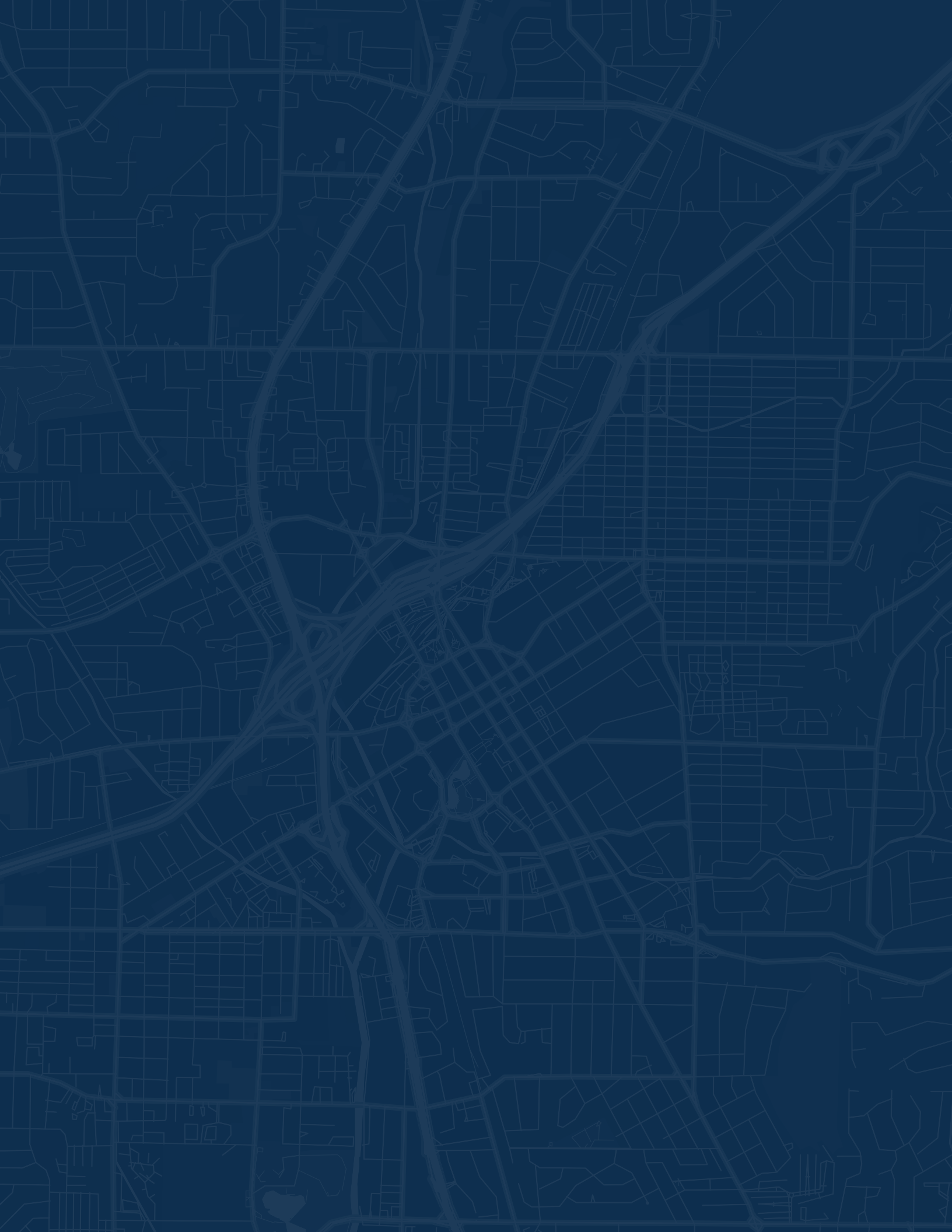
Final Report

Huntsville High-Capacity Transit

Huntsville Area Metropolitan Planning Organization

April 2022



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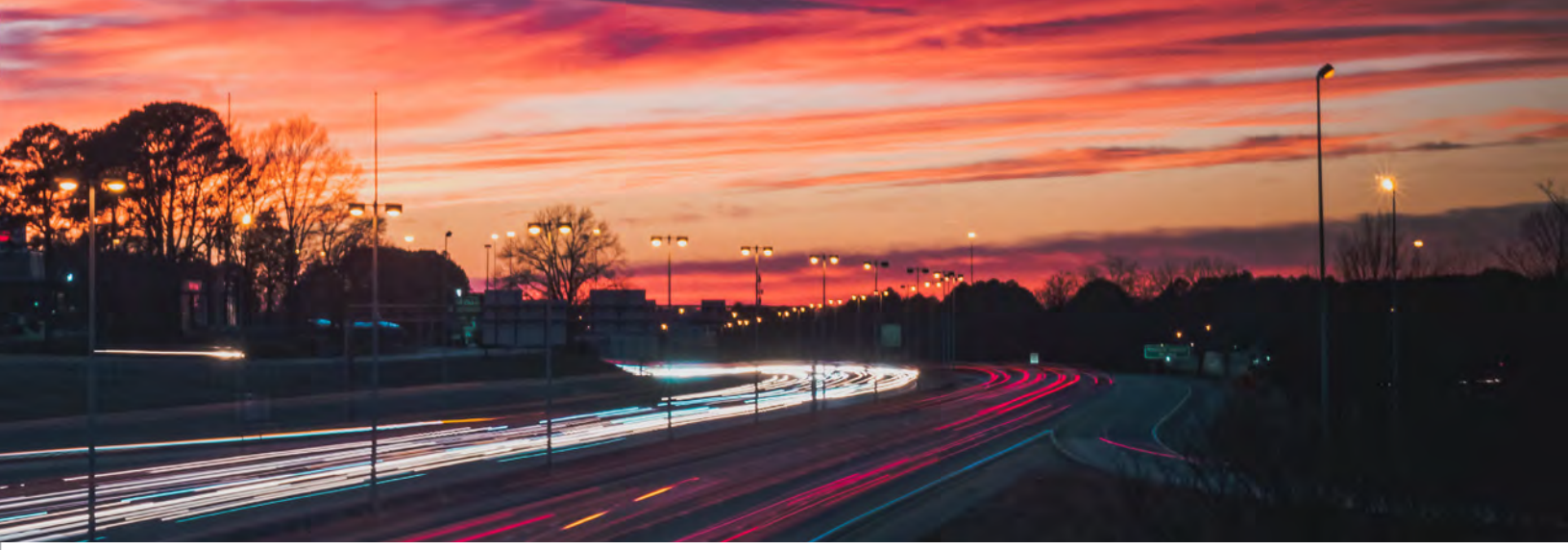
1.0

Introduction

The Huntsville Area Metropolitan Planning Organization (MPO) jurisdiction, comprised of Madison County and the eastern portion of Limestone County, is a hub for higher education, defense, space exploration, and high-tech corporations in northeast Alabama. It is also a regional center for shopping and entertainment. With more commercial and residential developments planned, the Huntsville metropolitan area's population and employment are expected to increase greatly over the next 25 years.



To accommodate the growth and develop as a region with a robust transportation network, the Huntsville Area MPO has embarked on the **High-Capacity Transit (HCT) Concepts & Corridors Plan**. The Plan builds on the 2019 Huntsville Transit Study and aims to advance planning for developing a future high-quality transit system for the region.

The Huntsville HCT Concepts & Corridors Plan examined existing and future population, employment, and land use in the Huntsville region to identify corridors with potential for high-capacity transit. This included an assessment of the corridors to understand the appropriate technology, operating scenarios, and capital costs required to implement a service. The effort also reimagines the corridors with higher density and transit supportive designs and looks to enhance connections to existing and emerging regional activity centers. The results of this study outline a regional vision and establish the next steps in advancing refined premium transit lines, funding options, and timelines.

Two corridors were identified through the study process: the Airport Connector service operating between Huntsville International Airport and Downtown Huntsville, and the 72-Medical HCT route operating primarily on US 72 between Balch Road in Madison and the Downtown Huntsville Medical Center. The 72-Medical Corridor was examined for opportunities for integrated land use planning and transit-oriented developments (TOD). Corridor and site renderings were created to demonstrate how an integrated land use and transportation plan can create a more cohesive and multimodal environment. In addition, an implementation roadmap has been developed to guide the MPO in advancing the recommended approach to developing a rapid transit project.

This report provides the blueprint for how the Huntsville and Madison area can be transformed with the implementation of HCT.

1.1 Project Goals

The Huntsville HCT Concepts and Corridors Plan is designed to improve the livability, competitiveness, and sustainability of communities in the MPO area by identifying potential corridors for HCT service to add to the region's mobility network. This project was designed to help the MPO and community stakeholders achieve the following goals:

1

Identify existing conditions and high ridership corridors in the transit system

2

Identify regional transit connections to existing and emerging activity centers

3

Identify travel market characteristics and demand for high-capacity transit

4

Examine five, ten, and twenty-year scenarios for the system by identifying corridors for premium transit upgrades

5

Develop renderings for future HCT corridor options

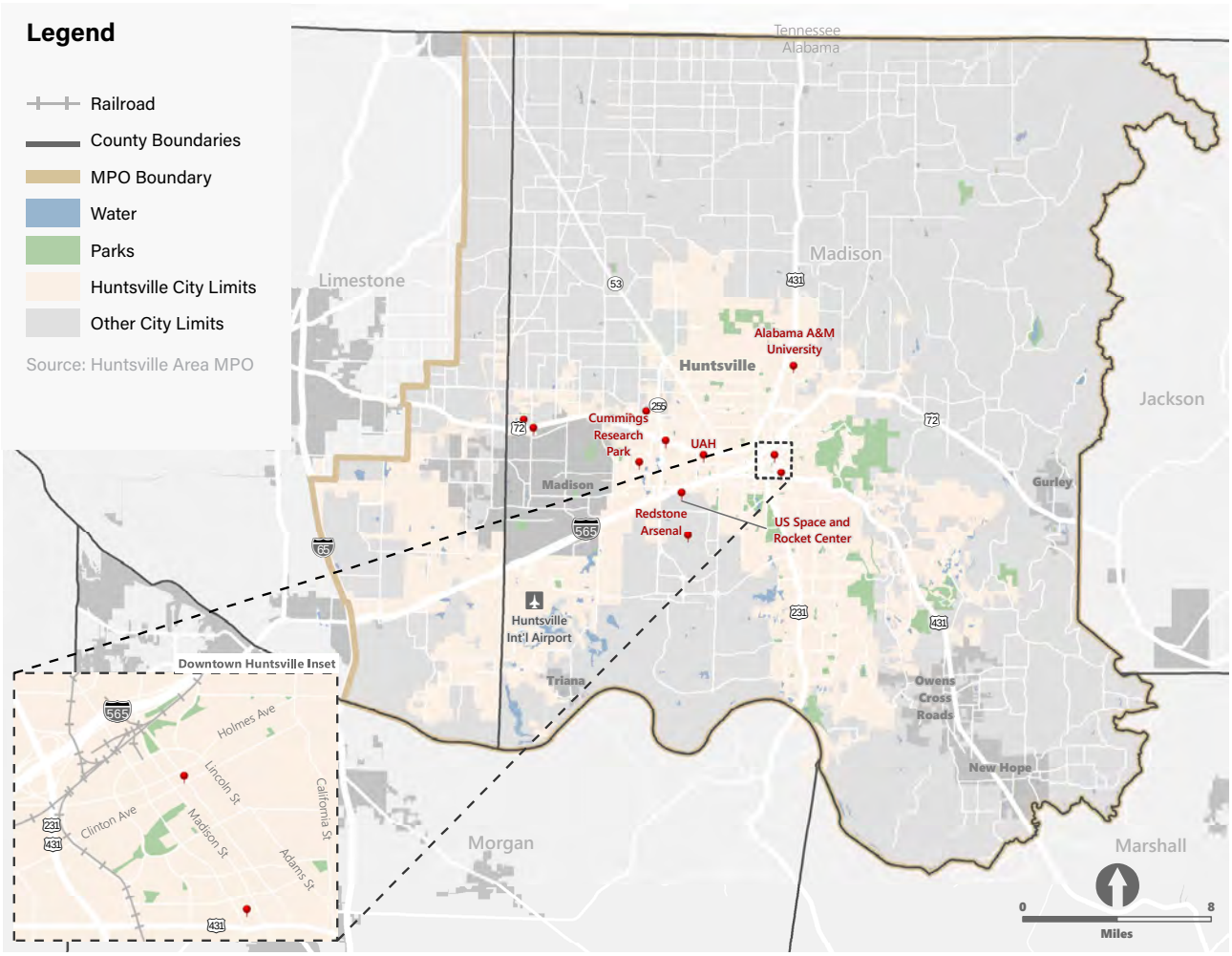
6

Identify funding sources to promote transit within the Huntsville MPO area

1.2 Study Area

For this project, the study area consists of the MPO area, as shown in **Figure 1-1.** It is comprised of the cities of Huntsville, Madison, Triana, Owens Cross Roads, New Hope, and Gurley in Madison County, unincorporated Madison County, and the eastern portion of Limestone County. Some key trip generators within the MPO boundaries are Redstone Arsenal, Cummings Research Park, the U.S. Space and Rocket Center, the University of Alabama in Huntsville, Alabama Agricultural & Mechanical (A&M) University, and the Huntsville International Airport (HSV).

Figure 1-1 | MPO Study Area



2.0

Huntsville MPO Area Now

2.1 Existing Transit Network

Current transit service in Madison County is comprised of the fixed route Huntsville Orbit system, as shown in **Figure 2-1**, and several demand response systems**.** The Orbit system is comprised of 10 bus routes and a circulator for the University of Alabama in Huntsville (UAH). The main 10 bus routes operate Mondays through Saturdays out of the Downtown Transfer Center on Cleveland Avenue between Church and Jefferson Streets. The UAH circulator (Route 11) provides Friday evening service to shopping destinations for UAH students. The system provides service between Downtown Huntsville, major employment centers, and nearby neighborhoods.

Figure 2-1 | Existing Transit System

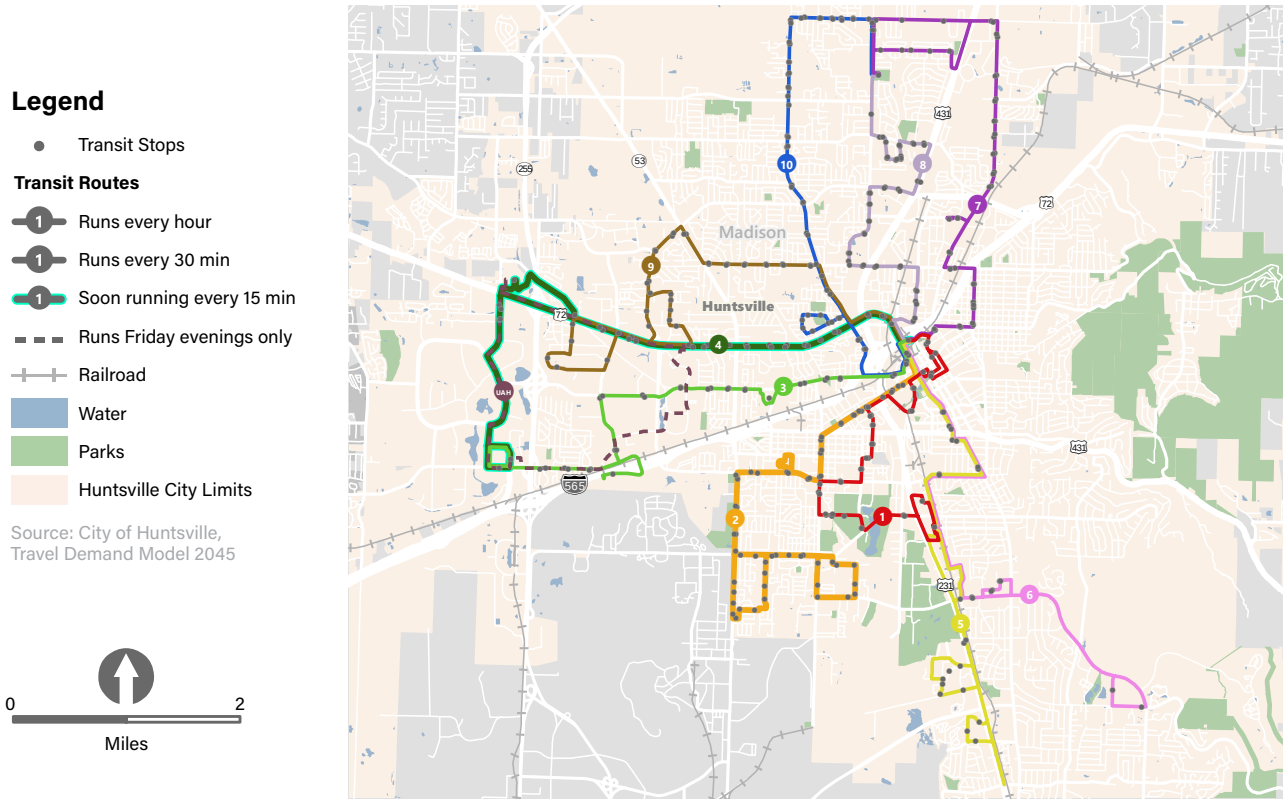


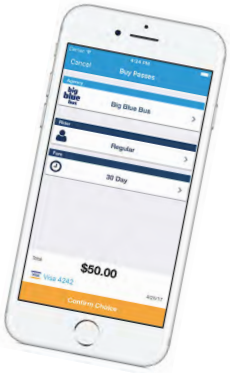
Table 2-1 shows the frequency and span of existing transit routes. Routes 1, 2, and 4 operate every 30 minutes on weekdays, while the rest of the bus routes operate every hour. The span of the bus routes is typically from 6:00 AM to 9:00 PM, with 8:00 PM being the start time of the last trip. On Saturdays, all fixed route services operate on an hourly basis from 7:00 AM to 7:00 PM. Route 11 is a one-way loop for UAH students that makes a trip every 45 minutes between 5:00 PM and 8:45 PM on Fridays.

Table 2-1 | Existing Transit System Span & Frequency

Route #	Route Name	Weekday Span & Frequency	Saturday Span & Frequency
1	Brahan Spring	6 to 8 AM: Every hour 9 AM to 6 PM: Every 30 mins 6 to 8 PM: Every hour	7 AM to 6 PM: Every hour
2	Patton	5 AM: One trip 6 AM to 8 PM: Every 30 mins	7 AM to 6 PM: Every hour
3	Holmes, UAH	6 AM to 8 PM: Every hour	7 AM to 6 PM: Every hour
4	University Drive	6 AM to 8 PM: Every 30 mins (Soon planned to improve to every 15 minutes)	7 AM to 6 PM: Every hour
5	Byrd Spring	6 AM to 8 PM: Every hour	7 AM to 6 PM: Every hour
6	Jones Valley	6:30 AM to 7:30 PM: Every hour	7 AM to 6 PM: Every hour
7	Meridian, A&M	6 AM to 8 PM: Every hour	7 AM to 6 PM: Every hour
8	Blue Spring	6 AM to 8 PM: Every hour	7 AM to 6 PM: Every hour
9	Oakwood	6 AM to 8 PM: Every hour	7 AM to 6 PM: Every hour
10	Pulaski Pike	6 AM to 8 PM: Every hour	7 AM to 6 PM: Every hour
11	UAH Campus	Fridays only 5 PM to 8:45 PM: Every 45 mins	

FARES:

It costs $1.00 for a one-way ticket and $0.50 for seniors and individuals with disabilities. Children under 32" ride for free when accompanied by a paying adult. Transfers are free. Tickets can be purchased at the downtown Huntsville Transit station or using the Token mobile application.



In addition to the fixed route ORBIT system, there are three demand response systems in the MPO area. The City of Huntsville runs a demand response paratransit service called Access. The City of Madison's demand response service is called Madison Assisted Ride System (MARS). In unincorporated Madison County, the County offers Transportation for Rural Areas of Madison (TRAM). These services require reservations in advance.

Demand Response Systems in MPO Area

access huntsville transit

Madison Assisted Ride System

TRAM

2.2 Transfer Center Relocation

The construction of a new Downtown Transfer Center for the Huntsville Orbit system is underway. It will be located along Pratt and Washington St NW. Upon completion of the center, all fixed route services will be rerouted to operate out of this center. There will no longer be service at the current Downtown Transfer Center on Cleveland Ave NW. **Figure 2-2** depicts the existing and future transfer stations.

Figure 2-2 | Huntsville Existing and Future Transfer Stations

Existing Transfer Station New Transfer Station

3.0

Huntsville MPO Area in the Future

3.1 Future Transit

The Huntsville MPO is interested in promoting regional and intercity rail service in an effort expand the reach of the labor force and provide improved access to major employers in Huntsville.

Amtrak recently released a corridor expansion plan[1]. The plan calls for a connection between Atlanta and Nashville with stops in Marietta (GA), Cartersville (GA), Dalton (GA), Chattanooga (TN), Bridgeport (AL), Tullahoma (TN), and Murfreesboro (TN). Although the vision plan is a positive step as it promotes intercity rail service into the state, as the largest city in Alabama, Huntsville is noticeably excluded from the plan, while cities such as Bridgeport, AL with a population of just over 2,000 (2019) are included. The cities of Huntsville and Madison are only approximately 70 miles west of Bridgeport and contain a much larger regional market, including Redstone Arsenal, which employs people from 14 Alabama counties and nine different Tennessee counties. As a regional destination for employment, as well as for shopping, entertainment, and medical care, the Huntsville region is well suited to be incorporated in a regional rail service. More specifically, Huntsville MPO would like to see intercity rail connections between Birmingham, Decatur, Huntsville, and Nashville.

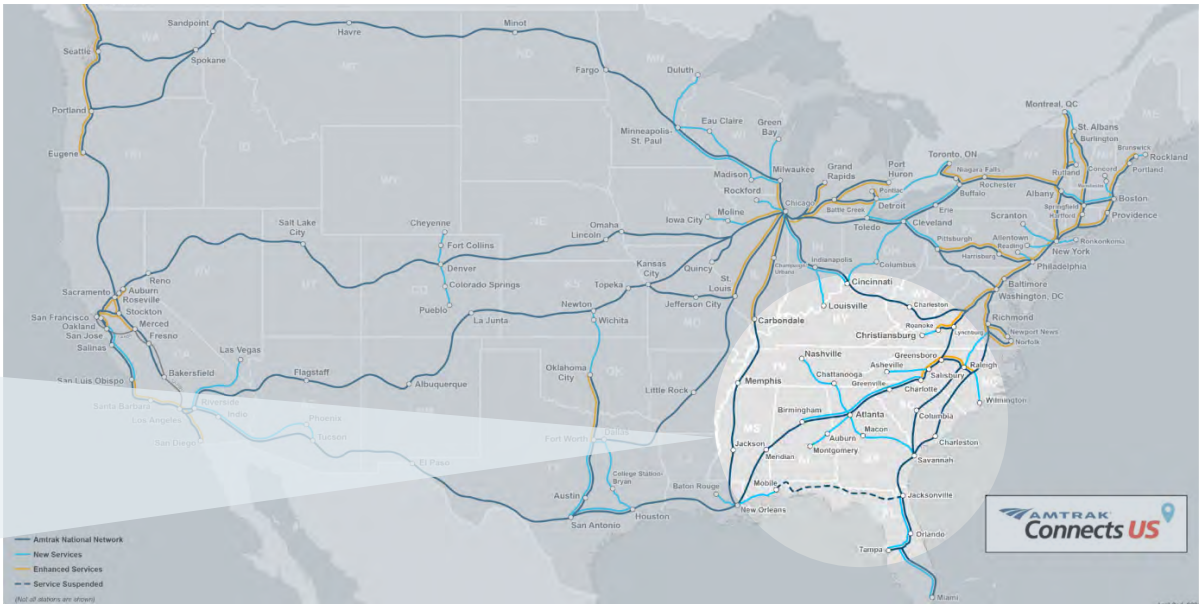
Huntsville

Huntsville MPO desired intercity rail connections

1 https://www.amtrak.com/content/dam/projects/dotcom/english/public/documents/corporate/reports/Amtrak-2021-Corridor-Vision-060121.pdf

2 http://www.huntsvillempo.org/wp-content/uploads/2021/09/TRiP-2045-LRTP_Updated-9-2021-C.pdf

Image | Amtrak Corridor Expansion Plan



Additionally, the City of Madison identified several potential transit corridors in their latest transportation plan, including US 72, Madison Blvd, Hughes Rd and Wall-Triana Hwy. The US 72 and Madison Blvd corridors were identified because of their transit oriented development (TOD) opportunities. Hughes Rd and Wall-Triana Hwy are more residential and have been identified for local bus routes. In Huntsville, Route 4 was recommended for 15-minute service in the 2019 Huntsville Transit Study, but the City currently has not set a date to implement the service improvement.

The region recognizes the need to expand transit service coverage and improve service frequency to make it a desirable transportation option for the region. Identifying options for implementing a more convenient service will help achieve multiple MPO Long Range Transportation Plan goals including enhancing multimodal integration and connectivity, improving resiliency and reliability of the transportation system, increasing accessibility and mobility, and supporting economic vitality.[2]

3.2 Population Growth

Population within the MPO area is projected to grow between now and 2045. **Figure 3-1** shows the growth of population between 2019 and 2045. Areas of high population growth are along the US 231 South and US 72 West corridors, between AL 53 and US 431 North, and between US 72 and AL 53. Some of the areas with the most significant projected growth include the southeastern portions of Limestone County, areas to the east of the Huntsville International Airport, areas from the north of Owens Cross Roads to US 72, and Northeast Madison County. Though these areas expect higher population growth rates than some other portions of the MPO area, it does not directly correlate to higher population density. As depicted in **Figure 3-2**, areas of future high population density are along US 72 West from Downtown Huntsville into the City of Madison, north of I-565, west of Highway 53, south along US 231, and in the area surrounding Downtown Huntsville.

Figure 3-1 | Percent Change in Population from 2019 to 2045

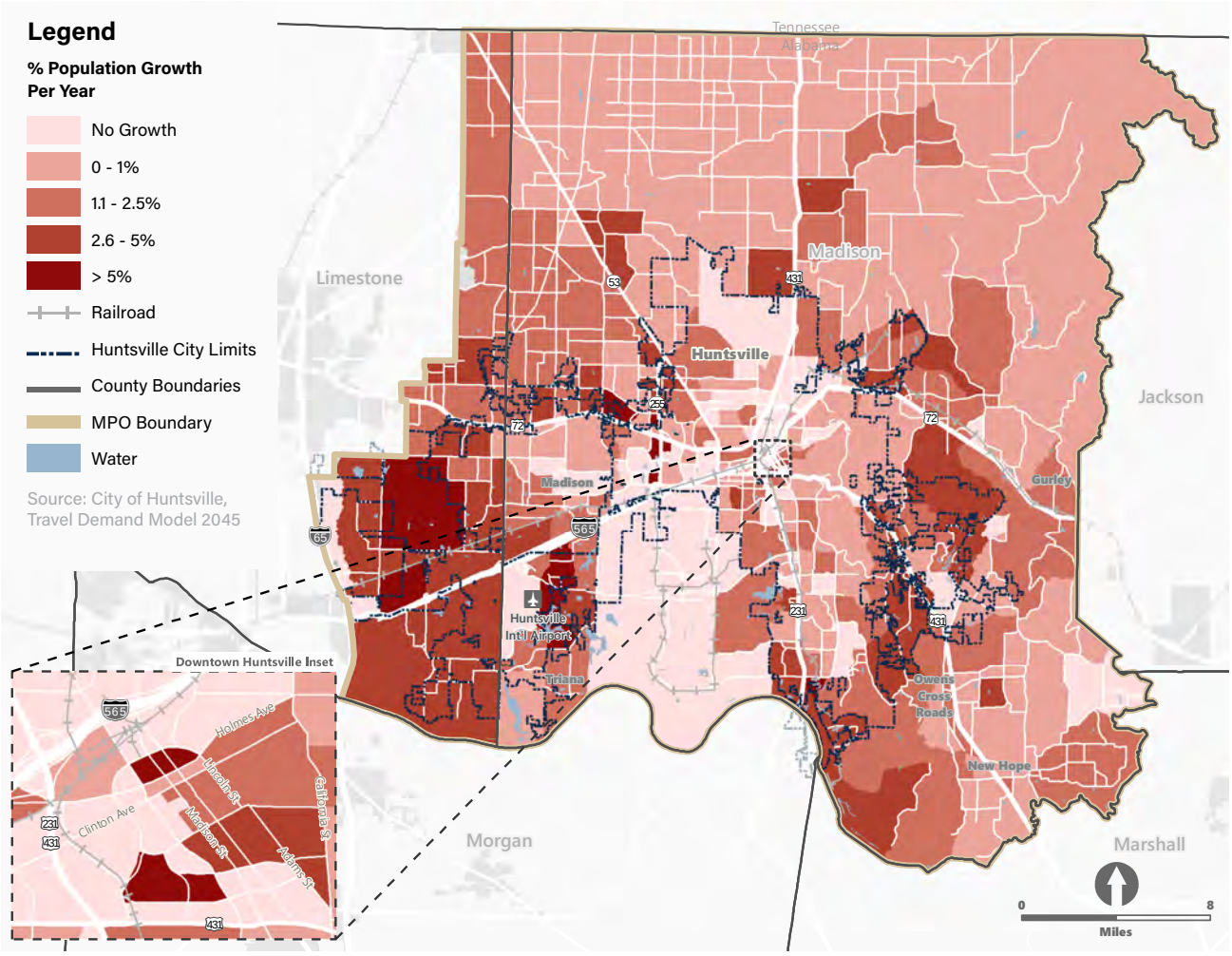
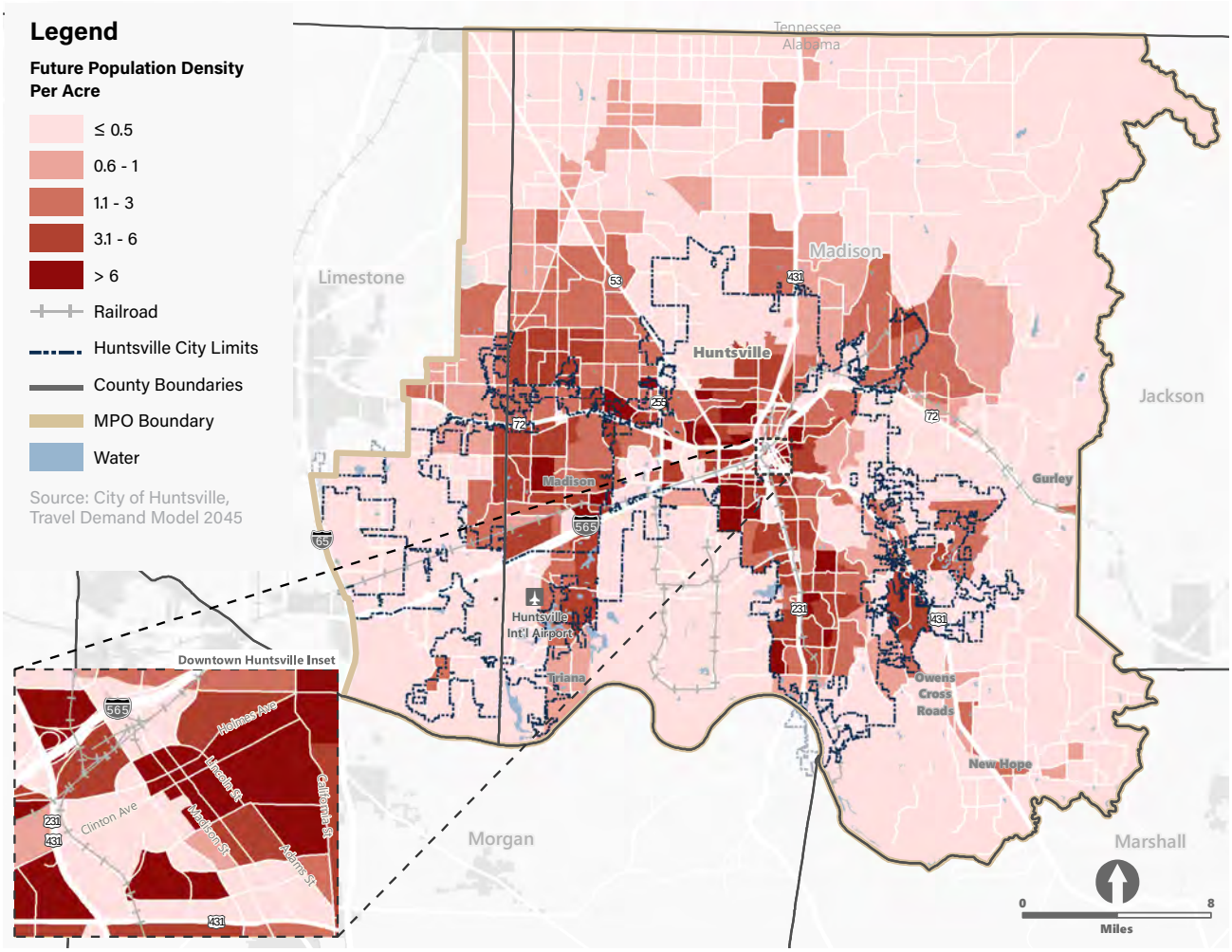


Figure 3-2 | Population Density 2045



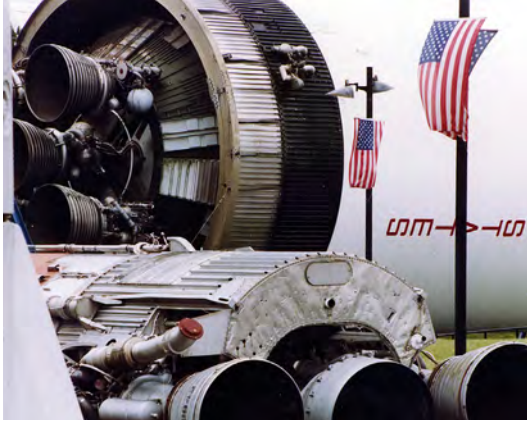
3.3 Employment Growth

Existing employment is mainly concentrated around the major corridors such as I-565, US 231, US 431, and US 72. Many of the MPO area's top employers also exist along these corridors, including Redstone Arsenal, Huntsville Hospital, and the NASA/Marshall Space Flight Center. **Table 3-1** summarizes the area's top employers by number of employees, with Redstone Arsenal as the region's largest employer (nearly 29,000 more employees than the second largest employer).

Table 3-1 | 2021 Leading Employers

Rank	Company	Industry	Employees
1	U.S. Army/Redstone Arsenal	Government	38,000
2	Huntsville Hospital	Health Care	9,352
3	NASA/Marshall Space Flight Center	Government	6,000
4	Huntsville City Schools	Education	3,000
5	The Boeing Company	Research and Development	2,900

Source: Huntsville/Madison County Chamber, April 2021



HUNTSVILLE
The Star of Alabama

Growing employers of note:

- **Huntsville Hospital**
- **The Federal Bureau of Investigation**
- **Toyota**
- **Mazda Toyota**

Mazda Toyota has hired about 1,600 people so far on its way toward meeting its obligation of 4,000 employees, which leaves **2,400 jobs** yet to be filled.

Employment in the MPO area is projected to grow between now and 2045. Extending beyond just the main thoroughfares of I-565 and US 231, employment growth is expected in Downtown Huntsville, to the west of Downtown Huntsville between US 72 and I-565, North Huntsville, the eastern portions of Limestone County, and the area surrounding the Redstone Arsenal.

Figure 3-3 | Percent Change of Employment from 2019 to 2045

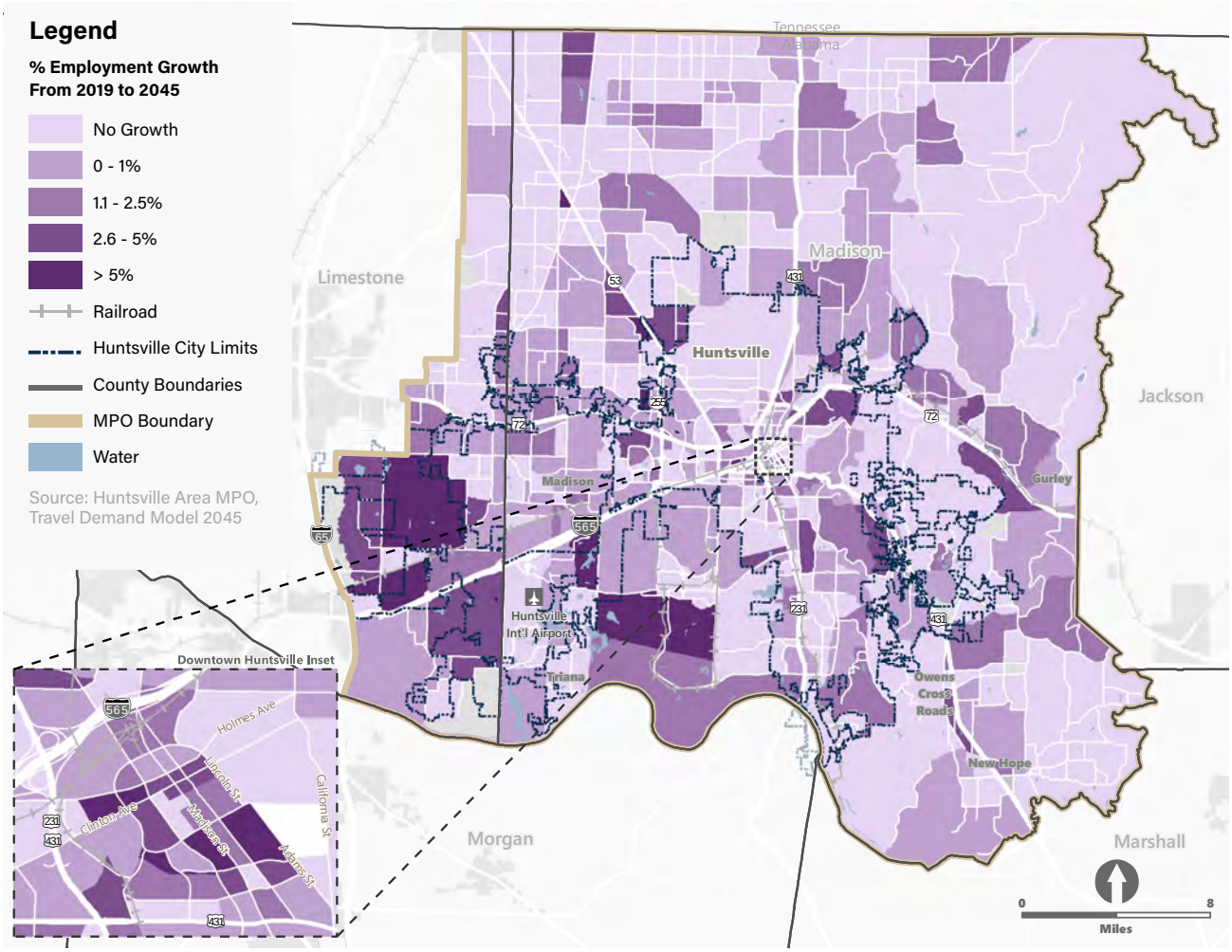
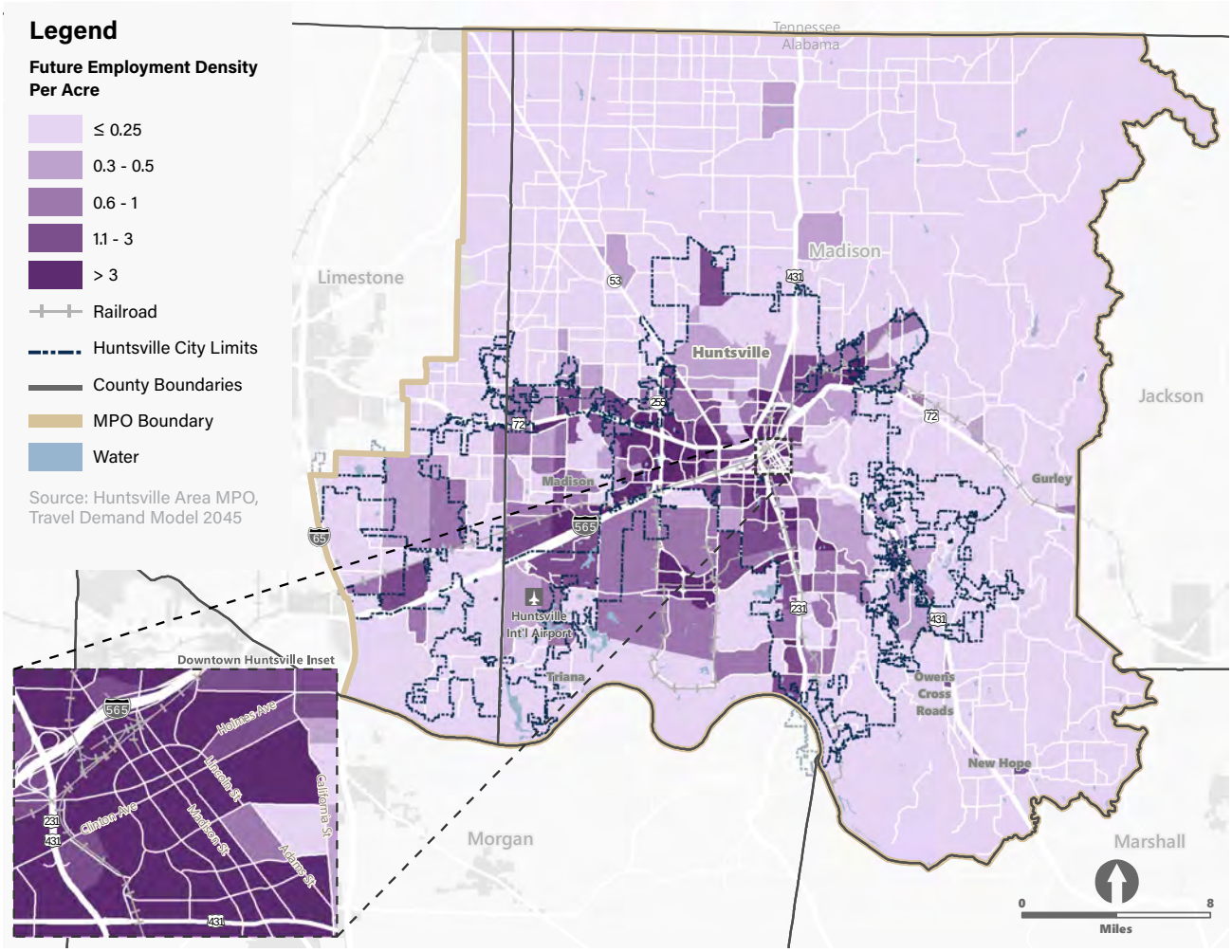


Figure 3-3 shows the projected employment growth from 2019 to 2045. Areas in Downtown Huntsville, north and east of the Huntsville International Airport, and southeastern Limestone County show the potential for the largest growth in employment through 2045. Though these areas expect higher employment growth rates than some other portions of the MPO area, it does not directly correlate to higher population density.

As depicted in Figure **3-4**, high employment density by 2045 is expected along US 72 West between US 72 West and I-565, south along US 231, and in and south of Downtown Huntsville.

Figure 3-4 | Employment Density 2045



3.4 Activity Growth

Activity is defined here as the combined population and employment for an area. It provides a quick measure of development for use in targeting transit investments. **Figure 3-5** shows the growth between 2019 and 2045. Growth is expected throughout most of the MPO area. Still, the largest growth projection is north of I-565 in the southeastern portions of Limestone County, where the Mazda Toyota Manufacturing plant is located. The area east of Huntsville International Airport and south of Redstone Arsenal, blocks in Downtown Huntsville, and the area along US 72 West are expected to experience significant activity growth. As with the population and employment growth maps, though these areas expect higher activity growth rates than some other portions of the MPO area, it does not directly correlate to higher activity density. As depicted in **Figure 3-6**, high activity density by 2045 is expected along US 72 West between Downtown Huntsville and the City of Madison, north of I-565, west of Highway 53, south along US 23, and in and around Downtown Huntsville.

Activity Growth:

Combined Population and Employment for an Area

Figure 3-5 | Activity Growth From 2019 to 2045

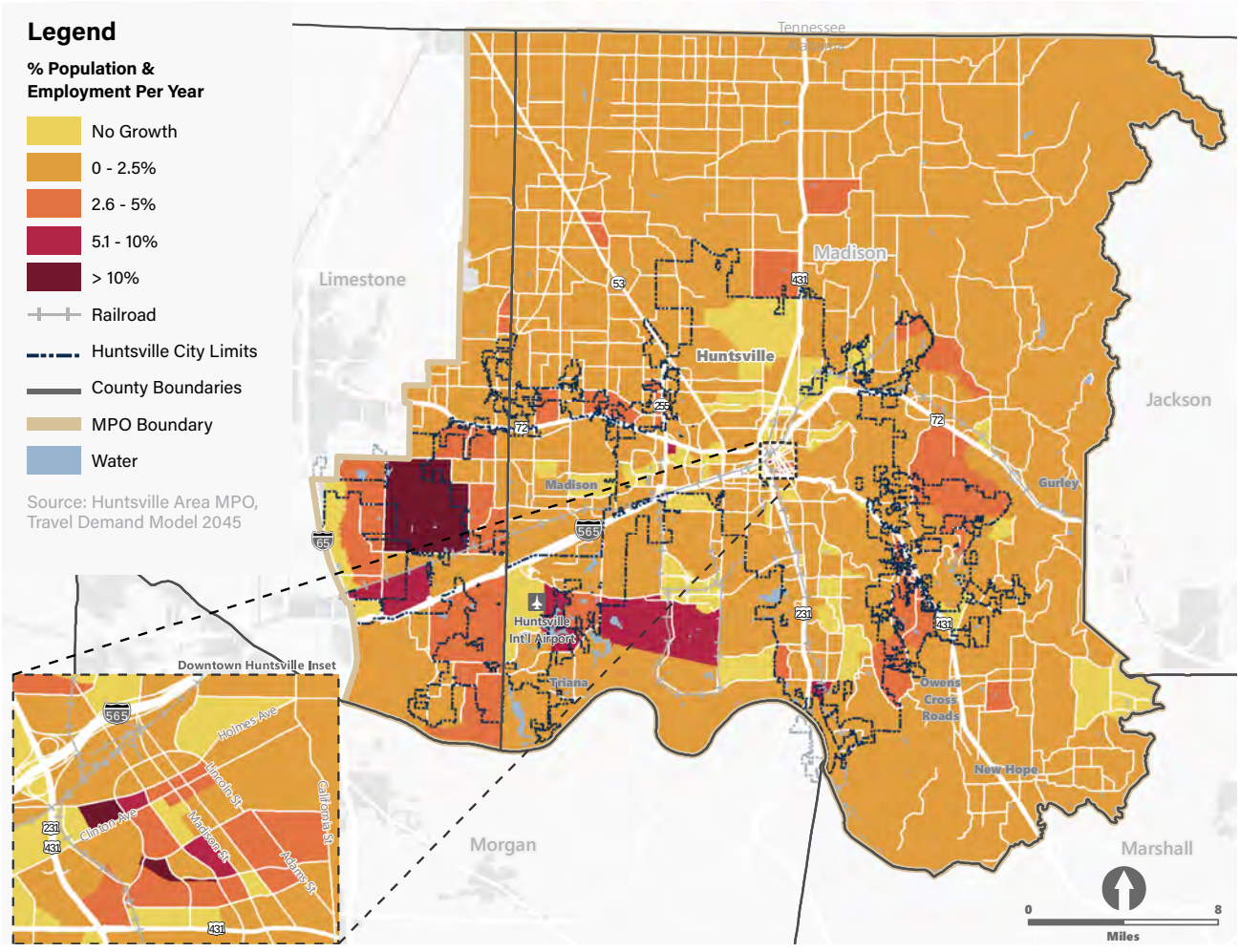
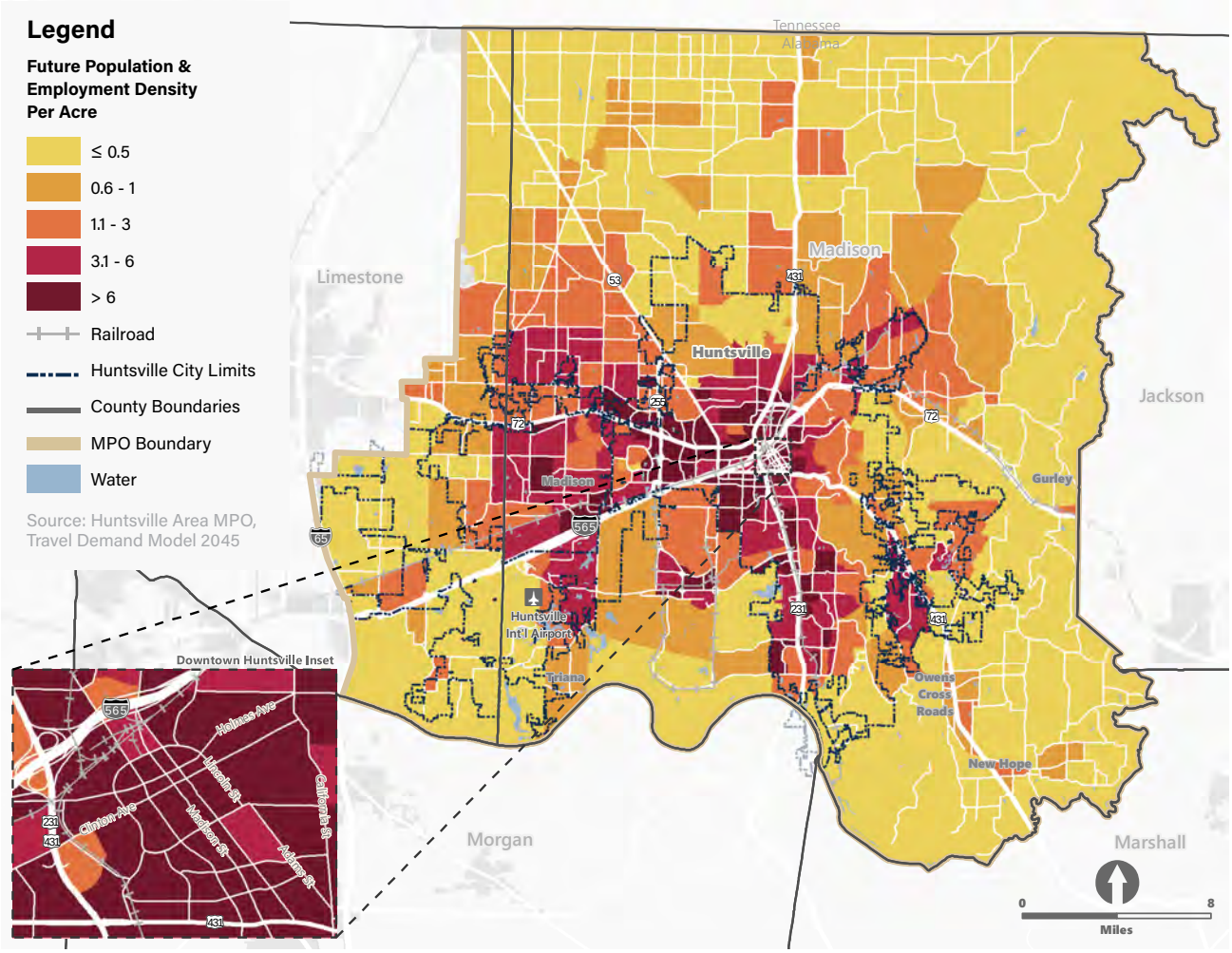


Figure 3-6 | Activity Density 2045



4.0

Future Transit Options

As described, the Huntsville region is anticipating activity growth throughout the area. The current transit system will need to evolve to match the anticipated growth. Planning for its evolution requires not only understanding where growth is anticipated, but understanding travel patterns and transit users as well.

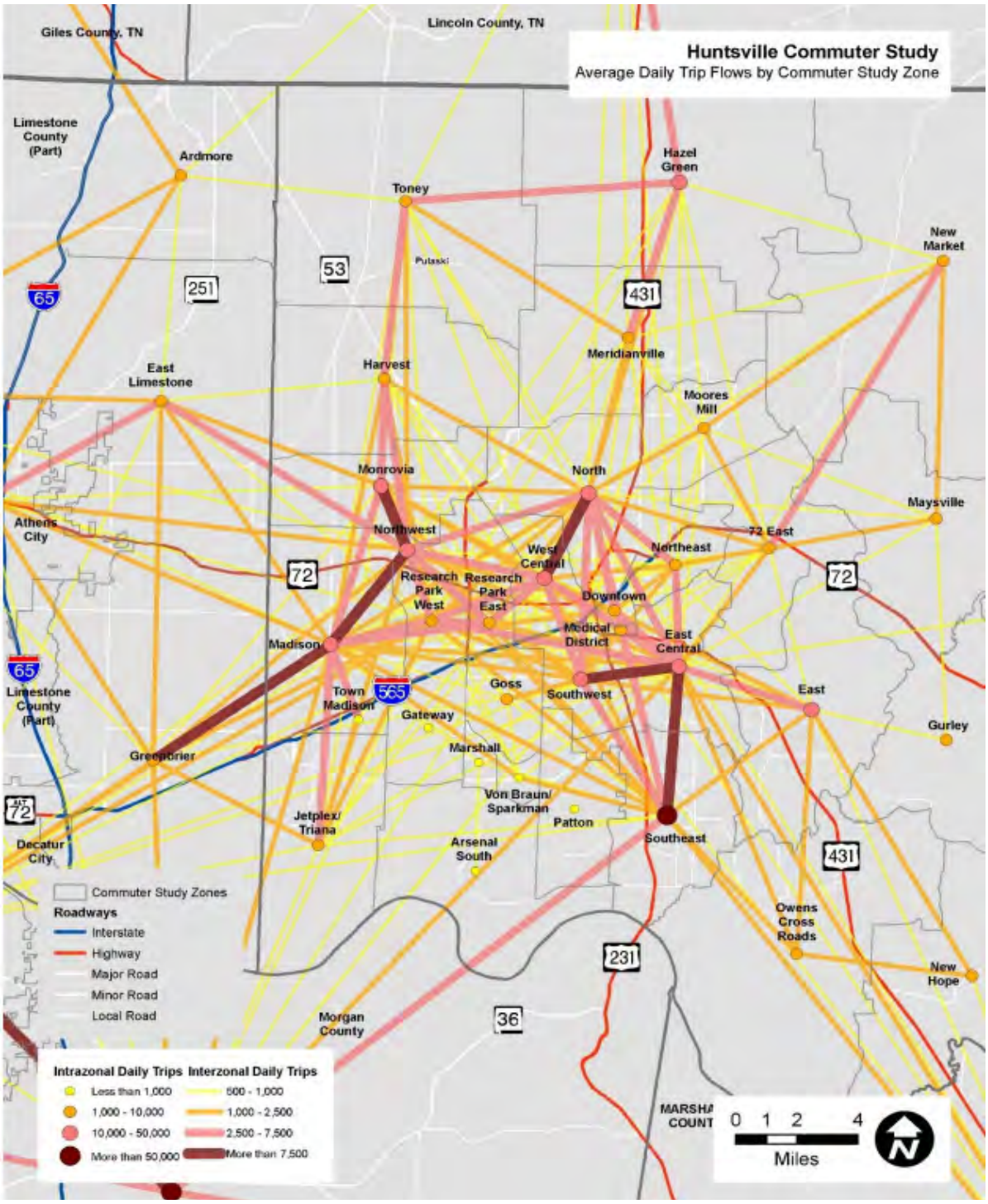
4.1 Commuting Patterns

In 2020, The Huntsville Area MPO conducted the Huntsville Area Regional Commuter Study. The study used traffic counting software, technologies, and data collected by StreetLight InSight to understand where and how people are commuting. In looking at average weekday traffic flows, the study found a predominant number of morning commuter trips into Huntsville occur between the following areas:

1. Greenbriar and Madison to the East Central and Southeast districts following I-565, US 72 West, Memorial Parkway South, and Governors Drive
2. Madison to Northwest and Monrovia via Research Park Boulevard
3. North district to West Central, Southwest, and Southeast districts primarily using Memorial Parkway.

Figure 4-1 shows the average weekday trip flows between origins and desitations within the MPO area. The map does not reflect corridors utilized, rather it shows where people are traveling between. Understanding where people are traveling is essential for identifying potential HCT transit corridors to ensure the service aligns with where people are traveling to and from.

Figure 4-1 | Average Daily Trip Flows by Commuter Study Zone



Source: Huntsville Area Regional Commuter Study (2020)

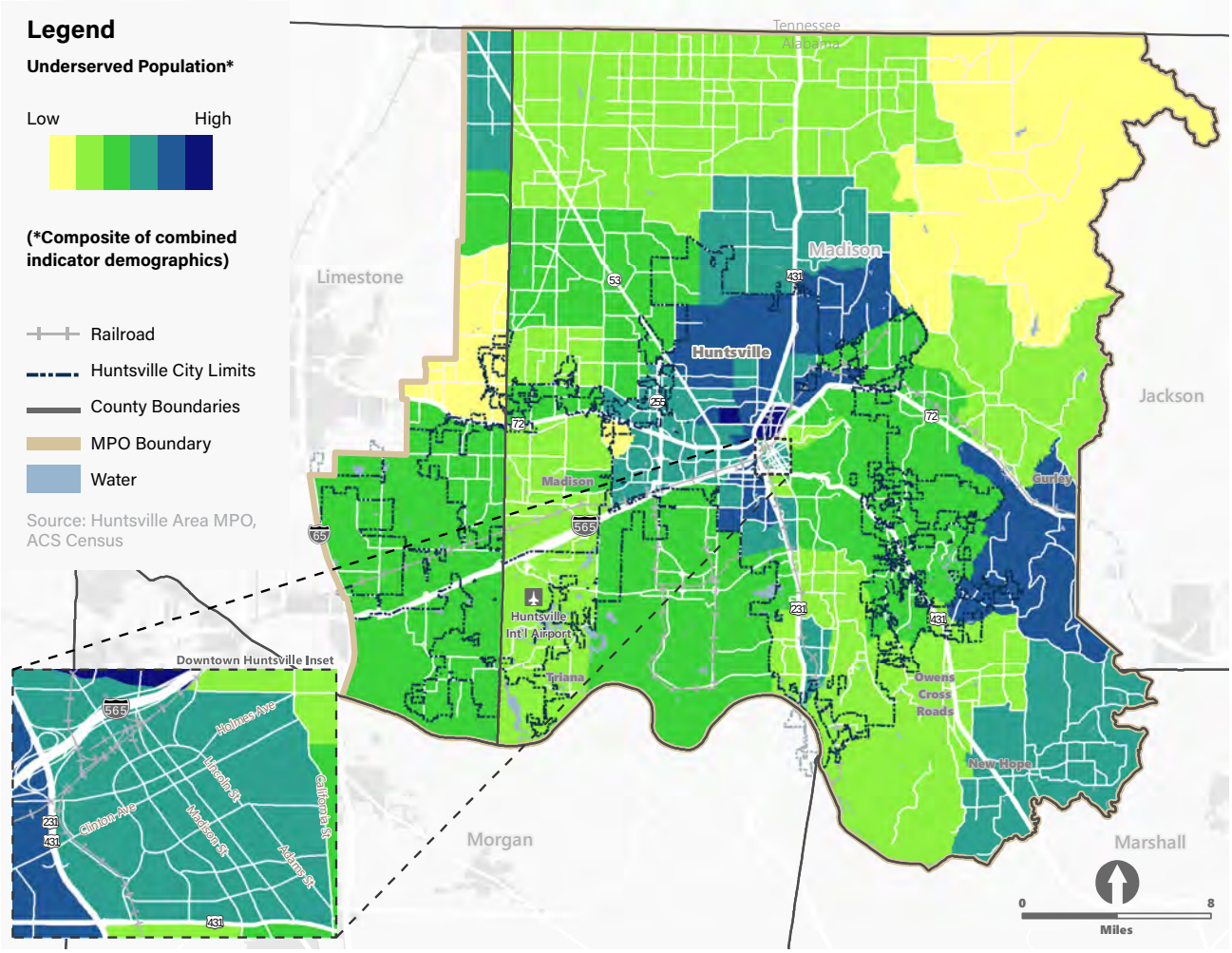
4.2 Transit Propensity

Factors driving transit ridership, such as race, vehicle ownership, disability, income, and age, were combined into a transit propensity index, as shown in **Figure 4-2**. This metric provides an overall measure of a population's likelihood to ride transit. In the Huntsville MPO area, the highest transit propensity areas lie in the City of Huntsville and in the southeastern part of Madison County. Within Huntsville, transit propensity occurs predominantly in the north, though it is also observed in its downtown, to the south along Memorial Parkway, and to the west between AL 53 and I-565. US 72 runs through the heart of this western area. The Gurley and New Hope areas in the southeast corner of the Huntsville MPO also show high transit propensity because the areas have low vehicle ownership and many low-income households. While transit is needed in the area, it has low population and employment density and does not forecast significant activity growth. As such, the area would not be a good candidate for high capacity transit at this time.

Transit Propensity:

An overall measure of a population's likelihood to ride transit

Figure 4-2 | Huntsville Area MPO Transit Propensity



4.3 Potential Transit Corridors

4.3.1 Initial Corridor Identification

Initial corridors were identified based on transit propensity, commuter patterns, activity density, regional connections, and major destinations (employment, higher education institutions, and activity centers). The initial list of corridors is presented in **Figure 4-3** and includes the following corridors:

- US 72 West
- US 72 East
- I-565 / Madison Blvd
- Memorial Parkway North (US 231/ 431)
- Memorial Parkway South (US 231)
- HCMRA Rail Corridor
- US 431 South / Governor's Drive
- Jefferson St / Washington St / Madison St / Whitesburg Dr
- Meridian St
- Holmes Ave / Bradford Dr
- Clinton Ave West / Triana Blvd
- Winchester Rd
- AL-53 Northwest
- AL-255 (Research Park Blvd)

Once the initial set of potential corridors was established, the corridors were screened against the stated goals for the HCT corridor. Criteria to advance any of the initial corridors were as follows:

Radial in Nature

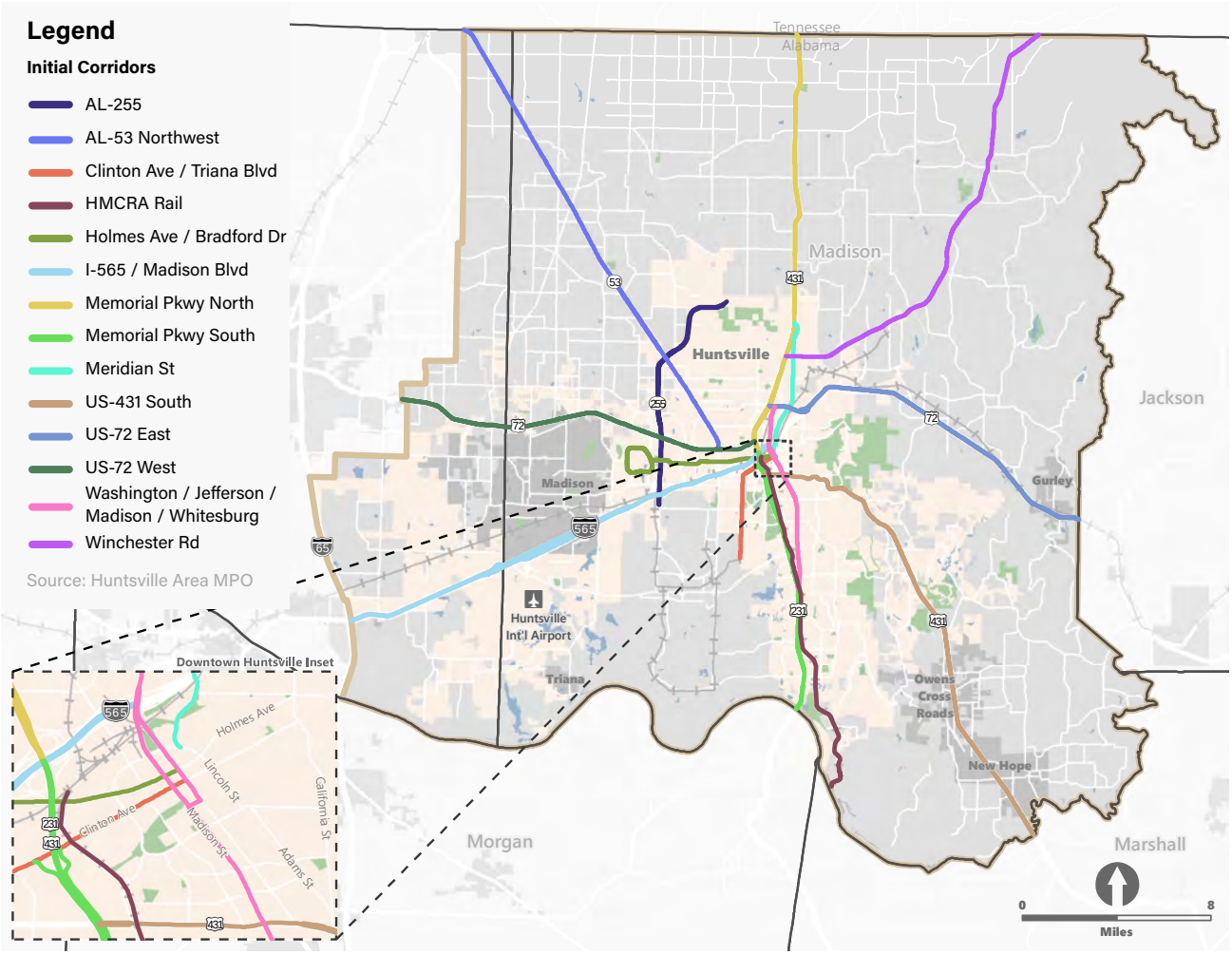
- The corridor needs to provide a direct connection to Downtown Huntsville. While bypass corridors can have significant travel demand and benefit from transit service, the premier HCT route should provide a central connection to the heart of the metropolitan area.

Existing Higher Development Intensity

- While momentum for growth occurs along the more rural alternatives, a strong initial ridership is important for the success of high-capacity transit. The premier HCT route should be in a "central" area from a development perspective.

Based on these criteria, five corridors were eliminated from further evaluation. AL-255 did not meet the radial in nature criteria, and US 431 South, Winchester Rd, US 72 East, and AL-53 Northwest were removed due to a lack of development density.

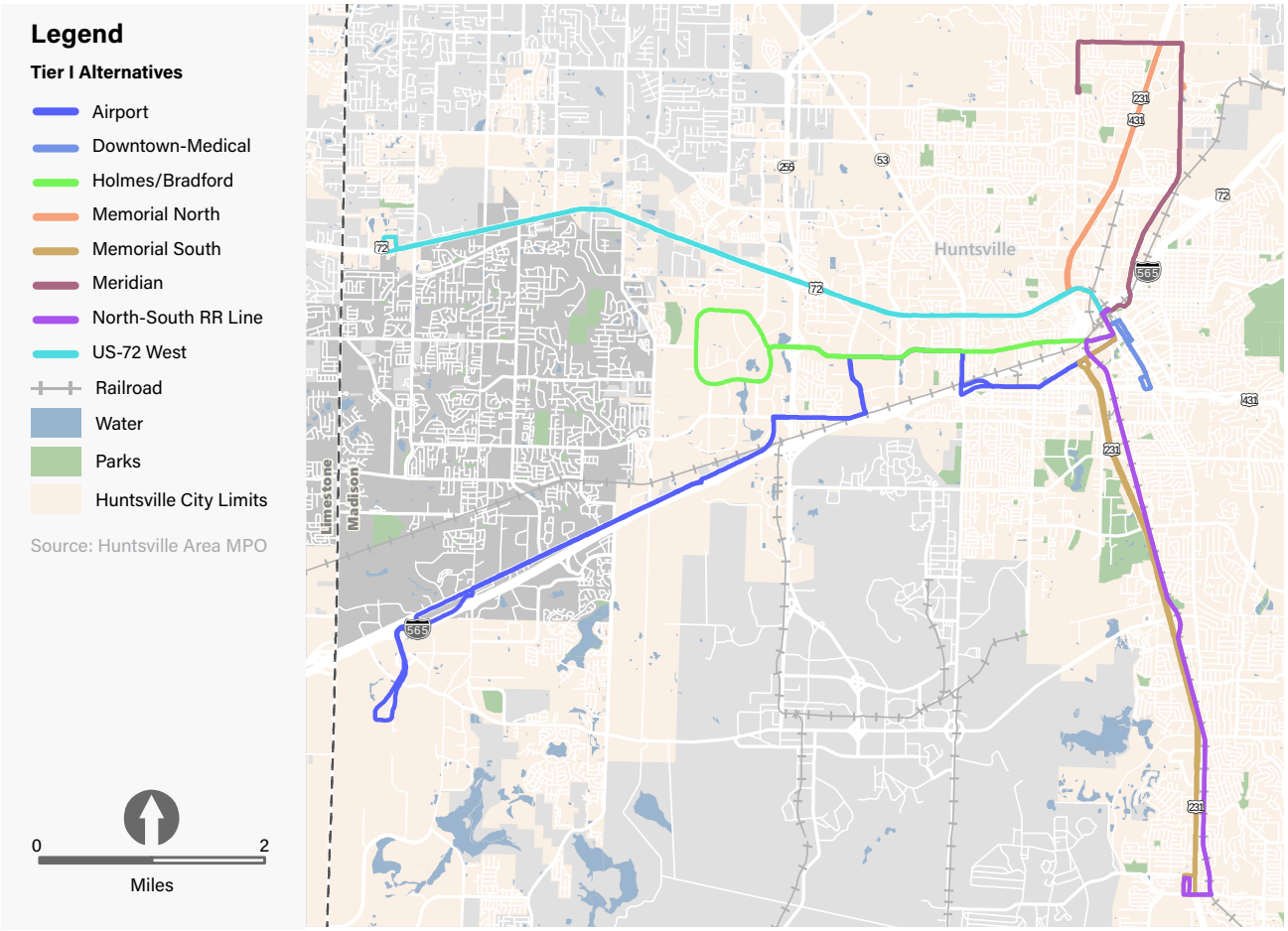
Figure 4-3 | Initial Corridors



4.3.2 Tier I Evaluation

Of the remaining nine corridors, the I-565/Madison Blvd and Clinton Ave corridors were combined into one alternative. As such, a total of eight corridor segments were advanced for further analysis. For each of these segments, a proposed transit route was drawn, and limits were defined. The corridors were analyzed individually, with the potential to combine corridors into a final route depending on performance and logical connections. The eight corridors are shown in **Figure 4-4**. All routes would begin at the Downtown Transfer Center.

Figure 4-4 | Tier I Alternatives



To evaluate the eight alternatives, a set of screening criteria was developed, as shown in **Figure 4-5**. Each alternative was given a raw number for each criterion, and the number was converted to a score of 1, 2, or 3. The conversion for each criterion was a mathematical calculation based on how the raw numbers ranked in relation to the other alternatives. The output number from 1 to 3 was rounded to the nearest integer. Each criterion was then weighted, and each alternative was given a score. The scoring is detailed in Appendix A.

Figure 4-5 | Tier I Screening Criteria

Support Multimodal Activity	Serve Diverse Travel Market Needs	Sustain Economic Competitiveness and Development
▶ Regional commuter corridors served ▶ Service to planned Park-n-Ride facilities ▶ Pedestrian bicycle access ▶ Traffic Volumes	▶ Population density ▶ Employment Density ▶ Service to major employers ▶ Transit propensity ▶ Service to colleges and universities	▶ Planned developments ▶ Activity centers & special generators ▶ Developable land

In addition to the evaluation, site visits and client input were also considered, and thus, the advancement process was holistic. Five alternatives were advanced. The three alternatives not advanced and the rationale for not advancing them are shown in **Table 4-1**.

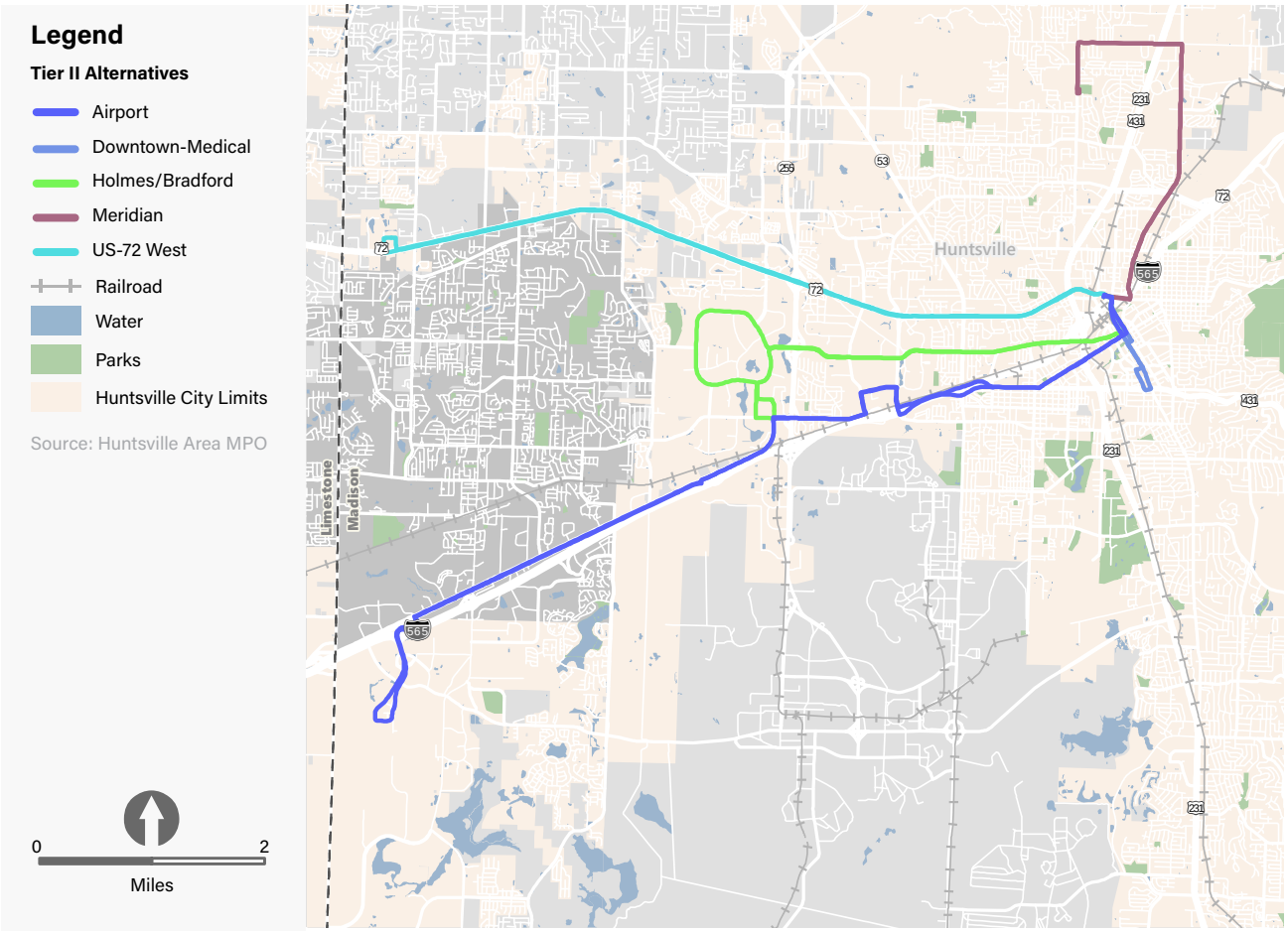
Table 4-1 | Alternatives Not Advanced

Eliminated Alternative	Rationale
Memorial Parkway North	Except for Memorial Parkway's interchanges, the express lanes are not grade separated from the local lanes. Thus, any HCT vehicle can only stop at interchanges, and crossing conditions between these interchanges would be perilous for riders accessing or egressing the vehicle. Additionally, the pedestrian infrastructure at interchanges and along the corridor is subpar and would require significant upgrades. The premier HCT route would benefit from a corridor with greater pedestrian accessibility.
Memorial Parkway South	
HMCRA North-South Railroad Line	Roadway alongside the rail corridor is limited. Use of the corridor for HCT would require coordination with HMCRA. Paving over the rails for BRT would create an additional challenge. Thus, it was not advanced for the premier HCT corridor.

4.3.3 Tier II Evaluation

The alternatives considered in the Tier II evaluation were further refined based on additional considerations. All alternatives were rerouted to end at the upcoming Downtown Transfer Station rather than the current one. This new station will be near the intersection of Pratt Ave and Church St. The Tier II alternatives and refinements are shown in **Figure 4-6**.

Figure 4-6 | Tier II Alternatives



To provide a more thorough evaluation of the five remaining corridors, the project team expanded the set of screening criteria to measure and compare corridors. Like in Tier I, Tier II alternatives for each criterion were initially given a score of 1, 2, or 3, reflecting a "low, medium, high" manner of evaluation. Scores were then given percentage weights. Each of the four broad categories were weighted equally at 25%. The revised list of criteria is outlined **Figure 4-7** and a complete list of screening criteria, units of measurement, and weights can be found in Appendix A.

Figure 4-7 | Tier II Screening Criteria

The top three performing alternatives are US 72 West, Airport-Madison Blvd, and Downtown-Medical. The US 72 West alternative's strong performance is due to its status as a regional commuter corridor, its service to planned developments and activity centers, and its strong positioning to provide fast, direct transit service. Notably, it is also along a planned expansion of UAH into what is presently the Executive Plaza Office Park. The Airport-Madison Blvd alternative shares similar strengths and would provide an important connection for residents and visitors between the Huntsville International Airport, the Bridge Street development, UAH, the Von Braun Center, and Downtown Huntsville. However, it does not have the developments and population density of US 72 West. Finally, Downtown-Medical's performance comes from its density, activity centers, and infrastructure to support multimodal activity. Additionally, with no transit route running for any significant length on Washington, Jefferson, or Madison Streets, a HCT route would be primed to serve that role. The two corridors not advanced and the rationale for not advancing them are shown in **Table 4-2**. Though not identified for HCT at this time, local investments to increase ridership could make these corridors viable for HCT in the future. Appendix B details the scores between the alternatives.

Table 4-2 | Alternatives Not Advanced

Eliminated Alternative	Rationale
Holmes-Bradford	Despite serving the Cummings Research Park, population and employment density along the corridor would not support a high capacity transit service at this time. This aligns with the relatively low transit ridership seen in the corridor. Additionally, there are limited opportunities for connections to other transit services.
Meridian	The Meridian corridor is unable to support multimodal activity at this time. There are limited pedestrian and bicycle facilities, high traffic volumes, and low existing transit ridership. There is also not as much right of way available to make the necessary improvements for a HCT service; however, the City has identified infrastructure and transit service improvements for the corridor, which could make it a more competitive candidate for HCT in the future.

4.4 Identified Corridors

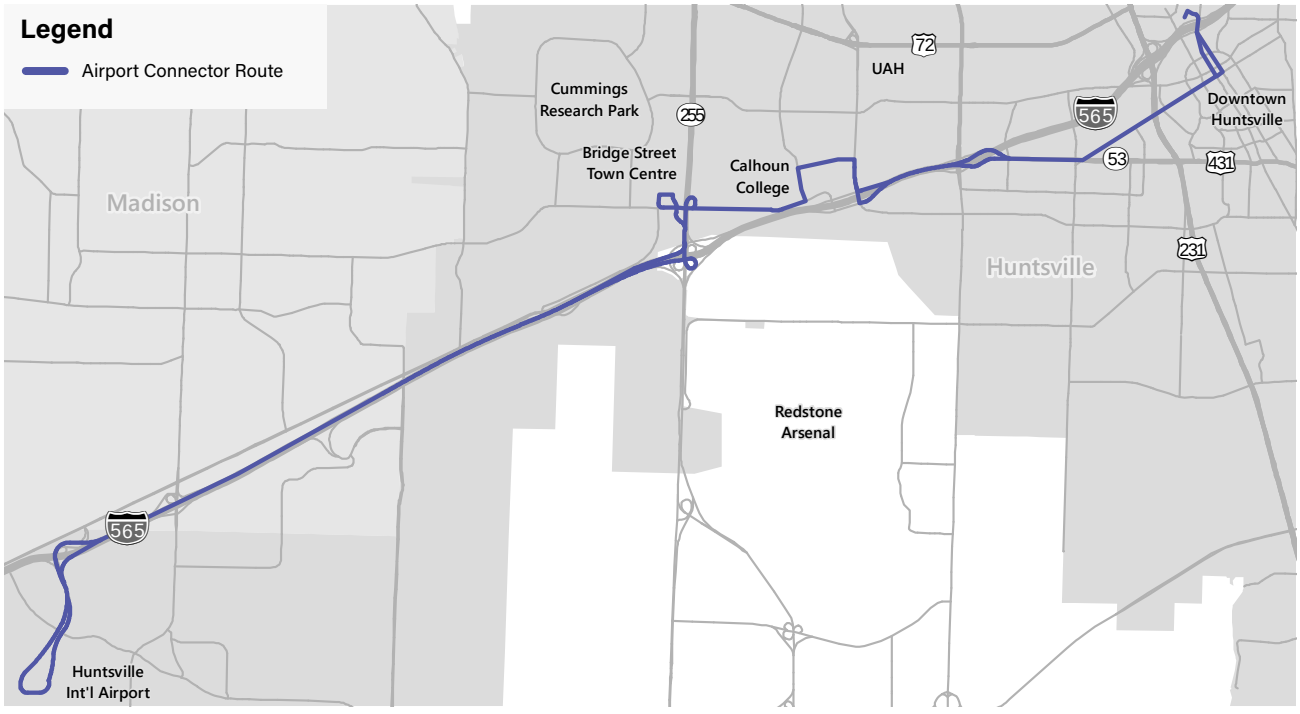
Based on the Tier I and Tier II evaluation, two transit corridors were identified for further exploration and refinement: the Airport Connector, and the US 72 and Medical corridors combined into one alternative, the 72-Medical route.

4.4.1 Airport Connector

Image Source: huntsville.org

The Airport Connector service has been identified to provide service from HSV to the new Downtown Transfer Center primarily using I-565. Major activity centers along the corridor include the Von Braun Center, the University of Alabama in Huntsville (UAH), and the Bridge Street Town Centre. A service on this corridor would provide important connections between the airport, major employment centers, higher education institutions, and Downtown Huntsville. The service would not only make business and tourism travel more convenient out of the airport, but would support the development investments being made along the corridor and in Downtown Huntsville (hotels, convention center, etc.). The corridor was screened to understand the appropriate mode (local bus, express service, BRT, etc.), as described in the next section, but initial recognition of corridor conditions suggested a tailored bus service to match airport flows, enabling the growth of the corridor's transit market until there is demand for more frequent service. **Figure 4-8** depicts the Airport Connector route alignment.

Figure 4-8 | Airport Connector Route



4.4.2 72-Medical

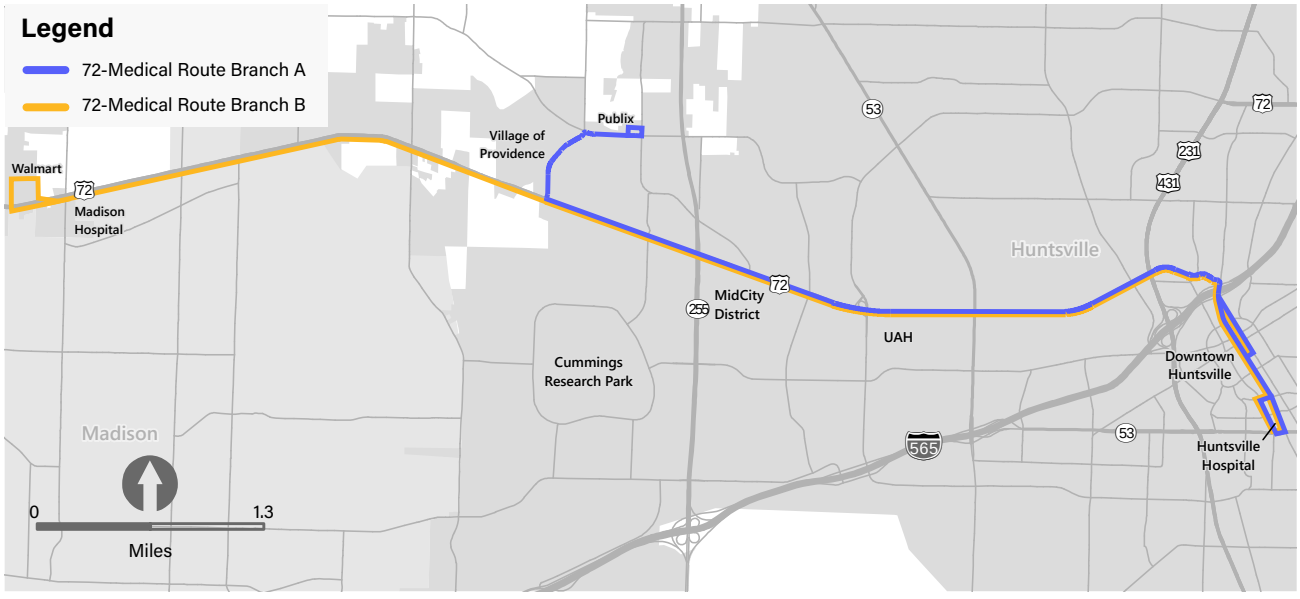
Image Source: huntsville.org

The combination of the US 72 West and Downtown Medical Corridor as the 72-Medical route has been identified as the top corridor with HCT potential. Service on the US 72 West portion of the alignment would be comprised of a trunk line between Downtown Huntsville and Providence Main Street with two branches from that point. One branch would serve the Village of Providence (Branch A) and terminate at the nearby Publix, while the other would extend west to the Walmart Supercenter at Balch Rd in Madison (Branch B). The trunk service will operate east of Providence Main St, serving the new Transfer Station at Pratt and Church, using southbound on Jefferson/Madison Streets and northbound Franklin/Washington Streets into the heart of Downtown, and terminating at Huntsville Hospital.

Image Source: huntsville.org

The route would support new and upcoming developments such as MidCity, Clift Farms, the Village of Providence, and the UAH northwest expansion. US 72 runs along the north side of UAH, which connects to Holmes Avenue and thus facilitates an extension of the Holmes Ave market. Relatedly, the trunk service would operate between the Village of Providence and Downtown Huntsville because there is more of an existing transit market there. The branch out to Madison would operate less frequently since current demand does not warrant a rapid service. However, introducing service out to Madison will begin building transit demand along that portion of the corridor and presents an opportunity for the expansion of the rapid system in the future. **Figure 4-9** depicts the 72-Medical route with its A and B branches.

Figure 4-9 | 72-Medical Route Alignment

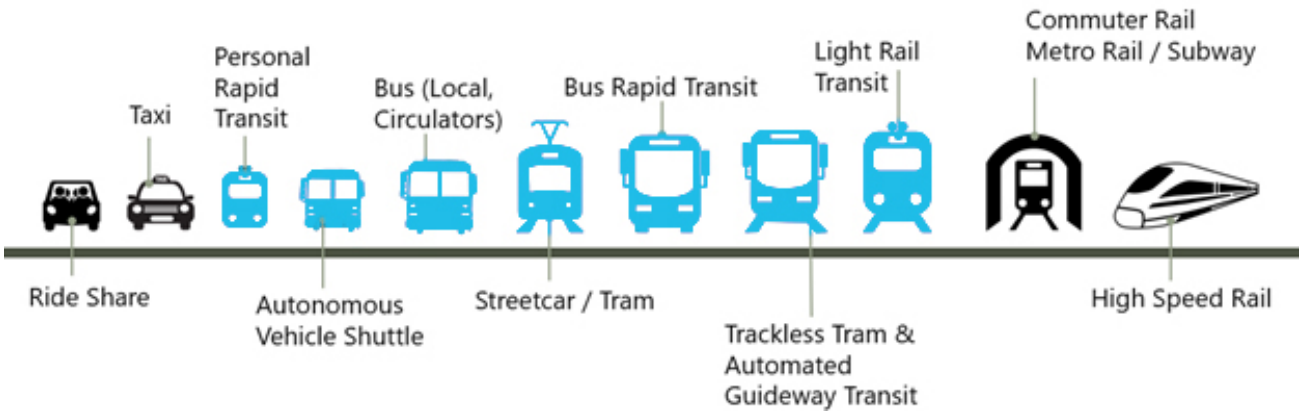


4.5 Technology Assessment

4.5.1 Potential Transit Modes

Within transit, there is a spectrum of technologies designed to meet different needs and serve different transit markets. While services such as ride share offer direct connections for patrons, they have minimal carrying capacity, are often used for short trips, and travel speeds are dependent on traffic conditions. On the other end of the spectrum, commuter and high speed rail can carry hundreds of people, traverse vast distances, and operate on a set schedule with more reliable speeds. In general, the spectrum of technologies range in carrying capacity, system accessibility, frequency, travel speed (reliability), and cost to implement. As it pertains to identifying a mode for the identified corridors, carrying capacity (meeting and planning for demand) and cost to implement were key considerations, though other factors were evaluated, as described below. **Figure 4-10** depicts the spectrum of transit technologies with the seven modes evaluated depicted in blue.

Figure 4-10 | Spectrum of Transit Technologies



While seven modes were evaluated, the three primary modes under consideration were bus rapid transit (BRT), light rail transit (LRT), and streetcar. A description of these modes is listed in **Table 4-3**, with a full list of modes evaluated described in Appendix C.

Table 4-3 | Premium Transit Technologies

Mode	Average Passenger Capacity (per car)	Average Capital Cost Per Mile	Service Area	Average Service Range	Average Distance Between Stops
 **Bus Rapid Transit (BRT)**	40-60	$4M to $36M	Regional Suburban Urban	10 - 25 miles	0.5 - 2 miles
 **Light Rapid Transit (LRT)**	60-175	$80M to $100M	Regional Urban	10 - 20 miles	1 mile
 **Streetcar**	30-100	$5M to $50M	Urban	1 - 7 miles	0.25 - 0.5 miles

4.5.2 Tier I Evaluation—Meeting Contextual Needs

To determine the most appropriate vehicle technology, it is important to understand the operating environment and transit markets served. While each area served is unique, the contrasts of the corridor can be simplified to the following: **principal arterial** and **town center**.

4.5.2.1 Principal Arterial

US 72 West is a principal arterial connecting the western suburbs to the Downtown Huntsville area, as depicted in **Figure 4-11**. A successful HCT route on this corridor would have the following characteristics:

- **High speed travel.** To maintain improved travel times, longer distances between stops are necessary. Vehicle's speed will need to be comparable or improved relative to corridor general traffic.
- **Maneuverability.** While a comprehensive crash analysis is beyond the scope of this study, City-data.com shows a high incidence of crashes along the U.S. 72 corridor. Given the speed of the corridor, transit vehicles will need to maneuver quickly around obstructions. If curbside transit lanes are constructed, the transit vehicle may experience obstacles such as vehicles turning right, vehicle breakdowns, crashes, and police pullovers. In such instances, it is important for the transit vehicle to be able to maneuver quickly the disturbance.
- **Expandability.** In the long term, there is the potential to extend the HCT line further west. A mode that can do this easily is advantageous.

Figure 4-11 | Principal Arterial Context – US 72

4.5.2.2 Town Center

The 72-Medical route would operate in three town center environments: Downtown Huntsville, the Medical District, and the Village of Providence. In the town center environments, as depicted in **Figure 4-12**, HCT should have the following characteristics:

- **Ability to operate in mixed traffic.** The right-of-way is constrained, such that adding a transit lane may not be feasible without repurposing space.
- **Small turning radius requirements.** The vehicle will need to make turns in an environment with smaller corner radii.
- **Routing flexibility.** The vehicle would be operating on main streets that may close at times for street parades, festivals, or utility work. The ability for the vehicle to take a different route easily would be advantageous in this context.
- **Slightly closer stops.** In areas where population and employment density are greatest, it is appropriate to site stops slightly closer together to improve passenger convenience

Figure 4-12 | Town Center Context – Downtown Huntsville (Washington St & Clinton Ave)

4.5.2.3 Tier I Evaluation: Meeting Contextual Needs

Table 4-4 shows an evaluation of transit modes with respect to the contextual assessment criteria. BRT is the only mode meeting all criteria. Trackless tram and AV shuttle are also strong performers, though neither can travel at the high speeds needed for the US 72 corridor, and trackless tram would not meet the turning radius requirements in Downtown. With an AV shuttle, several of its capabilities are theoretically possible but are presently limited as a proven technology. For example, when operating in mixed traffic, AV shuttles may show hypersensitivity and stop with high frequency. Light rail may be the most sensible conventional mode next to BRT, but has limited maneuverability and is more difficult to expand. The investment would need to be justified in terms of ridership demand.

Table 4-4 | Contextual Evaluation of Technologies

	BRT	LRT	Streetcar	AV Shuttle	Trackless Tram	Automated Guideway Transit	Personal Rapid Transit
Principal Arterial							
High speed capable	✅	✅	❌	❌	❌	✅	✅
Maneuverability	✅	❌	❌	🟡	✅	❌	🟡
Expandability	🟢	🔴	🔴	🟢	🟢	🔴	🔴
Town Center							
Mixed traffic capable	✅	🟡	✅	🟡	✅	❌	❌
Small turning radius	✅	❌	❌	✅	❌	❌	✅
Routing flexibility	✅	❌	❌	🟡	✅	❌	🟡

Key: ✅ Yes ❌ No 🟢 Easy 🟡 Limited 🔴 Difficult Evaluated But Not Primary Contenders

4.5.3 Tier II Evaluation: Pricing

The infrastructure investment required for LRT is more costly to implement than BRT, as shown in **Table 4-5**. This table presents the average costs per mile to implement LRT and BRT, based on an evaluation of other US cities that have implemented LRT and BRT. The large range in costs for both systems stems from any one or a number of the following elements based on the system configuration: right-of-ways, need for vehicles with left-side boarding, the amount of signal upgrades, and the extent of utility relocation work. This highlights the economics to default to BRT unless the projected ridership would exceed its capacity.

Table 4-5 | Costs between BRT and LRT

Mode	Average Capital Cost Per Mile (estimated from other LRT/BRT US cities)
BRT	$4M to $36M
LRT	$80M to $100M

4.5.4 Tier III Evaluation: Capacity and Passenger Flow Analysis

BRT and LRT are the two modes that are high-speed and capable of mixing in traffic. LRT, however, would be costlier and carry significantly more restrictions than BRT. To justify LRT, the expected ridership would need to exceed the capacity of BRT. Passenger capacity per hour is a product of capacity per vehicle and frequency per hour. For the purpose of this evaluation, frequency is held constant at 15-minute headways. The resulting hourly capacities are shown in **Table 4-6**.

Table 4-6 | Passenger Per Hour Capacities at 15-Minute Headways

Bus Rapid Transit (BRT)			Light Rail Transit (LRT)			
Standard	**Articulated**	**Bi-Articulated**	**1-Car**	**2-Car**	**3-Car**	**4-Car**
238	544	918	425	850	1,275	1,700

4.5.4.1 Stop-Level Ridership

Existing ridership from stop-level data related to the 72-Medical route was computed via the method outlined by the Federal Transit Administration (FTA) for New Starts and Small Starts grant warrants. Routes 1, 4, 5, 6, 9, 10, and 11 overlap enough of the 72-Medical line's quarter-mile buffer that part of their ridership can counted toward corridor ridership. Routes 4, 5, and 6 provide significant overlap, and therefore, ridership entering the corridor is counted in addition to boardings within the corridor. For the other routes, only boardings within the corridor are counted. Ridership is shown in **Table 4-7**.

The total hourly ridership for the corridor is approximately 89, which is significantly below the hourly capacity of 238 for a standard bus. Based on these ridership numbers, a rapid service using a standard 40' bus would meet the corridor's needs. However, it is expected a new HCT route would induce a greater ridership per revenue hour than the existing system. Larger buses could be purchased in anticipation of the future transit demand growth or could be purchased later once demand is proven. If the system is implemented with 40' buses, stop improvements should be designed with 60' buses in mind to proactively plan for system growth.

Table 4-7 | Existing Corridor Ridership

Route	Riders Entering	Riders Boarding	Total Weekday Ridership	Hourly Ridership
1	N/A	207	207	14
4	130	492	622	42
5	60	121	181	12
6	37	55	92	6
9	N/A	154	154	10
10	N/A	71	71	5
Total	**227**	**1,100**	**1,327**	**89**

4.5.5 Final Technology Selection

As the Huntsville metropolitan area is in the early stages of building a strong transit market, bus transit technologies have been identified as the most appropriate modes for both the 72-Medical and Airport corridors. A limited stop express bus service is identified for the Airport route connecting the Huntsville International Airport to Downtown Huntsville primarily using I-565. An express bus would support the growth a transit market which could lead to demand for a more rapid service in the future; in the interim, an express service that can be easily implemented would provide an important connection between the airport and Downtown Huntsville and the many activity centers between the two. BRT is identified as the appropriate technology for the 72-Medical alignment given the existing and future activity density within the corridor and existing ridership levels. Implementing BRT is also more cost-effective and more flexible to expand than rail.

BRT is also a flexible technology and can be designed and implemented in such a way to act as a precursor to rail investments should the transit market demand a higher capacity mode. However, the current focus of these HCT lines is to identify corridors suitable for transit today, and which can be low-cost and easy to implement; convenient and efficient alternatives to personal automobiles are needed to shift the region's travel patterns in a proactive way.

BRT Example

5.0

Funding – FTA Capital Investment Grants

The Capital Investment Grant (CIG) program structure includes New Starts, Small Starts, and Core Capacity categories, described in **Table 5-1**. While there are a set of criteria used to rate each project, projects meeting the Project Warrants Justification capital cost and ridership thresholds outlined in **Table 5-2** can pursue an expedited implementation timeline. For each class listed in the table, both columns must be met. Within these categories, the Huntsville 72-Medical corridor should position itself to pursue the Project Warrants Justification track within the Small Starts program. More on the CIG program can be found online at transit.dot.gov[2].

Table 5-1 | FTA CIG Categories

New Starts	Small Starts	Core Capacity
Fixed guideway > $400 million or seeking ≥ $150 million in CIG funds	Fixed guideway or corridor-based BRT < $400 million and seeking < $150 million in CIG funds	Expands capacity by ≥ 10% in an existing fixed guideway corridor that is at capacity today or will be in five years

Table 5-2 | FTA Small Starts Project Warrants Justifications

Class	Total Proposed SS Project Capital Cost	Existing Weekday Transit Trips in the Corridor
1	$0 < $50 million	3,000 or more
2	$50 < $100 million	6,000 or more
3	$100 million < $175 million	9,000 or more
4	$175 < $240 million	12,000 or more

5.1 Huntsville & CIG

To understand where the 72-Medical corridor stands as it relates to competing for CIG funding, the FTA ridership calculation methodology[3] was used to calculate corridor ridership. The calculation is primarily based on stop-level activity in the desired project corridor, but some parallel routes stop activity can also be counted.

In total, the 72-Medical corridor had 1,327 average weekday riders in the corridor based on 2019 ridership data. As existing routes do not extend as far along US 72 as the proposed corridor does, the system's average passengers per mile was used to estimate a range in ridership for the new service area. Using this approach, the new service to Madison is expected to have 400-560 average weekday riders, putting the corridor total between approximately 1,730 and 1,890 average weekday boardings. This falls short of the 3,000 average daily boardings (ADB) required to seek Small Starts Project Justification Warrants.

A high-level ridership sensitivity analysis was conducted and showed that if HCT service levels were implemented in the corridor, the corridor would be short a few hundred riders to qualify for CIG Warrants. The ridership estimates also align with the technology selection, as BRT capacities would be able to meet expected demand. Notably, the sensitivity test did not reflect changes in land use that are occurring along the corridor, nor does it reflect how service improvements such as span of service or improvements to other routes could complement and enhance the ridership projections. The combination of land use and other service improvements should be explored as a follow up to this study. Details of the ridership sensitivity analysis can be found in Appendix D.

2 https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FAST_Updated_Interim_Policy_Guidance_June%20_2016.pdf

3 https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/Warrants_New_Small_Starts_June%202016_Final.pdf

6.0

Operating Scenarios

A range of service frequencies were examined to understand potential operating costs and vehicle needs. Operating costs were calculated using Orbit's 2019 actual operating costs, inflated to 2022 dollars. The 72-Medical corridor operating scenarios were based on FTA guidance and the Airport Express service options were developed to balance cost efficiency with service convenience.

6.1 72-Medical BRT

As described, the HCT line would have two operating patterns: one line that serves the Village of Providence, and one that serves the Madison Walmart at Balch Rd. The patterns would alternate such that frequent service is provided from US 72 and Providence Main St to the Downtown Huntsville Medical Center; the stretch of the corridor with frequent service is referred to as the trunk. The branch service to Madison Walmart would operate less frequently.

For the 72-Medical corridor to compete for federal funds, it must adhere to the definition of a corridor based project. Corridor based projects:

1. Do **not** require dedicated transit lanes
2. Have defined stations with route information
3. Provide faster travel times compared to normal bus
4. Have a 14 hour operating span on weekdays (weekend service not required)
5. Have 15 minute or faster all-day service or 10 minute or faster peak frequency with 20 minute off-peak
6. Must be a branded service

Given the FTA criteria, weekday operating scenarios using 10-, 12-, and 15-minutes headways for the trunk of the 72-Medical corridor were explored. This would result in 20-, 24-, or 30-minute headways on the branch to the Madison Walmart. These frequencies would be the "all-day" frequencies. When transit demand is lower during the early morning and late night hours, "shoulder" frequencies were assumed; the shoulder frequencies assumed were double the "all-day" frequencies.

Additional assumptions were made for the operating speed, span of service, and number of annual operating days. Since Route 4 is the main route operating in the HCT corridor, operating speed was calculated by averaging Route 4 travel time (using the posted schedule and distance between stops) in the US 72 and downtown corridors. Finally, while weekend service is not required to receive federal funding, industry best practice is to offer service seven days a week on premium lines so Saturday and Sunday service were included in the calculations. Weekend service was assumed to have a shorter span and lower frequency than weekday service. There are also more Sunday days of service than there are annual Sundays, but it was assumed several holidays would operate a Sunday level of service. An overview of scenario assumptions and cost estimating methodology is provided in Appendix E.

Costs were estimated using Huntsville's actual 2019 operating costs adjusted for inflation to 2022 dollars ($4.30/mile and $70/hour). Under these assumptions, annual operating costs range from approximately $1,412,000 to $3,177,000 on a per revenue hour basis and between $1,358,000 and $3,055,000 on a cost per vehicle mile basis, as outlined in **Table 6-1**. For comparison, the cost to operate service at the baseline thresholds established by FTA (15-minute all-day service, 14-hour span of service, weekend service not required) are provide as well.

Table 6-1 | Annual 72-Medical Operating Costs (2022 dollars)

	Days of Service	Vehicle Needs	Weekday Frequency (All-day / Shoulder)	Annual Cost per Rev Hour Basis	Annual Cost per Vehicle Mile Basis
Scenario 1	365	6	10 / 20	$3,177,045	$3,054,699
Scenario 2	365	5	12 / 24	$2,571,271	$2,472,253
Scenario 3	365	4	15 / 30	$2,074,463	$1,994,577
FTA Baseline	255	3	15 / 15	$1,412,657	$1,358,256

6.2 Airport Express Bus

The Airport Express Bus is proposed to operate as a limited stop service along I-565 from Huntsville International Airport to Downtown Huntsville. Major activity centers along the corridor include the Von Braun Center, the University of Alabama in Huntsville (UAH), and the Bridge Street Town Centre. Since the Airport Express service is not identified for HCT, the operating scenarios reflect that of an all-day limited stop service. To effectively compete with private ride-hailing services, however, the service has to provide some degree of convenience so three scenarios were explored: 20-, 24-, and 30-minute headways.

As with the 72-Medical route, operating speed, days of service, and span of service were held constant; these assumptions and details of the methodology are provided in Appendix F.

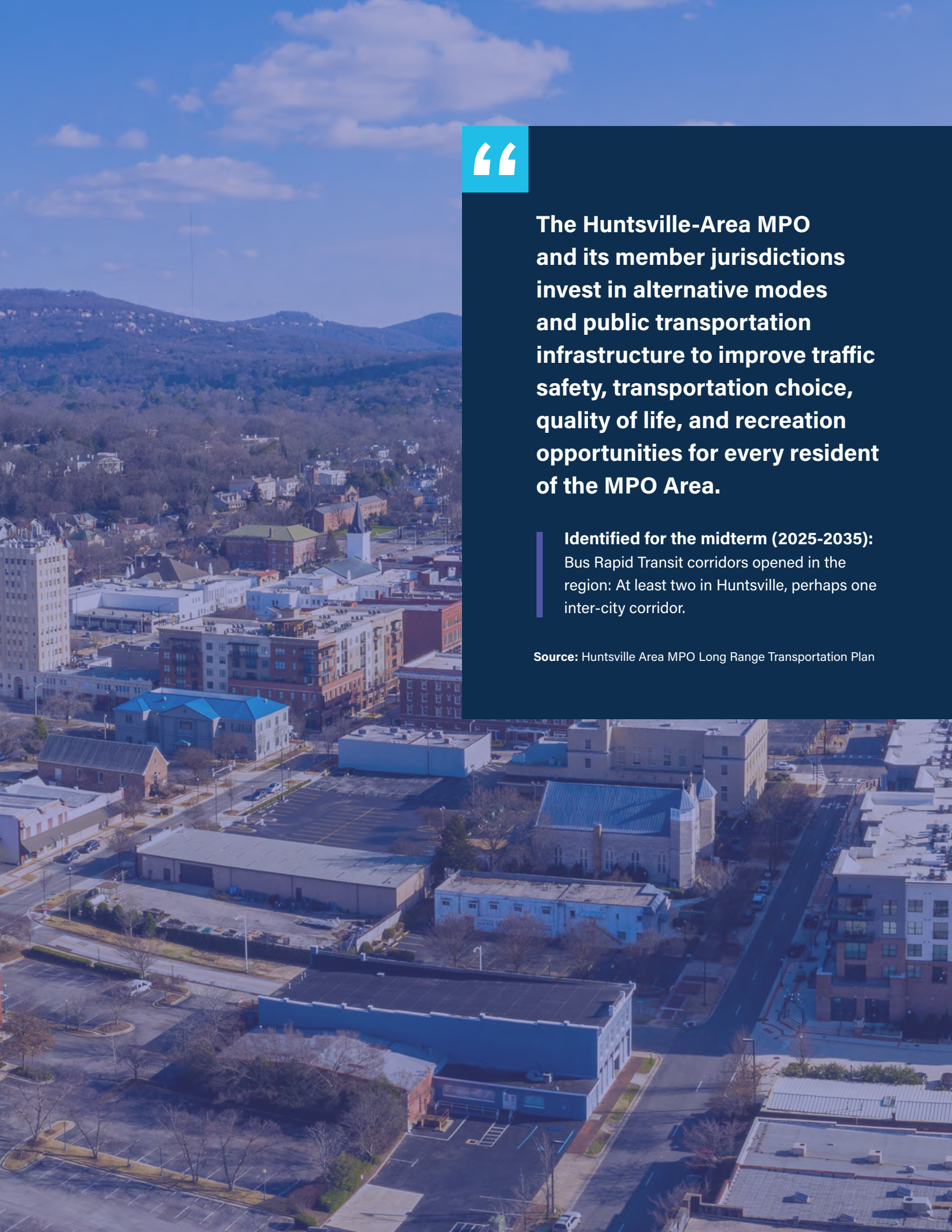
Costs were projected once again using Huntsville's actual 2019 operating costs adjusted for inflation to 2022 dollars. Under these assumptions, annual operating costs range from approximately $591,000 to $886,000 on a per revenue hour basis and between $1,578,000 and $2,367,000 on a cost per vehicle mile basis, as outlined in **Table 6-2**. Capital costs for this service would be negligible and would be limited to additional bus shelters and information that could be drawn from the existing transit capital budget.

Table 6-2 | Annual Operating Costs (2022 dollars)

	Days of Service	Weekday Frequency (All-day / Shoulder)	Annual Cost per Rev Hour Basis	Annual Cost per Vehicle Mile Basis
Scenario 1	365	20 / 40	$886,099	$ 2,366,600
Scenario 2	365	24 / 60	$723,821	$1,933,186
Scenario 3	365	30 / 60	$590,733	$1,577,733

The large discrepancy in the cost per revenue hour estimate compared to the cost per vehicle mile estimate stems from the 50 mph assumed operating speed, because it would primarily operate on I-565. This assumed speed is significantly faster than the system average operating speed, which is likely between 10-14 mph[4]. The cost per vehicle mile is a much more realistic operating cost estimate for the Airport Express compared to the cost per vehicle revenue hour estimate.

4 https://cityobservatory.org/urban-buses-are-slowing-down/#:~:text=This%20gives%20us%20a%20single,mph%2C%20or%20about%206.6%25



The Huntsville-Area MPO and its member jurisdictions invest in alternative modes and public transportation infrastructure to improve traffic safety, transportation choice, quality of life, and recreation opportunities for every resident of the MPO Area.

Identified for the midterm (2025-2035): Bus Rapid Transit corridors opened in the region: At least two in Huntsville, perhaps one inter-city corridor.

Source: Huntsville Area MPO Long Range Transportation Plan

7.0

Stops Spacing and Siting

Stop spacing and siting are important system elements that can influence the accessibility, efficiency, and safety a transit service. Stop spacing needs to balance accessibility and travel speed and siting should align with the surrounding built environment.

Stop spacing should be determined based on the goals for the route. For example, local routes should have stops placed more closely together to increase accessibility to the network. Doing so comes at the price of travel speed, however, so rapid lines should have further distance between stops. Stops should also be placed closer together in areas where passengers are going short distances, such as in dense urban cores, and stops on principal arterials should have further apart. Depending on the context, stop spacing should be between 0.2 and 0.5 miles apart[5, 6].

A bus stop can be located at the near side of the intersection, the far side of the intersection, or at mid-block locations. In general, far side stops are preferable because they allow the highest priority to transit operations at most signalized intersections; however, other types of stops may be justified in certain situations. **Figure 7-1** through **Figure 7-3** depict near side, mid-block and far side bus stop locations.

Initial stop locations have been identified for the 72-Medical corridor. The initial stop location identification was based on standard spacing, sounding land uses, and major activity centers. This was completed as a high-level exercise and does not identify stops as curb running or median running. Stop locations will need further analysis and refinement as a next step toward implementation. **Figure 7-4** and **Figure 7-5** depict the draft stop locations.

5 https://www.transit.dot.gov/research-innovation/stops-spacing-location-and-design

6 https://nacto.org/publication/transit-street-design-guide/transit-system-strategies/network-strategies/from-stops-to-stations/

Figure 7-1 | Far Side Bus Stop at University Dr and Meadow Dr

Figure 7-2 | Mid-block Bus Stop on Madison St between Spring and Fountain Circle

Figure 7-3 | Near Side Bus Stop at Gallatin St and Longwood Dr

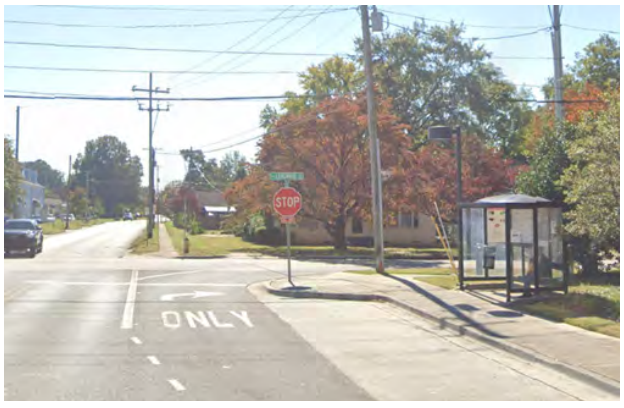


Figure 7-4 | Station Map: 72-Medical West

Figure 7-5 | Station Map: 72-Medical East

8.0

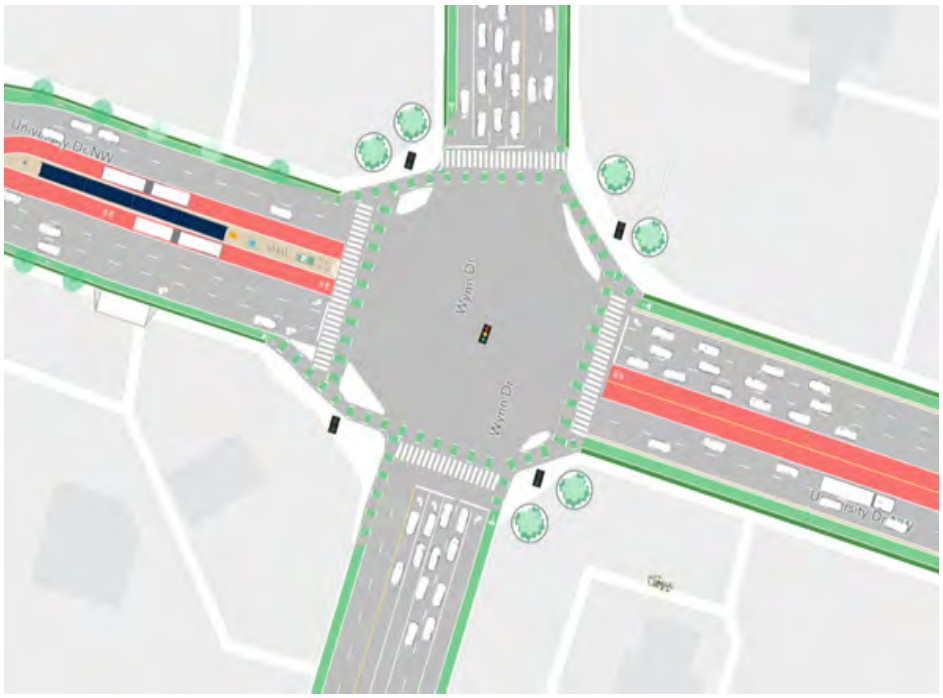
First Mile/Last Mile Connections

Traditionally, transit accessibility depends heavily on the quality of bicycle and pedestrian infrastructure around transit stops. In recent years, the introduction of micromobility options, such as e-scooters and bike-shares, has increased demand for active transportation infrastructure, especially near transit stops. Identifying corridors for alternative mobility options will be a crucial element of evolving the transportation network in Huntsville to better support transit.

8.1 Bicycle & Pedestrian Infrastructure

Bicycle and pedestrian trips are almost always a part of a transit trip, as riders walk or bike to/from their origin or destination from the transit stop. In many auto-oriented communities, however, there is limited, disjointed, ill-maintained, and unsafe bicycle and pedestrian infrastructure. In the last two decades or so, however, people have begun to demand more of their streets; they want options and are pushing cities to build more balanced transportation networks. Key transit corridors should be fitted with shaded and protected pedestrian environments and wide bike lanes where possible in an effort to expand access to both origins and destinations. While not every road should accommodate all modes, local and arterial streets should support a network of bicycle and pedestrian corridors that connect to transit. For example, bicycle infrastructure on Wynn Dr would increase accessibility to the BRT system for communities north of US 72 and the businesses south of US 72. In combination with bicycle facilities on Bradford Dr, Cummings Research Park, UAH, and Calhoun Community College could all be accessed by alternative transportation modes. **Figure 8-1** demonstrates what US 72 and Wynn Dr could look like with center running BRT lanes and bicycle facilities on both corridors.

Figure 8-1 | US 72 and Wynn Dr with Center Running BRT and Bicycle Facilities



8.2 Micromobility

Over the past decade, technology has shifted the mobility ecosystem from siloed modal services to a complete trip approach of connecting people door-to-door or as first and last mile solution across multiple services. New entrants to the market such as e-scooters and bike-share have enabled transit agencies and private providers to adopt a more customer-centric approach to trip planning and payments. The technologies should be strategically integrated into the transportation landscape by identifying high-ridership transit stops to place shared-devices.

8.3 Microtransit

Microtransit services are intended for shorter trips under approximately 20 minutes in duration in defined service zones. Microtransit services utilize vehicles that are smaller than traditional transit vehicles and are meant to improve first and last mile connections to higher frequency transit routes. Microtransit solutions are meant to provide direct, efficient, and demand responsive service. These services can be on-demand or pre-scheduled. Operating specifics such as service hours and coverage area can be tailored to meet the needs and/or resources of the agency (e.g., feet availability, operating budget, etc.). An example of a microtransit vehicle operating in Columbus, Ohio is shown to the left.

9.0

Corridor Renderings

Implementing a HCT service is a tremendous opportunity to transform an existing streetscape, serve activity centers, and spark development (or redevelopment). Corridor renderings were assembled to demonstrate what transit oriented development could look like along US 72 to integrate land use and transportation planning. Two roadway configurations for side running versus center running BRT were also prepared to demonstrate how the concepts can transform a streetscape.

9.1 Transit Oriented Development

9.1.1 Understanding Transit Oriented Development

TOD is a phrase used to describe a type of community or district designed to capitalize on transit accessibility. Planned as compact, walkable, mixed use places, TODs offer people greater transportation choices, reduce dependence on automobiles, support more sustainable and equitable development, and build demand for enhanced transit services.

Typically, TODs are medium- to high-density mixed-use places centered around transit stops or stations. As most transit trips begin and end with a walking trip, pedestrian-friendliness is a key factor in TOD planning and design. Successful TODs are designed with walkable streets and public spaces, buildings with active ground floor uses, pedestrian-oriented entries and facades, and convenient connections to transit. With robust transit service and the right mix of uses, TODs have successfully expanded mobility options; reducing parking demand, auto dependence, and transportation costs; and increased transit ridership. The Village of Providence is an area built with the street network and building densities to support transit.

Village of Providence

Image Source: villageofprovidence.com

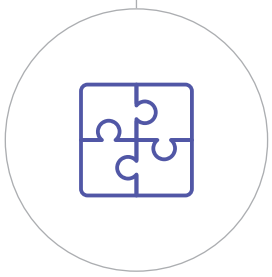
Successful TOD projects and places share a number of qualities setting them apart from more conventional forms of development. As highlighted below, successful TODs are walkable and connected, dense and diverse, and context sensitive:

Walkable & Connected

Access and mobility are key features of successful TODs. Successful TODs provide pedestrian-friendly streetscapes and public spaces, building frontages oriented to sidewalks, and high-quality urban design contributing to a distinct sense of place and community. TODs are also multi-modal places, providing accommodations for a variety of travel options, from local and regional transit, private cars and delivery vehicles, to last mile mobility options like bike share, car share, and emerging forms of micro-mobility. TODs typically provide less vehicular parking than comparable developments and it is located in a manner that maintains walkability, aesthetic cohesiveness, and reserves valuable real estate for higher uses.

Dense & Diverse

Successful TODs include a dense mix of complementary uses, including housing, retail and services, employment, entertainment, and civic uses. Diverse uses and demographics in a TOD help increase market resiliency, reduce auto dependence, and leverage public investment in transportation and transit infrastructure. Diverse housing choices, including options for lower income residents who rely on public transit, helps build market demand for a variety of goods and services, and deliver lower combined housing and transportation costs for all TOD residents. The “right” density varies by context, but as a general rule minimum, residential densities can range from seven units per acre for bus-based TOD to 30 units per acre or more for rail-based TOD.



Context Sensitive

Transit oriented projects are not “one size fits all”—the scale, character, intensity, and use mix of projects can vary greatly depending on their location in the region and the needs of surrounding communities. TOD projects and places are designed to fit the scale of surrounding neighborhoods, offer uses to serve community needs, and advance local objectives for placemaking, community building, economic development, and neighborhood improvement.

9.1.2 Demonstrating TOD along University Drive (US 72)

To demonstrate the potential for TOD along the 72-Medical corridor, a series of underutilized properties were identified and evaluated for their potential to transform over time into more walkable, transit-supportive places. The specific area selected for the TOD demonstration includes parcels with similar characteristics. Sites in this area tend to be auto-oriented in form, disconnected and isolated from surrounding destinations, and underutilized. These sites are also within or adjacent to properties subject to ongoing redevelopment planning efforts.

The TOD demonstration area includes parcels along University Drive between Wynn Drive and Sparkman Drive, including a car dealership, two underutilized strip malls, and several smaller scale, auto-oriented sites. The demonstration area also includes properties identified for redevelopment as part of UAH's Expansion Plan. UAH's plan was incorporated into the TOD concept drafted herein; it was modified slightly solely as a means to create a more fully integrated concept with the identified parcels. The new MidCity redevelopment project is located west of the identified site and the Cummings Research Park Expansion Plan will shape the future of areas immediately south of the demonstration site. The identified TOD site and adjacent developments are depicted in **Figure 9-1** and the existing UAH Mixed Use Master Plan is depicted in **Figure 9-2**.

Figure 9-1 | TOD Concept Site and Surrounding Developments

Figure 9-2 | UAH Mixed Use District Master Plan[7]

7 https://www.uah.edu/images/administrative/president/executive-plaza-townhall-master-plan.pdf

9.1.3 TOD Concepts & Strategies

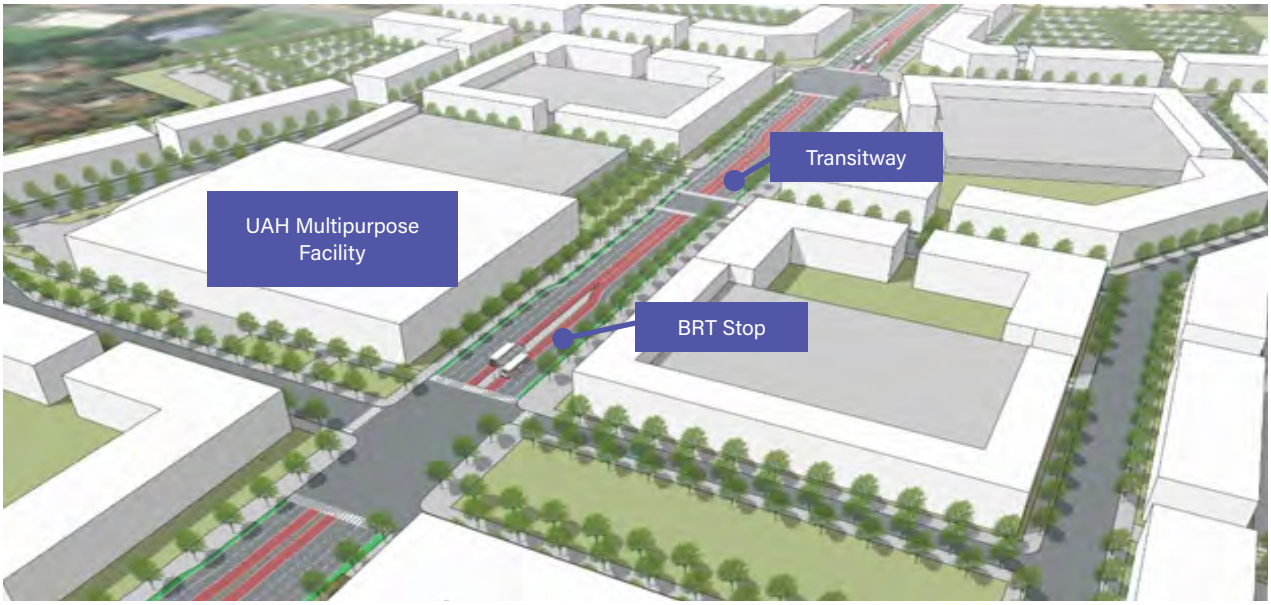
TOD concept sketches were prepared to illustrate the potential for creating walkable, transit-supportive places along the University Dr corridor. Following TOD best practices, the concept sketches show the following:

- TOD centered around BRT stops;
- Redevelopment shaped by an interconnected network of walkable and bikeable streets;
- Buildings positioned and aligned to define and activate streets, streetscapes, and public spaces; and
- Parking incorporated in midblock locations to minimize its visibility and impact on the quality of the pedestrian environment.

The BRT stop location is a central feature of the plan—the street network is designed to guide transit riders between destinations and the BRT platform, public spaces provide places for waiting and informal gathering, and buildings along the University Dr help provide a sense of enclosure and presence for the station. Additionally, the proposed UAH Multipurpose Facility provides a focal point for TOD development. By pushing this major trip generator closer to University Drive, the facility takes on a greater visual prominence along the corridor, links the UAH Master Plan with the BRT station and TOD development sites to the north, and creates an anchor for a new public space at the primary crossroads identified in the UAH Expansion Plan, as depicted in **Figure 9-3** and **Figure 9-4**. **Figure 9-4** also highlights the BRT system; these renderings depict a median-running BRT system configuration.

Figure 9-3 | TOD Site Plan along University Dr

Figure 9-4 | Westward View of University Dr at UAH Multipurpose Facility



TOD Principle: Context Sensitive

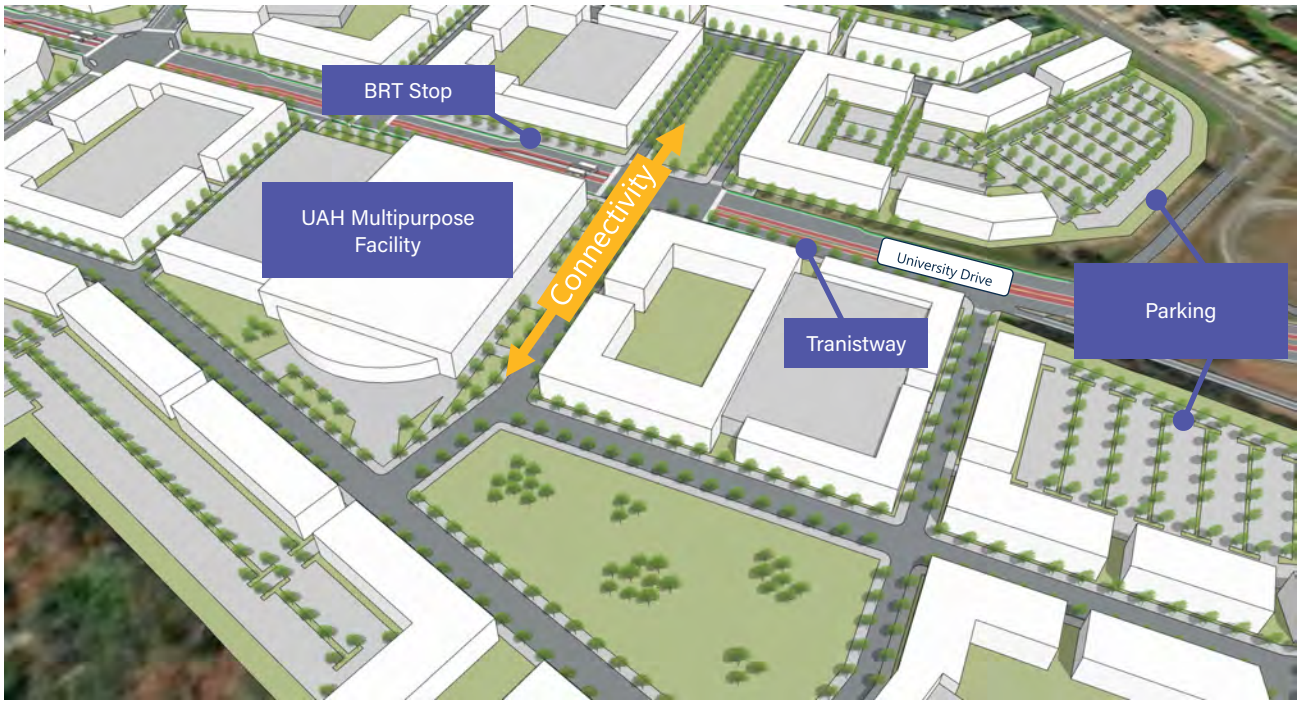
Creating a plan with more dense buildings near the UAH Multipurpose Facility is a logical TOD strategy given the magnitude of the activity generated by the site and the University in general

The plan also focuses building frontage and pedestrian activity at the following locations:

- Along the primary north-south spine and central green spaces (**Figure 9-5**);
- Along east-west corridors to the north and south of University Drive connecting Wynn Drive and Sparkman Drive (**Figure 9-6**); and
- Along the Wynn Drive corridor (**Figure 9-6**).

Additionally, surface parking and landscape buffers are placed in locations where existing conditions restrict the creation of pedestrian-friendly environments, for example, at the intersection of Sparkman Drive and University Drive. Where the TOD demonstration area abuts neighborhoods or more auto-oriented forms of development, buildings are set back from the perimeter of the site and landscape buffers are shown to help ease transitions and minimize impacts.

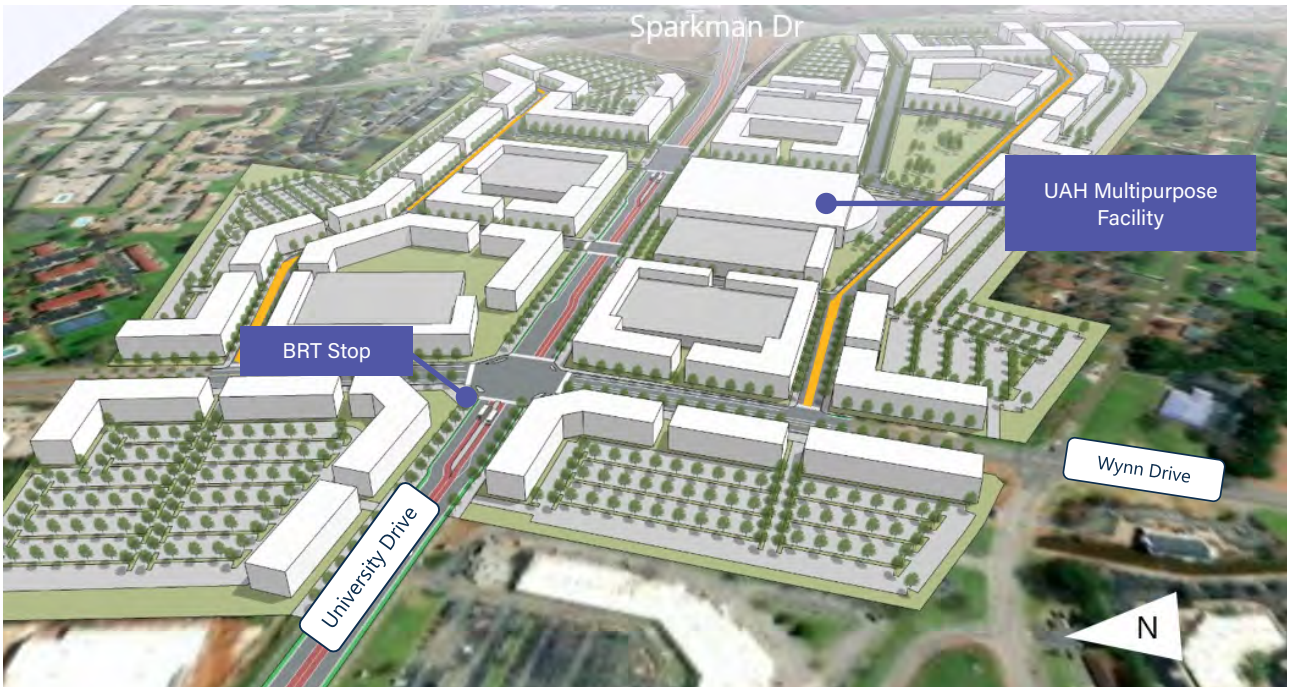
Figure 9-5 | North-South Promenade Connecting UAH and North University Dr TOD Site



TOD Principle: Walkable and Connected

Making a clear pedestrian promenade across University Drive connects the developments and creates a unified sense of place.

Figure 9-6 | New East-West Connections between Wynn Dr and Sparkman Dr



TOD Principle: Dense and Diverse

TOD is not a one size fits all. Having larger buildings and facilities facing University Drive and scaling back building size for those facing communities results in developments that are appropriate in scale to their surroundings.

9.2 Cross Sectional Options

BRT can be designed to operate in the median (center of roadway), curbside (side of roadway) or a combination of both. Median running bus lanes require dedicated transit lanes but consequently offer a faster travel time. Stations can either be split at intersections, meaning the stop in direction of travel is on the far side of the intersection, or stations can be a shared platform; using a shared platform requires the use of left-door boarding.

Curbside bus lanes can be implemented more quickly than median running as they don't require exclusive guideway and median-located stops. Stops for curbside bus lanes will always be on the curb; they can be located nearside or far side of the intersection, but as outlined in Section 7.0, far side stops are often preferred. Curbside bus lanes have more flexibility to be implemented with dedicated lanes in stretches of the corridor where space allows, or to utilize smaller investment opportunities such as queue jumps and transit signal priority at intersections. Without fully dedicate bus lanes, however, curbside bus lanes lose the travel time benefits that are experienced with median running systems.

Some HCT operate both median and side running in the same corridor. In revisiting the peer review, only one of seven peers had mixed operations in the corridor. The benefit of this configuration would be to utilize median running if/where space allows it but returning to curbside where it does not. Switches between configurations should be limited as it creates more complicated intersection designs and vehicle operations.

Figure 9-7 depicts conceptual arterial cross sections of center and median running bus lane configurations with split and shared stops, respectively. **Figure 9-8** outlines the pros and cons of the two configurations. **Figure 9-9** through **Figure 9-12** depict corridor design concepts for US 72 with the TOD concept.

Figure 9-7 | BRT Lane Configurations on Typical Arterial Roadway

Center Running

Side Running

Figure 9-8 | BRT Lane Configurations Pros & Cons

Center Running / Side Running Comparison		
Criteria	**Center Running (Exclusive Bus Only Lane)**	**Side Running (Bus & Business Access Only Lane)**
Reliable Rapid Transit	Dedicated lanes allow for better reliability	Reliability is impacted due to conflicts with vehicles turning or temporarily stopped in shared use lane
BRT Vehicle Speed	Speed is reliable and predictable	Vehicle speeds fluctuate as a result of traffic in shared use lane
Left-Turning Movement of Vehicles	Improves left turns by moving them to signalized intersections	Does not improve lefts from the median
Right-Turn Movements	Avoids conflicts with vehicles turning right	Increases conflicts between bus and vehicles turning right
Pedestrian Access/ Mobility from BRT Platform	Reduces pedestrian crossing distance	Pedestrians have to cross all vehicles travel lanes
Economic Development	Infrastructure shows permanence for development community	No strong presences of permanent infrastructure
BRT Roadway Capacity	Retains all existing traffic lanes	Reduces lanes for general traffic because outside lane is restricted to bus or right turning vehicles only
BRT Vehicle Capital Cost	Could require left and right side boarding BRT vehicles	Able to use standard right-hand boarding vehicles
Station Capital Cost	Able to accommodate one station platform in the median	Requires stations on either side of the road
Right-of-Way Acquisition	Less or possibly no ROW acquisition needed	ROW acquisition likely needed to accommodate station platforms
Connectivity to Other Buses	Transfers occurs at marked pedestrian connections	Transfers may occur at shared transit stops
Roadway Obstruction	BRT vehicle boarding does not impact vehicles in traffic lanes	Other buses using corridor also use lane which could delay BRT vehicles and traffic

Exclusive bus lane - physically separated BRT lane

Standard Lane - Business Access and Transit (BAT) Lane Only. No improvements to current roadway configuration, including left turn and U-Turn movements within the median

Figure 9-9 | Dual Lane Median Running BRT near UAH Multipurpose Facility

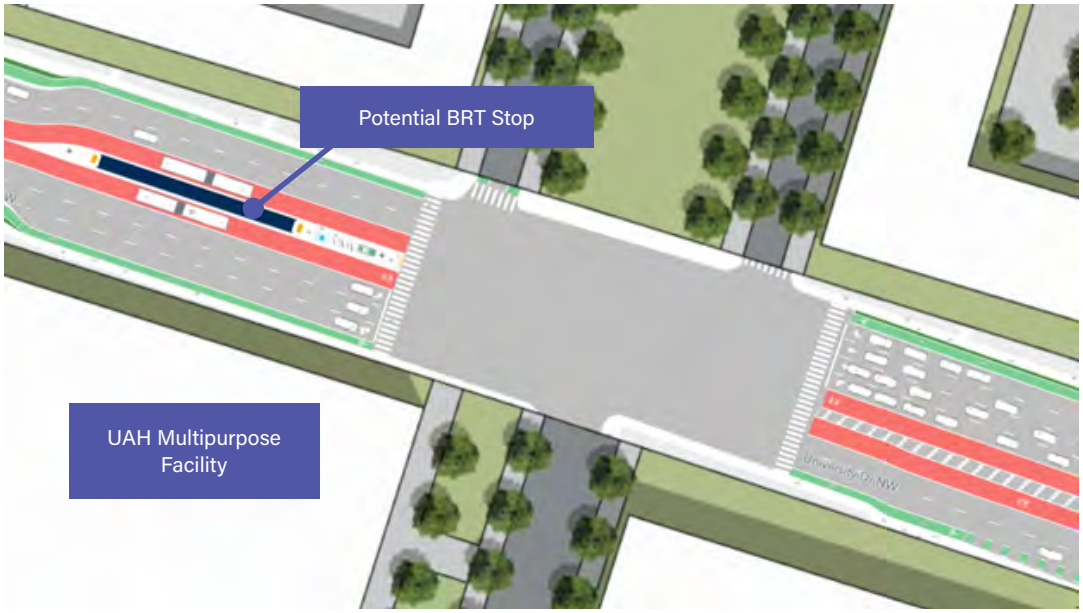


Figure 9-10 | Single Lane Median Running BRT at Wynn Dr and University Dr

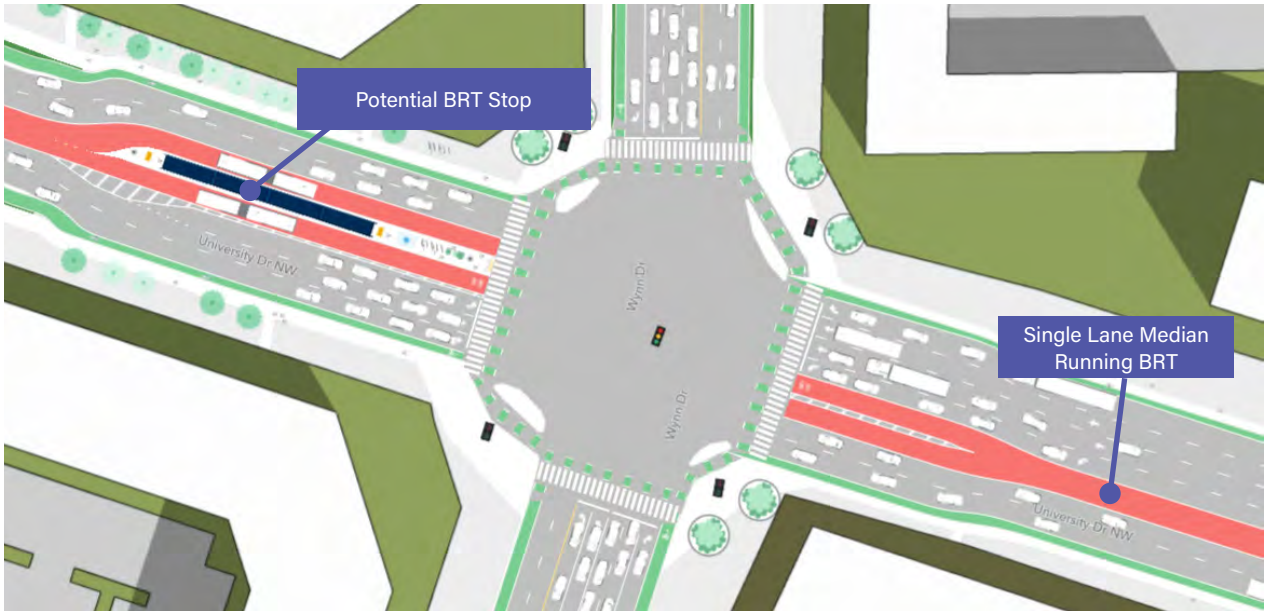


Figure 9-11 | Dual Lane Median Running BRT at Wynn Dr and University Dr

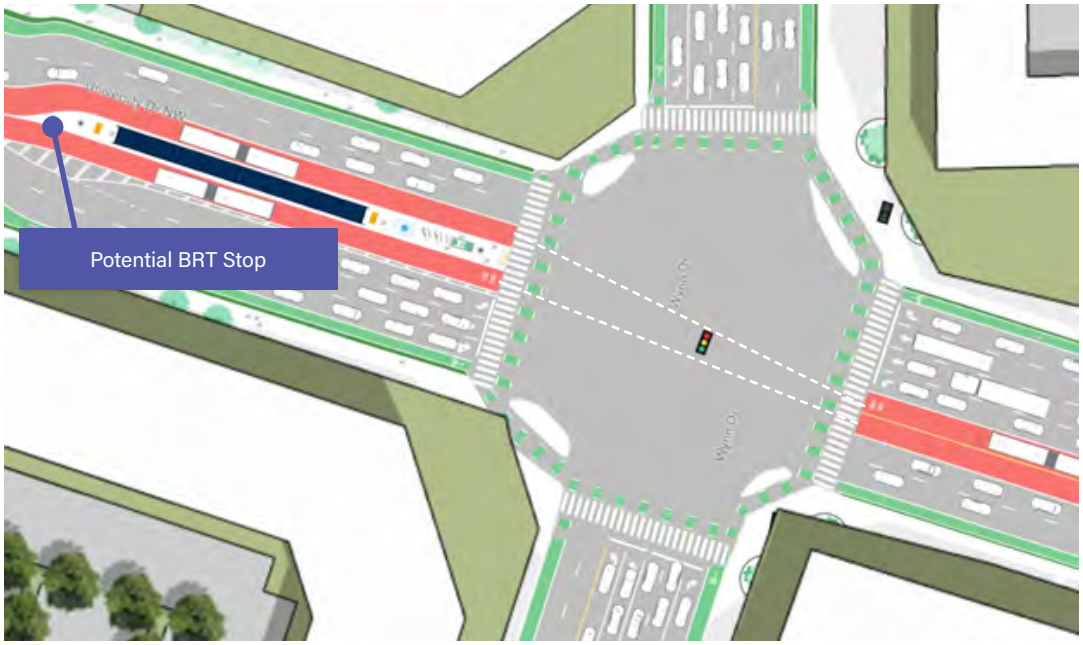
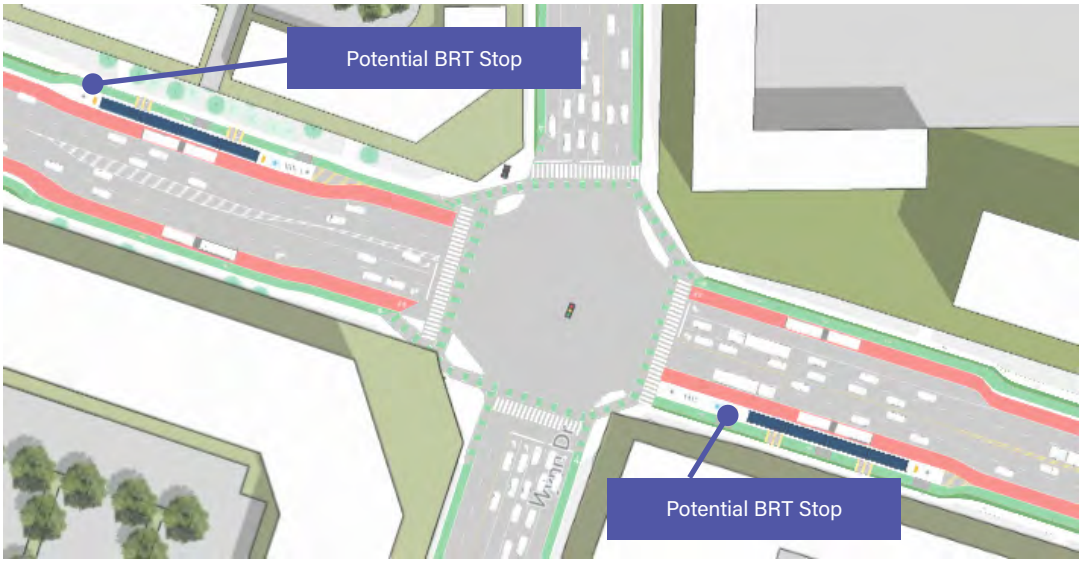


Figure 9-12 | Curb Running BRT at Wynn Dr and University Dr



9.3 Station Design Options

The quality of a BRT station will play a large role in the quality of the system. As noted, stations can be in the median or curbside, depending on the HCT alignment. Two key elements of a BRT station are off-board fare collection and platform-level boarding.

Off-board fare collection is one the most important factors in reducing travel time and improving the passenger experience. The two main approaches to off-board fare collection are barrier-controlled and proof-of-payment. Using the barrier-controlled method, passengers pass through a gate, turnstile, or checkpoint where their ticket is verified, or fare is deducted from a smart-pass upon entering the station. Proof-of-payment is the alternative method where passengers pay at a kiosk and collect a paper ticket or reusable pass; fares are occasionally checked on board the vehicle by an inspector. Both approaches can significantly reduce delays, but barrier-controlled entry is slightly preferable because it minimizes fare evasion and eliminates the need for fare inspectors. The data collected by barrier-controlled systems can also be useful in future system planning[8]. Since Huntsville recently launched mobile ticketing on their Orbit system, however, it would be most logical to use a proof-of-payment method.

A third approach is more like traditional bus fare payment method and uses onboard fare validation. Passengers would still purchase tickets/fares before boarding but validate them on the vehicle through rapid electronic readers available at all bus doors. While this provides time savings for passengers, it is not as efficient as barrier-controlled or proof-of-payment systems. A full evaluation of fare structures and collection methods is required as a next step toward project implementation.

Finally, having platform-level boarding is one of the most important ways of reducing boarding and alighting times per passenger. Platform-level boarding eliminates the need to deploy an ADA ramp for the elderly or disabled and significantly eases travel for people with suitcases or strollers. Platform-level stations are a defining characteristics of a proper BRT system.

Figure 9-13 and **Figure 9-14** depict off-board fare collection on a curbside BRT system and platform-level boarding on a median-running BRT system, respectively.

8 https://www.itdp.org/library/standards-and-guides/the-bus-rapid-transit-standard/

Figure 9-13 | Station Design Concept – Off-board Fare Collection (in yellow) (Minneapolis)

Figure 9-14 | Station Design Concept – Platform-Level Boarding (Albuquerque)

10.0

Right-Sizing for Affordability and Financing

For the Huntsville HCT evaluation, a right-sizing and affordability approach was included. The purpose of right-sizing was to advance an alternative that meets both existing and future demand for the next 20 years. In addition, flexibility for expansion has been included to assure as demand grows, the transit agency could improve the operating plan to adjust to market demands. For example, going from 10 minutes to 5 minute frequency on US 72 would double the capacity with minimal capital investment other than fleet or facility storage. Other possibilities to reduce operating cost would be to provide 60-foot coaches in the corridor, providing additional capacity with minimal operating cost increases.

As noted earlier in this report, the study team did evaluate rail alternatives for the US 72 corridor. Currently, rail provides surplus capacity and cost that is not proportional with the City's revenue needs for both capital and operating costs of rail.

The study team has also been evaluating the possibility for federal involvement through the FTA Capital Investment Grant (CIG) program or other competitive programs offered by the FTA. The City of Birmingham is advancing a BRT project using RAISE grant funds (issued by FTA), which is another potential funding option for the Huntsville area to explore. RAISE discretionary grants, which were originally created under the American Recovery and Reinvestment Act as TIGER grants, can be used for a wide variety of projects, including BRT. Service options for BRT offer the city the most competitive project in which to capture federal funding.

Conceptual Cost – Conceptual costs were developed based on peer city BRT projects. Jacksonville, Florida and Birmingham, Alabama costs were used as peer projects for comparison purposes. Both Jacksonville and Birmingham are transit priority BRT projects utilizing existing rights-of-way. Jacksonville is currently in the Federal Transit Administration (FTA) Capital Investment Grant (CIG) program and estimated at $33.1 million for 12.9 miles, or approximately $2.8 million per mile. The cost also included the purchase of 15 40-foot compressed natural gas buses. Birmingham is funded through a $40 million FTA TIGER grant with a total cost of approximately $64 million for 10 miles, or approximately $6.4 million per mile. The cost includes the purchase of 15 40-foot low or no-emissions buses. A cost estimate for the University Drive transit priority project is based on both Jacksonville and Birmingham and escalated based on possible year of revenue service.

The 72-Medical HCT corridor will include level boarding stations, improved station amenities, better pedestrian access to stations, transit priority treatments, off-board fare payment, branded transit vehicles, enhanced safety and security at stations, and increased transit service frequencies. Based on these assumptions and the costs of the peer projects, the total project cost is estimated at $55-65 million, or approximately $5 million per mile. As additional engineering design is completed, the cost estimate will be evaluated and revised. Based on the current FTA CIG program, the Huntsville region could expect up to 50% federal CIG funding toward the program should it meet the FTA criteria for funding.

Anticipated Project Development Cost and Funding Source – Subsequent to the Phase 1 completion, Phase 2 of this effort to obtain Project Development approval is estimated at about $500,000 of which local funds would be required. After Project Development approval, the region would be eligible for federal reimbursement for project costs assuming the project meets FTA CIG approval milestones and a Small Start Grant Agreement is awarded.

Timeline for Completing Project Development Activities – Phase 2 of the 72-Medical BRT project is currently being scoped. The intent is to have an Locally Preferred Alternative (LPA) selected by Q3 of 2023. Once the LPA is adopted in the Regional Transportation Plan (RTP), local funds would be necessary to fund the environmental analysis and conceptual engineering until the project is accepted in the CIG Pipeline.

Preliminary schedules for key Project Development milestones to advance toward a Small Starts Grant Agreement are outlined below:

- **Q4 2023** Submit request for entry into Project Development
- **Q1 2024** Submit request to use project justification warrants approach
- **Q2 2024** Submit final environmental documentation (NEPA) to FTA. Assumed to be a Categorical Exclusion
- **Q2 2024** Submit request for project justification rating
- **Q4 2024** Request Small Starts design and construction funding
- **Q2 2025** Notice of Small Starts design and construction funding award
- **Q3 2025** Request to execute Small Starts Grant Agreement
- **Q3 2025** Small Starts Grant Agreement executed
- **Q3 2026** Complete design
- **Q4 2026** Construction start date
- **Q4 2028** Operationally complete/begin revenue service

As noted, the project is estimated to cost between $55 and $65 million dollars. Using the conservative estimate of $65 million, a cash flow estimate based on the above timeline has been drafted and is outlined below.

As stated in previous **Table 5-2** on page 42, and assuming the lower level of project warrants at 3,000 riders or more, the FTA CIG share of the project could be $50 million or less. Evidence from other Small Starts projects in the FTA CIG program indicates that Huntsville could expect between a 50% and 75% share of the project coming from the FTA. As the project advances, the MPO should continue to coordinate with FTA on the federal contribution to the project.

- **2022** Begin Phase 2 Advance Planning - $250,000
- **2023** Complete Phase 2 Advance Planning, develop request for Warrants justification to FTA, complete NEPA - $500,000
- **2024** Complete NEPA, Complete Preliminary Engineering - $1.5 million
- **2025-2026** Complete Preliminary Engineering and complete Final Design - $1.5 million
- **2025** Order vehicles - $8 million
- **2025** Begin Construction - $16.5 million
- **2027** Complete Construction, Revenue Service Begin - $16.5 million

11.0

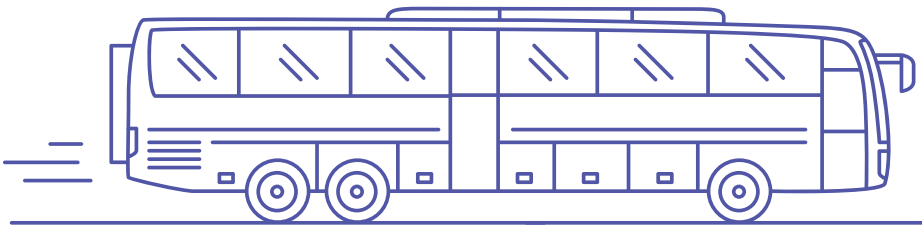
Conclusion

Based on the analysis herein, the City of Huntsville is well suited to implement two new services: an express bus service between Huntsville International Airport and Downtown Huntsville and a BRT line on US 72 between the Madison Walmart at Balch Rd and the Huntsville Hospital.

Although there are service improvements needed to build ridership in the corridor, the 72-Medical route has the potential to compete for FTA CIG Small Starts Project Justification Warrants. Actions such as advancing TOD land use planning and identifying local funding sources could begin now to better position the corridor for federal funding. Additionally, the corridor's configuration will need to be refined and adopted as a locally preferred alternative (LPA) in local planning documents; this is required to receive federal funding.

More specifically, a range of service improvements, including increasing Route 4 frequency to 15- or 12- minutes and adding service to Madison could be implemented to help Huntsville reach the 3,000 average daily boarding minimum needed for Small Starts Warrants. A more detailed analysis of the entire Orbit network should be explored for frequency and routing improvements that could also boost corridor ridership. The evolving landscape along US 72 will likewise contribute to corridor ridership, as projects such as UAH's Mixed Use District and growth in Madison will densify currently underutilized land. This should be monitored closely by city and MPO staff for several reasons including opportunities for partnerships to support funding and implementation of the service.

Finally, coordination with other city, county, and FTA representatives should be ongoing to coordinate opportunities for advancing the 72-Medical corridor into the first phase of the FTA Small Starts process, referred to as Project Development. FTA Project Development approval would set a program implementation schedule and advance the planning process.



Appendices

Appendix A - Tier II Screening Criteria

Category	Measure	Unit of Measurement	Weight
Support Multimodal Activity (25%)	Regional Commuter Corridors served	Number of corridors	5.6%
	Service to planned park-n-ride facilities	Number of P&R facilities	5.6%
	Pedestrian/Bicycle facilities within half mile	Miles per route mile	5.6%
	Traffic Volumes within half mile	VMT per route mile	2.8%
	Quarter-mile Walkshed	Square miles per route mile	2.8%
	Existing ridership within 1/2 mile	Riders per route mile	2.8%
Serve Diverse Travel Market Needs (25%)	Population density within ½ mile (2019)	Population per acre	5.6%
	Employment density with ½ mile (2019)	Jobs per acre	5.6%
	Transit propensity within 1/2 mile (2019)	Weighted average score	5.6%
	Service to UAH and A&M	Number of universities	5.6%
	Service to other colleges	Number of colleges	2.8%
Sustain Economic Competitiveness and Development (25%)	Planned development acres within 1/2 mile	Acres per route mile	5%
	Activity centers & special generators (airport, malls, hospitals)	Number of centers/ generators	10%
	Developable land	Acres per route mile	5%
	Serving new area	Percent of route miles	5%
Provide Speedy Service (25%)	Directness of route	Straight line miles / route miles	8.3%
	Corridor speed limit	Miles per hour (weighted average)	8.3%
	Available right of way	Holistic score	8.3%

Appendix B - Tier II Corridor Evaluation Results

Valuation Summary	US 72 West	Holmes-Bradford	Downtown-Medical	Meridian	Airport-Madison Blvd
Support Multimodal Activity					
Regional Commuter Corridors served	3	3	1	1	3
Service to planned park-n-ride facilities	3	2	1	2	3
Pedestrian/Bicycle facilities within half mile	1	1	3	1	1
Traffic Volumes within half mile	1	2	3	1	2
Quarter-mile Walkshed	2	3	3	2	1
Existing ridership within ½ mile	2	2	3	1	2
SUMMARY	2.11	2.11	2.11	1.33	2.11
Serve Diverse Travel Market Needs					
Population density within ½ mile (2019)	3	1	3	3	1
Employment density with ½ mile (2019)	1	2	3	1	1
Transit propensity within ½ mile (2019)	1	2	2	3	1
Service to UAH and A&M	3	3	1	3	3
Service to other colleges	1	1	1	3	3
SUMMARY	1.89	1.89	2.11	2.56	1.67
Sustain Economic Competitiveness and Development					
Planned development acres within ½mile	3	2	1	2	1
Activity centers & special generators (airport, malls, hospitals)	3	2	3	1	3
Developable land	2	3	1	2	2
Serving new area	2	2	3	1	3
SUMMARY	2.60	2.20	2.20	1.40	2.40
Provide Speedy Service					
Directness of route	3	2	3	1	3
Corridor speed limit	3	1	1	2	2
Available Right of Way	3	2	1	1	3
SUMMARY	3.00	1.67	1.67	1.33	2.67
SUMMARY	2.40	1.97	2.02	1.66	2.21

Appendix C - Technologies Evaluated

Mode	Description	Photo
Bus Rapid Transit (BRT)	Bus rapid transit (BRT) is a higher-speed form of bus transit that has longer spacing between stops than traditional local bus. It often has additional features to make its attractiveness comparable to a train, such as enhanced stops (often called "stations"), off-board fare payment, level boarding, and dedicated lanes or roadways. It is often regarded as a low-cost form of premium transit.	 9
Light Rail Transit (LRT)	Light rail transit (LRT) is a form of rail transit that is characterized by having service characteristics common to that of a heavy rail system (such as high capacity and speed), but with smaller and lighter vehicles. These smaller vehicles allow LRT systems to operate in environments that heavy rail cars cannot, such as on existing streets. LRT systems typically operate in dedicated right-of-way, being physically separated from other modes of street traffic. LRT stations vary from street-level platforms to elevated and underground platforms.	 10
Streetcar	Modern streetcars are a form of rail transit typically found in urban centers and have frequent stops near high activity destinations. Streetcar systems are distinguishable from other forms of rail transit due to their smaller and lighter vehicles. They can operate in dedicated right-of-way or mix with vehicular traffic.	 11
Autonomous Vehicle Shuttle (AV Shuttle)	AV shuttles are small transit vehicles with limited self-driving capabilities. Speeds are currently low, though this has the potential to improve as the technology evolves. They are currently piloted in various places around the globe, including the Lake Nona neighborhood of Orlando, Florida, and in Peoria, Arizona.	 12

Mode	Description	Photo
Trackless Tram (TT)	TT's, also known as Autonomous Rail Rapid Transit, are often considered a hybrid between a BRT and LRT. It generally offers the same type of operating characteristics as an LRT system but can operate in existing streets or its own guideways, without the need for a fixed rail line. TT systems use rubber-tired vehicles with advanced navigation technology below the tram and embedded in the roadway to guide the vehicle. Thus far, they have only been implemented on several systems in China.	 13
Automated Guideway Transit (AGT)	AGT systems feature autonomous vehicles guided by a track. Vehicles come in a varying array of sizes, from those that resemble small shuttles to those that resemble LRT systems. AGT systems operate on a fixed route and fixed schedule, similar to traditional transit modes.	 14
Personal Rapid Transit (PRT)	PRT systems are similar to AGT systems. However, a PRT guideway features frequent merge/diverge points. This allows for non-stop, point-to-point travel depending on the transit rider's destination, bypassing all intermediate stations. It can be likened to a horizontal elevator. PRT shuttles are small, allowing only enough space for a single person or group.	 15

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Appendix D - Ridership Estimates

Since it is expected the HCT service would operate at a higher frequency than existing service, ridership elasticities can be applied to estimate how service frequency improvements could impact ridership. Elasticities vary based on the time of the service improvement, as outlined in the following table.

Ridership Elasticities

Period	Elasticity
Peak	-.37 +/- .19
Off Peak	-.46 +/- .26
All Hours	-.47 +/- .21

Though the "All Hours" elasticity could be used because frequency would improve for the entire day, peak elasticities were also explored to understand the range of possibilities. The elasticities were applied to three service improvement scenarios: 15-, 12-, and 10-minute headways. Additionally, the elasticities were only applied to the existing corridor ridership. Ridership to Madison was not included because it was estimated separately since it is service in a new corridor. As presented in the table below, corridor ridership gets closest to qualifying for CIG Warrants with 10-minute frequencies (note: values were rounded for simplicity).

Corridor Ridership Estimates with Service Improvements

	Original Headway	New Headway	Existing Ridership	Ridership with Service Improvements	Ridership to Madison	Total Corridor Ridership	Difference to CIG Warrants
Scenario 1	30	15	1,327	1,690- 1,810	400-560	2,090 – 2,370	630-910
Scenario 2	30	12	1,327	1,810 – 1,980	400-560	2,210 - 2,540	460-790
Scenario 3	30	10	1,327	1,910 – 2,120	400-560	2,310 – 2,680	320-690

Appendix E - 72-Medical Operating Assumptions

Given the FTA criteria, weekday operating scenarios using 10-, 12-, and 15-minutes headways for the trunk of the 72-Medical corridor were explored. This would result in 20-, 24-, and 30-minute headways on the branch to the Madison Walmart. These frequencies would be the "all-day" frequencies. When transit demand is lower during the early morning and late night hours, "shoulder" frequencies were assumed; the shoulder frequencies assumed were double the "all-day" frequencies.

Additional assumptions were made for the operating speed, span of service, and number of annual operating days. Since Route 4 is the main route operating in the HCT corridor, operating speed was calculated by averaging Route 4 travel time (using the posted schedule and distance between stops) in the US 72 and downtown corridors. Finally, while weekend service is not required to receive federal funding, industry best practice is to offer service seven days a week on premium lines so Saturday and Sunday service were included in the calculations. Weekend service was assumed to have a shorter span and lower frequency than weekday service. There are also more Sunday days of service than there are annual Sundays, but it was assumed several holidays would operate a Sunday level of service. An overview of scenario assumptions is provided at right.

Shared 72-Medical Operating Scenario Assumptions

Operating Characteristic	Assumption
Operating Speed	18 mph
Days of service	365
Route miles	29.7
Weekday span of service	18 hours
Saturday span of service	16 hours
Sunday span of service	12 hours

Using these assumptions, annual revenue miles, revenue hours, and vehicle needs were calculated for the three scenarios, as outlined in the table below. The scenarios are defined by their weekday all-day frequency.

Annual 72-Medical Operating Characteristics & Vehicle Needs

	Scenario 1 10-min freq.	Scenario 2 12-min freq.	Scenario 3 15-min freq.
Annual Revenue Miles	710,395	574,943	463,855
Annual Revenue Hours	39,466	31,941	25,770
Vehicle Needs	6	5	4

Once annual vehicle miles and revenue hours were calculated, annual operating costs were projected. Costs were estimated using Huntsville's actual 2019 operating costs adjusted for inflation to 2022 dollars ($4.30/mile and $70/hour). Under these assumptions, annual operating costs range from approximately $1,412,000 to $3,177,000 on a per revenue hour basis and between $1,358,000 and $3,055,000 on a cost per vehicle mile basis. For comparison, the cost to operate service at the baseline thresholds established by FTA (15 minute all-day service, 14 hour span of service, weekend service not required) are provide as well. Operating using the FTA baseline conditions would require three vehicles.

Appendix F - Airport Express Operating Assumptions

The Airport Express Bus is proposed to operate as a limited stop service along Interstate 565 from Huntsville International Airport to Downtown Huntsville. Major activity centers along the corridor include the Von Braun Center, the University of Alabama in Huntsville (UAH), and the Bridge Street Town Centre. Since the Airport Express service is not identified for HCT, the operating scenarios reflect that of an all-day limited stop service. To compete with private ride-hailing services, however, the service has to provide some degree of convenience so three scenarios were explored: 20-, 24-, and 30-minute headways.

As with the 72-Medical route, operating speed, days of service, and span of service were held constant; these assumptions are outlined in the table at right.

Shared Airport Operating Scenario Assumptions

Operating Characteristic	Assumption
Operating Speed	50 mph
Days of service	365
Route miles	33.0
Weekday span of service	18 hours
Saturday span of service	16 hours
Sunday span of service	12 hours

Using these assumptions, annual revenue miles, revenue hours, and vehicle needs were calculated for the three scenarios, as outlined in the table below. The scenarios are defined by their weekday all-day frequency.

Annual Operating Characteristics & Vehicle Needs

	Scenario 1 20-min freq.	Scenario 2 24-min freq.	Scenario 3 30-min freq.
Annual Revenue Miles	550,372	449,578	366,915
Annual Revenue Hours	11,007	8,992	7,338
Vehicle Needs	2	2	1

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