HIGH SPEED RAIL PLANNING SERVICES

FINAL REPORT

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HNTB

GDOT Georgia Department of Transportation

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TABLE OF CONTENTS

ATLANTA-BIRMINGHAM EXECUTIVE SUMMARY

Background and Purpose *ES-1*
Purpose and Objective *ES-2*
Corridor Description and History *ES-2*
Representative Route Development *ES-2*
Corridor Evaluation *ES-3*
Operating Plan ES-6
Ridership and Revenue ES-6
Capital Costs ES-7
Operating and Maintenance Costs ES-8
Corridor Evaluation ES-9
Operating Ratio ES-9
Benefit-Cost ES-10
Key Findings ES-10
Hybrid High Performance Scenario *ES-11*
Ridership and Revenue ES-12
Costs ES-13
Feasibility Evaluation ES-14
Final Conclusions *ES-15*

ATLANTA-MACON-JACKSONVILLE EXECUTIVE SUMMARY

Background and Purpose *ES-1*
Purpose and Objective *ES-2*
Corridor Description and History *ES-2*
Representative Route Development *ES-2*
Corridor Evaluation *ES-3*
Operating Plan ES-6
Ridership and Revenue ES-6
Capital Costs ES-7
Operating and Maintenance Costs ES-8
Corridor Evaluation ES-9
Operating Ratio ES-9
Benefit-Cost ES-10
Key Findings ES-10
Hybrid High Performance Scenario *ES-11*
Ridership and Revenue ES-12
Costs ES-13
Feasibility Evaluation ES-14
Final Conclusions *ES-15*

ATLANTA-CHATTANOOGA-NASHVILLE- LOUISVILLE EXECUTIVE SUMMARY

Background and Purpose *ES-1*
Purpose and Objective *ES-2*
Corridor Description and History *ES-2*
Representative Route Development *ES-2*
Corridor Evaluation *ES-3*
Operating Plan ES-6
Ridership and Revenue ES-6
Capital Costs ES-7
Operating and Maintenance Costs ES-8
Corridor Evaluation ES-9
Operating Ratio ES-9
Benefit-Cost ES-10
Key Findings ES-11
Hybrid High Performance Scenario *ES-11*

Ridership and Revenue ES-13
Costs ES-13
Feasibility Evaluation ES-14
Final Observations *ES-15*

SECTION I: BACKGROUND INFORMATION AND METHODOLOGIES

1 INTRODUCTION AND BACKGROUND 1-1
1.1 Description/History of High-Speed Rail and Designated Corridors *1-1*
1.2 Technology Considerations *1-2*
1.2.1 Alternative 1: 90-110 mph Emerging High-Speed Rail 1-2
1.2.2 Alternative 2: 180-220 mph Express High-Speed Rail 1-2
1.2.3 Alternative 3: 220+ mph Maglev 1-3
2 STUDY PURPOSE AND OBJECTIVES 1-5
2.1 Corridor Descriptions and History *1-5*
2.1.1 Atlanta – Birmingham 1-5
2.1.2 Atlanta – Macon – Jacksonville 1-6
2.1.3 Atlanta – Chattanooga – Nashville – Louisville 1-7
2.2 Purpose and Objectives *1-9*
3 ASSUMPTIONS AND METHODOLOGIES 1-11
3.1 Corridor Alternatives Development *1-11*
3.1.1 Existing Conditions 1-11
3.1.1.1 Base Data 1-11
3.1.1.2 Environmental Data 1-12
3.1.1.3 Demographic Data 1-14
3.1.1.4 Existing Travel Patterns 1-15
3.1.2 Stakeholder Outreach 1-16
3.1.3 Corridor Screening and Analysis Process 1-18
3.1.4 Step 1: Identification of Universe of Corridor Alternatives 1-19
3.1.4.1 90-110 mph Shared Use 1-19
3.1.4.2 180-220 mph Dedicated Use 1-19
3.1.5 Step 2: Alternative Screening and Representative route Selection 1-21
3.1.5.1 90-110 mph Shared Use 1-21
3.1.5.2 180-220 mph Dedicated Use 1-22
3.1.6 Step 3: Refinement of Representative routes 1-22
3.1.7 Step 4: Evaluate Feasibility of Each Representative Corridor 1-23
3.2 Capital Cost Methodology *1-24*
3.2.1 FRA Standard Cost Categories (SCC) 1-24
3.2.2 Unit Cost Development Method 1-30
3.2.2.1 Quantities 1-31
3.2.2.2 Unit Costs 1-31
3.2.3 Detailed Methodologies 1-37
3.2.3.1 Shared Use and Dedicated Use Track 1-37
3.2.3.2 Track Geometry 1-47
3.2.3.3 Interstate Interchanges 1-48
3.2.3.4 At-Grade Crossings 1-50
3.2.3.5 Earthwork 1-51
3.2.3.6 Structures 1-52
3.2.3.7 Stations 1-57
3.2.3.8 Right-of-Way/Real Estate 1-59
3.2.3.9 Signaling and Communication 1-60
3.2.3.10 Cost of Vehicles 1-61
3.2.3.11 Professional Services 1-63
3.2.3.12 Contingencies 1-64
3.2.3.13 Phasing Scenarios for Capital Costs 1-64
3.3 Ridership and Revenue Methodology *1-64*
3.3.1 Geographic Scope and Zoning Structure 1-65
3.3.2 Market Analysis 1-67
3.3.2.1 Inter-Urban Travel Market 1-67

3.3.2.2 Local Travel Market 1-68
3.3.2.3 Connect Air Market 1-69
3.3.3 Demand Estimation Model 1-69
3.3.3.1 Step 1: In-Scope Travel Market 1-71
3.3.3.2 Step 2: Market Future Growth 1-73
3.3.3.3 Step 3: Level of Service Characteristics 1-73
3.3.3.4 Step 4: Mode Choice 1-75
3.3.3.5 Step 5: Induced Demand 1-79
3.3.3.6 Step 6: Rail Farebox Revenue 1-81
3.4 Operating and maintenance Methodology 1-81
3.4.1 Operating plan Development 1-81
3.4.1.1 Train Service and Operating Assumptions 1-81
3.4.1.2 Potential Station Locations 1-82
3.4.1.3 Train Technology Assumptions 1-82
3.4.1.4 Other Rolling Stock and Operational Requirements 1-83
3.4.2 Operating Plan Model 1-84
3.4.2.1 Train Performance 1-84
3.4.2.2 Train Scheduling and Fleet Requirements 1-85
3.4.2.3 Train Size, Frequency and Load Factors 1-86
3.4.3 Operating and Maintenance Costs 1-86
3.4.4 Public-Private Benefit Analysis 1-90
3.4.4.1 Benefit-Cost Analysis 1-91
3.4.4.2 Estimate of Economic Benefits 1-92
3.4.4.3 User Benefits – Consumer Surplus 1-93
3.4.4.4 Non-User Benefits 1-95
3.4.4.5 Public and Private Benefit Estimations 1-98
3.4.5 Evaluation Ranges 1-98
3.4.5.1 Conservative Scenario 1-99
3.4.5.2 Intermediate Scenario 1-99
3.4.5.3 Optimistic Scenario 1-99

SECTION II: ATLANTA TO BIRMINGHAM

1 EXISTING CONDITIONS AND BACKGROUND 2-1
1.1 Evaluated Alternatives 2-3
1.1.1 90-110 mph Shared Use Corridors 2-3
1.1.2 180-220 mph Dedicated Use Corridors 2-6
1.2 Demographics and Socioeconomics 2-8
1.2.1 Total Population, Density, Race and Age 2-8
1.2.2 Employment and Employment Centers 2-12
1.2.3 Socioeconomic Characteristics - Income 2-14
1.2.4 Environmental Justice 2-17
1.3 Land Use – Urban vs. Rural 2-19
1.4 Travel patterns 2-21
1.4.1 Automotive Travel 2-21
1.4.2 Air Travel 2-21
1.5 Environmental Issues 2-22
1.5.1 Threatened and Endangered Species 2-22
1.5.2 Cultural Resources 2-23
1.6 Issues and Opportunities 2-24
2 STAKEHOLDER OUTREACH 2-27
3 REPRESENTATIVE ROUTES 2-31
3.1 90-110 mph Emerging High-Speed Rail (Shared Use) 2-31
3.1.1.1 Major Terminal Stations 2-33
3.1.1.2 Intermediate Stations 2-37
3.2 180-220 mph Express High-Speed Rail (Dedicated Use) 2-40
3.2.1 Proposed Stations 2-42
4 OPERATING PLAN AND SCHEDULE 2-43
4.1 90-110 mph Shared Use 2-43

4.1.1 Speed Profile and Timetable 2-43
4.1.2 Operating Plan 2-44
4.2 180-220 mph Dedicated Use 2-45
4.2.1 Speed Profile and Timetable 2-45
4.2.2 Operating Plan 2-46
5 RIDERSHIP AND REVENUE 2-47
5.1 Corridor Demographics 2-47
Existing (2010) 2-47
5.1.1 Future Year (2020-2035) Demographics 2-49
5.2 Market Analysis 2-53
5.2.1 The Inter-Urban Market 2-53
5.2.1.1 Automobile Travel 2-53
5.2.1.2 Bus Service 2-55
5.2.1.3 Direct Air Service 2-56
5.2.1.4 Rail Service 2-57
5.2.2 Local Travel Market 2-57
5.2.3 Connect Air Market 2-58
5.3 Forecasts 2-59
5.3.1 90-110 mph Shared Use Ridership and Revenue Forecasts (2021-2040) 2-60
5.3.2 180-220 mph Dedicated Use Ridership and Revenue Forecasts (2021-2040) 2-61
5.3.3 Ridership and Revenue Forecast Comparison (2021-2040) 2-62
5.4 Sensitivity Analysis 2-63
5.4.1 Shared Use Fare Sensitivity 2-63
5.4.2 Dedicated Use Fare Sensitivity 2-64
5.4.3 Shared and Dedicated Use Total Ridership and Revenue Summary 2-65
5.4.4 Evaluation Scenarios 2-65
5.4.4.1 Conservative Scenario Estimates 2-66
5.4.4.2 Intermediate Scenario Estimates 2-66
5.4.4.3 Optimistic Scenario Estimates 2-66
6 FORECASTED COSTS 2-69
6.1.1 90-110 mph Shared Use 2-69
6.1.2 180-220 mph Dedicated Use 2-76
6.1.3 Comparing Capital Costs 2-83
6.2 Operating and maintenance Costs 2-83
6.2.1 90-110 mph Shared Use 2-84
6.2.2 180-220 mph Dedicated Use 2-84
7 CORRIDOR EVALUATION 2-85
7.1 Feasibility Measurements 2-85
7.1.1 90-110 mph Shared Use 2-86
7.1.1.1 Operating Ratio 2-86
7.1.1.2 Benefit-Cost 2-86
7.1.2 180-220 mph Dedicated Use 2-87
7.1.2.1 Operating Ratio 2-87
7.1.2.2 Benefit-Cost 2-88
7.1.3 Key Findings 2-88
8 HYBRID HIGH PERFORMANCE SCENARIO 2-91
8.1 Ridership and Revenue 2-92
8.2 Costs 2-93
8.3 Feasibility Evaluation 2-94
8.4 Phasing Scenarios for Capital Costs 2-95
8.4.1 Additional Implementation Options – Commuter Rail 2-96
8.5 Conclusion 2-97

SECTION III: ATLANTA-MACON-JACKSONVILLE

1 EXISTING CONDITIONS AND BACKGROUND 3-1
1.1 Evaluated Alternatives 3-3
1.1.1 90-110 mph Shared Use Corridors 3-3
1.1.1.1 Atlanta to Macon 3-5

1.1.1.2 Macon to Savannah 3-7
1.1.1.3 Savannah to Jacksonville 3-9
1.1.2 180-220 mph Dedicated Use Corridors 3-11
1.2 Demographics and Socioeconomics 3-13
1.2.1 Total Population, Density, Race and Age 3-13
1.2.2 Employment and Employment Centers 3-17
1.2.3 Socioeconomic Characteristics – Income 3-19
1.2.4 Environmental Justice 3-22
1.3 Land Use – Urban vs. Rural 3-24
1.4 Travel patterns 3-27
1.4.1 Automotive Travel 3-27
1.4.2 Air Travel 3-27
1.5 Environmental Issues 3-28
1.5.1 Threatened and Endangered Species 3-29
1.5.2 Cultural Resources 3-29
1.6 Issues and Opportunities 3-30
2 STAKEHOLDER OUTREACH 3-37
3 REPRESENTATIVE ROUTES 3-41
3.1 90-110 mph Emerging High-Speed Rail (Shared Use) 3-41
3.1.1 Atlanta – Macon 3-42
3.1.2 Macon – Savannah 3-48
3.1.3 Savannah – Jacksonville 3-51
3.2 180-220 mph Express High-Speed Rail (Dedicated Use) 3-55
3.2.1 Atlanta to Macon 3-55
3.2.2 Macon to Savannah 3-58
3.2.3 Savannah to Jacksonville 3-60
4 OPERATING PLAN AND SCHEDULE 3-63
4.1 90-110 mph Shared Use 3-63
4.1.1 Speed Profile and Timetable 3-63
4.1.2 Operating Plan 3-64
4.2 180-220 mph Dedicated Use 3-65
4.2.1 Speed Profile and Timetable 3-65
4.2.2 Operating Plan 3-66
5 RIDERSHIP AND REVENUE 3-69
5.1 Corridor Demographics 3-69
5.1.1 Base Year (2010) Demographics 3-69
5.1.2 Future Year (2020-2035) Demographics 3-72
5.2 Market Analysis 3-78
5.2.1 The Inter-Urban Market 3-79
5.2.1.1 Automobile Travel 3-79
5.2.1.2 Bus Service 3-81
5.2.1.3 Direct Air Service 3-82
5.2.1.4 Rail Service 3-83
5.2.2 Local Travel Market 3-83
5.2.3 Connect Air Market 3-83
5.3 Forecasts 3-84
5.3.1 90-110 mph Shared Use Ridership and Revenue Forecasts (2021-2040) 3-86
5.3.2 180-220 mph Dedicated Use Ridership and Revenue Forecasts (2021-2040) 3-87
5.3.3 Ridership and Revenue Forecasts (2021-2040) 3-88
5.4 Fare Sensitivity Analysis 3-89
5.4.1 Shared Use Fare Sensitivity 3-89
5.4.2 Dedicated Use Fare Sensitivity 3-89
5.4.2.1 Shared Use and Dedicated Use Total Ridership and Revenue Summary 3-90
5.4.3 Evaluation Scenarios 3-90
5.4.3.1 Conservative Scenario Estimates 3-91
5.4.3.2 Intermediate Scenario Estimates 3-91
5.4.3.3 Optimistic Scenario Estimates 3-92
6 FORECASTED COSTS 3-93

6.1 Capital Costs 3-93
6.1.1 90-110 mph Shared Use 3-93
6.1.2 180-220 mph Dedicated Use 3-102
6.1.3 Comparing Capital Costs 3-110
6.2 Operating and maintenance Costs 3-111
6.2.1 90-110 mph Shared Use 3-112
6.2.2 180-220 mph Shared Use 3-112
7 CORRIDOR EVALUATION 3-115
7.1 Feasibility Measurements 3-115
7.1.1 90-110 mph Shared Use 3-116
7.1.1.1 Operating Ratio 3-116
7.1.1.2 Benefit-Cost 3-116
7.1.2 180-220 mph Dedicated Use 3-117
7.1.2.1 Operating Ratio 3-117
7.1.2.2 Benefit-Cost 3-118
7.1.3 Key Findings 3-118
8 HYBRID HIGH PERFORMANCE SCENARIO 3-121
8.1 Ridership and Revenue 3-122
8.2 Costs 3-123
8.3 Feasibility Evaluation 3-124
8.3.1.1 Corridor Truncation Analysis 3-125
8.4 Phasing Scenarios for Capital Costs 3-125
8.4.1 Additional Implementation Options – Commuter Rail 3-126
8.5 Conclusion 3-127

SECTION IV: ATLANTA-CHATTANOOGA-NASHVILLE-LOUISVILLE

1 EXISTING CONDITIONS AND BACKGROUND 4-1
1.1 Evaluated Alternatives 4-3
1.1.1 90-110 mph Shared Use Corridors 4-3
1.1.1.1 Atlanta to Chattanooga 4-5
1.1.1.2 Chattanooga to Nashville (CSXT) 4-8
1.1.1.3 Nashville to Louisville (CSXT) 4-11
1.1.1.4 Chattanooga to Louisville via Danville, KY (NS) 4-13
1.1.1.5 Chattanooga to Lexington, KY via Danville (NS) 4-16
1.1.1.6 Lexington to Louisville 4-19
1.1.1.7 Nashville to Knoxville: NS and the Nashville and Eastern Railroad 4-21
1.1.2 180-220 mph Dedicated Use Corridors 4-23
1.1.2.1 Atlanta to Chattanooga 4-23
1.1.2.2 Chattanooga to Louisville via Nashville 4-25
1.1.2.3 Chattanooga to Louisville via Lexington 4-27
1.1.3 220+ mph Maglev Corridor 4-29
1.2 Demographics and Socioeconomics 4-29
1.2.1 Total Population, Density, Race and Age 4-33
1.2.1.1 Total Population and Density 4-33
1.2.1.2 Minority Populations 4-36
1.2.1.3 Aging Population 4-38
1.2.2 Employment and Employment Centers 4-40
1.2.3 Socioeconomic Characteristics - Income 4-43
1.2.4 Environmental Justice 4-46
1.3 Land Use – Urban vs. Rural 4-49
1.4 Travel patterns 4-51
1.4.1 Automotive Travel 4-51
1.4.2 Air Travel 4-51
1.5 Environmental Issues 4-52
1.5.1 Threatened and Endangered Species 4-53
1.5.2 Cultural Resources 4-56
1.6 Issues and Opportunities 4-58
2 STAKEHOLDER OUTREACH 4-63

3 REPRESENTATIVE ROUTES 4-69
3.1 90-110 mph Emerging High-Speed Rail (Shared Use) 4-69
3.1.1 Atlanta-Chattanooga (CSXT Corridor) 4-71
3.1.1.1 Stations 4-73
3.1.2 Chattanooga-Nashville (CSXT Corridor) 4-81
3.1.2.1 Stations 4-82
3.1.3 Nashville - Louisville (CSXT Corridor) 4-85
3.1.3.1 Stations 4-86
3.2 180-220 mph Express High-Speed Rail (Dedicated Use) 4-90
3.2.1 Atlanta –Chattanooga 4-91
3.2.2 Chattanooga-Nashville 4-91
3.2.3 Nashville-Louisville 4-92
3.3 220+ mph Maglev High-Speed Rail (Maglev) 4-92
3.3.1 Atlanta-Chattanooga 4-92
3.3.2 Chattanooga-Nashville 4-93
3.3.3 Nashville-Louisville 4-93
4 OPERATING PLAN AND SCHEDULE 4-95
4.1 90-110 mph Shared Use 4-95
4.1.1 Speed Profile and Timetable 4-95
4.1.2 Operating Plan 4-97
4.2 180-220 mph Dedicated Use 4-97
4.2.1 Speed Profile and Timetable 4-97
4.2.2 Operating Plan 4-99
4.3 220+ mph Maglev 4-100
4.3.1 Speed Profile and Timetable 4-100
4.3.2 Operating Plan 4-103
5 RIDERSHIP AND REVENUE 4-105
5.1 Corridor Demographics 4-105
5.1.1 Base Year (2010) Demographics 4-105
5.1.2 Future Year (2020-2035) Demographics 4-108
5.2 Market Analysis 4-116
5.2.1 The Inter-Urban Market 4-116
5.2.1.1 Automobile Travel 4-116
5.2.1.2 Bus Service 4-119
5.2.1.3 Direct Air Service 4-120
5.2.2 Local Travel Market 4-121
5.2.3 Connect Air Market 4-122
5.3 Forecasts 4-122
5.3.1 90-110 mph Shared Use Ridership and Revenue Forecasts (2021-2040) 4-124
5.3.2 180-220 mph Dedicated Use Ridership and Revenue Forecasts (2021-2040) 4-126
5.3.3 Maglev Ridership and Revenue (2021-2040) 4-127
5.3.4 Ridership and Revenue Forecasts (2021-2040) 4-128
5.4 Fare Sensitivity Analysis 4-128
5.4.1 Shared Use Fare Sensitivity 4-128
5.4.2 Dedicated use Fare Sensitivity 4-129
5.4.3 Shared Use and Dedicated Use/Maglev Total Ridership and Revenue Summary 4-130
5.4.4 Evaluation Scenarios 4-131
5.4.4.1 Conservative Scenario Estimates 4-131
5.4.4.2 Intermediate Scenario Estimates 4-131
5.4.4.3 Optimistic Scenario Estimates 4-132
6 FORECASTED COSTS 4-133
6.1 Capital Costs 4-133
6.1.1 90-110 mph Shared Use 4-134
6.1.2 180-220 mph Dedicated Use 4-139
6.1.3 220+ mph Maglev 4-146
6.1.4 Comparing Capital Costs 4-148
6.2 Operating and maintenance Costs 4-149

6.2.1 90-110 mph Shared Use 4-150
6.2.2 180-220 mph Dedicated Use 4-150
6.2.3 220+ mph Maglev 4-151
7 CORRIDOR EVALUATION 4-153
7.1 Feasibility Measurements 4-153
7.1.1 90-110 mph Shared Use 4-154
7.1.1.1 Operating Ratio 4-154
7.1.1.2 Benefit-Cost 4-154
7.1.2 180-220 mph Dedicated Use 4-155
7.1.2.1 Operating Ratio 4-155
7.1.2.2 Benefit-Cost 4-156
7.1.3 220+ mph Maglev 4-157
7.1.3.1 Operating Ratio 4-157
7.1.3.2 Benefit Cost Ratio 4-157
7.1.4 Key Findings 4-158
8 HYBRID HIGH PERFORMANCE SCENARIO 4-159
8.1 Ridership and Revenue 4-160
8.2 Costs 4-161
8.3 Feasibility evaluation 4-162
8.3.1.1 Corridor Truncation Analysis 4-163
8.4 Phasing Scenarios for Capital Costs 4-164
8.4.1 Additional Implementation Options – Atlanta – Chattanooga – Nashville –Louisville 4-165
8.5 Conclusion 4-167

SECTION V: CONCLUSIONS AND NEXT STEPS

1 CORRIDOR COMPARISONS 5-1
1.1 Shared Use 5-1
1.2 Dedicated Use 5-2
1.3 Hybrid High Performance Scenario 5-3
1.4 Key Conclusions 5-4
2 SYSTEM INTEGRATION ANALYSIS 5-5
2.1 System Integration Analysis 5-5
3 FUNDING OPPORTUNITIES 5-9
3.1 Federal Capital Grants 5-10
3.1.1 Passenger Rail Investment and Improvement Act of 2008 (PRIIA) 5-10
3.1.2 American Recovery and Reinvestment Act of 2009 (ARRA) and Transportation Investment Generating Economic Recovery (TIGER) 5-10
3.1.3 High-Speed and Intercity Passenger Rail (HSIPR) 5-11
3.1.3.1 Service Develop Program Grants 5-11
3.1.3.2 Individual Project Grants 5-12
3.1.3.3 Planning Grants 5-13
3.1.4 Section 130 Highway-Rail Grade Crossing Improvement Program 5-14
3.1.5 Rail Line Relocation and Improvement Capital Grant Program 5-14
3.1.6 FHWA Congestion Mitigation and Air Quality 5-14
3.1.7 FHWA Surface Transportation Program 5-15
3.1.8 FHWA Transportation Enhancement Program 5-15
3.1.9 High-Speed Rail Crossing Improvement Program 5-15
3.2 Federal Financing and Loan Programs 5-16
3.2.1 Rail Rehabilitation and Improvement Financing Program (RRIF) 5-16
3.2.2 US DOT Transportation Infrastructure Finance and Innovation Act (TIFIA) 5-17
3.2.3 FHWA Grant Anticipation Revenue Vehicle Bond (GARVEE) 5-17
3.2.4 IRS Tax Exempt Private Activity Bonds (PAB) 5-18
3.3 State and Local Capital Match Funding 5-19
3.3.1 State General Fund Appropriations 5-19
3.3.2 State General Obligation and General Revenue Bonds 5-19
3.3.3 Freight Railroad Contributions 5-19

3.3.4 Transportation Equity Funds 5-20
3.3.5 Local General Fund Appropriations 5-20
3.3.6 Local Bonding 5-20
3.3.7 Value Capture Taxes 5-20
3.3.7.1 Land Value Taxes 5-21
3.3.7.2 Local Tax Incremental Financing (TIF) and Tax Allocation Districts (TAD) 5-21
3.3.7.3 Special Assessments - Community Improvement Districts (CID) 5-21
3.3.7.4 Developer Impact Fees 5-22
3.3.7.5 Air Rights 5-22
3.3.7.6 Joint Development 5-22
3.3.8 Special Purpose Local Option Sales Tax (SPLOST) 5-22
3.3.9 Specialized Local Funding Programs 5-23
3.3.9.1 Georgia Regional TSPLOST 5-23
3.3.9.2 Tennessee: Gasoline Tax for Local Transportation Funding 5-23
3.3.10 Public Private Partnerships (P3) 5-24
3.4 Funding Sources and Strategies for Operating Support 5-24
3.4.1 State Appropriations 5-24
3.4.2 Congestion Mitigation and Air Quality Funds (CMAQ) 5-24
3.4.3 FHWA Traffic Mitigation Funding 5-25
3.4.4 Revenue Maximizing Strategies 5-25
3.4.5 Operating Cost Control Strategies 5-26
3.5 Private Sector Alternatives 5-27
3.5.1 Joint Development 5-27
3.5.2 Public Private Partnerships 5-27
3.6 Funding Summary 5-28

APPENDICES

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LIST OF TABLES

TABLE 1: ATLANTA-BIRMINGHAM OPERATING PLANS 1-6
TABLE 2: ATLANTA-BIRMINGHAM TOTAL RIDERSHIP AND REVENUE (2021-2040 IN 2010$) 1-7
TABLE 3: ATLANTA-BIRMINGHAM TOTAL CAPITAL COSTS (2010$) 1-7
TABLE 4: FIXED AND VARIABLE OPERATING AND MAINTENANCE CATEGORIES 1-8
TABLE 5: ATLANTA-BIRMINGHAM TOTAL OPERATING AND MAINTENANCE COSTS 1-9
TABLE 6: ATLANTA-BIRMINGHAM OPERATING RATIOS (2021-2050) 1-10
TABLE 7: ATLANTA-BIRMINGHAM BENEFIT-COST RATIOS (2021-2050) 1-10
TABLE 8: ATLANTA-BIRMINGHAM HYBRID HIGH PERFORMANCE OPERATIONS 1-12
TABLE 9: ATLANTA-BIRMINGHAM HYBRID HIGH PERFORMANCE RIDERSHIP AND REVENUE (2021-2040 IN 2010$) 1-13
TABLE 10: ATLANTA-BIRMINGHAM HYBRID HIGH PERFORMANCE RAIL CAPITAL COSTS (2010$) 1-13
TABLE 11: ATLANTA-BIRMINGHAM HYBRID HIGH PERFORMANCE RAIL ALTERNATIVE OPERATING AND MAINTENANCE COSTS (2021-2040 IN $ MILLIONS AND 2010$) 1-14
TABLE 12: ATLANTA-BIRMINGHAM HYBRID HIGH PERFORMANCE RAIL ALTERNATIVE OPERATING RATIO 1-14
TABLE 13: ATLANTA-BIRMINGHAM HYBRID HIGH PERFORMANCE ALTERNATIVE BENEFIT-COST RATIO (2021-2050) 1-14
TABLE 3-1: BASE DATA AND SOURCES 1-12
TABLE 3-2: ENVIRONMENTAL DATA AND SOURCES 1-13
TABLE 3-3: DEMOGRAPHIC DATA AND SOURCES 1-14
TABLE 3-4: TRAVEL DATA AND SOURCES 1-15
TABLE 3-5: TRANSPORTATION INFRASTRUCTURE DATA AND SOURCES 1-15
TABLE 3-6: CORRIDOR STAKEHOLDERS 1-18
TABLE 3-7: LEVEL OF ACCURACY VS. PROJECT DEVELOPMENT 1-24
TABLE 3-8: FRA STANDARD COST CATEGORIES 1-25
TABLE 3-9: FRA COST ITEMS 1-25
TABLE 3-10: FRA COST ITEM EXPANSION 1-30
TABLE 3-11: SCC SUB-CATEGORY UNIT COSTS 1-32
TABLE 3-12 CURRENT CORRIDOR FREIGHT DENSITIES 1-38
TABLE 3-13: FUTURE FREIGHT DENSITY INCREASES 1-39
TABLE 3-14: EVALUATED CORRIDOR DENSITIES 1-40
TABLE 3-15: CAPACITY IMPROVEMENT METHODOLOGY 1-42
TABLE 3-16: HIGH-SPEED RAIL INTERCHANGE OPTIONS 1-48
TABLE 3-17: STRUCTURE COSTS 1-53
TABLE 3-18: UNIT COST BY STRUCTURE TYPE 1-53
TABLE 3-19: REAL ESTATE COST ITEMS 1-60
TABLE 3-20: PROFESSIONAL SERVICES PERCENTAGES 1-64
TABLE 3-21: VALUES OF TIME 1-78
TABLE 3-22: OPERATING COST CATEGORIES AND PRIMARY COST DRIVERS 1-88
TABLE 3-23: UNIT OPERATING AND MAINTENANCE COSTS 1-90
TABLE 3-24: KEY ELEMENTS OF THE BENEFIT-COST ANALYSIS 1-91
TABLE 3-25: COST PER TON OF POLLUTANT (VOC, CO, NO_x, PM10 AND SO_x) 1-96
TABLE 1-1: ATLANTA-BIRMINGHAM RACE OF STUDY AREA POPULATION 2-10
TABLE 1-2: ATLANTA-BIRMINGHAM INTERCITY AUTO TRIP TABLE (ATS 1995) 2-21
TABLE 1-3: LOCAL AIR TRIPS IN 2010 2-21
TABLE 1-4: ATLANTA-BIRMINGHAM AIR SERVICES SUMMARY 2-22
TABLE 1-5: ATLANTA-BIRMINGHAM STUDY AREA COUNTIES KNOWN ENDANGERED AND THREATENED SPECIES 2-23
TABLE 1-6: ISSUES AND OPPORTUNITIES 24

TABLE 2-1: STAKEHOLDER OUTREACH MEETINGS 2-28
TABLE 3-1: ATLANTA-BIRMINGHAM SHARED USE ROUTE CHARACTERISTICS 2-31
TABLE 3-2: ATLANTA-MACON-JACKSONVILLE SHARED USE PROPOSED STATIONS 2-33
TABLE 3-3: ATLANTA-BIRMINGHAM DEDICATED USE CHARACTERISTICS 2-40
TABLE 4-1: ATLANTA-BIRMINGHAM SHARED USE SPEED AND TRAVEL TIME TABLE 2-44
TABLE 4-2: ATLANTA-BIRMINGHAM SHARED USE TRAIN FREQUENCY AND SIZE 2-44
TABLE 4-3: ATLANTA-BIRMINGHAM DEDICATED USE SPEED AND TRAVEL TIME TABLE 2-46
TABLE 4-4: ATLANTA-BIRMINGHAM DEDICATED USE TRAIN FREQUENCY AND SIZE 2-46
TABLE 5-1: HISTORICAL POPULATION TREND FOR MPO COVERAGE AREAS 2-48
TABLE 5-2: HISTORICAL EMPLOYMENT TREND FOR MPO COVERAGE AREAS 2-49
TABLE 5-3: POPULATION FORECASTS FOR MPO COVERAGE AREAS 2-51
TABLE 5-4: EMPLOYMENT FORECASTS FOR MPO COVERAGE AREAS 2-53
TABLE 5-5: ATLANTA-BIRMINGHAM SELECTED TRAFFIC COUNTS 2-53
TABLE 5-6: TRAVEL TIMES AND DISTANCES BETWEEN CITY PAIRS 2-54
TABLE 5-7: OBSERVED AUTO TRAFFIC GROWTH (IN AADT) BETWEEN 1995 AND 2010 2-54
TABLE 5-8: ATLANTA-BIRMINGHAM BUS SERVICE SUMMARY 2-55
TABLE 5-9: ATLANTA-BIRMINGHAM MAJOR AIRPORT CHARACTERISTICS 2-56
TABLE 5-10: ORIGIN-DESTINATION AIR TRIPS BY DIRECTION (Q4 2009-Q3 2010) 2-57
TABLE 5-11: AIR SERVICES SUMMARY 2-58
TABLE 5-12: EXTERNAL FACTOR ANALYSES 2-60
TABLE 5-13: 90-110 MPH SHARED USE BASE ANNUAL RIDERSHIP AND REVENUE (2021-2040 IN 2010$) 2-61
TABLE 5-14: SHARED USE BASE 2035 ANNUAL STATION BOARDINGS AND SEGMENT VOLUMES (BI-DIRECTIONAL) 2-61
TABLE 5-15: 180-220 MPH DEDICATED USE BASE RIDERSHIP AND REVENUE (2021-2040 IN 2010$) 2-62
TABLE 5-16: DEDICATED USE BASE CASE 2035 ANNUAL STATION BOARDINGS AND SEGMENT VOLUMES (BI-DIRECTIONAL) 2-62
TABLE 5-17: FARE SENSITIVITY FOR SHARED USE HIGH-SPEED RAIL SERVICE (2021-2040 IN 2010$) 2-64
TABLE 5-18: FARE SENSITIVITY FOR DEDICATED USE HIGH-SPEED RAIL SERVICE 2-64
TABLE 5-19: SHARED USE TOTAL RIDERSHIP AND REVENUE SUMMARY (2021-2040) 2-65
TABLE 5-20: DEDICATED USE TOTAL RIDERSHIP AND REVENUE SUMMARY (2021-2040) 2-65
TABLE 5-21: INTERMEDIATE SCENARIO ANNUAL RIDERSHIP AND REVENUE ESTIMATES (2021-2040 IN 2010$) 2-66
TABLE 5-22: OPTIMISTIC SCENARIO ANNUAL RIDERSHIP AND REVENUE ESTIMATES (2021-2040 IN 2010$) 2-67
TABLE 6-1: FRA STANDARD COST CATEGORIES 2-69
TABLE 6-2: ATLANTA-BIRMINGHAM TOTAL SHARED USE CAPITAL COST BY SCC CATEGORY (2010$) 2-70
TABLE 6-3: ATLANTA-BIRMINGHAM TOTAL SHARED USE CAPITAL COST SEGMENT ONE 2-71
TABLE 6-4: ATLANTA-BIRMINGHAM TOTAL SHARED USE CAPITAL COST SEGMENT TWO 2-72
TABLE 6-5: ATLANTA-BIRMINGHAM TOTAL SHARED USE CAPITAL COST SEGMENT THREE 2-73
TABLE 6-6: ATLANTA-BIRMINGHAM TOTAL SHARED USE CAPITAL COST SEGMENT FOUR 2-74
TABLE 6-7: ATLANTA-BIRMINGHAM TOTAL SHARED USE CAPITAL COST SEGMENT FIVE 2-75
TABLE 6-8: ATLANTA-BIRMINGHAM TOTAL DEDICATED USE CAPITAL COST (2010$) 2-76
TABLE 6-9: ATLANTA-BIRMINGHAM TOTAL DEDICATED USE CAPITAL COST SEGMENT ONE 2-77
TABLE 6-10: ATLANTA-BIRMINGHAM TOTAL DEDICATED USE CAPITAL COST SEGMENT TWO 2-78
TABLE 6-11: ATLANTA-BIRMINGHAM TOTAL DEDICATED USE CAPITAL COST SEGMENT THREE 2-79
TABLE 6-12: ATLANTA-BIRMINGHAM TOTAL DEDICATED USE CAPITAL COST SEGMENT FOUR 2-80
TABLE 6-13: ATLANTA-BIRMINGHAM TOTAL DEDICATED USE CAPITAL COST SEGMENT FIVE 2-81
TABLE 6-14: ATLANTA-BIRMINGHAM TOTAL DEDICATED USE CAPITAL COST SEGMENT SIX 2-82
TABLE 6-15: TOTAL CAPITAL COST BY ROUTE/TECHNOLOGY 2-83
TABLE 6-16: ATLANTA-BIRMINGHAM FIXED AND VARIABLE COST CATEGORIES 2-84
TABLE 6-17: ATLANTA-BIRMINGHAM SHARED USE O&M COSTS (2010$ MILLIONS) 2-84
TABLE 6-18: ATLANTA-BIRMINGHAM DEDICATED USE O&M COSTS (2010$ MILLIONS) 2-84
TABLE 7-1: ATLANTA-BIRMINGHAM SHARED USE OPERATING RATIO (2010$ MILLIONS) 2-86

Table 7-2: Atlanta-Birmingham Shared Use Benefit-Cost Analysis (2021-2050) 2-87
Table 7-3: Atlanta-Birmingham Dedicated Use Operating Ratio 2-87
Table 7-4: Atlanta-Birmingham Dedicated Use Benefit-Cost Analysis 2021-2050 2-88
Table 8-1: Atlanta-Birmingham Operations Comparison 2-92
Table 8-2: Atlanta-Birmingham Hybrid Operating Plan 2-92
Table 8-3: Atlanta-Birmingham Hybrid High Performance alternative Ridership and Revenue (in millions and 2010$) 2-93
Table 8-4: Atlanta-Birmingham Total Hybrid Capital Cost by SCC Category (2010$) 2-93
Table 8-5: Atlanta-Birmingham Hybrid O&M Costs (2010$ millions) 2-94
Table 8-6: Atlanta-Birmingham Hybrid Operating Ratio 2-95
Table 8-7: Atlanta-Birmingham Hybrid Benefit-Cost Analysis (2021-2050) 2-95
Table 1-1: Atlanta-Macon-Jacksonville State Populations and Densities 3-13
Table 1-2: Atlanta-Macon-Jacksonville Racial and Ethnic Distribution, 2010 3-15
Table 1-3: Major Employment Areas 3-17
Table 1-4: Atlanta-Macon-Jacksonville 2010 Median Household Income 3-20
Table 1-5: Intercity Auto Trip Table (ATS 1995) 3-27
Table 1-6: Observed Auto Traffic Growth (in AADT) Between 1995 and 2010 3-27
Table 1-7: Local Air Trips in 2010 3-28
Table 1-8: Connect Air Volumes 3-28
Table 1-9: Study Area Counties Known Endangered and Threatened Species 3-29
Table 1-10: Atlanta-Macon-Jacksonville Issues and Opportunities 3-31
Table 2-1: Atlanta-Macon-Jacksonville Stakeholder Outreach Meetings 3-38
Table 3-1: Atlanta-Macon-Jacksonville Shared Use Proposed Stations 3-42
Table 3-2: Atlanta-Macon Shared Use Characteristics 3-42
Table 3-3: Macon-Savannah Shared Use Characteristics 3-48
Table 3-4: Savannah-Jacksonville Shared Use Characteristics 3-51
Table 3-5: Atlanta-Macon-Jacksonville Dedicated Use Proposed Stations 3-55
Table 4-1: Atlanta-Macon-Jacksonville Shared Use Speed and Travel Time Table 3-64
Table 4-2: Atlanta-Macon-Jacksonville Shared Use Train Frequency and Size 3-65
Table 4-3: Atlanta-Macon-Jacksonville Dedicated Use Speed and Travel Time Table 3-66
Table 4-4: Atlanta-Macon-Jacksonville Dedicated Use Train Frequency and Size 3-67
Table 5-1: Historical Population Trend for MPO Coverage Area 3-72
Table 5-2:Historical Employment Trend for MPO Coverage Area 3-72
Table 5-3: Population Forecasts for MPO Coverage Areas 3-75
Table 5-4: Employment Forecasts for MPO Coverage Areas 3-78
Table 5-5: Observed Auto Traffic Growth (AADT) between 1995 and 2010 3-79
Table 5-6: Travel Times and Distances between City Pairs 3-81
Table 5-7: Atlanta-Macon-Jacksonville Bus Services Summary 3-81
Table 5-8: Atlanta-Macon-Jacksonville Corridor Major Airport Characteristics 3-82
Table 5-9: Origin-Destination Air Trips by Direction (Q4 2009 to Q3 2010) 3-82
Table 5-10: Atlanta-Macon-Jacksonville Corridor Air Services Summary 3-84
Table 5-11: External Factor Analyses 3-85
Table 5-12: Shared Use Base Case Ridership and Revenue (2021-2040 in 2010$) 3-86
Table 5-13: Shared Use Base Case 2035 Annual Station Boardings and Segment Volumes (bi-directional) 3-86
Table 5-14: Dedicated Use Base Case Ridership and Revenue (2021-2040 in 2010$) 3-87
Table 5-15: Dedicated Use Base Case 2035 Annual Station Boardings and Segment Volumes (bi-directional) 3-88
Table 5-16: Fare Sensitivity for Shared Use Rail Service (2021-2040 in 2010$) 3-89
Table 5-17: Fare Sensitivity for Dedicated Use Rail Service 3-90
Table 5-18: Shared Use Total Ridership and Revenue Summary (2021-2040) 3-90
Table 5-19: Dedicated Use Total Ridership and Revenue Summary (2021-2040) 3-90
Table 5-20: Intermediate Scenario Annual Ridership and Revenue Estimates (2021-2040 in 2010$) 3-92

TABLE 5-21: OPTIMISTIC SCENARIO ANNUAL RIDERSHIP AND REVENUE ESTIMATES (2021-2040 IN 2010$) 3-92
TABLE 6-1: FRA STANDARD COST CATEGORIES..... 3-93
TABLE 6-2: ATLANTA-MACON-JACKSONVILLE TOTAL SHARED USE CAPITAL COST BY SCC CATEGORY (2010$) 3-94
TABLE 3-6-3: ATLANTA-MACON-JACKSONVILLE TOTAL SHARED USE CAPITAL COST SEGMENT ONE..... 3-95
TABLE 6-4: ATLANTA-MACON-JACKSONVILLE TOTAL SHARED USE CAPITAL COST SEGMENT TWO 3-96
TABLE 6-5: ATLANTA-MACON-JACKSONVILLE SHARED USE CAPITAL COST SEGMENT THREE..... 3-97
TABLE 6-6: ATLANTA-MACON-JACKSONVILLE TOTAL SHARED USE CAPITAL COST SEGMENT FOUR 3-98
TABLE 6-7: ATLANTA-MACON-JACKSONVILLE TOTAL SHARED USE CAPITAL COST SEGMENT FIVE 3-99
TABLE 6-8: ATLANTA-MACON-JACKSONVILLE TOTAL SHARED USE CAPITAL COST SEGMENT SIX..... 3-100
TABLE 6-9: ATLANTA-MACON-JACKSONVILLE SHARED USE CAPITAL COST SEGMENT SEVEN..... 3-101
TABLE 6-10: ATLANTA-MACON-JACKSONVILLE TOTAL DEDICATED USE CAPITAL COST (2010$) 3-102
TABLE 6-11: ATLANTA-MACON-JACKSONVILLE TOTAL DEDICATED USE CAPITAL COST SEGMENT ONE 3-103
TABLE 6-12: ATLANTA-MACON-JACKSONVILLE TOTAL DEDICATED USE CAPITAL COST SEGMENT TWO..... 3-104
TABLE 6-13: ATLANTA-MACON-JACKSONVILLE TOTAL DEDICATED USE CAPITAL COST SEGMENT THREE... 3-105
TABLE 6-14: ATLANTA-MACON-JACKSONVILLE TOTAL DEDICATED USE CAPITAL COST SEGMENT FOUR.... 3-106
TABLE 6-15: ATLANTA-MACON-JACKSONVILLE DEDICATED USE CAPITAL COST SEGMENT FIVE 3-107
TABLE 6-16: ATLANTA-MACON-JACKSONVILLE DEDICATED USE CAPITAL COST SEGMENT SIX..... 3-108
TABLE 6-17: ATLANTA-MACON-JACKSONVILLE TOTAL DEDICATED USE CAPITAL COST SEGMENT SEVEN... 3-109
TABLE 6-18: ATLANTA-MACON-JACKSONVILLE DEDICATED USE CAPITAL COST SEGMENT EIGHT..... 3-110
TABLE 6-19: TOTAL CAPITAL COST BY ROUTE/TECHNOLOGY 3-111
TABLE 6-20: ATLANTA-MACON-JACKSONVILLE FIXED AND VARIABLE COST CATEGORIES..... 3-112
TABLE 6-21: ATLANTA-MACON-JACKSONVILLE SHARED USE O&M COSTS (2010$ MILLIONS)..... 3-112
TABLE 6-22: ATLANTA-MACON-JACKSONVILLE DEDICATED USE O&M COSTS (2010$ MILLIONS) 3-113
TABLE 7-1: ATLANTA-MACON-JACKSONVILLE SHARED USE OPERATING RATIO 3-116
TABLE 7-2: ATLANTA-MACON-JACKSONVILLE SHARED USE BENEFIT-COST ANALYSIS (2021-2050)..... 3-117
TABLE 7-3: ATLANTA-MACON-JACKSONVILLE DEDICATED USE OPERATING RATIO..... 3-117
TABLE 7-4: ATLANTA-MACON-JACKSONVILLE DEDICATED USE BENEFIT-COST ANALYSIS (2021-2050) ... 3-118
TABLE 8-1: ATLANTA-MACON-JACKSONVILLE OPERATIONS COMPARISON..... 3-122
TABLE 8-2: ATLANTA-MACON-JACKSONVILLE HYBRID OPERATING PLAN 3-122
TABLE 8-3: ATLANTA-MACON-JACKSONVILLE HYBRID HIGH PERFORMANCE ALTERNATIVE RIDERSHIP AND REVENUE (IN MILLIONS AND 2010$) 3-123
TABLE 8-4: ATLANTA-MACON-JACKSONVILLE TOTAL HYBRID CAPITAL COST BY SCC CATEGORY (2010$). 3-123
TABLE 8-5: ATLANTA-MACON-JACKSONVILLE HYBRID O&M COSTS (2010$ MILLIONS)..... 3-124
TABLE 8-6: ATLANTA-MACON-JACKSONVILLE HYBRID OPERATING RATIO 3-124
TABLE 8-7: ATLANTA-MACON-JACKSONVILLE HYBRID BENEFIT-COST ANALYSIS (2021-2050)..... 3-124
TABLE 1-1: WEST AND EAST CORRIDOR COMPARISON 4-31
TABLE 1-2: STATEWIDE AND STUDY CORRIDOR POPULATION DISTRIBUTIONS..... 4-33
TABLE 1-3: POPULATION DENSITY COMPARISON OF MAJOR JURISDICTIONS AND MPOS..... 4-34
TABLE 1-4: TOP 10 COUNTIES BY DENSITY..... 4-34
TABLE 1-5: STATE BY STATE COMPARISON OF MINORITY AND HISPANIC POPULATIONS 4-36
TABLE 1-6: RACE AND ETHNIC DISTRIBUTION (2010) 4-36
TABLE 1-7: STATE BY STATE COMPARISON OF THE AGING POPULATION 4-38
TABLE 1-8: COUNTY BY COUNTY COMPARISON OF THE AGING POPULATION..... 4-40
TABLE 1-9: COUNTIES WITH LARGEST EMPLOYMENT..... 4-42
TABLE 1-10: MEDIAN HOUSEHOLD INCOME BY STATE..... 4-43
TABLE 1-11: INTERCITY AUTO TRIP TABLE (ATS 1995)..... 4-51
TABLE 1-12: LOCAL AIR TRIPS IN 2010 4-52
TABLE 1-13: CONNECTING AIR VOLUMES IN 2010..... 4-52
TABLE 1-14: KNOWN ENDANGERED AND THREATENED SPECIES LIST 4-54
TABLE 2-1: ATLANTA-CHATTANOOGA-NASHVILLE-LOUISVILLE STAKEHOLDER OUTREACH MEETINGS..... 4-64
TABLE 3-1: ATLANTA-CHATTANOOGA-NASHVILLE-LOUISVILLE SHARED USE PROPOSED STATIONS 4-71
TABLE 3-2: ATLANTA-CHATTANOOGA SHARED USE CHARACTERISTICS..... 4-72

Table 3-3: Chattanooga-Nashville Shared Use Characteristics 4-81
Table 3-4: Nashville-Louisville Shared Use Characteristics 4-85
Table 3-5: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Proposed Stations 4-90
Table 3-6: Atlanta-Chattanooga Dedicated Use Characteristics 4-91
Table 3-7: Chattanooga-Nashville Dedicated Use Characteristics 4-91
Table 3-8: Nashville-Louisville Dedicated Use Characteristics 4-92
Table 3-9: Atlanta-Chattanooga Maglev Characteristics 4-93
Table 3-10: Chattanooga-Nashville Maglev Characteristics 4-93
Table 3-11: Chattanooga-Nashville Maglev Characteristics 4-94
Table 4-1: Atlanta-Chattanooga-Nashville-Louisville Shared Use Speed and Travel Time Table 4-96
Table 4-2: Atlanta-Chattanooga-Nashville-Louisville Shared Use Train Frequency and Size 4-97
Table 4-3: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Speed and Travel Time Table 4-99
Table 4-4: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Train Frequency and Size 4-100
Table 4-5: Atlanta-Chattanooga-Nashville-Louisville Maglev Speed and Travel Time Table 4-102
Table 4-6: Atlanta-Chattanooga-Nashville-Louisville Maglev Train Frequency and Size 4-103
Table 5-1: Historical Population Trend for MPO Coverage Areas 4-108
Table 5-2: Historical Employment Trend for MPO Coverage Areas 4-108
Table 5-3: Population Forecasts for MPO Coverage Areas 4-112
Table 5-4: Employment Forecasts for MPO Coverage Areas 4-116
Table 5-5: Observed Auto Traffic Growth (AADT) between 1995 and 2010 4-117
Table 5-6: Travel Times and Distances between City Pairs 4-119
Table 5-7: Atlanta-Chattanooga-Nashville-Louisville Bus Service Summary 4-119
Table 5-8: Airport Characteristics 4-120
Table 5-9: Destination Air Trips by Direction Q4 2009 to Q3 2010 4-121
Table 5-10: Air Services Summary 4-122
Table 5-11: External Factor Analyses 4-124
Table 5-12: Shared Use Base Ridership and Revenue 4-125
Table 5-13: Shared Use Base Case 2035 Annual Station Boardings and Segment Volumes (bi-direction) 4-125
Table 5-14: Dedicated Use Base Ridership and Revenue 4-126
Table 5-15: Dedicated Use Base Case 2035 Annual Station Boardings and Segment Volumes (bi-directional) 4-127
Table 5-16: Maglev Base Ridership and Revenue 4-127
Table 5-17: Fare Sensitivity for Shared Use Service 4-129
Table 5-18: Fare Sensitivity for Dedicated Use Service (2010$) 4-130
Table 5-19: Shared Use Total Ridership and Revenue Summary (2010$) 4-130
Table 5-20: Dedicated Use Total Ridership and Revenue Summary (2010$) 4-130
Table 5-21: Intermediate Scenario Annual Ridership and Revenue Estimates (2021-2040 in 2010$) 4-132
Table 5-22: Optimistic Scenario Annual Ridership and Revenue Estimates 4-132
Table 6-1: FRA Standard Cost Categories 4-133
Table 6-2: Atlanta-Chattanooga-Nashville-Louisville Total Shared Use Capital Cost by SCC Category (2010$) 4-134
Table 6-3: Total Corridor Capital Costs 90-110 mph Shared Use Segment One 4-136
Table 6-4: Total Corridor Capital Costs 90-110 mph Shared Use Segment Two 4-137
Table 6-5: Total Corridor Capital Costs 90-110 mph Shared Use Segment Three 4-139
Table 6-6: Atlanta-Chattanooga-Nashville-Louisville Total Dedicated Use Capital Cost (2010$) 4-140
Table 6-7: Total Corridor Capital Costs 180-220 mph Dedicated Use Segment One 4-142
Table 6-8: Total Corridor Capital Costs 180-220 mph Dedicated Use Segment Two 4-143
Table 6-9: Total Corridor Capital Costs 180-220 mph Dedicated Use Segment Three 4-145

Table 6-10: Atlanta-Chattanooga-Nashville-Louisville Total Maglev Capital Cost (2010$) . 4-146
Table 6-11: Total Corridor Capital Costs 220+ mph Maglev Segment One 4-147
Table 6-12: Total Corridor Capital Costs 22+ mph Maglev Segment Two..... 4-147
Table 6-13: Total Corridor Capital Costs 220+ mph Maglev Segment Three 4-148
Table 6-14: Total Capital Cost by Alignment/Technology 4-148
Table 6-15: Atlanta-Chattanooga-Nashville-Louisville Fixed and Variable Cost Categories .. 4-150
Table 6-16: Atlanta-Chattanooga-Nashville-Louisville Shared Use O&M Costs (2010$ millions) ..
..... 4-150
Table 6-17: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use O&M Costs 4-150
Table 6-18: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use O&M Costs (2010$
millions) 4-151
Table 7-1: Atlanta-Chattanooga-Nashville-Louisville Shared Use Operating Ratio..... 4-154
Table 7-2: Atlanta-Chattanooga-Nashville-Louisville Shared Use Benefit-Cost Analysis (2021-
2050) 4-155
Table 7-3: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Operating Ratio 4-156
Table 7-4: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Benefit-Cost Analysis .....
..... 4-156
Table 7-5: Atlanta-Chattanooga-Nashville-Louisville Maglev Operating Ratio..... 4-157
Table 7-6: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Benefit-Cost Analysis –
2020-2050 (2010$ millions) 4-157
Table 8-1: Atlanta-Chattanooga-Nashville-Louisville Operations Comparison..... 4-160
Table 8-2: Atlanta-Chattanooga-Nashville-Louisville Hybrid Operating Plan..... 4-160
Table 8-3: Atlanta-Chattanooga-Louisville-Nashville-Louisville Hybrid High Performance
Alternative Ridership and Revenue (in millions and 2010$)..... 4-161
Table 8-4: Atlanta-Chattanooga-Nashville-Louisville Total Hybrid Capital Cost by SCC Category
..... 4-162
Table 8-5: Atlanta-Chattanooga-Nashville-Louisville Hybrid O&M Costs (2010$ millions)..... 162
Table 8-6: Atlanta-Chattanooga-Nashville-Louisville Hybrid Operating Ratio 4-163
Table 8-7: Atlanta-Chattanooga-Nashville-Louisville Hybrid Benefit-Cost Analysis (2021-2050) ..
..... 4-163
Table 1-1: Study Corridors 110 mph Diesel-Electric Shared Use Comparison 5-1
Table 1-2: Study Corridors Steel-Wheel/Maglev Dedicated Use Comparison..... 5-2
Table 1-3: Study Corridors Hybrid Comparison 5-3
Table 2-1: High-Speed Rail System Operating Ratios (2021-2040) 5-6
Table 2-2: High-Speed Rail System Benefit-Cost Ratios (2021-2050) 5-7

LIST OF FIGURES

Figure 1: Atlanta-Birmingham Representative Routes and Stations 1-5
Figure 2: Atlanta-Birmingham Total Ridership and Revenue (2021-2040 in 2010$) 1-7
Figure 3: Atlanta-Birmingham Total Capital Costs (2010$) 1-8
Figure 3-1: At-Grade, Open Drainage Typical Section 1-44
Figure 3-2: At-Grade, Closed Drainage Typical Section 1-45
Figure 3-3: Trench/Retained Cut Typical Section 1-45
Figure 3-4: Dedicated Track within Existing Freight Corridor Typical Section 1-46
Figure 3-5: High-Speed Rail Interchange Option Details 1-49
Figure 3-6: Typical Grade Separations (Overpass and Underpass) 1-51
Figure 3-7: Interstate Crossing 1-54
Figure 3-8: Minor Roadway 1-54
Figure 3-9: Major Waterway 1-54
Figure 3-10: Minor Waterway 1-55
Figure 3-11: Viaduct Guideway 1-56
Figure 3-12: Intermediate Station Footprint 1-58
Figure 3-13: Talgo Series 8 1-62
Figure 3-14: Alston AGV and Siemens Velaro EMU (left to right) 1-62
Figure 3-15 Transrapid Maglev 1-63
Figure 3-16: Geographic Study Area 1-66
Figure 3-17: Demand Estimation Model Process 1-70
Figure 3-18: Diversion Model 1-76
Figure 3-19: Example 110 mph Speed Profile 1-85
Figure 3-20: Example Segment Loading Chart 1-86
Figure 3-21: Economic Measure of Consumer Surplus 1-94
Figure 3-22: Consumer Surplus Calculation as shown in the Maglev Deployment Program 1-95
Figure 1-1: Atlanta-Birmingham Study Area 2-2
Figure 1-2: Atlanta-Birmingham Shared Use Evaluated Alternatives 2-5
Figure 1-3: Atlanta-Birmingham Dedicated Use Evaluated Alternative 2-7
Figure 1-4: Atlanta-Birmingham Population Density 2-9
Figure 1-5: Atlanta-Birmingham Minority Populations 2-11
Figure 1-6: Atlanta-Birmingham Employment Density 2-13
Figure 1-7: Atlanta-Birmingham Average Annual Household Income 2009 2-16
Figure 1-8: Atlanta-Birmingham Urbanized Areas 2-20
Figure 2-1: Atlanta-Birmingham Issues and Opportunities 2-29
Figure 3-1: Atlanta-Birmingham Shared Use Representative Route and Stations 2-32
Figure 3-2: H-JAIA Station Location 2-34
Figure 3-3: Atlanta MMPT Station Location 2-35
Figure 3-4: Birmingham Intermodal Transportation Facility 2-36
Figure 3-5: Douglasville Intermediate Station 2-38
Figure 3-6: Anniston Intermediate Station 2-39
Figure 3-7: Atlanta-Birmingham Dedicated Use Representative Route and Stations 2-41
Figure 3-8: Anniston, AL Dedicated Use Station Location 2-42
Figure 4-1: Atlanta-Birmingham Shared Use Speed Profile 2-43
Figure 4-2: Atlanta-Birmingham Dedicated Use Speed Profile 2-45
Figure 5-1: Atlanta-Birmingham Base Year (2010) Population Map 2-47
Figure 5-2: Atlanta-Birmingham Base Year (2010) Employment Map 2-48
Figure 5-3: Atlanta-Birmingham 2020 Population 2-49
Figure 5-4: Atlanta-Birmingham 2035 Population 2-50
Figure 5-5: Atlanta-Birmingham 2020-2035 Population Growth 2-50
Figure 5-6: Atlanta-Birmingham 2020 Employment 2-51
Figure 5-7: Atlanta-Birmingham 2035 Employment 2-52
Figure 5-8: Atlanta-Birmingham 2020-2035 Employment Growth 2-52

Figure 5-9: Atlanta-Birmingham Observed Auto Traffic (in AADT) in 1995 and 2010 2-55
Figure 5-10: Atlanta-Birmingham Corridor Total Ridership and Revenue Forecasts (2021-2040 in 2010$) 2-63
Figure 6-1: Atlanta-Birmingham Shared Use Segment One 2-71
Figure 6-2: Atlanta-Birmingham Shared Use Segment Two 2-72
Figure 6-3: Atlanta-Birmingham Shared Use Segment Three 2-73
Figure 6-4: Atlanta-Birmingham Shared Use Segment Four 2-74
Figure 6-5: Atlanta-Birmingham Shared Use Segment Five 2-75
Figure 6-6: Atlanta-Birmingham Dedicated Use Segment One 2-77
Figure 6-7: Atlanta-Birmingham Dedicated Use Segment Two 2-78
Figure 6-8: Atlanta-Birmingham Dedicated Use Segment Three 2-79
Figure 6-9: Atlanta-Birmingham Dedicated Use Segment Four 2-80
Figure 6-10: Atlanta-Birmingham Dedicated Use Segment Five 2-81
Figure 6-11: Atlanta-Birmingham Dedicated Use Segment Six 2-82
Figure 6-12: Total Capital Cost by Technology 2-83
Figure 1-1: Atlanta-Macon-Jacksonville Study Area 3-2
Figure 1-2: Atlanta to Jacksonville Potential Shared-Use Routes 3-4
Figure 1-3: Macon Alternatives and Connectivity 3-6
Figure 1-4: Savannah Alternatives and Connectivity 3-8
Figure 1-5: Jacksonville Alternatives and Connectivity 3-10
Figure 1-6: Atlanta-Macon-Jacksonville Potential Dedicated Use route 3-12
Figure 1-7: Atlanta-Macon-Jacksonville Study Area Population Density 3-14
Figure 1-8: Atlanta-Macon-Jacksonville Percent of Minorities by County 3-16
Figure 1-9: Atlanta-Macon-Jacksonville Employment Density by County 3-18
Figure 1-10: Atlanta-Macon-Jacksonville Household Median Income by County 3-21
Figure 1-11: Atlanta-Macon-Jacksonville U.S. Census Urbanized Areas 3-26
Figure 2-1: Atlanta-Macon-Jacksonville Issues and Opportunities 3-39
Figure 3-1: Shared Use Representative Route (Atlanta to Macon) 3-43
Figure 3-2: Atlanta MMPT Station Location 3-44
Figure 3-3: H-JAIA Station Location 3-45
Figure 3-4: Griffin Intermediate Station 3-46
Figure 3-5: Macon Station 3-47
Figure 3-6: Shared Use Representative route (Macon to Savannah) 3-49
Figure 3-7: Savannah Intermediate Station 3-50
Figure 3-8: Shared Use Representative Route (Savannah to Jacksonville) 3-52
Figure 3-9: Brunswick Mobility Center Location 3-53
Figure 3-10: Jacksonville Regional Transportation Center Location 3-54
Figure 3-11: Dedicated Use Representative Route (Atlanta to Macon) 3-57
Figure 3-12: Dedicated Use Representative Route (Macon to Savannah) 3-59
Figure 3-13: Dedicated Use Representative Route (Savannah and Jacksonville) 3-61
Figure 4-1: Atlanta-Macon-Jacksonville Shared Use Speed Profile 3-63
Figure 4-2: Atlanta-Macon-Jacksonville Dedicated Use Speed Profile 3-65
Figure 5-1: Atlanta-Macon-Jacksonville Base Year (2010) Population 3-70
Figure 5-2: Atlanta-Macon-Jacksonville Base Year (2010) Employment 3-71
Figure 5-3: Atlanta-Macon-Jacksonville 2020 Population 3-73
Figure 5-4: Atlanta-Macon-Jacksonville 2035 Population 3-74
Figure 5-5: Atlanta-Macon-Jacksonville 2020-2035 Population Growth 3-75
Figure 5-6: Atlanta-Macon-Jacksonville 2020 Employment 3-76
Figure 5-7: Atlanta-Macon-Jacksonville 2020 Employment 3-77
Figure 5-8: Atlanta-Macon-Jacksonville 2020-2035 Employment Growth 3-78
Figure 5-9: Observed Auto Traffic (AADT) in 1995 and 2010 3-80
Figure 5-10: Atlanta-Macon-Jacksonville Corridor Base Case Ridership and Revenue Forecasts (2021-2040 in 2010$) 3-88
Figure 6-1: Atlanta-Macon-Jacksonville Shared Use Segment One 3-95

Figure 6-2: Atlanta-Macon-Jacksonville Shared Use Segment Two 3-96
Figure 6-3: Atlanta-Macon-Jacksonville Shared Use Segment Three 3-97
Figure 6-4: Atlanta-Macon-Jacksonville Shared Use Segment Four 3-98
Figure 6-5: Atlanta-Macon-Jacksonville Shared Use Segment Five 3-99
Figure 6-6: Atlanta-Macon-Jacksonville Shared Use Segment Six 3-100
Figure 6-7: Atlanta-Macon-Jacksonville Shared Use Segment Seven 3-101
Figure 6-8: Atlanta-Macon-Jacksonville Dedicated Use Segment One 3-103
Figure 6-9: Atlanta-Macon-Jacksonville Dedicated Use Segment Two 3-104
Figure 6-10: Atlanta-Macon-Jacksonville Dedicated Use Segment Three 3-105
Figure 6-11: Atlanta-Macon-Jacksonville Dedicated Use Segment Four 3-106
Figure 6-12: Atlanta-Macon-Jacksonville Dedicated Use Segment Five 3-107
Figure 6-13: Atlanta-Macon-Jacksonville Dedicated Use Segment Six 3-108
Figure 6-14: Atlanta-Macon-Jacksonville Dedicated Use Segment Seven 3-109
Figure 6-15: Atlanta-Macon-Jacksonville Dedicated Use Segment Eight 3-110
Figure 6-16: Total Capital Cost by Route/Technology 3-111
Figure 1-1: Atlanta-Chattanooga-Nashville-Louisville Study Area 4-2
Figure 1-2: Atlanta-Chattanooga-Nashville-Louisville Existing Rail Corridors and Evaluated Alternatives 4-4
Figure 1-3: Atlanta to Chattanooga Evaluated Alternatives 4-7
Figure 1-4: Chattanooga to Nashville Evaluated Alternative 4-9
Figure 1-5: CSXT West of Chattanooga (note limited right-of-way) 4-10
Figure 1-6: CSXT South of Downtown Nashville (note cut and limited additional right-of-way) 4-10
Figure 1-7: Nashville to Louisville Evaluated Alternative 4-12
Figure 1-8: Chattanooga to Louisville via Danville Evaluated Alternative 4-14
Figure 1-9: NS Route, Summerset, KY (note cut in terrain) 4-15
Figure 1-10: NS Route, between Danville and Summerset (note cut in terrain) 4-16
Figure 1-11: Chattanooga to Lexington, KY via Danville Evaluated Alternative 4-18
Figure 1-12: Lexington to Louisville Evaluated Alternative 4-20
Figure 1-13: Nashville to Knoxville Evaluated Alternative 4-22
Figure 1-14: Atlanta to Chattanooga Dedicated Use Evaluated Alternative 4-24
Figure 1-15: Chattanooga to Louisville Dedicated Use Evaluated Alternatives 4-26
Figure 1-16: Chattanooga to Louisville via Danville Dedicated Use Corridor 4-28
Figure 1-17: Study Area 4-30
Figure 1-18: Study Area Counties 4-32
Figure 1-19: Corridor Study Cities Population Comparison 4-33
Figure 1-20: Atlanta-Chattanooga-Nashville-Louisville Population Density 4-35
Figure 1-21: Atlanta-Chattanooga-Nashville-Louisville Percent Minorities 4-37
Figure 1-22: Atlanta-Chattanooga-Nashville-Louisville Percent of Aging Population by County 4-39
Figure 1-23: Atlanta-Chattanooga-Nashville-Louisville Employment Density by County 4-41
Figure 1-24: Atlanta-Chattanooga-Nashville-Louisville Median Household Income by County 4-44
Figure 1-25: Atlanta-Chattanooga-Nashville-Louisville Urbanized Areas 4-50
Figure 1-26: Locations of Known Critical Habitats 4-55
Figure 1-27: Locations of Registered Cultural Resources 4-57
Figure 2-1: Atlanta-Chattanooga-Nashville-Louisville Issues and Opportunities 4-66
Figure 3-1: H-JAIA Station 4-73
Figure 3-2: Atlanta MMPT Station 4-74
Figure 3-3: Cumberland/Galleria Station 4-75
Figure 3-4: Marietta Station 4-76
Figure 3-5: Cartersville Station 4-77
Figure 3-6: Dalton Station 4-78
Figure 3-7: Chattanooga Lovell Field Station 4-79

Figure 3-8: Chattanooga Downtown Station 4-80
Figure 3-9: Murfreesboro Station 4-82
Figure 3-10: Nashville Airport Station 4-83
Figure 3-11: Nashville Downtown Station 4-84
Figure 3-12: Bowling Green Station 4-86
Figure 3-13: Elizabethtown Station 4-87
Figure 3-14: Louisville Airport Station 4-88
Figure 3-15: Louisville Downtown Station 4-89
Figure 4-1: Atlanta-Chattanooga-Nashville-Louisville Shared Use Speed Profile 4-95
Figure 4-2: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Speed Profile 4-98
Figure 4-3: Atlanta-Chattanooga-Nashville-Louisville Maglev Speed Profile 4-101
Figure 5-1: Atlanta-Chattanooga-Nashville-Louisville Base Year (2010) Population 4-106
Figure 5-2: Atlanta-Chattanooga-Nashville-Louisville Base Year (2010) Employment 4-107
Figure 5-3: Atlanta-Chattanooga-Nashville-Louisville 2020 Population 4-109
Figure 5-4: Atlanta-Chattanooga-Nashville-Louisville 2035 Population 4-110
Figure 5-5: Atlanta-Chattanooga-Nashville-Louisville 2020-2035 Population Growth 4-111
Figure 5-6: Atlanta-Chattanooga-Nashville-Louisville 2020 Employment 4-113
Figure 5-7: Atlanta-Chattanooga-Nashville-Louisville 2035 Employment 4-114
Figure 5-8: Atlanta-Chattanooga-Nashville-Louisville 2020-2035 Employment Growth 4-115
Figure 5-9: Observed Auto Traffic (AADT) in 1995 and 2010 4-118
Figure 5-10: Atlanta-Chattanooga-Nashville-Louisville Corridor Base Case Ridership and Revenue Forecasts (2021-2040) 4-128
Figure 6-1: Atlanta-Chattanooga-Nashville-Louisville Shared Use Segment One 4-135
Figure 6-2: Atlanta-Chattanooga-Nashville-Louisville Shared Use Segment Two 4-137
Figure 6-3: Atlanta-Chattanooga-Nashville-Louisville Shared Use Segment Three 4-138
Figure 6-4: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Segment One 4-141
Figure 6-5: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Segment Two 4-143
Figure 6-6: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Segment Three 4-144
Figure 6-7: Total Capital Cost by Alignment/Technology 4-149

GLOSSARY OF TERMS

AADT –Annual Average Daily Traffic

ABS –Automatic Block Signals

ACS – American Community Survey

ADECA – Alabama Department of Economic and Community Affairs

ALDOT – Alabama Department of Transportation

ARC – Atlanta Regional Commission

AREMA – American Railway Engineers and Maintenance Association

ARRA – American Recovery and Reinvestment Act

ATS – American Travel Survey

BJCTA – Birmingham Jefferson County Transit Authority

BPR – Bureau of Public Roads

BRT – Bus Rapid Transit

BTS – Bureau of Transportation Statistics

CCI –Construction Cost Index

CE – Categorical Exclusion\

CHRPA – Chattanooga-Hamilton County Regional Planning Agency

CID – Community Improvement District

CMAQ – Congestion and Mitigation Air Quality Program

CORE MPO – Chamber County-Savannah Metropolitan Planning Committee

CTC – Centralized Traffic Control

DB1B – Airline Origin and Destination Survey

DCA – Department of Community Affairs

DNR – Department of Natural Resources

EARPC –East Alabama Regional Planning Commission

EIS – Environmental Impact Study

EJ – Environmental Justice

EMU – Electric Multiple Units

FAA – Federal Aviation Administration

FD – Final Design

FRA – Federal Rail Administration

FTA – Federal Transit Authority

FWHA – Federal Highway Administration

GARVEE – Grant Anticipation Revenue Vehicle Bond

GDOT – Georgia Department of Transportation

GIS – Geographic Information System

GNAHRGIS – Georgia's natural Archaeological and Historical Resources GIS

GO – General Obligation

GPA – Georgia Ports Authority

GRPA – Georgia Regional Passenger Authority

H-JAIA – Hartsfield-Jackson Atlanta International Airport

HSGT – High Speed Ground Transportation

HSIPR – High Speed and Intercity Passenger Rail

JTA – Jacksonville Transit Authority

KRPDA – Kentuckiana Regional Planning and Development Agency

KYTC – Kentucky Transportation Cabinet

LOS – Level of Service

Maglev – Magnetic Levitation

MBPZ - Macon-Bibb Planning and Zoning

MHSRC –Midwest High Speed Rail Coalition

MMPT – Multi-Modal Passenger Terminal

MPO – Metropolitan Planning Organization

MSA – Metropolitan Statistical Area

MWRRS – Midwest Regional Rail System

NEPA – National Environmental Policy Act

NHRP – National Register of Historic Places

NIST – National Institute of Standards and Technology

NNEPRA – Northern New England Passenger Rail Authority

NPV – Net Percent Value

NS – Norfolk Southern

OBS – On Board Service

OMB – Office of Management and Budget

P3 – Public Private Partnerships

PRIIA – Passenger Rail Investment and Improvement Act of 2008

PTC – Positive Train Control

RPCGB – Regional Planning Commission of Greater Birmingham

RRIF – Railroad Rehabilitation and Improvement Financing Program

SAFETEA-LU – Safe Automobile Flexible Efficient Transportation Equity Act: A Legacy for Users

SCC – Standard Cost Categories

SDP – Service Development Programs

SEHSR – Southeast High Speed Rail

SMART – Suburban Mobility Authority for Regional Transportation

SPLOST – Special Purpose Local Option Sales Tax

STP – Surface Transportation Program

TAD – Tax Allocation Districts

TDOT – Tennessee Department of Transportation

TEA-21 – Transportation Equity Act for the 21st Century of 1998

TIF – Tax Incremental Financing

TIGER – Transportation Investment Generating Economic Recovery

TIFIA – Transportation Infrastructure Finance and Innovation Act

TMP – Transportation Management Plan

TPO – Transportation Planning Organization

TRB – Transportation Research Board

TSPLOST – Transportation Special Purpose Local Option Sales Tax

TTI – Texas Transportation Institute

TWC –Track Warranted Control

UGA – University of Georgia, Athens

UIC – International Union of Railways

US FWS – United States Fish and Wildlife Services

US DOT – United States Department of Transportation

VMT – Vehicle Miles Traveled

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ATLANTA-BIRMINGHAM EXECUTIVE SUMMARY

BACKGROUND AND PURPOSE

The purpose of this High Speed Rail Planning Study is to evaluate the feasibility of high-speed rail for three corridors in the southeastern United States. The corridors are as follows:

- Atlanta, GA to Birmingham, AL;
- Atlanta, GA to Macon, GA to Jacksonville, FL; and
- Atlanta, GA to Chattanooga, TN to Nashville, TN to Louisville, KY.

The feasibility of implementing and operating high-speed and intercity passenger rail was examined within each corridor for Emerging High-Speed Rail (90-110 mph) and Express High-Speed Rail (180-220 mph) in all three corridors; and Maglev (220+ mph) in the Atlanta-Chattanooga-Nashville-Louisville corridor.

A representative route was elected for each corridor for both Emerging High-Speed Rail (Shared Use) with speeds up to 90-110 mph, and Express High-Speed Rail (Dedicated Use) with speeds up to 150-220 mph. Additionally, Maglev technology was included in the Atlanta-Chattanooga-Nashville-Louisville Corridor. It should be noted that the representative routes are not preferred or recommended alternatives, but are presented as an example of an alternative to develop reasonable estimates for each corridors' high-speed rail performance. Each representative route may have a variety of specific alignments that will be analyzed through the NEPA process, should the route be selected for future analysis.

Emerging High-Speed Rail generally involves utilizing an existing rail corridor owned and operated by a freight railroad. This type of service is also commonly called "Shared Use". Diesel-electric Tilt Train Technology is proposed for Shared Use corridors due to curvature and topography on these routes and typically achieves top speeds of 90-110 mph.

Express High-Speed Rail achieves top speeds from 180 to 220 mph on completely grade-separated, electrified, dedicated track (with the possible exception of some shared right-of-way in terminal areas). Express High-Speed Rail intends to relieve air and highway capacity constraints. In this report, Express High-Speed Rail is referred to as "Dedicated Use".

Magnetic Levitation, abbreviated as Maglev, was only considered along the Atlanta-Chattanooga-Nashville-Louisville corridor, per special permission from the Federal

Railroad Administration (FRA). Maglev is an advanced train technology in which magnetic force lifts, propels, and guides a vehicle over a Guideway. Maglev permits cruising speeds between 250 and 300 mph. This alternative also involves establishing a new passenger rail corridor, designated solely to high-speed passenger rail service.

PURPOSE AND OBJECTIVE

The overall purpose of this study is to determine the relative feasibility of each corridor with regards to capital costs, funding and financing opportunities, operation and maintenance costs, ridership and revenue, operating ratios and benefit-cost analysis. Each corridor is studied independently of one another, and the feasibility of each corridor is dependent upon the potential benefits anticipated from investment in transportation between the major cities and along each of the corridors.

CORRIDOR DESCRIPTION AND HISTORY

The Atlanta-Birmingham corridor extends from the Hartsfield-Jackson Atlanta International Airport (H-JAIA) to the proposed downtown Atlanta Multi Modal Passenger Terminal (MMPT) and onto downtown Birmingham, AL. This particular rail corridor was included in the 1997 *High-Speed Ground Transportation for America* report and is one of the 11 federally-designated high-speed rail corridors.

Georgia Department of Transportation (GDOT), in partnership with the Regional Planning Commission of Greater Birmingham (RPCGB) analyzed this route segment as a part of this feasibility study as a connection between the Gulf Coast High-Speed Rail Corridor (New Orleans-Birmingham-Atlanta) and the Southeast High-Speed Rail Corridor (Atlanta-Charlotte-Raleigh-Washington D.C.).

There are two major multi-modal projects underway in Atlanta and Birmingham that support the potential need for high-speed rail service between the two cities. In Atlanta, the Atlanta MMPT is proposed to be located in downtown Atlanta. In Birmingham, the Birmingham-Jefferson County Transit Authority (BJCTA) is designing a new multi-modal center adjacent to the existing Amtrak station that will accommodate rail, bus, and taxi services.

REPRESENTATIVE ROUTE DEVELOPMENT

One of the first steps for this feasibility study was to identify representative corridor routes for each study corridor. Once the representative routes were established, capital costs, forecast ridership, revenues, operating costs, operating ratio, benefit-cost ratio and other comparative factors were calculated.

A high-level screening analysis was applied to the Atlanta-Birmingham corridor to identify a representative route for each technology for further evaluation.

Representative routes were identified for: 1) 90-110 mph Emerging High-Speed Rail (Shared Use) on a shared-use freight corridor; and 2) 180-220 mph Express High-Speed Rail (Dedicated Use) on a dedicated, fully grade-separated corridor. The screening and analysis methodology employed to identify a representative route for each operating technology consisted of four steps:

1. Identify the initial universe of route alternatives for each operating technology based on identifying those routes which provide basic connectivity for each of the major city pairs;
2. Screen the initial universe of route alternatives using both quantitative and qualitative factors to identify a representative route for each technology. Representative routes were chosen primarily based on the following quantitative and qualitative factors to deliver the highest level of service with the least public and environmental cost:
    - Route alternative geometry and travel time,
    - Route alternative freight traffic density (for Shared Use routes),
    - Stakeholder knowledge and input on route alternative issues and opportunities, and
    - Intermodal connectivity through potential stations.

    These routes contain several alignment alternatives that would be further analyzed through the NEPA process, should the corridors pass the feasibility threshold;
3. Further refine representative route alignments based upon a more detailed analysis including: service goals including travel time, station location and accessibility, operating feasibility, engineering feasibility, and cost factors; and
4. Evaluate each representative route in terms of its feasibility with regard to capital costs, forecast ridership, revenues, operating costs, operating ratio, benefit-cost ratio and other comparative factors.

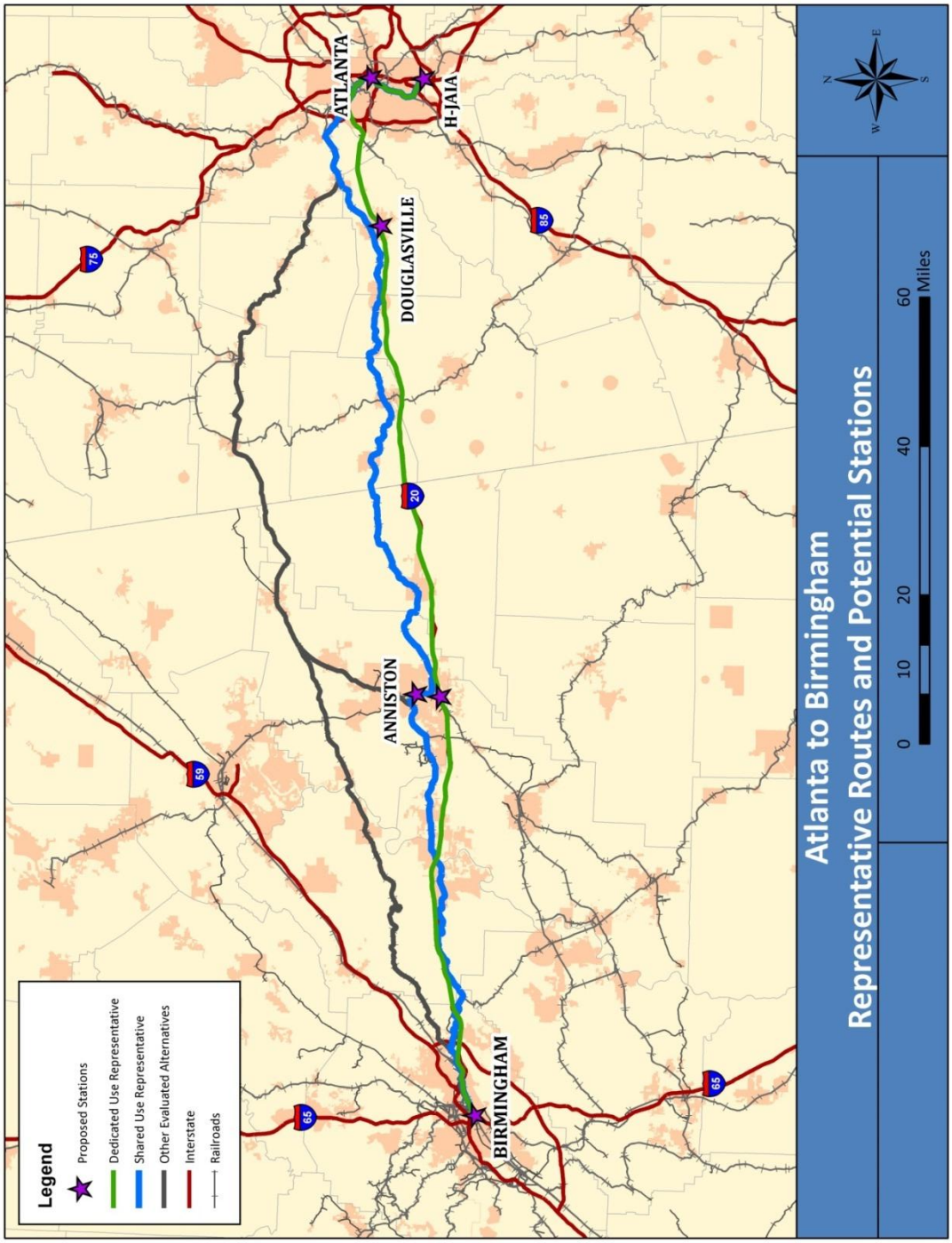
CORRIDOR EVALUATION

The Atlanta-Birmingham Corridor is the shortest of the three study corridors and connects Atlanta, GA and Birmingham, AL. Representative routes for 90-110 mph Shared Use and 180-220 mph Dedicated Use corridor operations were identified based on a technical and stakeholder review of the corridor. The selected routes are shown in Figure 1 on page ES-4, along with alternatives that were reviewed.

The Shared Use route follows the NS and Amtrak Crescent corridor, with potential stations at H-JAIA, Atlanta MMPT, Douglasville, GA, Anniston, AL and downtown Birmingham. The Dedicated Use route follows, primarily, the I-20 interstate corridor and transitions to freight route (utilizing freight right-of-way, but on separate tracks) entering and exiting Atlanta and Birmingham. The Dedicated Use route uses the same stations as Shared Use, with the exception of moving the

Anniston station southward 3.2 miles in order to intersect with the Dedicated Use route (illustrated in Figure 1).

Figure 1: Atlanta-Birmingham Representative Routes and Stations



OPERATING PLAN

Operating plans and schedules were developed for the Shared Use and Dedicated use routes. The Atlanta-Birmingham Corridor Shared Use route will have an average speed of 64 mph and will take approximately 2 hours and 46 minutes to travel the corridor, 20 minutes slower than average auto travel time using the Interstate highway. Although diesel-electric equipment technology can provide top speeds of 110 mph, curves and station stops reduce average speeds. The Dedicated Use 180-220 mph route will have an average speed of 117 mph and will take 1 hour and 18 minutes to travel the 151 mile corridor, a 1 hour and 8 minute travel time savings over auto travel. The frequencies were established to create a balance between ridership and operating and maintenance costs.

Table 1: Atlanta-Birmingham Operating Plans

	Shared Use	Dedicated Use
Rail Distance (miles)	176.0	150.7
Travel Time (hr : min)	2:46	1:18
Average Speed (mph)	64	117
Frequency (round trips per day)	6	10
Estimated Auto Time (hr : min)	2:26	2:26
Travel Time – Auto Time	+0:20	-1:08

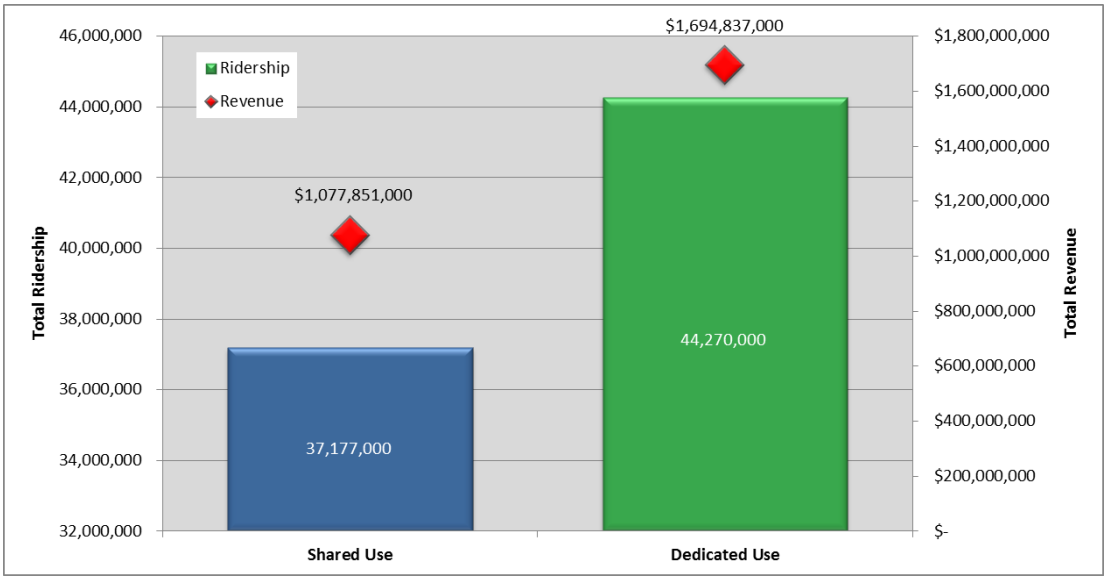
RIDERSHIP AND REVENUE

The study developed the annual ridership and revenue forecasts for both the Shared Use and Dedicated Use routes. The ridership and revenue analysis demonstrated that lower fare structures produce higher ridership levels, but generate lower revenues. Therefore, in order to optimize and balance ridership, revenue, and overall transportation system benefits (consumer surplus) study concluded that the $0.28/mile fare structure for Shared Use and $0.40/mile for Dedicated Use resulted in the optimum balance. Table 4 and Figure 2 illustrate ridership and revenue for years 2021, 2030 and 2040 as well as total ridership and revenue (2021-2040) for the two representative routes. The table and graph show that an increase in level of service and higher travel speeds associated with the 220 mph Dedicated Use corridor service results in an increase in both ridership and revenue for the corridor. The graph also indicates that while ridership may not increase substantially between Shared Use and Dedicated Use technologies, the higher fare used results in a significant increase in the overall revenue.

Table 2: Atlanta-Birmingham Total Ridership and Revenue (2021-2040 in 2010$)

	Shared Use		Dedicated Use	
	Ridership	Revenue	Ridership	Revenue
2021	1,613,000	$46,054,000	1,946,000	$72,791,000
2030	1,847,000	$53,480,000	2,199,000	$84,113,000
2040	2,087,000	$61,731,000	2,481,000	$96,693,000
Total	**37,177,000**	**$1,077,851,000**	**44,270,000**	**$1,694,837,000**

Figure 2: Atlanta-Birmingham Total Ridership and Revenue (2021-2040 in 2010$)



CAPITAL COSTS

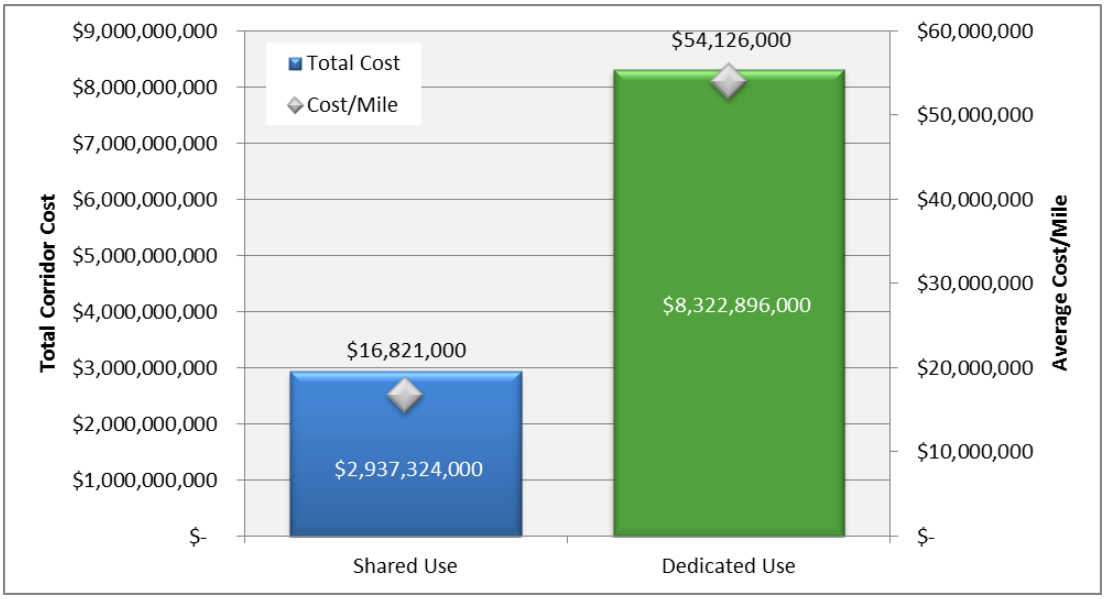
The Atlanta-Birmingham Corridor has the least expensive capital costs of the three corridors. This is primarily due to the short length of the corridor, but may also be partially attributed to the topography and geometry of the track along the corridor.

Table 5 and Figure 3 outline the total capital costs and costs per mile for Shared Use and Dedicated Use routes. The high Dedicated Use costs are mostly associated with the electrification of the track, comprising about 25 percent of the total capital cost and a significant portion of the operations and maintenance costs as well.

Table 3: Atlanta-Birmingham Total Capital Costs (2010$)

	Shared Use	Dedicated Use
Total Cost	$2,937,324,000	$8,322,896,000
Cost per Mile	$16,821,000	$54,126,000

Figure 3: Atlanta-Birmingham Total Capital Costs (2010$)



Operating and Maintenance Costs

Table 6 shows a breakdown of variable and fixed costing categories used to calculate total operating and maintenance costs. Table 7 illustrates the operating and maintenance costs for 2021, 2030 and 2040 as well as total costs (2021-2040). Total Shared Use operating and maintenance costs equate to approximately $930.3 million compared to the Dedicated Use estimate of $1.7 billion for the same time period.

Table 4: Fixed and Variable Operating and Maintenance Categories

Variable Costs
Train Crew
On-Board Services
Equipment Maintenance
Fuel or Energy
Insurance
Call Center
Credit Car + Travel Agency Commissions
Fixed Costs
Stations
Track and Electrification Maintenance
Administration and Management

Table 5: Atlanta-Birmingham Total Operating and Maintenance Costs (2021-2040 in $ millions and 2010$)

	Shared Use			Dedicated Use		
	Variable	Fixed	Total	Variable	Fixed	Total
2021	$20.9	$22.5	$43.4	$35.0	$44.4	$79.4
2030	$21.8	$22.5	$44.3	$36.6	$44.4	$81.0
2040	$22.7	$22.5	$45.2	$38.1	$44.4	$82.5
Total	**$457.8**	**$472.5**	**$930.3**	**$767.9**	**$932.4**	**$1,700**

CORRIDOR EVALUATION

High-speed rail service in the Atlanta-Birmingham Corridor was evaluated by using both operating ratios and benefit-cost analyses. The study evaluated three scenarios, Conservative, Intermediate and Optimistic, to show the impact of a range of ridership, revenue, capital and operating cost estimates typically encountered in a feasibility-level analysis. Unadjusted base forecasts for ridership, revenue, capital and operating costs were used for the Conservative scenario. Base ridership and revenue estimates were increased for Dedicated Use corridors to establish the Intermediate and Optimistic scenarios.[1] Operating costs were adjusted by the appropriate ridership drivers. Capital cost estimates were adjusted downward in the Intermediate and Optimistic scenarios for all technologies.

Operating Ratio

Both the 90-110 mph Shared use and 180-220 mph Dedicated Use representative routes performed well under each of the three sensitivity scenarios, all operating above a 1.0 ratio as outlined in Table 8. It is notable that significant operating revenue surpluses are shown for both technologies during the first year of operation in 2021 using even the most conservative ridership and revenue forecasts. The revenue surpluses then steadily increase over the 20-year planning period to 2040. This provides a strong incentive for potential private sector investors and operators.

[1] Ridership adjustments for Intermediate and Optimistic Scenarios were only made for Dedicated Use corridor 180-220 mph electrified, steel-wheel and Maglev technologies (Maglev in Atlanta-Louisville corridor only) based on a peer review of regional and national high-speed rail corridor studies. No scenario ridership adjustment was made for Shared Use corridor diesel-electric technology results based on a peer review of other shared-use corridor studies.

Table 6: Atlanta-Birmingham Operating Ratios (2021-2050)

	Conservative	Intermediate	Optimistic
Shared Use[2]			
2021	1.15	1.15	1.15
2030	1.32	1.32	1.32
2040	1.49	1.49	1.49
Dedicated Use			
2021	1.10	1.72	1.87
2030	1.25	1.86	2.00
2040	1.41	2.00	2.12

Benefit-Cost

Similar to operating ratios, the study evaluated the benefit-cost ratio for the two representative routes and all three sensitivity scenarios. The results in Table 9 show that the Shared Use route alternative does not demonstrate a benefit-cost ratio over 1.0 for any of the sensitivity scenarios and Dedicated Use route alternative produces a benefit-cost ratio above 1.0 for the Optimistic scenario.

Table 7: Atlanta-Birmingham Benefit-Cost Ratios (2021-2050)

	Conservative	Intermediate	Optimistic
Shared Use	0.80	0.88	0.95
Dedicated Use	0.48	0.92	1.13

KEY FINDINGS

The Shared Use and Dedicated Use alternatives perform well under the operating ratio analysis, resulting in ratios well above 1.0 for all three scenarios. This indicates strong operations with lower associated risks to owners and operators. Positive operating ratios indicate an ability to pay down debt services and bonds, and can lead to reduced reliability on public investment subsidies. Additionally, operating surpluses on an annual basis may finance a "rail maintenance fund", requiring less

[2] Shared Use operating ratios did not vary between the three sensitivity levels because the same "Conservative Scenario" base case ridership and revenue forecasts were used for each of the scenarios. No scenario ridership adjustment was made for Shared Use corridor diesel-electric technology results based on a peer review of other shared-use corridor studies.

investment in future years for capital maintenance costs. Positive operating ratios will likely spark private sector investment interest in the corridor, providing additional funding opportunities.

The Dedicated Use route using 180-220 mph electrified, steel-wheel technology shows a benefit-cost ratio of 1.13 for the Optimistic scenario. None of the Shared Use route scenarios show a benefit-cost ratio greater than 1.0.

It should be noted that this feasibility study includes very high-level data and estimates. A more detailed corridor analysis with more definitive study boundaries, travel demand models, and cost estimates, could yield a better benefit-cost evaluation, narrowing the range of estimates.

Taking into account both the operating ratios and benefit-cost ratio and benefit-cost analysis, the study recommends that the results of this analysis be used to set priorities for future state planning and corridor development activities In particular, this study finds that high speed rail service is feasible in the Atlanta-Birmingham Corridor.

HYBRID HIGH PERFORMANCE SCENARIO

One of the results from the Shared Use and Dedicated Use analyses was the introduction of a "hybrid" alternative to offset a portion of the initial capital costs (compared to the Dedicated Use) while improving the travel speeds (compared to the Shared Use), thus positively impacting the operating ratio and benefit-cost analysis. While some analyses were completed for the Hybrid High Performance scenario, there was insufficient data available for a full analysis to be completed. Therefore, more performance and financial details regarding the Hybrid High Performance scenario will need to be explored through the NEPA process. This feasibility study intends to introduce the concept of the Hybrid High Performance scenario and provide a high-level feasibility estimates based on the results found during the Shared Use and Dedicated Use analyses. These estimates include:

- Operational estimates;
- Ridership and revenue;
- Capital Costs; and
- Operating and Maintenance Costs.

From these estimates, the study calculates the high-level operating ratio and Benefit-Cost ratio to compare against the previously identified Shared Use and Dedicated Use ratios to determine if the Hybrid High Performance scenario should be included in a future NEPA analysis.

The study developed a Hybrid High Performance scenario that provides a level of service between Shared Use and Dedicated Use, utilizing fully grade-separated track geometry with no shared-use freight operations. However, rather than electrified high-speed technology, the Hybrid High Performance scenario would implement Diesel-Electric Tilt Technology initially, and when ridership and revenue increase in later operating years, it can be upgraded to a fully-electrified system, obtaining travel speeds of 220 mph or more.

One of the main benefits of the Hybrid High Performance scenario includes significantly lower capital costs compared to the 180-220 mph electrified technology assumed for the Dedicated Use route. However, the Hybrid High Performance scenario still has the potential to reach speeds of up to 130 mph. The study estimated that the Hybrid High Performance scenario would only take approximately 22 minutes longer than the electrified train on the Dedicated Use route. The 130 mph Hybrid High Performance scenario is approximately 1 hour, 16 minutes faster than auto travel by interstate from Atlanta to Birmingham (Table 10).

Table 8: Atlanta-Birmingham Hybrid High Performance Operations

Segment	Shared Use	Dedicated Use	Hybrid High Performance
Rail Distance (miles)	176.0	150.7	150.7
Travel Time (hr : min)	2:46	1:18	1:40
Average Speed (mph)	64	117	90
Frequency (round trips/day)	6	10	10
Estimated Auto Time (hr : min)	2:56	2:56	2:56
Travel Time – Auto Time	+0:10	-1:38	-1:16

Ridership and Revenue

The study estimated based on the decrease in average speed and increase in corridor travel time, the revenue for the Hybrid High Performance scenario would decrease 7.3 percent from the Dedicated Use forecasts (refer to Appendix G). Table 11 shows the estimated ridership and revenue for the Hybrid High Performance scenario for 2021, 2030, and 2040 as well as a total ridership and revenue (2021-2040) as compared to Dedicated Use forecasts.

Table 9: Atlanta-Birmingham Hybrid High Performance Ridership and Revenue (2021-2040 in 2010$)

	Hybrid High Performance		Dedicated Use	
	Ridership	Revenue	Ridership	Revenue
2021	1,805,000	$67,484,000	1,946,000	$72,791,000
2030	2,039,000	$77,981,000	2,199,000	$84,113,000
2040	2,300,000	$89,644,000	2,481,000	$96,693,000
Total	**41,043,000**	**$1,571,284,000**	**44,270,000**	**$1,684,837,000**

Costs

As previously mentioned, the capital costs, operating costs, and maintenance costs for the Hybrid High Performance scenario will be significantly less than the Dedicated Use route due to the elimination of the track electrification. This also results in decreased in vehicle cost since diesel vehicles are also less expensive than fully electrified vehicles.

Table 12 outlines the Hybrid High Performance scenario capital cost estimates compared to the Dedicated Use technology. Capital costs for the 130 mph Hybrid High Performance scenario are almost two-thirds (2/3) of those for the 180-220 mph electrified steel-wheel technology.

Table 10: Atlanta-Birmingham Hybrid High Performance Rail Capital Costs (2010$)

	Hybrid High Performance	Dedicated Use
Total Cost	$5,455,325,000	$8,322,897,000
Cost per Mile	$35,477,000	$54,399,000

Operating and maintenance costs for the Hybrid High Performance scenario will also be reduced from the Dedicated Use estimates due to less required track inspection and maintenance because heavy freight trains will not be sharing the track. Table 13 illustrates the estimates the Hybrid High Performance scenario operating and maintenance costs for 2021, 2030 and 2040 as well as total operating and maintenance costs (2021-2040) compared to the Dedicated Use route.

Table 11: Atlanta-Birmingham Hybrid High Performance Scenario Operating and Maintenance Costs (2021-2040 in $ millions and 2010$)

	Hybrid High Performance Rail			Dedicated Use		
	Variable	Fixed	Total	Variable	Fixed	Total
2021	$34.4	$31.8	$66.2	$35.0	$44.4	$79.4
2030	$35.8	$31.8	$67.6	$36.6	$44.4	$81.0
2040	$37.2	$31.8	$69.0	$38.1	$44.4	$82.2
Total	**$751.8**	**$667.8**	**$1,420**	**$767.9**	**$932.4**	**$1,700**

Feasibility Evaluation

Similar to the Shared Use and Dedicated Use routes, the study developed an operating ratio and benefit-cost ratio for the Hybrid Performance alternative. Table 14 and Table 15 illustrate the results of these analyses for the three sensitivity scenarios: Conservative, Intermediate and Optimistic as compared to the Dedicated Use route.

Table 12: Atlanta-Birmingham Hybrid High Performance Scenario Operating Ratio

	Conservative	Intermediate	Optimistic
Hybrid High Performance			
2021	1.18	1.85	2.02
2030	1.34	2.00	2.14
2040	1.51	2.13	2.26
Dedicated Use			
2021	1.10	1.72	1.87
2030	1.25	1.86	2.00
2040	1.41	2.00	2.12

Table 13: Atlanta-Birmingham Hybrid High Performance Scenario Benefit-Cost Ratio (2021-2050)

	Conservative	Intermediate	Optimistic
Hybrid High Performance	0.72	1.28	1.62
Dedicated Use	0.48	0.92	1.13

Initial investigation into the Hybrid High Performance scenario indicates that an incremental approach to high-speed rail may provide significant advantages in the Atlanta-Birmingham Corridor both in terms of reducing initial capital cost requirement and increasing benefit-cost ratios.

The study used high-level estimates for revenue and costs associated with the Hybrid High Performance scenario. Therefore, a more detailed analysis of this alternative is needed to make definitive conclusions regarding the feasibility of the Hybrid High Performance scenario. The study recommends that the Hybrid High Performance scenario be included in the next phase of the passenger rail planning analysis as a viable technology alternative for passenger rail within the Atlanta-Birmingham Corridor.

FINAL CONCLUSIONS

High-speed rail service in the Atlanta-Birmingham Corridor presents an opportunity to provide needed transportation solutions and promotes economic development. While high-speed rail is not the only transportation solution, this study gives evidence that passenger high-speed rail will provide added mobility and transportation choices to consumers. High-speed rail can provide more efficient and cost-effective means to consumers, providing added connectivity to major cities such as Atlanta and Birmingham through commercial centers and national/international destinations.

This study illustrates that although the initial investment in high-speed rail is significant, the mobility and economic opportunities offered by this new mode are also significant. Based on the analysis findings, this study determines that high-speed rail is feasible in the Atlanta-Birmingham Corridor. It is further recommended that a Tier 1 NEPA Document and Service Development Plan be pursued for high-speed rail service within the corridor. This analysis should continue to address a range of technology alternatives including the Hybrid High Performance implementation approach.

ATLANTA-MACON-JACKSONVILLE EXECUTIVE SUMMARY

BACKGROUND AND PURPOSE

The purpose of this High Speed Rail Planning Study is to evaluate the feasibility of high-speed rail for three corridors in the southeastern United States. The corridors are as follows:

- Atlanta, GA to Birmingham, AL;
- Atlanta, GA to Macon, GA to Jacksonville, FL; and
- Atlanta, GA to Chattanooga, TN to Nashville, TN to Louisville, KY.

The feasibility of implementing and operating high-speed and intercity passenger rail was examined within each corridor for Emerging High-Speed Rail (90-110 mph) and Express High-Speed Rail (180-220 mph) in all three corridors; and Maglev (220+ mph) in the Atlanta-Chattanooga-Nashville-Louisville corridor.

A representative route was elected for each corridor for both Emerging High-Speed Rail (Shared Use) with speeds up to 90-110 mph, and Express High-Speed Rail (Dedicated Use) with speeds up to 150-220 mph. Additionally, Maglev technology was included in the Atlanta-Chattanooga-Nashville-Louisville Corridor. It should be noted that the representative routes are not preferred or recommended alternatives, but are presented as an example of an alternative to develop reasonable estimates for each corridors' high-speed rail performance. Each representative route may have a variety of specific alignments that will be analyzed through the NEPA process, should the route be selected for future analysis.

Emerging High-Speed Rail generally involves utilizing an existing rail corridor owned and operated by a freight railroad. This type of service is also commonly called "Shared Use". Diesel-electric Tilt Train Technology is proposed for Shared Use corridors due to curvature and topography on these routes and typically achieves top speeds of 90-110 mph.

Express High-Speed Rail achieves top speeds from 180 to 220 mph on completely grade-separated, electrified, dedicated track (with the possible exception of some shared right-of-way in terminal areas). Express High-Speed Rail intends to relieve air and highway capacity constraints. In this report, Express High-Speed Rail is referred to as "Dedicated Use".

Magnetic Levitation, abbreviated as Maglev, was only considered along the Atlanta-Chattanooga-Nashville-Louisville corridor, per special permission from the Federal

Railroad Administration (FRA). Maglev is an advanced train technology in which magnetic force lifts, propels, and guides a vehicle over a Guideway. Maglev permits cruising speeds between 250 and 300 mph. This alternative also involves establishing a new passenger rail corridor, designated solely to high-speed passenger rail service.

PURPOSE AND OBJECTIVE

The overall purpose of this study is to determine the relative feasibility of each corridor with regards to capital costs, funding and financing opportunities, operation and maintenance costs, ridership and revenue, operating ratios and benefit-cost analysis. Each corridor is studied independently of one another, and the feasibility of each corridor is dependent upon the potential benefits anticipated from investment in transportation between the major cities and along each of the corridors.

CORRIDOR DESCRIPTION AND HISTORY

The Atlanta-Macon-Jacksonville corridor extends from the proposed downtown Atlanta Multi Modal Passenger Terminal (MMPT) to Hartsfield-Jackson Atlanta International Airport (H-JAIA) to Macon, GA, Savannah, GA and downtown Jacksonville, FL. The Atlanta-Macon-Jacksonville Corridor is a variation of the federally designated high-speed rail corridor. The original corridor travels from Atlanta, Macon, Jesup, Georgia and Jacksonville, Florida. This route was included in the route alternative analysis; however, the route including Savannah, GA was chosen based on the increase in ridership and revenue associated with the higher population. The Savannah metropolitan statistical area (MSA) is the fourth largest travel market in the state of Georgia, and the Savannah to Jacksonville Corridor is also part of the federally-designated Southeast High Speed Rail Corridor (SEHSR).

There are two multi-modal projects underway in Atlanta and Jacksonville that support the potential need for high-speed rail service between the two cities. In Atlanta, the Atlanta MMPT is proposed in downtown Atlanta. Jacksonville, FL is also proposing a new multi-modal terminal for downtown Jacksonville that will accommodate both intercity rail and local transit and ground transportation alternatives.

REPRESENTATIVE ROUTE DEVELOPMENT

One of the first steps for this feasibility study was to identify representative corridor routes for each study corridor. Once the representative routes were established, capital costs, forecast ridership, revenues, operating costs, operating ratio, benefit-cost ratio and other comparative factors were calculated.

A high-level screening analysis was applied to the Atlanta-Macon-Jacksonville Corridor to identify a representative route for each technology for further

evaluation. Representative routes were identified for: 1) 90-110 mph Emerging High-Speed Rail (Shared Use) on a shared-use freight corridor; and 2) 180-220 mph Express High-Speed Rail (Dedicated Use) on a dedicated, fully grade-separated corridor. The screening and analysis methodology employed to identify a representative route for each operating technology consisted of four steps:

1. Identify the initial universe of route alternatives for each operating technology based on identifying those routes which provide basic connectivity for each of the major city pairs;
2. Screen the initial universe of route alternatives using both quantitative and qualitative factors to identify a representative route for each technology. Representative routes were chosen primarily based on the following quantitative and qualitative factors to deliver the highest level of service with the least public and environmental cost:
    - Route alternative geometry and travel time,
    - Route alternative freight traffic density (for Shared Use routes),
    - Stakeholder knowledge and input on route alternative issues and opportunities, and
    - Intermodal connectivity through potential stations.

    These routes contain several alignment alternatives that would be further analyzed through the NEPA process, should the corridors pass the feasibility threshold;
3. Further refine representative route alignments based upon a more detailed analysis including: service goals including travel time, station location and accessibility, operating feasibility, engineering feasibility, and cost factors; and
4. Evaluate each representative route in terms of its feasibility with regard to capital costs, forecast ridership, revenues, operating costs, operating ratio, benefit-cost ratio and other comparative factors.

CORRIDOR EVALUATION

The Atlanta-Macon-Jacksonville Corridor connects Atlanta, Macon and Savannah, Georgia with Jacksonville, Florida. Representative routes for 110 mph Shared Use and 180-220 Dedicated Use corridor operations were identified based on a technical analysis and stakeholder review of the corridor. The selected routes are shown in Figure 1 on page ES-4, along with alternatives that were reviewed.

Shared Use Route Representative Route: 110 mph, Diesel-Electric Technology:

- NS S-Line from Atlanta, Georgia to Macon, Georgia;
- Georgia Central Railroad from Macon, Georgia to Savannah, Georgia;
- Partially abandoned CSXT S-Line from Savannah, Georgia to Callahan, Florida; and

- CSXT A-Line from Callahan, Florida to Jacksonville, Florida.

The Shared Use route proposes a total of seven potential stations including Atlanta MMPT, H-JAIA, Griffin, Macon, Savannah, Brunswick, and Jacksonville.

Dedicated Use Representative Route: 180-220 mph, Electrified Steel-Wheel Technology:

The proposed Dedicated Use route generally follows Interstate 75 (I-75) and the NS Griffin "S-Line" from Atlanta to Macon, and Interstate 16 (I-16) from Macon to Savannah. There is one primary opportunity for a Dedicated Use route between Savannah and Jacksonville following the partially abandoned CSXT S-Line. There are two routing options, then, entering the Jacksonville metropolitan area. The first option is to continue following the CSXT S-Line from Savannah through Brunswick into Jacksonville providing access to the Jacksonville International Airport, but bypassing the existing Jacksonville Amtrak station. The second option provides a transition from the CSXT S-Line to the CSXT A-Line just north of the city. This option would access the Amtrak station, but bypass the Jacksonville International Airport.

Figure 1: Atlanta-Macon-Jacksonville Representative Routes and Stations



OPERATING PLAN

Operating plans and schedules were developed for the Shared Use and Dedicated use routes. The Atlanta-Macon-Jacksonville Corridor Shared Use route will have an average speed of 77 mph and will take approximately 5 hours and 19 minutes to travel the corridor, 6 minutes faster than auto travel time using the Interstate highway. Although diesel-electric equipment technology can provide top speeds of 110 mph, curves and station stops reduce average speeds. The Dedicated Use 180-220 mph route will have an average speed of 131 mph and will take 2 hour and 49 minutes to travel the 368 mile corridor – a 2 hour and 35 minute travel time savings over auto travel. The frequencies were established to create a balance between ridership and operating and maintenance costs.

Table1: Atlanta-Macon-Jacksonville Operating Plans

	Shared Use	Dedicated Use
Rail Distance (miles)	408.6	368.1
Travel Time (hr : min)	5:18	2:49
Average Speed (mph)	77	131
Frequency (round trips per day)	8	14
Estimated Auto Time (hr : min)	5:24	5:24
Travel Time – Auto Time	-0:06	-2:35

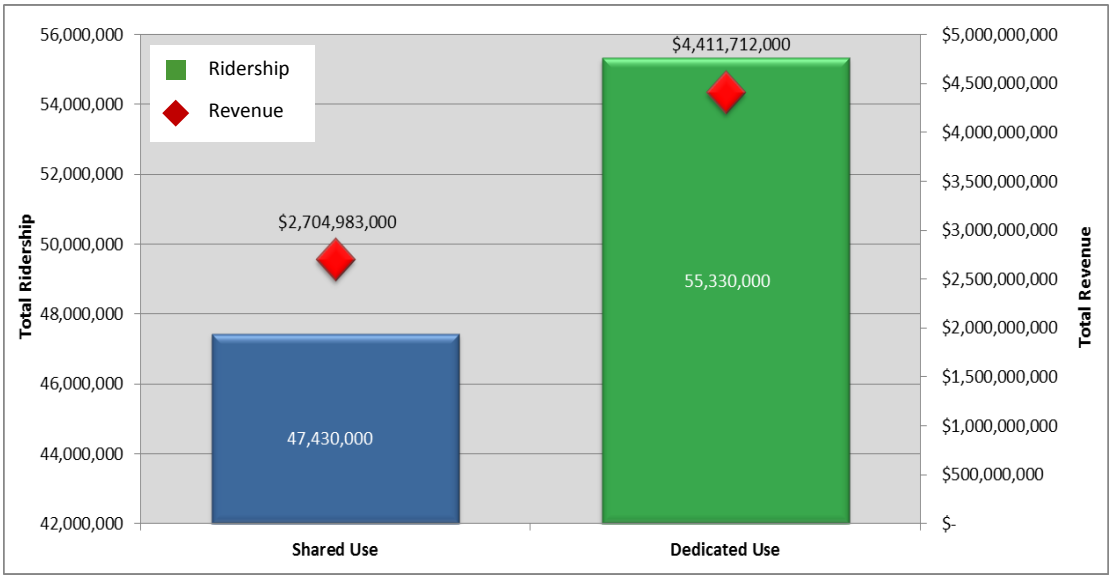
RIDERSHIP AND REVENUE

The study developed the annual ridership and revenue forecasts for both the Shared Use and Dedicated Use routes. The ridership and revenue analysis demonstrated that lower fare structures produce higher ridership levels, but generate lower revenues. Therefore, in order to optimize and balance ridership, revenue, and overall transportation system benefits (consumer surplus) study concluded that a $0.28/mile fare structure for Shared Use and $0.40/mile for Dedicated Use resulted in optimum balance. Table 2 and Figure 2 illustrate ridership and revenue for years 2021, 2030 and 2040 as well as total ridership and revenue (2021-2040) for the two representative routes. The table and graph show that an increase in level of service and higher travel speeds associated with the 220 mph Dedicated Use corridor service results in an increase in both ridership and revenue for the corridor. The graph also indicates that while ridership may not increase substantially between Shared Use and Dedicated Use technologies, the higher fare used results in a significant increase in the overall revenue.

Table 2: Atlanta-Macon-Jacksonville Total Ridership and Revenue (2021-2040 in 2010$)

	Shared Use		Dedicated Use	
	Ridership	Revenue	Ridership	Revenue
2021	2,011,000	$109,776,000	2,355,000	$181,193,000
2030	2,353,000	$133,908,000	2,745,000	$218,512,000
2040	2,732,000	$160,723,000	3,178,000	$259,978,000
Total	**47,430,000**	**$2,704,983,000**	**55,330,000**	**$4,411,712,000**

Figure 2: Atlanta-Macon-Jacksonville Total Ridership and Revenue (2021-2040 in 2010$)



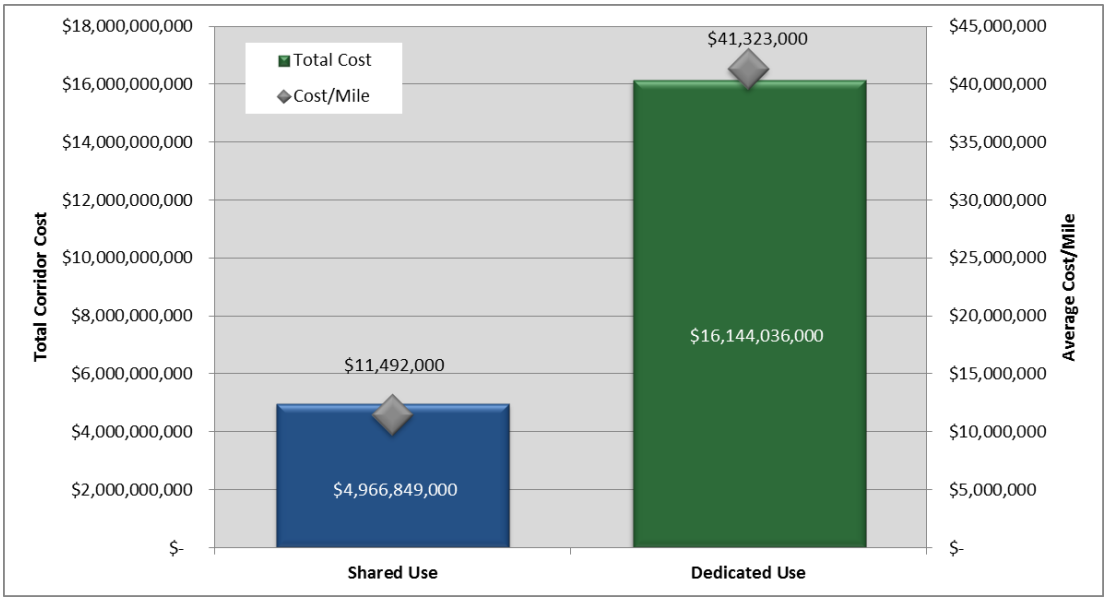
CAPITAL COSTS

The Atlanta-Macon-Jacksonville Corridor reflected the lowest cost per mile of the three study corridors. This is due to the flat terrain and relatively straight geometry of both the Shared Use and Dedicated routes. Table 3 and Figure 3 outline the total capital costs and costs per mile for Shared Use and Dedicated Use routes. The high Dedicated Use costs are mostly associated with the electrification of the track, comprising about 25 percent of the total capital cost and a significant portion of the operations and maintenance costs as well.

Table 3: Atlanta-Macon-Jacksonville Total Capital Costs (2010$)

	Shared Use	Dedicated Use
Total Cost	$4,966,849,000	$16,144,036,000
Cost per Mile	$11,492,000	$41,323,000

Figure 3: Atlanta-Macon-Jacksonville Total Capital Costs (2010$)



OPERATING AND MAINTENANCE COSTS

Table 4 shows a breakdown of variable and fixed costing categories used to calculated total operating maintenance costs. Table 5 illustrates the operating and maintenance costs for 2021, 2030 and 2040 as well as total costs (2021-2040). Total Shared Use operating and maintenance costs equate to approximately $2.1 billion compared to the Dedicated Use estimate of $4.1 billion for the same time period.

Table 4: Fixed and Variable Operating and Maintenance Categories

Variable Costs
Train Crew
On-Board Services
Equipment Maintenance
Fuel or Energy
Insurance
Call Center
Credit Car + Travel Agency Commissions
Fixed Costs
Stations
Track and Electrification Maintenance
Administration and Management

Table 5: Atlanta-Macon-Jacksonville Total Operating and Maintenance Costs (2021-2040 in $ millions and 2010$)

	Shared Use			Dedicated Use		
	Variable	Fixed	Total	Variable	Fixed	Total
2021	$60.1	$35.6	$95.7	$109.1	$80.9	$190.1
2030	$62.8	$35.6	$98.5	$113.9	$80.9	$194.8
2040	$65.6	$35.6	$101.2	$118.7	$80.9	$199.6
Total	**$1,320**	**$747.6**	**$2,067**	**$2,392**	**$1,699**	**$4,090**

CORRIDOR EVALUATION

High-speed rail service in the Atlanta-Macon-Jacksonville Corridor was evaluated by using both operating ratios and benefit-cost analyses. The study evaluated three scenarios, Conservative, Intermediate and Optimistic, to show the impact of a range of ridership, revenue, capital and operating cost estimates typically encountered in a feasibility-level study. Unadjusted base forecasts for ridership, revenue, capital and operating costs were used for the Conservative scenario. Base ridership and revenue estimates were increased for Dedicated Use corridors to establish the Intermediate and Optimistic scenarios.[3] Operating costs were adjusted by the appropriate ridership drivers. Capital cost estimates were adjusted downward in the Intermediate and Optimistic scenarios for all technologies

Operating Ratio

Both the 90-110 mph Shared Use and 180-220 mph Dedicated Use representative routes performed well under each of the three sensitivity scenarios, all operating above a 1.0 ratio as outlined in Table 6. It is notable that significant operating revenue surpluses are shown for both technologies during the first year of operation in 2021 using even the most conservative ridership and revenue forecast. The revenue surpluses then steadily increase over the 20-year planning period to 2040. This provides a strong incentive for potential private sector investors and operators.

[3] Ridership adjustments for Intermediate and Optimistic Scenarios were only made for Dedicated Use corridor 180-220 mph electrified, steel-wheel and Maglev technologies (Maglev in Atlanta-Louisville corridor only) based on a peer review of regional and national high speed rail corridor studies. No scenario ridership adjustment was made for Shared Use corridor diesel-electric technology results based on a peer review of other shared-use corridor studies.

Table 6: Atlanta-Macon-Jacksonville Operating Ratios (2021-2050)

	Conservative	Intermediate	Optimistic
Shared Use[4]			
2021	1.25	1.25	1.25
2030	1.48	1.48	1.48
2040	1.73	1.73	1.73
Dedicated Use			
2021	1.14	1.83	2.04
2030	1.35	2.00	2.17
2040	1.56	2.15	2.29

Benefit-Cost

Similar to operating ratios, the study evaluated the benefit-cost ratio for the two representative routes and all three sensitivity scenarios. The results in Table 7 show that the Shared Use route alternative has benefit-cost ratio of 1.0 or more for both the Intermediate and Optimistic scenarios and the Dedicated Use route alternative has a benefit-cost ratio greater than 1.0 for the Optimistic scenario.

Table 7: Atlanta-Macon-Jacksonville Benefit-Cost Ratios (2021-2050)

	Conservative	Intermediate	Optimistic
Shared Use	0.92	1.00	1.07
Dedicated Use	0.49	0.93	1.12

KEY FINDINGS

The Shared Use and Dedicated Use alternatives perform well under the operating ratio analysis, resulting in ratios well above 1.0 for all three scenarios. This indicates strong operations with lower associated risks to owners and operators. Positive operating ratios indicate an ability to pay down debt services and bonds, and can lead to reduced reliability on public investment subsidies. Additionally, operating surpluses on an annual basis may finance a "rail maintenance fund", requiring less investment in future years for capital maintenance costs. Positive operating ratios

[4] Shared Use operating ratios did not vary between the three sensitivity levels because the same "Conservative Scenario" base case ridership and revenue forecasts were used for each of the scenarios. No scenario ridership adjustment was made for Shared Use corridor diesel-electric technology results based on a peer review of other shared-use corridor studies.

will likely spark private sector investment interest in the corridor, providing additional funding opportunities.

The benefit-cost results show ratios greater than 1.0 for both Shared Use and Dedicated Use for the Optimistic scenario and well as for the Shared Use Conservative scenario.

It should be noted that this feasibility study includes very high-level data and estimates. A more detailed corridor analysis with more definitive study boundaries, travel demand models, and cost estimates, could yield a better benefit-cost evaluation narrowing the range of estimates.

Taking into account the both operating ratios and benefit-cost ratios, the study recommends that the results of this analysis be used to set priorities for future state planning and corridor development activities. In particular, this study finds that high speed rail service is feasible in the Atlanta-Macon-Jacksonville Corridor.

The study developed an additional "Hybrid" High Performance scenario, discussed in detail below that further supports the above conclusions. This alternative has the potential to reduce initial capital costs and positively impact the benefit-cost analysis while maintaining the ability to achieve higher speeds along the corridor.

HYBRID HIGH PERFORMANCE SCENARIO

One of the results from the Shared Use and Dedicated Use analyses was the introduction of a "hybrid" alternative to offset a portion of the initial capital costs (compared to the Dedicated Use) while improving the travel speeds (compared to the Shared Use), thus positively impacting the operating ratio and benefit-cost analysis. While some analyses were completed for the Hybrid High Performance scenario, there was insufficient data available for a full analysis to be completed. Therefore, more performance and financial details regarding the Hybrid High Performance scenario will need to be explored through the NEPA process. This feasibility study intends to introduce the concept of the Hybrid High Performance scenario and provide a high-level feasibility estimates based on the results found during the Shared Use and Dedicated Use analyses. These estimates include:

- Operational estimates;
- Ridership and revenue;
- Capital Costs; and
- Operating and Maintenance Costs.

From these estimates, the study calculates the high-level operating ratio and Benefit-Cost ratio to compare against the previously identified Shared Use and

Dedicated Use ratios to determine if the Hybrid High Performance scenario should be included in a future NEPA analysis.

The study developed a Hybrid High Performance scenario that provides a level of service between Shared Use and Dedicated Use, utilizing fully grade-separated track geometry with no shared-use freight operations. However, rather than electrified high-speed technology, the Hybrid High Performance scenario would implement diesel-electric tilt technology initially, and when ridership and revenue increase in later operating years, it can be upgraded to a fully-electrified system, obtaining travel speeds of 220 mph or more.

One of the main benefits of the Hybrid High Performance scenario include significantly lower capital costs compared to the 180-220 mph electrified technology assumed for the Dedicated Use route. However, the Hybrid High Performance scenario, which utilizes diesel-electric tilt train technology, still has the potential to reach speeds of up to 130 mph. The study estimated that the Hybrid High Performance scenario would take approximately 1 hour, 7 minutes longer than the electrified train on the Dedicated Use route. The Hybrid High Performance is approximately 1 hour, 29 minutes faster than auto travel by interstate from Atlanta to Jacksonville (Table 8).

Table 8: Atlanta-Macon-Jacksonville High Performance Operations

Segment	Shared Use	Dedicated Use	Hybrid High Performance
Rail Distance (miles)	408.6	368.1	368.1
Travel Time (hr : min)	5:18	2:49	3:55
Average Speed (mph)	77	131	94
Frequency (round trips/day)	8	14	14
Estimated Auto Time (hr : min)	5:24	5:24	5:24
Travel Time – Auto Time	-0:06	-2:35	-1:29

Ridership and Revenue

The study estimated based on the decrease in average speed and increase in corridor travel time, the revenue for the Hybrid High Performance scenario would decrease 19.21 percent from the Dedicated Use forecasts (refer to Appendix G). Table 9 shows the estimated ridership and revenue for the Hybrid High Performance scenario for 2021, 2030, and 2040 as well as a total ridership and revenue (2021-2040) as compared to Dedicated Use forecasts.

Table 9: Atlanta-Macon-Jacksonville High Performance Ridership and Revenue (2010$)

	Hybrid High Performance		Dedicated Use	
	Ridership	Revenue	Ridership	Revenue
2021	2,061,000	146,386,000	2,355,000	$181,193,000
2030	2,402,000	176,536,000	2,745,000	$218,512,000
2040	2,781,000	210,036,000	3,178,000	$259,978,000
Total	**48,414,000**	**$3,564,222,000**	**55,330,000**	**$4,411,712,000**

Costs

As previously mentioned, the capital costs, operating costs, and maintenance costs for the Hybrid High Performance scenario will be significantly less than the Dedicated Use route due to the elimination of the track electrification. This also results in decreased in vehicle cost since diesel vehicles are also less expensive than fully electrified vehicles.

Table 10 outlines the Hybrid High Performance scenario capital cost estimates compared to the Dedicated Use technology. Capital costs for the 130 mph Hybrid technology alternative are almost half of those for the 180-220 mph electrified steel-wheel technology.;=

Table 10: Atlanta-Macon-Jacksonville High Performance Scenario Capital Costs (2010$)

	Hybrid High Performance	Dedicated Use
Total Cost	$8,904,394,000	$16,144,036,000
Cost per Mile	$22,792,000	$41,323,000

Operating and maintenance costs for the Hybrid High Performance scenario will also be reduced from the Dedicated Use estimates due to less required track inspection and maintenance because heavy freight trains will not be sharing the track. Table 11 illustrates the estimates the Hybrid High Performance scenario operating and maintenance costs for 2021, 2030 and 2040 as well as total operating and maintenance costs (2021-2040) compared to the Dedicated Use route.

Table 11: Atlanta-Macon-Jacksonville Hybrid High Performance Scenario Operating and Maintenance Costs (2021-2040 in $ millions and 2010$)

	Hybrid High Performance Rail			Dedicated Use		
	Variable	Fixed	Total	Variable	Fixed	Total
2021	$114.6	$50.2	$164.7	$109.1	$80.9	$190.1
2030	$118.4	$50.2	$168.6	$113.9	$80.9	$194.8
2040	$122.3	$50.2	$172.4	$118.7	$80.9	$199.6
Total	**$2,487**	**$1,054**	**$3,541**	**$2,392**	**$1,699**	**$4,090**

Feasibility Evaluation

Similar to the Shared Use and Dedicated Use routes, the study developed an operating ratio and benefit-cost ratio for the Hybrid Performance alternative. Table 12 and Table 13 illustrate the results of these analyses for the three sensitivity scenarios: Conservative, Intermediate and Optimistic as compared to the Dedicated Use and Maglev routes.

Table 12: Atlanta-Macon-Jacksonville Hybrid High Performance Scenario Operating Ratio

	Conservative	Intermediate	Optimistic
Hybrid High Performance			
2021	1.03	1.66	1.86
2030	1.21	1.95	2.17
2040	1.41	2.18	2.39
Dedicated Use			
2021	1.14	1.83	2.04
2030	1.35	2.00	2.17
2040	1.56	2.15	2.29

Table 13: Atlanta-Macon-Jacksonville Hybrid High Performance Scenario Benefit-Cost Ratio (2021-2050)

	Conservative	Intermediate	Optimistic
Hybrid High Performance	0.63	1.21	1.48
Dedicated Use	0.49	0.93	1.12

Initial investigation into the Hybrid High Performance scenario indicates that an incremental approach to high-speed rail may provide significant advantages in the Atlanta-Macon-Jacksonville Corridor both in terms of reducing initial capital cost requirements and increasing the benefit-cost ratios.

The study used high-level estimations for revenue and costs associated with the Hybrid High Performance scenario. Therefore, a more detailed analysis of this alternative is needed to make definitive conclusions regarding the feasibility of the Hybrid High Performance scenario. The study recommends that the Hybrid High Performance scenario be included in the next phase of the passenger rail planning analysis as a viable technology alternative for passenger rail within the Atlanta-Macon-Jacksonville Corridor.

FINAL CONCLUSIONS

High-speed rail service in the Atlanta-Macon-Jacksonville Corridor presents an opportunity to provide needed transportation solutions and promote economic development. While high-speed rail is not the only transportation solution, this study gives evidence that passenger high-speed rail will provide added mobility and transportation choices to consumers. High-speed rail can provide more efficient and cost-effective means to consumers, providing added connectivity to major cities such as Atlanta and Birmingham through commercial centers and national / international destinations.

This study illustrates that although the initial investment in high-speed rail is significant, the mobility and economic opportunities offered by this new more are significant. Based on the analysis findings, this study determines that high-speed rail is feasible in the Atlanta-Macon-Jacksonville Corridor. It is further recommended that a Tier 1 NEPA Document and Service Development Plan be pursued for high-speed rail service within the corridor. This analysis should continue to address a range of technology alternatives including the Hybrid High Performance implementation approach.

ATLANTA-CHATTANOOGA-NASHVILLE-LOUISVILLE EXECUTIVE SUMMARY

BACKGROUND AND PURPOSE

The purpose of this High Speed Rail Planning Study is to evaluate the feasibility of high-speed rail for three corridors in the southeastern United States. The corridors are as follows:

- Atlanta, GA to Birmingham, AL;
- Atlanta, GA to Macon, GA to Jacksonville, FL; and
- Atlanta, GA to Chattanooga, TN to Nashville, TN to Louisville, KY.

The feasibility of implementing and operating high-speed and intercity passenger rail was examined within each corridor for Emerging High-Speed Rail (90-110 mph) and Express High-Speed Rail (180-220 mph) in all three corridors; and Maglev (220+ mph) in the Atlanta-Chattanooga-Nashville-Louisville corridor.

A representative route was elected for each corridor for both Emerging High-Speed Rail (Shared Use) with speeds up to 90-110 mph, and Express High-Speed Rail (Dedicated Use) with speeds up to 150-220 mph. Additionally, Maglev technology was included in the Atlanta-Chattanooga-Nashville-Louisville Corridor. It should be noted that the representative routes are not preferred or recommended alternatives, but are presented as an example of an alternative to develop reasonable estimates for each corridors' high-speed rail performance. Each representative route may have a variety of specific alignments that will be analyzed through the NEPA process, should the route be selected for future analysis.

Emerging High-Speed Rail generally involves utilizing an existing rail corridor owned and operated by a freight railroad. This type of service is also commonly called "Shared Use". Diesel-electric Tilt Train Technology is proposed for Shared Use corridors due to curvature and topography on these routes and typically achieves top speeds of 90-110 mph.

Express High-Speed Rail achieves top speeds from 180 to 220 mph on completely grade-separated, electrified, dedicated track (with the possible exception of some shared right-of-way in terminal areas). Express High-Speed Rail intends to relieve air and highway capacity constraints. In this report, Express High-Speed Rail is referred to as "Dedicated Use".

Magnetic Levitation, abbreviated as Maglev, was only considered along the Atlanta-Chattanooga-Nashville-Louisville corridor, per special permission from the Federal Railroad Administration (FRA). Maglev is an advanced train technology in which magnetic force lift, propel, and guide a vehicle over a Guideway. Maglev permits cruising speeds between 250 and 300 mph. This alternative also involves establishing a new passenger rail corridor, designated solely to high-speed passenger rail service.

PURPOSE AND OBJECTIVE

The overall purpose of this study is to determine the relative feasibility of each corridor with regards to capital costs, funding and financing opportunities, operation and maintenance costs, ridership and revenue, operating ratios and benefit-cost analysis. Each corridor is studied independently of one another, and the feasibility of each corridor is dependent upon the potential benefits anticipated from investment in transportation between the major cities and along each of the corridors.

CORRIDOR DESCRIPTION AND HISTORY

The Atlanta-Chattanooga-Nashville-Louisville corridor extends between the Hartsfield-Jackson Atlanta International Airport (H-JAIA) and Downtown Louisville, KY. As documented in the Georgia State Rail Plan, the Atlanta-Chattanooga Corridor has been a subject of study for over 10 years and was part of the GDOT 1997 Intercity Rail Plan. The Atlanta Regional Commission (ARC) analyzed the corridor from 1999 to 2003. Currently, the State of Georgia is preparing a Tier I EIS considering 180 mph high-speed rail and Maglev within the corridor. The State of Tennessee prepared a State Rail Plan in 2003, and the Kentucky Transportation Cabinet (KYTC) State Rail Plan was completed in 2002. Both the Tennessee and Kentucky State Rail Plans explored options and the opportunity for high-speed service. These plans link Chattanooga, Nashville, and Louisville, KY.

REPRESENTATIVE ROUTE DEVELOPMENT

One of the first steps for this feasibility study was to identify representative corridor routes for each study corridor. Once the representative routes were established, capital costs, forecast ridership, revenues, operating costs, operating ratio, benefit-cost ratio and other comparative factors were calculated.

A high-level screening analysis was applied to the Atlanta-Chattanooga-Nashville-Louisville Corridor to identify a representative route for each technology for further evaluation. Representative routes were identified for: 1) 90-110 mph Emerging High-Speed Rail (Shared Use) on a shared-use freight corridor; 2) 180-220 mph Express High-Speed Rail (Dedicated Use) on a dedicated, fully grade-separated corridor; and 3) 220+ mph Maglev on a dedicated, fully grade-separated corridor.

The screening and analysis methodology employed to identify a representative route for each operating technology consisted of four steps:

1. Identify the initial universe of route alternatives for each operating technology based on identifying those routes which provide basic connectivity for each of the major city pairs;
2. Screen the initial universe of route alternatives using both quantitative and qualitative factors to identify a representative route for each technology. Representative routes were chosen primarily based on the following quantitative and qualitative factors to deliver the highest level of service with the least public and environmental cost:
    - Route alternative geometry and travel time,
    - Route alternative freight traffic density (for Shared Use routes),
    - Stakeholder knowledge and input on route alternative issues and opportunities, and
    - Intermodal connectivity through potential stations.

    These routes contain several alignment alternatives that would be further analyzed through the NEPA process, should the corridors pass the feasibility threshold;
3. Further refine representative route alignments based upon a more detailed analysis including: service goals including travel time, station location and accessibility, operating feasibility, engineering feasibility, and cost factors; and
4. Evaluate each representative route in terms of its feasibility with regard to capital costs, forecast ridership, revenues, operating costs, operating ratio, benefit-cost ratio and other comparative factors.

CORRIDOR EVALUATION

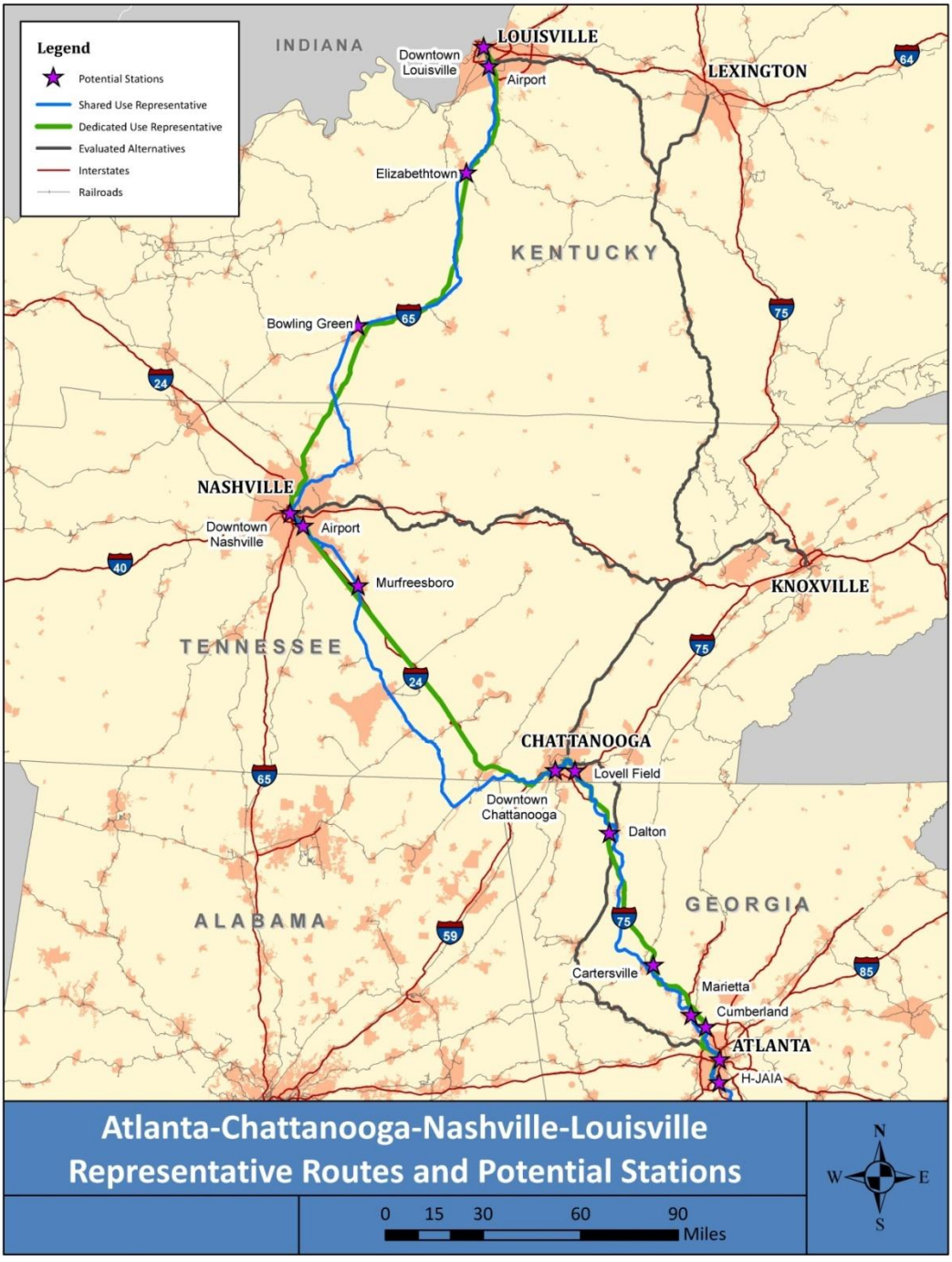
The representative routes were identified based on a technical and stakeholder review of the corridor. The selected routes are shown in Figure 1 on page ES-4, along with alternatives that were reviewed.

The Shared Use route follows the CSXT route, with potential stations at Hartsfield-Jackson International Airport (H-JAIA), Atlanta Multi-Modal Passenger Terminal (MMPT), Cumberland/Galleria, Marietta, Cartersville, Dalton, Lovell Airport Field, Downtown Chattanooga, Murfreesboro, Nashville International Airport, Downtown Nashville, Bowling Green, Elizabethtown, Louisville International Airport, and Downtown Louisville. The Dedicated Use route uses the same stations as Shared Use, with the exception of the Marietta station due to station location and route proximity.

The Dedicated Use/Maglev route follows I-75 from Atlanta to Chattanooga, I-24 from Chattanooga to Nashville, and I-65 from Nashville to Louisville. The Atlanta to

Chattanooga segment is the same as that used in the Tier I EIS. Both the Shared Use and Dedicated Use routes use viaduct structures entering and exiting Atlanta, Chattanooga, Nashville, and Louisville.

Figure 1: Atlanta-Chattanooga-Nashville-Louisville Representative Routes and Stations



OPERATING PLAN

Operating plans and schedules were developed for the Shared Use, Dedicated Use, and Maglev corridors. The Atlanta-Chattanooga-Nashville-Louisville Corridor Shared Use route will have an average speed of 72 mph and will take approximately 6 hours and 55 minutes to travel the corridor, 1 minute slower than auto travel time using the Interstate highway. The Dedicated Use route will have an average speed of 122 mph and will take 3 hours and 32 minutes to travel the 428-mile corridor, substantially quicker than driving. The Maglev operation will have an average speed of 143 mph and will take 3 hours and 2 minutes, 30 minutes quicker than Dedicated Use and almost 4 hours quicker than automobile travel. The frequencies were established to create a balance between ridership and operating and maintenance costs

.

Table 1: Atlanta-Chattanooga-Nashville-Louisville Operating Plans

		Shared Use	Dedicated Use	Maglev
Rail Distance (miles)		489.8	428.2	428.2
Travel Time (hr : min)		6:55	3:32	3:02
Average Speed (mph)		72	122	143
Frequency (round trips per day)	Atlanta-Chattanooga	16	28	28
	Chattanooga-Nashville	10	20	20
	Nashville-Louisville	5	12	12
Estimated Auto Time (hr : min)		6:54	6:54	6:54
Travel Time – Auto Time		+0:01	-3:22	-3:52

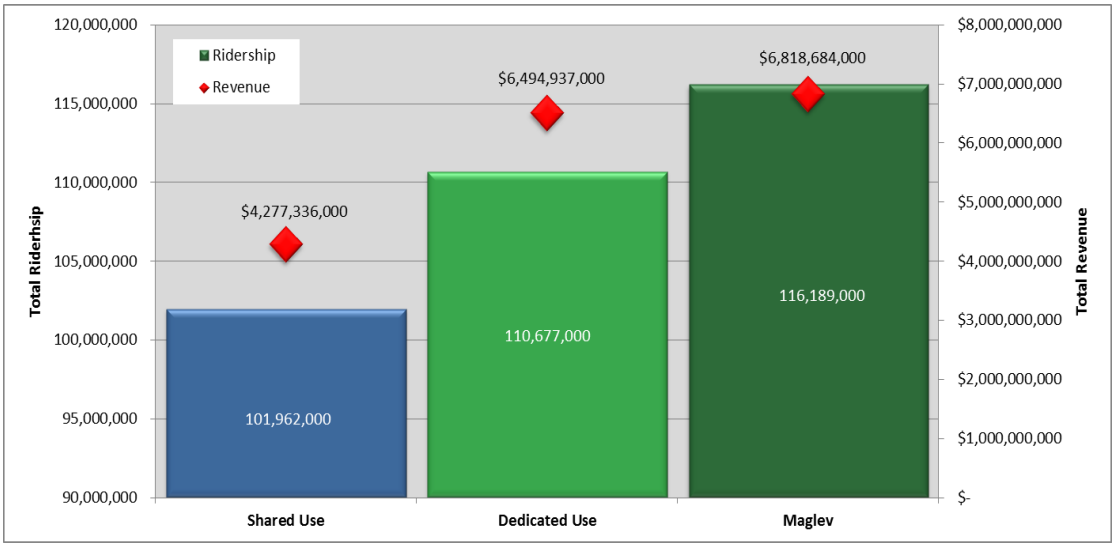
RIDERSHIP AND REVENUE

The study determined the annual ridership and revenue for the Shared Use and Dedicated Use/Maglev routes. The ridership and revenue analysis suggested that lower fare structures produce higher ridership levels, but generate lower revenues. Therefore, in order to optimize and balance ridership and revenue and overall transportation system benefits (consumer surplus) study concluded that the $0.28/mile fare structure for Shared Use and $0.40/mile for Dedicated Use / Maglev resulted in the optimum balance. Table 2 and Figure 2 illustrate ridership and revenue for years 2021, 2030 and 2040 as well as total ridership and revenue (2021-2040) for the two representative routes. The table and graph show that an increase in level of service and higher travel speeds results in an increase in both ridership and revenue for the corridor. The graph also indicates that while ridership may not increase substantially between Shared Use and Dedicated Use/Maglev technologies, the higher fare used results in a significant increase in the overall revenue.

Table 2: Atlanta-Chattanooga-Nashville-Louisville Total Ridership and Revenue (2021-2040 in 2010$)

	Shared Use		Dedicated Use		Maglev	
	Ridership	Revenue	Ridership	Revenue	Ridership	Revenue
2021	4,380,000	$175,529,000	4,715,000	$267,084,000	4,949,000	$284,385,000
2030	5,060,000	$211,849,000	5,491,000	$321,712,000	5,764,000	$337,733,000
2040	5,816,000	$252,205,000	6,353,000	$382,410,000	6,669,000	$401,454,000
Total	**101,962,000**	**$4,277,336,000**	**110,677,000**	**$6,494,937,000**	**116,189,000**	**$6,818,384,000**

Figure 2: Atlanta-Chattanooga-Nashville-Louisville Total Ridership and Revenue (2021-2040 in 2010$)



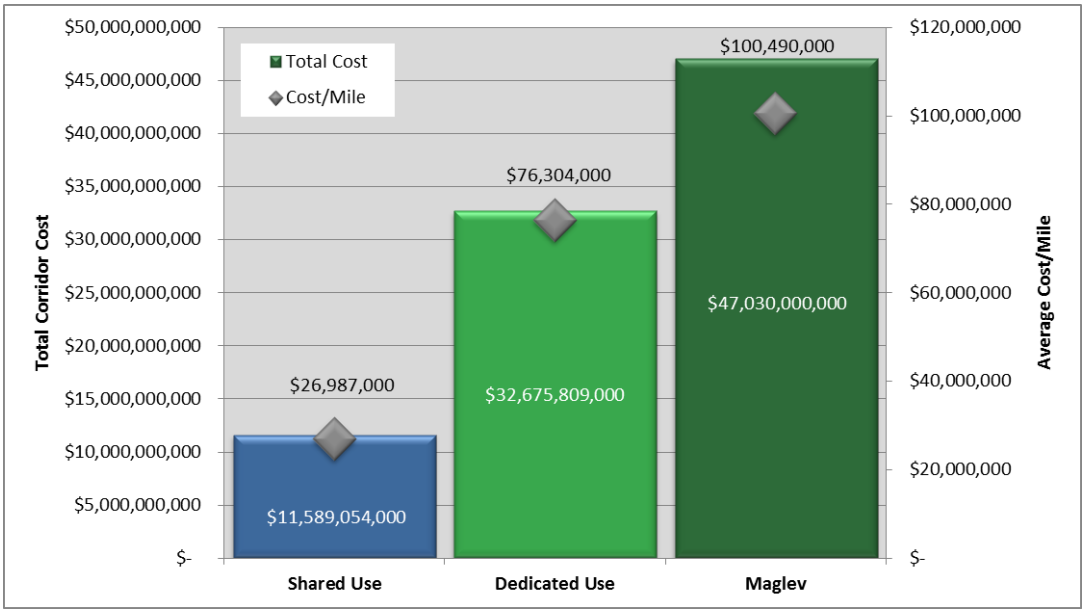
CAPITAL COSTS

The Atlanta-Chattanooga-Nashville-Louisville Corridor capital costs considered the mountainous terrain and geometry of the track and corridor. Table 3 and Figure 3 outline the total capital costs and costs per mile for Shared Use and Dedicated Use/Maglev routes. The high Dedicated Use and Maglev costs are mostly tied to the electrification of the track, comprising about 25 percent of the total capital cost and a significant portion of operating and maintenance costs as well.

Table 3: Atlanta-Chattanooga-Nashville-Louisville Total Capital Costs (2010$)

	Shared Use	Dedicated Use	Maglev
Total Cost	$11,589,054,366	$32,675,809,000	$43,030,000,000
Cost per Mile	$26,978,000	$76,304,000	$100,490,000

Figure 3: Atlanta-Chattanooga-Nashville-Louisville Total Capital Costs (2010$)



Operating and Maintenance Costs

Table 4 shows a breakdown of variable and fixed costing categories used to calculate total operating and maintenance costs. Table 5 illustrates the operating and maintenance costs for 2021, 2030 and 2040 as well as total costs (2021-2040). Shared Use operating and maintenance costs equate to approximately $2.8 billion compared to the Dedicated Use estimate of $5.8 billion and Maglev estimate of $4.5 billion for the same time period.

Table 4: Fixed and Variable Operating and Maintenance Categories

Variable Costs
Train Crew
On-Board Services
Equipment Maintenance
Fuel or Energy
Insurance
Call Center
Credit Car + Travel Agency Commissions
Fixed Costs
Stations
Track and Electrification Maintenance
Administration and Management

Table 5: Atlanta-Chattanooga-Nashville-Louisville Total Operating and Maintenance Costs (2021-2040 in $ millions and 2010$)

	Shared Use			Dedicated Use			Maglev		
	Variable	Fixed	Total	Variable	Fixed	Total	Variable	Fixed	Total
2021	$88.0	$40.6	$128.6	$168.8	$101.6	$270.4	$95.1	$97.4	$192.4
2030	$91.8	$40.6	$132.4	$175.3	$101.6	$276.9	$113.8	$98.0	$211.8
2040	$96.0	$40.6	$136.6	$182.4	$101.6	$284.0	$134.7	$98.8	$233.5
Total	**$1,928**	**$852.6**	**$2,780**	**$3,681**	**$2,134**	**$5,814**	**$2,391**	**$2,059**	**$4,449**

CORRIDOR EVALUATION

High-speed rail service in the Atlanta-Chattanooga-Nashville-Louisville Corridor was evaluated by using both operating ratios and benefit-cost analyses. The study evaluated three scenarios, Conservative, Intermediate and Optimistic, to show the impact of a range of ridership, revenue, capital and operating cost estimates typically encountered in feasibility-level analysis. Unadjusted base forecasts for ridership, revenue, capital and operating costs were used for the Conservative scenario. Base ridership and revenue estimates were increased for Dedicated Use corridors to establish the Intermediate and Optimistic scenarios.[5]

Operating Ratio

The 90-110 mph Shared Use, 180-220 mph Dedicated Use and 220+ mph Maglev representative routes performed well under each of the three sensitivity scenarios, all operating above a 1.0 ratio as outlined in Table 6. It is notable that significant operating revenue surpluses are shown for all three technologies during the first year of operation in 2021 using even the most conservative ridership and revenue forecasts. The revenue surpluses then steadily increase over the 20-year planning period to 2040. This provides a strong incentive for potential private sector investors and operators.

[5] Ridership adjustments for Intermediate and Optimistic Scenarios were only made for Dedicated Use corridor 180-220 mph electrified, steel-wheel and Maglev technologies based on a peer review of regional and national high speed rail corridor studies. No scenario ridership adjustment was made for Shared Use corridor diesel-electric technology results based on a peer review of other shared-use corridor studies.

Table 6: Atlanta-Louisville Operating Ratios (2021-2040)

	Conservative	Intermediate	Optimistic
Shared Use[6]			
2021	1.49	1.49	1.49
2030	1.74	1.74	1.74
2040	2.01	2.01	2.01
Dedicated Use			
2021	1.21	1.95	2.16
2030	1.39	2.23	2.45
2040	1.62	2.40	2.58
Maglev			
2021	1.75	2.23	2.35
2030	1.91	2.38	2.49
2040	2.06	2.51	2.61

Benefit-Cost

Similar to operating ratios, the study evaluated the benefit-cost ratio for the three representative routes and all three sensitivity scenarios. The results in Table 7 show that the Shared Use does not demonstrate a benefit-cost ratio over 1.0 for any of the sensitivity scenarios; Dedicated Use shows a benefit-cost ratio near 1.0 for the Optimistic scenario; Maglev does not demonstrate a benefit-cost ratio over 1.0 for any of the sensitivity scenarios.

Table 7: Atlanta-Louisville Benefit-Cost Ratios (2021-2050)

	Conservative	Intermediate	Optimistic
Shared Use	0.71	0.78	0.85
Dedicated Use	0.40	0.78	0.96
Maglev	0.34	0.65	0.80

[6] Shared Use operating ratios did not vary between the three sensitivity levels because the same "Conservative Scenario" base case ridership and revenue forecasts were used for each of the scenarios. No scenario ridership adjustment was made for Shared Use corridor diesel-electric technology results based on a peer review of other shared-use corridor studies.

KEY FINDINGS

The Shared Use, Dedicated Use and Maglev alternatives perform well under the operating ratio analysis, resulting in ratios well above 1.0 for all three scenarios. This indicates strong operations with lower associated risks to owners and operators. Positive operating ratios indicate an ability to pay down debt services and bonds, and can lead to reduced reliability on public investment subsidies. Additionally, operating surpluses on an annual basis may finance a "rail maintenance fund", requiring less investment in future years for capital maintenance costs. Positive operating ratios will likely spark private sector investment interest in the corridor, providing additional funding opportunities.

The benefit-cost results are not greater than one for any of the representative routes. It should be noted that this feasibility study includes very high-level data and estimates. A more detailed corridor analysis with more definitive study boundaries, travel demand models, and cost estimates, could yield a better benefit-cost evaluation narrowing the range of estimates.

Taking into account the operating ratios and benefit-cost ratios, the study recommends that the results of this analysis be used to set priorities for future state planning and corridor development activities. In particular, this study finds that high speed rail service is feasible in the Atlanta-Chattanooga-Nashville-Louisville Corridor.

The study developed an additional "Hybrid" High Performance scenario, discussed in detail below that further supports the above conclusions. This alternative has the potential to reduce initial capital costs and positively impact the benefit-cost analysis while maintaining the ability to achieve higher speeds along the corridor.

HYBRID HIGH PERFORMANCE SCENARIO

One of the results from the Shared Use and Dedicated Use analyses was the introduction of a "hybrid" alternative to offset a portion of the initial capital costs (compared to the Dedicated Use) while improving the travel speeds (compared to the Shared Use), thus positively impacting the operating ratio and benefit-cost analysis. While some analyses were completed for the Hybrid High Performance scenario, there was insufficient data available for a full analysis to be completed. Therefore, more performance and financial details regarding the Hybrid High Performance scenario will need to be explored through the NEPA process. This feasibility study intends to introduce the concept of the Hybrid High Performance scenario and provide a high-level feasibility estimates based on the results found during the Shared Use and Dedicated Use analyses. These estimates include:

- Operational estimates;
- Ridership and revenue;
- Capital Costs; and
- Operating and Maintenance Costs.

From these estimates, the study calculates the high-level operating ratio and Benefit-Cost ratio to compare against the previously identified Shared Use and Dedicated Use ratios to determine if the Hybrid High Performance scenario should be included in a future NEPA analysis.

The study developed a Hybrid High Performance scenario that provides a level of service between Shared Use and Dedicated Use, utilizing fully grade-separated track geometry with no shared-use freight operations. However, rather than electrified high-speed technology, the Hybrid High Performance scenario would implement Diesel-Electric Tilt Technology initially, and when ridership and revenue increase in later operating years, it can be upgraded to a fully-electrified system, obtaining travel speeds of 220 mph or more.

One of the main benefits of the Hybrid High Performance scenario includes significantly lower capital costs compared to the 180-220 mph electrified technology assumed for the Dedicated Use route. However, the Hybrid High Performance scenario still has the potential to reach speeds of up to 130 mph. The study estimated that the Hybrid High Performance scenario would only take approximately 1 hour, 29 minutes longer than the electrified train on the Dedicated Use route. The 130 mph Hybrid High Performance scenario is approximately 1 hour, 52 minutes faster than auto travel by interstate from Atlanta to Louisville (Table 8).

Table 8: Atlanta-Chattanooga-Nashville-Louisville Hybrid High Performance Operations

		Hybrid High Performance	Dedicated Use	Maglev
Rail Distance (miles)		428.2	428.2	428.2
Travel Time (hr : min)		5:02	3:32	3:02
Average Speed (mph)		86	122	143
Frequency (round trips per day)	Atlanta-Chattanooga	16	28	28
	Chattanooga-Nashville	10	20	20
	Nashville-Louisville	5	12	12
Estimated Auto Time (hr : min)		6:54	6:54	6:54
Travel Time – Auto Time		-1:52	-3:22	-3:52

Ridership and Revenue

The study estimated based on the decrease in average speed and increase in corridor travel time, the revenue for the Hybrid High Performance scenario ridership and revenue would decrease 16.04 percent from the Dedicated Use forecasts (refer to Appendix G). Table 9 shows the estimated ridership and revenue for the Hybrid High Performance scenario for 2021, 2030, and 2040 as well as a total ridership and revenue (2021-2040) as compared to Dedicated Use forecasts.

Table 9: Atlanta-Chattanooga-Nashville-Louisville Hybrid High Performance Ridership and Revenue (2021-2040 in 2010$)

	Hybrid High Performance		Dedicated Use		Maglev	
	Ridership	Revenue	Ridership	Revenue	Ridership	Revenue
2021	4,126,000	$224,244,000	4,715,000	$267,084,000	4,949,000	$283,385,000
2030	4,804,000	$270,109,000	5,491,000	$321,712,000	5,764,000	$337,733,000
2040	5,559,000	$321,071,000	6,353,000	$382,410,000	6,669,000	$401,454,000
Total	**92,925,000**	**$5,453,149,000**	**110,677,000**	**$6,494,937,000**	**116,189,000**	**$6,818,384,000**

Costs

As previously mentioned, the capital costs for the Hybrid High Performance scenario will be significantly less than the Dedicated Use route due to the elimination of the track electrification. This also results in decreased in vehicle cost since diesel vehicles are also less expensive than fully electrified vehicles.

Table 10 outlines the Hybrid High Performance scenario capital cost estimates compared to the Dedicated Use/Maglev routes. Capital costs for the 130 mph Hybrid High Performance scenario are half of those for the 180-220 mph electrified steel-wheel technology and nearly one-third (1/3) of Maglev.

Table 10: Atlanta-Chattanooga-Nashville-Louisville Hybrid High Performance Capital Costs (2010$)

	Hybrid High Performance	Dedicated Use	Maglev
Total Cost	$16,428,173,000	$32,675,809,000	$43,030,000,000
Cost per Mile	$38,366,000	$76,304,000	$100,490,000

Operating and maintenance costs for the Hybrid High Performance scenario will also be reduced from the Dedicated Use estimates due to less required track inspection and maintenance because heavy freight trains will not be sharing the track. Table 11 illustrates the estimates the Hybrid High Performance scenario operating and maintenance costs for 2020, 2030 and 2040 as well as total operating and maintenance costs (2020-2040) compared to the Dedicated Use and Maglev routes.

Table 11: Atlanta-Chattanooga-Nashville-Louisville Hybrid High Performance Scenario Operating and Maintenance Costs (2021-2040 in $ millions and 2010$)

	Hybrid High Performance			Dedicated Use			Maglev		
	Variable	Fixed	Total	Variable	Fixed	Total	Variable	Fixed	Total
2021	$183.8	$69.3	$253.1	$168.8	$101.6	$270.4	$95.1	$97.4	$192.4
2030	$189.2	$69.3	$258.5	$175.3	$101.6	$276.9	$113.8	$98.0	$211.8
2040	$195.2	$69.3	264.5	$182.4	$101.6	$284.0	$134.7	$98.8	$233.5
Total	**$3,973**	**$1,455**	**$5,429**	**$3,681**	**$2,134**	**$5,814**	**$2,391**	**$2,059**	**$4,449**

Feasibility Evaluation

Similar to the Shared Use, Dedicated Use, and Maglev routes, the study conducted an operating ratio and benefit-cost ratio for the Hybrid Performance alternative. Table 12 and Table 13 illustrate the results of these analyses for the three sensitivity scenarios: Conservative, Intermediate and Optimistic as compared to the Dedicated Use and Maglev routes.

Table 12: Atlanta-Chattanooga-Nashville-Louisville Hybrid High Performance Scenario Operating Ratios (2021-2040)

	Conservative	Intermediate	Optimistic
Hybrid High Performance			
2021	1.03	1.66	1.86
2030	1.21	1.93	2.16
2040	1.41	2.22	2.46
Dedicated Use			
2021	1.21	1.96	2.16
2030	1.39	2.23	2.45
2040	1.62	2.40	2.58
Maglev			
2021	1.75	2.23	2.35
2030	1.91	2.38	2.49
2040	2.06	2.51	2.61

Table 13: Atlanta-Chattanooga-Nashville-Louisville Hybrid High Performance Scenario Benefit-Cost Ratio (2021-2050)

	Conservative	Intermediate	Optimistic
Hybrid High Performance	0.59	1.16	1.43
Dedicated Use	0.40	0.78	0.96
Maglev	0.34	0.65	0.80

Initial investigation into the Hybrid High Performance scenario indicates that an incremental approach to high-speed rail may provide significant advantages in the Atlanta-Chattanooga-Nashville-Louisville Corridor both in terms of reducing initial capital cost requirement and increasing benefit-cost ratios.

The study used high-level estimations for revenue and costs associated with the Hybrid High Performance scenario. Therefore, a more detailed analysis of this alternative is needed to make definitive conclusions regarding the feasibility of the Hybrid High Performance scenario. The study recommends that the Hybrid High Performance scenario be included in the next phase of the passenger rail planning analysis as a viable technology alternative for passenger rail within the Atlanta-Chattanooga-Nashville-Louisville Corridor.

FINAL OBSERVATIONS

High-speed rail service in the Atlanta-Chattanooga-Nashville-Louisville Corridor presents an opportunity to provide needed transportation solutions and promote economic development. While high-speed rail is not the only transportation solution, this study gives evidence that passenger high-speed rail will provide added mobility and transportation choices to consumers. High-speed rail can provide more efficient and cost-effective means to consumers, providing added connectivity to major cities such as Atlanta, Chattanooga, Nashville and Louisville through commercial centers and national/international destinations.

This study illustrates that although the initial investment in high-speed rail is significant, the mobility and economic opportunities offered by this new mode are also significant. Based on the analysis findings, this study determines that high-speed rail is feasible in the Atlanta-Chattanooga-Nashville-Louisville Corridor. It is further recommended that a Tier 1 NEPA Document and Service Development Plan be pursued for high-speed rail service within the corridor, while also noting the findings outlined in the current Tier 1 EIS documentation for the Atlanta-Chattanooga Corridor. This analysis should continue to address a range of technology alternatives including the Hybrid High Performance implementation approach.

SECTION I:

BACKGROUND INFORMATION AND METHODOLOGIES

1 INTRODUCTION AND BACKGROUND

1.1 DESCRIPTION/HISTORY OF HIGH-SPEED RAIL AND DESIGNATED CORRIDORS

The U.S. Department of Transportation (DOT), in conjunction with the Transportation Research Board (TRB) has undertaken research that indicates that high-speed ground transportation (HSGT) systems, including high-speed rail, could be a competitive alternative to highway and domestic air travel in high-density travel markets and corridors in the United State, including the Boston to New York, New York to Washington and San Francisco to Los Angeles corridor. TRB Special Report 233, *In Pursuit of Speed, New Options for Intercity Passenger Transport*, concludes that "HSGT systems could be an effective alternative in corridors where travel demand is increasing but expanding capacity to reduce highway and airport congestion and delays is very difficult."

The Federal Railroad Administration (FRA) also completed a study of the potential for HSGT systems, drawing similar conclusions to the TRB. In its 1997 study *High-Speed Ground Transportation for America*, (commonly referred to as the Commercial Feasibility Study or CFS) the FRA estimated the total costs and benefits if implementing a range of HSGT systems from incremental high-speed rail with top speeds of 90 to 150 mph ("IHSR," termed "Accelerail" in the 1997 report) to new high-speed rail (with 175-200 mph top speeds) and maglev (up to 300 mph) in 11 illustrative corridors. The study identified the potential for diverted trips to competitive high-speed rail and ground transportation services, especially for trips between 100 and 600 miles. The study found that HSGT's total benefits exceed total costs in many of the illustrative corridors.

The purpose of this High Speed Rail Planning Study is to evaluate the feasibility of high-speed rail for three corridors in the southeastern United States. The corridors are as follows:

- Atlanta, GA to Birmingham, AL;
- Atlanta, GA to Macon, GA to Jacksonville, FL; and
- Atlanta, GA to Chattanooga, TN to Nashville, TN to Louisville, KY.

The feasibility of implementing and operating high-speed and intercity passenger rail was examined within each corridor for Emerging High-Speed Rail (90-110 mph); Express High-Speed Rail (180-220 mph) in all three corridors; and Maglev (220+ mph) in the Atlanta-Chattanooga-Nashville-Louisville Corridor.

1.2 TECHNOLOGY CONSIDERATIONS

Three levels of service alternatives for intercity high-speed passenger rail service will be evaluated based on developed service scenarios and operating plans. However, Magnetic Levitation technology (Maglev) will only be considered for the Atlanta-Chattanooga-Nashville-Louisville Corridor.

1.2.1 ALTERNATIVE 1: 90-110 MPH EMERGING HIGH-SPEED RAIL

FRA defines Emerging High-Speed Rail as "developing corridors of 100-500 miles, with strong potential for future high-speed regional and/or express service. Top speeds of up to 90-100 mph on primarily shared track (eventually using positive train control technology), with advanced grade crossing protection or separation. Emerging High-Speed Rail is intended to develop the passenger rail market, and provide some relief to other modes."

Emerging High-Speed rail generally involves utilizing an existing rail corridor owned and operated by a freight railroad. This type of service is also commonly called "Shared-Use". Operating, service level and maintenance agreements need to be negotiated with the freight railroad for passenger service to operate. This alternative is very limited in that it is bound to the existing rail network between the points of interest. Maximum speeds for the shared-use alternative is 110 mph based on acceptance by the freight railroads.

Diesel-electric Tilt Train Technology will be utilized on the Shared Use corridors due to curvature and topography on these corridors and typically achieves top speeds of 90-110 mph. With the system, car bodies are tilted at curves to compensate for unbalanced car body centrifugal acceleration to a greater extent than the compensation produced by the track cant, so that passenger do not feel centrifugal acceleration and thus trains can run at higher speed along curves.

1.2.2 ALTERNATIVE 2: 180-220 MPH EXPRESS HIGH-SPEED RAIL

FRA defines Express High-Speed Rail as "frequent, express service between major population centers 200-600 miles apart, with few Intermediate stops. Top speeds will range from 180 to 220 mph on completely grade-separated, dedicated rights-of-way (with the possible exception of some shared track in terminal areas)." Express High-Speed Rail intends to relieve air and highway capacity constraints. In this report, Express High-Speed Rail is referred to as "Dedicated Use".

This alternative primarily involves establishing a new passenger rail corridor, designated solely to high-speed passenger rail service. In developing corridor service alternatives for consideration, the study examined existing interstate and state highway corridors, power and other utility corridors, the Governor's Road Improvement Program (GRIP) network in Georgia, private railroad rights-of-way and "greenfield" routes. Electrification will be utilized with a Push-Pull Train.

1.2.3 ALTERNATIVE 3: 220+ MPH MAGLEV

Magnetic Levitation, abbreviated as Maglev, is advanced trains technology in which magnetic force lifts, propels, and guides a vehicle over a guideway. Utilizing state-of-the-art electric power and control systems, this configuration eliminates contact between vehicle and guide way and permits cruising speeds between 250 and 300 mph.

These trains systems use electromagnetic forces to lift and propel trains along a guide way within exclusive right-of-way. The trains, when operating, hover a small distance above the guideway, eliminating friction and rolling resistance, while operating at speeds of up to 310 mph. The operating speeds of Maglev make it appropriate for consideration within an intercity corridor. A Maglev system operating in Shanghai, China is the only one in operation today. Test facilities exist in Germany and Japan.

This alternative primarily involves establishing a new passenger rail corridor, designated solely to high-speed passenger rail service. Significant portions of the Guideway may be elevated on a structure between the points of interest. Again, for this level of service, the study examined existing interstate and state highway corridors, power and other utility corridors, the GRIP network, private railroad rights-of-way and "greenfield" routes. Maglev was only considered along the Atlanta-Chattanooga-Nashville-Louisville Corridor, based on Maglev consideration in other studies along this corridor and special permission from FRA.

2 STUDY PURPOSE AND OBJECTIVES

2.1 CORRIDOR DESCRIPTIONS AND HISTORY

2.1.1 ATLANTA – BIRMINGHAM

The Atlanta-Birmingham Corridor extends from Hartsfield-Jackson Atlanta International Airport (H-JAIA) to the Atlanta Multi-Modal Passenger Terminal (MMPT) and onto the existing Birmingham downtown Amtrak station. This particular rail corridor was included in the 1997 *High-Speed Ground Transportation for America* report and is one of the 11 federally-designated high-speed rail corridors.

Georgia Department of Transportation (GDOT), in partnership with the Regional Planning Commission of Greater Birmingham (RPCGB) views this route as a connecting segment between the Gulf Coast High-Speed Rail Corridor (New Orleans-Birmingham-Atlanta) and the Southeast High-Speed Rail Corridor (Atlanta-Charlotte-Raleigh-Washington D.C.).

As outlined in the Georgia State Rail Plan (2009), Amtrak currently serves both cities as a part of the Crescent service; however, there are limitations of speed due to the sharing of track with NS. Therefore, the plan states that there may be a need for high-speed passenger rail service between the two cities to create competition for other modes of travel along the corridor (such as automobiles and airplanes).

There are two major multi-modal projects underway in Atlanta and Birmingham that support the potential need for high-speed rail service between the two cities. In Atlanta, the Atlanta Multi-Modal Passenger Terminal (MMPT) is proposed to be located in downtown Atlanta. Recently, GDOT began an Environmental Impact Statement (EIS) and selected a Master Developer study to explore additional opportunities. It is envisioned that the terminal will serve as the hub for high-speed rail, commuter rail, heavy-rail (MARTA) and other ground transportation (bus, taxi, etc.) for the Atlanta region.

In Birmingham, the Birmingham Multi-Modal Transit Center received $8 million in American Recovery and Reinvestment Act (ARRA) funding, jumpstarting the planning process. The center will coordinate all existing transit services in the region, including Amtrak, Suburban Mobility Authority for Regional Transportation (SMART) bus service, airport connections, and taxi services. In addition, a new level of bus service will be added to connect Birmingham to other transit hubs across the northern Alabama region.

2.1.2 ATLANTA – MACON – JACKSONVILLE

The Atlanta-Macon-Jacksonville Corridor extends from the Atlanta MMPT through to the existing Macon station, and travels to Savannah, GA onto the proposed Jacksonville terminal station. The Atlanta-Macon-Jacksonville Corridor is a variation of the federally designated high-speed rail corridor. The original corridor travels from Atlanta to Macon and Jesup, GA and onto Jacksonville, FL. This route was included in the route alternative analysis; however, the route including Savannah, GA was chosen based on the increase in ridership and revenue associated with the higher population. The Savannah metropolitan statistical area (MSA) is the fourth largest travel market in the state of Georgia. The Savannah to Jacksonville Corridor is also part of the federally-designated Southeast High-Speed Rail Corridor (SEHSR) which extends from Raleigh, NC to Jacksonville, FL via Columbia, SC and Savannah, GA.

An Atlanta to Jacksonville corridor was studied in the 2003 *Atlanta to Jacksonville Intercity Passenger Rail Service Study* by GDOT, the Georgia Regional Passenger Authority (GRPA), and Amtrak. High-speed service was evaluated in addition to conventional and moderate services (up to 79 mph). This study followed the U.S. dedicated corridor providing service in Macon and Jesup, and bypassing Savannah. In this study, total capital costs (2003 dollars) required to implement the service was estimated to be between $104 million and $393 million depending on service level and frequency.

A portion of the proposed corridor coincides with the 2008 Volpe National Transportation System Center study *Evaluation of High-Speed Rail Options in the Macon-Atlanta-Greenville-Charlotte Rail Corridor*. This study included four stations location within a portion of the current feasibility study area including stations in Macon, Griffin, H-JAIA, and the Atlanta MMPT. The study developed seven potential scenarios in which some or all of these four stations were served. The report concluded that the best alternative for the corridor is 125-150 mph Diesel high-speed rail technology with 14 station stops (including all four stations previously mentioned).

Over the past two decades, the corridor between Atlanta and Macon has also been studied as a potential commuter rail line to serve populations traveling between these cities. The commuter rail would encompass 103-mile corridor with 13 potential stations including the proposed Atlanta MMPT, Hapeville, Morrow, Hampton, Griffin, Forsyth and Macon. The study estimates that the cost for this project is approximately $400 million (2010 dollars) and operating costs about $25 million per year

The Atlanta-Macon-Jacksonville Corridor also ties into recent studies in Florida, including the *Northeast Florida Commuter Rail Feasibility Study* from Jacksonville Transportation Authority (JTA) in 2008. This study evaluated various commuter rail

options from Jacksonville to other areas of Northeast Florida. The proposed high-speed rail corridor would use this system as a feeder system to generate ridership.

Finally, there are a number of proposed multi-modal centers that would accommodate the high-speed rail service in this corridor. As previously mentioned, the northern terminus of the corridor is the Atlanta MMPT proposed for downtown Atlanta. Additionally, there are three other centers in existence or proposed:

- **Macon Intermodal Passenger Terminal Facility:** In 2001, Macon Planning and Zoning Commission (MBPZ) contracted for an intermodal Terminal Facility to accommodate the potential upgrades in commuter, intercity and high-speed rail through Macon, GA. The project location is adjacent to the Macon Terminal Station on Fifth Street in downtown Macon.
- **Coastal Region Mobility Center:** A study is currently being conducted to plan the location and function of the Coastal Region Brunswick Mobility Center, an intermodal transportation hub to serve the areas of Brunswick, GA, Fort Stewart and King Bay's Naval Base. The center will include the regional rural (FTA Section 5311) transit service, Greyhound, and a fixed-route transit system planned for Brunswick. The Coastal Region is currently looking at two potential locations near Brunswick and Everett, GA.
- **Jacksonville Regional Transportation Center (JRTC):** The City of Jacksonville, in conjunction with the Jacksonville Transportation Authority (JTA), is currently in the final design phase for a new regional transportation center to be located at the current location of the Convention Center. The JRTC will serve rail and ground transportation services for the region including Amtrak and Greyhound in the near future and potentially high-speed rail long term.

2.1.3 ATLANTA – CHATTANOOGA – NASHVILLE – LOUISVILLE

The Atlanta-Chattanooga-Nashville-Louisville Corridor connects in Louisville with federally designated high-speed rail corridors servicing Illinois, Indiana, Michigan, and Ohio. This rail corridor was not included in the 1997 *High-Speed Ground Transportation for America* report. GDOT in partnership with Kentucky Transportation Cabinet (KYTC), Tennessee Department of Transportation (TDOT) and City of Chattanooga analyzed this route segment as an extension and connection of the Midwest Network (Chicago to Louisville) and requested that it be placed on the national system. This corridor provides high-speed rail connection between the eastern portion of the Midwest region to the southeast region.

Currently, GDOT is also studying the potential for HSGT between Atlanta and Chattanooga as part of a Tier I EIS. This feasibility study uses the Tier I EIS as a benchmark to ensure that estimates are consistent with the concurrent work in the Atlanta to Chattanooga Corridor. Maglev technology was originally the focus of this corridor study effort, but the study effort has been broadened to consider all

potential HSGT technologies. The Tier I environmental document is not yet complete, but it appears that it will recommend the I-75 corridor as the preferred route. The Atlanta to Chattanooga corridor has been a subject of study for over 10 years and was part of the GDOT 1997 Intercity Rail Plan. The Atlanta Regional Commission (ARC) has also studied the corridor from 1999 to 2003.

In 1999, the KYTC assessed the potential for high-speed passenger service through a study *Examination of I-75, I-64 and I-71 High Speed Rail Corridors* between the Kentucky cities of Lexington, Louisville and Covington. Detailed ridership estimates were not developed; instead, comparisons were made to rail systems in operation in the U.S. at the time, adjusting for some of the differences in the Kentucky corridors. An order of magnitude cost estimate for the 266-route mile system was placed at $5.48 billion (1998 dollars) plus the cost of vehicles. The conclusion of the document indicates that ridership would only contribute to 15 percent of the revenue needed to cover costs of the system.

Also in 2002-2003, Tennessee and Kentucky completed State Rail Plans that explored the opportunity for high-speed rail service. Tennessee explored the potential for high-speed rail from Chattanooga to Nashville and beyond to Louisville, KY. The State Rail Plan included two other corridors from Knoxville to Chattanooga and Knoxville to Nashville. The Kentucky State Rail Plan outlined the potential for the state to join the Midwest High Speed Rail Coalition (MWRRC) which was founded in 1996.

In 2008, Tennessee conducted a study connecting Chattanooga to Nashville titled *Accelerate Your Journey – Chattanooga to Nashville Maglev Feasibility Study.* This study recommended a Maglev technology route largely in the I-24 corridor with five passenger station locations: downtown Nashville, Nashville Airport, Murfreesboro, downtown Chattanooga and the Chattanooga airport. This route, when joined with the Atlanta-Chattanooga planning and evaluation efforts was intended to provide a Maglev connection between Atlanta and Nashville.

Commuter rail service is available in Nashville in an eastern corridor between downtown Nashville and Lebanon, TN. This service is operated by the Regional Transit Authority (RTA) on an existing short line railroad. The Nashville region is also considering commuter rail service between downtown Nashville and Clarksville, TN. Louisville has also explored the potential of commuter rail service between downtown Louisville and Elizabethtown, KY (adjacent to Fort Knox).

The Atlanta-Chattanooga-Nashville-Louisville Corridor has the potential to connect several key military installations; Arnold Air for Base in Tennessee, Fort Campbell and Fort Knox in Kentucky. These facilities may benefit from good connectivity along the rail corridor and access to major airports and cities.

The terrain in the corridor, particularly around Chattanooga and to a lesser extent north of Nashville represents a significant issue to high-speed rail routes. The mountainous/rolling terrain has limited the potential for Shared Use routes through these areas. The existing freight lines for the CSXT are heavily used between Atlanta and just north of Nashville, and from Atlanta to Chattanooga for the NS rail lines.

2.2 Purpose and Objectives

The overall purpose of this study is to determine the overall feasibility of each corridor with regards to capital costs, funding and financing opportunities, operating and maintenance costs, ridership and revenue, operating ratios and benefit-cost analyses. Each corridor is studied independently of one another, and the feasibility of each corridor is dependent upon the potential benefits anticipated from investment in transportation between the major cities and along each of the corridors.

A representative route was selected for each corridor for both Emerging High-Speed Rail (Shared Use) with speeds up to 90-110 mph, and Express High-Speed Rail (Dedicated Use) with speeds up to 150-220 mph. Additionally, Maglev technology was included in the Atlanta-Chattanooga-Nashville-Louisville Corridor. It should be noted that the representative routes are not preferred or recommended alternatives, but are presented as an example of an alternative to develop reasonable estimates for each corridors' high-speed rail performance. Each representative route may have a variety of specific alignments that will be analyzed through the NEPA process, should the route be selected for future analysis.

Once the representative routes were established, a detailed analysis of capital, operating and maintenance cost, and ridership and revenue was performed. The feasibility of the routes was dependent upon the projected improvements in transportation between the major cities and along the routes in each of the corridors.

Section I, Chapter 3 - Assumptions and Methodologies, outlines the process and methods used for estimating the variability for each corridor. Sections II through IV of this report outline the findings, results and recommendations for the Atlanta-Birmingham, Atlanta-Macon-Jacksonville and Atlanta-Chattanooga-Nashville-Louisville Corridors, respectively. Section V presents corridor comparisons and recommended next steps for each of the corridors.

3 ASSUMPTIONS AND METHODOLOGIES

3.1 CORRIDOR ALTERNATIVES DEVELOPMENT

One of the first steps of the analysis process was to outline representative routes for each of the three corridors. This feasibility study did not determine a preferred alternative, but rather selected routes that were thought to provide an overall representation of the performance of the corridor and the technology options. If the corridors are determined to be feasibility, it will be the responsibility of future studies to determine the preferred alternative, specific alignments and station locations.

A representative route was developed for both the Shared Use and Dedicated Use technologies. Developing these routes comprised of a three-step process including baseline (existing) conditions, a technical corridor screening process and stakeholder outreach for each corridor.

3.1.1 EXISTING CONDITIONS

To estimate the improvements that high-speed rail will bring to the corridors, a baseline of existing conditions was collected and documented for the representative routes in each corridor. Existing conditions included a variety of factors and characteristics including population demographics and socioeconomic characteristics, employment patterns, land use patterns, transportation systems and environmentally critical areas. The subsequent sections (Sections II-IV) outline the unique existing conditions for each of the three corridors.

The study collected and integrated relevant geographic information system (GIS) data and other data for the three study corridors and their surrounding areas. The study coordinated with states, regions, counties, cities and other key stakeholders within each corridor to collect a large amount of data to effectively complete the studies with meaningful results and recommendations.

3.1.1.1 Base Data

The study collected base data elements that make up the foundation for maps and data associated with the three corridors for Alabama, Florida, Georgia, Kentucky and Tennessee. Table 3-1 outlines the collected base data.

Table 3-1: Base Data and Sources

Data Element	Description	Source
State Boundaries	State Boundaries for each of the five states	U.S. Census Bureau
County Boundaries	County boundaries for each of the five states	U.S. Census Bureau
Census Tract Boundaries	Census track Boundaries for each of the five states	U.S. Census Bureau
Census Block Group Boundaries	Census Block Group Boundaries for each of the five states	U.S. Census Bureau
City Boundaries	City boundaries for each of the five states	State GIS Resources[7]
MPO Boundaries	Metropolitan Planning Organization boundaries for each of the five states	State GIS Resources
MSA Boundaries	Metropolitan Statistical Area boundaries for each of the five states	State GIS Resources
Congressional Districts	Congressional District boundaries for each of the five states	State GIS Resources
Community Facilities	Includes hospitals, schools, colleges and universities	State GIS Resources
Land Use (Current and Future)	Current and Future land uses for the study corridors	State GIS Resources

3.1.1.2 Environmental Data

Environmental data for this feasibility study refers to the natural landscapes within the study area. There was an emphasis placed on any potentially critical areas such as wetlands, ponds and streams which were mapped and analyzed to understand the potential mitigation efforts necessary in future planning studies. Table 3-2 summarizes the environmental data needed for this feasibility study. It should be noted that historical resources are included in the environmental section due to their relations with the National Environmental Policy Act (NEPA) planning process.

[7] State GIS Resources refer to GIS and Database sites provided by the states within the study areas.

Table 3-2: Environmental Data and Sources

Data Element	Description	Source
Lakes	Lakes	State GIS Resources
Rivers/Streams	Rivers and Streams	State GIS Resources
Wetlands	Wetlands	National Wetland Inventory
Floodplains	Floodplains	Federal Emergency Management Administration (FEMA)
Parks/Recreational	Parks and Recreational areas	State GIS Resources
Conservation Land	Conservation lands including national and state parks, cultural centers, monuments	State GIS Resources, National Park Service
Forests	National and State Forests	National and State Forestry Services
Non-Attainment Areas	N_{OX}, Ozone, PM_{10}, $PM_{2.5}$, S_{OX}	State GIS Resources
USGS Topographic Quadrants	Topographic quadrants	U.S. Geological Survey (USGS)
National Historic Resources	Known eligible and registered historic resources	State Historic Preservation Officer (SHPO)

There are additional environmental data that was not included as a part of the data collection and mapping efforts due to the high-level of a feasibility and data required for thorough consideration, but are important aspects of the FRA Procedures for Considering Environmental Impacts[8]. These items will need to be taken into consideration if further analysis (including the NEPA process) is recommended for each study corridor. These additional aspects include:

- Noise and vibration;
- Solid waste disposal;
- Coastal zone management;
- Use of energy resources;

[8] Federal Railroad Administration, Procedures for Considering Environmental Impacts [FRA Dicejt Bi, EO-1, Notice 5], Federal Register, Vol. 64, No. 101(https://www.fra.dot.gov/Downloads/RRDev/FRAEnvProcedures.pdf)

- Use of other natural resources;
- Aesthetic and design quality impacts;
- Possible barriers to the elderly and handicapped;
- Existing and planned land use;
- Public Health;
- Public safety;
- Use of 4(f)-protected properties; and
- Construction period impacts.

Some of these items are touched on in the environmental and demographics analysis for each corridor, but each aspect will need to be carefully considered in future studies.

3.1.1.3 Demographic Data

Demographic data refers to current and future socioeconomic information including race and ethnicity, employment and income levels. It is important to understand the current conditions of the population to accurately measure the demand for transportation infrastructure and estimate future ridership and revenue levels. It is also important to understand potential environmental justice (EJ) populations that may need to be considered in future planning efforts.

The demographic data collected as a part of the existing conditions will help project ridership of a high-speed passenger rail. Current demographics refer to the 2010 U.S. Census, when available. Otherwise, demographic information is the most recent available from the U.S. Census Bureau. Table 3-3 outlines the demographic data collected and their sources.

Table 3-3: Demographic Data and Sources

Data Element	Description	Source
Total Population	Total existing population	U.S. Census Bureau
Race/Ethnicity	Current race and ethnicity at the county level	U.S. Census Bureau
Age	Current age distribution at the county level	U.S. Census Bureau
Employment	Total current employment at the county level	U.S. Census Bureau
Household Income	Current median household income at the county level	U.S. Census Bureau
Low-Income	Current number of persons living below poverty level at the county level	U.S. Census Bureau

3.1.1.4 Existing Travel Patterns

High-speed rail feasibility is partially determined by the success of other modes of travel between major cities in the same corridor. High-speed rail competes with both air and automotive travel, and will therefore be more successful where air and auto travel have consistently moderate to high travel between the major cities. In order to understand the existing travel patterns for each of the three study corridors, Table 3-4 outlines the data employed to estimate the market share for high-speed rail.

Table 3-4: Travel Data and Sources

Data Element	Description	Source
Intercity Auto Trips	Annual Person Auto Trips (Round Trips)	1995 American Travel Survey
Local Air Trips	Annual Person Local Air Trips (round trips)	2010 USDOT DB1B and T-100 Airline Database
Connecting Air Volumes	Total Enplanements an Connecting Air volumes	2010 T-100 Airline Database

Additionally, data was collected on the existing transportation system infrastructure to understand the existing travel patterns outlined above. Table 3-5 illustrates the infrastructure data collected as a part of the feasibility study.

Table 3-5: Transportation Infrastructure Data and Sources

Data Element	Description	Source
Interstates	Interstate System	National Transportation Atlas
Major highways/roads	Major highways and local roads	National Transportation Atlas
Roadway Bridges	Roadway bridge locations	National Transportation Atlas
Rail Lines	Existing and abandoned railroads	National Transportation Atlas
Rail Owners, Corridor Volumes and Frequencies	Rail line owners, number of trains per day, and frequency of trains	Railroad Owners
Track Charts	Tracking charts for all railroads in study corridors	Railroad Owners
Rail Crossings	All rail/road crossings including at grade/grade separated data	National Transportation Atlas
Rail Bridges	Railroad bridge locations	National Transportation Atlas
Amtrak Stations	Locations of Amtrak Stations	National Transportation Atlas

Existing travel patterns are first used to quantify the base year trip tables for the current modes by trip purpose and market segment. These current trip tables are then used in conjunction with future demographic and socioeconomic characteristics to explain the size of each market segment and to calculate mode-specific growth rates using growth models (direct demand models).

The existing travel patterns are first used to derive the existing mode shares and trip volumes for each mode between the major city pairs in the region. The trip tables estimated using the existing travel patterns are then grown to future years using newly estimated direct demand models that use the existing and future demographic characteristics as inputs. These direct demand models explain the relationship between demographic characteristics and the travel patterns.

The demand forecasting methodology uses binary diversion models to calculate high-speed rail ridership. Each diversion model computes, for each combination of trip purpose, market segment and current mode, the probability that a traveler would choose high-speed rail over its current mode of travel as a function of each mode's level of service attributes. The probabilities are then multiplied by the future year mode-specific travel volumes to calculate the diverted volumes from the existing modes to the new high-speed rail system. The inclusion of each mode's level of service attributes in the diversion models enables the study to test several high-speed rail service frequencies and to accordingly adjust them to the ridership level. The forecasting approach is explained in more detail in Section 3.3 as well as graphically shown in Figure 3-18.

3.1.2 Stakeholder Outreach

Stakeholder outreach is an essential component of a high-speed rail feasibility study and outreach occurred along each corridor throughout the study process. Outreach efforts intend to educate, inform and involve the corridor stakeholders as to the purpose and progress of the project by highlight local issues, technical considerations and potential impacts. Outreach techniques were designed to education and update key stakeholders on the potential for high-speed rail along each corridor.

The study engaged key stakeholders along each corridor including elected officials, financial partners, federal, state and regional agencies and interest groups throughout the study process. The goal for the outreach was to include a group of agencies that would have valuable input at the feasibility level. A comprehensive list of stakeholders was compiled for each corridor and included all state, regional and local agencies within a 50-mile buffer of the corridor. GDOT, along with other state financial partners, reviewed the list and refined it to key stakeholders with a high-level perspective on high-speed rail. Stakeholders generally included state and

regional agencies involved in transportation projects and local cities and MPOs of the major cities along each corridor.

Communication with these entities was on-going, but the study conducted three formal stakeholder outreach meetings at the beginning, middle and end of the study timeline to provide updates and input into the study processes and analyses techniques. For each of the corridors, the study first met with key stakeholders early on in the study process to introduce the study and its purpose and need. Additionally, the study presented a number of meeting materials outlining the corridor screening process (Section 3.1.3) and solicited input into opportunities and issues along each corridor to help determine the representative routes for the Shared Use and Dedicated Use alternatives within the corridors. Refer to Appendix A for meeting materials and handouts.

Toward the middle of the study timeline, once preliminary capital cost and ridership and revenue analyses were completed, the study conducted a series of webinar-based conference calls with stakeholders from each of the corridors to update on the corridors' progress and present the initial technical data. The study, again, solicited questions from the stakeholders in order to clarify any concerns or issues along the corridor. Refer to Appendix A for meeting materials.

At the end of the feasibility study, the study met with stakeholders along the various corridors to present the final costing, ridership and revenue analyses as well as operating ratios and benefit-cost analyses. The study outlined the findings and recommendations for each of the corridors and presented the next steps for the corridor. Refer to Appendix A for meeting materials. Table 3-6 outlines the stakeholders for each of the three corridors that attended the outreach meetings.

Table 3-6: Corridor Stakeholders

Atlanta- Birmingham	Atlanta-Macon-Jacksonville	Atlanta-Chattanooga-Nashville-Louisville
• Alabama Department of Economic and Community Affairs • Alabama Department of Transportation • Birmingham-Jefferson County Transit Authority • City of Birmingham • City of Anniston • East Atlanta Regional Planning Commission • Regional Planning Commission of Greater Birmingham	• Bibb County • City of Macon • Coastal Regional Commission • Jacksonville Transportation Authority • Macon-Bibb Planning and Zoning • North Florida Transportation Planning Organization • Savannah Metropolitan Planning Commission	• City of Chattanooga • City of Lexington • Chattanooga-Hamilton County Regional Planning Agency • Clarksville Metropolitan Planning Organization • The Enterprise Center (Chattanooga-Hamilton County, TN) • Kentuckiana Regional Planning and Development Agency • Kentucky Transportation Cabinet • Nashville Area Metropolitan Planning Organization • The Transit Alliance (Middle Tennessee) • Transit Authority of River City • Tennessee Department of Transportation

3.1.3 Corridor Screening and Analysis Process

One of the first steps for this feasibility study was to identify a representative corridor route for each study corridor, technology and speed in which the study could evaluate in more detail with regard to capital costs, forecast ridership, revenues, operating costs, operating ratio, benefit-cost ratio and other comparative factors.

A high-level screening analysis was applied to the three study corridors to identify a representative route for each technology for further evaluation. Representative routes were identified for: 1) 90-110 mph Emerging High-Speed Rail (Shared Use) on a shared-use freight corridor; 2) 180-220 mph Express High-Speed Rail (Dedicated Use) on a dedicated, fully grade-separated corridor; and 3) 220+ mph Maglev on a dedicated, fully grade-separated corridor (for Atlanta-Chattanooga-Nashville-Louisville Corridor). The screening and analysis methodology to identify a representative route for each operating technology consists of four steps:

1. Identify the initial universe of route alternatives for each operating technology based on identifying those routes which provide basic connectivity for each of the major city pairs;
2. Screen the initial universe of route alternatives using both quantitative and qualitative factors to identify a representative route for each technology. Representative routes were chosen primarily based on the following quantitative and qualitative factors to deliver the highest level of service with the least public and environmental cost:
    - Route alternative geometry and travel time,
    - Route alternative freight traffic density (for Shared Use routes),
    - Stakeholder knowledge and input on route alternative issues and opportunities, and
    - Intermodal connectivity through potential stations.

    These routes contain several alignment alternatives that would be further analyzed through the NEPA process, should the corridors pass the feasibility threshold;
3. Further refine representative route alignments based upon a more detailed analysis including: service goals including travel time, station location and accessibility, operating feasibility, engineering feasibility, and cost factors; and
4. Evaluate each representative route in terms of its feasibility with regard to capital costs, forecast ridership, revenues, operating costs, operating ratio, benefit-cost ratio and other comparative factors.

3.1.4 Step 1: Identification of Universe of Corridor Alternatives

3.1.4.1 90-110 mph Shared Use

In the case of the 90-110 mph Shared Use alternatives, all current, abandoned and historic freight rail corridor routes serving major city pairs in the three study corridors were inventoried.

3.1.4.2 180-220 mph Dedicated Use

The screening process for identifying representative routes for 180-220 mph Dedicated Use operations uses a one-step level of analysis followed with a more detailed evaluation to confirm the feasibility of the selected corridor. The study first identified a universe of potential corridor routes including freight rail, electric transmission easements, cross-county greenfield routes and interstate highway corridors.

Existing freight rail corridors were discarded due to the existing track geometry which included numerous curves that severely limit top speeds and travel times.

Thirty minute (30') curves are generally considered to be the upper limit of curvature that can support 180-220 mph operations, with 15 minute (15') curves considered most desirable. The exception to this is within urban areas where existing freight rail corridors often offer the best accessibility to proposed or existing station locations. Average speeds within urban areas are typically slower than for inter-city travel, allowing the existing freight right-of-way to provide the best alternative within these relatively short "last mile" routes.

The study then reviewed the potential use of electric transmission line corridor easements. The study determined that these utility easements were generally not feasible because they are typically laid out in tangent sections without regard for vertical profile changes. The resulting sharp changes in elevation were found to be inconsistent with the geometric requirements of 180-220 mph (generally less than 3 percent grades). In addition, electric utility corridors are often buried underground in urban areas and did not typically offer "last mile" rail connectivity to existing or proposed station locations.

True cross-county greenfield corridors were also considered. The study concluded, however, that the level of engineering analysis required to lay out a viable "pure" greenfield corridor was beyond the scope of a feasibility analysis. The goal of this feasibility study was to provide an evaluation of feasibility of a representative route for each of the three study corridors and speed technologies so that the application of this operating technology could be compared among the three corridors. Therefore, the representative routes generally follow interstate corridors where more accurate information could be obtained (e.g., route geometry and topography) for a high-level analysis.

The study determined that the interstate highway corridors offered the best opportunity for use as Dedicated Use representative routes. The interstates are generally designed to have curves less than 30', which is suitable for 180-220 mph operations. Interstate vertical geometry in non-mountainous areas is also generally consistent with 180-220 mph electrified operations. The interstate highway routes in the southern and coastal areas of Georgia were found to be particularly desirable geometrically. The study also concluded that the interstate highway corridors would be appropriate for higher speed Maglev operations in the Atlanta-Chattanooga-Nashville-Louisville Corridor. This route was chosen to maintain consistency with the Atlanta-Chattanooga Tier I EIS. Although this study is not yet finalized, the report indicates that the I-75 corridor was selected for both an electrified 180-220 mph and 220+ mph Maglev operations.

The study assumed that viable high-speed rail operations along interstate highway corridors are to be on one of three basic routes: within the highway median, alongside the outside highway lane within the highway right-of-way, or in purchased right-of-way adjacent to the highway right-of-way. Where selected interstate

highway curves were greater than 30', the high-speed rail route was adjusted to leave the immediate highway corridor if justified by travel time savings.

3.1.5 Step 2: Alternative Screening and Representative Route Selection

3.1.5.1 90-110 mph Shared Use

For the Shared Use corridor operations, the second step of the screening process involved the application and comparison of the following data for each evaluated alternative as identified in Step One above:

1. Length of Route – Miles of Track as
    a. A measure of connectivity; and
    b. A measure of direction/indirection;

2. Ownership – Class I, Regional or Shortline, Abandoned or Recreation as
    a. A measure of ability to purchase the corridor for passenger rail; and
    b. A measure of potential to control the dispatch of passenger trains.

3. Class of Track as
    a. A measure of current improvement levels; and
    b. A measure of potential incremental track up-grade costs.

4. Predominant Track Configuration – Single, Single with sidings, double or triple track, etc. as a measure of existing capacity and density.

5. Degree of Curvature – 1 degree 30 minutes (1° 30') maximum curvature generally consistent with 110 mph operations. Expressed in number of curves greater than 1° 30' and percent miles greater than 1° 30' as
    a. A measure of limitation on achievable top speeds; and
    b. A measure of maximum curvature generally consistent with 110 mph operations.

6. Million Gross Tons of Freight per year as
    a. A measure of current freight activity and potential freight conflicts;
    b. A measure of congestion; and
    c. A measure of competing freight demand for a given route.

7. Number of Trains per day (converted from million gross tons or from freight railroad information) as
    a. A measure of current freight activity and potential freight conflicts;
    b. A measure of congestions; and
    c. A measure of competing freight demand for a given route.

8. 90-110 mph travel time – Calculated based on mileage and track class as a measure of comparative mobility.

9. 90-110 mph average speed as a measure of comparative mobility.

A comparison matrix of all evaluated corridors and the technical characteristics can be seen in Appendix C of this report. Additionally, more detailed information including stakeholder insight for each of the evaluated corridors is located in subsequent section (Sections II, III, and IV).

3.1.5.2 180-220 mph Dedicated Use

The interstate highway routes for 180-220 mph Dedicated Use operations were further evaluated a high level using the following criteria:

1. Miles of Interstate Highway as
    a. A measure of connectivity; and
    b. A measure of direction/indirection.

2. Degree of Curvature – 30 minute (30') maximum curvature generally consistent with 180-220 mph operations. Expressed in numbers of curves greater than 30' and percent miles greater than 30' as
    a. A measure of limitations on achievable top speeds; and
    b. A measure of maximum curvature generally consistent with 180-220 mph operations.

3. Auto travel times as a measure of comparative measure of mobility.

4. 180-220 mph high-speed rail travel time as a measure of comparative measure of mobility.

5. 180-220 mph high-speed rail average speed as a measure of comparative measure of mobility.

A comparison matrix of the 180-220 mph corridors and the associated technical characteristics can be seen in Appendix C of this report. Additionally, more detailed information including stakeholder insight for each of the interstate corridors is located in subsequent section (Sections II, III, and IV).

3.1.6 Step 3: Refinement of Representative Routes

The third step in the development of representative route for further evaluation was to refine the representative route based on accessibility, operating

considerations and travel time improvements. In particular, this involved refining route routes to optimize station accessibility and operating characteristics in and out of the major cities including: Atlanta, Birmingham, Macon, Savannah, Jacksonville, Chattanooga, Nashville and Louisville.

3.1.7 Step 4: Evaluate Feasibility of Each Representative Corridor

The final step in the evaluation process was to develop more detailed information on each representative route and technology alternative which can be used to assess the comparative feasibility of the corridor for future high-speed rail service.

The study utilized operating ratios and benefit-cost calculations as well as other factors to evaluate the three study corridors following the methodology used in the FRA 1997 Commercial Feasibility Report to Congress: "High Speed Ground Transportation in America".

Forecast ridership, revenue and operating cost data was used to determine the degree to which annual operating revenues can cover operating costs. This can be expressed as an operating ratio of revenues divided by operating costs. A ratio greater than one (>1.0), indicates an operating surplus. Operating ratios are also an indicator of whether there may be an opportunity for private sector investment. The operating ratio is typically seen as a comparative measure of the economic efficiency of high-speed rail service in one corridor versus another.

Information on ridership, revenues and operating and capital costs over time as also used to calculate a benefit-cost ratio for each given level of high-speed rail service. Here, benefits, as measured by revenues and other user and societal benefits, are compared to costs including capital, operating and maintenance costs over time, as well as other societal costs expressed in dollar terms. A discount rate is used to express benefits and costs in net present value (NPV) terms and a benefit-cost ratio greater than one implies a net value (or benefit) to society. The benefit-cost ratio can be seen as a comparative measure of the societal rate of return of a public investment in high speed rail in one corridor versus another. A more technical discussion of benefit-cost analysis is found later in Section 3.4.4.

This same information on ridership and revenues and operating and capital costs can also be used individually to assess a high-speed rail project's feasibility in terms of other measures such as: a project's impact on state budget priorities, project impact on state credit ratings, viability of private sector contributions, eligibility for various federal grant and loan program, and state and local economic impact in terms of jobs, incomes and property values. However, for the purposes of this study, the corridor feasibility primarily focuses on operating and benefit-cost ratios.

3.2 CAPITAL COST METHODOLOGY

Capital cost estimates for this study were completed at the conceptual engineering level (5-10 percent) with a +/- 30 percent level of accuracy. Table 3-7 illustrates the level of accuracy of engineering cost estimates associated with various levels of project development.

Table 3-7: Level of Accuracy vs. Project Development

Project Development Phase	Engineering Design Level	Approximate Level of Accuracy[9]
Conceptual Engineering	5-10 percent	+/- 30 percent
Preliminary Engineering	30 percent	+/- 15 percent
Final Design	100 percent	+/- 10 percent or better

3.2.1 FRA STANDARD COST CATEGORIES (SCC)

To achieve a consistent costing methodology, the study used the FRA Standard Cost Categories (SCC) in developing all capital cost estimates for the three corridors. Preparing the capital cost estimate according to current FRA SCC allows the easy transition and preparation for future funding applications. This approach will greatly reduce the need to re-evaluate quantities, unit costs and individual items for future application. FRA SCC is separated into ten categories for capital projects/programs. The categories are broad enough to be applied to all three corridors and each of the different technology considerations (refer back to Section 1.2). The ten major categories are shown below in Table 3-8.

[9] Level of Accuracy is implied and is based on typical industry practice

Table 3-8: FRA Standard Cost Categories

FRA Standard Cost Categories for Capital Projects/Programs
10 Track Structures & Track
20 Stations, Terminals, Intermodal
30 Support Facilities: Yards, Shops, Administration Buildings
40 Sitework, Right-of-Way, Land, Existing Improvements
50 Communications & Signaling
60 Electric Traction
70 Vehicles
80 Professional Services
90 Unallocated Contingencies
100 Finance Charges

Each category is broken down into subcategory items that expand the capital cost estimate of each major category. The study only utilized categories 10 through 80 because categories 90 and 100 do not apply to the current Feasibility Study. The values for these categories will be determined in later evaluations. Below (Table 3-9) is a list of all FRA subcategories and definitions for category 10 Track Structures & Track through 80 Professional Services.

Table 3-9: FRA Cost Items

10 Track Structures and Track		
	Item	**Definition**
10.01	Track Structure: Viaduct	Include elevated track structure of significant length consisting of multiple spans of generally equal length.
10.02	Track Structure: Major/Movable Bridge	Include all elevated track structures with a movable span, and/or with a span of significant length (generally of approximately 400’ or longer)
10.03	Track Structure: Under-grade Brides	Include elevated track structure of greater than 20 feet that does not fall into 10.01 and 10.02
10.04	Track Structure: Culvert & Drainage Structure	Include all minor undergrade passageways (generally of 20 feet or less in width)
10.05	Track Structure: Cut & Fill (> 4’ height/depth)	Include grading and subgrade stabilization of roadbed

	Item	Definition
10.06	Track Structure: At-grade (grading and sub-grade stabilization)	All grading and subgrade stabilization of roadbed not included under cost categories 10.01 through 10.05 and 10.07
10.07	Track Structure: Tunnel	Definition self-explanatory
10.08	Track Structure: Retaining Walls & Systems	Definition self-explanatory
10.09	Track New Construction: Conventional Ballasted	Include all ballasted track construction on prepared subgrade, on new or existing rights-of-way
10.10	Track New Construction: Non-Ballasted	Include all slab, direct fixation, embedded, and other non-ballasted track construction on prepared subgrade, on new or existing rights-of-way
10.11	Track Rehabilitation: Ballast and Surfacing	Include undercutting, ballast cleaning, tamping, and surfacing not associated with new track construction
10.12	Track Rehabilitation: Ditching & Drainage	Definition self-explanatory
10.13	Track Rehabilitation: Component Replacement (Rails, ties, etc.)	Definition self-explanatory
10.14	Track: Special Track Work (Switches, turnouts, insulated joints)	Include minor turnouts and interlocking, such as crossovers and turnouts at the ends of passing tracks
10.15	Track: Major Interlockings	Significant interlockings at major stations and where routes converge from three or more directions
10.16	Track: Switch Heaters (with power & control)	Include cost of power distribution equipment from commercial power source to interlocking location
10.17	Track: Vibration & Noise Dampening	Definition self-explanatory
10.18	Other Linear Structures (including fence, sound walls, crash barrier, etc.)	Definition self-explanatory
20 Stations, Terminals, Intermodal		
20.01	Station Buildings: Intercity Passenger Rail Only	Definition self-explanatory
20.02	Station Buildings: Joint use (commuter rail, intercity bus)	Definition self-explanatory

	Item	Definition
20.03	Platforms	Definition self-explanatory
20.04	Elevators, Escalators	Definition self-explanatory
20.05	Joint Commercial Development	Construction at station sites intended to support non-transportation commercial activities (shopping, restaurants, residential, office space). Do not include cost of incidental commercial use of station space intended for use by passengers (newsstands, snack bar, etc.). Costs may not be allowable for Federal reimbursement
20.06	Pedestrian/Bike access and accommodation, landscaping, parking lots	Include sidewalks, paths, plazas, landscape, site and station furniture, site lighting, signage, public artwork, bike facilities, permanent fencing
20.07	Automobile, Bus, Van Accessways including roads	Include all on-grade paving
20.08	Fare Collection Systems and Equipment	Include fare sales and swipe machines, fare counting equipment
20.09	Station Security	Definition self-explanatory
30 Support Facilities: Yards, Shops, Administration Buildings		
30.01	Administration Buildings: Office, Sales, Storage, Revenue Counting	Definition self-explanatory
30.02	Light Maintenance Facility	Include service, inspection, and storage facilities and equipment
30.03	Heavy Maintenance Facility	Include heavy maintenance and overhaul facilities and equipment
30.04	Storage or Maintenance-of-Way Building	Definition self-explanatory
30.05	Yard and Yard Track	Include yard construction and track associated with yard
40 Sitework, Right-of-Way, Land, Existing Improvements		
40.01	Demolition, Clearing, Site Preparation	Include project/program-wide clearing, demolition and fine grading
40.02	Site utilities, utility relocation	Include all site utilities-storm, sewer, water, gas, electric
40.03	Hazardous Material, contaminated soil, removal/mitigation, ground water treatments	Include underground storage tanks, fuel tanks, other hazardous materials and treatments, etc.
40.04	Environmental mitigation: wetlands, historic/archeology, parks	Include other environmental mitigation not listed

	Item	Definition
40.05	Site structures including retaining walls, sound walls	Definition self-explanatory
40.06	Temporary facilities and other indirect costs during construction	Definition self-explanatory
40.07	Purchase or lease of real estate	If the value of right-of-way, land and existing improvements is to be used as in-kind local match to the Federal funding of the project/program, include the total cost on this line item. In backup documentation, separate cost for land from cost for improvements. Identify whether items are leased, purchased or acquired through payment or for free. Include the costs for permanent surface and subsurface easements, trackage rights, etc.
40.08	Highway/pedestrian overpass/grade separation	Other than the grade separations included in this line item, highway-rail grade crossing safety enhancements generally fall under 50.06
40.09	Relocation of existing households and businesses	In compliance with Uniform Relocation Act
50 Communications & Signaling		
50.01	Wayside signaling equipment	Definition self-explanatory
50.02	Signal power access and distribution	Definition self-explanatory
50.03	On-board signaling equipment	Include on-board cab signal, Automatic Train Control (ATC), and Positive Train Control (PTC) related equipment
50.04	Traffic control and dispatching systems	Definition self-explanatory
50.05	Communications	Definition self-explanatory
50.06	Grade crossing protection	Includes all types of highway-rail grade crossing safety enhancements expect for grade separation projects, which fall under 40.08
50.07	Hazard detectors: dragging equipment high water, slide, etc.	Definition self-explanatory
50.08	Station train approach warning system	Definition self-explanatory

	Item	Definition
60 Electric Traction		
60.01	Traction Power Transmission: High Voltage	Definition self-explanatory
60.02	Traction Power Supply: Substations	Definition self-explanatory
60.03	Traction Power Distribution: Catenary and third rail	Definition self-explanatory
60.04	Traction Power Control	Definition self-explanatory
70 Vehicles		
70.00	Vehicle Acquisition: Electric Locomotive	Definition self-explanatory
70.01	Vehicle Acquisition: Non-Electric Locomotive	Definition self-explanatory
70.02	Vehicle Acquisition: Electric Multiple Unit	Definition self-explanatory
70.03	Vehicle Acquisition: Diesel Multiple Unit	Definition self-explanatory
70.04	Vehicle Acquisition: Loco-hauled passenger cars with ticketed space	Include cars with coach space, sleeping compartments, etc.
70.05	Vehicle Acquisition: Loco-hauled passenger cars without ticketed space	Include dedicated food service, lounge, baggage and other service support cars
70.06	Vehicle Acquisition: Maintenance of Way Vehicles	Definition self-explanatory
70.07	Vehicle Acquisition: Non-railroad support vehicles	Definition self-explanatory
70.08	Vehicle Refurbishment: Electric Locomotive	Definition self-explanatory
70.09	Vehicle Refurbishment: Non-Electric Locomotive	Definition self-explanatory
70.10	Vehicle Refurbishment: Electric Multiple Unit	Definition self-explanatory
70.11	Vehicle Refurbishment: Diesel Multiple Unit	Definition self-explanatory
70.12	Vehicle Refurbishment: Loco-hauled passenger cars with ticketed space	Include coaches, sleeping cars, etc.
70.13	Vehicle Refurbishment: Non-passenger Loco-hauled car without ticketed space	Include food service, lounge, baggage and other service support cars
70.14	Vehicle Refurbishment: Maintenance of Way Vehicles	Definition self-explanatory
70.15	Spare Parts	Definition self-explanatory

	Item	Definition
80 Professional Services		
80.01	Service Development/Service Environmental	Definition self-explanatory
80.02	Preliminary Engineering/Project Environmental	Definition self-explanatory
80.03	Final Design	Definition self-explanatory
80.04	Project Management for Design and Construction	Definition self-explanatory
80.05	Construction Administration & Management	Definition self-explanatory
80.06	Professional Liability and other Non-Construction Insurance	Definition self-explanatory
80.07	Legal; Permits; Review Fees by Other Agencies, Cities, etc.	Definition self-explanatory
80.08	Surveys, testing, investigation	Definition self-explanatory
80.09	Engineering Inspection	Definition self-explanatory
80.10	Start Up	Definition self-explanatory

The study expanded several subcategory cost items to capture more detail for the cost items. Items requiring expansion were decided during the data gathering and capital cost estimate activities of the feasibility study. The subcategory expansions include:

Table 3-10: FRA Cost Item Expansion

10.09	Track New Construction: Conventional Ballasted	
	10.09.01	Track New Construction: 136LB CWR w/ Concrete Ties
	10.09.02	Track New Construction : 136LB CWR w/ Wood Ties

3.2.2 Unit Cost Development Method

The study developed all unit costs in 2010 dollars for the design and construction of high-speed passenger rail and maglev infrastructure. Unit costs were derived from various sources and publications. The unit costs for each of the items included cost of material, labor, overhead and profit. Refer to Section 3.2.3 for detailed unit cost developments. Below is a list of resources that was referenced in developing the unit costs:

- Published construction documents such as "RSMeans Heavy Construction Cost Data", current edition;
- GDOT and other State Transportation agencies weighted unit cost;
- Federal Transit Authority (FTA) website for typical elements cost;

- California and Florida High-Speed Rail feasibility Studies and Preliminary Design documents;
- Wisconsin and Illinois Planning and Design Documents;
- Various Class I railroad cost estimates for similar sized projects; and
- Estimating experience and historical costs for similar projects.

Unit costs needed adjustments from previous years to 2010 base year dollars. Escalating these unit costs to 2010 dollars was done by utilizing the *Engineering News Record* Construction Cost Index (CCI) for Atlanta, GA. The CCI uses local prices for Portland cement and 2x4 lumber and the national average price for structural steel. The CCI also uses local union wages, plus fringes, for carpenters, bricklayers and iron workers. The following formula was used to escalate unit costs to 2010 dollars:

$$Unit\ Cost_{2010} = (Unit\ Cost_{Year\ X}) \times \frac{(December\ 2010\ Index) - (Prior\ year\ Index)}{(Prior\ Year\ Index)}$$

The feasibility study was based on U.S. Customary Units defined by the National Institute of Standards and Technology (NIST). U.S. Customary Units are officially used in the U.S., and are also known in the U.S. as "English" of "Imperial" units. Actual units of measure for each of the items were determined during the capital cost estimations.

3.2.2.1 Quantities

From the various data sources in the data collection process, the study developed conceptual take-off quantities for several of FRA cost categories. These quantities are related to earthwork, structures, track roadbed, rail, track materials, turnouts, stations, support facilities, site work, right-of-way, communication & signaling, electric traction, and vehicles.

Take off quantities were made from maps, drawings, typical sections and sketches created during the feasibility study for each corridor and level of service. Take-off quantities were (+/-) 30 percent of actual quantities.

3.2.2.2 Unit Costs

Table 3-11 outlines the unit costs for each FRA SCC sub-category. Because this study is at the feasibility level, the study did not estimate costs for Section 90 (Unallocated Contingencies) and 100 (Finance Charges). The values for these categories will be determined in later evaluations. These unit costs, again, were developed based on regional and national references.

Table 3-11: SCC Sub-Category Unit Costs

10 Track Structures and Track				
	Item	**Unit**	**Shared Use**	**Dedicated Use**
10.01	Track Structure: Viaduct	Corridor Mile	$47,000,000	$47,000,000
10.02	Track Structure: Major/Movable Bridge	Lump Sum	Varies	Varies
10.03	Track Structure: Undergrade Brides	Lump Sum	Varies	Varies
10.04	Track Structure: Culvert & Drainage Structure	Each	$57,000	$57,000
10.05	Track Structure: Cut & Fill (> 4' height/depth)			
10.05.01	Rolling Terrain	Corridor Mile	$1,073,000	$1,073,000
10.05.02	Mountainous Terrain	Corridor Mile	$2,145,000	$2,145,000
10.06	Track Structure: At-grade (grading and subgrade stabilization)	Corridor Mile	$715,000	$715,000
10.07	Track Structure: Tunnel	Corridor Mile	$116,000,000	$116,000,000
10.08	Track Structure: Retaining Walls & Systems	Track Mile	$1,281,000	$1,281,000
10.09	Track New Construction: Conventional Ballasted			
10.09.01	136 lb. CWR on Concrete Ties	Track Mile	$894,000	$894,000
10.09.02	136 lb. CR on Wood Ties	Track Mile	$1,010,000	$1,010,000
10.10	Track New Construction: Non-Ballasted	Track Mile	N/A	N/A
10.11	Track Rehabilitation: Ballast and Surfacing	Track Mile	$132,000	$132,000
10.12	Track Rehabilitation: Ditching & Drainage	Track Mile	$38,000	$38,000
10.13	Track Rehabilitation: Component Replacement (Rails, ties, etc.)			
10.13.01	30% Track Rehabilitation	Track Mile	$427,000	$427,000
10.13.02	60% Track Rehabilitation	Track Mile	$491,000	$491,000
10.13.03	100% Track Rehabilitation	Track Mile	$966,000	$966,000

	Item	Unit	Shared Use	Dedicated Use
10.14	Track: Special Track Work (Switches, turnouts, insulated joints)			
10.14.01	Turnout; No. 11	Each	$150,000	$150,000
10.14.02	Turnout; No. 20	Each	$200,000	$200,000
10.14.03	Turnout; No. 24	Each	$475,000	$475,000
10.15	Track: Major Interlockings	Each	N/A	N/A
10.16	Track: Switch Heaters (with power & control)	Each	$45,000	$45,000
10.17	Track: Vibration & Noise Dampening	Track Mile	N/A	N/A
10.18	Other Linear Structures (including fence, sound walls, crash barrier, etc.)	Corridor Mile	$122,000	$122,000
20 Stations, Terminal, Intermodal				
20.01	Station Buildings: Intercity Passenger Rail Only	Each	$5,610,000	$5,610,000
20.02	Station Buildings: Joint use (commuter rail, intercity bus)			
20.02.01	Atlanta MMPT	Lump Sum	$217,121,588	$217,121,588
20.02.02	H-JAIA	Lump Sum	$62,034,739	$62,034,739
20.02.03	Birmingham Transit Station	Lump Sum	$18,610,422	$18,610,422
20.02.04	Jacksonville Multimodal	Lump Sum	$43,424,318	$43,424,318
20.03	Platforms	Linear Feet	$1,080	$1,080
20.04	Elevators, Escalators	Each	$350,000	$350,000
20.05	Joint Commercial Development	Square Foot	$150	$150
20.06	Pedestrian/Bike access and accommodation, landscaping, parking lots	Lump Sum	N/A	N/A
20.07	Automobile, Bus, Van Accessways including roads	Lump Sum	N/A	N/A
20.08	Fare Collection Systems and Equipment	Each	$250,000	$250,000
20.09	Station Security	N/A	N/A	N/A
30 Support Facilities: Yards, Shops, Administration Buildings				
30.01	Administration Buildings: Office, Sales, Storage, Revenue Counting	N/A	N/A	N/A
30.02	Light Maintenance Facility	N/A	$6,203,473	$6,203,473

	Item	Unit	Shared Use	Dedicated Use
30.03	Heavy Maintenance Facility	Lump Sum	$29,776,674	$37,220,844
30.04	Storage or Maintenance-of-Way Building	N/A	N/A	N/A
30.05	Yard and Yard Track	Lump Sum	N/A	N/A
40 Sitework, Right-of-Way, Land, Existing Improvements				
40.01	Demolition, Clearing, Site Preparation	Lump Sum	Varies	Varies
40.02	Site utilities, utility relocation	Corridor Mile	$59,000	$59,000
40.03	Hazardous Material, contaminated soil, removal/mitigation, ground water treatments	N/A	N/A	N/A
40.04	Environmental mitigation: wetlands, historic/archeology, parks	Acre	N/A	N/A
40.05	Site structures including retaining walls, sound walls	Track Mile	$2,561,000	$2,561,000
40.06	Temporary facilities and other indirect costs during construction	Lump Sum	N/A	N/A
40.07	Purchase or lease of real estate	Lump Sum	Varies	Varies
40.08	Highway/pedestrian overpass/grade separation	Lump Sum	Varies	Varies
40.09	Relocation of existing households and businesses	Lump Sum	Varies	Varies
50 Communications & Signaling				
50.01	Wayside signaling equipment	Corridor Mile	$970,000	$970,000
50.02	Signal power access and distribution	Corridor Mile	$5,500	$5,500
50.03	On-board signaling equipment	Each	$400,000	$400,000
50.04	Traffic control and dispatching systems	Each	$9,000,000	$9,000,000
50.05	Communications	Corridor Mile	$555,000	$555,000
50.06	Grade crossing protection			
50.06.01	Public At-Grade	Each	$411,000	$411,000
50.06.02	Private At-Grade	Each	$293,000	$293,000

	Item	Unit	Shared Use	Dedicated Use
50.07	Hazard detectors: dragging equipment high water, slide, etc.	Corridor Mile	$7,500	$7,500
50.08	Station train approach warning system	Each	$137,500	$137,500
60 Electric Traction				
60.01	Traction Power Transmission: High Voltage	Corridor Mile	$60,400	$60,400
60.02	Traction Power Supply: Substations	Corridor Mile	$1,800,000	$1,800,000
60.03	Traction Power Distribution: Catenary and third rail	Track Mile	$3,600,000	$3,600,000
60.04	Traction Power Control	Corridor Mile	$1,625,000	$1,625,000
70 Vehicles				
70.00	Vehicle Acquisition: Electric Locomotive	N/A	N/A	N/A
70.01	Vehicle Acquisition: Non-Electric Locomotive	N/A	N/A	N/A
70.02	Vehicle Acquisition: Electric Multiple Unit			
70.02.01	Electric Multiple Unit (EMU)	Each	N/A	$43,450,000
70.02.02	Maglev Unit	Each	N/A	$79,290,000
70.03	Vehicle Acquisition: Diesel Multiple Unit	Each	$32,500,000	N/A
70.04	Vehicle Acquisition: Loco-hauled passenger cars with ticketed space	N/A	N/A	N/A
70.05	Vehicle Acquisition: Loco-hauled passenger cars without ticketed space	N/A	N/A	N/A
70.06	Vehicle Acquisition: Maintenance of Way Vehicles	N/A	N/A	N/A
70.07	Vehicle Acquisition: Non-railroad support vehicles	N/A	N/A	N/A
70.08	Vehicle Refurbishment: Electric Locomotive	N/A	N/A	N/A
70.09	Vehicle Refurbishment: Non-Electric Locomotive	N/A	N/A	N/A

	Item	Unit	Shared Use	Dedicated Use
70.10	Vehicle Refurbishment: Electric Multiple Unit	N/A	N/A	N/A
70.11	Vehicle Refurbishment: Diesel Multiple Unit	N/A	N/A	N/A
70.12	Vehicle Refurbishment: Loco-hauled passenger cars with ticketed space	N/A	N/A	N/A
70.13	Vehicle Refurbishment: Non-passenger Loco-hauled car without ticketed space	N/A	N/A	N/A
70.14	Vehicle Refurbishment: Maintenance of Way Vehicles	N/A	N/A	N/A
70.15	Spare Parts	Lump Sum	N/A	N/A
80 Professional Services				
80.01	Service Development/Service Environmental	2% of Total Cost	Varies	Varies
80.02	Preliminary Engineering/Project Environmental	4% of Total Cost	Varies	Varies
80.03	Final Design	4% of Total Cost	Varies	Varies
80.04	Project Management for Design and Construction	4% of Total Cost	Varies	Varies
80.05	Construction Administration & Management	6% of Total Cost	Varies	Varies
80.06	Professional Liability and other Non-Construction Insurance	N/A	Varies	Varies
80.07	Legal; Permits; Review Fees by Other Agencies, Cities, etc.	N/A	Varies	Varies
80.08	Surveys, testing, investigation	2% of Total Cost	Varies	Varies
80.09	Engineering Inspection	2% of Total Cost	Varies	Varies
80.10	Start Up	N/A	Varies	Varies

3.2.3 DETAILED METHODOLOGIES

3.2.3.1 Shared Use and Dedicated Use Track

Shared Use

In Shared Use corridors, the passenger operation involves passenger trains operating on existing freight routes and tracks. This requires coordination with freight train volumes. This study uses the assumption that passenger trains will not restrict the current or future freight operations and schedules.

Below are assumed values for current freight densities for the various freight segments that could have future passenger service. The density values are daily weighted averages for the entire route and can be seen in Table 3-12. Daily weighted average is defined as the average density over the entire route and is determined by multiplying the density by the distance over which it operates. Summing these values over the route and dividing by the total length provides the "weighted "average of density on the entire route. For the purposes of calculation, the study assumes that a typical carload is 60 gross tons, in which typical trains consist of two locomotives and 70 cars. Therefore, the following formula was used to calculate the average trains per day for a particular segment length:

$$Daily\ Weighted\ Density\ (trains\ per\ day) = \left(Annual\ Million\ Gross\ Tons\ * \left(\frac{1}{60}\right) * \left(\frac{1}{70}\right) * \left(\frac{1}{365}\right)\right) * Route\ Length.$$

These daily weighted densities were then summed and divided by the total corridor length to equal the corridor weighted average.

Table 3-12 Current Corridor Freight Densities

Corridor	Railroad Owner	Density (trains/day)
Atlanta – Birmingham	NS	26.3
Atlanta – Jacksonville	NS S-Line	2.5
	NS H-Line	43.4
	Georgia Central Railroad	0.8
	CSXT S-Line (Savannah to Richmond Hill)	9.5
	CSXT S-Line (Richmond Hill to Kingsland)	0.3
	CSXT (Callahan to Jacksonville)	65.2
Atlanta – Louisville	CSXT (Atlanta to Chattanooga)	29.0
	NS (Atlanta to Chattanooga)	45.0
	CSXT (Chattanooga to Nashville)	22.5
	CSXT (Nashville to Louisville)	22.5
	Private (Chattanooga to Harriman)	45.0
	Nashville & Eastern	12.0
	NS (Chattanooga to Danville)	45.0
	NS (Danville to Louisville)	25.0

For the purposes of this feasibility study, the study assumed current freight operations will grow by the percentages outlined in Table 3-13. This percentage reflects the growth through 2035 and is taken from the *National Rail Freight Infrastructure Capacity and Investment Study* (September 2007).

Table 3-13: Future Freight Density Increases

Corridor	Railroad Owner	Density Increase (through 2035)	2035 Freight Density (trains/day)	2040 Freight Density Estimate[10]
Atlanta – Birmingham	NS	100%	52.6	52.9
Atlanta – Jacksonville	NS S-Line	50%	3.6	3.9
	NS H-Line	100%	86.8	87.1
	Georgia Central Railroad	50%	1.2	1.4
	CSXT S-Line (Savannah to Richmond Hill)	50%	14.2	14.4
	CSXT S-Line (Richmond Hill to Kingsland)	50%	0.5	0.6
	CSXT (Callahan to Jacksonville)	100%	130.4	130.7
Atlanta – Louisville	CSXT (Atlanta to Chattanooga)	100%	58.0	58.3
	NS (Atlanta to Chattanooga)	100%	90.0	90.3
	CSXT (Chattanooga to Nashville)	100%	45.0	45.3
	CSXT (Nashville to Louisville)	100%	45.0	45.3
	Private (Chattanooga to Harriman)	50%	67.5	67.7
	Nashville & Eastern	50%	18.0	18.2
	NS (Chattanooga to Danville)	100%	90.0	90.3
	NS (Danville to Louisville)	50%	37.5	37.7

Chapter 3.4 explains the calculations behind estimating passenger train frequency. However, as a rule, higher ridership associated with faster options support more train frequencies, along with larger, more efficient trains. Train size and frequency are increased together to accommodate the ridership increase. Therefore, an

[10] 2040 Freight Density Estimates were extrapolated using the Average Annual Growth Rate (AAGR) between 2010 and 2035.

iterative approach was used to identify the optimal investment and operating strategy for each of the three corridors.

As will be seen in Section II-IV, the corridors have unique characteristics and ridership patterns that lead to estimating corridor frequencies. This study optimizes ridership and frequencies based on these unique characteristics. The passenger train frequency estimates below illustrate the preliminary train frequency estimates that were then used to help calculate the necessary capacity improvements along each corridor.

- Atlanta – Birmingham Corridor: 6 round trips (12 trains/day)
- Atlanta – Macon – Jacksonville: 8 round trips (16 trains/day)
- Atlanta – Chattanooga: 16 round trips (32 trains/day)
- Chattanooga – Nashville: 10 round trips (20 trains/day)
- Nashville – Louisville: 5 round trips (10 trains/day)

Based on these passenger rail densities in combination with the projected freight densities, the density values in Table 3-14 were used to develop the necessary capacity improvements.

Table 3-14: Evaluated Corridor Densities

Corridor	Railroad Owner	Evaluated Density
Atlanta – Birmingham	NS Crescent	64.6
Atlanta – Jacksonville	NS S-Line	21.0
	NS H-Line	102.8
	Georgia Central Railroad	13.6
	CSXT S-Line (Savannah to Richmond Hill)	31.0
	CSXT S-Line (Richmond Hill to Kingsland)	16.6
	CSXT A-Line (Callahan to Jacksonville)	142.4
Atlanta – Louisville	CSXT (Atlanta to Chattanooga)	74.0
	NS (Atlanta to Chattanooga)	106.0
	CSXT (Chattanooga to Nashville)	57.0
	CSXT (Nashville to Louisville)	53.0
	Private (Chattanooga to Harriman)	79.5
	Nashville & Eastern	30.0
	NS (Chattanooga to Danville)	102.0
	NS (Danville to Louisville)	45.5

In developing a capital cost estimate, the study made the following assumptions and took the following approach to increasing track capacity to accommodate current and future freight operations and proposed passenger service:

- Freight railroads will require access to any track infrastructure the proposed passenger service builds on private railroad property;
- Existing mainline and siding tracks will be completely replaced with 136-pound CWR and concrete ties;
- All mainline turnouts will be replaced with power turnouts and passing sidings will require No. 20/24[11] power turnouts;
- Minimum freight sidings are two miles and passenger sidings are 10 miles;
- Universal crossovers should be No. 20/24; and
- Proposed track centers are 20-feet.

Table 3-15 illustrates the methodology for increasing track capacity on the various existing track corridors based on the evaluated densities outline in Table 3-14.

[11] No. 20/No. 24 refers to the specific angle of the diversion of the train movement. Larger turnouts reflect higher traveling speeds.

Table 3-15: Capacity Improvement Methodology

Average Trains/Day[12]	Existing # of Main tracks	New Signal System	Track Improvement
≤ 30	1	PTC	Upgrade existing mainline track to Class 6 standards
			Upgrade and extend all sidings to lengths of 2 miles
			Maintain a minimum siding spacing of 8-10 miles
			Add 10 mile passenger siding every 50 miles
			Upgrade all mainline turnouts to power turnouts
30 < x ≤ 75	1	PTC	Upgrade existing mainline track to Class 6 standards
			Connect all sidings creating a double track system
			Space double crossovers every 12 miles
			Upgrade all mainline turnouts to power turnouts
75 < x ≤ 100	2	PTC	Upgrade existing mainline tracks to Class 6 standards
			Space double crossovers every 8 miles
			Upgrade all mainline turnouts to power turnouts
100 < x ≤ 135	2	PTC	Upgrade existing mainline tracks to Class 6 standards
			Add third track
			Space double crossovers every 12 miles
			Upgrade all mainline turnouts to power turnouts

[12] Average trains/day based on future freight density plus proposed passenger service trains

Dedicated Use

In Dedicated Use corridors, the passenger operation involves passenger trains operating on dedicated routes and tracks. This separates passenger service from existing and future freight operations.

However, in "last mile" situations where passenger trains enter and exits city stations such as Atlanta, Macon, Savannah, Jacksonville, Birmingham, Chattanooga, Nashville and Louisville, the study assumed passenger trains will operate on sealed corridors at reduced speeds (110 mph). A sealed corridor does allow for at-grade crossings. Typically, the passenger rail will utilize an existing freight corridor route and purchase additional right-of-way to approach the destination station. For the purposes of this feasibility study, the study assumed that the dedicated technology cannot operate on existing freight tracks and vice versa.

Again based on the iterative approach and taking into consideration the unique characteristics and ridership patterns of each of the three study corridors, the passenger train frequency estimates for the three corridors follows:

- Atlanta – Birmingham: 10 round trips (20 trains/day)
- Atlanta – Macon – Jacksonville: 14 round trips (28 trains/day)
- Atlanta – Chattanooga: 28 round trips (56 trains/day)
- Chattanooga – Nashville: 20 round trips (40 trains/day)
- Nashville – Louisville: 12 round trips (24 trains/day)

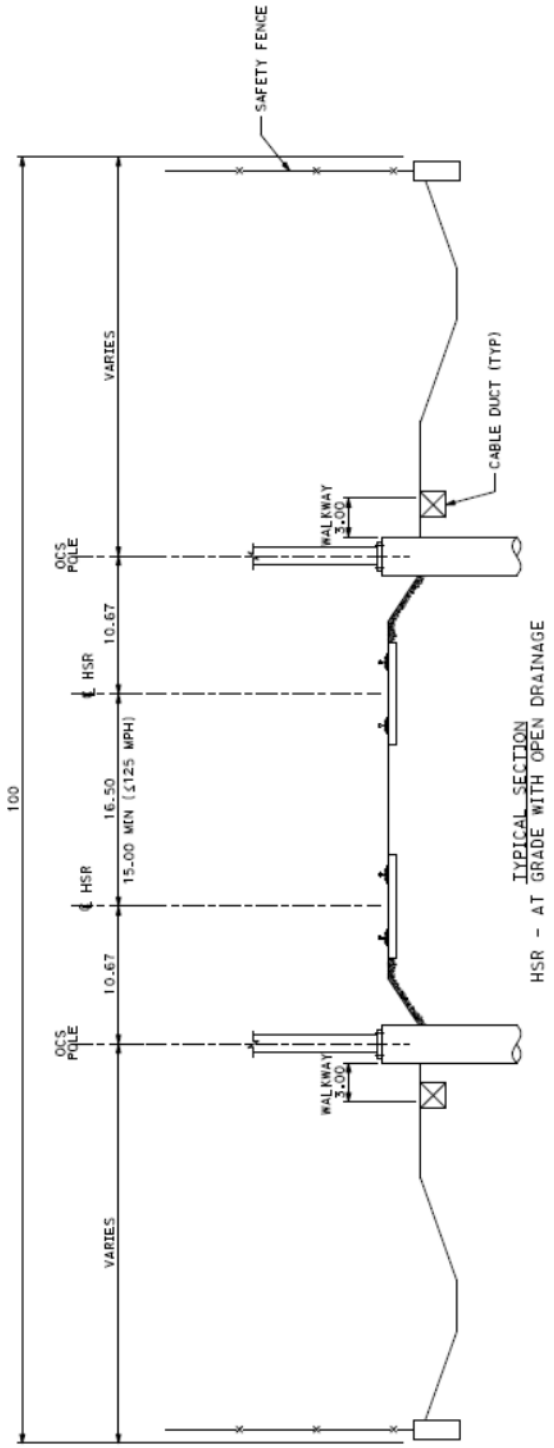
To develop a capital cost estimate, the study made the following assumptions and took the following approach for constructing dedicated track infrastructure:

- Double track corridors for bi-directional operation;
- Build track to FRA Class 9 standards;
- Track will be 136-pound CWR on concrete ties;
- Universal crossovers should be No. 24 or greater and spaced every 25 miles for the purpose of maintenance; and
- Proposed track centers are 16.5 feet with a minimum of 15 feet in segments[13] where speed is reduced to less than 125 mph.

Figure 3-1 through Figure 3-4 demonstrate the various types of typical sections applied to various segments along the dedicated corridors.

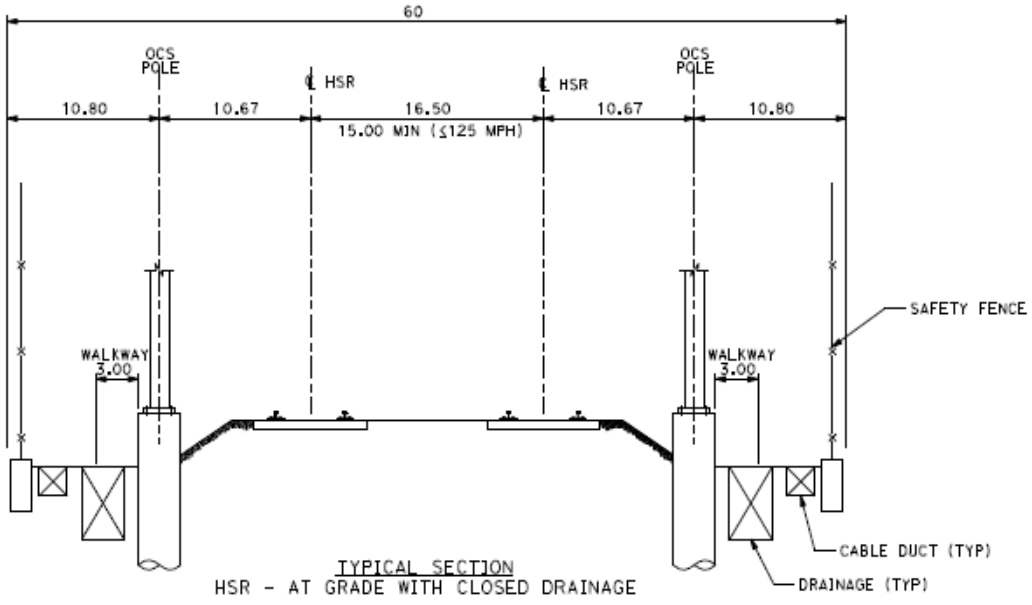
[13] This is not an industry standard and is not required by FRA

Figure 3-1: At-Grade, Open Drainage Typical Section



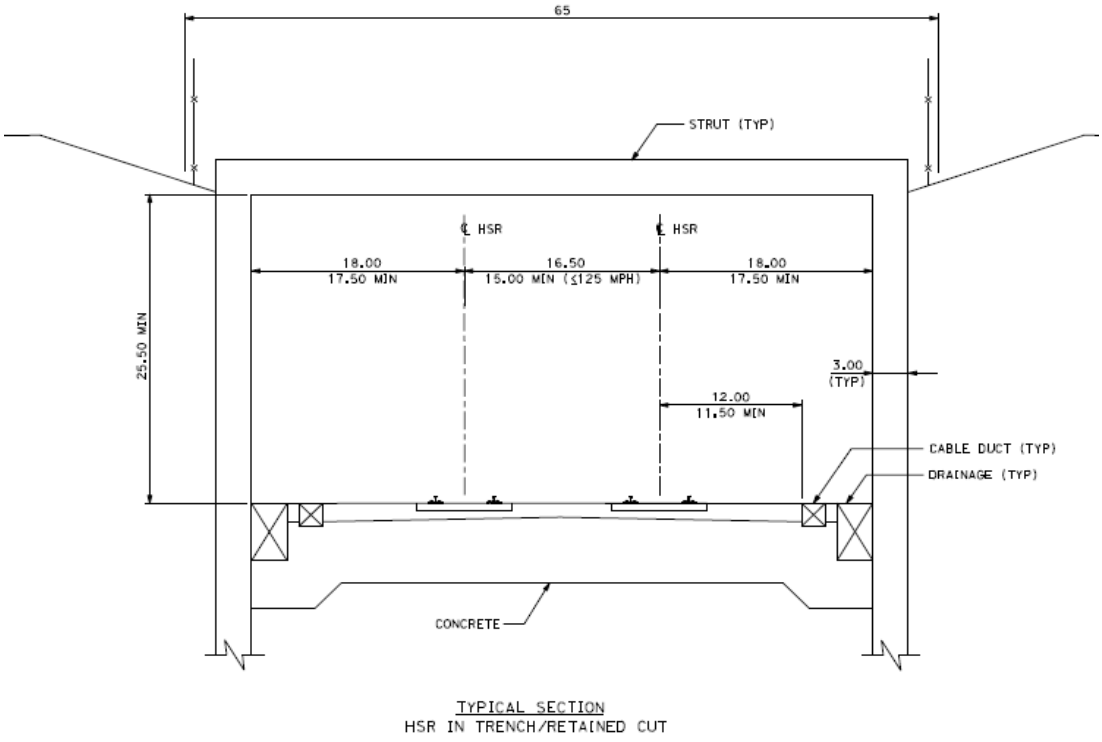
Source: California High-Speed Train: Project Environmental Impact Report (2010)

Figure 3-2: At-Grade, Closed Drainage Typical Section



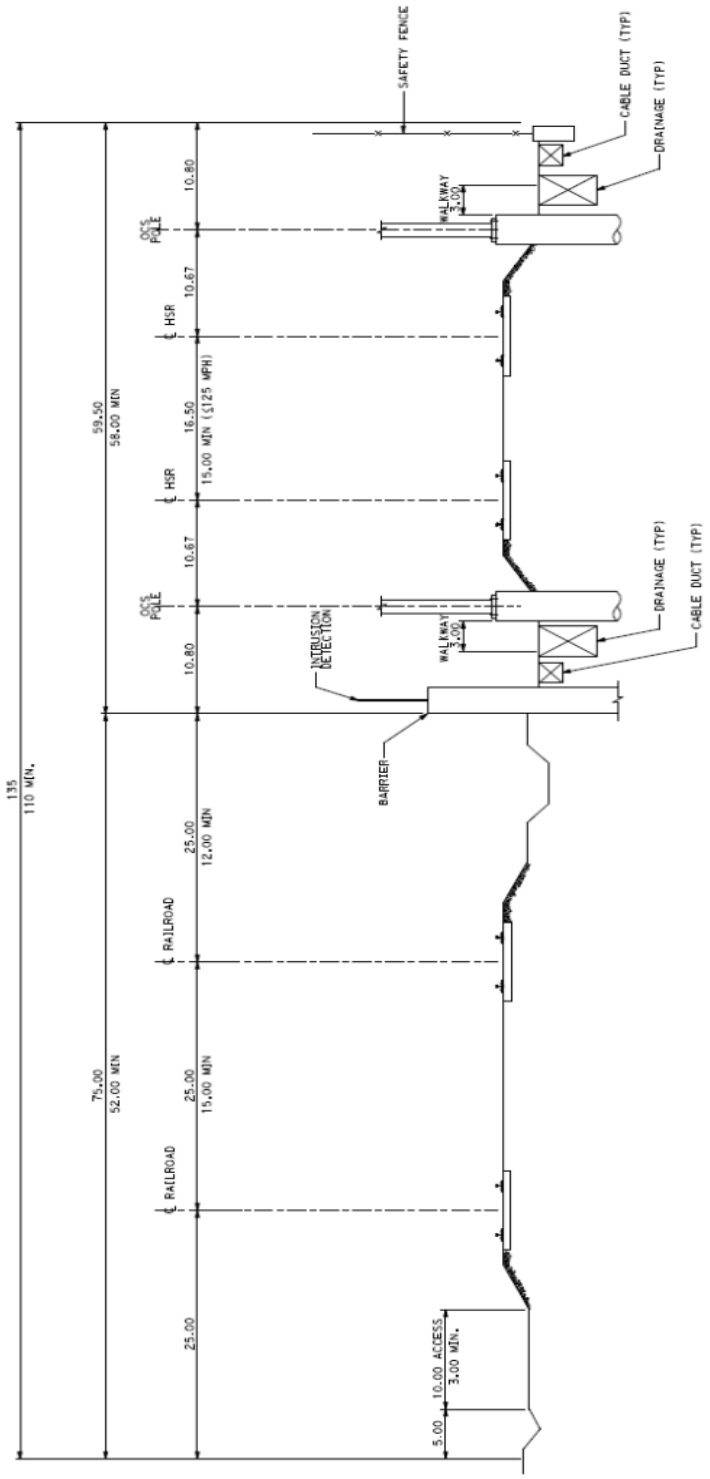
Source: California High-Speed Train: Project Environmental Impact Report (2010)

Figure 3-3: Trench/Retained Cut Typical Section



Source: California High-Speed Train: Project Environmental Impact Report (2010)

Figure 3-4: Dedicated Track within Existing Freight Corridor Typical Section



Source: California High-Speed Train: Project Environmental Impact Report (2010)

3.2.3.2 Track Geometry

The general basis of the route design was to follow best practices of the current high-speed rail liens (i.e., Japanese and European) as well as the guidance of the International Union of Railways (UIC) and the Manual of Railway Engineering of the American Railway Engineering and Maintenance Association (AREMA). The study also utilized the current American projects in California and Florida.

Shared Use

Shared Use geometry will be limited to the existing track horizontal and vertical geometry. For this feasibility study, the study did not perform any analysis associated with easing curves for better travel times, as this would have been too involved for this level study.

It is recommended that this be looked at further as a part of future detailed studies if the corridors are determined feasible for further analysis. Future engineering can study a number of factors to increase the travel times on the existing freight corridors including decreasing the degree of curvature, lengthening spirals, and increasing super-elevation.

Dedicated Use

Dedicated Use geometry was more in-depth due to greater design speeds (125 mph < 200 mph). Again, it was not within the scope of the feasibility study to create a detailed horizontal route. However, for this study, the study utilized the following geometry characteristics:

- Maximum degree of curve is 0°30'00";
- Maximum super-elevation is six (6) inches *(Applied super-elevation plus under balance)*;
- Maximum length of spiral is 1,500 feet (*based on 1.63*E $_a$*V and E_a=4", V=220 mph);* and
- Minimum length of a segment is 600 feet.

It should be noted that the spiral length stated above is stated as information only. Length of spiral is individually calculated for each curve based on type of spiral, design speed, applied super-elevation and degree of curve. It is outside the scope of the feasibility study to design each curve and determine an acceptable spiral length. This exercise will be required at a later phase of design.

For vertical grade, the only factor that was considered at the feasibility level was the corridor grade. The desirable ruling grade should be 1.25 percent with a maximum of 2.5 percent.

3.2.3.3 Interstate Interchanges

The vertical routes of intercity passenger rail, high-speed rail, and Maglev are usually less flexible in their rate of change and maximum percent grades than local roads and interstate highways. For example, intercity passenger rail systems typically have a maximum grade of two percent, compared to interstate highways with a maximum grade of four percent (with exceptions). Preferred operating grades for high-speed rail also do not exceed two percent, although current systems do have instances of grades up to six percent with lower operating speeds.

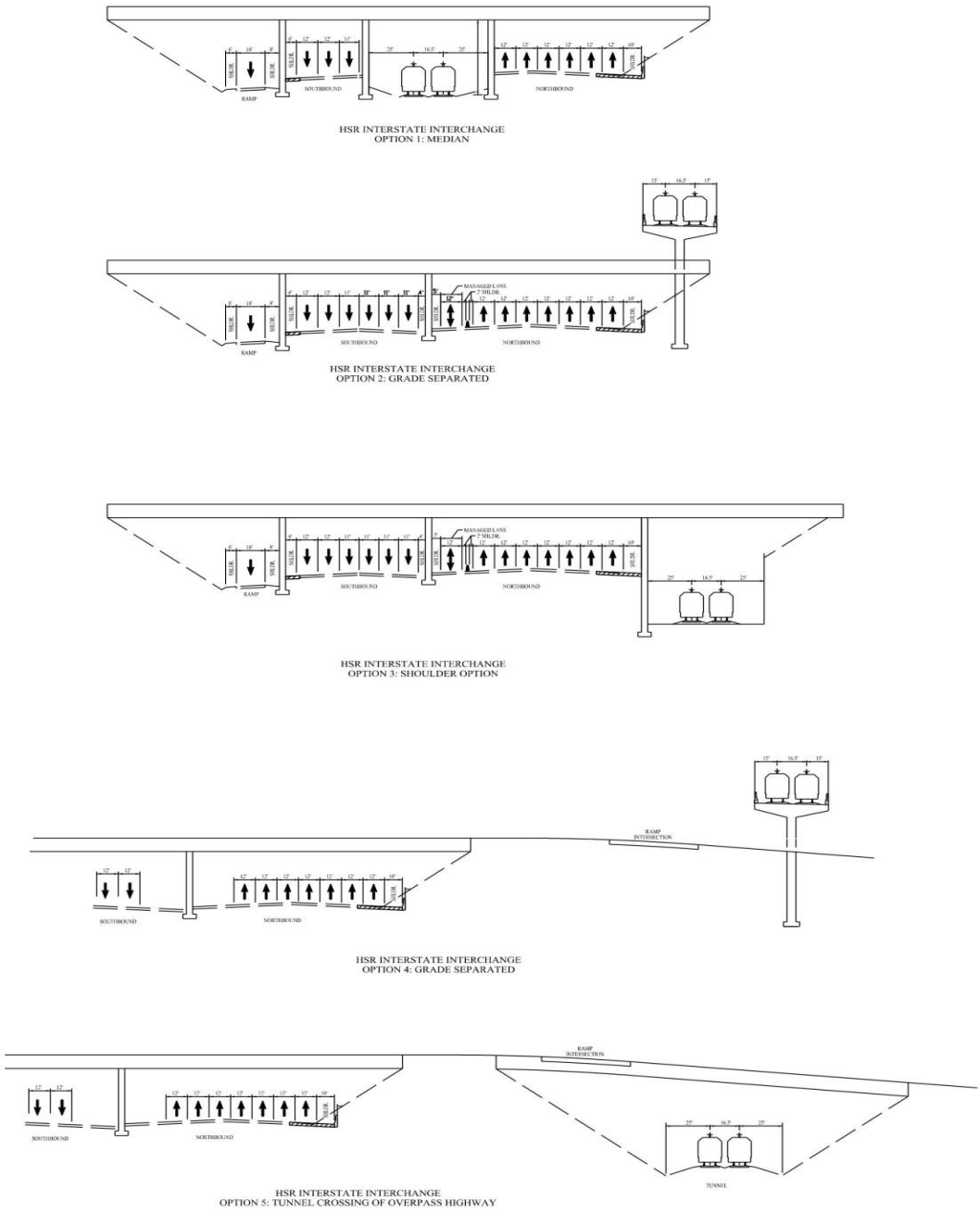
Costs for interstate interchanges can reach $100 million per grade separation, depending upon the characteristics of the interchange and the incoming route of the high-speed rail system. This large range in cost is due to the minimal percent vertical grades that allow high-speed rail systems to achieve their top speeds as mentioned previously. The minimal vertical change in route results in lengthy retaining walls and other approach structures and lengthy overpasses. Therefore, in most interchange scenarios, it is proposed that the highways and interstates are elevated over the high-speed rail route.

The Atlanta-Chattanooga-Nashville-Louisville and Atlanta-Birmingham Corridors both locate routes in rolling hills, eroded plateaus, and mountainous terrain resulting in a combination of interchange types. For this feasibility study, Table 3-16 and Figure 3-5 outline the interchange details and costs that were used based on the scenario.

Table 3-16: High-Speed Rail Interchange Options

Option	Description	Cost (in millions)
Flyover Structures	High-speed rail flyover shoulder to half multi-lane into interstate median	$95
	High-speed rail flyover half multi-lane into median to shoulder	$95
	High-speed rail flyover shoulder across entire multi-lane to shoulder	$150
Bridge	High-speed rail bridge over an interchange	$23
	High-speed rail bridge over and away from interchange	$23
Grade Under	High-speed rail grade under interchange	$93
	High-speed rail grade under intersecting roadway/ramp	$3

Figure 3-5: High-Speed Rail Interchange Option Details



Source: California High-Speed Train: Project Environmental Impact Report (2010)

3.2.3.4 At-Grade Crossings

Shared Use

In Shared Use corridors, the passenger operation involves passenger trains operating in sealed corridors. Sealed corridors affect every public and private at-grade crossing in order to maintain a specific level of protection.

For the purpose of this feasibility study, all public at-grade crossings will be upgraded to quad gates, flashing lights, and audible bells activated by constant warning time system that adjusts for different train speeds. All private crossings will be upgraded to single gates, flashing lights, and audible bells activated by the constant warning system.

This feasibility study assumes all at-grade crossings will remain open and that all crossings will need to be upgraded to the proposed audible bell warning system.

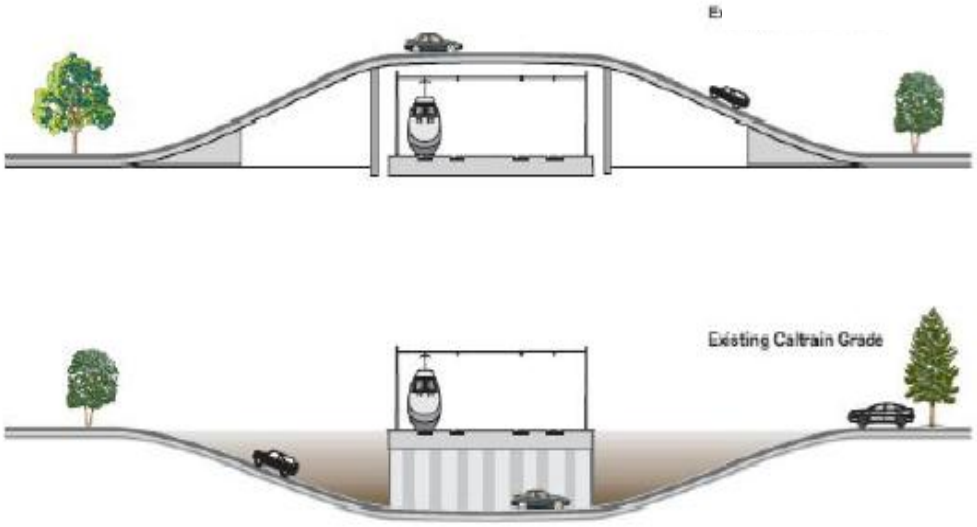
Dedicated Use

In Dedicated Use corridors, the passenger train operates within a corridor that has no at-grade crossings, eliminating any potential risk for interference between roadways and rail operations. The corridor will require every public and private at-grade crossing to be grade separated (or closed).

For the purposes of this feasibility study, all public at-grade crossings will remain open and will be grade-separated. Approach and various types of grade separations are discussed in Section 3.2.3.6. All private crossings will be closed and access will need to be realigned. It was determined at the beginning of the study that grade separating private crossings would not be cost effective.

This feasibility study assumes that all public crossings will be road over rail (Figure 3-6). This is primarily based on the fact that roadway horizontal and vertical geometry standards are much more flexible than typical railroad geometry standards. In addition, typical highways structures have lower associated costs than railroad structures.

Figure 3-6: Typical Grade Separations (Overpass and Underpass)



Source: California High-Speed Train: Project Environmental Impact Report(2010)

3.2.3.5 Earthwork

In Shared Use routes, where passenger trains share track with freight operations, the existing corridors may or may not have been graded for additional track infrastructure. Therefore, the standards for earthwork will vary along the corridor depending on the time period of the work. In Dedicated Use routes, the passenger operations will commence on new infrastructure where no previous earthwork (in most cases) has been completed.

Due to the variables and requirements of doing field investigations and evaluating terrain information, the study relied solely on information developed by Federal and State agencies to classify terrain. The following categories and definitions were used for all three corridors as outline by the Geometric Design Projects for Highways (ASCE Press, 2000):

- **Flat:** conditions where sight distances, as governed by both horizontal and vertical restrictions, are generally long or could be made to be so without construction difficulty or major expense;
- **Coastal:** conditions similar to Flat Terrain with the addition of wetland and marsh areas that may require frequent elevation;
- **Rolling:** conditions where the natural slopes consistently rise above and fall below the rail grade and where occasional steep slopes offer some restriction to normal horizontal and vertical route; and
- **Mountainous:** conditions where longitudinal and transverse changes in the elevation of the group with respect to rail are abrupt and where benching

and side hill excavation is frequently required to obtain acceptable horizontal and vertical route.

Unit Costs

The unit cost for each classification was based on the Coastal and Flat terrain types. These two types of terrains pose the least amount of earthwork challenges and are the basis of an ideal condition. Coastal and Flat terrain classifications will be considered FRA Standard Cost Category Item 10.06 Track Structure: At-Grade (grading and subgrade stabilization). Refer to Section 3.2.3 for detailed unit cost development.

At the feasibility study level, the study had limited information on existing elevations, existing and proposed vertical track routes, soils and several other variables related to earthwork. Therefore, the study used a factor approach for Rolling and Mountainous terrain classifications. The following factors were applied:

- Rolling: Factor of 1.5
- Mountainous: Factor of 3

These terrain locations will be classified under FRA SSC 10.05 Track Structure: Cut and Fill (>4 feet height/depth) as 10.05.01 Rolling and 10.05.02 Mountainous.

3.2.3.6 Structures

Table 3-17 outlines the structural costs along each corridor. All costs, except the viaduct, are calculated based on Cost/Linear Foot of Track. Bridges built for double tracks should multiply by two to account for the second track.

Table 3-17: Structure Costs

Structure	Assumption	Unit Cost (in millions)
Rail over Interstate	196-foot span with a center pier, using Deck Plate Girders	$1.76
Rail over major roadway	156-foot span with a center pier, using Deck Plate Girders	$1.40
Rail over minor roadway	72-foot clear span, using Deck Plate Girders	$0.68
Rail over major waterway	120-foot clear span, using Deck Plate Girders. If waterway can be traversed with 120-foot span, enter as multiple bridges placed end to end	$1.10
Rail over major water way (greater than 120-foot spans)	120-150 foot span using Through-Plate Girders	$0.012/Linear Foot of Track
	150-350 foot span using Through Truss	$0.025/Linear Foot of Track
Rail over minor waterway	24-foot clear span using Concrete Slab Bridge. If waterway can be traversed with 24-foot spans, enter as multiple bridges placed end to end.	$0.11
Viaduct Guideway	All viaducts will be built 50-feet wide to accommodate two tracks, for either immediate or future use	$0.009/Linear Foot of Track

Costs were developed using the following planning-level unit costs by structure type in Table 3-18. Costs are by linear foot of single track. For bridges containing two tracks, costs should be doubled to calculate a cost for the linear foot of the bridge.

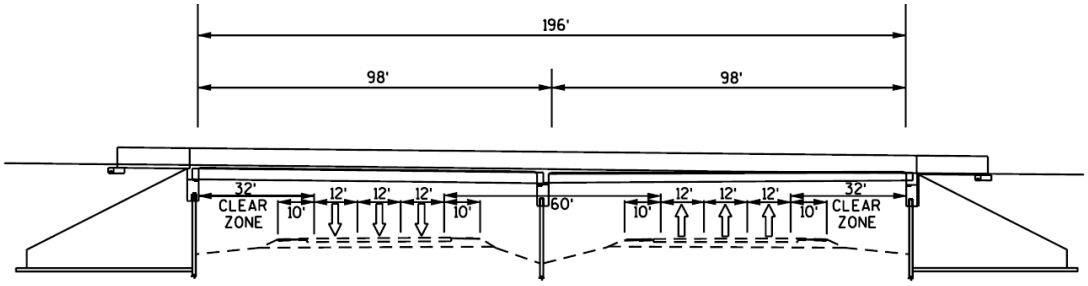
Table 3-18: Unit Cost by Structure Type

Structure Type	Maximum Span (feet)	Cost/Foot of Track
Concrete Slab	24	$4,500
30” Double Cell Box Beam	35	$5,500
42” Double Cell Box Beam	49	$6,000
Wide Flange Deck Girder	65	$7,000
Deck Plate Girder	120	$9,000
Through Plate Girder	150	$12,000
Truss	350	$25,000

For bridges crossing roadways, the structures are sized to span the roadway and the roadside Clear Zone. This is specified as the desired practice whenever practical, in

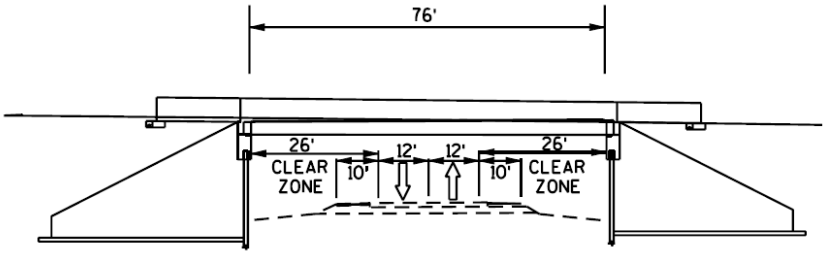
the GDOT *Bridge and Structures Design Policy Manual*, Section 2.3.2, and the AASHTO's *Roadside Design Guide* and is detailed in Figure 3-7 through Figure 3-11.

Figure 3-7: Interstate Crossing



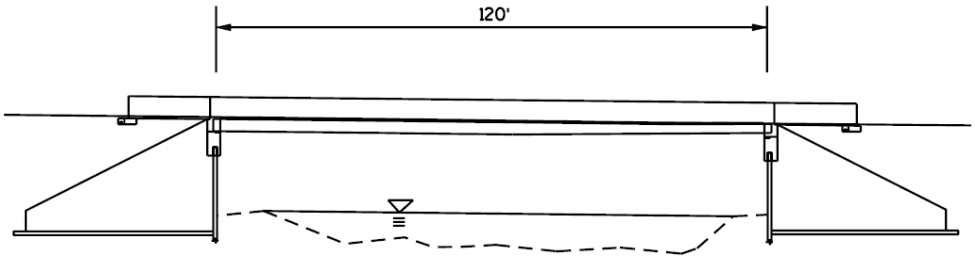
- Uses a 156-foot span with a center pier, using Deck Plate Girders
- $9,000/linear Foot of Track
- 156' X $9,000/FT of Track = $1,404,000

Figure 3-8: Minor Roadway



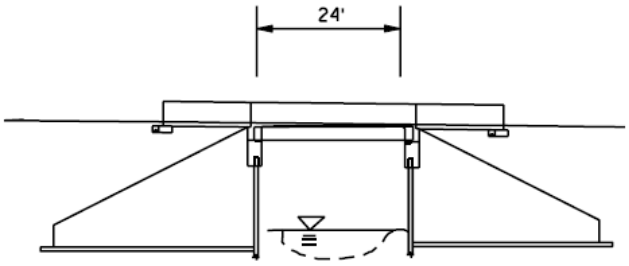
- Uses a 76-foot clear span, using Deck Plate Girders
- $9,000/Linear Foot of Track
- 76' X $9,000/FT of Track = $684,000

Figure 3-9: Major Waterway



- Uses a 120-foot clear span, using Deck Plate Girders
- $9,000/Linear Foot of Track
- 120' X $9,000/FT of Track = $1,080,000

Figure 3-10: Minor Waterway

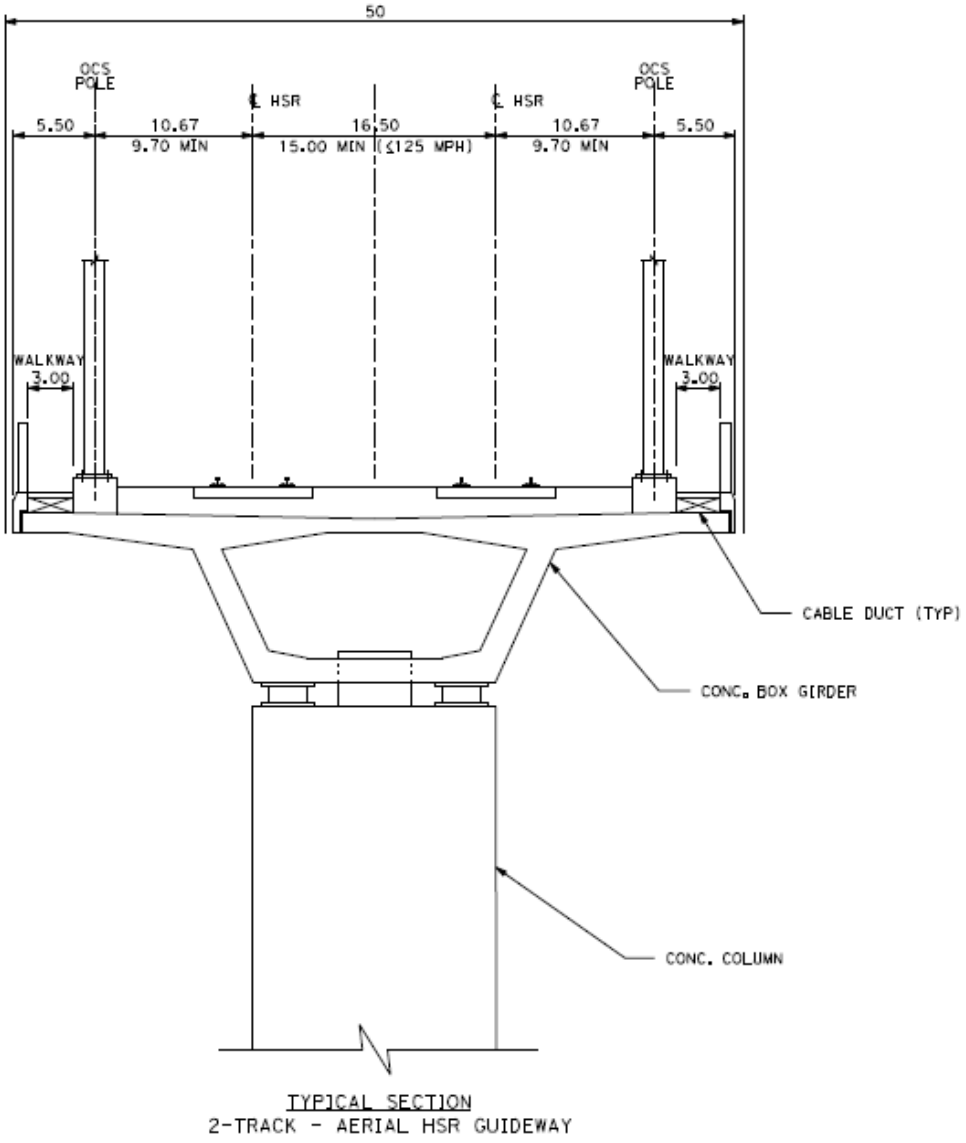


- Uses a 24-foot clear span, using Concrete Slab Bridge
- $4,500/Linear Foot of Track
- 24’ X $4,500/FT of Track = $108,000

If spans are required that are greater than 120 feet, use the following:

- Spans 120-150 feet, Through-Plate Girders: $12,000/Linear Foot of Track
- Spans 150-350 feet, Through Truss: $25,000/Linear Foot of Track

Figure 3-11: Viaduct Guideway



Source: California High-Speed Train: Project Environmental Impact Report (2010)

For the purposes of this planning level effort, viaducts are considered to be structures that consist of many short spans that are typically the same length, built over land, in easily accessible urban areas. Structures of this type have receptive spans and substructures. Because of this, viaducts offer a significant cost savings due to economies of scale for bridge components and efficiencies for construction.

- Uses a 60-foot span with Concrete Box Girder
- $4,418/Linear Foot of Track
- All viaducts can accommodate two tracks
- 2 Tracks X $4,418/FT of Track = $8,828/Linear Foot of Bridge

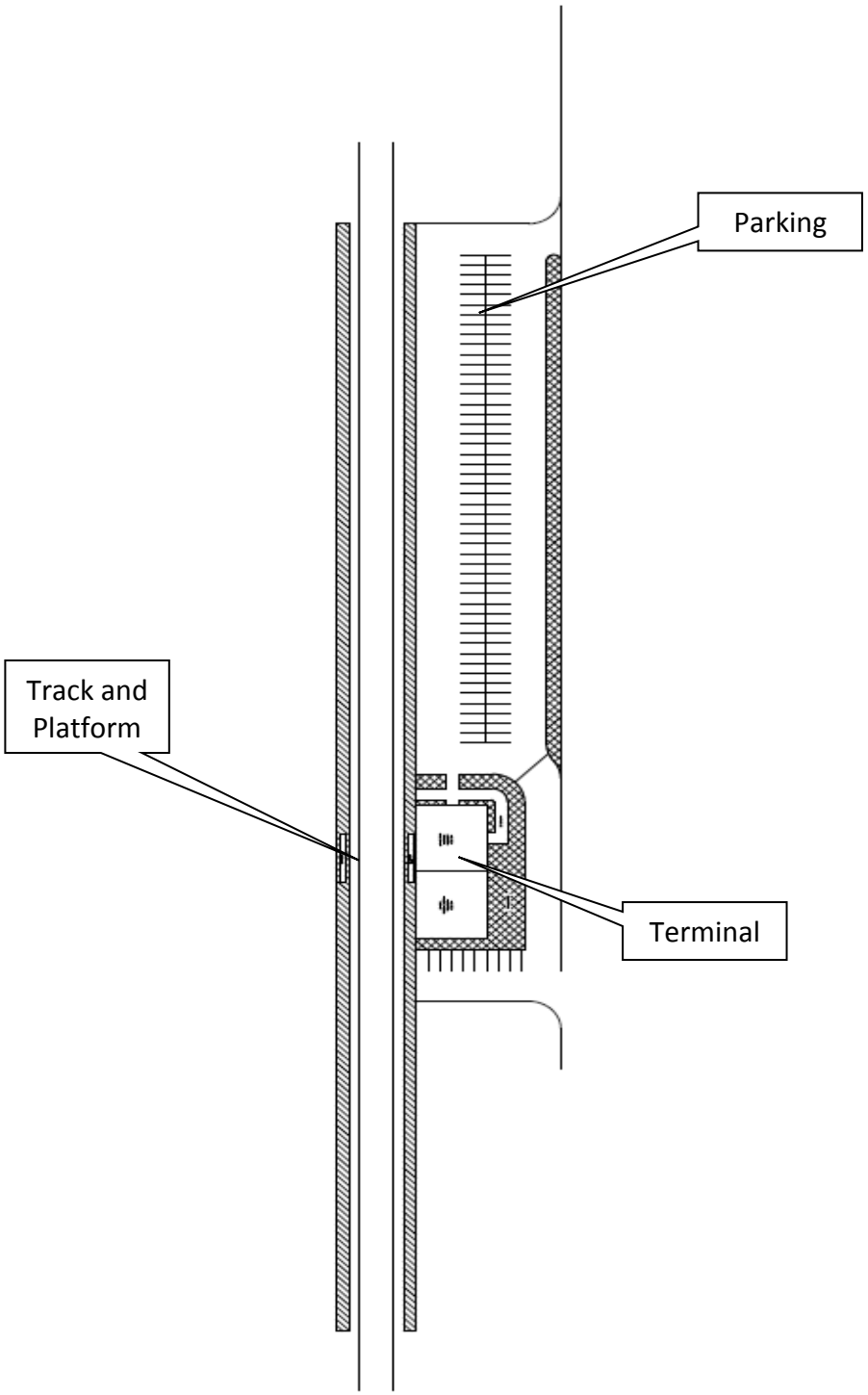
3.2.3.7 Stations

The study assumes that unless plans are underway for a proposed station, the station buildings will be based on a typical Intermediate footprint. Unit of measure was based on square foot of the proposed building and covers the construction of the station. Additionally, costs were generated for elevators, platforms, fare collections and other miscellaneous items. For larger stations that are proposed under alternative plans, the total cost will be assumed for this feasibility study. These stations include:

- MMPT;
- H-JAIA
- Birmingham Multimodal Terminal; and
- Jacksonville Multimodal Terminal.

For the purposes of this feasibility study, the study has assumed all Intermediate stations (those not already under current plans) will be classified as Amtrak "Medium" stations and will be approximately 6,600 sq. ft. buildings. Based on other studies and sources for typical building construction costs, the unit cost for stations was $215/sq. ft. It should be noted, that this cost was considered Conservative in nature. At this time, no elevators or escalators and overhead bridges above the track are included in the station base cost. If the Intermediate station requires any of these items, they will need to be added into the correct categories in subsequent studies. Figure 3-12 illustrates a typical Intermediate station cost.

Figure 3-12: Intermediate Station Footprint



3.2.3.8 Right-of-Way/Real Estate

The feasibility study evaluated five uses of property; existing railroad rights-of-way, highway rights-of-way, the GRIP network in Georgia, power and other utility corridors and "greenfield" routes.

The costing approach for Shared Use situations involved determining the property value of the existing railroad right-of-way based on adjacent land values. This land value was included in corridor cost estimates to address the public use of the privately-owned railroad right-of-way. The study assumed construction of new passenger tracks can generally occur inside existing railroad right-of-way. For situations where new passenger track does not fit inside the railroad right-of-way, an assumed additional 50-ft of property was added. In isolated situations where more detailed engineering will be done at the feasibility level, this approach was modified to better reflect the specific area.

The use of state-owned highway rights-of-way will generally have no cost impact. The costing methodology assumes that right-of-way or air rights will be granted by the various state transportation agencies at no cost to the passenger rail system.

The costing approach for existing utility rights-of-way will also be based on adjacent property values. A right-of-way width of 100 feet was assumed for passenger rail service. Ultimate compensation will be determined during negotiations with the host utility company.

Right-of-way cost approach for Dedicated Use (greenfield) situations will be based on existing property values. A right-of-way width of 100 feet was assumed for passenger rail service. For "last-mile" situations, the study used engineering judgment to decide if two new dedicated tracks can be constructed parallel to the existing freight tracks. The assumption is that an agreement can be obtained with the existing freight railroads to build proposed future capacity improvements. The general approach will be to parallel the existing freight centerline of track at a specified distance.

The study utilized the GDOT Office of Planning right-of-way value database and other similar databases in neighbor states as appropriate to determine property values. The use of property was separated into the following categories in Table 3-19.

Table 3-19: Real Estate Cost Items

40.07	Purchase or Lease of Real Estate		
	Subcategory	Item	Definition
	40.07.01	Railroad Owned – Urban	Corridor route on urban railroad owned property
	40.07.02	Railroad Owned – Rural	Corridor route on rural railroad owned property
	40.07.03	Utility Owned – Urban	Corridor route on urban utility owned property
	40.07.04	Utility Owned – Rural	Corridor route on rural utility owned property
	40.07.05	State Owned	Existing interstate, highway and GRIP rights-of-way
	40.07.06	Land Acquisition – Urban	Purchase of urban designated property
	40.07.07	Land Acquisition – Rural	Purchase of rural designated property

3.2.3.9 Signaling and Communication

Shared Use

The existing freight corridors already have signaling and communications in place. These systems could be Track Warranted Control (TWC), Automatic Block Signals (ABS), or Centralized Traffic Control (CTC).

FRA requires all signaling and communications for passenger service to have Positive Train Control (PTC) signal and communication network. Currently, no existing freight railroad has implemented PTC. Therefore, all existing railroad signaling and communications along the three corridors will require upgraded or replacement equipment in order to implement the Shared Use passenger service.

Upgrading or replacing existing signaling will involve new signals, signal houses, relays, cable, pull boxes, track circuits, etc. The following assumptions were used to determine the required signal improvements:

- Any existing freight line with ABS or TWC will receive a complete new signaling system;
- Even in areas where there is an existing CTC system in place, the communications will need to be fully upgraded to handle a new full PTC system.

Most failures of PTC systems have been caused by the communication network and not the signals. Therefore, for the purpose of this feasibility study, the study assumed that new communications will be required regardless of the existing communication system.

Dedicated Use

Since the Dedicated Use routes are primarily greenfield corridors, the study assumed new PTC signaling and communication will be required for the entire route.

3.2.3.10 Cost of Vehicles

Vehicle unit cost estimates, based on developed service plans, was prepared for three generic vehicle technologies: 1) 90-110 mph diesel-electric locomotive and tilt coach technology; 2) 150-220 mph electric multiple unit (EMU) technology; and 3) 250-300 mph Maglev technology.

The diesel-electric technology used in shared-use passenger and freight corridors will be FRA Tier I compliant. Other technologies will operate on dedicated right-of-ways and meet European crashworthiness standards. Vehicle purchase costs (including design) will be included in FRA standard cost category 70 on a cost-per-train set basis. The train set seating capacity was based on the service plan developed for each corridor (typically 400 to 500 seats) and the train set will be ADA accessible including restrooms. Each train set will include a dining/bistro car. All train sets will feature standard amenities including 2x2 seating, video displays, automated station announcement/displays, audio entertainment availability, Wi-Fi internet access and 110 volt power at each seat. Costs for an appropriate number of spare cars and replacement parts will also be included in the estimate.

Costs were blended from several sources as appropriate, and escalated to 2010 dollars using *Engineering News Record* Cost Indices. Sources for the cost estimates include study vehicle experience on the Wisconsin DOT Milwaukee-Madison Corridor Project, the Illinois Chicago to St. Louis Corridor; the California High-Speed Rail Authority Program; the Florida DOT Tampa to Orlando HSR Corridor Program; and other public and proprietary sources.

Representative Train Technologies

1. *90-110 mph Single Level Diesel Electric Tilt Technology*

Figure 3-13: Talgo Series 8



- Talgo Series 8 tilt coaches and two push-pull "Next Generation" 3,000 horsepower, lightweight locomotives
- 184 meters in length, 397 passenger capacity

2. *150-220 mph Single Level Electrified Tilt Technology*

Figure 3-14: Alston AGV and Siemens Velaro EMU (left to right)





- Alstom AGV EMU, 196 meters in length, 450-500 passenger capacity
- Siemens Velaro E EMU, 200 meters in length, 400-600 passenger capacity

3. *250-340 mph Transrapid Maglev Technology*

Figure 3-15 Transrapid Maglev



- 153 meters in length, 600-650 passenger capacity

3.2.3.11 Professional Services

The costing approach for professional services was based on percentages of the construction cost for categories 10 through 60. Cost category 70: Vehicles will be excluded because professional services for vehicle procurement, design, and manufacturing will be included in the cost of the vehicles.

These percentages are common practice percentages for a feasibility study. The following table (Table 3-20) shows the assumed percentage values that were used for the feasibility study:

Table 3-20: Professional Services Percentages

80 Professional Services		
	Item	**Percentage**
80.01	Service Development/Service Environmental	2%
80.02	Preliminary Engineering/Project Environmental	4%
80.03	Final Design	4%
80.04	Project Management for Design and Construction	4%
80.05	Construction Administration & Management	6%
80.06	Professional Liability and other non-construction insurance	0%, negligible
80.07	Legal; Permits; Review Fees by other agencies, cities, etc.	2%
80.08	Surveys, testing, investigation	2%
80.10	Start Up	Not applicable

3.2.3.12Contingencies

The study approached contingencies the same way the FRA grant applications approach contingencies during the funding application process. The FRA process allows for different contingencies applied to different cost categories. For the purpose of this feasibility study, the study applied a constant contingency (30 percent) value to the various categories. However, for future refinements and investigations the contingencies for each of the categories can adjust with this type of methodology.

The contingency factor will be large at the conceptual engineering level (generally 30 percent with allowances for special cases). This is primarily based on the fact that average unit costs were used and detailed design analysis was not done.

3.2.3.13Phasing Scenarios for Capital Costs

Once capital costs estimates were complete, the study examined phasing scenarios for the capital costs in order to reduce the initial public investment into the construction and delivery of high-speed rail. Other operational characteristics were not included in these phasing scenarios; therefore, there are no details that support the phases. Detailed capital cost and delivery of service phasing will be more appropriate during the NEPA process, but an introduction to the concept of phasing is included as a part of this feasibility analysis.

3.3 RIDERSHIP AND REVENUE METHODOLOGY

This section presents the ridership and revenue forecasting methodology. The key feature of the methodology is the use of binary diversion models to calculate high-speed rail ridership. Each diversion model computes, for each combination of trip

purpose, market segment and current model, the probability that a traveler would choose high-speed rail over its current model of travel as a function of the respective modes' service attributes. These probabilities are then multiplied by the trip volumes of the existing modes to predict the volume of travel that will divert to high-speed rail. Induced (new) travel on the high-speed rail mode is also calculated using a generalized cost based on travel utility function directly related to the diversion model. Total high-speed rail ridership is obtained by summing the diverted and induced demand volumes for the individual market segments.

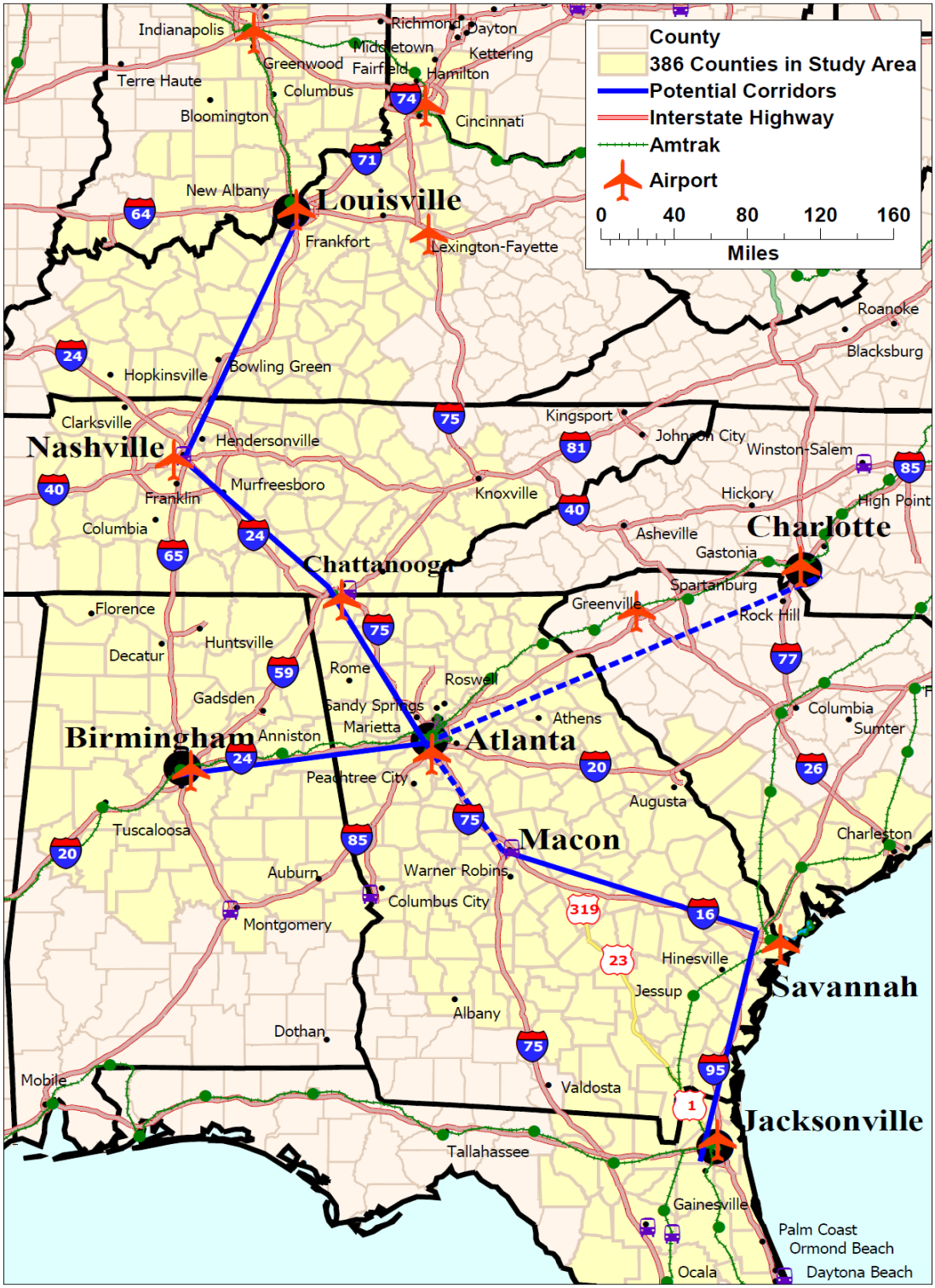
This section begins with a brief description of the geographic scope and the zoning structure used for the demand forecasting, followed by an analysis of the potential markets considered and ending with a presentation of the demand forecasting modeling methodology.

3.3.1 Geographic Scope and Zoning Structure

The demand forecasting task covers a geographic area that follows the three corridors and extends approximately 50 miles on either side of the proposed routes, which is a typical planning assumption for access catchment for high-speed rail services. However, the 50-mile distance is indicative rather than absolute, and was adjusted as appropriate in specific instances to accommodate, for example, important population centers located just outside the 50-mile cut-off.

The area within the geographic boundary created by the process described above was split into a number of zones. Given the size of the study area and the multiple corridors, the zoning structure was at the county level. The total number of counties (zones) including within the study area for all three corridors was 386 zones. This definition of zone provided a good balance between having sufficient granularity to reflect the differences in level of service characteristics for residents of adjacent areas, and the need to model a large area for a feasibility study. The counties included within the study area formed the geographic basis for all subsequent travel demand forecasting analysis performed as a part of this feasibility study. Figure 3-16 shows the straight line routes for the three corridors and counties included as a part of the study area.

Figure 3-16: Geographic Study Area



3.3.2 MARKET ANALYSIS

The first step in forecasting the potential ridership and revenue of the proposed rail service is to estimate the current in-scope travel markets inside the study area. The in-scope travel markets are the key travel markets competing with the proposed high-speed rail service. The three main travel markets have been identified as:

- The inter-urban travel markets;
- The local travel markets; and
- The connect air market.

3.3.2.1 Inter-Urban Travel Market

Inter-urban travel is longer distance travel between major metropolitan areas within the study area (e.g., travel between the counties of the Atlanta urban area and the counties of the Chattanooga urban area). There are three travel markets from which the proposed high-speed rail services my draw their patronage from:

- Automobile travel;
- Bus service; and
- Air service.

Each of these travel markets are described in more detail. However, the quantitative estimates for these markets are presented in each subsequent section describing the corridor-specific results, later in this report.

Automobile Travel

Automobile is the dominate travel mode in the three study corridors. Unfortunately, up to date and reliable inter-urban travel volume data is not available anywhere for the U.S. unless original new data collection efforts are undertaken. Therefore, this study depends on existing sources for quantifying the automobile travel market. Some information exists on specific aspects of inter-urban travel (such as journey-to-word data from the 2000 U.S. Census and 2006-2008 American Community Survey). In the absence of original data collection, the best source of information on inter-urban automobile volumes within these rail corridors is still the 1995 Automobile Travel Survey (ATS). In addition, up-to-date traffic count data are available on major roadways and interstate, which the study used to validate automobile travel volumes calculated from the ATS.

Bus Service

There are a variety of bus services that operate in the corridors. Commercial bus operators are generally reluctant to release ridership numbers. Nevertheless, in

the absence of any information from the operators, approximate ridership estimates based on bus capacity and load factors were prepared for this study. It should be noted that charter bus operators have been excluded from the analysis.

Direct Air Service

The study area is served by a number of large airports including Atlanta, Chattanooga, Birmingham, Jacksonville and Nashville. Of particular importance is the large airport hub, H-JAIA, the busiest airport in the U.S., and a major hub for Delta and AirTran airlines. This airport services as a gateway for passengers throughout the southeastern U.S. to connect to numerous domestic and international destinations, as well as a connection point for many longer-distance trips.

The other airports in the study area are primarily served by feeder flights to hubs that serve various carriers; this obliges passenger traveling to other destinations to make a connection. Services between these airports are provided by both mainline and regional aircrafts.

It is evident that the largest air markets are those that include H-JAIA. Other significant travel markets include direct air service between Jacksonville, FL and Nashville, TN, Jacksonville, FL and Birmingham, AL and Birmingham, AL and Louisville, KY, each with more than 20,000 passengers in each direction as seen from Q4 2009 to Q3 2010 air volumes.

The point-to-point air markets between the major airports in the study area are presented in subsequent sections describing the corridor-specific travel patterns later in this report.

3.3.2.2 Local Travel Market

Local travel is shorter-distance travel within the different urban areas of the study area. For the Atlanta urban area, this includes travel within the 20-county metropolitan area (ARC area). For the rest of the study area, local travel is defined as travel within a 30-mile radius of each of the proposed rail stations. There are three main types of local trips considered for this feasibility study:

- Journeys to work (most likely to originate in the suburbs and terminate in the city centers);
- Local trips for leisure purposes; and
- Local trips to access the airport.

3.3.2.3 Connect Air Market

There are a number of airports in the study area where it may be possible that a new high-speed rail service may change the purpose of the airport, and allow for passenger to start their air journey at these airports. To establish the potential size of these markets, the study examined data on the number of total passengers traveling between the key city pairs. This differs from the direct air market presented earlier which shows just eh passengers traveling between original and destination airports (both located within the study area), and does not include connections to flights to other national and international destinations.

Of all of the key airport pairs in the study area, most include H-JAIA, which reflects the importance of H-JAIA as a hub to air travel in the region. Comparing total passenger counts on the air routes in the study area with the true origin-destination traffic on the same airport pairs demonstrates how many of the passengers are connecting. This comparison shows that much of the connecting traffic involving H-JAIA (particularly the short-haul routes such has H-JAIA-Chattanooga and H-JAIA-Birmingham) and that the connections are significantly lower for airport pairs not involving the H-JAIA hub.

With proposed rail stations at H-JAIA and other study area airports, high-speed rail will be available option to attract air trips between these airports which are then ultimately connection to/from airports outside the study area. Out demand forecasting methodology incorporates the possible diversion of these trips to the proposed rail modes.

3.3.3 DEMAND ESTIMATION MODEL

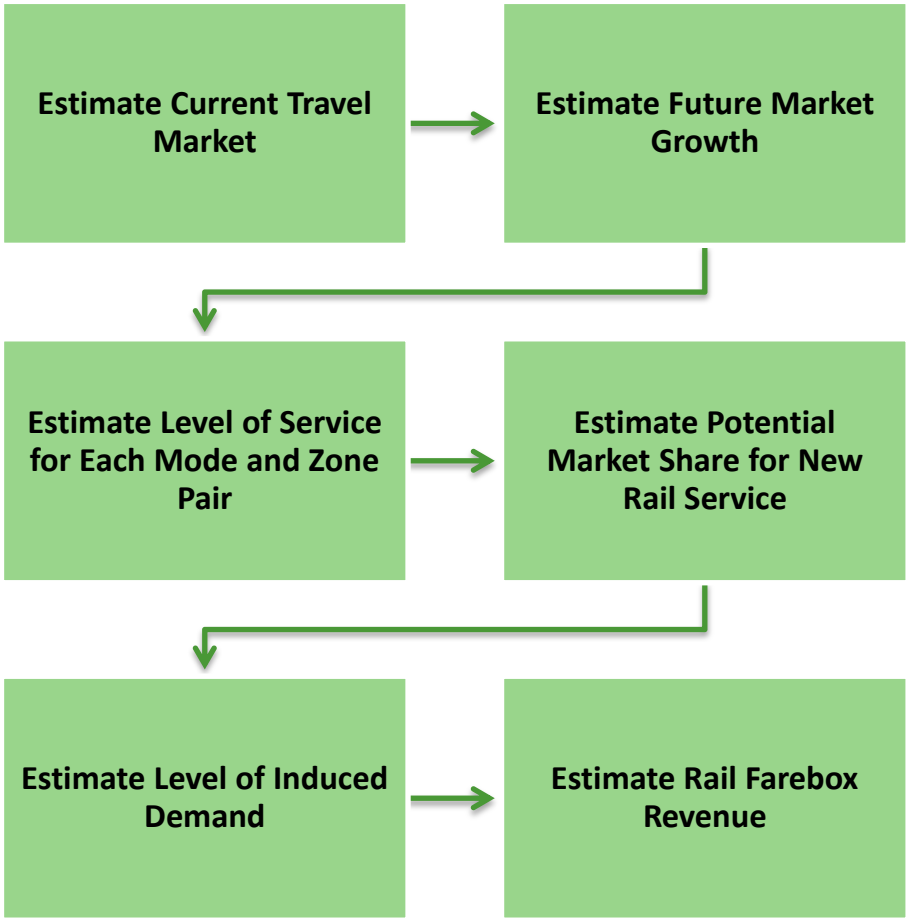
The study used the following approach to forecast the potential ridership and revenue of the proposed high-speed rail services through six broad steps:

1. Estimate the current in-scope travel market (including trips by air, bus, train, and automobile). These estimates are developed on a zone-to-zone basis as outlined in the next section. They are also disaggregated by trip purpose.
2. Estimate how this market will grow in the future. These estimates will reflect forecast socio-economic trends (such as changes in population and employment) and assumptions regarding the sensitivity of changes in trip making behavior to these trends.
3. Estimate the Level of Service (LOS) characteristics for each mode and each zone pair. For a trip by common carrier (including the proposed rail service), this takes into account the in-vehicle time, frequency of service, fare, and time/cost needed to access and egress the mode's station from the trip's actual origin and destination respectively (e.g., the traveler's home, place of work or leisure destination). For a trip by automobile, this takes into

account the origin-destination travel time (including any delays due to road congestion) and vehicle operating costs (largely fuel cost).

4. Estimate the potential market share that the new service will capture (i.e., the ridership). This is estimated using the LOS characteristics calculated in the previous step and the established mode choice models and modeling methodology.
5. Estimate the level of induced demand. These are new inter-urban trips that are not made in the no-project situation, but that occur as a result of the improved service provided by the proposed project.
6. Estimate the rail farebox revenue. This is calculated using the ridership calculated in the previous two steps and the fare assumptions used for the new rail service from Step 3 above. Note that the level of ridership is sensitive to the level of fare.

Figure 3-17: Demand Estimation Model Process



These forecasting steps pre-suppose a number of additional tasks that the study carried out. These include collecting and analyzing data; preparing input assumptions and tables; specifying, building and testing the forecasting model; producing and reviewing forecasts; and running sensitivity tests.

3.3.3.1 Step 1: In-Scope Travel Market

The first step in the high-speed rail ridership forecasting process was to forecast total intercity air, automobile and bus travel between the major metropolitan areas making up each corridor.

Intercity Auto

There is no standard up-to-date source of information about inter-city auto trip making in the U.S. that is sufficiently detailed to be used in the project-level forecasting; however, the accuracy of the auto trip tables strongly influences the accuracy of the ridership and revenue forecasts for the new high-speed rail services. Conducting new original data collection efforts including survey work to establish inter-city automobile travel patterns and levels was not within the scope of this feasibility study.

For this study, the study adopted a direct demand modeling approach to calculate automobile travel-related data within the study area. While the accuracy of trip tables created in this manner was likely lower than that of trip tables prepared from original data collection, the accuracy is nonetheless expected to be suitable for a feasibility-level study. The study developed econometric travel demand models which forecast total county-to-county auto trips based on changes in the underlying socioeconomic and level of service characteristics (both are important drivers of travel) of and between the counties.

Auto travel was estimated with the help of linear regression analysis using historical auto volumes between the largest Metropolitan Statistical Areas (MSAs) as the dependent variable, and socioeconomic and level of service measures as the independent or explanatory variables. The general specification of the model is:

The model was estimated using historical auto trip data for trips to and from the major MSAs from the latest 1995 ATS. The Woods and Poole economic forecasts provided historical and future forecasts of socioeconomic variable such as population and employment. Travel distance information was obtained from the network geographic using a network based model.

Bus Service

Commercial bus operators are generally reluctant to release ridership numbers. However, in the absence of any information from the operators, approximate

ridership estimates based on bus capacity and load factors were prepared. In order to calculate bus travel volumes from the supply side data in the study area, a seating capacity of 50 seats per bus and a 50 percent load factor were assumed.

Local Air and Connect Air

The Bureau of Transportation Statistics (BTS) website publishes U.S. air carrier statistics, monthly data reported by certified U.S. air carriers. The data contains information on passengers transported with both origin and destination airports are located within the U.S. and its territories. Local air and connect air volume data were prepared using the DB1B market and T-100 Segment database from the BTS. The airline origin and destination survey (DB1B) is a 10 percent sample of airline tickets from reporting carriers[14]. The market data provides information on origin and destination airports, true origin-destination passenger volumes and fares. The T-100 segment data includes data on passenger volume, total available seats and scheduled flight departures for all air trip segments. Airport-to-airport volumes were then allocated to the county pair level using socioeconomic information. The trip purpose (business vs. non-business) distribution was estimated using data on trip-making characteristics from the U.S. Census Bureau, county business patterns, and Woods and Poole data.

Local Trips

Local trips were estimated based on two sources. For the Atlanta-metro area, the study based the analysis on results of the Atlanta-Chattanooga Tier I EIS completed in 2010. This was done to make the best use of significantly more detailed modeling of the local trips in response to similar proposed high-speed rail service in the Atlanta-Chattanooga EIS[15]. For all other areas, the 2000 U.S. Census Journey to Work data was scaled accordingly based on Woods and Poole employment growth. The typical ratio of commuting trips to leisure trips was used to size the overall local trip markets within each major urban area.

[14] http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0

[15] The EIS involved the use of the Atlanta Regional Commission (ARC) model and the associated input data to predict local high-speed rail ridership in the Atlanta metro area.

3.3.3.2 Step 2: Market Future Growth

Auto

Future auto travel was predicted using the econometric auto total travel demand models described earlier. Future travel was forecasted through the application of these models, adjusted to match historical traffic growths in the region.

Air Travel (Direct and Connect Air)

Air trips (both direct and connect) were assumed to increase at the rate of enplanement growths at the study area airports as forecasted by the Federal Aviation Administration (FAA) Terminal Area Forecast.

Bus Travel

Bus trips were assumed to increase at the rate of population growth of the metropolitan area served by the high-speed rail system.

3.3.3.3 Step 3: Level of Service Characteristics

To estimate the entire highway based travel times including county to county auto travel time and access and egress times to/from the airports and stations (both rail and bus), the study used a combination of two common approaches in travel demand forecasting. The first was to prepare (code) a representation of the networking using network modeling software (i.e., Cube Voyager) and use the highway network to estimate free flow travel times. The second approach was the estimate the times using actual travel time data sources from commercial trip planning software (e.g., MapQuest and Google Maps) supplemented with real time travel alert websites (e.g., www.sigalert.com, www.beathetraffic.com). These two techniques were combined with other assumptions (regarding vehicle operating costs, running times, fares or service frequencies) to estimate various mode specific levels of service (LOS) characteristics between all relevant county pairs. In addition, travel times calculated from commercial trip planning software were used to check the travel times obtained through network modeling software.

Irrespective of the method used to calculate the LOS characteristics, the Cube Voyager network modeling software was used to develop the study forecast, as it offers the capability to hold and manipulate the large volumes of data created in preparing demand forecast, and has other useful functionality.

Following is a brief summary of the LOS characteristics for the various mods that were used to estimate rail ridership forecasts for this study.

Intercity Auto

Auto travel times between county pairs were estimated using a combination of network based and real-time traffic data as mentioned above. Automobile travel distances and times between the counties from commercial trip planning software were also used as supporting information in order to better reflect speed limits and representative congestion levels on each route. Highway congestion was measured using the Texas Transportation Institute (TTI) index and congestion growth into the future yeas was based on historical TTI trends. Automobile operating costs of 15 cents/mile for non-business and 55 cents/mile for business travelers were used.

Local Air and Connect Air

Airport to airport journey times and frequencies were estimated based on individual airport pair statistics from flight search engines. A terminal processing time of 45 minutes was used to represent the total time spend (including security delays) at the airport terminals before boarding a flight. Access/egress times to/from the nearest airport to the origin/destination county were calculated based on highway access using network models as described above. Airport to airport airfares were calculated based on data from BTS's DB1B segment database.

Rail

High-speed rail characteristics such as proposed stops, station to station running times and frequencies were based on the assumptions adopted by the engineering study which were the results of research on rail services and stops in other similar studies, detailed stakeholder feedback, terrain analysis and simulation of train operations, etc. Distance based rail fares (separate for Shared Use and Dedicated Use services) were used with a fixed boarding fee based on research of several existing Amtrak corridor services and a few other international high-speed rail systems. For the Shared Use and Dedicated Use high-speed rail services, distance based fares of $0.28 per mile and $0.40 per mile (with a $5.00 boarding fee) were used, respectively as the base fares for the three corridors.

Bus

Bus level of services such as frequency, travel time and fares were obtained from the bus operator websites.

Service frequencies are generally low, although services between the major metropolitan areas are more frequent. Fares are, broadly speaking, between $30 and $70 and correlated with the trip duration. Travel times are highly variable and reflect stopping patterns and/or transfer times.

Local Trips

Diversions of local trips to high-speed rail were estimated based on using diversion percentages calculated for the intercity markets. Hence, no LOS characteristic was needed for this market segment.

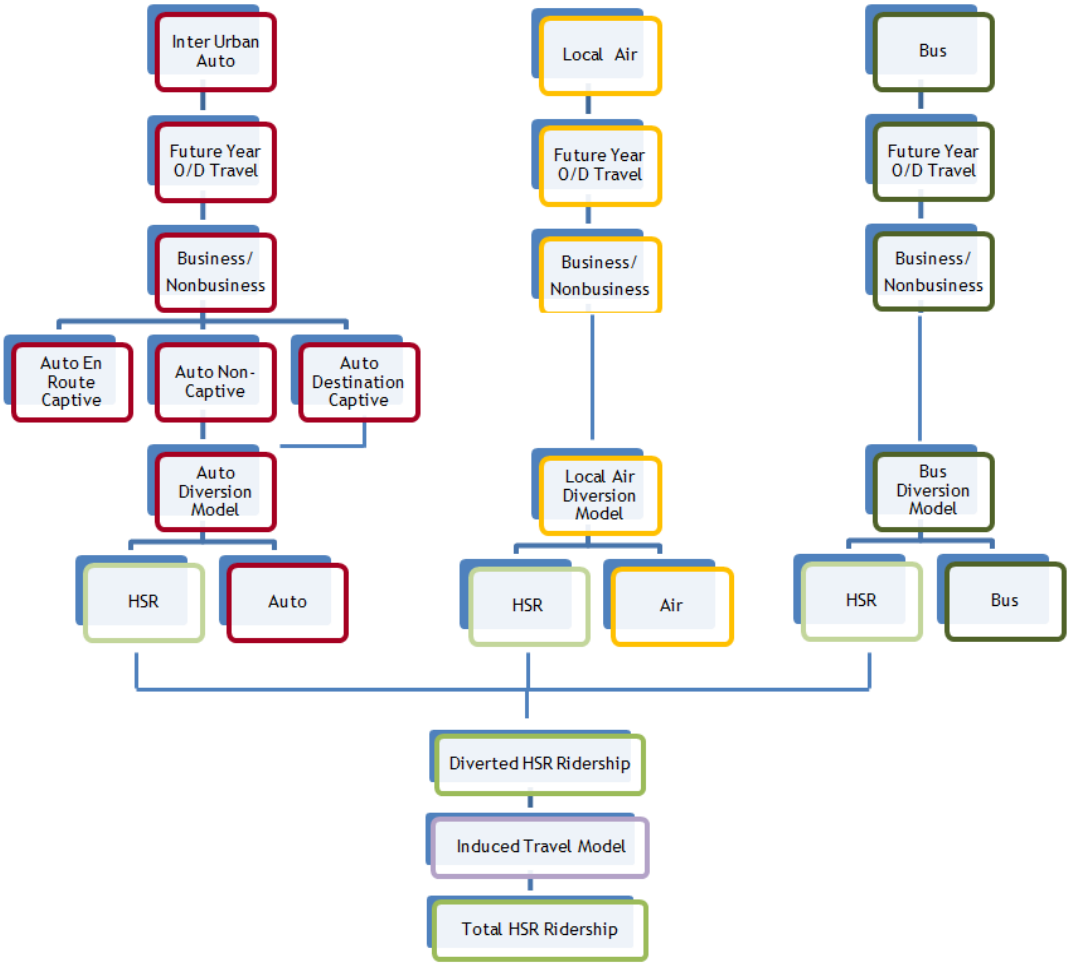
3.3.3.4 Step 4: Mode Choice

The study's well-tested high-speed rail forecasting methodology was applied to this feasibility study. The key feature of the ridership and revenue forecasting methodology is its use of binary diversion models to calculate high-speed rail ridership. This methodology is practical, transparent and easily evaluated for the reasonableness and accuracy of its relationships, and it reflects a theoretically satisfying choice structure. The approach is similar to that adopted in the recent Atlanta-Chattanooga study, in the Volpe Center's Charlotte-Atlanta-Macon study, and in many other studies. Forecasts produced using this methodology has been benchmarked to Amtrak's Acela Express and Northeast Direct ridership and revenue in the Northeast Corridor.

The model uses separate binary (two mode) logit relationships to predict traveler diversions from each existing mode to the new high-speed rail service. This forecasting approach is graphically shown in Figure 3-18 below. Travel market segments are carefully defined based on a combination of current mode, trip purpose and other traveler and trip characteristics. Market segments include:

- Inter-urban auto travel (business and non-business);
- Local air travel (business and non-business); and
- Inter-urban bus travel (business and non-business).

Figure 3-18: Diversion Model



Inter-Urban Auto, Local Air and Bus Mode Choice Model Estimation

Each model is a binary choice model, which predicts the probability that a traveler would choose high-speed rail over their existing mode given the respective attributes of the two modes.

These three market segments are all shown in Figure 3-18 above. The auto travel market is further segmented into three groups: 1) those who do not need a vehicle at their final destination ("non-captive"); 2) those who need a vehicle at their final destination ("destination-captive"); and 3) those who need to make automobile trips at Intermediate stops during their trip ("en-route-captive"). The likelihood of selecting high-speed rail for intercity-travel will be very different for the three groups. Empirical work suggests that many auto travelers are, in fact, both en-route and destination-captive.

Each diversion model shown in Figure 3-18 computes, for each combination of trip purpose, market segment and current mode, the probably that a traveler would choose high-speed rail over his / her current mode of travel as a function of each mode's service attributes. These probabilities are then multiplied by the trip volumes of the existing modes to predict the volume of travel that will divert to high-speed rail. Induced (new) travel on the high-speed rail mode is separately forecast (described later) using models based on generalized costs. Total high-speed rail ridership is obtained by summing the predictions for the individual market segments.

Modal service attributes include time, cost, frequency, reliability and quality of service with time and cost disaggregated into their access, egress, terminal and line haul components. Mode-specific constants account for the effects of other (non-explicitly modeled) characteristics of high-speed rail relative to other modes.

The models relate to overall "utility" experienced by travelers in each market segment to the respective price and service levels of their respective modes. The general specification for each model is as follows:

$$U = \alpha + \beta_1 * Cost + \beta_2 * Travel\ Time + \beta_3 * Access/Egress\ Time + \beta_4 * Waiting\ Time$$

Where α represents the modal constant (the inherent preference for the mode with all other attributes being equal), β_1, β_2, β_3 and β_4 are modal coefficients, and waiting time represents a transformation of service frequency.

These model parameters are usually estimated and calibrated using travel behavior data from new stated and revealed preference surveys conducted locally for study area under consideration. However, it was beyond the scope of this study to conduct primary travel survey data collection. Rather, the study drew heavily on the recent Household Travel Survey conducted by the study in 2009 as part of the Atlanta-Chattanooga HSGT EIS study. This survey sampled approximately 1,000 households in the Atlanta-Chattanooga corridor. Indeed, similar inter-urban binary mode choice models (as described above) were estimated for travel between Atlanta and Chattanooga using the survey data. The study used those models as starting points for this feasibility study. However, the study then adapted and modified the models as required to reflect the specificity of the other current study corridors, using readily-available data and information developed in other studies in the study area and experience in other high-speed rail corridors.

This is a very plausible demand forecasting approach because it allows for different intercity market segments to exhibit realistic differences in their tradeoffs among time, cost comfort, etc., and so accounts explicitly for the actual diversity of travel behavior in the study corridor. The approach also makes it easy to carry out a wide

range of sensitivity analyses to determine the effects of various changes on competitiveness, financial viability and benefits.

The advantages of this approach included its economy in avoiding original data collection, and some confidence derived from the adoption of a model that has already demonstrated its utility and applicability in studies elsewhere including within the study area (Atlanta to Chattanooga). Its robustness and reasonableness in these other applications provide considerable assurance that it is a useful and credible tool for the present feasibility study.

The values of time of travelers in each market segment calculated from the model coefficients of the diversion models used for this study are presented below in Table 3-21 for the various components of travel time (and the terminal transfer penalty for connecting air passengers). These values of time strongly support our findings in previous high-speed rail studies. First, as expected, the values of line-haul time for air travelers are higher than for private vehicle travelers, and both are much higher in general than for bus travelers. Line-haul time savings on high-speed rail are much more important to air travelers than private vehicle travelers, and more important in both cases (except for short non-business private vehicle trips) than they are to bus travelers. This means that bus travelers are much more sensitive to price differences between modes than they are to time differences. Also as expected, the values of line-haul time for business travelers are higher than for non-business travelers traveling on the same mode.

Table 3-21: Values of Time

Value in 2010 dollars	Air		Auto		Bus	
	Business	Non business	Business	Non business	Business	Non business
In-vehicle value of time ($)	$27	$15	$19	$12	$10	$5

Connect Air Model

The connect air model estimates the share of current air travelers that connect at H-JAIA from one of the six major airports in the study area that will be using the proposed high-speed rail mode to complete the connecting leg of their journey within the study area. The six major airports in the study area with connection at H-JAIA are: Savannah (SAV), Jacksonville (JAX), Birmingham (BHM), Chattanooga (CHA), Nashville (BNA) and Louisville (LOU).

The study estimated a connect air model for this study by using representative (not average or composite) destinations and routes from each of the six major airports with connection at H-JAIA. The connect air model then uses an air route choice model to predict the percentage of connect air travelers that will switch to the

proposed high-speed rail mode from the air mode for the connecting leg of their trip inside the study area.

The representative destinations were selected first. The top 10 destinations from each of the six airports were analyzed. Based on the distribution, the study combined the destination into representative geographic areas and then selected one city/airport within each to act as a representative destination. The four representative areas and destinations used are: Florida, U.S. Northeast quadrant, west of the Mississippi River and International.

Next, the study selected representative routes based on the markets and carriers on each representative destination. The study did not estimate the average or composite level of service characteristics, but used the actual services to these destinations, as this is more transparent and representative of actual experiences on a given route.

After selecting representative destinations and routes, the study estimated an ordinary least square regression-based route choice model based on the market shares and volumes along each route for each destination. Once the model was estimated, the study applied it to the introduction of a new route between each of the six airports and the final destination through H-JAIA. These new routes would connect each of the six airports with H-JAIA by the proposed high-speed rail service.

Local Trips

Local trips diverted to high-speed rail were estimated based on already observed/calculated diversion percentages to the potential rail service from the inter-urban markets. For the Atlanta metropolitan area, the study used results of the local markets with proper modification as appropriate from the Atlanta-Chattanooga HSGT Tier I EIS.

3.3.3.5 Step 5: Induced Demand

Most transportation planners recognize that the introduction of new transportation facilities typically generate new or induced traffic (trips that would not be made at all if the new facility was not built). The final step in the inter-urban high-speed rail ridership forecasting process is, therefore, to forecast the amount of induced travel on the high-speed rail mode.

Total ridership is obtained by summing the induced demand and the diverted rail trips described above for the individual market segments. The study defines new travel induced by the introduction of the high-speed rail system in the market as follows:

Induced Travel = Total Travel with High-Speed rail – Total Travel before High-Speed Rail

The number of induced trips will be a function of the change in the overall "impedance" to travel in the corridor; by providing another transportation option. Total travel on all modes is related to a composite generalized cost computed overall of the modes, as follows:

$$Total\ Travel\ all\ modes = (S / E)^{a} x\ GC_{ccomposite}^{q}$$

Where:

Total travel all modes = Total travel volume between Origin/Destination on all modes;

S / E = Socioeconomic factors for Origin and Destination;

$GC_{composite}$= Generalized cost of travel between Origin and Destination; and

A, q = estimation coefficients.

This composite generalized cost is known as the logsum and is calculated using the utility estimates for each mode form the diversion models:

$$GC_{composite} = ln(e^{Uprivatevehicle}+e^{Uair}+e^{Ubus}+e^{UHSR})$$

Consequently:

Total travel before high-speed rail: Ta = $(S / E) x (GCa)^{q}$

Total travel after high-speed rail: Tb = $(S / E) x (GCb)^{q}$

And, the percent increase in total travel becomes:

Induced Demand % = $[Ta-Tb] / Tb = [GCa^{q}-GCb^{q}] / GCb^{q}$

Induced demand was considered for the inter-urban market, where it is reasonable to assume that improved access in the corridor would lead to some trips that would not have occurred without the existence of the high-speed rail system. Using the behavioral survey results from the Atlanta-Chattanooga HSGT Tier I EIS, the study estimated induced demand parameter for the various intercity markets.

This calculation was done for each market segment. Total high-speed rail trips were then computed as the sum of the trips diverted from the existing modes and these new trips induced by the introduction of the high-speed rail system.

The study developed specific ridership forecasts for two years, 2015 and 2035. In order to illustrate annual ridership forecasts between 2021 and 2040, the study

interpolated ridership between 2015 and 2035 and extrapolated ridership from 2036 to 2040.

3.3.3.6 Step 6: Rail Farebox Revenue

The farebox revenue was calculated using the ridership calculated in the previous two steps and the fare assumptions used for the new high-speed rail service from Step 3 above. Note that the level of ridership is sensitive to the level of fare.

Detailed ridership and revenue results are presented for each of the Atlanta-Birmingham, Atlanta-Macon-Jacksonville and Atlanta-Chattanooga-Nashville-Louisville Corridors separately in the corridor-specific sections of the report.

3.4 OPERATING AND MAINTENANCE METHODOLOGY

A key requirement for developing an operating plan and costs is to work in tandem with ridership and revenue forecasts to adjust train sizes and frequencies levels to appropriately match demand, for providing enough capacity while still producing acceptable load factors. In addition, there is a need to respect financial constraints on the operation of the system (e.g., the FRA's requirement for high-speed rail systems to produce a positive operation ration). The results of this interactive analysis are then used to identify the system operating costs.

As a rule, higher ridership associated with faster options can also support more train frequencies, along with larger, more efficient trains. Train size and frequencies will be increased together, in a balanced way, to accommodate the ridership increase. Train frequency increases the ridership and revenue impact of an initial speed improvement. At the same time, ridership increases associated with higher speed options often allow the use of larger, more efficient trains. This is why an iterative approach was needed to identify the optimal investment and operating strategy for each of the three corridors.

3.4.1 OPERATING PLAN DEVELOPMENT

3.4.1.1 Train Service and Operating Assumptions

Train timetables were developed for both Shared Use and Dedicated Use speed options and route combinations identified for each corridor. Schedules were designed to maximize utilization of the train sets, while also ensuring that any scheduled meetings between passenger trains occur in stations or double track, while respecting constraints on minimum turn time at route endpoint stations, and required schedule buffer guidelines. In addition to this, trains were scheduled at convenient times for capturing a portion of the daily peak-hour commuter traffic while providing an effective all-day intercity service for business travelers as well as recreational and leisure travelers with convenient off-peak travel options. Clearly,

the higher the frequency of service, the easier it was to meet these conflicting needs.

A second consideration for the service is the quality of travel offered. Quality of service can have a significant impact on ridership levels and it is critical that any new rail service offers a modern transportation environment that is comfortable, convenient, economical and safe. It was assumed in this analysis that the quality of service offered by the rail system would reflect all of these critical attributes.

3.4.1.2 Potential Station Locations

Based on an assessment of the prospective rail demand, the study identified the general locations for potential stations along each corridor. On average, station spacing on the corridors was limited to one stop every 30-60 miles, with exception to the Atlanta-Chattanooga segment in order to reflect the proposed operating plan in the Atlanta-Chattanooga HSGT Tier I EIS. More station stops increase travel times, decrease average train speed and cause high-speed rail service to become less competitive. Slower-speed systems can accommodate more stops and if traffic volumes are high enough, the stopping patterns at smaller, Intermediate stations can be "thinned" to develop express local service patterns. This can be done while providing at least a minimum base line level of service to each station. The study developed a set of station locations that are compatible with each proposed route option, and the operating plan reflects the frequency of service that was determined as most appropriate to the needs of each station.

Specific station site planning is beyond the scope of this study and sites will likely be finalized in future project development phases. Local governments, business interests and citizens groups would be involved in the station location planning and design process. However, for the purposes of the current study, prospective station sites were selected by the study and the operational assessment will be consistent with the assumptions made in the capital cost development and with the ridership and revenue forecasts.

3.4.1.3 Train Technology Assumptions

As outlined in Section 1.2, there are three technology considerations for this feasibility study. In the Atlanta-Birmingham and Atlanta-Macon-Jacksonville Corridor, the study is considering a 90-110 mph Shared Use Emerging High-Speed Rail and 180-220 mph Dedicated Use Express High-Speed Rail. Along the Atlanta-Chattanooga-Nashville-Louisville Corridor, the study is also considering at 220+ Maglev option.

A key study assumption that determines transit time is a passenger car's "tilt" or "non-tilt" design. The track in curves is typically banked (super-elevated) up to six degrees (6°), which results in designation of a balance speed for each curve (at

which speed a vehicle occupant would feel no sideways force in the curve). However, up to four degrees (4°) of imbalance (cant deficiency) is acceptable for passenger comfort. Beyond this, onboard hydraulic systems (active tilt) or car suspension designs (passive tilt) can permit even higher speeds, by lowering the centrifugal forces felt inside cars.

Another key issue for determining the suitability of train technology for the three study corridors is compliance with FRA safety requirements. The FRA has Tier I safety requirements that pertain to all passenger trains operating up to a maximum speed of 125 mph. More stringent Tier 2 requirements are applied to passenger trains operating with speeds 125-150 mph. For the dedicated and Maglev corridors, safety regulations will follow European standards since no FRA standards are currently in place.

3.4.1.4 Other Rolling Stock and Operational Requirements

Consistent with the assumptions customarily made in feasibility-level planning studies, the following general assumptions are proposed regarding operating requirements for the rolling stock:

- Trains will be reversible for easy push-pull operations (able to operate in either direction without turning the equipment at the terminal stations);
- Trains will be accessible from low-level station platforms for passenger access and egress, which is required to ensure compatibility with freight operations;
- Trains will have expandable capacity for seasonal fluctuations and will allow for coupling two or more trains together to double or trip capacity as required;
- Train configuration will include galley space, accommodating roll-on/roll-off cart service for on-board food service. Optionally, the train may include a bistro area where food service can be provided during the entire trip;
- On-board space is required for stowage of small, but significant, quantities of mail and express packages, and also to provide for an optional checked baggage service for pre-arranged tour groups;
- Each end of the train will be equipped with a standard North American coupler that will allow for easy recovery of a disabled train by conventional locomotives;
- Trains will not require mid-route servicing, with the exception of food top-off. Refueling, potable water top-off, interior cleaning, required train inspections and other requirements will be conducted at night, at the layover facilities located at or near the terminal stations. Trains would be stored overnight on the station tracks, or they would be moved to a separate train layover facility. Ideally, overnight layover facilities should be located close to the passenger stations and in the outbound direction so a

train can continue, without reversing direction, after its final station stop; and

- Trains must meet all applicable regulatory requirements including:
  - FRA safety requirements for crash-worthiness,
  - Requirements for accessibility for disabled persons,
  - Material standards for rail components for high-speed operations, and
  - Environmental regulations for waste disposal and power unit emissions.

3.4.2 Operating Plan Model

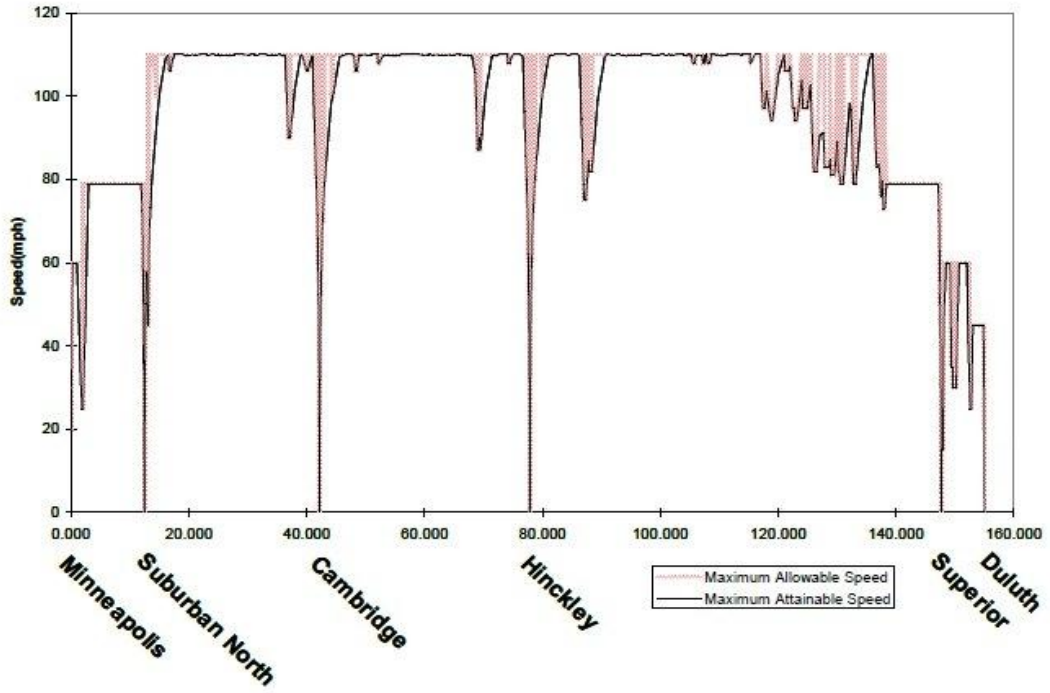
3.4.2.1 Train Performance

The study used the TEMS LOCOMOTION™ Train Performance Calculator to estimate train-running times for each operating scenario. For each route and train technology, this program uses route geometry and infrastructure, together with train performance characteristics to estimate running times and levels of service. The study added recovery time into the schedules to remain consistent with FRA guidelines and allow for minor delays en route due to freight traffic congestion along the line, mechanical difficulties, weather factors, temporary speed restrictions or other operating difficulties. For the purposes of this study, the study used eight percent recovery time as this represents an Intermediate level of schedule slack that is appropriate for the Shared-Use option that includes substantial capacity improvements, but which continues to co-mingle freight and passenger services together on the same tracks.

Higher acceleration as well as tilt can result in a substantial reduction in end-to-end running times. However, if the train is mismatched to the infrastructure (a high-speed train on low quality infrastructure, or a conventional train on high-speed infrastructure) these benefits will not be achieved. Using the wrong equipment can result in a flawed evaluation of the potential for upgrading a rail line. For this feasibility study, the study avoided making this common mistake by ensuring an appropriate match of the train technology to the infrastructure of each route.

The TEMS LOCOMOTION™ program developed the train speed profiles by mile as well as the overall running time calculation. For example, Figure 3-19 shows an example speed profile that was developed for a 110 mph operating over a Midwestern corridor. The speed limits applicable to each segment of the route, as well as the impact of curve speed limits and station stops, can clearly be seen on the graphic.

Figure 3-19: Example 110 mph Speed Profile



For the three study corridors, a similar detailed running time assessment was developed for the Shared Use, Dedicated Use and Maglev (Atlanta-Chattanooga-Nashville-Louisville Corridor only). In addition, the operational analysis assessed the impact of raising or lowering speeds, easing curves or skipping stops to help prioritize the capital investment strategy for each corridor. With the addition of appropriate schedule pad, this process developed the point-to-point running times needed to develop detailed train schedules for each corridor.

3.4.2.2 Train Scheduling and Fleet Requirements

The study calculated the number of train sets required for day-to-day operations for each corridor and technology. These train sets must be large enough to cover all assignments in the operating plan with sufficient spares for maintenance, yet, without excess equipment sitting idle. Typically, intercity corridor weekday services will face a stronger demand than weekends.

While it is typical to assume reduced weekend operations for high-speed rail corridors, sometimes this assumption is modified for special circumstances. Each corridor was studied to determine if there were strong tourist attractions and if it may be appropriate to employ a different weekend train scheduling assumption. None of the corridors presented a strong case for an alternative weekend schedule.

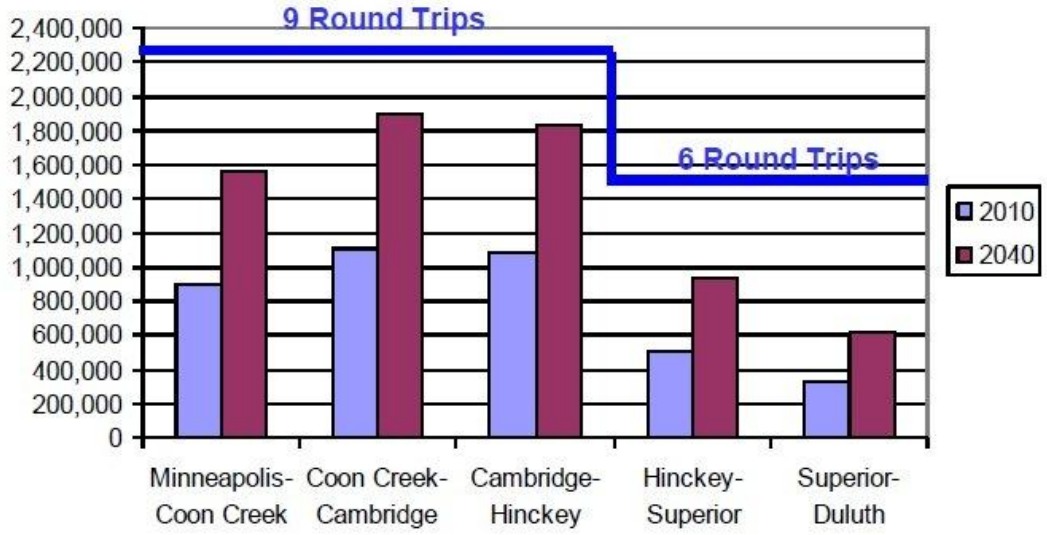
The operational analysis for each of the three study corridors was developed in concert with the engineering assessment of proposed passing siding locations for

each corridor. A specific analysis of train scheduling was developed for each of the three study corridors to ensure that the proposed passenger train schedules are operationally feasible with respect to the passing and station infrastructure provided.

3.4.2.3 Train Size, Frequency and Load Factors

In addition to timing trains to meet the anticipated needs of the market, the operational assessment determined what size the trains need to be and over what portion of the route they need to run. Whatever combination of train sizes and frequencies are chosen for each corridor and technology pairs, the operating plan must ensure there are enough seats to carry all of the passengers over the peak load segment; beyond this, it is desirable to minimize empty seat-miles, for matching supply to forecasted demand as closely as possible. A segment-loading chart, similar to that shown in, is useful tool for this purpose. This chart shows the number of passenger forecast over every segment of the route enabling the study to determine both the peak load segment as well as for forecasting average load factors across the entire route.

Figure 3-20: Example Segment Loading Chart



3.4.3 Operating and Maintenance Costs

In addition to assessing the physical feasibility of the operating plan, the study assessed the level of operating costs for supporting the needs of the financial and economic analysis. This section describes the build-up of the unit operating costs that were used in conjunction with the operating plans, to assess the total operating cost of each corridor for Shared-Use and Dedicated-Use. Because there are a number of corridor and technology considerations in place, it was essential to

maintain consistency of the costing basis across all options. For developing a fair comparison:

- Costs that depend on the propulsion/speed should reflect legitimate differences between technologies and routes; and
- Costs that do not depend on propulsion/speed should remain the same across all technologies and routes.

For developing operating and maintenance costs for this study, the study adapted the bottom-up costing framework that was originally developed for the MWRRS and Ohio Hub studies. This enabled the direct development of costs based on directly-controllable and route-specific factors, and allowed sensitivity analyses to be performed on the impact of specific cost drivers. It also enabled direct and explicit treatment of overhead cost allocations, to ensure that costs which do not belong to a corridor are not inappropriately allocated to the corridor, as would be inherent in a simple average cost-per-train mile approach. This also allows benchmarking and direct comparability of Georgia costs with those developed by other high-speed rail studies across the nation, including those in which the proposed corridor route would connect.

As background, the MWRRS costing framework was developed in conjunction with nine states that comprised the MWRRS steering committee and with Amtrak. In addition, freight railroads, equipment manufacturers and others provided input into the development of the costs. This methodology has been most recently validated with recent operating experience based on public data available from other sources, particularly the Northern New England Passenger Rail Authority's (NNEPRA) Down-easter costs and data on Illinois and Oklahoma operations that was provided by Amtrak. These costs were brought to a 2010 costing basis and included additional cost categories, such as electrification and Maglev technologies, which have been added into the MWRRS framework.

Following the MWRRS methodology as outline in Table 3-22, nine specific costs were used for this study. Variable costs include:

- Equipment maintenance;
- Energy and fuel;
- Train and onboard service (OBS) crews; and
- Insurance liability.

Additionally, ridership influences marketing and sales. Fixed costs include:

- Administrative costs;
- Station costs; and

- Track and right-of-way maintenance costs (includes signals, communication and power supply).

Table 3-22: Operating Cost Categories and Primary Cost Drivers

Drivers	Cost Categories
Train Miles	Equipment Maintenance
	Energy and Fuel
	Train and Engine Crews
	Onboard Service (OBS) Crews
Passenger Miles	Insurance Liability
Ridership and Revenue	Sales and Marketing
Fixed Costs	Service Administration
	Track and ROW Maintenance
	Station Costs

Operating costs developed for this study were benchmarked to be consistent with unit operating costs from other recent studies. These costs were fine-tuned and updated to current 2010 dollars consistent with the ridership and revenue and capital cost projects. The costs were then applied to the train-miles, number of station, passenger volumes and other cost factors developed specifically for this study. Cost factors that vary by train technology, such as fuel usage and equipment maintenance, were developed from discussions with manufacturers and/or users of the technology and/or by cost benchmarking from both public and confidential sources. A cost development approach was used to fine-tune those items with the greatest potential impact on the bottom line. The study forecasted operating and maintenance costs for three years: 2021, 2030, and 2040. The study interpolated annual operating and maintenance costs between 2021 and 2030 and also between 2030 and 2040.

Operating costs were categorized as variable or fixed. As described below, fixed costs include both route and system overhead costs. Route costs can be clearly identified to specific train services, but do not change much if fewer or additional trains were operated.

- **Variable Costs:** change with the volume of activity and are directly dependent on ridership, passenger miles or train miles. For each variable cost, a principal cost driver was identified and used to determine the total cost of that operating variable. An increase or decrease in any of these will directly drive operating costs higher or lower.
- **Fixed Costs:** generally predetermined, but may be influenced by external factors, such as the volume of freight tonnage, or may include a relatively small component of activity-driven costs. As a rule, costs identified as fixed

remained stable across a broad range of service intensities. Within fixed costs are two sub-categories:

- Route costs such as track maintenance, train control and station expense that, although fixed, can still be clearly identified at the route level.
- Overhead or System costs such as headquarters management, call center, accounting, legal, and other corporate fixed costs that are shared across routes or even nationally. A portion of overhead cost (such as direct line supervision) may be directly identifiable but most of the cost is fixed. Accordingly, assignment of such costs becomes an allocation issue that raises equity concerns. These kinds of fixed costs are handled separately.

Operating costs were developed based on the following premises:

- Based on results of recent studies, a variety of sources including suppliers, current operators' histories, testing programs and prior internal analysis from other passenger corridors were used to develop the base-line cost data. Actual costs will be subject to negotiation between the passenger rail authority and contract rail operator(s).
- Freight railroads will maintain the track and right-of-way that they own, but ultimately, the actual cost of track maintenance will be resolved through negotiations with the railroads. For this study, a track maintenance cost model was used that reflects actual freight railroad cost data. The costs for maintaining the Dedicated Use and Maglev Guideway were directly assessed.
- Maintenance of train equipment will be contracted out to the equipment supplier.
- Train operating practices follow existing work rules for crew staffing and hors of service. Operating expenses for train operations, crews, management and supervision were developed through a bottom-up staffing approach based on typical passenger rail organizational needs.

Table 3-23 outlines the unit costs for each of the three corridor based on the technology considerations.

Table 3-23: Unit Operating and Maintenance Costs

Annual Costs	Shared Use	Dedicated Use	Maglev
Variable per Train Mile			
Train Crew	$4.66	$3.20	$2.13
On Board Services	$1.81	$1.60	$1.07
Equipment Maintenance	$11.67	$12.94	$7.73
Fuel or Energy	$3.94	$7.63	$7.74
Variable per Other			
Insurance (per messenger mile)	$0.02	$0.02	$0.02
Call center (per passenger)	$0.66	$0.66	$0.66
Credit Card/Travel Agency Commissions	2.8%	2.8%	2.8%
Fixed Costs			
Stations	Specific	Specific	Specific
Track and Electrification Maintenance (per track mile)	$50,000	$75,000	$65,000
Administration and Management (fixed)	$13,029,600	$13,029,600	$13,029,600
Administration and Management (per track mile)	$1.53	$1.53	$1.53

3.4.4 PUBLIC-PRIVATE BENEFIT ANALYSIS

The Public-Private Benefits Analysis is designed to identify the benefit-cost returns to both the public and private sector. The benefit-cost analysis is designed to show whether a project is good for local and regional communities as well as states and countries, and how the benefits are distributed between the public and private sectors. In developing the benefit-cost analysis, the study used the methodology set out in the FRA *High-Speed Ground Transportation for America*, September 1997, and the *Maglev Deployment Program*, July 1999.

Given the uncertainties associated with the ridership and revenue and capital costs for each corridor, the Public-private Benefits analysis used a range of values to reflect the likely potential outcomes. These range from Conservative estimates with low revenue and high costs incorporated, to an aggressive, or Optimistic, estimate based on higher revenue and lower costs incorporated. Further, the study developed an Intermediate estimate that is a "middle of the road" estimate which takes into account slightly higher ridership and slightly lower costs than that of the Conservative estimates.

In estimating the benefits for the different passenger rail options, the study had to make high-level assumptions regarding the operating plan. For example, the study assumed to have 325 days per year operation, in line with the original Atlanta-Chattanooga HSGT EIS study. This suggests a five day per week operation along with a high-level of service; Saturday morning and Sunday afternoon/evening, with only a skeletal operation on Saturday afternoon/evening, and Sunday morning. More corridor specific assumptions regarding the operating plan are outlined in subsequent sections.

3.4.4.1 Benefit-Cost Analysis

This feasibility analysis will determine if the three study corridors provide a wide range of benefits. The methodology used to estimated economic benefits and costs is based on the approach of the FRA and its analysis of the feasibility of implementing high-speed passenger rail service in selected travel corridors throughout the country[16]. In that study, revenues and benefits were quantified as shown in Table 3-24.

Table 3-24: Key Elements of the Benefit-Cost Analysis

Types of Benefits	Types of Costs	Measures of Economic Benefits

• Benefits to Users
  ○ Consumer Surplus
  ○ System Revenues
  ○ Ancillary Revenues
  ○ OBS
• Benefits for Public at Large
  ○ Airport Congestion Delay Savings
  ○ Airport Reduced Emissions
  ○ Highway Congestion Delay Savings
  ○ Highway Congestion Fuel Savings
  ○ Highway Reduced Emissions
	• Capital Investment Needs
	• Operations and Maintenance Expenses
		• Benefit-Cost Ratio
		• Net Present Value

Two measures of economic benefits were used to evaluate each corridor's Net Present Value (NPV) and benefit-cost ratios, which are defined as follows:

[16] FRA, *High-Speed Ground Transportation for America,* pp. 3-7 and 3-8, September 1997

$$Net\ Present\ Value = Present\ Value\ of\ Total\ Benefits - Present\ Value\ of\ Total\ Cost$$

and

$$Cost - Benefit\ Ratio = \frac{Present\ Value\ of\ Benefits}{Present\ Value\ of\ Costs}$$

Present values are calculated using the standard financial discounting formula:

$$PV = \sum C_t / (I + r)^t$$

Where:

PV	=	Present value of the project benefits or costs (e.g., revenue)
C_t	=	Cash flow for t years
R	=	Interest Rate reflecting opportunity cost of capital
T	=	Time

For a feasibility analysis, revenues and cost cash flows for the three study corridors were discounted to the 2010 base year using a three percent (3%) real discount rate. The three percent discount rate intended to reflect the real cost of money in the market as reflected by the long-term bond markets.

3.4.4.2 Estimate of Economic Benefits

Benefit-cost analysis takes a social perspective by attributing economic values to resource efficiency and environmental factors, such as reduced infrastructure, congestion, time savings, and emissions reduction. These benefits accrue to both users and non-users of the system:

- ***Users*** of the system enjoy a consumer surplus benefit that reflects the additional fare value that the individual would be willing to pay for riding the train, as a result not only of time savings, but other aspects of the service (quality, frequency reliability) as measured by the Generalized Cost framework. Benefit-cost analysis recognizes consumer surplus and places that value on parity with the revenues of the system. This is because revenues are merely consumer surplus that is transformed into revenue by charging a fare. Thus, the analysis is only concerned with the overall value of economic benefits, not the distribution of those benefits between the producer and consumer. The portion of economic benefit that is transferred to the producer shows up as farebox revenue. The share of benefit that is allowed to remain with the consumer is called consumer surplus.

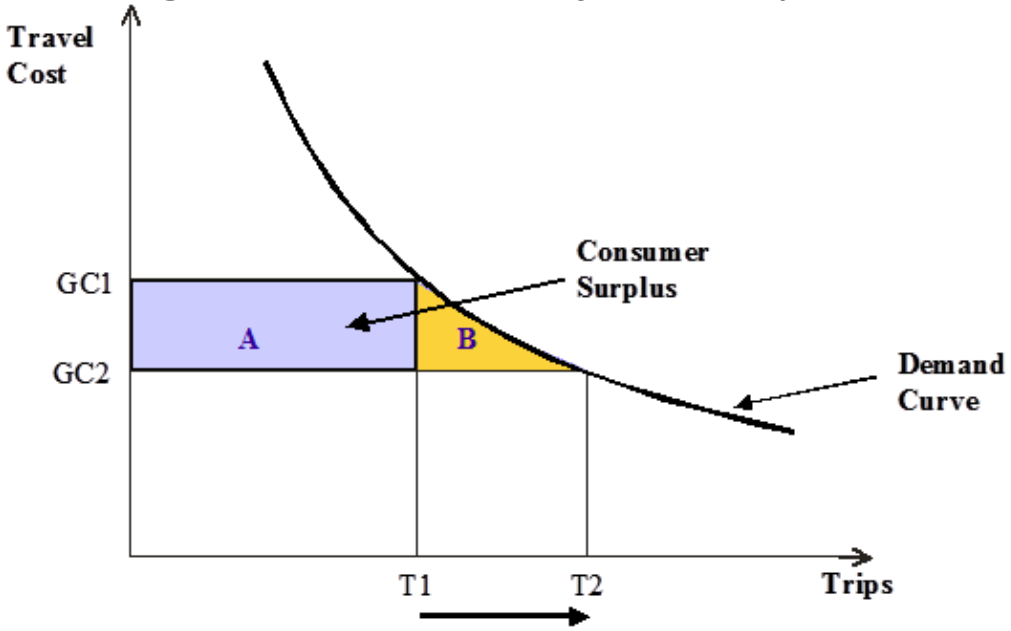
- ***Non-User*** benefits are for people who continue to drive their cars or fly, but who benefit from reduced congestion and improved air quality as a result of diversion from the higher and air to rail. The analysis measures benefits to the motoring public from decongestion that is a product of travelers diverted from the highway and air to the rail, and benefits to society as a whole resulting from reduction of air pollution from reduced emissions.

The following sections describes the calculations of these additional non-cash benefits and merges the results of these calculations together with the cash benefits to develop an overall benefit-cost assessment. Following Office of Management and Budget (OMB) guidelines, the results are aggregated over a 30-year system life using net present values at real interest rates of three percent (3%).

3.4.4.3 User Benefits – Consumer Surplus

Consumer surpluses are realized when a user obtains more value from the rail trip, such as greater convenience, greater reliability or reduced travel time, than was actually represented (and paid for) in the fare. Classically, consumer surplus can also be considered the difference (or delta Δ) between the maximum fare the rider would be willing to pay to use the service and the fare that was actually charged. Figure 3-21illustrates the concept of Consumer Surplus as typically used in transportation analyses. A demand curve is represented in terms of generalized cost of travel, which includes the fare, but also other important attributes such as travel time, reliability, frequency, etc. This ensures consistency between the behavioral characteristics of the demand model and the evaluation of the economic benefit of travel to individuals.

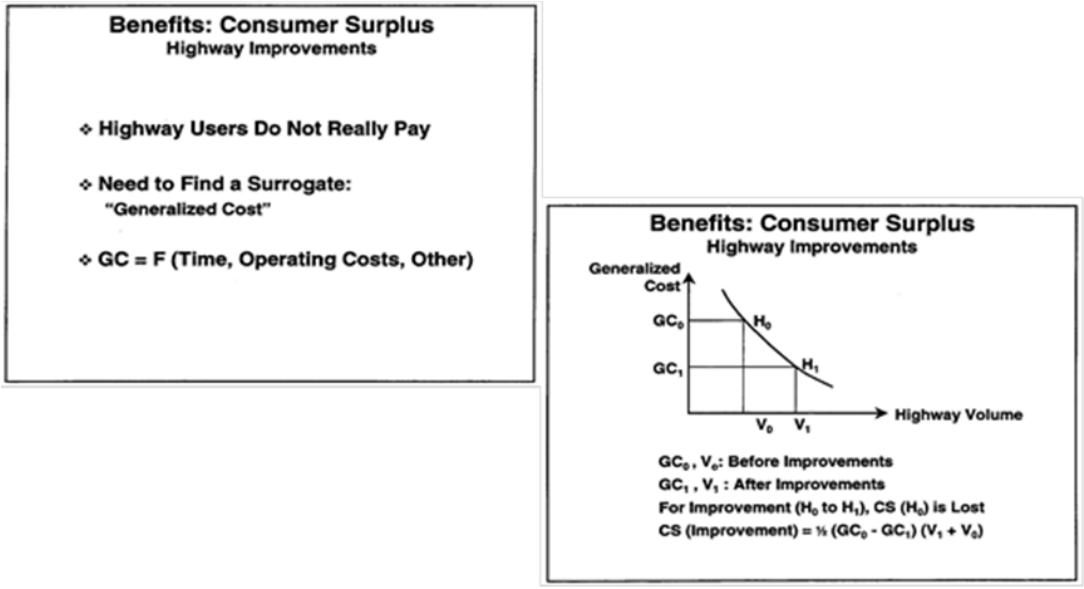
Figure 3-21: Economic Measure of Consumer Surplus



Consumer Surplus = A + B

As can be seen from Figure 3-22, when an improvement is made to the transportation system that reduces the generalized cost of travel (from GC1 to GC2), demand responds by increasing travel from T1 to T2. In economic terms, this results in a definition of Consumer Surplus, as being the sum of these two areas (area A and area B) under the demand curve. Area A reflects the economic benefit of the service improvement to existing users; whereas Area B represents the benefit to new users attracted to the system. This definition of the demand curve in terms of generalized cost is well documented in the transportation planning literatures. The FRA 2005 Maglev Deployment Program recognized this as a legitimate methodology for streamlining the Consumer Surplus calculation (refer to Figure 3-22).

Figure 3-22: Consumer Surplus Calculation as shown in the Maglev Deployment Program



Source: USDOT/FRA Maglev Deployment Program, 1999

3.4.4.4 Non-User Benefits

Non-user benefits include highway and airport non-user benefits. Two major categories of highway non-user benefits that were assessed were emissions savings and congestions reduction. The assessment for airport non-user benefits includes airport congestion savings and emission savings.

Emissions Reduction

Highway congestion and emission benefits were estimated using data on auto trips diverted to rail from their feasibility-level forecast. Tons of emissions savings were calculated by multiplying diverted vehicle miles traveled (VMT) with emission rates as shown in Appendix B. The VMT were then multiplied by cost per ton of emissions as shown below in Table 3-25. Several critical pollutants were included for evaluation in estimating the potential emissions saving value. The dollar amounts applied for the reduced pollutant volume resulting from the VMT reduction were obtained from the Corporate Average Fuel Economy for MY2011 Passenger Cars and Light Trucks (March 2009) and were inflated to a 2010 equivalent to obtain an estimated monetary value for the pollutants. A summary of the estimated diverted vehicle miles, tons of auto emissions saved and cost of emissions saved due to auto trips diverted to the rail system is provided in Appendix B.

Table 3-25: Cost per Ton of Pollutant (VOC, CO, NO_x, PM10 and SO_x)

Pollutants	Cost per Ton (2010$)[17]
VOC	$1,785
CO	$510.33
NO_x	$4,200
PM-10	$176,400
CO_2	$27.60

Highway Congestion Time Savings

The highway congestion delay savings consists of the time savings to the remaining highway users that result from diversion of auto users to the rail system.

The assumption is that less congestion leads to improved operating speeds for the remaining road uses, which results in shorter overall travel times. Applying an average regional value of time to the remaining highway automobile occupants monetizes the time savings. The time savings were estimated using the volume-capacity, speed and time profile analysis that evaluated the expected change in average travel times along highway corridors parallel to the rail system using the Bureau of Public Roads (BPR) time adjustment factor equation (as shown in Appendix B). The following outlines the main assumptions used for all three technologies to develop the highway congestion delay benefits:

- Average vehicle occupancy rates of 1.2 for business users and 1.5 for non-business users;
- Average freeway capacity of 2,000 vehicles per lane;
- Major corridors include I-16, I-20, I-65, I-75 and I-95; and
- Highway growth patterns are based on State Highway Authority projects.

Highway Congestion Fuel Savings

Another component due to reduction in overall congestion on the highway system is reduction excess fuel expenditure. The excess fuel component is used instead of actual fuel consumed component because the base fuel cost is already included in the generalized cost components and is embedded in the consumer surplus results.

[17] Corporate Average Fuel Economy for MY2011 Passenger Cars and Light Trucks (March 2009), page VIII-60,Table VIII-5 "Economic Values for Benefits Computations (2007$)

As such, only the excess congestion fuel over and above the normally consumed fuel levels for a trip can be considered an added benefit of the system.

The excess fuel consumed refers to the fuel consumed while sitting in traffic congestion and is unrelated to the actual fuel consumed by each traveler. The assumption is that less congestion leads to improved operating speeds for the remaining road users, which results in shorter overall travel times and less fuel consumption.

The excess fuel savings resulting from diverting vehicular travel to the rail system was estimated using average excess fuel consumption values generated by using the fuel economy and vehicle speed relationship. The total cost savings from the reduced excess fuel consumption were then estimated by applying an average fuel cost for the study corridors.

Airport Congestion and Emissions Reduction

Airport congestion and emissions reduction benefits were based on the 1997 FRA *Commercial Feasibility Study*. Air congestion projections were estimated using passenger air trips and air trips diverted to rail (refer to each corridor's Ridership and Revenue section of this report for additional details). The FRA study calculated travel time saved by air passengers (those not diverted to rail) due to reduced congestions, deviations from scheduled flight arrival and departure times, and additional time spent on the taxiway or en route.

Air passenger delay benefits per diverted air trip were estimated at $24.60 (2010$), based on the Southeast corridor from the 1997 FRA study. This value, multiplied by the relevant option air trips (in millions) diverted to rail each year yields the 30-year discount benefit.

Benefits to air carriers in terms of operating costs savings resulting from reduced congestion at airports are calculated the same way as the time savings benefit to air travelers. For its study corridors, the FRA study estimated the benefits to air carriers by multiplying the projected reduction in the number of aircraft hours of delay by the average cost to the airlines for each hour of delay. For this study, the calculate air carrier benefits per diverted air trip were $13.40 (2010$). This value, multiplied by the number of air trips diverted to rail each year yields the 30-year discount benefit.

The diversion of travelers to rail from air also generates emissions savings estimated as $5.38 per diverted air trip. This value, multiplied by the relevant option air trips diverted to rail each year yields the 30-year discount benefit.

3.4.4.5 Public and Private Benefit Estimations

A key element of the FRA public-private partnership analysis is the assessment of both public and private benefits. To test the "franchisability" of a corridor, the FRA uses the "operating ratio" of revenues divided by operating costs. A service with a positive operating ratio greater than 1.0 generates an operating surplus. A positive operating ratio gives evidence of a strong, self-supporting operating system that is less likely to need operating subsidies and reduces the operating risk for the owner, investor and operator. The following equation was used in this analysis to determine the operating ratios for each corridor and evaluation range:

$$Operating\ Ratio = \frac{Annual\ Revenue}{Annual\ Operating\ Cost}$$

With respect to the public benefit of a project, a benefit-cost analysis was performed to show how the overall public benefits relate to the overall costs of the project. The FRA benefit-cost methodology identifies costs (capital, operating and maintenance) and benefits (fare revenues, on-board service revenue, consumer surplus and external resources) that can be monetized and then calculates a benefit cost ratio. Similar to the operating ratio, a benefit-cost ration greater than 1.0 is desirable and the ratio can be used to compare the relative social desirability of multiple high-speed rail projects. In order to capture the benefits and costs over time with a three percent (3%) discount rate for NPV, the benefit-cost analysis was based on forecasts from 2021 to 2050 (a 30-year discounting period).

$$Benefit\ Cost\ Ratio = \frac{Total\ Public\ Benefits}{Total\ Project\ Costs}$$

3.4.5 EVALUATION RANGES

In setting up the evaluation, three scenarios were developed to show the impact of a range of ridership, revenue, capital and operating cost estimates typically encountered in a feasibility-level analysis. Unadjusted base forecasts for ridership, revenue, capital and operating costs were used for the Conservative Scenario. Base ridership and revenue estimates were increased for Dedicated Use corridors to establish the Intermediate and Optimistic Scenarios.[18] Operating costs were

[18] Ridership adjustments for Intermediate and Optimistic Scenarios were only made for Dedicated Use corridor 180-220 mph electrified, steel-wheel and Maglev technologies (Maglev in Atlanta-Louisville corridor only) based on a peer review of regional and national high speed rail corridor studies. No scenario ridership adjustment was made for Shared Use corridor diesel-electric technology results based on a peer review of other shared-use corridor studies.

adjusted by the appropriate ridership drivers. Capital cost estimates were adjusted downward in the Intermediate and Optimistic Scenarios for all technologies.

The three scenarios are intended to capture and illustrate the relatively wide range of estimates at the feasibility-level of study. As corridors are deemed feasible for further evaluation, future studies will provide greater detail in the analysis of ridership, revenues and costs, narrowing the range of estimates.

3.4.5.1 Conservative Scenario

- Ridership/Revenue = Direct estimates based on travel demand model which include a county based market assessment and demographic forecasts along with assumptions for increased fuel costs and congestion.
- Operating and Maintenance Costs = Direct estimates based on unit costs and scenario drivers
- Capital costs = Direct estimates based on unit costs including a 30 percent contingency

3.4.5.2 Intermediate Scenario

- Ridership/Revenue = An "intermediate" 75 percent increase from the Conservative Scenario for Dedicated Use corridors only. Based on a peer review of national and regional high-speed rail studies that employed more detailed and sophisticated ridership forecasts.
- Operating and Maintenance Costs = Direct estimates based on unit costs and scenario drivers
- Capital Costs = Direct estimates based on unit costs including a 15 percent contingency

3.4.5.3 Optimistic Scenario

- Ridership/Revenue = An "optimistic" 100 percent increase from the Conservative Scenario for Dedicated-Use corridors only. Again, based on a peer review of national and regional high-speed rail studies that employed more detailed and sophisticated ridership forecasts.
- Operating and Maintenance Costs = Direct estimates based on unit costs and scenario drivers
- Capital Costs = Direct estimates based on unit costs without a contingency

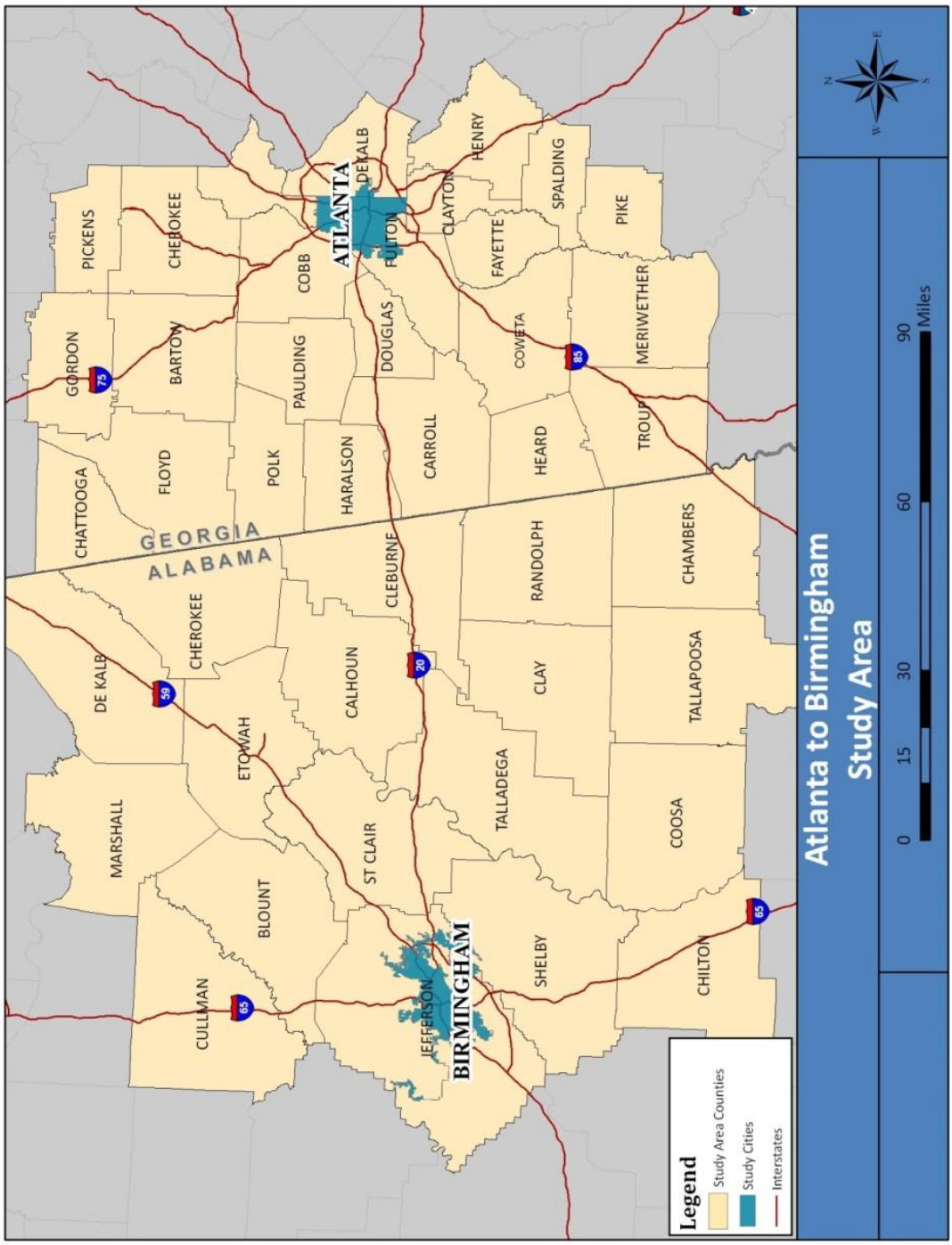
SECTION II:
ATLANTA TO BIRMINGHAM

1 EXISTING CONDITIONS AND BACKGROUND

In order to estimate the improvements that high-speed rail will bring to the Atlanta-Birmingham Corridor, a baseline of existing conditions was established. Existing conditions can include a variety of factors and characteristics; however, for the purposes of this feasibility study, the existing conditions include population demographics and socioeconomic characteristics, employment patterns, land use patterns, transportation systems, and environmentally critical areas.

A 100-mile wide study area was established around three Shared Use and one Dedicated Use evaluated routes. The basis of the existing conditions assessment is based on this study area and the counties within. This size study area was chosen to be consistent with the ridership and revenue forecasting catchment area. Further, a 100-mile corridor allows for connecting opportunity areas that high-speed rail will benefit. A map of all Georgia and Alabama counties included in the study area can be seen in Figure 1-1, below.

Figure 1-1: Atlanta-Birmingham Study Area



1.1 EVALUATED ALTERNATIVES

The study evaluated a number of potential route alternatives for both Shared Use and Dedicated Use technologies to determine the best representative route to utilize throughout the study analyses. It should be noted that this route is not a preferred route for the corridor, but rather, is a route that can represent the overall feasibility of the corridor. If this corridor is determined feasible from this representative route, it will be necessary, in the future, to conduct an alternatives analysis to determine a preferred route through the NEPA process.

1.1.1 90-110 MPH SHARED USE CORRIDORS

There are three rail routes that were considered for the Atlanta to Birmingham for 90-110 mph technology. These routes use a combination of existing and abandoned freight and passenger rail infrastructure. All three options can be seen in Figure 1-2. Additionally, the characteristics for these corridors can be seen in Appendix C. Each of these proposed routes was subject to a technical review by the project study as well as input from key local stakeholders to determine the representative route for the corridor.

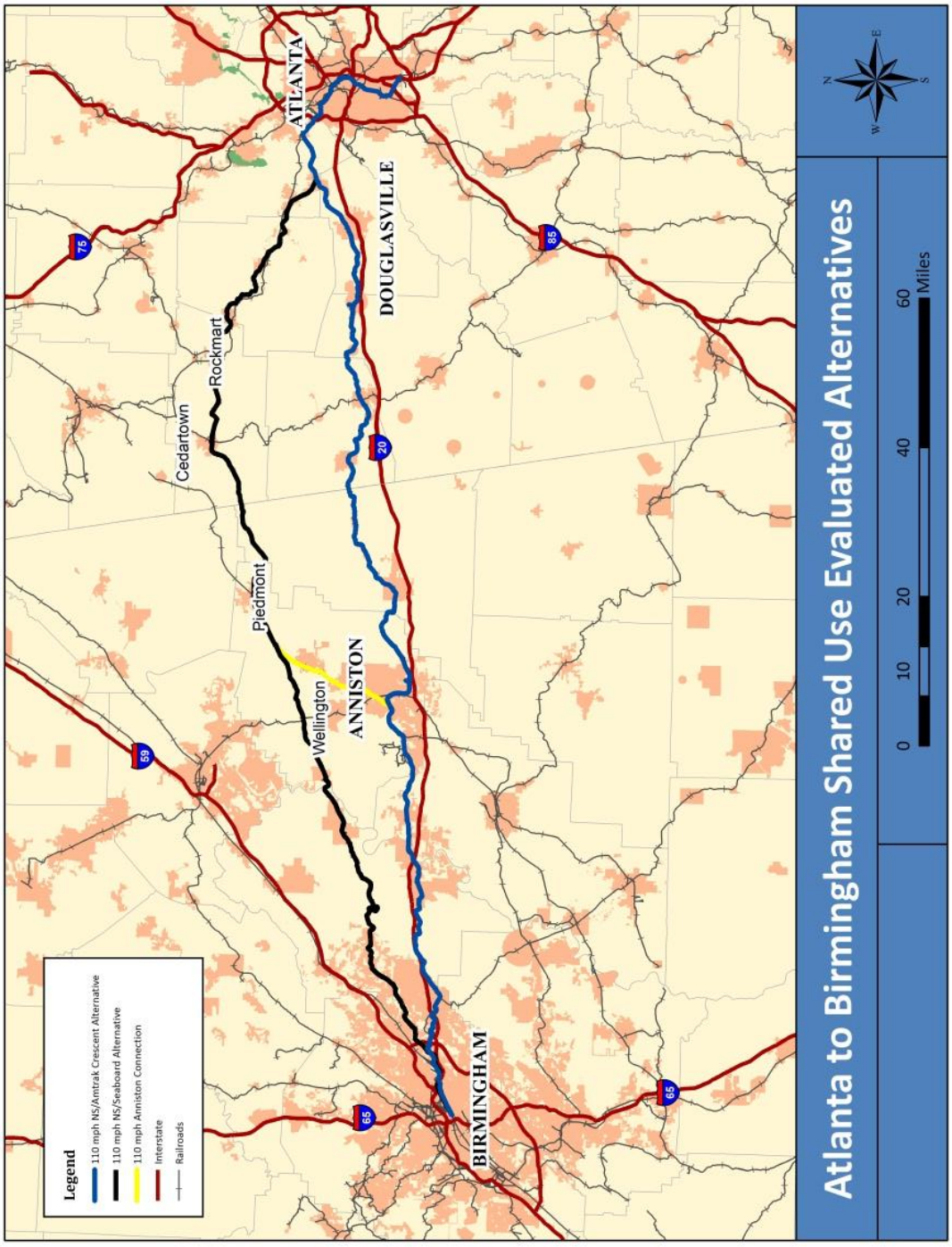
The first alternative follows the NS and Amtrak crescent corridor. The route is approximately 176 miles and is a single Class 4 track with sidings. A preliminary analysis reveals that there are 355 curves that exceed a radius of one degree, 30 minutes. This equates to 67.5 miles or 41 percent of the corridor. This information was gathered by measuring the radius of each individual curve along the existing freight corridors using GIS and AutoCAD software. In addition to the two passenger trains per day, a daily weighted average density of 26.3 freight trains per day uses the corridor. The estimated passenger travel time based on the track geometry for this corridor is about 166 minutes with an average speed of 64 mph.

The second alternative in consideration is the Seaboard Route; this route consists of the NS route for Atlanta to Rockmart and the CSXT Seaboard from Rockmart to Birmingham. This route is 169 miles and consists of a single track with sections of Class 1, 3, 4 with some abandoned sections. There are 306 curves that exceed the limit the one degree, 30 minute curvature, for a total of 49 miles (29 percent of the route). This track carries an average of 17.5 trains per day, most of which can be found between Atlanta, GA and Austell, GA. The estimated travel time is 169 minutes with an average speed of 60 mph. A large portion of the route was abandoned by CSXT in the 1980s and has since been converted to the Chief Ladiga bike trails.

There is opportunity in Anniston, AL to move the service from the Seaboard to the NS Crescent route via an abandoned track beginning in Jacksonville, AL through Anniston and connecting with the NS line in Piedmont, AL. Using this route, the total route is 174 miles with a combination of abandoned and Class 1, 3, and 4

tracks. The connection is approximately 25 miles and encompasses 14 curves with a radius greater than one degree, 30 minutes (2.86 miles or 11 percent of the total miles). The estimated travel time is 174 minutes with an average speed of 60 mph.

Figure 1-2: Atlanta-Birmingham Shared Use Evaluated Alternatives



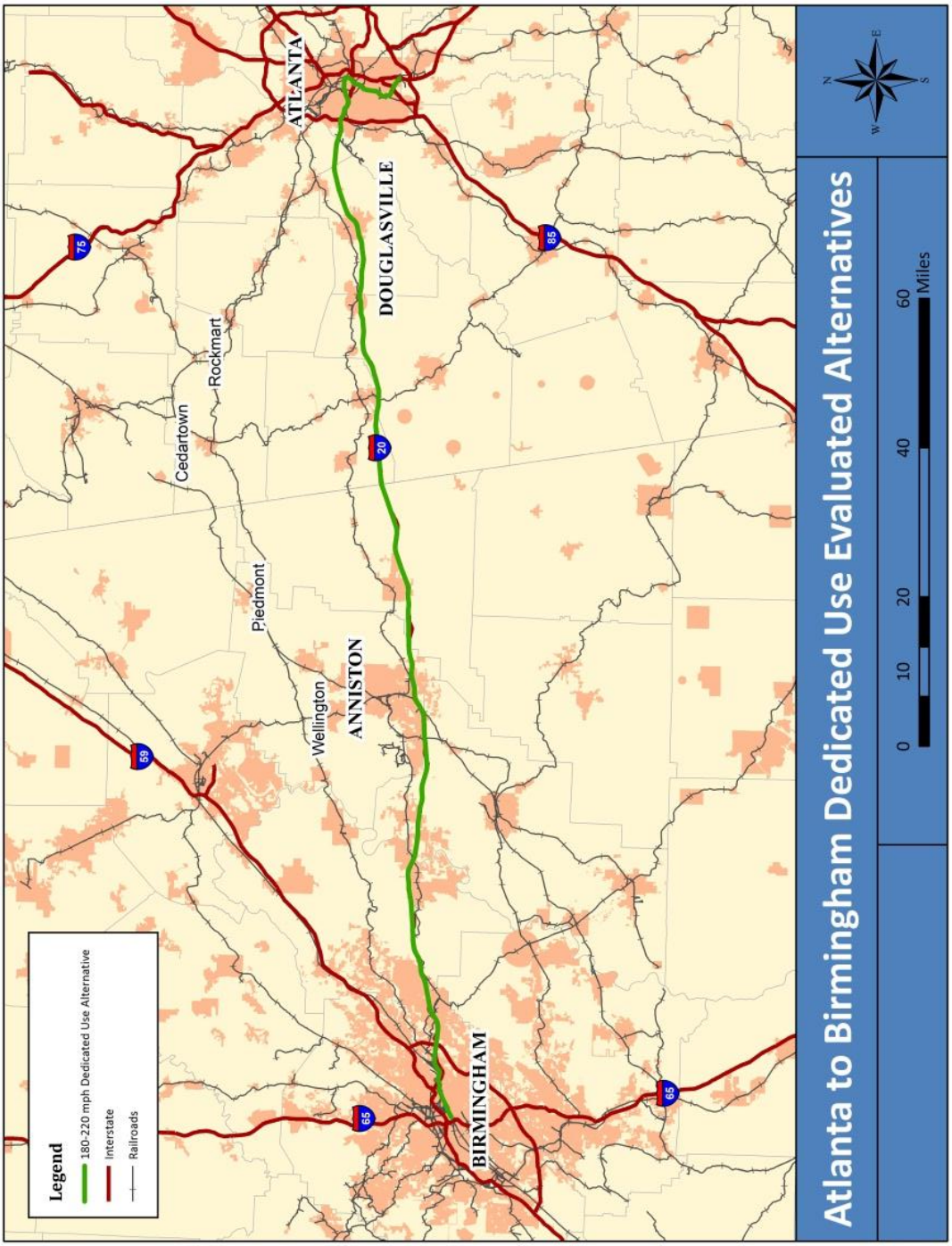
1.1.2 180-220 MPH DEDICATED USE CORRIDORS

The study assumed that viable high-speed rail operations along interstate highway corridors are to be on one of three basic routes: within the highway median, alongside the outside highway lane within the highway right-of-way, or in purchased right-of-way adjacent to the highway right-of-way. Where selected interstate highway curves were greater than 30', the high-speed rail route was adjusted to leave the immediate highway corridor if justified by travel time savings. It should be noted that while there is not a preferred alignment alternative as a part of the feasibility study, but variations in these basic routes will have an impact on cost and environmental considerations.

The proposed Dedicated Use route generally follows the Interstate 20 (I-20) corridor. For 180-220 mph high-speed rail, to maintain top speeds, the track cannot exceed a curvature of greater than 30 minutes. For most of the Dedicated Use route, the interstate is a four- lane, rural facility with a 70 mile-per-hour speed limit and at least a 45-foot median, allowing for the trains to use the interstate median. The corridor transitions to a 6-lane facility with speed limits varying between 55 and 65 miles per hour with urban cross-sections both east of Birmingham and also near Douglasville, GA just west of Atlanta. In these areas, it will be necessary to use the shoulder of the interstate route to construct the high-speed rail track. In some instances, the route utilizes a true greenfield route in areas where the interstate right-of-way corridor geometry cannot be eased to the extent necessary for the high-speed train technology. Near downtown Atlanta (within the I-285 perimeter) the Dedicated Use route transitions from the interstate corridor to the NS corridor to connect to the proposed MMPT.

This route is approximately 151 miles with 24 curves that exceed the 30 minute curvature radius. This is equal to about seven miles (five percent) of the corridor. The estimated travel time is approximately 78 minutes with an average speed of 117 mph. Figure 1-3 illustrates this representative Dedicated Use corridor route.

Figure 1-3: Atlanta-Birmingham Dedicated Use Evaluated Alternative



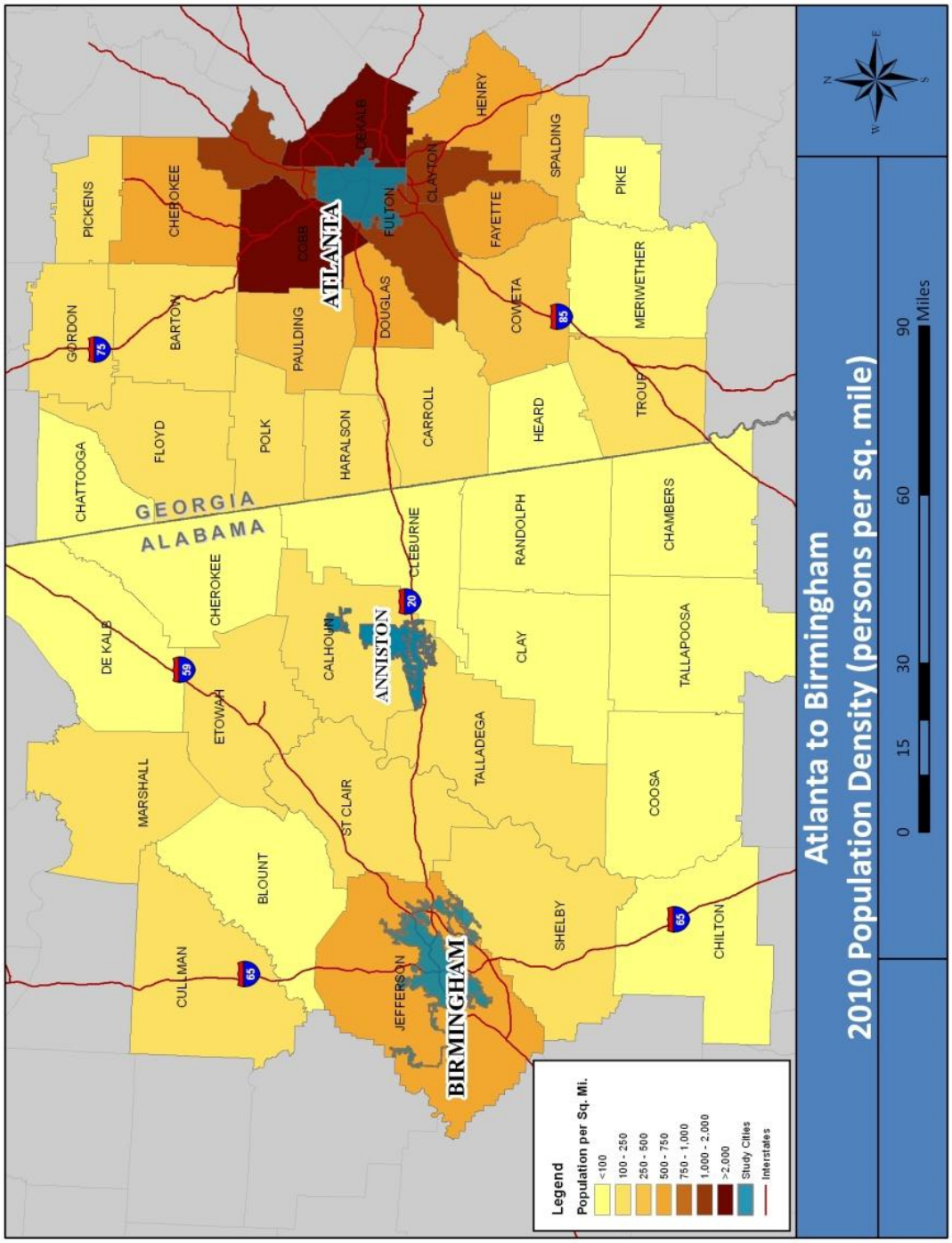
1.2 Demographics and Socioeconomics

1.2.1 Total Population, Density, Race and Age

In order for high-speed rail to be feasible, it must serve areas of high population and employment density in order to produce a market for high-speed rail service. Other characteristics, such as age and race must be considered as this can impact the population's propensity to ride transit.

For the purpose of assessing population, data was reviewed and aggregated from a county level from the 2010 U.S. Census. The total existing (2010) population of the 41 counties in the 100 mile study corridor area is 5,913,667. Despite the fact that most of the study area lies within Alabama, a majority of this population (70%) is located in Georgia. As illustrated in Figure 1-4, population densities vary along the corridor, but are generally higher in Georgia. These densities range from above 2,000 persons per square mile in DeKalb County, GA (2,580) and Cobb (2,023) County, GA to under 50 persons per square mile in many of the rural Alabama Counties, including Cherokee (47), Clay (28), Cleburne (27), Coosa (18), and Randolph (39) Counties. This indicates that much of the corridor is rural and exhibits a potential need for high-speed travel between the major origin and destinations of Atlanta and Birmingham. Appendix D provides 2010 total populations and population density by county.

Figure 1-4: Atlanta-Birmingham Population Density



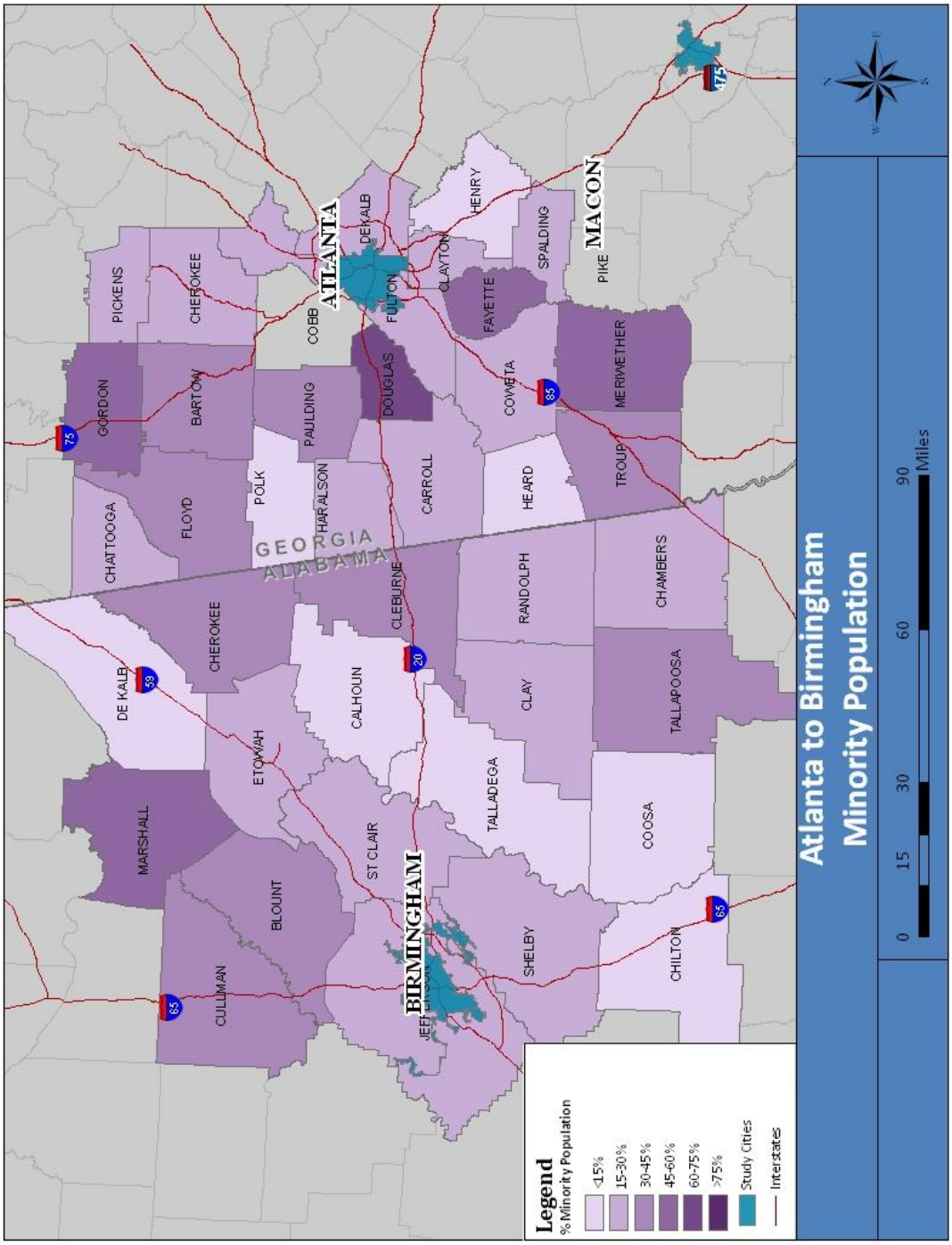
The distribution of race along the corridor is shown in Table 1-1. Most counties along the corridor follow a general trend of majority Caucasian populations, followed by smaller African American and Hispanic populations. Compared to state levels, the distribution of race and ethnicity along the corridor reflect similar patterns to Georgia and slightly lower Caucasian population than Alabama, as illustrated in Table 1-1. However, most of the counties in Georgia, with the exception of Clayton County, DeKalb County and Fulton County, African Americans are the minority. Figure 1-5 illustrates the distribution of minority. Appendix D provides the 2010 racial and ethnic distribution by county.

Table 1-1: Atlanta-Birmingham Race of Study Area Population

Race	Percent of Total Population (2010)	Statewide Georgia – Percent of Total Population (2010)	Statewide Alabama – Percent of Total Population (2010)
White	56.4%	59.7%	68.5%
Black/African American	30.9%	30.5%	26.2%
Hispanic or Latino	7.7%	8.8%	3.9%
American Indian	0.2%	0.3%	0.6%
Asian/Pacific Native	2.9%	3.2%	1.1%
Other	1.7%	2.2%	3.6%

Source: U.S. Census Bureau (2010)

Figure 1-5: Atlanta-Birmingham Minority Populations

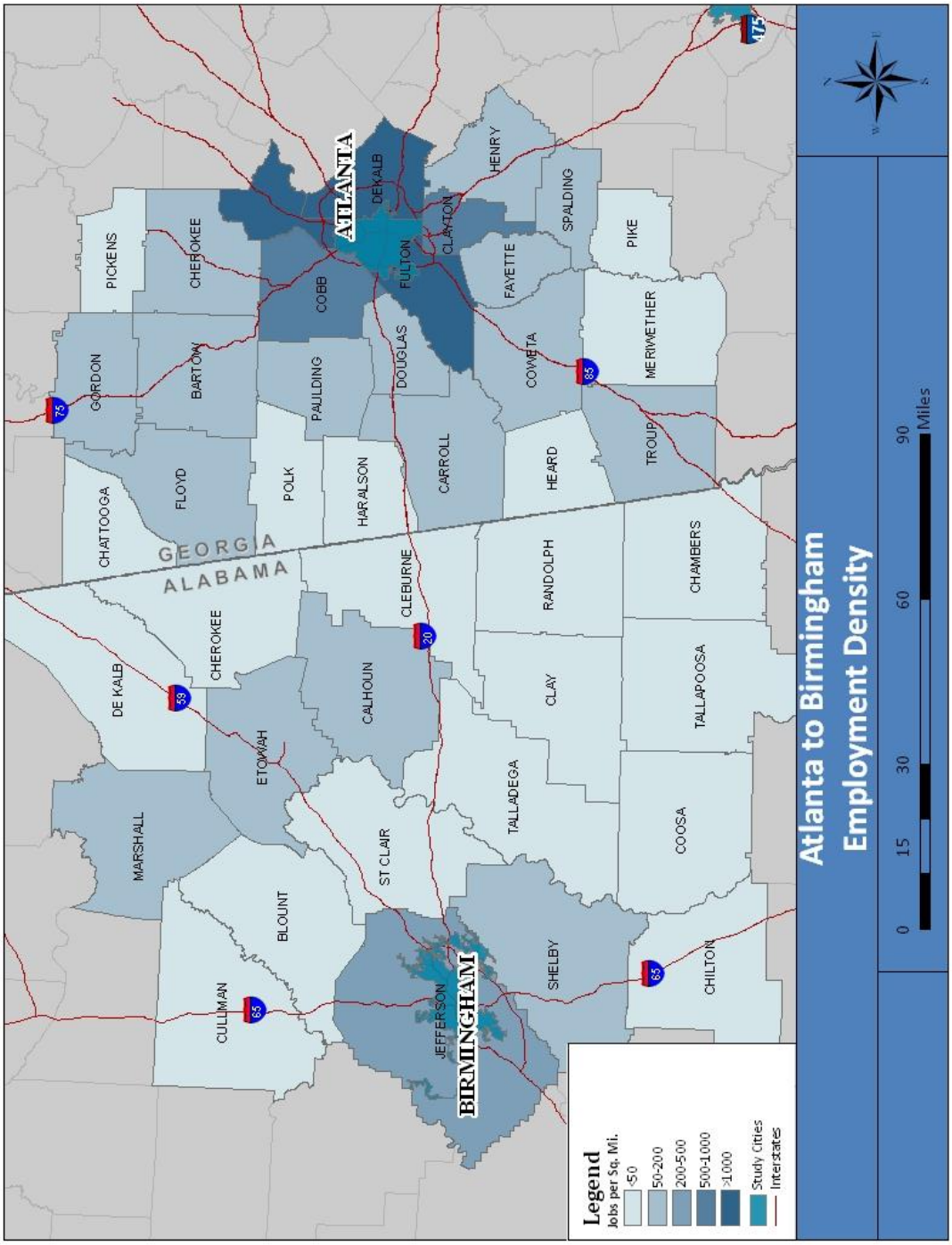


As seen with similar aging trends across the United States, the 2010 senior populations (ages 65 and older) in Alabama and Georgia make up approximately seven percent and six percent of the total population, respectively. However, in the 41-county study area of the Atlanta to Birmingham corridor, the senior population is slightly higher at eight and half percent. Seniors can play a major role in ridership for many transportation alternatives. Many of these seniors are transit dependent and would potentially rely on this high-speed rail corridor for their travels between the two cities, or perhaps from a more rural area to a major city for services such as medical treatment and shopping. Appendix D provides the 2010 aging population by county.

1.2.2 EMPLOYMENT AND EMPLOYMENT CENTERS

Employment distribution is important to understand potential trip patterns since employment centers serve as the destination for most trips whether they are work trips, school trips, shopping trips, or medical trips. Employment densities vary significantly along the study corridor, as illustrated in Figure 1-6. The distributions range from over 1,000 jobs per square mile in Fulton County and DeKalb County, GA to less than 10 jobs per square mile in some of the rural counties in Georgia and Alabama. Over half (55 percent) of the total employment in the corridor is located in the metropolitan Atlanta counties of Cobb, Clayton, DeKalb and Fulton, GA. Another 16 percent of the corridor's employment is located within the Birmingham area, in Jefferson and Shelby Counties. Appendix D provides employment data by county for 2009.

Figure 1-6: Atlanta-Birmingham Employment Density



Major employment centers include hospitals, large office parks, universities, shopping malls, military bases and other activity centers. High-speed rail offers an advantage to populations by offering more reliable, quicker commutes to major employment centers. As previously mentioned, there is opportunity to reach average speed of 117 miles per hour, yielding travel times between the two destinations of just over one hour. This is similar to the automobile commutes workers currently make from suburbs to inner cities. Opening the opportunity for greater distances can potentially increase the economic activity and viability on a regional scale and it may, in turn, enhance the attractiveness of the cities to major industries and businesses.

In general, there are a number of major employment centers within both cities. In Atlanta, there are major universities such as, Georgia Institute of Technology, Georgia State University, Emory University and the Atlanta University System; four major hospitals: Grady Hospital, Piedmont Hospital, Emory Midtown Hospital, and Children's Hospital of Atlanta. Atlanta is home to Fortune 500 companies including, but not limited to The Home Depot (#30), UPS (#48), Coca-Cola Company/Enterprises (#70), Delta Airlines (#88), Southern Company (#147), Genuine Parts (#215), First Data (#236), SunTrust Bank (#244), AGCO (#340), Newell-Rubbermaid (#397), and Mohawk Industries (#427). Further, there is a multitude of small companies and branches of major national and international firms represented in Atlanta. Finally, Atlanta is home to the busiest international airport in the United States, H-JAIA, which accommodates almost 90 million passengers annually (H-JAIA, 2010).

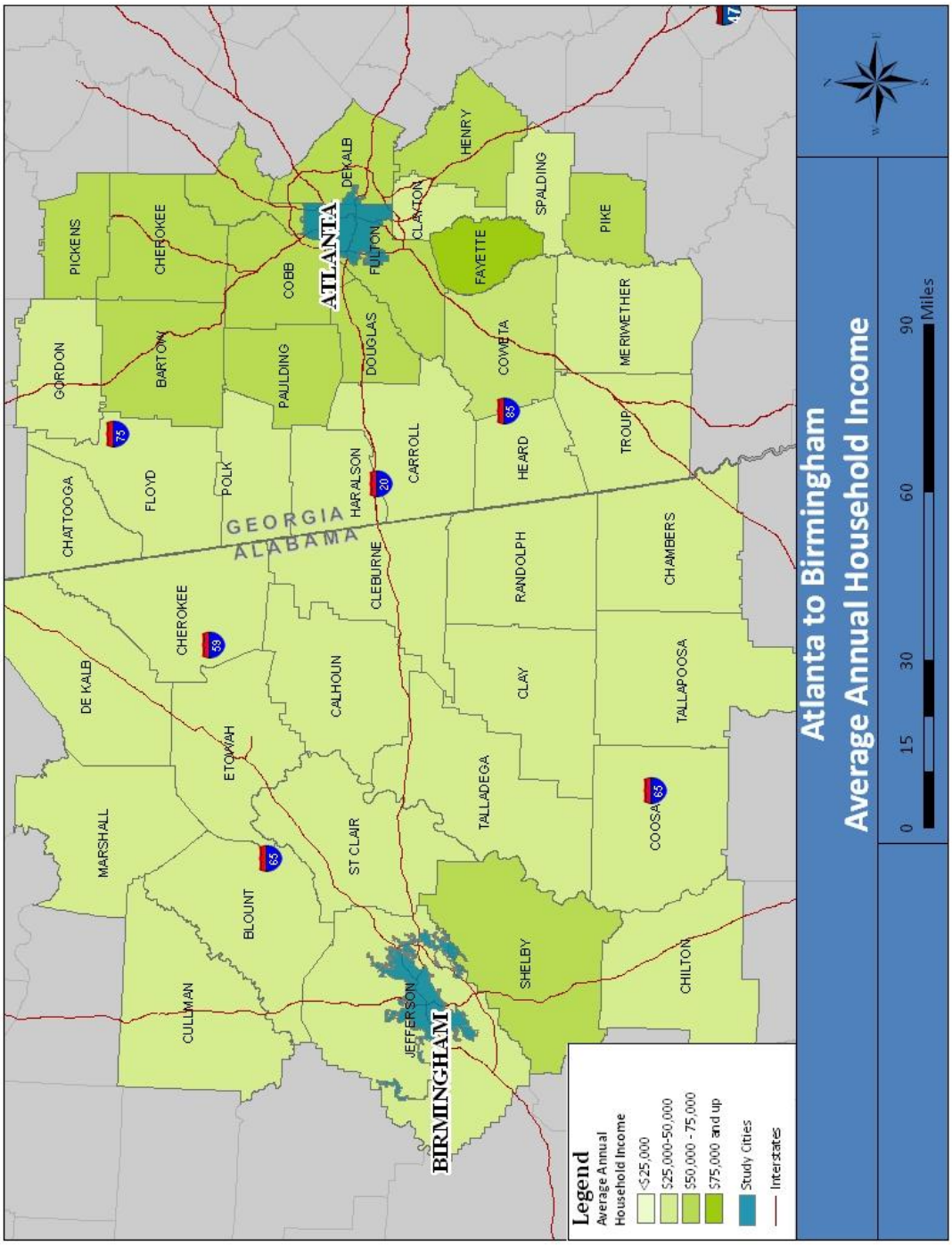
In Birmingham, University of Alabama Birmingham and Stamford University have a large presence. There are two major hospitals including the University of Alabama Hospital and Children's Hospital of Birmingham. Regions Financial Corporation (Fortune 500 #293) houses its headquarters in Birmingham. Other corporations such as Alabama Power, Belk, Books-A-Million, CVS Caremark Corporation, EBSCO Industries, Hibbett Sports, Inc., and State Farm Insurance Companies all have a major presence in Birmingham. Finally, Birmingham-Shuttlesworth International Airport served nearly three million passengers in 2010, making it one of the largest international airports in the southeastern United States.

1.2.3 Socioeconomic Characteristics - Income

Similar to age, income is often a good indicator of an individual's propensity to ride transit. Figure 1-7 shows the average annual household income for counties within the study area. Average incomes for Georgia counties within the study area are similar to that of the nation ($51,833 compared to $51,425 nationally) while those in Alabama are significantly lower (averaging $46,152). Several counties far exceed this average (30 percent or more), including Fayette ($82,678), Cobb ($69,728), Cherokee ($68,627) in Georgia and Shelby ($71,785) in Alabama. Similarly, several

counties have average annual household incomes which are more than 30 percent lower than the national average, including Chattooga ($34,249) and Meriwether ($35,566) in Georgia and Chambers ($35,614), Randolph ($34,185) and Talladega ($35,487) in Alabama. Appendix D provides the income distribution by county for 2009.

Figure 1-7: Atlanta-Birmingham Average Annual Household Income 2009



1.2.4 ENVIRONMENTAL JUSTICE

A full environmental analysis will be necessary for a Tier I NEPA study. However, the feasibility study can begin to identify areas where environmental justice (EJ) issues may surface along the corridor. Minority populations were identified along the Atlanta-Birmingham corridor. The percentage of minority populations within each county along the corridor was compared to the state percentages of minority populations. Those counties whose minority populations exceeded the state average are considered potential EJ counties. Additionally, the county median household income was compared to the statewide median household income. Counties that showed a lower median income than the state are considered potential EJ counties. Table 1-2 illustrates the potential EJ counties and the thresholds met. The detailed demographics for each county are in Appendix D.

Table 1-2: Atlanta-Birmingham Potential EJ by County

County	Thresholds	
	Race/Ethnicity	Household Income
Georgia		
Carroll		✓
Chattooga		✓
Clayton	✓	✓
DeKalb	✓	
Douglas	✓	
Floyd		
Fulton	✓	
Floyd		✓
Gordon		✓
Haralson		✓
Heard		✓
Henry	✓	
Meriwether		✓
Polk		✓
Spalding		✓
Troup		✓
Alabama		
Calhoun		✓
Chambers	✓	✓
Cherokee		✓
Chilton		✓
Clay		✓
Cleburne		✓
Coosa	✓	✓
Cullman		✓
DeKalb		✓
Etowah		✓
Jefferson	✓	
Marshall		✓
Randolph		✓
Talladega	✓	✓
Tallapoosa		✓

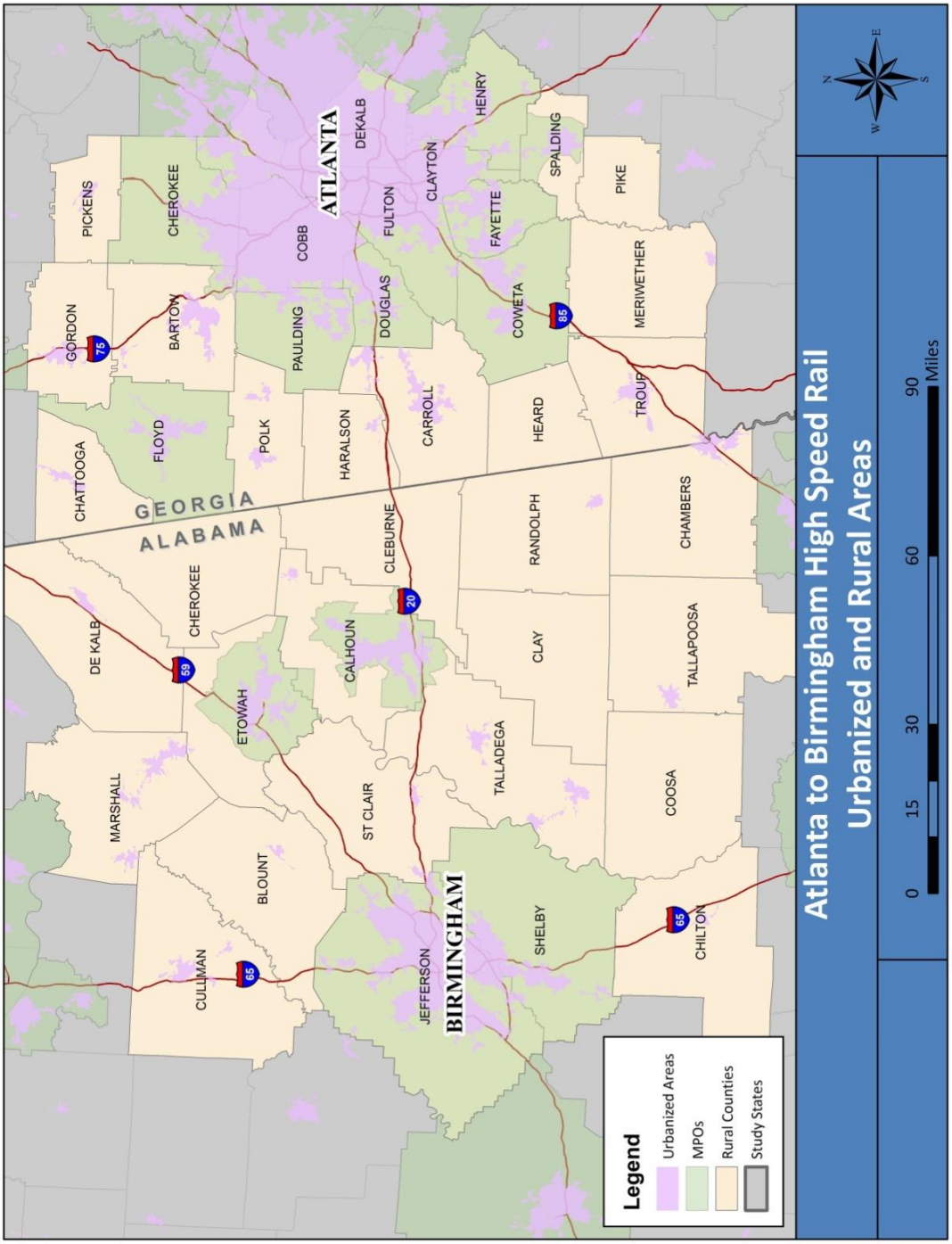
Source: U.S. Census Bureau, 2010

1.3 LAND USE – URBAN VS. RURAL

The study area consists of both urban and rural areas. According to the U.S. Census, urban areas are defined as "densely settled territory, which consist of core census block groups or blocks that have a population density of at least 1,000 people per square mile and surrounding census blocks that have an overall density of at least 500 people per square mile (U.S. Census, 2000). The two terminal points, Atlanta and Birmingham, are major cities with dense commercial, office and residential development near the city centers. Between these two major cities, Anniston serves as an employment and residential center for central Alabama. Between these cities along the corridor, there is a mix of suburban and rural communities and areas.

Figure 1-8 illustrates the location of census-defined urban areas along the study corridor. From Birmingham, traveling east, land uses transition from urban to rural just outside the Jefferson County, AL border and remains rural for much of the route through Alabama with the exception of Calhoun County, AL (City of Anniston). As the route continues east into Georgia, the surrounding land uses remain rural until I-20 reaches the suburbs of metropolitan Atlanta, specifically Paulding County, GA. The study area encompasses a majority of the metro Atlanta region, as it is expected to attract trips from the Atlanta and its surrounding suburbs.

Figure 1-8: Atlanta-Birmingham Urbanized Areas



1.4 TRAVEL PATTERNS

High-speed rail feasibility is partially determined by the success of other modes of travel between major cities. High-speed rail competes with both air and automotive travel, and will therefore, be more successful in corridors where air and auto travel have consistently moderate to high travel between the major cities.

1.4.1 AUTOMOTIVE TRAVEL

The ridership and revenue forecasting methodology utilizes annual auto round-trip estimation from the 1995 ATS conducted by the BTS. This is the most recent intercity travel survey data available. The survey found that there were over one million (1,174,715) vehicular roundtrips between Atlanta and Birmingham annually. The roundtrips between cities can be seen in Table 1-3.

Table 1-3: Atlanta-Birmingham Intercity Auto Trip Table (ATS 1995)

Originating City	Annual Person Trips (Round Trips)
Atlanta	479,181
Birmingham	695,534

Source: ATS, 1995

Traffic counts were also observed between 1995 and 2010 to understand total volumes along the interstates. It should be noted that traffic counts can be misleading because they include both long-distance travel and local travel. Therefore, while traffic counts can give an indication on the demand between the major cities, these are not definitive figures intercity travel. On average, the traffic has increased by 1.71 percent per year between Atlanta and Birmingham (from 25,963 to 33,460, daily).

1.4.2 AIR TRAVEL

Local air travel refers to air passenger volumes on direct flights between the major airports within the study corridor. The Federal Highway Administration (FHWA) Airline DB1B provided volumes for 2010. It should be noted that these figures do not include transfers at either end of corridor, only trips originating in and destined for one of the study cities. The survey determined that there were 7,310 air passengers travelling between Atlanta and Birmingham in 2010. These total volumes can be seen in Table 1-4.

Table 1-4: Local Air Trips in 2010

Originating City	Annual Person Trip (Round Trips)
Atlanta	3,960
Birmingham	3,350

Source: FHWA Airline Origin and Destination Survey Database, 2010 (Q1-Q4)

Air connections are also an important comparison to high-speed rail travel. In many cases along the corridor, connecting flights play an important role in the airport's function. These passengers should be taken into consideration as high-speed rail could potentially serve to replace a flight connection link to another airport. Table 1-5 shows segment-level traffic information for the H-JAIA and Birmingham-Shuttlesworth Airport pair which provides a reliable estimate for the connect air market under consideration. The table includes total passengers, scheduled seats, scheduled departures, average daily frequency, average sets per flight, and average passenger per flight for Q4 2009 to Q3 2010.

Table 1-5: Atlanta-Birmingham Air Services Summary

City Pair	Passengers	Seats	Scheduled Departures	Flights/ Day	Seats/ Flight	Passengers / Flight
ATL-BHM	257,423	324,154	4,745	13	68	54

Source: FHWA Airline Origin and Destination Survey Database, 2010 (Q1-Q4)

1.5 Environmental Issues

Environmentally sensitive areas for the purposes of this study include those that potentially contain threatened and endangered species and/or cultural resources such as properties listed on the NRHP or that are outlined in Section 4(f) of the USDOT Act of 1966. FRA must comply with Section 4(f) guidelines for the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refugees, or public and private historical sites unless the following conditions apply: 1) there is no feasible and prudent alternative to the use of the land; and 2) the actions includes all possible planning to minimize harm to the property resulting from use.

As previously mentioned there are additional environmental aspects that should be considered in future studies, but given the high-level analysis if this feasibility analysis, these aspects are more appropriate during the NEPA process.

1.5.1 Threatened and Endangered Species

Threatened and endangered species lists are maintained by the U.S. FWS. The four corridors were reviewed for the potential of threatened and endangered species on a county basis. The county reports "contain species that are known to or are believed to occur in the county" (U.S. FWS). These counties include Carroll, Cobb, Douglas, Fulton, Haralson, Paulding and Polk in Georgia and Calhoun, Cleburne, Jefferson, Shelby, St. Clair, and Talladega counties in Alabama. A full list of species can be found in Appendix E. There are currently 27 species within study area counties (displayed in Table 1-6) that are listed as endangered, 13 species that are

considered threatened, three species are candidates, and one is potentially endangered.

Table 1-6: Atlanta-Birmingham Study Area Counties Known Endangered and Threatened Species

Species	Status	Species	Status
Red-cockaded woodpecker	Endangered	Goldline darter	Threatened
Southern acornshell	Endangered	Vermilion darter	Endangered
Upland comb shell	Endangered	Rush darter	Potentially Endangered
Finelined pocketbook	Threatened	Etowah darter	Endangered
Ovate clubshell	Endangered	Mohr's Barbara button	Threatened
Southern clubshell	Endangered	Green pitcher-plant	Endangered
Triangular kidneyshell	Endangered	White fringeless orchid	Considered
Coosa moccasinshell	Endangered	Tennessee yellow-eyed grass	Endangered
Southern pigtoe	Endangered	Michaux's sumac	Endangered
Gulf moccasin shinyrayed pocketbook	Endangered	Little amphiantus	Threatened
Orangeacre mucket	Threatened	Georgia rockcress	Considered
Alabama moccasinshell	Threatened	Gentian pinkroot	Endangered
Dark pigtoe	Endangered	Georgia aster	Considered
Pygmy sculpin	Threatened	Alabama leather flower	Endangered
Blue shiner	Threatened	Indiana bat	Endangered
Cherokee darter	Threatened	Gray bat	Endangered
Watercress darter	Endangered	Painted rocksnail	Threatened
Cahaba shiner	Endangered	Cylindrical lioplax	Endangered
Plicate rocksnail	Endangered	Round rocksnail	Threatened
Tulotoma snail	Endangered	Rough hornsnail	Endangered
Flat pebblesnail	Endangered	Lacy elimia	Threatened
Flattened mush turtle	Threatened		

Source: U.S. FWS, 2011

1.5.2 CULTURAL RESOURCES

Using the same counties as the endangered species screening, the study looks at the NRHP to understand the magnitude of historic resources within the corridor. Within the study area, there are a total of 573 places that are listed on the NRHP. While only some of these properties will be located within a close proximity to representative routes, additional resources could potentially be identified during a field survey that are considered eligible for inclusion if the project moves forward into further environmental review. Properties that intersect the high-speed rail

route will need further exploration to determine if there are any adverse impacts before making a preferred route recommendation. A list of the National Register for these counties can be found in Appendix E.

1.6 Issues and Opportunities

As noted in the previous sections, each of the high-speed rail alternatives has potential benefits as well as obstacles to implementation. Issues include environmental impacts, operational barriers, and political concerns. Opportunities for success include the potential to serve key facilities and populations, travel time savings and benefits to freight services operating on these lines. These issues and opportunities, described in Table 1-7, were identified through technical analysis as well as through stakeholder interviews (refer to Chapter 2).

Table 1-7: Issues and Opportunities

Alternative	Opportunities	Issues
110 mph Shared Use Corridors		
NS/Amtrak Crescent	• Utilizes existing NS right-of-way • Could directly serve Anniston/Fort McClellan/ Jacksonville State University • Direct route resulting in shorter travel times • Existing Amtrak route	• High percentage of miles with curvature greater than 1 degree, 30 minutes (41%/68 miles) • Relatively long travel time (166 minutes at 60 mph) due to high number of curves • High train volumes (averages 26 trains/day) • Development of NS Crescent Corridor will result in increased freight traffic in the future • High freight volumes could cause increased passenger train delay • Will require major capacity improvements on NS line from Atlanta to Austell to accommodate passenger service • Route would not serve planned Anniston multimodal center
Seaboard Route (NS Atlanta to Rockmart, Seaboard Rockmart to Birmingham)	• Utilizes existing right-of-way • Potential to serve Anniston/Fort McClellan/Oxford/ Jacksonville University via station in or near Piedmont • Low train volumes because much of route is abandoned or operated by shortlines	• Relatively indirect route resulting in longer travel times • Would require capacity improvements on NS line from Atlanta to Rockmart • Major improvements/track replacement needed to upgrade corridor to Class 6, especially on

Alternative	Opportunities	Issues
	(averages 18 trains/day which is mainly from Atlanta to Rockmart) • Less potential for passenger train delay • Lower percentage of miles with curvature greater than 1 degree, 30 minutes (30%/49 miles) compared to the NS/Amtrak route • Opportunity to benefit NS freight capacity by rerouting Amtrak • Opportunity to benefit Amtrak by reducing train delays due to reduced freight traffic on the Seaboard route	the abandoned corridor from Cedartown to Wellington • May require the relocation of existing bike trails (Silver Comet and Chief Ladiga Trails) • Does not directly serve Anniston area
Seaboard/ NS Route (Anniston Sub-Alternative)	• Serves Anniston area (including Fort McClellan) • Directly passes Jacksonville State University • Utilizes existing right-of-way • Low train volumes on Seaboard segment (averages less than 5 trains per mile on segment between Rockmart and Piedmont) • Opportunity to benefit NS freight capacity by rerouting Amtrak (on NS Corridor between Anniston and Atlanta) • Opportunity to benefit Amtrak by reducing train delays (on NS Corridor between Anniston and Atlanta)	• Current Anniston Amtrak station is not accessible by the connection between the Seaboard and NS routes • Additional miles and stop in Anniston make the travel time between endpoints longer (adds an additional 25 miles and an overall travel time from Atlanta to Birmingham 174 minutes) • More potential for passenger train delay due to higher traffic volumes (averages between 18 and 26 trains/day) between Anniston and Birmingham • The Anniston connection has an additional 2.86 miles of curves exceeding 1 degree, 30 minutes (11% of miles) • Increased travel time due to the increase in freight volumes and a potential stop in Anniston • Seaboard portion of track would require major improvements to be upgraded to a Class 6 facility • May require the relocation of existing bike trails (Silver Comet and Chief Ladiga Trails)

Alternative	Opportunities	Issues
		• Reduced speeds due to curves required through Anniston
220 mph Dedicated Use Corridor		
Interstate 20/NS Greenfield	• Direct route (150 miles) resulting in shorter travel times • Travel time is 60% that of Shared Use routes • Less than 5% of miles (7 miles) exceed curve limit of 30 minutes • Potential to serve Anniston/Fort McClellan/Oxford/Jacksonville State University via station in or near Oxford	• Significantly higher cost than Shared Use alternative • Limited available right-of-way in some areas especially in the urban areas of Atlanta, Anniston and Birmingham • Will require significant land takings and associated social and environmental impacts

2 STAKEHOLDER OUTREACH

As a part of the High-Speed Rail Feasibility Study effort, the study developed a Public Involvement Plan identifying targeted stakeholders as well as outreach techniques designed to encourage two-way communication for the duration of the study effort. Refer to Appendix A for the Public Involvement Plan in its entirety. The purpose of the outreach effort was to keep key stakeholders along the Atlanta-Birmingham Corridor informed of the study process and results, and to identify local issues and opportunities for consideration in the development of alternative routes. In some cases, the study received local input on methodologies for the corridor to determine the best representative routes for the corridor (subsequent sections outline the major input of the stakeholders). Input from local stakeholders also ensured that the study reflects the most recent and accurate data available to determine high-speed rail feasibility.

For the Atlanta-Birmingham Corridor, the study worked with the following stakeholder organizations:

- Alabama Department of Economic and Community Affairs (ADECA);
- Alabama Department of Transportation (ALDOT);
- The Atlanta Regional Commission (ARC);
- Birmingham-Jefferson County Transit Authority (BJCTA);
- City of Anniston;
- City of Birmingham;
- East Alabama Regional Planning Commission (EARPC); and
- Regional Planning Commission of Greater Birmingham (RPCGB).

The study held three rounds of stakeholder involvement activities throughout the study process. Table 2-1 shows the three rounds of meetings and the details of each meeting for the Atlanta-Birmingham Corridor. The first round of meetings took place in May 2011 in which the study met with representatives of each of the stakeholders to introduce them to the study project scope and schedule. The study described the study corridor and the potential alternatives that were under a technical review to determine the best alternative to represent a Shared Use and Dedicated Use routes. The study also presented corridor maps outlining all identified strengths, weaknesses, issues and opportunities along each of the potential alternatives (Figure 2-1). The study gathered input from the stakeholders to combine with technical data to develop the Issues and Opportunities table (refer back to Table 1-6) and, ultimately, the representative routes. Refer to Appendix A for the stakeholder agenda and handout packet presented at each of these meetings.

Table 2-1: Stakeholder Outreach Meetings

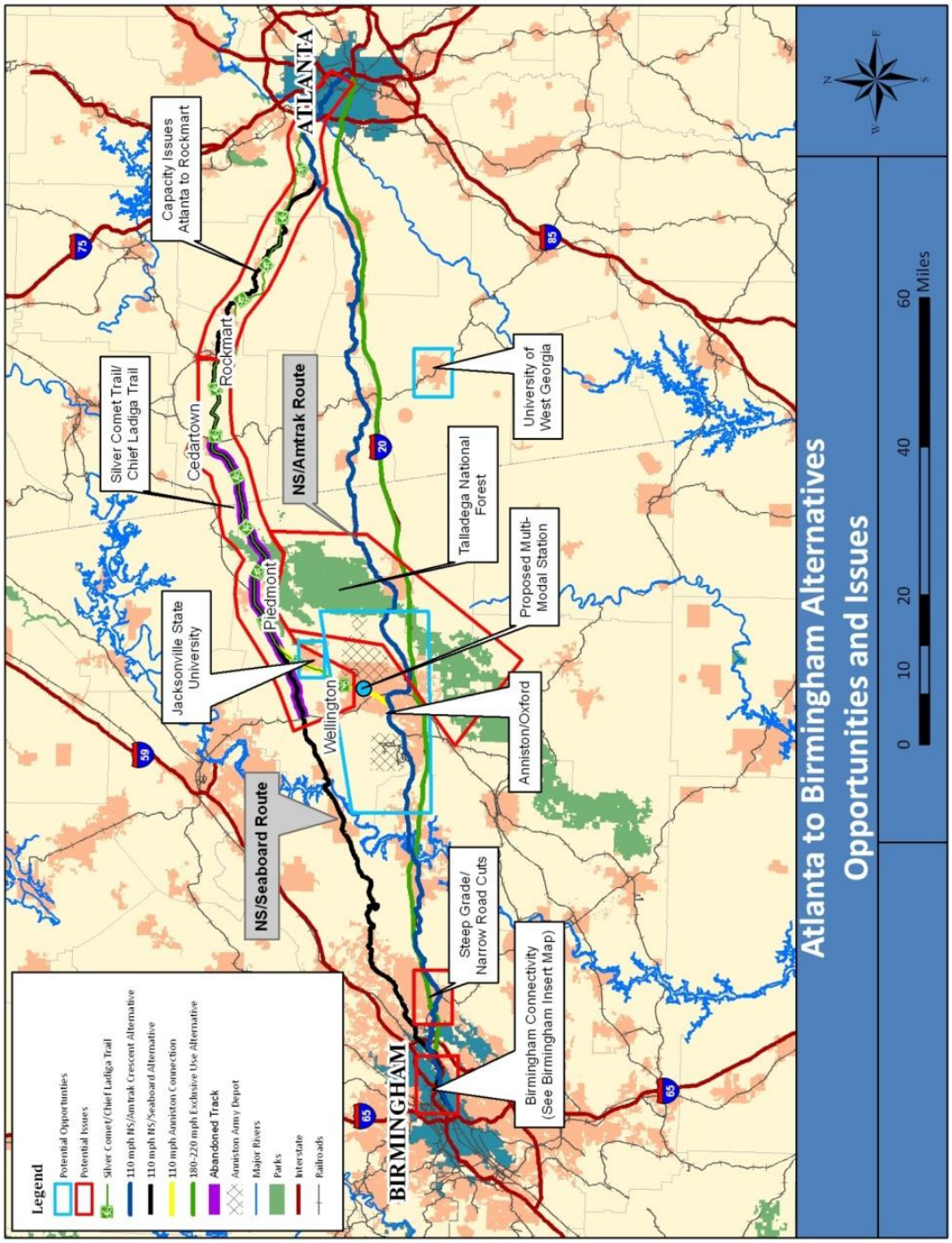
Stakeholder	Date	Time (EST)	Location
Round One, Stakeholder Meetings			
City of Anniston / EARPC	May 16, 2011	8:00-9:45 AM	Anniston, AL
BJCTA	May 16, 2011	10:15-11:00AM	Birmingham, AL
RPCGB	May 16, 2011	11:00 AM-12:00 PM	Birmingham, AL
ADECA	May 16, 2011	2:30-3:30 PM	Montgomery, AL
ALDOT	May 16, 2011	4:00-5:00 PM	Montgomery, AL
ARC	May 27, 2011	11:00 AM-12:00 PM	Atlanta, GA
Round Two, Corridor Webinar			
All Stakeholders	September 8, 2011	3:00-4:00 PM	On-Line
Round Three, Stakeholder Meetings			
BJCTA	November 14, 2011	10:00-11:00 AM	Birmingham, AL
RPCGB	November 14, 2011	11:00 AM-12:00 PM	Birmingham, AL
ADECA	November 14, 2011	2:00-3:00 PM	Montgomery, AL
ALDOT	November 14, 2011	3:30-4:30 PM	Montgomery, AL
ARC	November 30, 2011	9:00-10:00 AM	Atlanta, GA
City of Anniston / EARPC	December 13, 2011	1:30-2:30 PM	Anniston, AL
City of Birmingham	December 13, 2011	4:30-5:30 PM	Birmingham, AL

Major Stakeholder Input

Stakeholders provided valuable insight into issues and opportunities along the corridor to assist the study in developing the representative routes for the Shared Use and Dedicated Use services. Outlined below, are a few of the main feedback comments heard across the corridor.

- The Chief Ladiga Trail is an important rails to trails project in Alabama, and it will be difficult with public involvement and environmentally to use this corridor for passenger rail.
- The Talladega National Forest is a major environmental concern that will be an important obstacle moving forward in environmental studies.
- There is potential for a multi-modal station along the Anniston connection line that Anniston would be interested in pursuing further if this study determines that connection line to be feasible.
- There is no longer an active military base in Anniston (this opportunity area was eliminated from Figure 2-1).
- Anniston could generate a good portion of ridership for commuting to and from Birmingham.

Figure 2-1: Atlanta-Birmingham Issues and Opportunities



The second round of meetings was a virtual webinar and conference call held in September 2011 to provide an update on the corridor progress and present preliminary results on capital costs, operating and maintenance costs, and ridership and revenue for both the Shared Use and Dedicated Use representative routes. Additionally, the study presented a variety of technology considerations for the corridor and gave an update on the federal funding options and strategies moving forward. Refer to Appendix A for the webinar agenda and presentation.

Major Stakeholder Input

- Stakeholders participants in the webinar session showed an overall interest in development of the capital cost estimates and technology alternatives.
- Stakeholders inquired about freight railroad agreements and whether the railroad owners would allow higher speeds on the freight corridors. The study stated that worked with railroad owners, and agreements would need to be in place for speeds greater than 79 mph.

The third and final round of meetings was held in November 2011 in which the study presented the final estimates for capital costs, operating and maintenance costs and ridership and revenue. Additionally, the study ran operating ratio and consumer surplus analyses to determine the overall feasibility of the Atlanta-Birmingham Corridor and made final observations and recommendations for the corridor moving forward. Refer to Appendix A for the meeting agenda and presentation.

Major Stakeholder Input

- Stakeholders agreed that a Dedicated Use alternative would be the better option for the corridor.
- Stakeholders were pleased with the cost and ridership estimates, understanding that a feasibility-level study would produce high-level estimates.
- Stakeholders were generally encouraged with the results, and showed interest in next steps.

3 REPRESENTATIVE ROUTES

Representative Shared Use and Dedicated Use routes were identified in the Atlanta-Birmingham Corridor to provide a basis for developing ridership and revenue forecasts, capital costs, and operating and maintenance costs to assess the feasibility of the corridor for high-speed rail service. The representative routes were selected based on an analysis of physical, cost and service factors as well as stakeholder input. Each is an illustrative route for the corridor for purposes of determining feasibility, and is not intended to represent a locally preferred route. Final decisions on routes and specific alignments will be made in future environmental study phases if the corridor is determined to be feasible.

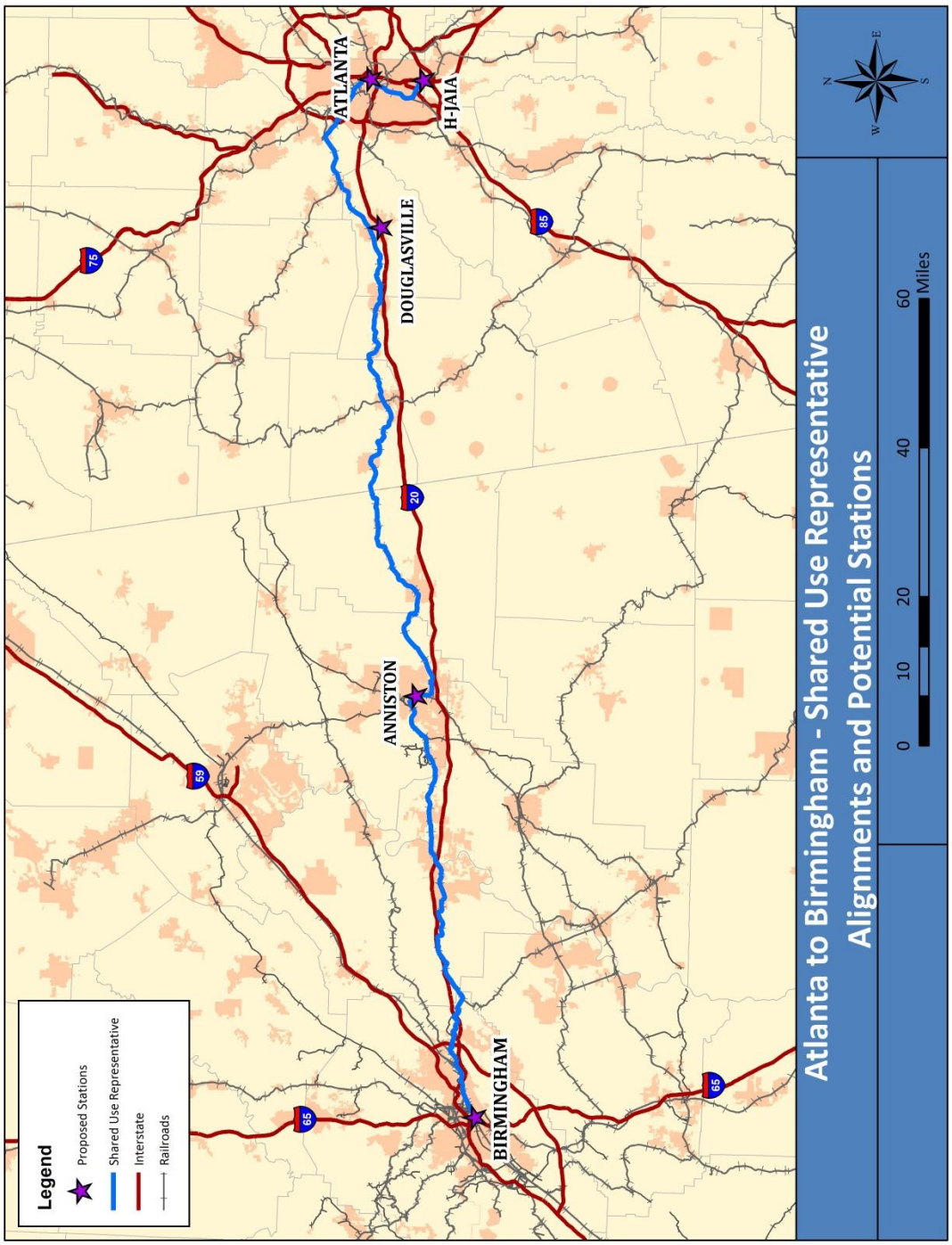
3.1 90-110 MPH EMERGING HIGH-SPEED RAIL (SHARED USE)

In identifying capacity improvements required for 90-110 mph Shared Use operations in the Atlanta-Birmingham Corridor, the study assumed that all infrastructure improvements could be made within the existing freight right-of-way (assumed at 100 feet). All segment corridors are currently single track with passing sidings. The proposed Shared Use Corridor was assumed to be double track for each of the segments in order to accommodate new passenger service as well as the existing and forecasted freight operations. Table 3-1 describes the Shared Use route in detail. Figure 3-1 illustrates the Shared Use representative route.

Table 3-1: Atlanta-Birmingham Shared Use route Characteristics

Atlanta-Birmingham	
Train Capacity	Class 4 - Single track with Sidings
Train Frequency	Existing: 26.3 freight trains per day (average)
	Future: 52.6 freight trains per day (average)
	Proposed passenger frequency: 6 round trips per day
Track Geometry and Capacity	Total Corridor: 176.0 route miles
	41% of corridor / 67.5 miles exceed 1 degree, 30 minute curves
Travel Time Estimations (Schedule Time Including Station Stops)	2 hours, 46 minutes

Figure 3-1: Atlanta-Birmingham Shared Use Representative Route and Stations



In developing the station locations, the study took into consideration airports, transit connections, major downtown areas and minor cities and suburbs. Refer to Chapter 4 for station details as they pertain the operating plan and schedule

Two types of stations were evaluated as a part of the operating plan schedule and also capital costs. Major stations refer to major city stations in which the study assumes locations, costs and designs as outlined by previous studies and plans. The source of the capital costs for each of these stations is documented below. Additionally, the study developed an Intermediate station plan and an associated lump sum cost estimate that was used for all other, smaller-scale stations (refer to Section I: Chapter 3 for details).

Table 3-2: Atlanta-Macon-Jacksonville Shared Use Proposed Stations

Potential Stations	Estimated Cost	Source of Cost Estimate
H-JAIA, Atlanta GA	$100 million	Feasibility Study Estimate
MMPT, Atlanta GA	$350 million	Feasibility Study Estimate[19]
Douglasville, GA	$7.2 million	Feasibility Study Estimate
Anniston, AL	$7.2 million	Feasibility Study Estimate
Birmingham, AL	$30 million	BJCTA

3.1.1.1 Major Terminal Stations

There are three major terminal stations along the Atlanta-Birmingham Corridor:

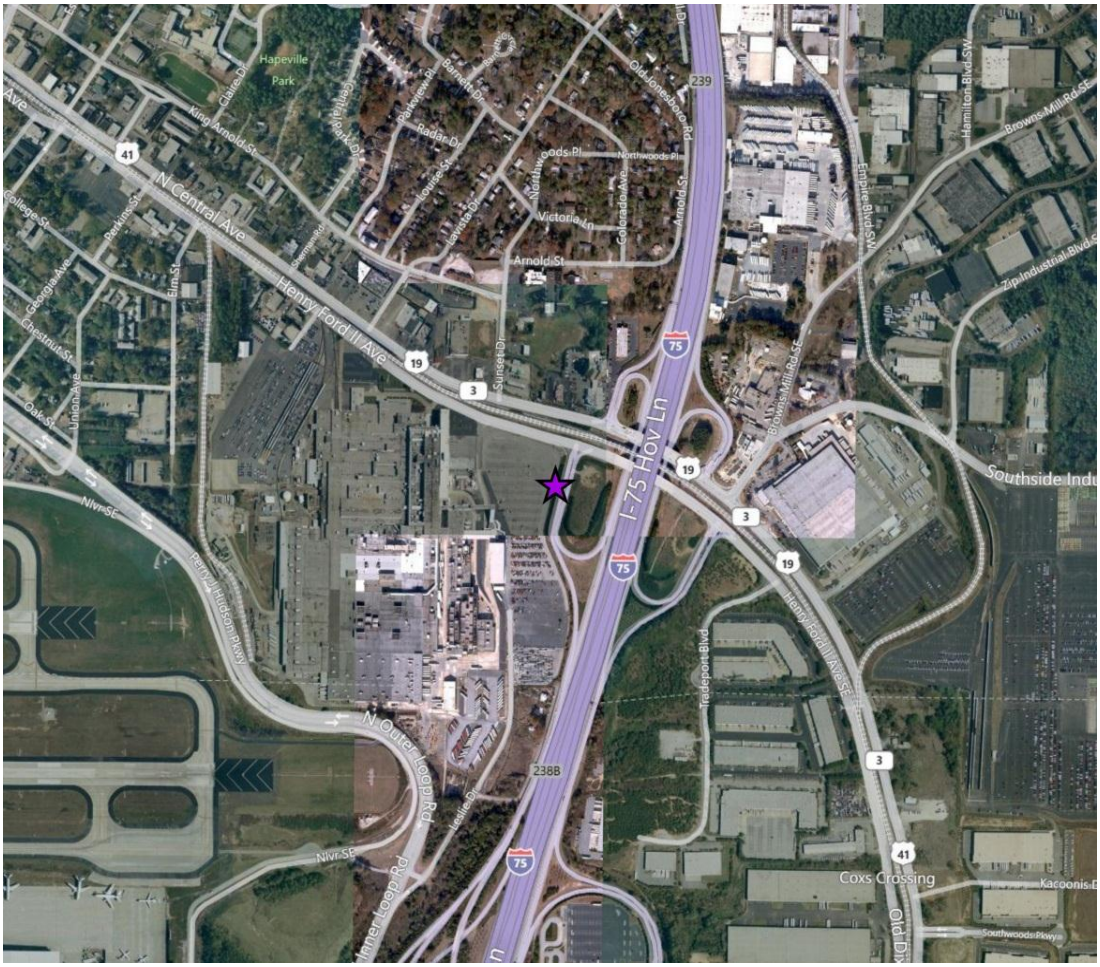
- H-JAIA;
- Atlanta MMPT; and
- Birmingham Multimodal Station.

[19] MMPT Cost estimates are based on Central Atlanta Progress 1992 estimates of $165,650,000. This was elevated to 2011 dollars using the Consumer Price Index (CPI), and added a 30 percent contingency.

Hartsfield-Jackson Atlanta International Airport

The H-JAIA station is proposed on a site adjacent to the airport in which intermodal connections could potentially be constructed between the rail terminal and the airport terminals. This site, located at the southwest corner of the intersection I-75 and Henry Ford II Avenue (US Highway 19/41) and the NS Jackson rail line as illustrated in Figure 3-2. The cost of this station is estimated at approximately $100 million.

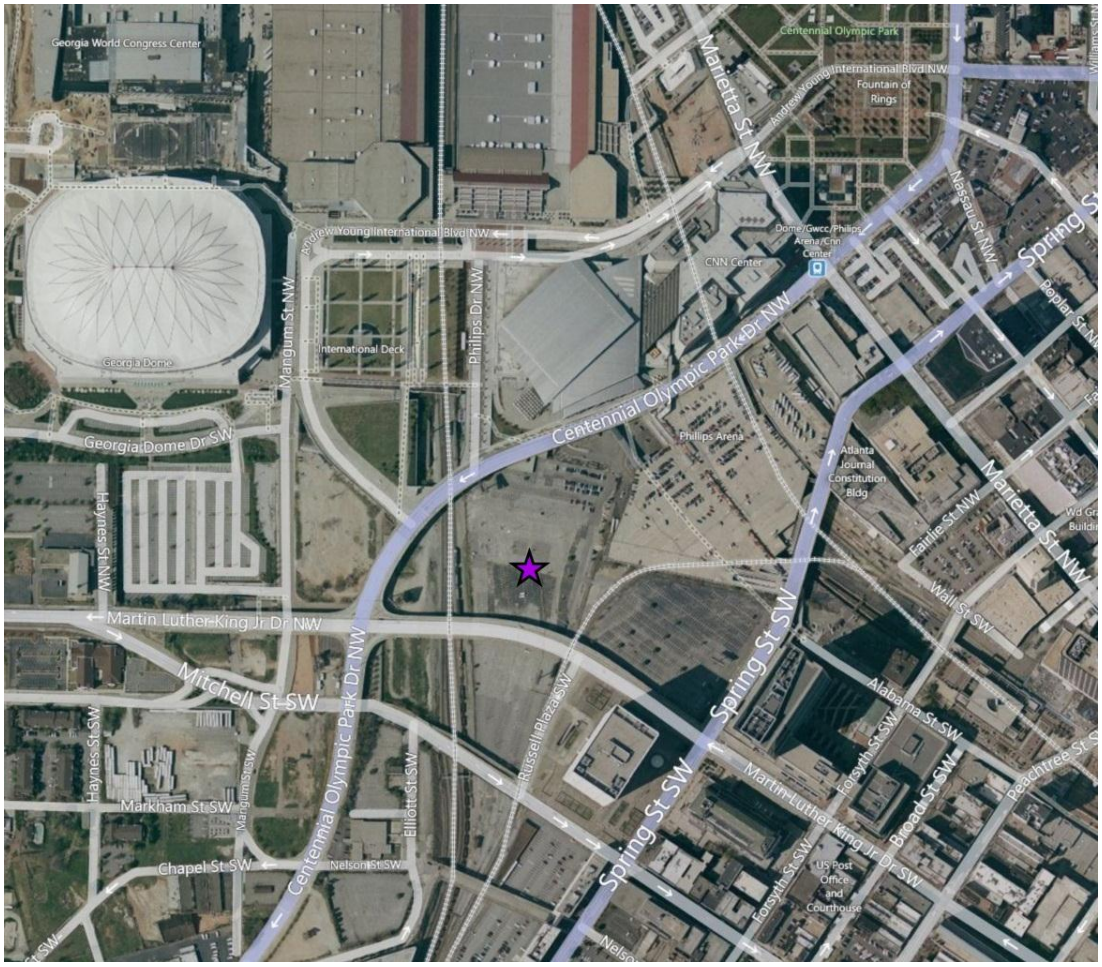
Figure 3-2: H-JAIA Station Location



Atlanta Multi-Modal Passenger Terminal

The AMMPT is an on-going public private partnership initiative in downtown Atlanta. The MMPT is proposed as a major high-speed, commuter rail and transit hub for the Atlanta metropolitan area. Although the exact location of the MMPT is not yet determined, Figure 3-3 displays the study area for the MMPT that was used for the purposes of this study. The estimated cost for the station and track infrastructure that was incorporated into the capital cost estimates for this feasibility study are $350 million based on estimates from Central Atlanta Progress, elevated costs to 2011 dollars and added contingency.

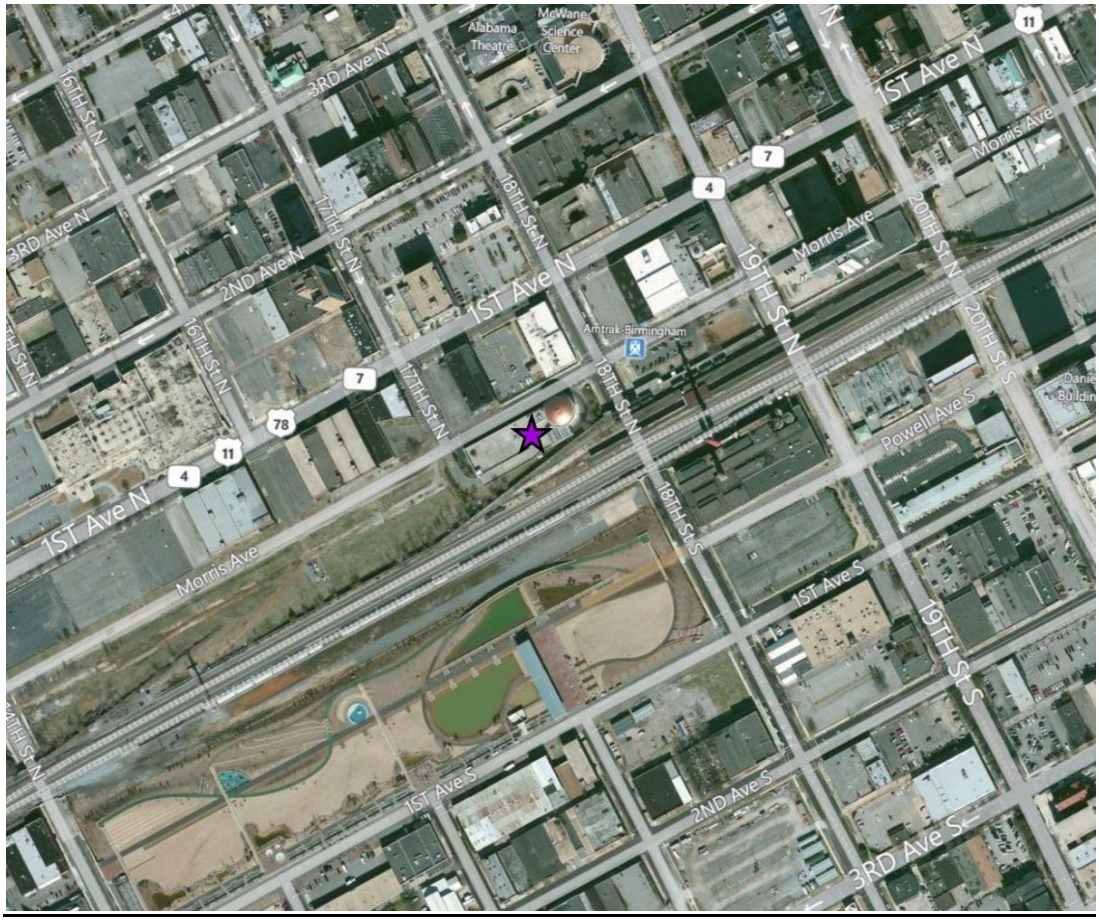
Figure 3-3: Atlanta MMPT Station Location



Birmingham Intermodal Transportation Facility

The City of Birmingham along with BJCTA is working with private consulting firms to design and build a new intermodal facility for the City. This facility will house BJCTA as well as provide a transportation hub for various modes of ground transportation including bus, taxis and the current Amtrak rail service. The facility will replace the existing BJCTA station in downtown. As of now, construction is estimated to begin in 2012 and be completed in 2014 and has an estimated cost of $30 million. Figure 3-4 outlines the proposed location of the new intermodal transportation facility

Figure 3-4: Birmingham Intermodal Transportation Facility



3.1.1.2 Intermediate Stations

Intermediate stations are located between major city destinations along the Atlanta-Birmingham Corridor. These stations serve smaller city and suburban populations and are not as large as major destination terminals. As outlined in Section I: Chapter 3, the Intermediate stations are characterized as Amtrak "medium" stations with a 6,600 square foot station building and 2,000 linear foot platform. The estimated cost for these Intermediate stations is approximately $7.3 million per station with an added 30 percent contingency. For the Atlanta-Birmingham Corridor, the study identified two potential small city and/or suburban Intermediate stations:

- Douglasville, GA and
- Anniston, AL.

Douglasville, Georgia

A station was located in Douglasville, GA to capture the western Atlanta suburbs as well as a portion of the southern and northern Atlanta suburbs for those that would rather travel to this station than the Atlanta MMPT site in downtown. Additionally, this station would capture a portion of western Georgia travelling to either Alabama or Atlanta. Figure 3-5 illustrates the proposed station location for the purposes of developing the operating plan and estimating ridership for the corridor.

Figure 3-5: Douglasville Intermediate Station



Anniston, Alabama

Similar to Douglasville, the study proposed a station in Anniston, AL to capture ridership from Anniston and the surrounding areas. Anniston is located between Birmingham and the Georgia state line providing a good area for a centrally station. In addition, Anniston currently houses an Amtrak station for the Crescent corridor service. Therefore, the study upgraded the existing station to the Intermediate station specifications. Figure 3-6 shows the location of the existing Amtrak station and proposed Intermediate high-speed rail station.

Figure 3-6: Anniston Intermediate Station



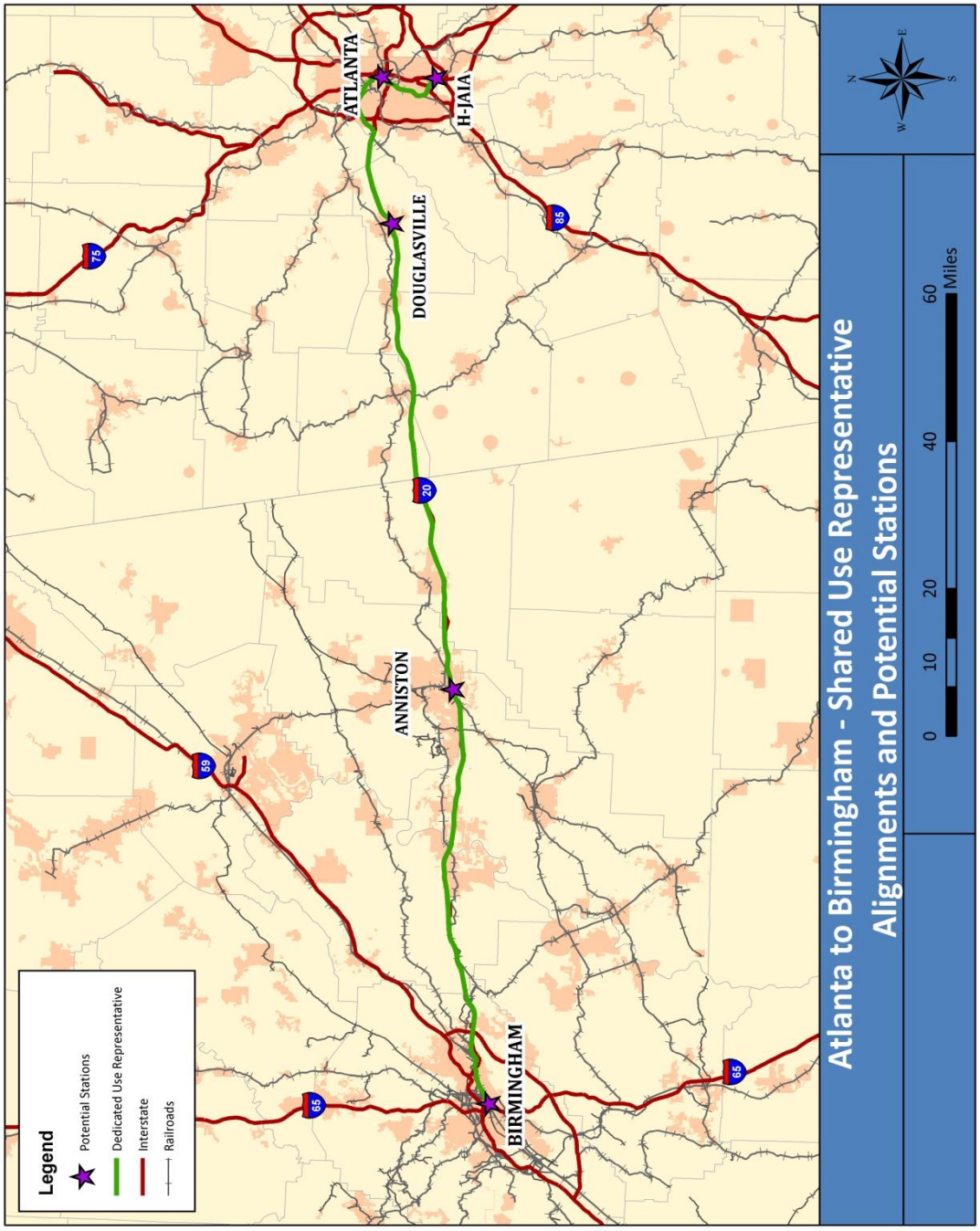
3.2 180-220 MPH EXPRESS HIGH-SPEED RAIL (DEDICATED USE)

The Atlanta-Birmingham 180-220 mph Dedicated Use alternative is a greenfield interstate highway route that utilizes existing freight corridor right-of-way for the last few miles into each major city (Atlanta, GA and Birmingham, AL). The shared "last mile" corridors still fully separate passenger and freight operations to maximize system efficiency. The Dedicated Use alternative is an electrified, steel-wheel, double-track system. The required right-of-way is assumed to be 60-feet in urban areas and 100-feet in rural areas. Table 3-3 and Figure 3-7 outlines the Dedicated Use track characteristics.

Table 3-3: Atlanta-Birmingham Dedicated Use Characteristics

	Atlanta-Birmingham
Train Capacity	Double track with universal crossover every 50 miles
Train Frequency	Proposed Frequency: 10 round trips per day
Track Geometry and Capacity	Total Corridor: 150.7 route miles
	4.9% of corridor / 7.0 miles exceed 30 minute curves
Travel Time Estimations (Schedule Time Including Station Stops)	1 hour, 18 minutes

Figure 3-7: Atlanta-Birmingham Dedicated Use Representative Route and Stations



3.2.1 PROPOSED STATIONS

For the Atlanta-Birmingham Corridor, the study utilized an identical set of station locations for the Dedicated Use route with the exception of the Anniston station. The existing Amtrak station in Anniston is approximately 3.2 miles north of the Dedicated Use representative route; therefore, for the Dedicated Use, the study assumed a new Intermediate station just south of the existing Amtrak station, as illustrated in Figure 3-8.

Figure 3-8: Anniston, AL Dedicated Use Station Location



The other station locations were each designed to maximized accessibility to existing freight rail right-of-way as the routes entered urban areas. Table 3-2 (in section 3.2.1) outlines the potential station and their associated costs.

4 OPERATING PLAN AND SCHEDULE

Timetables were developed for each of the speed options and each of the routes identified for the corridor. As discussed in Section I of the report, for the Shared Use option, tilting diesel-electric trains with a maximum speed limit of 110 mph were simulated over the existing NS rail route. For the Dedicated Use option, 220 mph electric trains were simulated. A five percent (5%) slack time allowance was added to the simulated running times to produce the suggested train schedules.

4.1 90-110 MPH SHARED USE

4.1.1 SPEED PROFILE AND TIMETABLE

The study ran a speed profile for the Atlanta-Birmingham Shared Use as illustrated in Figure 4-1. The average speed along the 176-mile corridor was approximately 64 mph, with peaks near or above 100 mph.

Figure 4-1: Atlanta-Birmingham Shared Use Speed Profile

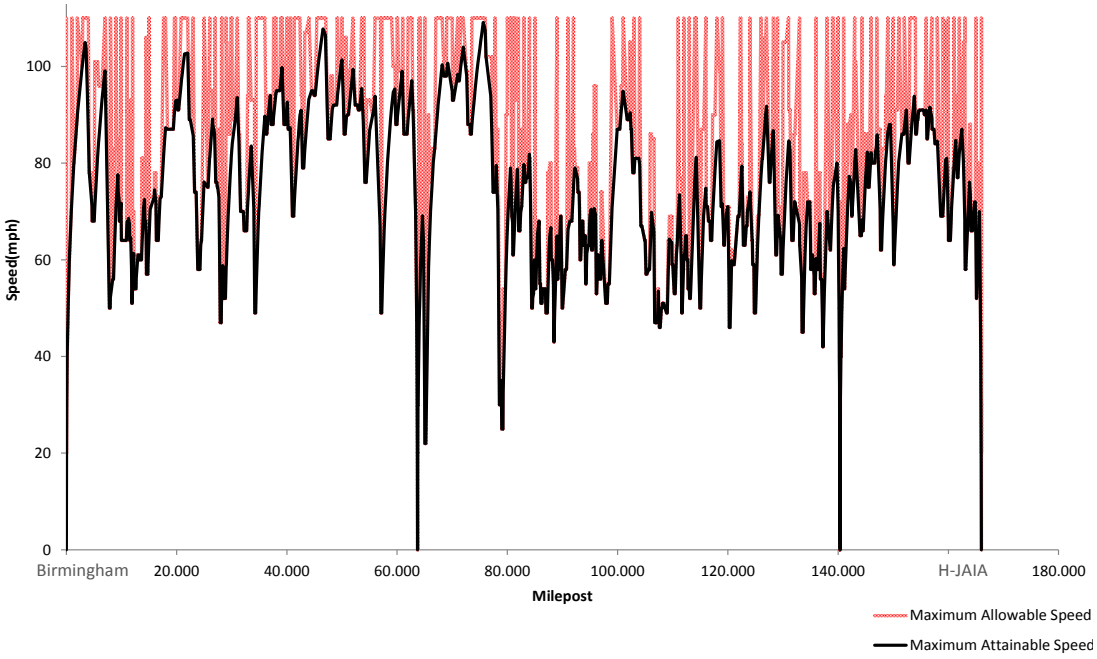


Table 4-1 illustrates a typical travel time table outlining the route station segments, rail distance, scheduled travel time, cumulative travel time and average speed for the Atlanta-Birmingham Shared Use corridor.

Table 4-1: Atlanta-Birmingham Shared Use Speed and Travel Time Table

Shared Use				
Segment	**Rail Distance**	**Travel Time**	**Cumulative Travel Time**	**Average Speed (mph)**
Birmingham	0.0	0:00	0:00	0
Anniston	63.7	0:56	0:56	68
Douglasville	76.4	1:19	2:15	58
Atlanta MMPT	26.7	0:23	2:38	67
Atlanta Airport	9.0	0:08	2:47	65
Total	**176.0**	**2:46**	**2:46**	**64**

As seen in the above Figure 4-1 and Table 4-1, although the tilting diesel-electric train would be capable of operating at 110 mph or better, curves on the existing NS rail line would restrict the train to 79 mph or less, even taking the train's tilt capability into account. The table indicates a travel time of 2 hours and 46 minutes, slower than the average auto driving time (2 hours 26 minutes) between the two end destinations.

4.1.2 Operating Plan

The running times were used in conjunction with the prospective train frequencies to develop an initial assessment of the ridership forecast for the Atlanta-Birmingham Shared Use Corridor. In addition, the results of the three corridors were compared to one another, resulting in frequency adjustments so that each corridor could utilize the same train size, for corridor compatibility. As a result, the train frequencies and train sizes were adjusted after initial ridership and revenue results to balance planned train capacity against ridership for the corridor. The Shared Use operations are projected to run six round trips per day, with 250 seats per train. Given the combination of train frequencies and running times, four train-sets would be required to cover the Shared Use equipment rotation.

Table 4-2: Atlanta-Birmingham Shared Use Train Frequency and Size

Scenario	Round Trips per Day	# of Seats per Train	# of Train-Sets
Shared Use	6	250	4

4.2 180-220 MPH DEDICATED USE

4.2.1 SPEED PROFILE AND TIMETABLE

The study developed a speed profile for the Atlanta-Birmingham Dedicated Use route as illustrated in Figure 4-2. The average speed along the 151-mile corridor was approximately 117 mph, with consistent segments near or above 150 mph.

Figure 4-2: Atlanta-Birmingham Dedicated Use Speed Profile

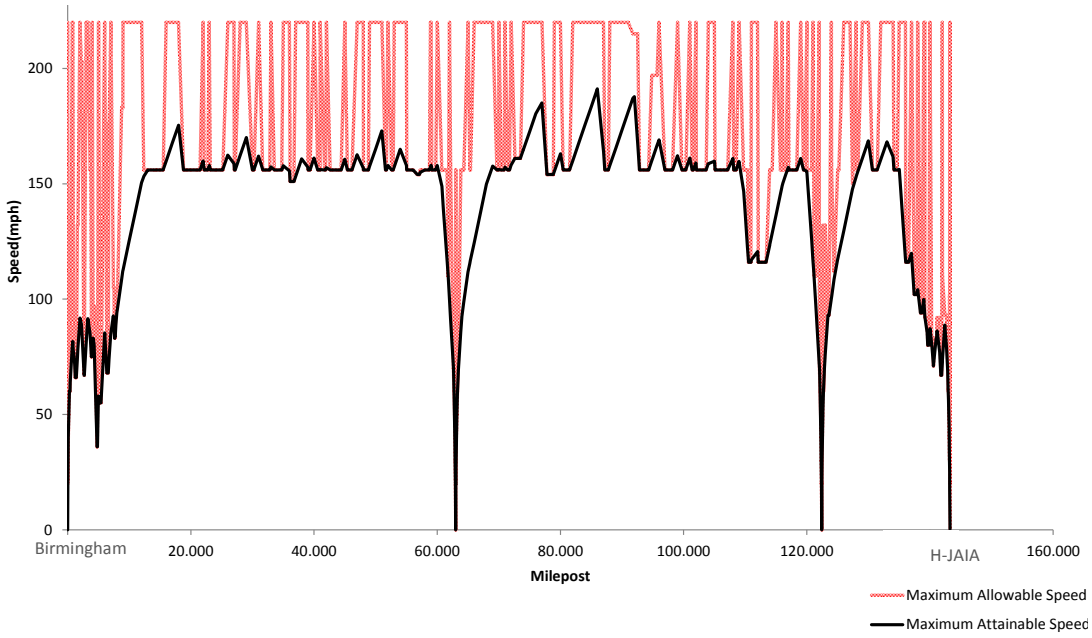


Table 4-3 illustrates a typical travel time table outlining the route station segments, rail distance, scheduled travel time, cumulative travel time and average speed for the Atlanta-Birmingham Dedicated Use corridor.

Table 4-3: Atlanta-Birmingham Dedicated Use Speed and Travel Time Table

Dedicated Use				
Segment	**Rail Distance**	**Travel Time**	**Cumulative Travel Time**	**Average Speed (mph)**
Birmingham	0.0	0:00	0:00	0
Anniston	63.0	0:32	0:32	116
Douglasville	59.4	0:28	1:00	126
Atlanta MMPT	20.8	0:12	1:12	101
Atlanta Airport	7.4	0:06	1:18	76
Total	**150.7**	**1:18**	**1:18**	**117**

As seen in the above Table 4-2 and Table 4-3 the proposed Dedicated Use route following I-20 would achieve higher speeds, although as the speed profile shows, curvature on the route would allow maximum speeds of 150 mph. However, the running time comparison with the automobile is favorable with an average travel time of 1 hour, 18 minutes, compared to auto travel at 2 hours, 26 minutes.

4.2.2 Operating Plan

Similar to Shared Use, the running times were used in conjunction with the prospective train frequencies to develop an initial assessment of the ridership forecast for the Atlanta-Birmingham Dedicated Use Corridor. In addition, the results of the three corridors were compared to one another, resulting in frequency adjustments so that each corridor could utilize the same train size, for corridor compatibility. The train frequencies and train sizes were adjusted after initial ridership and revenue results to balance planned train capacity against ridership for the corridor. As a result, the Dedicated Use operations are projected to run ten round trips per day, with 265 seats per train. Given the combination of train frequencies and running times, five train-sets would be needed for the Dedicated Use option.

Table 4-4: Atlanta-Birmingham Dedicated Use Train Frequency and Size

Scenario	Round Trips per Day	# of Seats per Train	# of Train-Sets
Dedicated Use	10	265	5

5 RIDERSHIP AND REVENUE

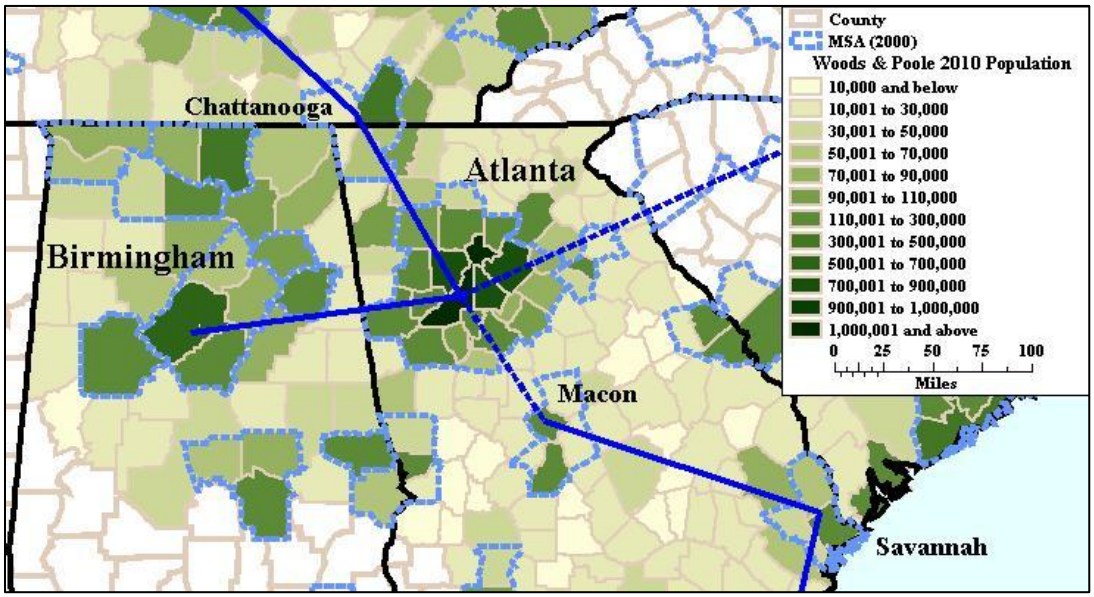
5.1 CORRIDOR DEMOGRAPHICS

This chapter presents information on the demographic characteristics and builds upon the existing conditions section (refer back to Chapter 1). For the purposes of ridership and revenue, information on corridor population and employment is presented for both the base (2010) and future years (2020-2040). All of the historical demographic information presented in Section 5.1.1 was obtained from Woods and Poole Economic Forecasts 2011 which are based on U.S. Census Bureau data. Similarly, Woods and Poole also produce future year forecasts on demographics. Refer back to Section I: Chapter 3 for detailed ridership and revenue methodologies.

EXISTING (2010)

The Atlanta-Birmingham Corridor has two main centers of population, located at each end of the corridor (Atlanta and Birmingham), with areas of low density in between the cities. Figure 5-1 presents a county-level population map focused on the Atlanta-Birmingham Corridor.

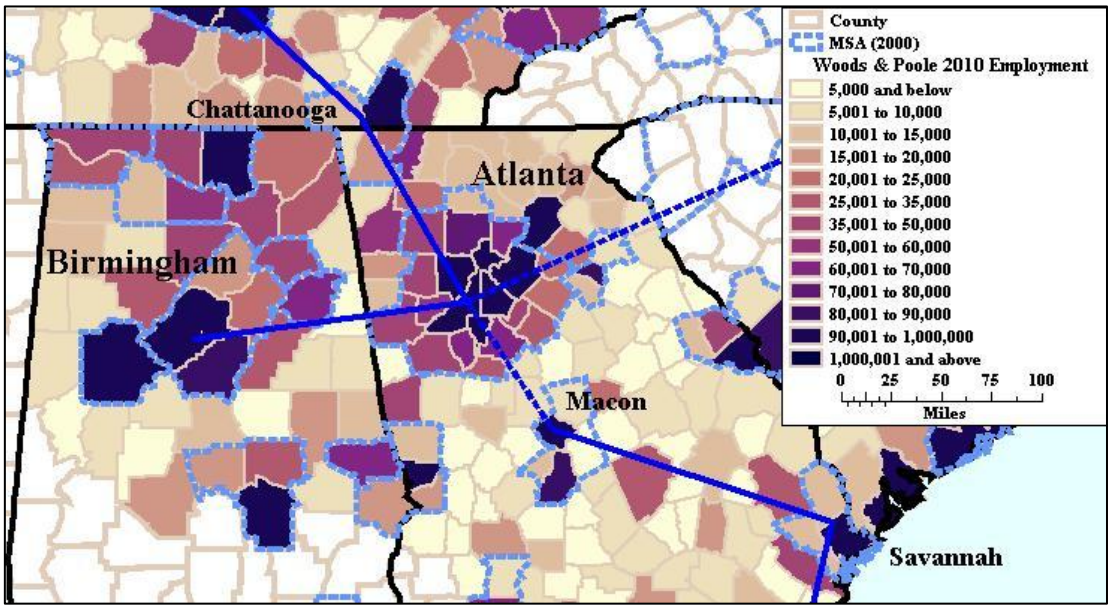
Figure 5-1: Atlanta-Birmingham Base Year (2010) Population Map



Source: Woods and Poole Economic Forecasts, 2011

Similarly, as shown in Figure 5-2, the two metropolitan statistical areas (MSA) (Atlanta and Birmingham) are also the major centers of employment, with Atlanta being the dominant employment hub in the corridor.

Figure 5-2: Atlanta-Birmingham Base Year (2010) Employment Map



Source: Woods and Poole Economic Forecasts, 2011

Table 5-1 Table 5-2 show the historical population and employment trends for the Metropolitan Planning Organization (MPO) coverage areas for the ARC and RPCGB. Atlanta has experienced rapid population growth over the past five years, while the population growth in Birmingham has been more modest. However, the recent economic downturn has hit the employment sector of both regions significantly with Atlanta observing almost no increase in employment and Birmingham experiencing negative employment growth over the last five years.

Table 5-1: Historical Population Trend for MPO Coverage Areas

MPO	2005 Population	2010 Population	05-10 CAGR[20]
ARC	4,934,314	5,566,062	2.44%
RPCGB	831,393	865,070	0.80%

Source: Woods and Poole Economic Forecasts, 2011

[20] Compound Annual Growth Rate (CAGR)

Table 5-2: Historical Employment Trend for MPO Coverage Areas

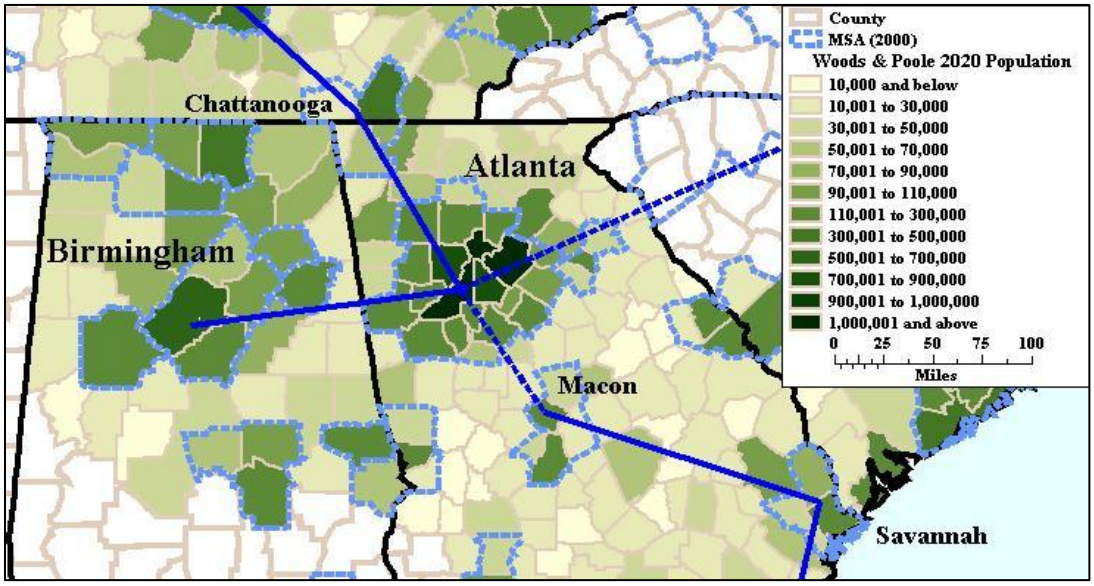
MPO	2005 Population	2010 Population	05-10 CAGR
ARC	3,013,970	3,012,811	-0.01%
RPCGB	558,737	518,476	-1.48%

Source: Woods and Poole Economic Forecasts, 2011

5.1.1 FUTURE YEAR (2020-2035) DEMOGRAPHICS

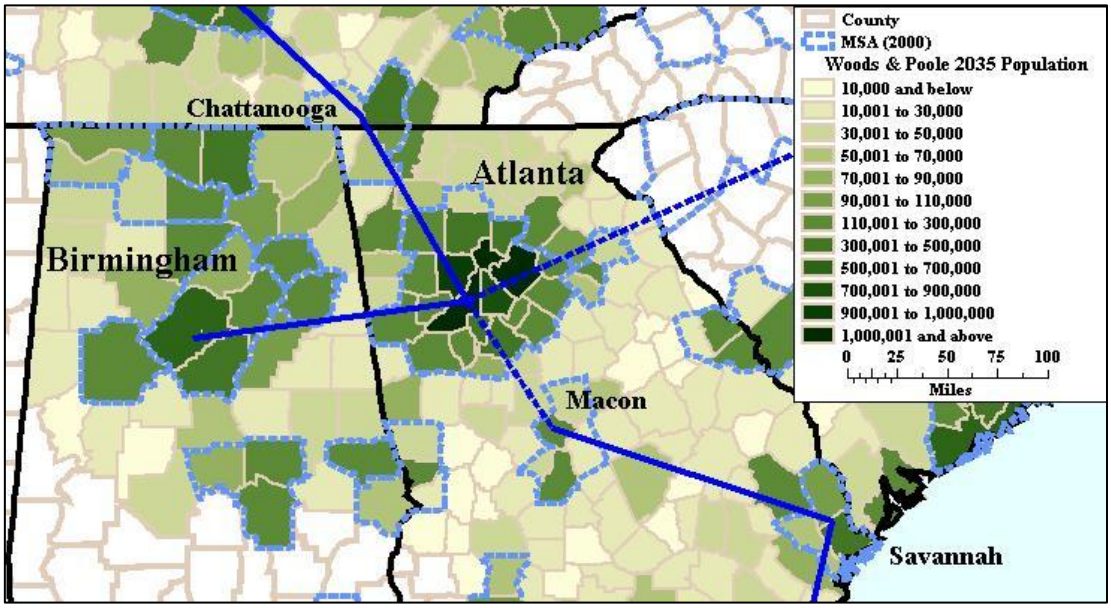
The 2020 and 2035 (Figure 5-3 and Figure 5-4, respectively) geographic distribution of population at the county level will remain essentially similar compared to 2010 populations. The highest projected population growths in the region are observed in the suburban areas surrounding Atlanta and Birmingham as seen in Figure 5-5.

Figure 5-3: Atlanta-Birmingham 2020 Population



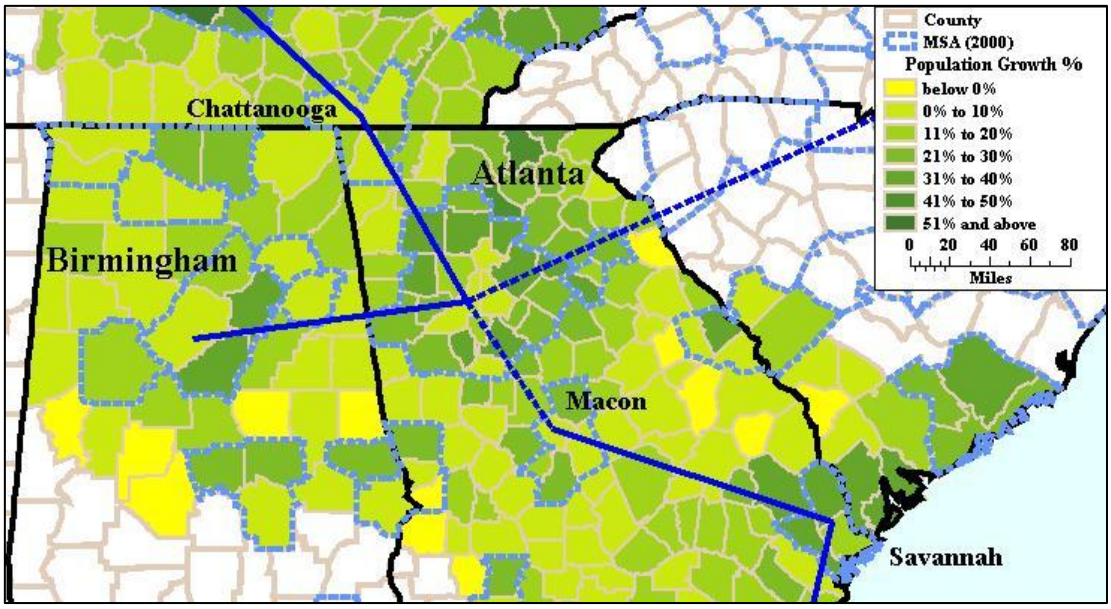
Source: Woods and Poole Economic Forecasts, 2011

Figure 5-4: Atlanta-Birmingham 2035 Population



Source: Woods and Poole Economic Forecasts, 2011

Figure 5-5: Atlanta-Birmingham 2020-2035 Population Growth



Source: Woods and Poole Economic Forecasts, 2011

The population growth forecast follow the latest trends observed in the region and nationwide, predicting a slower annual population growth in future years as compared to the rapid population growth observed over the past decade. Table 5-3 shows that the areas covered by both the ARC and RPCGB are expected to experience healthy population growths until 2035.

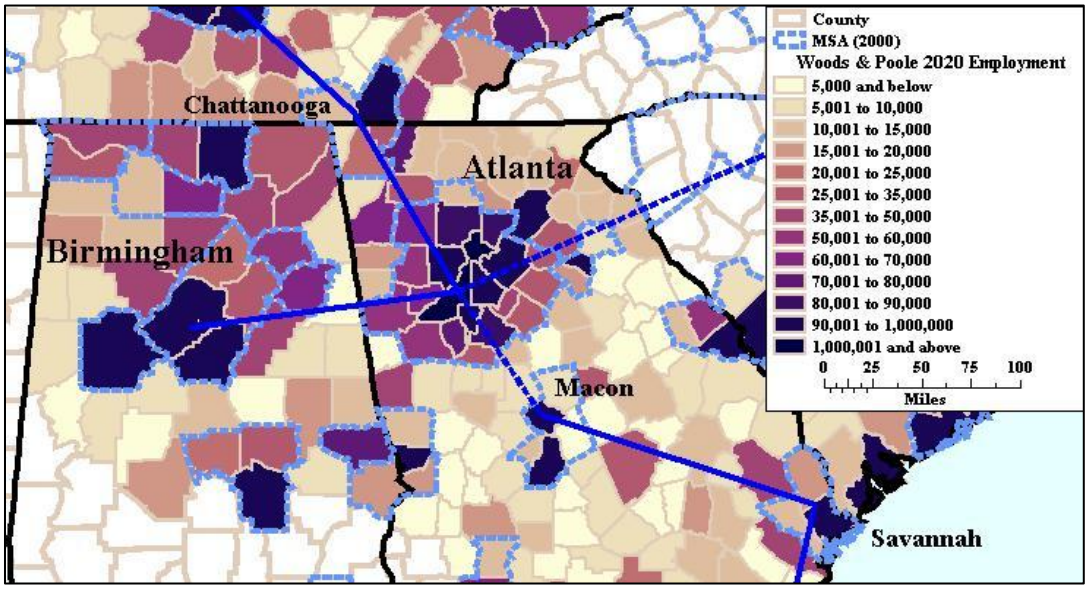
Table 5-3: Population forecasts for MPO Coverage Areas

MPO	2005 Population	2010 Population	2020 Population	2035 Population	05-10 CAGR	20-35 CAGR
ARC	4,934,314	5,566,062	6,523,568	7,997,611	2.44%	1.37%
RPCGB	831,393	865,070	943,910	1,067,896	0.80%	0.83%

Source: woods and Poole Economic Forecasts, 2011

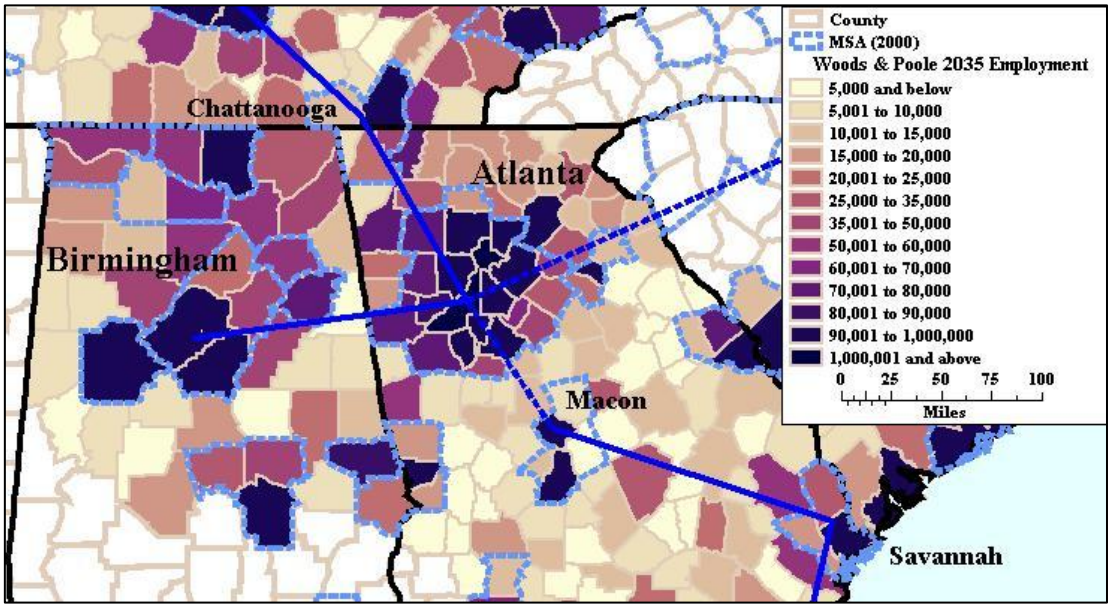
Figure 5-6 and Figure 5-7 show the county level employment for the years 2020 and 2035, respectively; while Figure 5-8 and Table 5-4 present the employment growths between 2020 and 2035. The employment growth forecasts are following similar trends to what is observed at the population level, with a slower population growth observed in Birmingham compared to Atlanta.

Figure 5-6: Atlanta-Birmingham 2020 Employment



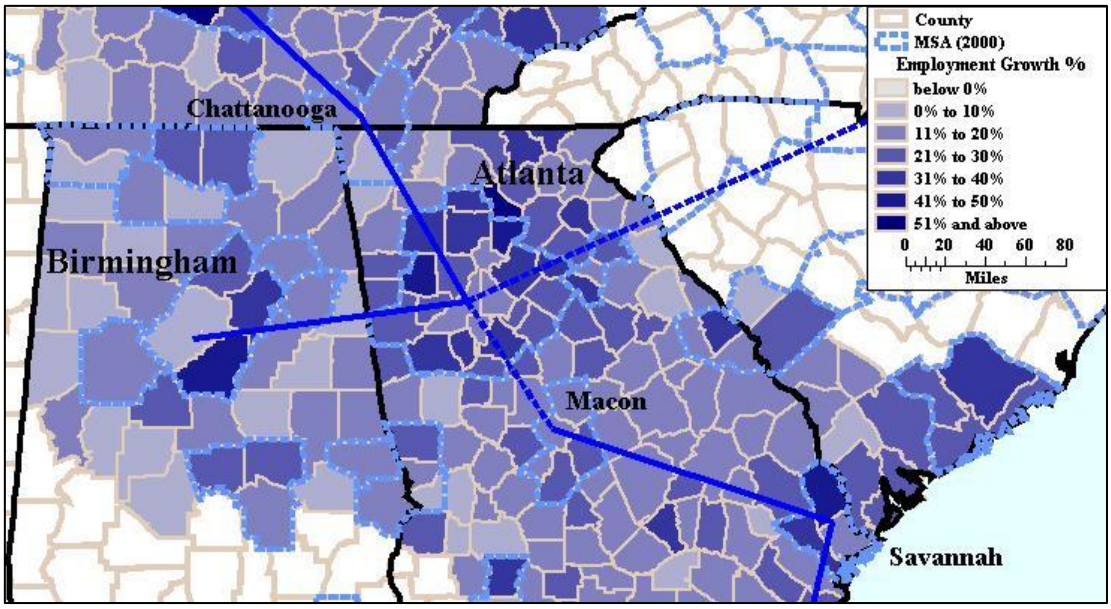
Source: Woods and Poole Economic Forecasts, 2011

Figure 5-7: Atlanta-Birmingham 2035 Employment



Source: Woods and Poole Economic Forecasts, 2011

Figure 5-8: Atlanta-Birmingham 2020-2035 Employment Growth



Source: Woods and Poole Economic Forecasts, 2011

Table 5-4: Employment Forecasts for MPO Coverage Areas

MPO	2005 Emp.	2010 Emp.	2020 Emp.	2035 Emp.	05-10 CAGR	20-35 CAGR
ARC	3,013,970	3,012,811	3,545,633	4,425,027	-0.01%	1.49%
RPCGB	558,737	518,476	585,062	681,173	-1.48%	1.02%

Source: Woods and Poole Economic Forecasts, 2011

5.2 MARKET ANALYSIS

As discussed in Section I: Chapter 3, three main travel markets have been identified in this corridor – the inter-urban travel market; the local travel market; and the connect air market.

5.2.1 THE INTER-URBAN MARKET

There are four travel modes by which inter-urban trips can currently be made between Atlanta and Birmingham:

- Automobile travel;
- Bus service;
- Air service; and
- Rail service.

5.2.1.1 Automobile Travel

Automobile is the predominant mode of transportation utilized between Atlanta and Birmingham. Traffic count data is available on major roadways and interstates connecting these cities. Table 5-5 sets out some recent relevant traffic count data (annual average daily traffic [AADT]) on I-20, the main intercity highway between Atlanta and Birmingham. It is important to note that these represent total traffic volumes on the designated road section, and not the origin-destination demand from one section endpoint to the other.

Table 5-5: Atlanta-Birmingham Selected Traffic Counts

Location	AADT[21]	Year and Count Site Reference
I-20 between Atlanta and Birmingham	30,000	2011, I20 @ Alabama line 143-0126-1

Source: http://aldotgis.dot.state.al.us/atd/default.aspx

[21] The traffic counts should not be interpreted as the volume of trips between these cities. AADTs are rounded to the nearest thousand vehicles

Table 5-6 shows end to end automobile travel distances and travel times in the corridor. The data is sourced from commercial journey planning software (Mapquest.com) and reflects speed limits and representative congestion levels on each route.

Table 5-6: Travel Times and Distances between City Pairs

Route	Distance (miles)	Time (min)
Atlanta - Birmingham	147	151

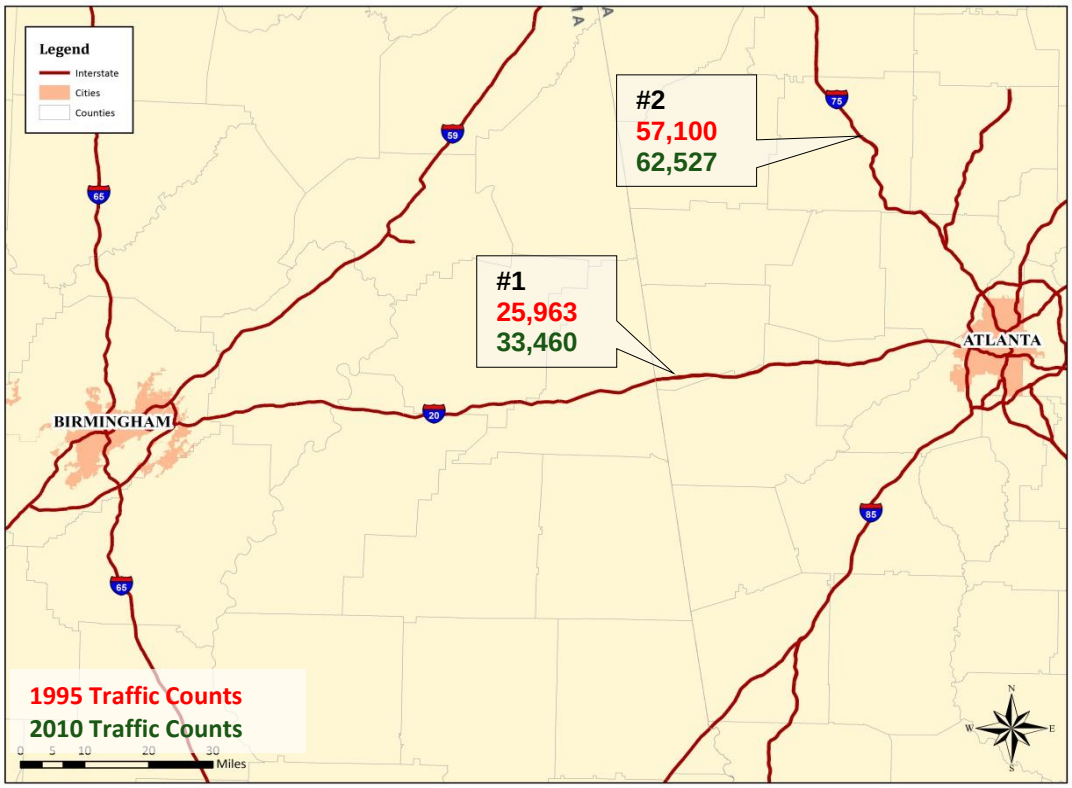
Source: Mapquest.com

The historical traffic counts data show an average annual growth of 1.71 percent between Atlanta and Birmingham since 1995 (as seen in Table 5-7 and Figure 5-9).

Table 5-7: Observed Auto Traffic Growth (in AADT) between 1995 and 2010

Corridor	Location	Traffic Count 1995	Traffic Count 2010	CAGR 95-10
Within the Birmingham to Atlanta Corridor:				
Atlanta - Birmingham	I-20	25,963	33,460	1.71%
Outside the Birmingham to Atlanta Corridor (for comparison purposes):				
Louisville – Atlanta	I-75	57,100	62,527	0.61%

Figure 5-9: Atlanta-Birmingham Observed Auto Traffic (in AADT) in 1995 and 2010



Source: http://aldotgis.dot.state.al.us/atd/default.aspx

5.2.1.2 Bus Service

A summary of the bus services between Atlanta and Birmingham is presented in Table 5-8.

Table 5-8: Atlanta-Birmingham Bus Service Summary

City Pair	Route	Operator	Travel time	Frequency	Full fare[22]
Atlanta – Birmingham	Airport to Airport	Airport Express	3h 30m	M-F 3x/day S-S 2x/day	$9
Atlanta – Birmingham	City to city	Greyhound	2h 30m (direct) 2h 55m (w/stops)	5x/day	$35-$39
Atlanta – Birmingham	Airport to city	Greyhound	5h 10m-7h 20m	2x/day	$35-$39

Source: www.grehound.com, www.amtrak.com, www.theairportexpress.com

[22] Full or standard weekday and weekend fares, Rounded to nearest dollar

The table shows that there are a variety of bus services operating in the corridors. Service frequencies are generally low. Travel times are highly variable and reflect stopping patterns, congestion and/or transfer times.

Commercial bus operators are generally reluctant to release ridership numbers. Nevertheless, in the absence of any information from these operators, approximate ridership estimates based on bus capacity and load factors were prepared. Based on the service frequencies set out in the table above, and assumptions of 50 seats per bus and load factors of 50 percent, there are potentially 45,000 one-way trips being made per year (in each direction), which is substantially smaller than the potential auto market.

There may also be some charter bus operators; however, these operations have been excluded from the analysis.

5.2.1.3 Direct Air Service

The study area is served by two large airports. Table 5-9 presents the key characteristics of these airports. The table includes the airport's ranking among U.S. airports in terms of 2010 domestic passenger enplanements, scheduled departures, passenger carriers operating at the airport, and enplanements per departure.

Of particular importance is the large hub airport in the study area, H-JAIA, the world's busiest airport and a major hub for Delta and AirTran airlines. This airport serves as a gateway for passengers throughout the southeast to connect to flights to numerous domestic and international destinations, as well as a connection point for many longer-distance trips.

Table 5-9: Atlanta-Birmingham Major Airport Characteristics

Code	Airport	Rank	2010 Passenger Enplanements	2010 Scheduled Departures	2010 Passenger Carriers	Enplanements per Departure
ATL	H-JAIA	1	38,362,000	429,258	31	89
BHM	Birmingham-Shuttlesworth Airport	73	1,434,000	24,794	21	58

Source: Airport Snapshots from www.bts.gov

Table 5-10 shows the total number of true origin-destination trips between each pair of study area airports by direction, with outbound passenger volumes shown to the left of the diagonal and inbound passenger volumes shown to the right of the diagonal. Given the relatively short distance between these two airports, there are not too many true origin-destination air trip made in this corridor. As seen in the table, there is only about 8,000 point to point air trips between Atlanta and

Birmingham annually. However, given the presence of H-JAIA as a major hub, there are a significant number of connect air trips (described later under Chapter 5.2.3) between the two corridor airports.

Table 5-10: Origin-Destination Air Trips by Direction (Q4 2009-Q3 2010)

Destination / Origin	ATL	BHM
ATL		4,330
BHM	3,790	

Source: DB1B Market Data (www.bts.gov)

5.2.1.4 Rail Service

Amtrak's Crescent service currently services the Atlanta to Birmingham corridor. The Crescent service includes a daily train in each direction between New York City, New York and New Orleans, Louisiana. The schedule running time for this service between Atlanta and Birmingham is approximately 4 hours, 10 minutes. The adult one-way fare quoted on the Amtrak website is $32. The service offers the typical facilities provided on Amtrak's long-distance trains and the online journey planner suggests reservations.

Given the significant travel time disadvantage of Amtrak's Crescent service compared to the auto mode, the low frequency of service and likely focus of Amtrak's marketing for this service towards longer-distance (or even end-to-end) trips, the study estimated the mode of share of conventional rail for trips between Atlanta and Birmingham to be negligible.

5.2.2 Local Travel Market

There are three main types of local trips:

- Journeys to work (most likely to originate in the suburbs and terminate in the city centers);
- Local trips for leisure purposes; and
- Local trips to access the airport, as part of a longer trip (where the ultimate destination is outside the study corridor and where the longer trip itself is not expected to shift the new high-speed rail service).

Local trips were estimated using the U.S. Census 2000 Journey to Work data and the Atlanta-Chattanooga HSGT Tier I EIS study. In the Atlanta-Birmingham Corridor, 149,000 communing trips were estimated to have been made in 2015 between Birmingham and Anniston, AL, and Douglasville and Atlanta, GA. This was calculated using information from the 2000 Census Journey to Work data and

forecasting using Woods and Poole socio-economic and demographic forecasts. The total number of local trips was then calculated as multiples of the communing trips identified in the 2000 Census. Local trips to access H-JAIA and other local trips for the Atlanta metro area were taken directly with appropriate adjustments form the Atlanta-Chattanooga HSGT Tier I EIS study.

5.2.3 Connect Air Market

The proposed high-speed rail service may provide a viable service between H-JAIA and the Birmingham-Shuttlesworth Airport, which may result in attracting current connect air travelers between the two airports. The connect air travel market differs from the data shown in Table 5-10 on page 2-55 shows just the passenger traveling between Atlanta and Birmingham, and does not include connecting flights to other destinations.

Table 5-11 shows segment-level traffic information for the H-JAIA and Birmingham-Shuttlesworth Airport pair which provides a reliable estimate for the connect air market under consideration. The table includes total passengers, scheduled seats, scheduled departures, average daily frequency, average sets per flight, and average passenger per flight for Q4 2009 to Q3 2010.

Table 5-11: Air Services Summary

City Pair	Passengers	Seats	Scheduled Departures	Flights/ Day	Seats/ Flight	Passengers / Flight
ATL-BHM	257,423	324,154	4,745	13	68	54

Source: T-100 segment data for scheduled passengers in corridor from/to ATL for Q4 2009 to Q3 2010, www.bts.gov

As illustrated by the relatively small average aircraft sizes for Atlanta-Birmingham, many of the flights are operated using regional aircraft, which typically provides service on short-haul routes between medium-sized cities and large hubs.

Comparing passenger counts on these routes with the true origin-destination traffic on the same airport pairs presented in Table 5-10, Table 5-11 above demonstrates that almost all of the air travelers in this market are connecting. Given the high share of connecting traffic and relatively shorter distance (ATL-BHM: 150 miles) between the airports, it is plausible for air travelers in Birmingham to consider H-JAIA as a possible alternate origin/destination of their air trips as long as they can get to/from H-JAIA in a relatively quick time using the proposed high-speed rail system.

5.3 FORECASTS

This section presents the ridership and revenue forecasts for the base case fare scenarios[23] (refer back to Section I: Chapter 3) for both the proposed Shared Use and Dedicated Use high-speed rail services. A fare sensitivity analysis is also presented later in this chapter.

The demand forecasting methodology uses binary diversion models to calculate high-speed rail ridership. Each diversion model computes, for each combination of trip purposes, market segment and current model, the probability that a traveler would choose high-speed rail over its current mode of travel as a function of each mode's level of service attributes. The probabilities are then multiplied by the future year mode-specific travel volumes to calculate the diverted volumes from the existing modes to the new high-speed rail system. The inclusion of each mode's level of service attributes in the diversion models enables the study to test several high-speed rail service frequencies and to accordingly adjust them to the ridership level. The forecasting approach is explained in more detail in Section 1, Chapter 3 within section 3.3 and also graphically in Figure 3-18.

In the subsequent sections, the study presents the base case ridership and revenue forecasts for both the proposed Shared Use and Dedicated Use rail services. Based on benchmarks against other regional high-speed ground transportation studies and the broad estimates of a feasibility study, it was decided to use the doubling of auto operating costs and the four percent increase in highway congestion between 2015 and 2035 as a part of the bases cases for a total of 28 percent increase (in addition to the fare and other base case assumptions) for both service levels.

In order to account for unforeseen increases in factors that contribute directly towards ridership and revenue, the study studied the following:

- Effect of higher auto operating costs (e.g., higher fuel prices);
- Effect of higher-socioeconomic forecast between 2015 and 2035; and
- Effect of higher congestion.

The results of these sensitivity analyses are presented in Table 5-12 below:

[23] $0.28/mile with $5 boarding fee for Shared Use and $0.40/mile with $5 boarding fee for Dedicated Use.

Table 5-12: External Factor Analyses

Scenario Tested	% Increase in Ridership
Doubling auto operating costs	+24%
Higher population growth (additional 0.5% annually above W&P forecasts)	+10%
Higher congestion (additional 14% between 2015 and 2035 above SDG forecasts)	+4%

- **Doubling Auto Operating Costs:** Higher increases in fuel prices could be possible, but coupled with continuing fuel efficiency advances, increasing operating costs by a factor of two is a plausible scenario. This scenario would add as much as a 24 percent increase in ridership and revenue. This is compared to the base case where average auto costs were $0.10/mile and $0.55/mile for non-business and business travel purposes, respectively. The impact of higher operating costs is more prominent in Atlanta due to the relatively higher sensitivity to cost in that metropolitan region.
- **Higher Population Growth:** The study tested a scenario that increases population by an additional 0.5 percent above the Woods and Poole forecast, annually, between 2015 and 2035. This would result in an additional 10 percent increase.
- **Higher Congestion Growth:** For the base case, the study used historical trends in congestion growth in Atlanta and reported by the TTI. This translated to an 11 percent increase in the travel time from the base case scenarios between 2015 and 2035. Then, the study assumed that travel times would increase by an additional 14 percent increase from the base case assumption of 11 percent growth for a total growth of 25 percent. The resulting impact of congestion on ridership would result in an approximate increase of four percent in ridership and revenue.

5.3.1 90-110 MPH SHARED USE RIDERSHIP AND REVENUE FORECASTS (2021-2040)

During the assumed first year of operation in 2021, the proposed Shared Use rail service ridership will be 1.6 million with an associated ticket revenue figure of $46.1 million. By 2040, 2.1 million riders and $61.7 million ticket revenue (annually) are expected during steady state operation. Table 5-13 illustrates the annual ridership and revenue for 2021, 2030 and 2040 as well as total ridership and revenue (2021-2040), rounded to the nearest thousand, expected for the Atlanta-Birmingham Corridor.

Table 5-13: 90-110 mph Shared Use Base Annual Ridership and Revenue (2021-2040 in 2010$)

Year	Ridership	Revenue
2021	1,613,000	$46,054,000
2030	1,847,000	$53,480,000
2040	2,087,000	$61,731,000
Total	**37,177,000**	**$1,077,851,000**

Table 5-14 presents the projected bi-directional station boardings and segment volumes for the shared use high-speed rail in the corridor in 2035. It is evident from the table that the majority of the boardings take place at the three larger city stations H-JAIA, Atlanta MMPT and Birmingham Terminal Station. Additionally, most of the ridership flows are end to end or H-JAIA airport access trips from downtown Atlanta MMPT.

Table 5-14: Shared Use Base 2035 Annual Station Boardings and Segment Volumes (Bi-Directional)

Station	2035 Boardings	2035 Segment Volumes
Birmingham	476,253	952,627
Anniston	62,799	995,880
Douglas	94,704	940,663
Atlanta MMPT	888,210	889,706
Atlanta Airport	444,853	-
Total Annual Boardings	**1,966,819**	

5.3.2 180-220 MPH DEDICATED USE RIDERSHIP AND REVENUE FORECASTS (2021-2040)

With a base fare assumption of $0.40/mile with $5 boarding fee, the Atlanta-Birmingham Corridor would attract approximately 1.9 million riders in the first year of operation (2021) and ticket revenue of $83.8 million. By 2040, 2.5 million riders are expected on an annual basis during steady state operation, with ticket revenue of $96.7 million.

The proposed Dedicated Use high-speed rail service operating plan assumes a higher frequency and lower running times between all station pairs compared to those of the Shared Use service. Hence, the Dedicated Use service would naturally attract significantly more riders than the shared use service. But, the base case fare assumption for the Dedicated Use service is also significantly higher compared to

that of the Shared Use service ($0.40/mile as opposed to $0.28/mile). This increased fare has offset the frequency and travel time advantage of the Dedicated Use service over the Shared Use serviced a large extent. This can be seen in Table 5-15 that the ridership advantages of the Dedicated Use service over the Shared Use service for all years are only in the order of 16 percent. However, the higher base fare assumption for the Dedicated Use service has resulted in significant higher ticket revenue figures. The ticket revenue advantages of the Dedicated Use service over the Shared use service are more than 36 percent (considerably higher than the ridership advantage) for all years as presented in Table 5-15.

Table 5-15: 180-220 mph Dedicated Use Base Ridership and Revenue (2021-2040 in 2010$)

Year	Ridership	Revenue
2021	1,946,000	$83,791,000
2030	2,199,000	$84,113,000
2040	2,481,000	$96,693,000
Total	**44,270,000**	**$1,694,837,000**

Table 5-16 shows that the station boardings and ridership flows (in 2035) for various segments between the station pairs for the Dedicated Use service follow the same trend as those of the Shard Use service.

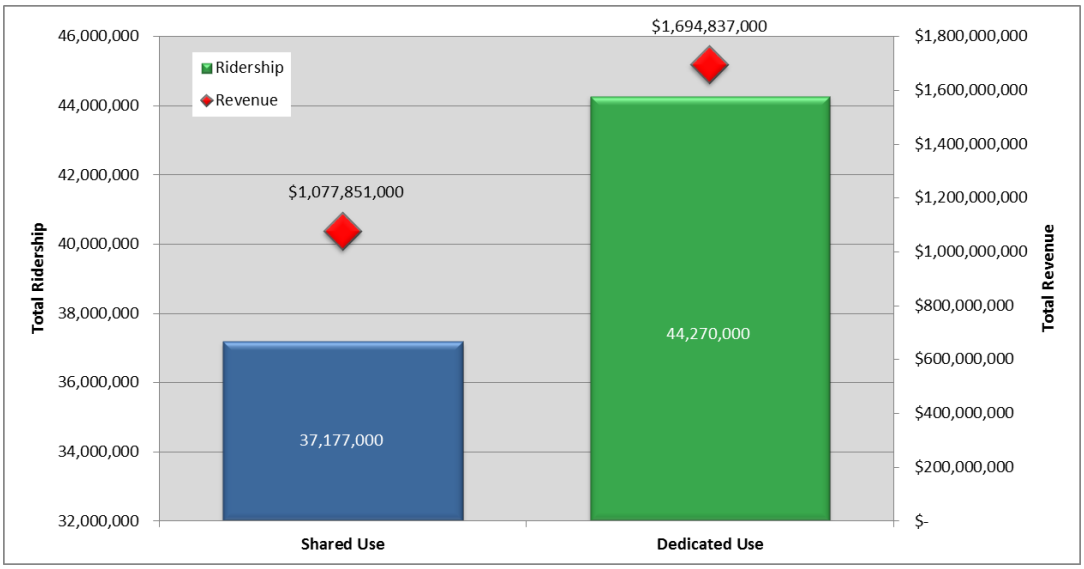
Table 5-16: Dedicated Use Base Case 2035 Annual Station Boardings and Segment Volumes (bi-directional)

Station	2035 Boardings	2035 Segment Volumes
Birmingham	650,917	1,301,940
Anniston	59,549	1,303,883
Douglas	114,782	1,265,197
Atlanta MMPT	964,474	1,100,590
Atlanta Airport	550,295	-
Total Annual Boardings	**2,340,017**	

5.3.3 Ridership and Revenue Forecast Comparison (2021-2040)

Figure 5-10 presents total ridership and revenue for the base case scenario for both the proposed Shared Use and Dedicated Use high-speed rail services between 2021 and 2040. Over these 20 years of operation, the ridership (and revenue) accrual for the Shared Use and Dedicated Use services are expected to be about 38.7 million riders (and $1.1 billion) and 46.2 million riders (and $1.8 billion), respectively.

Figure 5-10: Atlanta-Birmingham Corridor Total Ridership and Revenue Forecasts (2021-2040 in 2010$)



5.4 SENSITIVITY ANALYSIS

In addition to the base case and earlier sensitivity analyses discussed in Section I: Chapter 3, additional sensitivity tests on the effects of fares was performed. The following sections present the results of the sensitivity analysis. The effect of fares on ridership and revenue is presented first for both the Shared and Dedicated Use high-speed rail services.

5.4.1 SHARED USE FARE SENSITIVITY

Table 5-17 presents the total ridership and revenue (rounded to the nearest thousand) numbers for the Atlanta-Birmingham Corridor for two fare scenarios ($0.20/mile and $0.40/mile both with $5 boarding fees) in addition to the base case ($0.28/mile with $5 boarding fee) for the Shared Use high-speed rail service for three separate years (2021, 2030 and 2040). It is evident from the table that increasing fares to even $0.40/mile generates revenue increases compared to lower fare scenarios including the base case. This suggests that the base fare of $0.28/mile for the Shared Use service is below the revenue maximizing fare. However, the $0.28/mile fare generates higher ridership levels, thus increasing Consumer Surplus, which is described in detail in Section I: Chapter 3. It is important to maximize both ridership and revenue in order to not only receive farebox revenues, but also provide a valuable service to consumers. Additionally, passenger rail service can have positive impact on non-users such as auto motorists and those flying that are also important to capture.

Table 5-17: Fare Sensitivity for Shared Use High-Speed Rail Service (2021-2040 in 2010$)

Year	Annual Volume and Revenue		
	Scenario 1 - $0.20/mile	**Scenario 2 - $0.28/mile**	**Scenario 3 - $0.40/mile**
2021	1,840,000	1,613,000	1,375,000
	$40.0 M	**$46.1 M**	**$51.9 M**
2030	2,083,000	1,847,000	1,558,000
	$46.3 M	**$53.5 M**	**$60.5 M**
2040	2,353,000	2,087,000	1,760,000
	$53.3 M	**$61.7 M**	**$70.0 M**

5.4.2 DEDICATED USE FARE SENSITIVITY

Table 5-18 presents the total ridership and revenue (rounded to nearest thousand) numbers for the Atlanta-Birmingham Corridor for two fare scenarios ($0.55/mile and $0.70/mile both with $5 boarding fees) in addition to the base case ($0.40/mile with $5 boarding fee) for the Dedicated Use high-speed rail service for three separate years. Similar to the Shared Use service sensitivity, increasing fares above the base fare of $0.40/mile generates higher revenues for the Dedicated Use service indicating that the base fares are lower than the revenue maximizing levels. In fact, substantial additional ticket revenue (in the order of 20 percent additional revenue) can be generated with the $0.70/mile fare level compared with the base case. However, the higher fare levels are also associated with significant ridership loss and consequently public benefits loss.

Table 5-18: Fare Sensitivity for Dedicated Use High-Speed Rail Service

Year	Annual Volume and Revenue		
	Scenario 1 - $0.40/mile	**Scenario 2 - $0.55/mile**	**Scenario 3 - $0.70/mile**
2021	1,946,000	1,647,000	1,427,000
	$72.8 M	**$82.2 M**	**$87.8 M**
2030	2,199,000	1,862,000	1,612,000
	$84.1 M	**$95.1 M**	**$101.7 M**
2040	2,481,000	2,102,000	1,818,000
	$96.7 M	**$109.5 M**	**$117.0 M**

5.4.3 Shared and Dedicated Use Total Ridership and Revenue Summary

Table 5-19 and Table 5-20 below summarize the total number of passengers and revenue that will be accrued over 20 years of operations starting in the assumed opening year of 2021 for the Shared Use and Dedicated Use services, respectively.

Table 5-19: Shared Use Total Ridership and Revenue Summary (2021-2040)

Years 2021-2040	Ridership	Revenue (2010$)
Scenario 1 - $0.20/mile	41,928,000	$932.8 million
Scenario 2 - $0.28/mile	38,792,000	$1.1 billion
Scenario 3 - $0.40/mile	31,353,000	$1.2 billion

Table 5-20: Dedicated Use Total Ridership and Revenue Summary (2021-2040)

Years 2021-2040	Ridership	Revenue (2010$)
Scenario 1 - $0.40/mile	46,188,000	$1.8 billion
Scenario 2 - $0.55/mile	37,487,000	$1.9 billion
Scenario 3 - $0.70/mile	32,448,000	$2.1 billion

5.4.4 Evaluation Scenarios

In setting up the evaluation, three scenarios were developed to show the impact of a range of ridership, revenue, capital and operating cost estimates typically encountered in a feasibility-level analysis. Unadjusted base forecasts for ridership, revenue, capital and operating costs were used for the Conservative Scenario. Base ridership and revenue estimates were increased for Dedicated Use corridors to establish the Intermediate and Optimistic Scenarios.[24] Operating costs were adjusted by the appropriate ridership drivers. Capital cost estimates were adjusted downward in the Intermediate and Optimistic Scenarios for all technologies.

[24] Ridership adjustments for Intermediate and Optimistic Scenarios were only made for Dedicated Use corridor 180-220 mph electrified, steel-wheel and Maglev technologies (Maglev in Atlanta-Louisville corridor only) based on a peer review of regional and national high speed rail corridor studies. No scenario ridership adjustment was made for Shared Use corridor diesel-electric technology results based on a peer review of other shared-use corridor studies.

The three scenarios are intended to capture and illustrate the relatively wide range of estimates at the feasibility-level of study. As corridors are deemed feasible for further evaluation, future studies will provide greater detail in the analysis of ridership, revenues and costs, narrowing the range of estimates.

5.4.4.1 Conservative Scenario Estimates

Conservative scenario estimates use base case ridership and revenue forecast and capital cost estimates for the operating ratio and benefit-cost analysis. Refer back to Section I: Chapter 3 for additional details on the Conservative estimate methodology. Table 5-15 on page 2-60 summarizes base case ridership and revenue forecasts.

5.4.4.2 Intermediate Scenario Estimates

The Intermediate scenario represents a balance between Conservative and Optimistic scenarios, balancing both ridership and cost risks. The ridership and revenue estimates are approximately 75 percent higher than the Conservative estimates. Table 5-22 outlines the Intermediate scenario ridership and revenue estimates for 2021, 2030 and 2040 as well as total (2021-2040) rounded to the nearest thousand.

Table 5-21: Intermediate Scenario Annual Ridership and Revenue Estimates (2021-2040 in 2010$)

Year	Dedicated Use	
	Ridership	Revenue
2021	3,406,000	$127,384,000
2030	3,849,000	$147,198,000
2040	4,341,000	$169,213,000
Total	**77,473,000**	**$2,965,965,000**

These ridership and revenue levels, in conjunction with forecast operating and maintenance costs and capital costs (refer to Chapter 6), were used to calculate scenario-based operating ratios and benefit-cost ratios (refer to Chapter 7) for use in the feasibility evaluation.

5.4.4.3 Optimistic Scenario Estimates

This scenario uses higher ridership and revenue and a lower capital cost estimates for the Atlanta-Birmingham Corridor. The ridership and revenue estimates are increased by 100 percent to become comparable to other peer studies within the

southeast region and nationally. Table 5-21 outlines the ridership and revenue estimates (to the nearest thousand) for the Optimistic scenario.

Table 5-22: Optimistic Scenario Annual Ridership and Revenue Estimates (2021-2040 in 2010$)

Year	Dedicated Use	
	Ridership	Revenue
2021	3,893,000	$145,582,000
2030	4,399,000	$168,226,000
2040	4,961,000	$193,386,000
Total	**88,540,000**	**$3,532,740,000**

6 FORECASTED COSTS

The study gathered regional and national infrastructure and equipment capital costs data to estimate total design and construction costs for the Atlanta-Birmingham high-speed rail corridor. As aforementioned in Section I: Chapter 3, the study prepared capital costs at the conceptual engineering level (5-10 percent design level) with a +/- 30 percent level of accuracy. The study used FRA standard cost categories (SCC) as required by FRA grant applications. To recap, the Table 6-1 illustrates these FRA SCC.

Table 6-1: FRA Standard Cost Categories

FRA Standard Cost Categories for Capital Projects/Programs
10 Track Structures & Track
20 Stations, Terminals, Intermodal
30 Support Facilities: Yards, Shops, Administration Buildings
40 Sitework, Right-of-Way, Land, Existing Improvements
50 Communications & Signaling
60 Electric Traction
70 Vehicles
80 Professional Services
90 Unallocated Contingencies
100 Finance Charges

This chapter outlines the total capital costs for the Atlanta-Birmingham high-speed rail corridor for both 90-110 mph Shared Use and 180-220 mph Dedicated Use routes and technologies. It should be noted that these unit costs are only preliminary costs, and actual costs for the corridor will be dependent upon a preferred route and technology, which this study does not determine.

6.1.1 90-110 MPH SHARED USE

The 90-100 mph Shared Use, as outlined in previous chapters, will use diesel-electric operating equipment and will share existing freight railroad right-of-way and track infrastructure. Therefore, the overall capital costs are less than the 180-220 mph Dedicated Use technology, which is on a dedicated route and is a fully electrified system. Table 6-2 provides the overall Atlanta-Birmingham corridor capital costs by major SCC category. For a more detailed breakdown of capital costs by sub-category, refer to Appendix F at the end of this report.

Table 6-2: Atlanta-Birmingham Total Shared Use Capital Cost by SCC Category (2010$)

Costing Category		Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures & Track	$755,913,000	$226,774,000	$982,687,000
20	Stations, Terminals, Intermodal	$308,987,000	$92,696,000	$401,683,000
30	Support Facilities: Yards, Shops, Administration Buildings	$35,980,000	$10,794,000	$46,774,000
40	Sitework, Right-of-Way, Land, Existing Improvements	$276,874,000	$83,062,000	$359,936,000
50	Communications & Signaling	$339,569,000	$101,871,000	$441,440,000
60	Electric Traction	N/A	N/A	N/A
70	Vehicles	$130,000,000	$39,000,000	$169,000,000
80	Professional Services	$535,805,000	N/A	$535,805,000
90	Unallocated Contingencies	N/A	N/A	N/A
100	Finance Charges	N/A	N/A	N/A
TOTAL COST		**$2,383,128,000**	**$554,197,000**	**$2,937,324,000**
TOTAL COST PER MILE (174.6 MILES)				**$16,821,000**

To further understand the detailed SCC costs of the Atlanta-Birmingham Corridor, Figure 6-1 through Figure 6-5 and Table 6-3 through Table 6-7 illustrates the capital costs by segment. Segments were developed based on station location and natural breaks in the corridor such as state boundaries. It should be noted that station and maintenance facility costs were only accounted for in the segment in which the station and/or maintenance facility is located. Additionally, vehicle costs were only accounted for in the total corridor capital costs, and were not included in the segment costs.

Figure 6-1: Atlanta-Birmingham Shared Use Segment One

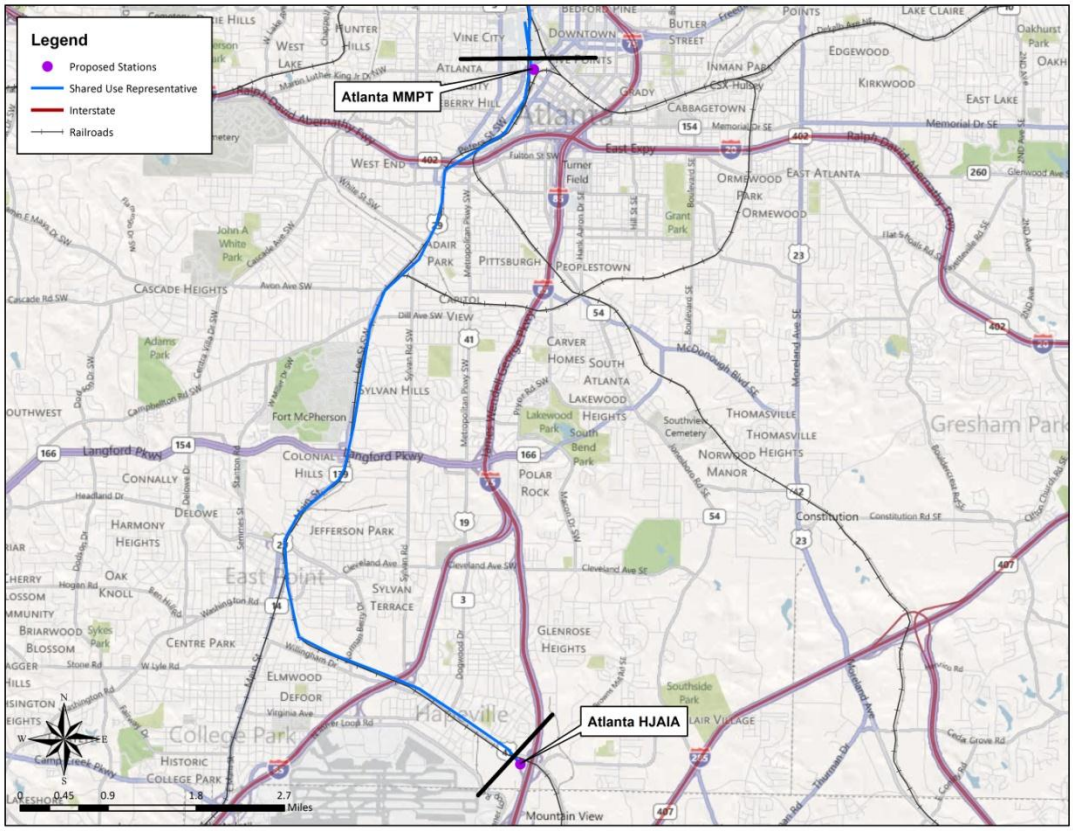


Table 6-3: Atlanta-Birmingham Total Shared Use Capital Cost Segment One

Segment 1: 90-110 mph Shared Use – Atlanta Airport (H-JAIA) to Atlanta MMPT			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$25,819,000	$7,746,000	$33,565,000
Stations, Terminals, Intermodal	$279,156,000	$83,747,000	$362,903,000
Support Facilities: Yards, Shops, Administration Buildings	$29,777,000	$8,933,000	$38,710,000
Sitework, R/W, Land	-	-	-
Communications & Signaling	$18,005,000	$5,402,000	$23,407,000
Electric Traction	-	-	-
Vehicles	-	-	-
Professional Services	$110,060,000	N/A	$110,060,000
Unallocated Contingencies	N/A	N/A	N/A
Finance Charges	N/A	N/A	N/A
Total Cost	**$462,817,000**	**$105,828,000**	**$568,645,000**
Cost Per Mile (8.5 Miles)			**$66,899,000**

Figure 6-2: Atlanta-Birmingham Shared Use Segment Two

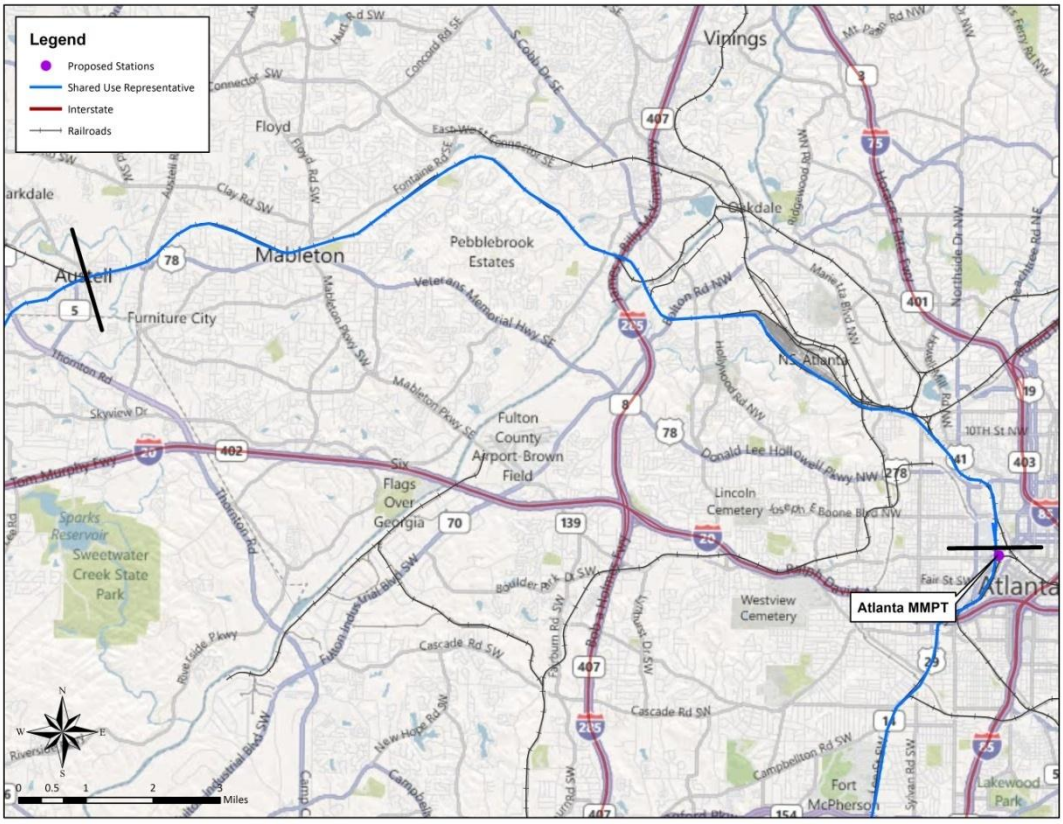


Table 6-4: Atlanta-Birmingham Total Shared Use Capital Cost Segment Two

Segment 2: 90-110 mph Shared Use – Atlanta MMPT to Austell, GA			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$79,603,000	$23,881,000	$103,485,000
Stations, Terminals, Intermodal	-	-	-
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$90,237,000	$27,071,000	$117,308,000
Communications & Signaling	$29,106,000	$8,732,000	$37,838,000
Electric Traction	-	-	-
Vehicles	-	-	-
Professional Services	$62,071,000	-	$62,072,000
Unallocated Contingencies	N/A	N/A	N/A
Finance Charges	N/A	N/A	N/A
Total Cost	**$261,017,000**	**$59,684,000**	**$320,703,000**
Cost Per Mile (17.9 Miles)			**$17,916,000**

Figure 6-3: Atlanta-Birmingham Shared Use Segment Three

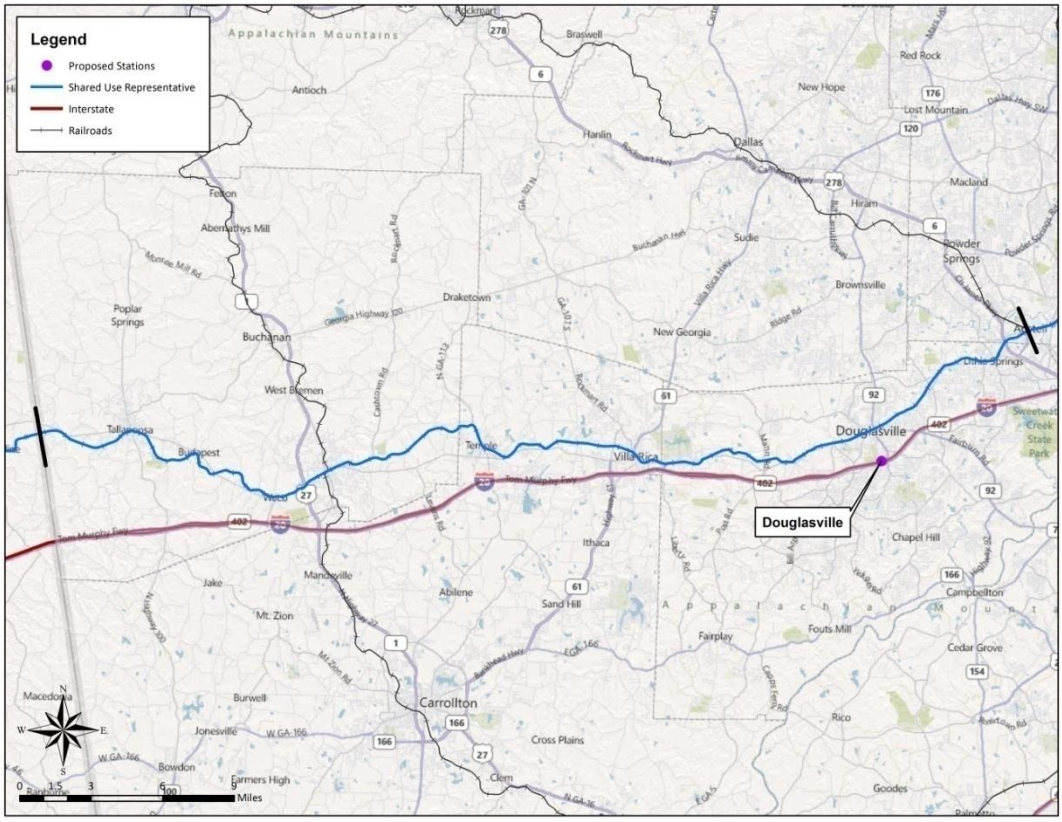


Table 6-5: Atlanta-Birmingham Total Shared Use Capital Cost Segment Three

Segment 3: 90-110 mph Shared Use – Austell, GA to GA/AL State Line			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$168,615,000	$50,584,000	$219,199,000
Stations, Terminals, Intermodal	$5,610,000	$1,683,000	$7,293,000
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W Land	$22,560,000	$6,768,000	$29,328,000
Communications & Signaling	$105,043,000	$31,513,000	$136,556,000
Electric Traction	-	-	-
Vehicles	-	-	-
Professional Services	$94,170,000	-	$94,170,000
Unallocated Contingencies	N/A	N/A	N/A
Finance Charges	N/A	N/A	N/A
Total Cost	**$395,998,000**	**$90,548,000**	**$486,546,000**
Cost Per Mile (49.9 Miles)			**$9,750,000**

Figure 6-4: Atlanta-Birmingham Shared Use Segment Four

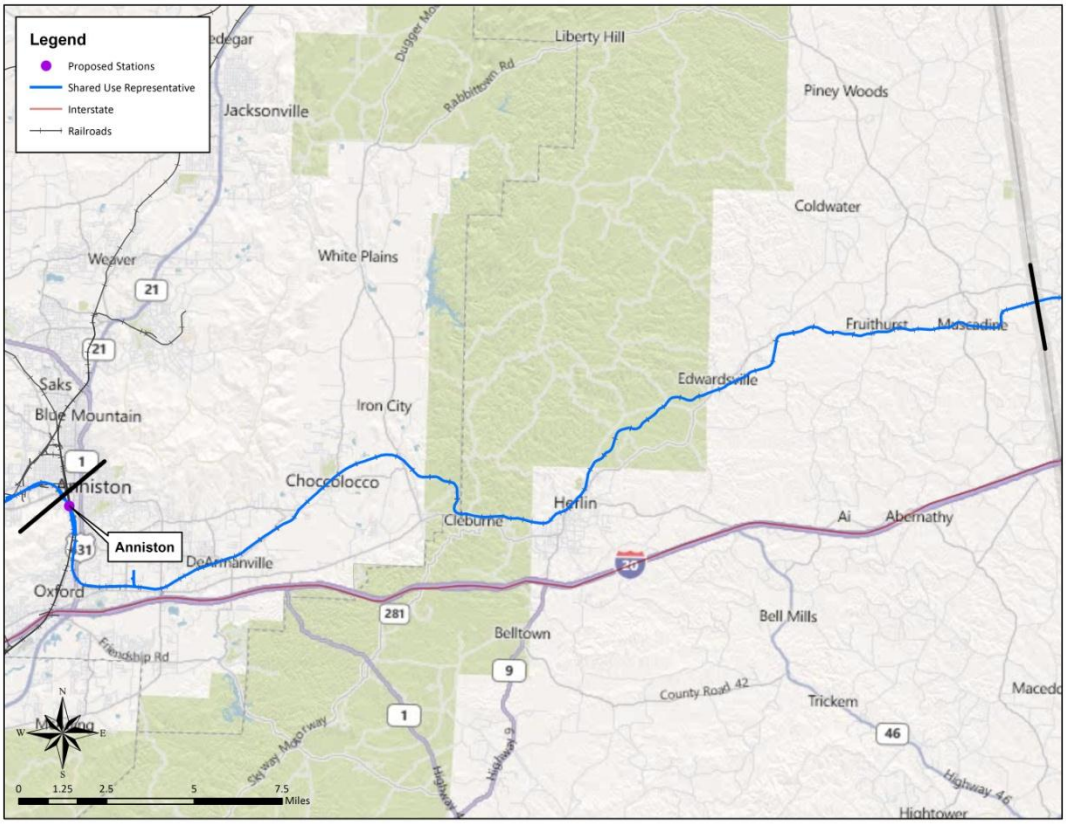


Table 6-6: Atlanta-Birmingham Total Shared Use Capital Cost Segment Four

Segment 4: 90-110 mph Shared Use –GA/AL State Line to Anniston, AL			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$152,176,000	$45,653,000	$197,829,000
Stations, Terminals, Intermodal	$5,610,000	$1,683,000	$7,293,000
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$21,410,000	$6,423,000	$27,833,000
Communications & Signaling	$69,730,000	$20,919,000	$90,650,000
Electric Traction	-	-	-
Vehicles	-	-	-
Professional Services	$77,665,000	-	$77,665,000
Unallocated Contingencies	N/A	N/A	N/A
Finance Charges	N/A	N/A	N/A
Total Cost	**$326,591,000**	**$74,678,000**	**$401,270,000**
Cost Per Mile (37.2 Miles)			**$10,786,000**

Figure 6-5: Atlanta-Birmingham Shared Use Segment Five

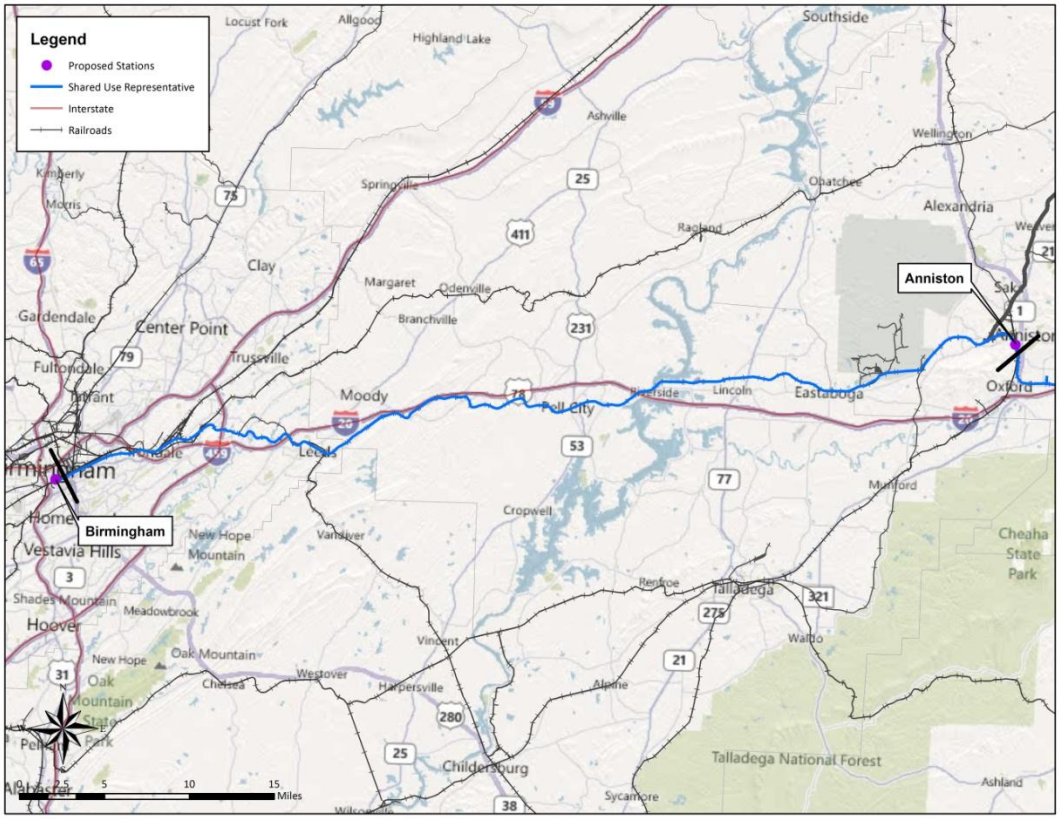


Table 6-7: Atlanta-Birmingham Total Shared Use Capital Cost Segment Five

Segment 5: 90-110 mph Shared Use – Anniston, AL to Birmingham, AL			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$329,700,000	$98,910,000	$428,610,000
Stations, Terminals, Intermodal	$18,610,000	$5,583,000	$24,194,000
Support Facilities: Yards, Shops, Administration Buildings	$6,204,000	$1,861,000	$8,065,000
Sitework, R/W, Land	$142,667,000	$42,800,000	$185,467,000
Communications & Signaling	$117,684,000	$35,305,000	$152,989,000
Electric Traction	-	-	-
Vehicles	-	-	-
Professional Services	$191,838,000	-	$191,838,000
Unallocated Contingencies	N/A	N/A	N/A
Finance Charges	N/A	N/A	N/A
Total Cost	**$806,703,000**	**$184,459,000**	**$991,163,000**
Cost Per Mile (61.2 Miles)			**$16,195,000**

6.1.2 180-220 MPH DEDICATED USE

The 180-220 mph Dedicated Use route on a fully separated, dedicated route utilizing interstate, rail line and greenfield right-of-way. Within urban corridors, the route is shared with freight right-of-way. The track will be separated from freight operations and will not interfere with freight traffic. The total capital costs for Dedicated Use are higher than Shared Use due to the electrification of the track, electrified vehicles, land acquisition and relocations. Table 6-8 outlines the total Atlanta-Birmingham Dedicated Use corridor costs by SCC.

Table 6-8: Atlanta-Birmingham Total Dedicated Use Capital Cost (2010$)

Costing Category	Allocated Cost	Contingency (30%)	Total Cost
Track Structures & Track	$1,906,481,000	$571,944,000	$2,478,425,000
Stations, Terminals, Intermodal	$308,987,000	$92,696,000	$401,683,000
Support Facilities: Yards, Shops, Administration Buildings	$43,424,000	$13,027,000	$56,452,000
Sitework, R/W, Land	$828,647,000	$248,594,000	$1,077,240,000
Communications & Signaling	$257,181,000	$77,154,000	$334,336,000
Electric Traction	$1,643,166,000	$492,980,000	$2,136,116,000
Vehicles	$217,250,000	$65,175,000	$282,425,000
Professional Services	$1,564,369,000	N/A	$1,556,220
Unallocated Contingencies	N/A	N/A	N/A
Finance Charges	N/A	N/A	N/A
Total Cost	**$6,796,505,000**	**$1,569,570,000**	**$8,322,896,000**
Total Cost Per Mile (153.8 Miles)			**$54,126,000**

To further understand the detailed SCC costs of the Atlanta-Birmingham Dedicated Use corridor, Figure 6-6 through Figure 6-11 and Table 6-9 through Table 6-14 illustrates the capital costs by segment. Segments were developed based on station location and natural breaks in the corridor such as state boundaries. Again, similar to the Shared Use segment costs, it should be noted that station and maintenance facility costs were only accounted for in the segment in which the station and/or maintenance facility is located. Additionally, vehicle costs were only accounted for in the total corridor capital costs, and were not included in the segment costs.

Figure 6-6: Atlanta-Birmingham Dedicated Use Segment One

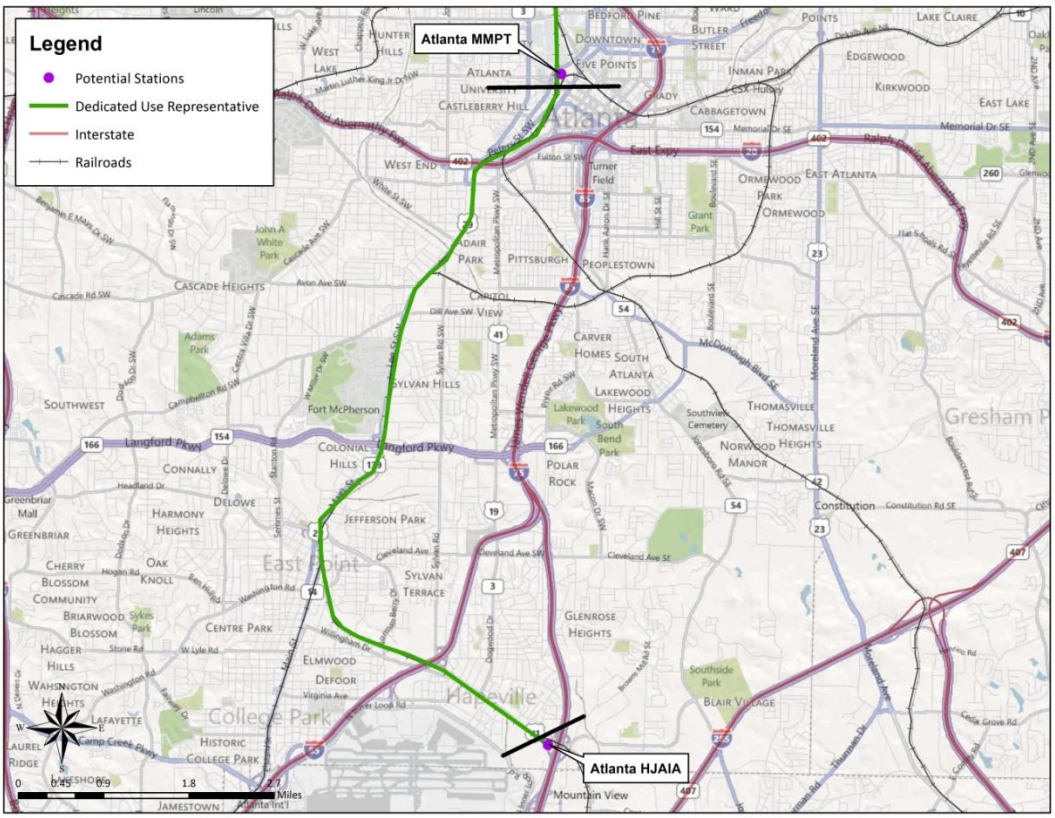


Table 6-9: Atlanta-Birmingham Total Dedicated Use Capital Cost Segment One

Segment 1: 90-110 mph Shared Use – Atlanta Airport (H-JAIA) to Atlanta MMPT			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$61,249,000	$18,375,000	$79,624,000
Stations, Terminals, Intermodal	$279,156,000	$83,747,000	$362,903,000
Support Facilities: Yards, Shops, Administration Buildings	$37,221,000	$11,166,000	$48,387,000
Sitework, R/W, Land	$195,601,000	$58,680,000	$254,281,000
Communications & Signaling	$16,711,000	$5,013,000	$21,724,000
Electric Traction	$90,399,000	$27,120,000	$117,518,000
Vehicles	-	-	-
Professional Services	$212,265,000	-	$212,265,000
Unallocated Contingencies	N/A	N/A	N/A
Finance Charges	N/A	N/A	N/A
Total Cost	**$892,602,000**	**$204,101,000**	**$1,096,701,000**
Cost Per Mile (8.5 Miles)			**$129,023,000**

Figure 6-7: Atlanta-Birmingham Dedicated Use Segment Two

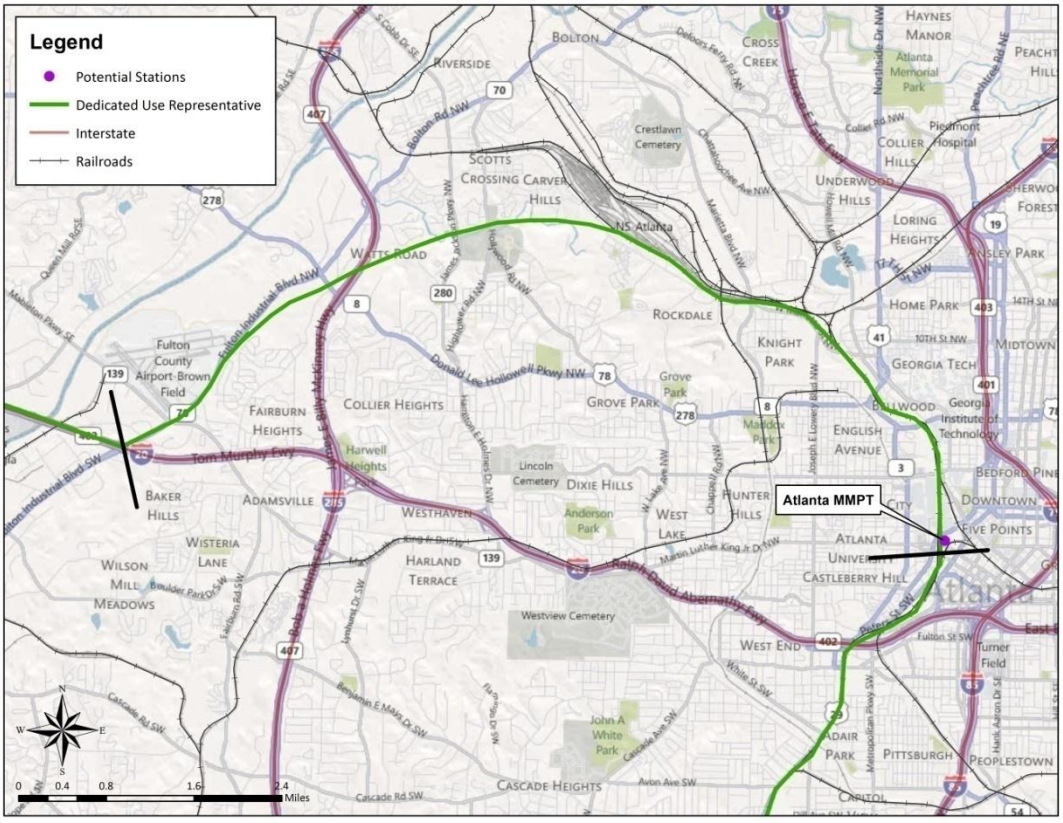


Table 6-10: Atlanta-Birmingham Total Dedicated Use Capital Cost Segment Two

Segment 2: 90-110 mph Shared Use – Atlanta MMPT to Fulton Industrial Blvd Interchange			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$172,767,000	$51,830,000	$224,597,000
Stations, Terminals, Intermodal	-	-	-
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$254,611,000	$76,383,000	$330,995,000
Communications & Signaling	$24,642,000	$7,392,000	$32,034,000
Electric Traction	$108,671,000	$32,601,000	$141,272,000
Vehicles	-	-	-
Professional Services	$174,935,000	-	$174,935,000
Unallocated Contingencies	N/A	N/A	N/A
Finance Charges	N/A	N/A	N/A
Total Cost	**$735,626,000**	**$168,206,000**	**$903,833,000**
Cost Per Mile (10.2 Miles)			**$88,611,000**

Figure 6-8: Atlanta-Birmingham Dedicated Use Segment Three

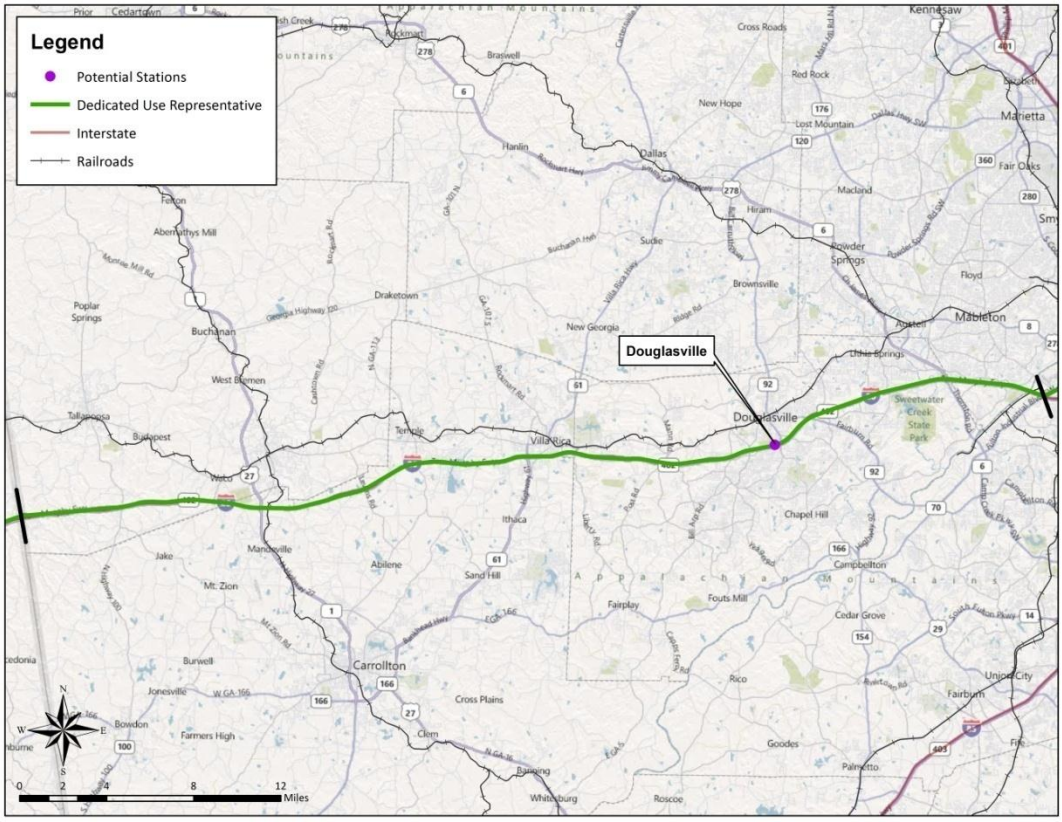


Table 6-11: Atlanta-Birmingham Total Dedicated Use Capital Cost Segment Three

Segment 3: 90-110 mph Shared Use – Fulton Industrial Blvd to GA/AL State Line			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$501,341,000	$150,402,000	$651,744,000
Stations, Terminals, Intermodal	$5,610,000	$1,683,000	$7,293,000
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$138,352,000	$41,506,000	$161,576,000
Communications & Signaling	$74,578,000	$22,373,000	$96,951,000
Electric Traction	$518,135,000	$155,441,000	$673,576,000
Vehicles	-	-	-
Professional Services	$386,261,000	-	$381,873,000
Unallocated Contingencies	N/A	N/A	N/A
Finance Charges	N/A	N/A	N/A
Total Cost	**$1,624,277,000**	**$371,405,000**	**$1,973,013,000**
Cost Per Mile (48.5 Miles)			**$40,689,000**

Figure 6-9: Atlanta-Birmingham Dedicated Use Segment Four

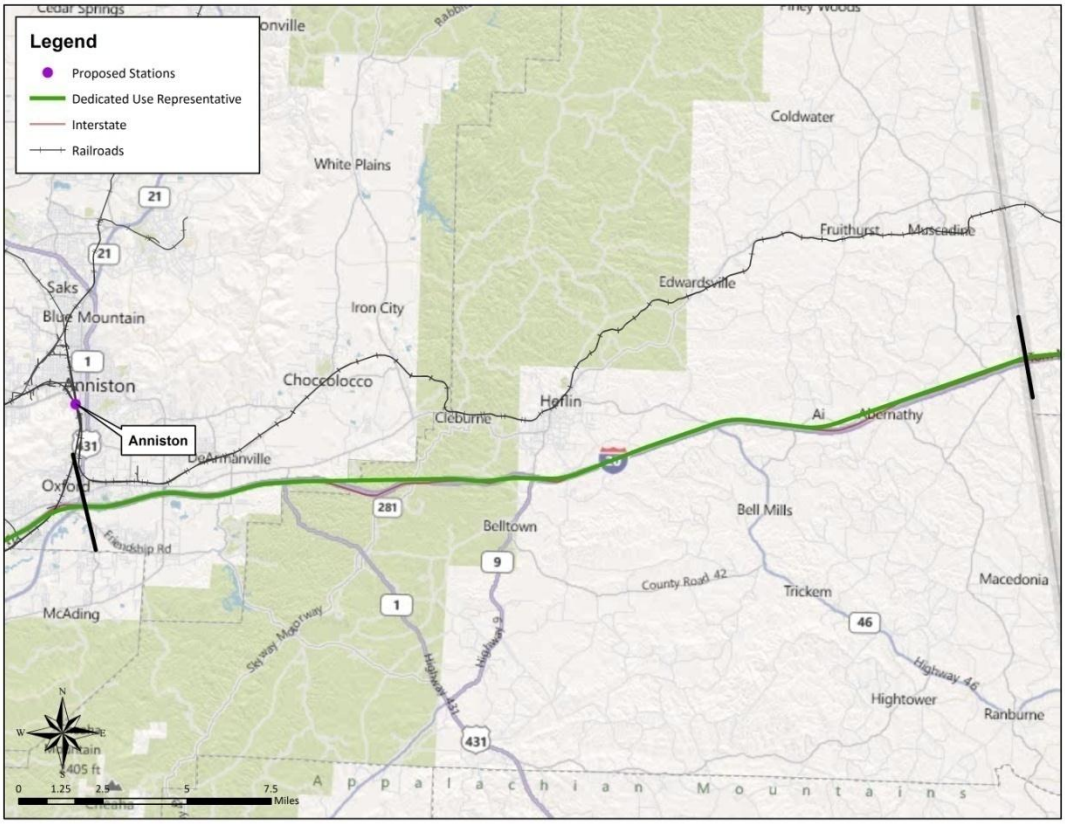


Table 6-12: Atlanta-Birmingham Total Dedicated Use Capital Cost Segment Four

Segment 4: 90-110 mph Shared Use –GA/AL State Line to Anniston, AL			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$310,769,000	$93,231,000	$403,999,000
Stations, Terminals, Intermodal	$5,610,000	$1,683,000	$7,293,000
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$55,384,000	$16,615,000	$66,776,000
Communications & Signaling	$47,186,000	$14,156,000	$61,342,000
Electric Traction	$327,864,000	$98,359,000	$426,223,000
Vehicles	-	-	-
Professional Services	$233,006,000	-	$231,752,000
Unallocated Contingencies	N/A	N/A	N/A
Finance Charges	N/A	N/A	N/A
Total Cost	**$979,819,000**	**$224,044,000**	**$1,197,385,000**
Cost Per Mile (30.7 Miles)			**$39,028,000**

Figure 6-10: Atlanta-Birmingham Dedicated Use Segment Five

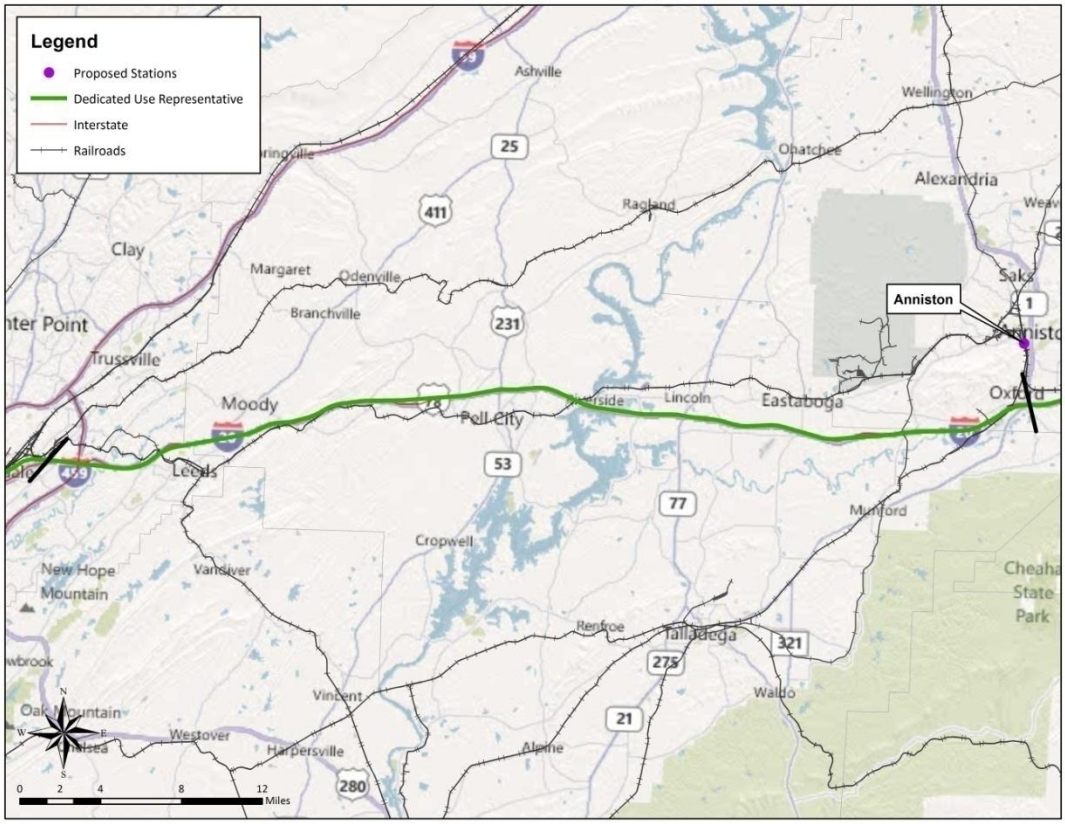


Table 6-13: Atlanta-Birmingham Total Dedicated Use Capital Cost Segment Five

Segment 5: 90-110 mph Shared Use – Anniston, AL to Birmingham Shared Use			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$803,275,000	$240,982,000	$1,044,257,000
Stations, Terminals, Intermodal	-	-	-
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$100,117,000	$30,035,000	$119,706,000
Communications & Signaling	$74,362,000	$22,309,000	$96,671,000
Electric Traction	$516,675,000	$155,003,000	$671,678,000
Vehicles	-	-	-
Professional Services	$466,262,000	-	$463,755,000
Unallocated Contingencies	N/A	N/A	N/A
Finance Charges	N/A	N/A	N/A
Total Cost	**$1,960,693,000**	**$448,329,000**	**$2,396,066,000**
Cost Per Mile (48.3 Miles)			**$49,557,000**

Figure 6-11: Atlanta-Birmingham Dedicated Use Segment Six

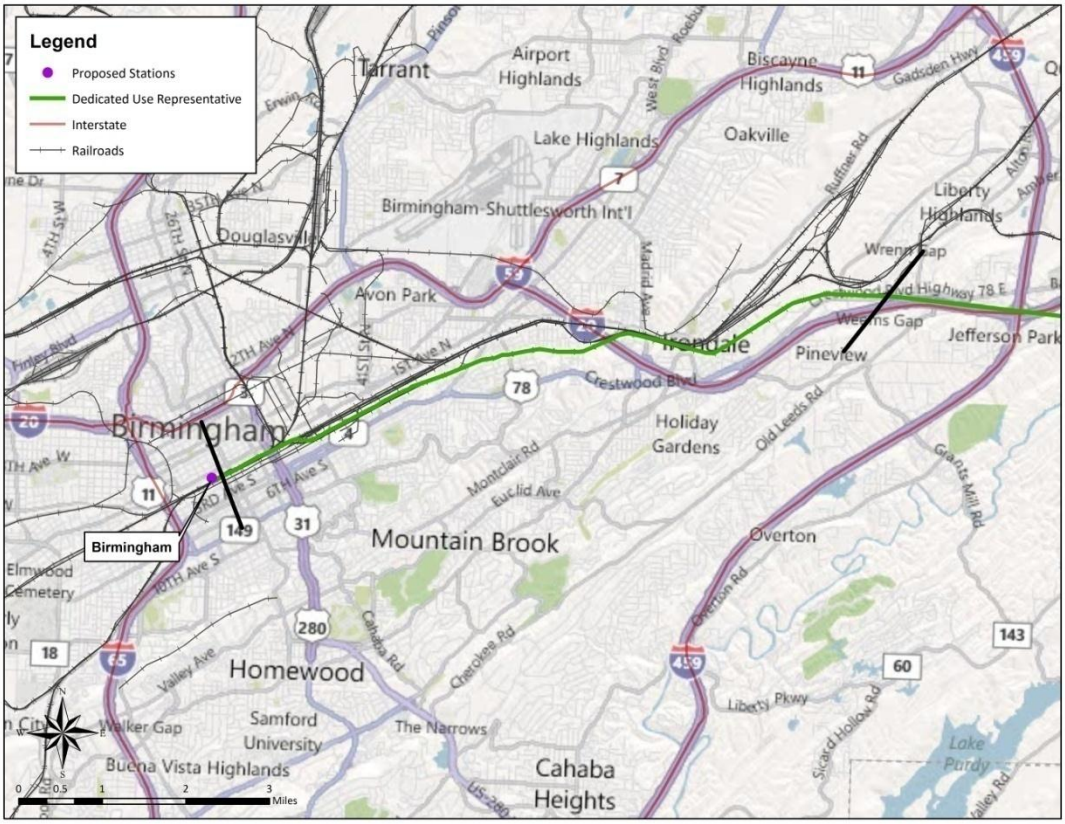


Table 6-14: Atlanta-Birmingham Total Dedicated Use Capital Cost Segment Six

Segment 6: 90-110 mph Shared Use –Birmingham Shared Use to Birmingham Station			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$57,080,000	$17,124,000	$74,205,000
Stations, Terminals, Intermodal	$18,610,000	$5,583,000	$24,194,000
Support Facilities: Yards, Shops, Administration Buildings	$6,203,000	$1,861,000	$8,065,000
Sitework, R/W, Land	$110,698,000	$33,209,000	$143,907,000
Communications & Signaling	$19,704,000	$5,911,000	$25,615,000
Electric Traction	$81,423,000	$24,427,000	$105,850,000
Vehicles	-	-	-
Professional Services	$91,640,000	-	$91,640,000
Unallocated Contingencies	N/A	N/A	N/A
Finance Charges	N/A	N/A	N/A
Total Cost	**$385,358,000**	**$88,115,000**	**$473,475,000**
Cost Per Mile (7.6 Miles)			**$62,299,000**

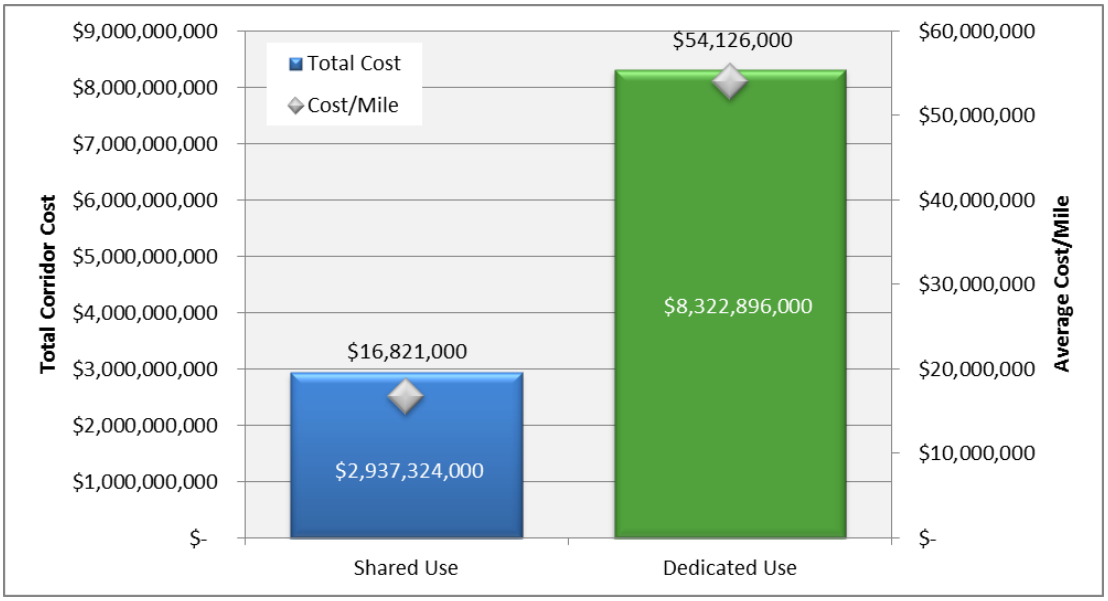
6.1.3 COMPARING CAPITAL COSTS

Table 6-15 and Figure 6-12 illustrate the total capital cost differences between Shared Use and Dedicated Use technologies. While it is evident that Shared Use total cost is far less than Dedicated Use, the Dedicated Use ridership and revenue (refer back to Chapter 5) is substantially higher.

Table 6-15: Total Capital Cost by Route/Technology

	Shared Use	Dedicated Use
Total Cost	$2,937,324,000	$8,322,896,332
Cost per Mile	$16,821,000	$54,125,618

Figure 6-12: Total Capital Cost by Technology



The last item that will determine the feasibility of the capital cost will be funding and financing opportunities. Section V, Chapter 3 outlines some potential funding and financing sources; however, additional funding analysis will be necessary in the future to understand realistic funding levels at the federal, state and local levels.

6.2 OPERATING AND MAINTENANCE COSTS

Operating and Maintenance costs were separated into fixed costs and variable costs. Table 6-16 outlines the fixed and variable cost categories used for this feasibility analysis.

Table 6-16: Atlanta-Birmingham Fixed and Variable Cost Categories

Fixed Cost Categories	Variable Cost Categories
• Stations • Track and Electrification Maintenance • Administration and Management	• Train Crew • On Board Services • Equipment Maintenance • Fuel/Energy • Insurance • Call Center • Credit Card/Travel Agency Commissions

6.2.1 90-110 MPH SHARED USE

The fixed and variable costs for the Shared Use Corridor are substantially less than Dedicated Use due to less required inspection, maintenance and repair on track and lower ridership levels (thus creating lower variable costs). Table 6-17 provides operating and maintenance cost estimates for 20201 (start up), 2030 and 2040 (feasibility planning horizon).

Table 6-17: Atlanta-Birmingham Shared Use O&M Costs (2010$ millions)

	2021	2030	2040	Total (2021-2040)
Variable O&M Costs	$20.9	$21.8	$22.7	$457.8
Fixed O&M Costs	$22.5	$22.5	$22.5	$472.5
Total O&M Costs	**$43.4**	**$44.3**	**$45.2**	**$930.3**

6.2.2 180-220 MPH DEDICATED USE

The Dedicated Use operating and maintenance costs are higher than Shared Use due to the track electrification maintenance as well as higher ridership. Table 6-18 provides the operating and maintenance costs for 2021, 2030 and 2040.

Table 6-18: Atlanta-Birmingham Dedicated Use O&M Costs (2010$ millions)

	2021	2030	2040	Total (2021-2040)
Variable O&M Costs	$35.0	$36.6	$38.1	$767.9
Fixed O&M Costs	$44.4	$44.4	$44.4	$932.4
Total O&M Costs	**$79.4**	**$81.0**	**$82.5**	**$1,700**

7 CORRIDOR EVALUATION

7.1 FEASIBILITY MEASUREMENTS

The study utilized two feasibility measurements for the Atlanta-Birmingham Corridor (operating ratios and benefit-cost calculations). The feasibility analysis was done for both Shared Use and Dedicated Use routes. Refer back to Section I: Chapter 3 for detailed methodology information on these measures.

A key element of the feasibility analysis is an assessment of both public and private benefits. To test the "franchisability" of a corridor as a public-private partnership, the analysis uses the "operating ratio" of revenues divided by operating costs. A service with a positive operating ratio greater than 1.0 generates an operating surplus. A positive operating ratio gives evidence of a strong, self-supporting operating system that is less likely to need operating subsidies and reduces the operating risk for the owner, investor and operator.

The benefit-cost analysis identifies all costs (capital, operating and maintenance) and all benefits (fare revenues, on-board service revenue, consumer surplus and external resources) and monetizes the value of each to determine a benefit-cost ratio. Similar to the operating ratio, a benefit-cost ratio of greater than 1.0 is desirable.

It should be mentioned that for both operating ratios and benefit-cost analyses, the standard period for assessing discounted cash flows is 25 to 30 years. Therefore, for the purposes of the feasibility analyses, the horizon year was extended from 2040 to 2050 to account for the three (3%) percent discount rate.

In setting up the feasibility evaluation, three scenarios were developed to show the impact of a range of ridership, revenue, capital and operating cost estimates typically encountered in a feasibility-level analysis. Unadjusted base forecasts for ridership, revenue, capital and operating costs were used for the Conservative Scenario. Base ridership and revenue estimates were increased for Dedicated Use corridors to establish the Intermediate and Optimistic Scenarios.[25] Operating costs

[25] Ridership adjustments for Intermediate and Optimistic Scenarios were only made for Dedicated Use corridor 180-220 mph electrified, steel-wheel and Maglev technologies (Maglev in Atlanta-Louisville corridor only) based on a peer review of regional and national high speed rail corridor studies. No scenario ridership adjustment was made for Shared Use corridor diesel-electric technology results based on a peer review of other shared-use corridor studies.

were adjusted by the appropriate ridership drivers. Capital cost estimates were adjusted downward in the Intermediate and Optimistic Scenarios for all technologies.

The three scenarios are intended to capture and illustrate the relatively wide range of estimates at the feasibility-level of study. As corridors are deemed feasible for further evaluation, future studies will provide greater detail in the analysis of ridership, revenues and costs, narrowing the range of estimates. Refer back to Section I: Chapter 3 for more detailed information on the development of these evaluation scenarios.

7.1.1 90-110 MPH SHARED USE

7.1.1.1 Operating Ratio

Table 7-1 provides the operating ratio for the Atlanta-Birmingham Shared Use route. Operating revenues include both farebox revenue and on board service revenue. Operating and maintenance costs include both fixed and variable costs (refer back to Chapter 6). Separate ridership and revenue scenarios were not developed for the Shared Use route. Therefore, Table 7-1 only presents the "Conservative" scenario using base-case ridership and revenue forecasts. Revenues, costs, operating surplus/deficits and operating ratio are estimated for 2021, 2030 and 2040 to understand the overall performance of the Shared Use route. The 110 mph Shared Use route generates an operating ratio greater than 1.0 providing a revenue surplus for all forecast years.

Table 7-1: Atlanta-Birmingham Shared Use Operating Ratio (2010$ millions)

	2021	2030	2040
Total Operating Revenue	**$50.1**	**$58.3**	**$67.3**
Farebox Revenues	$46.0	$53.5	$61.7
Ancillary Revenues	$0.5	$0.5	$0.6
On-Board Services	$3.6	$4.3	$4.9
Total Operating Costs	**$43.4**	**$44.3**	**$45.2**
Fixed Operating Costs	$22.5	$22.5	$22.5
Variable Operating Costs	$20.9	$21.8	$22.7
Operating Surplus (Deficit)	**$6.7**	**$14.0**	**$22.1**
Operating Ratio	**1.15**	**1.32**	**1.49**

7.1.1.2 Benefit-Cost

The study includes Shared Use route capital cost scenarios for use in the benefit-cost analysis, since base-case capital costs are substantial and include a 30 percent contingency. Table 7-2 outlines the benefit-cost results for each scenario. More

details are included in Appendix G. The first scenario includes the Conservative (base) ridership and revenue as well as capital costs with the 30 percent contingency. The Intermediate scenario the capital cost contingency is reduced to 15 percent, and the Optimistic scenario removes the contingency completely from the capital cost estimates.

Table 7-2: Atlanta-Birmingham Shared Use Benefit-Cost Analysis (2021-2050)

	Conservative	Intermediate	Optimistic
Shared Use	0.80	0.88	0.95

The Shared Use service alternative has a benefit-cost ratio between 0.80 and 0.95, with an Intermediate value of 0.88. The Shared Use route did not generate a benefit-cost ratio above 1.0. However, if the Atlanta-Birmingham Corridor were operated as a part of a larger Atlanta Hub System the benefit-cost ratio will improve. Refer to Section V: Chapter 2 for more detailed information on the feasibility of an integrated high-speed rail system.

7.1.2 180-220 MPH DEDICATED USE

7.1.2.1 Operating Ratio

Table 7-3 displays operating ratios for the Atlanta-Birmingham Dedicated Use route. Ridership, revenue, and capital cost scenarios were developed for all Dedicated Use routes. Refer back to Section I: Chapter 3 for detailed methodologies for the Conservative, Intermediate and Optimistic sensitivity scenarios.

The Conservative scenario uses base-case ridership and revenue forecasts and operating and maintenance costs. The Intermediate scenario includes moderately increasing revenue and operating costs; and Optimistic illustrates aggressive revenues and their associated operating costs. The Intermediate and Optimistic scenarios were developed based on benchmarking this feasibility study with other high-speed ground transportation studies both within the region and nationally.

Table 7-3: Atlanta-Birmingham Dedicated Use Operating Ratio

	Conservative	Intermediate	Optimistic
Dedicated Use			
2021	1.10	1.72	1.87
2030	1.25	1.86	2.00
2040	1.41	2.00	2.12

Similar to the Shared Use route, the Dedicated Use route produces operating ratios greater than 1.0 for all scenarios and forecast years.

7.1.2.2 Benefit-Cost

Table 7-4 outlines the three benefit-cost scenarios for the Dedicated Use route and the three scenarios outlined in section 7.1.2.1. Variations in capital costs were also included in the calculations. The Conservative scenario uses base-case ridership and revenue as well as base-case capital and operating and maintenance costs. The Intermediate scenario is based on a 75 percent increase in ridership and revenues and a capital cost contingency of 15 percent rather than 30 percent. The Optimistic scenario increases ridership and revenue by 100 percent over the Conservative scenario and eliminates the capital cost contingency.

Table 7-4: Atlanta-Birmingham Dedicated Use Benefit-Cost Analysis 2021-2050

	Conservative	Intermediate	Optimistic
Dedicated Use	0.48	0.92	1.13

The Dedicated Use route produces benefit-cost ratios between 0.48 and 1.13, with an Intermediate value of 0.92. This indicates that high-speed rail service is potentially feasible in the Optimistic case, which suggests that the Atlanta-Birmingham Corridor should continue to be evaluated in future environmental and engineering studies. Future studies should also consider the benefits of an integrated Atlanta-Hub System. Refer to Section V: Chapter 2 for more details on the potential for an Atlanta-hub high-speed rail system.

7.1.3 KEY FINDINGS

The Shared Use and Dedicated Use route and technology alternatives perform well under the operating ratio analysis, resulting in ratios well above 1.0 for all three scenarios. This indicates strong operations with lower associated risks to owners and operators. Positive operating ratios indicate an ability to pay down debt services and bonds, and can lead to reduced reliability on public investment subsidies. Additionally, operating surpluses on an annual basis may finance a "rail maintenance fund", requiring less investment in future years for capital maintenance costs. Positive operating ratios will likely spark private sector investment interest in the corridor, providing additional funding opportunities.

The benefit-cost results do not exceed 1.0 for any of the representative routes, with the exception of the Dedicated Use 180-220 mph technology option, which shows a benefit-cost ratio of 1.13 for the Optimistic scenario.

It should be noted that this feasibility study includes very high-level data and estimates. A more detailed corridor analysis with more definitive study boundaries, travel demand models, and cost estimates, could yield a better benefit-cost evaluation with a narrow range of estimates.

Taking into account the operating ratios and benefit-cost ratios, the study recommends that the results of this analysis be used to set priorities for future state planning and corridor development activities In particular, this study finds that high speed rail service is feasible in the Atlanta-Birmingham Corridor.

The study developed an additional “Hybrid” High Performance scenario, discussed in detail in Chapter 8 that further supports the above conclusions. This alternative has the potential to reduce initial capital costs and positively impact the benefit-cost analysis while maintaining the ability to achieve higher speeds along the corridor.

8 HYBRID HIGH PERFORMANCE SCENARIO

One of the results from the Shared Use and Dedicated Use analyses was the introduction of a "hybrid" scenario to offset a portion of the initial capital costs (compared to the Dedicated Use) while improving the travel speeds (compared to the Shared Use), thus positively impacting the operating ratio and benefit-cost analysis. While some analyses were completed for the Hybrid High Performance scenario, there was insufficient data available for a full analysis to be completed. Therefore, more performance and financial details regarding the Hybrid High Performance scenario will need to be explored through the NEPA process. This feasibility study intends to introduce the concept of the Hybrid High Performance scenario and provide a high-level feasibility estimates based on the results found during the Shared Use and Dedicated Use analyses. These estimates include:

- Operational estimates;
- Ridership and revenue;
- Capital Costs; and
- Operating and Maintenance Costs.

From these estimates, the study calculates the high-level operating ratio and Benefit-Cost ratio to compare against the previously identified Shared Use and Dedicated Use ratios to determine if the Hybrid High Performance scenario should be included in a future NEPA analysis.

The Hybrid High Performance scenario that provides a level of service between Shared Use and Dedicated Use, utilizing fully grade-separated track geometry with no shared-use freight operations. However, rather than electrified high-speed technology, the Hybrid High Performance scenario would implement Diesel-Electric Tilt Technology initially, and when ridership and revenue increase in later operating years, the service can be upgraded to a fully-electrified system, obtaining travel speeds of 220 mph or more.

One of the main benefits of the Hybrid High Performance scenario includes significantly lower capital costs compared to the 180-220 mph electrified technology assumed for the Dedicated Use route. However, the Hybrid High Performance scenario still has the potential to reach speeds of up to 130 mph. The study estimated that the Hybrid High Performance scenario would only take approximately 22 minutes longer than the electrified train on the Dedicated Use route. The 130 mph Hybrid High Performance scenario is approximately 1 hour, 16 minutes faster than auto travel by interstate from Atlanta to Birmingham (Table 8-1).

Table 8-1: Atlanta-Birmingham Operations Comparison

Segment	Shared Use	Dedicated Use	Hybrid High Performance
Rail Distance (miles)	176.0	150.7	150.7
Travel Time (hr : min)	2:46	1:18	1:40
Average Speed (mph)	64	117	90
Frequency (round trips/day)	6	10	10
Estimated Auto Time (hr : min)	2:56	2:56	2:56
Travel Time – Auto Time	+0:10	-1:38	-1:16

This chapter outlines the high-level revenue, cost, and feasibility results of the Hybrid High Performance scenario. However, it should be mentioned that these estimates do not incorporate the upgrade to electrification of the corridor, as those costs will only be incurred if ridership and revenue warrant the upgrade in later years.

8.1 Ridership and Revenue

To estimate ridership and revenue, the study calculated high-level estimates based on the decrease in vehicle speed as compared to the Dedicated Use. Travel time, speed profiles and train frequencies were adjusted as necessary.

Table 8-2: Atlanta-Birmingham Hybrid Operating Plan

	Hybrid High Performance Scenario
Travel Time	1 hour, 40 minutes
Train Frequency	10 round trips per day
Train Capacity	250 seats per train

The study estimated based on the decrease in average speed an increase in corridor travel time, the revenue for the Hybrid High Performance scenario would decrease by approximately 7.3 percent from the Dedicated Use forecasts (refer to Appendix G). Table 8-3 shows the estimated ridership and revenue for the Hybrid High Performance scenario for 2021, 2030, and 2040.

Table 8-3: Atlanta-Birmingham Hybrid High Performance Scenario Ridership and Revenue (in millions and 2010$)

Year	Conservative Scenario		Intermediate Scenario		Optimistic Scenario	
	Ridership	Revenue	Ridership	Revenue	Ridership	Revenue
2021	1,805,000	$67.5	3,158,000	$118.1	3,609,000	$135.0
2030	2,039,000	$78.0	3,568,000	$136.5	2,353,000	$156.0
2040	2,300,000	$89.6	4,025,000	$156.9	4,600,000	$179.3
Total	41,043,000	$1,571	71,825,000	$2,966	82,085,000	$3,143

8.2 Costs

As previously mentioned, the capital costs, operating costs, and maintenance costs will be significantly less than the Dedicated Use route due to the elimination of the track electrification. This also results in decreased in vehicle cost since diesel vehicles are also less expensive than fully electrified vehicles.

Table 8-4Table 8-4 outlines the Hybrid High Performance scenario capital cost estimates by major FRA SCC. Again, this alternative uses the Dedicated Use representative route and diesel, steel-wheel technology. Appendix F includes the detailed sub-category costs for the Hybrid High Performance scenario.

Table 8-4: Atlanta-Birmingham Total Hybrid Capital Cost by SCC Category (2010$)

Costing Category	Allocated Cost	Contingency (30%)	Total Cost
Track Structures & Track	$1,817,054,000	$ 545,116,000	$2,362,170,000
Stations, Terminals, Intermodal	$308,987,000	$92,696,000	$401,683,000
Support Facilities: Yards, Shops, Administration Buildings	$43,424,000	$13,027,000	$56,452,000
Sitework, R/W, Land	$832,505,000	$249,752,000	$1,082,257,000
Communications & Signaling	$257,181,000	$77,154,000	$334,336,000
Electric Traction	N/A	N/A	N/A
Vehicles	$217,250,000	$65175,000	$282,425,000
Professional Services	$1,016,855,000	N/A	$1,016,855,000
Unallocated Contingencies	N/A	N/A	N/A
Finance Charges	N/A	N/A	N/A
TOTAL COST	**$4,456,957,000**	**$1,030,714,000**	**$5,536,177,000**
TOTAL COST PER MILE (153.8 Miles)			**$36,003,000**

Operating and maintenance costs will also be reduced from the Dedicated Use estimates due to less required track inspection and maintenance. Table 8-5

illustrates the estimate Hybrid High Performance scenario operating and maintenance costs for 2021 (startup year) and 2040 (horizon year).

Table 8-5: Atlanta-Birmingham Hybrid O&M Costs (2010$ millions)

	2021	2030	2040	Total (2021-2040)
Variable O&M Costs	$34.4	$35.8	$37.2	$751.8
Fixed O&M Costs	$31.8	$31.8	$31.8	$667.8
Total O&M Costs	**$66.2**	**$67.6**	**$69.0**	**$1,420**

8.3 FEASIBILITY EVALUATION

Similar to the Shared Use and Dedicated Use, the study developed an operating ratio and benefit-cost ratio for the Hybrid High Performance scenario. Table 8-6 and Table 8-7 illustrate the results of these analyses for the three Conservative, Intermediate and Optimistic scenarios. Appendix G outlines more detailed operating ratio analysis.

Table 8-6: Atlanta-Birmingham Hybrid Operating Ratio

	Conservative	Intermediate	Optimistic
Hybrid High Performance			
2021	1.18	1.85	2.02
2030	1.34	2.00	2.14
2040	1.51	2.13	2.26
Dedicated Use			
2021	1.10	1.72	1.87
2030	1.25	1.86	2.00
2040	1.41	2.00	2.12

This positive operating performance is largely due to lower operating cost due to single tracking and the avoidance of electrification maintenance costs as well as lower operating costs associated with fewer frequencies (10 round trips per day).

Table 8-7: Atlanta-Birmingham Hybrid Benefit-Cost Analysis (2021-2050)

	Conservative	Intermediate	Optimistic
Hybrid High Performance	0.72	1.28	1.62
Dedicated Use	0.48	0.92	1.13

The Hybrid High Performance scenario produces benefit-cost ratios of 0.72 to 1.62 with an Intermediate case of 1.28. The Hybrid High Performance scenario shows the best potential for implementation, especially if combined with an integrated hub system (refer to Section V: Chapter 2).

8.4 Phasing Scenarios for Capital Costs

This discussion focuses on reducing capital costs for the initial implementation of high-speed rail within the Atlanta-Birmingham Corridor. The Hybrid High Performance scenario can be incrementally improved to 180-220 mph Dedicated Use service as corridor population trends results in higher ridership and demand for service improvements.

By phasing the corridor, the capital costs can also be phased in order to efficiently and effectively implement high-speed rail in order to meet current and future demands while maintain reasonable capital cost expenditure.

Phase I: Atlanta-Douglasville, GA

Phase I implementation of the passenger rail service proposes to connect the H-JAIA to Douglasville, GA, a distance of approximately 36 miles with station stops at H-JAIA, Atlanta MMPT and Douglasville. This phase would follow, primarily, I-20 right-of-way, with the exception of the route through downtown Atlanta in which it would utilize the Norfolk Southern right-of-way to access both the Atlanta MMPT and H-JAIA.

Phase I could potentially be paired with Intercity Passenger Rail, transporting commuters from the western Atlanta suburbs into the city, which would help boost initial ridership along the corridor.

Phase II: Douglasville, GA – Anniston, AL

Phase II implementation of the high-speed passenger rail service proposes to connect Douglasville to downtown Anniston, AL, a distance of approximately 76 miles and will include the station in Anniston. This route would continue to follow the I-20 right-of-way corridor and would face some topographic and curvature challenges entering and exiting the city of Anniston.

Phase III: Anniston – Birmingham, AL

Phase III of the implementation process would complete the high-speed rail route between Atlanta and Birmingham by providing the connection between Anniston and Birmingham. This final segment is approximately 64 miles, and would include the station in downtown Birmingham. Ridership along the corridor could be expected to increase significantly with the completion of this final segment allowing the full connection between the two major cities, Atlanta and Birmingham.

8.4.1 Additional Implementation Options – Commuter Rail

Commuter rail opportunities exist in both Atlanta and Birmingham and could serve as a first step in implementing the Atlanta-Birmingham Corridor. Currently, there are no specific plans for commuter service from Atlanta to the western portion of Georgia. However, possible commuter opportunities exist between Atlanta and Douglasville that would provide commuter benefits to western Atlanta suburbs as well as long-term intercity benefits, if constructed on the same route as the high-speed passenger rail service. Additionally, while there are no plans for commuter rail service in Alabama, the Birmingham to Anniston segment of the corridor could provide some commuter service in the future, potentially elevating ridership within the segment for the introduction of intercity high-speed passenger service.

8.5 CONCLUSION

Initial investigation into the Hybrid High Performance scenario indicates that an incremental approach to high-speed rail may provide significant advantages in the Atlanta-Birmingham Corridor both in terms of reducing initial capital cost requirement and increasing benefit-cost ratios.

The study used high-level estimates for revenue and costs associated with the Hybrid High Performance scenario. Therefore, a more detailed analysis of this alternative is needed to make definitive conclusions regarding the feasibility of the Hybrid High Performance scenario. The study recommends that the Hybrid High Performance scenario be included in the next phase of the passenger rail planning analysis as a viable technology alternative for passenger rail within the Atlanta-Birmingham Corridor.

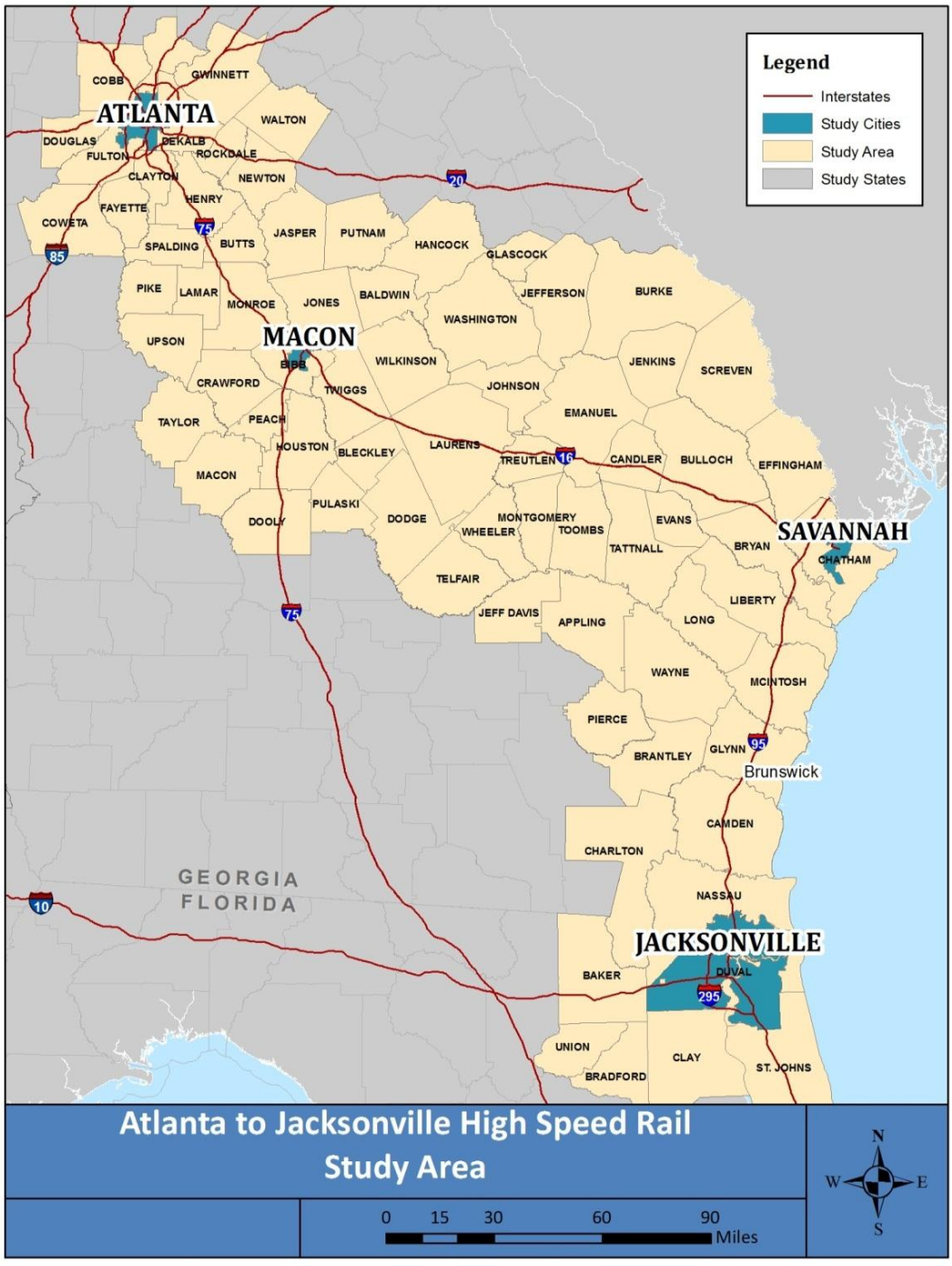
SECTION III:
ATLANTA-MACON-JACKSONVILLE

1 EXISTING CONDITIONS AND BACKGROUND

In order to estimate the improvements that high-speed rail will bring to the Atlanta-Macon-Jacksonville Corridor, a baseline of existing conditions was established. Existing conditions can include a variety of factors and characteristics; however, for the purposes of this feasibility study, the existing conditions include existing route alternatives and their associated attributes, population demographics and socioeconomic characteristics, employment patterns, land use patterns, issues and opportunities along the corridor, and environmentally critical areas.

A 400-mile long and 100-mile wide study area was established around the Shared Use and Dedicated Use evaluated route alternatives. The basis of existing conditions assessment is based on this study area and the associated counties. This size study area was determined to be consistent with the ridership and revenue forecasting catchment area that will follow in the study process. Further, the study corridor allows for connections to opportunity areas surrounding the high-speed rail route. The existing conditions assessment focuses on county-level data within the study area. A map of all Georgia and Florida Counties included in the study area can be seen in Figure 1-1.

Figure 1-1: Atlanta-Macon-Jacksonville Study Area



1.1 EVALUATED ALTERNATIVES

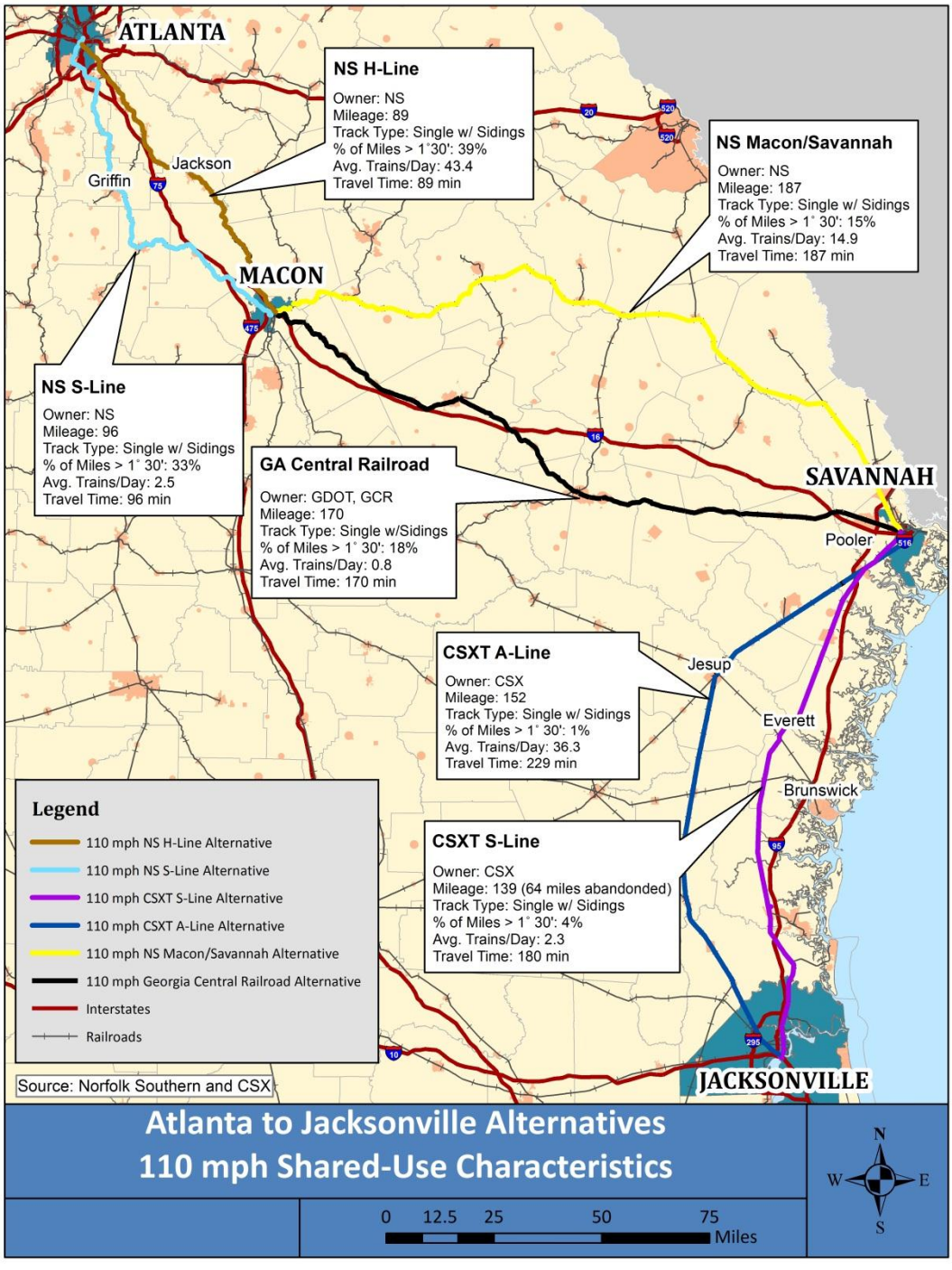
The study evaluated a number of potential route alternatives for both Shared Use and Dedicated Use technologies to determine the best representative route to utilize throughout the study analyses. It should be noted that this route is not a preferred route for the corridor, but rather, is a route that can represent the overall feasibility of the corridor. If this corridor is determined feasible from this representative route, it will be necessary, in the future, to conduct an alternatives analysis to determine a preferred route through the NEPA process.

1.1.1 90-110 MPH SHARED USE CORRIDORS

There are a number of rail routes that were considered for the Atlanta-Macon-Jacksonville 110 mph technology. These routes use a combination of existing and abandoned freight and passenger rail infrastructure. All of the potential routes can be seen in Figure 1-2. A table illustrating the characteristics of each of these route alternatives can be seen in Appendix C. Each of these proposed routes was subject to a technical review by the project study as well as input from key local stakeholders to determine the representative route for the corridor. The technical review included measuring the radius of each individual curve along both the Shared Use and Dedicated Use route alternatives using GIS and AutoCAD software. This then allowed for maximum and average speeds to be calculated to understand travel time differences between the various alternatives and technologies.

This representative route for each of the three corridors including the Atlanta-Macon-Jacksonville Corridor will advance onto the next phase of the feasibility study analysis. This route does not represent a final determination of an route for the corridor, but rather, is a route that can represent the overall feasibility of the corridor for the purposes of this analysis. If this corridor is determined feasible from this representative route, it will be necessary in the future to conduct an alternatives analysis to determine the preferred route and alignment.

Figure 1-2: Atlanta to Jacksonville Potential Shared-Use Routes



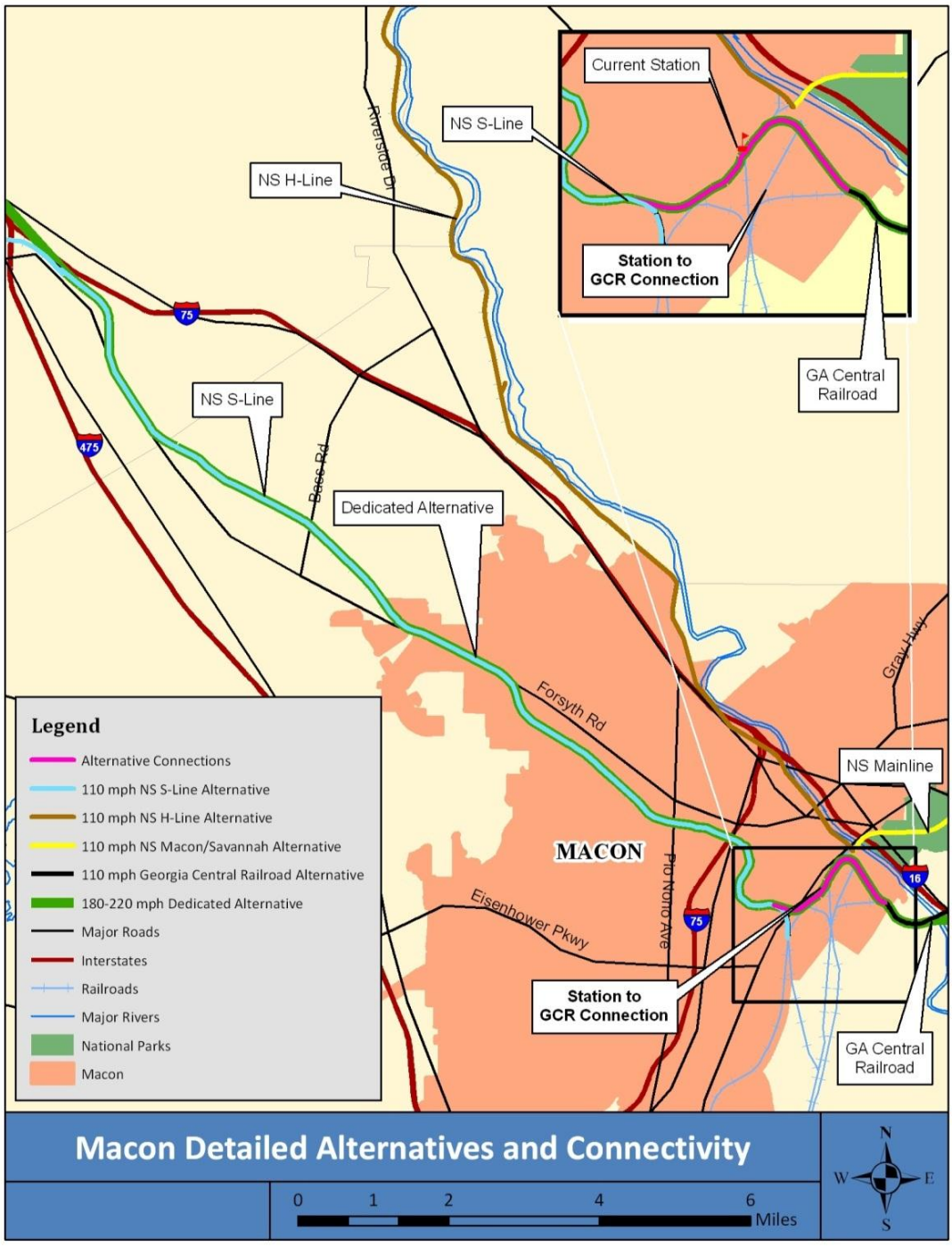
1.1.1.1 Atlanta to Macon

There are two routes that are under consideration for the segment between Atlanta and Macon. The first alternative follows the NS "H-Line" line through Jackson, GA. The corridor is 88 miles and is a Class 4 single track with sidings. A preliminary analysis reveals that there are 193 curves that exceed a radius of one degree, 30 minutes. This equates to 34.5 miles or 39 percent of the corridor that exceeds the curvature limits. This route sees an average of 43 freight trains per day. The estimated passenger travel time based on the track geometry is about 88 minutes with an average speed of 60 mph without additional improvements and curve easements.

The second alternative from Atlanta to Macon follows the NS "S-Line" line through Griffin, GA. This route is a single track with sidings that varies from Class 2 to Class 3. The route is 103 miles in length and has a total of 143 curves that exceed the one degree, 30 minute limit for a total of 34 miles (or 36 percent of the total route). Currently, the corridor's daily weighted average is 2.5 freight trains per day. The estimated passenger travel time is about 89 minutes with an average speed of 67 mph without additional improvements and curve easements. Within Macon, there is an issue with connectivity to both the existing train station and the Georgia Central Railroad (GCR) towards Savannah. It may be necessary, to build a connection within Macon for this alternative to be feasible. This proposed connection can be seen in Figure 1-3.

This second route reflects the same proposed route for the Macon-Atlanta Intercity Rail, as outlined in the Georgia 2009 State Rail Plan. It is thought that the implementation of an intercity rail would benefit high-speed rail by allowing the line to be more cost-effective through the sharing of infrastructure and operations. Within the State Rail Plan, it is proposed that the intercity passenger rail would operate three daily trains with stops in Macon, Griffin, H-JAIA and Atlanta (potentially the proposed MMPT site). The estimated cost for this service is $235 million and it is estimated that 275,000 passengers will utilize this service in 2030. FTA has already issued an environmental Finding of No Significant Impact (FONSI) along the NS S-Line and has been included in the Atlanta Regional Commission Transportation Improvement Plan. Additionally, a portion of the commuter rail line is included in the Transportation Investment Act of 2010 within the ARC and Three Rivers Regional Commission for the Atlanta to Griffin segment with funding levels equaling $23,000,000.

Figure 1-3: Macon Alternatives and Connectivity

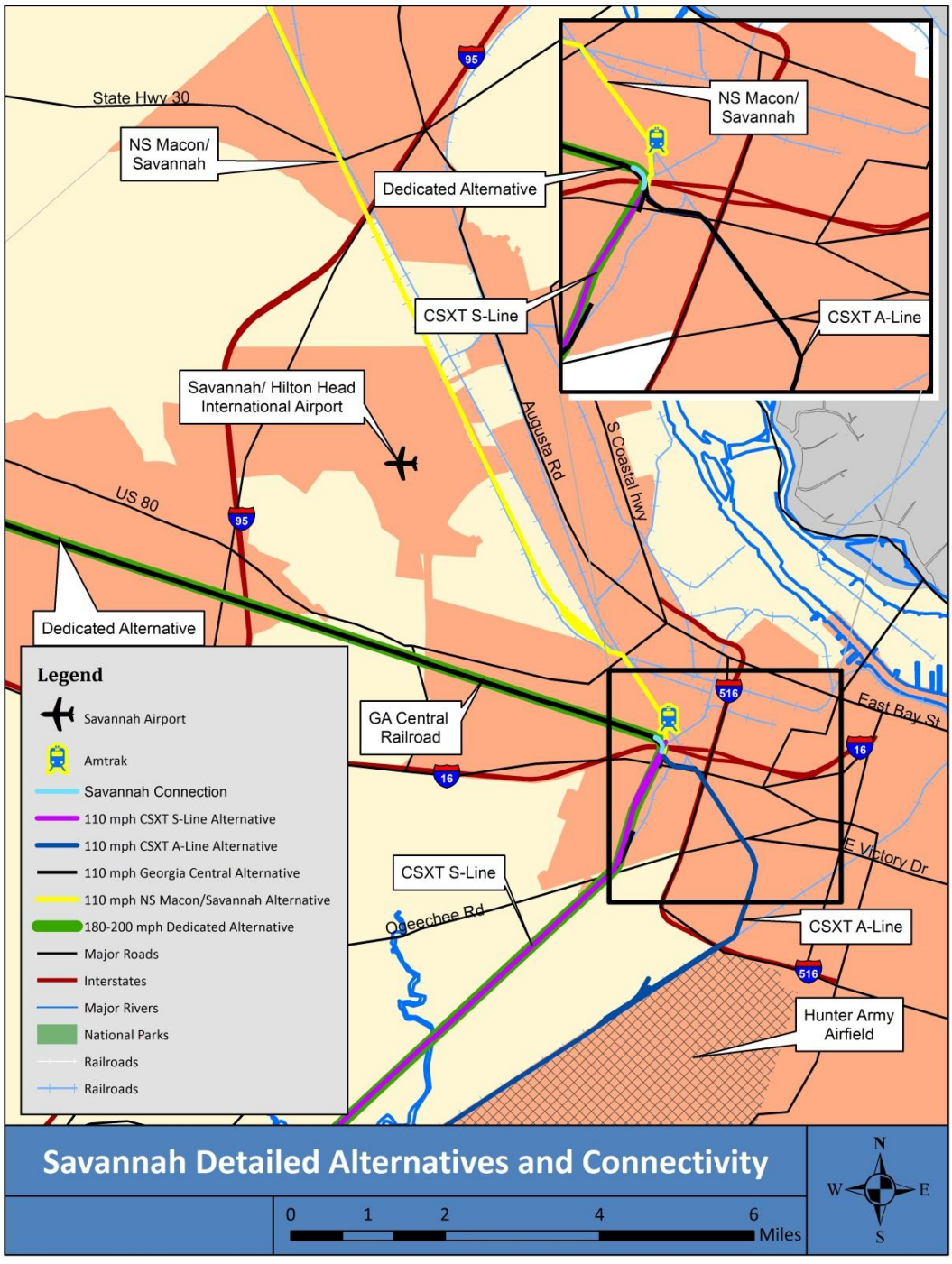


1.1.1.2 Macon to Savannah

There are two alternative routes between Macon and Savannah for the 90-110 mph Shared Use corridor. The first option is the GCR. This corridor is a 170-mile single track with sidings. It is a Class 3 track and has access to the Savannah Amtrak station and Savannah International Airport. There are approximately 150 curves that exceed a one degree, 30 minute radius for a total of 30 miles (or 18 percent of the corridor). The track has a very low volume of trains with a daily weighted average density of 0.8 trains. The estimated passenger travel time for this corridor is 136 minutes with an average speed of 74 mph.

The second option is to utilize the NS that runs north and east of I-16. The NS corridor provides access to both the Savannah International Airport and the Savannah Amtrak Station, similar to the GCR. This line is a total of 187 miles, and is a Class 3 single track with sidings. There are 62 curves that exceed the one degree, 30 minute radius limit for a total of 29 miles (or 15 percent of the corridor). This is a mainline connection for NS between Macon and Savannah; therefore, the average daily volume is approximately 15 trains. The passenger travel time for this route is about 187 minutes with an average speed of 60 mph. These options and connectivity can be seen in Figure 1-4.

Figure 1-4: Savannah Alternatives and Connectivity

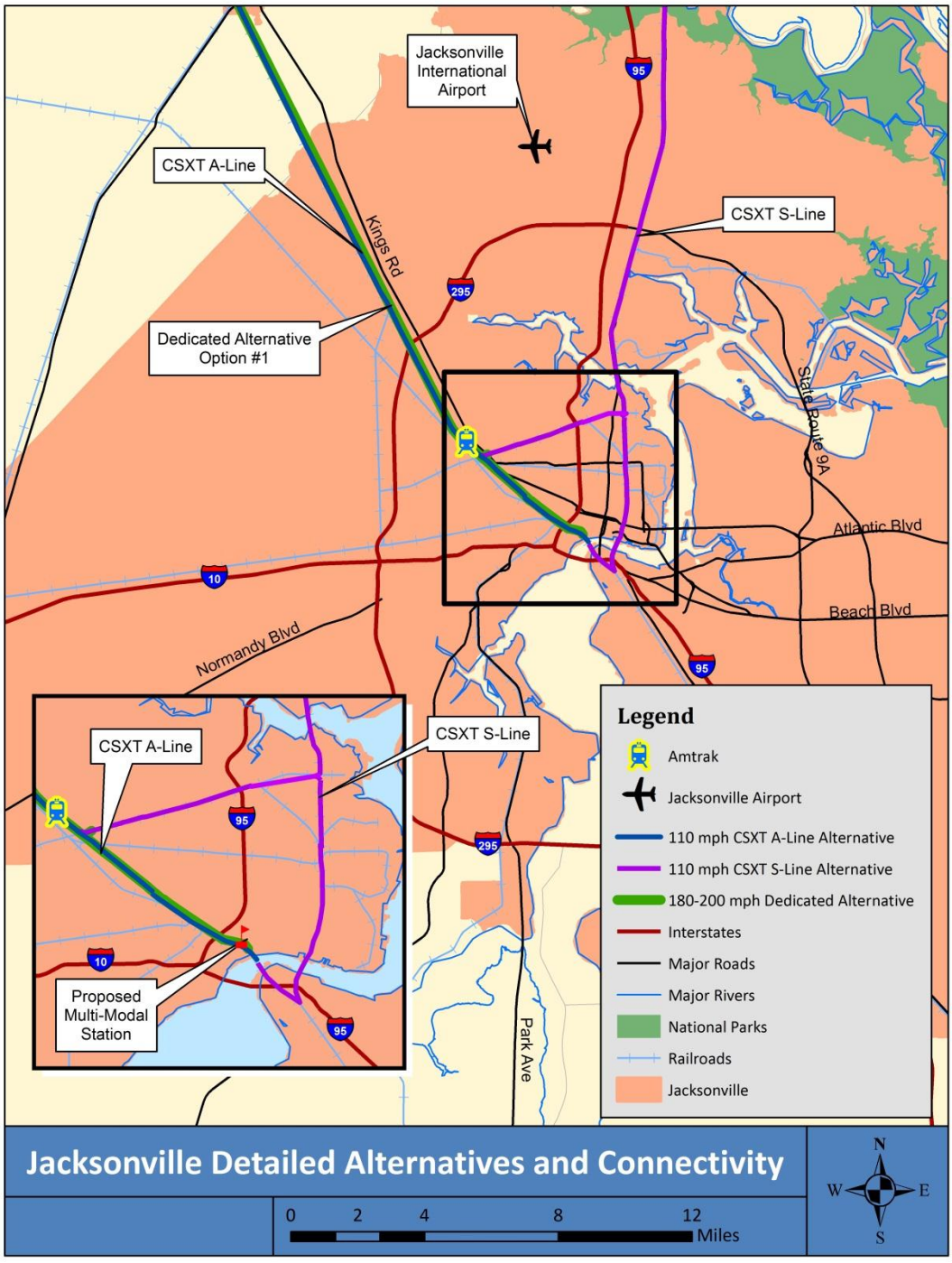


1.1.1.3 Savannah to Jacksonville

There are two 110 mph Shared Use rail route alternatives between Savannah and Jacksonville. The first follows the CSXT S-Line (refer back to Figure 1-2), which is a combination of Class 1, 3 and abandoned track and is a total of 137.7 miles. The track is single with sidings, where a portion of the track is currently abandoned for approximately 64 miles from south of Riceboro, GA to north of Kingsland, GA. Along this route, there are 19 curves that exceed one degree, 30 minute radius, totally 6 miles (or 4 percent of the route). Most of the train volume occurs as localized traffic in and around Savannah and Jacksonville with a daily weighted average density of 2.3 trains per day. Finally, because this track is relatively straight, the passenger travel time is estimated at 93 minutes with an average speed of 88 mph.

The other route alternative between Savannah and Jacksonville is the CSXT (A-Line) route through Jesup, GA (refer back to Figure 1-2). This route is also the current Amtrak corridor from Savannah to Jacksonville. The track is 151 miles of Class 4 single track with sidings. There are nine curves that exceed one degree, 30 minutes for a total of two miles (1 percent of the total route). In addition to the two passenger trains daily, the track experiences an average of 36 freight trains per day. The passenger travel time is estimated to be 113 minutes with an average speed of 80 mph. These alternatives and their connections to the Jacksonville area can be seen in Figures 1-4, 1-5 and 1-6.

Figure 1-5: Jacksonville Alternatives and Connectivity

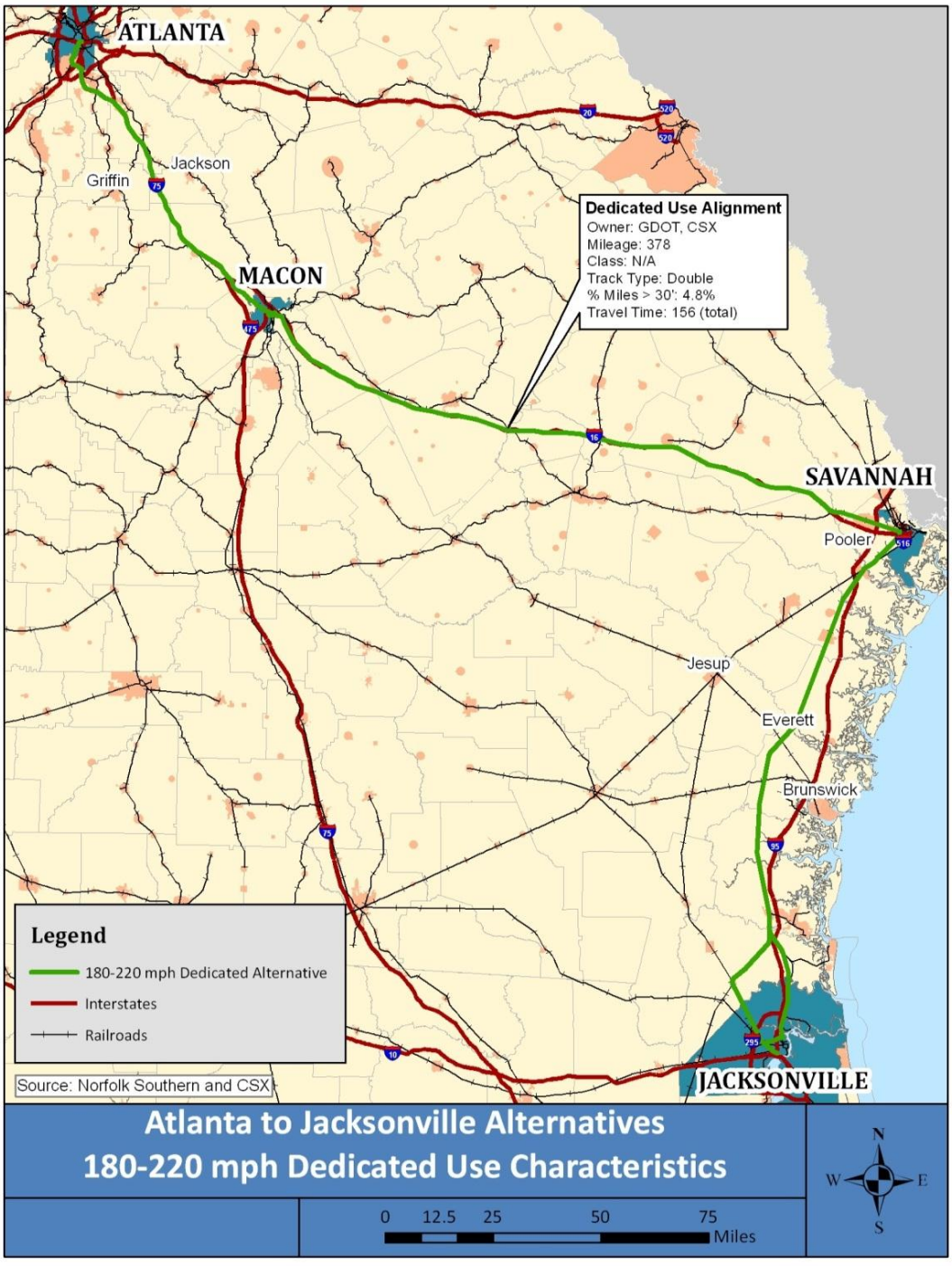


1.1.2 180-220 MPH DEDICATED USE CORRIDORS

The study assumed that viable high-speed rail operations along interstate highway corridors are to be on one of three basic routes: within the highway median, alongside the outside highway lane within the highway right-of-way, or in purchased right-of-way adjacent to the highway right-of-way. Where selected interstate highway curves were greater than 30', the high-speed rail route was adjusted to leave the immediate highway corridor if justified by travel time savings. It should be noted that while there is not a preferred alignment alternative as a part of the feasibility study, but variations in these basic routes will have an impact on cost and environmental considerations.

The proposed Dedicated Use route generally follows Interstate 75 (I-75) and the NS Griffin "S-Line" from Atlanta to Macon, and Interstate 16 (I-16) from Macon to Savannah. Between Atlanta and Macon, the route follows the Norfolk Southern alignment before intersecting with I-75 in Henry County. There is one primary opportunity for a Dedicated Use route between Savannah and Jacksonville following the partially abandoned CSXT S-Line. There are two routing options entering the Jacksonville metropolitan area. The first option is to continue following the CSXT S-Line from Savannah through Brunswick into Jacksonville providing access to the Jacksonville International Airport, but bypassing the existing Jacksonville Amtrak station. The second option provides a transition from the CSXT S-Line to the CSXT A-Line just north of the city. This option would access the Amtrak station, but bypass the Jacksonville International Airport. Both options will access the Jacksonville Transportation Authority's proposed Regional Transportation Center (discussed in more detail in Chapter 3). The Dedicated Use route is 368 miles from Atlanta to Jacksonville. There are approximately 105 curves that exceed a 30 minute radius along the entire route. This is equal to 18 miles (less than 5 percent of the total route). The estimated passenger travel time is 169 minutes with an average speed of 131 mph between Atlanta and Jacksonville.

Figure 1-6: Atlanta-Macon-Jacksonville Potential Dedicated Use route



1.2 Demographics and Socioeconomics

1.2.1 Total Population, Density, Race and Age

Population, employment mix, land use, and location of major travel destinations help define travel patterns and can impact mode choices. A thorough analysis of existing demographic and socioeconomic characteristics of the study area was performed and the results are documented in the following sections. As aforementioned, the study area is a 400-miles long and 100-mile wide corridor from Atlanta, GA to Jacksonville, FL via Macon and Savannah, GA. Refer back to Figure 1-1 (page 3-2) for the study area and the counties included for the purposes of this existing conditions report.

Understanding the distribution and characteristics of an area's population is critical to transportation planning. In order for high-speed rail to be feasible, it must serve areas of high population density which can produce ridership and revenue. Other characteristics, such as employment, socioeconomics and existing travel patterns must also be considered as this can impact the population's propensity to ride transit.

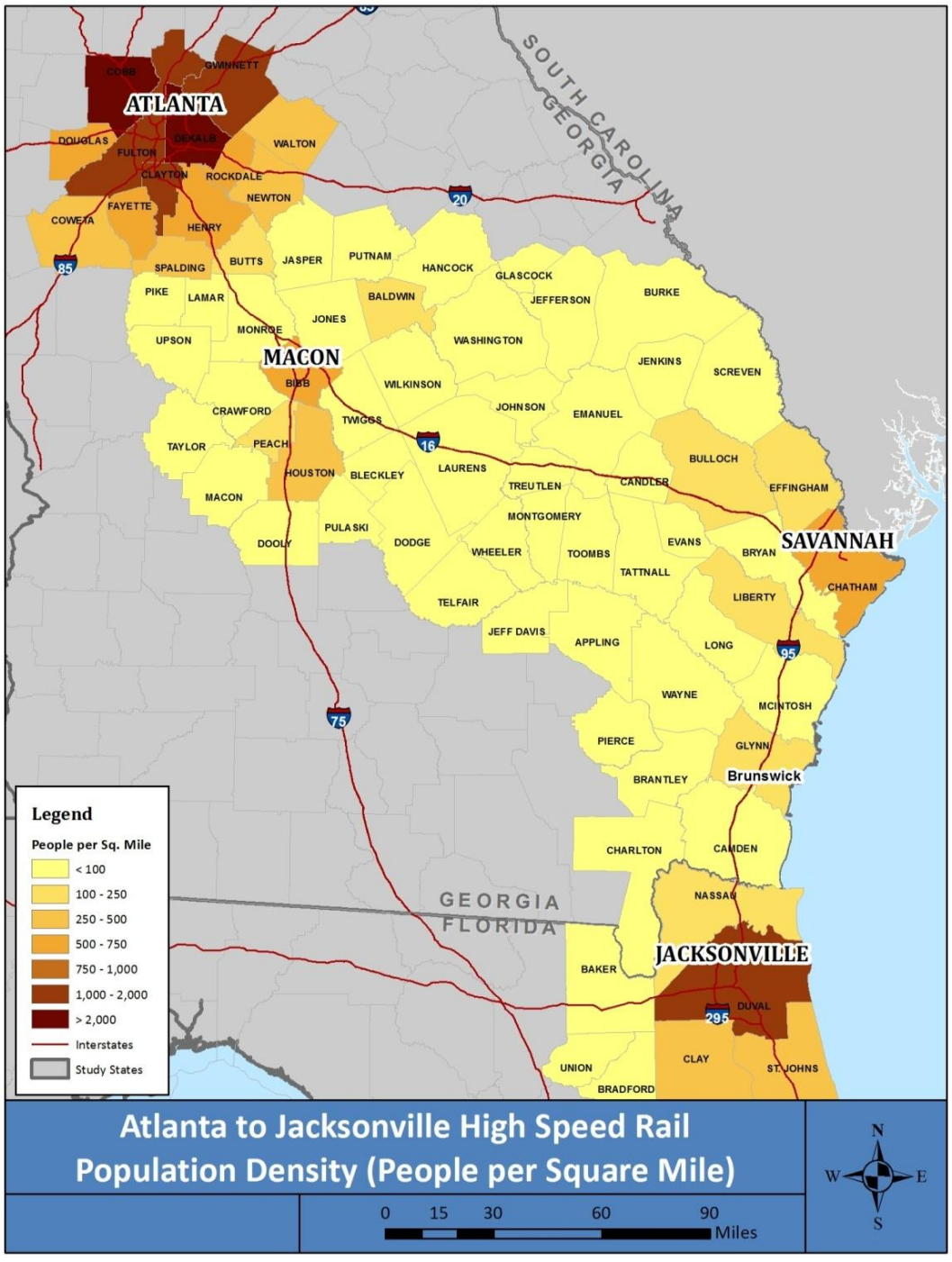
For the purpose of assessing population, data was reviewed and aggregated at the county level. The total existing (2010) population of the 74 counties in the study area is 7,366,406. Ninety percent of the study area population is located in Georgia. Further, while the population densities vary along the corridor, the average population density on the county level is approximately 284 people per square mile.

Table 1-1: Atlanta-Macon-Jacksonville State Populations and Densities

State	Number of Counties	Study Area Population	% of Total Population	Average Population Density
Georgia	67	5,976,755	62%	272
Florida	7	1,389,651	7%	295
Total	74	7,366,406	26%	284

Densities in Georgia are slightly lower than Florida, 272 people per square mile versus 295 people per square mile, as seen in Figure 1-7. The densities range from greater than 2,000 persons per square mile in DeKalb County, GA (2,580 people/square mile) and Cobb County, GA (2,023 people/square mile) Counties to less than 50 persons per square mile in many rural Georgia and Florida counties. Figure 1-7 illustrates this distribution of population densities. Appendix D provides more detailed 2010 total population and population density by county.

Figure 1-7: Atlanta-Macon-Jacksonville Study Area Population Density



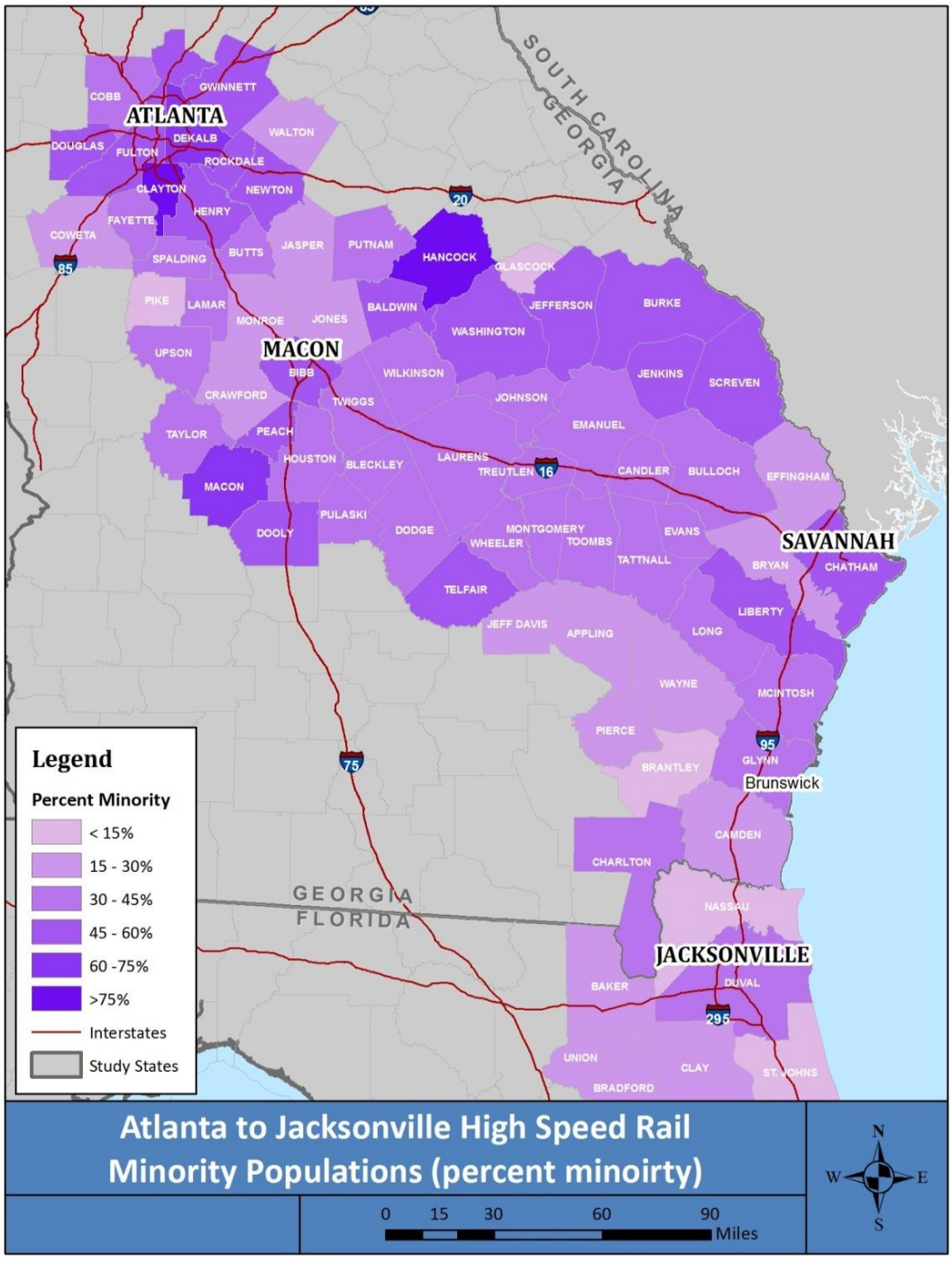
The distribution of race/ethnicity along the corridor is shown in Figure 1-8. Most counties along the corridor follow the same general trend, with white as the majority, followed by Black/African American, then Hispanic/Latino. Compared to state levels, the distribution of race and ethnicity along the corridor reflect similar patterns to Georgia and slightly lower Caucasian population than Florida, as illustrated in Table 1-2. However, in several Georgia counties, including many rural counties, such as Macon County and Warren County, GA, minorities are the majority of the population. Appendix D provides the 2010 racial and ethnic distribution by county.

Table 1-2: Atlanta-Macon-Jacksonville Racial and Ethnic Distribution, 2010

Race	Study Corridor - Percent of Total Population (2010)	Statewide Georgia – Percent of Total Population (2010)	Statewide Florida – Percent of Total Population (2010)
White	51.7%	59.7%	75.0%
Black/African American	33.1%	30.5%	16.0%
Hispanic or Latino	8.9%	8.8%	22.5%
American Indian	0.2%	0.3%	0.4%
Asian/Pacific Native	4.1%	3.2%	2.4%
Other	2.0%	2.2%	2.6%

Source: U.S. Census Bureau, 2010

Figure 1-8: Atlanta-Macon-Jacksonville Percent of Minorities by County



As seen with similar aging trends across the U.S., over the past decade there has been an increase in the aging population (ages 65 and older) in Georgia and Florida. The 2010 U.S. Census shows that 10.7 percent of the population in Georgia is older than 65 years and 17.3 percent of the population in Florida is older than 65 years. The corridor's study area shows that the aging population of the study area is approximately 10.5 percent, similar to the Georgia percentage. Many of these seniors are transit dependent and could potentially rely on this high-speed rail corridor for their travels between the larger cities of Atlanta, Macon, Savannah, and Jacksonville, or perhaps from rural areas in Georgia to the major cities for services such as medical treatment and shopping. Appendix D provides the 2010 aging population by county.

1.2.2 Employment and Employment Centers

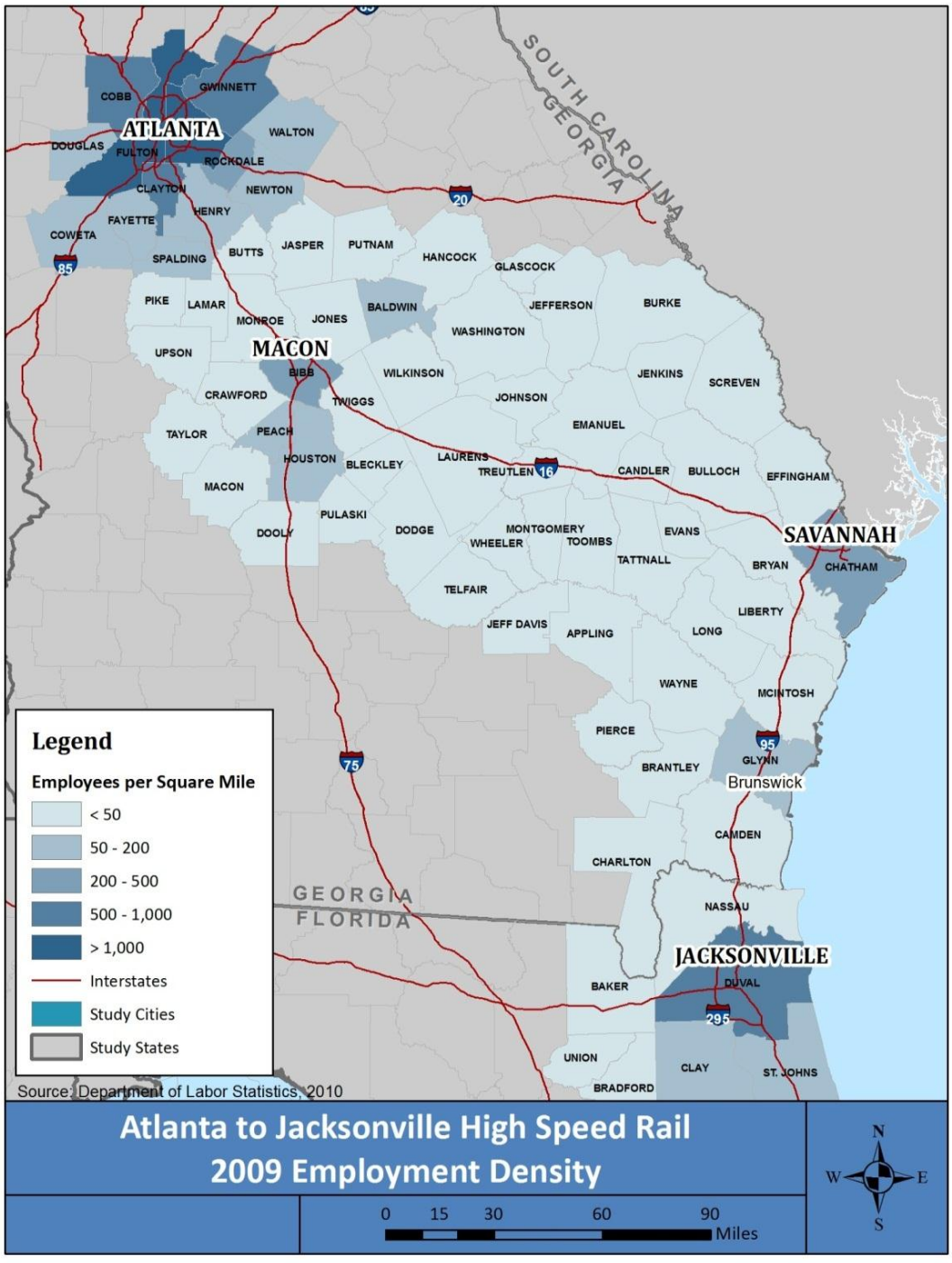
Employment distribution is important to understanding potential trip patterns since employment centers serve as a destination for many trips whether they are work, school, shopping, or medical related. Using the U.S. Bureau of Labor Statistics (BLS) data from 2009, indicates that the majority of employment along this corridor occurs in the urbanized areas including the metropolitan Atlanta counties of Fulton, Cobb, Gwinnett, DeKalb, and Clayton Counties, GA (74 percent of jobs), Bibb and Houston Counties, GA (5.5 percent of jobs) ,and Savannah/Chatham County, GA (5.2 percent of jobs). The total study area in Georgia employs approximately 2,491,430 people (81 percent of the total employment in Georgia). The study area around Jacksonville, FL employs more than 560,000 people, 7.9 percent of total employment in Florida. The employment density by county can be seen in Table 1-3. Appendix D provides detailed employment data by county for 2009.

Table 1-3: Major Employment Areas

Employment Area	% of Total State Jobs
Atlanta Metropolitan Area	74.0%
Macon Metropolitan Area	5.5%
Savannah/Chatham County	5.2%
Georgia Study Area Total	81.0%
Jacksonville Metropolitan Area	7.9%

Source: U.S. Census Bureau, 2010

Figure 1-9: Atlanta-Macon-Jacksonville Employment Density by County



Major employment centers include hospitals, large office parks, universities, shopping malls and other activity centers. Atlanta is home to a number of Fortune 500 companies, including but not limited to, The Home Depot (#30), UPS (#48), Coca-Cola Company (#70), Delta Airlines (#88), Southern Company (#147), Genuine Parts (#215), Fist Data (#236), SunTrust Bank (#244), AGCO (#340), and Newell-Rubbermaid (#397). The City of Savannah is home to one of the largest ports on the United States' east coast. The Georgia Ports Authority (GPA) reported in 2007, that the Port of Savannah was the fourth-busiest and fastest-growing container terminal in the United States (GPA, 2010). Currently, GA lawmakers are pushing for federal support to dredge the port to accommodate larger cargo ships in conjunction with the opening of the expanded Panama Canal in 2014.

Both Savannah and Macon are home to two of the largest military operations in Georgia, Fort Stewart near Hinesville, GA and Robins Air Force Base in the City of Warner Robins just south of Macon, GA. The military plays a large role in the employment and economic vitality of these cities and may therefore provide a substantial portion of ridership on this high-speed rail corridor.

Jacksonville, FL is home to three Fortune 500 companies: CSXT (#230), Winn-Dixie Stores (#324), and Fidelity National Financial (#398). Jacksonville also relies on the Port of Jacksonville, a major employer in the region for economic stability. In 2010, the Jacksonville Port Authority reports that the Port transferred more than eight million tons including 800,000 containers and 500,000 automobiles. The Port of Jacksonville also hosts cruise passengers with over 70 cruises embarking from the port in 2010.

1.2.3 Socioeconomic Characteristics – Income

High-speed rail service relies upon ridership and revenue for successful operations. Understanding the socioeconomic characteristics of the study corridor will help determine if the corridor is feasible for future high-speed rail service. These characteristics serve as important inputs to the ridership and revenue analysis.

The median household income in 2010 for the study area is approximately $44,684 with the Georgia study area counties averaging $40,058 and Florida counties averaging $49,310. When compared to the national average in 2009 ($50,221), Georgia's average is slightly lower than the national while Florida's average is slightly higher (as seen in Table 1-4). In Georgia, the highest median incomes can be found in and around metropolitan Atlanta including Fayette County ($77,491), Cobb County ($62,893), Gwinnett County ($58,732) and Fulton County ($56,313). The lowest median incomes along the study corridor include: Hancock, Johnson, and Telfair Counties, GA, all with a median income between $25,000 and $28,000, annually. The county with the highest median incomes in the study area within Florida is St. Johns County ($62,180). The county with the lowest median income is Bradford County, FL ($38,360). Figure 1-10 illustrates the distribution of median

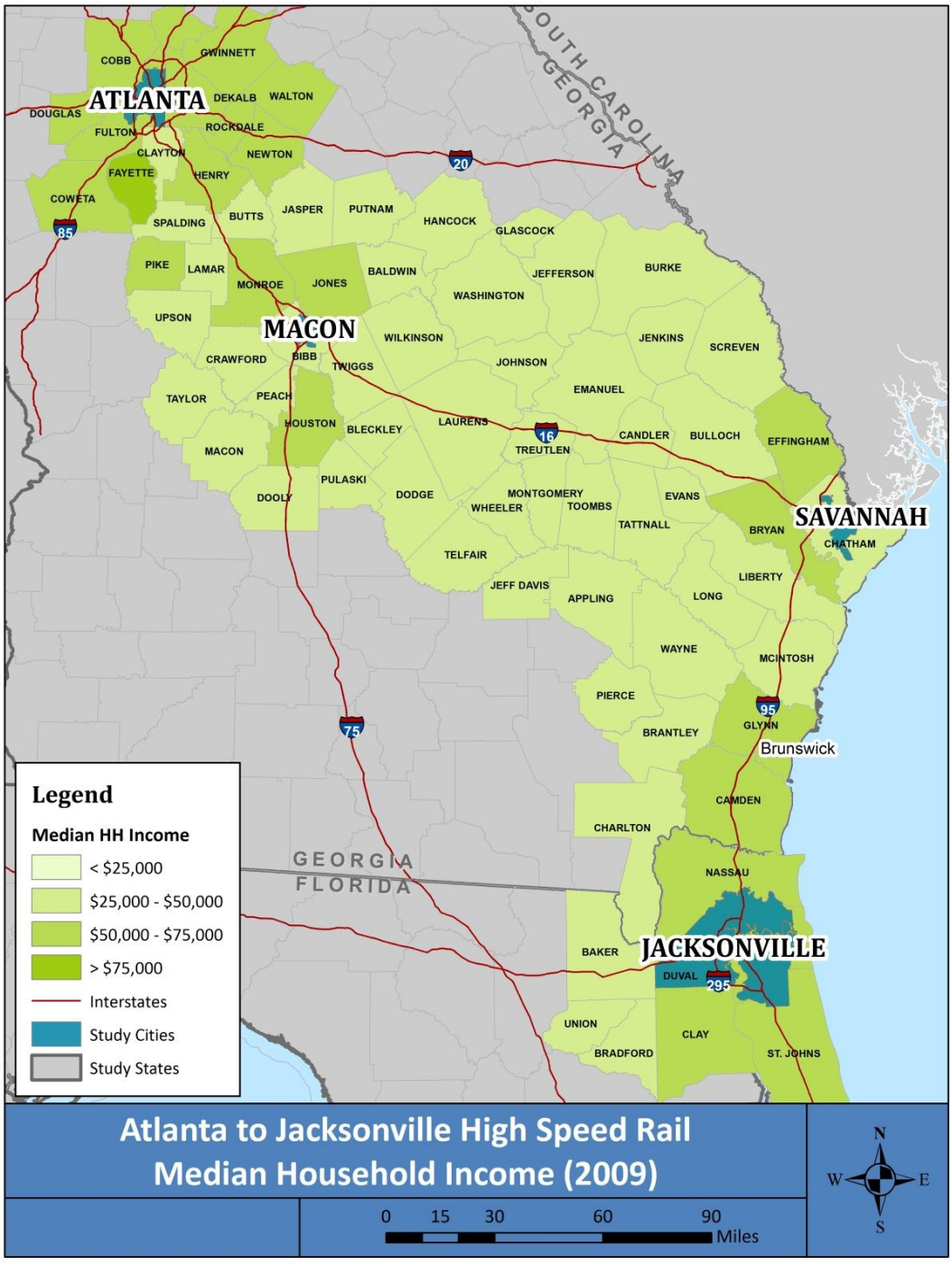
household incomes for the corridor. Appendix D provides the income distribution by county for 2009.

Table 1-4: Atlanta-Macon-Jacksonville 2010 Median Household Income

Study Area	Highest Median HH Income	Lowest Median HH Income	Average Median HH Income
Georgia Counties	$77,491 (Fayette Co.)	$25,102 (Hancock Co.)	$40,058
Florida Counties	$62,180 (St. Johns Co.)	$38,360 (Bradford Co.)	$49,310
National Average	-	-	$50,221

Source: U.S. Census American Community Survey, 2010

Figure 1-10: Atlanta-Macon-Jacksonville Household Median Income by County



1.2.4 Environmental Justice

A full environmental analysis will be necessary for a Tier I NEPA study. However, the feasibility study can begin to identify areas where environmental justice (EJ) issues may surface along the corridor. Minority populations were identified along the Atlanta-Macon-Jacksonville corridor. The percentage of minority populations within each county along the corridor was compared to the state percentages of minority populations. Those counties whose minority populations exceeded the state average are considered potential EJ counties. Additionally, the county median household income was compared to the statewide median household income. Counties that showed a lower median income than the state are considered potential EJ counties. Table 1-5 illustrates the potential EJ counties and the thresholds met. The detailed demographics for each county are in Appendix D.

Table 1-5: Atlanta-Macon-Jacksonville Potential EJ by County

County	Thresholds	
	Race/Ethnicity	Household Income
Georgia		
Baldwin	✓	✓
Bibb	✓	✓
Bleckley		✓
Brantley		✓
Bulloch		✓
Burke	✓	✓
Butts		✓
Candler		✓
Charlton		✓
Chatham	✓	✓
Clayton	✓	✓
Crawford		✓
DeKalb	✓	
Dooly	✓	✓
Dodge	✓	✓
Douglas	✓	
Emanuel		✓
Evans		✓
Fulton	✓	
Glascock		✓
Glynn		✓
Gwinnett	✓	
Hancock	✓	✓
Henry	✓	
Jasper		✓
Jeff Davis		✓
Jefferson		✓
Jenkins	✓	✓
Johnson		✓
Lamar		✓
Laurens		✓
Liberty	✓	✓
Long		✓
Macon	✓	✓

County	Thresholds	
	Race/Ethnicity	Household Income
McIntosh		✓
Montgomery		✓
Newton	✓	
Peach	✓	✓
Pierce		✓
Pulaski		✓
Putnam		✓
Rockdale		✓
Screven	✓	✓
Spalding		✓
Tattnall		✓
Taylor		✓
Telfair	✓	✓
Toombs		✓
Treutlen		✓
Twiggs		✓
Upson		✓
Washington	✓	✓
Wayne		✓
Wheeler		✓
Wilkinson		✓
Florida		
Bradford		✓
Duval	✓	✓
Union		✓

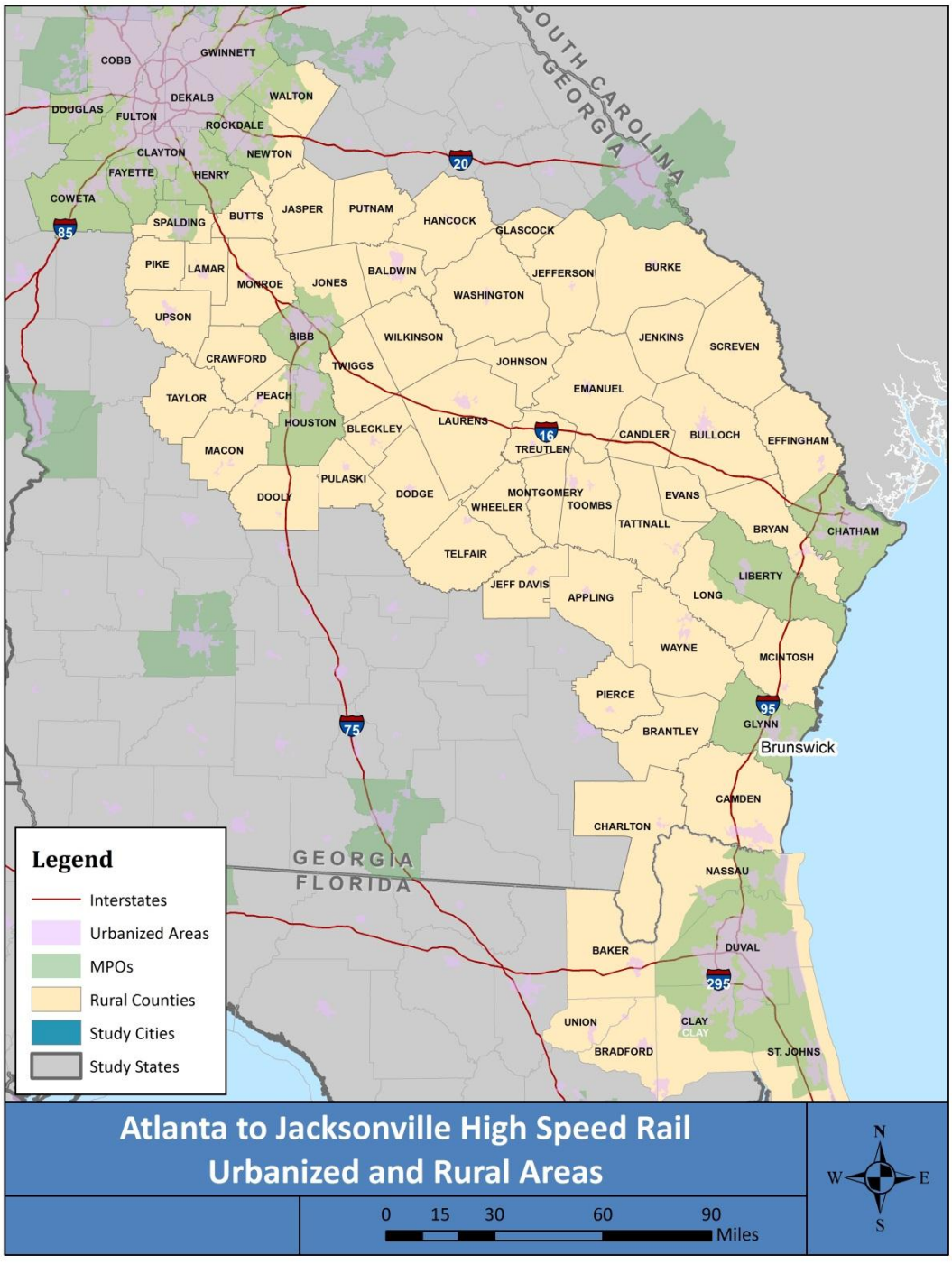
Source: U.S. Census Bureau, 2010

1.3 Land Use – Urban vs. Rural

The study area consists of both urban and rural areas. According to the U.S. Census, urban areas are defined as "densely settled territory, which consists of core census block groups or blocks that have a population density of at least 1,000 people per square mile and surrounding census blocks that have an overall density of at least 500 people per square mile" (U.S. Census, 2010). The two terminal points, Atlanta and Jacksonville, are major cities with dense commercial, office and residential development near the city centers. Between these two major cities, there are three urbanized areas, Macon, Savannah and Brunswick, GA, which also are employment and residential centers for middle and south Georgia. Between these three larger cities along the corridor, there is a mix of suburban and rural communities.

From Atlanta, traveling south, the land use remains urban until Butts County, just south of the Atlanta MPO area. From there, the land use is rural until Bibb and Houston Counties, GA. From Bibb and Houston Counties, traveling south east towards Savannah, GA, the corridor study area is rural with until Chatham County (City of Savannah). From Savannah heading south towards Jacksonville, the land use remains fairly rural with urbanized areas such as Liberty and Glynn Counties (cities of Brunswick, St Marys and Kingsland, GA). Figure 1-11 shows the urbanized areas along the study corridor. The majority of the corridor is rural, thus supporting for high-speed rail by allowing higher travelling speeds, and maintaining capital costs through lower property acquisition costs.

Figure 1-11: Atlanta-Macon-Jacksonville U.S. Census Urbanized Areas



1.4 TRAVEL PATTERNS

High-speed rail feasibility is partially determined by the frequency of travel between major cities. High-speed rail provides an alternative to both air and automotive travel. For this particular corridor, existing travel patterns and volumes associated with travel between Atlanta, Macon, Savannah, and Jacksonville will be assessed.

1.4.1 AUTOMOTIVE TRAVEL

The ridership and revenue forecasting methodology for this analysis utilizes annual auto round-trip estimation from the 1995 ATS conducted by the BTS. This is the most recent intercity travel survey data available. For the Atlanta to Jacksonville corridor, the survey found that there were almost one-half million (442,290) round trip auto trips annually between Atlanta and Jacksonville. The round trips between cities can be seen in Table 1-5.

Table 1-6: Intercity Auto Trip Table (ATS 1995)

Originating City	Annual Person Trips (Round Trips)
Atlanta	345,499
Jacksonville	76,791

Source: ATS, 1995

Traffic counts were also observed between 1995 and 2010 to understand total volumes along the interstates. It should be noted that traffic counts can be misleading since they include both long-distance travel and local travel. Therefore, while traffic counts can give an indication on the demand between the major cities, these are not definitive figures for intercity travel. Overall, the traffic has increased by an average of 3.41 percent between Atlanta and Jacksonville. Table 1-6 shows the increase in traffic volumes between 1995 and 2010 for all interstates between Atlanta and Jacksonville.

Table 1-7: Observed Auto Traffic Growth (in AADT) Between 1995 and 2010

Corridor	Location	Traffic Count 1995	Traffic Count 2010	AGR '95-'10	Overall Annual Growth
Atlanta-Jacksonville	I-75 (Atlanta to Macon)	45,900	74,121	3.73%	3.41%
	I-16 (Macon to Savannah)	8,400	13,560	3.24%	
	I-95 (Savannah to Jacksonville)	29,000	51,199	3.25%	

Source: State DOT Traffic Count Data

1.4.2 AIR TRAVEL

Local air travel refers to air passenger volumes on direct flights between the major airports within the study corridor. The FHWA DB1B provided volumes for 2010. The

survey determined that there were 268,940 air passengers travelling between Atlanta, Savannah, and Jacksonville collectively. These total volumes can be seen in Table 1-7.

Table 1-8: Local Air Trips in 2010

Air Passenger Volumes in 2010	ATL-Atlanta	JAX- Jacksonville	SAV- Savannah	Total
ATL-Atlanta	-	109,280	25,020	134,300
JAX- Jacksonville	109,830	-	-	109,830
SAV- Savannah	24,810	-	-	24,810
TOTAL	**134,640**	**109,280**	**25,020**	**268,940**

Source: FHWA Airline Origin and Destination Survey Database, 2010 (Q1-Q4)

Air connections are also an important point of comparison to high-speed rail travel. These passengers should be taken into consideration as high-speed rail could potentially serve to replace a flight connection link to another airport. Table 1-8 shows segment level traffic information for the H-JAIA and Jacksonville airport pair which provides a reliable estimate for the connect air market under consideration. The table includes total passengers, scheduled seats, scheduled departures, average daily frequency, average seats per flight, and average passenger per flight for Q4 2009 to Q3 2010.

Table 1-9: Connect Air Volumes

City Pair	Passengers	Seats	Scheduled Departures	Flights / Day	Seats / Flight	Passengers / Flight
ATL-JAX	697,411	886,537	6,383	17	139	112

Source: T-100 segment data Q4 2009 to Q3 2010, www.bts.gov

1.5 Environmental Issues

Environmentally sensitive areas for the purposes of this study include those that potentially contain threatened and endangered species and/or cultural resources such as properties listed on the NRHP or that are outlined in Section 4(f) of the USDOT Act of 1966. FRA must comply with Section 4(f) guidelines for the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refugees, or public and private historical sites unless the following conditions apply: 1) there is no feasible and prudent alternative to the use of the land; and 2) the actions includes all possible planning to minimize harm to the property resulting from use.

As previously mentioned there are additional environmental aspects that should be considered in future studies, but given the high-level analysis if this feasibility analysis, these aspects are more appropriate during the NEPA process.

1.5.1 Threatened and Endangered Species

Threatened and endangered species lists are maintained by the U.S. FWS. All routes within this corridor were reviewed for the potential of threatened and endangered species on a county basis. The county report "contain Species that are known to or are believed to occur in the county" (U.S. FWS). Refer back to Figure 1-1 on page 3-2 for a map of the counties included in the study area. A detailed list of species by county can be found in Appendix E. There are currently 17 species within study area counties (displayed in Table 1-9) that are listed as endangered, five species that are considered threatened, and one is potentially endangered.

Table 1-10: Study Area Counties Known Endangered and Threatened Species

Species	Status
Red-cockaded woodpecker	Endangered
Wood stork	Endangered
Fringed campion	Endangered
Relict trillium	Endangered
Hairy rattleweed	Endangered
Canby's dropwort	Endangered
Black Spored quillwort	Endangered
Little amphianthus	Threatened
Michaux's sumac	Endangered
Pondberry	Endangered
American chaffseed	Endangered
Mat-forming quillwort	Endangered
Frosted Flatwoods salamander	Threatened
Eastern Indigo snake	Threatened
Hawksbill sea turtle	Endangered
Leatherback sea turtle	Endangered
Green sea turtle	Threatened
Loggerhead sea turtle	Threatened
West Indian manatee	Endangered
Altamaha spinymussel	Potentially Endangered
Purple bankclimber	Threatened
Oral pigtoe	Endangered
Shinyrayed pocketbook	Endangered
Gulf moccasin shell	Endangered

Source: U.S. FWS

1.5.2 Cultural Resources

Using the same study area as the endangered species screening, the study looked at the NRHP to understand the magnitude of historic resources within the corridor.

Within the study area, there are a total of 745 structures listed on the NRHP. While only some of the properties will be located within a close proximity to the representative routes, additional resources could potentially be identified during field surveys that may be considered eligible for inclusion if the project moves forward into further environmental review. In Georgia, the Georgia Department of Natural Resources (DNR), GDOT, Department of Community Affairs (DCA) and the University of Georgia (UGA) sponsor the Georgia's Natural, Archaeological, and Historic Resources GIS database (GNAHRGIS). This database provides information on previously surveyed properties for National Register eligibility. For the 34 counties within the study area in Georgia, a total of 8,264 properties "appear to meet National Register criteria", and 3,337 properties "may meet National Register criteria" (GNAHRGIS, 2011). This database will be an important guideline if the corridor advances for further study.

Properties that intersect the high-speed rail route will need further exploration to determine if there are any adverse impacts before making a preferred route recommendation. A list of the properties on the NRHP within the study area can be found in Appendix E.

1.6 Issues and Opportunities

As noted in the previous sections, each of the high-speed rail alternatives has potential benefits as well as obstacles to implement. Issues include environmental impacts, operational barriers and political concerns. Opportunities for success include the potential to serve key facilities and populations, travel time savings and benefits to freight services operating on evaluated lines. These issues and opportunities, described in Table 1-10, were identified through technical analysis as well as through stakeholder interviews (refer back to Chapter 2).

Table 1-11: Atlanta-Macon-Jacksonville Issues and Opportunities

Alternative	Opportunities	Issues
110 mph Shared Use Corridors		
Atlanta to Macon		
NS Griffin "S Line"	• Utilizes existing right-of-way • Potential to share capital and operating costs with the proposed Macon-Atlanta Intercity Rail. • Relatively low freight train volumes (averages 2.5 trains/day) • Less potential for passenger train delay • Less percentage of miles with curvature greater than 1 degree, 30 minutes (33%/34.38 miles) • NS has provided a letter of support for joint use on the Griffin corridor • Provides connection to H-JAIA • Macon is open to discussion alternative station locations • Potential to add a connection around the west side of Macon bypassing Ocmulgee and heavily developed areas. This would have the potential to connect to Macon State University	• Poor connectivity within Macon to the current train station, the GA Central Railroad, and the NS Mainline to Savannah • Shared operations with intercity passenger rail could negatively affect operating schedules and times. • Improvements/track replacement needed to upgrade track and infrastructure to Class 6 track • Less direct route from Atlanta to Macon compared to NS Jackson route resulting in longer travel times • Will require land taking and associated social and environmental impacts • Will encounter historic resource issues (i.e., Ocmulgee Monument)
NS Jackson "H Line"	• Utilizes existing right-of-way • More direct route from Atlanta to Macon, resulting in shorter travel times • Existing Class 4 track. Fewer improvements needed to upgrade track to Class 6. • Serves a greater population within 30 miles (3.8 million versus 2.6 million for Griffin route) • Good connectivity within Macon to the current train station and the GA Central Railroad • Macon is open to discussion alternative station locations	• Approximately 39% of miles (35 miles) exceed curve limit of 1 degree, 30 minutes • Greater potential for passenger train delay due to high train volumes (averages 43.4 trains/day) • Will require capacity improvements on NS line from Atlanta to Macon to accommodate passenger service • Route bypasses H-JAIA • Poor connectivity within Macon from current train station to the NS Mainline (Macon to Savannah) • Will encounter historic resource issues (i.e. Ocmulgee Monument)

Alternative	Opportunities	Issues
NS Griffin to NS Jackson Hybrid	• Utilizes existing right-of-way • Allows trains to use the less congested NS Griffin line, but provides the connectivity needed in Macon to access the current train station and access to GA Central Railroad • Less potential for passenger train delay • Has the potential to provide NS with more capacity by connecting the Griffin and Jackson routes for bi-directional traffic • Macon is open to discussion alternative station locations	• Approximately five miles of greenfield is required to transition from NS Griffin to NS Jackson • Between 33% and 39% of miles exceed curve limit of 1 degree, 30 minutes • Will require land taking and associated social and environmental impacts. • Will require capacity improvements on NS line from Bolingbrook to Macon • Poor connectivity within Macon from current train station to the NS Mainline (Macon to Savannah)
Macon to Savannah		
Georgia Central Railroad	• Utilizes existing right-of-way • Potential to serve Pooler, GA and the Savannah International Airport • Low freight train volumes (averages 0.8 trains/day) • Approximately 18% of miles (30 miles) exceed curve limit of 1 degree, 30 minutes • Route segment can be developed as an intrastate Georgia corridor – does not need the cooperation of any other state or host railroad to progress development • Potential to serve Fort Stewart • Potential to locate Savannah station in a more convenient location, not tied to existing Amtrak station • Savannah is planning for future transit including a feeder bus system and Light Rail or Bus Rapid Transit to access a station • Potential to coordinate with Bulloch County 5311 system to provide access to the City of Statesboro and Georgia Southern University	• Major improvements and/or track replacement needed to upgrade track to Class 6 • Bypasses a direct connection to the major GA university (Georgia Southern University) • Track operation issues in Savannah trying to connect to the current Amtrak station • Provides service to a smaller population than that of the NS route (about 40% less)

Alternative	Opportunities	Issues
NS Mainline	• Utilizes existing right-of-way • Not many improvements needed to upgrade to Class 6 • NS is working to move the line to the GCR to avoid the National Monument and turn around movements in Macon • Approximately 15% of miles (28 miles) exceed curve limit of 1 degree, 30 minutes • Direct proximity to the Savannah International Airport • Directly passes Savannah Amtrak Station • Catches a higher population (within a 30 mile buffer area) than the GCR (930,000 versus 550,000 people) • Potential to locate Savannah station in a more convenient location, not tied to existing Amtrak station • Savannah is planning for future transit including a feeder bus system and Light Rail or Bus Rapid Transit to access a station • Potential to coordinate with Bulloch County 5311 system to provide access to the City of Statesboro and Georgia Southern University	• Indirect route from Macon to Savannah requires more mileage and longer travel times • Higher freight traffic density (14 trains/day) • Will require major capacity improvements to accommodate passenger service • The increased population is associated with the City of Augusta. A rural station would be necessary to serve this population resulting in Augusta residents driving long distances (greater than 30 miles) to access the line
Savannah to Jacksonville		
CSXT S-Line (Everett)	• Utilizes existing right-of-way, partially abandoned between Brunswick and Kings Bay. • Potential to serve Brunswick, the proposed multi-modal station and the Navy's King's Bay Nuclear Submarine Base • Low freight train volumes since much of route is abandoned or operated by shortlines (averages 2.3 trains/day) mainly in and around Savannah and Jacksonville • Less potential for passenger train delay	• Major improvements and/or track replacement needed to upgrade track to Class 6 • Rails to trails project has already been constructed in Jacksonville • A school has been constructed within the right-of-way in Jacksonville • Additional route would be needed through downtown Jacksonville in order to access the existing Amtrak station. • Will require significant land

Alternative	Opportunities	Issues
	• Only 4% of miles (5.8 miles) exceed curve limit of 1 degree, 30 minutes • Provides access to the Jacksonville International airport (passes within 3 miles) and proposed Jacksonville Regional Transportation Center • Amtrak is looking to extend service to Orlando and Miami via the Florida East Coast	takings and associated social and environmental impacts • May be issues associated with existing bridges requiring additional resources and environmental impacts.
CSXT A-Line (Jesup)	• Utilizes existing right-of-way • Potential to serve Hinesville and Fort Stewart • Provides access to the Amtrak station and the proposed Jacksonville Regional Transportation Center • CSXT and the Port of Jacksonville are studying the potential for a direct connection between the Port and the rail line by restoring the "Gross Connector" • Amtrak is looking to extend service to Orlando and Miami via the Florida East Coast	• Will require major capacity improvements to accommodate passenger service • Longer route (13 miles longer than CSXT S-Line) • More potential for passenger train delay due to higher freight traffic over entire route • Does not provide access to the Jacksonville International Airport (but passes within 8 miles) • Portion of route is on CSXT mainline
CSXT S-Line/CSXT A-Line Hybrid	• Utilizes existing right-of-way • Allows for the utilization of the S-Line right-of-way for a majority of the route • Provides direct access to the Jacksonville Amtrak station and the proposed Jacksonville Regional Transportation Center • Less potential for passenger train delay • Potential to serve Brunswick, the proposed multi-modal station and the Navy's King's Bay Nuclear Submarine Base • There is potential for freight connection between the A-Line and S-Line	• Will require major capacity improvements around Jacksonville to accommodate passenger service • Does not provide direct access to the Jacksonville International Airport (but passes within 3 miles) • Will require land acquisition to transition from CSXT S-Line to CSXT A-Line • High freight volumes could cause increased passenger train delays near Jacksonville

Alternative	Opportunities	Issues
180-220 mph Dedicated Use Corridors (Atlanta to Jacksonville)		
Interstate, and Rail Route (using CSXT S-Line from Savannah to Jacksonville)	• Significantly shorter travel time (169 minutes at an average speed of 131 mph) • Shorter distance than the Shared Use routes • Less than 5% of miles (18 miles) exceed curve limit of 30 minutes • Use transmission line corridors north of Bolingbroke to north of Macon to provide a straight path for a portion of the segment • Does not have to share rail right-of-way with freight for a majority of the route • Allows for an average speed of 131 mph • Provides direct and indirect access to a number of opportunity areas including Georgia Southern University, Robins AFB, Savannah International Airport and Amtrak station • Provides access to the Jacksonville International Airport and proposed multi-modal station in Jacksonville • Potential to serve Brunswick, the proposed multi-modal station and the Navy's King's Bay Nuclear Submarine Base	• Will require significant land takings and associated social and environmental impacts • Significantly higher cost than shared use alternative • Requires curve easements along existing railroad corridor between Savannah and Jacksonville • Requires a bypass route for Everett and Yulee and Callahan • Will require indirect route through downtown Jacksonville to existing Amtrak station

Alternative	Opportunities	Issues
180-220 mph Dedicated Use Corridors (Atlanta to Jacksonville)		
Interstate, and Rail Route (using CSXT route from Callahan to Jacksonville)	• Significantly shorter travel time • Shorter distance (than the greenfield route using the S-Line from Savannah to Jacksonville • Less than 5% of miles exceed curve limit of 30 minutes • Use transmission line corridor north of Bolingbroke to north of Macon provides a straight path for a portion of the segment • Does not have to share rail right-of-way with freight for a majority of the route • Provides access to a number of opportunity areas including Georgia Southern University, Robins AFB, Savannah Int'l Airport and Amtrak station • Potential to serve Brunswick, the proposed multi-modal station and the Navy's King's Bay Nuclear Submarine Base • Provides access to the proposed multi-modal station in Jacksonville	• Does not provide directly serve the Jacksonville International Airport • Requires a bypass route for Everett and Callahan

2 STAKEHOLDER OUTREACH

As a part of the High-Speed Rail Feasibility Study effort, the study developed a Public Involvement Plan identifying targeted stakeholders as well as outreach techniques designed to encourage two-way communication for the duration of the study effort. Refer to Appendix A for the Public Involvement Plan in its entirety. The purpose of the outreach effort was to keep key stakeholders along the Atlanta-Macon-Jacksonville Corridor informed of the study process and results, and to identify local issues and opportunities for consideration in the development of alternative routes. In some cases, the study received local input on methodologies for the corridor to determine the best representative routes for the corridor (subsequent sections outline the major input of the stakeholders). Input from local stakeholders also ensured that the study reflects the most recent and accurate data available to determine high-speed rail feasibility.

For the Atlanta-Macon-Jacksonville Corridor, the study worked with the following stakeholder organization:

- The Atlanta Regional Commission (ARC);
- City of Macon, GA;
- Coastal Regional Commission (CRC);
- Jacksonville Transportation Authority (JTA);
- Macon-Bibb Planning and Zoning (MBPZ);
- North Florida Transportation Planning Organization (TPO); and
- Savannah Metropolitan Planning Organization (CORE MPO).

The study held three rounds of stakeholder involvement activities throughout the study process. Table 2-1 shows the three rounds of meetings and the details of each meeting for the Atlanta-Macon-Jacksonville Corridor. The first round of meetings took place in May 2011 in which the study met with representatives of each of the stakeholders to introduce them to the study project scope and schedule. The study described the study corridor and the potential alternatives that were under a technical review to determine the best alternative to represent a Shared Use and Dedicated Use routes. The study also presented corridor maps outlining all identified strengths, weaknesses, issues and opportunities along each of the potential alternatives (Figure 2-1). The study gathered input from the stakeholders to combine with technical data to develop the Issues and Opportunities table (refer back to Table 1-10 on page 3-28) and, ultimately, the representative routes. Refer to Appendix A for the stakeholder agenda and handout packet presented at each of these meetings.

Table 2-1: Atlanta-Macon-Jacksonville Stakeholder Outreach Meetings

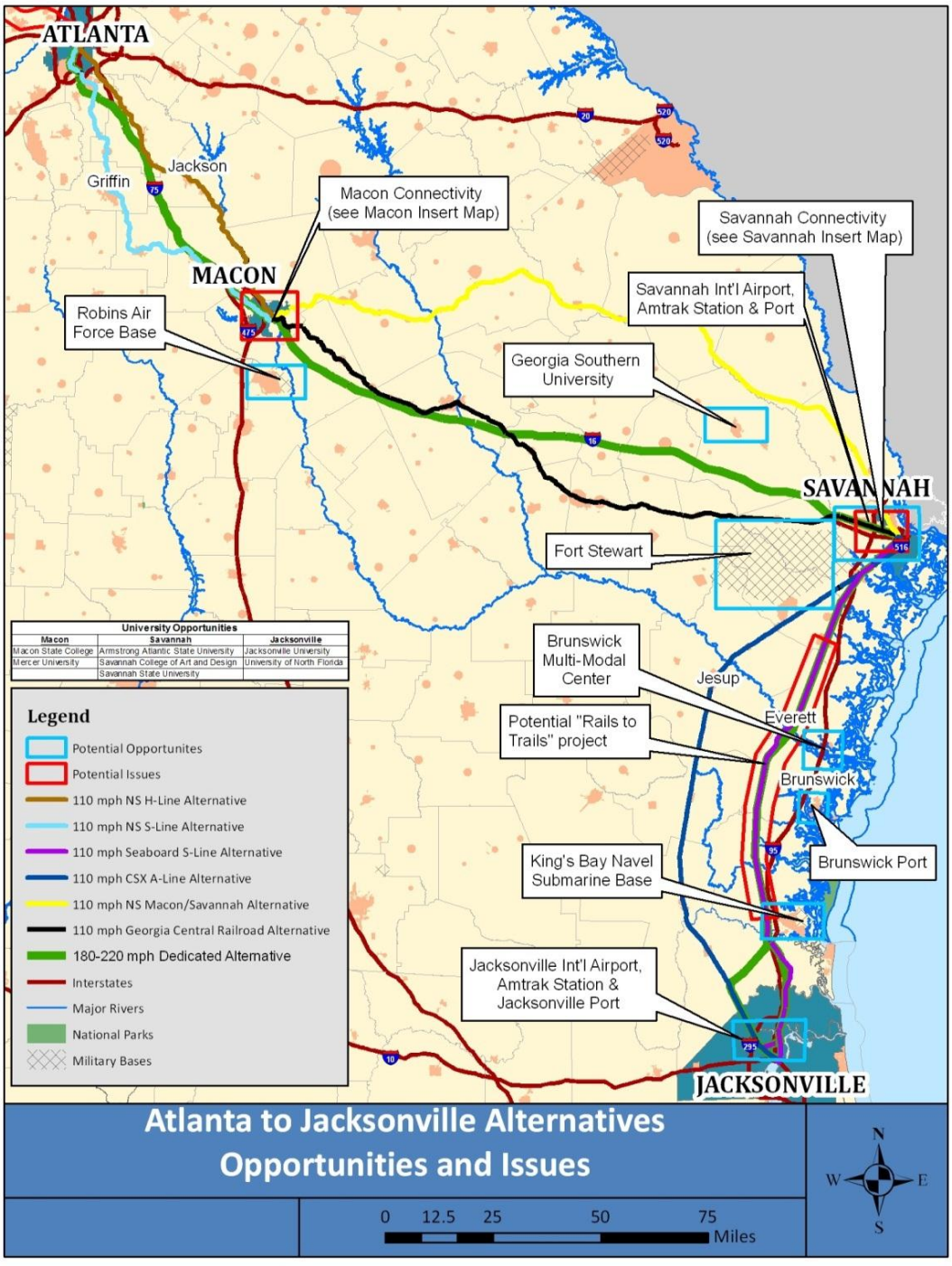
Stakeholder	Date	Time	Location
Round One, Stakeholder Meetings			
JTA	May 24, 2011	3:30-4:30 PM	Jacksonville, FL
North Florida TPO	May 25, 2011	9:00-10:00 PM	Jacksonville, FL
Coastal Regional Commission	May 25, 2011	1:00-2:00 PM	Brunswick, GA
CORE MPO	May 25, 2011	4:00-5:00 PM	Savannah, GA
MBPZ	May 26, 2011	2:00-3:00 PM	Macon, GA
City of Macon	May 26, 2011	3:30-4:30 PM	Macon, GA
ARC	May 27, 2011	11:00 AM-12:00 PM	Atlanta, GA
Round Two, Corridor Webinar			
All Stakeholders	September 8, 2011	10:00-11:30 AM	On-Line
Round Three, Stakeholder Meetings			
CORE MPO	November 9, 2011	9:00-10:00 AM	Savannah, GA
JTA	November 9, 2011	2:00-3:00 PM	Jacksonville, FL
North Florida TPO	November 9, 2011	4:00-5:00 PM	Jacksonville, FL
Coastal Regional Commission	November 10, 2011	3:00-4:00 PM	St. Simons, FL
MPBZ/City of Macon	November 15, 2011	2:00-3:00 PM	Macon, GA
ARC	November 30, 2011	9:00-10:00 AM	Atlanta, GA

Major Stakeholder Input

Stakeholders provided valuable insight into issues and opportunities along the corridor to assist the study in developing the representative routes for the Shared Use and Dedicated Use service. Outlined below, are the main feedback comments heard across the corridor:

- There is a potential rails to trails program along the CSXT S-Line that may present obstacles for both the Shared Use and Dedicated Use route between Savannah, GA and Jacksonville, FL.
- The Ports of Savannah, Brunswick and Jacksonville are an important component of the local economies. These ports need to be taken into consideration when making decisions regarding passenger and freight rail.
- Trains will be difficult to maneuver through Macon, GA as there are a number of physical and environmental barriers (i.e., Ocmulgee National Monument); however, the City is open to negotiations and alternative routes around the city.
- Historic properties in Macon and Savannah will need to be taken into consideration if environmental studies begin.

Figure 2-1: Atlanta-Macon-Jacksonville Issues and Opportunities



The second round of meetings was a virtual webinar and conference call held in September 2011 to provide an update on the corridor progress and present preliminary results on capital costs, operating and maintenance costs, and ridership and revenue for both the shared use and Dedicated Use representative routes. Additionally, the study presented a variety of technology considerations for the corridor and gave an update on the federal funding options and strategies moving forward. Refer to Appendix A for the webinar agenda and presentation.

Major Stakeholder Input

- The stakeholder participants showed an overall interest in development of the capital cost estimates and technology alternatives.
- Stakeholders inquired about freight railroad agreements and whether the railroad owners would allow higher speeds on the freight corridors. The study stated that they worked with railroad owners, and agreements would need to be in place for speeds greater than 79 mph.

The third and final round of meetings was held in November 2011 in which the study presented the final estimates for capital costs, operating and maintenance costs and ridership and revenue. Additionally, the study ran operating ratio and consumer surplus analyses to determine the overall feasibility of the Atlanta-Macon-Jacksonville Corridor and made final observations and recommendations for the corridor moving forward. Refer to Appendix A for the meeting agenda and presentation.

Major Stakeholder Input

- Stakeholders stated that they believed a Dedicated Use alternative would be the better option for the corridor.
- Stakeholders were generally pleased with the estimates produced for a feasibility study, and realized that the estimates would be more detailed in future studies.
- Stakeholders showed support for the study, and showed interest in the next steps.

3 REPRESENTATIVE ROUTES

Representative Shared Use and Dedicated use routes were identified in the Atlanta-Macon-Jacksonville Corridor to provide a basis for developing ridership and revenue forecasts, capital costs, and operations and maintenance costs to assess the feasibility of the corridor for high-speed rail service. The representative routes were selected based on an analysis of physical, cost and service factors as well as stakeholder input. Each is an illustrative route for the corridor for purposes of determining feasibility, and is not intended to represent a locally preferred alternative. Final decisions on routes and specific alignments will be made in future environmental study phases if the corridor is determined to be feasible.

3.1 90-110 MPH EMERGING HIGH-SPEED RAIL (SHARED USE)

In identifying capacity improvements required for 90-110 mph Shared Use operations in the Atlanta-Macon-Jacksonville Corridor, the study assumed that all infrastructure improvements could be made within the existing freight right-of-way (assumed at 100 feet).

In developing the station locations, the study took into consideration airports, transit connections, major downtown areas and minor cities and suburbs. Refer to Chapter 4 for station details as they pertain to the operating plan and schedule

Two types of stations were evaluated as a part of the operating plan schedule and also capital costs. Major stations refer to major city stations in which the study assumes locations, costs and designs as outlined by previous studies and plans. The source of the capital costs for each of these stations is documented in Chapter 6. Additionally, the study developed an Intermediate station plan and an associated lump sum cost estimate that was used for all other, smaller-scale stations (refer to Section I: Chapter 3 for details).

Table 3-1: Atlanta-Macon-Jacksonville Shared Use Proposed Stations

Potential Stations	Estimated Cost	Source of Cost Estimate
MMPT, Atlanta GA	$350 million	Feasibility Study Estimate[26]
H-JAIA, Atlanta GA	$100 million	Feasibility Study Estimate
Griffin, GA	$7.2 million	Feasibility Study Estimate
Macon, GA	$7.2 million	Feasibility Study Estimate
Savannah, GA	$7.2 million	Feasibility Study Estimate
Brunswick, GA	$7.2 million	Feasibility Study Estimate
Jacksonville, FL	$50 million	JTA

3.1.1 ATLANTA – MACON

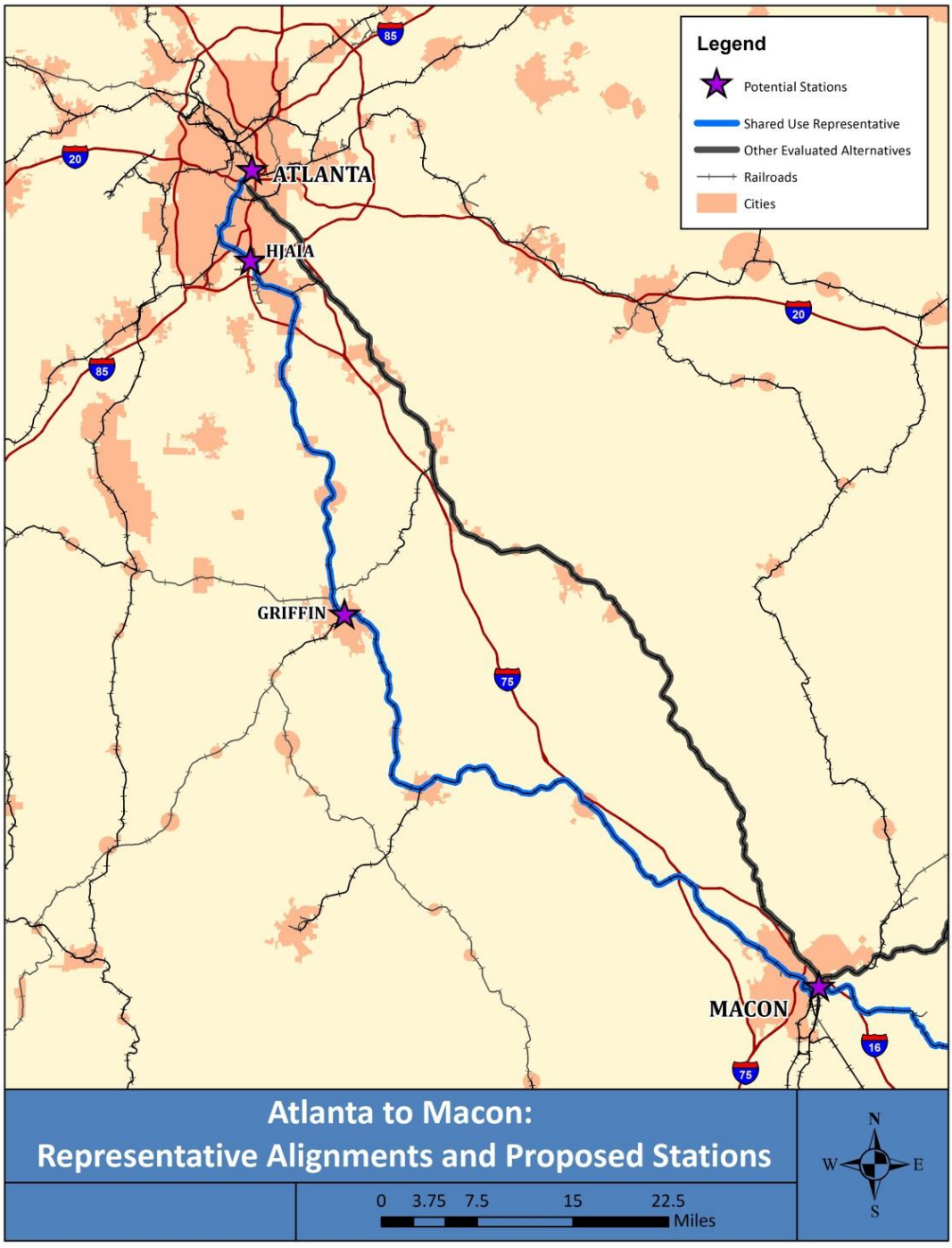
Beginning at the proposed Atlanta Multimodal Passenger Terminal (MMPT), the Atlanta to Macon segment of the Atlanta-Macon-Jacksonville Shared Use Corridor follows the NS S-Line (also referred to as the NS Griffin Line) to the Hartsfield-Jackson Atlanta International Airport (H-JAIA), Griffin, GA station, and Macon, GA station. Table 3-2 and Figure 3-1 outlines the segment characteristics and illustrates the Shared Use representative route and proposed stations between Atlanta and Macon.

Table 3-2: Atlanta-Macon Shared Use Characteristics

Atlanta-Macon	
Train Capacity	Class 2 and 3 - Single track with Sidings
Train Frequency	Existing: 2.5 freight trains per day (average)
	Future: 5.0 freight trains per day (average)
	Proposed passenger frequency: 8 round trips per day
Track Geometry and Capacity	Total Corridor: 103.0 route miles
	36% of corridor / 34.4 miles exceed 1 degree, 30 minute curves
Travel Time Estimations (Schedule Time Including Station Stops)	1 hour, 29 minutes

[26] MMPT Cost estimates are based on Central Atlanta Progress 1992 estimates of $165,650,000. This was elevated to 2011 dollars using the Consumer Price Index (CPI), and added a 30 percent contingency.

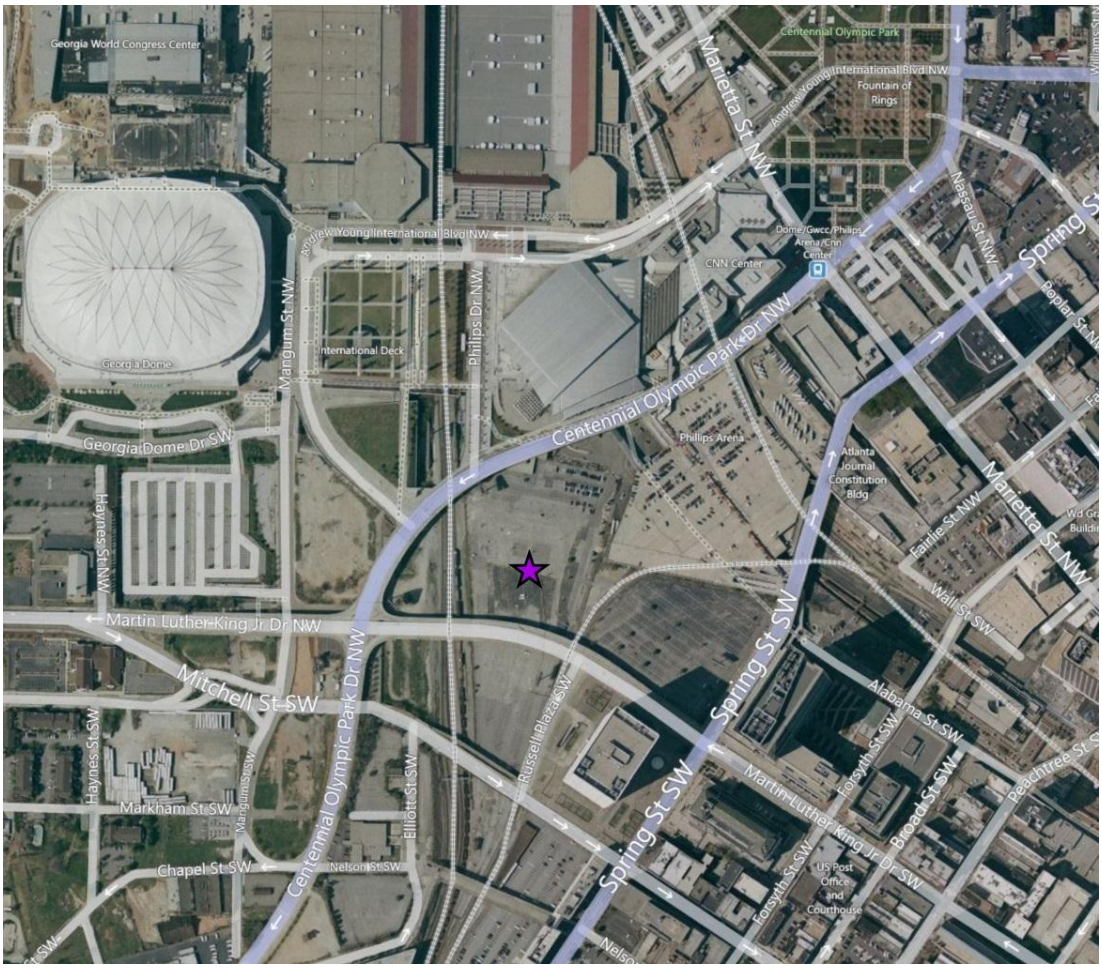
Figure 3-1: Shared Use Representative Route (Atlanta to Macon)



Proposed Atlanta Multi-Modal Passenger Terminal

The MMPT is an on-going public private partnership initiative in downtown Atlanta. The MMPT is proposed as a major high-speed, commuter rail, and transit hub for the Atlanta metropolitan area. Although the exact location of the MMPT is not yet determined, Figure 3-2 displays the study area for the MMPT that was used for the purposes of this study. The estimated cost for the station and track infrastructure that was incorporated into the capital cost estimates for this feasibility study are $350 million based on estimates from Central Atlanta Progress, elevated costs to 2011 dollars and added contingency.

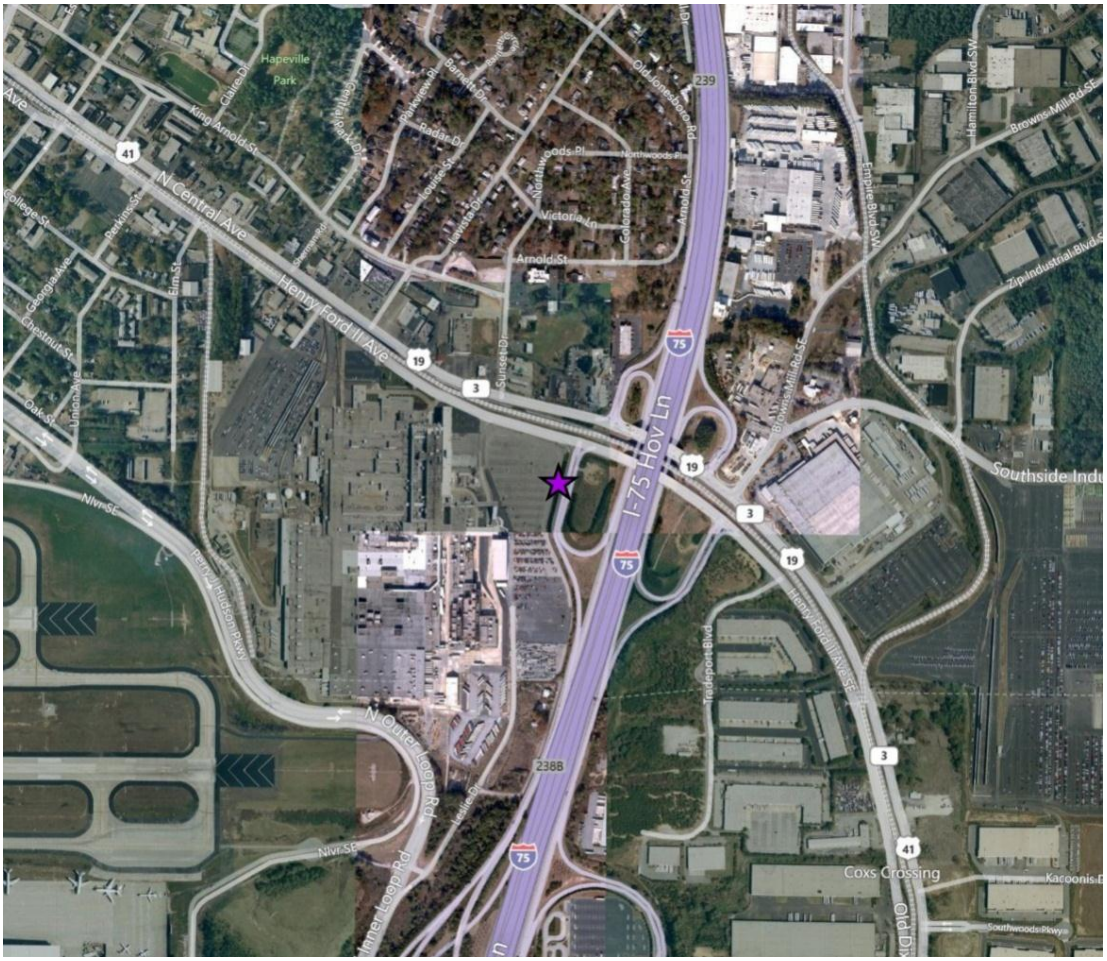
Figure 3-2: Atlanta MMPT Station Location



Hartsfield-Jackson Atlanta International Airport

The H-JAIA station is proposed on a site adjacent to the airport in which intermodal connections could potentially be constructed between the rail terminal and the airport terminals. This site, located at the southwest corner of the intersection I-75 and Henry Ford II Avenue (US Highway 19/41) and the NS Jackson rail line as illustrated in Figure 3-3. The cost of this station is estimated at approximately $100 million.

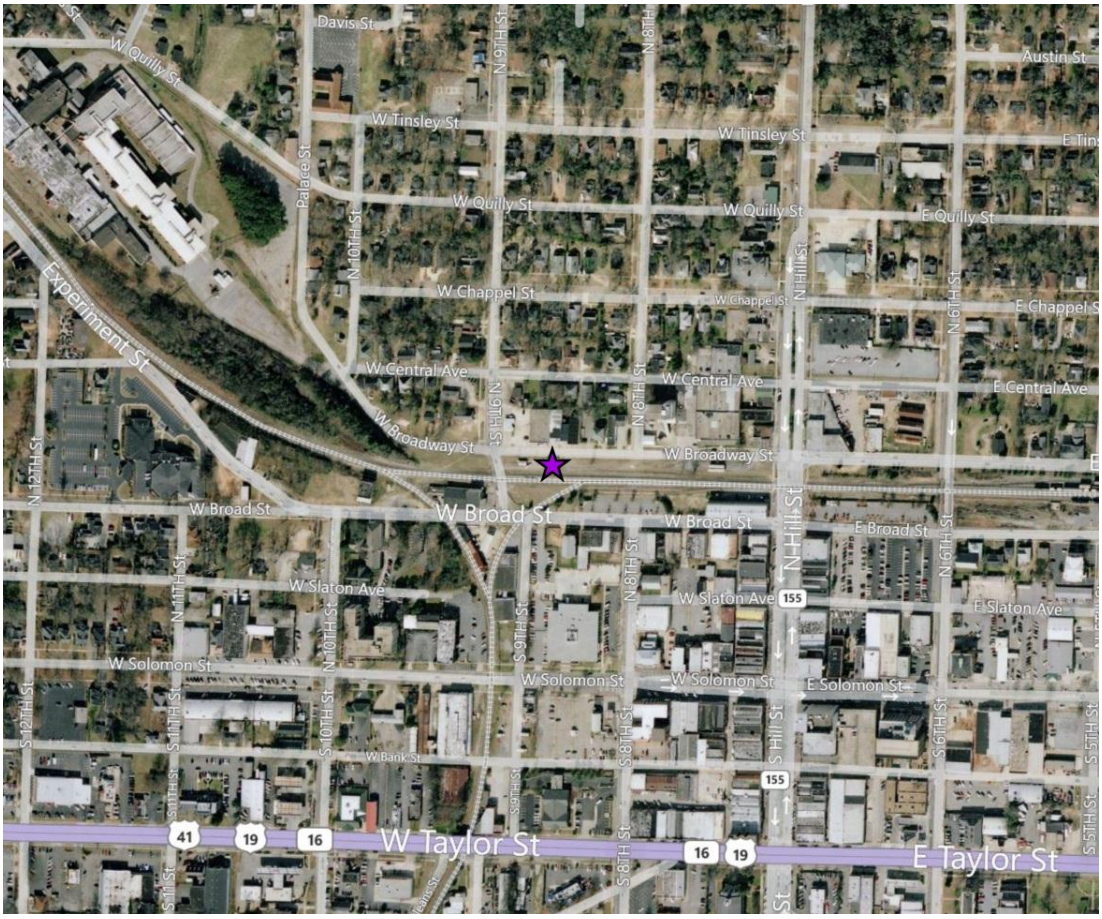
Figure 3-3: H-JAIA Station Location



Griffin, Georgia

A station was located in Griffin, GA to capture ridership from the southern suburban communities in the Atlanta metro area. Additionally, this location was designated as a station for a commuter rail line previously studied between Atlanta and Macon as well as in the Charlotte-Atlanta-Macon high-speed rail feasibility study by Volpe in 2008. Figure 3-4 shows the potential location of the Griffin station that was used to develop the operating plan and estimating ridership for the Shared Use Corridor.

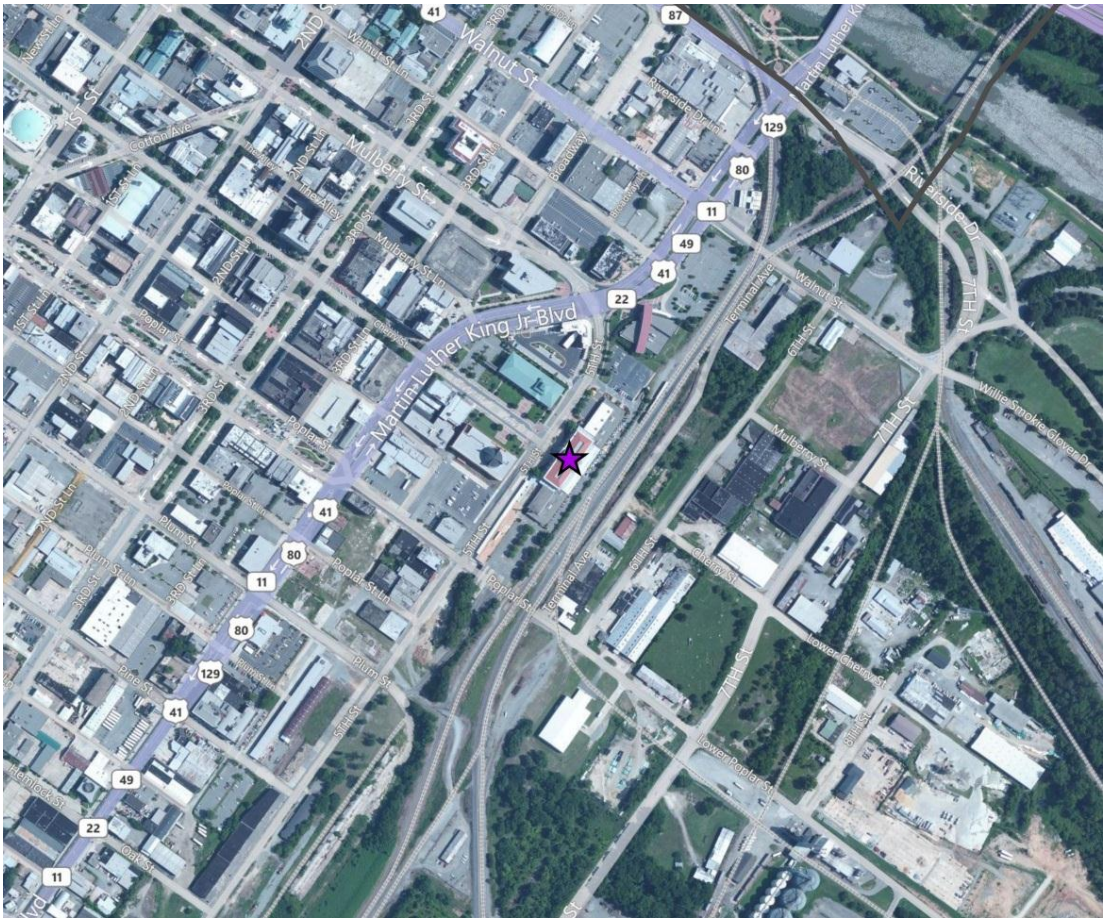
Figure 3-4: Griffin Intermediate Station



Macon, Georgia

The City of Macon recently sponsored a major rehabilitation effort on the historic downtown train station. The proposed high-speed rail corridors run adjacent to the existing site; however, additional infrastructure will be required to access the train platforms. Therefore, the study included the Macon station in the Intermediate Station category, since these improvements could cost approximately the same or less than a new Intermediate station. The Macon station would capture ridership from the Macon metropolitan area, Georgia College and State University, and Warner Robins (the home of Robins Air Force Base). Figure 3-5 shows the location of the Macon station.

Figure 3-5: Macon Station



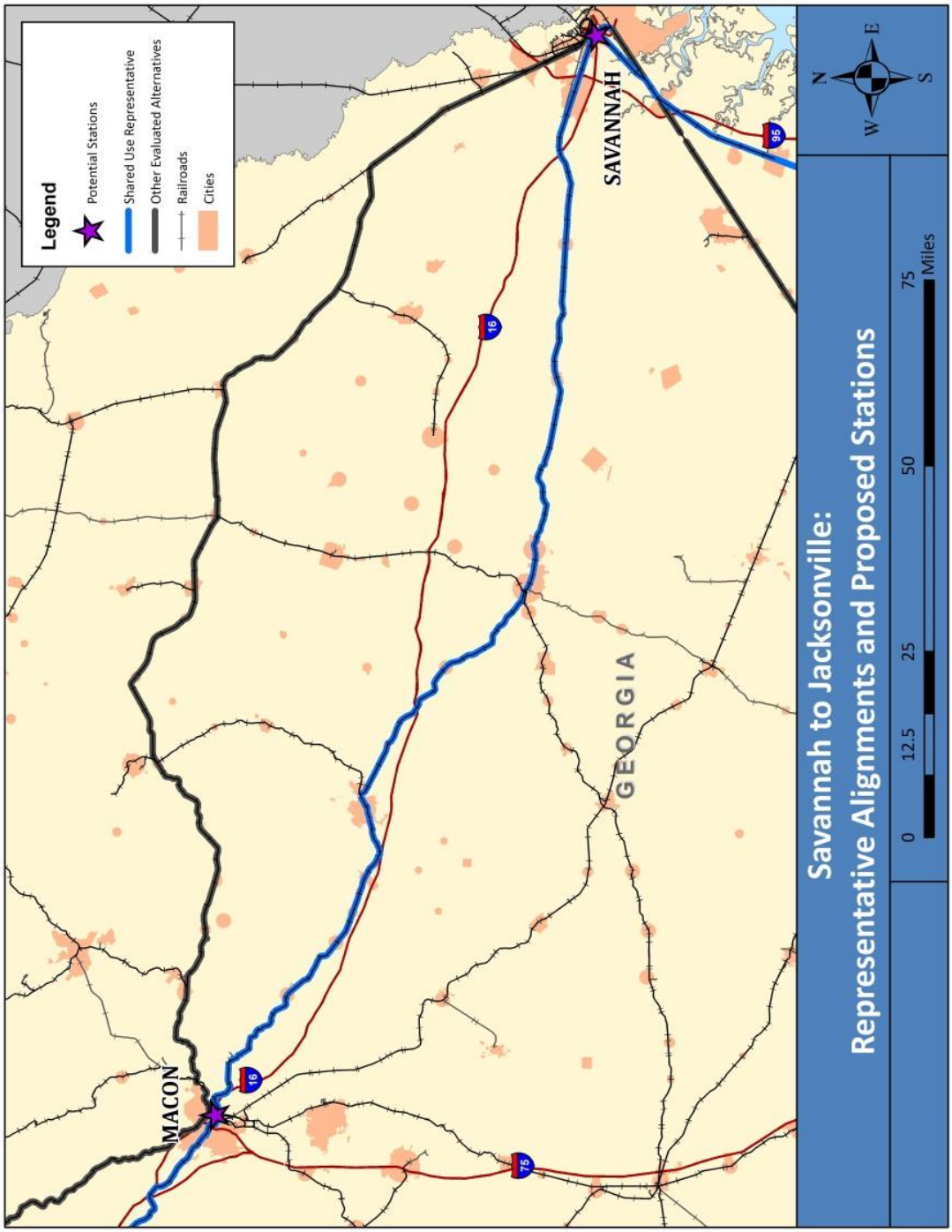
3.1.2 MACON – SAVANNAH

From the Macon station, the Shared Use route follows the GCR corridor into the proposed Savannah, GA station. Table 3-3 outlines the segment characteristics and Figure 3-6 shows the Shared Use representative route between Macon and Savannah.

Table 3-3: Macon-Savannah Shared Use Characteristics

Macon-Savannah	
Train Capacity	Class 3 - Single track with Sidings
Train Frequency	Existing: 0.8 freight trains per day (average)
	Future: 1.6 freight trains per day (average)
	Proposed passenger frequency: 8 round trips per day
Track Geometry and Capacity	Total Corridor: 170.0 route miles
	18% of corridor / 29.8 miles exceed 1 degree, 30 minute curves
Travel Time Estimations (Schedule Time Including Station Stops)	2 hours, 16 minutes

Figure 3-6: Shared Use Representative route (Macon to Savannah)



Savannah, Georgia

Savannah is served by an existing Amtrak Station (built in 1962) for the Silver Star service that follows the Atlantic coast. This station is located just north of the downtown Savannah area, and north of the GCR.

It was determined that high-speed rail access to the existing Amtrak station would be difficult if the GCR right-of-way connecting to the CSXT S-Line route were to be used. The benefit of shifting the rail station location south of the existing Amtrak Station location is the improved rail operation and the avoidance of potentially significant capital costs to access the existing station along the representative route. Therefore, the proposed station location was shifted to approximately 0.5 miles south of I-16 near the intermodal yard. This new station location would capture similar ridership compared to the existing station location from the Savannah metropolitan area, as well as college communities (Statesboro Georgia and Georgia Southern University) and military institutions such as Fort Stewart and Hunter Air Field. Additionally, there is the potential to attract ridership from areas just north of Savannah such as Hilton Head, SC. Figure 3-7 shows the proposed location for the Savannah Intermediate station to develop the operating plan and ridership estimations.

Figure 3-7: Savannah Intermediate Station



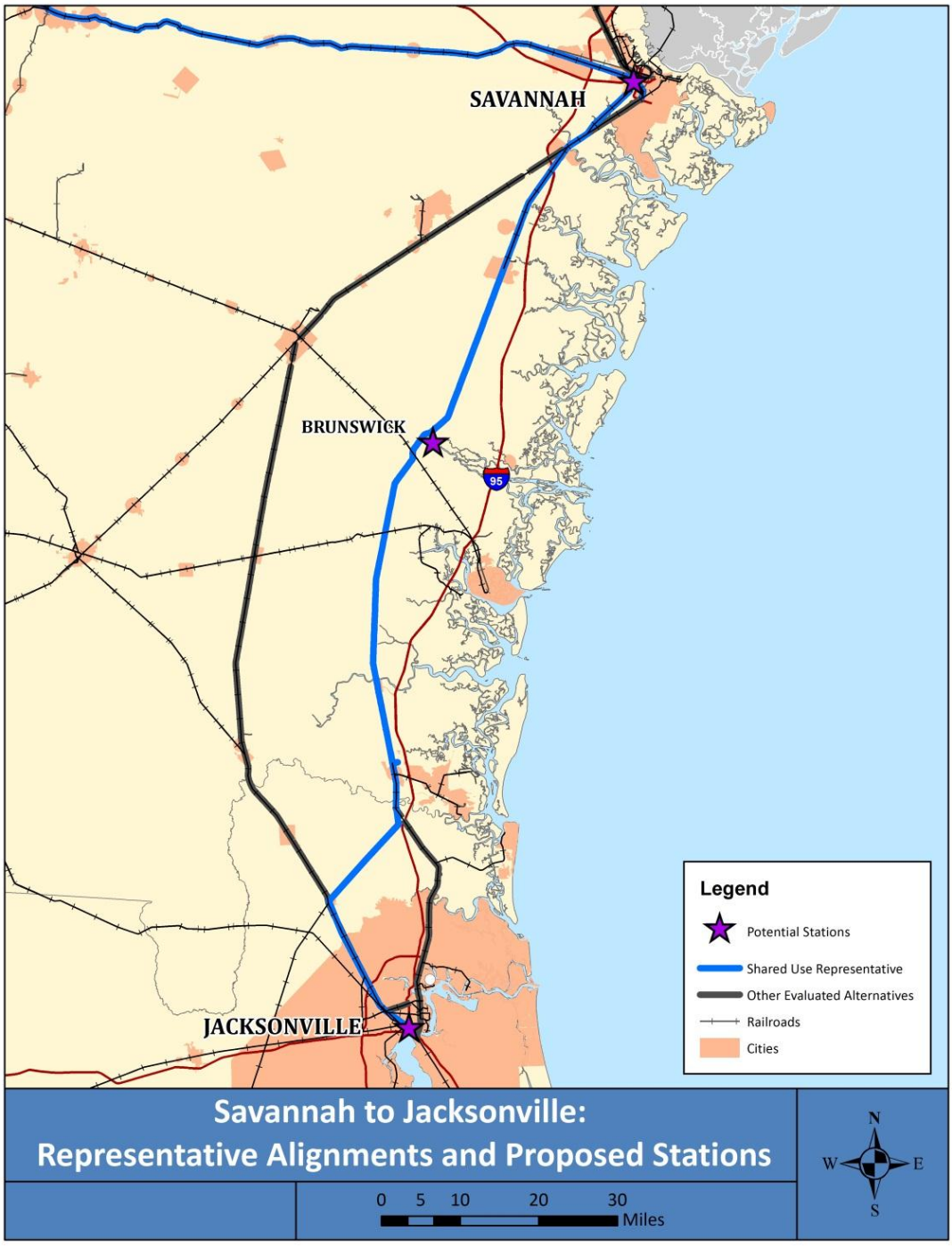
3.1.3 SAVANNAH – JACKSONVILLE

Once in Savannah the Shared Use Corridor follows the partially abandoned CSXT S-Line with a stop at a proposed station in the Brunswick, GA area. Near Kingsland, GA, the route moves off the Seaboard route to another abandoned rail corridor and travels southwest until intersecting with the active CSXT A-Line. From there, the route follows the heavily-used CSXT A-line south into the proposed Jacksonville Regional Transportation Center. Table 3-4 shows the route characteristics and Figure 3-8 illustrates this Shared Use representative route between Savannah, GA and Jacksonville, FL.

Table 3-4: Savannah-Jacksonville Shared Use Characteristics

Savannah-Jacksonville	
Train Capacity	Class 1, 3, abandoned - Single track with Sidings
Train Frequency	Existing: 2.3 freight trains per day (average)
	Future: 4.6 freight trains per day (average)
	Proposed passenger frequency: 8 round trips per day
Track Geometry and Capacity	Total Corridor: 137.7 route miles
	4% of corridor / 5.8 miles exceed 1 degree, 30 minute curves
Travel Time Estimations (Schedule Time Including Station Stops)	1 hours, 25 minutes

Figure 3-8: Shared Use Representative Route (Savannah to Jacksonville)



Brunswick, Georgia

Brunswick, GA is the second largest port city in Georgia. Brunswick is also near a number of tourist and recreation areas including many popular Georgia barrier islands such as Cumberland Island/St Marys/Kings Bay, Jekyll Island and St. Simons Island.

The CRC (located in Brunswick) is supporting planning work for a multi-modal transportation center (the Brunswick Mobility Center) for the area. While this mobility center would primarily serve regional and rural bus transit services, the station could potentially include a high-speed rail component. The location chosen for this feasibility study is a potential site under consideration for the mobility center, although the exact location is still to be determined.

The Intermediate station cost estimate was used for this station. Figure 3-9 shows the approximate location of the Brunswick Mobility Center.

Figure 3-9: Brunswick Mobility Center Location

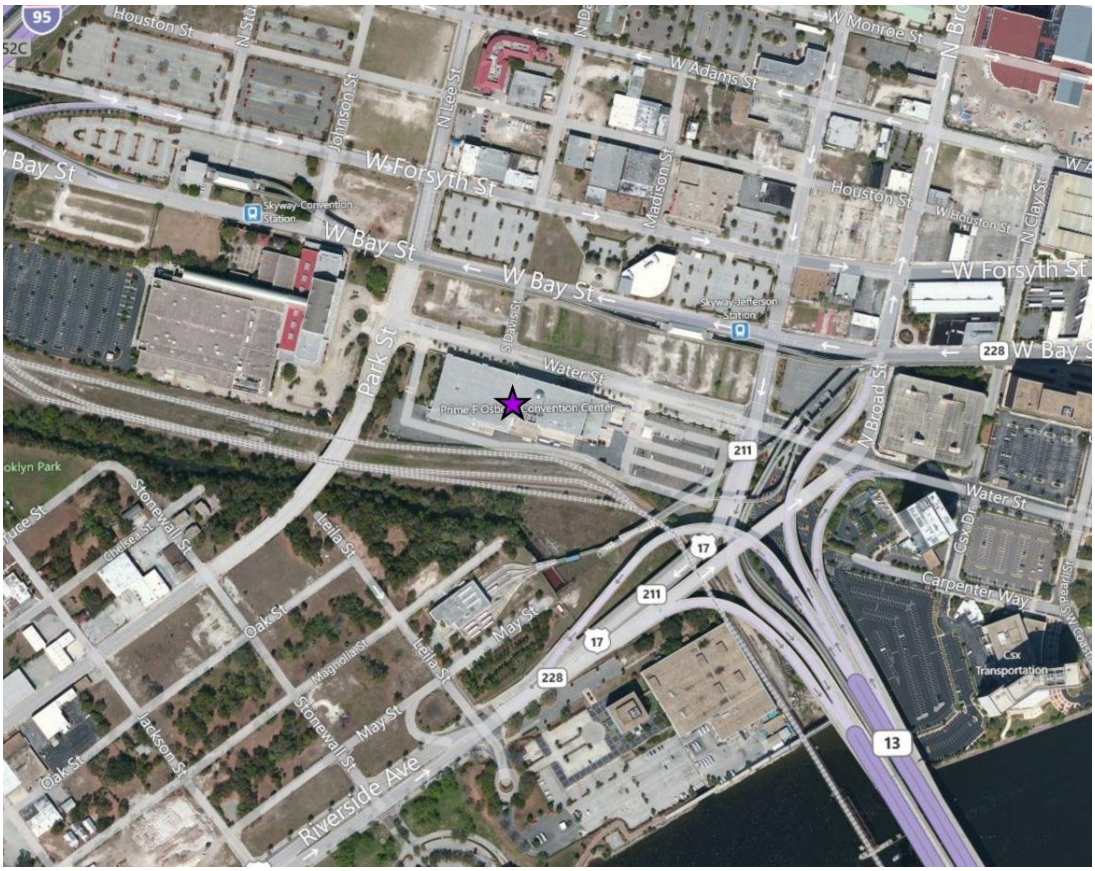


Jacksonville Regional Transportation Center

The Jacksonville Transportation Authority (JTA) has plans for a regional multi-modal hub to manage all transportation operating in Northeast Florida including transit service. The estimated total cost for the rail component of this station site is approximately $50 million (JTA, 2011).

Currently, the transportation center is in final design and will be built in three phases. The first phase will include a Traffic Management Center, additional parking, administration, and retail. Phase two includes Bus Rapid Transit (BRT) and Greyhound bus station. The final phase will be to move Amtrak to the new location. Additionally, high-speed rail services could be added if the high-speed rail corridor is determined to be feasible. Figure 3-10 shows the proposed location of the Jacksonville Regional Transportation Center.

Figure 3-10: Jacksonville Regional Transportation Center Location



3.2 180-220 MPH EXPRESS HIGH-SPEED RAIL (DEDICATED USE)

The Atlanta-Macon-Jacksonville 180-220 mph Dedicated Use route is a greenfield interstate highway route that utilizes existing freight corridor right-of-way for the last few miles into each major city (Atlanta, Macon, and Savannah, GA and Jacksonville, FL). The shared "last mile" corridors still fully separate passenger and freight operations to maximize system efficiency. The Dedicated Use alternative is an electrified, steel-wheel, double-track system. The required right-of-way is assumed to be 60-feet in urban areas and 100-feet in rural areas.

For the Atlanta-Macon-Jacksonville Corridor, the study used the same station locations for the Dedicated Use route as were used for the Shared Use route with the exception of the Griffin station. The Griffin station was eliminated because the Dedicated Use route follows the I-75 right-of-way, some distance from Griffin, GA.

The other station locations were each designed to maximized accessibility to the existing freight rail right-of-way as the routes entered urban areas. Table 3-4 outlines the potential Dedicated Use stations. Refer back to Section 3.1.1 for these station details and proposed locations.

Table 3-5: Atlanta-Macon-Jacksonville Dedicated Use Proposed Stations

Potential Stations	Estimated Cost	Source of Cost Estimate
MMPT, Atlanta GA	$350 million	Feasibility Study Estimate/Central Atlanta Progress[27]
H-JAIA, Atlanta GA	$100 million	Feasibility Study Estimate
Macon, GA	$7.2 million	Feasibility Study Estimate
Savannah, GA	$7.2 million	Feasibility Study Estimate
Brunswick, GA	$7.2 million	Feasibility Study Estimate
Jacksonville, FL	$50 million	JTA, 2011

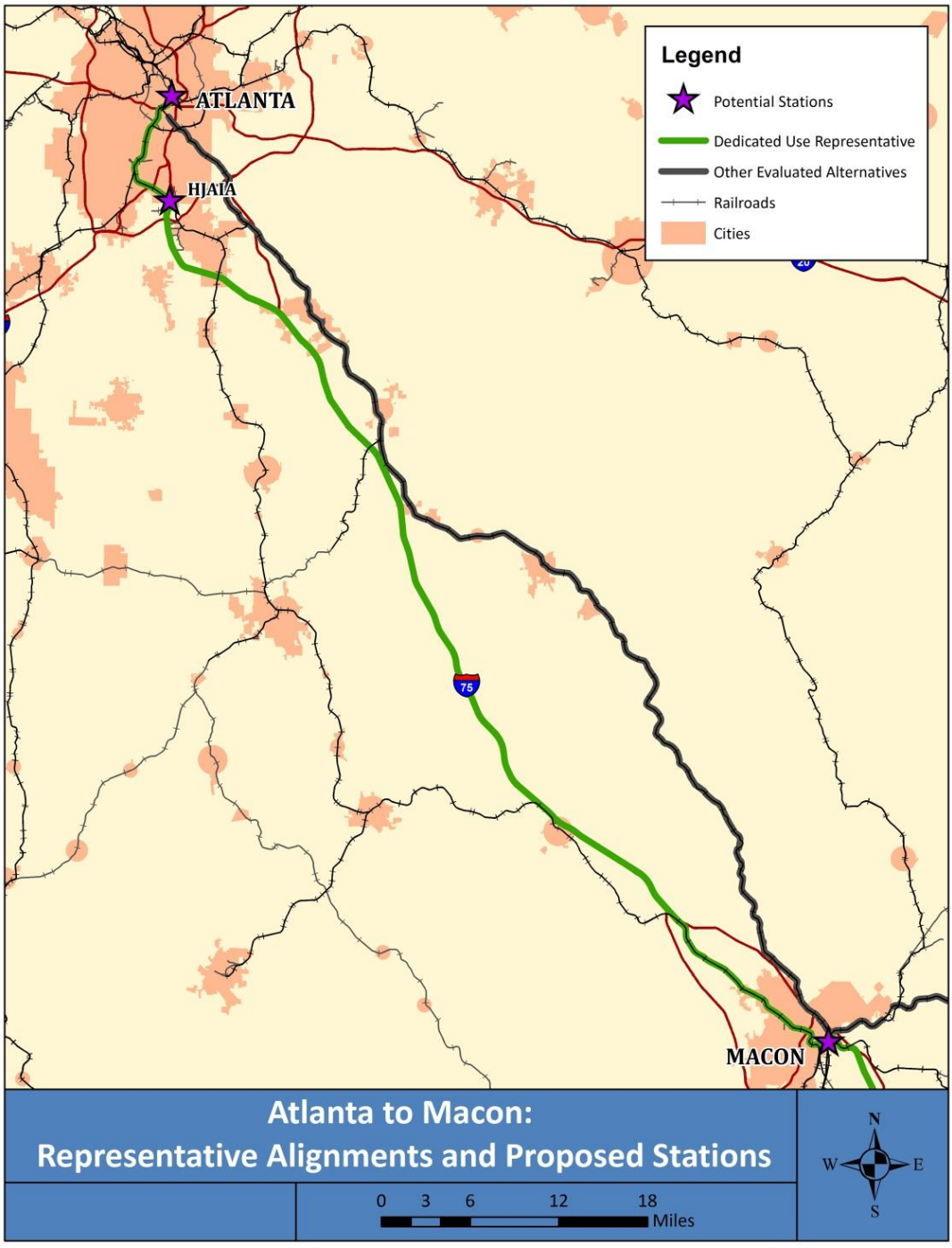
3.2.1 ATLANTA TO MACON

The Dedicated Use route follows the NS S-Line right-of-way in a fully separate track system between the Atlanta MMPT to H-JAIA station and then cuts to the east until intersecting with a route alignment adjacent to I-75. The route then follows the

[27] Central Atlanta Progress estimated MMPT construction and related expenditures to be $165,650,000 in 1992. This was elevated to 2011 dollars and a contingency was added, as this project is currently going through cost revisions as a public-private partnership.

interstate route until the approach into Macon, where the route moves to the NS S-Line right-of-way until connecting to the GCR right-of-way by a new greenfield connection. The Macon station is located on this greenfield connection. Figure 3-11 shows the Dedicated Use route between Atlanta and Macon.

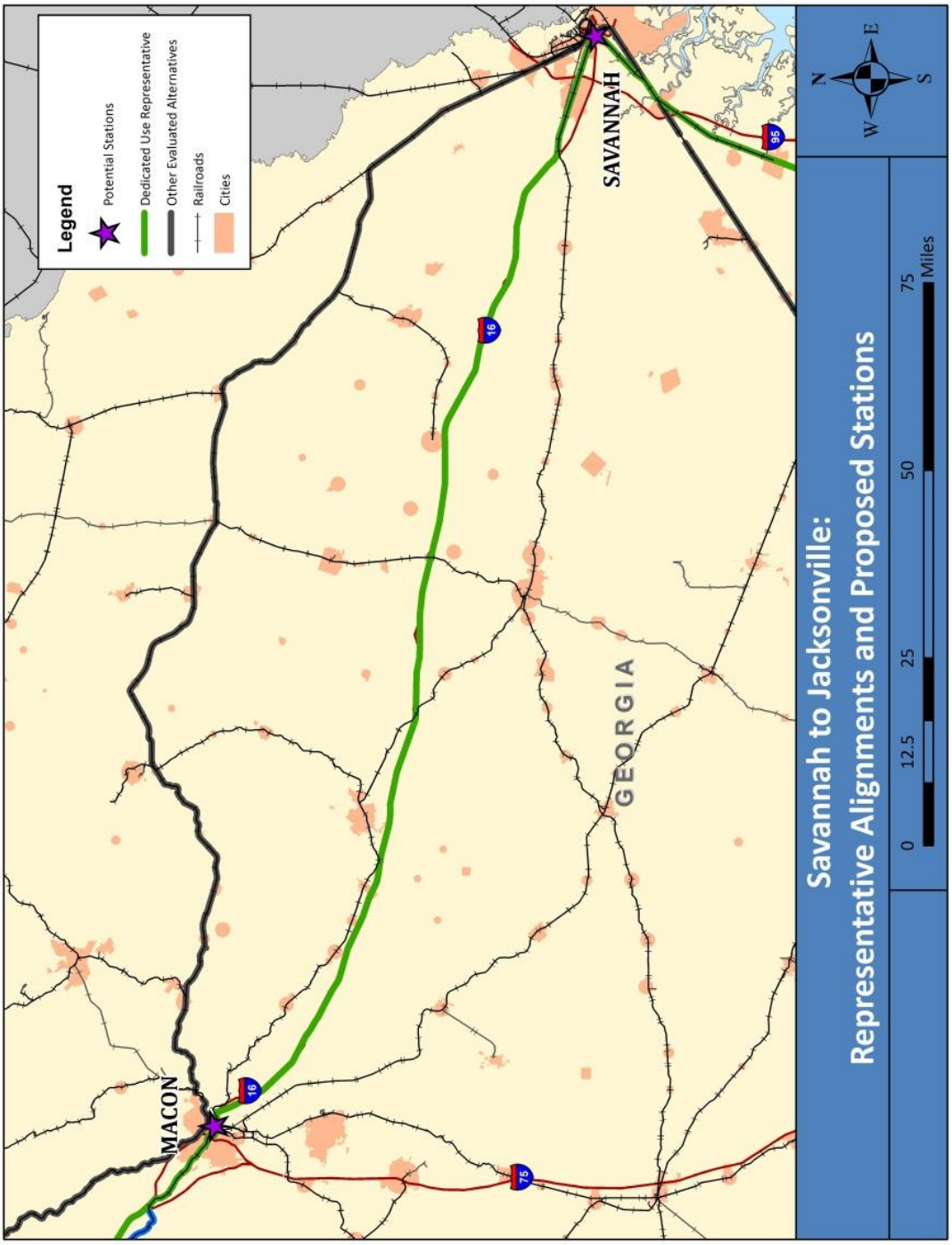
Figure 3-11: Dedicated Use Representative Route (Atlanta to Macon)



3.2.2 MACON TO SAVANNAH

From the Macon terminal station, the Dedicated Use route follows the GCR right-of-way corridor until intersecting with I-16, and then follows a route adjacent to the interstate into the City of Pooler, GA, slightly northwest of Savannah, GA. In Pooler, the route moves back to the GCR right-of-way into the proposed Savannah Station. Figure 3-12 illustrates the route between Macon and Savannah, GA.

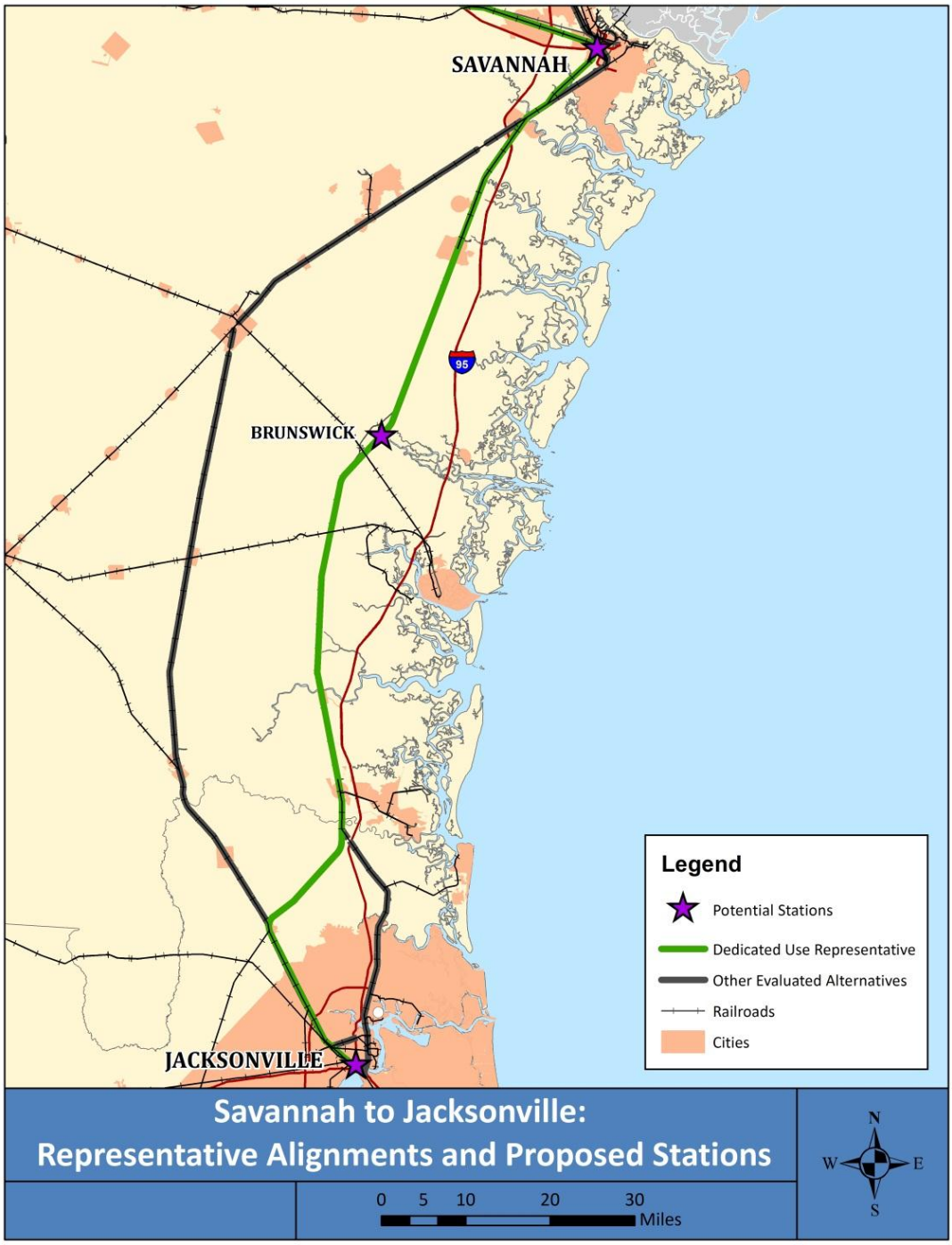
Figure 3-12: Dedicated Use Representative Route (Macon to Savannah)



3.2.3 SAVANNAH TO JACKSONVILLE

The Dedicated Use route between Savannah, GA and Jacksonville, FL is identical to the Shared Use route given the opportunity to use a largely abandoned, freight rail right-of-way. The route follows the abandoned CSXT S-Line from Savannah to Kingsland, GA, where the route transfers to another abandoned rail line moving southwest until intersecting with the CSXT A-Line. The route then follows the CSXT A-Line right-of-way into the terminal station at the proposed Jacksonville, FL Regional Transportation Center. Figure 3-13 shows this route between Savannah and Jacksonville.

Figure 3-13: Dedicated Use Representative Route (Savannah and Jacksonville)



4 OPERATING PLAN AND SCHEDULE

Timetables were developed for each of the speed options and each of the routes identified for the corridor. As discussed in Section I of the report, for the Shared Use option, tilting diesel-electric trains with a maximum speed limit of 110 mph were simulated over the existing rail routes. For the Dedicated Use option, 220 mph electric trains were simulated. A five percent (5%) slack time allowance was added to the simulated running times to produce the suggested train schedules.

4.1 90-110 MPH SHARED USE

4.1.1 SPEED PROFILE AND TIMETABLE

The study ran a speed profile for the Atlanta-Macon-Jacksonville Shared Use as illustrated in Figure 4-1. The average speed along the 408-mile corridor was approximately 77 mph, with peaks near or above 100 mph.

Figure 4-1: Atlanta-Macon-Jacksonville Shared Use Speed Profile

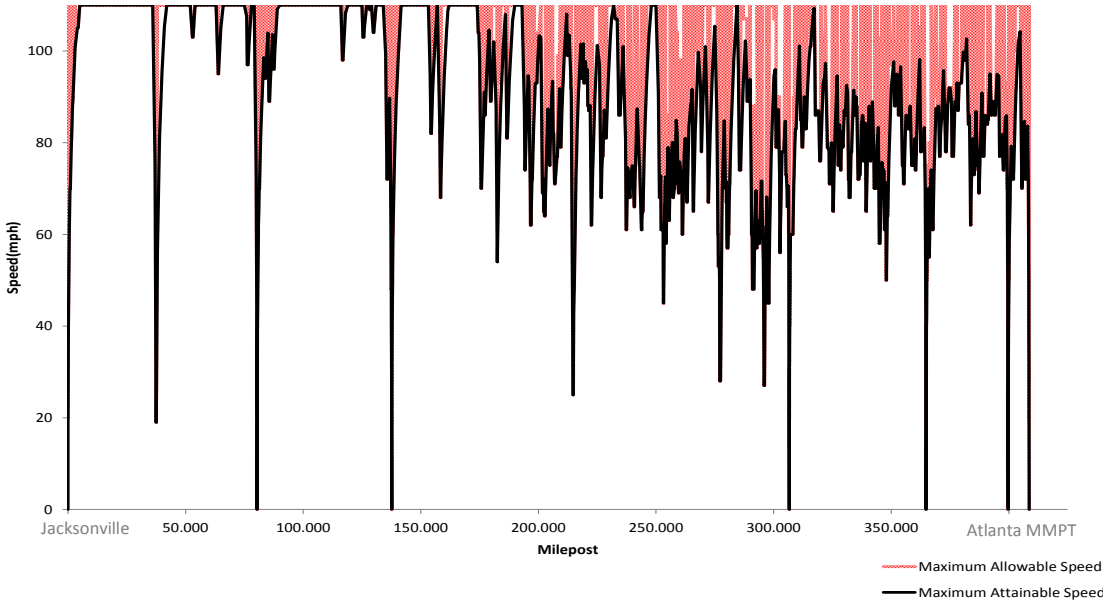


Table 4-1 illustrates a typical travel time table outlining the route station segments, rail distance, scheduled travel time, cumulative travel time and average speed for the Atlanta-Macon-Jacksonville Shared Use corridor.

Table 4-1: Atlanta-Macon-Jacksonville Shared Use Speed and Travel Time Table

Shared Use				
Segment	**Rail Distance**	**Travel Time**	**Cumulative Travel Time**	**Average Speed (mph)**
Atlanta MMPT	0.0	0:00	0:00	0
H-JAIA	9.0	0:08	0:08	65
Griffin	34.9	0:31	0:39	67
Macon	58.2	0:50	1:29	69
Savannah	169.0	2:16	3:45	74
Brunswick	57.3	0:39	4:24	87
Jacksonville	80.4	0:54	5:18	89
Total	**408.6**	**5:18**	**5:18**	**77**

As seen in the above Figure 4-1 and Table 4-1, the tilting diesel train capable of operating at 110 mph or better achieves that performance between Jacksonville and Savannah, but between Atlanta and Savannah, curves on the GCR and NS rail lines would restrict the train to 79 mph or less, even taking its tilt capability into account. Nonetheless, because of the higher speed capability on the southern end of the route, the Shared Use route averages a higher speed (77 mph) than the other study corridors. The table indicates a travel time of 5 hours and 18 minutes, similar to the driving time, which takes approximately 5 hours and 24 minutes.

4.1.2 Operating Plan

The running times were used in conjunction with prospective train frequencies to develop an initial assessment of the ridership forecast for the Atlanta-Macon-Jacksonville Corridor. In addition, the results of the three corridors were compared to one another and the frequencies were adjusted so that each corridor could use the same train size, for corridor compatibility. As a result, the train frequencies and train sizes were adjusted after initial ridership forecasts to balance planned train capacity against ridership for the corridor. As a result, the Shared Use operations were projected to run eight round trips per day, with 250 seats per train. Given the combination of train frequencies and running times, eight train-sets would be required to cover the Shared Use equipment rotation.

Table 4-2: Atlanta-Macon-Jacksonville Shared Use Train Frequency and Size

Scenario	Round Trips per Day	# of Seats per Train	# of Train-Sets
Shared Use	8	250	8

4.2 180-220 MPH DEDICATED USE

4.2.1 SPEED PROFILE AND TIMETABLE

The study developed a speed profile for the Atlanta-Macon-Jacksonville Dedicated Use route as illustrated in Figure 4-2. The average speed along the 368-mile corridor was approximately 131 mph, with consistent segments near or above 200 mph.

Figure 4-2: Atlanta-Macon-Jacksonville Dedicated Use Speed Profile

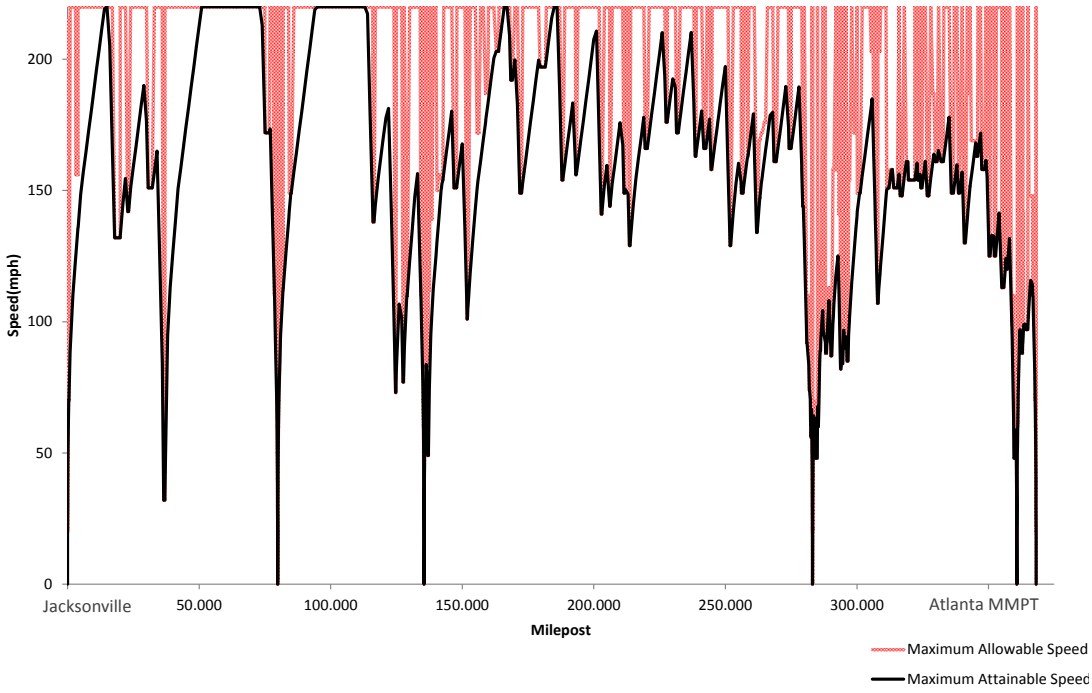


Table 4-3 illustrates a typical travel time table outlined the route station segments, rail distances, scheduled travel time, cumulative travel time and average speed for the Atlanta-Macon-Jacksonville Dedicated Use route.

Table 4-3: Atlanta-Macon-Jacksonville Dedicated Use Speed and Travel Time Table

Dedicated Use				
Segment	**Rail Distance**	**Travel Time**	**Cumulative Travel Time**	**Average Speed (mph)**
Atlanta MMPT	0.0	0:00	0:00	0
H-JAIA	7.4	0:06	0:06	76
Griffin				
Macon	77.7	0:42	0:48	112
Savannah	147.6	1:01	1:49	146
Brunswick	55.6	0:25	2:14	131
Jacksonville	79.9	0:35	2:49	138
Total	**368.1**	**2:49**	**2:49**	**131**

As seen in the above Figure 4-2 and Table 4-3, the proposed Dedicated Use route following I-75, I-16 and the abandoned CSXT S-Line would achieve higher speeds, with many segments reaching top speeds of over 200 mph. However, curvature on the route would limit the average train speed to 150 mph between Atlanta and Savannah. There is the possibility of easing curves to increase the overall average speed. The running time comparison with the automobile is favorable with an average travel time of two hours and 49 minutes, compared to auto travel at five hours and 24 minutes.

4.2.2 Operating Plan

Similar to Shared Use, the running times were used in conjunction with the prospective train frequencies to develop an initial assessment of the ridership forecast for the Atlanta-Macon-Jacksonville Dedicated Use corridor. In addition, the results of the three corridors were compared to one another, resulting in frequency adjustments so that each corridor could utilize the same train size, for corridor compatibility. As a result, the train frequencies and train sizes were adjusted after initial ridership and revenue results to balance planned train capacity against ridership for the corridor. As a result, the Dedicated Use operations are projected to run 14 round trips per day, with 265 seats per train. Given the combination of train frequencies and running times, eight train-sets would be needed for the Dedicated Use option.

Table 4-4: Atlanta-Macon-Jacksonville Dedicated Use Train Frequency and Size

Scenario	Round Trips per Day	# of Seats per Train	# of Train-Sets
Dedicated Use	14	265	8

5 RIDERSHIP AND REVENUE

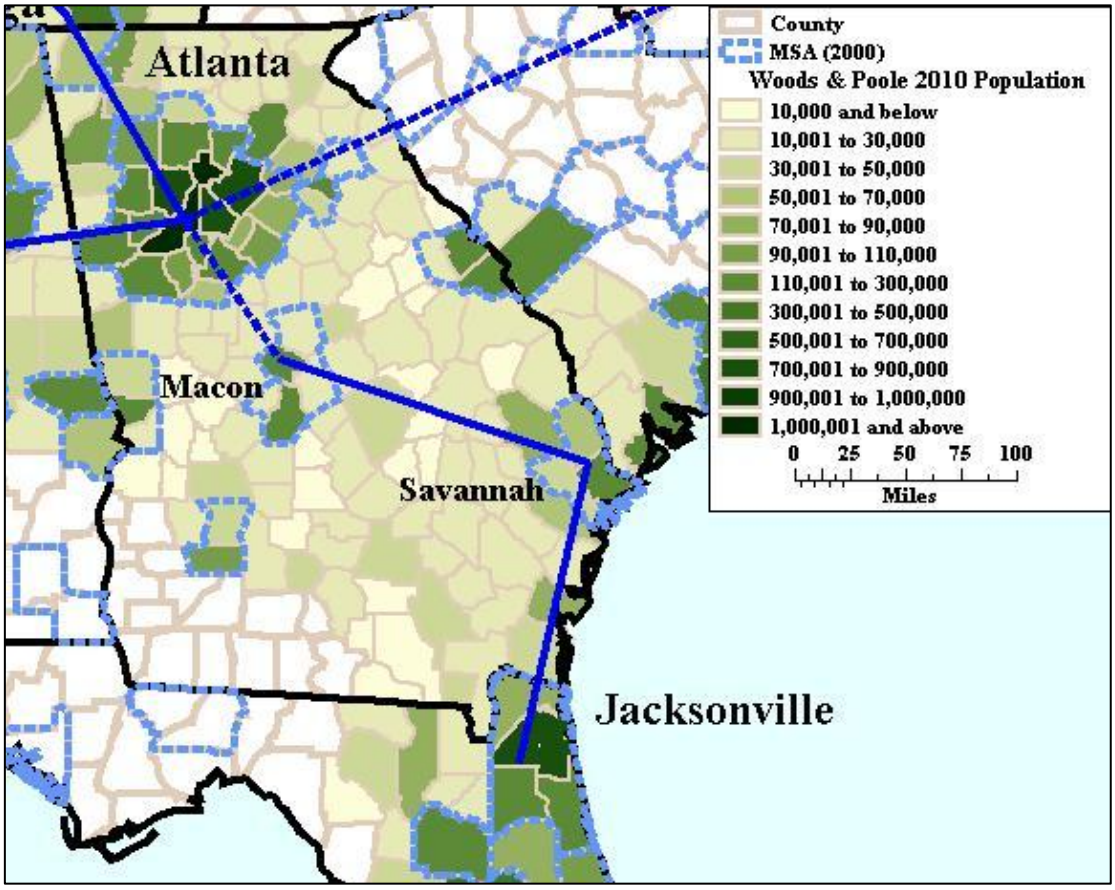
5.1 CORRIDOR DEMOGRAPHICS

This chapter presents information on the demographic characteristics for the Atlanta-Macon-Jacksonville Corridor. Specifically, information on corridor population and employment is presented for both the base (2010) and future years (2021-2040). All of the historic demographic information presented in Section 5.1.1 were obtained from Woods and Poole Economic Forecasts 2011 which are based on U.S. Census data. Similarly, Woods and Poole also produce future year forecast on demographics which are used in this study and presented later in this chapter. Refer back to Section I: Chapter 3 for detailed ridership and revenue methodologies.

5.1.1 BASE YEAR (2010) DEMOGRAPHICS

In addition to the two major metropolitan areas (Jacksonville and Atlanta) at the two ends of the corridor, there are two other significant population centers along the corridor (Macon, GA and Savannah, GA). Figure 5-1 presents a county-level population map focusing on the Atlanta-Macon-Jacksonville Corridor.

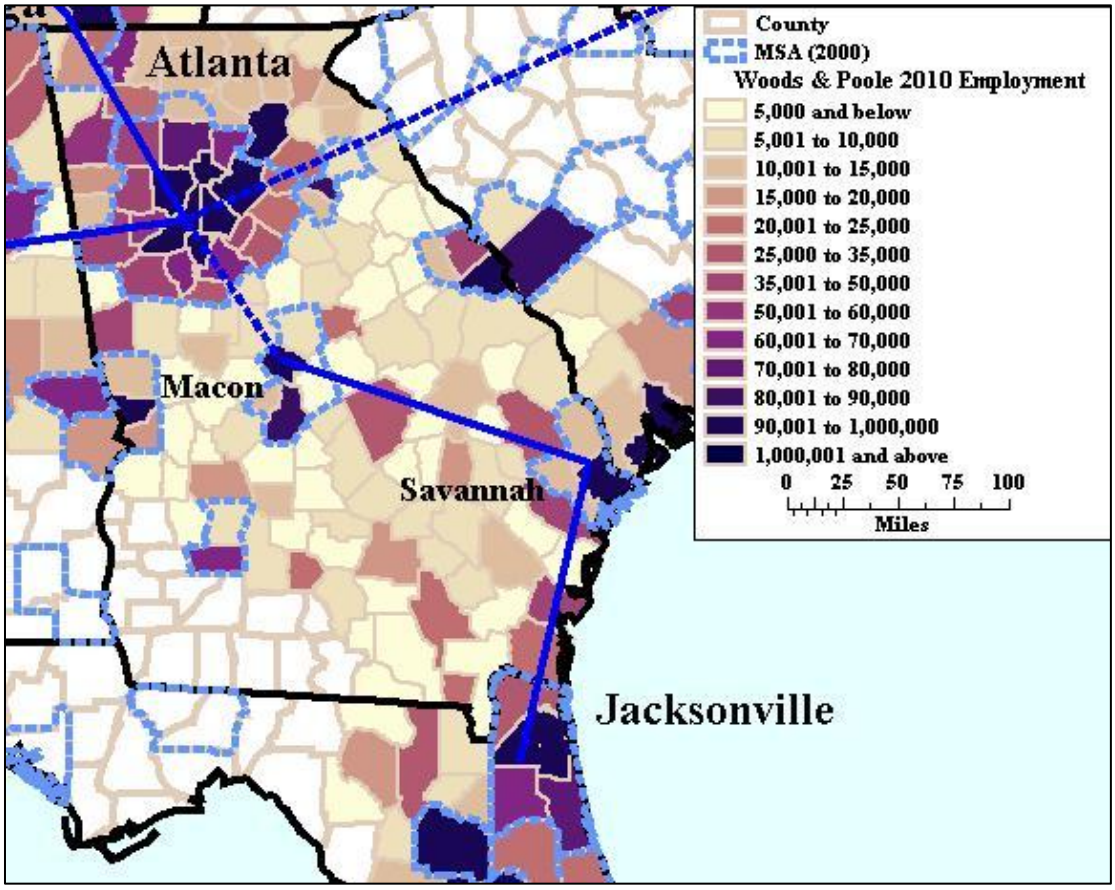
Figure 5-1: Atlanta-Macon-Jacksonville Base Year (2010) Population



Source: Woods and Poole Economic Forecasts, 2011

Similarly, as shown in Figure 5-2, the four MSA areas – Atlanta, Macon, Savannah and Jacksonville – are also the major employment centers in the corridor, with Atlanta being the dominant employment hub.

Figure 5-2: Atlanta-Macon-Jacksonville Base Year (2010) Employment



Source: Woods and Poole Economic Forecasts, 2011

Table 5-1 and Table 5-2 show the historical population and employment trends for the metropolitan planning organization (MPO) coverage areas for Atlanta (ARC), Jacksonville (North Florida Transportation Planning Organization [North Florida TPO]), Macon (Macon-Bibb County Planning and Zoning Commission [MBPZ]) and Savannah (Coastal Regional Metropolitan Planning Organization [CORE MPO]). Atlanta has experienced a rapid population growth over the past five years (2.44 percent annually) while the population growth in Macon has been modest (0.28 percent annually). Both Jacksonville and Savannah showed slight population growth during this same time period (about 1.5 percent annually, each). However, the recent economic downturn has hit the employment sector of all urban regions significantly with Atlanta and Jacksonville observing almost no increase in employment, and Macon experiencing negative employment growth over the past five years. Only Savannah shows a modest employment growth over this period (0.66 percent annually).

Table 5-1: Historical Population Trend for MPO Coverage Area

MPO	2005 Population	2010 Population	05-10 CAGR[28]
ARC	4,934,314	5,566,062	2.44%
Jacksonville TPO	1,224,142	1,319,085	1.51%
MBPZ	154,272	156,455	0.28%
Savannah MPC	239,889	259,077	1.55%

Source: Woods and Poole Economic Forecasts, 2011

Table 5-2:Historical Employment Trend for MPO Coverage Area

MPO	2005 Population	2010 Population	05-10 CAGR
ARC	3,013,970	3,012,811	-0.01%
Jacksonville TPO	772,606	769,138	-0.09%
MBPZ	110,426	109,315	-0.20%
Savannah MPC	172,000	177,713	0.66%

Source: Woods and Poole Economic Forecasts, 2011

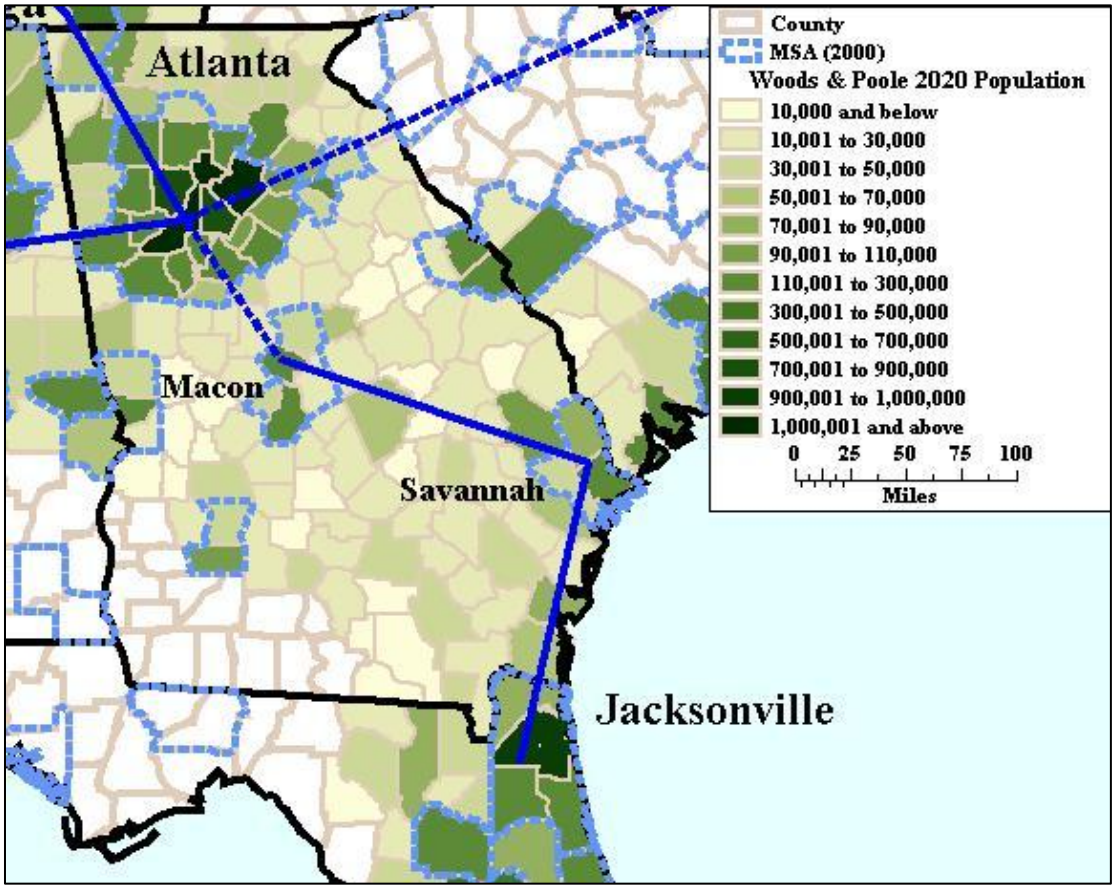
5.1.2 FUTURE YEAR (2020-2035) DEMOGRAPHICS

The 2020 and 2035 (as seen in Figure 5-3 and Figure 5-4, respectively) geographic distribution of population at the county level will remain essentially similar compared to that of 2010. The highest projected population growth in the corridor is observed in the suburban areas surrounding Atlanta and as seen in Figure 5-5.

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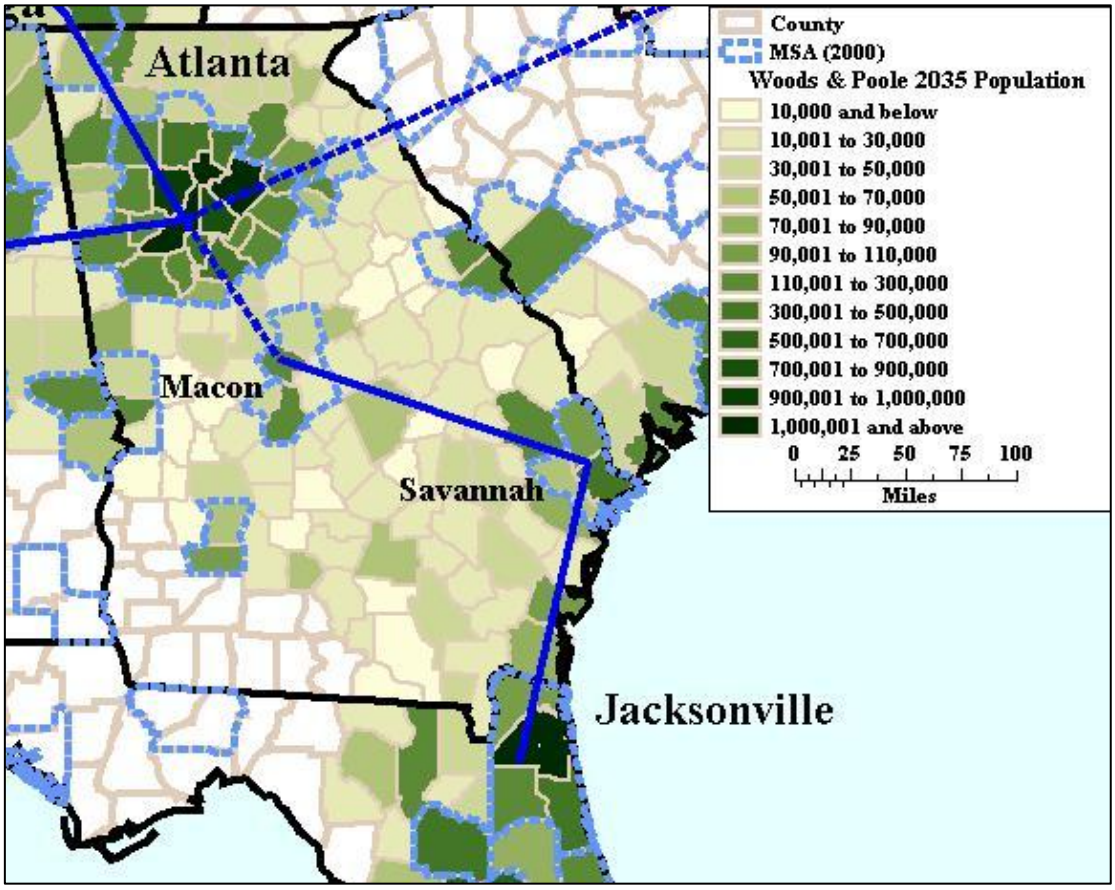
[28] Compound Annual Growth Rate (CAGR)

Figure 5-3: Atlanta-Macon-Jacksonville 2020 Population



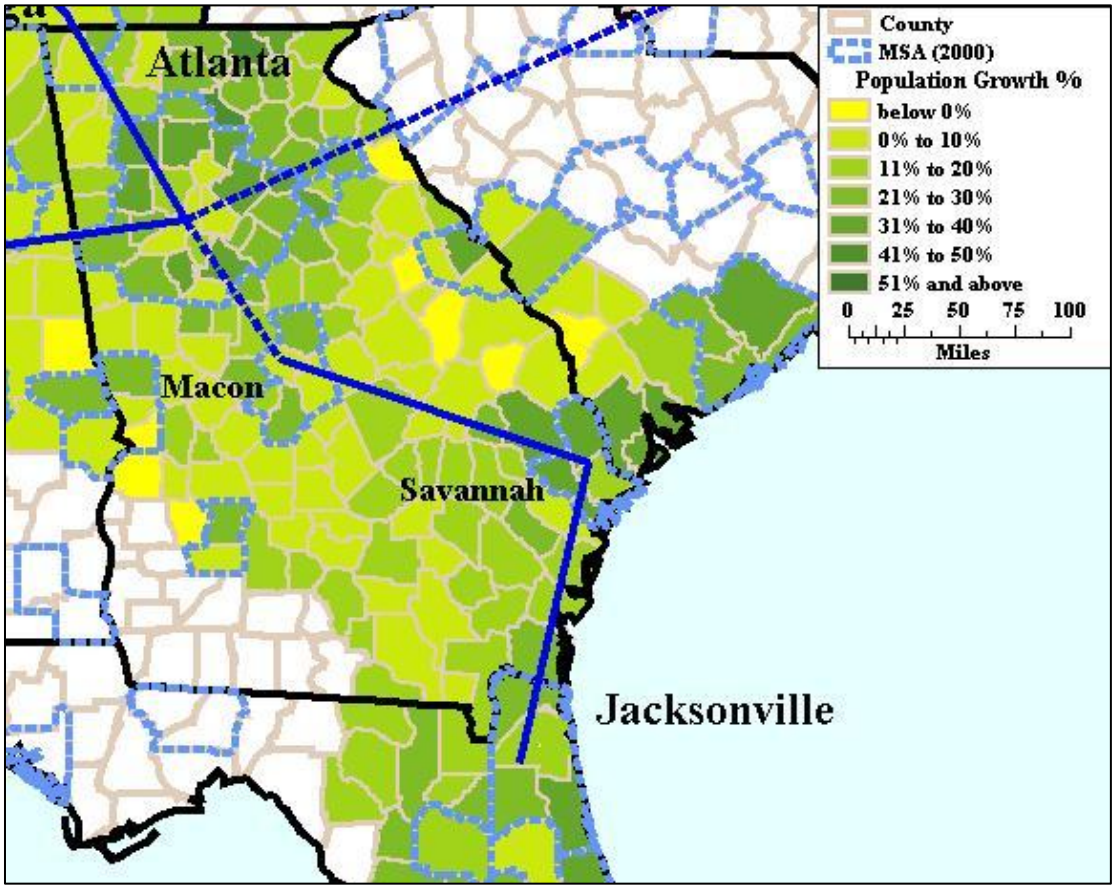
Source: Woods and Poole Economic Forecasts, 2011

Figure 5-4: Atlanta-Macon-Jacksonville 2035 Population



Source: Woods and Poole Economic Forecasts, 2011

Figure 5-5: Atlanta-Macon-Jacksonville 2020-2035 Population Growth



Source: Woods and Poole Economic Forecasts, 2011

The population growth forecasts follow the latest trends observed in the region and nationwide, predicting a slower annual population growth in future years as compared to the rapid population growth observed over the past decade. Table 5-3 shows that the areas covered by the ARC, CORE MPO and North Florida TPO are expected to experience healthy population growths until 2035, whereas MBPZ growth will remain modest (project 0.31 percent annually).

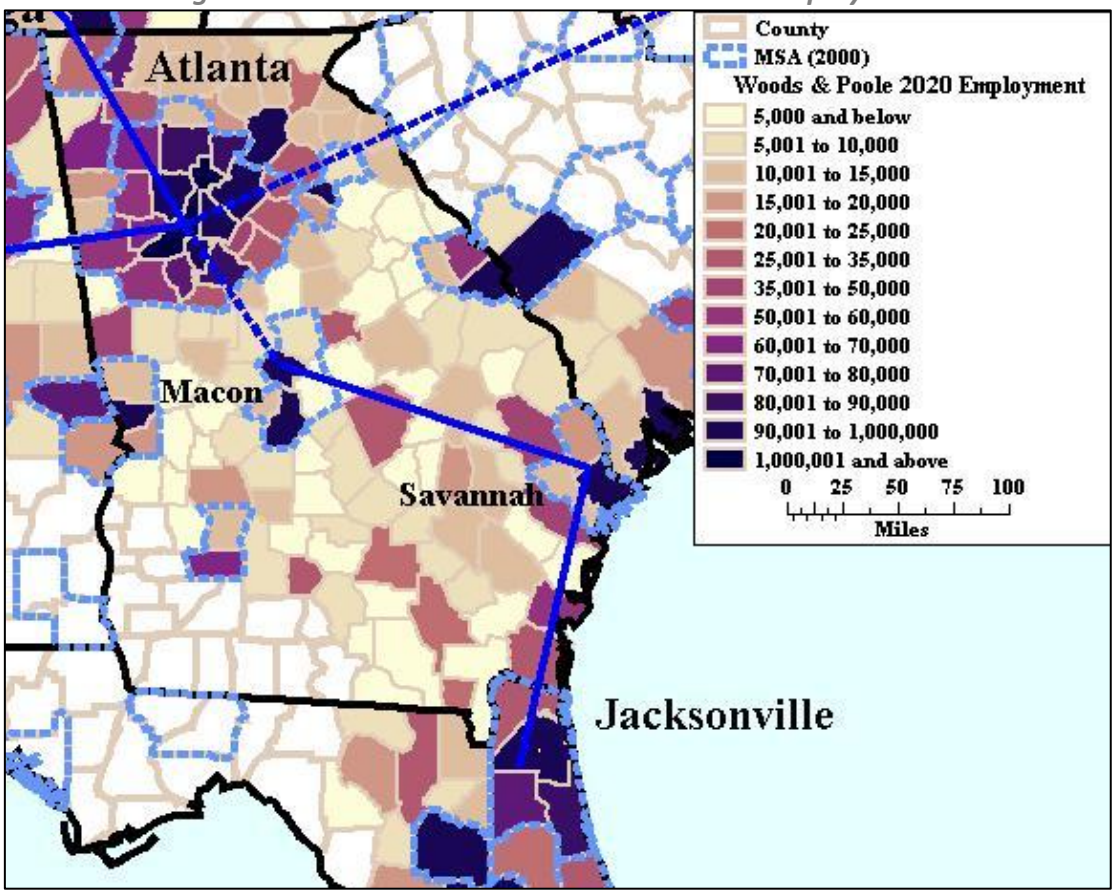
Table 5-3: Population Forecasts for MPO Coverage Areas

MPO	2005 Population	2010 Population	2020 Population	2035 Population	05-10 CAGR	20-35 CAGR
ARC	4,934,314	5,566,062	6,523,568	7,997,611	2.44 %	1.37 %
North Florida TPO	1,224,142	1,319,085	1,496,787	1,772,015	1.51%	1.13%
MBPZ	154,272	156,455	160,998	168,611	0.28%	0.31%
CORE MPO	239,889	259,077	281,075	316,033	1.55%	0.78%

Source: Woods and Poole Economic Forecasts, 2011

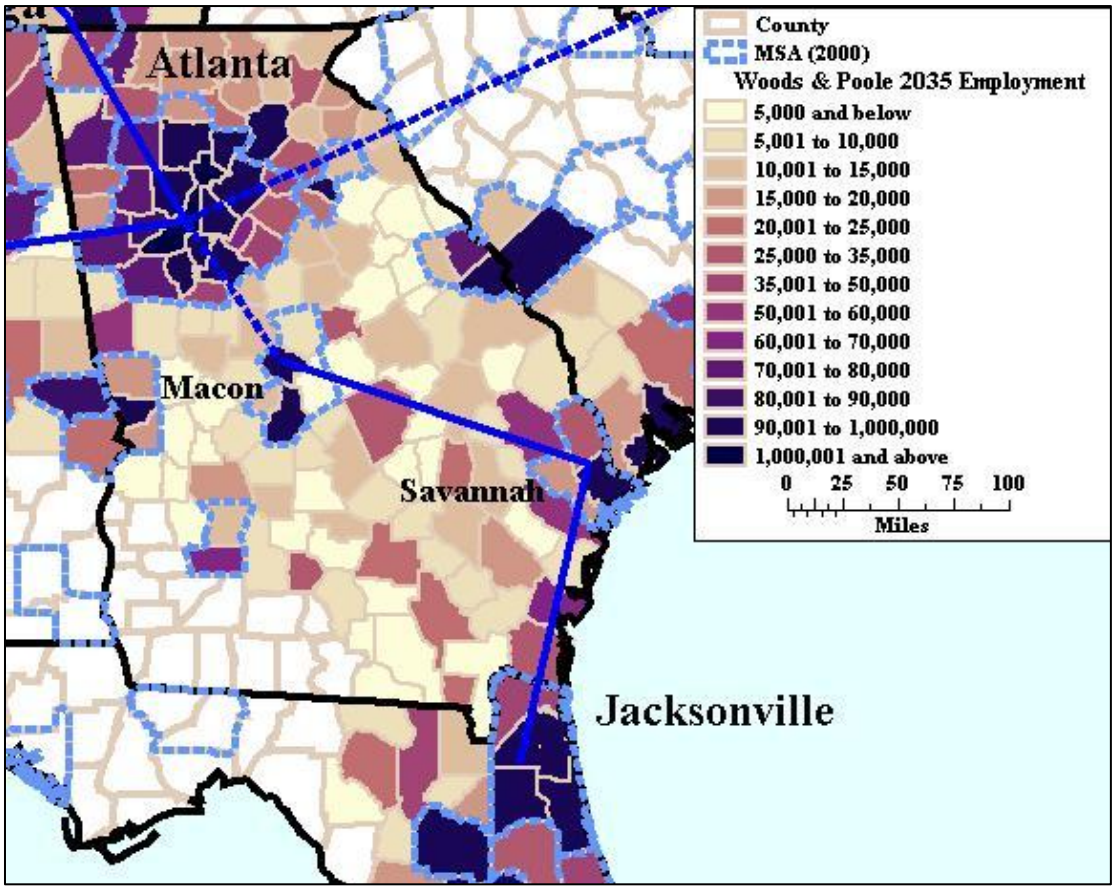
Figure 5-6 and Figure 5-7 show the county-level employment for the years 2020 and 2035, respectively; while Figure 5-8 and Table 5-4 present the employment growths between 2020 and 2035. Table 5-4 shows that all four major metropolitan areas are expected to have a yearly employment growth ranging between approximately one percent and 1.5 percent between 2020 and 2035.

Figure 5-6: Atlanta-Macon-Jacksonville 2020 Employment



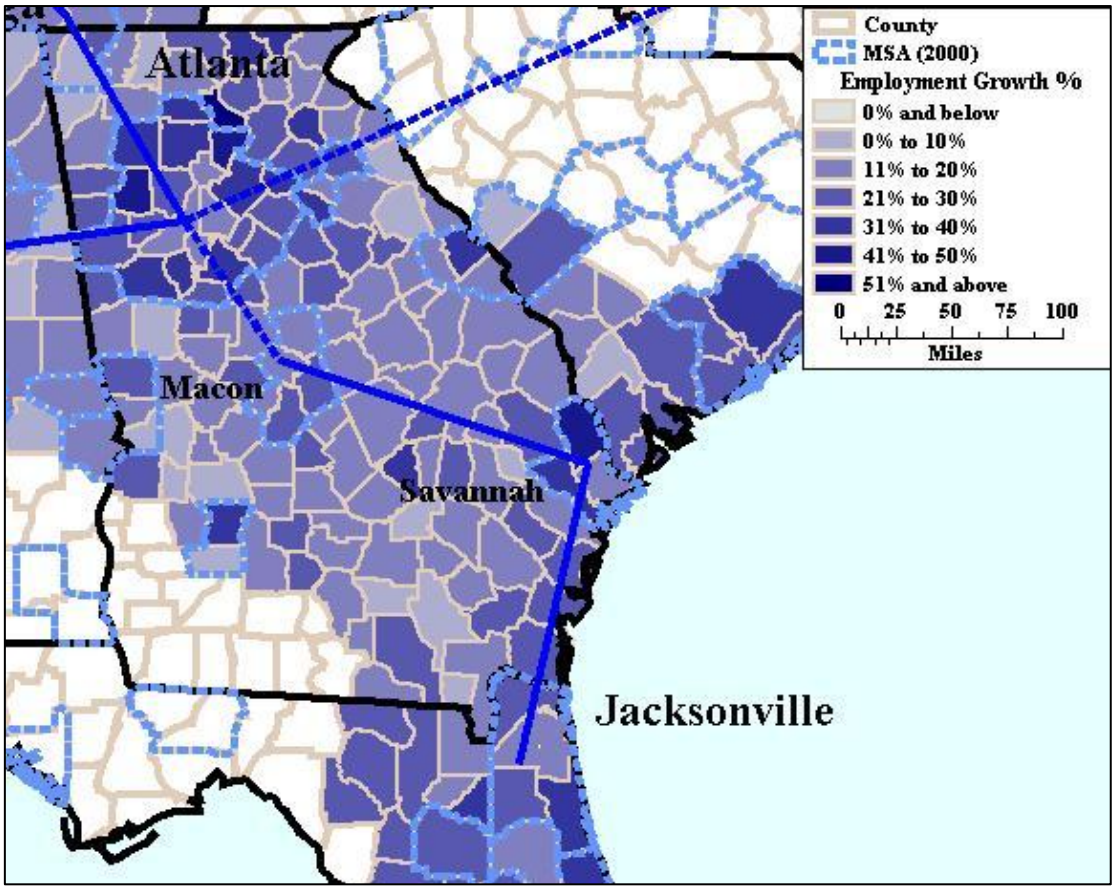
Source: Woods and Poole Economic Forecasts, 2011

Figure 5-7: Atlanta-Macon-Jacksonville 2020 Employment



Source: Woods and Poole Economic Forecasts, 2011

Figure 5-8: Atlanta-Macon-Jacksonville 2020-2035 Employment Growth



Source: Woods and Poole Economic Forecasts, 2011

Table 5-4: Employment Forecasts for MPO Coverage Areas

MPO	2005 Emp.	2010 Emp.	2020 Emp.	2035 Emp.	05-10 CAGR	20-35 CAGR
ARC	3,013,970	3,012,811	3,545,633	4,425,027	-0.01%	1.49%
North Florida TPO	772,606	769,138	894,016	1,088,149	-0.09%	1.32 %
MBPZ	110,426	109,315	124,591	146,634	-0.20%	1.09%
CORE MPO	172,000	177,713	199,562	229,440	0.66%	0.93%

Source: Woods and Poole Economic Forecasts, 2011

5.2 MARKET ANALYSIS

As discussed in Section I: Chapter 3, three main travel markets have been identified in this corridor – the inter-urban travel market; the local travel market; and the connect air market.

5.2.1 THE INTER-URBAN MARKET

There are four travel modes by which inter-urban trips can currently be made between the major cities in the corridor:

- Automobile travel;
- Bus service;
- Air service; and
- Rail service.

5.2.1.1 Automobile Travel

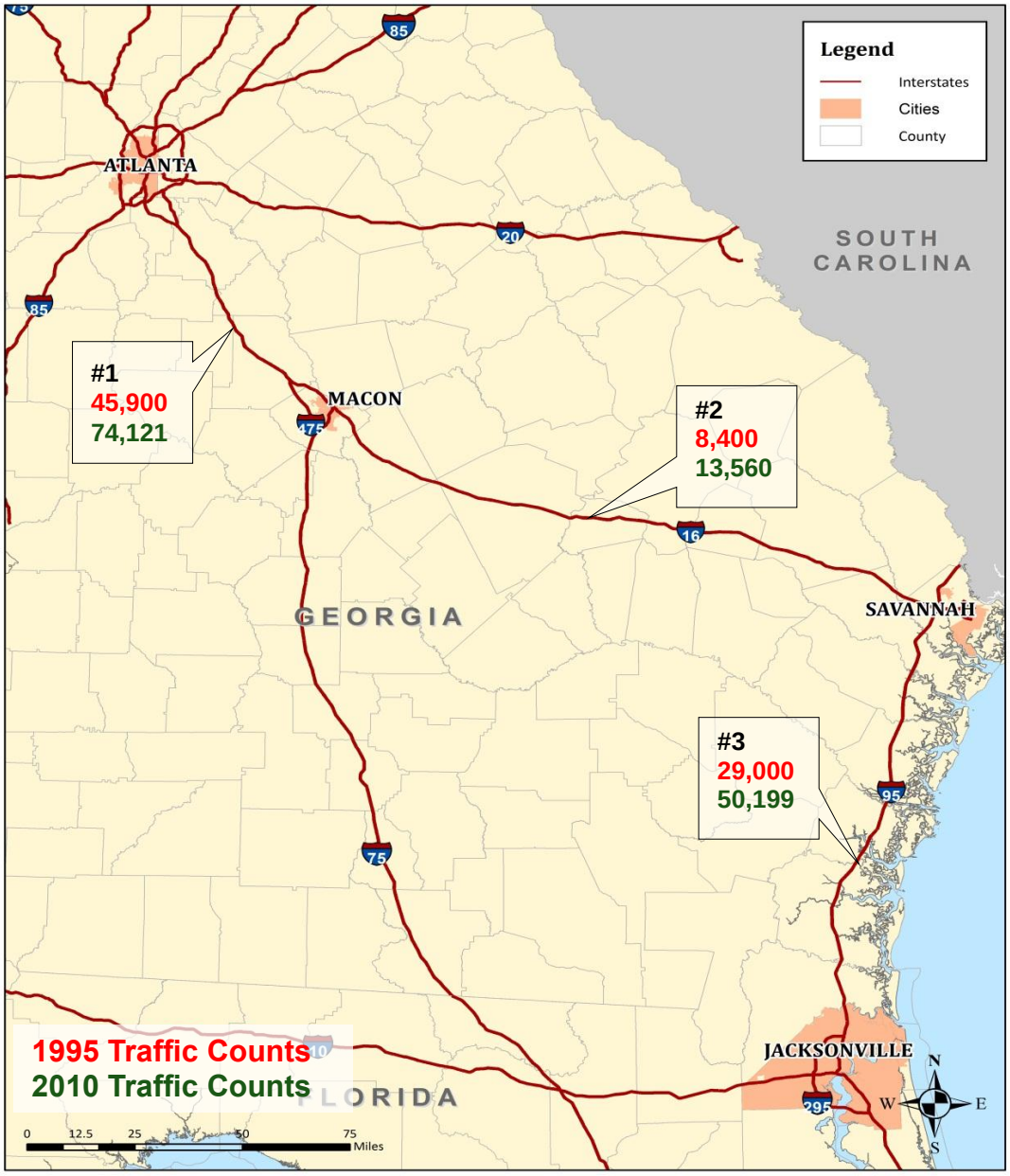
Automobile is the predominant mode of transportation utilized between Atlanta, Macon, Savannah and Jacksonville. Traffic count data is available on major roadways and interstates connecting these cities. Table 5-5 presents some recent relevant traffic count data (annual average daily traffic – AADT) on the main intercity highways: I-75 between Atlanta and Macon, I-16 between Macon and Savannah and I-95 between Savannah and Jacksonville. It is important to note that these represent total traffic volumes on the designated road section, and not the origin-destination demand from one section endpoint to the other. The historical traffic counts data show an average annual growth of 3.41 percent between Atlanta and Jacksonville since 1995 (as seen in Table 5-5 and Figure 5-9).

Table 5-5: Observed Auto Traffic Growth (AADT) between 1995 and 2010

Corridor	Location	Traffic Count 1995	Traffic Count 2010	CAGR 95-10
Atlanta-Jacksonville	#1: I-75 between Atlanta and Macon	45,900	74,121	3.25%
	#2: I-16 between Macon and Savannah	8,400	13,560	3.24%
	#3: I-95 between Savannah and Jacksonville	29,000	50,199	3.73%

Source: http://tpas.dot.ga.gov, www2.dot.stat.efl.us

Figure 5-9: Observed Auto Traffic (AADT) in 1995 and 2010



Source: http://tpas.dot.ga.gov, www2.dot.stat.efl.us

Table 5-6 shows end to end automobile travel distances and times in the corridor. This data is obtained from commercial journey planning software (Mapquest.com) and reflects speed limits and representative congestion levels on each route.

Table 5-6: Travel Times and Distances between City Pairs

Route	Distance (miles)	Time (min)
Atlanta – Jacksonville	346	325
Atlanta – Savannah	249	240
Atlanta – Macon	86	93

Source: Mapquest.com

5.2.1.2 Bus Service

A summary of the bus services between Atlanta and Jacksonville is presented in Table 5-7.

Table 5-7: Atlanta-Macon-Jacksonville Bus Services Summary

City Pair	Route	Operator	Travel time	Frequency	Full fare[29]
Atlanta – Jacksonville	City to city (Via Savannah)	Greyhound	8h 55m to 11h 40m (transfer time)	4x/day	$66 - $73
Atlanta – Macon	City to city	Greyhound	1h 25m, 1h 40m (with an airport stop)	6x/day	$21 - $24

Source: www.greyhound.com

Table 5-7 shows that there are two services operating in the corridor. Service frequencies are generally low. Travel times are highly variable, in some cases, and reflect variability in stopping patterns, congestion and/or transfer times.

Commercial bus operators are generally reluctant to release ridership numbers. Nevertheless, in the absence of any information from these operators, approximate ridership estimates based on bus capacity and load factors were prepared. Based on the service frequencies set out in the table above, 50 seats per bus and load factors of 50 percent, there are potentially 24,000 trips being made (in each direction) between Atlanta and Jacksonville and 36,000 trips made between Atlanta and Macon, which is significantly smaller compared to the potential auto market. There may also be some charter bus operators; however, these operations have been excluded from the analysis.

[29] Full or standard weekday and weekend fares, rounded to nearest dollar

5.2.1.3 Direct Air Service

The study area is served by three medium to large airports. Table 5-8 presents key characteristics of these airports. The table includes the airport's ranking among U.S. airports in terms of 2010 domestic passenger enplanements, scheduled departures, passenger carriers operating at the airport, and enplanements per departure.

Of particular importance is the extremely large hub airport in the study area, H-JAIA, which is the world's busiest airport and a major hub for Delta and AirTran airlines. This airport serves as a gateway for passengers throughout the southeast to connect to flights to numerous domestic and international destinations, as well as a connection point for many longer-distance trips.

Table 5-8: Atlanta-Macon-Jacksonville Corridor Major Airport Characteristics

Code	Airport	Rank	2010 Passenger Enplanements	2010 Scheduled Departures	2010 Passenger Carriers	Enplanements per Departure
ATL	H-JAIA	1	38,362,000	429,258	31	89
JAX	Jacksonville International	55	2,739,000	34,715	30	79
SAV	Savannah/ Hilton Head International	93	790,000	15,140	22	52

Source: Airport snapshots form www.bts.gov

Table 5-9 shows the total number of true origin-destination trips between each pair of study area major airports by direction, with outbound passenger volumes shown to the left of the diagonal and inbound passenger volumes shown to the right of the diagonal. The airports in the study area are primarily served by feeder flights to hubs that serve various carriers; this obliges passengers traveling to other destinations to make a connection. Services between these airports and the various hub airports are provided with a combination of mainline and regional aircraft.

Table 5-9: Origin-Destination Air Trips by Direction (Q4 2009 to Q3 2010)

Destination/ Origin	ATL	JAX
ATL		106,440
JAX	107,050	

Source: DB1B market data, www.bts.gov

As seen in Table 5-9, there are more than 200,000 point to point air trips between Atlanta and Jacksonville annually. Given the presence of H-JAIA as a major hub,

there are also a significant number of connect air trips (described later under Section 5.2.3) between the two corridor airports.

5.2.1.4 Rail Service

Amtrak's Silver and Palmetto services currently serve the Savannah and Jacksonville areas. However, this operates between New York City, NY, and Miami, FL and is not a viable option for people making trips between Jacksonville and the Macon and Atlanta, GA regions and is therefore not further considered in this study.

5.2.2 LOCAL TRAVEL MARKET

There are three main types of local trips:

- Journeys to work (most likely to originate in the suburbs and terminate in the city centers);
- Local trips for leisure purposes; and
- Local trips accessing the airport, as a part of a longer trip (where the ultimate destination is outside the study corridors and where the longer trip itself is not expected to shift the new high-speed rail service.

Local trips were estimated using the 2000 U.S. Census Journey to Work data and the Atlanta-Chattanooga High Speed Ground Transportation Tier I EIS study. Using information from the 2000 Census and growth rates from Woods and Poole socioeconomic and demographic forecasts, 11,000 commuting trips were estimated to have been made in the year 2015 between Savannah and Brunswick. The total number of local trips was then calculated as multiples of the commuting trips identified in the U.S. Census. Local trips to access H-JAIA and other local trips for the Atlanta metropolitan area were taken directly with appropriate adjustments from the Atlanta-Chattanooga HSGT Tier I EIS study.

5.2.3 CONNECT AIR MARKET

The proposed high-speed rail service may provide a viable service between H-JAIA and the Jacksonville airports which may result in attracting current connect air travelers between these two airports. The connect air travel market differs from the data shown in Table 5-9 (on page 3-78) for the direct air market which shows just the passengers traveling between each point, and does not include connecting flights to other destinations.

Table 5-10 (page 3-78) shows segment-level traffic information for the H-JAIA-Jacksonville airport pair which provide a reliable estimate for the connect air market under consideration. The table includes total passengers, scheduled seats, schedule departures, average daily frequency, average seats per flight, and average passenger per flight for Q4 2009 to Q3 2010.

Table 5-10: Atlanta-Macon-Jacksonville Corridor Air Services Summary

City Pair	Passengers	Seats	Scheduled Departures	Flights / Day	Seats / Flight	Passengers / Flight
ATL-JAX	697,411	886,537	6,383	17	139	112

Source: T-100 segment data Q4 2009 to Q3 2010, www.bts.gov

Comparing passenger counts on these routes with the true origin-destination traffic on the same airport pairs presented in Table 5-9 (page 3-78) demonstrates that most of the air travelers in this market are connecting.

Given the high share of connecting traffic and relatively shorter distance between H-JAIA and Jacksonville airport, it seems plausible for air travelers to consider H-JAIA as a possible alternate origin/destination of their air trips as long as they can get to/from H-JAIA in a relatively quick time using the proposed high-speed rail system.

5.3 FORECASTS

This section presents the ridership and revenue forecasts for the base case fare scenarios[30] (refer back to Section I: Chapter 3) for both the proposed Shared Use and Dedicated Use rail services. Sensitivity analysis results are also presented later in Section 5.4.

The demand forecasting methodology uses binary diversion models to calculate high-speed rail ridership. Each diversion model computes, for each combination of trip purpose, market segment and current mode, the probability that a traveler would choose high-speed rail over its current mode of travel as a function of each mode's level of service attributes. The probabilities are then multiplied by the future year mode-specific travel volumes to calculate the diverted volumes from the existing modes to the new high-speed rail system. The inclusion of each mode's level of service attributes in the diversion models enables the study to test several high-speed rail services frequencies and to accordingly adjust them to the ridership level. The forecasting approach is explained in more detail in Section 1, Chapter 3, specifically section 3.3 and graphically in Figure 3-18.

In the subsequent sections, the study presents the base case ridership and revenue forecasts for both the proposed Shared Use and Dedicated Use rail services. Based on benchmarks against other regional high-speed ground transportation studies and the broad estimates of a feasibility study, it was decided to use the doubling of auto

[30] $0.28/mile with $5 boarding fee for Shared Use and $0.40/miles with $5 boarding fee for Dedicated Use

operating costs and the four percent increase in highway congestion between 2015 and 2035 as a part of the base cases for a total of 28 percent increase (in addition to the fare and other base case assumptions) for both Shared and Dedicated services.

In order to account for unforeseen increases in factors that contribute directly towards ridership and revenue, the study increased the base case ridership and revenue estimates to include the following:

- Effect of higher auto operating costs (e.g., higher fuel prices);
- Effect of higher-socioeconomic forecast between 2015 and 2035; and
- Effect of higher congestion.

The results of these sensitivity analyses are presented in Table 5-11 below:

Table 5-11: External Factor Analyses

Scenario tested	% Increase in ridership
Doubling auto operating costs	+24%
Higher population growth (additional 0.5% annually above W&P forecasts)	+10%
Higher congestion (additional 14% between 2015 and 2035 above SDG forecasts)	+4%

- **Doubling Auto Operating Costs:** Higher increases in fuel prices could be possible, but coupled with continuing fuel efficiency advances, increasing operating costs by a factor of two is a plausible scenario. This scenario would add as much as a 24 percent increase in ridership and revenue. This is compared to the base case where average auto costs were $0.10/mile and $0.55/mile for non-business and business travel purposes, respectively. The impact of higher operating costs is more prominent in Atlanta due to the relatively higher sensitivity to cost in that metropolitan region.
- **Higher Population Growth:** The study tested a scenario that increases population by an additional 0.5 percent above the Woods and Poole forecast, annually, between 2015 and 2035. This would result in an additional 10 percent increase. It was determined that this higher population growth was too aggressive and was therefore not included in the base scenario.
- **Higher Congestion Growth:** For the base case, the study used historical trends in congestion growth in Atlanta and reported by the Texas Transportation Index (TTI). This translated to an 11 percent increase in the travel time from the base case scenarios between 2015 and 2035. Then, the study assumed that travel times would increase by an additional 14 percent

increase from the base case assumption of 11 percent growth for a total growth of 25 percent. The resulting impact of congestion on ridership would result in an approximate increase 4 percent in ridership and revenue.

5.3.1 90-110 MPH SHARED USE RIDERSHIP AND REVENUE FORECASTS (2021-2040)

During the assumed first year of operation in 2021, the proposed Shared Use high-speed rail service ridership will be approximately 2.0 million with an associated ticket revenue figure of $109.8 million. By 2040, more than 2.7 million passengers and $160.7 million in ticket revenue are expected during steady state operation. Table 5-12 illustrates the annual ridership and revenue for 2021, 2030 and 2040 as well as total ridership and revenue (2021-2040), rounded to the nearest thousand, expected for the Atlanta-Macon-Jacksonville Corridor.

Table 5-12: Shared Use Base Case Ridership and Revenue (2021-2040 in 2010$)

Year	Ridership	Revenue
2021	2,011,000	$109,776,000
2030	2,353,000	$133,908,000
2040	2,732,000	$160,723,000
Total	**47,430,000**	**$2,704,983,000**

Table 5-13 presents the bi-directional station boardings and segment volumes for the Shared Use rail service in the corridor. It is evident from the table that the majority of the boardings take place at big city stations (Atlanta H-JAIA, Atlanta MMPT, Macon, Savannah and Jacksonville), but of equal importance is the local H-JAIA access trips from Atlanta MMPT which constitute a large market.

Table 5-13: Shared Use Base Case 2035 Annual Station Boardings and Segment Volumes (bi-directional)

Station	Boardings	Volume
Atlanta MMPT	978,252	
Atlanta Airport	523,376	1,956,608
Griffin	70,342	1,278,023
Macon	203,545	1,418,733
Savannah	220,048	1,246,800
Brunswick	111,110	950,251
Jacksonville	435,501	870,834
Total Annual Boardings	**2,542,173**	

5.3.2 180-220 MPH DEDICATED USE RIDERSHIP AND REVENUE FORECASTS (2021-2040)

With a base fare assumption of $0.40/mile with $5 boarding fee, the Atlanta-Macon-Jacksonville Corridor would attract about 2.4 million riders with associated ticket revenue of $181.2 million in the first year of operation (2021). By 2040, almost 3.2 million riders are expected on an annual basis during steady state operation, with ticket revenue of $260.0 million.

The proposed Dedicated Use high-speed rail service operating plan assumes higher frequency and lower running time between all station pairs compared to those of the Shared Use service. Hence, the Dedicated Use service would naturally attract significantly more riders than the Shared Use service. However, the base case fare assumption for the Dedicated Use service is also significantly higher compared to that of the Shared Use service ($0.40/mile as opposed to $0.28/mile). This increased fare has offset the frequency and travel time advantage of the Dedicated Use service over the Shared Use service to a large extent. This can be seen in Table 5-14 where the ridership advantages of the Dedicated Use over the Shared Use for all three years are only in the order of 15 percent. This would have been much higher if same fare assumptions were used for the two services. However, the higher base fare assumption for the Dedicate Use has resulted in significantly higher ticket revenue figures. The ticket revenue advantages of the Dedicated Use over the Shared Use are more than 30 percent – considerably higher than the ridership advantage – for all three years as presented in the table.

Table 5-14: Dedicated Use Base Case Ridership and Revenue (2021-2040 in 2010$)

Year	Ridership	Revenue
2021	2,355,000	$181,193,000
2030	2,745,000	$218,512,000
2040	3,178,000	$259,978,000
Total	**55,330,000**	**$4,411,712,000**

Table 5-15 shows the station boardings and ridership flows for various segments between the station pairs for the Dedicated Use service follow the same trend as those of the Shared Use service, but higher volumes.

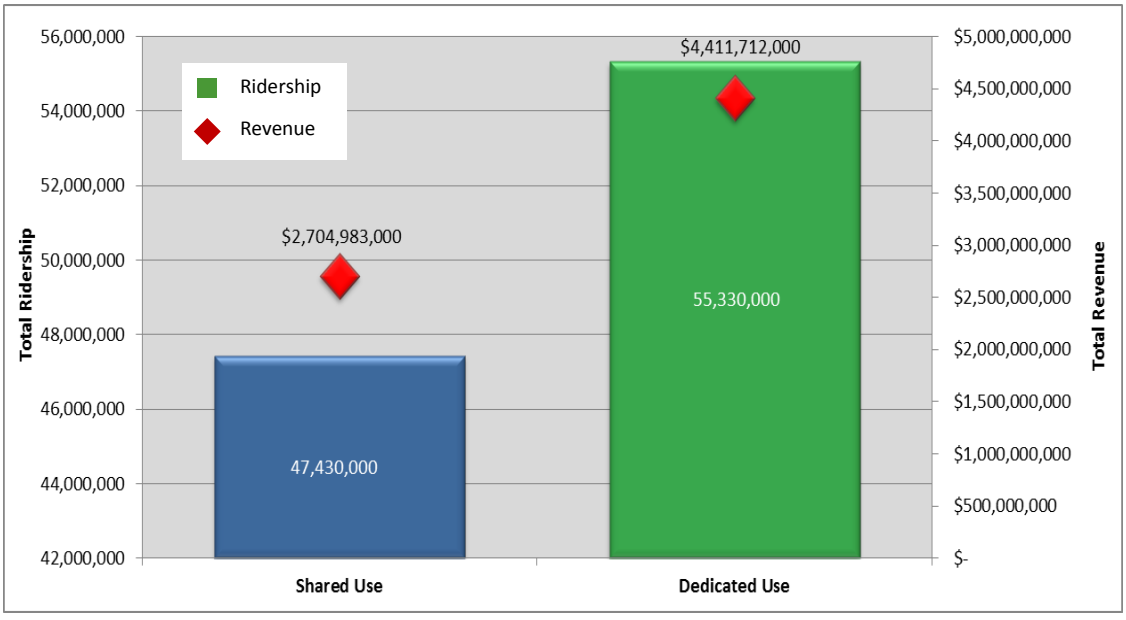
Table 5-15: Dedicated Use Base Case 2035 Annual Station Boardings and Segment Volumes (bi-directional)

Station	Boardings	Volume
Atlanta MMPT	1,000,978	
Atlanta Airport	790,874	2,002,174
Griffin	*No stop*	1,788,203
Macon	171,328	1,788,203
Savannah	299,393	1,670,988
Brunswick	122,002	1,235,246
Jacksonville	576,734	1,153,208
Total Annual Boardings	**2,961,309**	

5.3.3 RIDERSHIP AND REVENUE FORECASTS (2021-2040)

Figure 5-10 presents year by year ridership and revenue forecasts for base case scenarios for both the proposed Shared Use and Dedicated Use high-speed rail services between 2021 and 2040. Over these 20 years of operation, the ridership (and revenue) accrual for the Shared Use and Dedicated Use services are expected to be about 49.4 million (and $2.8 billion) and 57.6 million (and $4.6 billion), respectively.

Figure 5-10: Atlanta-Macon-Jacksonville Corridor Base Case Ridership and Revenue Forecasts (2021-2040 in 2010$)



5.4 Fare Sensitivity Analysis

In addition to the base case and earlier sensitivity analyses discussed above, additional sensitivity tests on the effects of fares were performed. The following sections present the results of the fare sensitivity analysis. The effect of fares on ridership and revenue is presented first for both the Shared and Dedicated Use high-speed rail services.

5.4.1 Shared Use Fare Sensitivity

Table 5-16 presents the total ridership and revenue numbers for the Atlanta-Jacksonville corridor for two fare scenarios ($0.20/mile and $0.40 mile both with $5 boarding fees) in addition to the base case ($0.28/mile with $5 boarding fee) for the Shared Use rail service for three separate years. Increasing fares to $0.40/mile generates less revenue compared to the base case fare, while decreasing fares to $0.20/mile also generates less revenue compared to our base case. This suggests that the revenue maximizing fare is somewhere between $0.20/mile and $0.40/mile. It is important to maximize both ridership and revenue in order to not only receive farebox revenues, but also provide a valuable service to consumers. Additionally, passenger rail service can have positive impact on non-users such as auto motorists and those flying that are also important to capture.

Table 5-16: Fare Sensitivity for Shared Use Rail Service (2021-2040 in 2010$)

Year	Annual Volume and Revenue		
	Scenario 1 - $0.20/mile	**Scenario 2 - $0.28/mile**	**Scenario 3 - $0.40/mile**
2021	2,393,000	2,011,000	1,544,000
	$102.3 M	**$109.8 M**	**$103.2 M**
2030	2,806,000	2,353,000	1,799,000
	$124.7 M	**$133.9 M**	**$126.3 M**
2040	3,265,000	2,732,000	2,083,000
	$149.6 M	**$160.7 M**	**$152.1 M**

5.4.2 Dedicated Use Fare Sensitivity

Table 5-17 presents the total ridership and revenue numbers for the Atlanta-Macon-Jacksonville Corridor for two fare scenarios ($0.55/mile and $0.70/mile both with $5 boarding fees) in addition to the base case ($0.40/mile with $5 boarding fee) for the Dedicated Use high-speed rail service for three separate years. In this case, increasing fares above the base fare of $0.40/mile generates lower revenues for the Dedicated Use service indicating that the base fare is close to the revenue

maximizing levels. This suggests that even higher revenue could be expected in this corridor by decreasing the base fare further.

Table 5-17: Fare Sensitivity for Dedicated Use Rail Service

Year	Annual Volume and Revenue		
	Scenario 1 - $0.40/mile	Scenario 2 - $0.55/mile	Scenario 3 - $0.70/mile
2021	2,355,000	1,817,000	1,465,000
	$181.2 M	**$175.5 M**	**$162.4 M**
2030	2,745,000	2,113,000	1,689,000
	$218.5 M	**$211.7 M**	**$194.0 M**
2040	3,178,000	2,442,000	1,938,000
	$260.0 M	**$251.9 M**	**$229.2 M**

5.4.2.1 Shared Use and Dedicated Use Total Ridership and Revenue Summary

Table 5-18 and Table 5-19 below summarize the total number of passengers and revenue that will be accrued over 20 years of operation starting from the assumed opening year of 2021 for the Shared Use and Dedicated Use services, respectively.

Table 5-18: Shared Use Total Ridership and Revenue Summary (2021-2040)

Shared Use Total Ridership and Revenue Summary		
Years 2021-2040	Ridership	Revenue (2010$)
Scenario 1 - $0.20/mile	56,572,000	$2.5 billion
Scenario 2 - $0.28/mile	49,403,000	$2.8 billion
Scenario 3 - $0.40/mile	36,261,000	$2.6 billion

Table 5-19: Dedicated Use Total Ridership and Revenue Summary (2021-2040)

Dedicated Use Total Ridership and Revenue Summary		
Years 2021-2040	Ridership	Revenue (2010$)
Scenario 1 - $0.40/mile	57,642,000	$4.6 billion
Scenario 2 - $0.55/mile	42,589,000	$4.3 billion
Scenario 3 - $0.70/mile	34,020,000	$3.9 billion

5.4.3 EVALUATION SCENARIOS

In setting up the evaluation, three scenarios were developed to show the impact of a range of ridership, revenue, capital and operating cost estimates typically encountered in a feasibility-level analysis. Unadjusted base forecasts for ridership, revenue, capital and operating costs were used for the Conservative Scenario. Base ridership and revenue estimates were increased for Dedicated Use corridors to establish the Intermediate and Optimistic Scenarios.[31] Operating costs were adjusted by the appropriate ridership drivers. Capital cost estimates were adjusted downward in the Intermediate and Optimistic Scenarios for all technologies.

The three scenarios are intended to capture and illustrate the relatively wide range of estimates at the feasibility-level of study. As corridors are deemed feasible for further evaluation, future studies will provide greater detail in the analysis of ridership, revenues and costs, narrowing the range of estimates.

5.4.3.1 Conservative Scenario Estimates

Conservative scenario estimates use base case ridership and revenue forecasts and capital costs estimates for the operating ratio and benefit-cost analysis. Refer back to Section I: Chapter 3 for additional details on the Conservative scenario estimate methodology. Table 5-14 on page 3-81 summarizes base case ridership and revenue forecasts.

5.4.3.2 Intermediate Scenario Estimates

The Intermediate scenario represents a balance between Conservative and Optimistic scenarios, balancing both ridership and cost risks. The ridership and revenue estimates are approximately 75 percent higher than the Conservative estimates. Table 5-21 outlines the Intermediate scenario ridership and revenue estimates for 2021, 2030 and 2040 as well as total (2021-2040) rounded to the nearest thousand.

[31] Ridership adjustments for Intermediate and Optimistic Scenarios were only made for Dedicated Use corridor 180-220 mph electrified, steel-wheel and Maglev technologies (Maglev in Atlanta-Louisville corridor only) based on a peer review of regional and national high speed rail corridor studies. No scenario ridership adjustment was made for Shared Use corridor diesel-electric technology results based on a peer review of other shared-use corridor studies.

Table 5-20: Intermediate Scenario Annual Ridership and Revenue Estimates (2021-2040 in 2010$)

Year	Dedicated Use	
	Ridership	Revenue
2021	4,122,000	$127,384,000
2030	4,804,000	$147,198,000
2040	5,561,000	$169,213,000
Total	**96,827,000**	**$3,091,148,000**

These ridership and revenue levels, in conjunction with forecast operations and maintenance costs and capital costs (Chapter 6), were used to calculate scenario-based operating ratios and benefit-cost ratios (Chapter 7) for use in the feasibility evaluation.

5.4.3.3 Optimistic Scenario Estimates

This scenario uses a higher ridership and revenue and a lower capital cost estimate for the Atlanta-Macon-Jacksonville Corridor. The ridership and revenue estimates are increased by 100 percent to become comparable to other peer studies within the southeast region and nationally. Table 5-20 outlines the ridership and revenue estimates (to the nearest thousand) for the Optimistic scenario.

Table 5-21: Optimistic Scenario Annual Ridership and Revenue Estimates (2021-2040 in 2010$)

Year	Dedicated Use	
	Ridership	Revenue
2021	4,711,000	$145,582,000
2030	5,490,000	$168,226,000
2040	6,356,000	$193,386,000
Total	**110,660,000**	**$3,389,675,000**

6 FORECASTED COSTS

6.1 CAPITAL COSTS

The study gathered regional and national infrastructure and equipment capital cost data to estimate total design and construction costs for the Atlanta-Macon-Jacksonville Corridor. As aforementioned in Section I: Chapter 3, the study prepared capital costs at the conceptual engineering level (5-10 percent design level) with a +/- 30 percent level of accuracy. The used FRA standard cost categories (SCC) as required for FRA grant applications. To recap, Table 6-1 illustrates these FRA SCC.

Table 6-1: FRA Standard Cost Categories

FRA Standard Cost Categories for Capital Projects/Programs
10 Track Structures & Track
20 Stations, Terminals, Intermodal
30 Support Facilities: Yards, Shops, Administration Buildings
40 Sitework, Right-of-Way, Land, Existing Improvements
50 Communications & Signaling
60 Electric Traction
70 Vehicles
80 Professional Services
90 Unallocated Contingencies
100 Finance Charges

This chapter outlines the total capital costs for the Atlanta-Macon-Jacksonville high-speed rail corridor for both 90-110 mph Shared Use and 180-220 mph Dedicated Use technologies. It should be noted that these unit costs are only preliminary costs, and actual costs for the corridor will be dependent upon a preferred route and technology, which this study does not determine.

6.1.1 90-110 MPH SHARED USE

The 90-100 mph Shared Use, as outlined in previous chapters, will use diesel-electric operating equipment and will share existing freight railroad right-of-way and track infrastructure. Therefore, the overall capital costs are less than the 180-220 mph Dedicated Use technology, which is on a dedicated route and is a fully electrified system. Table 6-2 provides the overall Atlanta-Macon-Jacksonville Corridor capital costs by major SCC category. For a more detailed breakdown of capital costs by sub-category, refer to Appendix Fat the end of this report.

Table 6-2: Atlanta-Macon-Jacksonville Total Shared Use Capital Cost by SCC Category (2010$)

Costing Category		Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures & Track	$1,121,487,000	$336,446,000	$1,457,933,000
20	Stations, Terminals, Intermodal	$345,021,000	$103,506,000	$448,527,000
30	Support Facilities: Yards, Shops, Administration Buildings	$42,184,000	$12,655,000	$54,839,000
40	Sitework, Right-of-Way, Land, Existing Improvements	$514,292,000	$154,288,000	$668,579,000
50	Communications & Signaling	$845,511,000	$254,553,000	$1,103,065,000
60	Electric Traction	-	-	-
70	Vehicles	$260,000,000	$78,000,000	$338,000,000
80	Professional Services	$895,906,000	N/A	$895,906,000
90	Unallocated Contingencies	-	-	-
100	Finance Charges	-	-	-
TOTAL COST		**$4,024,401,000**	**$939,448,000**	**$4,966,849,000**
TOTAL COST PER MILE (432.2 MILES)				**$11,492,000**

To further understand the detailed SCC costs of the Atlanta-Macon-Jacksonville Corridor, Figure 6-1 through Figure 6-7 and Table 6-3 through Table 6-9 illustrates the capital costs by segment. Segments were developed based on station location and natural breaks in the corridor such as state boundaries. It should be noted that station and maintenance facility costs were only accounted for in the segment in which the station and/or maintenance facility is located. Additionally, vehicle costs were only accounted for in the total corridor capital costs, and were not included in the segment costs.

Figure 6-1: Atlanta-Macon-Jacksonville Shared Use Segment One

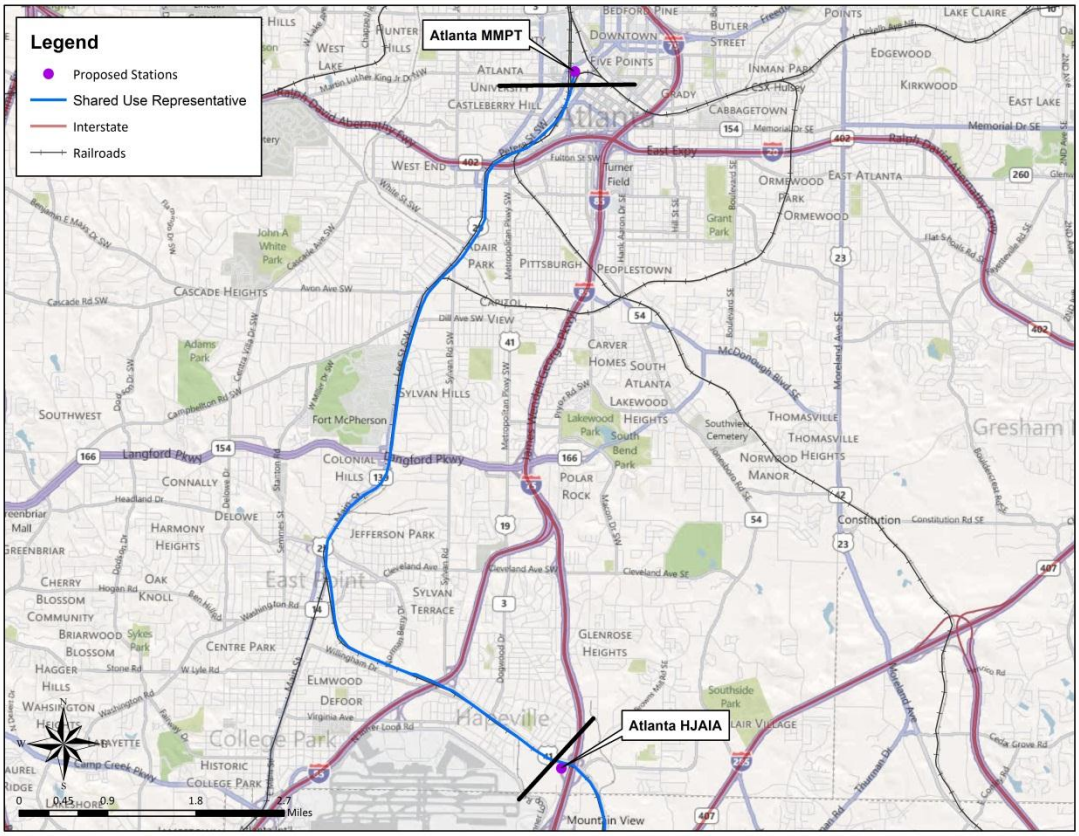


Table 6-3: Atlanta-Macon-Jacksonville Total Shared Use Capital Cost Segment One

Segment 1: 90-110 mph Shared Use – Atlanta MMPT to Atlanta Airport (H-JAIA)			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$25,819,000	$7,746,000	$33,565,000
Stations, Terminals, Intermodal	$279,156,000	$83,747,000	$362,903,000
Support Facilities: Yards, Shops, Administration Buildings	$29,777,000	$8,933,000	$38,710,000
Sitework, R/W, Land	-	-	-
Communications & Signaling	$18,005,000	$5,402,000	$23,407,000
Electric Traction	-	-	-
Vehicles	-	-	-
Professional Services	$110,060,000	-	$110,060,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$462,817,000**	**$105,828,000**	**$568,645,000**
Cost Per Mile (8.5 Miles)			**$66,899,000**

Figure 6-2: Atlanta-Macon-Jacksonville Shared Use Segment Two

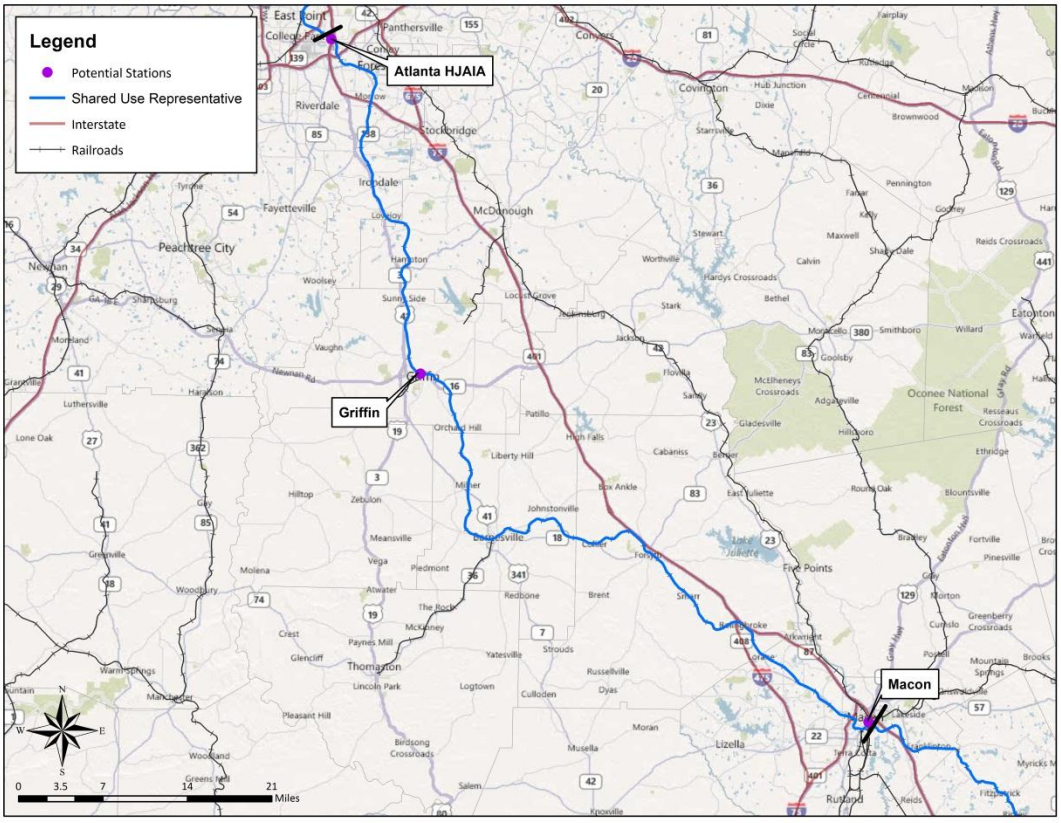


Table 6-4: Atlanta-Macon-Jacksonville Total Shared Use Capital Cost Segment Two

Segment 2: 90-110 mph Shared Use – Atlanta H-JAIA to Macon, GA			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$216,721,000	$65,016,000	$281,734,000
Stations, Terminals, Intermodal	$11,220,000	$3,366,000	$14,586,000
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$92,583,000	$27,775,000	$120,358,000
Communications & Signaling	$198,054,000	$59,416,000	$257,470,000
Electric Traction	-	-	-
Vehicles	-	-	-
Professional Services	$161,796,000	-	$161,796,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$80,374,000**	**$155,573,000**	**$835,947,000**
Cost Per Mile (93.2 Miles)			**$8,969,000**

Figure 6-3: Atlanta-Macon-Jacksonville Shared Use Segment Three

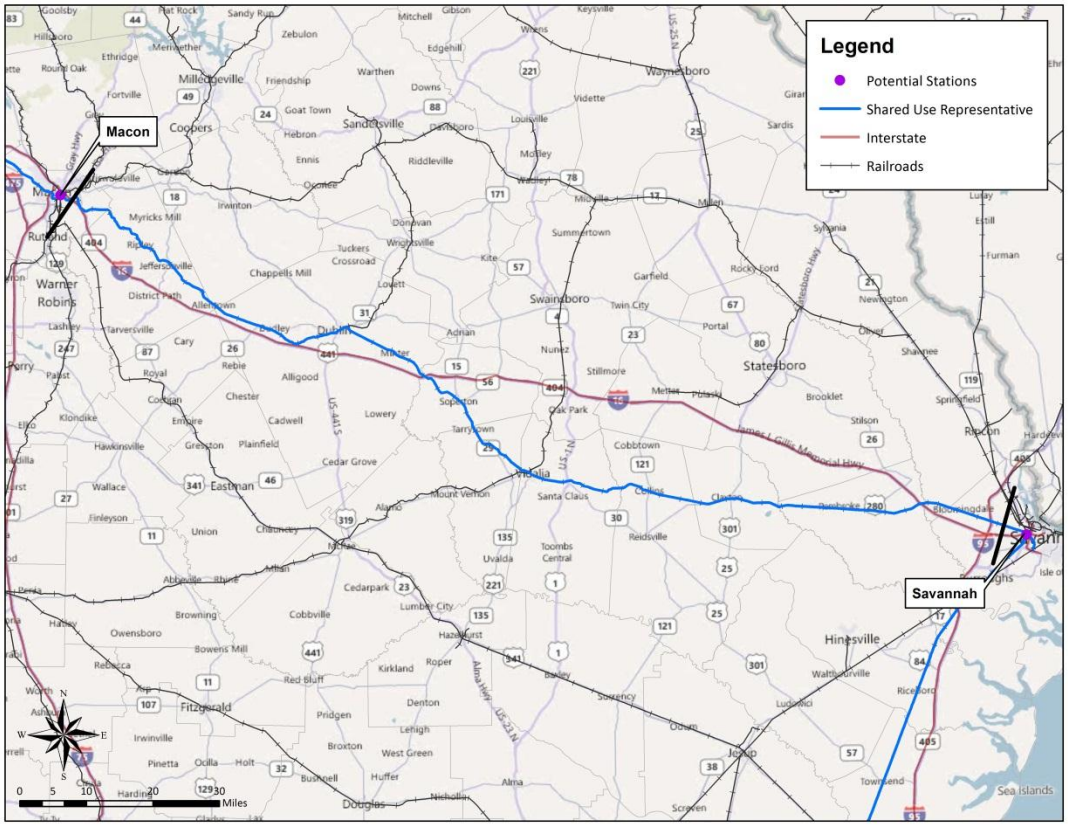


Table 6-5: Atlanta-Macon-Jacksonville Shared Use Capital Cost Segment Three

Segment 3: 90-110 mph Shared Use – Macon, GA to Savannah, GA			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$348,539,000	104,562,000	$453,101,000
Stations, Terminals, Intermodal	$5,610,000	1,683,000	$7,293,000
Support Facilities: Yards, Shops, Administration Buildings	$6,204,000	1,861,000	$8,065,000
Sitework, R/W, Land	$62,582,000	18,775,000	$81,357,000
Communications & Signaling	$349,483,000	104,845,000	$454,328,000
Electric Traction	-	-	-
Vehicles	-	-	-
Professional Services	$240,994,000	-	$240,994,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$1,013,421,000**	**$231,726,000**	**$1,245,138,000**
Cost Per Mile (169.6 Miles)			**$7,342,000**

Figure 6-4: Atlanta-Macon-Jacksonville Shared Use Segment Four

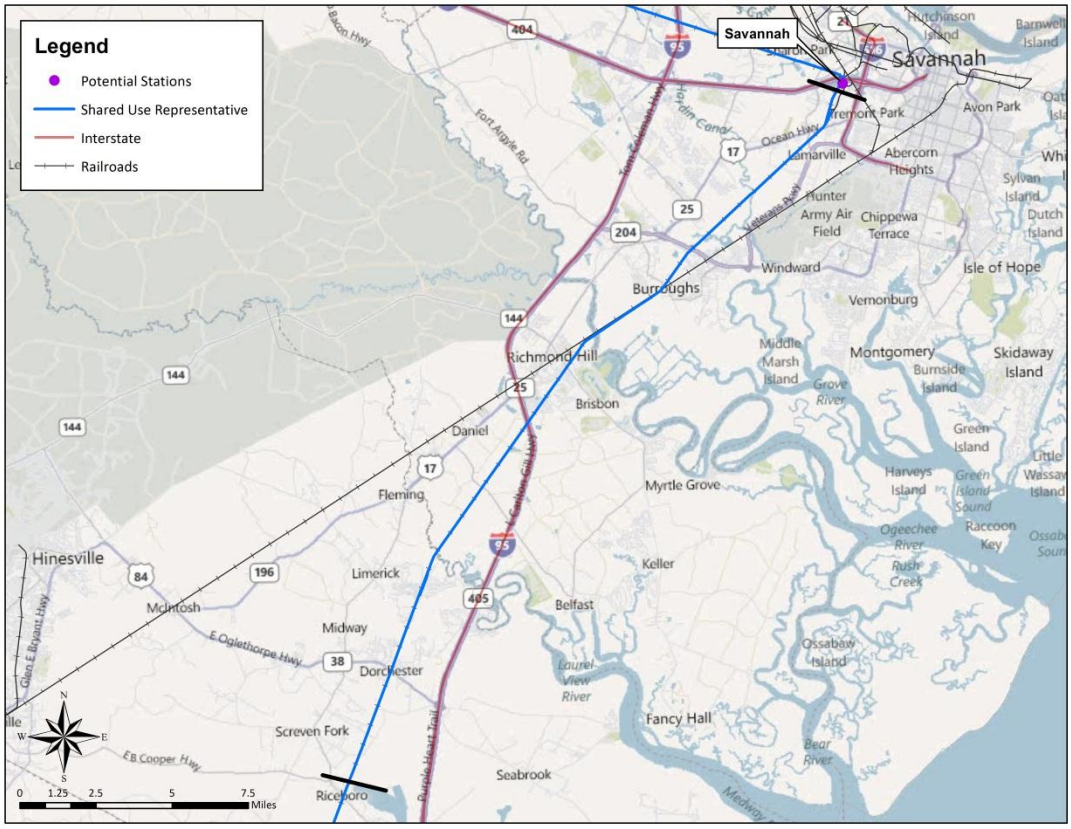


Table 6-6: Atlanta-Macon-Jacksonville Total Shared Use Capital Cost Segment Four

Segment 4: 90-110 mph Shared Use – Savannah, GA to Riceboro, GA			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$173,820,000	$52,146,000	$225,966,000
Stations, Terminals, Intermodal	-	-	-
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$36,472,000	$10,942,000	$47,413,000
Communications & Signaling	$77,367,000	$23,210,000	$100,578,000
Electric Traction	-	-	-
Vehicles	-	-	-
Professional Services	$89,750,000		$89,750,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$377,409,000**	**$86,298,000**	**$463,707,000**
Cost Per Mile (45.4 Miles)			**$10,213,000**

Figure 6-5: Atlanta-Macon-Jacksonville Shared Use Segment Five

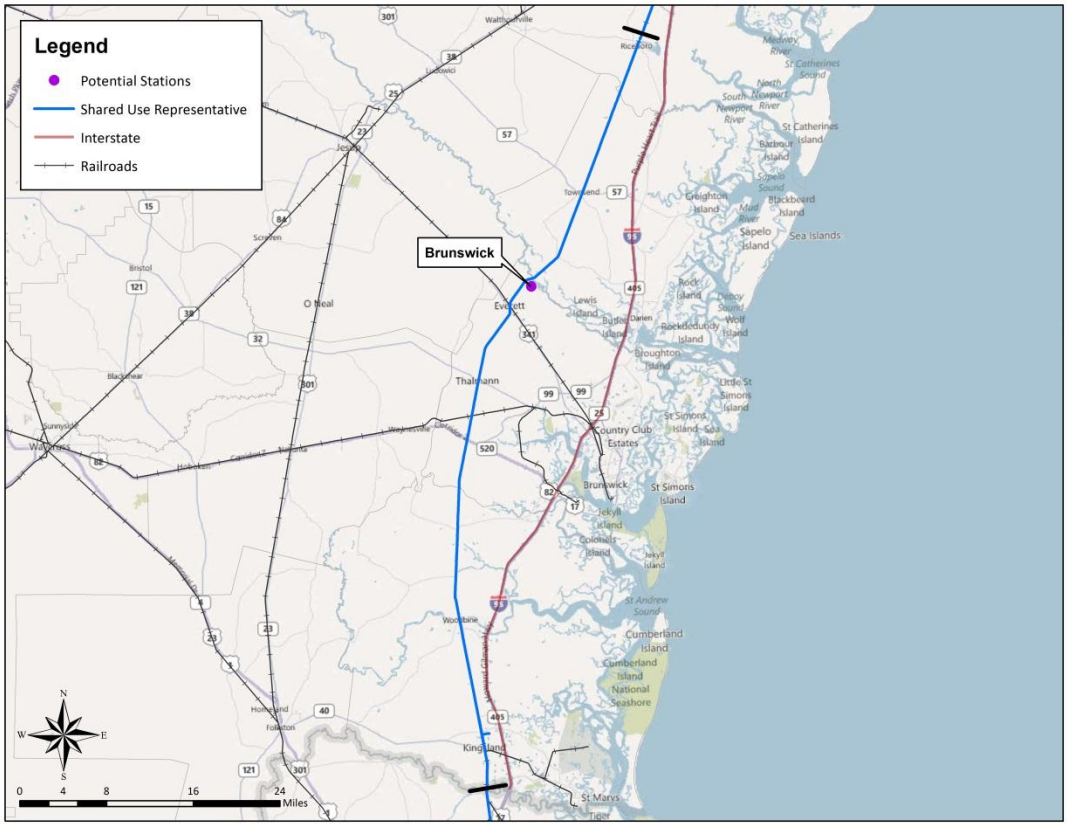


Table 6-7: Atlanta-Macon-Jacksonville Total Shared Use Capital Cost Segment Five

Segment 5: 90-110 mph Shared Use – Riceboro, GA to GA/FL Boarder			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$253,362,000	$76,009,000	$329,371,000
Stations, Terminals, Intermodal	$5,610,000	$1,683,000	$7,293,000
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$214,497,000	$64,349,000	$278,846,000
Communications & Signaling	$135,352,000	$40,605,000	$175,957,000
Electric Traction	-	-	-
Vehicles	-	-	-
Professional Services	$189,952,000	-	$189,952,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$798,773,000**	**$182,646,000**	**$981,419,000**
Cost Per Mile (73.0 Miles)			**$13,444,000**

Figure 6-6: Atlanta-Macon-Jacksonville Shared Use Segment Six

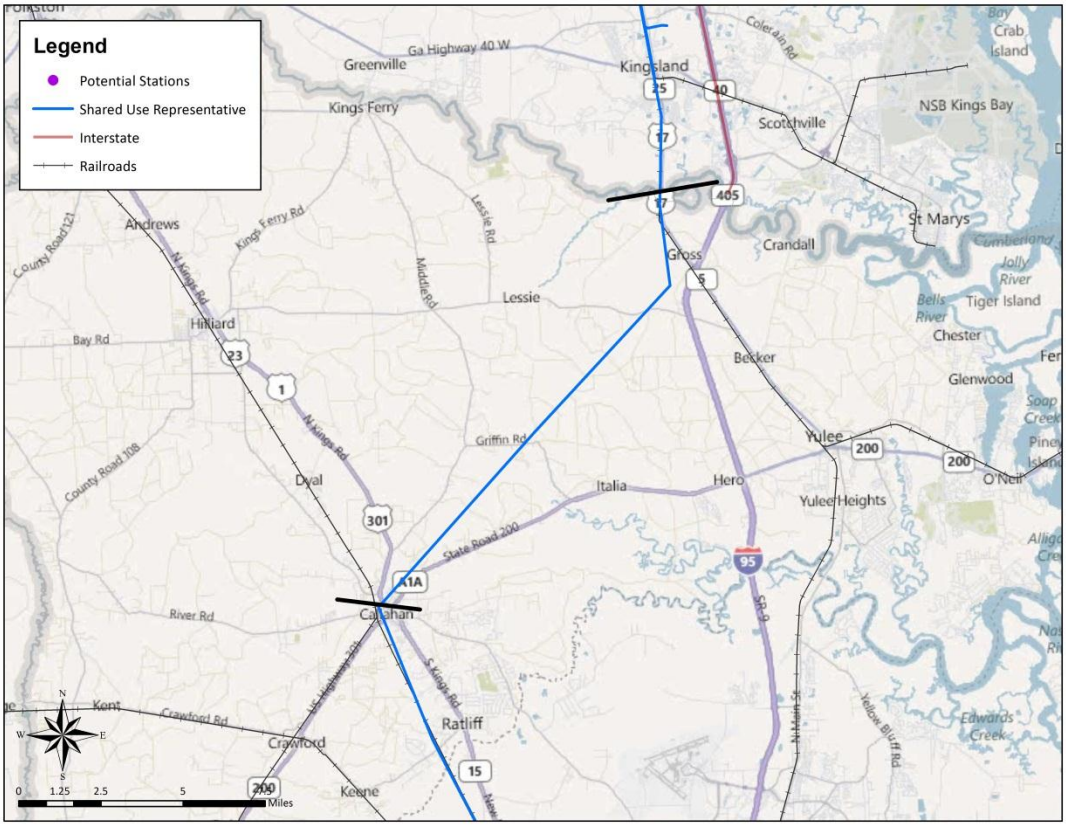


Table 6-8: Atlanta-Macon-Jacksonville Total Shared Use Capital Cost Segment Six

Segment 6: 90-110 mph Shared Use – GA/FL Boarder to Callahan, FL			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$64,546,000	$19,364,000	$83,909,000
Stations, Terminals, Intermodal	-	-	-
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$61,143,000	$18,343,000	$79,486,000
Communications & Signaling	$34,959,000	$10,488,000	$45,446,000
Electric Traction	-	-	-
Vehicles	-	-	-
Professional Services	$50,122,000	-	$50,122,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$210,770,000**	**$48,195,000**	**$258,965,000**
Cost Per Mile (22.7 Miles)			**$11,408,000**

Figure 6-7: Atlanta-Macon-Jacksonville Shared Use Segment Seven

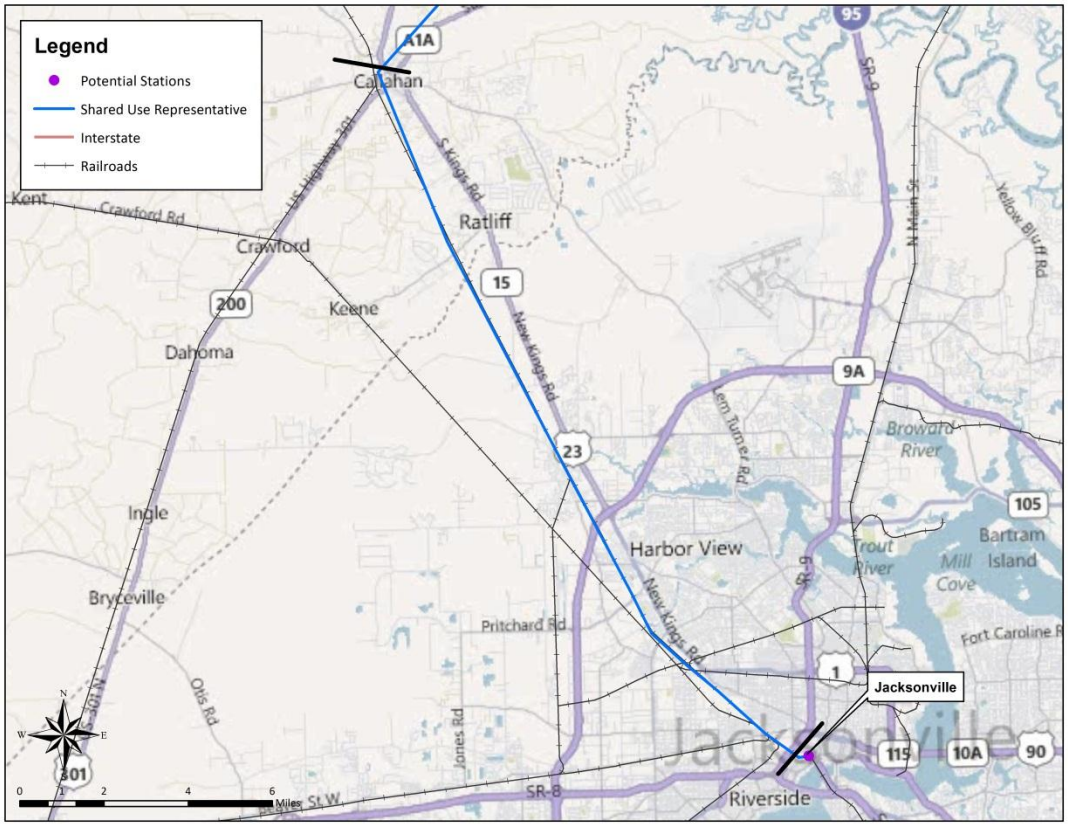


Table 6-9: Atlanta-Macon-Jacksonville Shared Use Capital Cost Segment Seven

Segment 7: 90-110 mph Shared Use – Callahan, FL to Jacksonville, FL			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$38,680,000	$11,604,000	$50,284,000
Stations, Terminals, Intermodal	$43,424,000	$13,027,000	$56,452,000
Support Facilities: Yards, Shops, Administration Buildings	$6,204,000	$1,861,000	$8,065,000
Sitework, R/W, Land	$47,016,000	$14,105,000	$61,121,000
Communications & Signaling	$35,292,000	$10,588,000	$45,880,000
Electric Traction	-	-	-
Vehicles	-	-	-
Professional Services	$53,232,000	-	$53,232,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$223,848,000**	**$51,185,000**	**$275,033,000**
Cost Per Mile (19.7 Miles)			**$13,961,000**

6.1.2 180-220 MPH DEDICATED USE

The 180-220 mph Dedicated Use runs on a fully separated, dedicated route utilizing interstate, rail line and greenfield right-of-way. Within urban corridors, the route is shared with freight right-of-way. The track will be separated from freight operations and will not interfere with freight traffic. The total capital costs for Dedicated Use are higher than Shared Use due to the electrification of the track, electrified vehicles, land acquisition and relocations. Table 6-10 outlines the total Atlanta-Macon-Jacksonville Dedicated Use corridor costs by SCC.

Table 6-10: Atlanta-Macon-Jacksonville Total Dedicated Use Capital Cost (2010$)

Costing Category	Allocated Cost	Contingency (30%)	Total Cost
Track Structures & Track	$3,330,970,000	$999,291,000	$4,330,261,000
Stations, Terminals, Intermodal	$339,411,000	$101,823,000	$441,234,000
Support Facilities: Yards, Shops, Administration Buildings	$49,628,000	$14,888,000	$64,516,000
Sitework, Right-of-Way, Land, Existing Improvements	$1,222,198,000	$366,659,000	$1,588,585,000
Communications & Signaling	$617,774,000	$185,332,000	$803,106,000
Electric Traction	$4,174,608,000	$1,252,382,000	$5,426,991,000
Vehicles	$347,600,000	$104,280,000	$451,880,000
Professional Services	$3,037,192,000	-	$3,037,192,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
TOTAL COST	**$13,119,381,000**	**$3,024,655,000**	**$16,144,036,000**
TOTAL COST PER MILE (368.1 Miles)			**$41,323,000**

To further understand the detailed SCC costs of the Atlanta-Macon-Jacksonville Dedicated Use Corridor, Figure 6-8 through Figure 6-15 and Table 6-11 through Table 6-18 illustrates the capital costs by segment. Segments were developed based on station location and natural breaks in the corridor such as state boundaries. Again, similar to the Shared Use segment costs, it should be noted that station and maintenance facility costs were only accounted for in the segment in which the station and/or maintenance facility is located. Additionally, vehicle costs were only accounted for in the total corridor capital costs, and were not included in the segment costs.

Figure 6-8: Atlanta-Macon-Jacksonville Dedicated Use Segment One

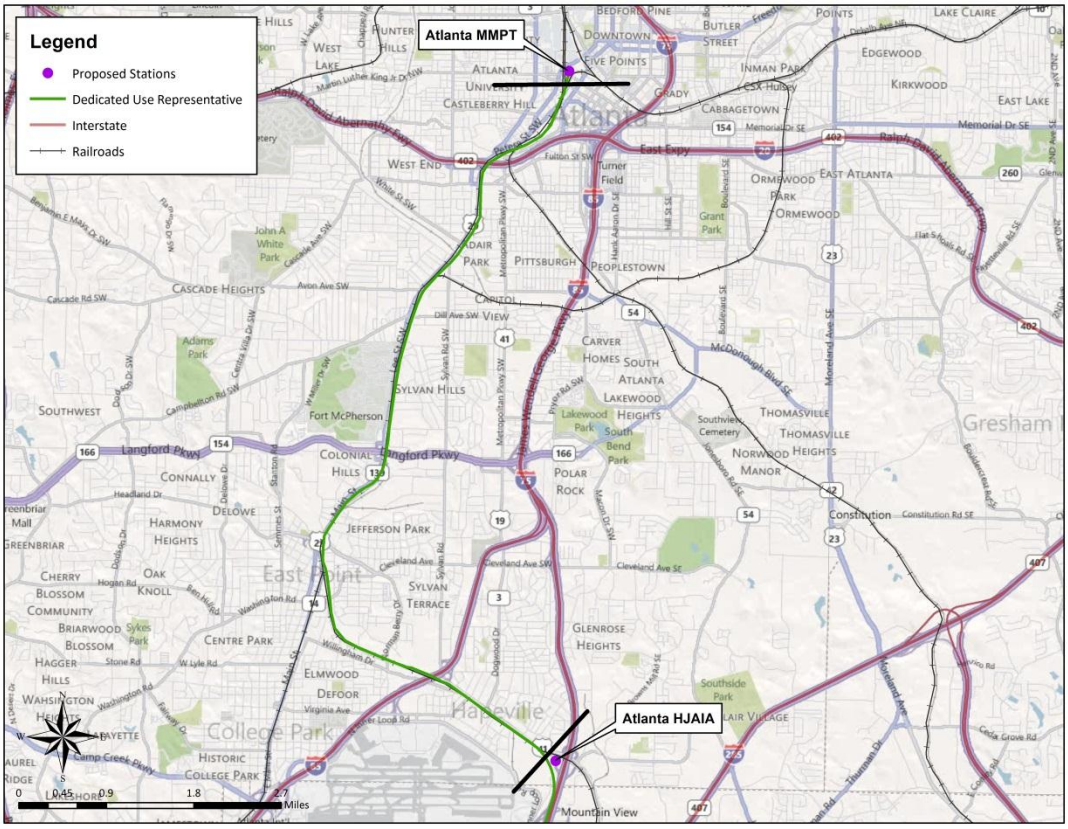


Table 6-11: Atlanta-Macon-Jacksonville Total Dedicated Use Capital Cost Segment One

Segment 1: 180-220 mph Dedicated Use – Atlanta MMPT to Atlanta Airport (H-JAIA)			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures &Track	$61,249,000	$18,375,000	$79,624,000
Stations, Terminals, Intermodal	$279,156,000	$83,747,000	$362,903,000
Support Facilities: Yards, Shops, Administration Buildings	$37,221,000	$11,166,000	$48,387,000
Sitework, R/W, Land	$195,601,000	$58,680,000	$254,281,000
Communications & Signaling	$16,711,000	$5,013,000	$21,724,000
Electric Traction	$90,398,000	$27,120,000	$117,518,000
Vehicles	-	-	-
Professional Services	$212,265,000	-	$212,265,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$892,601,000**	**$204,101,000**	**$1,096,702,000**
Cost Per Mile (8.5 Miles)			**$129,023,000**

Figure 6-9: Atlanta-Macon-Jacksonville Dedicated Use Segment Two

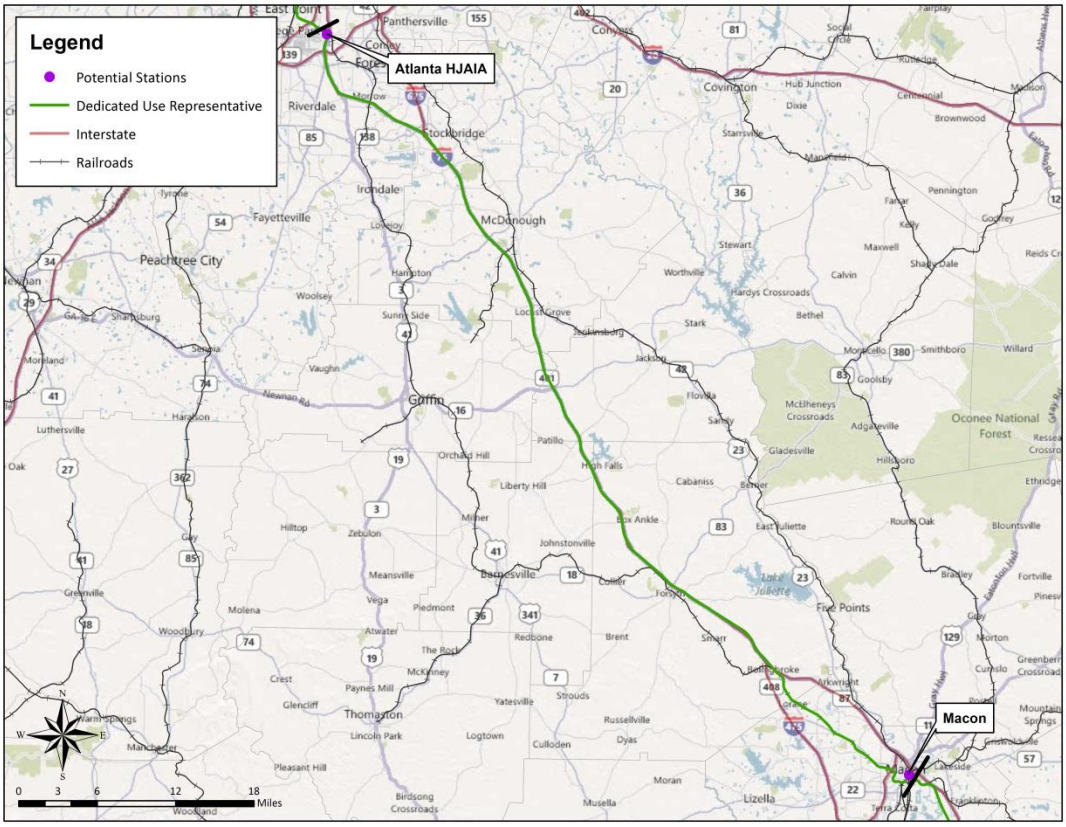


Table 6-12: Atlanta-Macon-Jacksonville Total Dedicated Use Capital Cost Segment Two

Segment 2: 180-220 mph Dedicated Use – Atlanta H-JAIA to Macon, GA			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$1,193,553,000	$358,066,000	$1,551,619,000
Stations, Terminals, Intermodal	$5,610,000	$1,683,000	$7,293,000
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$104,823,000	$31,447,000	$136,269,000
Communications & Signaling	$97,740,000	$29,322,000	$127,062,000
Electric Traction	$679,057,000	$203,717,000	$882,774,000
Vehicles	-	-	-
Professional Services	$649,204,000	-	$649,204,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$2,729,987,000**	**$624,235,000**	**$3,354,222,000**
Cost Per Mile (63.6 Miles)			**$52,739,000**

Figure 6-10: Atlanta-Macon-Jacksonville Dedicated Use Segment Three

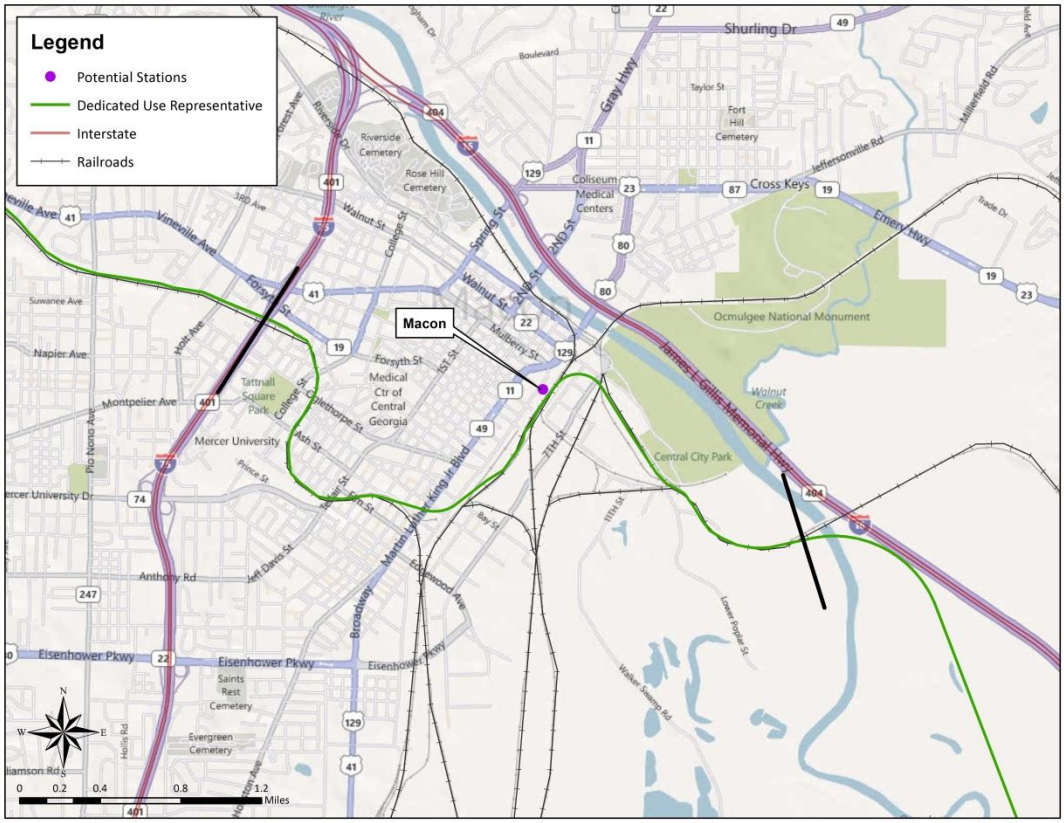


Table 6-13: Atlanta-Macon-Jacksonville Total Dedicated Use Capital Cost Segment Three

Segment 3: 180-220 mph Dedicated Use – City of Macon			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$118,456,000	$35,537,000	$153,993,000
Stations, Terminals, Intermodal	-	-	-
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W Land	$75,278,000	$22,584,000	$97,862,000
Communications & Signaling	$30,367,000	$9,110,000	$39,477,000
Electric Traction	$171,857,000	$51,557,000	$223,414,000
Vehicles	-	-	-
Professional Services	$123,539,000	-	$123,539,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$519,497,000**	**$118,788,000**	**$638,285,000**
Cost Per Mile (16.0 Miles)			**$39,892,000**

Figure 6-11: Atlanta-Macon-Jacksonville Dedicated Use Segment Four

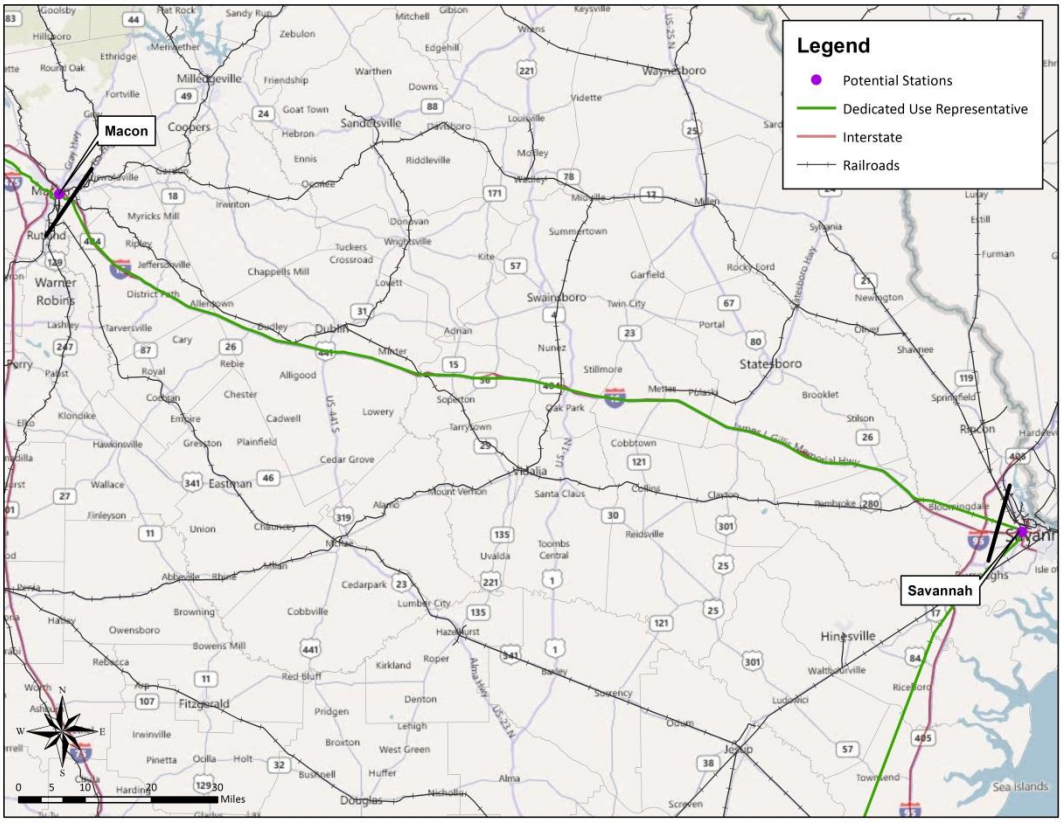


Table 6-14: Atlanta-Macon-Jacksonville Total Dedicated Use Capital Cost Segment Four

Segment 4: 180-220 mph Dedicated Use –Macon, GA to Savannah, GA			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$1,169,703,000	$350,911,000	$1,520,613,000
Stations, Terminals, Intermodal	$5,610,000	$1,683,000	$7,293,000
Support Facilities: Yards, Shops, Administration Buildings	$6,204,000	$1,861,000	$8,065,000
Sitework, R/W, Land	$163,539,000	$49,062,000	$212,600,000
Communications & Signaling	$217,935,000	$65,380,000	$283,315,000
Electric Traction	$1,514,121,000	$454,236,000	$1,968,358,000
Vehicles	-	-	-
Professional Services	$960,059,000	-	$960,059,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$4,037,171,000**	**$923,133,000**	**$4,960,304,000**
Cost Per Mile (141.7 Miles)			**$35,005,000**

Figure 6-12: Atlanta-Macon-Jacksonville Dedicated Use Segment Five

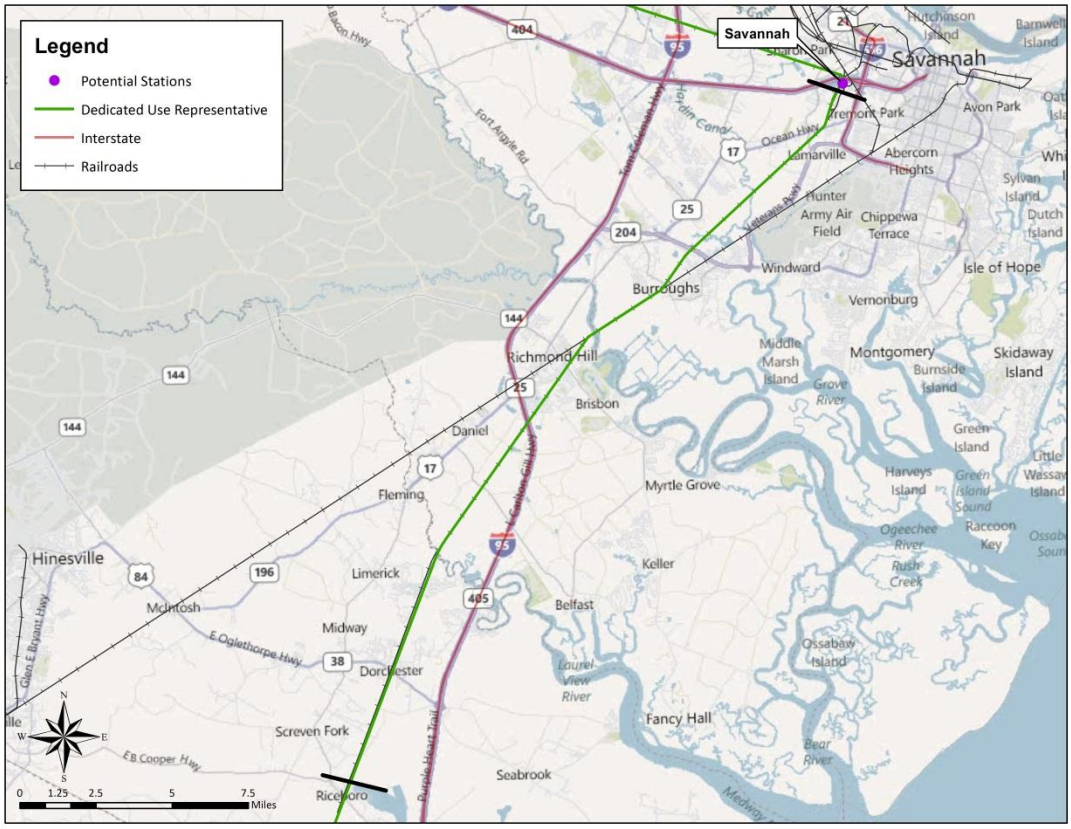


Table 6-15: Atlanta-Macon-Jacksonville Dedicated Use Capital Cost Segment Five

Segment 5: 180-220 mph Dedicated Use – Savannah, GA to Riceboro, GA			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$216,395,000	$64,919,000	$281,314,000
Stations, Terminals, Intermodal	-	-	-
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$260,199,000	$78,060,000	$338,258,000
Communications & Signaling	$77,367,000	$23,210,000	$100,578,000
Electric Traction	$484,904,000	$145,741,000	$630,375,000
Vehicles	-	-	-
Professional Services	$324,126,000	-	$324,126,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$1,362,991,000**	**$311,930,000**	**$1,674,651,000**
Cost Per Mile (45.4 Miles)			**$36,887,000**

Figure 6-13: Atlanta-Macon-Jacksonville Dedicated Use Segment Six

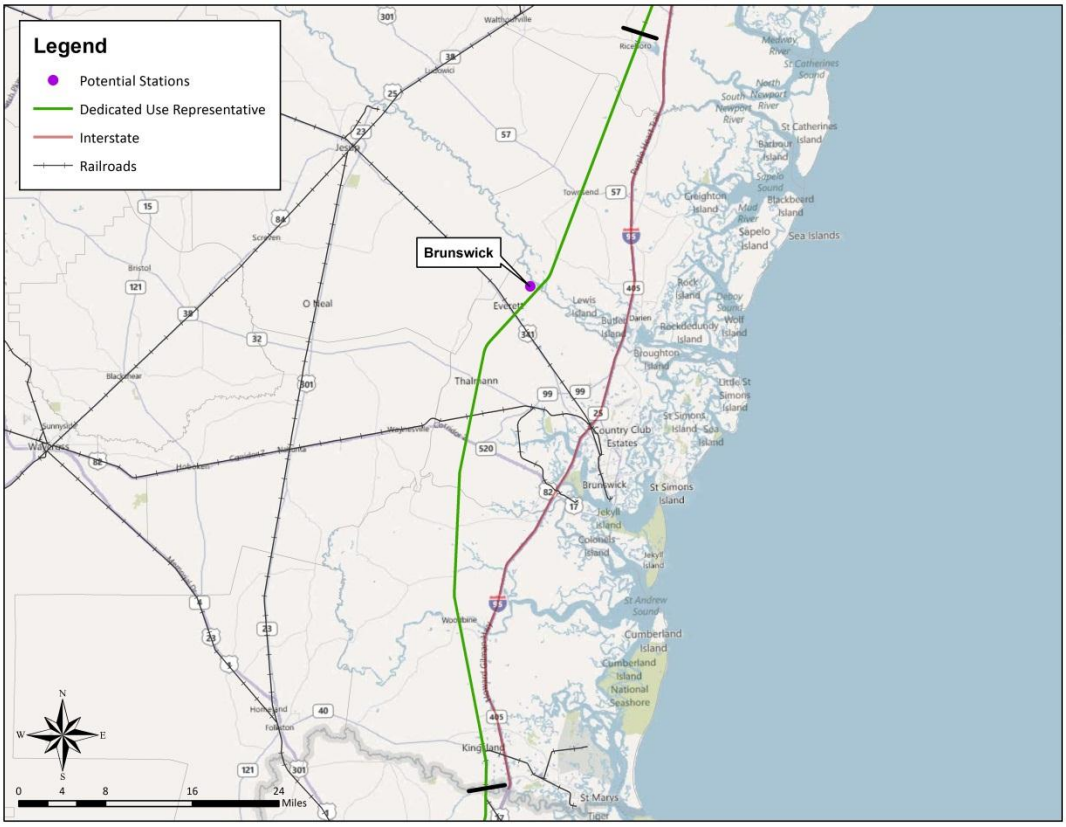


Table 6-16: Atlanta-Macon-Jacksonville Dedicated Use Capital Cost Segment Six

Segment 6: 180-220 mph Dedicated Use – Riceboro, GA to GA/FL Boarder			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$338,924,000	$101,677,000	$440,601,000
Stations, Terminals, Intermodal	$5,610,000	$1,683,000	$7,293,000
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$214,497,000	$64,349,000	$278,846,000
Communications & Signaling	$112,336,000	$33,701,000	$146,036,000
Electric Traction	$780,462,000	$234,139,000	$1,014,600,000
Vehicles	-	-	-
Professional Services	$452,970,000	-	$452,970,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$1,904,799,000**	**$435,549,000**	**$2,340,348,000**
Cost Per Mile (73.0 Miles)			**$32,059,000**

Figure 6-14: Atlanta-Macon-Jacksonville Dedicated Use Segment Seven

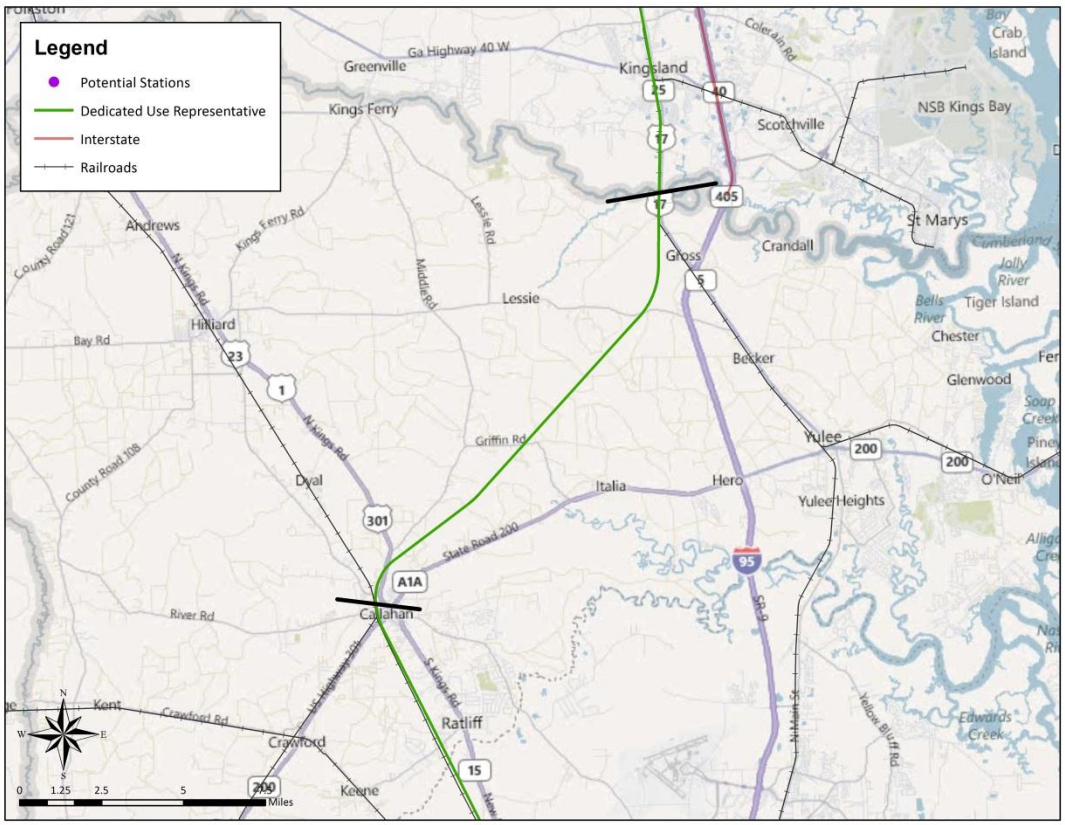


Table 6-17: Atlanta-Macon-Jacksonville Total Dedicated Use Capital Cost Segment Seven

Segment 7: 180-220 mph Dedicated Use – GA/FL Boarder to Callahan, FL			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$89,197,000	$26,759,000	$115,956,000
Stations, Terminals, Intermodal	-	-	-
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$61,143,000	$18,343,000	$79,486,000
Communications & Signaling	$34,959,000	$10,488,000	$45,446,000
Electric Traction	$242,879,000	$72,864,000	$315,743,000
Vehicles	-	-	-
Professional Services	$133,592,000	-	$133,592,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$561,770,000**	**$128,454,000**	**$690,224,000**
Cost Per Mile (22.7 Miles)			**$30,406,000**

Figure 6-15: Atlanta-Macon-Jacksonville Dedicated Use Segment Eight

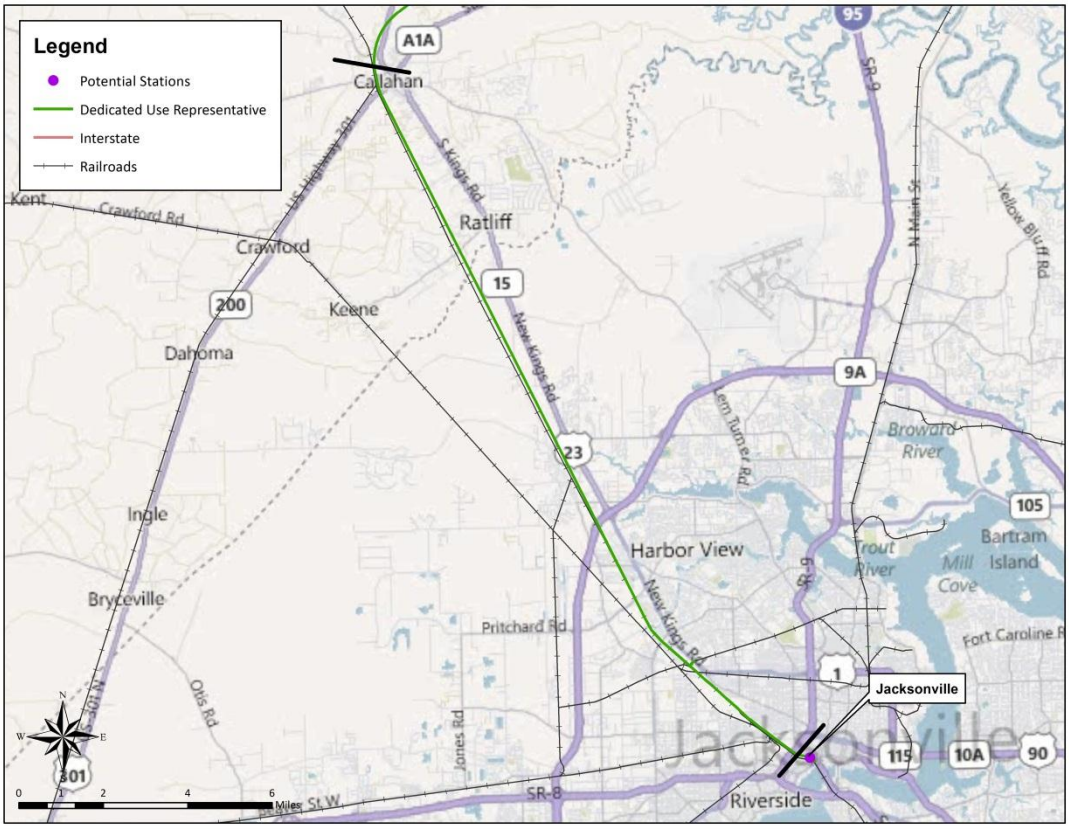


Table 6-18: Atlanta-Macon-Jacksonville Dedicated Use Capital Cost Segment Eight

Segment 8: 180-220 mph Dedicated Use – Callahan, FL to Jacksonville, FL			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$143,493,000	$43,048,000	$186,540,000
Stations, Terminals, Intermodal	$43,424,000	$13,027,000	$56,452,000
Support Facilities: Yards, Shops, Administration Buildings	$6,204,000	$1,861,000	$8,065,000
Sitework, R/W, Land	$147,120,000	$44,136,000	$191,256,000
Communications & Signaling	$30,360,000	$9,108,000	$39,468,000
Electric Traction	$210,930,000	$63,279,000	$274,209,000
Vehicles	-	-	-
Professional Services	$181,437,000	-	$181,437,000
Unallocated Contingencies	N/A	N/A	N/A
Finance Charges	N/A	N/A	N/A
Total Cost	**$762,968,000**	**$174,459,000**	**$937,427,000**
Cost Per Mile (19.7 Miles)			**$47,585,000**

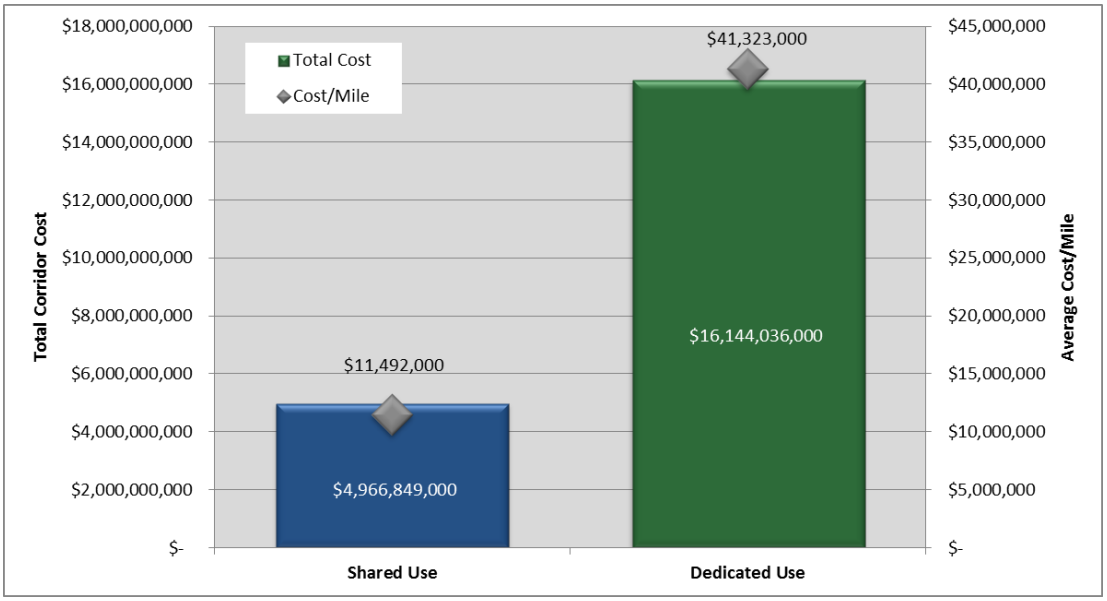
6.1.3 Comparing Capital Costs

Table 6-19 and Figure 6-16 illustrate the total capital cost differences between Shared Use and Dedicated Use technologies. While it is evident that Shared Use total cost is far less than Dedicated Use, the Dedicated Use ridership and revenue (refer back to Chapter 5) is substantially higher.

Table 6-19: Total Capital Cost by Route/Technology

	Shared Use	Dedicated Use
Total Cost	$4,966,849,000	$16,144,036,000
Cost per Mile	$11,492,000	$41,323,000

Figure 6-16: Total Capital Cost by Route/Technology



The last item that will determine the feasibility of the capital costing will be funding and financing opportunities. Section V: Chapter 3 outlines some potential funding and financing sources; however, additional funding analysis will be necessary in the future to understand realistic funding levels at the federal, state and local levels.

6.2 Operating and Maintenance Costs

For the Atlanta-Macon-Jacksonville Corridor, two technologies were assessed as a part of the feasibility study, as mentioned in previous sections:

- Shared Use of the existing NS, GCR and CSXT rail lines using tilting diesel technology, operating up to 110 mph with grade crossings; and
- Doubled-tracked, Dedicated Use high-speed corridor using 220 mph electric rail technology on a fully grade-separated route.

Also as previously mentioned, operating and maintenance costs were separated into fixed costs and variable costs. Table 6-20 outlines the fixed and variable cost categories used for this feasibility analysis.

Table 6-20: Atlanta-Macon-Jacksonville Fixed and Variable Cost Categories

Fixed Cost Categories	Variable Cost Categories
• Stations • Track and Electrification Maintenance • Administration and Management	• Train Crew • On-Board Services • Equipment Maintenance • Fuel/Energy • Insurance • Call Center • Credit Card/Travel Agency Commissions

6.2.1 90-110 MPH SHARED USE

The fixed and variable costs for the Shared Use corridor are substantially less than Dedicated Use due to less required inspection, maintenance and repair on track and lower ridership levels (thus creating lower variable costs). Table 6-21 provides the operating and maintenance cost estimates for 2021 (start-up), 2030 and 2040 (feasibility planning horizon).

Table 6-21: Atlanta-Macon-Jacksonville Shared Use O&M Costs (2010$ millions)

	2021	2030	2040	Total (2021-2040)
Variable O&M Costs	$60.1	$62.8	$65.6	$1,320
Fixed O&M Costs	$35.6	$35.6	$35.6	$747.6
Total O&M Costs	**$95.7**	**$98.5**	**$101.2**	**$2,067**

6.2.2 180-220 MPH SHARED USE

The Dedicated Use operating and maintenance costs are higher than Shared Use due to the track electrification maintenance as well as higher ridership. Table 6-22 provides the operating and maintenance costs for 2021,2030 and 2040.

Table 6-22: Atlanta-Macon-Jacksonville Dedicated Use O&M Costs (2010$ millions)

	2021	2030	2040	Total (2021-2040)
Variable O&M Costs	$109.1	$113.9	$118.7	$2,392
Fixed O&M Costs	$80.9	$80.9	$80.9	$1,699
Total O&M Costs	**$190.1**	**$194.8**	**$199.6**	**$4,090**

7 CORRIDOR EVALUATION

7.1 FEASIBILITY MEASUREMENTS

The study utilized two feasibility measurements for the Atlanta-Macon-Jacksonville Corridor (operating ratios and benefit-cost calculations). The feasibility analysis was done for both Shared Use and Dedicated Use routes. Refer back to Section I: Chapter 3 for detailed methodology information on these measures.

A key element of the feasibility analysis is an assessment of both public and private benefits. To test the "franchisability" of a corridor as a public-private partnership, the analysis uses the "operating ratio" of revenues divided by operating costs. A service with a positive operating ratio greater than 1.0 generates an operating surplus. A positive operating ratio gives evidence of a strong, self-supporting operating system that is less likely to need operating subsidies and reduces the operating risk for the owner, investor and operator.

The benefit-cost analysis identifies all costs (capital, operating and maintenance) and all benefits (fare revenues, on-board service revenue, consumer surplus and external resources) and monetizes the value of each to determine a benefit-cost ratio. Similar to the operating ratio, a benefit-cost ratio of greater than 1.0 is desirable.

It should be mentioned that for both operating ratios and benefit-cost analyses, the standard period for assessing discounted cash flows is 25 to 30 years. Therefore, for the purposes of the feasibility analyses, the horizon year was extended from 2040 to 2050 to account for the three percent (3%) discount rate.

In setting up the feasibility evaluation, three scenarios were developed to show the impact of a range of ridership, revenue, capital and operating cost estimates typically encountered in a feasibility-level analysis. Unadjusted base forecasts for ridership, revenue, capital and operating costs were used for the Conservative Scenario. Base ridership and revenue estimates were increased for Dedicated Use corridors to establish the Intermediate and Optimistic Scenarios.[32] Operating costs were adjusted by the appropriate ridership drivers. Capital cost estimates were

[32] Ridership adjustments for Intermediate and Optimistic Scenarios were only made for Dedicated Use corridor 180-220 mph electrified, steel-wheel and Maglev technologies (Maglev in Atlanta-Louisville corridor only) based on a peer review of regional and national high speed rail corridor studies. No scenario ridership adjustment was made for Shared Use corridor diesel-electric technology results based on a peer review of other shared-use corridor studies.

adjusted downward in the Intermediate and Optimistic Scenarios for all technologies.

The three scenarios are intended to capture and illustrate the relatively wide range of estimates at the feasibility-level of study. As corridors are deemed feasible for further evaluation, future studies will provide greater detail in the analysis of ridership, revenues and costs, narrowing the range of estimates. Refer back to Section I: Chapter 3 for more detailed information on the development of these evaluation scenarios.

7.1.1 90-110 MPH SHARED USE

7.1.1.1 Operating Ratio

Table 7-1 provides the operating ratio for the Atlanta-Macon-Jacksonville Shared Use route. Operating revenues include both farebox revenue and on board service revenue. Operating and maintenance costs include both fixed and variable costs (refer back to Chapter 6). Separate ridership and revenue scenarios were not developed for Shared Use routes. Therefore, Table 7-1 only presents the "Conservative" scenario using base case ridership and revenue forecasts. Revenues, costs, operating surplus/deficits and operating ratio are forecasted for 2021, 2030 and 2040 to understand the overall performance of the Shared Use route. The 90-110 mph Shared Use route generates an operating ratio greater than 1.0 providing a revenue surplus for all forecast years.

Table 7-1: Atlanta-Macon-Jacksonville Shared Use Operating Ratio (2010$ millions)

	2021	2030	2040
Total Operating Revenue	**$120.1**	**$146.0**	**$175.2**
Farebox Revenues	$110.0	$133.9	$160.7
Ancillary Revenues	$1.1	$1.3	$1.6
On-Board Services	$89.0	$10.7	$12.9
Total Operating Costs	**$95.7**	**$98.5**	**$101.2**
Fixed Operating Costs	$35.6	$35.6	$35.6
Variable Operating Costs	$60.1	$62.8	$65.6
Operating Surplus (Deficit)	**$24.4**	**$47.5**	**$74.0**
Operating Ratio	**1.25**	**1.48**	**1.73**

7.1.1.2 Benefit-Cost

The study includes Shared Use route capital cost for use in the benefit-cost analysis, since base-case capital costs are substantial and include a 30 percent contingency.

Table 7-2 outlines the benefit-cost results for each scenario. More details are included in Appendix G. The first scenario includes the Conservative (base) ridership and revenue as well as capital costs with the 30 percent contingency. Under the Intermediate scenario, the capital cost contingency is reduced to 15 percent, and the Optimistic scenario removes the contingency completely.

Table 7-2: Atlanta-Macon-Jacksonville Shared Use Benefit-Cost Analysis (2021-2050)

	Conservative	Intermediate	Optimistic
Shared Use	0.92	1.00	1.07

The Shared Use service alternative has a benefit cost ratio between 0.92 and 1.07, with an Intermediate value of 1.00. This corridor shows the best Shared Use benefit-cost results of the three study corridors due to having the lowest improvement costs per mile. This results from the use of the low density NS S-Line between Atlanta and Macon and the low density GCR between Macon and Savannah. From Savannah to Jacksonville, the abandoned CSXT S-Line right-of-way has good geometry, resulting in the lowest capital costs per mile of any of the Shared Use routes. If the Atlanta-Macon-Jacksonville Corridor were operated as a part of a larger Atlanta Hub System, the benefit-cost ratio will improve. Refer to Section V: Chapter 2 for more detailed information on the feasibility of an integrated high-speed rail system.

7.1.2 180-220 MPH DEDICATED USE

7.1.2.1 Operating Ratio

Table 7-3 displays operating ratios for the Atlanta-Macon-Jacksonville Dedicated Use route. Ridership, revenue and capital cost scenarios were developed for all dedicated routes. Refer back to Section I: Chapter 3 for detailed methodologies for the Conservative, Intermediate and Optimistic sensitivity scenarios.

The Conservative scenario uses base-case ridership and revenue forecasts and operating and maintenance costs. The Intermediate scenario includes moderately increasing revenue and operating costs; and Optimistic illustrates aggressive revenues and their associated operating costs. The Intermediate and Optimistic scenarios were developed based on benchmarking this feasibility study with other high-speed ground transportation studies both within the region and nationally.

Table 7-3: Atlanta-Macon-Jacksonville Dedicated Use Operating Ratio

	Conservative	Intermediate	Optimistic
Dedicated Use			
2021	1.14	1.83	2.04
2030	1.35	2.00	2.17
2040	1.56	2.15	2.29

Similar to the Shared Use route, the Dedicated Use route produces operating ratios greater than 1.0 for all scenarios and forecast years. The operating ratio for the first year of service in 2021 is greater than 1.0 even under the Conservative ridership and revenue forecast scenario, which makes the route potentially attractive for private investment for a franchise operator.

7.1.2.2 Benefit-Cost

Table 7-4 outlines the three benefit-cost scenarios for the Dedicated Use route and the three scenarios outlined in section 7.1.2.1. Variations in capital costs were also included in the calculations. The Conservative scenario uses base-case ridership and revenue as well as base-case capital and operating and maintenance costs. The Intermediate scenario is based on a 75 percent increase in ridership and revenue and a capital cost contingency of 15 percent rather than 30 percent. The Optimistic scenario increases ridership and revenue by 100 percent over the Conservative scenario and eliminates the capital cost contingency.

Table 7-4: Atlanta-Macon-Jacksonville Dedicated Use Benefit-Cost Analysis (2021-2050)

	Conservative	Intermediate	Optimistic
Dedicated Use	0.49	0.93	1.12

The Dedicated Use route produces benefit-cost ratios between 0.49 and 1.12, with an Intermediate value of 0.93. This indicates that high-speed rail service is potentially feasible in the Optimistic case, which suggests that the Atlanta-Macon-Jacksonville Corridor should continue to be evaluated in future environmental and engineering studies. Future studies should also consider the benefits of an integrated Atlanta-Hub system. Refer to Section V: Chapter 2 for more details on the potential for an Atlanta-hub high-speed rail system.

7.1.3 KEY FINDINGS

The Shared Use and Dedicated Use alternatives perform well under the operating ratio analysis, resulting in ratios well above 1.0 for all three scenarios. This indicates strong operations with lower associated risks to owners and operators. Positive

operating ratios indicate an ability to pay down debt services and bonds, and can lead to reduced reliability on public investment subsidies. Additionally, operating surpluses on an annual basis may finance a "rail maintenance fund", requiring less investment in future years for capital maintenance costs. Positive operating ratios will likely spark private sector investment interest in the corridor, providing additional funding opportunities.

The benefit-cost results show ratios greater than 1.0 for both Shared Use and Dedicated Use for the Optimistic scenario and well as for both the Shared Use Intermediate and Optimistic scenarios.

It should be noted that this feasibility study includes very high-level data and estimates. A more detailed corridor analysis with more definitive study boundaries, travel demand models, and cost estimates, could yield a better benefit-cost evaluation narrowing the range of estimates.

Taking into account the operating ratios and benefit-cost ratios, the study recommends that the results of this analysis be used to set priorities for future state planning and corridor development activities. In particular, this study finds that high speed rail service is feasible in the Atlanta-Macon-Jacksonville Corridor. It is further recommended that a Tier 1 NEPA Document and Service Development Plan be pursued for high-speed rail service in the corridor.

The study developed an additional "Hybrid" High Performance scenario, discussed in detail in Chapter 8 that further supports the above conclusions. This alternative has the potential to reduce initial capital costs and positively impact the benefit-cost analysis while maintaining the ability to achieve higher speeds along the corridor.

8 HYBRID HIGH PERFORMANCE SCENARIO

One of the results from the Shared Use and Dedicated Use analyses was the introduction of a "hybrid" alternative to offset a portion of the initial capital costs (compared to the Dedicated Use) while improving the travel speeds (compared to the Shared Use), thus positively impacting the operating ratio and benefit-cost analysis. While some analyses were completed for the Hybrid High Performance scenario, there was insufficient data available for a full analysis to be completed. Therefore, more performance and financial details regarding the Hybrid High Performance scenario will need to be explored through the NEPA process. This feasibility study intends to introduce the concept of the Hybrid High Performance scenario and provide a high-level feasibility estimates based on the results found during the Shared Use and Dedicated Use analyses. These estimates include:

- Operational estimates;
- Ridership and revenue;
- Capital Costs; and
- Operating and Maintenance Costs.

From these estimates, the study calculates the high-level operating ratio and Benefit-Cost ratio to compare against the previously identified Shared Use and Dedicated Use ratios to determine if the Hybrid High Performance scenario should be included in a future NEPA analysis.

The Hybrid High Performance scenario that provides a level of service between Shared Use and Dedicated Use, utilizing fully grade-separated track geometry with no shared-use freight operations. However, rather than electrified high-speed technology, the Hybrid High Performance scenario would implement Diesel-Electric Tilt Technology initially, and when ridership and revenue increase in later operating years, it can be upgraded to a fully-electrified system, obtaining travel speeds of 220 mph or more.

One of the main benefits of the Hybrid High Performance scenario includes significantly lower capital costs compared to the 180-220 mph electrified technology assumed for the Dedicated Use route. However, the Hybrid High Performance scenario still has the potential to reach speeds of up to 130 mph. The study estimated that the Hybrid High Performance scenario would only take approximately 1 hour, 7 minutes longer than the electrified train on the Dedicated Use route. The 130 mph Hybrid High Performance scenario is approximately 1 hour, 29 minutes faster than auto travel by interstate from Atlanta to Jacksonville (Table 8-1).

Table 8-1: Atlanta-Macon-Jacksonville Operations Comparison

Segment	Shared Use	Dedicated Use	Hybrid High Performance
Rail Distance (miles)	408.7	368.1	368.1
Travel Time (hr : min)	5:20	2:48	3:55
Average Speed (mph)	77	131	94
Frequency (round trips/day)	8	14	14
Estimated Auto Time (hr : min)	5:24	5:24	5:24
Travel Time – Auto Time	-0:05	-1:29	-2:36

This chapter outlines the potential revenues, costs, and feasibility results of the Hybrid High Performance scenario. However, it should be mentioned that these estimates do not incorporate a future upgrade to a fully-electrified corridor, as those costs will only be incurred if ridership and revenue warrant the upgrade in later years.

8.1 Ridership and Revenue

To estimate ridership and revenue, the study calculated high-level estimates based on the decrease in vehicle speed as compared to the Dedicated Use. Travel time, speed profiles and train frequencies were adjusted as necessary.

Table 8-2: Atlanta-Macon-Jacksonville Hybrid Operating Plan

	Hybrid High Performance Scenario
Travel Time	3 hour, 55 minutes
Train Frequency	14 round trips per day
Train Capacity	250 seats per train

The study calculated that the ridership and revenue would decrease by approximately 19.2 percent from the Dedicated Use ridership and revenue forecasts (refer to Appendix G). This decrease in ridership was derived based on the slower average speed of the Hybrid and longer trip times. Table 8-3 shows the estimated ridership and revenue for the Hybrid High Performance scenario for the three sensitivity levels: Conservative, Intermediate and Optimistic.

Table 8-3: Atlanta-Macon-Jacksonville Hybrid High Performance Scenario Ridership and Revenue (in millions and 2010$)

Year	Conservative Scenario		Intermediate Scenario		Optimistic Scenario	
	Ridership	Revenue	Ridership	Revenue	Ridership	Revenue
2021	2,061,000	$146.4	3,606,000	$188.1	4,122,000	$135.0
2030	2,402,000	$176.5	4,203,000	$136.5	4,804,000	$156.0
2040	2,781,000	$210.0	4,866,000	$156.9	5,561,000	$179.3
Total	48,414,000	$3,564	84,724,000	$6,237	96,827,000	$7,128

8.2 Costs

As previously mentioned, the capital costs, operating costs, and maintenance costs will be significantly less than the Dedicated Use route due to the elimination of the track electrification. This also results in decreased in vehicle costs since diesel vehicles are also less expensive than fully electrified vehicles. Table 8-4 outlines the Hybrid High Performance scenario capital cost estimates by major FRA SCC. Again, this scenario uses the Dedicated Use representative route and diesel, steel-wheel technology. Appendix F includes the detailed sub-category costs for the Hybrid High Performance scenario.

Table 8-4: Atlanta-Macon-Jacksonville Total Hybrid Capital Cost by SCC Category (2010$)

Costing Category		Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures & Track	$3,085,102,000	$925,531,000	$4,010,632,000
20	Stations, Terminals, Intermodal	$339,411,000	$101,823,000	$441,234,000
30	Support Facilities: Yards, Shops, Administration Buildings	$49,628,000	$14,888,000	$64,516,000
40	Sitework, Right-of-Way, Land, Existing Improvements	$1,222,198,000	$366,659,000	$1,588,858,000
50	Communications & Signaling	$617,774,000	$185,332,000	$803,106,000
60	Electric Traction	-	-	-
70	Vehicles	$260,000,000	$78,000,000	$338,000,000
80	Professional Services	$1,658,003,000	-	$1,658,003,000
90	Unallocated Contingencies	-	-	-
100	Finance Charges	-	-	-
TOTAL COST		**$7,232,116,000**	**$1,672,233,000**	**$8,904,349,000**
TOTAL COST PER MILE (368.1 Miles)				**$22,792,000**

Operating and maintenance costs will also be reduced from the Dedicated Use estimates due to less required track inspection and maintenance. Table 5-8 illustrates the estimate Hybrid High Performance scenario operating and maintenance costs from 2020 through 2040.

Table 8-5: Atlanta-Macon-Jacksonville Hybrid O&M Costs (2010$ millions)

	2021	2030	2040	Total (2021-2040)
Variable O&M Costs	$114.6	$118.4	$122.3	$2,487
Fixed O&M Costs	$50.2	$50.2	$50.2	$1,054
Total O&M Costs	**$164.7**	**$168.6**	**$172.4**	**$3,541**

8.3 FEASIBILITY EVALUATION

Similar to the Shared Use and Dedicated Use routes, the study calculated an operating ratio and benefit-cost ratio for the Hybrid High Performance scenario. Table 8-6 and Table 8-7 Illustrate the results of these analyses for the Conservative, Intermediate and Optimistic scenarios.

Table 8-6: Atlanta-Macon-Jacksonville Hybrid Operating Ratio

	Conservative	Intermediate	Optimistic
Hybrid High Performance			
2021	1.03	1.66	1.86
2030	1.21	1.95	2.17
2040	1.41	2.18	2.39
Dedicated Use			
2021	1.14	1.83	2.04
2030	1.35	2.00	2.17
2040	1.56	2.15	2.29

This positive operating performance is largely due to lower operating cost due to single tracking and the avoidance of electrification maintenance costs as well as lower operating costs associated with fewer frequencies (14 round trips per day).

Table 8-7: Atlanta-Macon-Jacksonville Hybrid Benefit-Cost Analysis (2021-2050)

	Conservative	Intermediate	Optimistic
Hybrid High Performance	0.63	1.21	1.48
Dedicated Use	0.49	0.93	1.12

The Hybrid High Performance scenario produces benefit-cost ratios of 0.63 to 1.48 with an Intermediate case of 1.21. The Hybrid High Performance scenario shows the best potential for implementation, especially if combined with an integrated hub system (refer to Section V: Chapter 2).

8.3.1.1 Corridor Truncation Analysis

In addition to the Hybrid High Performance scenario analysis, the study also evaluated the feasibility levels of a truncated version of the Atlanta-Macon-Jacksonville Corridor at Savannah to determine the impact it might have on the viability of implementing the project. This analysis produced operating ratios in the range of 0.90 to 1.80 with an Intermediate case of 1.61. While this indicates that a truncated Savannah corridor might cover its operating cost, the result is substantially worse than the original Atlanta-Macon-Jacksonville Corridor. Additionally, the truncation produced a negative benefit-cost ratio ranging from 0.35 to 0.90. It appears that Jacksonville is generating approximately two-thirds (2/3) of the ridership for the whole corridor, as compared to Savannah with one-third (1/3) of total ridership. Based on these results, the study does not recommending further investigation of a truncated corridor.

8.4 PHASING SCENARIOS FOR CAPITAL COSTS

This discussion focuses on reducing capital costs for the initial implementation of high-speed rail within the Atlanta-Macon-Jacksonville Corridor. The Hybrid High Performance scenario can be incrementally improved to 180-200 mph Dedicated Use service as corridor population trends results in higher ridership and demand for service improvements.

By phasing the corridor, these initially capital costs can also be phased in order to efficiently and effectively implement high-speed rail in order to meet current and future demands while maintaining reasonable capital cost expenditure.

Phase I: Atlanta – Macon, GA

Phase I implementation of the passenger rail service proposes to connect the Atlanta MMPT to Macon, GA, a distance of approximately 85 miles and includes station stops at Atlanta MMPT, H-JAIA, and Macon, GA. This route would follow the NS S-Line, until intersecting with I-75, and follow the interstate right-of-way into Macon, where it will again, utilize the existing freight right-of-way to access the Macon station.

Phase I would likely have significant ridership, as it would serve a major travel corridor (I-75). Additionally, this corridor is included in the Georgia State Rail Plan as

a proposed commuter rail corridor. Refer to Section 8.4.1 for additional details regarding the potential for commuter rail options within this corridor.

Phase II: Macon – Savannah, GA

Phase II implementation of the high-speed passenger rail service proposes to connect Macon to downtown Savannah, a distance of approximately 148 miles. This route would follow the I-16 right-of-way and does not encounter significant natural barriers due to the minimal topographic variance and little curvature in the existing interstate right-of-way.

Phase II would also draw significant ridership between Savannah and Macon by serving one of the largest cities in the state as well as a number of other ridership attractions such as the Georgia Port, military installations and universities and colleges. Similar to Phase I, implementation, this segment could also benefit from proposed commuter rail service, in which more details are provided in Section 8.4.1.

Phase III: Savannah, GA – Jacksonville, FL

Phase III will complete the implementation of high-speed rail along the Atlanta-Macon-Jacksonville Corridor, with an approximate distance of 136 miles. This segment includes station stops at Brunswick, GA and downtown Jacksonville, FL.

8.4.1 Additional Implementation Options – Commuter Rail

Commuter rail opportunities in all four cities along the corridor could serve as a first step in implementing the high-speed rail corridor.

The Georgia State Rail plan outlines a number of potential intercity and commuter rail opportunities along the Atlanta-Macon-Jacksonville portion of the corridor. The plan includes the following projects:

- **Macon – Atlanta:** As previously mentioned in Section III of this report, a commuter rail line is proposed for the Atlanta-Macon corridor. This corridor proposes improvements along the existing NS S-Line and services Atlanta, Griffin and Macon. Capital costs are estimated at $235 million and 275,000 passengers are expected in 2030. The FTA issued a FONSI along the NS S-Line and the corridor has been included in the long-range transportation plans for both the state as well as ARC. Agreements between the passenger rail operator and NS are still needed for the project to move into the implementation phases.
- **Savannah – Macon – Atlanta:** This commuter rail was proposed to link Atlanta and Savannah and to high-speed rail lines that pass through both cities. Since this time, the proposed high-speed rail corridors have changed

slightly, with the addition of this study's high-speed corridor linking Atlanta and Savannah. This intercity service proposes to utilize the NS line to Jesup and the CSX line from Jesup to Savannah with station in Dodge, Wayne and Chatham counties, or utilize the GCR with stops in Toombs and Chatham Counties. The capital costs for the commuter rail is estimated at $326 million and ridership is expected around 550,000 passengers in 2030. It is expected that this service would begin shortly after the opening of the Macon-Atlanta commuter operation.

- **Jacksonville Intercity Extension:** This project proposes connecting the commuter rail service from Savannah to Jacksonville utilizing the CSX line between Jesup and Jacksonville. It is proposed that this service would open shortly after the Savannah segment opens. Capital costs are estimated at $149 million with approximately 161,000 passengers in 2030.

All three of these commuter rail projects connect the four major cities along the high-speed rail corridor, helping to boost ridership and revenue for the corridor. It is possible that once high-speed rail service is initiated, the commuter rail service could be minimized to provide more frequent trips along shorter distances, allowing the high-speed rail system to only provide express intercity service with faster travel times between the major city destinations.

8.5 CONCLUSION

Initial investigation into the Hybrid High Performance scenario indicates that an incremental approach to high-speed rail may provide significant advantages in the Atlanta-Macon-Jacksonville Corridor both in terms of reducing initial capital cost requirement and increasing benefit-cost ratios.

The study used high-level estimates for revenue and costs associated with the Hybrid High Performance scenario. Therefore, a more detailed analysis of this alternative is needed to make definitive conclusions regarding the feasibility of the Hybrid High Performance scenario. The study recommends that the Hybrid High Performance scenario be included in the next phase of the passenger rail planning analysis as a viable technology alternative for passenger rail within the Atlanta-Macon-Jacksonville Corridor.

SECTION IV:

ATLANTA-CHATTANOOGA-NASHVILLE-LOUISVILLE

1 EXISTING CONDITIONS AND BACKGROUND

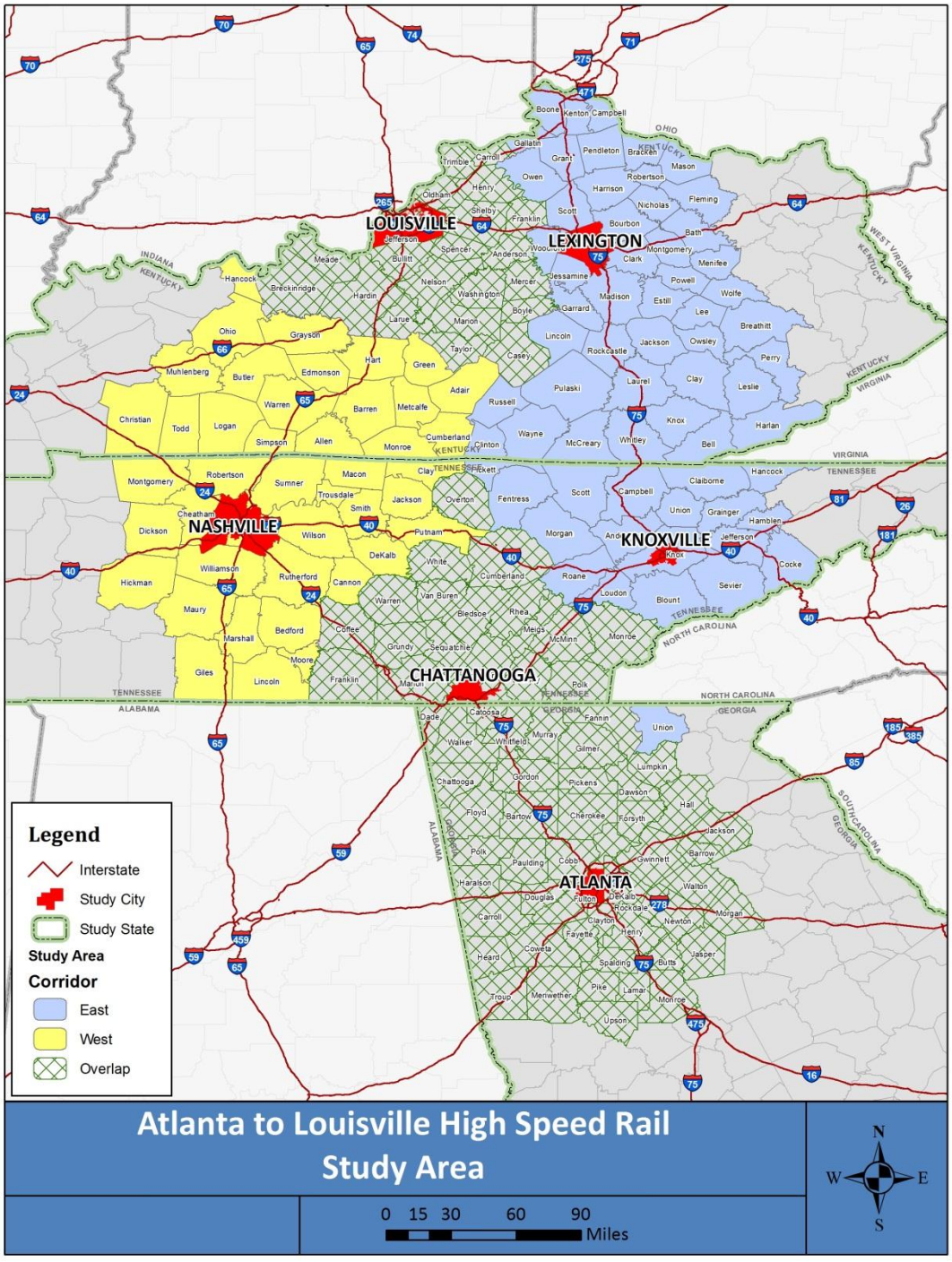
To estimate the potential for high-speed rail in the Atlanta-Chattanooga-Nashville-Louisville Corridor, and the value of providing the service, a baseline of existing conditions data was collected and documented. This data was used to develop potential routes and future conditions within each of the corridors. Existing conditions can include a variety of factors and characteristics. For the purposes of this feasibility study, the existing conditions include evaluated alternatives, population, demographics, and socioeconomic characteristics, employment patterns, land use patterns, transportation systems, major corridor features and characteristics, and environmentally critical areas were collected for the study area.

A table illustrating the characteristics of each of the evaluated alternatives can be seen in Appendix C. Each of the proposed alternatives was subject to a technical review by the project study as well as input from key stakeholders to determine the representative routes for the corridor.

The representative routes for the Atlanta-Chattanooga-Nashville-Louisville Corridor will advance onto the next phase of the planning process. It should be noted that this route is not a preferred route for the corridor, but rather, is an route that can represent the overall feasibility of the corridor. If this corridor is determined feasible from this representative route, it will be necessary in the future to conduct an alternatives analysis to determine a preferred route.

The technical review included an exploration of the west and east routes following the existing interstates (I-75, I-24, and I65) and railroad routes (CSXT, NS and R.J. Corman) during the initial review and analysis of the preliminary route alternatives connecting Atlanta, GA to Louisville, KY. This process helped identify the most suitable alternatives based on the existing conditions of the project area. Although engineering, design, topographic, right-of-way acquisitions and costs are major considerations, social and demographic characteristics play an important role in the review and analysis process as well. Open source data sets were used to assess the characteristics of the population, employment centers, land use, and environmentally sensitive areas within the study corridor. The study corridor was delineated by generating a 100-mile wide buffer around the evaluated alternatives (see Figure 1-1).

Figure 1-1: Atlanta-Chattanooga-Nashville-Louisville Study Area



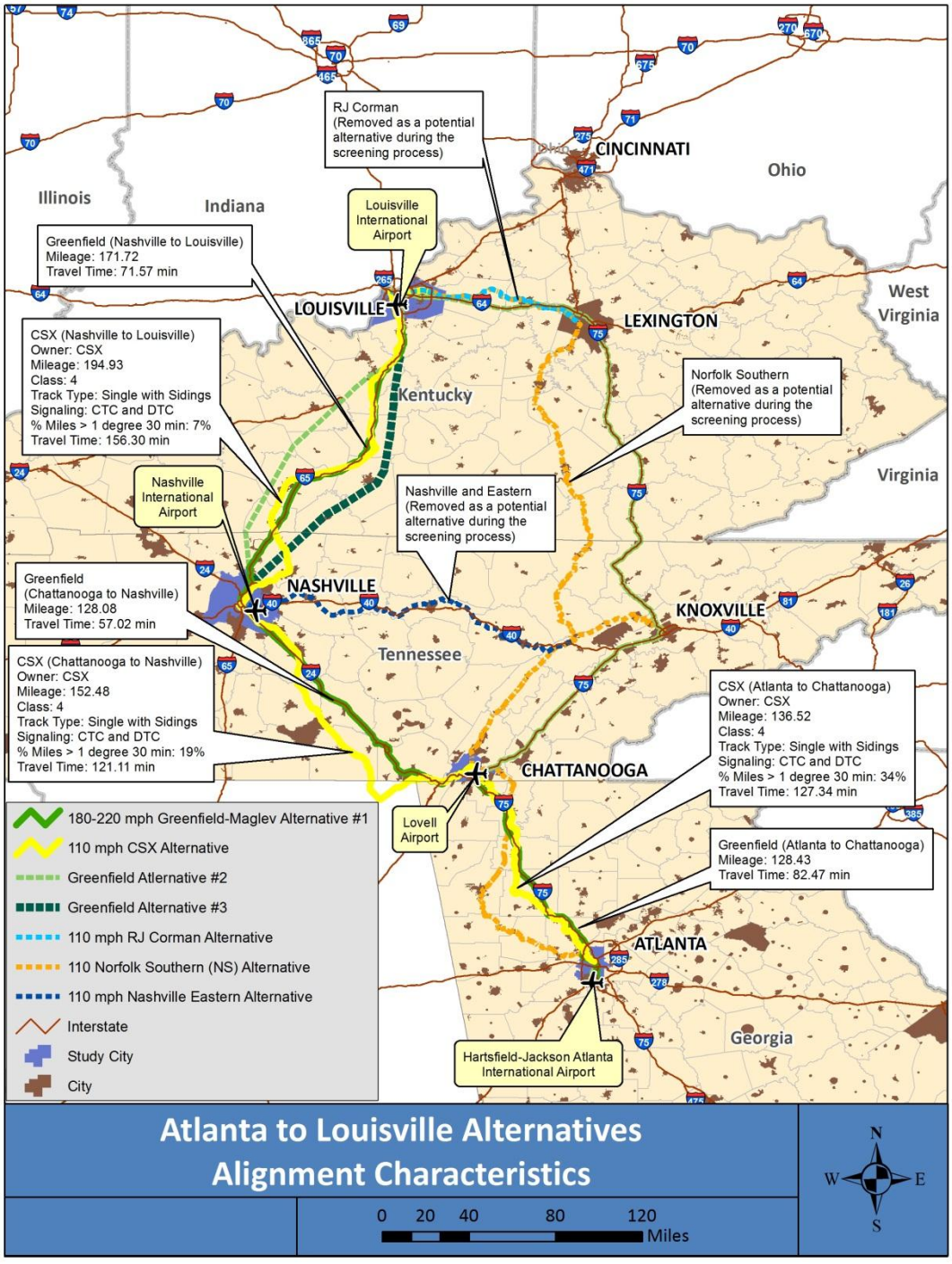
1.1 EVALUATED ALTERNATIVES

1.1.1 90-110 MPH SHARED USE CORRIDORS

After conducting meetings with stakeholders and reviewing the Georgia, Tennessee and Kentucky State Rail Plans, a number of existing rail corridors were taking under consideration for the Atlanta-Chattanooga-Nashville-Louisville 90-110 mph technology.

Various Shared Use alternatives were established to determine a representative route for the Atlanta-Chattanooga-Nashville-Louisville Corridor; one that connects Atlanta, GA to Louisville, KY via Chattanooga to Nashville, TN utilizing CSXT rail corridors; and one that connects Atlanta to Louisville via Danville, KY (outside Lexington) utilizing NS and R.J. Corman rail corridors; and a connection between Nashville and Knoxville, TN connecting the CSXT and NS basic routes was evaluated as a potential alternative. These routes use a combination of existing route – NS, CSXT and short lines including the Nashville and Eastern Railroad (partially abandoned), and the R.J. Corman Railroad between Lexington and Louisville. The existing rail corridors can be seen in Figure 1-2. A table illustrating the characteristics of each of these alternatives can be found in Appendix C.

Figure 1-2: Atlanta-Chattanooga-Nashville-Louisville Existing Rail Corridors and Evaluated Alternatives



The existing freight routes throughout the Atlanta-Chattanooga-Nashville-Louisville study area all have similar track configurations and navigate through difficult terrain, including geologic systems of valleys, ridges, plateaus, and the Blue Ridge mountains, with the exception of the Nashville to Louisville segment, which navigates through rolling hill terrain.

The existing freight routes also present capacity challenges to the introduction of passenger rail service. Both of the Class I railroad corridors (CSXT and NS) are key freight routes carrying goods and materials from the Southeast to the Midwest. Prior to the current recession, freight traffic was extremely heavy on segments of both CSXT and NS facilities between Atlanta and Louisville. Traffic has eased most recently; however, it is anticipated that as economic conditions improve, usage will return to pre-recession levels. Freight traffic will continue to increase as economic conditions evolve; particularly the Volkswagen plant recently opened in Chattanooga and increased port activity along the east coast as a result of the Panama Canal expansion project. This study uses present traffic levels in the CSXT and NS rail corridors as a baseline based on field inspections and verbal conversations with each railroad.

With the anticipated increase of approximately 85 percent in rail freight tonnage by 2040, there would be a major increase in traffic and trains on these key routes for both CSXT and NS railroads. With completion of the improvements of the Panama Canal to handle larger container ships, shipping is anticipated to be diverted to increase at eastern ports. A significant portion of the shipped goods will be moving to the Midwest and Chicago connections, impacting freight traffic within the Atlanta-Chattanooga-Nashville-Louisville Corridor and potentially adding 20-30 trains per day on the segments under study over the present operation. These estimates will be verified through further formal discussions with both CSXT and NS.

To accommodate the anticipated need for added freight capacity, the Shared Use route will need to provide for an additional passenger track and new 10-mile passing sidings every 30 miles within each corridor alternative to accommodate new passenger rail service. It should be noted that no detailed freight analysis was developed for this report, and there may be issues related to the use of the existing freight corridors for passenger rail capability and expansion to accommodate future freight demands.

1.1.1.1 Atlanta to Chattanooga

Two Shared Use Corridor routes were considered for the Atlanta, GA and Chattanooga, TN segment; one each along the NS and CSXT corridors. The current capacity constraints on the existing single line track with sidings and the future

forecasted increase in freight traffic may require both railroads to add double track to these routes in order to accommodate potential freight traffic needs.

The CSXT and NS routes are old routes having been initially established more than a century ago. Due to their age, they tend to follow the "lay of the land". Therefore, the existing topography creates a considerable number of sharp curves reducing overall speed.

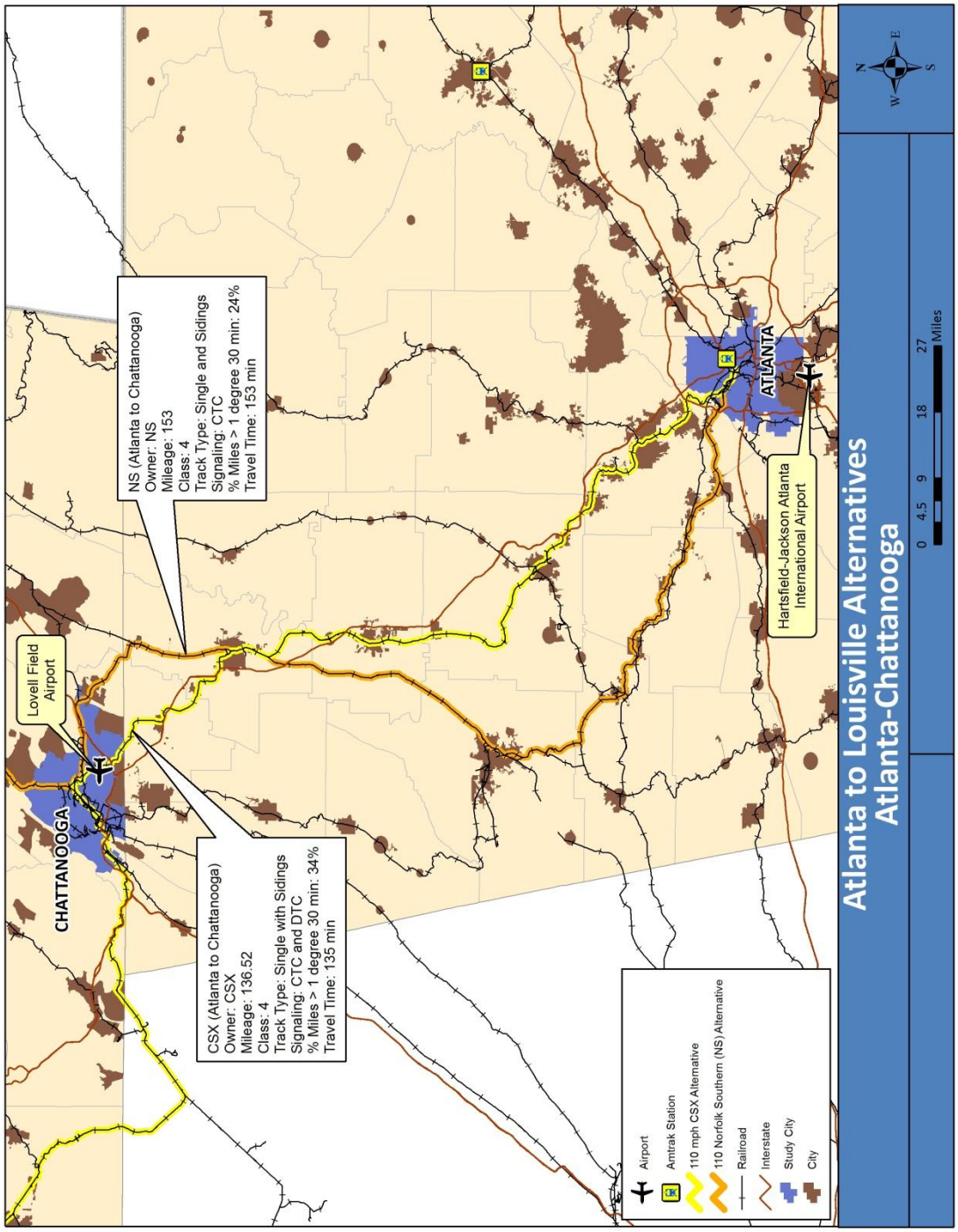
The segment between Atlanta and Chattanooga is under a more detailed study at the present time as part of a NEPA Tier I Environmental Analysis. As a part of that process, multiple routes have been considered including the existing NS and CSXT rail routes identified in this study. The parameters of Tier I evaluation specify speeds higher than 180 mph. To that end, the existing rail corridors were evaluated and found unsuitable for the higher speed requirements of that study. Therefore, only new route alternatives are being considered in the NEPA Tier I EIS analysis.

NS Route

This alternative follows the NS route through Rome, GA depicted in Figure 1-3, the corridor is 153 miles and is a Class 4 single track with sidings, and is CTC traffic controlled. A large percentage of freight traffic is general freight and intermodal traffic. This is the key route for NS traffic flow from the southeast to the Midwest and Chicago connections.

A preliminary analysis reveals that there are 203 curves that exceed a radius of one degree, 30 minutes. This curvature covers 36 miles or 24 percent of the corridor. This route has a daily weighted average density of 40-50 freight trains per day. Pre-recession, NS was operating approximately 70 trains per day between Atlanta and Austell, GA. If the routes were made for passenger service of 60 mph on curve, 80 mph on straight track and 30 mph within five miles of station sites, the estimated travel time for this route would be approximately 153 minutes, with an average speed of 60 mph.

Figure 1-3: Atlanta to Chattanooga Evaluated Alternatives



CSXT Route

The CSXT alternative from Atlanta to Chattanooga follows the CSXT line through Cartersville, GA. From Atlanta to Chattanooga, CSXT leases the right-of-way along this route within the State of Georgia. This route is a Class 4 single track with sidings, and is DTC traffic controlled. The route is 144.1 miles in length and has a total of 70 curves that exceed one degree, 30 minutes for a total of 45 miles or 34 percent of the total route (refer back to Figure 1-3). The CSXT line has higher percentage of miles of curve track than the NS route, but future trains per day over the segment is less than the project trains per day of the NS route between Atlanta and Chattanooga.

Currently, this route has a daily weighted average density of 28-30 freight trains per day and is one of the key routes for CSXT traffic flow from the southeast to the Midwest and Chicago connections. The most congested segment of the route is from Atlanta to Cartersville, which is the key route for movement of coal from Corbin, KY to the utility coal plants in the southeast. If the CSXT route was used for passenger service, 60 mph on curves, 80 mph on straight track and 30 mph within five miles of station sites, the estimated travel time for this route would be about 137 minutes with an average speed of 62 mph. The average speed takes into account the slower speed entering and departing the major terminals.

1.1.1.2 Chattanooga to Nashville (CSXT)

The CSXT route is the only rail route between Chattanooga and Nashville, TN. As depicted in Figure 1-4, this corridor is a 152.5 mile single track with sidings and DTC-CTC traffic controlled. There are approximately 61 curves that exceed a one degree, 30 minute radius for a total of 30 miles or 19 percent of the corridor. This corridor has a daily weighted average density of 20-25 trains per day. Forecasts call for substantially more freight traffic in the future.

The CSXT route follows the line of least resistance through mountainous terrain northwest of Chattanooga. Similar to the existing rail routes between Atlanta and Chattanooga, speeds of 110 mph could require additional right-of-way to ease the existing curves for the higher speed and for dedicated passenger rail lines. With the capacity constraints of single track, heavy traffic and the predicted increase in freight traffic in the future, CSXT may have to add double track to the existing track structure. If the routes were made for passenger service, the estimated travel time for this route would be about 121 minutes with an average speed of 75 mph.

Significant portions of the CSXT route are in intermittent rock cuts, increasing the difficulty and costs associated with additional right-of-way requirements and track construction as depicted in Figure 1-5 and Figure 1-6.

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Figure 1-4: Chattanooga to Nashville Evaluated Alternative

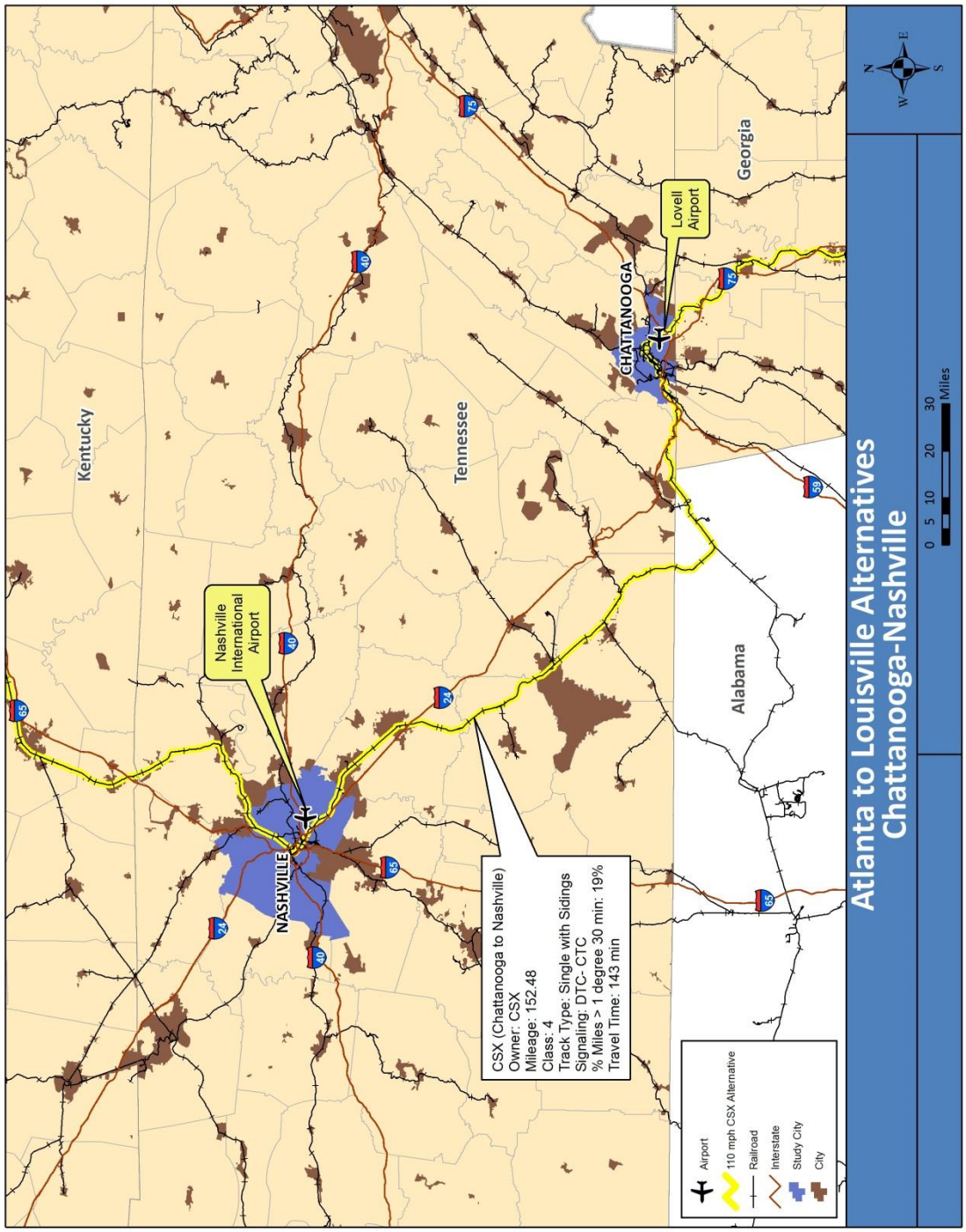


Figure 1-5: CSXT West of Chattanooga (note limited right-of-way)



Source: Rail Pictures.net

Figure 1-6: CSXT South of Downtown Nashville (note cut and limited additional right-of-way)



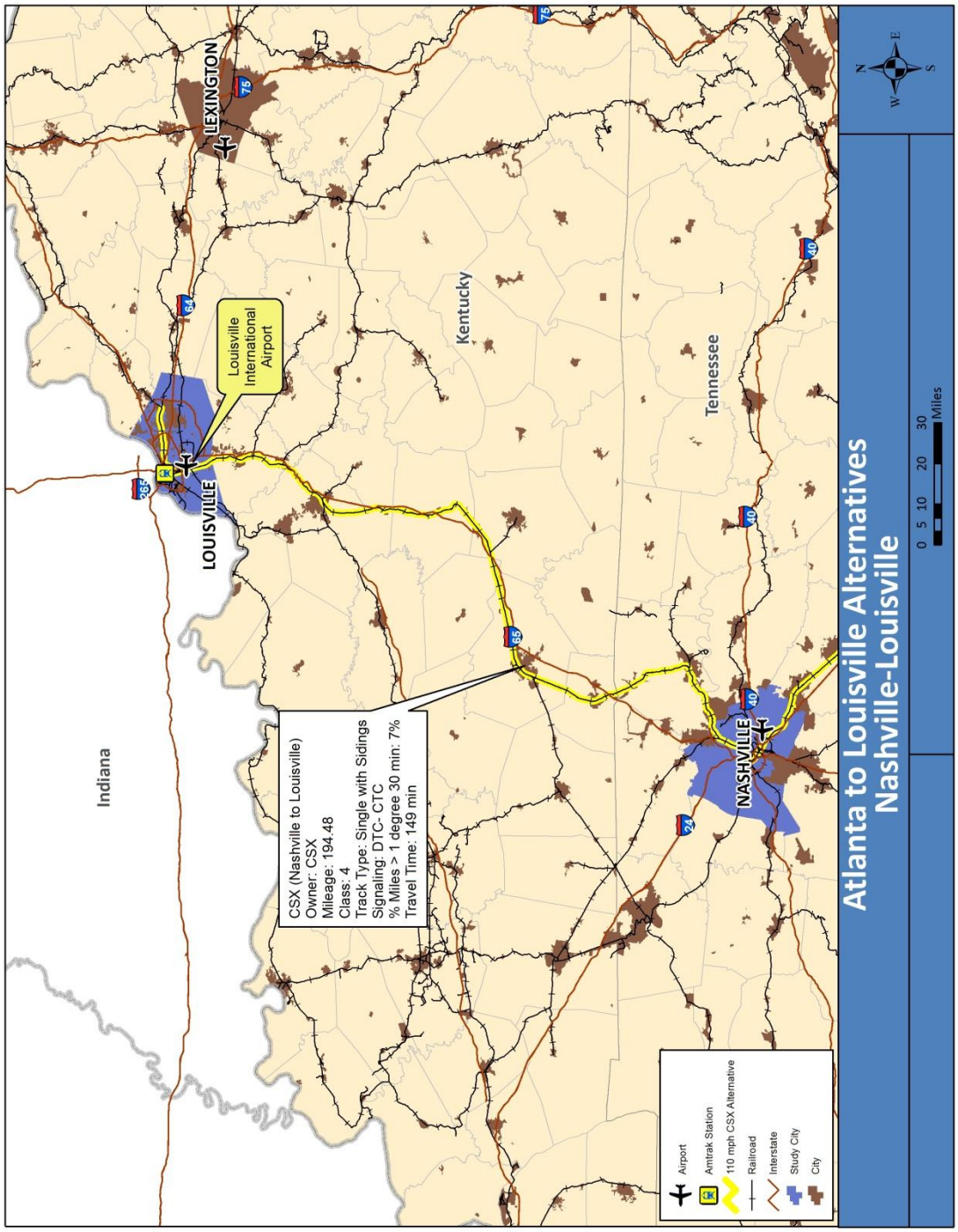
Source: Study Picture

1.1.1.3 Nashville to Louisville (CSXT)

The CSXT route is the only existing rail route between Nashville, TN and Louisville, KY. As shown in Figure 1-7, this corridor is 195 miles and generally single track with sidings and is DTC-CTC traffic controlled. There are approximately 20 curves that exceed a one degree, 30 minute radius for a total of 12 miles or seven percent of the corridor. This serves as the key freight route for CSXT from Nashville through Cincinnati, Ohio to the Midwest. This corridor has a daily weighted average density of 20-25 trains per day. If the routes were made for passenger service, the estimated travel time for this corridor would be about 157 minutes with an average speed of 75 mph.

Between downtown Nashville and Amqui, TN (approximately 10 miles north of Nashville) before the line splits between Chicago, Illinois and Louisville, KY, the line is double tracked and the freight traffic is extremely dense. From Amqui to Louisville, the line is single track with sidings. This segment has the best potential to achieve faster speeds (90 mph) due to the lower density freight traffic, minimal curvature constraints, and minimal terrain challenges, by adding one passenger rail line with minor easement of curves and minor right-of-way changes.

Figure 1-7: Nashville to Louisville Evaluated Alternative



1.1.1.4 Chattanooga to Louisville via Danville, KY (NS)

To avoid the problematic topography between Chattanooga and Nashville, another Shared Use alternative was evaluated using the NS line through Danville and on to Louisville. This route roughly runs parallel to and west of I-75 as illustrated in Figure 1-8. The NS route from Chattanooga to Louisville via Danville is 308 miles of Class 4 single track with sidings and is CTC traffic controlled.

Between Chattanooga and Danville, there are approximately 114 curves that exceed a one degree, 30 minute radius for a total of 44 miles or 21 percent of the corridor. This is the key route for NS traffic from the southeast to the Midwest and western connections at Chicago. This route currently has a daily weighted average density of 40-50 trains per day and the traffic is predicted to increase over the next 20 years.

The NS route from Chattanooga to Louisville via Danville follows the line of least resistance through mountainous terrain. In order to get to speeds of 110 mph, it will require more right-of-way to smooth out the curves for the higher speeds. However, due to numerous deep cuts, high fills, tunnels, and bridges on this line, the easing of the curves would be very difficult. The capacity constraints of the current single track, the existing heavy traffic and the predicted increase in freight traffic in the future, may cause the NS to add double track to this route to accommodate the future freight traffic. The addition of passenger service will require one dedicated passenger track and sidings. The NS route has wide right-of-way but encounters difficult terrain as shown in Figure 1-9 and Figure 1-10.

Figure 1-8: Chattanooga to Louisville via Danville Evaluated Alternative

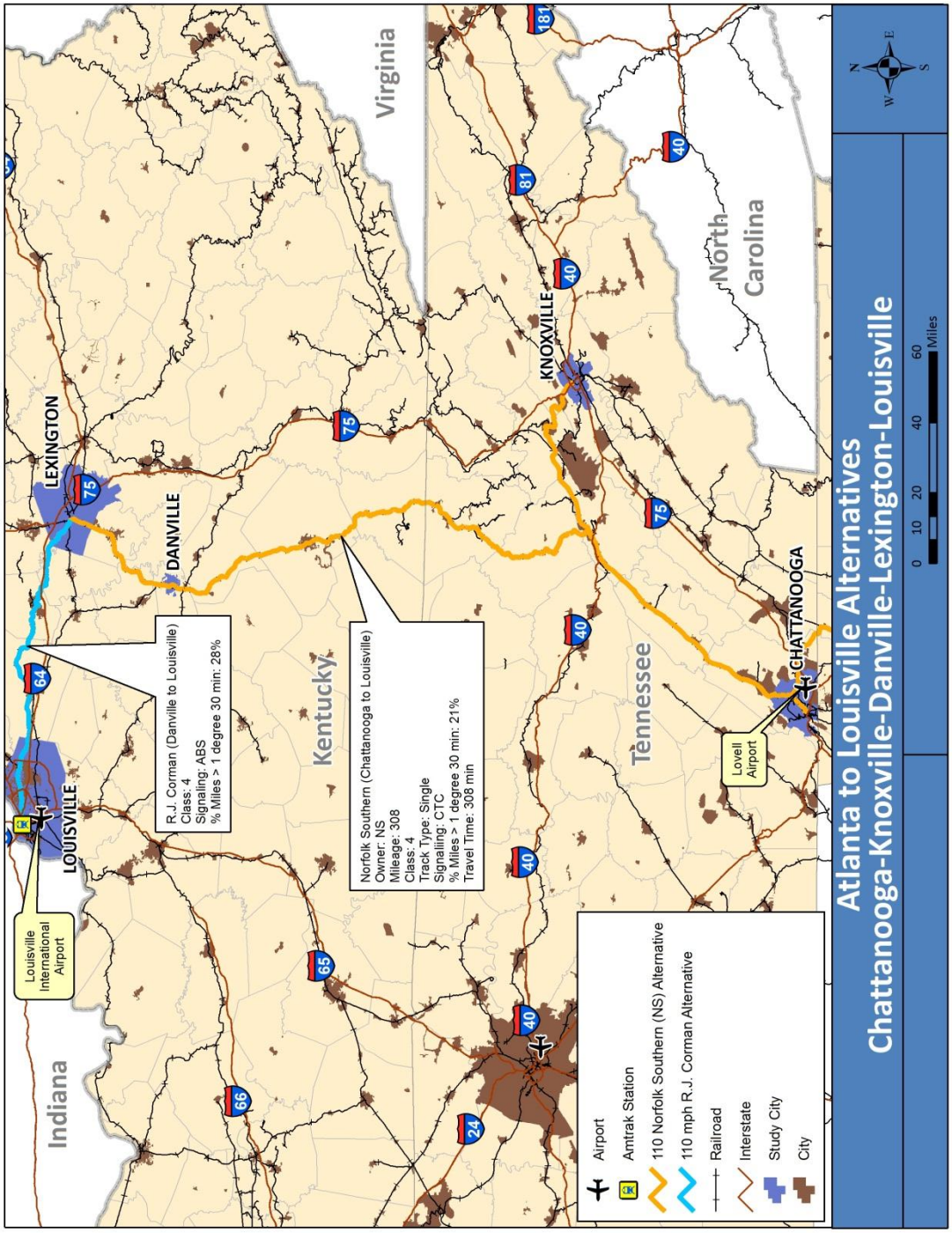
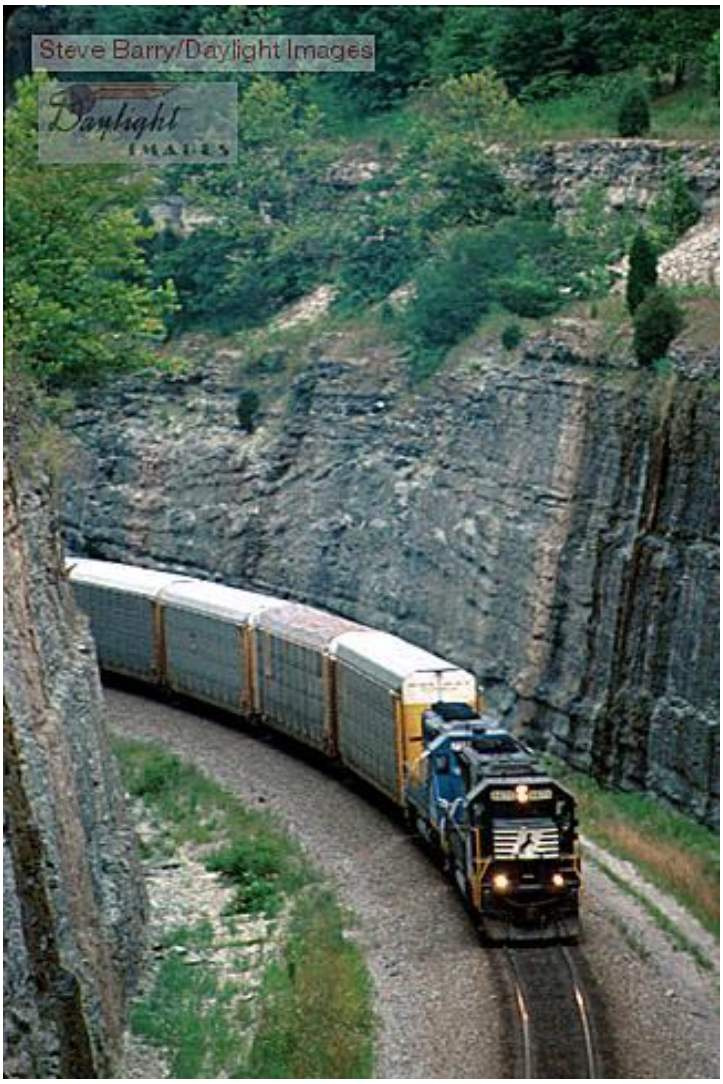


Figure 1-9: NS Route, Summerset, KY (note cut in terrain)



Source: Study Picture

Figure 1-10: NS Route, between Danville and Summerset (note cut in terrain)



Source: Daylight Images

Between Danville and Louisville, there are approximately 51 curves that exceed a one degree, 30 minute radius for a total of 28 miles or 28 percent of the corridor. This route sees a daily weighted average density of 20-30 trains per day; the track is Class 4 track and is ABS traffic controlled. If the routes were made for passenger service, the estimated travel time for the Chattanooga to Louisville corridor would be about 308 minutes with an average speed of 60 mph.

1.1.1.5 Chattanooga to Lexington, KY via Danville (NS)

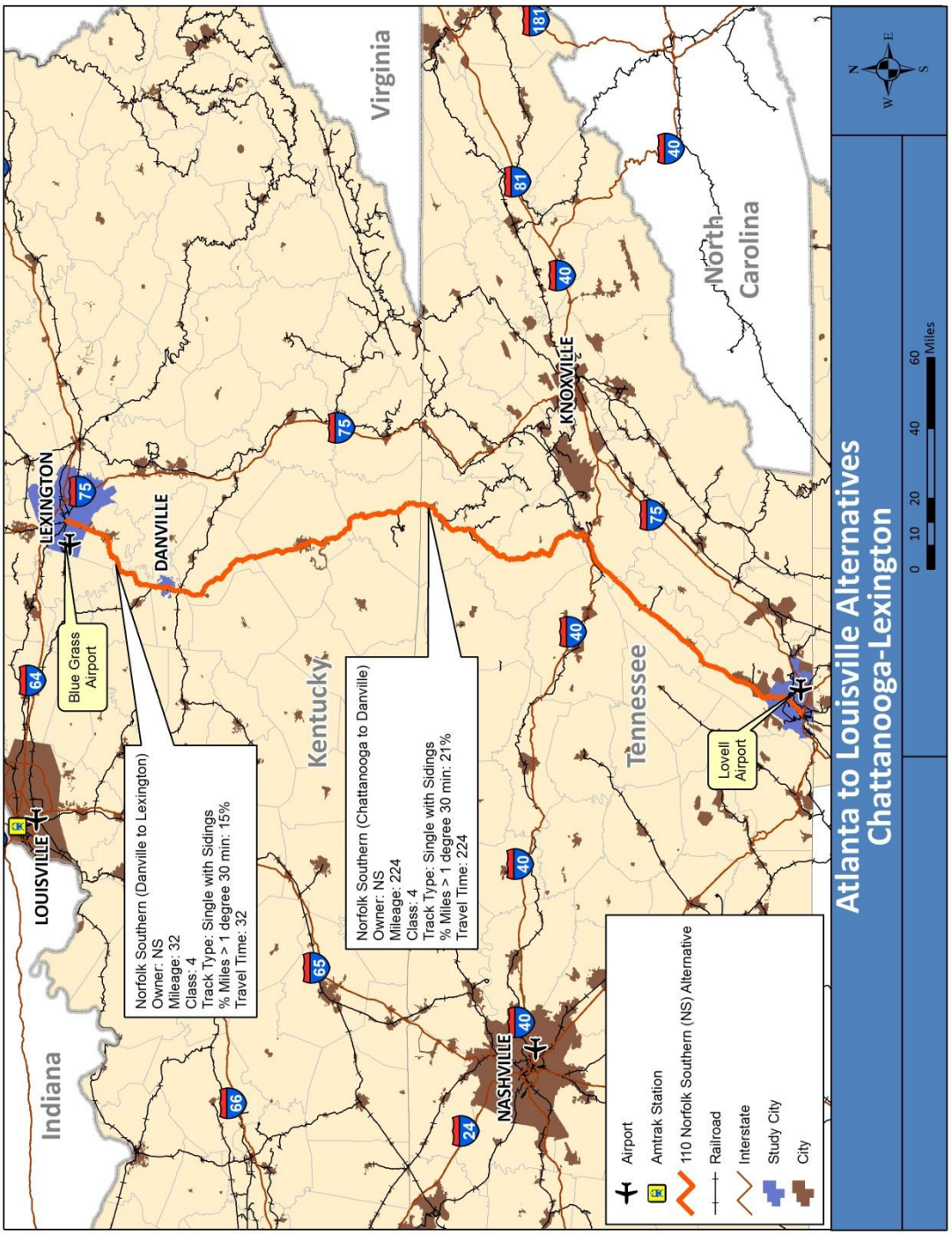
Figure 1-11 shows the NS route from Chattanooga to Lexington via Danville and is 256 miles long, single track with sidings and Class 4 track. Overall, approximately 19 percent of the route or 49 miles have curves that exceed one degree, 30 minutes. Travel time would be approximately 256 minutes with an average speed of 60 mph.

The existing density is 40-50 trains per day. This is the key route for NS traffic from the southeast to the Midwest and western connections at Chicago, Illinois and the traffic is expected to increase up to 50 percent in the next 20 years.

Two segments make up the Chattanooga to Lexington via Danville route; the Chattanooga to Danville, and the Danville to Lexington segment. Between Chattanooga and Danville, there are approximately 114 curves that exceed a one degree, 30 minute radius for a total of 44 miles or 21 percent of the corridor length. The Chattanooga to Danville segment is 224 miles long and average speeds would be approximately 60 mph, providing a travel time of 224 minutes.

The Danville to Lexington segment is 32 miles long and has a total of 8 curves that exceed one degree, 30 minute limit for a total of five miles or 15 percent of the total route. Travel time would be 32 minutes. Travel time for the route (both segments) is 256 minutes from Chattanooga to Louisville. It should be noted that these two routes would not provide passenger service to Nashville, TN.

Figure 1-11: Chattanooga to Lexington, KY via Danville Evaluated Alternative

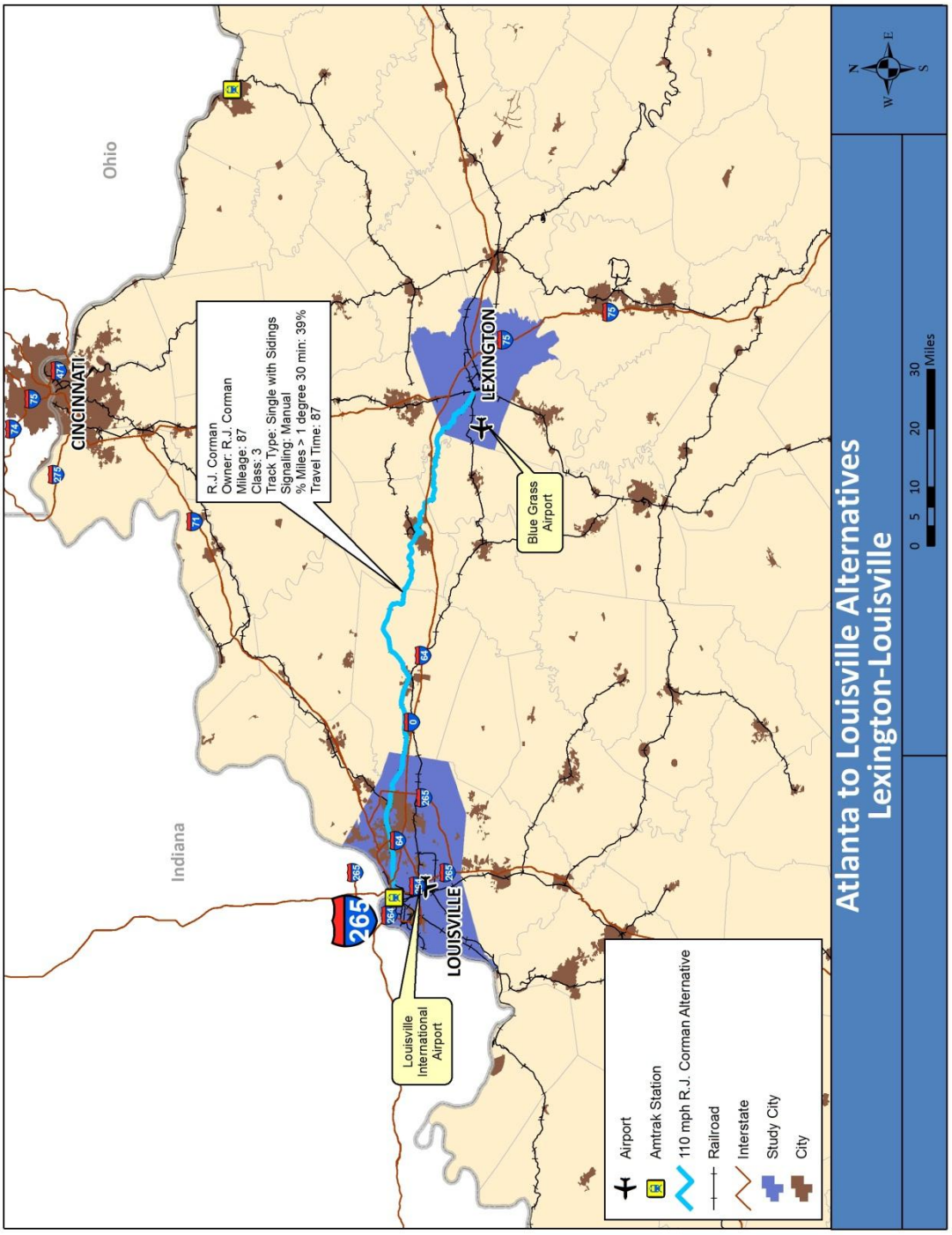


1.1.1.6 Lexington to Louisville

R.J. Corman Railroad is the owner of the former CSXT route from Lexington to Louisville. The railroad connects to the CSXT mainline from Louisville to Cincinnati, Ohio and has traffic rights over CSXT to Louisville. The route is 87 miles long, Class 3 single track with sidings, manual traffic control, and low density. This route has 90 curves greater than one degree, 30 minutes, for a total of 35 miles, or 39 percent of the corridor.

The track would have to be upgraded for higher speeds plus signaling. Even with low traffic density and the large number of curves exceeding one degree, 30 minutes, there may be opportunity to add double track. At the same time, it might require the addition of one dedicated track for the passenger service, and this may require extra right-of-way. After upgrades, the running time would be approximately 87 minutes at an average speed of 60 mph. This average speed takes into account entering and departing the major terminals at slower speeds.

Figure 1-12: Lexington to Louisville Evaluated Alternative



1.1.1.7 Nashville to Knoxville: NS and the Nashville and Eastern Railroad

The Tennessee State Rail Plan references the Bristol-Knoxville corridor via NS and the possibility of the connection from Knoxville to Nashville via the NS and the Nashville and Eastern Railroad. The distance is approximately 186 miles from Knoxville to Nashville.

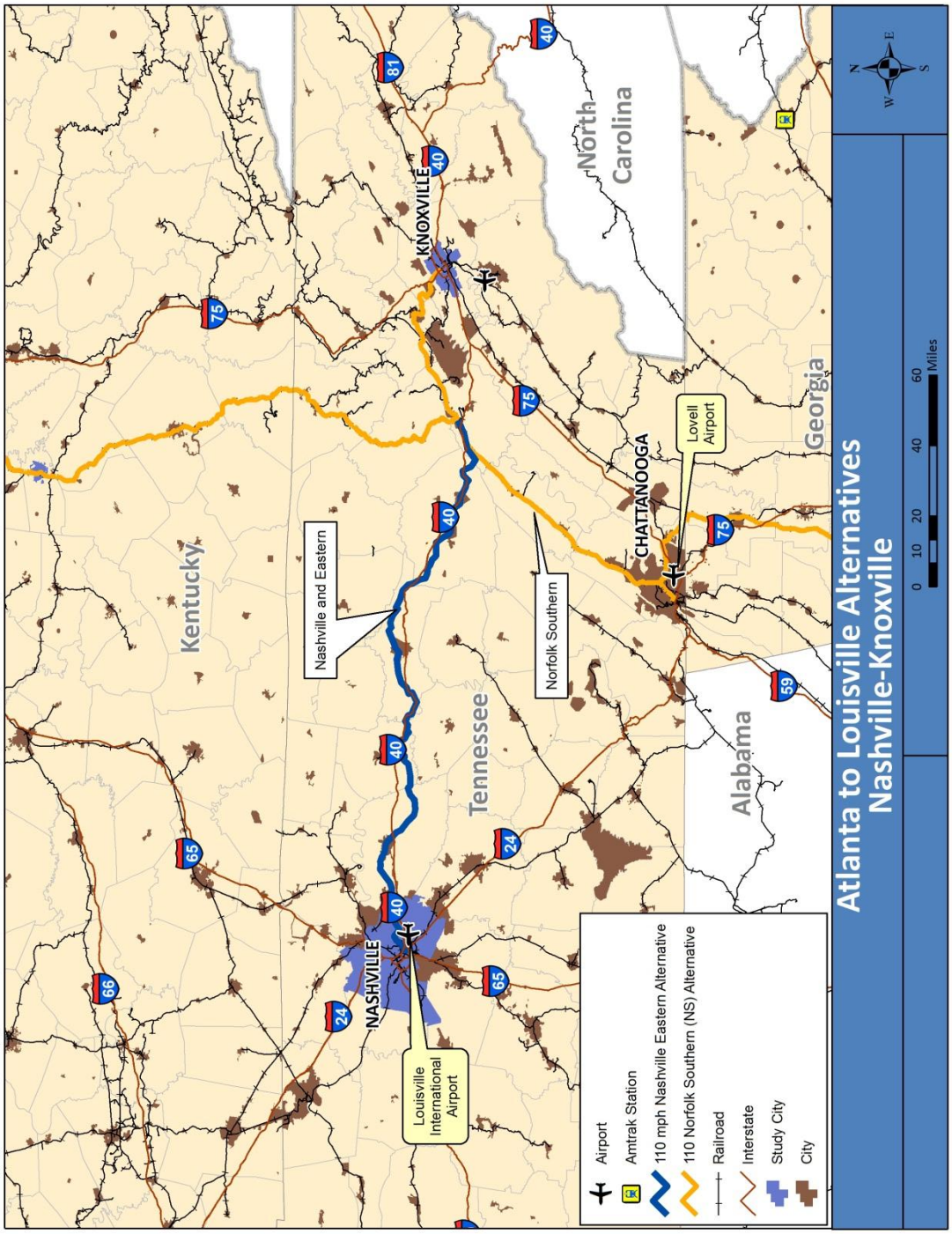
The Nashville and Eastern is Class 2 and Class 3 track and is manual block traffic controlled. The track from Nashville to Monterey, TN is in operation with freight rail traffic. Additionally, there is commuter service between Lebanon and Nashville. Beyond Monterey, the track is out of service for approximately 30 miles, but the track is in operation from Harriman, at the NS mainline, westward for 13 miles with a private operator. The Nashville and Eastern line would have to be completely rehabilitated, including track and bridges. Due to extreme curvature, substantial right-of-way would have to be purchased to satisfy the one degree, 30 minute requirement.

The route from the Nashville and Eastern railroad to NS mainline would follow NS to Knoxville with Class 4 track. The line is a 39-mile single track with 2 long sidings, CTC traffic controlled, and a daily weighted average density of 15-25 trains per day. The NS route to Knoxville has 130 curves over one degree, 30 minutes and the length of the curves is 17 miles equaling 47 percent of the route. Many of the curves on this segment are between five and eight degrees. This curvature will have a major impact on the passenger and freight operations.

If the routes were made for passenger service, NS main line to Knoxville, the estimated travel time for this route would be about 39 minutes with an average speed of 60 mph. This would require a separate passenger track for the operation to achieve the speeds required.

The distance from Nashville to Knoxville route would be approximately 186 miles with travel time of 186 minutes and an average speed of 60 mph. The average speed takes into account entering and leaving major terminals at slower speeds and extreme curvature at slower speeds.

Figure 1-13: Nashville to Knoxville Evaluated Alternative



1.1.2 180-220 MPH DEDICATED USE CORRIDORS

The study assumed that viable high-speed rail operations along interstate highway corridors are to be on one of three basic routes: within the highway median, alongside the outside highway lane within the highway right-of-way, or in purchased right-of-way adjacent to the highway right-of-way. Where selected interstate highway curves were greater than 30', the high-speed rail route was adjusted to leave the immediate highway corridor if justified by travel time savings. It should be noted that while there is not a preferred alignment alternative as a part of the feasibility study, but variations in these basic routes will have an impact on cost and environmental considerations.

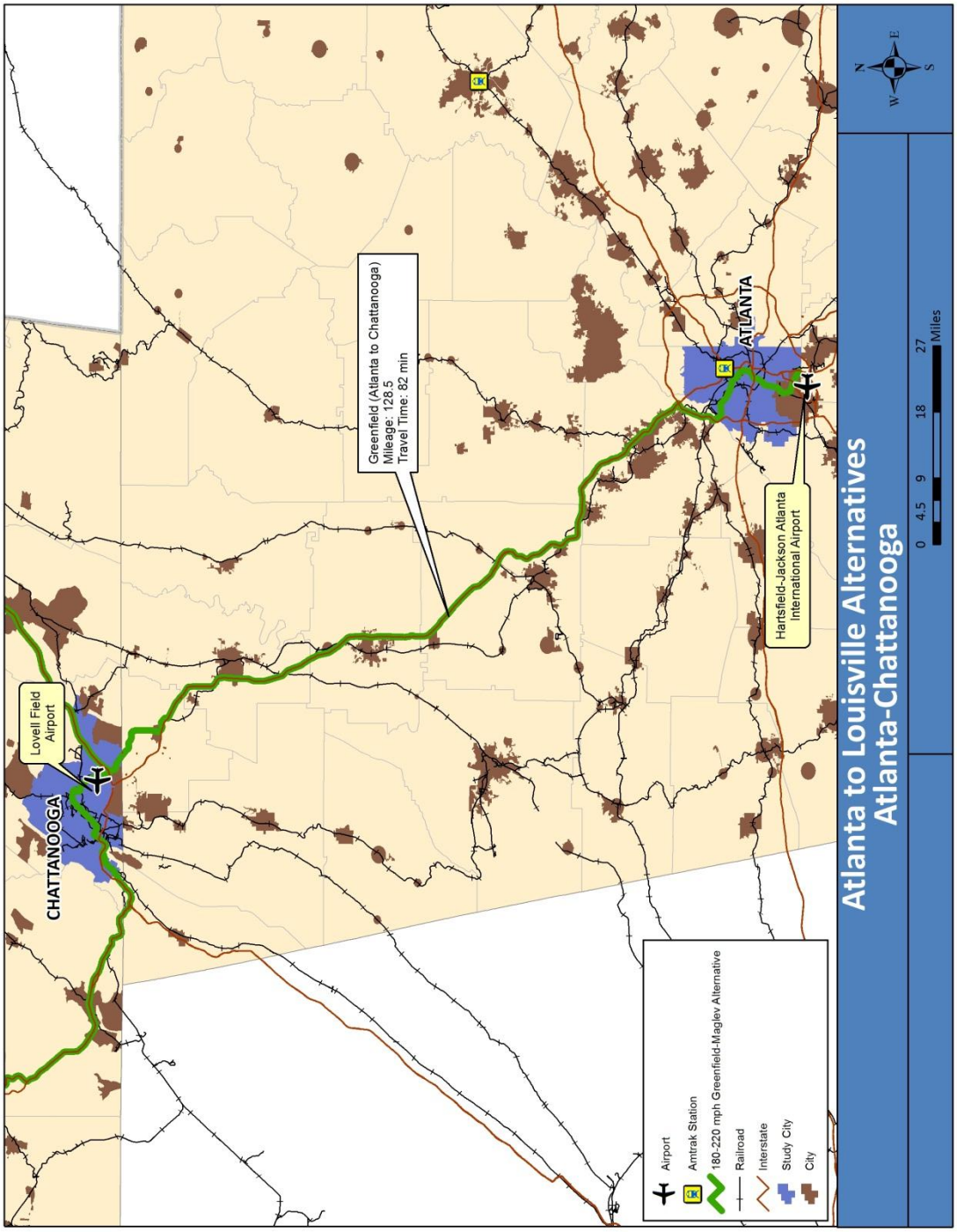
The Dedicated Use routes reflect the higher speed geometry of 220 mph high-speed rail technology. Shared Use corridors with freight generally offer a less than optimal solution for high-speed passenger service. The curve requirements and need to completely separate the passenger rail from crossings and other conflicts makes the concept of Shared Use problematic except entering and leaving larger urban areas (Atlanta, Chattanooga, Nashville and Louisville). Clearly, there are challenges in placing high-speed rail within the existing interstate corridors; however, this is a more optimal solution than existing freight rail routes. The standards for 220 mph routes are zero degrees, 30 minute curves and grades of no more than two percent (2%).

It should be noted that entering and leaving Atlanta, Chattanooga, Nashville and Louisville on Shared Use track has the potential for delays due to the congestion in these cities and increased travel times between the major cities; however, interstate roadways have generally been substantially widened in urban areas limiting the availability of space for high-speed passenger service.

1.1.2.1 Atlanta to Chattanooga

The 220 mph Dedicated Use alternative generally follows the route of I-75 between Atlanta and Chattanooga, as seen in Figure 1-14, and connects H-JAIA with the Chattanooga Airport (Lovell Field). This is the recommended route present in the public meetings on the Tier I EIS now underway. This corridor is 128.4 miles long and has 143 curves greater than 30 minutes. These curves comprise 46 percent of the corridor length or nearly 50 miles. Travel time is approximately 83 minutes.

Figure 1-14: Atlanta to Chattanooga Dedicated Use Evaluated Alternative



1.1.2.2 Chattanooga to Louisville via Nashville

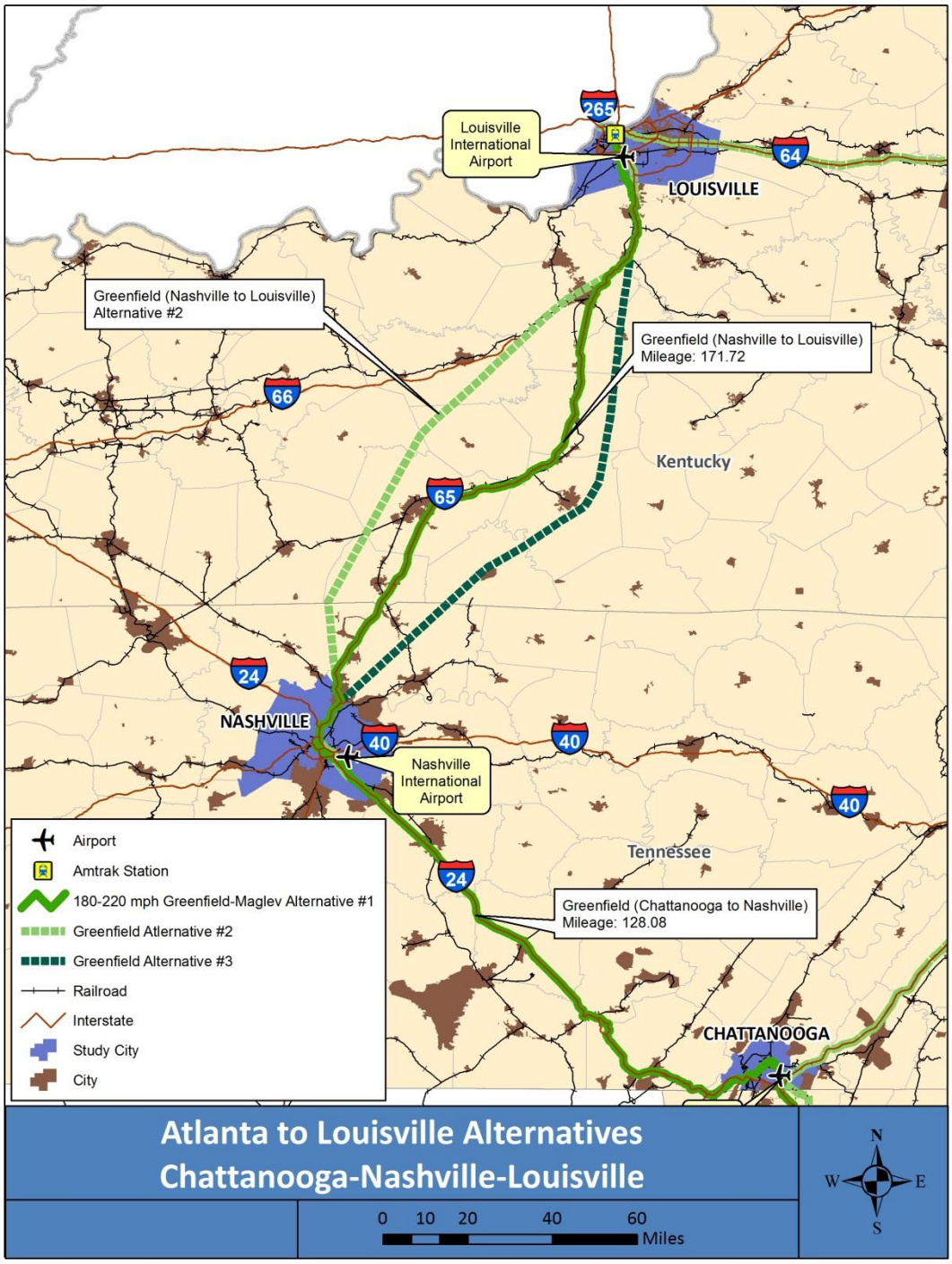
From Chattanooga to Louisville, the proposed Dedicated Use route follows the I-24 and I-65 interstate highway corridors. A second and third alternative were also identified; an exclusive route north of Nashville, either west or east of the I-65 corridor. Exclusive routes were identified for the Nashville-Louisville segment due to the low population density and the potential for high speeds to reduce the overall travel time in the corridor.

The I-24/I-65 route is approximately 300 miles in length and has 189 curves greater than 30 minutes. These curves comprise 28 percent of the corridor length or approximately 87 miles. Auto travel time is 304 minutes; high-speed rail travel time is 196 minutes with an average travel speed of 123 mph. This alternative provides access to the Nashville airport, downtown Nashville, the Louisville airport and downtown Louisville.

From Chattanooga to Louisville, the western route mileage is approximately the same as the interstate route (I-24 and I-65).The western alternative follows a new Dedicated Use route north of Nashville, west of I-65 and Mammoth Cave National Park before realigning with I-65 south of Fort Knox in Elizabethtown, KY to Louisville. The eastern alternative follows a path diverging from I-65 north of Nashville and rejoining I-65 northeast of Elizabethtown. Mileage on the eastern route is approximate 125 miles in length, slightly less than the interstate route.

Speeds could be substantially higher between Nashville and Louisville due to the new Dedicated Use route design. The western new route alternative suffers from a ridge and valley topography that may limit the potential for this route. The eastern new route bisects a portion of the Western Pennyroyal Region of Kentucky, underlain by bedrock with a high potential for Karst development.

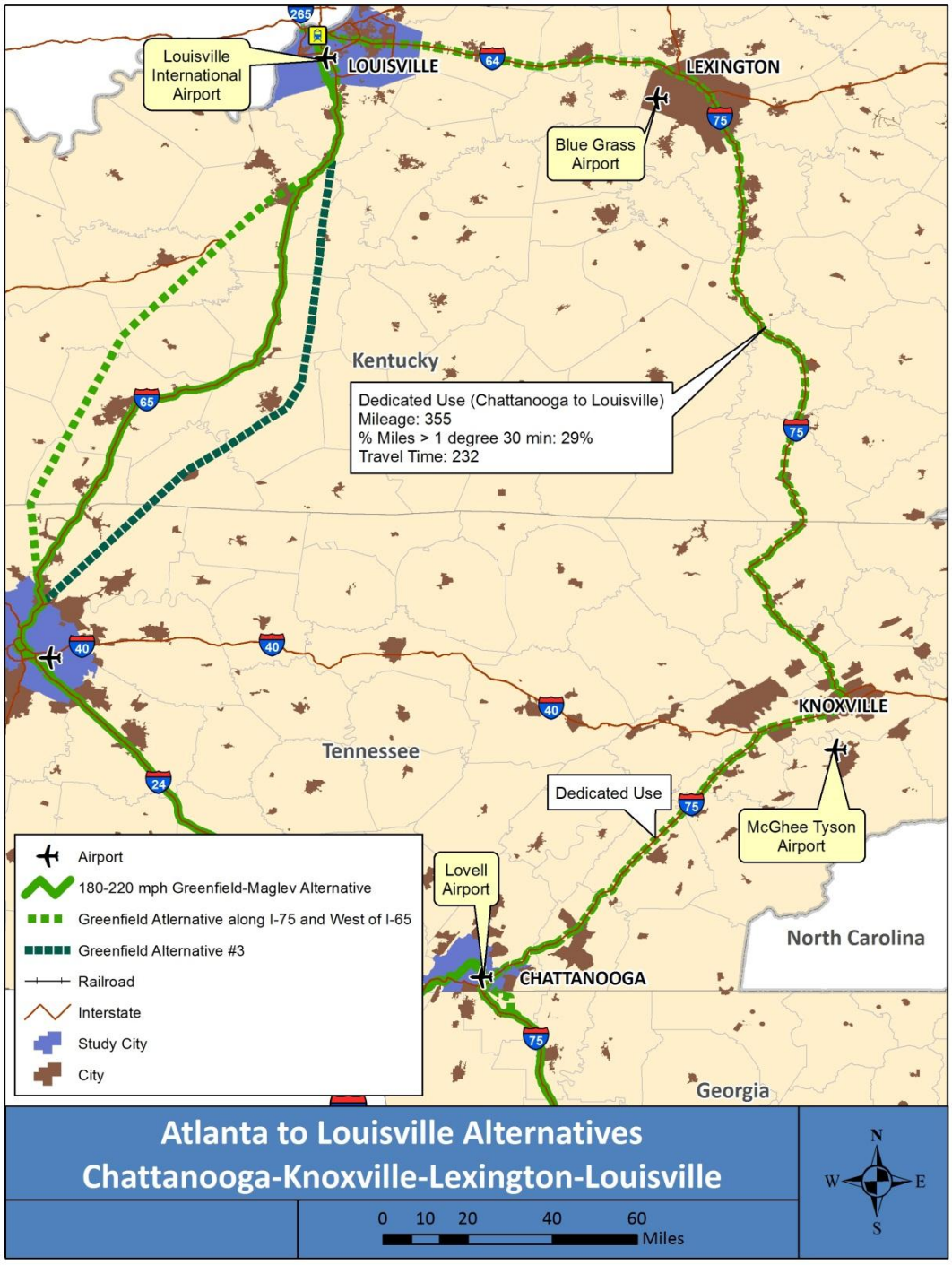
Figure 1-15: Chattanooga to Louisville Dedicated Use Evaluated Alternatives



1.1.2.3 Chattanooga to Louisville via Lexington

This route follows the I-75 corridor out of Chattanooga and then the I-64 corridor between Lexington and Louisville in Kentucky. This route would bypass Nashville, and provide service near Knoxville. The total distance of this corridor is 355 miles. The route has 107 curves in excess of 30 minutes, comprising approximately 104 miles or 29 percent of the corridor length. Travel time is 232 minutes with an average speed of 95 mph.

Figure 1-16: Chattanooga to Louisville via Danville Dedicated Use Corridor



1.1.3 220+ MPH MAGLEV CORRIDOR

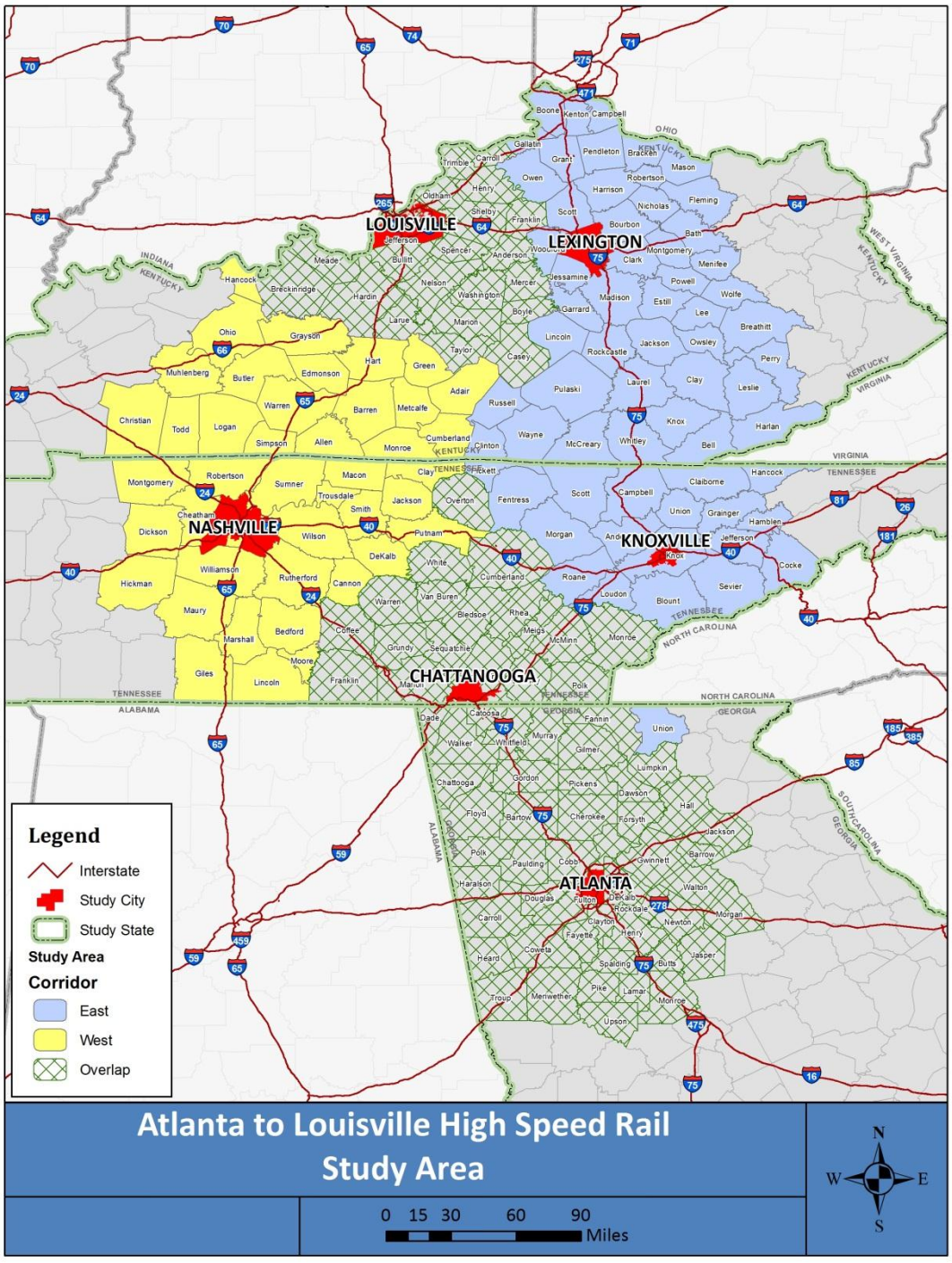
Maglev could follow either of the 180-220 mph Dedicated Use routes. Travel time would be substantially lower, 66 minutes from Atlanta to Chattanooga and 116 minutes (total of 3 hours) from Chattanooga to Louisville as shown in Figure 1-15.

1.2 DEMOGRAPHICS AND SOCIOECONOMICS

The exploration of the west and east routes following the existing interstates and railroad routes helped identify the most suitable alternatives based on the existing conditions of the project area. Although engineering, design, topographic, right-of-way acquisition and costs are major considerations, social and demographic characteristics play an important role in the review and analysis process as well.

Many factors influence the transportation needs of an area. Population, employment mix, land use and the location of major travel destinations along the corridor can strongly influence transportation mode choices. An analysis of existing demographic and socio-economic characteristics of the corridor study area was performed and the results are documented in the following sections. Of particular importance is the connectivity between the major cities along the corridor; Atlanta, Chattanooga, Nashville and Louisville for the western route, and Atlanta, Chattanooga, Knoxville, Lexington and Louisville for the eastern route. As shown in Figure 1-17, the western study corridor is approximately 500 miles long, and the eastern study corridor is approximately 545 miles in length and includes three states. Counties within 50 miles (100 miles total width) of the various alternatives outlined in Section 1.1 were included in the analysis. Open source data sets were used to assess the characteristics of the population, employment, and land use, all aggregated to the county level.

Figure 1-17: Study Area



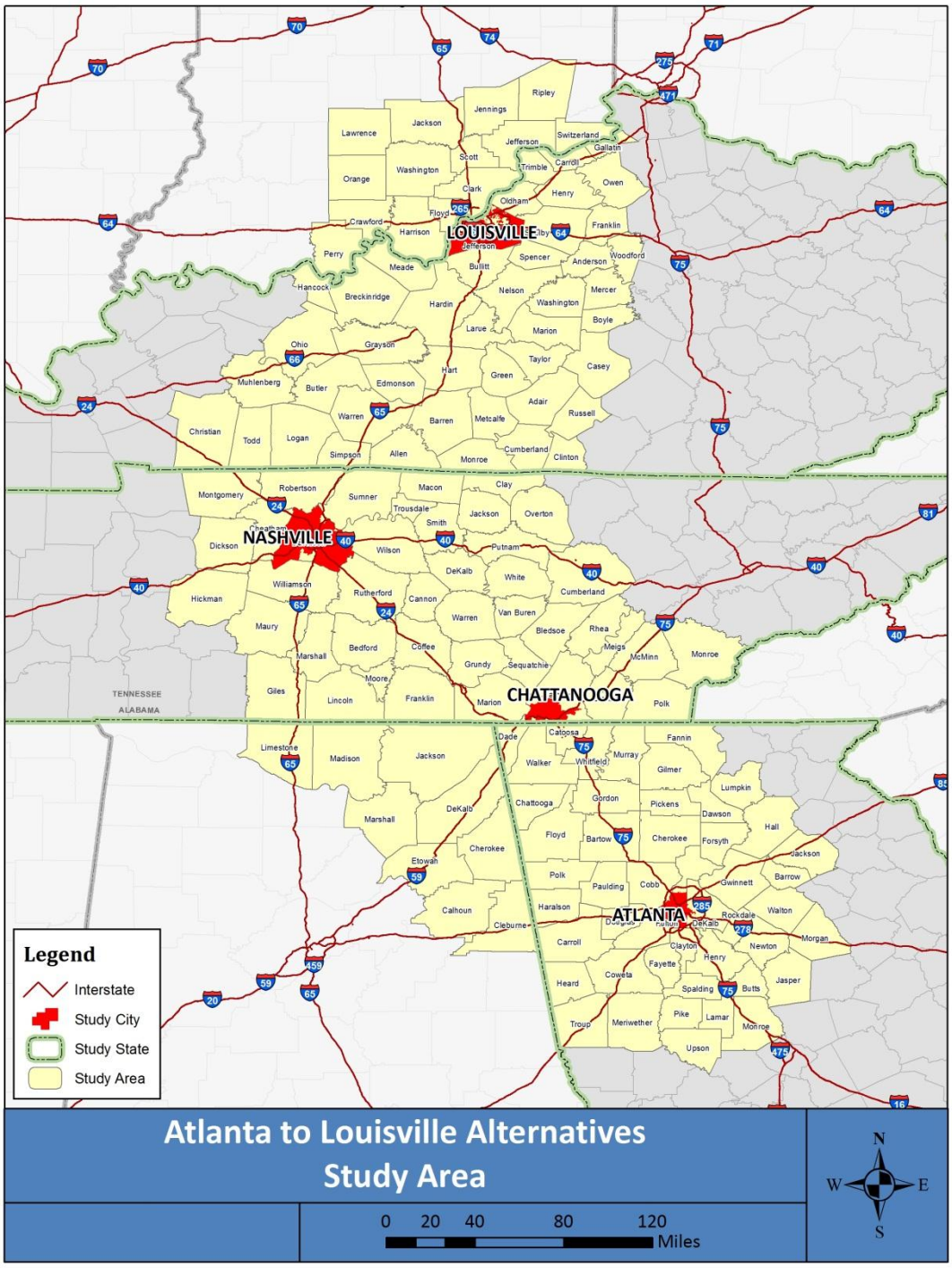
Following technical review and stakeholder input, the Atlanta-Chattanooga-Nashville-Louisville route was concluded to be the more likely to maximize ridership and revenue due to the higher population in Nashville (626,681) compared to Knoxville (178,874) and Lexington (295,803).This western corridor includes 156 counties including nine counties in Alabama and 14 counties in Indiana as outlined in Table 1-1 and Figure 1-18. Counties in both Alabama and Indiana are included in this assessment since increased connectivity from the implementation of the high-speed rail system have the potential to impact the proximate areas by drawing nearby residents from counties in AL and IN to job opportunities, special events, and other activities. However, more focus will be given to the counties that are within the three study states (Georgia, Tennessee and Kentucky) since the majority of the potential alternatives are within these states.

Table 1-1: West and East Corridor Comparison

	Atlanta-Chattanooga: Nashville-Louisville (West Corridor)			
	Counties	**Area (sq. mi.)**	**Population**	**Population Density**
Georgia	46	14,819	6,240,009	421
Alabama	9	6,267	898,911	143
Tennessee	42	18,138	3,003,385	166
Kentucky	45	15,506	1,943,447	125
Indiana	14	5,206	515,402	99
Total / Average	156	59,936	12,601,154	210
	Atlanta-Chattanooga : Lexington-Louisville (East Corridor)			
	Counties	**Area (sq. mi.)**	**Population**	**Population Density**
Georgia	45	14,465	6,216,344	430
Alabama	6	4,226	388,299	92
Tennessee	43	15,801	2,336,521	148
Kentucky	70	21,338	3,016,288	141
Indiana	16	5,601	571,577	102
Total / Average	180	61,431	12,529,029	204

Source: U.S. Census Bureau, 2010

Figure 1-18: Study Area Counties



1.2.1 Total Population, Density, Race and Age

1.2.1.1 Total Population and Density

According to the 2010 U.S. Census, the total population within the study corridor is approximately 12,600,000 with an average density per county of 220 persons per square mile (sq. mi.). As shown in Table 1-2, the study corridor counties within Georgia have the greatest density and absolute population when compared to the other states. In addition, approximately 64 percent of Georgia's population is within the study corridor. As illustrated in Figure 1-19, the average population densities of the study cities reflect the findings at the state level. Atlanta has the greatest population density of over 3,173 persons per square mile; followed by Louisville, which has a density of 1,746 persons per square mile (Table 1-3). Chattanooga is the least dense of the major corridor cities with 1,237 persons per square mile.

Table 1-2: Statewide and Study Corridor Population Distributions

State	Statewide Population	Statewide Population per sq. mi.	Study Corridor County Population	Study Corridor County Population per sq. mi.	Percent of State population
Alabama	4,779,736	91	898,911	143	19%
Georgia	9,687,653	163	6,240,009	428	64%
Indiana	6,483,802	178	515,402	118	8%
Kentucky	4,339,367	107	1,943,447	122	45%
Tennessee	6,346,105	151	3,003,385	145	47%

Source: U.S. Census Bureau, 2010

Figure 1-19: Corridor Study Cities Population Comparison

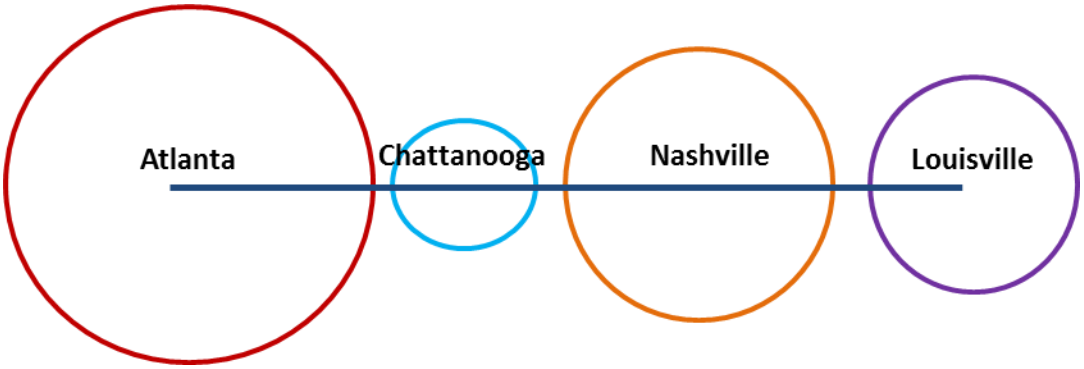


Table 1-3: Population of Major Metropolitan Statistical Areas (MSAs)

Jurisdiction/MPO	Population
Atlanta	5,268,680
Louisville/Jefferson County	1,031,130
Nashville-Davidson County	1,589,964
Chattanooga	378,812

Source: U.S. Census Bureau, 2010

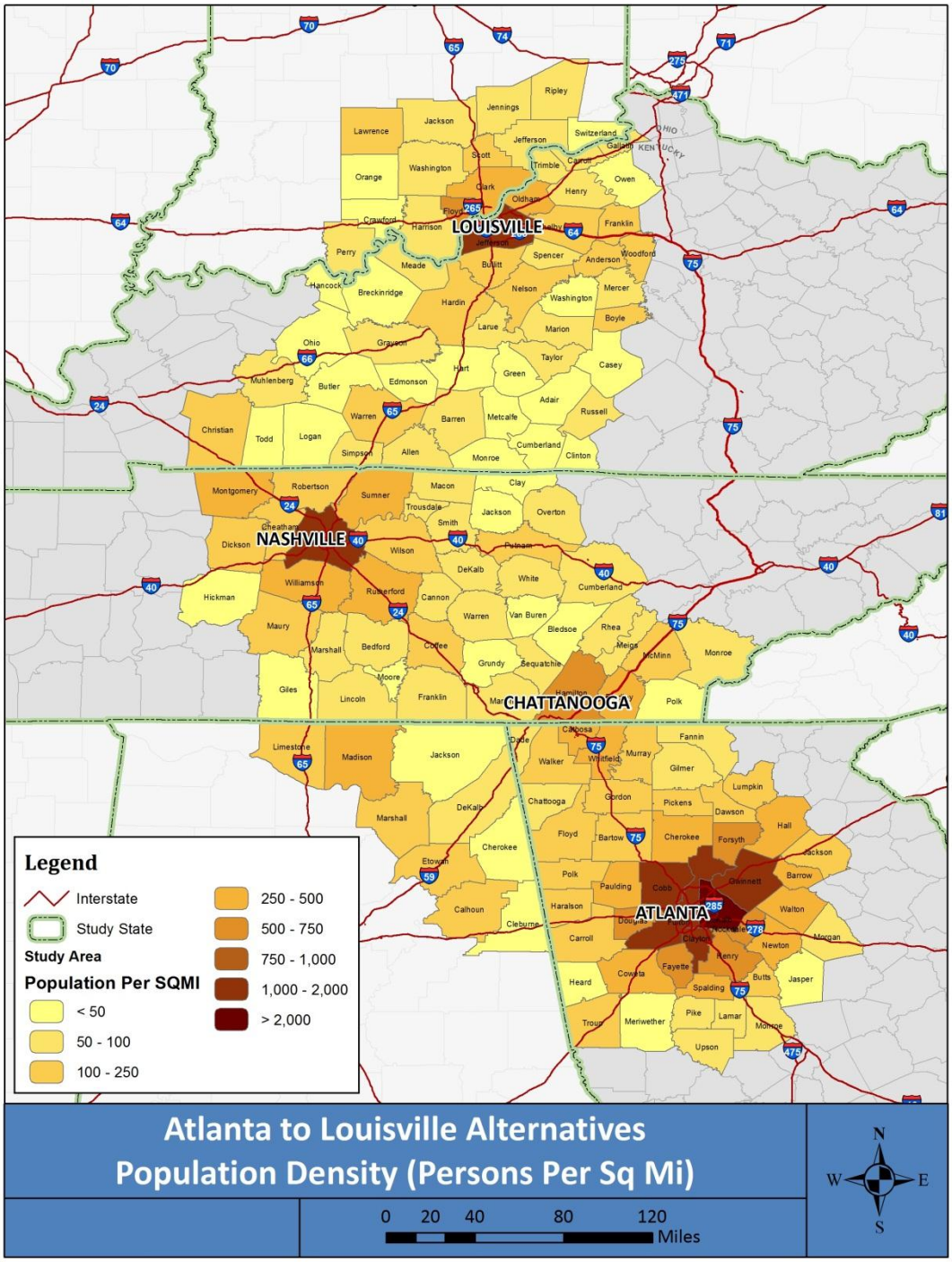
In a county-by-county comparison, more Georgia counties are densely populated than the other study area states (Table 1-4). DeKalb County, GA has 2,580 persons per sq. mi.; followed by Cobb County, GA, Jefferson County, KY (Louisville), Gwinnett, GA, and Clayton, GA. Figure 1-20 illustrates this density pattern. Notice that the highest density locations are located around major cities. In addition, population density generally follows the interstate corridors.

Table 1-4: Top 10 Counties by Density

County and State	Density
DeKalb, GA	2,580
Cobb, GA	1,997
Jefferson, KY	1,860
Gwinnett, GA	1,842
Clayton, GA	1,798
Fulton, GA	1,721
Davidson, TN	1,192
Forsyth, GA	709
Douglas, GA	661
Rockdale, GA	644

Source: U.S. Census Bureau, 2010

Figure 1-20: Atlanta-Chattanooga-Nashville-Louisville Population Density



1.2.1.2 Minority Populations

In addition to being the most populated state, Georgia also has the greatest minority populations. Minority populations include Hispanic/Latino, Asian, American Indian and Alaska Native, Black/African American, Native Hawaiian and Other Pacific Islanders, and other races (one and two or more).

Table 1-5 shows Kentucky has the lowest percentage of minorities. The Hispanic population accounts for less than 10 percent of the population in all of the states and minorities vary from 12 percent to 40 percent.

Table 1-5: State by State Comparison of Minority Populations

State Totals	Alabama	Georgia	Indiana	Kentucky	Tennessee
White	67.0%	55.9%	81.5%	86.3%	75.6%
Black/African American	26.0%	30.1%	9.0%	7.7%	16.5%
Hispanic or Latino	3.9%	8.8%	6.0%	3.1%	4.6%
American Indian/Alaska Native	0.5%	0.2%	0.2%	0.2%	0.3%
Asian/Pacific Native	1.1%	3.3%	1.6%	1.1%	1.4%
Other/Two or More Races	1.3%	1.8%	1.7%	1.6%	1.5%

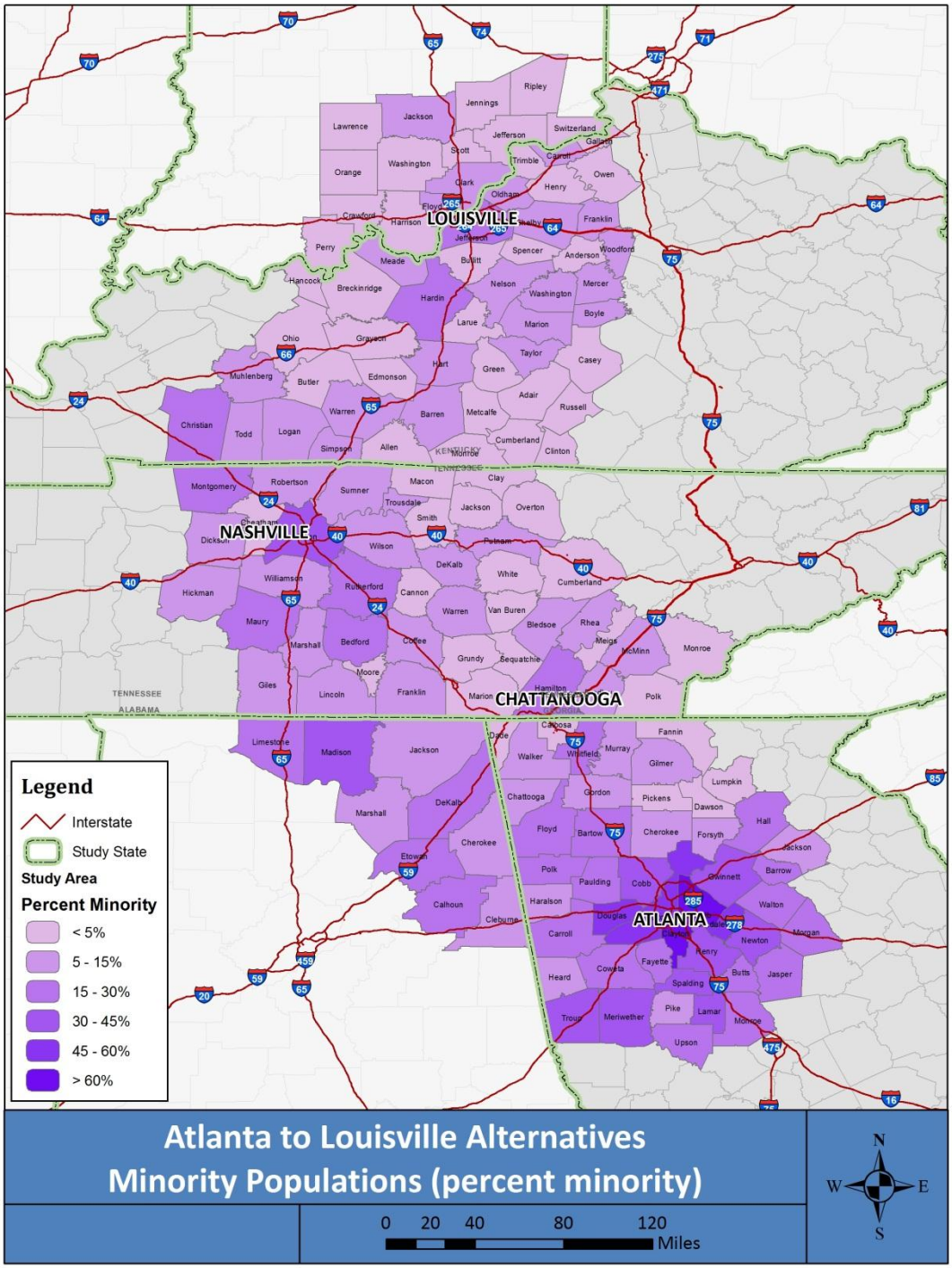
Source: U.S. Census Bureau, 2010

In general, the minority population distribution within the study corridor is similar to the distribution within the states as a whole, where whites have the largest population (see Table 1-6), comprising over 70 percent of the population; while African Americans makes up approximately 20 percent of the population. Notice in Figure 1-21 that the distribution of the minority population closely follows the general distribution of the population density (refer back to Figure 1-20. Hispanics represent approximately eight percent of the population, which is near the total Hispanic population in Georgia.

Table 1-6: Race and Ethnic Distribution (2010)

Race/Ethnicity	Percent of Study Corridor Population
White	67.2%
Black/African American	19.9%
American Indian/Alaska Native	0.2%
Asian/Pacific Native	3.4%
Other / Two or More Races	0.6%
Hispanic or Latino	8.7%

Figure 1-21: Atlanta-Chattanooga-Nashville-Louisville Percent Minorities



1.2.1.3 Aging Population

Planning communities for the aging population (65 years and older) to age in place has become a popular topic as the aging population increases across the nation. Providing multiple transportation options is an important design element in many communities since this either promotes or hinders mobility for the aging population. According to the 2010 U.S. Census, the national aging population has increased slightly from 12.4 percent in 2000 to 12.6 percent in 2010 timeframe. This trend holds true for all of the study states (see Table 1-7). Georgia has the smallest percentage of population of aging residents in comparison to the other states, particularly within metro Atlanta. Notice in Figure 1-22, the aging population tends to reside away from the major cities or outside of the metropolitan statistical areas. In a county-by-county comparison, as shown in Table 1-8, the greatest percentage of the aging population is distributed in rural counties within the three study states. Over 26 percent of the residents in Cumberland County, TN are 65 years or older, followed by Fannin County, GA with over 21 percent and Cumberland County, KY with nearly 20 percent. The range of the aging population within the study corridor is from seven percent to 26 percent and the average is 13 percent, which is slightly more than the national average (12.6 percent).

Table 1-7: State by State Comparison of the Aging Population

State	Aging Population in 2000	Aging Population 2010
U.S	12.4%	12.6%
Alabama	12.0%	13.8%
Georgia	9.6%	10.7%
Indiana	12.4%	12.9%
Kentucky	12.5%	12.7%
Tennessee	12.4%	13.3%

Source: U.S. Census Bureau, American Community Survey

Figure 1-22: Atlanta-Chattanooga-Nashville-Louisville Percent of Aging Population by County

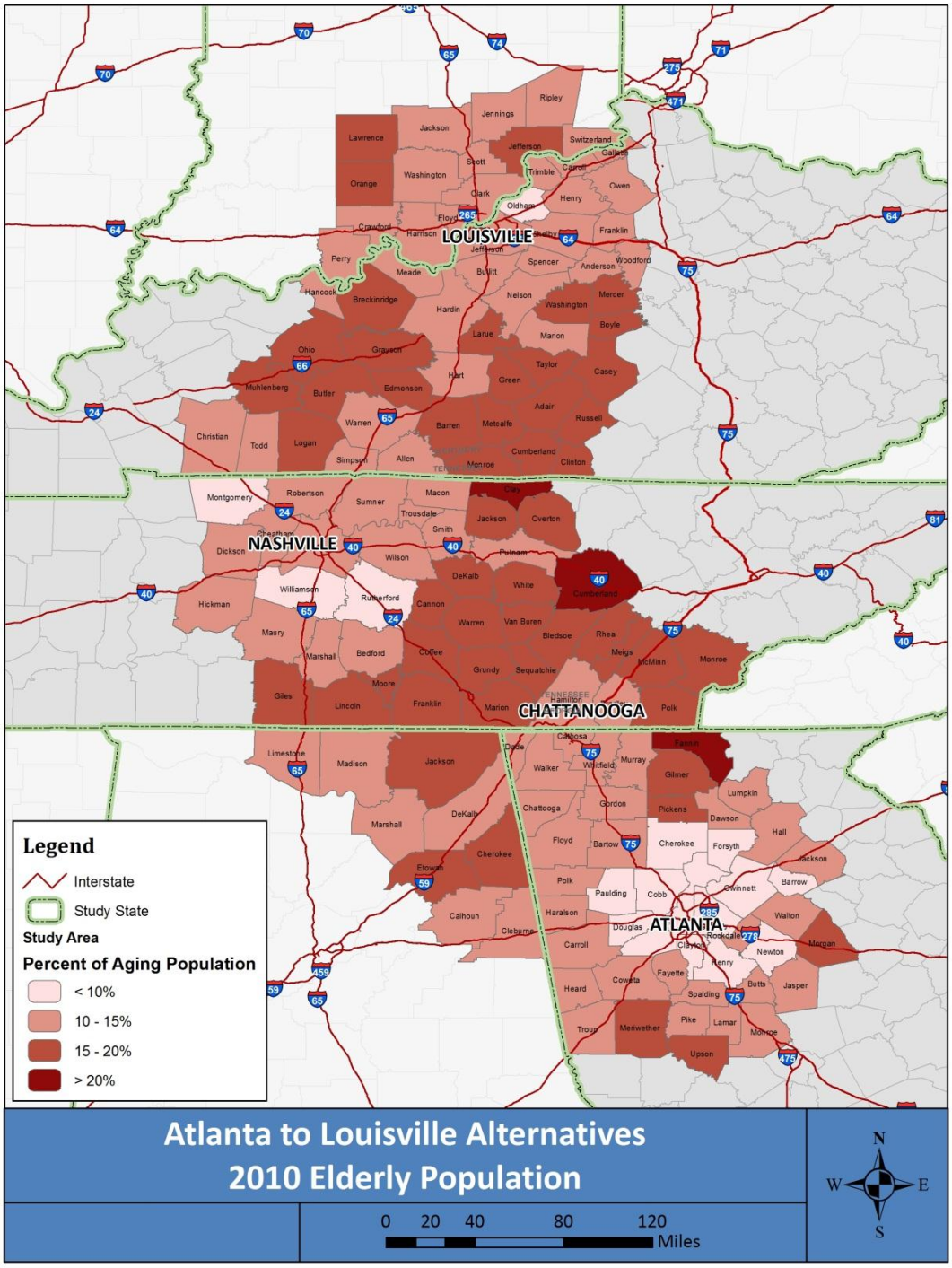


Table 1-8: County by County Comparison of the Aging Population

County and State	Aging Population from 2010
Cumberland, TN	26.1%
Fannin, GA	21.4%
Cumberland, KY	19.5%
Jackson, TN	17.8%
Clay, TN	17.7%
Polk, TN	17.5%
Cherokee, AL	17.5%
Taylor, KY	17.3%
Overton, TN	17.3%
Clinton, KY	17.1%

Source: U.S. Census Bureau, American Community Survey

1.2.2 Employment and Employment Centers

The major employment centers are located in the cities along the study corridor as well as along the interstates. As shown in Figure 1-23, Atlanta, GA and Louisville, KY had the highest concentration of employees in 2009. The Atlanta metropolitan area is the largest of the metro areas in the corridor and has multiple business districts, which attracts residents from the many surrounding counties. Over one quarter (28 percent) of employment within the study corridor occurs in four Georgia counties – Fulton, DeKalb, Cobb and Gwinnett counties; followed by Davidson County, TN with 7.5 percent, Jefferson County, KY with 7.4 percent , Knox County, TN with 3.9 percent, Hamilton County, TN with 3.2 percent and Fayette County, KY with 3.0 percent of the employment. Table 1-9 shows the counties with the largest proportion of employment within the study corridor. Notice that these counties are generally located near major cities. In 2009, the Georgia counties within the study corridor employed approximately 2.5 million people, which equates to 67 percent of Georgia's total employment. In the Kentucky study area, approximately 1.4 million people were employed, accounting for 82 percent of the state's total employment. Lastly, in the Tennessee study area, approximately 1.6 million people were employed in the study area, accounting for 66 percent of the state's total employment.

Figure 1-23: Atlanta-Chattanooga-Nashville-Louisville Employment Density by County

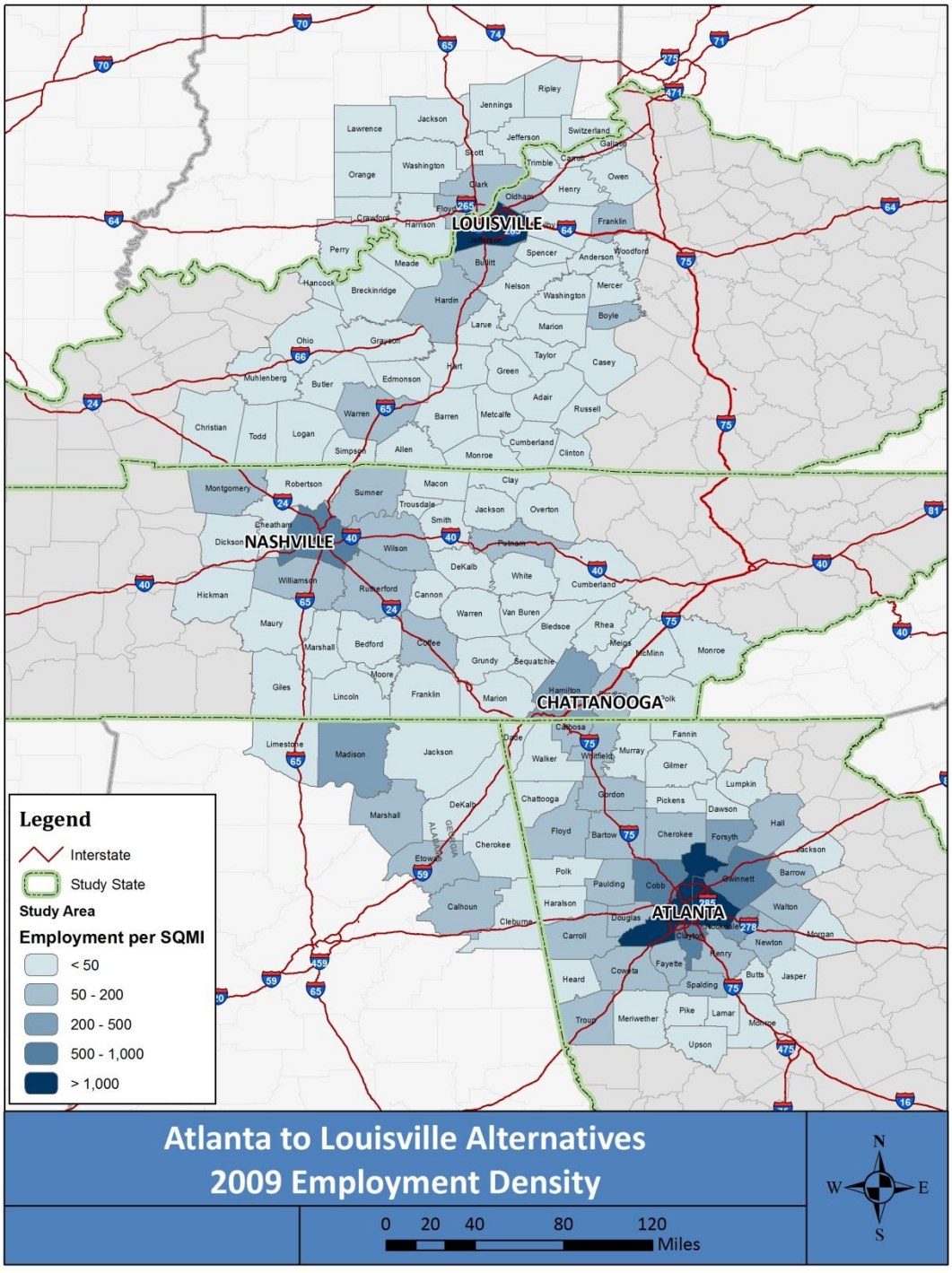


Table 1-9: Counties with Largest Employment

State	County	Employed	Percent of Employment within 100-mile Corridor
Georgia	Fulton	689,951	12.7%
Tennessee	Davidson	416,619	7.5%
Kentucky	Jefferson	408,057	7.4%
Georgia	Cobb	297,910	5.4%
Georgia	Gwinnett	297,220	5.4%
Georgia	DeKalb	280,087	5.1%
Tennessee	Knox	216,805	3.9%
Tennessee	Hampton	177,802	3.2%
Kentucky	Fayette	170,131	3.1%

There are a number of employment hubs located throughout metro Atlanta from Downtown to Midtown to Norcross. The major attractors of employment to Atlanta include many Fortune 500 firms such as Home Depot (#30), UPS (#48), Coca Cola (#70), Delta (#88), and Southern Company (#147), among others. According to the Georgia Department of Economic Development, Kia Motors chose to locate its first U.S. based plan in Troup County, GA, which is at the margin of the study corridor (2011). This is expected to generate approximately 2,500 jobs. Another potential job generator is the consolidation of Southwest Airlines facilities from Minnesota to Atlanta.

The major employment industries in Tennessee are trade, transportation and utilities, manufacturing, financial activities, professional and business services, government, and education and health services (Tennessee Department of Economic & Community Development, 2010). According to the Nashville Area Chamber of Commerce, the top employers in Nashville include Vanderbilt University & Medical Center, State of Tennessee, U.S. Government, Metro Nashville-Davidson County Public Schools, Nissan, Bridgestone, Dell Computer, and St. Thomas Health Services (Nashville Area Chamber of Commerce, 2011).

Similar to Nashville, Chattanooga's major employment industries are healthcare, education, and government services. They include BlueCross BlueShield of Tennessee, Hamilton County Department of Education, Tennessee Valley Authority (owned by the federal government), and Erlanger Health Care System (Chattanooga Area Chamber of Commerce, 2011). Manufacturing industries also play an important role in Chattanooga's job market. In May 2011, the Volkswagen plan opened in Chattanooga generating approximately 2,000 jobs.

Much like the other states, Kentucky has several key employers around its major cities. In Louisville, there are two Fortune 500 companies: Humana (#79) and Yum Brands (#214). Other major employers include UPS, Humana, Inc., Norton Healthcare, and Jewish Hospital Healthcare (Greater Louisville Economic Development, 2011).

1.2.3 Socioeconomic Characteristics - Income

Data from the American Community Survey (ACS) 2005-2009 estimates were used to evaluate the socioeconomic characteristics of the counties for the 100-mile wide study corridor rather than the latest 1-year estimates due to the exclusion of the counties having a population less than 65,000 people. However, the 1-year estimates for 2009 were used to compare the median household incomes of the cities due to unavailable 5-year estimates for the City of Louisville.

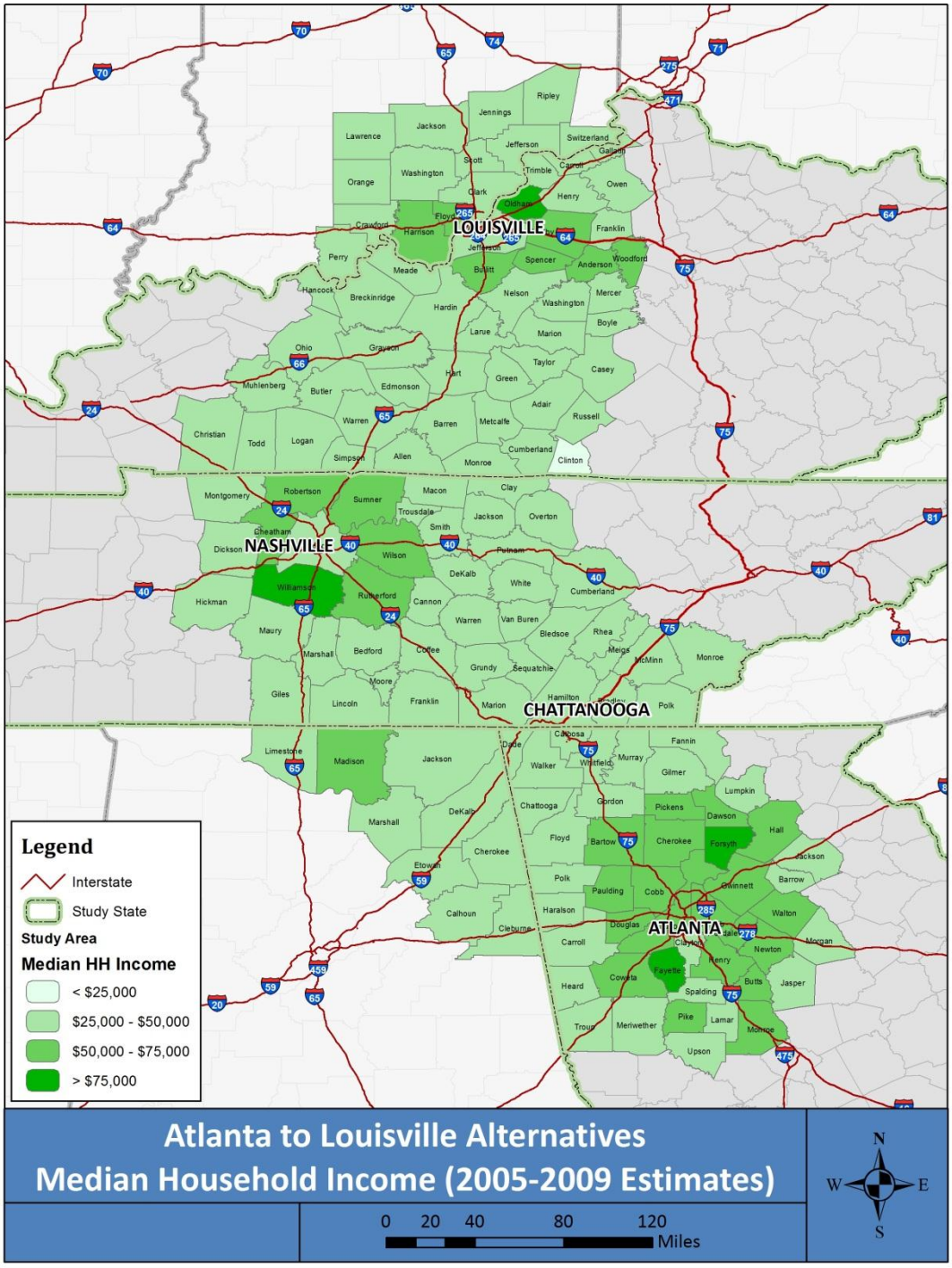
According to the ACS, the five-year estimate of the national median household income was $51,425. This is more than $8,000 higher than the median household income of the study corridor ($43,282) as a whole. The range within the study corridor is from $23,187 (Clifton County, KY) to $88,358 (Williamson County, TN). Table 1-10 is a summary of the median household income for the five states. Compared to the national median household income, all of the states have a lower median income. Georgia has the highest income ($49,466), while Kentucky has the lowest ($41,197). Generally, the highest earners live in the counties of the major cities or counties that are proximate to the major cities (see Figure 1-24).

Table 1-10: Median Household Income by State

State	Median Household Income (2005-2009)
National	$50,221
Alabama	$41,216
Georgia	$49,466
Indiana	$47,465
Kentucky	$41,197
Tennessee	$42,943

Source: U.S. Census Bureau, ACS

Figure 1-24: Atlanta-Chattanooga-Nashville-Louisville Median Household Income by County



The highest income earners in Georgia reside in the following counties:

- Forsyth County ($88,040);
- Fayette County ($81,206);
- Cobb County ($66,515);
- Cherokee County ($67,248); and
- Gwinnett County ($65,136).

The lowest median income households in Georgia, earning between $30,000 and $35,000 per year, are located in Chattooga County, Upson County and Gilmer County.

The highest income earners in Tennessee live near Nashville in the following counties:

- Williamson County ($88,358);
- Wilson County ($61,179);
- Sumner County ($54,708);
- Rutherford County ($53,063); and
- Cheatham County ($51,221).

While the lowest income households, earning less than $30,000 per year median income, are located in Grundy County, Van Buren County and Jackson County.

Much like the other state, the general trend of high income earners and their proximity to major cities is evident in Kentucky. The top earners are located in the follow counties:

- Oldham County ($78,460);
- Spencer County ($57,611);
- Woodford County ($56,478);
- Shelby County ($55,748); and
- Bullitt County ($52,594).

Clinton County has the lowest income earners out of all of the counties within the study corridor ($23,187). Workers in seven Kentucky counties earn less than $30,000 per year. These counties are located outside of the Louisville and Lexington metropolitan statistical areas.

The Alabama and Indiana counties within the 100-mile buffer do not have significantly high income households. In Alabama, the highest income earners live in Madison County $54,979 (the county seat of Huntsville, AL). The highest income earners in Indiana are also residents of one of the state's major cities with a population of 35,000 or more – New Albany in Floyd County ($52,242).

1.2.4 Environmental Justice

A full environmental analysis will be necessary for a Tier I NEPA study. However, the feasibility study can begin to identify areas where environmental justice (EJ) issues may surface along the corridor. Minority populations were identified along the Atlanta-Chattanooga-Nashville-Louisville corridor. The percentage of minority populations within each county along the corridor was compared to the state percentages of minority populations. Those counties whose minority populations exceeded the state average are considered potential EJ counties. Additionally, the county median household income was compared to the statewide median household income. Counties that showed a lower median income than the state are considered potential EJ counties. Table 1-11 illustrates the potential EJ counties and the thresholds met. The detailed demographics for each county are in Appendix D.

Table 1-11: Atlanta-Chattanooga-Nashville-Louisville Potential EJ by County

County	Thresholds	
	Race/Ethnicity	Household Income
Georgia		
Catoosa		✓
Chattooga		✓
DeKalb	✓	
Douglas	✓	
Fannin		✓
Floyd		✓
Fulton	✓	
Gilmer		✓
Gordon		✓
Gwinnett	✓	
Haralson	✓	✓
Lumpkin		✓
Murray		✓
Polk		
Walker	✓	✓
Whitfield		✓
Alabama		
Cherokee		✓
DeKalb		✓
Jackson		✓
Tennessee		
Bedford		✓
Bledsoe		✓
Bradley		✓
Cannon		✓
Coffee		✓
Cumberland		✓
Davidson	✓	
DeKalb		✓
Franklin		✓
Grundy		✓
Hamilton	✓	
Hickman		✓
Jackson		✓

County	Threshold	
	Race/Ethnicity	Household Income
Lincoln		✓
Macon		✓
Marion		✓
Marshall		✓
McMinn		✓
Meigs		✓
Montgomery	✓	
Polk		✓
Putnam		✓
Rhea		✓
Sequatchie		✓
Trousdale		✓
Van Buren		✓
Warren		✓
White		✓
Kentucky		
Allen		✓
Barren		✓
Breckinridge		✓
Butler		✓
Edmonson		✓
Franklin	✓	
Grayson		✓
Green		✓
Hardin	✓	
Hart		✓
Jefferson	✓	
Larue		✓
Logan		✓
Marion		✓
Metcalfe		✓
Monroe		✓
Muhlenberg		✓
Ohio		✓
Shelby	✓	
Simpson		
Taylor		✓

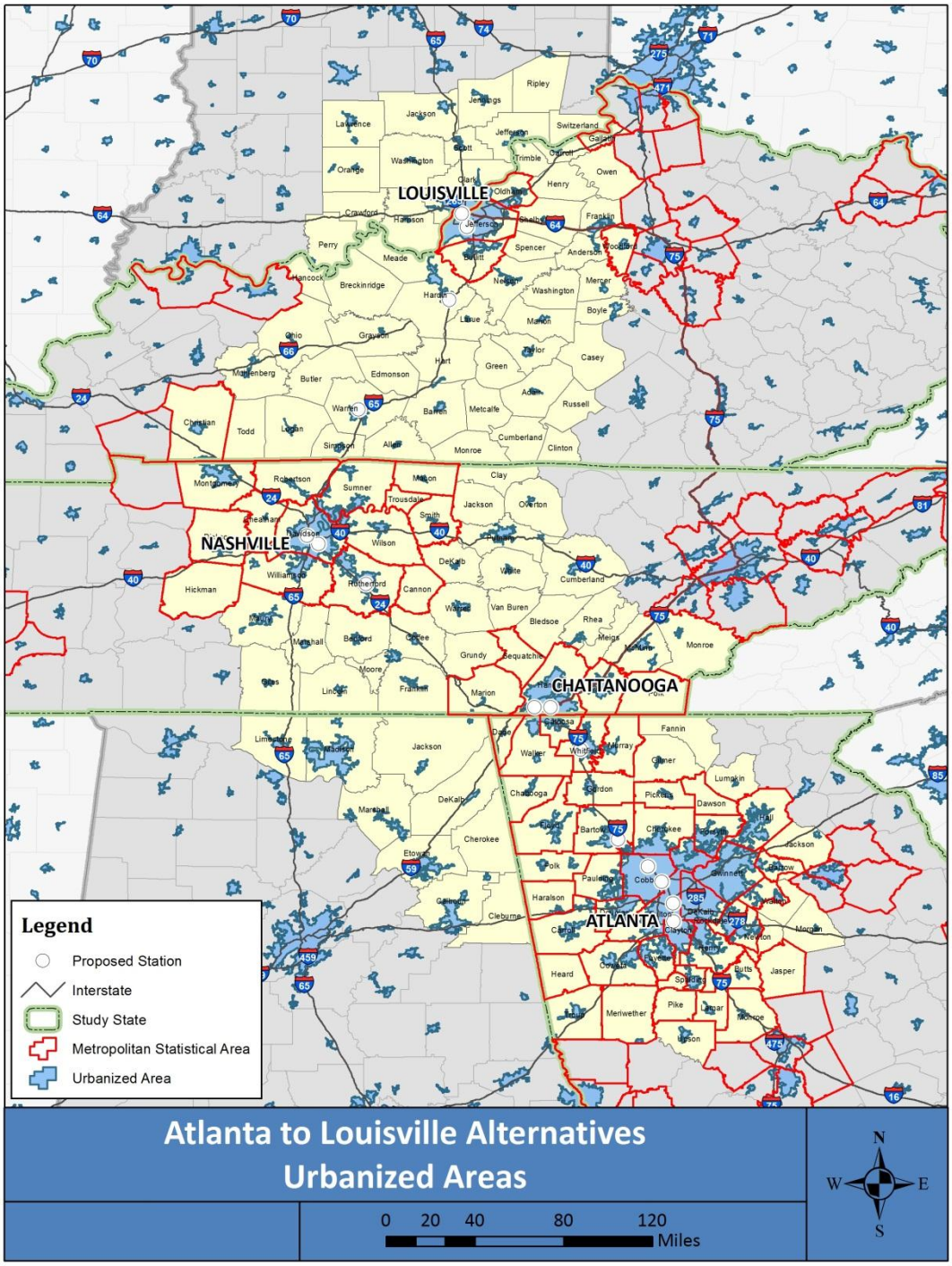
County	Threshold	
	Race/Ethnicity	Household Income
Todd		✓
Warren	✓	
Washington		✓

Source: U.S. Census Bureau, 2010

1.3 LAND USE – URBAN VS. RURAL

The study corridor is comprised of both urban and rural areas. However, the majority of the study corridor consists of rural areas. The U.S. Census defines rural areas as "all territory, population, and housing units located outside of urbanized areas (UA) and urbanized clusters(UC)" (U.S. Census Bureau, 2009). UAs and UCs are defined as "densely settled territory" consisting of lower census units such as blocks or block groups with a minimum population density of 1,000 people per square mile and are surrounded by census blocks with at least ½ (500 people per square mile) of the territory's density (U.S. Census Bureau, 2009). As shown in Figure 1-25, the terminals and potential station locations for the study corridor are located in urbanized areas.

Figure 1-25: Atlanta-Chattanooga-Nashville-Louisville Urbanized Areas



1.4 TRAVEL PATTERNS

High-speed rail feasibility is determined, at least in part, by the degree of connection between the cities in the corridor. High speed rail is an alternative to both auto and air travel and will be more successful in corridors where there is moderate to high travel between the major corridor cities.

1.4.1 AUTOMOTIVE TRAVEL

To be consistent with the ridership and revenue forecasting methodology, the study obtained the annual auto round trip estimation from the 1995 ATS conducted by the BTS. While this resource is somewhat dated, it remains the major statistical data measuring auto travel between major urban areas and cities.

The survey found a strong auto connection between Atlanta, GA, Chattanooga and Nashville, TN at the southern end of the corridor (see Table 1-12). The connection between Atlanta and Louisville was much less robust, likely due to the long distance for driving, with only 61,000 trips daily. The connection between Louisville and Nashville was stronger with approximately 91,000 trips.

Table 1-12: Intercity Auto Trip Table (ATS 1995)

Originating City	Destination City: Annual Person Trips (Round Trips)			
	Atlanta	Chattanooga	Nashville	Louisville
Atlanta	-	261,601	391,600	39,198
Louisville	61,138	50,457	96,197	-

1.4.2 AIR TRAVEL

Local air travel refers to direct air passenger volumes between the major airports in the study corridor. The FHWA DB1B was utilized to determine these volumes for 2010. It should be noted that transfers are not included; only trips originating in and destined for one of the corridor cities. The survey results are shown in Table 1-13. The survey determined that air travel originating from and destined to Atlanta is the greatest compared to the other city pairs, particularly air travel between Atlanta and Nashville.

Table 1-13: Local Air Trips in 2010

Origin Airport	Destination Airport			
	ATL	CHA	BNA	SDF
ATL - Atlanta	-	101,556	217,917	154,521
CHA – Chattanooga	103,392	-	576	18
BNA – Nashville	210,213	24,012	-	1,431
SDF - Louisville	156,654	27	1,566	-

Source: FHWA Airline Origin and Destination Survey Database, 2010 (Q1-Q4)

Air connections are also an important component of air travel in the corridor and in estimating the potential demand for high-speed rail travel. Along the Atlanta-Chattanooga-Nashville-Louisville Corridor, flight connections play an important part in an airport's function. These passengers may use high-speed rail for part of their journey to traveling to one of the airport hubs and accessing connecting flight to other domestic and international destinations outside the corridor. Table 1-14 illustrates the total enplanements at the originating airport and number of connecting passengers in 2010.

Table 1-14: Connecting Air Volumes in 2010

Originating Airport	Total Enplanements	Connect Air Volumes[33]
ATL - Atlanta	31,239,063	9,967,860
CHA – Chattanooga	255,708	50,310
BNA – Nashville	3,869,190	1,555,461
SDF - Louisville	1,387,575	364,842

Source: FHWA Airline Origin and Destination Survey Database, 2010 (Q1-Q4)

1.5 ENVIRONMENTAL ISSUES

Environmentally sensitive areas for the purposes of this study include the potential for threatened and endangered species and cultural resources such as properties listed on the NRHP or that are outlined in Section 4(f) of the DOT Act of 1966. FRA must comply with Section 4(f) guidelines for the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refugees, or public and private historical sites. These properties cannot be impacted by projects unless the following conditions apply: 1) there is no feasible and prudent alternative to the use of the

[33] Connect Air volumes are calculated by subtracting from the total enplanement: 1) the direct flights with destinations out of the corridor(considered as not divertible) and 2) the Local Air passengers (considered in Table 1-12).

land; and 2) the action includes all possible planning to minimize harm to the property resulting from use.

As previously mentioned there are additional environmental aspects that should be considered in future studies, but given the high-level analysis if this feasibility analysis, these aspects are more appropriate during the NEPA process.

1.5.1 Threatened and Endangered Species

The Shared Use and Dedicated Use routes were assessed for impacts to threatened and endangered species and cultural resources on a county basis.

The U.S. FWS maintains national threatened and endangered species lists. The corridors were reviewed for the potential of threatened and endangered species on a county basis. A species is designated as endangered with it is "in danger of extinction throughout all or a significant portion of its range" and threatened when it is "likely to become endangered within the foreseeable future" (U.S. FWS). The county reports "contain species that are known to or are believed to occur in the county" (U.S. FWS). A full list by county may be found in Appendix E.

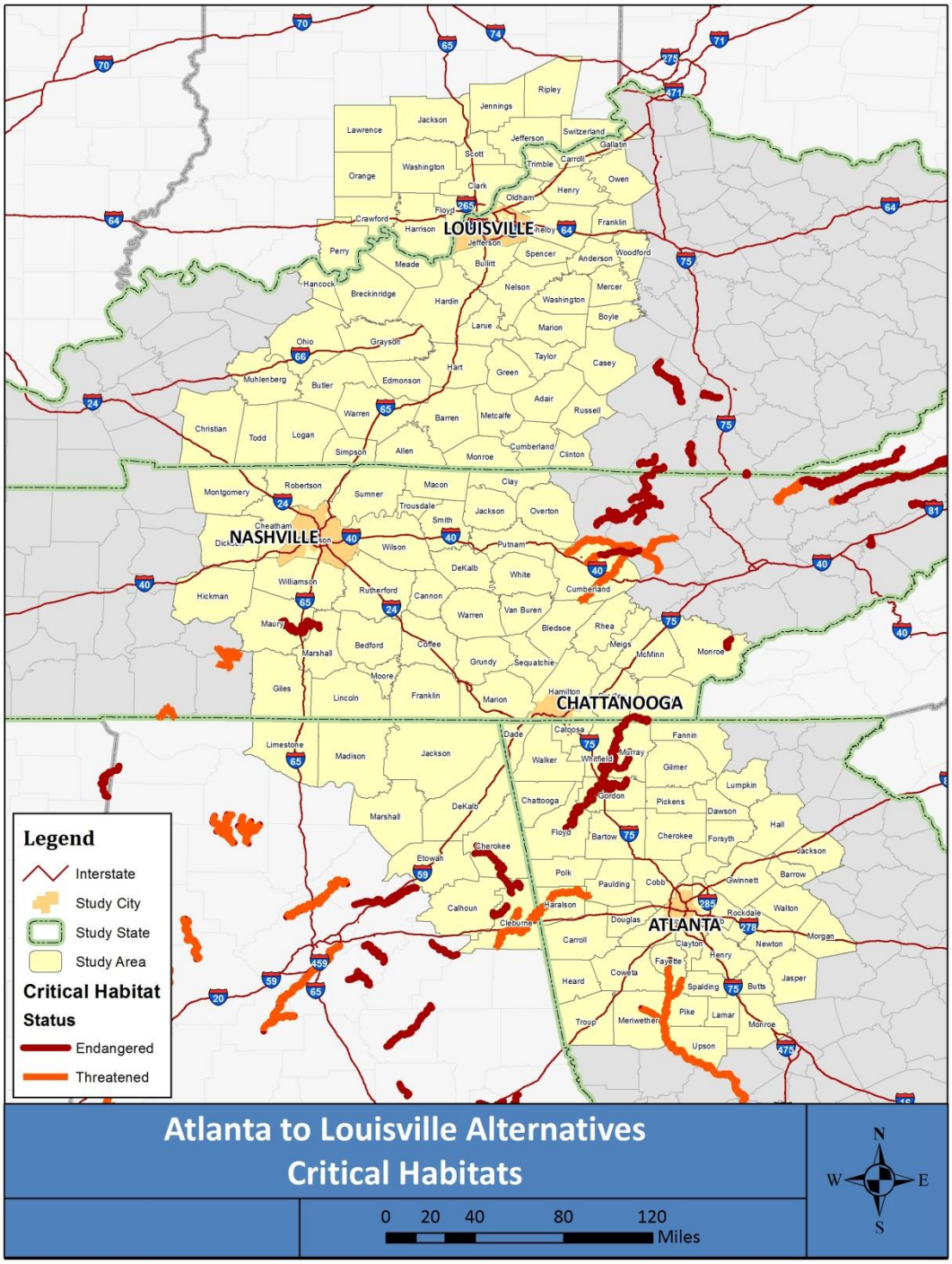
Table 1-15 is a list of known threatened and endangered species within and around the 100-mile wide study corridor. There are 15 known endangered species and six known threatened species within the vicinity of the study corridor. Figure 1-26 provides an approximate map of known critical species habitats within the vicinity of the study corridor. A full list of threatened and endangered species for the 21 counties identified as containing threatened and endangered species is provided in Appendix E.

Table 1-15: Known Endangered and Threatened Species List

Species	Status	Listing Date
Spotfin Chub	Threatened	10/11/1977
Slackwater darter	Threatened	10/11/1977
Smoky madtom	Endangered	10/26/1984
Cumberlandian combshell	Endangered	1/10/1997
Oyster mussel	Endangered	1/10/1997
Southern acornshell	Endangered	3/17/1993
Purple bankclimber (mussel)	Threatened	3/16/1998
Upland combshell	Endangered	3/17/1993
Oval pigtoe	Endangered	3/16/1998
Finelined pocketbook	Threatened	3/17/1993
Shinyrayed pocketbook	Endangered	3/16/1998
Fat three-ridge (mussel)	Endangered	3/16/1998
Ovate clubshell	Endangered	3/17/1993
Southern clubshell	Endangered	3/17/1993
Triangular Kidneyshell	Endangered	3/17/1993
Alabama moccasinshell	Threatened	3/17/1993
Coosa moccasinshell	Endangered	3/17/1993
Southern pigtoe	Endangered	3/17/1993
Gulf moccasinshell	Endangered	3/16/1998
Ochlocknee moccasinshell	Endangered	3/16/1998
Chipolas labshell	Threatened	3/16/1998

Source: U.S. FWS

Figure 1-26: Locations of Known Critical Habitats

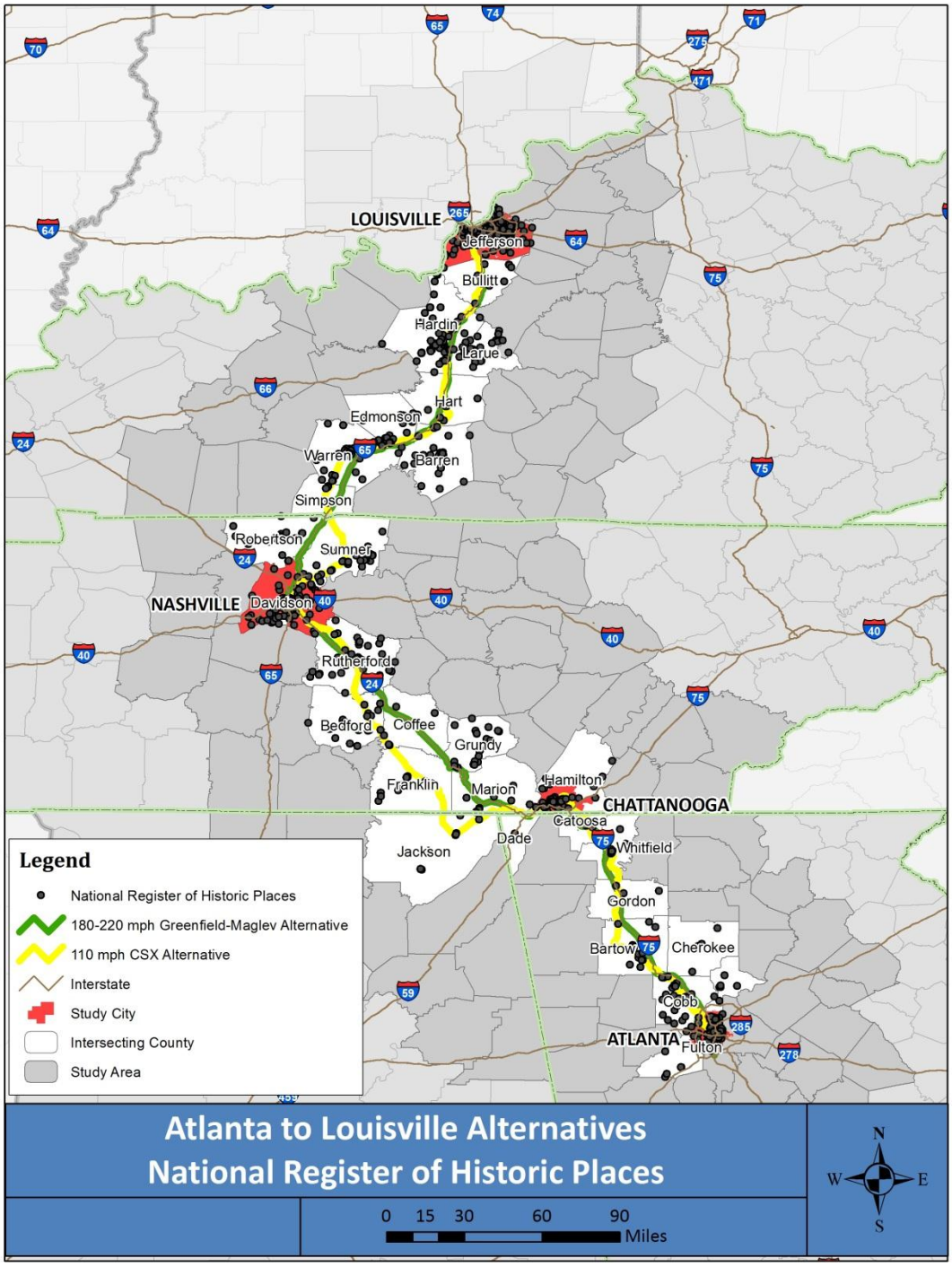


1.5.2 CULTURAL RESOURCES

The protection and preservation of socially valuable structures, districts and properties may be ensured by identifying cultural resources within the project area. The locations of historic places of the counties intersecting the proposed routes were retrieved from the NRHP database. The NRHP is managed by the National Park Service and leads a number of programs to protect and preserve the nation's archeological, architectural, curatorial, historical, and other culturally significant properties (National Park Service, 2011).

As shown in Figure 1-27, 43 counties intersect culturally significant resources. There are approximately 2,030 registered historic places within these counties. Georgia counties have 327 registered culturally significant resources. Kentucky counties have 1,210 resources, and Tennessee counties have 482 resources. Eleven registered culturally significant resources are found in Jackson County, AL, which is traversed by the CSXT route between Chattanooga and Nashville. Properties that intersect the high-speed rail route will need further exploration to determine if there are any adverse impacts before making a preferred route recommendation. Appendix E contains a list of registered historic properties for the 43 counties, according to the NRHP database.

Figure 1-27: Locations of Registered Cultural Resources



1.6 Issues and Opportunities

As noted in the previous sections, each of the high-speed rail alternatives has potential benefits as well as obstacles to implement. Issues include environmental impacts, operational barriers and political concerns. Opportunities for success include the potential to serve key facilities and populations, travel time savings and benefits to freight services operating on evaluated lines. These issues and opportunities, described in Table 1-16, were identified through technical analysis as well as through stakeholder interviews (refer to Chapter 2).

Table 1-16: Atlanta-Chattanooga-Nashville-Louisville Issues and Opportunities

Alternative	Opportunities	Issues
110 mph Shared Use Corridors		
Atlanta to Chattanooga		
NS	• Utilizes existing right-of-way • Relatively lower freight train volumes compared to CSXT alternative • Less percentage of miles with curvature greater than 1 degree, 30 minutes (26%/36 miles) compared to CSXT alternative • More compatible freight traffic mix with passenger rail compared to CSXT alternative • Potential to share track with the Atlanta-Birmingham Shared Use Corridor	• Segment is part of a key NS route to the Midwest and Chicago • Shared operations with intercity passenger rail could negatively affect operating schedules and times. • Improvements/track replacement needed to upgrade track and infrastructure to Class 6 track • Route bypasses major Atlanta suburbs, I-75 corridor and Lovell Field (Chattanooga) • Less direct route from Atlanta to Chattanooga, resulting in slightly longer travel times • Extensive horizontal and vertical curvature
CSXT	• Utilizes existing right-of-way, owned by the State of Georgia • More direct route from Atlanta to Chattanooga, resulting in shorter travel times • Good connectivity to H-JAIA and Lovell Field • More direct connections to major Atlanta suburbs and I-75 corridor	• Extremely heavy freight densities resulting in passenger service reliability issues • Restricted right-of-way, making curve expansions difficult • Larger percentage of curve compared to NS alternative (34%/45 miles) • High freight growth forecasted as a key route to Midwest and Chicago

Alternative	Opportunities	Issues
Chattanooga - Nashville		
CSXT	• Utilizes existing right-of-way • Relatively low freight train volumes currently (averages 22.5 trains/day) • Relatively low percentage of miles exceed curve limit of 1 degree, 30 minutes (19%/30 miles) • Provides good connectivity to downtown areas, transit and airports in Chattanooga and Nashville • Provides access to Arnold Air Force Base	• Major improvements and/or track replacement needed to upgrade track to Class 6 • Future freight volumes may result in service reliability issues • Segment included in the key route to the Midwest and Chicago • Problematic identifying rail alignment over the Cumberland Plateau • High potential for dramatic increases in freight train volumes as economic conditions change, resulting in service reliability issues
Nashville-Louisville		
CSXT	• Utilizes existing right-of-way • Relatively low freight train volumes currently (averages 22.5 trains/day) • Low percentage of miles exceed curve limit of 1 degree, 30 minutes (7%/12 miles) • Direct proximity Fort Knox • Provides good connectivity to downtown area, transit and airports in Nashville and Louisville • Bypasses Mammoth Cave National Park • Relative proximity to I-65 corridor • Alignment conducive to 1010 mph trains in the existing corridor	• Major improvements and/or track replacement needed to upgrade track to Class 6 • Future freight volumes may result in service reliability issues

Alternative	Opportunities	Issues
Chattanooga-Louisville (via Danville, KY)		
NS (Chattanooga to Louisville)	• Utilizes existing right-of-way • Relatively low percentage of miles exceed curve limit of 1 degree, 30 minutes (23%/72 miles) • Heavy Freight traffic	• Major improvements and/or track replacement needed to upgrade track to Class 6 • Future freight volumes may result in service reliability issues • Does not directly access Nashville, the second largest city in Tennessee • Does not directly access Knoxville or University of Tennessee • Key freight route to the Midwest and Chicago • Difficult vertical and horizontal geometry
NS (Chattanooga to Lexington)	• Utilizes existing right-of-way • Relatively low percentage of miles exceed curve limit of 1 degree, 30 minutes (19%/49 miles) • Provides good connectivity to downtown areas, transit and airports in Chattanooga and Lexington	• Major improvements and/or track replacement needed to upgrade track to Class 6 • Future freight volumes may result in service reliability issues • Does not access Nashville, the second largest city in Tennessee • Does not directly access Knoxville or University of Tennessee • Part of the key freight route to the Midwest and Chicago
RJ Colman (Lexington to Louisville)	• Utilizes existing right-of-way • Low freight traffic densities • Provides good connectivity to downtown areas, transit and airports in Lexington and Louisville • Generally follows the I-64 corridor	• Major improvements and/or track replacement needed to upgrade track to Class 6 • Connects the CSXT mainline from Louisville to Cincinnati, OH and could result in high freight densities in the future • Relatively high percentage of miles exceed curve limit of 1 degree, 30 minutes (39%/35 miles) • Numerous road crossings

Alternative	Opportunities	Issues
Nashville-Knoxville		
Nashville and Eastern (Nashville to NS)	• Utilizes existing right-of-way • Provides direct access to Tennessee Tech University • Low freight volumes (averages 2-4 trains/day)	• Major improvements and/or track replacement needed to upgrade track to Class 6 • Track is abandoned for approximately 30 miles • Relatively high percentage of miles exceed curve limit of 1 degree, 30 minutes (32%/37 miles) • Extreme curvature between Harriman and abandoned section would require the purchase of additional right-of-way to ease curves
NS (Nashville and Eastern to Knoxville)	• Utilizes existing right-of-way • Provides direct access to Knoxville and University of Tennessee	• Major improvements and/or track replacement needed to upgrade track to Class 6 • Relatively high freight volumes (45 trains/day) • High percentage of miles exceed curve limit of 1 degree, 30 minutes (47%/17 miles)
180-220 mph Dedicated Use Corridors		
Atlanta-Chattanooga		
Interstate Route	• Significantly shorter travel time and distance than the Shared Use routes • Provides good connectivity to a number of opportunity areas including I-75 corridor, airports, transit and downtown areas	• Will require significant land takings and associated social and environmental impacts • Significantly higher cost than Shared Use alternative • High percentage of miles exceed curve limit of 30 minutes (46%/59 miles)
Chattanooga –Nashville		
Interstate Route	• Significantly shorter travel time and distance than the Shared Use routes • Relatively low percentage of miles exceed curve limit of 30 minutes (15%/19 miles) • Provides good connectivity to a number of opportunity areas including I-24 corridor, airports, transit and downtown areas	• Will require significant land takings and associated social and environmental impacts • Significantly higher cost than Shared Use alternative • Major vertical grade considerations

Alternative	Opportunities	Issues
Nashville-Louisville		
Interstate Route	• Significantly shorter travel time and distance than the Shared Use routes • Relatively low percentage of miles exceed curve limit of 30 minutes (7%/21 miles) • Provides good connectivity to a number of opportunity areas including I-65 corridor, airports, transit and downtown areas	• Will require significant land takings and associated social and environmental impacts • Significantly higher cost than Shared Use alternative
Interstate and Greenfield (Western Alignment)	• Significantly shorter travel time and distance than the Shared Use routes • Provides direct access to Fort Knox	• Will require significant land takings and associated social and environmental impacts • Significantly higher cost than Shared Use alternative • Ridge and valley topography may limit alternative's potential
Interstate and Greenfield (Eastern Alignment)	• Significantly shorter travel time and distance than the Shared Use routes • Provides direct access to Fort Knox • Shorter distance than the Interstate Route or Western Alignment (approximately 50 miles less)	• Will require significant land takings and associated social and environmental impacts • Significantly higher cost than Shared Use alternative • Bedrock through the Western Pennyroyal Region may limit alternative's potential
Chattanooga-Louisville (via Lexington, KY)		
Interstate Route	• Significantly shorter travel time and distance than the Shared Use routes • Provides good connectivity to a number of opportunity areas including I-75 and I-64 corridors, airports, transit and downtown areas • Relatively low percentage of miles exceed curve limit of 30 minutes (29%/104 miles)	• Will require significant land takings and associated social and environmental impacts • Significantly higher cost than Shared Use alternative

2 STAKEHOLDER OUTREACH

As a part of this High-Speed Rail Feasibility Study, the study proposed stakeholder outreach through a Public Involvement Plan. Refer to Appendix A for more detailed information on this plan. The purpose of the stakeholder outreach is to keep key stakeholders along the Atlanta-Chattanooga-Nashville-Louisville Corridor informed of the study process and results. In some cases, the study received local input on methodologies for the corridor to determine the best practice for the corridor. Inputting local input allowed the study to reflect the most recent and accurate data available to determine high-speed rail feasibility.

For the Atlanta-Chattanooga-Nashville-Louisville Corridor, the study worked with various stakeholders, including:

- Chattanooga-Hamilton County Regional Planning Agency (Chattanooga MPO);
- City of Chattanooga;
- City of Lexington;
- Clarksville Metropolitan Planning Organization;
- The Enterprise Center (Chattanooga-Hamilton County, TN)
- Kentuckiana Regional Planning and Development Agency;
- Kentucky Transportation Cabinet;
- Nashville Area Metropolitan Planning Organization;
- Nashville Metropolitan Transit Agency;
- The Transit Alliance (Middle Tennessee);
- Transit Authority of River City; and
- Tennessee Department of Transportation.

The study held three rounds of stakeholder involvement activities throughout the study process. The first round of meetings took place in May 2011 in which the consultant team met with representatives of each of the stakeholders to introduce them to the study project scope and schedule. The consultant team described the study corridor and the potential alternatives that were under a technical review to determine the best alternative to represent a Shared Use and Dedicated Use routes. The study also presented corridor maps outlining all identified strengths, weaknesses, issues and opportunities along each of the potential alternatives (Figure 2-1). The study gathered input from the stakeholders to combine with technical data to develop the Issues and Opportunities table (refer back to Table 1-6) and, ultimately, the representative route. Refer to Appendix A for the stakeholder agenda and handout packet presented at each of these meetings.

Table 2-1: Atlanta-Chattanooga-Nashville-Louisville Stakeholder Outreach Meetings

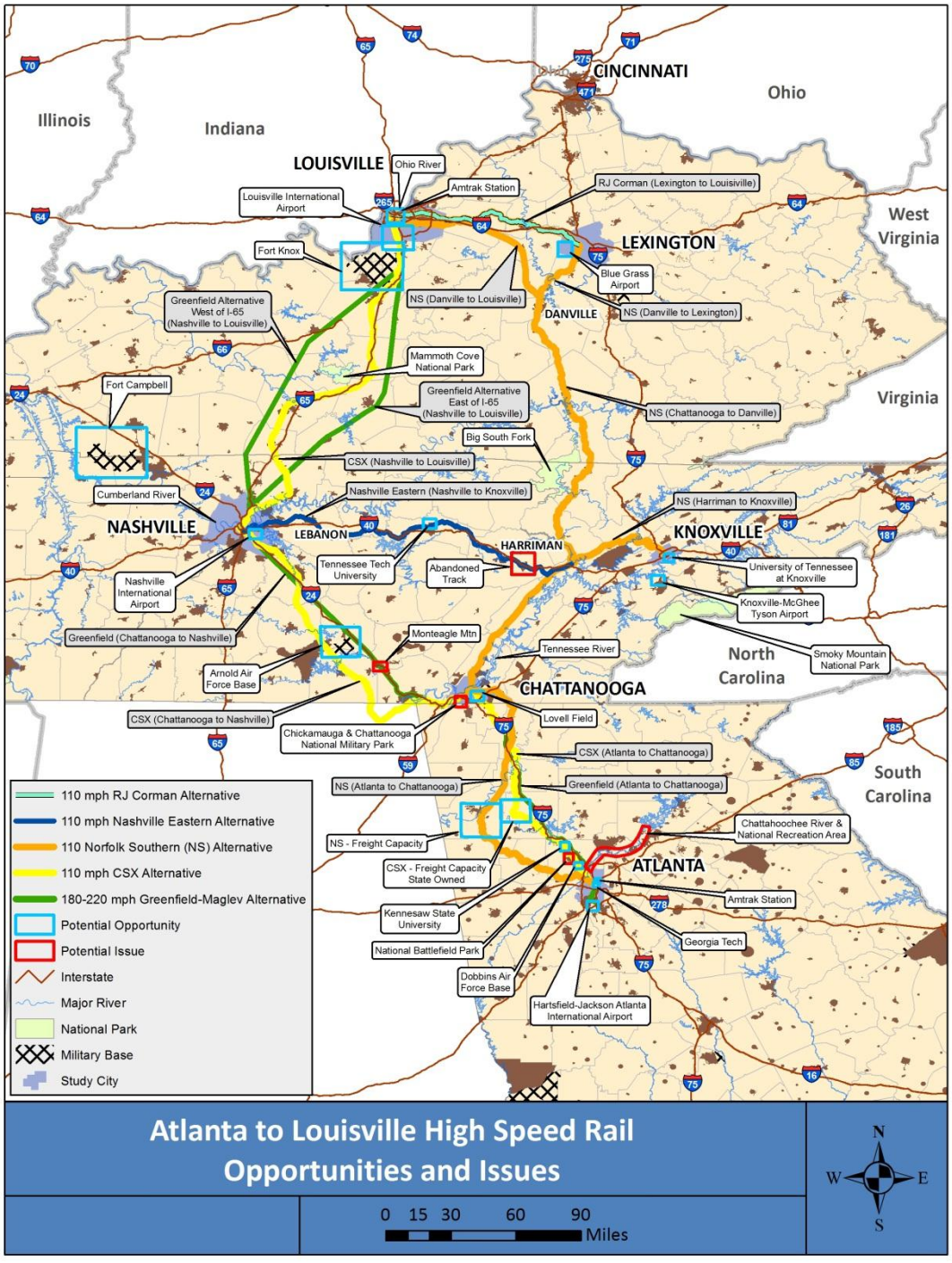
Stakeholder	Date	Time	Location
Round One, Stakeholder Meetings			
TARC	May 20, 2011	9:00 -10:00 AM	Louisville, KY
KIPDA	May 20, 2011	10:30-11:30 AM	Louisville, KY
KYTC	May 20, 2011	1:30-2:30 PM	Frankfort, KY
Lexington Mayor	May 20, 2011	4:30-5:30 PM	Lexington, KY
ARC	May 27, 2011	11:00 AM-12:00 PM	Atlanta, GA
Chattanooga MPO	July 20, 2011	10:30-11:30 AM	Chattanooga, TN
The Enterprise Center	July 20, 2011	10:30-11:30 AM	Chattanooga, TN
MTA	July 11, 2011	10:00-11:00 AM	Nashville, TN
The Transit Alliance	July 11, 2011	10:00-11:00 AM	Nashville, TN
Clarksville MPO	July 11, 2011	3:30-5:00 PM	Nashville, TN
TDOT	July 11, 2011	3:30-5:00 PM	Nashville, TN
Nashville MPO	July 11, 2011	3:30-5:00 PM	Nashville, TN
Round Two, Corridor Webinar			
All Stakeholders	September 8, 2011	1:00-2:30 PM	On-Line
Round Three, Stakeholder Meetings			
TARC	November 17, 2011	10:00-11:00 AM	Louisville, KY
KIPDA	November 16, 2011	10:00-11:00 AM	Louisville, KY
The Transit Alliance	November 8, 2011	2:00-3:00 PM	Nashville, TN
MTA	November 8, 2011	2:00-3:00 PM	Nashville, TN
KYTC	November 16, 2011	10:00-11:00 AM	Frankfort, KY
Nashville MPO	December 1, 2011	2:00-3:00 PM	Nashville, TN
TN Department of Transportation	December 1, 2011	2:00-3:00 PM	Nashville, TN
The Enterprise Center	November 15, 2011	1:00-2:00 PM	Chattanooga, TN
Chattanooga MPO	November 15, 2011	1:00-2:00 PM	Chattanooga, TN
Clarksville MPO			
ARC	November 30, 2011	9:00-10:00 AM	Atlanta, GA

Major Stakeholder Input

Stakeholders provided valuable insight into issues and opportunities along the corridor to assist the study in developing the representative routes for the Shared Use and Dedicated Use service. Outlined below, are the main feedback comments heard across the corridor:

- There is significant value in capturing the potential ridership and connectivity between Nashville and Atlanta. Unless there were significant technical reasons favoring an eastern route in the vicinity of Knoxville, most stakeholders supported the western route through Nashville.
- There was general support for a Clarksville/Fort Campbell connection to the high-speed rail system.
- Stakeholders were interested in the proposed station locations and the operational requirements for each station.
- Stakeholders noted the value of connectivity to Murfreesboro and Elizabethtown for commuter travel patterns, particularly with the re-tasking of Fort Knox from an active armor center to the Army's personnel center. This will result in an increase of civilian employees likely to be living in Louisville and working in Fort Knox/Elizabethtown.
- There were substantial environmental and construction issues identified with the greenfield route in Kentucky between Nashville and Louisville.

Figure 2-1: Atlanta-Chattanooga-Nashville-Louisville Issues and Opportunities



The second round of meetings was a virtual webinar and conference call in September 2011 to provide an update on the corridor progress and present preliminary results on capital costs, operating and maintenance costs, and ridership and revenue for both the Shared Use and Dedicated Use representative routes. Additionally, the study presented a variety of technology considerations for the corridor and gave an update on the federal funding options and strategies moving forward. Refer to Appendix A for the webinar agenda and presentation.

Major Stakeholder Input

- Stakeholder participants in the webinar session showed an overall interest in development of the capital cost estimates and technology alternatives.
- Stakeholders inquired about freight railroad agreements and whether the railroad owners would allow higher speeds on the freight corridors. The study stated that they worked with railroad owners, and agreements would need to be in place for speeds greater than 79 mph.

The third and final round of meetings were held in November and early 2011 in which the study presented the final estimates for capital costs, operating and maintenance costs and ridership and revenue. Additionally, the study ran operating ratio and consumer surplus analyses to determine the overall feasibility of the Atlanta-Chattanooga-Nashville-Louisville Corridor and made final observations and recommendations for the corridor moving forward. Refer to Appendix A for the meeting agenda and presentation.

Major Stakeholder Input

- The study informed the stakeholders that the population of Clarksville was included in the ridership forecasting due to its location relative to Nashville; however, a specific route through Clarksville was not part of the feasibility study.
- Stakeholders inquired about ensuing efforts and what would be required to progress the corridor to the subsequent phases and how to initiate the process.
- Stakeholders expressed interest in a Hybrid High Performance scenario as a way to potentially provide service meeting both operating and cost-benefit criteria.

3 REPRESENTATIVE ROUTES

Representative Shared Use and Dedicated Use routes were identified in the Atlanta-Chattanooga-Nashville-Louisville Corridor to provide a basis for developing ridership and revenue forecasts, capital costs, and operations and maintenance costs to assess the feasibility of the corridor for high speed rail service. The representative routes were selected based on an analysis of physical, cost and service factors as well as stakeholder input. Each is an illustrative route for the corridor for purposes of determining feasibility, and is not intended to represent a locally preferred alternative. Final decisions on routes and specific alignments will be made in future environmental study phases if the corridor is determined to be feasible.

3.1 90-110 MPH EMERGING HIGH-SPEED RAIL (SHARED USE)

In identifying capacity improvements required for 90-110 mph Shared Use operations in the Atlanta-Chattanooga-Nashville-Louisville Corridor, the study assumed that all infrastructure improvements could be made within the existing freight right-of-way (assumed at 100 feet).

The Atlanta-Chattanooga-Nashville-Louisville Corridor will use the CSXT freight (Shared Use) corridor. The CSXT Shared Use passenger operation consists of passenger trains operating on existing freight CSXT routes within existing CSXT right-of-way. The assumption is that the proposed passenger trains cannot restrict current or future freight operations. The passenger operation cannot restrict the time to perform maintenance of the track and structures for both the passenger and freight operation.

CSXT adjusts their operations reacting to economic conditions and climate. Since the beginning of the most recent economic recession in the late 2000s, CSXT began running longer trains in order to provide cost reductions in their operation. Prior to the recession, CSXT would typically run shorter, more frequent trains to meet time deadlines. CSXT estimates that in the future, as economic conditions improve, operations will resume to pre-recession levels. In order to add flexibility in the operation, an additional dedicated passenger track the complete length of the corridor will be added with 10 mile high speed sidings every 30 miles in the corridor, with Universal Crossovers located midway in the 10 mile sidings.

The Atlanta-Chattanooga-Nashville-Louisville routes all have similar track configurations, which are located through difficult terrain, including geologic systems of valleys, ridges, plateaus, and the Blue Ridge Mountains. This type of terrain presents curvatures that are in many cases greater than one degree, 30 minutes (110

mph trains can run at full speed on this radius of curvature). The Nashville to Louisville segment is generally in rolling hill terrain. The train operation will use Diesel Titling Train Technology to maintain higher speeds due to the extreme curvature on this corridor. PTC technology will be used in the Atlanta-Chattanooga-Nashville-Louisville Corridor

Listed below are the percentages of miles of curves that are greater than one degree, 30 minutes for each segment:

- Atlanta-Chattanooga-34 percent
- Chattanooga-Nashville-19 percent
- Nashville-Louisville-7 percent

These curves restrict the speed of both passenger trains and freight trains which also contributes to limited capacity for both passenger and freight trains due to reduced velocity of the trains.

The crew change terminal between Atlanta and Louisville will be Murfreesboro, TN. Crew change facilities will be constructed at Murfreesboro, and a minor maintenance facility and a support yard will be constructed at Louisville, KY. Fueling of the Diesel Titling Train consist would be contracted out to Fuel Truck to avoid building new fueling facilities.

Stations

In developing the station locations, the study took into consideration airports, transit connections, major downtown areas and minor cities and suburbs. Refer to Chapter 4 for station details as they pertain to the operating plan and schedule.

Two types of stations were evaluated as a part of the operating plan schedule and also capital costs. Major terminal stations refer to major city stations in which the study assumes locations, costs and designs as outlined by previous studies and plans. Additionally, the study developed an Intermediate station plan and an associated lump sum cost estimate that was used for all other, smaller-scale stations (refer to Section I: Chapter 3 for details).

Table 3-1: Atlanta-Chattanooga-Nashville-Louisville Shared Use Proposed Stations

Potential Stations	Estimated Cost	Source of Cost Estimate
H-JAIA, Atlanta GA	$100 million	Feasibility Study Estimate
MMPT, Atlanta GA	$350 million	Feasibility Study Estimate[34]
Cumberland Galleria, GA	$7.2 million	Feasibility Study Estimate
Marietta, GA	$7.2 million	Feasibility Study Estimate
Cartersville, GA	$7.2 million	Feasibility Study Estimate
Dalton, GA	$7.2 million	Feasibility Study Estimate
Chattanooga Airport, TN	$7.2 million	Feasibility Study Estimate
Chattanooga Downtown, TN	$7.2 million	Feasibility Study Estimate
Murfreesboro, TN	$7.2 million	Feasibility Study Estimate
Nashville Airport, TN	$7.2 million	Feasibility Study Estimate
Nashville Downtown, TN	$7.2 million	Feasibility Study Estimate
Bowling Green, KY	$7.2 million	Feasibility Study Estimate
Elizabethtown, KY	$7.2 million	Feasibility Study Estimate
Louisville Airport, KY	$7.2 million	Feasibility Study Estimate
Louisville Downtown, KY	$7.2 million	Feasibility Study Estimate

3.1.1 Atlanta-Chattanooga (CSXT Corridor)

This segment from Atlanta to Chattanooga follows the CSXT line through Cartersville, GA. From Atlanta to Chattanooga, CSXT leases the right-of-way from the State of Georgia. The present railroad is Class 4 track; single track with sidings; Direct Train Control (DTC)-CTC operation; and 144.1 corridor miles. In order to secure proper travel time and not intervene with the present freight operation, one dedicated track will be added to the complete route with three 10-mile high speed sidings for passenger meets, spaced 30 miles apart.

[34] MMPT Cost estimates are based on Central Atlanta Progress 1992 estimates of $165,650,000. This was elevated to 2011 dollars using the Consumer Price Index (CPI), and added a 30 percent contingency.

Table 3-2: Atlanta-Chattanooga Shared Use Characteristics

Atlanta-Chattanooga (CSX Shared Use)	
Train Capacity	Single track with Sidings-Direct Traffic Control-CTC
Train Frequency	Present freight traffic (Intermodal, Coal, Bulk Manifest, Automobile)
	Existing: 28-30 freight trains per day
	Future: 50-60 freight trains per day
	Future with Passenger Trains: 70-75 trains per day
Track Geometry and Capacity	Total Corridor – 144.1 route miles
	Urban: 15.5 miles
	34% of total corridor exceeds 1 degree, 30 minute curves
Travel Time Estimations (Schedule Time Including Station Stops)	2 hours, 17 minutes

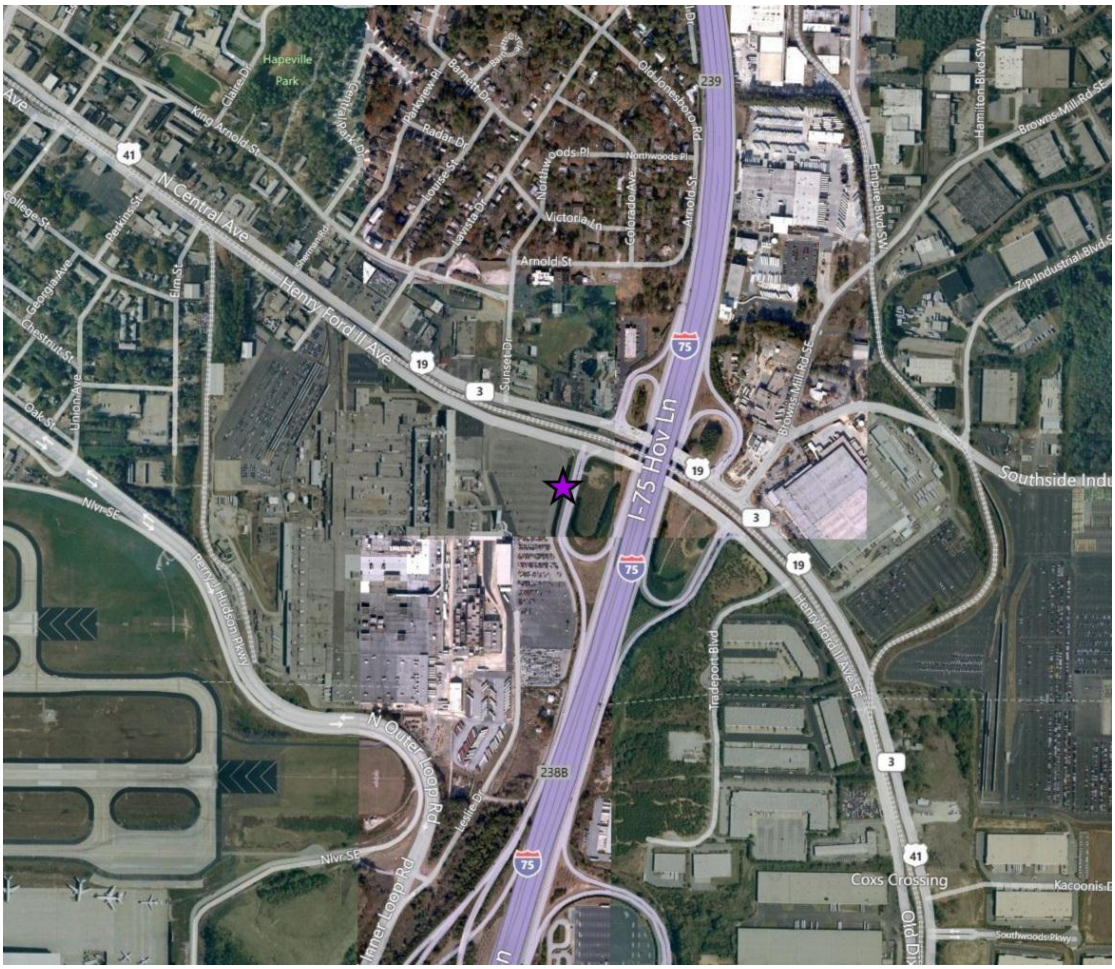
3.1.1.1 Stations

Hartsfield-Jackson Atlanta International Airport

The H-JAIA station is proposed to be located adjacent to the airport in which intermodal connections will be constructed between the rail terminal and the airport terminals. For the purposes of this feasibility study, the study located the H-JAIA station in the southwest corner of the intersection I-75 and the NS Jackson rail line as illustrated in Figure 3.1.

The 2008 Volpe study referenced a Hapeville station that would act as an airport connection station; otherwise, no previous studies have been completed on an airport high-speed rail station. Therefore, the study, based on common practice and experience, estimated the station to cost approximately $100 million.

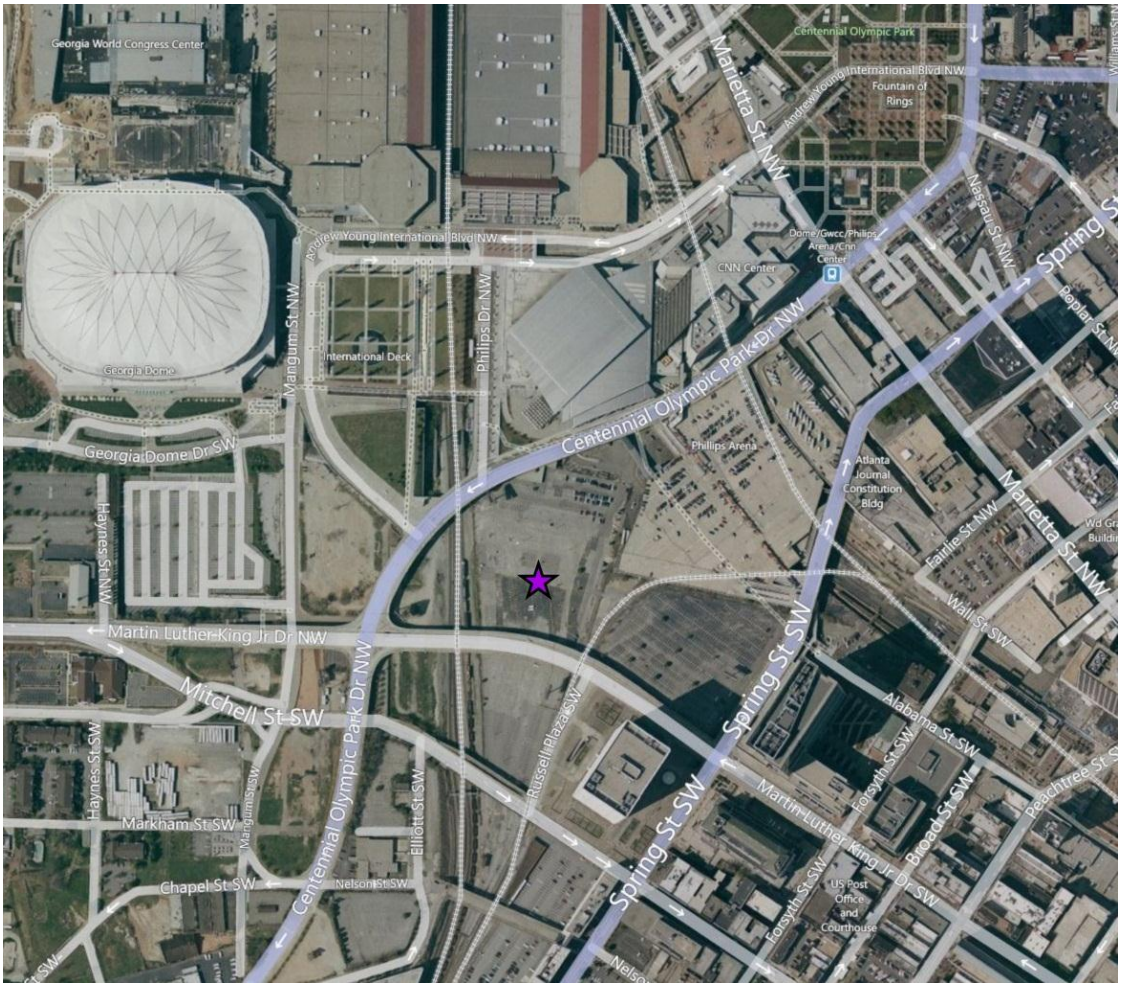
Figure 3-1: H-JAIA Station



Proposed Atlanta Multi-Modal Passenger Terminal

The MMPT is an on-going public private partnership initiative in downtown Atlanta. The MMPT is proposed as a major high-speed, commuter rail and transit hub for the Atlanta metropolitan area. Although the exact location of the MMPT has yet to be determined, Figure 3-2 outlines the study area for the MMPT that was used for the purposes of this study. The estimated cost for the station and track infrastructure that was incorporated into the capital cost estimates for this feasibility study are $350 million based on estimates from Central Atlanta Progress, elevated costs to 2011 dollars and added contingency.

Figure 3-2: Atlanta MMPT Station



Cumberland/Galleria Station - Smyrna, Georgia

The proposed Cumberland/Galleria station is located in the northwest corner of the I-285 and I-75 interchange in Cobb County, GA near the City of Smyrna and the unincorporated town of Vinings. The area is well known as a major attraction for conferences, retail shopping, and dining. This area has been identified as a regional activity center with popular destinations such as the Cobb Energy performing Arts Centre and Cumberland Mall. In addition, Dobbins Air Reserve Base, which employees 1,800 personnel[35], is less than two miles from the proposed station location.

Figure 3-3: Cumberland/Galleria Station

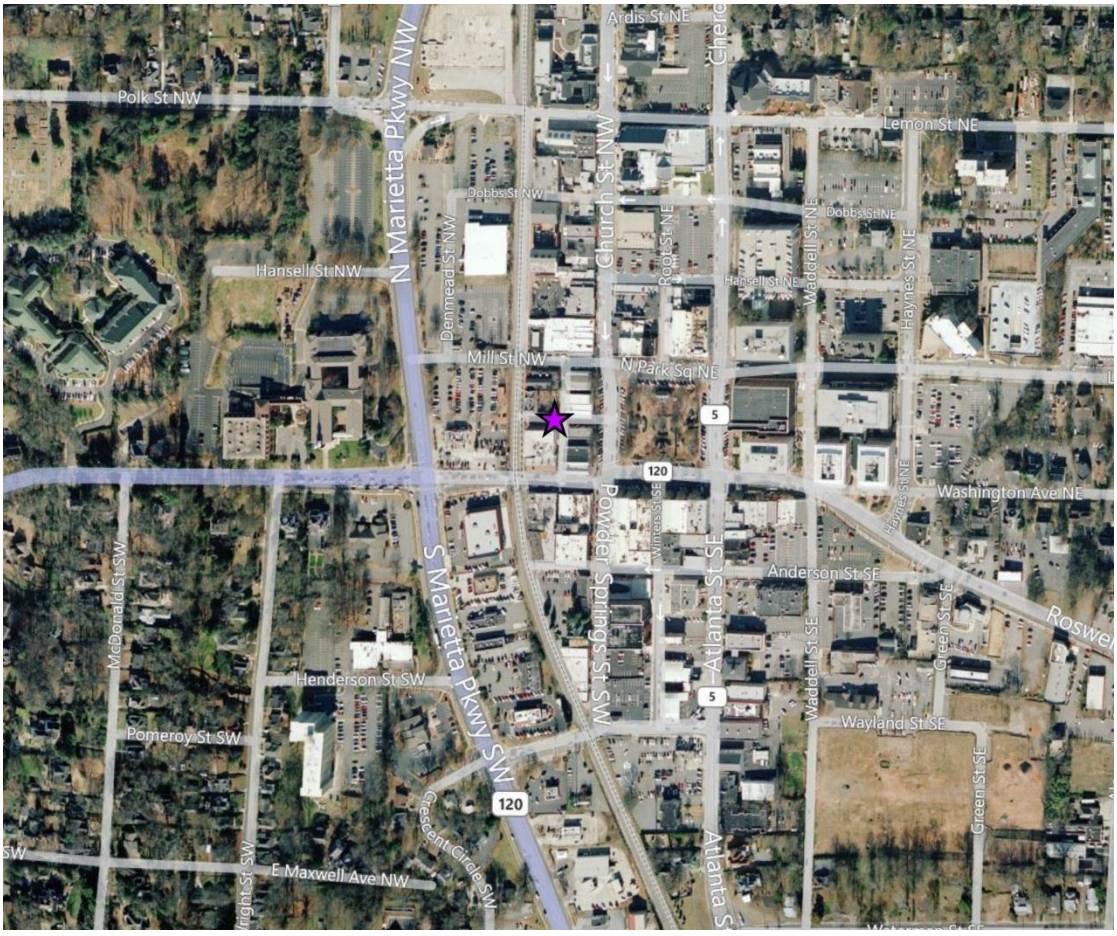


[35] Dobbins Air Reserve Base, http://www.dobbins.afrc.af.mil/library/index.asp

Marietta, Georgia

The potential station is located in downtown Marietta, GA. Marietta has been identified as a vibrant center of activity as a northern suburb of Atlanta. There are a number of community attractions including theater and an arts center within the city. In addition, Kennesaw State University, which is one of the largest universities in Georgia (over 24,100 students), is located within the vicinity of Marietta[36].

Figure 3-4: Marietta Station



[36] Kennesaw State University: http://www.kennesaw.edu/aboutksu.html

Cartersville, Georgia

The potential Cartersville station is located in the City of Cartersville off of Main Street. There are over 40,400 workers in the Cartersville-Bartow County area local workforce[37]. According to the 2010 U.S. Census, the labor force is double the city's population of approximately 19,700 residents. Its adjacent neighbor, Rome, GA, located in Floyd County, is the largest city in the Northwest Georgia Regional Commission. This station has the potential to capture residents and workers from Rome, which has a population of 96,300[38] and over 40,400[39] workers.

Figure 3-5: Cartersville Station



[37] Cartersville-Bartow County, GA, Economic Development: http://www.lcationbartow.com/pages/labor

[38] U.S. Census (2010): http://factfinder2.census.gov

[39] U.S. Census, American Community Survey (3-year estimates): http://factfinder2.census.gov

Dalton, Georgia

The Dalton station is located near the I-75 and West Walnut Avenue interchange in the City of Dalton, GA. Dalton is home to a vibrant carpet manufacturing industry that began in the beginning of the 20th Century[40], and is well known worldwide as the carpet capital of the world with nearly 90 percent of the world's carpet production. In addition, the construction of the Western and Atlantic Railroad connecting the city to Chattanooga, TN and later to Rome, GA played an important role in the city's economic development in the past and present.

Figure 3-6: Dalton Station



[40] City of Dalton, GA: http://www.cityofdalton-ga.gov/index.php/about-dalton/economics

Lovell Field Airport - Chattanooga, TN

There are two potential stations in Chattanooga, TN. One of the stations is at Lovell Field, just a few miles from the Georgia/Tennessee state line at the I-75/I-24 split. The station is anticipated to capture air travelers' connection to the other corridor cities, such as Atlanta, Nashville and Louisville as well as those traveling from the airport to downtown Chattanooga.

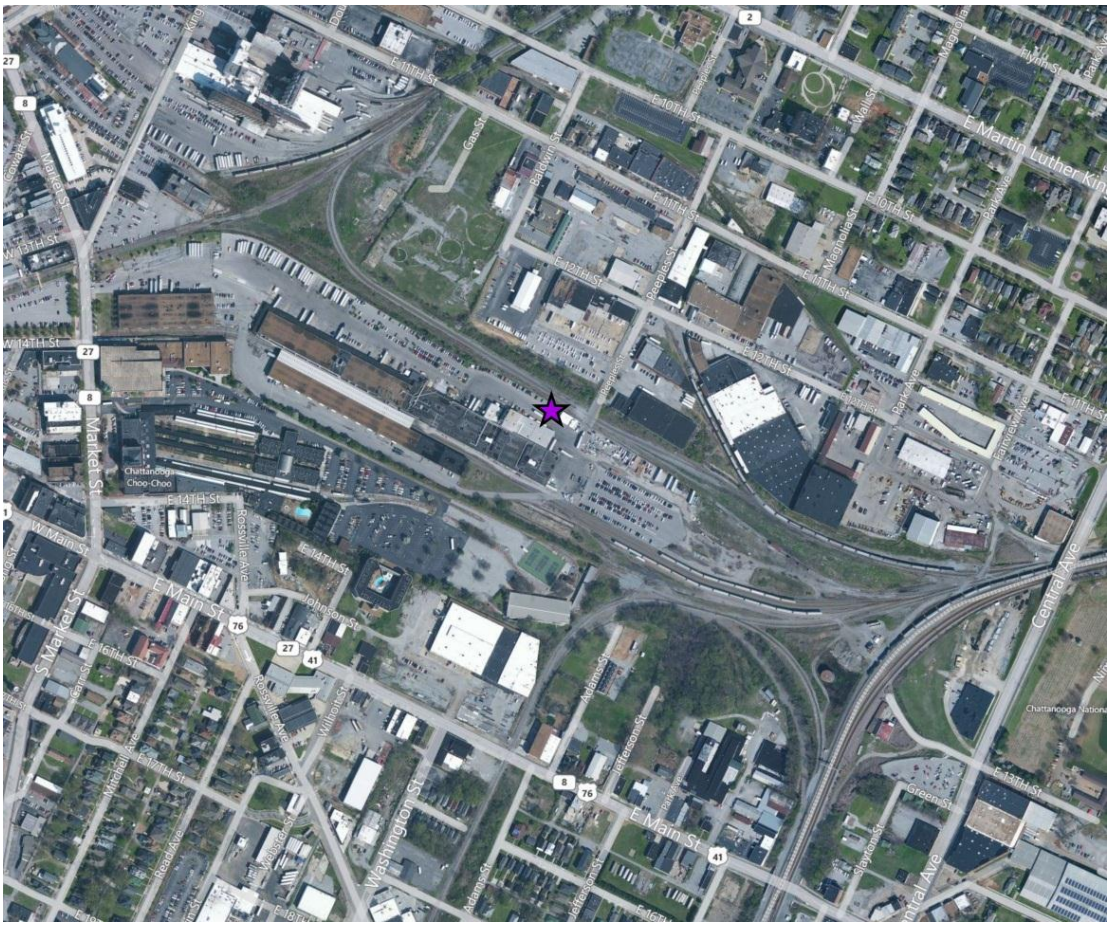
Figure 3-7: Chattanooga Lovell Field Station



Downtown Chattanooga Station – Chattanooga, TN

The second station in Chattanooga is located in downtown Chattanooga near the Choo Choo station, an old historic rail station that attracts tourists with restaurants, retail establishments and hotel. The downtown station is less than one mile from the Chattanooga Convention Center, Engel Stadium and University of Chattanooga. This downtown station would likely attract ridership from Hamilton County and areas in north Georgia.

Figure 3-8: Chattanooga Downtown Station



3.1.2 CHATTANOOGA-NASHVILLE (CSXT CORRIDOR)

This route is the key freight route for CSXT on freight traffic moving from the Southeast to the Midwest and Chicago connections. The present railroad is Class 4 track; single track with sidings; Direct Train Control-CTC operation; and 152.5 corridor miles. The train operation will use Diesel Titling Train Technology to maintain higher speeds in the extreme curvature on this corridor. Positive Train Control technology will be used in this segment.

In order to secure proper travel time and not interfere with the present freight operation, one dedicated track will be added to the complete route with three 10-mile high speed sidings for passenger meets spaced 30 miles apart. In future operations, PTC Traffic will be used on this segment.

Table 3-3: Chattanooga-Nashville Shared Use Characteristics

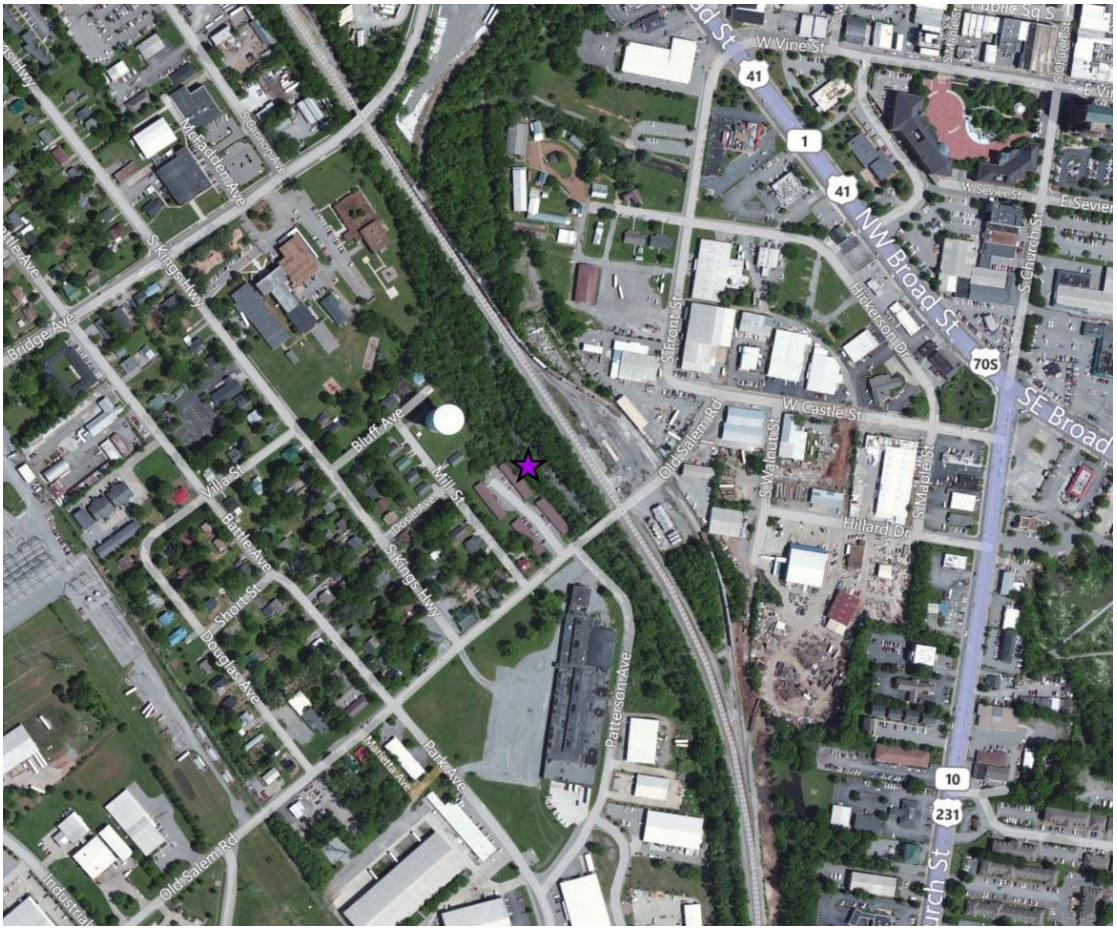
Chattanooga-Nashville (CSX Shared Use)	
Train Capacity	Single track with Sidings-Direct Traffic Control-CTC
Train Frequency	Present freight traffic (Intermodal, Coal, Bulk Manifest, Automobile)
	Existing: 20-25 freight trains per day
	Future: 45-55 freight trains per day
	Future with Passenger Trains: 60 trains per day
Track Geometry and Capacity	Total Corridor: 152.5 route miles
	Urban: 13.4 miles
	19% of total corridor exceeds 1 degree, 30 minute curves
Travel Time Estimations (Schedule Time Including Station Stops)	2 hours, 1 minute

3.1.2.1 Stations

Murfreesboro, TN

The Murfreesboro station is located in downtown Murfreesboro, TN near the intersection of Old Salem Highway and Mill Street. This station provides a connection between Murfreesboro and Nashville, providing a commuting alternative between the two cities. Murfreesboro is one of the fastest growing cities in Tennessee, with a population growth of 58 percent from 2000 to 2010[41]. The proposed station is less than two miles from Middle Tennessee State University (MTSU), which has the largest undergraduate enrollment in the state of nearly 25,000 students[42].

Figure 3-9: Murfreesboro Station



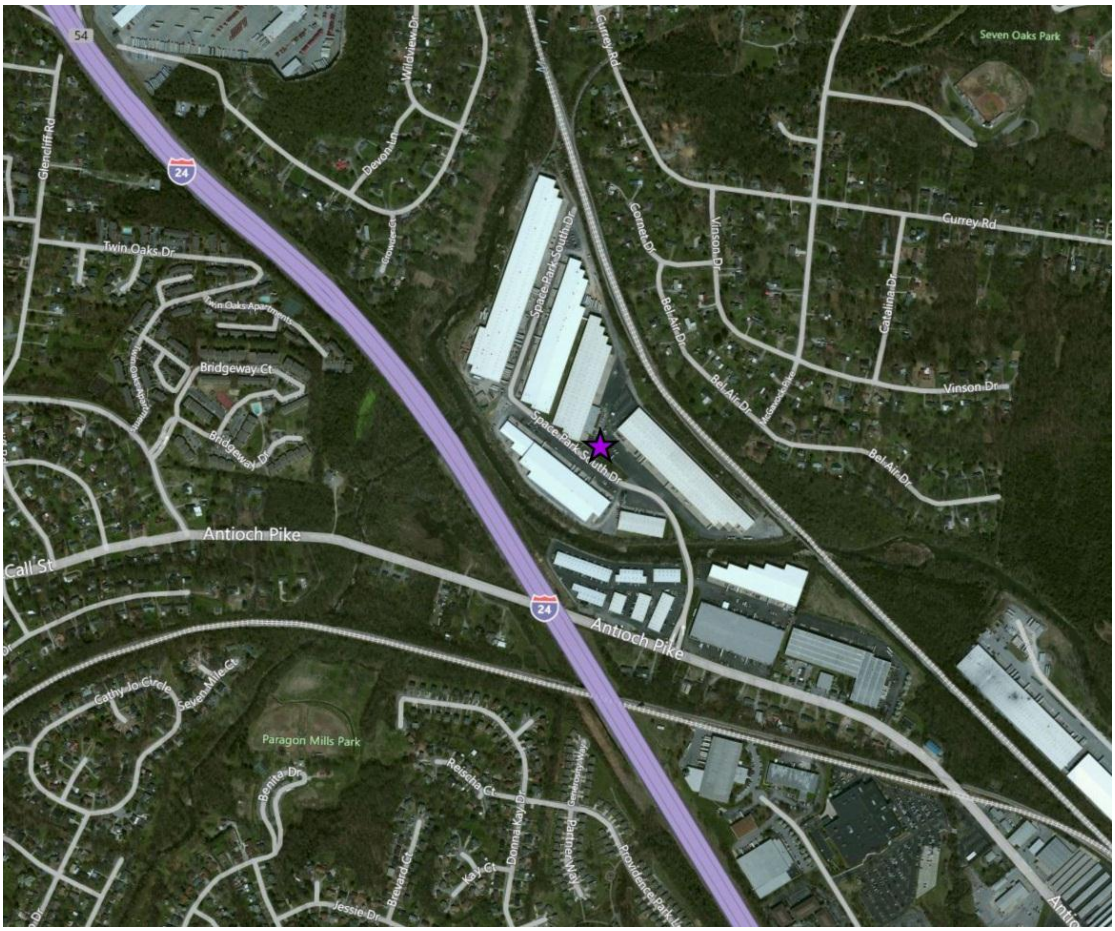
[41] U.S. Census Bureau: http://quickfacts.census.gov/qfd/states/47/4751560.html

[42] Middle Tennessee State University: http://www.mtsu.edu

Nashville International Airport Station – Nashville, TN

Nashville International Airport station is located near the intersection of Antioch Pike and I-24. This station would obtain ridership from the airport traveling to other cities along the corridor. Nashville International Airport had over 390,000 enplanements in September alone, with over 4.7 million enplanements in 2011[43]. According to the FAA, Nashville International Airport is the 38th largest airport in the nation[44].

Figure 3-10: Nashville Airport Station



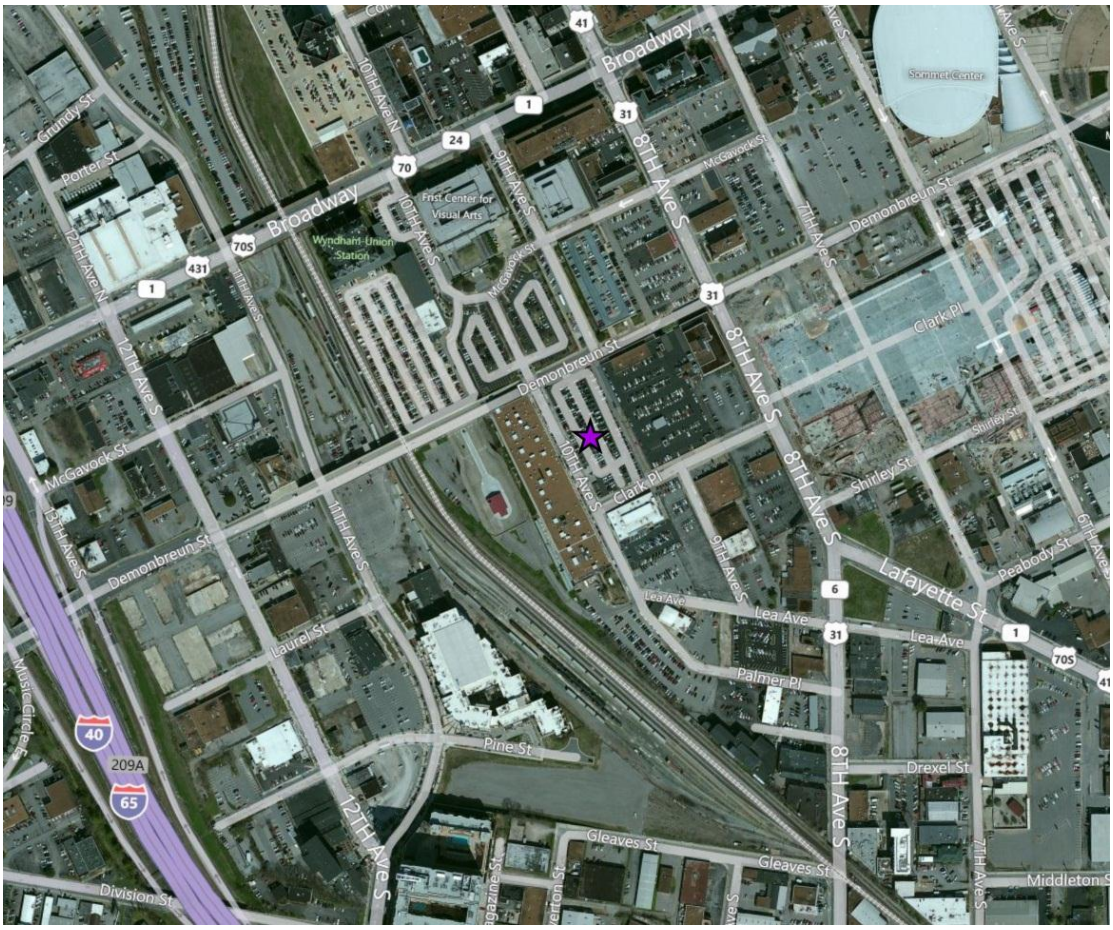
[43] Metropolitan Nashville Airport Authority: http://www.nashintl.com/about/data.aspx

[44] Federal Aviation Authority: http://www.faa.gov

Downtown Nashville Station – Nashville, TN

The downtown Nashville station is located near the intersection of 10th Avenue and Demonbreun Street. Nashville is the capital of Tennessee and is one of the largest cities in the state. The downtown Nashville station is less than two miles from Vanderbilt University. Other major destinations include Music City Center and the Country Music Hall of Fame and Museum. This station would attract ridership from the city as well as surrounding suburbs.

Figure 3-11: Nashville Downtown Station



3.1.3 NASHVILLE - LOUISVILLE (CSXT CORRIDOR)

This route is the key freight route for CSXT on freight traffic moving from the Southeast to the Midwest and Chicago connections. Approximately ten miles north of Nashville, the track splits and a substantial amount freight moves to the northwest to Chicago. The present railroad is Class 4 track; single track with sidings; Direct Train Control-CTC operation; and 194.9 corridor miles.

In order to secure proper travel time and not interfere with the present freight operation, one dedicated track will be added to the complete route with four 10-mile high speed sidings for passenger meets spaced 30 miles apart. The operation will use PTC Traffic Control.

Table 3-4: Nashville-Louisville Shared Use Characteristics

Chattanooga-Nashville (CSX Shared Use)	
Train Capacity	Single track with Sidings-Direct Traffic Control-CTC
Train Frequency	Present freight traffic (Intermodal, Coal, Bulk Manifest, Automobile)
	Existing: 20-25 freight trains per day
	Future: 45-50 freight trains per day
	Future with Passenger Trains: 55-60 trains per day
Track Geometry and Capacity	Total Corridor: 194.9 route miles
	Urban: 11.0 miles
	7% of total corridor exceeds 1 degree, 30 minute curves
Travel Time Estimations (Schedule Time Including Station Stops)	2 hours, 37 minutes

3.1.3.1 Stations

Bowling Green, KY

The Bowling Green, KY station is located within the City of Bowling Green near East 6th Street and Louisville Road. This station has the potential to capture ridership from nearby Clarksville, TN and Fort Campbell. Fort Campbell spans 105,000 acres with facilities to support the training of 23,000 soldiers[45].

Figure 3-12: Bowling Green Station



[45] Fort Campbell: http://www.campbell.army.mil/campbell/Pages/History.aspx

Elizabethtown, KY

The Elizabethtown, KY station is located in downtown Elizabethtown, approximately 7.5 miles from Fort Knox. This military base will provide a substantial portion of the ridership and revenue at this station. Fort Knox currently spans 109,000 acres and has over 40,000 soldiers and civilians.

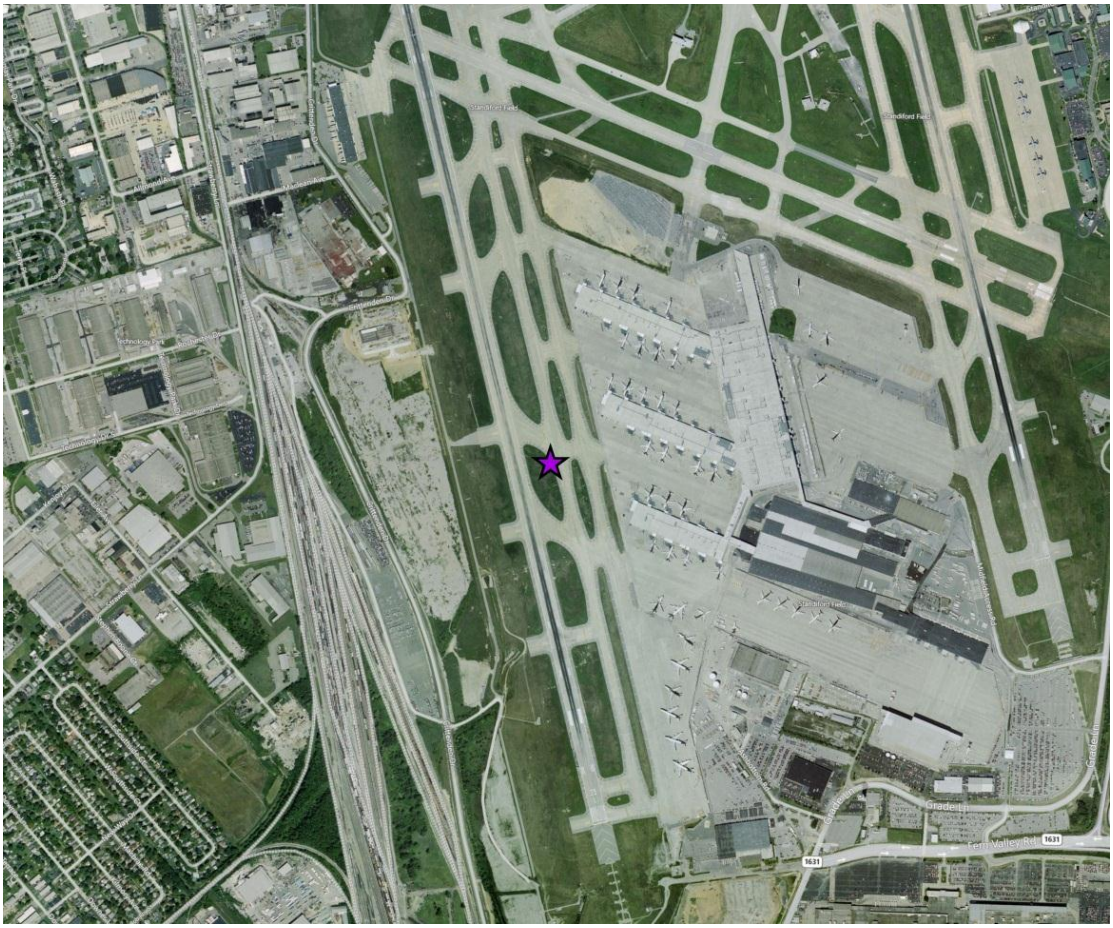
Figure 3-13: Elizabethtown Station



Louisville International Airport Station – Louisville, KY

The Louisville International Airport station is located near the airport. According to the FAA's 2010 airport rankings, the airport is the 69th largest in the nation.[46] In 2010, the airport had over 3.3 million passengers. Much like the reasoning behind the other proposed sites near an airport, the Louisville International Airport has the potential to increase ridership by drawing air travelers to other cities along the corridor.

Figure 3-14: Louisville Airport Station

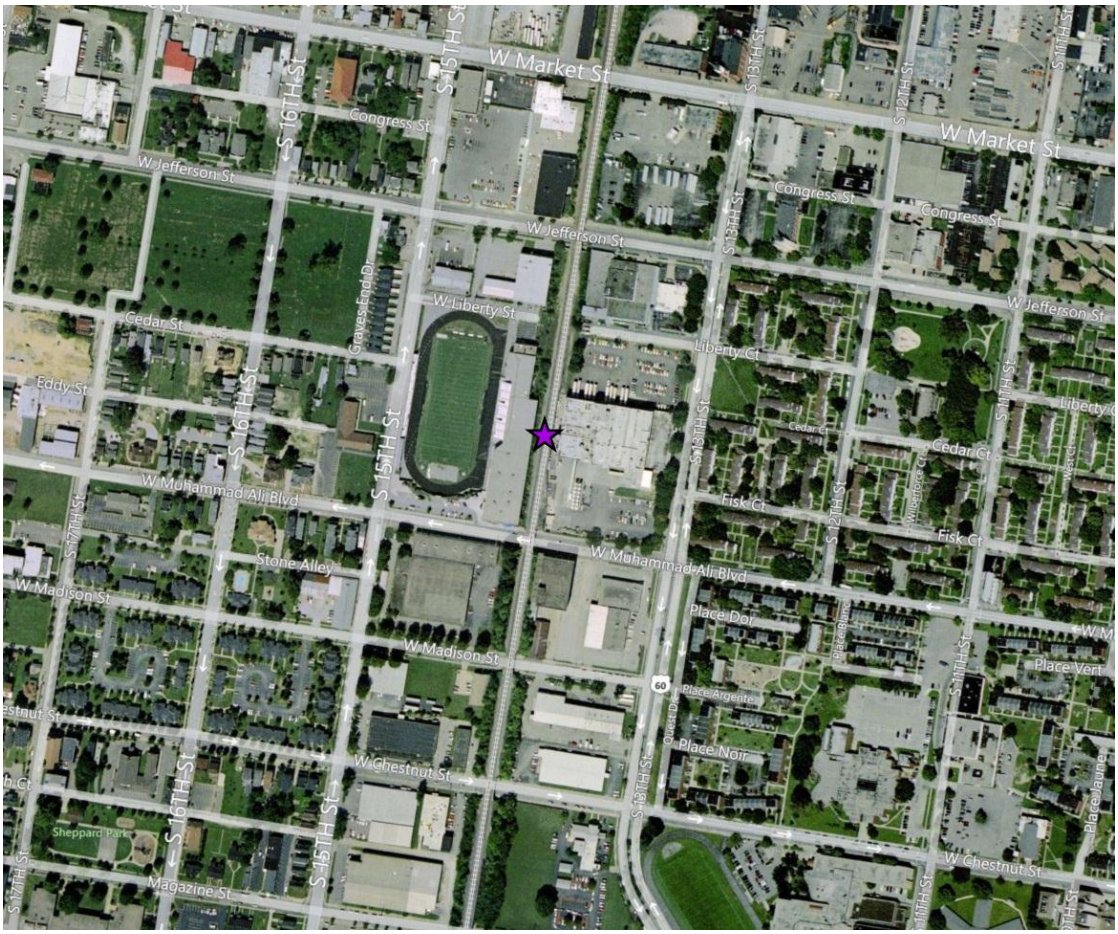


[46] Federal Aviation Authority, http://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/media/cy10_primary_enplanements.pdf

Downtown Louisville Station – Louisville, KY

The proposed downtown Louisville station is located near West Muhammad Ali Boulevard and South 13th Street. It is less than five miles from the University of Louisville, which has an enrollment of 21,000 students[47], and approximately 1.5 miles from the Kentucky/Indiana state line. Therefore, this station has the potential to attract riders from Lexington, KY and major Midwest cities including Cincinnati, Ohio.

Figure 3-15: Louisville Downtown Station



[47] University of Louisville, http://louisville.edu/about/history.html

3.2 180-220 MPH EXPRESS HIGH-SPEED RAIL (DEDICATED USE)

The entire Atlanta-Chattanooga-Nashville-Louisville Corridor would be double tracked and in order to add flexibility in the operation, Universal Crossovers would be located every 50 miles of the entire corridor with PTC Control. Due to major freight rail congestion in Atlanta, Chattanooga, Nashville and Louisville and with the future freight traffic growth, the use of viaduct structures with double track will be constructed entering and leaving these major cities to avoid major delays to the 180-220 Dedicated Use route. The operation will be electrified and operated with Electric Multiple Units (EMC) Technology.

The crew change terminal between Atlanta and Louisville will be Murfreesboro, TN. Crew Change facilities will be constructed at Murfreesboro. Major Maintenance facility and support yard will be located in the Atlanta area and a minor maintenance facility and a support yard will be constructed at Louisville, KY.

For the Atlanta-Chattanooga-Nashville-Louisville Corridor, the study used an identical set of station locations for the Dedicated Use route, with the exception of the Marietta station to accurately reflect the Atlanta-Chattanooga Tier I EIS. The other station locations were each designed to maximize accessibility to existing freight rail right-of-way as the routes enter urban areas. Table 3-5 outlines the potential Dedicated Use stations. Refer to Section 3.1 for station details and proposed locations.

Table 3-5: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Proposed Stations

Potential Stations	Estimated Cost	Source of Cost Estimate
H-JAIA, Atlanta GA	$100 million	Feasibility Study Estimate
MMPT, Atlanta GA	$350 million	1992 Design Concept
Cumberland Galleria, GA	$7.2 million	Feasibility Study Estimate
Cartersville, GA	$7.2 million	Feasibility Study Estimate
Dalton, GA	$7.2 million	Feasibility Study Estimate
Chattanooga Airport, TN	$7.2 million	Feasibility Study Estimate
Chattanooga Downtown, TN	$7.2 million	Feasibility Study Estimate
Murfreesboro, TN	$7.2 million	Feasibility Study Estimate
Nashville Airport, TN	$7.2 million	Feasibility Study Estimate
Nashville Downtown, TN	$7.2 million	Feasibility Study Estimate
Bowling Green, KY	$7.2 million	Feasibility Study Estimate
Elizabethtown, KY	$7.2 million	Feasibility Study Estimate
Louisville Airport, KY	$7.2 million	Feasibility Study Estimate
Louisville Downtown, KY	$7.2 million	Feasibility Study Estimate

3.2.1 ATLANTA –CHATTANOOGA

This route will follow the Atlanta-Chattanooga Tier I EIS route from Atlanta to Chattanooga. The route miles are 128.4 with 88.3 miles on a viaduct structure with double track and Universal Crossovers every 50 miles. Entering and leaving Atlanta and Chattanooga, the 180-220 Express High-Speed train will operate on a viaduct structure.

Table 3-6: Atlanta-Chattanooga Dedicated Use Characteristics

Chattanooga-Nashville (CSX Shared Use)	
Train Capacity	Double track with universal crossovers PTC Control
Train Frequency	16 High-Speed trains per day
Track Geometry and Capacity	Total Corridor: 128.4 route miles
Travel Time Estimations (Schedule Time Including Station Stops)	1 hour, 23 minutes

3.2.2 CHATTANOOGA-NASHVILLE

This dedicated use route is 128.1 route miles will operate on double track and Universal Crossovers placed every 50 miles. Entering and leaving Chattanooga and Nashville the 180-220 Express High-Speed train will operate on a viaduct structure. The operation will be electrified with an EMU with PTC operation.

Table 3-7: Chattanooga-Nashville Dedicated Use Characteristics

Chattanooga-Nashville (CSX Shared Use)	
Train Capacity	Double track with universal crossovers PTC Control
Train Frequency	16 High-Speed trains per day
Track Geometry and Capacity	Total Corridor – 128.1 route miles
	Tunnel: 10.0 miles
Travel Time Estimations (Schedule Time Including Station Stops)	57 minutes

3.2.3 NASHVILLE-LOUISVILLE

This Dedicated Use route, 171.7 route miles will operate as double track with Universal Crossovers placed every 50 miles. Entering and leaving Nashville and Louisville, the 180-220 Dedicated Use train will operate on a viaduct structure. The operation will operated with EMU with PTC Control.

Table 3-8: Nashville-Louisville Dedicated Use Characteristics

Chattanooga-Nashville (CSX Shared Use)	
Train Capacity	Double track with universal crossovers PTC Control
Train Frequency	16 High-Speed trains per day
Track Geometry and Capacity	Total Corridor: 171.7 route miles
	Urban: 11.0
Travel Time Estimations (Schedule Time Including Station Stops)	1 hour, 12 minutes

3.3 220+ MPH MAGLEV HIGH-SPEED RAIL (MAGLEV)

The 220+ mph Maglev will use the same dedicated route as the 180-220 mph Dedicated Use route on a Guide-Way Structure the entire length of the corridor. In order to add flexibility in the operation, universal crossovers will be located every 50 miles in the entire corridor. The operation of the Maglev Technology will operate with a push-pull train consist and PTC control.

The crew change terminals for the Atlanta-Louisville route will be at Atlanta and Louisville and crew facilities will be constructed at Louisville, with a major maintenance facility and support yard to be located in the Atlanta area and a minor maintenance facility and a support yard will be constructed at Louisville.

The Maglev route stations reflect the same stations as the Dedicated Use route. Refer back to Section 3.2 for station details.

3.3.1 ATLANTA-CHATTANOOGA

This route will follow 128.4 mile the Atlanta-Chattanooga Tier I EIS route currently in development. Maglev will operate with a push-pull train consist, double track and PTC control.

Table 3-9: Atlanta-Chattanooga Maglev Characteristics

Chattanooga-Nashville (CSX Shared Use)	
Train Capacity	Double track with universal crossovers PTC Control
Track Geometry and Capacity	Total Corridor: 128.4 route miles
	Rolling hills: 97.5 miles
	Mountains: 30.9 miles
Travel Time Estimations (Schedule Time Including Station Stops)	1 hour, 6 minutes

3.3.2 CHATTANOOGA-NASHVILLE

This Dedicated Use route of 128.1 route miles will operate as double track and PTC control. The operation will be Maglev with a push-pull train consist, PTC operation.

Table 3-10: Chattanooga-Nashville Maglev Characteristics

Chattanooga-Nashville (CSX Shared Use)	
Train Capacity	Double track with universal crossovers PTC Control
Track Geometry and Capacity	Total Corridor: 128.1 route miles
	Rolling hills: 78.4 miles
	Mountains: 49.7 miles
Travel Time Estimations (Schedule Time Including Station Stops)	50 minutes

3.3.3 NASHVILLE-LOUISVILLE

This dedicated use route of 171.7 route miles and will operate as double track on guide way Structures. The operation will be push-pull train consist with PTC control.

Table 3-11: Chattanooga-Nashville Maglev Characteristics

Chattanooga-Nashville (CSX Shared Use)	
Train Capacity	Double track with universal crossovers PTC Control
Track Geometry and Capacity	Total Corridor: 171.7 route miles
	Rolling hills: 139.7 miles
	Mountains: 21.0 miles
	Urban: 11.0 miles
Travel Time Estimations (Schedule Time Including Station Stops)	1 hour, 6 minutes

4 OPERATING PLAN AND SCHEDULE

Timetables were developed for each of the speed options and each of the routes identified for the corridor. As discussed in Section I of the report, for the Shared Use option, tilting diesel trains with a maximum speed limit of 110 mph were simulated over the existing CSXT rail route. For the Dedicated Use option, 220 mph electric trains were simulated. For the Maglev technology, 220 + mph trains were simulated. A five percent (5%) slack time allowance was added to the simulated running times to produce the suggested train schedules.

4.1 90-110 MPH SHARED USE

4.1.1 SPEED PROFILE AND TIMETABLE

The study ran a speed profile for the Atlanta-Chattanooga-Nashville-Louisville Shared Use route as illustrated in Figure 4-1. The average speed along the 484-mile corridor is approximately 72 mph, with many segments at or near 100 mph, especially north of Nashville, TN.

Figure 4-1: Atlanta-Chattanooga-Nashville-Louisville Shared Use Speed Profile

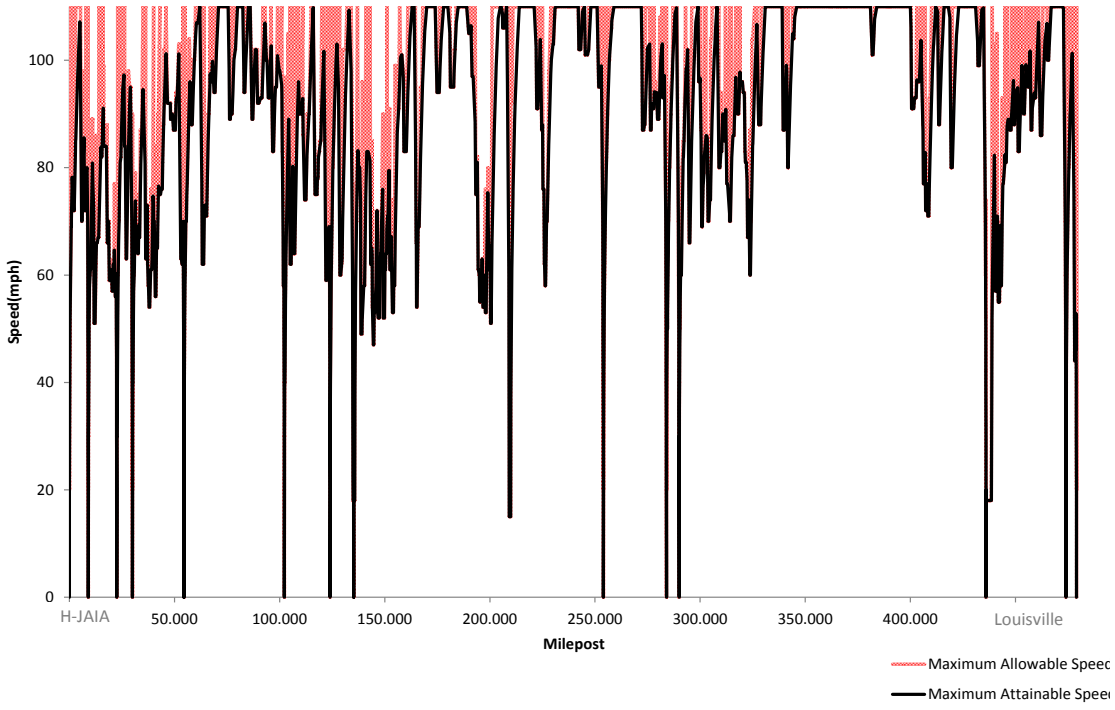


Table 4-1 illustrates a typical travel time table outlining the route station segments, rail distances, scheduled travel time, cumulative travel time and average speed for the Atlanta-Chattanooga-Nashville-Louisville Shared Use corridor.

Table 4-1: Atlanta-Chattanooga-Nashville-Louisville Shared Use Speed and Travel Time Table

Shared Use				
Segment	**Rail Distance**	**Travel Time**	**Cumulative Travel Time**	**Average Speed (mph)**
H-JAIA	0.0	0:00	0:00	0
Atlanta MMPT	7.62	0:10	0:10	46
Cumberland, GA	9.63	0:12	0:22	48
Marietta, GA	11.01	0:13	0:35	51
Cartersville, GA	26.68	0:26	1:01	61
Dalton, GA	46.49	0:35	1:36	80
Chattanooga Airport	31.05	0:29	2:05	64
Chattanooga Downtown	11.66	0:12	2:17	57
Murfreesboro	116.76	1:31	3:48	77
Nashville Airport	28.9	0:22	4:10	79
Nashville Downtown	6.82	0:08	4:18	49
Bowling Green, KY	71.41	0:54	5:12	80
Elizabethtown, KY	75.44	0:55	6:07	82
Louisville, KY Airport	43.89	0:44	6:51	60
Louisville, KY Downtown	4.19	0:04	6:55	59
Total	**483.9**	**6:55**	**6:55**	**72**

As seen in Figure 4-1 and Table 4-1, although the tilting diesel train would be capable of operating at 110 mph or better, curves on the existing CSXT rail lines would restrict the train to approximately 79 mph or less, even taking the train's tilt capability into account. The table indicates a travel time of 6 hours and 55 minutes, similar to the driving time (6 hours, 54 minutes).

4.1.2 Operating Plan

The running times were used in conjunction with the prospective train frequencies to develop an initial assessment of the ridership forecast for the Atlanta-Chattanooga-Nashville-Louisville Shared Use corridor. In addition, the results of the three corridors were compared to one another, resulting in frequency adjustments so that each corridor could utilize the same train size, for corridor compatibility. The train frequencies and train sizes were adjusted after initial ridership and revenue results to balance planned train capacity against ridership for the corridor. As a result, the Shared Use operations are projected to run between five and 16 round trips per day, with 250 seats per train. Given the combination of train frequencies and running times, between three and six train-sets would be required to cover the Shared Use equipment rotation.

Table 4-2: Atlanta-Chattanooga-Nashville-Louisville Shared Use Train Frequency and Size

Segment	Round Trips per Day	# of Seats per Train	# of Train-Sets
Atlanta-Chattanooga	16	250	6
Chattanooga-Nashville	10	250	4
Nashville-Louisville	5	250	3

4.2 180-220 mph Dedicated Use

4.2.1 Speed Profile and Timetable

The study developed a speed profile for the Atlanta-Chattanooga-Nashville-Louisville Dedicated Use route as illustrated in Table 4-2. The average speed along the 428-mile corridor was approximately 122 mph, with consistent segments near or above 200 mph north of Chattanooga, TN.

Figure 4-2: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Speed Profile

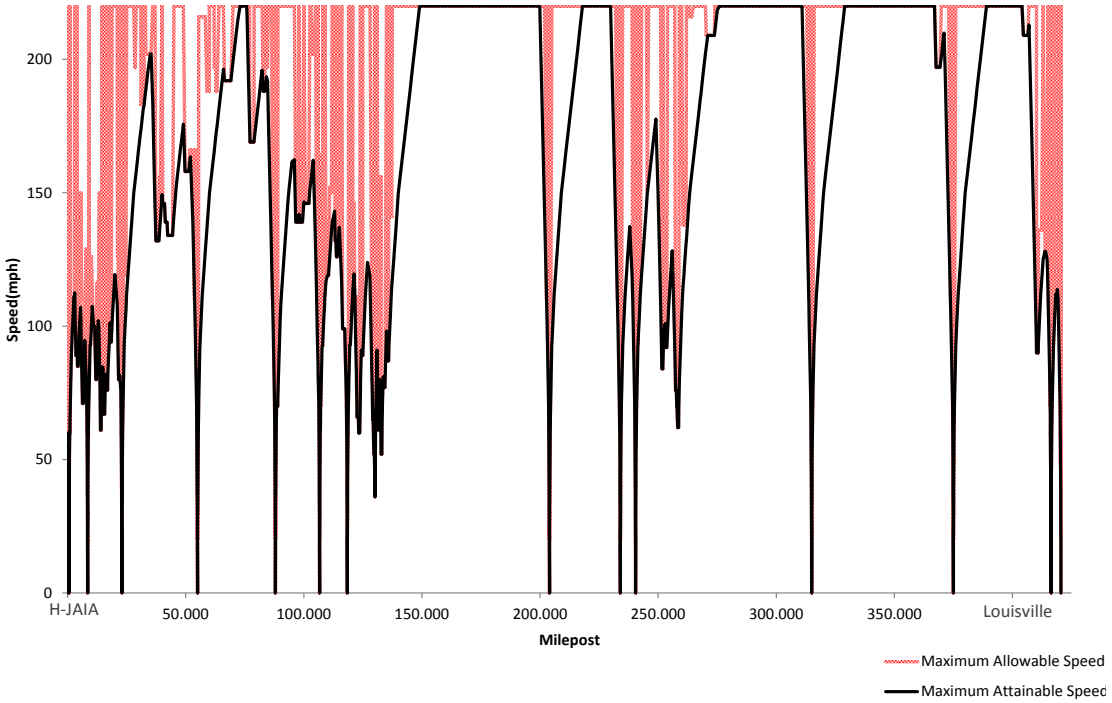


Table 4-3 illustrates a typical travel time table outlining the route station segments, rail distance, scheduled travel time, cumulative travel time and average speed for the Atlanta-Chattanooga-Nashville-Louisville Shared Use Corridor.

Table 4-3: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Speed and Travel Time Table

Dedicated Use				
Segment	**Rail Distance**	**Travel Time**	**Cumulative Travel Time**	**Average Speed (mph)**
H-JAIA	0.0	0:00	0:00	0
Atlanta MMPT	7.6	0:08	0:08	54
Cumberland, GA	13.5	0:13	0:21	64
Marietta, GA				
Cartersville, GA	33.0	0:18	0:39	112
Dalton, GA	34.9	0:17	0:56	126
Chattanooga Airport	30.2	0:18	1:14	102
Chattanooga Downtown	9.2	0:09	1:23	57
Murfreesboro	93.1	0:36	1:59	155
Nashville Airport	29.2	0:14	2:13	124
Nashville Downtown	5.8	0:07	2:20	50
Bowling Green, KY	59.2	0:24	2:44	148
Elizabethtown, KY	66.4	0:25	3:09	160
Louisville, KY Airport	41.9	0:19	3:28	130
Louisville, KY Downtown	4.2	0:04	3:32	95
Total	**428.2**	**3:32**	**3:32**	**122**

As seen in Figure 4-2 and Table 4-3, the proposed Dedicated Use route following I-75, I-24 and I-65 would achieve higher speeds, although as the speed profile shows, curvature between Atlanta and Chattanooga will limit speed performance in this segment. However, the running time comparison with the automobile is favorable with an average travel time of 3 hours, 32 minutes, compared to auto travel at 6 hours, 54 minutes.

4.2.2 Operating Plan

Similar to Shared Use, the running times were used in conjunction with the prospective train frequencies to develop an initial assessment of the ridership forecast for the Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Corridor. In

addition, the results of the three corridors were compared to one another, resulting in frequency adjustments so that each corridor could utilize the same train size, for corridor compatibility. As a result, the train frequencies and train sizes were adjusted after initial ridership and revenue results to balance planned train capacity against ridership for the corridor. As a result, the Dedicated Use operations are projected to run between 12 and 28 round trips per day, with 265 seats per train. Given the combination of train frequencies and running times, between four and eight train-sets would be needed for the Dedicated Use option.

Table 4-4: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Train Frequency and Size

Segment	Round Trips per Day	# of Seats per Train	# of Train-Sets
Atlanta-Chattanooga	28	265	8
Chattanooga-Nashville	20	265	5
Nashville-Louisville	12	265	4

4.3 220+ MPH MAGLEV

4.3.1 SPEED PROFILE AND TIMETABLE

The study also ran a speed profile for the Atlanta-Chattanooga-Nashville-Louisville Maglev technology as illustrated in Figure 4-3. Again, this alternative uses the same Dedicated Use representative route as the 220 mph electrified alternative. The average speed along the 428-mile corridor was approximately 143 mph, with consistent segments near or above 300 mph north of Chattanooga.

Figure 4-3: Atlanta-Chattanooga-Nashville-Louisville Maglev Speed Profile

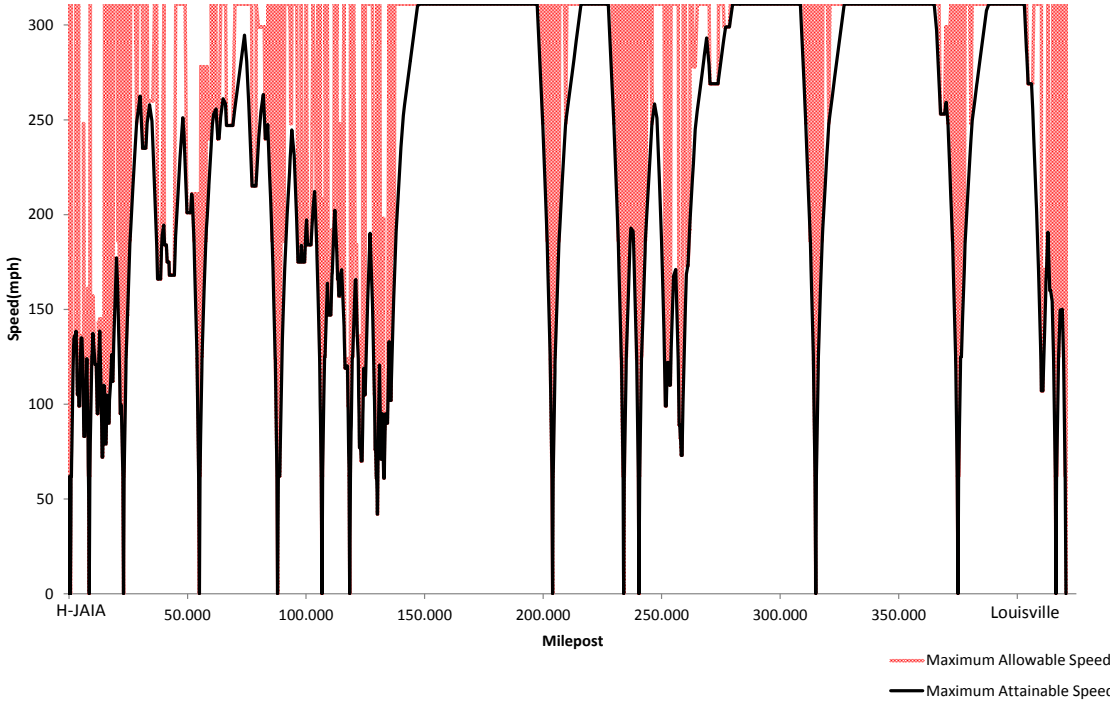


Table 4-5 illustrates a typical travel time table outlining the route station segments, rail distance, scheduled travel time, cumulative travel time and average speed for the Atlanta-Chattanooga-Nashville-Louisville Shared Use corridor.

Table 4-5: Atlanta-Chattanooga-Nashville-Louisville Maglev Speed and Travel Time Table

Dedicated Use				
Segment	**Rail Distance**	**Travel Time**	**Cumulative Travel Time**	**Average Speed (mph)**
H-JAIA	0.0	0:00	0:00	0
Atlanta MMPT	7.6	0:07	0:07	69
Cumberland, GA	13.5	0:10	0:17	81
Marietta, GA				
Cartersville, GA	33.0	0:14	0:31	143
Dalton, GA	34.9	0:13	0:44	160
Chattanooga Airport	30.2	0:14	0:58	130
Chattanooga Downtown	9.2	0:08	1:06	73
Murfreesboro	93.1	0:32	1:38	177
Nashville Airport	29.2	0:12	1:50	141
Nashville Downtown	5.8	0:06	1:56	57
Bowling Green, KY	59.2	0:22	2:18	164
Elizabethtown, KY	66.4	0:23	2:41	177
Louisville, KY Airport	41.9	0:18	2:59	144
Louisville, KY Downtown	4.2	0:03	3:02	75
Total	**428.2**	**3:02**	**3:02**	**143**

As seen in Figure 4-3 and Table 4-5, the proposed Maglev route following would achieve the highest speeds, although as the speed profile shows, curvature between Atlanta and Chattanooga would limit speeds below 300 mph. However, the running time comparison with the automobile is very favorable with an average travel time of 3 hours, 2 minutes, compared to auto travel at 6 hours, 54 minutes.

4.3.2 OPERATING PLAN

After simulating the Maglev technology, the Maglev operations are projected to run an identical operating plan to the Dedicated Use (220 mph) alternative with 12-28 round trips per day, with 265 seats per train. Given the combination of train frequencies and running times, between four and eight train-sets would be needed for the Maglev option.

Table 4-6: Atlanta-Chattanooga-Nashville-Louisville Maglev Train Frequency and Size

Segment	Round Trips per Day	# of Seats per Train	# of Train-Sets
Atlanta-Chattanooga	28	265	8
Chattanooga-Nashville	20	265	5
Nashville-Louisville	12	265	4

5 RIDERSHIP AND REVENUE

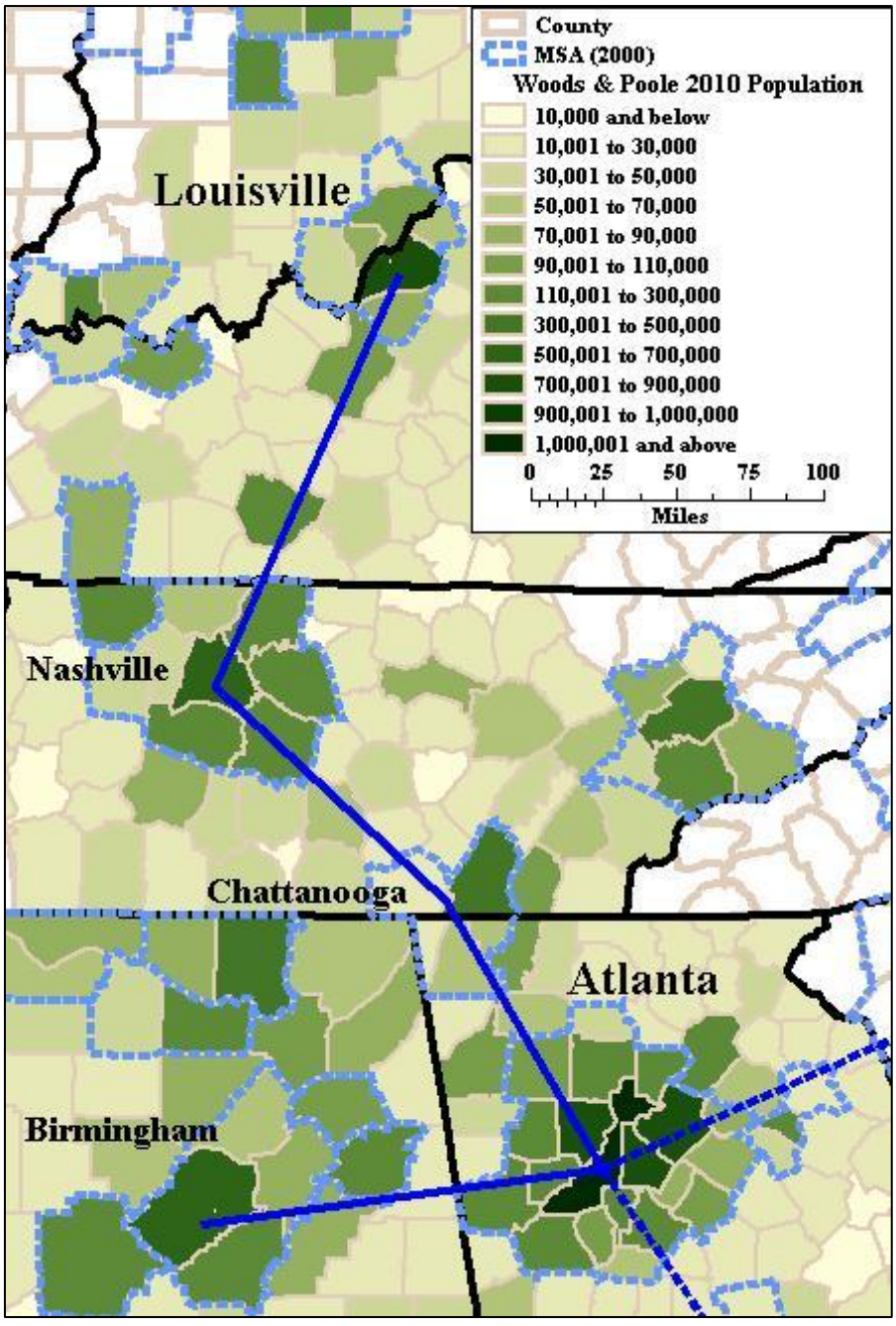
5.1 CORRIDOR DEMOGRAPHICS

This chapter presents information on the demographic characteristics for the Atlanta-Chattanooga-Nashville-Louisville Corridor. Specifically, information on corridor population and employment is presented for both the base (2010) and future (2020-2040) years. All of the historical demographic information presented in Section 5.1.1 were obtained from Woods and Poole Economic Forecasts 2011 which are based on U.S. Census data. Similarly, Woods and Poole also produce future year forecasts on demographics which are used in this study and presented later in this chapter. Refer back to Section I: Chapter 3 for detailed ridership and revenue methodologies.

5.1.1 BASE YEAR (2010) DEMOGRAPHICS

Atlanta, Chattanooga, Nashville and Louisville are the major population centers in this corridor. Figure 5-1 presents a county-level population map focused on the Atlanta-Chattanooga-Nashville-Louisville Corridor.

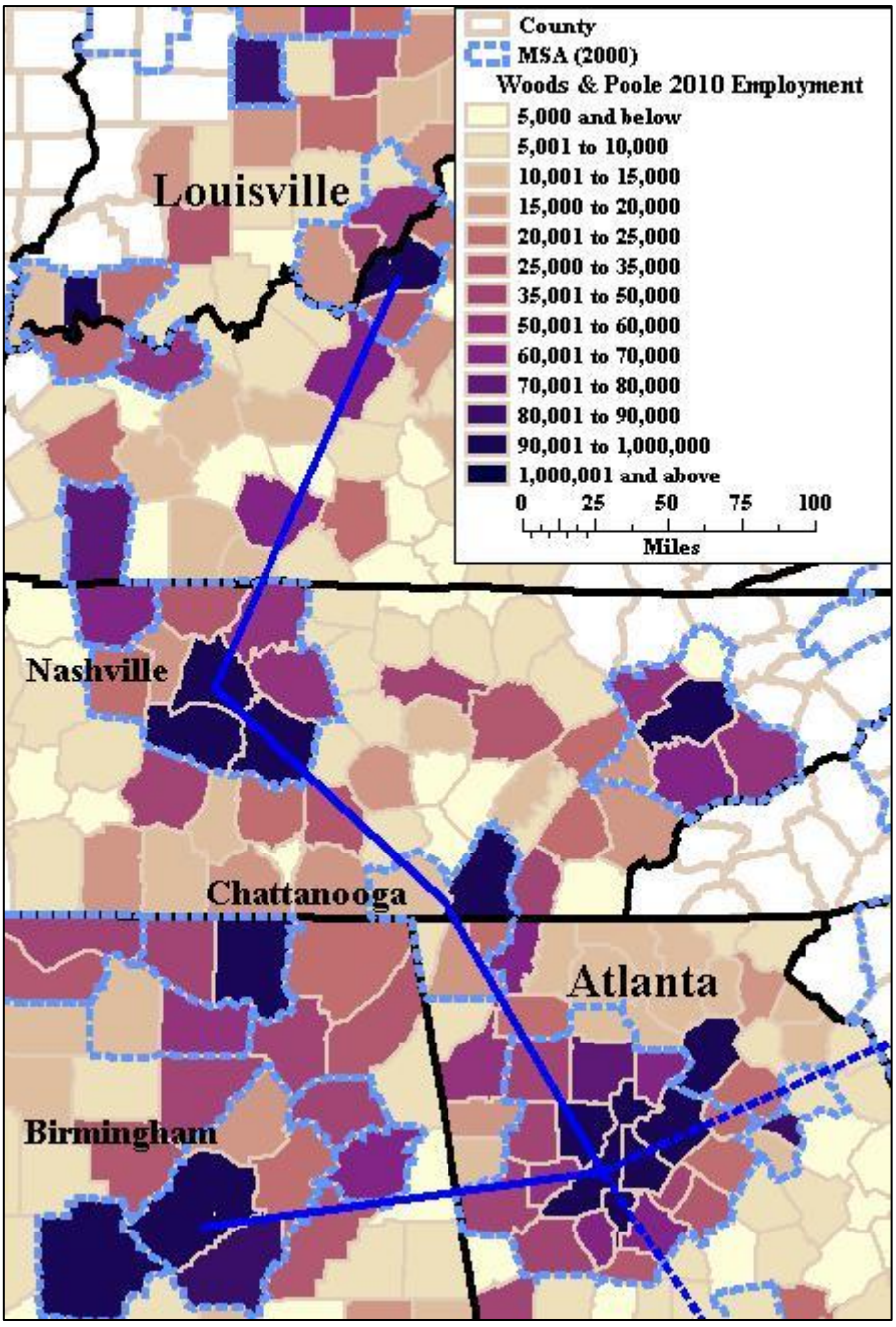
Figure 5-1: Atlanta-Chattanooga-Nashville-Louisville Base Year (2010) Population



Source: Woods and Poole Economic Forecasts, 2011

Similarly, as shown in Figure 5-2, the four MSAs – Atlanta, Chattanooga, Nashville and Louisville – are also the major centers of employment, with Atlanta being the dominant employment hub in the corridor.

Figure 5-2: Atlanta-Chattanooga-Nashville-Louisville Base Year (2010) Employment



Source: Woods and Poole Economic Forecasts, 2011

Table 5-1 and Table 5-2 show the historical population and employment trends for the MPO coverage areas for Atlanta (ARC), Chattanooga (Chattanooga-Hamilton County Regional Planning Agency [CHRPA]), Nashville (Nashville Area MPO) and Louisville (Kentuckiana Regional Planning and Development Agency [KRPDA]).

Atlanta and Nashville have experienced high annual population growths over the past five years (2.44 percent and 2.27 percent annually, respectively); while the

population growth in Louisville and Chattanooga has been modest (about 1 percent annually). However, the recent economic downturn has hit the employment sector of the study region significantly with Louisville and Nashville experiencing small increases in annual employment, Atlanta observed little to no increase in employment, and Chattanooga experiencing negative employment growth over the last five years.

Table 5-1: Historical Population Trend for MPO Coverage Areas

MPO	2005 Population	2010 Population	05-10 CAGR[48]
ARC	4,934,314	5,566,062	2.44%
KRPDA	998,901	1,044,388	0.89%
CHRPA	383,408	403,853	1.04%
Nashville Area MPO	1,283,160	1,435,704	2.27%

Source: Woods and Poole Economic Forecasts, 2011

Table 5-2: Historical Employment Trend for MPO Coverage Areas

MPO	2005 Employment	2010 Employment	05-10 CAGR
ARC	3,013,970	3,012,811	-0.01%
KRPDA	659,966	663,208	0.10%
CHRPA	266,396	258,663	-0.59%
Nashville Area MPO	902,292	910,972	0.19%

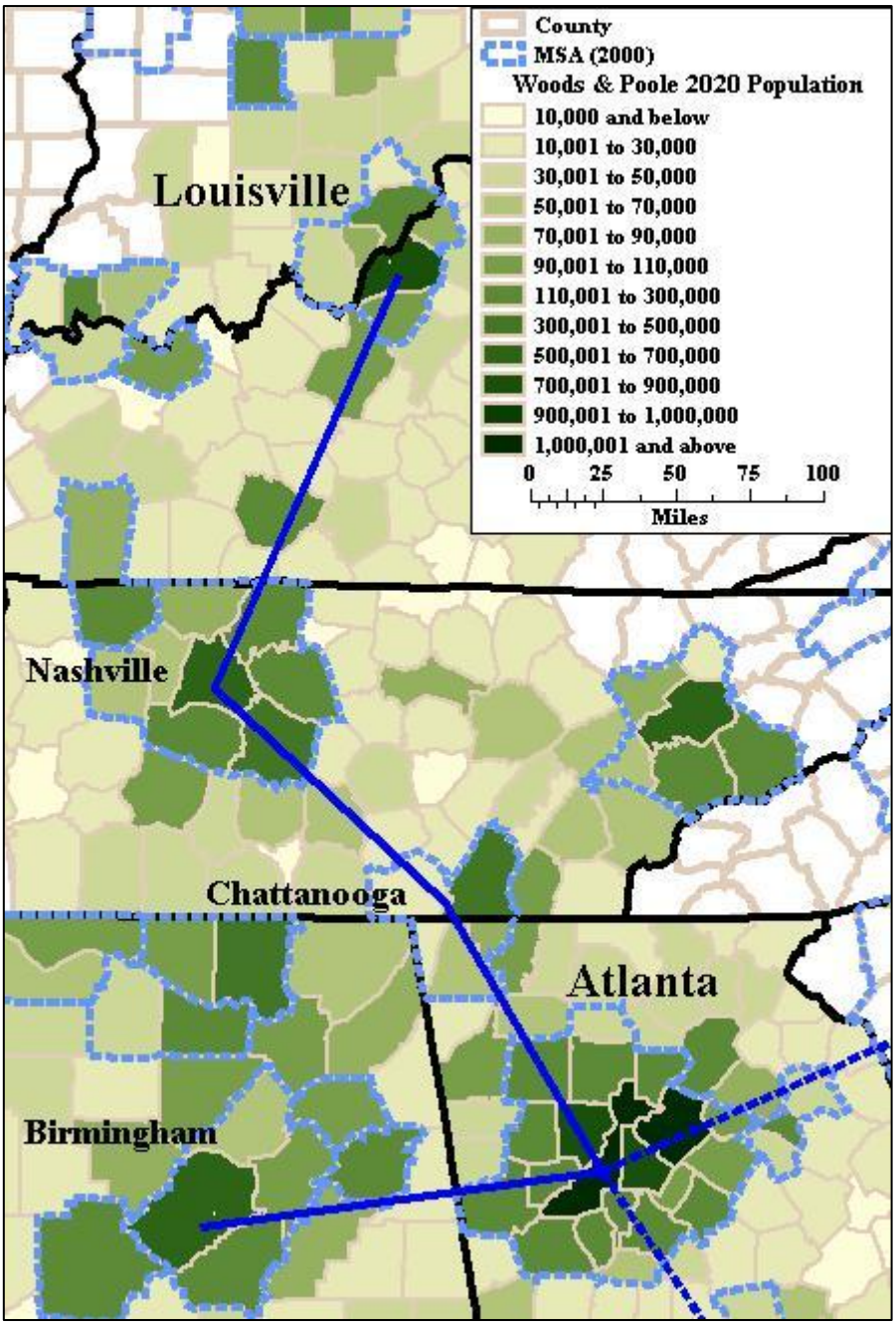
Source: Woods and Poole Economic Forecasts, 2011

5.1.2 Future Year (2020-2035) Demographics

The 2020 and 2035 (as seen in Figure 5-3 and Figure 5-4) geographic distribution of population at the county-level will reflect similar patterns compared to 2010. The highest population growths in region are observed in the suburban areas surrounding Atlanta, Nashville, and to a lesser extent, Louisville as seen in Figure 5-5.

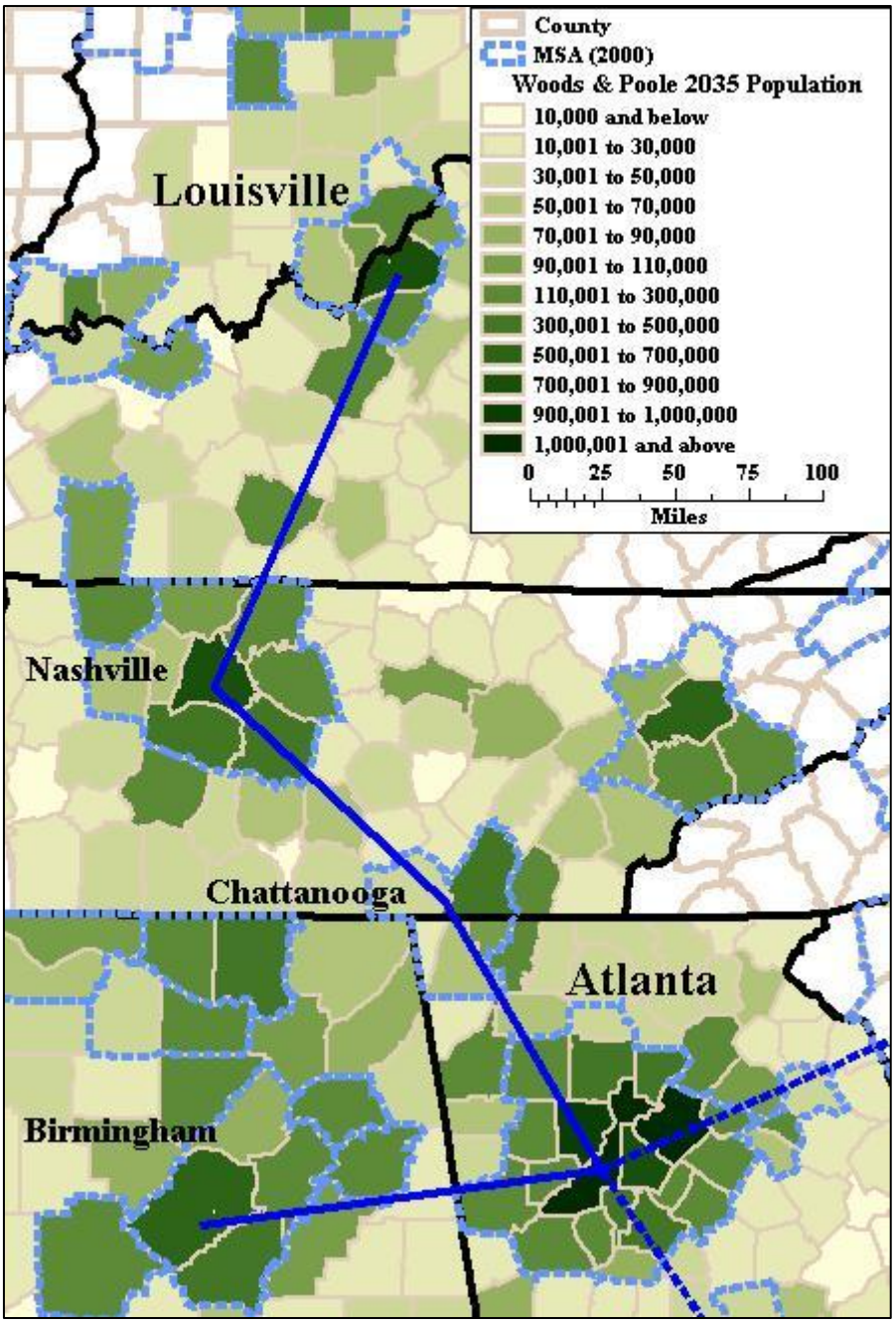
[48] Compound Annual Growth Rate (CAGR)

Figure 5-3: Atlanta-Chattanooga-Nashville-Louisville 2020 Population



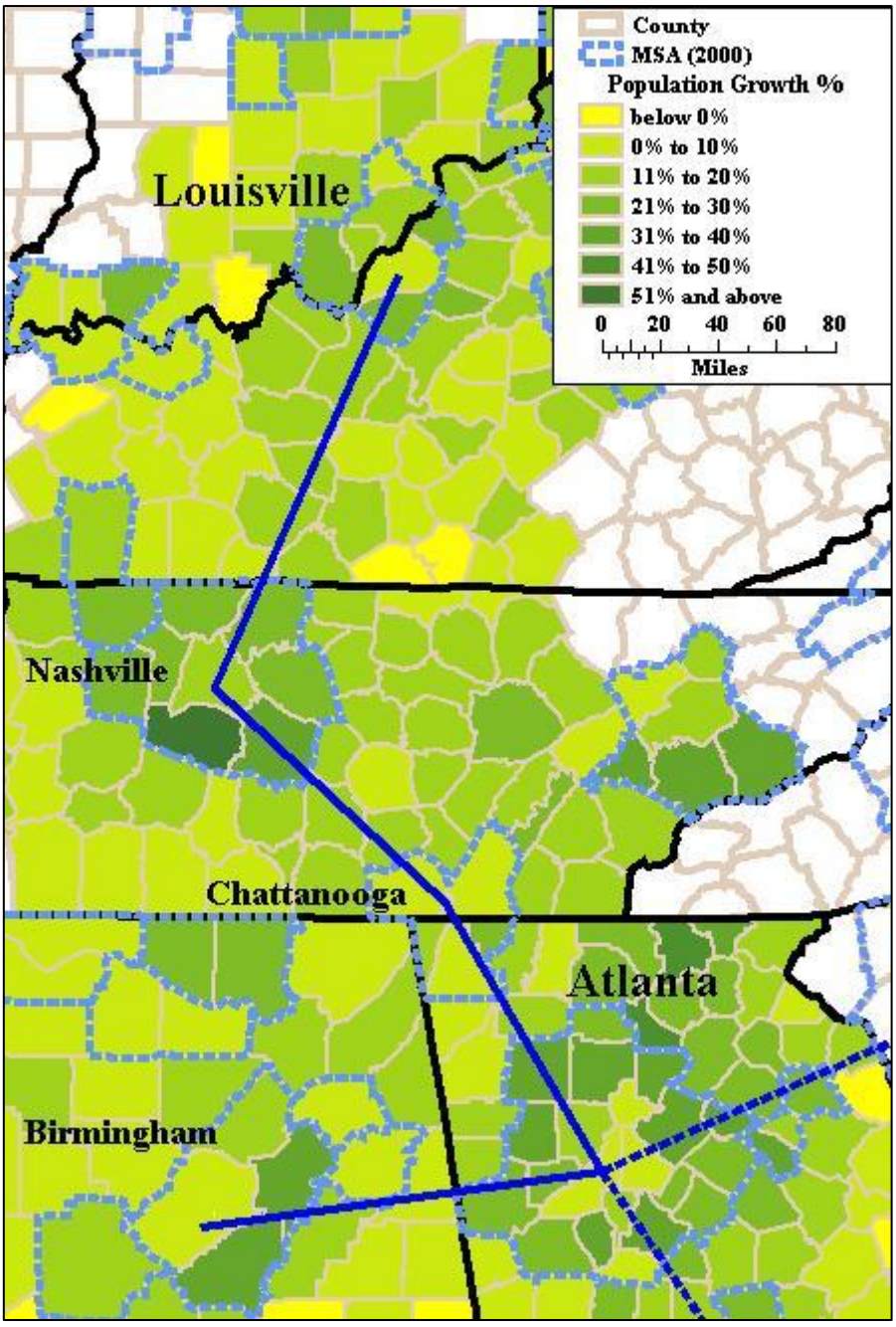
Source: Woods and Poole Economic Forecasts, 2011

Figure 5-4: Atlanta-Chattanooga-Nashville-Louisville 2035 Population



Source: Woods and Poole Economic Forecasts, 2011

Figure 5-5: Atlanta-Chattanooga-Nashville-Louisville 2020-2035 Population Growth



Source: Woods and Poole Economic Forecasts, 2011

The population growth forecasts are following the latest trends observed in the region and nationwide, predicting a slower annual population growth in future years as compared to the rapid population growth observed over the past decade. Table 5-3 shows that the areas covered by the ARC and Nashville Area MPOs are expected to experience healthy population growths until 2035, whereas KRPDA and CHRPA growths will remain modest.

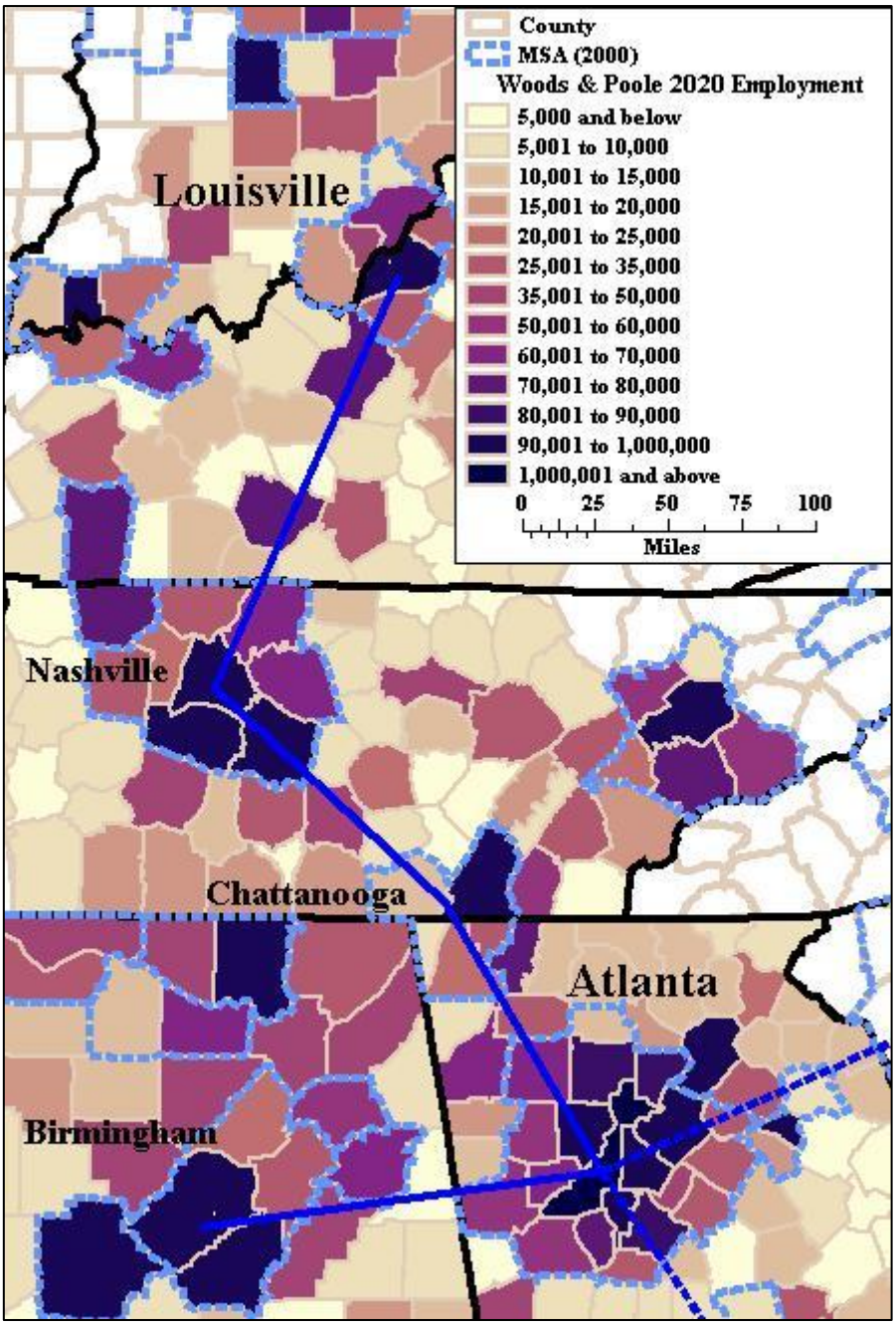
Table 5-3: Population Forecasts for MPO Coverage Areas

MPO	2005 Population	2010 Population	2020 Population	2035 Population	05-10 CAGR	20-35 CAGR
ARC	4,934,314	5,566,062	6,523,568	7,997,611	2.44%	1.37%
KRPDA	998,901	1,044,388	1,108,498	1,211,348	0.89%	0.59%
CHRPA	383,408	403,853	432,091	477,473	1.04%	0.67%
Nashville Area MPO	1,283,160	1,435,704	1,724,793	2,168,741	2.27%	1.54%

Source: Woods and Poole Economic Forecasts, 2011

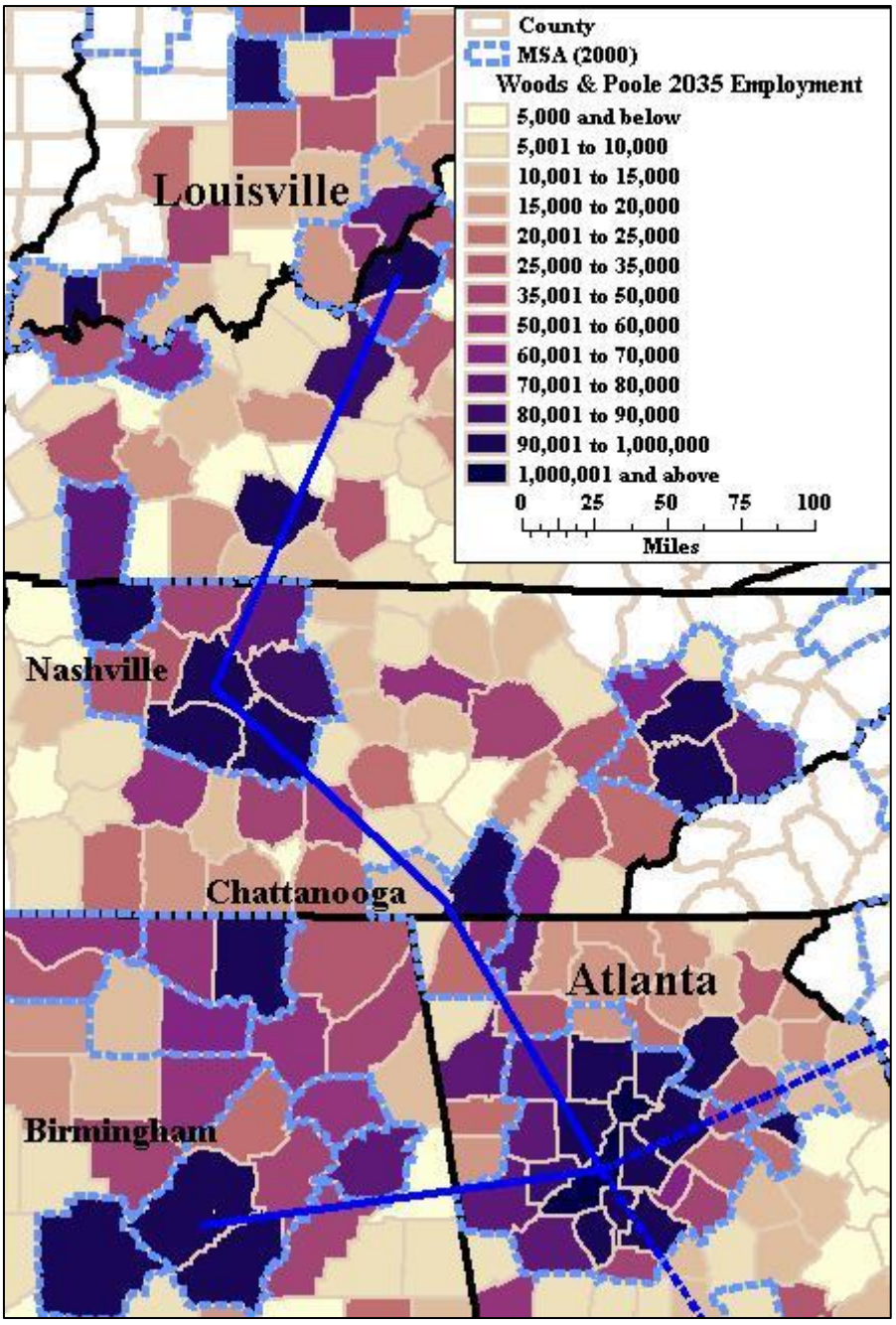
Figure 5-6 and Figure 5-7 show the county-level employment for the years 2020 and 2035, respectively; while Figure 5-8 and Table 5-4 present the employment growths between 2020 and 2035. Woods and Poole forecasts decent yearly employment growths up to 2035 in all four major metropolitan areas in spite of almost no employment growth over the past five years.

Figure 5-6: Atlanta-Chattanooga-Nashville-Louisville 2020 Employment



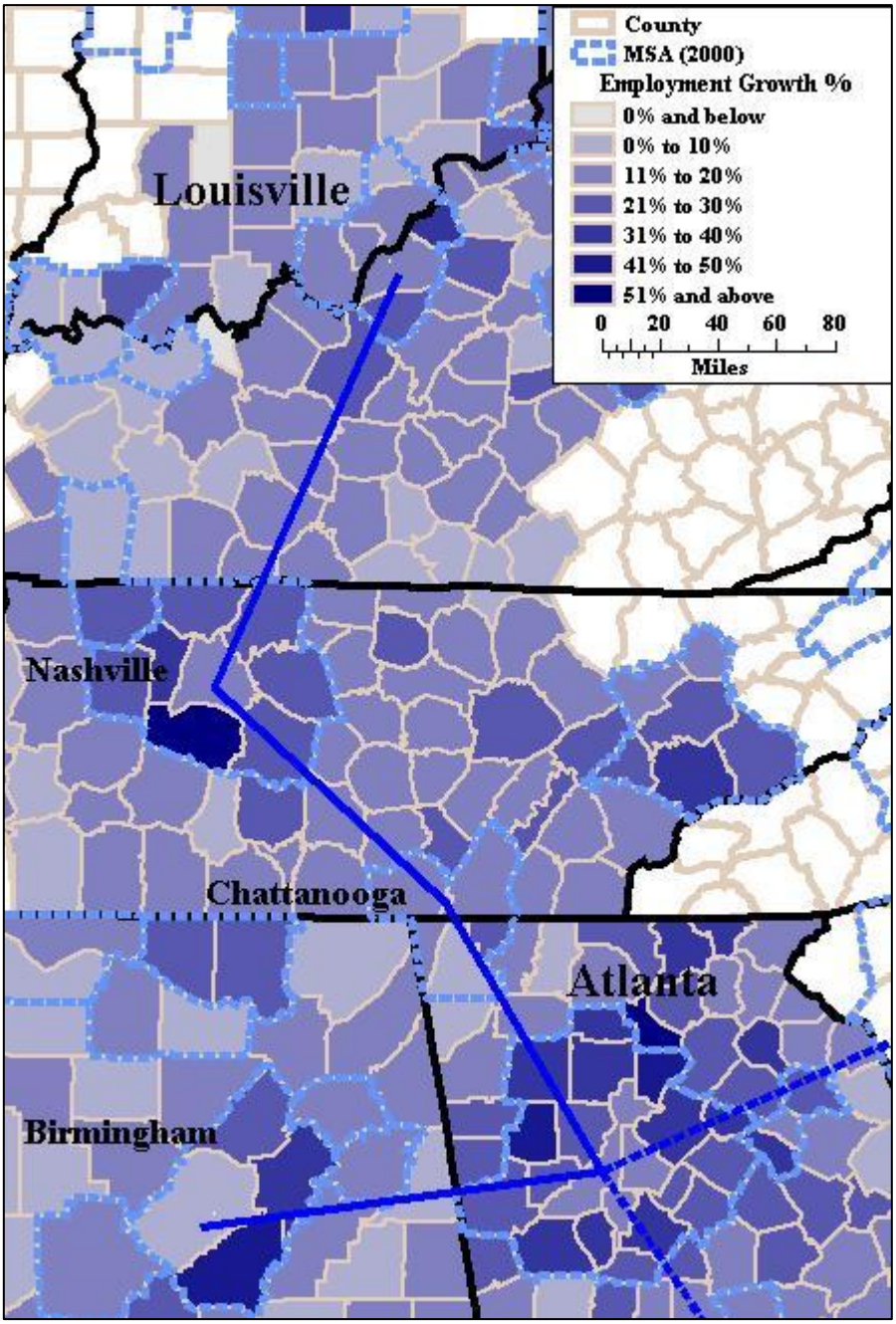
Source: Woods and Poole Economic Forecasts, 2011

Figure 5-7: Atlanta-Chattanooga-Nashville-Louisville 2035 Employment



Source: Woods and Poole Economic Forecasts, 2011

Figure 5-8: Atlanta-Chattanooga-Nashville-Louisville 2020-2035 Employment Growth



Source: Woods and Poole Economic Forecasts, 2011

Table 5-4: Employment Forecasts for MPO Coverage Areas

MPO	2005 Emp.	2010 Emp.	2020 Emp.	2035 Emp.	05-10 CAGR	20-35 CAGR
ARC	3,013,970	3,012,811	3,545,633	4,425,027	-0.01%	1.49%
KRPDA	659,966	663,208	743,523	859,324	0.10%	0.97%
CHRPA	266,396	258,663	295,521	353,653	-0.59%	1.20%
Nashville Area MPO	902,292	910,972	1,077,415	1,358,799	0.19%	1.56%

Source: Woods and Poole Economic Forecasts, 2011

5.2 MARKET ANALYSIS

As discussed in Section I: Chapter 3, three main travel markets have been identified in this corridor – the inter-urban travel market; the local travel market; and the connect air market.

5.2.1 THE INTER-URBAN MARKET

There are three travel modes by which inter-urban trips can currently be made between the major cities in the corridor:

- Automobile travel;
- Bus service; and
- Air service.

5.2.1.1 Automobile Travel

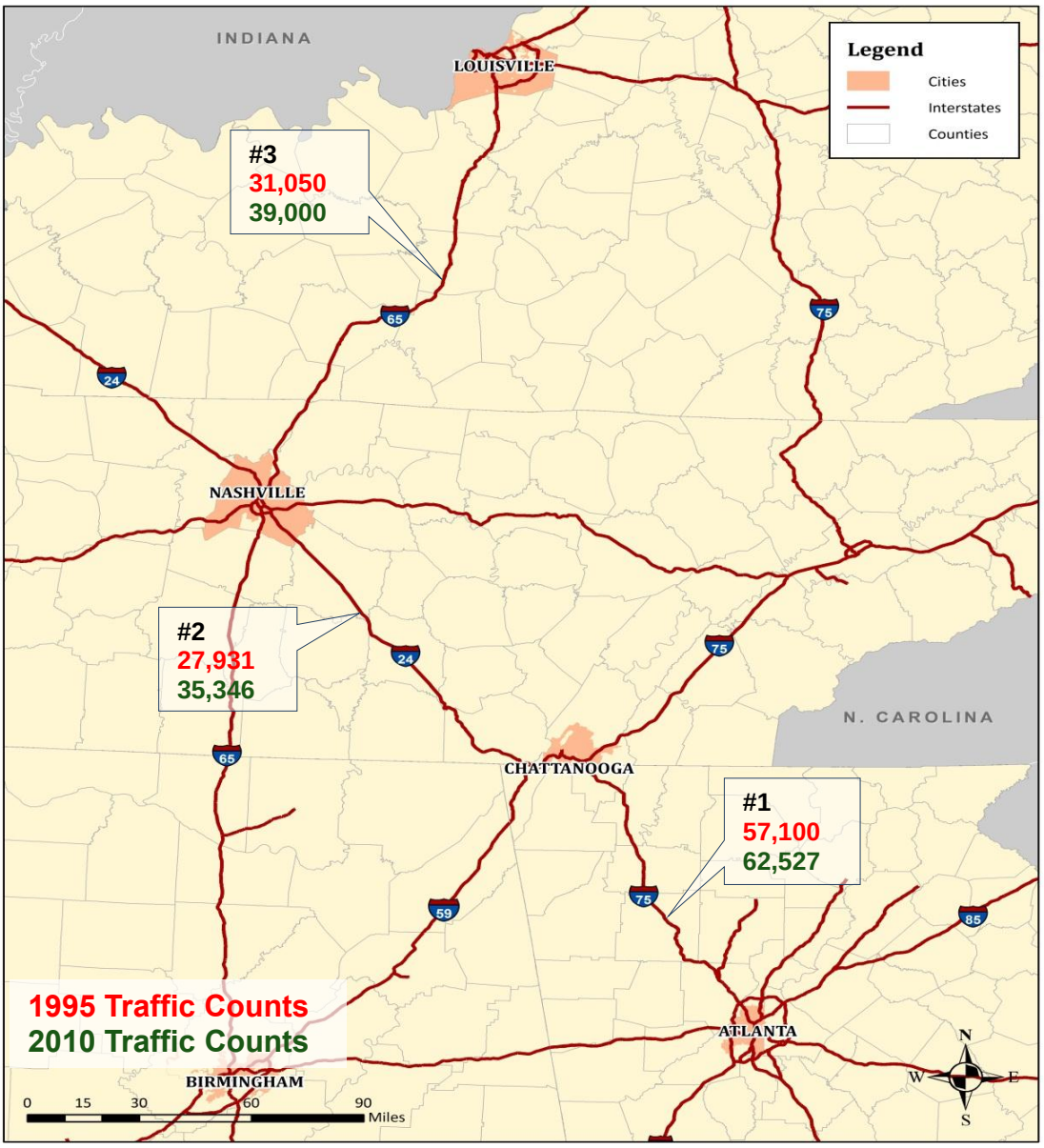
Automobile is the predominant mode of transportation utilized between Atlanta, Chattanooga, Nashville and Louisville. Traffic count data are available on major roadways and interstates connecting these cities. Table 5-5 shows historical traffic count data (annual average daily traffic [AADT]) on the main intercity highways: I-75 between Atlanta and Chattanooga, I-24 between Chattanooga and Nashville and I-65 between Nashville and Louisville. It is important to note that these represent total traffic volumes on the designated road section, and not the origin-destination demand from one section endpoint to the other. These historical traffic counts data shows an average annual growth of 1.24 percent between cities in the study corridor and Atlanta since 1995 (as seen in Table 5-5 and Figure 5-9).

Table 5-5: Observed Auto Traffic Growth (AADT) between 1995 and 2010

Corridor	Location	Traffic Count 1995	Traffic Count 2010	CAGR 95-10
Within the Louisville to Atlanta Corridor:				
Atlanta-Louisville	#1: I-75 between Chattanooga and Atlanta	57,100	62,527	0.61%
	#2: I-24 between Nashville and Chattanooga	27,931	35,346	1.58%
	#3: I-65 between Louisville and Nashville	31,050	39,000	1.53%

Source: http://tpas.dot.ga.gov, www.todot.state.tn.us, http://hytcgis.ky.gov

Figure 5-9: Observed Auto Traffic (AADT) in 1995 and 2010



Source: http://tpas.dot.ga.gov, www.todot.state.tn.us, http://hytcgis.ky.gov

Table 5-6 shows automobile travel distances and times between the major city pairs in the study area. The data is sourced from commercial journey planning software (Mapquest.com) and reflects speed limits and representative congestion levels on each route.

Table 5-6: Travel Times and Distances between City Pairs

Route	Distance (miles)	Time (min)
Atlanta - Chattanooga	118	117
Chattanooga – Nashville	135	131
Nashville - Louisville	176	170

Source: Mapquest.com

5.2.1.2 Bus Service

A summary of the bus services between Atlanta, Chattanooga and Louisville is presented in Table 5-7.

Table 5-7: Atlanta-Chattanooga-Nashville-Louisville Bus Service Summary

City Pair	Route	Operator	Travel time	Frequency	Full Fare[49]
Atlanta – Louisville	City to city (via Nashville and/or Chattanooga)	Greyhound	8h 5m to 9h 45m)	5x/day	$78-$85
Atlanta – Chattanooga	City to city	Greyhound	2h 10m or 2h 30m[50]	6x/day	$30-$33
Atlanta – Chattanooga	Airport to Airport	Groom	2h	19x/day	$39
Chattanooga – Nashville	Airport to Airport	Groom	2h 15m	19x/day	$39
Atlanta – Nashville	Airport to Airport	Groom	NA[51]	19x/day	$73
Atlanta – Nashville	City to city (Via Chattanooga)	Greyhound	4h 20m to 5h 10m	6x/day	$53-$58
Chattanooga –Louisville	City to city	Greyhound	6h 30m to 7h	5x/day	$78-$85
Chattanooga –Nashville	City to city	Greyhound	2h 20m to 2h 45m)	4x/day	$30-$33

Source: www.greyhound.com, www.redcouachusa.com, www.groometransportation.com

[49] Full or standard weekday and weekend fares, rounded to nearest dollar

[50] Additional service from airport is approximately 3.5 hours, due to transfer wait time

[51] Groom website does not provide a schedule of service

Table 5-7 shows that there are a variety of services operating in the corridors. Service frequencies are generally low. Travel times are highly variable and reflect variability in stopping patterns, congestion and/or transfer times.

Commercial bus operators are generally reluctant to release ridership numbers. Nevertheless, in the absence of any information from these operators, approximate ridership estimates based on bus capacity and load factors were prepared. Based on the service frequencies in the table above, 50 seats per bus and load factors of 50 percent, there are potentially 225,000 bus trips being made (in each direction) in this corridor. There may also be some charter bus operators; however, these operations have been excluded from the analysis.

5.2.1.3 Direct Air Service

The study area is served by a number of large airports. Table 5-8 presents a number of key characteristics of these airports. The table includes the airport's ranking among U.S. airports in terms of 2010 domestic passenger enplanements, scheduled departures, passenger carriers operating at the airport, and enplanements per departure.

Of particular importance is the extremely large hub airport in the study area, H-JAIA, which is the world's busiest airport and a major hub for Delta and AirTran airlines. This airport serves as a gateway for passengers throughout the southeast to connect to flights to numerous domestic and international destinations, as well as a connection point for many longer-distance trips.

Table 5-8: Airport Characteristics

Code	Airport	Rank	2010 Passenger Enplanements	2010 Scheduled Departures	2010 Passenger Carriers	Enplanements per Departure
ATL	H-JAIA	1	38,362,000	429,258	31	89
BNA	Nashville Metropolitan	37	4,398,000	63,954	28	69
SDF	Louisville International Airport	69	1,635,000	59,757	27	27
CHA	Lovell Field	147	288,000	8,203	12	35

Source: Airport snapshots, www.bts.gov

Table 5-9 shows the total number of true origin-destination trips between each pair of study area airports by direction, with outbound passenger volumes shown to the left of the diagonal and inbound passenger volumes shown to the right of the

diagonal. The airports other than H-JAIA are primarily served by feeder flights to hubs that serve various carriers; this obliges passengers traveling to other destinations to make a connection. Services between these airports and the various hub airports are provided with a combination of mainline and regional aircraft.

As seen in Table 5-9, it is evident that the largest air markets are those that include the hub airport, H-JAIA. The table also shows that the point-to-point air travel is not significant at all between all of the airport pairs in the corridor with Atlanta-Louisville market being the highest with only about 68,000 annual trips in both directions. Given the presence of H-JAIA as a major hub, there are also a significant number of connect air trips (described later under Section 5.2.3) between the corridor airports.

Table 5-9: Destination Air Trips by Direction Q4 2009 to Q3 2010

Destination / Origin	ATL	CHA	BNA	SDF
ATL		1,370	27,470	34,240
CHA	860		10	140
BNA	28,290	20		90
SDF	33,470	160	30	

Source: DB1B Market Data, Q4 2009 to Q3 2010, www.bts.gov

5.2.2 Local Travel Market

There are three main types of local trips:

- Journeys to work (most likely to originate in the suburbs and terminate in the city centers);
- Local trips for leisure purposes; and
- Local trips to access the airport, as part of a longer trip (where the ultimate destination is outside the study corridors and where the longer trip itself is not expected to shift to the new high-speed rail service).

Local trips were estimated using the 2000 U.S. Census Journey to Work data and the Atlanta-Chattanooga High Speed Ground Transportation EIS study. In the Atlanta-Chattanooga-Nashville-Louisville Corridor, 1.6 million commuting trips were estimated to have been made between the city pairs in 2015. This was calculated using information from 2000 U.S. Census Journey to Work data and forecasted using Woods and Poole socioeconomic and demographic forecasts. The total number of local trips was then calculated as multiples of the commuting trips identified in the U.S. Census. Local trips to access H-JAIA and other local trips for the Atlanta metropolitan areas were taken directly (with appropriate adjustments) from the Atlanta-Chattanooga High Speed Ground Transportation EIS study.

5.2.3 CONNECT AIR MARKET

The proposed high-speed rail service may provide a viable service between H-JAIA and the other corridor airports which may result in attracting current connect air travelers between the two airports. The connect air travel market differs from the data shown in Table 5-9 on page 4-111 for the direct air market which shows only the passengers traveling between each point, and does not include connecting flights to other destinations. Table 5-10 shows segment-level traffic information between H-JAIA and other airport pairs which provides a reliable estimate for the connect air market under consideration. The table includes total passengers, scheduled seats, scheduled departures, average daily frequency, average seats per flight, and average passengers per flight for Q4 2009 to Q3 2010.

Table 5-10: Air Services Summary

City Pair	Passengers	Seats	Scheduled Departures	Flights / Day	Seats / Flight	Passengers / Flight
ATL-BNA	274,598	350,410	4,519	12	78	63
ATL-SDF	183,625	228,704	3,464	9	66	56
ATL-CHA	119,140	160,038	3,360	9	48	36

Source: T-100 Segment Data, Q4 2009 to Q3 2010, www.bts.gov

As illustrated by the relatively small average aircraft sizes for Atlanta-Chattanooga, many of the flights are operated using regional aircraft, which typically provides service on short-haul routes between medium-sized cities and large hubs.

Comparing passenger counts on these routes with the true origin-destination traffic on the same airport pairs presented in Table 5-9 (page 4-111) demonstrates that the majority of the air travelers in these markets are connecting.

It may be plausible for air travelers in Louisville, Nashville and Chattanooga to consider H-JAIA as a possible alternate origin/destination of their air trips as long as they can get to/from H-JAIA in a relatively quick time using the proposed high-speed rail system.

5.3 FORECASTS

This section presents the ridership and revenue forecasts for the base case fare scenarios[52] for both the proposed Shared Use and Dedicated Use high-speed rail services. A fare sensitivity analysis is also presented later in Section 5.4.

[52] $0.28/mile with $5 boarding fee for Shared Use and $0.40/mile with $5 boarding fee for Dedicated Use.

The demand forecasting methodology uses binary diversion models to calculate high-speed rail ridership. Each diversion model computes, for each combination of trip purpose, market segment and current mode, the probability that a traveler would choose high-speed rail over its current mode of travel as a function of each mode's level of service attributes. The probabilities are then multiplied by the future year mode-specific travel volumes to calculate the diverted volumes from the existing modes to the new high-speed rail system. The inclusion of each mode's level of service attributes in the diversion models enables the study to test several high-speed service frequencies and to accordingly adjust them to the ridership level. The forecasting approach is explained in more detail in Section 1, Chapter 3, specifically section 3.3 and graphically in Figure 3-18.

The study presents the base case ridership and revenue forecasts for both the proposed Shared Use and Dedicated Use rail services. Based on benchmarks against other regional high-speed ground transportation studies and the broad estimates of a feasibility study, it was decided to use the doubling of auto operating costs and the four percent increase in highway congestion between 2015 and 2035 as a part of the base cases for a total of 28 percent increase (in addition to the fare and other base case assumptions) for both Shared and Dedicated services.

In order to account for unforeseen increases in factors that contribute directly towards ridership and revenue, the study studied the sensitivity of ridership with respect to the following factors:

- Effect of higher auto operating costs (e.g., higher fuel prices);
- Effect of higher-socioeconomic forecast between 2015 and 2035; and
- Effect of higher congestion in 2035.

The results of these sensitivity analyses are presented in Table 5-11 below:

Table 5-11: External Factor Analyses

Scenario tested	% Increase in ridership
Doubling auto operating costs in 2035 compared to 2015	+24%
Higher population growth (additional 0.5% annually above W&P forecasts)	+10%
Higher congestion (23% highway congestion increase between 2015 and 2035)	+4%

- **Doubling Auto Operating Costs:** Higher increases in fuel prices could be possible, but coupled with continuing fuel efficiency advances, increasing operating costs by a factor of two is a plausible scenario. This scenario would add as much as a 24 percent increase in ridership and revenue. This doubling of auto cost is assumed for the year 2035 compared to 2015 where average auto costs were $0.10/mile and $0.55/mile for non-business and business travel purposes, respectively. The impact of higher operating costs is more prominent in Atlanta due to the relatively higher sensitivity to cost in that metropolitan region.
- **Higher Population Growth:** The study tested a scenario that increases population by an additional 0.5 percent above the Woods and Poole forecast, annually, between 2015 and 2035. This would result in an additional 10 percent ridership increase. It was determined that this higher population growth was too aggressive and was therefore not included in the base scenario.
- **Higher Congestion Growth:** Translating historical trends in congestion growth in Atlanta as reported by the TTI would result in a nine percent increase in the travel time between 2015 and 2035. This nine percent increase in highway congestion over twenty years was considered too low by the study which in turn decided to use a more plausible 23 percent increase in highway congestion between 2015 and 2035. The resulting impact of this 14 percent additional highway congestion increase was four percent more ridership and revenue.

5.3.1 90-110 MPH SHARED USE RIDERSHIP AND REVENUE FORECASTS (2021-2040)

During the assumed first year of operation in 2021, the proposed Shared Use rail service ridership will be 4.4 million with an associated ticket revenue figure of $175.5 million (shown in Table 5-12). By 2040, more than 5.8 million riders and $252.2 million in ticket revenue are expected during steady operations.

Table 5-12: Shared Use Base Ridership and Revenue

Year	Ridership	Revenue
2021	4,380,000	$175,529,000
2030	$6,060,000	$211,846,000
2040	$5,816,000	$252,205,000
Total	**101,962,000**	**$4,277,336,000**

Table 5-13 presents the bi-directional station boardings and segment volumes for the Shared Use rail service in the corridor. It is evident from the table that the majority of the boardings take place at the larger city stations (Atlanta airport, Atlanta MMPT, Marietta, Chattanooga and Nashville); while the Louisville stations (downtown and airport) have less boardings due to their significantly longer distance to Atlanta – the main travel demand generator and attractor in the corridor. It is also important to note that local H-JAIA access trips from downtown Atlanta and the suburbs constitute a large market.

Table 5-13: Shared Use Base Case 2035 Annual Station Boardings and Segment Volumes (bi-direction)

Station	Boardings	Volume
Atlanta Airport	431,337	
Atlanta MMPT	1,701,122	862,673
Cumberland Galleria	131,393	2,538,405
Marietta	734,594	2,504,359
Cartersville	196,343	2,199,395
Dalton	182,907	2,214,605
Chattanooga Airport	342,593	2,125,015
Chattanooga Downtown	202,366	2,036,639
Murfreesboro	321,924	1,997,498
Nashville Airport	107,413	1,714,505
Nashville Downtown	571,453	1,545,339
Bowling Green	160,957	830,406
Elizabethtown	98,651	646,583
Louisville Airport	156,873	511,016
Louisville Downtown	98,390	196,937
Total Annual Boardings	**5,438,319**	

5.3.2 180-220 MPH DEDICATED USE RIDERSHIP AND REVENUE FORECASTS (2021-2040)

As seen in Table 5-14, with a base fare assumption of $0.40/mile with $5 boarding fee, the Atlanta-Chattanooga-Nashville-Louisville Corridor would attract about 4.7 million riders with associated ticket revenue of $267.1 million for the proposed Dedicated Use high-speed rail service in the first year of operation (2021). By 2040, approximately 6.4 million riders are expected during steady state operation, with ticket revenue of $382.4 million.

Table 5-14: Dedicated Use Base Ridership and Revenue

Year	Ridership	Revenue
2021	4,715,000	$267,084,000
2030	5,491,000	$321,712,000
2040	6,353,000	$382,410,000
Total	**110,677,000**	**$6,494,937,000**

In the Atlanta-Chattanooga-Nashville-Louisville Corridor, a major portion of the total ridership is the local trips between all the station pairs between H-JAIA and Cartersville. Given that the travel time advantage of the Dedicated Use high-speed rail service is minimal and base case fare disadvantage is more significant over the Shared Use service in these short distance station pairs, the Dedicated Use ridership in these local markets are almost the same as the Shared Use service. In addition, there is also no proposed station at Marietta (which is a significant travel generator/attractor in the corridor) for the Dedicated Use service to reflect the proposed stations in the Atlanta-Chattanooga HSGT Tier I EIS. While a good portion of the Marietta ridership will use the other adjacent stations such as Cumberland Galleria or Cartersville, there is also a significant ridership percentage that is lost as a result of eliminating the stop Marietta. This also contributed in a significant way in the local ridership figures being similar between the Dedicated and Shared Use services. This also ultimately resulted in the total ridership for the Dedicated Use service to be only nine percent higher than that of the Shared Use even though the Dedicated Use service has significantly higher ridership for the inter-urban market.

Table 5-15 shows that the station boardings and ridership flows for various segments between the station pairs for the Dedicated Use service follow the same trend as those of the Shared Use service.

Table 5-15: Dedicated Use Base Case 2035 Annual Station Boardings and Segment Volumes (bi-directional)

Station	Boardings	Volume
Atlanta Airport	755,755	-
Atlanta MMPT	1,496,201	1,511,326
Cumberland Galleria	584,643	2,738,353
Marietta	-	2,744,390
Cartersville	269,941	2,744,390
Dalton	191,404	2,874,105
Chattanooga Airport	446,752	2,818,193
Chattanooga Downtown	260,240	2,634,880
Murfreesboro	374,216	2,549,213
Nashville Airport	207,953	2,275,557
Nashville Downtown	676,681	1,919,767
Bowling Green	198,531	1,078,690
Elizabethtown	126,655	835,029
Louisville Airport	216,250	665,982
Louisville Downtown	116,463	233,124
Total Annual Boardings	**5,921,687**	

5.3.3 MAGLEV RIDERSHIP AND REVENUE (2021-2040)

The study estimates that ridership and revenue will increase by 4.98 percent over the Dedicated Use estimates based on the increase in speed and decrease of overall travel time between Atlanta and Louisville (-0:30). The study assumes the same fare structure for Maglev operations ($5 boarding fee and $0.40/mile). Table 5-16 illustrates the estimated ridership and revenue for the Maglev operations for 2021, 2030 and 2040 as well as total ridership and revenue (2021-2040).

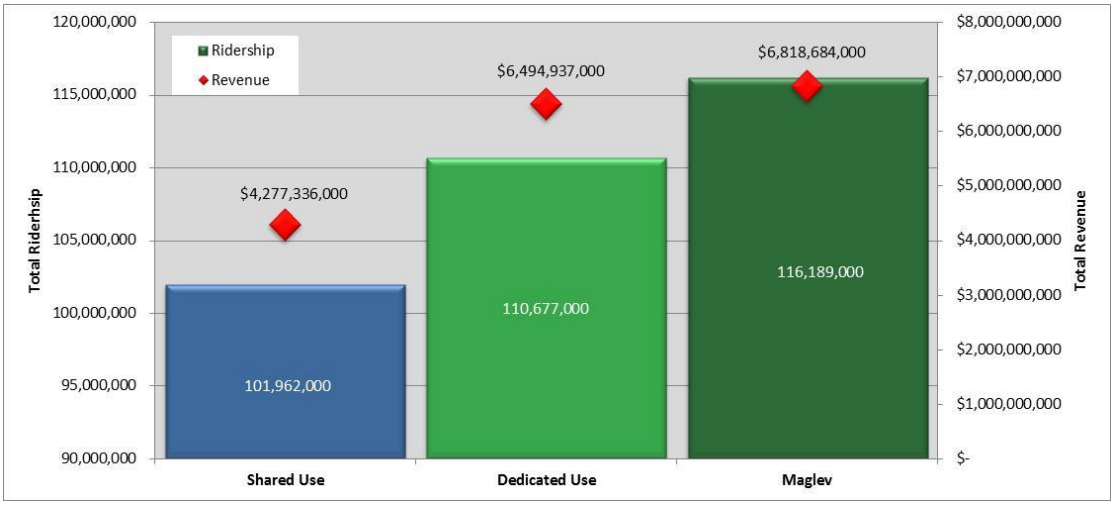
Table 5-16: Maglev Base Ridership and Revenue

Year	Ridership	Revenue
2021	4,949,000	$284,385,000
2030	5,764,000	$337,733,000
2040	6,669,000	$401,454,000
Total	**116,189,000**	**$6,818,384,000**

5.3.4 Ridership and Revenue Forecasts (2021-2040)

Figure 5-10 presents year by year ridership and revenue forecasts for base case scenarios for both the proposed Dedicated/Maglev and Shared Use high-speed rail services between 2021 and 2040. Over these 20 years of operation, the ridership (and revenue) accrual for the Shared Use, Dedicated Use and Maglev services are expected to be about 106.3 million (and $4.5 billion), 115.3 million (and $6.8 billion), and 121.1 million (and $7.1 billion), respectively.

Figure 5-10: Atlanta-Chattanooga-Nashville-Louisville Corridor Base Case Ridership and Revenue Forecasts (2021-2040)



5.4 Fare Sensitivity Analysis

In addition to the base case and earlier sensitivity analyses discussed above, additional sensitivity tests on the effects of fares were performed. The following sections present the results of the fare sensitivity analysis. The effect of fares on ridership and revenue is presented first for both the Shared and Dedicated Use high-speed rail services.

5.4.1 Shared Use Fare Sensitivity

Table 5-17 presents the total ridership and revenue numbers for the Atlanta-Chattanooga-Nashville-Louisville Corridor for two fare scenarios ($0.20/mile and $0.40/mile both with $5 boarding fees) in addition to the base case ($0.28/mile with $5 boarding fee) for the Shared Use rail service for three separate years. It is evident from the table that increasing fares to $0.40/mile generates revenue increases compared to lower fare scenarios including the base case. This suggests that the base fare of $.28/mile for the Shared Use service is below the revenue maximizing fare levels. It is important to maximize both ridership and revenue in order to not only receive farebox revenues, but also provide a valuable service to consumers.

Additionally, passenger rail service can have a positive impact on non-users such as auto motorists and those flying that are also important to capture.

Table 5-17: Fare Sensitivity for Shared Use Service

Year	Annual Volume and Revenue		
	Scenario 1 - $0.20/mile	Scenario 2 - $0.28/mile	Scenario 3 - $0.40/mile
2021	5,074,000	4,380,000	3,543,000
	$158.8 M	**$175.6 M**	**$181.1 M**
2030	5,866,000	6,060,000	4,086,000
	$191.0 M	**$211.9 M**	**$219.3 M**
2040	6,747,000	5,816,000	4,690,000
	$226.7 M	**$252.2 M**	**$261.7 M**

5.4.2 Dedicated use Fare Sensitivity

Table 5-18 presents the total ridership and revenue numbers for the Atlanta-Chattanooga-Nashville-Louisville Corridor for two fare scenarios ($0.55/mile and $0.70/mile both with $5 boarding fees) in addition to the base case ($0.40/mile with $5 boarding fee) for the Dedicated Use/Maglev high-speed rail service for three separate years. Increasing fares above the base fare of $0.40/mile generates higher revenues for the Dedicated Use service only when we raised the fare to $0.55/mile. When raised to $0.70/mile, the revenue goes down. This indicates that the base fares are lower than the revenue maximizing levels, and that the revenue maximizing fare is between $0.55/mile and the $0.70/mile level. However, the additional ticket revenue that may be generated with the $0.55/mile fare level compared to the base case is not significant. Further, higher fare levels are also associated with significant ridership loss and consequently public benefits loss.

Table 5-18: Fare Sensitivity for Dedicated Use Service (2010$)

Year	Annual Volume and Revenue		
	Scenario 1 - $0.40/mile	Scenario 2 - $0.55/mile	Scenario 3 - $0.70/mile
2021	4,715,000	3,802,000	3,124,000
	$267.1 M	**$273.1 M**	**$260.9 M**
2030	5,491,000	4,423,000	3,624,000
	$321.7 M	**$329.1 M**	**$314.6 M**
2040	6,353,000	5,114,000	4,180,000
	$382.4 M	**$391.3 M**	**$374.2 M**

5.4.3 Shared Use and Dedicated Use/Maglev Total Ridership and Revenue Summary

Table 5-19 and Table 5-20 below summarize the total number of passengers and revenue that will be accrued over 20 years of operation starting from the assumed opening year of 2021 for the Shared Use and Dedicated Use/Maglev services, respectively.

Table 5-19: Shared Use Total Ridership and Revenue Summary (2010$)

Shared Use Total Ridership and Revenue Summary		
Years 2021-2040	**Ridership**	**Revenue (2010$)**
Scenario 1 - $0.20/mile	118,208,000	$3.9 billion
Scenario 2 - $0.28/mile	106,266,000	$4.2 billion
Scenario 3 - $0.40/mile	82,330,000	$4.4 billion

Table 5-20: Dedicated Use Total Ridership and Revenue Summary (2010$)

Dedicated Use/Maglev Total Ridership and Revenue Summary		
Years 2021-2040	**Ridership**	**Revenue (2010$)**
Scenario 1 - $0.40/mile	115,306,000	$6.5 billion
Scenario 2 - $0.55/mile	89,157,000	$6.6 billion
Scenario 3 - $0.70/mile	73,032,000	$6.4 billion

5.4.4 EVALUATION SCENARIOS

In setting up the evaluation, three scenarios were developed to show the impact of a range of ridership, revenue, capital and operating cost estimates typically encountered in a feasibility-level analysis. Unadjusted base forecasts for ridership, revenue, capital and operating costs were used for the Conservative Scenario. Base ridership and revenue estimates were increased for Dedicated Use corridors to establish the Intermediate and Optimistic Scenarios.[53] Operating costs were adjusted by the appropriate ridership drivers. Capital cost estimates were adjusted downward in the Intermediate and Optimistic Scenarios for all technologies.

The three scenarios are intended to capture and illustrate the relatively wide range of estimates at the feasibility-level of study. As corridors are deemed feasible for further evaluation, future studies will provide greater detail in the analysis of ridership, revenues and costs, narrowing the range of estimates.

5.4.4.1 Conservative Scenario Estimates

Conservative scenario estimates use base-case ridership and revenue forecasts and capital cost estimates for the operating ratio and benefit-cost analysis. Refer back to Section I: Chapter 3 for additional details on the Conservative estimate methodology. Table 5-14 on page 5-116 summarizes base-case ridership and revenue forecasts.

5.4.4.2 Intermediate Scenario Estimates

The Intermediate scenario represents a balance estimate between the Conservative and Optimistic scenarios by increasing ridership and revenue above the Conservative scenario but remain lower than the Optimistic scenario. The ridership and revenue estimates are approximately 75 percent higher than the Conservative estimates. Table 5-21 outlines the Intermediate scenario ridership and revenue estimates.

[53] Ridership adjustments for Intermediate and Optimistic Scenarios were only made for Dedicated Use corridor 180-220 mph electrified, steel-wheel and Maglev technologies (Maglev in Atlanta-Louisville corridor only) based on a peer review of regional and national high speed rail corridor studies. No scenario ridership adjustment was made for Shared Use corridor diesel-electric technology results based on a peer review of other shared-use corridor studies.

Table 5-21: Intermediate Scenario Annual Ridership and Revenue Estimates (2021-2040 in 2010$)

Year	Dedicated Use		Maglev	
	Ridership	Revenue	Ridership	Revenue
2021	8,101,000	$467,397,000	8,504,000	$490,673,000
2030	9,609,000	$562,996,000	10,087,000	$591,033,000
2040	11,117,000	$669,217,000	11,671,000	$702,544,000
Total	**201,786,000**	**$11,366,139,000**	**211,835,000**	**$11,932,173,000**

These ridership and revenue levels, in conjunction with forecast operating and maintenance costs and capital costs (Chapter 6), were used to calculate scenario-based, operating ratios and benefit-cost ratios (Chapter 7) for use in the feasibility evaluation.

5.4.4.3 Optimistic Scenario Estimates

This scenario uses a higher ridership and revenue and a lower capital cost estimate for the Atlanta-Chattanooga-Nashville-Louisville Corridor. The ridership and revenue estimates are increased by 100 percent to become comparable to other peer studies within the southeast region and nationally. Table 5-22 outlines the ridership and revenue estimates for the Optimistic scenario..

Table 5-22: Optimistic Scenario Annual Ridership and Revenue Estimates

Year	Dedicated Use		Maglev	
	Ridership	Revenue	Ridership	Revenue
2021	9,258,000	$534,168,000	9,719,000	$560,770,000
2030	10,982,000	$643,424,000	11,528,000	$675,466,000
2040	12,705,000	$764,819,000	13,338,000	$802,907,000
Total	**230,612,000**	**$12,989,873,000**	**242,097,000**	**$13,636,769,000**

6 FORECASTED COSTS

6.1 CAPITAL COSTS

The study gathered regional and national infrastructure and equipment capital costs data to estimate total design and construction costs for the Atlanta-Chattanooga-Nashville-Louisville high-speed rail corridor. As aforementioned in Section I: Capital Cost Methodology, the study prepared capital costs at the conceptual engineering level (5 – 10 percent design level) with a +/- 30 percent level of accuracy. The study used FRA standard costing categories (SCC) as required for FRA grant applications. To recap, the Table 6-1 illustrates these FRA SCC.

Table 6-1: FRA Standard Cost Categories

FRA Standard Cost Categories for Capital Projects/Programs
10 Track Structures & Track
20 Stations, Terminals, Intermodal
30 Support Facilities: Yards, Shops, Administration Buildings
40 Sitework, Right-of-Way, Land, Existing Improvements
50 Communications & Signaling
60 Electric Traction
70 Vehicles
80 Professional Services
90 Unallocated Contingencies
100 Finance Charges

This chapter outlines the total capital costs for the Atlanta-Chattanooga-Nashville-Louisville high-speed rail corridor for 90-110 mph Shared Use, 180-220 mph Dedicated Use, and 220+ mph Maglev technologies. It should be noted that these unit costs are only preliminary costs, and actual costs for the corridor will be dependent upon a preferred alignment and technology, which this study does not determine.

Additionally, it will be important to understand further the potential for phased implementation in order to reduce capital costs for the initial implementation of high-speed rail within the Atlanta-Chattanooga-Nashville-Louisville Corridor. By phasing the corridor, these initial capital costs can also be phased in order to efficiently and effectively implement high-speed rail in order to meet current and future demands while maintaining reasonable capital cost expenditure.

6.1.1 90-110 MPH SHARED USE

The 90-100 mph Shared Use, as outlined in previous chapters, will use diesel-electric operating equipment and will share existing freight railroad right-of-way and track infrastructure. Therefore, the overall capital costs are less than the 180-220 mph Dedicated Use technology, which is on a dedicated alignment and is a fully electrified system. Table 6-2 provides the overall Atlanta-Chattanooga-Nashville-Louisville Corridor capital costs by major SCC category. For a more detailed breakdown of capital costs by sub-category, refer to Appendix F at the end of this report.

Table 6-2: Atlanta-Chattanooga-Nashville-Louisville Total Shared Use Capital Cost by SCC Category (2010$)

Costing Category		Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures & Track	$3,407,388,000	$1,022,216,000	$4,429,604,000
20	Stations, Terminals, Intermodal	$352,086,328	$105,625,898	$457,712,000
30	Support Facilities: Yards, Shops, Administration Buildings	$58,000,000	$17,400,000	$75,400,000
40	Sitework, Right-of-Way, Land, Existing Improvements	$1,978,288,000	$593,486,000	$2,571,774,000
50	Communications & Signaling	$1,052,752,000	$315,826,000	$1,386,578,000
60	Electric Traction	-	-	-
70	Vehicles	$422,500,000	$126,750,000	$549,250,000
80	Professional Services	$2,136,736,000	-	$2,136,736,000
90	Unallocated Contingencies	-	-	-
100	Finance Charges	-	-	-
TOTAL COST		**$9,407,750,000**	**$2,181,304,162**	**$11,589,054,366**
TOTAL COST PER MILE (483.9 MILES)				**$26,978,000**

To further understand the detailed SCC costs of the Atlanta-Chattanooga-Nashville-Louisville Corridor, Figure 6-1 through Figure 6-3 and Table 6-3 through Table 6-5 illustrates the capital costs by segment. Segments were developed based on station location and natural breaks in the corridor such as state boundaries. It should be noted that station and maintenance facility costs were only accounted for in the segment in which the station and/or maintenance facility is located. Additionally, vehicle costs were only accounted for in the total corridor capital costs, and were not included in the segment costs.

Figure 6-1: Atlanta-Chattanooga-Nashville-Louisville Shared Use Segment One

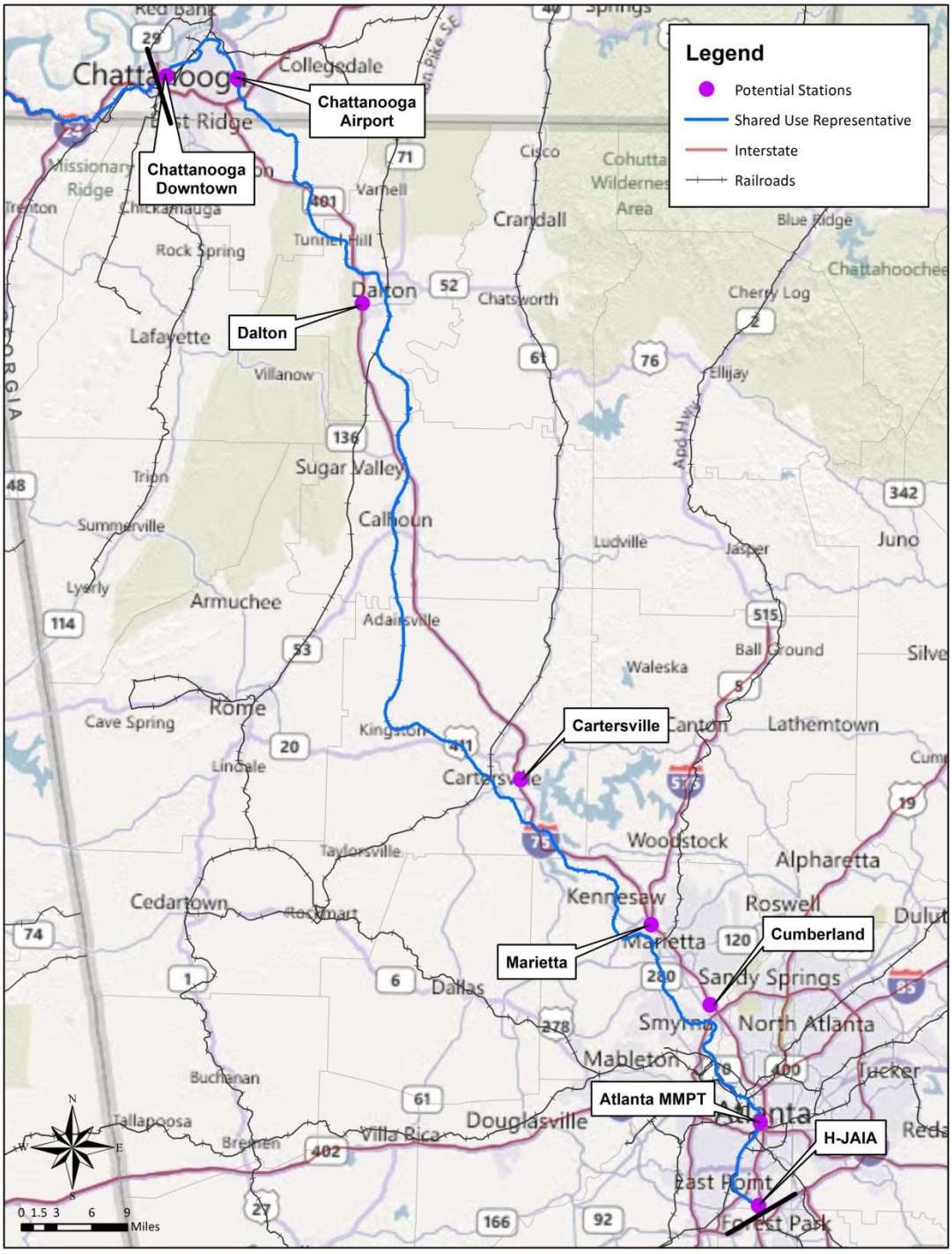


Table 6-3: Total Corridor Capital Costs 90-110 mph Shared Use Segment One

Segment 1: 90-110 mph Shared Use – Atlanta H-JAIA to Downtown Chattanooga			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$1,150,094,000	$345,028,000	$1,495,123,000
Stations, Terminals, Intermodal	$312,816,000	$93,845,000	$406,661,000
Support Facilities: Yards, Shops, Administration Buildings	$58,000,000	$17,400,000	$75,400,000
Sitework, R/W, Land	$573,073,00	$171,922,000	$744,995,000
Communications & Signaling	$296,110,000	$88,833,000	$384,943,000
Electric Traction	-	-	-
Vehicles	-	-	-
Professional Services	$745,709,000	-	$745,709,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$3,135,803,000**	**$717,028,000**	**$3,852,831,000**
Cost Per Mile (136.5 Miles)			**$28,255,000**

Figure 6-2: Atlanta-Chattanooga-Nashville-Louisville Shared Use Segment Two

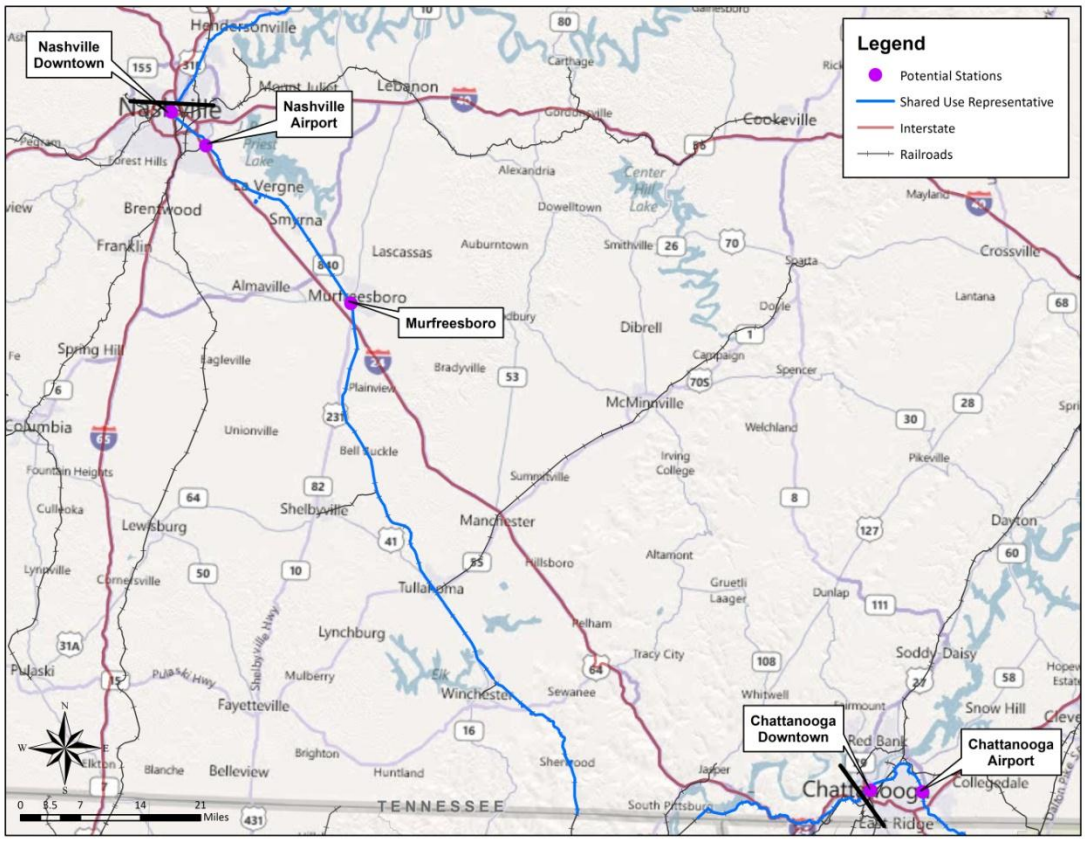


Table 6-4: Total Corridor Capital Costs 90-110 mph Shared Use Segment Two

Segment 2: 90-110 mph Shared Use – Downtown Chattanooga to Downtown Nashville			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$1,177,538,000	$353,261,000	$1,530,799,000
Stations, Terminals, Intermodal	$16,830,000	$5,049,000	$21,879,000
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$629,498,000	$188,849,000	$818,347,000
Communications & Signaling	$349,516,000	$104,855,000	$454,371,000
Electric Traction	-	-	-
Vehicles	-	-	-
Professional Services	$678,095,000	-	$678,095,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$2,851,477,000**	**$652,015,000**	**$3,503,492,000**
Cost Per Mile (152.5 Miles)			**$22,973,000**

Figure 6-3: Atlanta-Chattanooga-Nashville-Louisville Shared Use Segment Three

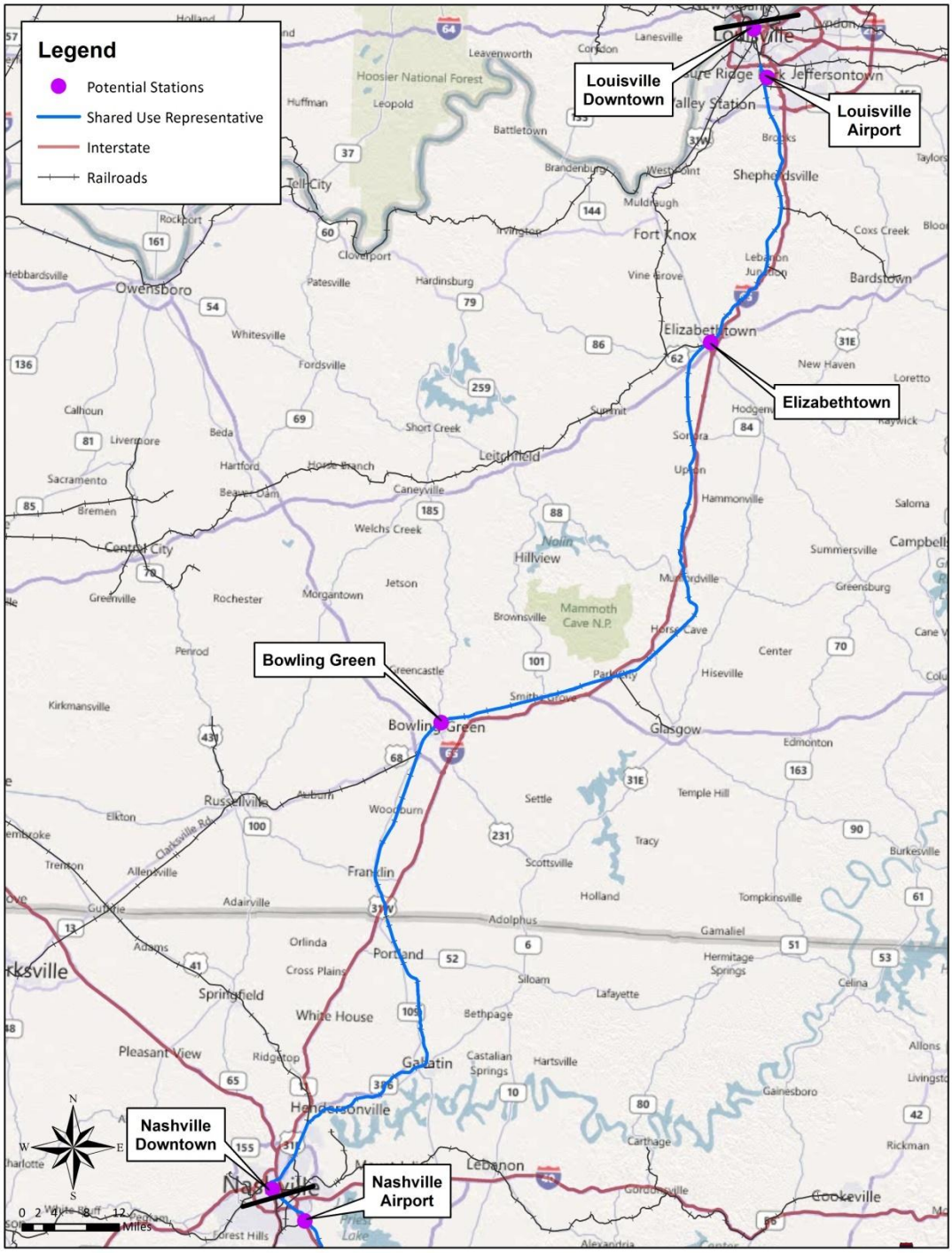


Table 6-5: Total Corridor Capital Costs 90-110 mph Shared Use Segment Three

Segment 3: 90-110 mph Shared Use – Downtown Nashville to Downtown Louisville			
	Allocated	Contingency (30%)	Total Cost
Track Structures & Track	$1,079,755,000	$323,927,000	$1,403,682,000
Stations, Terminals, Intermodal	$22,440,000	$6,732,000	$29,172,000
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$775,717,000	$232,715,000	$1,008,432,000
Communications & Signaling	$407,126,000	$122,138,000	$529,264,000
Electric Traction	-	-	-
Vehicles	-	-	-
Professional Services	$712,932,000	-	$712,932,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$2,997,970,000**	**$685,512,000**	**$3,683,482,000**
Cost Per Mile (194.9 Miles)			**$18,899,000**

6.1.2 180-220 MPH DEDICATED USE

The 180-220 mph Dedicated Use runs on a fully separated, dedicated alignment utilizing interstate, rail line and greenfield right-of-way. Within urban corridors, the alignment is shared with freight right-of-way. The track will be separated from freight operations and will not interfere with freight traffic. The total capital costs for Dedicated Use are higher than Shared Use due to the electrification of the track, electrified vehicles, land acquisition and relocations. Table 6-6 outlines the total Atlanta-Macon-Jacksonville Dedicated Use corridor costs by SCC.

Table 6-6: Atlanta-Chattanooga-Nashville-Louisville Total Dedicated Use Capital Cost (2010$)

Costing Category		Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures & Track	$13,462,000,000	$4,038,694,000	$17,501,007,000
20	Stations, Terminals, Intermodal	$346,476,000	$103,943,000	$450,419,000
30	Support Facilities: Yards, Shops, Administration Buildings	$70,000,000	$21,000,000	$91,000,000
40	Sitework, Right-of-Way, Land, Existing Improvements	$1,546,687,000	$437,006,000	$1,893,693,000
50	Communications & Signaling	$686,818,000	$206,045,000	$892,863,000
60	Electric Traction	3,652,373,000	$1,095712,000	$4,748,085,000
70	Vehicles	$738,650,000	$221,595,000	$960,245,000
80	Professional Services	$6,138,496,000	-	$6,138,496,000
90	Unallocated Contingencies	-	-	-
100	Finance Charges	-	-	-
	TOTAL COST	**$26,551,814,000**	**$6,123,995,000**	**$32,675,809,000**
TOTAL COST PER MILE (428.2 MILES)				**$76,304,000**

Figure 6-4: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Segment One

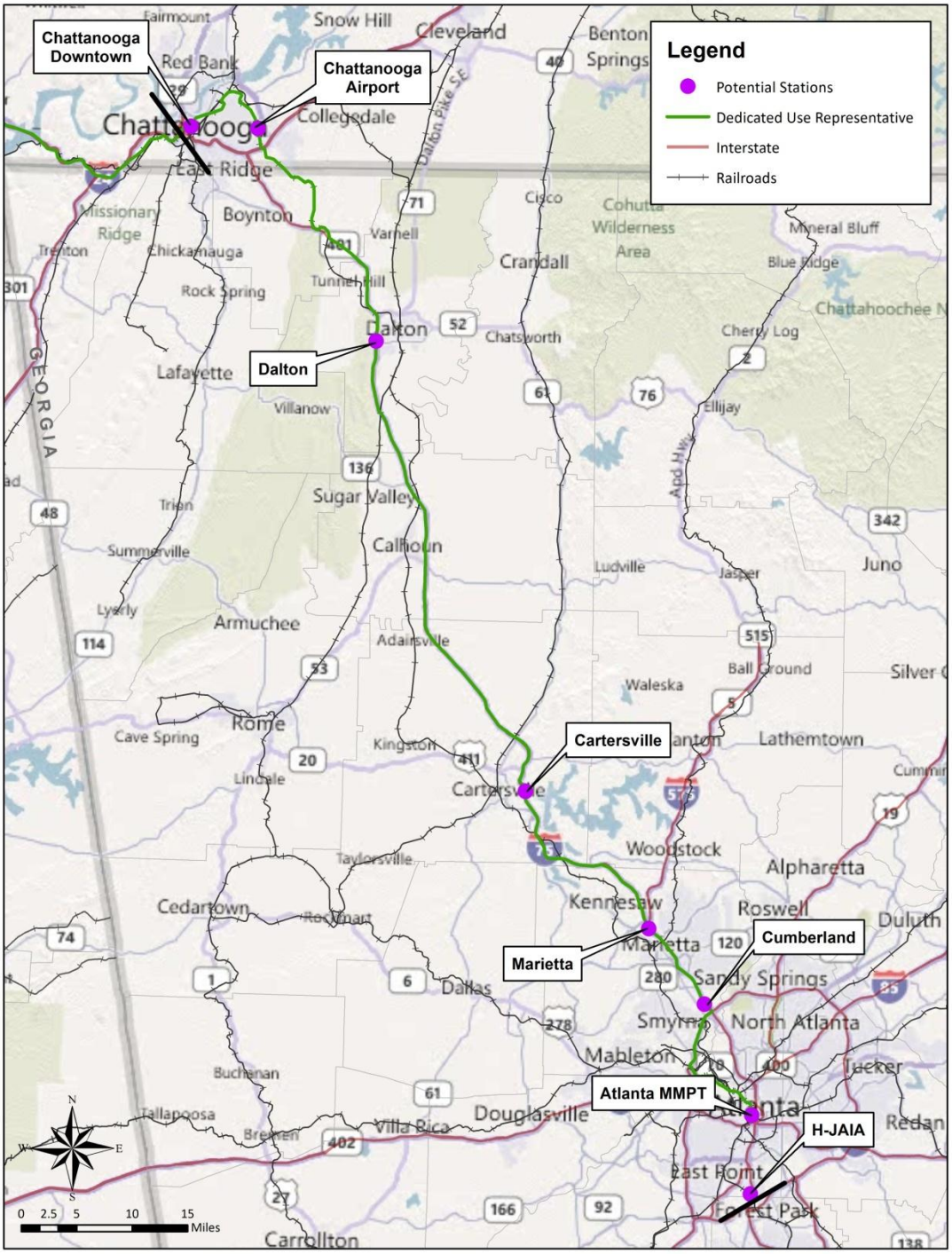


Table 6-7: Total Corridor Capital Costs 180-220 mph Dedicated Use Segment One

Segment 1: 180-220 mph Dedicated Use – Atlanta H-JAIA to Downtown Chattanooga			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$7,505,471,000	$2,251,641,000	$9,757,113,000
Stations, Terminals, Intermodal	$307,206,000	$92,162,000	$399,368,000
Support Facilities: Yards, Shops, Administration Buildings	$70,000,000	$21,000,000	$91,000,000
Sitework, R/W, Land	$256,278,000	$76,883,000	$333,161,000
Communications & Signaling	$206,925,000	$62,078,000	$269,003,000
Electric Traction	$909,978,000	$272,993,000	$1,182,971,000
Vehicles	-	-	-
Professional Services	$2,887,828,000	-	$2,887,828,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$12,143,687,000**	**$2,776,758,000**	**$14,920,444,000**
Cost Per Mile (128.4 Miles)			**$116,203,000**

Figure 6-5: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Segment Two

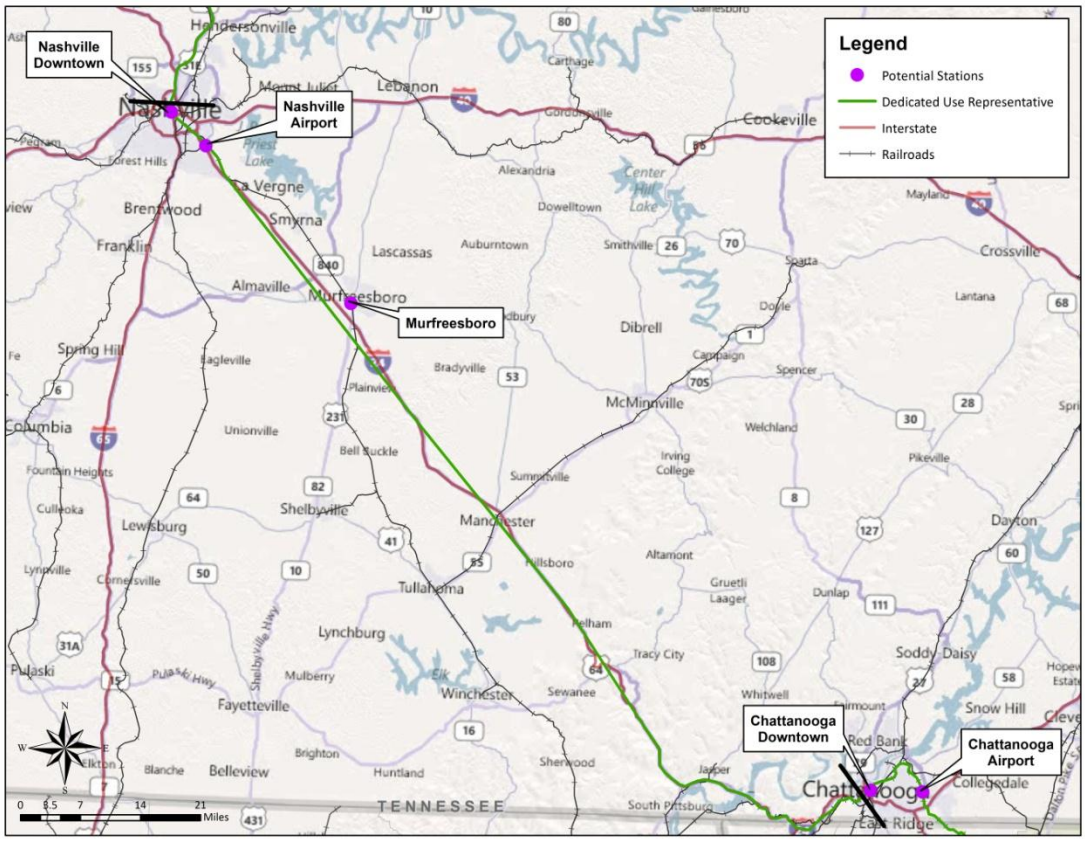


Table 6-8: Total Corridor Capital Costs 180-220 mph Dedicated Use Segment Two

Segment 2: 180-220 mph Dedicated Use –Downtown Chattanooga to Downtown Nashville			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$2,643,762,000	$793,129,000	$3,436,891,000
Stations, Terminals, Intermodal	$16,830,000	$5,049,000	$21,879,000
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$320,503,000	$96,151,000	$416,654,000
Communications & Signaling	$206,387,000	$61,916,000	$268,303,000
Electric Traction	$907,489,000	$272,249,000	$1,179,747,000
Vehicles	-	-	-
Professional Services	$1,277,634,000	-	$1,277,634,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$5,372,614,000**	**$1,228,494,000**	**$6,601,108,000**
Cost Per Mile (128.1 Miles)			**$51,531,000**

Figure 6-6: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Segment Three

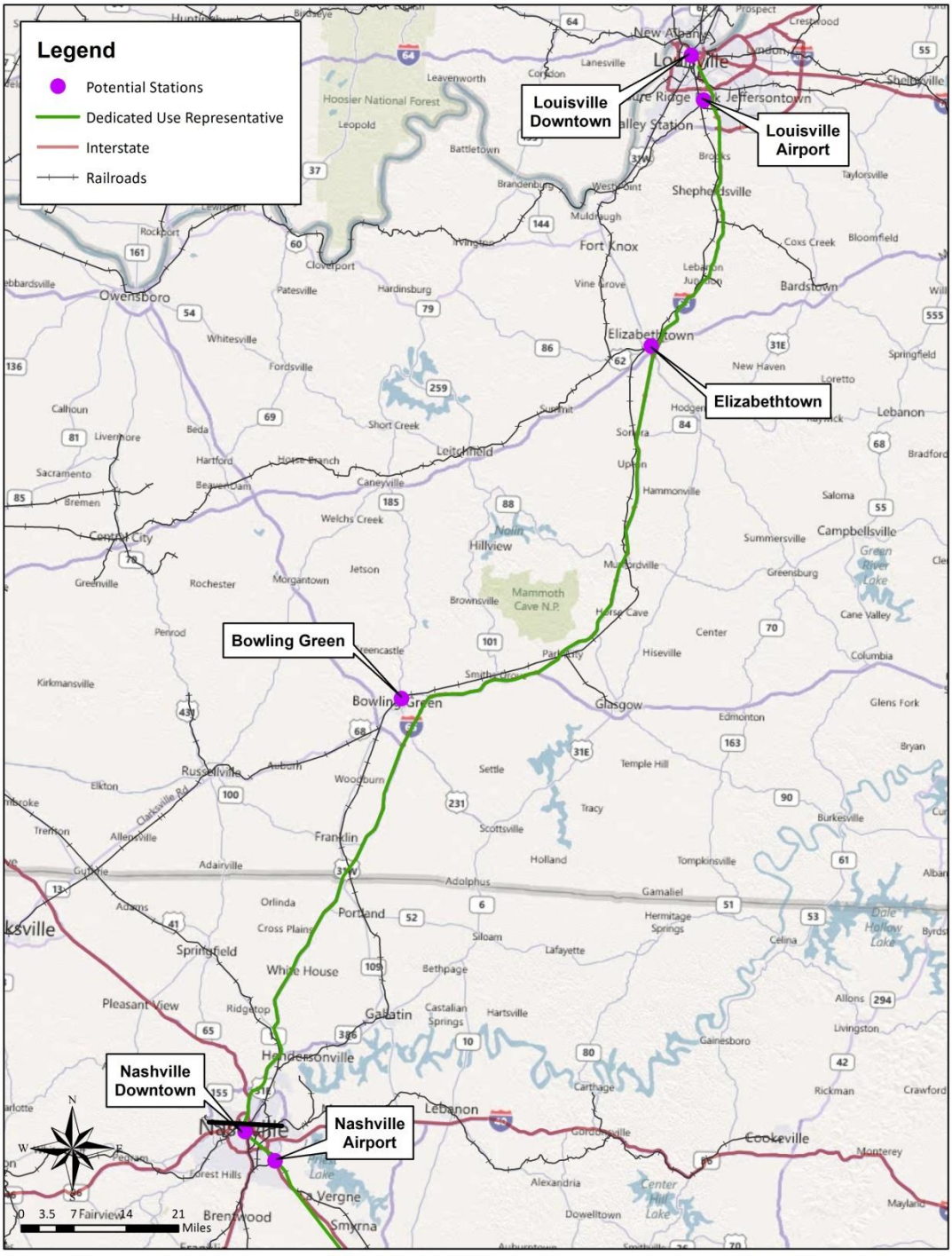


Table 6-9: Total Corridor Capital Costs 180-220 mph Dedicated Use Segment Three

Segment 3: 180-220 mph Dedicated Use – Downtown Nashville to Downtown Louisville			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$3,313,080,000	$993,924,000	$4,307,004,000
Stations, Terminals, Intermodal	$22,440,000	$6,732,000	$29,172,000
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$897,906,000	$263,972,000	$1,143,878,000
Communications & Signaling	$273,505,000	$82,052,000	$355,557,000
Electric Traction	$1,834,897,000	$550,469,000	$2,385,366,000
Vehicles	-	-	-
Professional Services	$1,973,035,000	-	$1,973,035,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$8,296,863,000**	**$1,897,149,000**	**$10,194,011,000**
Cost Per Mile (171.1 Miles)			**$59,579,000**

6.1.3 220+ MPH MAGLEV

The 220+ mph Maglev also runs on a fully separated, dedicated alignment utilizing interstate, rail line and greenfield right-of-way. Within urban corridors, the alignment will be elevated on its own Guideway. The total capital costs for Maglev are higher than both Shared Use and Dedicated Use due to the additional structural requirements. Segments are identical to those for Dedicated Use. Table 6-10 outlines the total Atlanta-Macon-Jacksonville Maglev corridor costs by SCC. Table 6-11 through Table 6-13 illustrate the estimated capital costs by segment.

Table 6-10: Atlanta-Chattanooga-Nashville-Louisville Total Maglev Capital Cost (2010$)

Costing Category		Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures & Track	$14,979,507,000	$4,493,852,000	$19,473,359,000
20	Stations, Terminals, Intermodal	$349,476,000	$103,943,000	$450,419,000
30	Support Facilities: Yards, Shops, Administration Buildings	$70,000,000	$21,000,000	$91,000,000
40	Sitework, Right-of-Way, Land, Existing Improvements	$1,289,729,000	$386,919,000	$1,676,648,000
50	Communications & Signaling	$4,467,204,000	$1,340,161,000	$5,807,365,000
60	Electric Traction	$4,453,592,000	$1,336,078,000	$5,789,670,000
70	Vehicles	$1,347,930,000	$404,379,000	$1,752,309,000
80	Professional Services	$7,989,231,000	-	$7,989,231,000
90	Unallocated Contingencies	-	-	-
100	Finance Charges	-	-	-
TOTAL COST		**$34,943,669,000**	**$8,086,331,000**	**$43,030,000,000**
TOTAL COST PER MILE (428.2 MILES)				**$100,490,000**

Table 6-11: Total Corridor Capital Costs 220+ mph Maglev Segment One

Segment 1: 220+ mph Maglev – Atlanta H-JAIA to Downtown Chattanooga			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$8,146,615,000	$2,443,985,000	$10,590,600,000
Stations, Terminals, Intermodal	$307,206,000	$92,162,000	$399,368,000
Support Facilities: Yards, Shops, Administration Buildings	$70,000,000	$21,000,000	$91,000,000
Sitework, R/W, Land	$257,266,000	$77,180,000	$334,446,000
Communications & Signaling	$1,336,635,000	$400,991,000	$1,737,626,000
Electric Traction	$1335,672,000	$400,702,000	$1,736,374,000
Vehicles	-	-	-
Professional Services	$3,573,459,000	-	$3,573,459,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$15,026,854,000**	**$3,436,018,000**	**$18,462,872,000**
Cost Per Mile (128.4 Miles)			**$143,791,000**

Table 6-12: Total Corridor Capital Costs 22+ mph Maglev Segment Two

Segment 2: 220+ mph Maglev – Downtown Chattanooga to Downtown Nashville			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$3,121,506,000	$936,452,000	$4,057,958,000
Stations, Terminals, Intermodal	$16,830,000	$5,049,000	$21,879,000
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$%282,557,000	$84,767,000	$367,324,000
Communications & Signaling	$1,332,993,000	$339,898,000	$1,732,890,000
Electric Traction	$1,332,032,000	$339,610,000	$1,731,642,000
Vehicles	-	-	-
Professional Services	$1,898,806,000	-	$1,898,806,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$7,984,723,000**	**$1,825,775,000**	**$9,810,498,000**
Cost Per Mile (128.1 Miles)			**$76,585,000**

Table 6-13: Total Corridor Capital Costs 220+ mph Maglev Segment Three

Segment 3: 220+ mph Maglev – Downtown Nashville to Downtown Louisville			
	Allocated	**Contingency (30%)**	**Total Cost**
Track Structures & Track	$3,711,386,000	$1,113,416,000	$4,824,801,000
Stations, Terminals, Intermodal	$22,440,000	$6,732,000	$29,172,000
Support Facilities: Yards, Shops, Administration Buildings	-	-	-
Sitework, R/W, Land	$749,906,000	$224,972,000	$974,878,000
Communications & Signaling	$1,797,576,000	$539,273,000	$2,336,849,000
Electric Traction	$1,758,888,000	$535,766,000	$2,321,654,000
Vehicles	-	-	-
Professional Services	$2,516,965,000	-	$2,516,965,000
Unallocated Contingencies	-	-	-
Finance Charges	-	-	-
Total Cost	**$10,584,162,000**	**$2,420,159,000**	**$13,004,321,000**
Cost Per Mile (171.1 Miles)			**$76,004,000**

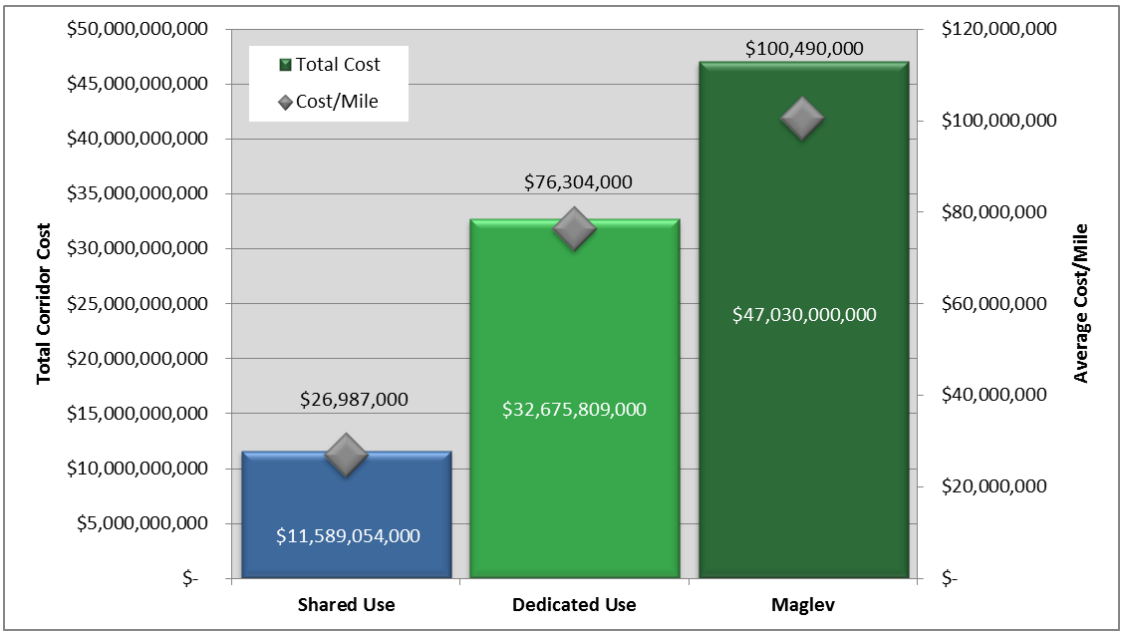
6.1.4 Comparing Capital Costs

Table 6-14 and Figure 6-7 illustrate the total capital cost differences between Shared Use, Dedicated Use and Maglev technologies. While it is evident that Shared Use total cost is far less than Dedicated Use, the Dedicated Use ridership and revenue (refer back to Chapter 5) is substantially higher.

Table 6-14: Total Capital Cost by Alignment/Technology

	Shared Use	**Dedicated Use**	**Maglev**
Total Cost	$11,589,054,000	$32,675,809,000	$43,030,000,000
Cost per Mile	$26,978,000	$76,304,000	$100,490,000

Figure 6-7: Total Capital Cost by Alignment/Technology



The last item that will determine the feasibility of the capital costing will be funding and financing opportunities. Section V:Chapter 3 outlines some potential funding and financing sources; however, additional funding analysis will be necessary in the future to understand realistic funding levels at the federal, state and local levels.

6.2 Operating and Maintenance Costs

For the Atlanta-Chattanooga-Nashville-Louisville Corridor, three technologies were assessed as a part of the feasibility study, as mentioned in previous sections:

- Shared Use of the existing NS rail line using tilting diesel technology, operating up to 110 mph with grade crossings;
- Doubled-tracked, Dedicated Use high-speed corridor using 220 mph electric rail technology on a fully grade-separated route; and
- Double-tracked, Dedicated Use high-speed corridor using 220+ mph Transrapid Maglev technology on a fully grade-separated route.

Also as previously mentioned, Operating and Maintenance costs were separated into fixed costs and variable costs. Table 6-14 outlines the fixed and variable cost categories used for this feasibility analysis.

Table 6-15: Atlanta-Chattanooga-Nashville-Louisville Fixed and Variable Cost Categories

Fixed Cost Categories	Variable Cost Categories
• Stations • Track and Electrification Maintenance • Administration and Management	• Train Crew • On Board Services • Equipment Maintenance • Fuel/Energy • Insurance • Call Center • Credit Card/Travel Agency Commissions

6.2.1 90-110 MPH SHARED USE

The fixed and variable costs for the Shared Use corridor are substantially less than Dedicated Use and Maglev due to less required inspection, maintenance and repair on track and lower ridership levels (thus creating lower variable costs). Table 6-15 provides operating and maintenance cost estimates for 2021 (start-up), 2030 and 2040 (feasibility planning horizon).

Table 6-16: Atlanta-Chattanooga-Nashville-Louisville Shared Use O&M Costs (2010$ millions)

	2021	2030	2040	Total (2021-2040)
Variable O&M Costs	$88.0	$91.8	$96.0	$1,928
Fixed O&M Costs	$40.6	$40.6	$40.6	$852.6
Total O&M Costs	**$128.6**	**$132.4**	**$136.6**	**$2,780**

6.2.2 180-220 MPH DEDICATED USE

The Dedicated Use operating and maintenance costs are higher than Shared Use due to the track electrification maintenance as well as higher ridership. Table 6-16 provides the operating and maintenance costs for 2021, 2030 and 2040.

Table 6-17: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use O&M Costs (2010$ millions)

	2021	2030	2040	Total (2021-2040)
Variable O&M Costs	$168.8	$175.3	$182.4	$3,681
Fixed O&M Costs	$101.6	$101.6	$101.6	$2,134
Total O&M Costs	**$270.4**	**$276.9**	**$284.0**	**$5,814**

6.2.3 220+ MPH MAGLEV

The Maglev operating and maintenance costs are higher than Shared Use, but lower than Dedicated Use due to track maintenance. Table 6-18 provides the operating and maintenance costs for 2021, 2030 and 2040.

Table 6-18: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use O&M Costs (2010$ millions)

	2020	2030	2040	Total (2021-2040)
Variable O&M Costs	$95.1	$113.8	$134.7	$2,391
Fixed O&M Costs	$97.4	$98.0	$98.8	$2,059
Total O&M Costs	**$192.4**	**$211.8**	**$233.5**	**$4,449**

7 CORRIDOR EVALUATION

7.1 FEASIBILITY MEASUREMENTS

The study utilized two feasibility measurements for the Atlanta-Chattanooga-Nashville-Louisville Corridor, operating ratios and benefit-cost calculations. The feasibility analysis was done for Shared Use Dedicated Use and Maglev routes. Refer back to Section I: Chapter 3 for detailed methodology information on these measures.

A key element of the feasibility analysis is an assessment of both public and private benefits. To test the "franchisability" of a corridor as a public-private partnership, analysis uses the "operating ratio" of revenues divided by operating costs. A service with a positive operating ratio greater than 1.0 generates an operating surplus. A positive operating ratio gives evidence of a strong, self-supporting operating system that is less likely to need operating subsidies and reduces the operating risk for the owner, investor and operator.

The benefit-cost analysis identifies all costs (capital, operating and maintenance) and all benefits (fare revenues, on-board service revenue, consumer surplus and external resources) and monetizes the value of each to determine a benefit-cost ratio. Similar to the operating ratio a benefit-cost ration of greater than 1.0 is desirable.

It should be mentioned that for the benefit-cost analyses, the standard period for assessing discounted cash flows is 25 to 30 years. Therefore, for the purposes of the feasibility analyses, the horizon year was extended from 2040 to 2050 to account for the three percent (3%) discount rate.

In setting up the feasibility evaluation, three scenarios were developed to show the impact of a range of ridership, revenue, capital and operating cost estimates typically encountered in a feasibility-level analysis. Unadjusted base forecasts for ridership, revenue, capital and operating costs were used for the Conservative Scenario. Base ridership and revenue estimates were increased for Dedicated Use and Maglev routes to establish the Intermediate and Optimistic Scenarios.[54] Operating costs were

[54] Ridership adjustments for Intermediate and Optimistic Scenarios were only made for Dedicated Use corridor 180-220 mph electrified, steel-wheel and Maglev technologies (Maglev in Atlanta-Louisville corridor only) based on a peer review of regional and national high speed rail corridor studies. No scenario ridership adjustment was made for Shared Use corridor diesel-electric technology results based on a peer review of other shared-use corridor studies.

adjusted by the appropriate ridership drivers. Capital cost estimates were adjusted downward in the Intermediate and Optimistic Scenarios for all technologies.

The three scenarios are intended to capture and illustrate the relatively wide range of estimates at the feasibility-level of study. As corridors are deemed feasible for further evaluation, future studies will provide greater detail in the analysis of ridership, revenues and costs, narrowing the range of estimates. Refer back to Section I: Chapter 3 for more detailed information on the development of these evaluation scenarios.

7.1.1 90-110 MPH SHARED USE

7.1.1.1 Operating Ratio

Table 7-1 presents provides the operating ratio for the Atlanta-Chattanooga-Nashville-Louisville Shared Use route. Operating revenues include both farebox revenue and on-board services revenue. Operating and maintenance costs include both fixed and variable costs (refer back to Chapter 6). Separate ridership and revenue scenarios were not developed for the Shared Use route. Therefore, Table 7-1 only presents the "Conservative" scenario using base-case ridership and revenue forecasts. Revenues, costs, operating surplus/deficits and operating ratio are for 2021, 2030 and 2040 to understand the overall performance of the Shared Use route. The 90-110 mph Shared Use route generates an operating ratio greater than 1.0 providing a revenue surplus for all forecast years.

Table 7-1: Atlanta-Chattanooga-Nashville-Louisville Shared Use Operating Ratio (2010$ millions)

	2021	2030	2040
Total Operating Revenue	**$191.3**	**$230.9**	**$274.9**
Farebox Revenues	$175.5	$211.8	$252.2
Ancillary Revenues	$1.8	$2.1	$2.5
On-Board Services	$14.0	$16.9	$20.2
Total Operating Costs	**$128.6**	**$132.4**	**$136.6**
Fixed Operating Costs	$40.6	$40.6	$40.6
Variable Operating Costs	$88.0	$91.8	$96.0
Operating Surplus (Deficit)	**$62.7**	**$98.5**	**$138.3**
Operating Ratio	**1.49**	**1.74**	**2.01**

7.1.1.2 Benefit-Cost

The study includes Shared Use route capital cost scenarios for use in the benefit-cost analysis, since base-case capital costs are substantial and include a 30 percent

contingency. Table 7-2 outlines the benefit-cost results for each scenario. More details are included in Appendix G. The first scenario includes the conservative (base) ridership and revenue as well as capital costs with the 30 percent contingency. Under the Intermediate scenario the capital cost contingency is reduced to 15 percent capital cost contingency, and the Optimistic scenario removes the contingency completely from the capital cost estimates.

Table 7-2: Atlanta-Chattanooga-Nashville-Louisville Shared Use Benefit-Cost Analysis (2021-2050)

	Conservative	Intermediate	Optimistic
Shared Use	0.71	0.78	0.85

The Shared Use service alternative has a benefit-cost ratio between 0.71 and 0.85, with an Intermediate value of 0.78. The stand-alone Shared Use route did not generate a benefit-cost ratio above 1.0. However, if the Atlanta-Chattanooga-Nashville-Louisville Corridor were operated as a part of a larger Atlanta Hub System, the benefit-cost ratio will improve. Refer to Section V: Chapter 2 for more details on the potential for an integrated high-speed rail system.

7.1.2 180-220 MPH DEDICATED USE

7.1.2.1 Operating Ratio

Table 7-3 displays operating ratios for the Atlanta-Chattanooga-Nashville-Louisville Dedicated Use route. Ridership, revenue and capital cost scenarios were developed for the Dedicated Use route. Refer back to Section I: Chapter 3 for detailed methodologies for the Conservative, Intermediate and Optimistic sensitivity scenarios.

The Conservative scenario uses base-case ridership and revenue forecasts and operating and maintenance costs. The Intermediate scenario includes moderately increasing revenue and operating costs; and Optimistic illustrates aggressive revenues and their associated operating costs. The Intermediate and Optimistic scenarios were developed based on benchmarking this feasibility study with other high-speed ground transportation studies both within the region and nationally.

Table 7-3: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Operating Ratio

	Conservative	Intermediate	Optimistic
Dedicated Use			
2021	1.21	1.95	2.16
2030	1.39	2.23	2.45
2040	1.62	2.40	2.58

Similar to the Shared Use alignment, the Dedicated Use produces positive operating ratios. The operating ratios at the low end of the ridership range are depressed by the high fixed costs for track maintenance, stations and administration. However, the optimistic scenario projections result in substantially higher ridership thereby bringing into better balance the level of demand and infrastructure on this corridor.

7.1.2.2 Benefit-Cost

Table 7-4 outlines the three benefit-cost scenarios for the Dedicated Use route including the three scenarios outlined in Section 7.1.2.1. Variations in capital costs and ridership and revenue were included in the calculations The Conservative scenario uses base-case ridership and revenue as well as base-case capital and operating and maintenance costs. The Intermediate scenario is based on a 75 percent increase in ridership and revenue and a capital cost contingency of 15 percent rather than 30 percent. The Optimistic scenario increases ridership and revenue by 100 percent over the Conservative scenario and eliminates the capital cost contingency.

Table 7-4: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Benefit-Cost Analysis

	Conservative	Intermediate	Optimistic
Dedicated Use	0.40	0.78	0.96

The Dedicated Use route produces benefit-cost ratios between 0.40 and 0.96, with an Intermediate value of 0.78. Although benefit-cost ratios are lower than the other two corridors, there is some possibility that the corridor could work as a high-speed in line the Optimistic case, which suggests that the Atlanta-Chattanooga-Nashville-Louisville Corridor should continue to be evaluated in future environmental and engineering studies. Future studies should also consider the benefits of an integrated Atlanta-Hub system. Refer to Section V: Chapter 2 for more details on the potential for a high-speed rail system.

7.1.3 220+ MPH MAGLEV

7.1.3.1 Operating Ratio

Table 7-5 demonstrates the Atlanta-Chattanooga-Nashville-Louisville Maglev technology operating ratio. A detailed proforma of costs and revenues is outlined in Appendix G.

Table 7-5: Atlanta-Chattanooga-Nashville-Louisville Maglev Operating Ratio

	Conservative	Intermediate	Optimistic
Maglev			
2021	1.75	2.23	2.35
2030	1.91	2.38	2.49
2040	2.06	2.51	2.61

The Maglev technology would have a slightly better operating result than the 220 mph electrified Dedicated Use route. This is due to the slightly higher ridership and revenue that a Maglev system would likely attract, coupled with lower operating costs that have been projected by Transrapid for the non-contact guideway system.

7.1.3.2 Benefit Cost Ratio

Table 7-6 outlines the three benefit-cost scenarios for the Maglev technology includes the three scenarios. A detailed proforma of costs and revenues is outlined in Appendix G.

Table 7-6: Atlanta-Chattanooga-Nashville-Louisville Dedicated Use Benefit-Cost Analysis – 2020-2050 (2010$ millions)

	Conservative	Intermediate	Optimistic
Maglev	0.34	0.65	0.80

The Maglev technology would produce benefit-cost ratios between 0.34 and 0.80, with an Intermediate value of 0.65. In spite of a ridership boost, the performance of the Maglev option is significantly constrained by geometry in the Atlanta-Chattanooga portion of the corridor; therefore, the Maglev option is not able to show its full potential. The performance gain that has been modeled for the corridor mostly occurs on the straighter geometry north of Chattanooga; however, the ridership impact is lower on this portion of the corridor. Given the cost differential between Maglev and Dedicated Use rail, the Maglev technology does not seem to be a likely option to be implemented initially.

7.1.4 KEY FINDINGS

The Shared Use, Dedicated Use and Maglev alternatives perform well under the operating ratio analysis, resulting in ratios well above 1.0 for all three scenarios. This indicates strong operations with lower associated risks to owners and operators. Positive operating ratios indicate an ability to pay down debt services and bonds, and can lead to reduced reliability on public investment subsidies. Additionally, operating surpluses on an annual basis may finance a "rail maintenance fund", requiring less investment in future years for capital maintenance costs. Positive operating ratios will likely spark private sector investment interest in the corridor, providing additional funding opportunities.

The benefit-cost results are not greater than one for any of the representative routes. It should be noted that this feasibility study includes very high-level data and estimates. A more detailed corridor analysis with more definitive study boundaries, travel demand models, and cost estimates, could yield a better benefit-cost evaluation with a smaller margin of error.

Taking into account the operating ratios and benefit-cost ratios, the study recommends that the results of this analysis be used to set for future corridor development activities. In particular, this study finds that high speed rail service is feasible in the Atlanta-Chattanooga-Nashville-Louisville Corridor. It is further recommended that a Tier 1 NEPA Document and Service Development Plan be pursued for high-speed rail service in the corridor, in addition to the Tier 1 EIS already underway for the Atlanta-Chattanooga segment of the corridor.

The study developed an additional "Hybrid" High Performance scenario, discussed in detail below that further supports the above conclusions. This alternative has the potential to reduce initial capital costs and positively impact the benefit-cost analysis while maintaining the ability to achieve higher speeds along the corridor.

8 HYBRID HIGH PERFORMANCE SCENARIO

One of the results from the Shared Use and Dedicated Use analyses was the introduction of a "hybrid" alternative to offset a portion of the initial capital costs (compared to the Dedicated Use) while improving the travel speeds (compared to the Shared Use), thus positively impacting the operating ratio and benefit-cost analysis. While some analyses were completed for the Hybrid High Performance scenario, there was insufficient data available for a full analysis to be completed. Therefore, more performance and financial details regarding the Hybrid High Performance scenario will need to be explored through the NEPA process. This feasibility study intends to introduce the concept of the Hybrid High Performance scenario and provide a high-level feasibility estimates based on the results found during the Shared Use and Dedicated Use analyses. These estimates include:

- Operational estimates;
- Ridership and revenue;
- Capital Costs; and
- Operating and Maintenance Costs.

From these estimates, the study calculates the high-level operating ratio and Benefit-Cost ratio to compare against the previously identified Shared Use and Dedicated Use ratios to determine if the Hybrid High Performance scenario should be included in a future NEPA analysis.

The Hybrid High Performance scenario that provides a level of service between Shared Use and Dedicated Use, utilizing fully grade-separated track geometry with no shared-use freight operations. However, rather than electrified high-speed technology, the Hybrid High Performance scenario would implement Diesel-Electric Tilt technology initially, and when ridership and revenue increase in later operating years, it can be upgraded to a fully-electrified system, obtaining travel speeds of 220 mph or more.

One of the main benefits of the Hybrid High Performance scenario includes significantly lower capital costs compared to the 180-220 mph electrified technology assumed for the Dedicated Use alignment. However, the Hybrid High Performance scenario still has the potential to reach speeds of up to 130 mph. The study estimated that the Hybrid High Performance scenario would only take approximately 1 hour, 30 minutes longer than the electrified train on the Dedicated Use alignment. The 130 mph Hybrid High Performance scenario is approximately 1 hour, 52 minutes faster than auto travel by interstate from Atlanta to Louisville (Table 8-1).

Table 8-1: Atlanta-Chattanooga-Nashville-Louisville Operations Comparison

		Hybrid High Performance	Dedicated Use	Maglev
Rail Distance (miles)		428.2	428.2	428.2
Travel Time (hr : min)		5:02	3:32	3:02
Average Speed (mph)		86	122	143
Frequency (round trips per day)	Atlanta-Chattanooga	16	28	28
	Chattanooga-Nashville	10	20	20
	Nashville-Louisville	5	12	12
Estimated Auto Time (hr : min)		6:54	6:54	6:54
Travel Time – Auto Time		-1:52	-3:21	-3:52

This chapter outlines the high-level revenue, cost, and feasibility results of the Hybrid High Performance scenario. However, it should be mentioned that these estimates do not incorporate the upgrade to electrification of the corridor, as those costs will only be incurred in ridership and revenue demand the upgrade in later years.

8.1 Ridership and Revenue

To estimate ridership and revenue, the study calculated high-level estimates based on the decrease in vehicle speed as compared to the Dedicated Use. Travel time, speed profiles and train frequencies were adjusted as necessary.

Table 8-2: Atlanta-Chattanooga-Nashville-Louisville Hybrid Operating Plan

	Hybrid High Performance Scenario
Travel Time	5 hour, 2 minutes
Train Frequency	Atlanta-Chattanooga: 16 Chattanooga-Nashville: 10 Nashville-Louisville : 5
Train Capacity	250 seats per train

The study calculated that the ridership and revenue would decrease by approximately 16.04 percent from the Dedicated Use ridership and revenue forecasts. Table 8-3 shows the estimated ridership and revenue for the Hybrid High Performance scenario for the three sensitivity levels: Conservative, Intermediate and Optimistic.

Table 8-3: Atlanta-Chattanooga-Louisville-Nashville-Louisville Hybrid High Performance Scenario Ridership and Revenue (in millions and 2010$)

	Hybrid High Performance		Dedicated Use		Maglev	
	Ridership	Revenue	Ridership	Revenue	Ridership	Revenue
2021	4,126,000	$224.2	4,715,000	$267.1	4,949,000	$283.4
2030	4,804,000	$270.2	5,491,000	$321.7	5,764,000	$337.7
2040	5,559,000	$321.1	6,353,000	$382.4	6,669,000	$401.5
Total	**92,925,000**	**$5,453**	**110,677,000**	**$6,495**	**116,189,000**	**$6,818**

8.2 Costs

As previously mentioned, the capital costs and operating and maintenance costs will be significantly less than the Dedicated Use and Maglev routes due to the elimination of the track electrification initially. This also results in a decrease in vehicle cost since diesel vehicles also cost less than fully electrified vehicles.

Table 8-4 outlines the Hybrid High Performance scenario capital cost estimates by major FRA SCC. Again, this alternative uses the Dedicated Use representative route and diesel, steel-wheel technology. Appendix F includes the detailed sub-category costs for the Hybrid High Performance scenario.

Table 8-4: Atlanta-Chattanooga-Nashville-Louisville Total Hybrid Capital Cost by SCC Category

Costing Category		Allocated Cost	Contingency (30%)	Total Cost
10	Track Structures & Track	$7,954,866,000	$2,386,460,00	$10,341,326,000
20	Stations, Terminals, Intermodal	$346,476,000	$103,943,000	$450,419,000
30	Support Facilities: Yards, Shops, Administration Buildings	$53,424,318	$16,027,000	$69,452,000
40	Sitework, Right-of-Way, Land, Existing Improvements	$808,864,000	$242,659,000	$1,051,524,000
50	Communications & Signaling	$686,818,000	$206,045,000	$892,863,000
60	Electric Traction	-	-	-
70	Vehicles	$422,500,000	$126,750,000	$549,250,000
80	Professional Services	$3,073,340,000	-	$3,073,340,000
90	Unallocated Contingencies	-	-	-
100	Finance Charges	-	-	-
TOTAL COST		**$13,346,289,000**	**$3,081,884,000**	**$16,428,173,000**
TOTAL COST PER MILE (428.2 Miles)				**$38,366,000**

Operating and maintenance costs will also be reduced from the Dedicated Use estimates due to less required track inspection and maintenance. Table 8-5 illustrates the estimate Hybrid High Performance scenario operating and maintenance costs from 2020 to 2040.

Table 8-5: Atlanta-Chattanooga-Nashville-Louisville Hybrid O&M Costs (2010$ millions)

	2020	2030	2040	Total (2021-2040)
Variable O&M Costs	$183.8	$189.2	$195.2	$3,973
Fixed O&M Costs	$69.3	$69.3	$69.3	$1,455
Total O&M Costs	**$253.1**	**$258.5**	**$264.5**	**$5,429**

8.3 FEASIBILITY EVALUATION

Similar to the Shared Use and Dedicated Use routes, the study calculated an operating ratio and benefit-cost ratio for the Hybrid High Performance scenario.

Table 8-6 and Table 8-7 illustrate the results of these analyses for the Conservative, Intermediate and Optimistic scenarios.

Table 8-6: Atlanta-Chattanooga-Nashville-Louisville Hybrid Operating Ratio

	Conservative	Intermediate	Optimistic
Hybrid High Performance			
2021	1.03	1.66	1.86
2030	1.21	1.93	2.16
2040	1.41	2.22	2.46
Dedicated Use			
2021	1.21	1.96	2.16
2030	1.39	2.23	2.45
2040	1.62	2.40	2.58
Maglev			
2021	1.75	2.23	2.35
2030	1.91	2.38	2.49
2040	2.06	2.51	2.61

This positive operating performance is largely due to lower operating cost due to single tracking and the avoidance of electrification maintenance costs as well as lower operating costs.

Table 8-7: Atlanta-Chattanooga-Nashville-Louisville Hybrid Benefit-Cost Analysis (2021-2050)

	Conservative	Intermediate	Optimistic
Hybrid High Performance	0.59	1.16	1.43
Dedicated Use	0.40	0.78	0.96
Maglev	0.34	0.65	0.80

The Hybrid High Performance scenario produces benefit-cost ratios of 0.59 to 1.43 with an Intermediate case of 1.16. The Hybrid shows the best potential for implementation, especially if combined with an integrated hub system (refer to Section V: Chapter 2).

8.3.1.1 Corridor Truncation Analysis

In addition to the Hybrid High Performance scenario analysis, the study also evaluated the feasibility level of a truncated version of the Atlanta-Chattanooga-Nashville-Louisville Corridor, by analyzing the Atlanta to Chattanooga, and Atlanta to Nashville segments of the corridor. This analysis produced operating ratios in the

range of 1.25 to 2.14 with an Intermediate case of 1.97 for the Atlanta to Chattanooga segment; operating ratios in the range of 1.29 to 2.32 with an Intermediate case of 2.09 for the Atlanta to Nashville segment. The benefit-cost ratio Atlanta-Louisville ranges from 0.59 to 1.43, Atlanta-Chattanooga ranges from 0.41 to 0.97, Atlanta-Nashville ranges from 0.59 to 1.44.

Truncating the corridor does not significantly improve the Operating Ratio and Benefit-Cost ratio of the overall Atlanta-Chattanooga-Nashville-Louisville Corridor. This is mainly due to the low capital costs offset the lower ridership between Nashville and Louisville. However, there are strong economic and social ties between Nashville and Atlanta that may not be reflected in a feasibility study that will need to be investigated further in future corridor studies.

8.4 Phasing Scenarios for Capital Costs

This discussion focuses on reducing capital costs for the initial implementation of high-speed rail within the Atlanta-Chattanooga-Nashville-Louisville Corridor. The Hybrid High Performance scenario can be incrementally improved to 180-220 mph Dedicated Use service as corridor population trends results in higher ridership and demand for service improvements. The initial build-out includes the construction of viaduct structures and tunnels entering and leaving corridor cities and single track with sidings beyond city limits and the impacts of urban development. Future improvements would include double tracking and electrification.

By phasing the corridor, these initial capital costs can also be phased in order to efficiently and effectively implement high-speed rail in order to meet current and future demands while maintaining reasonable capital cost expenditure.

Phase I: Atlanta – Cartersville, GA

Phase I implementation of the passenger rail service proposes to connect H-JAIA to Cartersville, GA, a distance of approximately 41 miles and includes station stops at H-JAIA, Atlanta MMPT, Cumberland Galleria, Town Center, and Cartersville. Initial infrastructure improvements would include tunnel and double track viaduct structure on the identified route within the Atlanta-Chattanooga Tier I EIS on new right-of-way, generally following I-75. This is with the exception of the route through downtown Atlanta in which the route would follow I-285 and reconnect with I-75 near H-JAIA.

Phase I would likely have significant ridership, as it would serve the major communities of the north metropolitan area of Atlanta. However, Phase I will be challenged by urban development and topography including rolling and mountainous terrain.

Phase II: Cartersville, GA – Chattanooga, TN

Phase II implementation of the high-speed rail service proposes to connect Cartersville to downtown Chattanooga, a distance of approximately 74 miles and will include station stops at Dalton, Lovell Field, and downtown Chattanooga. Initial infrastructure improvements would include single track with two 10-mile sidings following the identified route with the Atlanta-Chattanooga Tier I EIS on new right-of-way generally following I-75 with the exception of the route access to Lovell Field and downtown Chattanooga stations. The Phase II corridor is challenged by topography including rolling and mountainous terrain.

Phase III: Chattanooga – Nashville, TN

Phase II of the implementation process proposes to connect downtown Chattanooga to downtown Nashville, TN, with a distance of approximately 128 miles and includes station stops at Murfreesboro, Nashville airport and downtown Nashville. Initial infrastructure improvements would include single track with three 10-mile sidings and viaduct structure leaving and entering Chattanooga and Nashville.

The Phase III corridor is challenged by exceptional topography – including traversing the mountainous terrain of the Cumberland Plateau before entering the rolling terrain of the Nashville Basin resulting in significantly higher capital costs for this phase compared to Phases I and II. Current capital costs including the construction of a tunnel to avoid the steep climb and descent over the Cumberland Plateau.

Phase IV: Nashville, TN – Louisville, KY

Phase IV of the implantation proposes to finish the corridor and connect Nashville and Louisville, a distance of approximately 172 mile and includes station stops at Bowling Green, Elizabethtown, Louisville airport and downtown Louisville. Initial infrastructure improvements would include single track with four 10-mile passenger sidings and viaduct structures entering and leaving Nashville and Louisville.

8.4.1 Additional Implementation Options – Atlanta – Chattanooga – Nashville –Louisville

Commuter Rail

Commuter rail opportunities in the Atlanta, Nashville and Louisville metropolitan areas could serve as a first step in implementing the Chattanooga-Nashville-Louisville segments of the corridor. Through the implementation of these possible commuter rail projects, with ultimate high-speed rail use in mind, the problematic final miles into major urban areas could become easier to resolve.

Possible commuter opportunities exist along the corridor between Atlanta and Cartersville, GA, Murfreesboro to Nashville, TN as Elizabethtown/Ft. Knox and Louisville, KY. These commuter rail lines could be implemented within a coordinated route providing intermediate commuter benefits and long-term intercity benefits. In Louisville commuter rail studies were begun but later stopped. There is renewed interest in the potential of commuter rail with the re-tasking of Ft. Knox just outside of Elizabethtown to serve as the Army's Personnel function. This major employment generator could be well served by a strong connection to Louisville.

In Nashville, there is strong, bi-directional connectivity between the cities of Nashville and Murfreesboro. While commuter rail has not been directly studied, the potential for a transit link has been strongly endorsed by local and regional planning agencies. There is a commuter rail line already in operation to the west of Nashville, and there may be an opportunity to explore a commuter rail option to the southeast of the city, particularly if it could be an extension of a larger system and costs could be shared.

The Atlanta to Cartersville connection has not been studied for commuter rail, although there is an Alternatives Analysis underway for a shorter segment from Atlanta to Acworth, GA. There is considerable interest in the commutershed northwest of Atlanta, as the I-75 corridor encompasses chronic congestion. The potential exists for a commuter rail option that extends beyond Acworth to Cartersville.

Commuter rail could represent an early step in the implementation of high-speed rail service in the Atlanta-Chattanooga-Nashville-Louisville corridor. One of the major issues in high-speed rail services is the rout into the major cities, particularly the last 20 miles into the downtown areas. Co-locating with commuter rail could be a resolution to that issues and potential share costs between the two modes.

Nashville-Louisville Shared Use via Clarksville, TN

An alternate route could be examined in the future in which the passenger rail service would travel from Nashville through Clarksville, TN and connect with the CSXT Shared Use Corridor in Bowling Green, KY and onto Louisville. This corridor will add additional ridership from Clarksville as a major military installation at Fort Campbell and the surrounding counties in both Tennessee and Kentucky.

The total distance from Nashville via Clarksville to the CSXT main line south of Bowling Green is approximately 106 miles, with an additional 118.7 miles to Louisville. This alternate route would add an extra 30 miles to the representative Shared Use route and increase scheduled running time; however, it may be found that the additional ridership and revenue would offset the increase in travel time.

8.5 CONCLUSION

Initial investigation into the Hybrid High Performance scenario indicates that an incremental approach to high-speed rail may provide significant advantages in the Atlanta-Chattanooga-Nashville-Louisville Corridor both in terms of reducing initial capital cost requirement and increasing benefit-cost ratios.

The study used high-level estimates for revenue and costs associated with the Hybrid High Performance scenario. Therefore, a more detailed analysis of this alternative is needed to make definitive conclusions regarding the feasibility of the Hybrid High Performance scenario. The study recommends that the Hybrid High Performance scenario be included in the next phase of the passenger rail planning analysis as a viable technology alternative for passenger rail within the Atlanta-Chattanooga-Nashville-Louisville Corridor.

SECTION V:

CONCLUSIONS AND NEXT STEPS

1 CORRIDOR COMPARISONS

1.1 SHARED USE

Table 1-1 compares the three study corridors and their respective Shared Use routes. Based on the table, the Atlanta-Macon-Jacksonville Corridor performs well when compared to the others with the lowest capital cost per mile and the highest benefit-cost ratio. Atlanta-Chattanooga-Nashville-Louisville Corridor reflects the highest capital cost per mile, but also shows the highest ridership and revenue and the best operating ratios. Atlanta-Birmingham Corridor also has relatively low capital costs and operating and maintenances costs, but shows the lowest average speed and has the lowest operating ratio driven by relatively low ridership and revenue results.

Table 1-1: Study Corridors 110 mph Diesel-Electric Shared Use Comparison

	Atlanta-Birmingham	Atlanta-Macon-Jacksonville	Atlanta-Chattanooga-Nashville-Louisville
Route Length (miles)	176.0	408.6	489.8
Travel Time (hour : minute)	2:46	5:19	6:55
Average Speed	64 mph	77 mph	72 mph
Total Ridership	37,177,000	47,430,000	101,962,000
Total Revenue	$1,077,851,000	$2,704,983,000	$4,277,336,000
Total Capital Cost	$2,937,324,000	$4,966,849,000	$11,589,054,000
Total Cost per Mile	$16,821,000	$11,492,000	$26,316,000
Total O&M Costs	$930,300,000	$2,067,000,000	$2,780,000,000
Operating Ratios			
Conservative[55]			
2021	1.15	1.25	1.49
2030	1.32	1.48	1.74
2040	1.49	1.73	2.01
Benefit-Cost			
Conservative Scenario	0.80	0.92	0.71
Intermediate Scenario	0.88	1.00	0.78
Optimistic Scenario	0.95	1.07	0.85

[55] Operating ratios were only prepared for the Conservative Scenario for the 110 mph Shared Use routes.

1.2 DEDICATED USE

Table 1-2 compares the three study corridors and their Dedicated Use routes and technologies including Maglev in the Atlanta-Chattanooga-Nashville-Louisville Corridor. Again, all three study corridors and technologies have operating ratios greater than 1.0. The Atlanta-Macon-Jacksonville Corridor shows the best benefit-cost ratios largely due to its having the lowest capital cost per mile. The Atlanta-Chattanooga-Nashville-Louisville Corridor has the best operating ratios, but also the lowest benefit-cost ratios for all technologies. The Maglev technology in the Louisville Corridor has the highest operating ratio of any technology in any corridor. With the use of Maglev technology, the Atlanta-Chattanooga-Nashville-Louisville Corridor has the highest average speed. The Jacksonville Corridor has the highest average speed or electrified steel-wheel technology. Similar to Shared Use, the Atlanta-Birmingham 180-220 mph Dedicated Use service provides the lowest capital and operating and maintenance costs, but due to lower ridership and revenue, does not perform as well as the other corridors for either the operating ratio or benefit-cost ratio.

Table 1-2: Study Corridors Steel-Wheel/Maglev Dedicated Use Comparison

	Atlanta-Birmingham	Atlanta-Macon-Jacksonville	Atl-Chatt-Nash-Louis	Atl-Chatt-Nash-Louis (Maglev)
Corridor Length	150.7	368.1	428.2	428.2
Travel Time	1:18	2:48	3:33	3:02
Avg. Speed	117 mph	131 mph	122 mph	143 mph
Ridership	44,270,000	55,330,000	110,677,000	116,189,000
Revenue	$1694,837,000	$4,411,712,000	$6,494,937,000	$6,818,684,000
Capital Cost	$8,364,997,000	$16,144,036,000	$32,675,809,000	$47,030,000,000
Cost per Mile	$54,399,000	$41,323,000	$76,304,000	$100,490,000
O&M Costs	$1,700,000,000	$4,090,000,000	$5,814,000,000	$4,449,000,000
Operating Ratios				
Conservative				
2021	1.10	1.14	1.21	1.75
2030	1.25	1.35	1.39	1.91
2040	1.41	1.56	1.62	2.06
Intermediate				
2021	1.72	1.83	1.95	2.23
2030	1.86	2.00	2.23	2.38
2040	2.00	2.15	2.40	2.51
Optimistic				
2021	1.87	2.04	2.16	2.35
2030	2.00	2.17	2.45	2.49

	Atlanta-Birmingham	Atlanta-Macon-Jacksonville	Atl-Chatt-Nash-Louis	Atl-Chatt-Nash-Louis (Maglev)
2040	2.12	2.29	2.58	2.61
Benefit-Cost				
Conservative	0.48	0.49	0.40	0.34
Intermediate	0.92	0.93	0.78	0.65
Optimistic	1.13	1.12	0.96	0.80

1.3 Hybrid High Performance Scenario

Table 1-3 compares the three study corridors and the Hybrid High Performance scenario performs well in all three corridors. The Atlanta-Macon-Jacksonville and Atlanta-Chattanooga-Nashville-Louisville show a positive operation ratio for all three scenarios and a positive benefit-cost ratio at the Intermediate and Optimistic scenarios. However, this comparison shows that of the three corridors, the Atlanta-Birmingham Corridor Hybrid High Performance reflects the highest benefit-cost ratio. This is due to the small decrease in projected ridership as compared to the Dedicated Use (decrease of 7.3 percent); whereas, the Atlanta-Macon-Jacksonville and Atlanta-Chattanooga-Nashville-Louisville Corridors has significantly higher estimated reductions in ridership and revenue (decrease of 19.2 percent and 16.0 percent, respectively). Refer back to Section II-IV: Chapter 8 for more detailed description on the development of the Hybrid High Performance scenario.

Table 1-3: Study Corridors Hybrid Comparison

	Atlanta-Birmingham	Atlanta-Macon-Jacksonville	Atlanta-Chattanooga-Nashville-Louisville
Corridor Length (miles)	150.7	368.1	428.2
Travel Time (hour : minute)	1:40	3:55	5:02
Average Speed	90 mph	94 mph	85 mph
Total Ridership	41,043,000	48,414,000	92,925,000
Total Revenue	$1,571,284,000	$3,564,222,000	$5,453,149,000
Total Capital Cost	$5,487,672,000	$8,904,349,000	$16,428,173,000
Total Cost per Mile	$35,688,000	$22,792,000	$38,366,000
Total O&M Costs	$1,420,000,000	$3,541,000,000	$5,429,000,000
Operating Ratios			
Conservative			
2021	1.18	1.03	1.03
2030	1.34	1.21	1.21
2040	1.51	1.41	1.41

	Atlanta-Birmingham	Atlanta-Macon-Jacksonville	Atlanta-Chattanooga-Nashville-Louisville
Intermediate			
2021	1.85	1.66	1.66
2030	2.00	1.95	1.93
2040	2.13	2.18	2.22
Optimistic			
2021	2.02	1.86	1.86
2030	2.14	2.17	2.16
2040	2.26	2.39	2.46
Benefit-Cost			
Conservative Scenario	0.72	0.63	0.59
Intermediate Scenario	1.28	1.21	1.16
Optimistic Scenario	1.62	1.48	1.43

1.4 KEY CONCLUSIONS

When comparing the three study corridors and the four operating technologies: 110 mph diesel-electric Shared Use, 180-220 mph electrified steel-wheel (Dedicated Use, Maglev, and the Hybrid High Performance, it should be recognized that all corridors and all technologies have operating ratios greater than 1.0.

- The Atlanta-Macon-Jacksonville Corridor has the best relative performance as measured by the benefit-cost ratio and has the second best operating ratios.
- The Atlanta-Chattanooga-Nashville-Louisville Corridor has the best performance as measured by the operating ratio, but the worst performance as measured by the benefit-cost ratio.
- The Atlanta-Birmingham Corridor has the second best benefit-cost ratio, but has the weakest performance as measured by the operating ratio.
- The Hybrid High Performance technology alternative shows the strongest performance in all corridors in terms of the benefit-cost ratio; however, further engineering and ridership analysis is required to confirm these results.
- With regard to the other technologies, the 180-220 mph steel-wheel technology outperforms 110 mph diesel-electric technology by the operating ratio in all three corridors, but trails when measured by the benefit-cost ratio.
- Maglev technology has the best operating ratios of any technology, but the worst benefit-cost performance.

2 SYSTEM INTEGRATION ANALYSIS

2.1 SYSTEM INTEGRATION ANALYSIS

The initial feasibility analysis of the three study corridors examines each corridor as a separate free-standing service operating independently of other corridors. On the other hand, it is well known that there are significant system ridership benefits when a given corridor service operates as part of an interconnected network. With Atlanta providing an interconnected hub at the proposed MMPT, each of the individual corridors can feed ridership to the others with through-trips across the Atlanta hub or with seamless cross-platform transfers. In essence, coordinated system ridership will be substantially greater than the sum of independently operated corridors.

Atlanta functions as the current and historic rail hub of the South, similar to Chicago in the Midwest. Using ridership demand model results from the MWRRS[56], the study estimated the system ridership benefits of an Atlanta-hub system connecting the Birmingham, Macon-Jacksonville and Chattanooga-Nashville-Louisville Corridors. Using this ridership data, the study estimated resulting "system" operating ratios and benefit-cost ratios. Three technology scenarios were developed on a system-wide basis: 110 mph Shared Use diesel-electric technology, 180-220 mph Dedicated Use electrified, steel-wheel technology, and the 130 mph Hybrid technology. Maglev was not assessed from a system perspective, since Maglev evaluation was only evaluated for the Atlanta-Chattanooga-Nashville-Louisville Corridor.

- The Shared Use system utilizes the existing NS, CSXT, GCR and Seaboard rail lines and tilting diesel technology. The study estimated a 10 percent ridership increase for this scenario connecting the corridors through the Atlanta hub, based on a Conservative evaluation of the Midwest system model results.
- The Dedicated Use utilizes a double-tracked, dedicated corridor using electric rail technology. Based on the significant increase in frequencies over Shared Use (nearly 2x) and other factors, the study estimated the ridership for the Dedicated Use technology would receive a 30 percent increase.
- The Hybrid High Performance Rail uses the same dedicated corridor with single track with passing sidings every 25 miles. A 20 percent increase in ridership was estimated for this incremental approach.[57]

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[56] "Midwest Regional Rail System – A Transportation Network for the 21st Century, Executive Report, September 2004". Prepared by Transportation Economics and Management Systems Inc. and the HNTB Corporation

[57] It should be noted that a fourth Georgia corridor, the Southeast High Speed Rail (SEHSR) route to Charlotte, NC (previously studied by Volpe Center in 2008) was not included in the system analysis. If it were included, the study estimates that the additional connectivity provided by what is in effect, an extension of the Northeast Corridor, could contribute additional system ridership in the range of 10 to 30 percent.

(footnote continued)

In addition to sharing the ridership benefits, the Atlanta-hub high-speed rail system would also share the burden of capital cost, operating costs and maintenance costs. For example, the system has the ability to share the cost of the fixed administrative structure, the Atlanta MMPT and H-JAIA infrastructure in addition to the track and infrastructure within the Atlanta area, primarily between Atlanta MMPT and H-JAIA stations.

Similar to the three corridors, the study calculated operating ratios and benefit-cost ratios for three sensitivity scenarios: Conservative, Intermediate and Optimistic reflecting variations in ridership and revenue as well as costs. The Shared Use calculations did not include ridership or revenue variations since there were no comparable benchmarks as with the Dedicated Use and Hybrid.

Table 3-1 outlines the comprehensive operating ratios for the high-speed rail system for Shared Use, Dedicated Use and Hybrid. All three alternatives show very strong operating ratios well above 1.0 indicating the ability to contribute at least in part to their own capital costs.

Table 2-1: High-Speed Rail System Operating Ratios (2021-2040)

		Conservative	Intermediate	Optimistic
Shared Use	2021	1.66	1.66	1.66
	2030	1.94	1.94	1.94
	2040	2.24	2.24	2.24
Dedicated Use	2021	2.39	2.24	1.56
	2030	2.50	2.36	1.78
	2040	2.62	2.51	2.04
Hybrid	2021	2.27	2.09	1.31
	2030	2.54	2.36	1.53
	2040	2.72	2.57	1.76

Table 3-2 illustrates the comprehensive benefit-cost ratios for the high-speed rail system for the three technologies. The Shared Use system benefit-cost ratio is close to 1.0 using Conservative ridership and capital cost assumptions. All technology alternatives have positive system benefit-cost ratios using the Intermediate ridership and capital cost assumptions.

Table 2-2: High-Speed Rail System Benefit-Cost Ratios (2021-2050)

	Conservative	Intermediate	Optimistic
Shared Use	0.91	1.01	1.11
Dedicated Use	0.58	1.09	1.24
Hybrid	0.78	1.46	1.78

It should be noted that while an Atlanta-hub high-speed rail system produces positive operating ratios and benefit-cost ratios and ultimately passes the feasibility tests, the capital investment required for a fully built out system will be significant. Capital cost estimates for such a system range from $15.0 billion for a 110 mph Shared Use system, to $23.4 billion for a Hybrid system and $43.5 billion for a 180-220 mph Dedicated Use system. Such a system would clearly have to be staged out over time and the magnitude of such a system would require a national funding commitment like that associated with national high speed rail systems in Europe and Asia.

3 FUNDING OPPORTUNITIES

In order to better understand the financial feasibility issues associated with implementing high speed rail in the Southeastern U.S, the Study examined a variety of federal, state and local funding opportunities and strategies. In its research, the study examined sources of capital funding for infrastructure and equipment, as well as operating support to supplement fare revenue.

Capital Funding

Historically, funding for passenger rail service in the U.S. typically uses public sector grant and financing avenues to fund capital improvements including:

- Project development activities (i.e., planning, environmental compliance, preliminary engineering (PE) and final design (FD),
- Infrastructure construction (track, signals, stations), and
- Acquisition of operating equipment and construction of maintenance facilities.

These federal grant sources are usually matched with state funds. Local and private funding is typically limited to station development and instances where infrastructure improvements coincide with freight operations.

In addition to capital grant opportunities, there is also federal loan financing available to states to help fund capital costs for high-speed and intercity passenger rail programs. These financing options include low interest direct loans, loan guarantees, and federal interest tax expansions. In some areas, there are specialized financing tools such as tax incremental financing, local specialized transportation taxes, and public-private partnerships.

Operating Funding

With the limited federal and state funding across the country, a first step in managing operating support funding requirements, is to develop a service plan that maximizes ridership and revenues through high levels of service, aggressive pricing and traveler amenities.

Additionally, public-private partnership opportunities can be pursued to franchise the operation of the service and reduce public sector revenue risks. Public-private partnership opportunities can also be pursued through joint station development agreements and targeted advertising. Further, during the planning process, negotiations with Amtrak and/or private railroad owners can be used as a vehicle to

help minimize operating costs. National and international experience in Europe and Asia has been that high levels of service, when cost effectively provided, can generate operating profits that can be used to reduce capital debt service and/or provide funds for future maintenance and infrastructure replacement.

This chapter provides an inventory of current funding and financing opportunities at the federal, state and local levels for the three Study Corridors.

3.1 Federal Capital Grants

3.1.1 Passenger Rail Investment and Improvement Act of 2008 (PRIIA)

In October of 2008, Congress passed the Passenger Rail Investment and Improvement Act (PRIIA). This legislation reauthorizes funding for Amtrak, and in addition, provides a new statutory framework for a federal/state partnership to fund and develop U.S. high-speed and intercity passenger service using 80/20 federal/state capital grants.

The PRIIA legislation authorizes $3.4 billion in capital grants over five years to states, groups of states, interstate compacts, public agencies, and in some cases Amtrak.

Congressional action is required each year to appropriate the amounts authorized. Section 301 of the Act provides grants for Intercity Passenger Rail Service Capital Assistance. Section 501 provides capital grants for High-Speed Rail Corridor Development for federally designated corridors with planned speeds of 110 mph or greater. Section 302 Congestion Grants are focused on relieving rail congestion bottlenecks.

3.1.2 American Recovery and Reinvestment Act of 2009 (ARRA) and Transportation Investment Generating Economic Recovery (TIGER)

In February 2009, Congress passed the American Recovery and Reinvestment Act (ARRA) which appropriated $8 billion in 100 percent federal funding providing "capital assistance for high-speed corridors and intercity passenger service." This program is based on the statutory framework provided by PRIIA and focused funding on state-sponsored projects.

ARRA also provided $1.5 billion in 100 percent flexible multi-modal funding under the Transportation Investment Generating Economic Recovery (TIGER) Discretionary Grant Program. Since then, another $600 million in 80 percent federal funding was appropriated in 2010 for the TIGER II Discretionary Grant Program.

US DOT is authorized to award $526.9 million in TIGER Discretionary Grants pursuant to Division B of the Department of Defense and Full-Year Continuing Appropriations

Act, 2011 (Pub. L. 112-010, Apr. 15, 2011). This appropriation is similar, but not identical to the appropriation for the "TIGER" program authorized and implemented pursuant to ARRA and the National Infrastructure Investments or "TIGER II" program under the FY 2010 Appropriations Act. As with the TIGER and TIGER II programs, funds for the FY2011 TIGER program are to be awarded on a competitive basis for projects that will have a significant impact on the nation, a metropolitan area or a region. October 31, 2011 was the deadline for submission of applications.

3.1.3 HIGH-SPEED AND INTERCITY PASSENGER RAIL (HSIPR)

In developing guidance for ARRA grants as well as grants offered under subsequent PRIIA appropriations, a structure for the FRA's High Speed and Intercity Passenger Rail (HSIPR) Program has evolved. The current structure is best reflected in the most recent notices of funding availability (NOFA) for FY 2010 appropriations for 80/20 federal/state grants under three program areas:

- *Service Development Program Grants* issued in the Federal Register on July 1, 2010;
- *Individual Project Grants* also issued on July 1, 2010; and,
- *Planning Grants* issued in the Federal Register on April 1, 2010.

FRA will develop final guidance and regulations for the HSIPR Program over the next few years; however, these interim guidance documents will provide the basic framework for the PRIIA grant program as well as for future funding programs.

Under the FY 2010 appropriation for these programs, $2.1 billion was provided for Service Development Program Grants, $245 million was provided for Individual Projects, and $50 million was provided for Planning Grants. The basic features of each program are outlined below. It should be noted that no new appropriations provided for HSIPR in FY 2011 or 2012.

3.1.3.1 Service Develop Program Grants

Investment in Service Development Programs (SDP) is "the long-term interest" of the new FRA HSIPR Program. SDP Grants focus on developing new high-speed or intercity passenger services or substantially upgrading existing services. A SDP Grant provides an 80/20 percent federal/state basis and in-kind contributions are allowable with FRA approval. An SDP Grant application will typically contain sets of inter-related projects, which constitute the entirety or a distinct phase (or geographic section) of a long-range SDP. These projects will collectively produce benefits greater than the sum of each individual project and will generally address, in a comprehensive manner, the construction and acquisition of infrastructure, equipment, stations, and facilities necessary to operate high-speed and intercity passenger service.

There are two SDP categories: 1) Major SDPs, which is the default category for SDP grant requirements, and 2) Standard SDPs which cost less than $100 million, primarily benefit intercity passenger rail service with top speeds of 79 mph, use proven technology, and are submitted by applicants with proven HSIPR project implementation experience.

Major SDP's are unique because the award instrument will be a "Letter of Intent" for the cost of the entire program which will contain milestones, grant conditions and other requirements agreed upon by FRA and the grantee which must be fulfilled prior to any disbursement of funds. Funding will be obligated through cooperative agreements and disbursed to grantees as the agreed upon milestones are achieved. The award instrument for the Standard SDP is a traditional "cooperative agreement" with funding made available to grantees on a reimbursable basis.

Major SDPs will typically require a "two-tiered" NEPA approach: utilizing a Tier 1 EIS to address broad service issues ("Service NEPA" document); followed by a Tier 2 EIS, Environmental Assessment (EA), or Categorical Exclusion (CE) to address site-specific project environmental review requirements ("project NEPA" document). To be eligible for a Major SDP grant, an applicant must have completed and submitted a NEPA document satisfying FRA's "Service NEPA" requirement with the application. A project's preliminary engineering, site-specific NEPA, final design, and construction activities are eligible for funding.

Standard SDP's can utilize a "non-tiered" NEPA approach where one EIS or EA would cover both service issues and individual project components. The applicant must have completed and submitted with the application an EIS or EA that addresses, at a minimum, Service NEPA issues. For applications intended to advance directly into final design (FD), FRA requires project NEPA documents and all preliminary engineering (PE) for project components to be completed and submitted with the application.

3.1.3.2 Individual Project Grants

Individual Project Grants are intended to assist applicants with the capital costs of improving existing high-speed or intercity passenger service. Individual Project Grants are provided on an 80/20 percent federal/state basis and in-kind contributions are allowable with FRA approval. Awards are for projects which involve FD/construction or projects already having completed site-specific NEPA documentation; or completion of project NEPA and PE documentation. Completion of the grant activities should result in all of the documentation necessary for the project to move into the FD/construction stage. The intent is to fund discrete individual projects that result in operation or other tangible improvements (e.g., station rehabilitation) benefiting one or more existing high-speed or intercity passenger services.

All individual projects must be addressed in a SDP, State Rail Plan, or similar planning document. Final design and construction projects must have project NEPA documentation completed as well as PE. Grants for PE/NEPA work must be developed sufficiently to support immediate commencement of FD. There is no requirement for a "tiered" NEPA approach. All individual project grants must have operational independence upon implementation; the project will provide measurable benefits with no additional investment.

3.1.3.3 Planning Grants

There are two types of eligible planning projects under HSIPR: 1) Passenger Rail Corridor Investment Plans and 2) State Rail Plans. Grants are provided on an 80/20 percent federal/state basis and in-kind contributions are allowable with FRA approval.

Passenger Rail Corridor Investment Plans must include both SDPs and Corridor-Wide Environmental Documentation meeting Tier 1 service NEPA requirements. If an application has completed one of these documents, FRA must have accepted that document to receive a grant to complete the remaining component(s).

SDPs must include: a corridor development program rational; service plan; capital investment need assessment; financial forecast; public benefits assessment; and program management approach. Corridor-Wide Environmental Documents must satisfy FRA service NEPA requirements. FRA has defined service NEPA as at least a programmatic/Tier 1 environmental review (using tiered reviews and documents), or alternatively, a project environmental review that also addresses broader questions and likely environmental effects for the entire corridor. Simple corridor programs can be addressed with a project NEPA approach while more complex programs will require a tiered approach.

State Rail Plans must meet PRIIA requirements and specific requirements included in the notice of funding availability. These include:

- State multimodal goals addressing the role of rail,
- Description of the existing rail system and its performance,
- Discussion of the existing state rail program and analysis of the economic and environmental effects of rail,
- Discussion of existing rail proposals,
- Vision for rail transportation,
- 5- and 20-year service and investment program for passenger and freight rail with an assessment of public and private benefits, and
- Description of public and stakeholder participation as well as coordination with other transportation programs.

3.1.4 Section 130 Highway-Rail Grade Crossing Improvement Program

The FHWA Section 130 Highway Railroad Grade Safety Crossing program provides grants for the improvement of highway railroad grade crossings which enhance safety. This includes: separation or protection of grades at crossings; the reconstruction of existing railroad grade crossing structures; and, the relocation of highways or rail lines to eliminate grade crossings.

Funds from the FHWA Section 130 Program can be used for freight and passenger projects provided that the projects improve safety at-grade crossings. This may include a variety of methods, such as installation of warning devices, elimination of at-grade crossings by grade separation or consolidation, and closing of crossings. Work may also include replacement of crossing surfaces, improvement of road approaches, installation of new gates/flashers, and installation of other safety signal equipment. Funding may also be used for elimination of crossing hazards should a state choose to use the funds for this purpose. For example, any repair, construction, or reconstruction of roads and bridges affected by a project would be eligible.

Federal funds for grade-crossing safety improvements are available at a 90 percent federal share, with the remaining 10 percent to be paid by state and/or local authorities and/or the railroad. The federal share may amount to 100 percent for the following projects: signing, pavement markings, active warning devices, the elimination of hazards, and crossing closures. The decision on whether to allow 100 percent Federal funding rests with the individual States.

3.1.5 Rail Line Relocation and Improvement Capital Grant Program

Section 9002 of Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) authorized $350 million per year for the Rail Line Relocation and Improvement Program to provide financial assistance for local rail line relocation projects. For FY 2010, Congress appropriated $34.5 million for the program. Any construction project which improves the route or structure of a rail line and 1) involves a lateral or vertical relocation of any portion of the rail line, or 2) is carried out for the purpose of mitigating the adverse effects of rail traffic on safety, motor vehicle traffic flow, community quality of life, or economic development is eligible. The federal share for these funds is 90 percent, not to exceed $20 million per project. This program can be useful for passenger rail projects which require re-routing freight operations to provide access for passenger service.

3.1.6 FHWA Congestion Mitigation and Air Quality

The Congestion Mitigation and Air Quality Program (CMAQ) (Title 23 USC Section 149) was created in 1991 in order to provide innovative funding for transportation projects which improve air quality and help achieve compliance with national air

quality standards set forth by the Clean Air Act. Funding authorized through CMAQ is for projects in areas not meeting national air quality standards. The CMAQ program pays for transportation projects or programs which will contribute to attainment of national ambient air quality standards. The program encompasses projects and programs that reduce traffic congestion and help meet federal Clean Air Act requirements.

CMAQ funding may be used for freight and passenger projects that accomplish the program's air quality goals. Federal regulations indicate CMAQ funds may be used for intercity passenger projects located in a nonattainment or maintenance area if they reduce emissions and meet the program's other eligibility criteria. Capital costs, as well as operating expenses (for the first three years), are eligible as long as the project contributes to attainment or maintenance of the air quality standard through reduction in vehicle miles traveled, fuel consumption or through other factors. The regulations include eligibility for corridors where a portion of the corridor is in a non-attainment area. The federal cost share is typically 80 percent, although one hundred percent funding is also available under certain circumstances.

3.1.7 FHWA Surface Transportation Program

The FHWA Surface Transportation Program (STP) (Title 23 USC Section 133, 104(b)(3), 140) provides flexible funding for projects on any Federal-aid highway, bridges on public roads, transit capital investments, and intracity and/or intercity bus terminals and facilities. Eligible freight projects include preservation of abandoned rail corridors, bridge clearance increases to accommodate double-stack intermodal trains, and freight transfer yards.

3.1.8 FHWA Transportation Enhancement Program

Funds are available under the FHWA STP for the Transportation Enhancement Program. The purpose of this program is to fund projects which allow communities to strengthen the local economy, improve the quality of life, enhance the travel experience, and protect the environment. Transportation Enhancement Program funds can be used for rehabilitation and operation of historic transportation buildings, structures, or facilities and preservation of abandoned railway corridors (e.g. conversion of abandoned rail corridors to trails). The federal grant share is generally not less than 80 percent.

3.1.9 High-Speed Rail Crossing Improvement Program

The Federal Railroad Administration High-Speed Rail Crossing Improvement Program, authorized $50 million over the period of SAFETEA-LU, to fund projects which reduce or eliminate hazards at highway-rail grade crossings in designated high-speed corridors.

3.2 Federal Financing and Loan Programs

As aforementioned, there are a number of federal financing and loan programs that high-speed rail corridors may take advantage of in lieu of federal grants. These programs have lower interest than private bonds and do not necessarily require a state or local match.

3.2.1 Rail Rehabilitation and Improvement Financing Program (RRIF)

The Railroad Rehabilitation and Improvement Financing Program (RRIF) provides direct federal loans and loan guarantees to finance development of railroad infrastructure. The program was established by Transportation Equity Act for the 21st Century of 1998 (TEA- 21) and amended by SAFETEA-LU. Under this program, the FRA authorizes direct loans and loan guarantees up to $35 billion. Up to $7 billion is reserved for projects benefiting freight railroads other than Class I carriers.

The funding may be used to acquire, improve, or rehabilitate intermodal or rail equipment or facilities, including track, track components, bridges, yards, buildings, and shops. In addition, the funding can be used to refinance outstanding debt incurred for the purposes listed above as well as for developing or establishing new intermodal or railroad facilities. While the program has been used largely for freight rail projects, Passenger rail projects are also eligible.

In the case of passenger projects, RRIF funding is only workable where investment grade revenue and operating cost forecasts demonstrate the project has the potential to provide a substantial revenue stream after a significant public investment is typically made in infrastructure and/or equipment. Typically, projects receiving RIFF credit assistance must obtain an investment grade rating from at least one nationally recognized credit rating agency. Direct loans can fund up to 100 percent of a railroad project, with repayment periods of up to 35 years and interest rates equal to the U.S. Treasury rate. Eligible borrowers include railroads, state and local governments, government-sponsored authorities and corporations, joint ventures which include at least one railroad, and limited option freight shippers intending to construct a new rail connection.

The RRIF program provides financing on favorable terms; however, the applicant must identify a viable revenue stream to make payments over the loan period. This program is administered by the FRA, and final award decisions are overseen by the USDOT Credit Council and the White House's Office of Management and Budget (OMB).

3.2.2 US DOT Transportation Infrastructure Finance and Innovation Act (TIFIA)

The USDOT's Transportation Infrastructure Finance and Innovation Act (TIFIA) administered by the FRA, authorizes $10.6 billion in credit assistance on flexible terms in the form of secured loans, loan guarantees, and standby lines of credit. The TIFIA program was created in 1998 by the TEA-21 and amended by SAFETEA-LU.

TIFIA financial assistance is provided directly to public-private sponsors of surface transportation projects of national significance. The TIFIA credit program's fundamental goal is to leverage federal funds by attracting substantial private and other non-federal investment in critical improvements to the nation's surface transportation system. TIFIA can be used for both freight and passenger projects. A wide variety of intermodal and rail infrastructure projects, including passenger rail, are eligible and can include equipment, facilities, track, bridges, yards, buildings and shops.

TIFIA credit assistance provides improved access to capital markets, flexible repayment terms, and potentially more favorable interest rates than in private capital markets for similar instruments. The interest rate for TIFIA loans is the U.S. Treasury rate and the debt must be repaid within 35 years. TIFIA can support up to 33 percent of a project's cost and is restricted to projects costing at least $50 million. TIFIA can help advance qualified, large-scale projects which otherwise might be delayed or deferred because of size, complexity, or uncertainty over the timing of revenues.

Similar to the RRIF program above, TIFIA is not a funding source, but a method of financing projects through assisted borrowing. In the case of passenger projects, RRIF financing is only workable where investment grade revenue and operating cost forecasts show the project has the potential to provide a substantial revenue stream after a significant public investment is typically made in infrastructure and/or equipment. Projects receiving TIFIA credit assistance must obtain an investment grade rating from at least one nationally recognized credit rating agency.

3.2.3 FHWA Grant Anticipation Revenue Vehicle Bond (GARVEE)

Grant Anticipation Revenue Vehicle Bond (GARVEE) bonds can be issued by states under the guidelines in Section 122 of Title 23 of the United States Code. These bonds can be used for transportation projects with no stated limitations on transportation mode. GARVEE bonds may only be used for projects receiving federal funding and the project details must be approved by the FHWA. States repay the funds using anticipated federal funds. While FHWA must approve the project for federal funding, they do not approve the financing method, a state or local government must notify FHWA they will be using GARVEE bonds.

GARVEE bonds are useful when it is desirable to bring a project to construction more quickly than otherwise would be possible. Inflation, increased congestion, and lost economic development benefits associated with delay provide offsets to the additional interest costs of debt financing. Grant Anticipation Bonds are typically intended to meet short-term funding needs, usually less than one year to maturity, but sometimes as long as two to three years.

The PRIIA "Letter of Intent" provisions of the FRA High Speed and Intercity Passenger Rail Program can provide a basis for documenting to investors the availability and commitment of future federal grant funding. These bonds are not guaranteed by the federal government and the States do not guarantee the federal government will provide the expected financing. The State's share of the bond is backed by the State and the State may elect to either carry high interest rates or use other sources of revenue as security on the federal portion of the bonds.

3.2.4 IRS Tax Exempt Private Activity Bonds (PAB)

Private Activity Bonds (PABs) are federally tax-exempt bonds which can be used to finance the activities of private firms. Congress introduced private activity bonding eligibility for transportation projects through the amendment of Section 142 of the Internal Revenue Code. SAFETEA-LU added PAB eligibility for highway and freight transfer facilities (including highway-rail transfer). Mass transit projects and high-speed rail facilities (over 150 mph) were already eligible for PABs, up to a $15 billion limit for transportation-related PABs. As of August 2010, more than $2 billion of PABs have been issued. The program is administered by the USDOT, and according to the Council of Development Finance Agencies, the 2011 budget allows for each state to receive $95 per capita or $277.8 million, whichever is greater.

State and local governmental authorities must issue the bonds and the authorities traditionally serving as conduits for bond issuance include Development Authorities, Downtown Development Authorities, among others. Qualified projects include "any surface transportation project which receives Federal assistance under Title 23, United States Code" (FHWA, 2010). This includes rail facilities and vehicles as long as these projects are also receiving TIFIA credit assistance. The premise of this requirement is that bringing TIFIA and PABs together on surface transportation projects will encourage more private equity investment to transportation.

An application for funding allocation is required on an annual basis, and is subject to the federal cap on PAB's established for each state. Requirements to be included in the application include proposed date of bond issuance, financing/development team information, borrower information, project description, project schedule, financial structure, and a description of Title 23/49 funding received by the project. If a project receives an allocation and the schedule agreed upon in the application is not met, the allocation may be withdrawn.

3.3 State and Local Capital Match Funding

3.3.1 State General Fund Appropriations

The use of a General Fund Appropriation for a high-speed passenger rail project offers the most flexibility in terms of the use of state tax revenues. The downside for a high-speed rail project, like other transportation infrastructure projects, is that the significant amount of funding typically required over multiple years is not easily obtained in a budgetary or political cycle given the many other recurring demands for state appropriations.

In many of the southeastern states, a large portion of the state DOT general funds is acquired through motor fuel taxes. In some cases, these funds may not be used for rail or transit projects and are only obligated towards road and bridge infrastructure. Therefore, only a small percentage of the general fund appropriations are available to be split among all other alternative transportation projects.

3.3.2 State General Obligation and General Revenue Bonds

Most of the states have the ability to issue state bonds for transportation purposes and state bonding has many advantages as a source of state capital funding to match federal grant funds. Bonding allows a state to spread funding for large capital projects with continuing benefits over long time periods (typically up to 20 years). The resulting impact on the state budget is thus relatively small in any one year.

General GO are backed with the legal pledge of all state revenues. On the other hand, state revenue bonds are backed by the pledge of revenues from a specific source such as a dedicated sales tax or in the case of a passenger ground transportation project, ticket revenues. Given the political and underwriting challenges in obtaining a dedicated and marketable revenue source, GO bonds have many advantages over revenue bonds.

3.3.3 Freight Railroad Contributions

Passenger rail projects in shared-use freight rail corridors may have the opportunity to obtain capital funding from the host railroad where the project provides freight benefits. An example might include adding a double track on a congested single-track main line. Here the capacity benefits to the freight railroad may exceed the capacity consumed by the additional passenger service. Another example might be the replacement of jointed rail with more reliable and higher performance continuous welded rail, which can reduce maintenance costs and increase freight rail speeds. The negotiations involved with the freight railroad in such an arrangement can be time consuming and will typically involve the use of sophisticated capacity models and other kinds of operations analysis.

3.3.4 Transportation Equity Funds

Some of these study states may have specialized state grant programs that allows the state to fund alternative transportation programs and opens larger state funding sources. However, most states have not developed such grant programs, with the exception of Tennessee.

In Tennessee, the DOT has developed a fund typically used for aviation, rail, and waterway transportation modes. The revenue is collected by a sales tax on the petroleum used in these modes of transportation. The budget for each mode is based on the amount of revenue collected for that mode.

3.3.5 Local General Fund Appropriations

Local municipalities have the option of using their general funds to help match federal funds or make improvements to transit stations and surrounding developments. This capital must be budgeted ahead of time and approval must be received from the county commissioners and/or councils. The use of local general fund appropriations for stations and similar improvements has the same considerations as state general fund appropriations discussed above.

3.3.6 Local Bonding

Local municipalities may issue bonds for transportation improvement projects such as high-speed and intercity passenger ground transportation. They may use these bonds as the local match for federal funds. The bonds, similar to the state bonds, will be repaid with future revenue or general tax money. The use of local general obligation bond funding for stations and similar improvements has the same considerations as state bonding discussed above.

3.3.7 Value Capture Taxes

Transportation infrastructure such as passenger rail stations can increase the value of adjacent properties. In some cases, this increase can be quite substantial and public entities leading the development of this infrastructure believe it is necessary to capture some of this added value. Multiple tools have been created as a mean to capture some of this added value and are classified as “value capture taxes”. This method of obtaining capital to cover costs for transportation infrastructure is more prevalent in Asian and South American countries, but is become more popular in the U.S. It is important to note that value capture tools are limited to local tax jurisdictions and are most appropriate for local improvements such as stations. They are generally not feasible for intercity passenger ground transportation corridor improvements that cross multiple tax jurisdictions. There are five “tools” that are known as value capture taxes- these include Land Tax Increment Financing, Special Assessments, Development Impact Fees, and Air Rights. Each is allowed under the

current Georgia and/or Tennessee statutes. A brief description of the methods follows:

3.3.7.1 Land Value Taxes

Land value taxes are a type of property tax where property is assessed based on just its land value rather than applying the same tax rate to land and buildings. Land around a ground transportation corridor and/or station will increase due to the accessibility to the network. Allowing for the taxation of the land rather than buildings creates incentives for development because "the supply of land fixed, taxing it at a higher rate resulting in little economic distortion" (Center for Transportation Studies, University of Minnesota, 2009).

3.3.7.2 Local Tax Incremental Financing (TIF) and Tax Allocation Districts (TAD)

Tax incremental financing is used by local governments in both Georgia and Tennessee to finance improvements and developments that have the potential to increase tax revenues over time. These "incremental" tax revenues are then set aside and used to amortize a local bond issue that can be used to fund the required improvements. The tax incremental financing mechanism is particularly appropriate for passenger ground transportation stations and other "transit friendly" developments which tend to increase surrounding property values.

When a TIF project is created, the district agrees to place increased property tax revenues into an earmarked funds for a period of 25 years. During this time period, the local government receives the same level of funding as it does in the year the district was created. The surplus of tax funds is then "banked" to pay back issued bonds. Once this 25-year period is complete, the banked money is used to pay back the tax-free bonds. The selling of bond provides immediate funding for costly projects without significantly impacting property owner finances. In addition, once the 25-year period has expired, the local government will see a significant increase in their funding levels due to the ever-increasing property tax revenue.

3.3.7.3 Special Assessments - Community Improvement Districts (CID)

Also referred to as business improvement districts, CIDs are defined areas where businesses agree to pay additional taxes or fees to fund improvements within the district. Usually, these funds provide services such as security, capital improvements, and marketing.

The creation of a CID relies upon local businesses to petition for a CID. It must be determined that a majority of businesses are in favor of creating a district. Further, the state legislature must grant each local government the authority to create these districts. If the district is approved and created, all property owners within the district are required to pay the additional taxes and/or fees. However, residents, non-profits,

and government agencies are usually exempt from these contributions. The governance of the CID falls on a board created by property owners, businesses, and governments.

It is possible that a CID could be created along this high-speed ground transportation project to help fund passenger transportation stations and promote surrounding developments. Local development authorities around proposed stations may find this as an opportunity to fund a rail station, bring more business to the community, and spur real estate and economic growth.

3.3.7.4 Developer Impact Fees

Developer Impact Fees are charges on new developments by local jurisdictions. These charges are intended to cover additional public service costs that the development, when completed, will impose. The impact fees are typically calculated based on public service costs and may be used for off-site services such as roads, schools, and parks. The local jurisdiction in which the station is located may enact within their ordinances to impose developer impact fees for developments surrounding the stations' location.

3.3.7.5 Air Rights

Some state DOTs are authorized to lease air rights over existing or proposed limited-access highways for development such as commercial enterprises or activities. This could allow air rights to be leased to developers above transportation stations as long as the transportation line and station is within DOT right-of-way. Since stations can result in increases of property values, developers may want to develop land at higher densities around these stations.

3.3.7.6 Joint Development

The establishment of a passenger ground transportation station offers opportunities for additional on-site development beyond just the station facility. Other development opportunities can include restaurants and food service kiosks, vending machines, retail stores, and hotel and housing developments. Where such opportunities exist, developer financing can be a significant source of funding for station improvements in addition to public sources. The developer may also take on all property management responsibilities for the station, which can be a burden for either state or local government officials.

3.3.8 Special Purpose Local Option Sales Tax (SPLOST)

Special Purpose Local Option Sales Tax (SPLOST) is a tax increase that is applicable to the sales of fuels and food/beverages and may be used for a variety of purposes at the municipalities' discretion. On a Metropolitan Planning Organization or local level, a SPLOST can be implemented with voter approval. Typically, these SPLOSTs only last

a few years and if funds are needed beyond the expiration date, the SPLOST will have to be put to voter referendum again.

The local authority will be able to decide which projects to fund with the sales tax money including ground transportation stations and other infrastructure projects. In some counties, a project list must be published prior to public referendum.

3.3.9 Specialized Local Funding Programs

3.3.9.1 Georgia Regional TSPLOST

The Georgia State Legislature has proposed a regional Transportation Special Purpose Local Option Sales Tax (TSPLOST) in which the state would be divided among 12 regions (Regional Commission Boundaries) and allows voters to decide on a sales tax increase of 1 percent for 10 years to fund transportation projects. Rather than raising the gas tax, this funding would allow for multimodal transportation projects such as high-speed ground transportation projects. These funds can also be used to match federal funds allowing for state and local funds to be spent on other projects.

The projects that will be selected for funding must be from existing plans and/or studies and must be consistent with the policies of the Statewide Strategic Transportation Plan and the Atlanta Region's PLAN 2040. Allocation for transit is between 10-40 percent for capital and 0-10 percent for operation and maintenance within the Atlanta Region. Outside of the Atlanta region, there is between 0-10 percent allocation for transit capital, operation, and maintenance.

Within the Atlanta region, projects will be given priority if they cross county boundaries and include stops within multiple counties. Outside of Atlanta, priority will be given to projects in the construction or acquisition phases and existing systems will be given priority over new capacity projects.

The issue lies in which regions will pass the TSPLOST during the election of 2012. This will depend heavily upon the project list for each region, which will be finalized in fall 2011.Therefore, this bill may allow for transportation funding in some regions of Georgia but not all. Further, many communities will have to make decisions whether to continue with local SPLOSTS for schools and other public infrastructure.

3.3.9.2 Tennessee: Gasoline Tax for Local Transportation Funding

The State of Tennessee implements the Motor and Diesel Fuel Tax for local transportation project funding. A portion of these funds is transferred to cities and counties throughout the state to be used for local transportation projects. The funds are allocated based on the percentage of population in the latest US Census. Cities and Counties may use their portion of the funds for public transportation service. The funds must be used to maintain the level of service and extend the areas presently

served. It may not be used for personnel within the jurisdiction. Therefore, funds could be used to fund ground transportation station improvements or transit feeder systems to a station.

3.3.10 Public Private Partnerships (P3)

Public private partnerships (P3s) are a relatively new venture in transportation projects. Private investors and public entities join together to allow for more private sector participation from both a delivery and financing standpoint. There are many types of P3 structures, which vary in responsibility and risk. Some of the options include Design Build, Design Build Operate, Design Build Finance Operate, Long Term Lease, Lease Development Operate, and Private Contract Fee Services.

The P3s allow for more flexible funding by including the private sector into the project. Equity, bonds, PABs, flexible match, bank loans, Section 129 loans, and Transportation Infrastructure Finance and Innovation Act Credit are some examples of P3 financing techniques.

3.4 Funding Sources and Strategies for Operating Support

3.4.1 State Appropriations

Nationally, the predominate source for providing public sector operating support where revenues do not cover operating costs is the use of annual state appropriations. Most states currently contract with Amtrak to provide service, given that only Amtrak has a federal right of access to provide passenger rail service on existing freight lines. Amtrak then charges each state for any operating costs not covered by operating revenues. The challenge in using the annual state appropriations process to fund high-speed passenger service is that estimates must be made each year in advance of actual expenditure. If there is an unforeseen increase in factor costs such as fuel or labor, it may be difficult to adjust the appropriations level because of the long lead-time required by the state budget and appropriations process. The use of multi-year operating contracts is one mechanism to manage the uncertainty associated with the state budgetary process and potential changes in factor costs.

3.4.2 Congestion Mitigation and Air Quality Funds (CMAQ)

Operating expenses for intercity passenger rail service are eligible for FHWA Congestion Mitigation and Air Quality (CMAQ) funding for three years of operation. These provisions are clarified in the January 16, 2002 Federal Register Notice, “High Speed Rail Projects for the Congestion Mitigation and Air Quality Improvement Program (CMAQ)”. The project must be located in a non-attainment area and must be demonstrate a contribution to the attainment or maintenance of the air quality standard through reduction in vehicle miles traveled, fuel consumption or through

other factors. The regulations include eligibility for corridors where a portion of the corridor is in a non-attainment area. The federal cost share is typically 80 percent although 100 percent funding is available under certain circumstances.

3.4.3 FHWA Traffic Mitigation Funding

FHWA Traffic Mitigation project funding is available to federally eligible highway projects to address congestion resulting from construction activities in a given highway corridor under the Work Zone Safety and Mobility Rule (23 CFR 630 Subpart J). Where cost-effective as documented in a project Transportation Management Plan (TMP), new or enhanced intercity passenger rail service can be considered as a traffic congestion mitigation measure.

Federal highway funding can be used to subsidize all or part of the passenger rail operating costs during the life of the construction project. This funding option is most applicable to major multi-year highway improvement projects on high-volume interstate highways where passenger rail service operates in parallel to the highway corridor. The federal cost share can be either 80 or 90 percent with the higher figure dependent on whether the project is associated with mitigating congestion on an interstate highway.

3.4.4 Revenue Maximizing Strategies

While not a direct funding source, a revenue maximization strategy should be a key element of any state approach to minimizing state operating subsidies for intercity passenger rail service. This strategy begins in the service development planning process and continues through start-up and on-going operation. Elements for consideration in a revenue maximization strategy include service levels, intermodal connectivity, feeder bus networks, aggressive ticket pricing, traveler amenities, and advertising and marketing campaigns.

Setting an appropriate level of service to maximize revenues involves increasing frequencies, speeds and other service features to the point that marginal ridership and resulting revenues equal marginal operating costs. Generally, this means adding infrastructure and equipment improvements to increase frequencies and decrease travel times until these components are substantially less than auto travel times in the same corridor. An integrated feeder bus network scheduled to meet arriving and departing trains is another low cost, low risk method to increase ridership. Other approaches to encourage intermodal connectivity for local transit, bike/pedestrian, intercity bus, and air are also important.

States generally have flexibility in their ticket pricing strategy and often underprice state-supported passenger rail services. Airline type “revenue yield maximization” strategies including time of day, day of week and seasonal pricing can also be considered. State sponsored passenger rail service is ultimately a business, and

revenue maximization pricing is preferred over ridership maximization to insure its long-term financial viability.

Travelers are also attracted by the provision of on-board amenities, such as wide seats and ample foot room, food service, on-board video and audio programming. Wi-Fi access and 110-volt plug-in access for laptops, cell phones and other productivity enhancement devices used by travelers are other amenities to be considered. Passenger rail travel is a new experience for many potential travelers and an aggressive advertising and on-going marketing program is an important and cost-effective vehicle to maximize ridership.

3.4.5 Operating Cost Control Strategies

An operating cost control strategy should be a key element of a state's approach to minimizing state operating subsidies. An operating cost control strategy also begins in the service development planning process and continues through start-up and on-going operation. Elements for consideration in an operating cost control strategy include competitive bidding for the state operating franchise, careful negotiations with Amtrak or other operators, maintenance of operating equipment by the manufacturer or other outside vendor outsourcing of food service, cleaning services, station operations, and other activities.

Negotiations with Amtrak or other operators in developing an operating contract can also be used to control specific cost items. For example, some states have taken on the responsibility for reservations and information call centers to reduce contract costs. Other states have eliminated reserved service cut Amtrak contract costs.

Limited food service can be offered by vending machines at low cost and the use of carts for point of sale food service can be cheaper than operating a dining or bistro car. During periods of upward (or downward) uncertainty in fuel costs, Amtrak or other providers may agree to put these costs outside of an operating agreement. States may find this advantageous to accepting a high-end contract cost if they have the flexibility to budget for a range of fuel costs outside of a fixed cost contract.

Finally, states can consider contracting out for a variety of services which might be provided by the state more cheaply than through the operator. These services can include delivery of operating equipment maintenance services by the equipment manufacturer, as well as contracting out food service, cleaning services, and other activities.

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3.5 PRIVATE SECTOR ALTERNATIVES

3.5.1 JOINT DEVELOPMENT

The establishment of a passenger rail station offers opportunities for additional on-site development beyond just the station facility. Development opportunities can include restaurants and food service kiosks, vending machines, car rental, retail stores, and hotel and housing developments.

Where such opportunities exist, developer financing can be a significant source of funding for station improvements in addition to public sources. The developer may also take on all property management responsibilities for the station, which can be a burden for either state or local government officials.

3.5.2 PUBLIC PRIVATE PARTNERSHIPS

Long-term commercial contracts between governments and private companies to design, build, finance, and/or manage infrastructure projects, often labeled "public-private partnerships or P3" offer the potential to improve project quality and cost-effectiveness. However, the success of these contracts from the public's perspective depends upon government's capacity to capture these potential benefits. While some long-term infrastructure contracts have met their performance and cost-saving objectives, the failure of other high-visibility infrastructure contracts demonstrates that the long-term viability of these complex arrangements is far from guaranteed. [58]There are many types of P3 structures, which vary in responsibility and risk. Some of the options include: Design Build, Design Build Operate, Design Build Finance Operate, Long Term Lease, Lease Development Operate, and Private Contract Fee Services.

[58] See Pamela Bloomfield and F. Daniel Ahern, Jr., "Long-term Infrastructure Partnerships…" State and Local Government Review, Volume 43, No. 1, 2011, pages 49-59.

The P3s allow for more flexible funding by including the private sector into the project. Equity, bonds, private activity bonds (PABs), flexible match, bank loans, Section 129 loans, and TIFIA Credit are some examples of P3 financing techniques.

Offering a private sector operator a "franchise" to operate a service, is a public-private partnership opportunity which has advantages to a state governments interested in providing high speed rail service. Here the private operator takes on "revenue risk" that otherwise would be assumed by the public sector. State governments have extensive experience in funding and managing major transportation infrastructure projects and understand the risks involved. They do not generally have experience and expertise in railroad operations and business management.

Under a franchise agreement, the private operator takes on the future revenue risk associated with operating the service in return for the opportunity to capture future profits. The potential for a franchise agreement exists where forecast revenues exceed forecast operating costs i.e. where the operating ratio is greater than 1.0. The use of a competitive bidding process has the likelihood of further reducing costs to the state. Under this approach, the state award of a passenger rail service franchise would go to the proposal which has the greatest operating surplus or the least public funding contribution. For example, in circumstances where the operating ratio is substantially greater than 1.0, the franchisee may be willing use the revenue surplus to finance a portion of the capital investment required to implement the service. It should be recognized that based on national and international experience, the majority of the initial capital funding required for infrastructure and equipment will have to be provided by public sources.

The franchise approach will work best in situations where the state is pursuing high speed rail service on a dedicated use corridor that will be owned and fully controlled by the public sector. For shared-use operations on existing freight corridors, Amtrak has distinct advantages which make competition from other operators difficult. The National Rail Passenger Service Act of 1971, as amended by PRIIA, gives Amtrak the exclusive right of access to privately owned freight railroads. Under this federal statute, Amtrak can use existing available capacity on any privately owned freight corridor without cost. Beyond that, Amtrak is only obligated to pay incremental operating costs for use of host railroad track infrastructure.

3.6 FUNDING SUMMARY

There are two precepts to a general state funding strategy for high speed rail service: 1) maximize the use of non-state capital funding sources and 2) minimize revenue risk.

On the capital side, no single source of federal, local or private sector funding will likely be adequate for the major capital investment required for a state to initiate a

new high speed rail service. A nimble solution that mixes and matches a broad array of grants and funding sources is essential. As with the development of the interstate highway system, significant federal funding will be essential for states to fully implement high speed rail service. The Passenger Rail Investment and Improvement Act is significant in that it offers an 80/20 federal/state funding partnership like that used to successfully implement the interstate highway program. However, capital funding from this program will likely have to be supplemented from one or more of the other sources listed above to minimize state contributions.

On the operating side, public sector revenue risk can be minimized by private sector franchising along with the use of other innovative federal and private sector sources of operating funds as discussed above.

Regardless, financial planning at the state level is complicated by a global economic recession that has challenged policy makers. A threshold decision must be made regarding the role of government investment in transportation infrastructure as a tool to stimulate economic activity. Debate over this question is seen most clearly at the federal level. In spite of well documented transportation improvement needs, the multi-year authorization of the Federal Surface Transportation Program continues to be stalled. Several re-authorization proposals include a significant consolidation of existing federal transportation programs into a limited number of modal programs, while offering additional flexibility to states to set funding priorities. Debate continues regarding ultimate funding levels for the federal transportation program.