wide spectrum of forms, GRTA would establish a program management organization and staff it with a mix of its own personnel and personnel supplied by contracted professional firms. GRTA would select the positions and functions it wished to hold and assign the rest to the contractor.

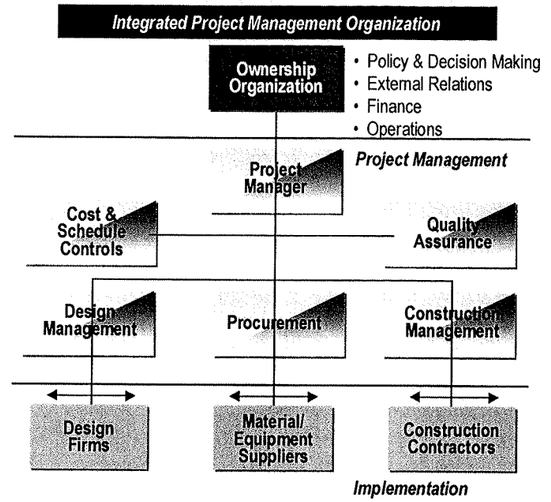


Figure 13-6 Alternative Approaches to Program Management – Integrated Program Management Organization

- Figure 13-7, Owner Provides All Program Management. In this alternative, GRTA would provide the entire program management organization, together with all of the systems and procedures required to perform the desired program management functions.

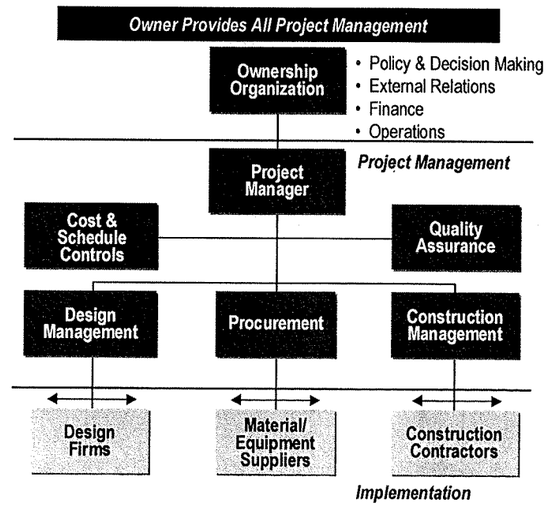


Figure 13-7 Alternative Approaches to Program Management – Owner Provides All Program Management

- Staffing implications of the alternatives shown, which are just three of several options, are indicated in Table 13-2, which takes into consideration variations in levels of performance. Experience has shown that owners' program management teams typically do not achieve the level of performance demonstrated by teams from program management contractors whose skills are constantly honed by global experience and competitive environment.

Table 13-2
Staffing Implications* of Alternative Program Management Concepts

Alternative	PM Contractor	Owner	Total
1. One Contractor Provides All Program Management	175	15	190
2. Integrated Program Management Organization	115	90	205
3. Owner Provides All Program Management	0	235	235

Note: 1 Owner staff = 0.8 Contractor staff

* Staffing estimates are based on a major highway program with numerous design, procurement and construction contracts. The intent of the estimates is to compare the impact of the alternative program management concepts on the staffing level of the Owner for obtaining the same level of program control.

13.3 STAKEHOLDER STRATEGIES

Implementation of a large, modern public infrastructure project requires the support of a large number of stakeholders, and minimization of any significant opposition. The development of stakeholder support, and the reconciliation of opposition, must begin at the earliest possible time and continue throughout the development period and thereafter. Following are some of the key issues to be considered in determining a stakeholder strategy for the Northwest Corridor Light Rail Transit System.

Stakeholder strategies blend the technical requirements of a major public program with the governmental, regulatory, procedural, and public dictates of the program. The critical goals of this function are to:

- Facilitate an understanding of the program and its effects among the local populations, contiguous jurisdictions, governmental agencies, business community, special constituencies, and funding and oversight bodies
- Create a seamless, integrated, professional organization modeled on the best public and private policies and practices to inform the public, local business, the FTA, other funding sources, and other stakeholders and respond to any concerns expressed

This will involve coordinating intergovernmental funding, obtaining regulatory approvals, managing media relations, and designing programs to inform the public and mitigate community disruptions.

Examples of the types of strategies that might be pursued include:

- External Affairs Programs
- "Friends of the NWLRT" Programs
- Project Mitigation Programs
- Community Outreach Programs
- Media Interface Programs
- Public Hearings

13.3.1 External Affairs Programs

External affairs programs focus on communicating program successes and community benefits to regulators, elected officials, media, and other interested parties, and establishing GRTA as a model of environmentally, economically, and socially responsive management.

The objective is to make certain that every agency involved in, or affected by, the Northwest Corridor Light Rail Transit System receives all necessary information in a timely, accurate manner.

13.3.2 "Friends of the NWLRT" Programs

A "Friends of the NWLRT" program would include citizens, business leaders and others to galvanize support for future bond measures, and function as a public advocacy organization.

13.3.3 Project Mitigation Programs

Project mitigation programs are proactive efforts to minimize impacts and disruptions, build public support, involve program delivery in community initiatives, and manage crises. These programs can include:

- Establishing an Environmental and Economic Development Working Group of environmental and community leaders to link with the advocacy community and oversee metrics to ensure compliance with the project's environmental and community development requirements.
- Designating area managers to oversee project-focused community relations and mitigation activities, identify impacts, evaluate issues against program imperatives (e.g., cost, schedule) to ultimately develop a strategy that is incorporated into the program execution plan

13.3.4 Community Outreach Programs

The objectives of community outreach programs are to encourage an exchange of ideas and information on issues related to a project, and to generate interest in, and support for, the new transit service. A community outreach program is intended to work alongside the technical work efforts. It requires a careful mix of informational and interactive activities to foster consensus among the Project's diverse constituencies. Outreach activities are scheduled and structured to reflect the Project's geographical, demographic, and commercial diversity and to facilitate open communications, problem resolution, and consensus building. The program evolves from phase to phase.

Phase I – During the NEPA process, the community relations program is designed to address the concerns of:

- Residents and businesses of the affected areas
- Elected officials, labor organizations, and government agencies
- Other critical local and regional stakeholders and constituencies

In addition, the program provides a channel for communication from the communities and other stakeholders, allowing the Project team to identify and address new or unanticipated local priorities and issues.

A Comprehensive Communications and Coordination Plan (CCCP) is developed which describes the elements of the community relations program for Phase I. The components of the plan can include:

- Advisory Committees, including a Technical Advisory Committee and Citizen Advisory Committee
- General information meetings and the public hearings

- Printed materials, including fact sheets, newsletters, and brochures
- Videos
- Web page
- Presentations

Phase II – At the completion of the EIS process, all Phase I activities continue; however, the emphasis shifts toward reaching closure on outstanding issues related to final design and mitigation measures during construction.

In addition, opportunities to share information with large segments of the public are developed. These include public forums and open houses, which provide occasions to offer project narrative and materials to a variety of constituencies. The objective of these kinds of forums will be to provide GRTA with an effective means of offering information and receiving input in non-confrontational environments.

Phase III – Although phases overlap, the public awareness program changes emphasis as construction activities begin to disseminate more information on construction activities. There is widespread dissemination of construction bulletins to alert residents, businesses, and other concerned parties to planned construction activities and potential disruptions and inconveniences. These notifications supplement the newsletters and Web page updates, which were begun in Phase I. Mailing and informational lists are updated to verify that the appropriate organizations, agencies, officials, and concerned individuals are receiving project materials.

Phase IV – The public awareness and informational program continue throughout start-up. It is supported by appropriate outreach activities. Construction task forces meet as required, and briefing of the various stakeholders and constituencies are scheduled as needed to make certain that open lines of communications are maintained until the Project is completed. The focus of the public awareness program shifts to support the opening of GRTA's new rail service.

13.3.5 Media Interface Programs

Media interface programs provide information, materials, and any other support required to assist with media briefings, announcements, and press releases.

13.3.6 Public Hearings

In accordance with the National Environmental Policy Act (NEPA) of 1969, public hearings will be held in Cobb and Fulton counties to provide a formal opportunity for public review of the DEIS. These public hearings will be in addition to the series of general information public meetings planned to occur throughout the development of the Project's design and the preparation of the DEIS.

13.4 PROJECT DELIVERY STRATEGIES

Selection of a project delivery strategy (also called a contracting strategy or a contract packaging strategy) will have a significant impact on the ultimate cost, schedule, and quality of the Northwest Corridor Light Rail Transit System, not to mention the risk GRTA will assume in undertaking to meet cost, schedule, and quality goals and commitments. Following are some of the key issues to be considered in determining a project delivery strategy for the Northwest Corridor Light Rail Transit System.

13.4.1 Range of Strategies Available

Customers for design and construction programs have a choice of a range of project delivery methods, including:

- Design-Bid-Build (DBB), in which a design is prepared, construction bids are solicited, and a construction contract is let.
- Design-Build (D-B, also often termed EPC or Turnkey), in which design is partially completed (typically about 30 percent complete) and a contract is let for completion of design and construction, frequently under a lump-sum contract.
- Build-Own-Transfer (BOT), in which a contractor takes an ownership position and is responsible for design and construction, with a defined term of operation and maintenance before turnover to another owner (transit authority, airport authority, etc.).
- Build-Own-Operate (BOO), in which a contractor takes an ownership position and is responsible for design, construction, and then perpetual operation and maintenance
- Public-Private Partnerships (PPP), in which a government entity and one or more private companies undertake a project together as owners.

13.4.2 Benefits of Various Project Delivery Strategies

Design-bid-build is the most traditional and conventional form of contracting for infrastructure projects (though not for process plants and various other types of projects). Some of the key benefits include the following:

- Owner control. The owner controls each element of the project delivery process.
- Competitive bidding. Each contract package can be designed to attract the optimum competition. Many design, manufacturing, and construction companies, including many local firms, are geared to compete for this type of packaging on a regular basis.
- Local participation. Directing work to local firms is facilitated.

The design-build method of project delivery has a number of benefits including the following:

- Single point of responsibility. Under the traditional design-bid-build approach, the owner provides the design to the construction contractor. Design-build virtually eliminates the opportunity for extensive claims if the design has flaws (errors and omissions). The need for the owner (or his program manager) to coordinate between designer and construction contractor is eliminated.
- Cost savings. Designers can work with the responsible construction organization to reduce costs (constructibility reviews).
- Schedule savings. Bid periods can be eliminated and construction can begin as various parts of design are completed (or partially completed with details to be provided by the field engineers).
- Earlier guaranteed cost. Typically the owner receives a guaranteed cost after design is about 30 percent complete instead of after completion of design and bidding as in the design-bid-build approach. This avoids wasting design cost if the program is too expensive and allows the owner to make earlier commitments (to users, for financing, etc.)

The build-own-transfer method of project delivery adds the following benefits to the design-build approach.

- **Financing**. Permits the owner to defer financing the project until the transfer.
- **Operations**. Permits the owner to develop an operations organization while an experienced operator operates the system for a period of time.
- **Accountability**. Permits the owner to hold the contractor accountable for performance of the system for a period of time.

The build-own-operate method of project delivery adds the following benefits.

- **Financing**. Permits the owner to avoid a major capital investment.
- **Operations**. Permits the owner to avoid developing an operations organization.
- **Accountability**. Permits the owner to hold the contractor accountable for performance of the system indefinitely.

The private-public partnership method of project delivery attracts private capital and management to public projects, while retaining public agency involvement in management.

13.4.3 Application to the Northwest Corridor LRT System

In the case of the Northwest Corridor Light Rail Transit System, these project delivery methods could be applied to the Preferred Initial Project in total or in part (see Section 11 for a description of the Preferred Initial Project). For example:

- The entire Preferred Initial Project could be broken into various design, procurement, and construction contracts
  - The procurement contracts, for equipment or materials (e.g., trains, cement, aggregate, rail, ties), would be selected where there would be advantages to the owner in terms of pricing, quality control, or vendor relations.
- The entire Preferred Initial Project could be packaged as one D-B, BOT, BOO, or PPP contract
- Individual elements of the Preferred Initial Project could be packaged differently:
  - The civil work could be broken into design-bid-build contracts
  - The rail systems (traction power, train controls, etc.) could be packaged as a design-build contract
  - Various parking facilities could be packaged as build-own-operate concessions
  - Various stations or developments in air rights over stations could be packaged as public-private-partnerships.

The contract packaging plan for the Preferred Initial Project should be guided by such matters as:

- The owner's risk management considerations
- The ability to finance the project with public funds
- The desire for the owner to have management control of the project development and operation
- The ability to bring the system into operation at the time desired
- The ability to attract the quality of contractors required to provide the quality of system desired
- The ability to attract competitive bidding to assure fair prices
- The ability to contract to local firms to the degree desired

13.4.4 Implementation Schedule

A preliminary implementation schedule is provided in Figure 13-8. This schedule is based on a conventional design-bid-build delivery strategy and can serve as a basis for evaluating other alternatives, should GRTA wish to investigate them. Highlights of this schedule are as follows:

The federal process for development of fixed guideway transit systems has been followed, including:

- Alternatives analysis
- NEPA process
- Preliminary Engineering
- Final Design
- Construction

The initial critical step, once a decision has been made to implement the Northwest Corridor LRT System, is to establish a program management organization to set up and manage the Alternatives Analysis and NEPA process. Contracted program management services have been included to support the GRTA staff throughout the development process, commencing as soon as possible after the decision to proceed.

The right-of-way acquisition process is begun as soon as possible, with actual purchases beginning immediately after a Record of Decision.

As the design proceeds and detailed constructibility analyses are performed, various contract packaging strategies and fast-tracking schemes will be explored to meet GRTA's objectives and the availability of funds.

In order to accelerate transit service to the northwest corridor, the Preferred Initial Project has been broken down into four Minimal Operating Segments (MOS) which have then been fast-tracked. The four segments, shown in Figure 13-9, are:

- MOS #1 – Trunkline Phase 1. This segment consists of 14.15 miles, 11 stations and runs from Chastain Road/I-575 Transfer Station to the Cumberland Boulevard Transfer Station. It includes the system's maintenance facility.
- MOS #2 – Cumberland Circulator Phase 1. This segment consists of 7.58 miles, and 21 stations. It includes the 4.41-mile Central Loop with 11 stations; the 2.48-mile leg down to the Paces Ferry Road/Home Depot Station that includes 8 stations; and the 0.69-mile leg up to the Windy Ridge Pkwy/Powers Ferry Road Station in Wildwood that includes 2 additional stations.
- MOS #3 – Trunkline Phase 2. This segment consists of 10.5 miles, and 5 stations. Cumberland Boulevard Transfer Station to Arts Center Station, Midtown Atlanta.
- MOS #4 – Town Center Area Circulator Phase 1. This segment consists of 3.66 miles, and 9 stations. Barrett Parkway Transfer Station, along Barrett Parkway, around the Mall, and on to the Chastain Meadows Parkway/Barrett Parkway Station.

The rationale for the establishment of these four segments, and the recommended order of their implementation is as follows.

MOS #1 –Trunkline Phase 1.

It is envisioned that MOS #1 should be the initial segment of the Northwest Corridor LRT System opened for revenue service

operation. First, given the magnitude of the detailed work accomplished for this segment of the Trunkline, as presented in this *Transit Implementation Study*, coupled with the early consensus that has been developed during the past year for the location of the Trunkline and its stations, the Alternatives Analysis work and the follow-on technical engineering work can be advanced expeditiously. Early completion of the preliminary and final engineering work will enable the construction of this segment to be the first to commence.

Secondly, the central maintenance and storage facility for the System is located within this segment and is required as an integral part of an initial operating segment. The light rail vehicles will be delivered to this facility and commence initial testing along the adjacent segment of the Trunkline. Thirdly, as explained in Section 11, this initial segment is anticipated to attract significant ridership levels and as such, can be expected to be looked upon favorably by the FTA and GRTA for initial revenue service operation.

MOS #2 – Cumberland Circulator Phase 1

Similar to MOS #1, a great deal of technical work has been accomplished in regard to the Cumberland Circulator, as presented within this *Transit Implementation Study* Final Report, that will enable the Alternatives Analysis work and the follow-on technical engineering work to be advanced expeditiously, resulting in early commencement of construction.

Secondly, a consensus has been established within the Cumberland CID during the last year, in regard to the routing of the Circulator and its station locations, which will also enable the Alternatives Analysis work, the preliminary and the final engineering work to proceed as quickly as possible. And third, as has been presented within Section 11, the projected ridership of this initial phase of the Circulator will be significant, as will its impact on and resulting increase in the Trunkline patronage.

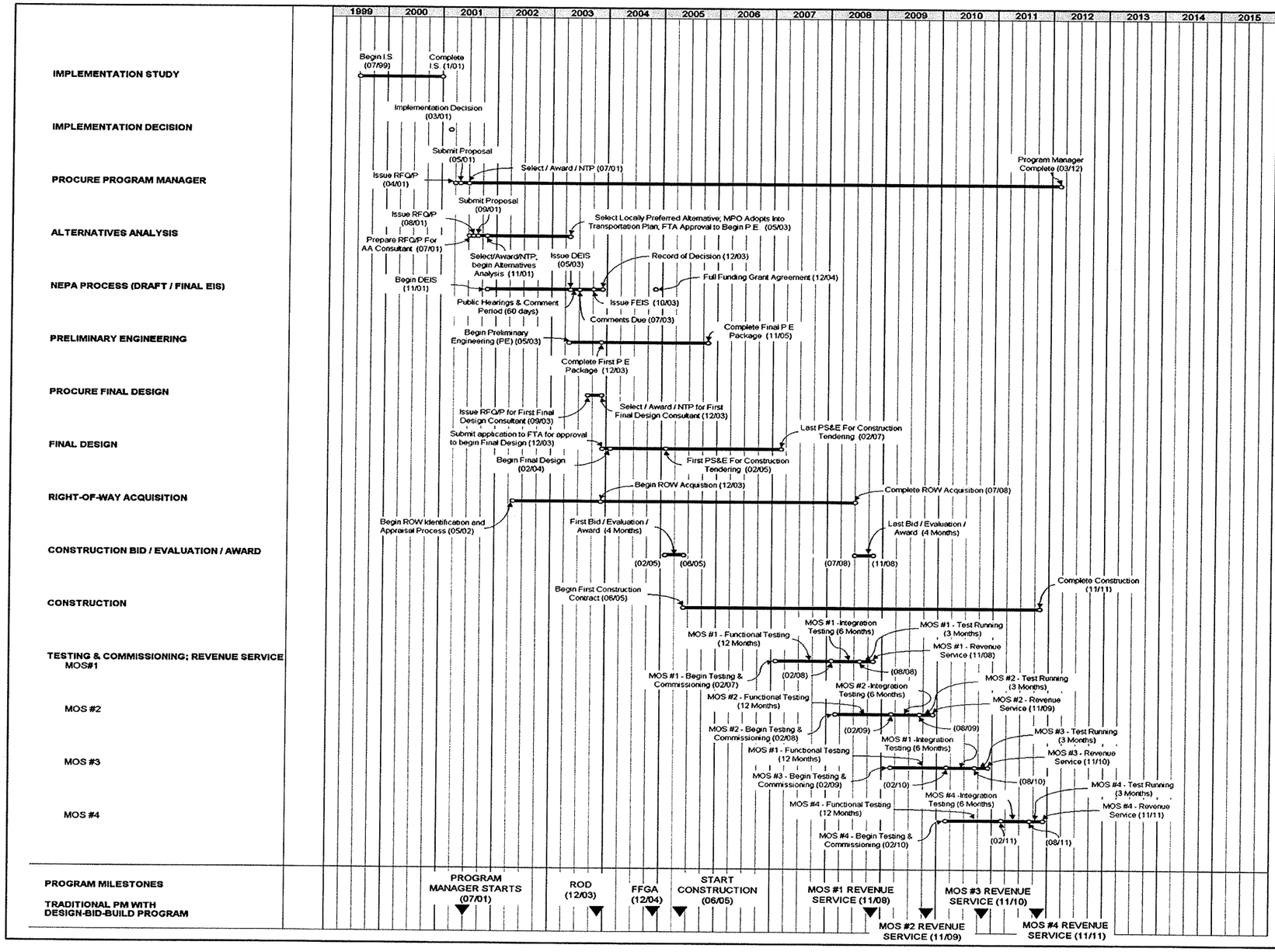
MOS #3 – Trunkline Phase 2

The continuation of the Trunkline southward into Fulton County, to Midtown Atlanta, where transfers would take place to the MARTA heavy rail rapid transit system at the Arts Center Station, would constitute the third segment of the Preferred Initial Project to be opened for revenue service. The detailed work accomplished for the Cobb County segments of the Northwest Corridor LRT System have not been performed for the Fulton County segment of the Trunkline, as explained within Subsection 1.1.3 of this Final Report. Therefore, with the immediate need to perform that work, it can be expected that this segment will move through the Alternatives Analysis process and the follow-on engineering phases at a slower pace, causing its construction to be completed after that of MOS #1 and MOS #2.

Secondly, in contrast to the relative ease with which a consensus was established for the Trunkline's location in the median of Cobb Parkway, there are a number of potential alignment and segments thereof, for the Trunkline in Fulton County that can be expected to take a longer time to resolve. Again, excepting the various studies that were conducted years ago, this work has not been done, which will result in a later revenue service opening date for MOS #3.

MOS #4 –Town Center Area Circulator Phase 1

The implementation of the initial phase of the Town Center Area Circulator, as MOS #4, would complete the implementation of the Preferred Initial Project of the Northwest Corridor LRT System. Although the conceptual engineering work and various technical investigations have been completed for the Town Center Area Circulator, as presented within this *Transit Implementation Study* Final Report, which would enable it to move through the Alternatives Analysis and technical engineering phases quickly, it is thought that the lower patronage expectations for this Circulator naturally result in its being recommended as the fourth and final segment of the Preferred Initial Project. This will enable its opening to align more directly with the significant future growth and densification that is projected for the Town Center Area.



SCHEDULE BASIS & ASSUMPTIONS

(1) A/E Consultant Selection process of 3 months.

(2) Construction contractor bid/evaluate/award/NTP process of 4 months.

(3) Preliminary Design, Final Design, and the NEPA Process will commence with FTA approvals in accordance with Section 5309 New Starts Criteria.

(4) Assumed 60 day duration for NEPA public hearings and comment period.

(5) Assumed 60 day duration from Issuance of FEIS to Record of Decision.

(6) Final Design consultant procurement begins 3 months prior to Record of Decision and concludes at Record of Decision.

(7) The first Preliminary Engineering Package is available for Final Design after 7 months of preliminary engineering.

(8) The first Final Design Package is available for construction tendering after 12 months of Final Design.

(9) Minimum Operating Segments (MOS) 1-4 are defined below and are phased to open 12 months apart

(a) MOS #1 – Trunkline Phase 1

14.15 miles, 11 stations. Cumberland Boulevard Transfer Station to Chastain Road/I-575 Transfer Station.

(b) MOS #2 – Cumberland Circulator Phase 1

7.9 miles, 21 stations. Includes the 4.73 mile Central Loop (including the .32 mile operating connection) with 11 stations; the 2.48 mile leg down to the Paces Ferry Road/Home Depot Station that includes 8 stations; and the .69 mile leg up to the Windy Ridge Pkwy./Powers Ferry Road Station in Wildwood that includes 2 additional stations.

(c) MOS #3 – Trunkline Phase 2

10.5 miles, 5 stations. Cumberland to Arts Center, transfer to MARTA.

(d) MOS #4 – Town Center Area Circulator Phase 1

3.66 miles, 9 stations. Barrett Parkway Transfer Station, along Barrett Parkway, around the Mall, and on to the Chastain Meadows Pkwy./Barrett Parkway Station.

(10) The Full Funding Grant Agreement (FFGA) is issued during the Final Design Process for the First Final Design Package (2 months prior to construction tendering).

Bechtel Infrastructure Corporation

Mayes, Sudderth, & Etheredge, Inc. Atlanta, GA / Little Rock, AR / Lexington, KY St. Marys, GA / Myrtle Beach, SC

FIGURE 13-8 TRADITIONAL DESIGN-BID-BUILD PROGRAM SCHEDULE

Transit Implementation Study

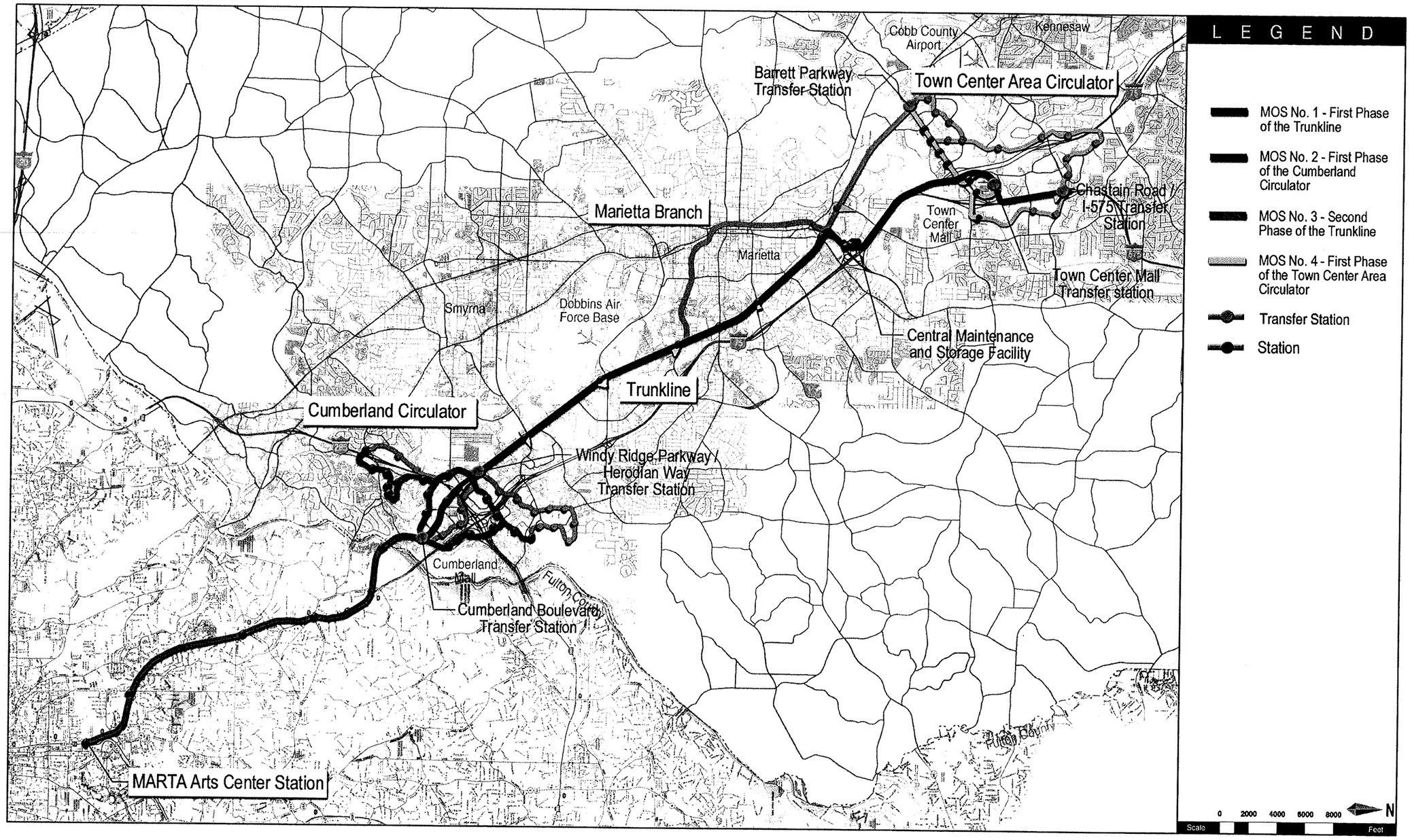


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FIGURE 13-9 MINIMAL OPERATING SEGMENTS OF THE PREFERRED INITIAL PROJECT

Transit Implementation Study

13.5 FINANCING STRATEGIES

As discussed in Section 10, financing the Northwest Corridor LRT System will be a very significant challenge. This section specifically demonstrates the range of available financial options, as applied to the estimated construction and O&M costs for the Preferred Initial Project.

Using assumptions consistent with the Atlanta Regional Commission's adopted 2025 Regional Plan, the following pages illustrate the magnitude of local effort likely to be required to meet the non-federal share of project costs of the Preferred Initial Project. A sensitivity analysis shows the effect of reducing federal financial participation from 80 percent to 50 percent. *The intent here is not to indicate any preference for particular funding strategies, but to give some sense of the level of financial effort involved as a basis for further discussions.*

It is currently envisioned that a first segment of the Preferred Initial Project could be completed and in operation by the end of year 2008. Key milestones toward that completion date are shown in Table 13-3.

13.5.1 Capital Construction Costs

The cost estimate for the Preferred Initial Project is approximately $3.3 billion (in constant year 2000 dollars), which includes funding for the Trunkline from the Town Center Area to a MARTA transfer at the Arts Center Station in Midtown Atlanta, as well as construction of initial operable segments of the Cumberland and Town Center Area Circulators.

To avoid precipitating controversy over assumed levels of federal or state financial assistance, while permitting calculation of an indicative local financial burden, the funding assumptions used in the adopted, and financially constrained, ARC 2025 Regional Plan were used as a starting point. Two scenarios were then developed – a Flexed Capital Scenario, and a New Start Capital Scenario – as described below.

Flexed Capital Scenario

The following assumptions were used for the Flexed Capital Scenario:

- Based on a total cost for the Preferred Initial Project of $3.3 billion in year 2000 dollars
- An allowance of $200 million for right-of-way was added to the $3.3 billion base cost. It was assumed that $100 million of this total would be donated to the project. This is important because donated right-of-way costs can be used to offset local matching requirements for federal funds.

Table 13-3
Key Financial Milestones

Start Date	Project Milestone	Financial Plan Activity
Spring 2001	Georgia Regional Transportation Authority (GRTA) assumes sponsorship of the Northwest Corridor Light Rail Transit Project	• Discussions with GRTA staff concerning approach, timetable, and roles for financial plan
November 2001	Commencement of the Alternatives Analysis	• Development of Preliminary Financial Plan in accordance with pending New Starts Guidance and in compliance with FTA June 2000 Guidance for Transit Financial Plans • Work with local public and private agencies under sponsor's direction to chart financial strategy acceptable to stakeholders • Under sponsor's direction, work with MPO to refine financial strategy and incorporate same into regional Unified Work Program and Transportation Improvement Program • Tentative decision whether federal New Start funding will be sought • Engage with Bond Rating Agencies on preliminary basis soliciting feedback on financial plan and strategy
May 2003	Commencement of the Preliminary Engineering and Draft Environmental Impact Statement (DEIS) work	• Further refinement of Financial Plan and local funding commitments • Reaction and adjustment to FTA initial rating of submitted local financial commitment data • Interaction with Federal Reauthorization legislation and support for GRTA/Cobb decision whether to pursue earmarked funding
February 2004	Commencement of the Final Engineering work for the Northwest Corridor Light Rail Transit Project	• Advance submittal to FTA demonstrating local financial commitments in terms of FTA evaluation criteria is required, leading to request for Full Funding Agreement • Finalization of Federal funding strategy and State and Regional financial contributions • Development and adoption of fare policy • Development and implement financial features of sponsoring/operating agency(s)
December 2004	FTA commits to the Full Funding Grant Agreement (FFGA) for the Northwest Corridor Light Rail Transit Project's construction	• Advance submittal of final Financial Plan and commitment of all non-federal funds (including full documentation) • Support for negotiations with FTA concerning elements and provisions of FFGA • Initial debt ratings, bond issuance, and commencement of other capital revenue streams • Implement plans for investment of idle fund balances
June 2005	Construction is commenced on the Northwest Corridor Light Rail Transit Project	• Development of Strategic Financial Plan designed to reflect real time financial impacts of construction decisions on capital and operating costs • Continued issuance of bonds and/or other debt • Preparation of, adoption, and implementation of short-term capital budgets
November 2008	Construction and operations testing are completed and the Northwest Corridor LRT Project's first operating segment (MOS #1) is opened to the public for revenue operation	• Preparation of 25-year Business Plan for Operations • Preparation of Recapitalization Plan • Preparation of and adoption of operating budget and short-term (3- to 5 year) operating plan

- Inflation will be 4 percent per year.
- Construction will begin in year 2005 and be completed in 6.5 years.
- Although partial revenue service will begin in 2008, it is assumed for purposes of illustration that full revenue service will commence in year 2010, with no partial service.
- Financing and interest costs during construction have not been included.
- Based on the ARC assumptions, it was assumed that:
  - No FTA or New Start funding would be available for this project (due to the requirements of other project against regional allocations)
  - 80 percent of the project costs to be funded by flexible funding from highway sources
  - Except for GRTA funds, no other State funds would be used
  - 20 percent of the project costs to be funded by GRTA and/or local sources (including private sources)

It should be noted that the project cost assumed in the ARC adopted plan is significantly lower than the $3.5 billion total used here as the result of more recent and updated studies.

Table 13-4 shows the results of applications of these assumptions to the estimated project cost.

New Start Capital Scenario

Due to the magnitude of the requirement for flexible funds under the previous scenario, a second scenario was developed, based on the assumption that New Start federal funds might be sought at a 50 percent level in lieu of flexible funds at the 80 percent level. All other assumptions are the same for both scenarios. Table 13-5 shows the results of application of the New Start Capital Scenario.

The intent of using these two scenarios is to essentially bound the parameters of federal financial participation. Of course, in actual practice, it is possible, and even likely, that some blending of the two approaches would occur. It should also be pointed out that flexed funding can occur at less than 80 percent and New Start Funding at more or less than 50 percent. However, at this stage in the process, it is reasonable to assume for the purpose at hand that federal participation will fall somewhere between the extremes illustrated by these two capital scenarios.

Table 13-4
Applications of Cost Assumptions to the Estimated Project Cost for the Flexed Capital Scenario

Capital Cost (in millions $)					Capital Funding (in millions $)				
					Federal			Non-Federal	
						80%		20%	
Year	Capital Cost Allocation	Capital Cost (Year 2000 $)	Inflation Rate	Capital Cost (Year of Expenditure $)	New Start (§ 5309)	Flexed and Multiple Use	Formula (§ 5307)	Direct State	GRTA/ Local
1	0.4%	14	4%	15		12			3
2	1.3%	46	4%	49		39			10
3	1.3%	46	4%	51		41			10
4	3.3%	116	4%	135		108			27
5	4.5%	158	4%	192		153			38
6	4.1%	144	4%	182		145			36
7	18.1%	634	4%	834		667			167
8	20.5%	718	4%	982		786			196
9	21.1%	739	4%	1,051		841			210
10	19.0%	665	4%	984		787			197
11	6.4%	224	4%	345		276			69
	100%	**3,500**		**4,819**		**3,855**			**964**

Table 13-5
Results of Application of the New Start Capital Scenario

Capital Cost (in millions $)					Capital Funding (in millions $)				
					50% Federal			50% Non-Federal	
					50%				50%
Year	Capital Cost Allocation	Capital Cost (Year 2000 $)	Inflation Rate	Capital Cost (Year of Expenditure $)	New Start (§ 5309)	Flexed and Multiple Use	Formula (§ 5307)	Direct State	GRTA/ Local
1	0.4%	14	4%	15	7				7
2	1.3%	46	4%	49	25				25
3	1.3%	46	4%	51	26				26
4	3.3%	116	4%	135	68				68
5	4.5%	158	4%	192	96				96
6	4.1%	144	4%	182	91				91
7	18.1%	634	4%	834	417				417
8	20.5%	718	4%	982	491				491
9	21.1%	739	4%	1,051	526				526
10	19.0%	665	4%	984	492				492
11	6.4%	224	4%	345	172				172
	100%	**3,500**		**4,819**	**2,410**				**2,410**

13.5.2 Operating and Maintenance Costs

In year 2000 dollars, it is estimated to cost approximately $17 million per year to operate and maintain the Trunkline from Town Center to Arts Center and $10 million per year to operate and maintain the Cumberland and Town Center Area Circulators.

As in the capital cost estimate, adopted ARC funding assumptions have been used to calculate a local share, to avoid unintended controversy over assumptions related to GRTA, federal, and state funding.

Unlike the treatment of capital cost financing, only one scenario was developed for funding operations and maintenance costs for this project.

The following assumptions were used with regard to operating and maintenance:

- Based on approximately $17 million per year for the Trunkline and $10 million per year for both circulators, in 2000 dollars.
- Revenue service to start in 2010
- Real growth in patronage will be 1.6 percent per year
- Inflation will be 4 percent per year
- Departing slightly from ARC assumptions of a constant 35 percent recovery ratio, it was assumed:
  - Fares and other system-generated revenue would be set to permit a recovery ratio of 50 percent for the Trunkline and 25 percent for the Circulators
  - During the first three years of operation:

    ~ 50 percent of the subsidy required after system-generated revenue would come from Federal CMAQ funds

    ~ The remaining 50 percent would come from Federal Formula Funds as "Preventative Maintenance"

    ~There would be no required GRTA/local contribution during this period
- After three years:

  ~ 25 percent of the operating cost would come from Federal Formula funds as "Preventative Maintenance"

  ~ The balance required would come from GRTA/local sources (including private)
- No state funds, except to the extent that GRTA is considered "state funding," would be involved.

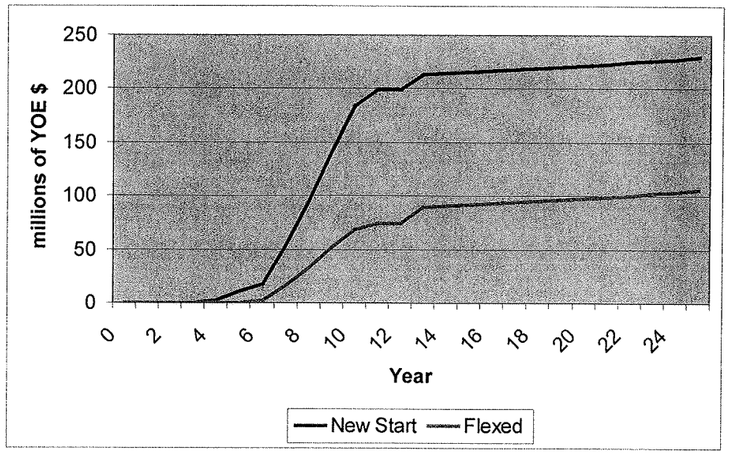
The result of application of these assumptions is shown on Table 13-6.

13.5.3 Local Share Capital and Operating Costs

In the attempt to scale the difficulty of meeting the GRTA/local funding shares shown above from non-federal sources, several indicative ways of raising local revenue are shown in the Tables 13-7 and 13-8. After deduction of an allowance for soft match credit for donated right-of-way, a pay-as-you-go (PAYG) and 100 percent bonded amount is shown for both the Flexed Capital Scenario (80 percent federal) and the New Start Capital Scenario (50 percent federal)

13.5.4 Scenario Summary

The results of the Flexed and New Start scenario analyses, presented in the previous sections, are graphically depicted below.



It is unlikely that either of these two scenarios can be used in its "pure" form. At the currently proposed project cost, as escalated to Year of Expenditure basis, (larger than ARC assumptions) and schedule (accelerated from the ARC assumptions), obtaining 80 percent of the capital costs from flexed funding may exceed the financial capacity of the region.

On the other hand, New Starts funding at 50 percent federal and 50 percent non-federal increases the GRTA/local financing requirements to the point of difficulty.

The most likely result is a blending of the two approaches. However, these scenarios depicted in the foregoing graphic probably bound the parameters of the GRTA/local funding requirement.

13.5.5 Conclusions

The key points in this financial assessment and analysis are as follows:

1. Sound financial planning is critical to project success and obtaining federal funds
2. Estimated project costs are substantial, but many options are available to fund them
3. Successful large projects emphasize sound financial fundamentals rather than over-match and innovative financing techniques
4. Indicative local share calculations show significant—but not impossible—financial effort will be required
5. Reducing federal share from 80 percent to 50 percent dramatically increases non-federal financial burden
6. A blended New Starts and Flexed funding approach may prove to be the best funding scenario

Table 13-6
Operating and Maintenance Cost Estimates –Preferred Initial Project

	Operating and Maintenance Cost ($millions)									Operating & Maintenance Cost Funding ($ millions)								
	Year 2000 $				Year of Expenditure (YOE) $					Farebox					Federal		Non-Federal	
																25%		
Milestone	Year	Town Ctr. - Arts Ctr Trunkline	Combined Circulators	Totals	Inflation 4%	Real Growth	Town Ctr. - Arts Ctr Trunkline	Combined Circulators	Total	Town Ctr. - Arts Ctr Trunkline	Trunkline Recovery Ratio	Combined Circulators	Circulator Recovery Ratio	Total Farebox	CMAQ	Preventive Maintenance	State	GRTA/ Local Balance
Start Service	10	17	10	27			25	15	40	12	50%	4	25%	17	11	11		1
	11	17	10	27	4%	1.60%	26	16	42	13	50%	4	25%	18	12	12		1
	12	17	10	27	4%	1.60%	28	17	45	14	50%	4	25%	19	12	13		1
	13	17	10	27	4%	1.60%	29	18	47	15	50%	4	25%	20		12		16
	14	17	10	27	4%	1.60%	31	19	50	15	50%	5	25%	21		12		17
	15	17	10	27	4%	1.60%	33	20	53	16	50%	5	25%	22		13		18
	16	17	10	27	4%	1.60%	34	21	56	17	50%	5	25%	23		14		19
	17	17	10	27	4%	1.60%	36	22	59	18	50%	6	25%	25		15		20
	18	17	10	27	4%	1.60%	39	23	62	19	50%	6	25%	26		15		21
	19	17	10	27	4%	1.60%	41	25	65	20	50%	6	25%	27		16		23
	20	17	10	27	4%	1.60%	43	26	69	21	50%	7	25%	29		17		24
	21	17	10	27	4%	1.60%	45	28	73	23	50%	7	25%	30		18		25
	22	17	10	27	4%	1.60%	48	29	77	24	50%	7	25%	32		19		27
	23	17	10	27	4%	1.60%	51	31	82	25	50%	8	25%	34		20		28
	24	17	10	27	4%	1.60%	54	33	86	27	50%	8	25%	36		22		30
	25	17	10	27	4%	1.60%	57	35	91	28	50%	9	25%	38		23		31
Totals		**268**	**163**	**431**			**619**	**377**	**996**	**309**		**94**		**418**	**35**	**254**		**302**

Table 13-7
Flexed Capital Scenario – Possible Non-Federal Funding Sources

	Capital Cost ($millions Year of Expenditure (YOE) basis)						Operating	Total	Indicators of Financial Effort Required				
					7.0% Interest 25 Yrs Term		($millions YOE basis)	($millions YOE basis)	5%	2%	3%	5%	5%
	Year	GRTA /Local	Donated ROW	Remaining PAYG after Soft Match	New Debt Service	Cumulative Debt Service	Operating GRTA/ Local	Total GRTA/ Local Burden	Current CID (5 mills on commercial property in CIDs only)	1¢ Statewide MFT	1¢ Cobb County MFT	0.25% Cobb Sales Tax	1 % of State Personal Income Tax Collections in Cobb County
									6	51	3	30	6
	1	3	3						6	52	3	32	6
	2	10	10						7	53	4	33	6
	3	10	10						7	54	4	35	7
	4	27	27						7	55	4	36	7
	5	38	38	0	0	0		0	8	56	4	38	7
	6	36	12	24	2	2		2	8	57	4	40	8
	7	167		167	14	16		16	8	59	4	42	8
	8	196		196	17	33		33	9	60	4	44	9
	9	210		210	18	51		51	9	61	4	47	9
	10	197		197	17	68	1	69	10	62	4	49	9
	11	69		69	6	74	1	75	10	63	5	51	10
	12					74	1	75	11	65	5	54	10
	13					74	16	90	11	66	5	57	11
	14					74	17	91	12	67	5	59	11
	15					74	18	92	12	69	5	62	12
	16					74	19	93	13	70	5	65	13
	17					74	20	94	14	71	5	69	13
	18					74	21	95	14	73	6	72	14
	19					74	23	97	15	74	6	76	15
	20					74	24	98	16	76	6	80	15
	21					74	25	99	17	77	6	84	16
	22					74	27	101	18	79	6	88	17
	23					74	28	102	18	80	7	92	18
	24					74	30	104	19	82	7	97	19
	25					74	31	106	20	84	7	102	20
Totals		**964**	**100**	**864**			**302**	**1,585**					
Averages									**12**	**66**	**5**	**59**	**11**

Table 13-8
New Start Capital Scenario – Possible Non-Federal Funding Sources

	Year	Capital Cost ($millions Year of Expenditure (YOE) basis)					Operating	Total	Indicators of Financial Effort Required				
					7.0% Interest 25 Yrs Term		($millions YOE basis)	($millions YOE basis)	5%	2%	3%	5%	5%
		GRTA/Local	Donated ROW	Remaining PAYG after Soft Match	New Debt Service	Cumulative Debt Service	Operating GRTA/Local	Total GRTA/ Local Burden	Current CID (5 mills on commercial property in CIDs only)	1¢ Statewide Motor Fuel Tax	1¢ Cobb County Motor Fuel Tax	0.25% Cobb Sales Tax	1 % of State Personal Income Tax Collections in Cobb County
									6	51	3	30	6
	1	7	7						6	52	3	32	6
	2	25	25						7	53	4	33	6
	3	26	26						7	54	4	35	7
	4	68	43	25	2	2		2	7	55	4	36	7
	5	96		96	8	10		10	8	56	4	38	7
	6	91		91	8	18		18	8	57	4	40	8
	7	417		417	36	54		54	8	59	4	42	8
	8	491		491	42	96		96	9	60	4	44	9
	9	526		526	45	141		141	9	61	4	47	9
	10	492		492	42	183	1	184	10	62	4	49	9
	11	172		172	15	198	1	199	10	63	5	51	10
	12					198	1	199	11	65	5	54	10
	13					198	16	214	11	66	5	57	11
	14					198	17	215	12	67	5	59	11
	15					198	18	216	12	69	5	62	12
	16					198	19	217	13	70	5	65	13
	17					198	20	218	14	71	5	69	13
	18					198	21	220	14	73	6	72	14
	19					198	23	221	15	74	6	76	15
	20					198	24	222	16	76	6	80	15
	21					198	25	223	17	77	6	84	16
	22					198	27	225	18	79	6	88	17
	23					198	28	226	18	80	7	92	18
	24					198	30	228	19	82	7	97	19
	25					198	31	230	20	84	7	102	20
Totals		2,410	100	2,310			302	3,780					
Averages									12	66	5	59	11