

## SCENARIO DETAILS: IMPROVE EXISTING SERVICES

# TRANSIT PRIORITY

Transit service is most attractive when it is faster than driving, or when the time differences are reasonable. The three scenarios include a wide variety of transit priority measures to make service faster:

- **Exclusive transit lanes**, which can be developed in a number ways, including in medians and in curb lanes.
- **Queue jump lanes**, which typically substitute a short stretch of parking for a curbside bus lane that allows buses to jump to the front of the queue at bus stops or traffic signals.
- **Transit signal priority** that extends green signals for approaching buses, which allows them pass through the intersection before the light turns red and provides them with an early green signal.
- **Transit Emphasis Corridors** that combine the above measures in urban corridors with high volumes of transit service.
- The development of Freeway BRT services that use **managed lanes** (shared use with high occupancy vehicles (HOVs) and other limited traffic).
- The use of **freeway shoulders** by express buses to bypass congestion.

These measures all contribute to transit service that is faster, more reliable, and more attractive to riders.

### EXCLUSIVE TRANSIT LANES

Exclusive transit lanes are traffic lanes that are dedicated for use by transit vehicles, either part-time (such as during peak commute hours) or at all times. Exclusive transit lanes are typically separated from general traffic by physical barriers, such as curbs or bollards, or by other visual elements, such as striping lanes or applying color to the pavement. Striping treatments have been shown to be effective at modifying driver behavior, leading to increased compliance and lower levels of required enforcement. The effectiveness of striping is due, in part, to the additional visibility that is provided beyond regular street signage. Exclusive lanes can be located either in the center of streets or in curb lanes. Scenarios 1 and 2 include the exclusive transit lanes as part of the development of light rail and BRT lines.

#### Curbside Lanes

Curbside lanes, which as the name implies, are located in the curbside lane and are the most common approach to exclusive bus lanes. This is largely because they are easier to implement than median lanes. Curbside lanes let buses continue moving without the need to weave in and out of traffic, and without getting stuck in general vehicle traffic. However, there is also much more friction with other traffic, particularly with turning traffic.

Curbside bus lanes can be exclusive to buses full-time, or they can be in effect only during certain hours or days. Most commonly, part-time bus lanes are shared with parking, with curb lanes used for bus service during peak periods and for parking at other times. In many cases, bus lanes are also shared with other uses, such as taxis. Curbside lanes can also function in contraflow lanes, in which buses travel in the opposite direction as regular traffic. In effect, a one-way street is converted to two-way, with regular traffic traveling in one direction, and buses in the other.

FIGURE 1 | CURBSIDE BUS LANES (NEW YORK CITY AND LOS ANGELES)

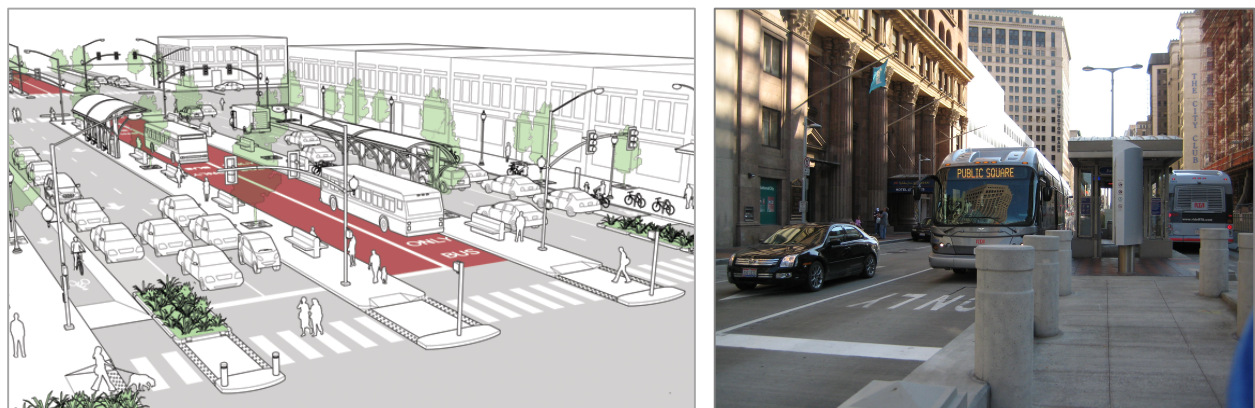


#### Median Lanes

With median lanes, transit service operates in the center of a roadway. Whereas transit vehicles traveling in curb lanes can face several conflicts from other vehicle traffic, including passenger drop-offs, commercial deliveries, and illegal parking, median lanes eliminate most of these conflicts and thus enhance service speed and reliability. Traffic controls can protect or prohibit left turns by other vehicles. Dedicated transit signal heads can help to minimize confusion over which traffic signals apply to left-turning vehicles versus transit vehicles.

With median lanes, stations are also located along the median. Stops may be located on the right side of the vehicle (which allows regular transit vehicles to serve the stop) or on the left side in the middle of the roadway (which necessitates the use of vehicles with doors on the left side). In Cleveland, HealthLine BRT vehicles are equipped with passenger doors on both sides to serve stops on both the left and right sides of the vehicle.

FIGURE 2 | MEDIAN BUS LANES

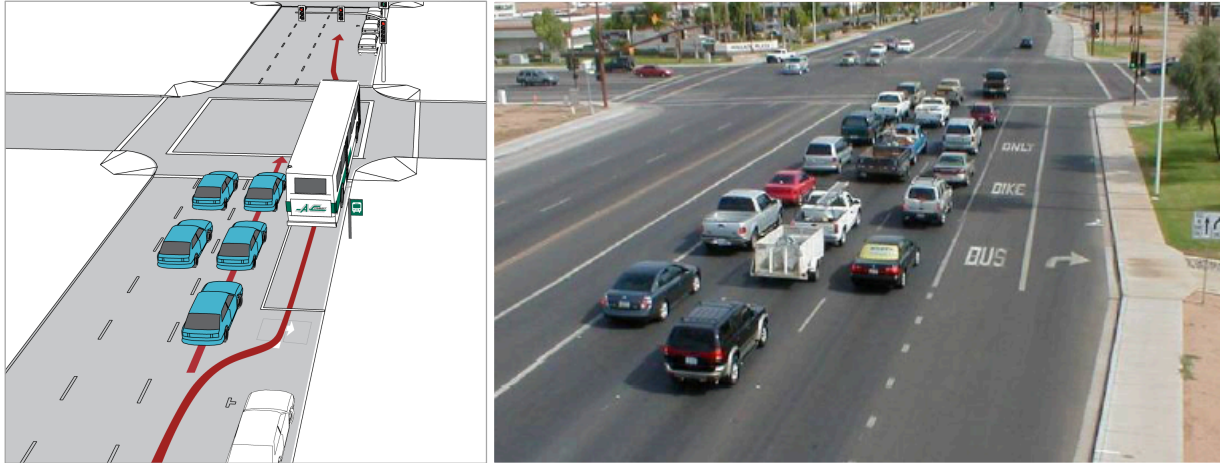


Median bus lanes typically restrict many left turns. As a result, they are often controversial in automobile-oriented communities, as many automobile drivers do not want those restrictions.

## QUEUE JUMP LANES

Queue jump lanes provide transit vehicles priority by creating a special lane at intersections that allows buses to move to the front of stopped traffic. In effect, they are short curbside bus lanes. The lanes are restricted to transit vehicles (and often also right turning vehicles). This allows buses to skip to the front of the line at a stop light. Queue jump lanes are often combined with signal priority, where the queue jump lane is provided a green signal before the general traffic lanes.

FIGURE 3 | QUEUE JUMP LANES



Queue jumps The use of queue jumps alone can result in travel time improvements of 5 to 25%. When paired with other bus treatments, additional travel time savings have been recorded. In all scenarios, queue jump lanes would be included as part of the development of Rapid Bus services and at other key intersections (that have not yet been identified).

## FREEWAY BRT

Most decisions about whether or not to use transit involve time and cost, and most transit services are slower than travel by private vehicle. However, when transit is faster or nearly as fast (for example, many rail services), large numbers of travelers will choose to travel by transit instead of by car. Thus, one of the most effective ways to encourage transit use is to make transit as fast as possible. Freeway bus services are designed to do this, and compared to other transit services, are unique in that they:

1. Operate along freeways, either in regular traffic lanes, in HOV lanes, or along the shoulders.
2. Have stations within the freeway right-of-way that are designed to minimize travel times by eliminating all or most of the local circulation that is required to serve stops or stations located outside of the freeway rights-of-way.

FIGURE 4 | FREEWAY BRT



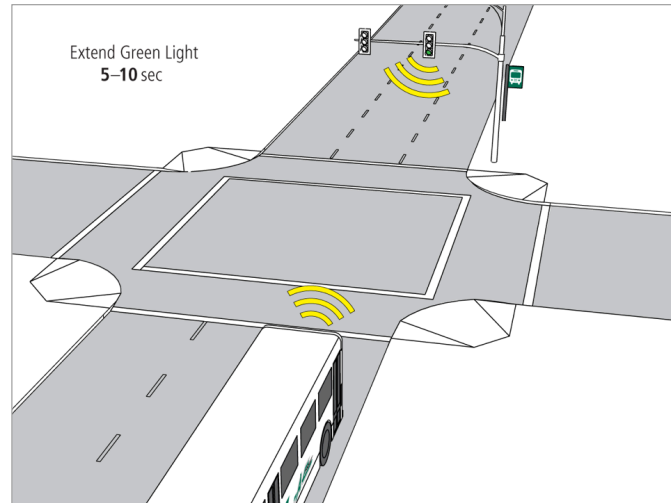


## TRANSIT SIGNAL PRIORITY

Transit Signal Priority gives preferential treatment to buses at traffic signals. Signal priority modifies normal traffic signal operation to facilitate the movement of transit vehicles by changing the signal to green early or by extending the green signal until the bus passes through. This significantly reduces signal delays, and can reduce bus travel times by 5% to more than 20%, depending upon the level of system investment.

Signal priority is typically implemented in conjunction with exclusive bus lanes. Signal priority systems vary in complexity. Some systems rely on transit operator intervention or activation, while others have automated systems that use transponders to connect with signal equipment.

FIGURE 5 | TRANSIT SIGNAL PRIORITY OPERATION



## TRANSIT EMPHASIS CORRIDORS

Transit Emphasis Corridors are corridors where priority is given to transit. Examples include Portland's Transit Mall, which is a one-way pair that dedicates two lanes to transit and one lane to other traffic, and San Francisco's Market Street, which is open to all traffic but heavily emphasizes transit (see Figure 6).

FIGURE 6 | TRANSIT EMPHASIS CORRIDORS (PORTLAND, OR AND SAN FRANCISCO)



Major benefits of transit emphasis corridors are that they make transit service faster and more reliable. Transit emphasis corridors also typically include more significant and higher quality stop facilities, which helps to make transit service more comfortable. All three scenarios include the development of Transit Emphasis Corridors in downtown Nashville

## SHOULDER-RUNNING BUS SERVICE

Twelve states have implemented policies that permit buses to operate on selected freeway shoulders in order to speed service, and more are now considering it. These policies allow buses on selected freeway and arterial shoulders in order to bypass congestion and maintain transit schedules. Bus on shoulder operation is a low-cost way to make freeway transit service faster and more reliable.

FIGURE 7 | BUS-ON-SHOULDER OPERATIONS (MINNEAPOLIS AND RALEIGH, NC)



Additional information on each of these types of improvements is provided in the Transit Strategies series of documents:

- Transit Priority: [nmotion2015.com/wp-content/uploads/2015/10/nMotion-Transit-Priority-151001.pdf](http://nmotion2015.com/wp-content/uploads/2015/10/nMotion-Transit-Priority-151001.pdf)
- Downtown Circulation: [nmotion2015.com/wp-content/uploads/2015/08/nMotion-Downtown-Transit-150710\\_FINAL.pdf](http://nmotion2015.com/wp-content/uploads/2015/08/nMotion-Downtown-Transit-150710_FINAL.pdf)
- 
- Freeway BRT: [nmotion2015.com/wp-content/uploads/2015/08/nMotion-Freeway-BRT-150712\\_FINAL.pdf](http://nmotion2015.com/wp-content/uploads/2015/08/nMotion-Freeway-BRT-150712_FINAL.pdf)
- Express Bus on Shoulder: [nmotion2015.com/wp-content/uploads/2015/11/nMotion-Express-Bus-151031\\_FINAL.pdf](http://nmotion2015.com/wp-content/uploads/2015/11/nMotion-Express-Bus-151031_FINAL.pdf)

## SUMMARY OF SCENARIO IMPROVEMENTS

As summarized in Table 1, transit priority measures would be used in variety of different ways in the three scenarios.

TABLE 1 | SUMMARY OF TRANSIT PRIORITY MEASURES BY SCENARIO

	Scenario 1 Comprehensive Regional System	Scenario 2 Bus-Focused Expansion	Scenario 3 Modest Improvements
Transit Lanes	<i>4 LRT and 3 BRT lines, and in Downtown Nashville</i>	<i>6 BRT Lines and in Downtown Nashville</i>	<i>In Downtown Nashville</i>
Queue Jump Lanes	<i>Along 13 Rapid Bus Lines and other selected intersections</i>	<i>Along 10 Rapid Bus Lines and other selected intersections</i>	<i>Along 7 Rapid Bus Lines and other selected intersections</i>
Signal Priority	<i>Along LRT, BRT, and Rapid Bus lines and other selected locations</i>	<i>Along BRT and Rapid Bus lines and other selected locations</i>	<i>Along Rapid Bus lines and other selected locations</i>
Transit Emphasis Corridors	<i>In Downtown Nashville</i>	<i>In Downtown Nashville</i>	<i>In Downtown Nashville</i>
Freeway BRT	<i>11 routes</i>	<i>11 routes</i>	<i>None</i>
Express Bus on Shoulder	<i>6 routes</i>	<i>6 routes</i>	<i>21 routes</i>

## SCENARIO 1 COMPREHENSIVE REGIONAL SYSTEM

Scenario 1 includes the most extensive use of transit priority measures:

### EXCLUSIVE TRANSIT LANES

Exclusive transit lanes would be developed along four light rail and three BRT lines:

#### Light Rail

- Gallatin Pike (Route 56L Gallatin)
- Murfreesboro Pike (Route 55L Murfreesboro)
- Nolensville Pike (Route 12L Nolensville)
- Charlotte Avenue (Route 50L Charlotte)

#### BRT

- 21st Avenue South/Hillsboro Pike (3B Hillsboro BRT)
- West End (7B West End BRT)
- Dickerson Pike (43B Dickerson BRT)

In addition, and as described further below, exclusive transit lanes would be included in the development of Transit Emphasis Corridors in downtown Nashville.

*Additional information on the light rail lines is provided in the Light Rail Scenario Details paper. Additional information on the BRT lines is provided in the Scenario Details BRT paper.*

### QUEUE JUMP LANES

In Scenario 1, queue jump lanes would be developed as conditions permit along 13 Rapid Bus lines, which would include:

- Route 4R East Nashville Rapid between Gallatin Road at Ardee Avenue and downtown via areas east of Gallatin Pike
- Route 9R MetroCenter Rapid between MetroCenter and downtown
- Route 17R 12th Avenue South Rapid via 21st Avenue South and 12th Avenue South Pike
- Route 18R Elm Hill/Airport Rapid between Murfreesboro BRT and downtown Nashville via Nashville International Airport

- Route 22R Bordeaux Rapid between Bordeaux and downtown via Clarksville Pike
- Route 25R Edgehill Rapid between Charlotte Avenue and Trevecca Nazarene University via Edgehill Avenue
- Route 29R Jefferson/TSU Rapid between Charlotte Avenue and downtown via TSU and Jefferson Street
- Route 31R Hospitals Rapid between Jefferson Street and Blakemore Avenue via Metro General Hospital, Saint Thomas Midtown Hospital, and Vanderbilt Medical Center
- Route 34R Opry Mills Rapid, between Gallatin Pike and downtown Nashville via Opry Mills
- Route 80R Gallatin Rapid between Gallatin and the outer end of the Gallatin Pike light rail line
- Route 82R Nolensville Rapid between Nolensville and the outer end of the Nolensville Pike light rail line
- Route 86R Smyrna/La Vergne Rapid between Smyrna and La Vergne and downtown Nashville via Murfreesboro Pike and I-24
- Route 96R Murfreesboro Rapid between Murfreesboro and downtown Nashville via Murfreesboro Pike and I-24

*Additional information on the light rail lines is provided in the Rapid Bus Scenario Details document.*

## TRANSIT SIGNAL PRIORITY

Transit signal priority would be implemented at most intersections along the light rail, BRT, and Rapid Bus lines described above. It would also be implemented along Transit Emphasis Corridors (as described below), and at other key intersections with high volumes of bus service (that have yet to be determined).

## TRANSIT EMPHASIS CORRIDORS

Transit Emphasis Corridors would be developed in downtown Nashville to make transit service faster and more efficient. There are a number of different ways in which this could be done; one example is illustrated in Figure 8.

*Addition information on the use of Transit Emphasis Corridors is provided in the Downtown Transit Scenario Details document.*

## FREEWAY BRT

In Scenario 1, Freeway BRT would be developed in high volume commuter corridors, which would include:

- Northeast Corridor along Ellington Parkway and Route 386 as far north as Gallatin
- Southeast Corridor along I-24 south as far south as Murfreesboro
- South Corridor along I-65 south as far south as Franklin or Spring Hill

The specific manner in which these services would be developed has not yet been determined. However, the most likely approach would be through:

- The use existing HOV lanes where they exist, the connection of those lanes to “in-line” stations within the freeway rights-of-ways, and greater HOV lane enforcement to ensure free travel flow.
- The development of new HOV and/or managed lanes, also including the development of in-line stations.



FIGURE 8 | DOWNTOWN NASHVILLE TRANSIT EMPHASIS CORRIDORS EXAMPLE



Eleven routes would operate via the Freeway BRT facilities:

#### Ellington Parkway/Route 386

- Route 85X White House Express (south of Route 386)
- Route 87X Gallatin Express
- Route 89X Springfield
- Route 92X Hendersonville Express

#### I-24 South

- Route 84X Murfreesboro Express
- Route 86R Smyrna/La Vergne Rapid
- Route 96R Murfreesboro Rapid (north of Bell Road)

#### I-65 South

- Route 90X Cool Springs Express
- Route 91X Franklin Express
- Route 95X Spring Hill
- Route 97X Columbia

*Additional information on Freeway BRT services is included in the Freeway BRT Scenario Details document.*



## EXPRESS BUS ON SHOULDER SERVICE

As described above, a major focus of Scenario 1 would be the development of Freeway BRT service in high ridership commuter corridors that would not be served by commuter rail. In lower volume commuter corridors, express buses would operate on freeway shoulders when regular lanes are congested. Five routes would operate in this manner:

### I-24 North

- Route 89X Springfield

### I-65- North

- Route 85X White House (north of I-65/Route 386 intersection)

### I-40 East

- Route 39X Airport

### I-40 West

- Route 24X Bellevue
- Route 88X Dickson

*Additional information on these services is included in the Express Bus on Shoulder Scenario Details document.*

## SCENARIO 2 BUS-FOCUSED EXPANSION

Scenario 1 includes similar approaches as Scenario 1, but in fewer places to reflect the overall scaled-back nature of Scenario 2.

## EXCLUSIVE TRANSIT LANES

Exclusive transit lanes would be developed along six BRT lines:

- Dickerson Pike
- Gallatin Pike (upgraded from BRT-lite)
- Murfreesboro Pike (upgraded from BRT-lite)
- Nolensville Pike (upgraded from BRT-lite, scheduled to start in 2016)
- West End
- Charlotte Avenue (upgraded from BRT-lite)

In addition, and as in Scenario 1, exclusive transit lanes would be included in the development of Transit Emphasis Corridors in downtown Nashville.

## QUEUE JUMP LANES

Queue jump lanes would be developed as conditions permit along 10 Rapid Bus lines, which would include:

- Route 4R East Nashville Rapid between Gallatin Road at Ardee Avenue and downtown via areas east of Gallatin Pike
- Route 7R Hillsboro Rapid in the 21st Avenue South/Hillsboro Pike corridor
- Route 9R MetroCenter Rapid between MetroCenter and downtown
- Route 17R 12th Avenue South Rapid via 21st Avenue South and 12th Avenue South Pike
- Route 22R Bordeaux Rapid in Clarksville Pike corridor
- Route 25 Edgemoor Rapid between Charlotte Avenue and Trevecca Nazarene University via Edgemoor Avenue

- Route 29 Jefferson/TSU Rapid between Charlotte Avenue and downtown via TSU and Jefferson Street
- Route 80R Gallatin between Gallatin and the outer end of the Gallatin Pike light rail line
- Route 82R Nolensville between Nolensville and the outer end of the Nolensville Pike light rail line
- Route 96R Murfreesboro Rapid between Murfreesboro and downtown Nashville via Murfreesboro Pike and I-24

## TRANSIT SIGNAL PRIORITY

Transit signal priority would be implemented at most intersections along the BRT and Rapid Bus lines described above. It would also be implemented along Transit Emphasis Corridors (as described below), and at other key intersections with high volumes of bus service (that have yet to be determined).

## TRANSIT EMPHASIS CORRIDORS

Transit Emphasis Corridors would be developed in downtown Nashville in a similar manner as described for Scenario 1.

## FREEWAY BRT

As with Scenario 1, Scenario 2 includes the development of Freeway BRT service in high volume corridors. Compared to Scenario 1, the routes and infrastructure improvements would be similar, but less service would be provided. A second difference would be that to the north, Freeway BRT facilities would be developed along I-65 rather than Ellington Parkway. This would be done because Scenario 2 includes express bus service to Clarksville rather than commuter rail, and through the shifting of the Freeway BRT facilities to I-65, Clarksville service would also benefit.

Twelve routes would operate in these corridors:

### I-65 North/Route 386

- Route 85X White House Express (south of I-24/I-65 junction)
- Route 87X Gallatin Express
- Route 89X Springfield
- Route 92X Hendersonville Express
- Route 94X Clarksville (south of I-24/I-65 junction)

### I-24 South

- Route 84X Murfreesboro Express
- Route 86X Smyrna/La Vergne Rapid
- Route 96R Murfreesboro Rapid

### I-65 South

- Route 90X Cool Springs Express
- Route 91X Franklin Express
- Route 95X Spring Hill
- Route 97X Columbia

## EXPRESS BUS ON SHOULDER SERVICE

As in Scenario 1, in lower volume commuter corridors, express buses would operate on freeway shoulders when regular lanes are congested. Six routes would operate in this manner:

#### I-24 North

- Route 89X Springfield
- Route 94X Clarksville (north of I-24/I-65 junction)

#### I-65- North

- Route 85X White House (north of intersection with Route 386)

#### I-40 East

- Route 39X Airport

#### I-40 West

- Route 24X Bellevue
- Route 88X Dickson
- Route 99X Ashland City (east of Route 155)

## SCENARIO 3 MODEST IMPROVEMENTS

In Scenario 3, the implementation of transit priority measures would be scaled back significantly in line with the more modes focus of the scenario.

### EXCLUSIVE TRANSIT LANES

Scenario 3 does not include the development of light rail or BRT, and thus does not include the exclusive transit lanes that would be associated with those projects. However, as in Scenarios 2 and 3, exclusive transit lanes would included in the development of Transit Emphasis Corridors in downtown Nashville.

### QUEUE JUMP LANES

Queue jump lanes would be developed as conditions permit along seven Rapid Bus lines, which would include:

- Route 3R West End Rapid in the West End Avenue corridor
- Route 7R Hillsboro Rapid in the 21st Avenue South/Hillsboro Pike corridor
- Route 12R Nolensville Rapid in the Nolensville Pike corridor
- Route 43R Dickerson Rapid in the Dickerson Road corridor
- Route 50R Charlotte Rapid in the Charlotte Avenue corridor
- Route 55RMurfreesboro Rapid in the Murfreesboro Pike corridor
- Route 56R Gallatin Rapid in the Gallatin Pike Corridor

## TRANSIT SIGNAL PRIORITY

Transit signal priority would be implemented at most intersections along the seven Rapid Bus lines described above. It would also be implemented along Transit Emphasis Corridors (as described below), and at other key intersections with high volumes of bus service.

## TRANSIT EMPHASIS CORRIDORS

Transit Emphasis Corridors would be developed in downtown Nashville in a similar manner as in Scenarios 1 and 2.



## FREEWAY BRT

Scenario 3 does not include the development of Freeway BRT service.

## EXPRESS BUS ON SHOULDER SERVICE

In Scenarios 1 and 2, many express services would be replaced by other premium services such as Freeway BRT, light rail (including connections to light rail), and Rapid Bus. Scenario 3, conversely, would maintain most existing express routes, and in a few cases develop new routes. Without Freeway BRT facilities, Express Bus on Shoulder service would be implemented in all major freeway corridors. Twenty-one routes would operate in this manner.

### I-24 North

- Route 89X Springfield/Joelton
- Route 94X Clarksville

### Ellington Parkway/I-65- North/Route 386

- Route 35X Rivergate
- Route 36X Madison
- Route 87X Gallatin
- Route 92X Hendersonville

### I-40 East

- Route 38X Antioch
- Route 39X Airport

### I-24 South

- Route 33X Hickory Hollow/Lenox
- Route 37X Tusculum/McMurray
- Route 38X Antioch
- Route 84X Murfreesboro
- Route 86X Smyra/La Vergne
- Route 96X Murfreesboro

### I-65 South

- Route 37X Tusculum/McMurray
- Route 24X Bellevue
- Route 90X Cool Springs
- Route 91X Franklin
- Route 95X Spring Hill

### I-40 West

- Route 24X Bellevue
- Route 88X Dickson