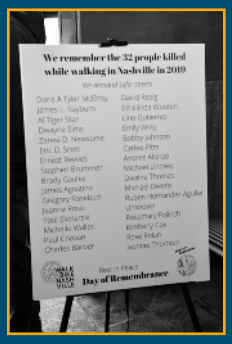
Metro Nashville Transportation Plan

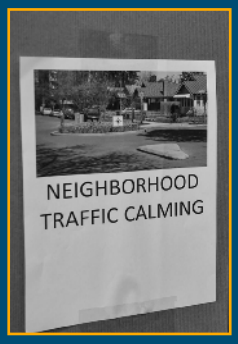
Office of Mayor John Cooper
December 2020







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METRO NASHVILLE TRANSPORTATION PLAN

Office of Mayor John Cooper

December 2020

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Table of Contents

Acknowledgments

The Metro Nashville Transportation Plan was prepared by the Office of Mayor John Cooper with assistance from Metro Nashville Departments and consultants InfraStrategies, HDR and Arcadis.

Mayor Cooper acknowledges the thousands of Nashville residents who expressed hope for a people-focused transportation plan in the listening sessions leading up to this plan as well as input contributed towards previous plans. These included NashvilleNext, WalknBike, Plan to Play, nMotion and other plans that continue to guide important decisions that impact our community as we walk, ride, and roll into the 21st century.

The Mayor's Office would also like to acknowledge contributions of Metro residents, stakeholder groups, current council members, Metro Council office, former Mayor Bill Purcell, the Tennessee Department of Transportation, WeGo Public Transit, Greater Nashville Regional Council, Federal Transit Administration, Federal Highway Administration, Nashville Area Chamber of Commerce, Community Listening Session hosts, assistance from Metro Planning, Public Works, Water Services/Stormwater, ITS, and Parks departments, and local universities.

METROPOLITAN GOVERNMENT OF NASHVILLE AND DAVIDSON COUNTY

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Dear Nashville,

You can't keep good people – or great ideas – down. That's a truth I've come to appreciate even more deeply in my first year as Mayor of Nashville and Davidson County.

Together, we confronted the challenges of a natural disaster and a global pandemic.

We also held fast to our vision for the future of Nashville beyond these unprecedented times – a Nashville that works for *everyone*.

That's why I'm so pleased to present my Transportation Plan.

This plan was built with all of us, working together.

Nearly two dozen community groups and organizations contributed to what you will read here.

We hosted eleven public listening sessions to hear from Nashvillians who will be directly impacted by our transportation strategy.

In addition, we received more than 2,700 comments and responses to our plan.

The result is a **people-first transportation plan** that positions us competitively for grant opportunities so we can make resources go further. This plan gives us a blueprint to focus on safety, smart technology, and equity for the future of transportation in our great city.

And with this plan, we have a ready platform to leverage upcoming federal and state funding opportunities and partnerships.

I'm proud of this work and proud of how we came together, listening to one another and celebrating great ideas, to get it done.

Sincerely,

John Cooper
Mayor

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Executive Summary

Mayor Cooper is delivering on his commitment to produce a new people-first transportation strategy within his first year of office: Metro Nashville's Transportation Plan proposes $1.6 billion in critical projects for community resilience, neighborhood livability, shared prosperity, and system preservation and performance.

The plan is informed by 11 public Listening Sessions held throughout Davidson County this year, along with targeted discussions with stakeholders and all 40 Metro Councilmembers. Many of you have been contributors and shapers of this effort.

Metro Nashville's Transportation Plan proposes core categories for investment that reflect our communities' and the region's stated priorities: Mass transit, neighborhood infrastructure (sidewalks, bikeways, greenways), a "state of good repair" for roads and bridges, traffic operations and signals, and safety/Vision Zero. Projects within the plan will be advanced via individual, opportunistic funding strategies, while more comprehensive, dedicated revenue streams—via the IMPROVE Act's authorizing mechanism for referendums, or other available legal framework—can be pursued in a future year once America's economy recovers from the pandemic-induced downturn. This plan offers the transportation choice and options for any post-COVID-19 scenarios that may develop.

In addition to a depth of contemporary feedback gathered from Nashvillians in 2020, the plan also rests on many years of careful study and community engagements through

VISION STATEMENT

A multimodal system for all that offers choice and better connects neighborhoods, residents, and businesses to the places that they need and want to go to in a safe manner.

Metro's adopted modal plans (nMotion, Access Nashville 2040, and WalknBike). **The strategic approach to the transportation plan achieves a "right size" level of investment placing approximately 92% of our population and 94% of our employment within a half mile of an improvement.**

Details of the plan include proposed investments in:

- A dramatic increase in frequency and span of service for the bus system, as outlined in WeGo's Better Bus proposal—including up to ten Neighborhood Transit Centers that would enable access to new crosstown routes;
- 13 miles of Bus Rapid Transit on Murfreesboro Pike, from downtown to Antioch/Hickory Hollow;
- 6.9 miles of Rapid Bus on Clarksville Pike, from downtown to Bordeaux/King's Lane;
- Infrastructure to support more trips and a smoother ride on the WeGo Star commuter-rail line;
- System-performance measures such as: more sidewalks and crosswalks, a Traffic Operations Center and signal synchronization, bikeways, greenways, and safety fixes to aggressively drive down traffic injuries and fatalities;
- Maintaining a state-of-good-repair for existing bridges, culverts, and roadways;
- A bicycle/pedestrian-accessible Interstate cap to reconnect the bifurcated west and east sides of Historic North Nashville at Jefferson Street;
- "Test bed" corridors for green infrastructure/ sustainability along Gallatin Pike, and for innovation/emerging-vehicle technologies along Charlotte Pike;
- A comprehensive planning effort for better mobility in and through downtown Nashville, including curb-space management, smart parking, and transit priority, and
- Downtown Neighborhood Traffic Project, which is intended to advance with identified funding within the first 18 months of this plan.

These projects form the solid foundation that will enable expanded transportation options, such as rail, to become a reality in the future as our system matures.

Metro Nashville Transportation Plan Project Highlights

Transit

Better Bus Service Expansion	$180M[2]
Murfreesboro Pike Bus Rapid Transit	$413.3M
Clarksville Pike Rapid Bus	$92.9M
WeGo Star Commuter Rail Improvements	$139.6M[3]
Total Transit	**$825.9M[1]**

Traffic/Multimodal/Safety

Sidewalks	$200M
State of Good Repair	$200M
Jefferson St. Multimodal Cap/Connector	$175M
Restoration & Resiliency, State Routes, Partnership Funding, and Innovation/ Sustainability corridors	$117M
Safety/Vision Zero/Traffic Calming	$75M
Active Transportation/ Bikeways/Greenways	$35M
Traffic Management System/ Signal Upgrades	$15M
Downtown Neighborhood Traffic Project	$1M
Traffic/Multimodal/Safety Total	**$818M**
All Projects Total	**$1.6439B**

Notes:
[1] Total annual operating $32M
[2] Annual operating $29M, which also includes Murfreesboro Pike BRT and Clarksville Pike Rapid Bus annual operating
[3] Annual operating $5.71M

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PART 1

Our Transportation Priorities

Nashville Mayor John Cooper's commitment to a new people-first transportation plan during his first year in office has advanced even with the challenges Metro has faced in the past months. His campaign transportation commitments and focus areas included:

- Upgrading the bus system,
- Tackling traffic and modernizing our traffic management system,
- Investing in neighborhood infrastructure including sidewalks, bikeways, and greenways,
- Improving safety and advancing the Mayor's Vision Zero Action Plan, and
- Exploring the creation of a Nashville Department of Mobility and Infrastructure to enhance efficient, effective management, performance and accountability

Prior to COVID-19 limitations on in person meetings, the Mayor's staff hosted 11 community listening sessions, individual meetings with each individual council member, and held numerous in-person and virtual stakeholder group meetings. The results from more than 2,600 participants showed their highest priorities being transit, sidewalks, state of good repair, and from a technical analysis perspective the traffic management modernization foundational to all. We also heard from council members and the community of the importance of improving the safety for all users of our transportation system. The Vision Zero Action Plan initiated by Mayor Cooper is now under development. Additionally, the plan considers equity in design at the project level to build a system serving all of Metro Nashville as well as discussion of supportive affordable housing strategies.

The plan projects will be advanced with individual funding strategies while more comprehensive dedicated funding possibilities are reserved for possible future consideration. We also relied upon the value of existing studies, plans and programs from WeGo, Metro Public Works, Metro Planning and others to leverage the value of previous initiatives and we performed general

cost estimate and scope validation updates. It is important to note that while detailed, this plan is a living document and will be updated over time as our community opportunities and challenges evolve.

Although this plan's projects likely seem very familiar, as we leveraged community and resource investments already found in previous plans and studies, you will also see refreshed approaches such as the Charlotte and Gallatin Innovation Corridors. Additionally, efforts like the traffic system modernization and project development design and delivery with the Equity in Design tool, construction management manual and the robust analysis of funding strategies, in addition to the parallel development of a Department of Mobility and Infrastructure, bring new value to Mayor Cooper's commitment in the Metro Nashville Transportation Plan.

Transit

Better Bus Public Transportation Service Expansion

WeGo Public Transit's "Better Bus" program seeks to build a fixed-route bus transit system that is more convenient, competitive and reliable. Service levels would begin to approach peer city per capita service levels, by establishing an all-day, all-week network; promoting spontaneous transit use; reducing travel times; and making transit easier to understand.

The Better Bus program can be implemented incrementally as funding sources become available but would need to follow a logical sequence for maximum success. Major features include longer service hours on major bus routes, new and improved crosstown routes and improvements to frequency of bus service (particularly during evenings and weekends), as well as infrastructure upgrades to improve system reliability, safety and dignity of customer experience. This would entail an increase in bus service hours of approximately 30%, requiring an expansion of the existing bus/van fleet.

Beyond bus fleet expansion, additional capital investments will be necessary to gain maximum leverage from the Better Bus program. Up to 10 Neighborhood Transit Centers would serve as convenient and pleasant locations to transfer between bus routes but would also serve as focal points for a multitude of possible mobility options such as rideshare services, bikeshare services, micro-mobility devices, carshare, private shuttles and better pedestrian connections to surrounding neighborhoods.

A "SoBro Transit Hub" would be developed as a larger transit center anchoring the southern section of Downtown Nashville. Although smaller in scale than WeGo Central at 4th and MLK, this facility would serve as a hub for services entering Downtown Nashville from the southern and western sections of the City and would anchor the northern terminus of the proposed Murfreesboro Pike Bus Rapid Transit project.

Tied directly to this facility would be the identification of a transit priority corridor through Downtown Nashville connecting the SoBro Hub and WeGo Central to facilitate a faster, more reliable connection of transit service through Downtown Nashville. This would reduce the frequency of required transfers through the creation of more "through-routing" opportunities among WeGo Public Transit route pairs. These

combined projects would enhance connections between neighborhoods on opposing ends of the Downtown Core and enhance the attractiveness of public transit services for Downtown users (workforce, students, tourists, etc.).

Among the highest priority project requests from users and Metro Council Members is an expansion of the passenger waiting shelter program. This program identifies a total of 68 current locations that warrant new shelters based on boarding activity, and an additional 25 sites that need to be expanded due to being undersized based on current usage.

Access service for persons with disabilities would also be expanded and improved through the extension of available service hours county-wide, expansion in Access service capacity to reduce travel times and improve on-time performance, and expand the span of the very popular "Access-on-Demand" same-day service option.

Finally, "Mobility on Demand" zones would be established in eight outlying sections of the county to provide on-demand feeder service to individuals, connecting less densely developed neighborhoods to adjacent neighborhood transit centers and/or stations along frequent transit network routes.

Better Bus Public Transportation Service Expansion Summary
(CAPITAL -$180M)
Annual operating - $29.5M

	Capital Investment	Annual Operating
Bus fleet & service-hour expansion to meet increased frequency, new cross-town/circulator routes, and AccessRide improvements	$21.1M (expanded bus/van fleet)	$21.4M (in addition to current service level funding)
Neighborhood Transit Centers	$92.6M	$3.2M
Downtown Transit Priority	$10M	-
SoBro Transit Hub	$40M	$0.8M
Bus-stop shelters (68 new; 25 expansions)	$16.4M	$0.3M
Access/Mobility-on-Demand Improvements	(included in overall bus/van fleet expansion above)	$3.0M
Fare capping (Best Value pricing for all riders)	—	$0.8M
Better Bus Total	$180.1M	$29.5M

The Better Bus improvements will be transformational to existing Metro wide WeGo service and are generally targeted at improvements that have been requested for years. In the future, dedicated lanes, transit priority and a significantly enhanced pedestrian environment will also boost the ridership gains further that may be made with bus system improvements including cross connectivity and neighborhood transit stations currently absent in the transit landscape. The shelter expansion project is about equity as well as quality of our service and experience for all who use it.

Generally, the impact of Better Bus is expanding the numbers of opportunities folks must access things like jobs, education, recreation, medical care, and commerce in a reasonable amount of time. In that sense, the real economic return is not to WeGo Public Transit in the form of fare revenue, ridership, or cost recovery; it is to the people who use it in the form of expanded economic opportunity.

Better Bus Expanded Detail

Service Investments

Better Bus service improvements will touch almost every current WeGo Public Transit route and service and will also create new travel opportunities. Access to more frequent service, more direct connections and more comfortable and convenient transfers will radically expand the economic opportunities of those Nashvillians who choose – or have no choice but to use – public transportation. This is accomplished through:

1. Longer Service Spans — Even the busiest WeGo bus routes typically operate between 5 a.m. and 11 p.m. Monday through Friday, with shorter hours on weekends. In the Better Bus program, the nine-busiest routes (serving over 70% of all current riders) will operate between 4:15 a.m. and 1:15 a.m. on Weekdays, 5:15 a.m. and 1:15 a.m. on Saturdays and 5:15 a.m. and 11:15 p.m. on Sundays. In a service-sector economy such as Nashville, this will significantly expand the number of employment opportunities available to residents.

2. Improved Weekend and Evening Service — The most frequent service request among current customers is better night and weekend service, when wait times can be excessive; compounding the challenges one faces when a transfer is required. Better Bus would come closer to providing an “all-day/all-week” network, with frequency of 20 minutes or better on the nine-busiest routes and upgraded off-peak frequency of 30-45 minutes on many other local routes.

3. Improved Frequency — A “Frequent Transit Network” – WeGo Public Transit’s nine-busiest routes (3 and 5–West End; 7–Hillsboro; 22–Bordeaux; 23–Dickerson Pike; 50–Charlotte Pike; 52–Nolensville; 55–Murfreesboro Pike; 56–Gallatin Pike; and the portion of the 4–Shelby between Downtown Nashville and Shelby at 11th Street in East Nashville) would see enhanced frequency, making service along these corridors more convenient, and also reducing travel times for individuals who transfer to these services from other local and connector routes. Peak frequency of between 10 and 20 minutes would be offered; with 20-30-minute off-peak frequency or better frequency at night and on weekends.

4. Improved Service on Other Routes – Although not part of the envisioned Frequent Transit Network, other local routes would see improvement in span and frequency. When

combined with routes targeted for upgrade in the Frequent Transit Network, 95% of current riders would see some improvement in their service.

5. Strategic Route Extensions — Although the WeGo Public Transit route network rates highly with respect to overall coverage of service areas likely to generate transit ridership, the Better Bus program would extend several routes to serve emerging Neighborhood Transit Centers to facilitate more crosstown connections. Examples include an extension of the 17–12th Avenue South route to the planned Hillsboro/Green Hills Transit Center adjacent to Hillsboro High School (where it would meet the 7–Hillsboro route); and extensions of the 9–Metro Center and 21–Wedgewood to the planned North Nashville Transit Center where they would connect with the 22–Bordeaux, 25–Midtown and 42–St. Cecilia/ Cumberland routes.

6. New and Improved Crosstown and Neighborhood Connections — A new crosstown is planned along Trinity Lane, connecting the planned North Nashville Transit Center at 26th Avenue North and Clarksville Pike with Gallatin Pike in East Nashville (where it would connect with the 56–Gallatin Pike and 4–Shelby routes) via Clarksville Pike and Trinity Lane, with mid-route connections to the 14–Whites Creek, 41–Golden Valley, 23–Dickerson Pike and 43–Hickory Hills routes. In addition, existing crosstown services including the 21–Wedgewood and 25–Midtown would be improved with respect to span and frequency.

7. Access and Access on Demand — Access services for persons with disabilities would be improved by expanding available service hours to match the expanded fixed route span (4:15 a.m. – 1:15 a.m. on weekdays), by extending the available service hours for the very popular "Access on Demand" same-day service to nights and weekends, and by increasing the number of vehicles assigned to the Access fleet to reduce travel times and improve on-time performance.

8. First Mile/Last Mile Mobility Zones — Many areas of Davidson County display demographic characteristics that warrant public transportation service (e.g. lower income levels, low rates of auto ownership, higher populations of senior citizens and persons with disabilities, etc.), but lack both the density and the pedestrian access network to make traditional fixed route public transit practical. The Better Bus program contemplates seven "First Mile/Last Mile Mobility" zones that would provide discounted "on-demand" trips (via either paratransit carriers like Access or rideshare partners such as Lyft and Uber) based on user choice. However, rather than carry these customers for a complete trip, which would be extremely expensive, these services would "feed" higher frequency fixed bus routes at locations that had sufficient passenger infrastructure (e.g. neighborhood transit center, Star Rail Station, passenger waiting shelter) to allow them to complete their trip. An initial pilot test of the concept is being planned for the Antioch area, with the following additional locations demonstrating promise for future expansion of the program based on their demographic characteristics, development patterns and complementary fixed bus routes: Goodlettsville/Madison, Bordeaux, Bellevue, Donelson, and Old Hickory.

9. Fare Capping/Best Value Pricing — WeGo Public Transit's emerging account-based fare collection system (enabling both mobile payment and "touchless" smart card payment) features the capacity for "fare capping." Traditionally, WeGo

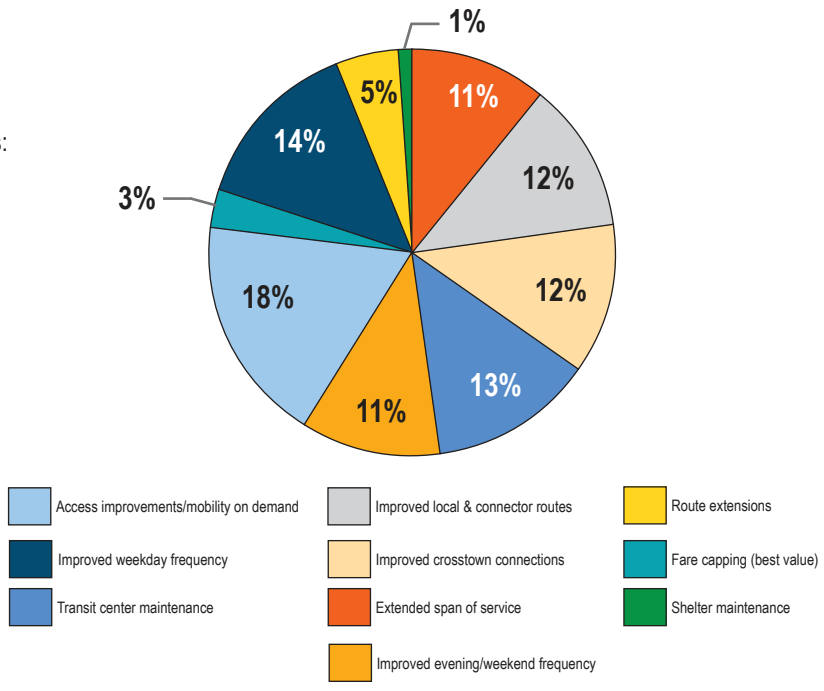
Public Transit has offered several discounted fare products (such as day passes, seven-day passes and 30-day passes) that offer larger discounts with greater use of the system. The higher price points for many of these products have presented a barrier to low income users, who seldom have enough money to purchase the better value product, even if their system use would make it a "better deal." Under fare capping, any user could open an account and load cash onto that account as they had it - $1.00 at a time, or $50 at a time. As trips are taken on that account, usage patterns are recorded and the customer automatically "upgraded" to the next higher value fare product.

As an example, a user might load $5 onto their account. When they "tap" the card for their first ride, $2 (the base fare) is deducted. When they tap a second time on the same day, another $2 is deducted. At this point, they will have reached the $4 price point for a day pass, and any additional "taps" on that service day would not be charged. This scenario would continue to the price points for seven-day and 30-day passes. Projected annual savings by current WeGo Public Transit riders is estimated at $800,000, but would likely be higher as even greater use of the system would be encouraged.

The projected annual operating expense investment in service expansion is $29.5 million, broken down in Fig. 1.

The result of these investments is the emergence of a transit network that is stratified by service type to address a range of needs – from high density/high ridership corridors to low-density and lifeline services. This service stratification is broadly categorized as follows:

Fig. 1: Better Bus investment allocations: additional annual operatoins and maintenance expense ($29.5 million total)



Frequent Service Network – The nine high-ridership corridors that currently carry over 70% of existing WeGo Public Transit ridership. They include Dickerson Pike, Gallatin Pike, Shelby Street, Murfreesboro Pike, Nolensville Pike, Hillsboro Pike, West End Avenue, Charlotte Avenue, and Clarksville Pike. Service is characterized by "straight-line" routing, and the highest levels of frequency and span in the system. This is the backbone that the remainder of the network is built around.

Local Service Network – Typically radial routes from Downtown Nashville that carry significant levels of ridership, but do not reach the threshold of ridership (at this time) for consideration in the frequent service network. These includes routes such as Lebanon Pike, Herman Street, Jefferson Street, and Elm Hill Pike/Airport, among others. Under Better Bus, almost all local service network routes would see some improvement in span and frequency.

Connector Network – These are generally crosstown routes and neighborhood circulators. They are typically lower in ridership than frequent or local network routes, and do not generally travel into Downtown Nashville. They often serve as feeders from neighborhoods to the frequent service network. They are often characterized by more circuitous routing and the use of smaller vehicles.

Express Routes – These are limited service, limited stop routes that generally serve park and ride lots and cater to a nine-to-five downtown office workforce.

First Mile/Last Mile Mobility Zones – Geographic zones in outlying areas of the county that would be serviced by a "general public" demand-based system (using the WeGo Access service resource or transportation networking companies like Lyft or Uber) to connect low-density neighborhoods to adjacent frequent service network routes. Users of this system could use it to travel within the zone, or to a station on a frequent service network route for connections to the broader transit network.

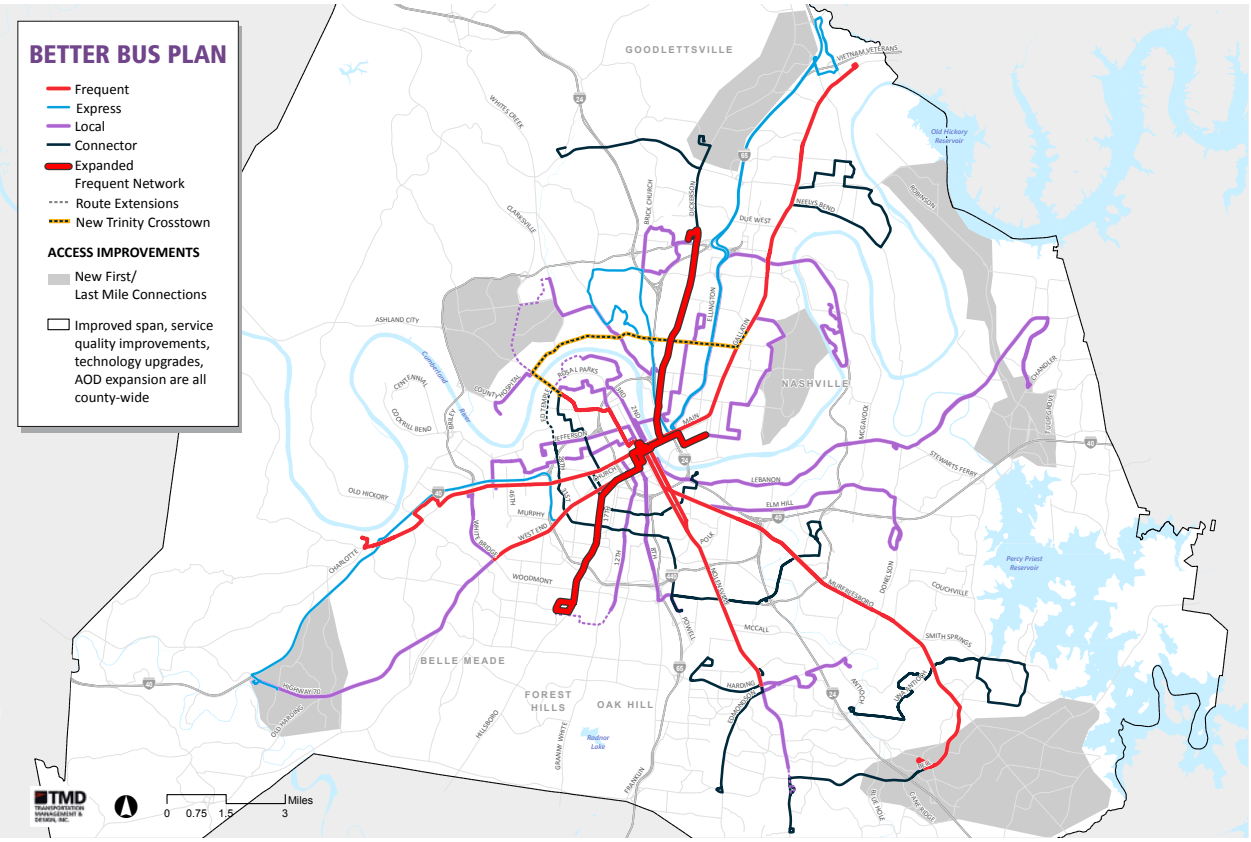
Access and Access on Demand – WeGo Public Transit's door-to-door service for persons with disabilities. Access is a one-day advance reservation system, where Access-on-Demand provides for same day travel at a premium price. This service is available to all locations in Davidson County.

The Fig. 2 network map on the next page illustrates the distribution of this service network geographically. The advantage of this approach to service enhancement is, as conditions change, service can transition up or down in the network categories to service types that are best suited to the nature of demand. For instance, as population, development, and demographic characteristics of a neighborhood change, a local service route may warrant upgrading to a frequent network route. As patterns of demand in a mobility-on-demand zone area emerge and grow, permanent connector network type service could emerge.

Transit Infrastructure Investments

Improved bus service as described above is at the core of the Better Bus program but can only achieve its true potential with complementary capital investments. Investments in both transit infrastructure but also in associated segments of the citywide transportation plan such as an expanded sidewalk network, Vision Zero Safety

Fig. 2: Better Bus Service Network – Access/Access on Demand Operate County-Wide



improvements, and investments in expanded greenways and bikeways. However, proposed capital investments in the transit portions of the plan will be critically important to the success of planned service enhancements.

Neighborhood Transit Centers

The plan contemplates the completion (and eventual maintenance and operation) of up to 10 Neighborhood Transit Centers.

A common complaint about the WeGo Public Transit bus network is that almost all trips require travel into the downtown core and back out again, regardless of the direction of a destination. With increasing congestion in the downtown core (and no transit priority) this is also a leading cause of deteriorating on-time performance. This form of "timed transfer/radial" system is quite common for smaller transit agencies, where service resources are insufficient to mirror all significant travel patterns. As service grows, the model becomes antiquated as it

- Forces too much bus traffic into the downtown core, and the transfer facilities that serve it;
- Increasing traffic congestion into and out of the core make travel times increasingly unreliable; and

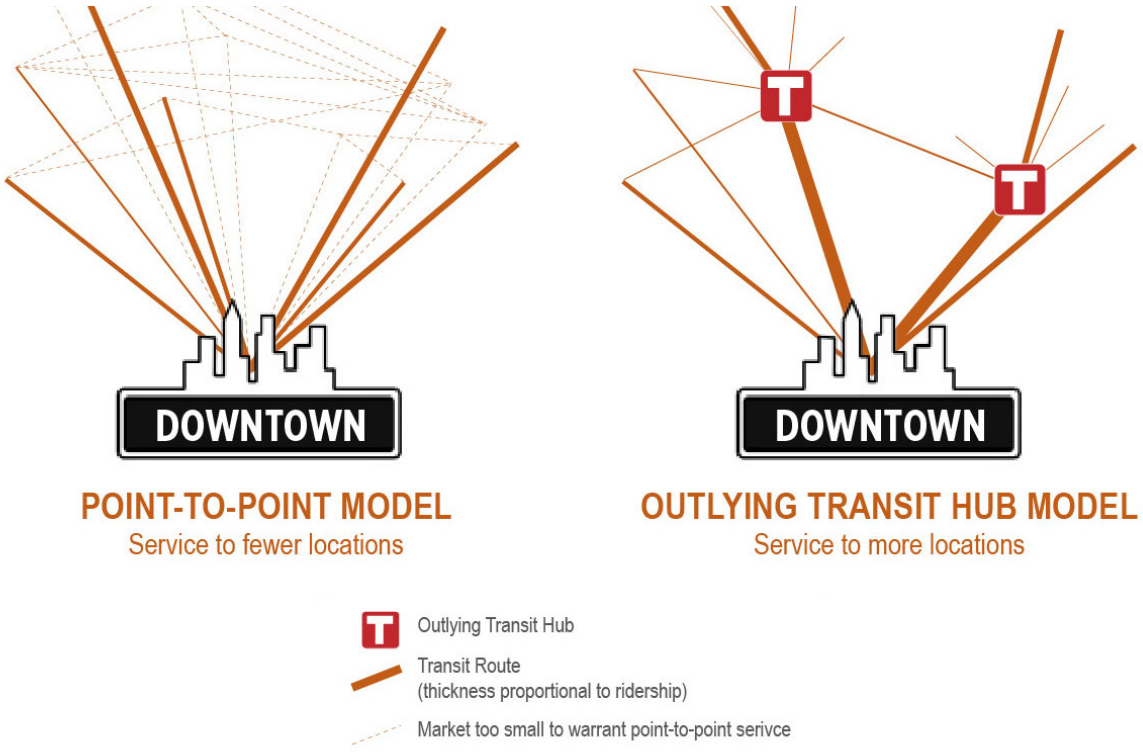
- Travel patterns in a changing and rapidly growing city will typically generate sufficient “crosstown trip” volume to make more direct service viable, allowing the transit agency to evolve to a more “decentralized” service model.

Fig 3. illustrates the difference between a pure radial transit model and a more decentralized model with outlying transit centers.

Over the past 10 years, WeGo Public Transit has added several crosstown and neighborhood circulator routes that do not travel to Downtown Nashville (typically our 70 series routes). However, their effectiveness has been limited due to (1) service that is insufficiently frequent to allow for a relatively quick transfer, and (2) a lack of sufficient infrastructure to make for a safe and comfortable transfer. As a result, an individual in, let’s say Berry Hill, who may have a faster trip to Antioch by using the 77 – Thompson Connector to the 55 – Murfreesboro to get to Antioch will more typically travel through Downtown Nashville because they know they will have a much more comfortable and safe experience at WeGo Central than trying to navigate the intersection of Thompson Lane and Murfreesboro Pike on foot.

For WeGo Public Transit, this plan identifies strategies to increase the number of crosstown and community circulator services, connecting to core radial services into Downtown Nashville at a network of neighborhood transit centers (see Fig. 4). Candidate locations for transit centers are where two or more individual bus routes meet. However, in addition to strictly being transfer locations for two bus routes, transit centers should be designed to act as local and regional “mobility hubs” that provide connections between

Fig. 3: Transit model comparison - Point-to-Point vs Outlining



local services, between local and regional services, and between downtown and non-downtown locations. In addition to bus service, they should safely and conveniently incorporate other mobility options to fill out the transportation "menu" for a neighborhood. Depending on the location and context for a particular center, this could include park-and-ride spaces, strong/safe pedestrian connections to surrounding neighborhoods, bikeshare and bicycle parking, space for taxi/private shuttle/transportation networking company (Lyft, Uber, etc.) pick-up and drop off, and space to accommodate emerging mobility options such as scooters. They can (and should) also be constructed in conjunction with surrounding development in a manner that supports both.

With respect to passenger amenities, centers should include some level of climate-controlled waiting facility with upgrades such as Wi-Fi, wayfinding information for the transportation system and the surrounding neighborhood, and real-time travel information. Public restrooms may be considered but are often left out of such centers due to the extremely high cost of maintenance and security. However, employee restrooms and break facilities would generally be included in these centers to accommodate Bus Operators and other agency employees who would not otherwise have access to such facilities. Centers would also incorporate security features such as emergency call boxes and digital video surveillance.

WeGo Public Transit currently has two such centers in active development – one at Hillsboro/Green Hills in partnership with Metro Nashville Public Schools and their overall Hillsboro High School renovation project (an "on-street" center); and one in North Nashville adjacent to the intersection of 26th Avenue North and Clarksville Pike (an "off-street" center). This plan includes these two sites, and programs eight additional locations which have yet to be identified. Following the "opportunistic" theme of this plan,

Fig. 4: The illustration (right) depicts a schematic of an "off-street" transit center, but "on-street" centers are also common

these facilities may arise in conjunction with other project in much the same way that the Hillsboro Green Hills and North Nashville/Clarksville Pike projects have – excellent locations, proximity to trip generators, and willing development partners.

Conceptually, WeGo Public Transit would like to locate such facilities in areas like:

- Antioch (near Hickory Hollow, serving routes 55 and 73, as well as potential RTA regional service)
- Berry Hill (Near 100 Oaks serving routes 8, 21, and 77)
- Dickerson Pike (Near Skyline Medical Center serving routes 23, 41 and 43, as well as potential RTA regional service)
- Madison (Along Gallatin Pike serving current routes 56 and 76)
- North Nashville near Tennessee State University (serving routes 21, 29 and possibly 19)
- The Nations (Along Charlotte Pike serving current routes 50, 3, and 19)
- West End near Vanderbilt University (serving routes 3, 5, 7 and 25)

Larger, regional centers (such as Hickory Hollow or Dickerson Pike) could also be planned to accommodate park-and-ride capacity.

SoBro Transit Hub

WeGo Central occupies a strategic location on the northern end of Downtown Nashville, adjacent to several government complexes such as the Courthouse and State Capitol. However, with Downtown jobs (and other activities) moving increasingly south of Broadway, the “single hub” system is becoming more and more problematic. First, as both service and ridership levels have increased, this facility is becoming increasingly overtaxed. On an average weekday, between 15,000 and 17,000 people travel through WeGo Central and over 2,200 bus movements occur. As large as this facility is, it is rapidly reaching its capacity, particularly during peak travel hours. Service resilience has also proven to be an issue, as twice over the past several years appearances by the President at the Municipal Auditorium next door has led the Secret Service to completely shutter the facility, forcing a temporary transfer location at significant expense to WeGo Public Transit, and a major inconvenience to customers.

Simultaneously, increasing traffic congestion through the Downtown core has made travel times through downtown extremely unreliable and unpredictable. During peak travel times, WeGo bus service traveling south from WeGo Central averages less than four miles per hour through the downtown core form – about the speed of a brisk walk.

Through partnership with the Convention Center Authority, land has been acquired in the rapidly growing SoBro section, immediately across Lafayette Street from the current Greyhound Bus Terminal. The development of a SoBro Transit Hub (significantly smaller than WeGo Central, but larger than planned neighborhood transit centers) would serve as a southern hub for service, and the northern anchor for the proposed Murfreesboro Pike Bus Rapid Transit line.

Given its location and site configuration, this project would be an ideal candidate for some type of public private partnership, with air rights development over a surface transit facility.

Downtown Transit Priority

The afore mentioned degradation and unpredictably of downtown traffic and travel times has become an increasing barrier to reliable transit service. This is true in all major cities with one exception – in those increasing numbers of cities who have developed transit priority corridors through their downtown cores. This plan does not propose a specific downtown transit priority corridor, but does set aside relatively modest funding for its establishment after an appropriate planning and public engagement process.

Development of a transit priority corridor (dedicated lanes, downtown "stations" and other upgrades) would further enhance the attractiveness by improving transit travel time and trip predictability. It would also promote more convenient and faster service through the enabling of "through-routing."

Presently, all downtown-bound routes terminate at WeGo Central. This is essential for current service reliability as the layover time that can be programmed at WeGo Central due to its terminal location also serves as recovery time for trips delayed by downtown traffic. Transit priority through the downtown core will facilitate more through-routing configurations. For instance, the 55 – Murfreesboro bus might be connected to the 56 - Gallatin, allowing for more people to have direct travel.

Downtown Transit Priority and the SoBro Transit Hub will be essential components of any eventual Murfreesboro Pike Bus Rapid Transit project, as ridership generated only to the edge of the downtown core will be insufficient to justify significant Federal investment. Development of a Downtown Transit Priority Corridor (as well as the SoBro hub and existing WeGo Central) will also significantly simplify future high capacity corridor development in the long-term along corridors like Gallatin Pike, Nolensville Pike and Charlotte Avenue.

Shelter Program Expansion

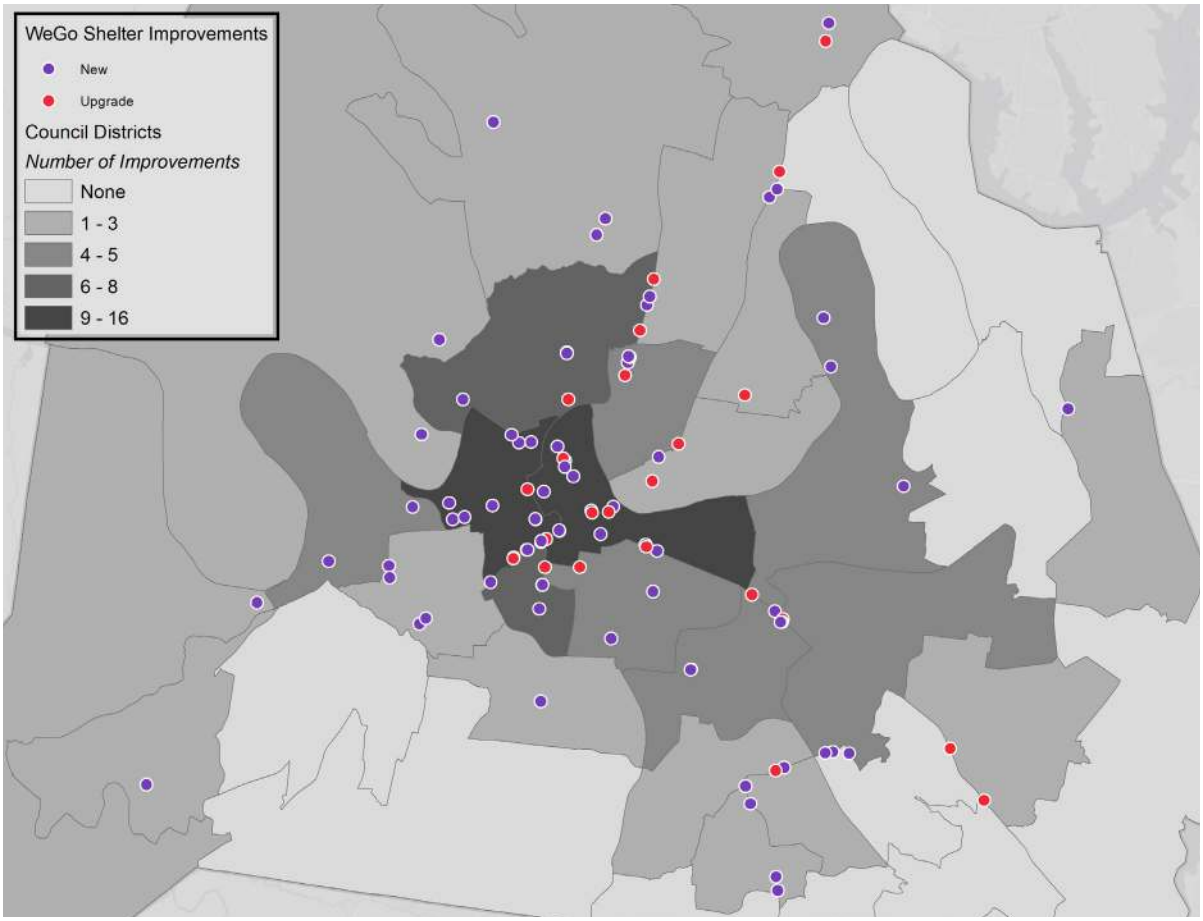
Over the past five years, WeGo Public Transit has more than doubled the number of passenger waiting shelters system-wide. There are now over 200 such facilities throughout the City. However, this is still not enough, as 68 current bus stops have been identified that board an average of over 25 passengers per day (the threshold for consideration of a shelter). An additional 25 locations have been identified that already have shelters, but where those shelters are undersized based on average daily boardings.

Under this program, these shelters (with associated site work and pedestrian infrastructure) would be constructed. Fig. 5 illustrates the distribution of these structures. Details on specific location needs are available upon request.

Benefits of the Better Bus Program

The value of a good public transportation system cannot be measured solely by ridership numbers, farebox collections or cost recovery. At its core, a good public transportation system affords access to opportunity for those who have very limited options. Ideally, those people who do have a choice to drive or to ride transit will choose transit in increasing numbers due to convenience, better travel time reliability, cost or environmental factors. But the increased opportunities that a good public transportation system offers those with low incomes, those who have disabilities, or those who simply can't drive is the difference maker in their lives. By expanding the hours of service, more

Fig. 5: New and expanded passenger waiting shelter sites



people can accept 2nd or 3rd shift employment, or overtime assignments on their current job. By improving service frequency and crosstown connections, the number of jobs available to someone from a particular neighborhood can expand exponentially.

Similarly, these improvements can offer the gift of time for a high school student traveling modest homes and neighborhoods to a magnet school for a gifted program. Time not spent waiting for infrequent and indirect bus service that could be better spent studying or in part-time employment.

Figs. 6 through 9 illustrate some of the "quantifiable benefits" of Better Bus. However, charts, graphs and numbers will never explain the benefits as well as the individual stories of the people who will benefit directly from these improvements.

Coverage of the bus network and more direct routing through approaches like crosstown routes are important to convenience and usability of the bus network. But the real game changer is high-frequency service in key corridors and safe and comfortable points to transfer onto the service. In addition to frequency improvements, additional

Fig. 6: Population with access to transit

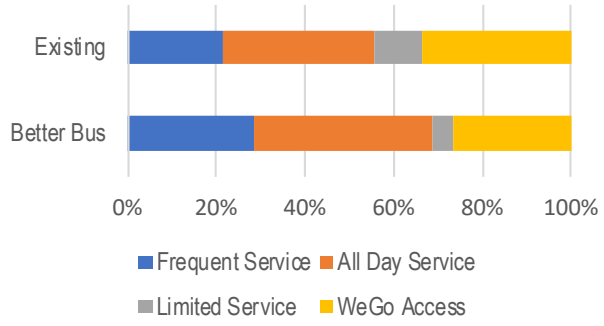


Fig. 7: Minority population with access to transit

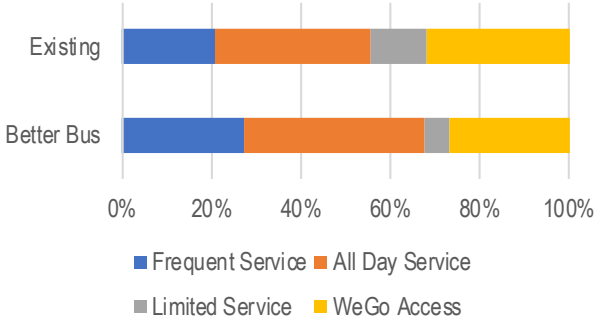


Fig. 8: Low income with access to transit

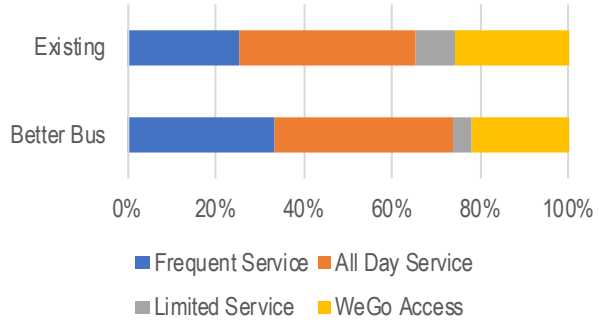
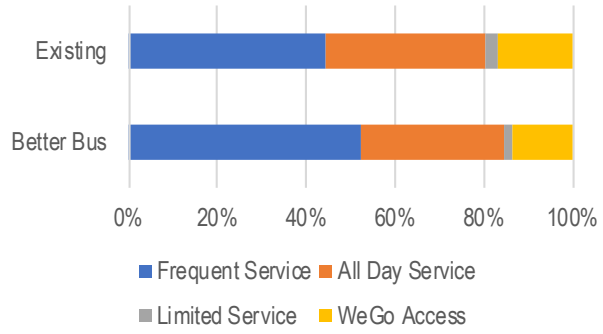


Fig. 9: Jobs accessable by transit



service hours have been the top priority for transit riders in Nashville for several years. The two charts below provide a comparative look at the span and frequency of transit service in Nashville. Fig. 10 illustrates the current service network, and Fig. 11 illustrates what is programmed into the full Better Bus service improvement program.

Worldwide, the common myth that people will not transfer to use transit being disproven – if transfers are of high quality. That is – fast and comfortable. If you must wait for a connecting bus route for 30 minutes in a drainage ditch, you won't use it. If, however, you wait less than 10 minutes in a comfortable station with seating and climate control, it suddenly becomes more dignified and civilized.

Beyond comfort and dignity, access to opportunity can expand exponentially in some neighborhoods. The following charts demonstrate the impact that the Better Bus service improvement program would have in significantly increasing the reach of the transit system from many neighborhoods. That is to say, "where can I get from here within an hour?"

Improvements contemplated in the Better Bus service expansion and improvement program would certainly increase ridership – as well as the numbers of people who would find transit to be attractive (particularly when combined with infrastructure investments and transit priority measures). However, the true value of the system will be measured through the enhanced access to opportunity afforded to those in our community

Fig. 10: Existing frequencies and spans by route

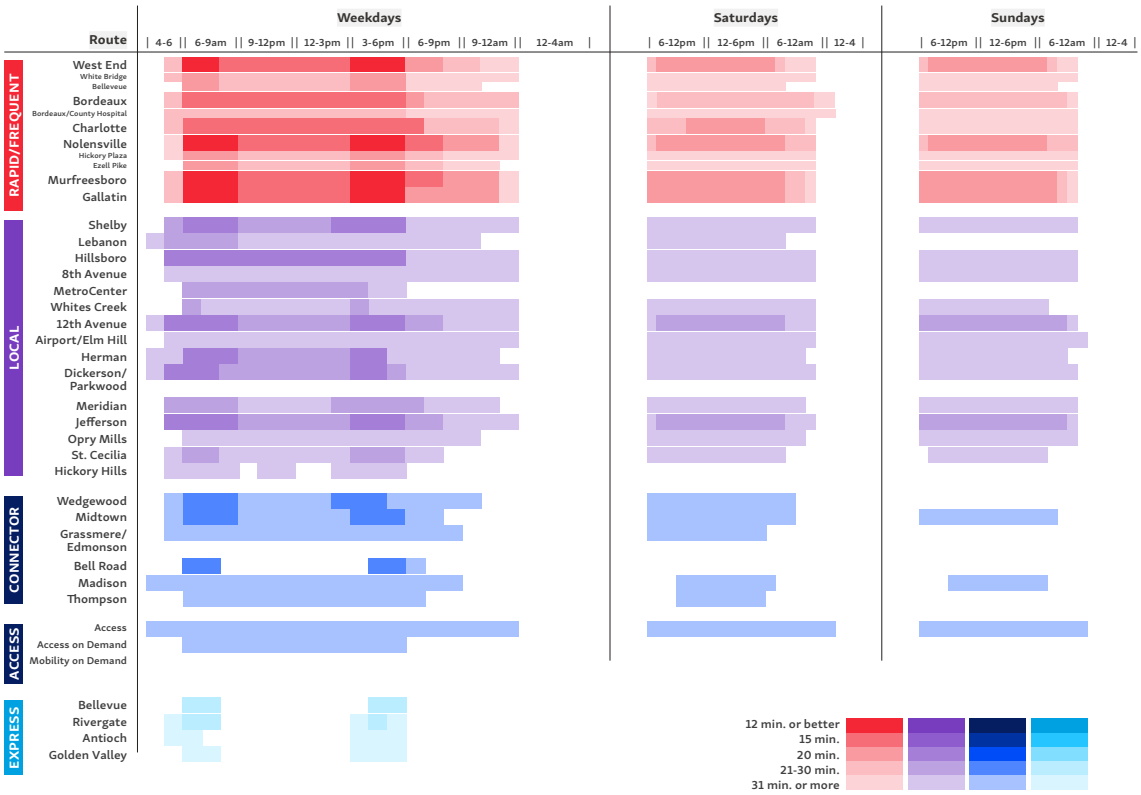
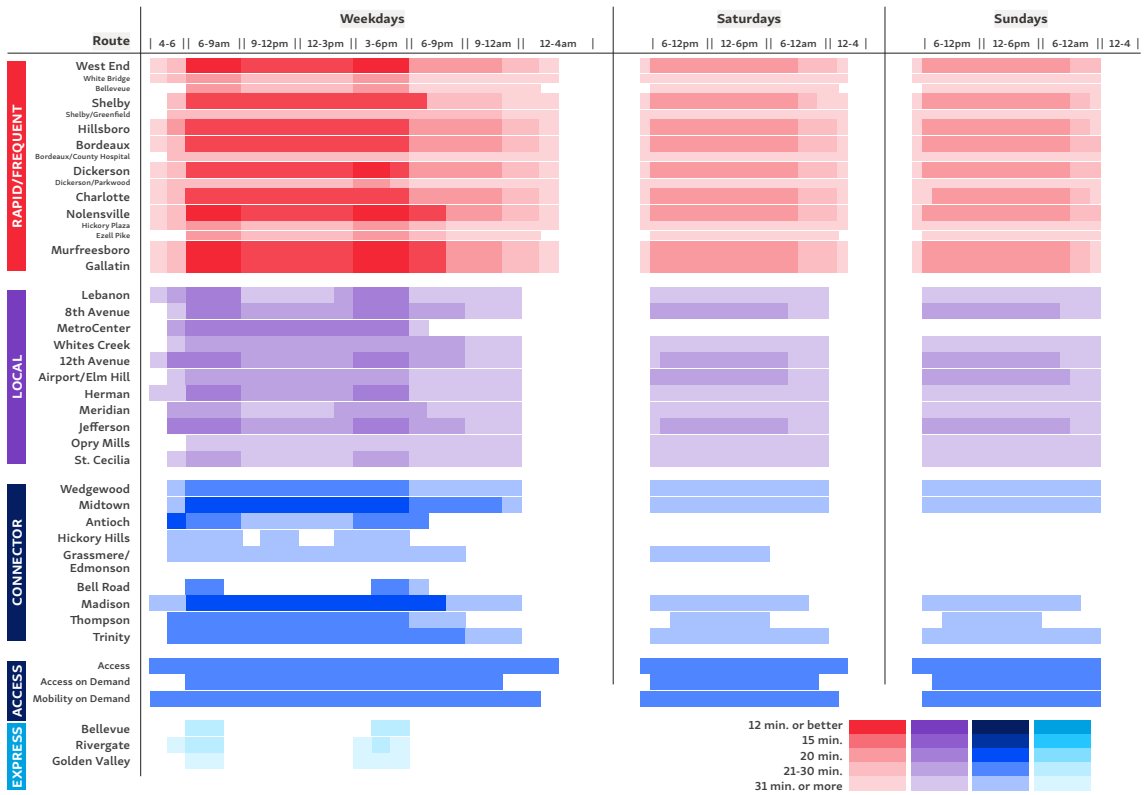


Fig. 11: Draft network frequencies and spans by route



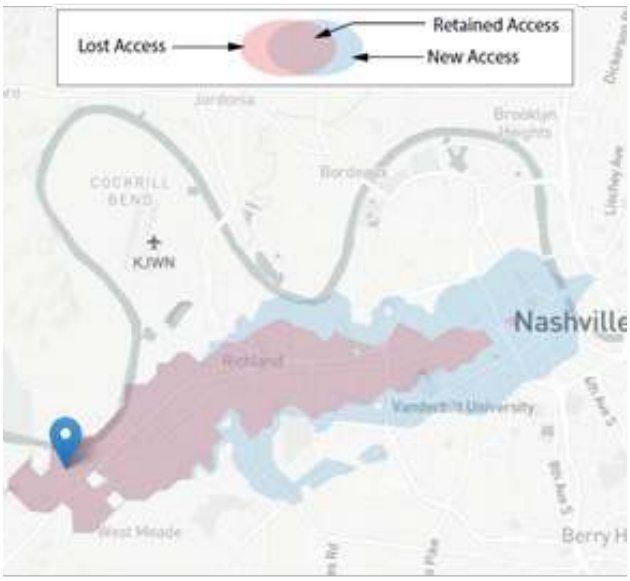


Fig. 12: Improved weekend access example — Charlotte Pike Walmart: points reachable in less than 60 minutes

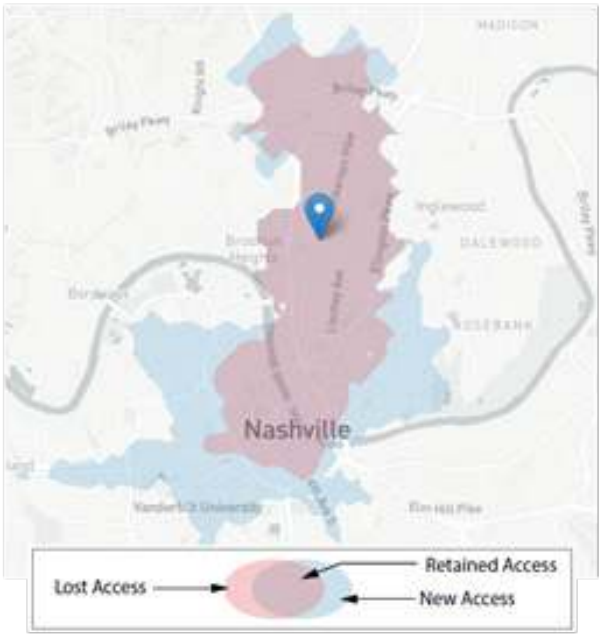


Fig. 13: Improved weekend access example — Dickerson Pike and Trinity Lane: points reachable in less than 60 minut4s

Fig. 14: Improved weekend access example — Clarksville Pike in Bordeaux: points reachable in less than 60 minutes

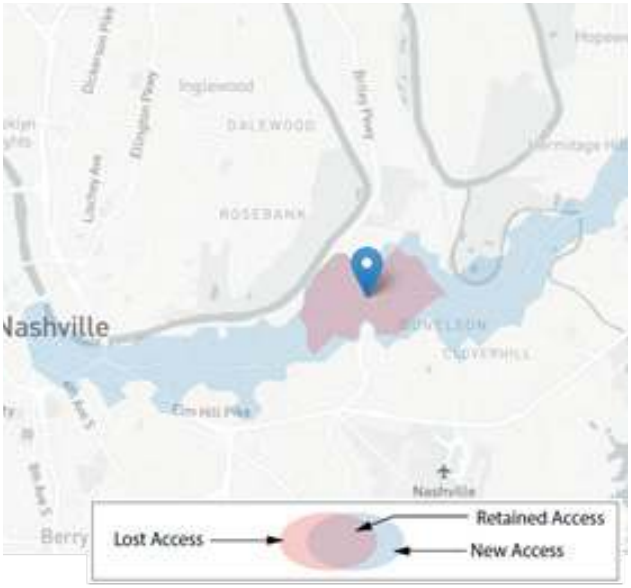


Fig. 15: Improved weekend access example — Lebanon Pike near Briley Parkway: points reachable in less than 60 minutes

who are typically overlooked. The opportunity of access to jobs, education, medical care and affordable housing – with reasonable travel times. We can make some attempts to quantify these improvements to society but, for those who directly benefit, they are priceless.

Murfreesboro Pike BRT

From Downtown/SoBro to Hickory Hollow at Bell Road – 12 miles

The project will originate at the Hickory Hollow commercial center in Antioch and will generally operate along Bell Road and Murfreesboro Pike to Downtown Nashville, terminating at the SoBro Transit Hub at 4th Avenue South and Ash Street. It will connect with Nashville International Airport, Thompson Lane, and Downtown Nashville south of Broadway (SoBro). It will follow existing MTA 55-Murfreesboro Pike (Fig.16) bus route, but will terminate at the SoBro Transit Hub instead of WeGo Central.

Buses running in majority dedicated lanes with iconic stations, off-board fare collection, platform-level boarding, high-capacity buses, and fast and frequent operations. Project cost also includes significant roadway, safety, traffic management/ ITS, pedestrian crossing, and sidewalk improvements.

This corridor was selected to advance the first bus rapid transit in Metro receiving a "BEST" in constructability as well as overall favorable rating from the *nMotion* recommendations and associated High Capacity Transit Study. Additionally, Murfreesboro Pike uniquely offers access to service jobs and other employment at the Airport and connects the Tier 1 Center at Hickory Hollow identified in *NashvilleNext* for "grow with intention". In addition to providing access to jobs at the airport there is opportunity for funding partnership as was identified in Let's Move Nashville for participation by both the Airport and Convention Center Authority.

Murfreesboro Pike BRT — CAPITAL - $413.3 million ($32 million per mile)

Federal	Local	Operating
103.325 million (25%)	$309.975 million (75%)	Additional operating and maintenance costs to support expanded service incorporated into "Better Bus" service expansion program (4 a.m. – 1 a.m.; 7 days per week; 10-minute peak; no worse than 20-minute headways off-peak)

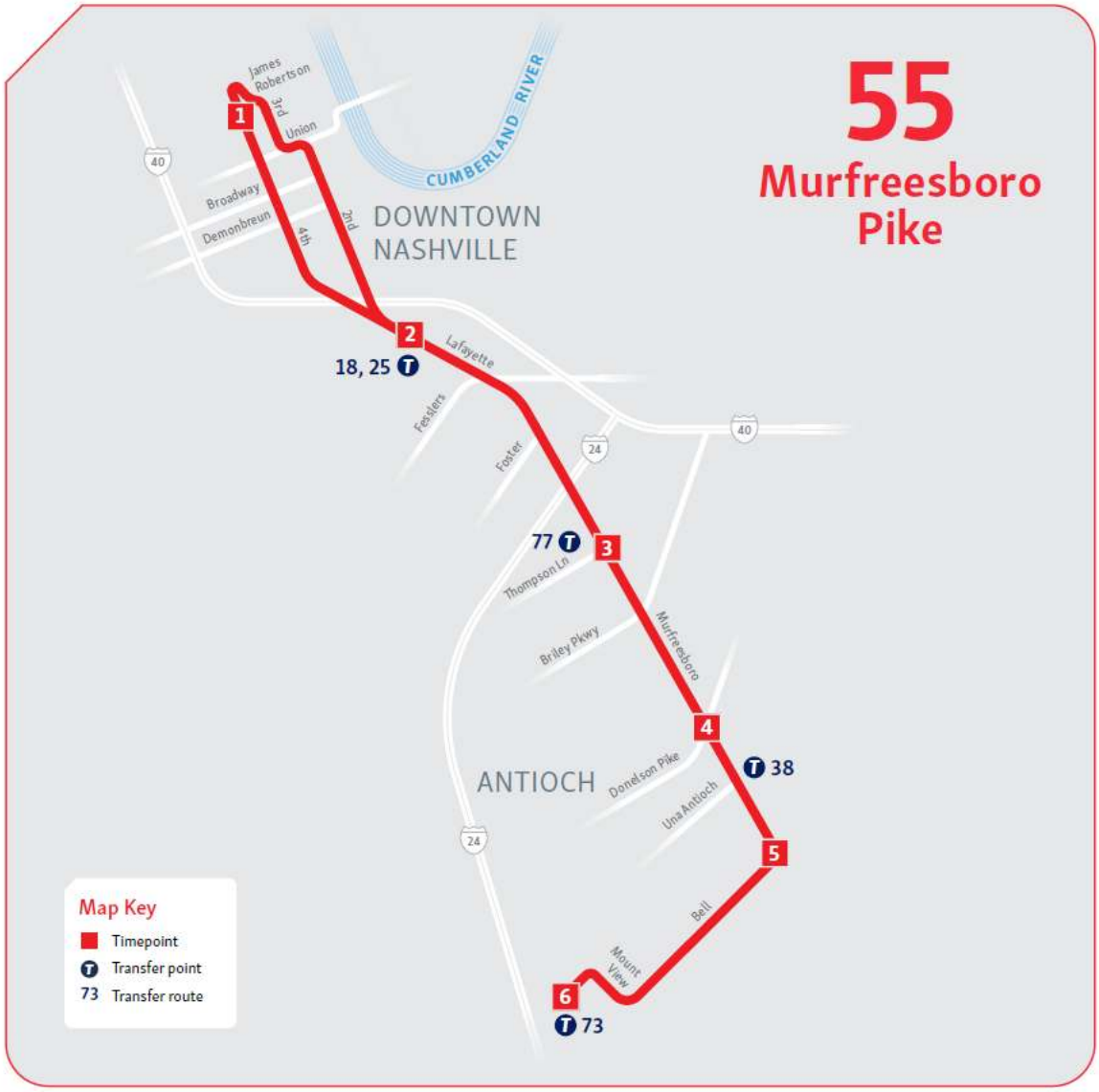


Fig. 16: Murfreesboro Pike BRT project would generally follow existing route **55-Murfreesboro Pike**

Clarksville Pike Rapid Bus

From downtown to Bordeaux at King's Lane – 6.9 miles

The project will generally operate along the existing 22-Bordeaux (Fig. 17) bus route, serving the Haynes Park, Bordeaux, North Nashville and Buena Vista neighborhoods. It will connect with the North Nashville Neighborhood Transit Center at Clarksville Pike and 26th Avenue North.

The Clarksville Pike Rapid Bus project will serve North Nashville with a Rapid Bus system that will include many of the amenities in a Gold Standard

Clarksville Pike Rapid Bus — CAPITAL - $92.9 million ($13.5 million per mile)

Federal	Local	Operating
$23.225 million (25%)	$69.675 million (75%)	Additional operating and maintenance costs to support expanded service incorporated into "Better Bus" service expansion program (4 a.m. – 1 a.m.; 7 days per week; 15-minute peak; no worse than 20-minute headways off-peak)

BRT project minus dedicated lanes. Infrastructure upgrades where feasible, will include features such as queue-jump lanes, transit signal priority, off-board fare collection, enhanced stops/stations, pedestrian safety upgrades, high-capacity buses, and fast, frequent service.

This corridor's improvements for rapid bus will particularly leverage the planned Neighborhood Transit Center at Clarksville Pike and 26th Avenue North, which will serve as a key station for Rapid Bus service in the Bordeaux-Clarksville Pike corridor, and a connection point to other WeGo Public Transit services. At this Center, riders on Clarksville Pike Rapid Bus service will be able to connect to the Jefferson Street corridor via the 25 – Midtown route; the neighborhoods of North Nashville via the 42 – St. Cecilia/ Cumberland route; the jobs of Metro Center and Germantown via a planned extension of the 9 – Metro Center route; Tennessee State University and the West End via a planned extension of the 21 – Wedgewood route; and a possible connection to East Nashville (including service along Dickerson and Gallatin Pikes) via a new Trinity Lane crosstown route, called out in WeGo Public Transit's Better Bus plan. This Neighborhood Transit Center will also promote connections to other mobility options such as rideshare operators, carshare operators, bikeshare, etc. Customers will see significant upgrades in amenities, including a climate-controlled waiting area, fare product vending machines, and real-time digital travel information. The Clarksville Pike Rapid Bus will serve destinations such as the McGruder Family Resource Center, Cumberland View Housing Complex, Nashville Farmers Market, and emerging affordable housing options along Clarksville Pike.

WeGo Star Commuter Rail

The WeGo Star is Middle Tennessee's only fixed guideway transit service, providing riders with reliable travel times along the 32-mile route between Lebanon and Riverfront Station in Downtown. The WeGo Star is a service of the Regional Transportation Authority of Middle Tennessee (RTA), which also offers commuter bus service in six additional regional travel

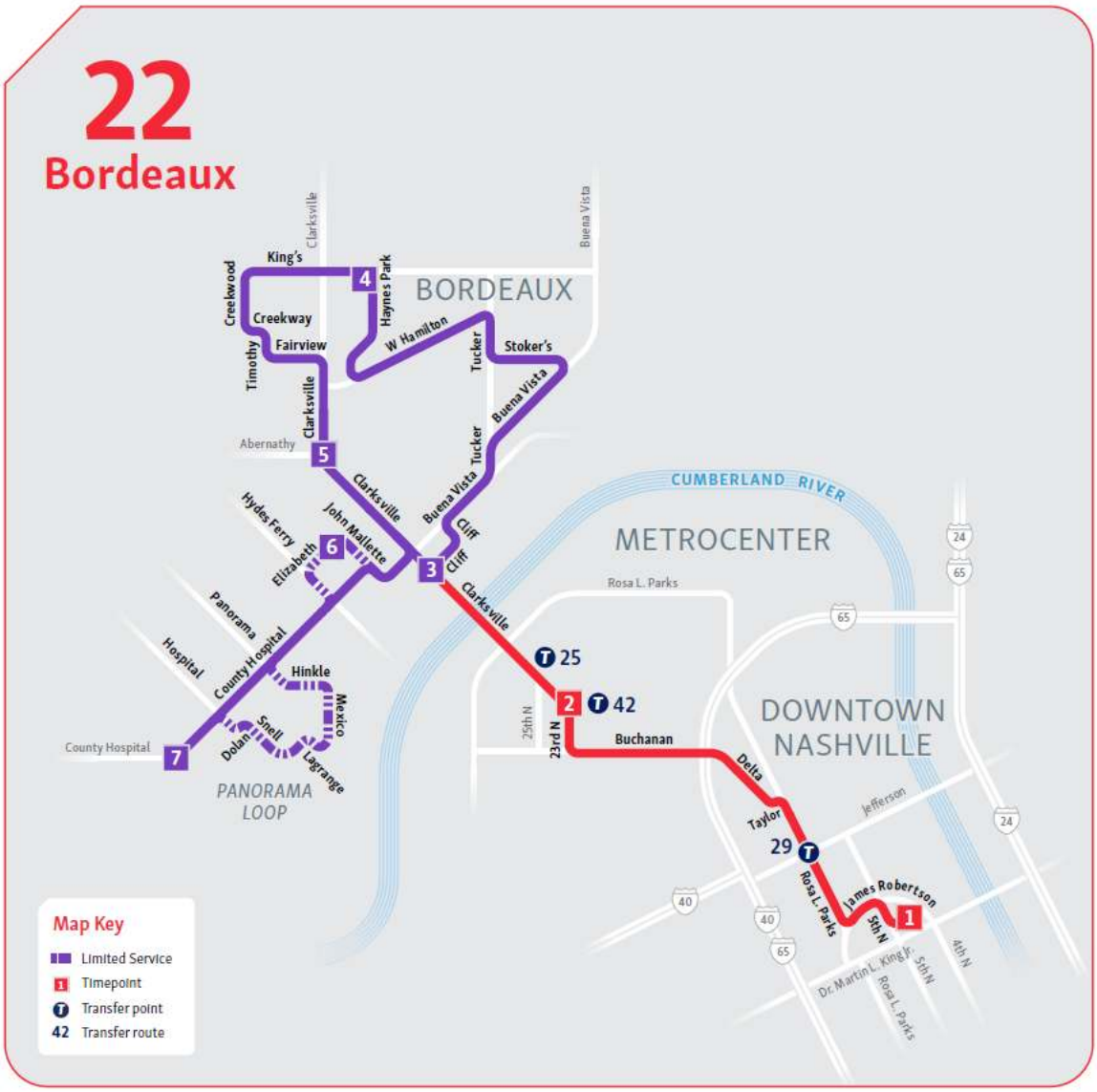


Fig. 17: Clarksville Pike Rapid Bus would generally follow the existing rotue **22-Bordeaux**

corridors. In spite of the fact that the Nashville – Wilson County corridor is only the fourth-busiest of these seven travel corridors in terms of population and interstate highway traffic volumes, the Star "punches above its weight" with respect to the share of daily commuters it carries:

- The Star carries over half of the total average daily passenger volume in the seven RTA regional commuter corridors.
- The Star carries over three times as many daily riders as the second highest ridership corridor in the region (Nashville – Rutherford County, which is the "busiest" regional commute corridor in terms of population and interstate highway traffic volumes).
- On a "per-trip" basis, the Star carries 10 times as many riders as the average of all regional commuter bus services – 130 v. 13.

One of the biggest limitations of the Star (and the single most frequently requested service improvement from riders) is the limited number of trips it offers – only 3 daily trips in each peak direction.

- In addition to its role in carrying the Downtown workforce, the Star is often deployed to serve large scale special events such as the New Year's Eve celebration downtown, 4th of July Fireworks, and Tennessee Titans home football games. These trains often "sell-out," carrying 400-700 people per trip.

The attractiveness of the Star (despite its limited service) comes from two characteristics lacking in the regional bus corridors: (1) reliable travel time, due to the fact that it does not operate in mixed traffic on the regional highway network as RTA Regional Buses must; and (2) well located, "purpose-built" park and ride lots that provide a

WeGo Star Commuter Rail Improvements CAPITAL -$139.6 million)
Annual operating - $5.71 million

Project	Capital Investment	Annual Operating
Creation of a "Downtown-Adjacent" railcar layover yard	$14 million	$0.08 million
Double-tracking/passing siding improvements	$9 million	N/A
Intersection improvements to create additional "protected crossings"	$6 million	$0.15 million
Crossing upgrades to allow for additional "quiet zones"	$8 million	$0.08 million
Park-and-ride capacity expansion	$12 million	$0.12 million
Possible infill stations:		
-Central Pike (Davidson)	$5 million	$0.08 million
-Golden Bear Parkway (Wilson)	$5 million	$0.08 million
-Expo Center (Wilson)	$16.5M	$0.62 million
Rail vehicle shop/yard upgrades	$2.5 million	N/A
Rail fleet expansion to provide additional trips	$31.6 million	N/A (included in service operation)
Positive train control system	$30.0 million	$0.5 million
Operation of additional service (4 additional daily peak direction trips each way)	N/A	$4.0 million
WeGo Star Improvements Total	$139.6 million	$5.71 million

safe and convenient location for commuters to park and catch the train.

Despite its advantages, the Star still under performs with respect to ridership compared to other commuter rail services across the nation. This is largely because service is limited, and the line is not immediately adjacent to higher population centers. This plan proposes to address the capital and operating shortfalls that would allow for additional trips to be operated. However, to fully recognize the potential that the Star might offer, these investments must be made in concert with deliberate efforts to generate more "transit-oriented development" (TOD) in the corridor. There is strong evidence that the market in Middle Tennessee is ready for this approach, most vividly demonstrated by significant private sector investment surrounding the Hamilton Springs Station in Lebanon, and the Mt. Juliet Station (both in Wilson County).

NashvilleNext, the most recently adopted Comprehensive Plan for Nashville and Davidson County, anticipated this type of growth as the neighborhood surrounding Donelson Station was identified as a "Tier 1 Center," and the area surrounding Hermitage Station as a "Tier 2" Center. In much the same way that public and private sector leadership developed the Hamilton Springs Station and Hamilton Springs development as the first "infill" station since the Star opened, there may be similar opportunities for an infill station adjacent to Central Pike.

In concert with planning for the capital and operating improvements that would position the Star for additional trips and improved service,

Project	Shared	Davidson	Wilson
Creation of a "Downtown-Adjacent" railcar layover yard	X		
Double-tracking/passing siding improvements	X		
Intersection improvements to create additional "protected crossings"		X	X
Crossing upgrades to allow for additional "quiet zones"		X	X
Park-and-ride capacity expansion		X	X
Possible Infill Stations:			
-Central Pike (Davidson)		X	
-Golden Bear Parkway (Wilson)			X
-Expo Center (Wilson)			X
Rail vehicle shop/yard upgrades	X		
Rail fleet expansion to provide additional trips	X		
Positive train control system	X		
Operation of additional service (4 additional daily peak direction trips each way)	X		

this plan proposes to engage in a collaborative planning process with the neighborhoods adjacent to Davidson County Star Stations (Donelson, Hermitage, and a potential Central Pike infill station) to examine the types of development that could be attractive, and increase the return on investment that Nashville receives from the Star. This is in keeping with the *NashvilleNext* theme of "Growth with Intention."

The proposed investments in this plan would facilitate the operation of more trips on the Star, providing for a much more convenient and attractive option for residents. Among these investments would be the installation of a Federally mandated "Positive Train Control" (PTC) system. The current lack of PTC on the line prevents the operation of any additional weekday trips on the schedule. In addition to opening up the schedule for more commuter-oriented service, this investment would also allow the Star to be deployed for more large-scale special events to help relieve congestion and pressure on downtown parking facilities.

Because this project represents the only multi-county transit investment in this plan, it is important to understand that the ultimate responsibility to identify funding for these capital and operating projects cannot fall solely to Nashville and Davidson County. Wilson County and the cities along the line (Mt. Juliet and Lebanon) will also need to play a large role, as will the State of Tennessee and the Tennessee Department of Transportation if these projects are to become reality. As with all other projects in

Summary of Public Transportation Investments

Program Element	Capital Investment	Annual Operations and Maintenance Cost (In addition to current service level spending of approximately $90 million annually)
Better Bus service and facility expansion program	$180.1 million	$29.5 million
Murfreesboro Pike Bus Rapid Transit	$413.3 million	N/A
Clarksville Pike Rapid Bus	$92.9 million	N/A
WeGo Star Commuter Rail Line Improvements	$139.6 million	$5.71 million
Total public transportation investment	$825.9 million	$35.21 million

this plan, funding will be sought “opportunistically” from as many potential sources as possible (including the Federal Government and the private sector).

Some of the specific projects identified above represent “shared infrastructure” between Davidson and Wilson County, and both would need to contribute in some fashion. Positive Train Control, Rail Vehicle Fleet Expansion, and Rail Vehicle Shop/Yard Upgrades are examples that fall into this category. Even if a project is located within a specific county (improvements to the rail vehicle shop/yard in Wilson County and creation of a “downtown-adjacent railcar layover yard” in Davidson County, for instance), they are considered “shared” projects because they are essential to the overall operation of the line.

Other specific projects would become the responsibility of the county in which they are located. Examples here include specific station improvements and quiet zone and protected crossing upgrades. In all cases, local funding would be required to leverage other available funds from private sources, State and Federal government.

The table on the previous page breaks the projects listed above into “Davidson,” “Wilson,” and “Shared” categories.

Traffic/Multimodal/Safety

Funding buckets described below represent the prioritization of investment levels of projects and project types. The projects that will be included in these programs are organized by Council District and presented in the Appendix.

$200M Sidewalks

The project funding plans to address 80% of the remaining priority sidewalk needs across the county. There are approximately 75 miles of sidewalk to be repaired and installed across the county. Metro Public Works began addressing these priority needs in 2016 and oversees assigning priority to sidewalk projects. Metro’s sidewalk priorities are defined in Chapter 5 of *WalknBike*, the city’s bicycle and pedestrian master plan. An update to *WalknBike* and the current Metro Public Works sidewalk prioritization process will be undertaken within the next 18 months.

$200M State of Good Repair

The project funding plans to covers the current gap in fully funding the annual paving and sidewalk repair budgets. It also fully addresses the backlog of paving needs and needed culvert/bridge repairs and brings approximately 30% of non-ADA compliant sidewalks into compliance.

$175M Jefferson Street Multimodal Cap/Connector

From Nashville Civic Design Center’s Plan of Nashville, shown in Fig. 18, and the U.S. Department of Transportation’s Every Place Counts Challenge, a cap over I-65/I-40 could

Fig. 18: Jefferson Street cap as proposed during US DOT Ladders of Opportunity; Every Place Counts Design Challenge, Summary Report

better connect the west and east sides of North Nashville with Jefferson Street serving as its anchor. The Jefferson Street bridge over I-40 (National Bridge ID: 19I00400057) carries approximately 14,000 vehicles per day. It was built in 1967 and was last inspected in 2013. At that time, it was rated to be in good condition, but narrow, cracked sidewalks and 24-foot-wide travel lanes create a hostile pedestrian environment on this bridge. As this bridge ages it will be important to ensure a state of good repair, seek opportunities to reconnect bifurcated communities, and expand access to social and economic activities.

The negative impacts of I-40 predicted by community members have been validated by numerous academic studies and local observations by professional planning staff in the years since I-40 was constructed through North Nashville. An intervention, like a freeway cap, could create new affordable office or retail space, supply shared parking, or support affordable housing for parcels made undevelopable because they were narrowed by the construction of the highway. Such an intervention could yield safety and placemaking benefits, generating economic value for neighbors and bridge users.

For planning purposes, an eight-acre cap (348,480 square feet) was assumed at $500/square foot, for a total of $175M. As illustrated above, the cap is located over I-65/I-40 and extends from Jefferson Street to Jackson Street. This provides improved connections along Jefferson and Jackson and “new” east and west connections via Meharry Boulevard and Phillips Street. Mixed use investments are shown along Jefferson Street and a park with pedestrian and/or bikeways occupy the remainder of the cap.

$117M Restoration & Resiliency, State Routes, Partnership Funding, and Innovation & Sustainability Corridors

Restoration & Resiliency

The project funding plans to provide for ongoing infrastructure restoration and resiliency efforts in the North Nashville, Germantown, East Nashville, and Donelson areas hardest hit by the recent storms. Resiliency may focus on those efforts to harden infrastructure to better withstand future events.

State Routes & Partnership Funding

This funding category will also allow for future partnerships with TDOT on needed State Route/Interstate improvements including those addressing freight and congestion in Metro, other federal/state/public private partnership funding, emerging needs and opportunities arising over the life of the program.

TDOT is in the process of identifying how best to address growing congestion and mobility needs within the 5-County Middle Tennessee Region (Davidson, Rutherford, Sumner, Williamson, and Wilson counties). While these plans are still under development, there are a number of project concepts that relate to better managing our roadways in and around the Inner Loop, as well as along major commuting corridors (such as West End) that serve and support Nashville-Davidson County as well as the region's surrounding counties.

The concepts of the plan focus on management solutions relative to freeways, arterials, and transit.. In addition to regional coordination with all of the partners, current project commitments identified within the IMPROVE Act are also considered to determine could leverage and partnership opportunities to best respond to the region's growing congestion and mobility needs. Although many of these needs are beyond available existing funding, there may be some potential opportunity to leverage funding for some of these projects (either associated with IMPROVE Act projects and/or other existing funding programs). Transit solutions and other operational solutions will be heavily dependent upon local funding and/or federal discretionary fund

A partnership effort with TDOT specifically related to Inner Loop and the West End corridor notes:

- A reconfiguration of the Inner Loop to address weaving and conflict points including creating a better collector-distributor roadway system on either side of the Inner Loop
- For major commuter arterial corridors (which includes West End) improvements focus on bottleneck intersection locations. Improvements at these locations range from turn lane improvements and signal timing changes to reconfiguration of intersection geometrics.
- Transit investments cross both interstate and arterial roadways. Building upon previous transit plans within the region as well as the congestion analysis undertaken by TDOT, 5 interstate corridors (I-24 E, I-65 S, I-40 W, I-24 W, and I-65 N) and 8 arterial roadways (Charlotte, Broadway/West End, 21st Ave/ Hillsboro Pike, Dickerson Pike, Nolensville, Pike, Gallatin Pike, and Clarksville Pike) were identified for transit investments. Investments

in park-and-ride lots, transit signal priority, and sidewalk and transit stop improvements are also envisioned with this category of improvements.

- This funding category specifically includes $6M of partnership funding for design necessary to advance capital improvements considered by TDOT for high capacity transit on West End Avenue from downtown to 31st. Avenue. Additional coordination with Vanderbilt University recognizes the necessary partnership for the transportation and land use vision for West End Avenue. Vanderbilt University has committed to partner with the city and other stakeholders to foster this conversation and develop a transportation and land use vision that appropriately accommodates the regional employment growth in this area.

In addition, there are a number of other program area considerations. These include:

- Investing in Regional Traffic Operations to improve traffic flow by upgrading infrastructure at 900+ traffic signals on state routes and actively managing daily demand
- Investing in Transportation Demand Management (TDM) programs to expand commute trip reduction programs such as ridesharing, carpooling, alternative modes, and other travel demand management strategies
- Exploring additional funding support for Non-Motorized Investments for local bicycle and pedestrian infrastructure and the continued filling of gaps on the state highway system
- Partnering with regional and local transit agencies to identify funding that would Support Transit Operations on the state highway system
- Consulting with freight partners to determine opportunities or technologies that would result in reduced truck traffic through downtown Nashville

TDOT's congestion study effort not only supports recommendations within the Metro Nashville Transportation Plan but are integrally to the success of both efforts. Additionally, Vanderbilt's FutureVU plan equally aligns with the strategies TDOT has identified and that of Metro's draft Plan. Collectively, we will work with other major employers like Vanderbilt within the region to support investments that allow use all modes (that are convenient, safe, and reliable) and best work to manage demand in a way that allows for continued economic growth of the region and state.

Innovation & Sustainability Corridors

Seven million dollars is set aside for the Martin Luther King, Jr. Boulevard/Charlotte Avenue Innovation Corridor & Gallatin Sustainability Corridor serving as living labs for technology and sustainability pilots and demonstrations including smart signals, crosswalks, parking, CAE (computer-aided engineering) vehicles, green infrastructure, solar powered features such as crosswalks, lighting, native species right-of-way plantings, and others.

MLK Jr. Boulevard/Charlotte Avenue Innovation Corridor

The MLK Jr. Boulevard/Charlotte Avenue Innovation Corridor fronts the State's Capital building and continues as a densely developed corridor with 88,000 jobs and 16,000 residents living within a half mile of the corridor (within the segment between Downtown Nashville and White Bridge Pike). The corridor follows Route 50-Charlotte Pike (Fig. 19) from WeGo Central on 5th Avenue North to I-40 near Nashville West shopping center. Specific project limits will be determined as the project design, including project phasing that is likely, advances.

Several large medical complexes, Centennial Park and Art Center occupy the corridor and most notably, Vanderbilt University, with 12,000 students and 8,000 faculty and staff are within a half mile of the corridor. The existing development and diversity of uses as well as potential partnership with Vanderbilt University engineering make this an optimum location for pilots demonstrating how technology can improve and balance mobility needs which is a noted goal for the Charlotte Avenue Corridor Study adopted in October 2018 by the Metro Planning Commission. Additionally, as was done in Chattanooga, honoring Dr. King with a corridor that advances our future mobility is a fitting action.

Fig. 19: Charlotte Pike Innovation Corridor will generally follow route 50 Charlotte Pike from Downtown Nashville to I-40 at Nashville West.

Fig. 20: Gallatin Pike Sustainability Corridor will generally follow route 56 Gallatin Pike

Gallatin Sustainability Corridor

The Gallatin Sustainability Corridor will leverage all sustainability activities deployed in the corridor including transit, bike and pedestrian improvements, solar, native plantings and landscaping, stormwater runoff management, potential cool street pavement and other technologies to demonstrate sustainability practice and value. This corridor follows Route 56 Gallatin Pike (Fig. 20) and extends from WeGo

Central on 5th Avenue to the RiverGate Mall. Specific project limits will be determined as the project design, including project phasing that is likely, advances.

$75M Safety/Vision Zero/Traffic Calming

This program of funding would serve to address the existing backlog of traffic calming requests maintained by Metro Public Works as well as to address operational safety improvements supporting the Vision Zero Action Plan, which is currently under development, addressing the highest accident locations and safety initiatives. This program fully funds all traffic calming requests and provides ongoing maintenance of traffic calming devises. It also addresses 10-15 major arterial issues per year.

$35M Active Transportation/ Bikeways/Greenways

This program funds approximately seven miles of new bikeway every year, growing our network by 20% over five years. Specific greenway needs are to be determined.

$15M Traffic Management System/ Signal Upgrades

This funding category implements the recommendations of the Traffic Management System Evaluation currently underway. Significant reductions in travel time delay and safety improvements through improved traffic flow and management are anticipated. Modernizing our traffic signal networks are a key component for all improvements in all modes, including the Better Bus initiatives.

- Full intersection detection upgrade – $30K – 20 intersections per year – $600K per year
- Partial detection upgrade – $20K – 10 intersections per year – $200K per year
- Communications – $500 per cell modem per year – assumes 500 modems per year – $250K per year.
- Traffic Control Center – 1.5 million in year one towards repurposing facility at Howard School complex and 4 staff each year upon commissioning at $250K per year
- Timing development and traffic-responsive equipment implementation – $3K per intersection – 200 intersections per year $600K
- CCTV installations – $6K per location – 50 locations per year – $300K
- Connected vehicle and new technology testing – $10K per location – 20 locations per year – $200K
- Intersection rewiring – $50K per intersection – 20 intersections per year – $1M

$1M Downtown Neighborhood Traffic Project

Metro Nashville, with a population of over 694,144 in 2019, includes one of the most visited downtowns in America with a vibrant business, travel and tourism and music industry. Over 16 million out of town visitors came to Nashville in 2019 including almost five million at downtown events. Home to major and minor league teams, sporting events also draw large crowds of supporters to the Downtown. As the pandemic lessens, a return to vibrancy for Downtown is anticipated.

To support these activities, as of the second quarter of 2020, Downtown Nashville boasts 9,381 hotel rooms and an additional 6,923 under construction or planned. The downtown resident population is numbered at 13,000 and 2,861 residential units are under construction. As of 2019, more than 72,000 employees work in downtown including well-known brands such as Amazon, Sony and Hospital Corporation of America. With continuous activity and cranes on the skyline, curb space in Downtown Nashville has been in great demand with loading/unloading, rideshare, micro-mobility and parking 24-hour activities.

Downtown is a unique neighborhood of businesses, employees, institutions and residents with delivery and service vehicles, cars, transit, rideshare services, scooters, bikes and pedestrians all competing for mobility.

Key areas of Downtown activity including Broadway, the influence of institutions such as Vanderbilt University, high growth west side corridors as well as initiatives such as the Coord pilot curbside infrastructure management pilot, parking modernization and transit needs must be considered in a strong community engagement project so that the weighting and prioritization of these demands is determined and this study/ project sets forth the necessary framework for design and implementation, including downtown transit priority.

Total $818M Capital

Total Operating $2.063M additional over current funding for DOT functions

OVERALL CAPITAL $1.6439B

OVERALL ANNUAL OPERATING $37.273M additional for transit and all other

REGIONAL AND STATE COORDINATION THROUGH GNRC AND TDOT. The plan recognizes that our Metro-focused efforts are mindful of regional collaboration opportunities in the Improve Act and Regional partnering opportunities identified in Appendix 7. Inner Loop Study and evaluation of how technology may be used to manage truck traffic on our freeway system. Coordination for potential Amtrak service to Atlanta. Appendix 7 provides a list of multiple opportuntities.

DOWNTOWN NASHVILLE infrastructure improvements will be undertaken through “bucket” categories including traffic management, safety, sidewalks and others as well as Better Bus programming defined through the Downtown planning effort underway including curbside infrastructure and parking management as well as the specific Downtown Neighborhood Traffic Project.

AFFORDABLE HOUSING STRATEGY: Includes the 2% funding of local capital detailed in the transit section above and commitment to an inventory of those corridors for existing affordable housing, forecasted need and identified opportunities/areas for development. This strategy draws from the Transit and Housing Affordability Task Force chaired by former Nashville Mayor Bill Purcell and Davidson County Clerk Brenda Wynn.

ESTABLISHED METRO MOBILITY PLANNING GOALS

Mobility investments presented in the Mayor's Plan are fully nested within *NashvilleNext*, the region, and state overall framework of policies and planned investments. It does not start from scratch. In order to create a plan that's right sized for Nashville in 2020, it used the public listening sessions to help prioritize among the scores of new investments recommended in adopted studies and plans

NashvilleNext envisions building a high-capacity transit system to make necessary densities achievable without disruption to quality of life. Realizing the vision relies on a dedicated financial commitment to improving transit.

NashvilleNext Guiding Principles

- Ensure opportunity for all
- Expand accessibility
- Create economic prosperity
- Foster strong neighborhoods
- Advance education
- Champion the environment
- Be Nashville

***Access Nashville 2040*,** a component of NashvilleNext, identifies a comprehensive framework for the city's multimodal transportation future, providing a coordinated approach to improving our transportation network through 2040

Goal Statement: By 2040, efficient land use policies and strategic investments in Nashville's transportation network will link all road users, regardless of their mode of transportation, with meaningful access to social and economic opportunities.

Major and Collector Street Plan (MCSP), a part of *Access Nashville 2040*, guides public and private investment in the major streets that make up the backbone of the city's transportation system. Emphasis is placed on designing streets that serve all people and reflect the character of the neighborhoods and centers through which users pass.

Goal Statement: The MCSP aims to help Nashvillians "complete the trip" by increasing the quality of streets in Nashville, meeting the needs of all users, people who walk, bike, take transit, move goods, and drive cars, in a manner that respects the context and users of the street.

WalknBike, Nashville's bicycle and pedestrian master plan, identified priority bicycle and pedestrian networks that form the basis for investment in these modes through 2040, recognizing their importance in connecting neighborhoods to the high-capacity transit corridors.

Goal Statement: The Nashville bicycle and pedestrian system will be a network of high-quality, comfortable, safe sidewalks and bikeways, connecting people to opportunity. The system, inclusive to users of all ages and abilities, will promote and encourage safety, health, education, and active transportation.

Plan to Play, Nashville's parks, recreation and greenway master plan recommended multi-use paths, greenways, that connect parks, communities and jobs.

Goal Statement: Nashville's parks and greenways offer life-enriching everyday experiences that are central to the city's identity as a green, active, diverse, creative, thriving, and healthy community.

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PART 2

How We Got Here

Nashville has always been a refuge for dreamers with heart and ambition exceeding their often-difficult circumstances.

It was for Americans venturing west from the crowded coasts during the early 1800s in search of a new life. It was for those who gained their freedom and searched with hope for a better future for their children following the Civil War and through Reconstruction. It is for musicians in search of others willing to hear their stories. It is for immigrants in search of peace and a living wage. It is for recent graduates starting their careers or moving on to post-secondary education. It is for men and women with the wild idea of starting a business. It is for the marginalized who courageously stood up to inequality bringing us ever closer to realizing our ideals of inclusion and equality for all. In all, Nashville is a collective of villages populated with residents of diverse backgrounds and points of view searching for something better. It's a collective formed over generations as communities joined to face the challenges of their time. In doing so, each generation finding hope that yielded progress and creativity for years to come. Nashville is not just a place; rather, it is a state of mind, a state of reinvention, and a state of bouncing back, stronger than ever.

At the start of 2020, optimism abounded in Nashville. Our voters had overwhelmingly elected a new mayor. Our home property values had soared. We had been attracting new, good-paying jobs and were welcoming new residents by the thousands. More tourists than ever filled our hotels, convention center, music venues, and other attractions. Many of our colleges and universities were experiencing record growth. We had record-low unemployment. Our health care and music industries were on track for another great year. Metro government was shoring up its budget and getting back to the basics while preparing for long-term, sustainable services to our residents.

Meanwhile, the consequences of Nashville's rapid growth had also become ever more apparent. Our roadways were pushed to their limits. While most agreed we had to do something to address

worsening traffic congestion, agreement on how had historically been difficult to find. As a result, multiple efforts – big and small – aimed at addressing our mobility woes failed in recent years. It's in that environment that Mayor Cooper launched a new people-based transportation plan that promised tangible outcomes. The time had arrived to move the needle in a positive direction and get things done.

Recovering to Build a Stronger Nashville

Then in early March, everything changed. On the evening of March 2nd and into the morning of March 3rd, a series of tornadoes touched down across Tennessee, including a National Weather Service-rated EF3 storm that landed northeast of Pegram. Over the course of an hour, the storm cut a gash across Davidson County from Bells Bend to Hermitage, ravaging neighborhoods in between and beyond. The storm killed two Nashvillians, injured 150 others, destroyed nearly 200 buildings, and left a record-breaking 100,000 without electricity.

A week later, with tornado recovery blazing forward as neighbors helped neighbors in droves, the COVID-19 pandemic arrived. This unprecedented health and economic crisis demanded a collective response. Under the leadership of Mayor Cooper, Metro took bold steps to mitigate virus spread. While effective in taming spread, our tourism economy suffered as tourists stayed home. We now faced rebuilding from a tornado during a global pandemic, along with all the interruptions to normal life that entailed.

While we adjust to the changing world around us, we know waiting for a return to normal to prepare our roads and transit for the future is not an option. As Nashville recovers from this series of events, it is more critical than ever to plan in a way that reflects the changing needs of our streets to help essential workers reach their jobs, to help unemployed workers find new opportunities, and to ensure the successful return of businesses and tourism. This plan represents a path toward that end in order to connect Nashvillians to jobs, services, and play. It is tailored to achieve equitable outcomes that prepare all Nashvillians for success, creating opportunities to grow, thrive, and participate in the recovery and renewal of prosperity.

Our Mobility History

We cannot understate transportation's impact on our progress as a community. Transportation shaped the character, functionality, and framework of Nashville as rapidly advancing technology gave way to new opportunities. We evolved from steamboats to streetcars to railroads to buses to private automobiles to shared mobility.

Much of Nashville's built environment is new relative to older cities like Philadelphia, Chicago, and St. Louis. Those cities largely developed before cars replaced walking, bicycling, and transit as the primary way of getting around town. Before driving a personal automobile became the primary mode of transportation, Nashvillians walked more as shops, schools, churches, and other daily destinations were built an easy walking distance from homes. Corner stores and other conveniences were woven into neighborhoods, and the absence of fast cars

made it safe for anyone, regardless of age or ability, to get around safely and conveniently. This human-scaled city form made walking the obvious choice. The traditional street grid, with small city blocks, meant that most people got adequate exercise in their daily routines.

Railroads arrived to take us from a sleepy pioneer town into an economic behemoth of trade, manufacturing, and finance before and after the arrival of Federal troops during the Civil War. Freight moved on the Louisville & Nashville Railroad. Starting with the first horse-drawn streetcar line in the 1860s came a new frontier.

Towards the end of the 19th century, Nashville was viewed as a southern model community of mass transit use through its horse-drawn and later electrified streetcar system operated by private entities including the Nashville Railway and Light Company (now known as the Nashville Electric Service). During the 1890s, Nashville was one of the first cities to welcome electrified trolleys during a time when electric-powered devices were greeted with mass paranoia as similar systems opened in Boston and elsewhere.[1] Neighborhoods within the old city limits grew and encircled around streets which featured streetcar service. Creating businesses and residences within walking distance to stops happened organically without any aforementioned planning.

Nashville's early transportation system did not offer all residents' equal service. In 1905, a statewide segregation law went into effect that resulted in a streetcar boycott that lasted for two years, longer than any other boycott of that era, including the Montgomery bus boycott in the 1950s. Several African American community leaders, refusing to accept such unfair treatment, opened their own four-line streetcar known as the Union Transportation Company. However, by 1906, after a lack of support by the Nashville Rail and Electric and a new city tax on privately owned streetcars, the company was unable to continue service. The boycott, however, lasted for another year.[2]

The predominance of dirt roads proved problematic for the first private vehicles and entrepreneurs took it upon themselves to establish toll roads, or turnpikes, which were macadamized facilitating cross town travel to the new suburbs. The use of the shared commons between buildings, also known as the public "right-of-way," shifted dramatically as the new vehicles shared space with pedestrians, streetcars, and bicyclists leading to the construction of Nashville's first sidewalks, traffic signals, and signage as a means to maintain safety and organization.

Like other Sunbelt cities, the introduction of the automobile transformed the Middle Tennessee region as Nashvillians were no longer tethered to interurban lines or travel within walking distance from their place of employment or shopping and could now choose to live wherever they could park a car. As Nashvillians embraced cheaper gasoline-powered vehicles, so too did private transit operators. Throughout the 1930s and 1940s, transit operators phased out streetcar lines in favor of buses with services consolidating into the Nashville Transit Company.

After World War II, Nashville's footprint expanded as government, banking, real estate, and other forces promoted the car-centric suburban growth that's since remained the prominent pattern of development in Davidson County. In doing so, we razed historic buildings to build storage for cars. We built offices, shopping centers, and schools on busy highways that would grow more disconnected from our neighborhoods by the decade. We even

separated types of housing that once lived happily side-by-side, segregating apartments from single-family homes. In this quest to suburbanize, we also used our transportation infrastructure to build barriers and divide us, rather than unite, on pathways to progress, opportunity, and prosperity.

Community investments decentralized just as the cost of maintenance and upkeep for new roads grew exponentially. Meanwhile, the automobile exacerbated problems related to “white flight” as communities in the urban core were unable to participate in the prosperity of a rising middle class. This new era of suburbanization ultimately led in 1963 to the consolidation of the City of Nashville and Davidson County to a Metropolitan Government.

As families left the original city limits for a slice of the American Dream, Nashville was left with a declining tax base and overburdened parks and public facilities. Since the private automobile was viewed as the way of the future, the new Metropolitan Government abandoned requirements for sidewalks in developing neighborhoods, decommissioned its streetcar lines, and assisted the Federal Government with the creation of the Interstate system.

Interstates further expanded vehicular mobility in conjunction with “urban renewal”. Our transportation “progress,” however, often failed in offering equitable benefits. Many infrastructure projects were detrimental to people of color and the natural environment. Road designs of the 1960s, especially our interstates, disproportionately disrupted minority communities. In Nashville, I-40 and what was then I-265 (now known as I-65) divided North Nashville and forever harmed Jefferson Street.

Approximately 16 blocks of quality housing stock and commerce along Jefferson Street were removed in areas where black businesses historically prospered. Much of it occurred under the guise of urban renewal. This severed cultural and economic African American centers in North Nashville and Edgehill. Capitol Hill was also impacted similarly by urban renewal.

Buses experienced diminishing travel times as a result of operating in mixed traffic and their revenues declined. With the allure of personal automobile ownership, what was once a private bus company sold its assets to Metro Nashville Davidson County in 1973.[3]

As communities embraced each new travel mode, the city’s physical form changed to accommodate by spreading out. Ironically, just as Americans flocked to the automobile after viewing it as the symbol of personal freedom portrayed in movies, songs and advertisements, they are now viewing the auto-centric environment an impediment to their livelihoods due to longer commutes and time spent in traffic. Now neighborhoods near Downtown, such as Germantown, Wedgewood-Houston, and East End, are experiencing mixtures of prosperity and displacement as a result of families returning to the central city.

As part of a greater national phenomena, working-age adults and young people now place higher incentive (than previous generations) on walkable neighborhoods with urban amenities, access to mass transit, and connectivity to greenways. An increase in population and density makes room for scooters, electric bicycles, and other micro-mobility options that have brought new challenges as well as new opportunities. More recent infrastructure investments such as

building Korean Veterans Boulevard and the Cumberland River Greenway have catalyzed new development and enhanced access to community resources.

At a Crossroads – Why This Plan Exists

Why does Nashville need another transportation plan? That's a fair question many have asked. We have certainly not fallen short on visioning and planning for a multimodal future. In other words, we have a lot of transportation plans but not a lot to show for it. Based on that history, it surprised no one that communities we engaged in 2020 did not ask for more planning. They asked for results that change their lives for the better.

While supported in concept by many Nashvillians, we have a spotty history when it comes to implementation of infrastructure efforts and to supporting expanded public transportation. In recent years the list of now infamous efforts has grown to include the AMP and Let's Move Nashville. In the meantime, our needs continue to grow just as material and labor costs for construction skyrocket.

Now in the COVID-19 era, we must accomplish more with less, even as needs mount. We have made strides in shifting our focus to moving people rather than moving cars. Many Nashvillians want complete streets that make room for everyone, not just those driving cars. We want room for us to safely walk, bike, ride transit, drive cars, and ride scooters. Nashvillians want us to address the need for investment in sidewalks as well as a backlog of repairs to bridges, railroad crossings, and traffic signals. They want us to deliver an equitable, 21st Century transportation system linking them to jobs, education, and affordable housing that also accommodates newcomers. They want a system ready and able to lead us to a future where all Nashvillians have the tools and access to opportunity that they need to reach their dreams.

Innovation is common, but so is public opposition to innovation. With each leap in the evolution of new modes of travel, many Nashvillians have pushed back against new transportation modes. For example, years ago some opposed the electrification of streetcars that replaced horse-drawn transit. More recent are disagreements among neighbors on the addition of new bicycle lanes. While disagreements over use of public space and right of way are normal and welcome, pushing our vulnerable populations to the fringes of society through systemic discrimination is not.

Much is left to do to prepare for a successful future. Our transportation system needs to provide everyone, regardless of their ability to drive or their economic means, safe access to work, education, and other destinations so that equitable opportunity for economic independence and prosperity is available to all. All of this while the national movement for racial equality seeks change that addresses past injustices, including our investments in mobility and use of public spaces. Equity goes beyond jobs, attainable housing, and educational opportunities. It also means ensuring that our streets treat all modes of travel with equal care.

Here we are. We still need a transportation system that can reliably take us – all of us – where we want to go. This plan seeks that outcome. With a people-first plan and multimodal approach, this plan aims to equitably balance investments in walking, cycling, and public

transit with surgical improvements to aid congested streets and high-crash locations. The plan also aims to reduce greenhouse gas emissions, lower per capita spending on vehicle fuel and maintenance costs, widen access to public transit, and preserve our historic and environmentally sensitive resources. Better streets, transit, bikeways, and sidewalks not only bring Nashvillians to economic opportunity, they bring our communities closer together by increasing interactions and engaging public space. This plan exists to remedy long-standing problems that affect all of us, regardless of how we currently get around or want to get around.

PART 3

Challenges We Face

Our community's extraordinary growth has not come without challenges. All the reasons that have attracted new residents and jobs – things that make Nashville such a great place to live – have also increased traffic and strained our transportation network.

More neighbors and businesses also mean more demand for municipal services and infrastructure. In addition, the influx of new residents and jobs has forced the question: how can we build a future city on the foundation of Nashville's history and identity, while recognizing that it must evolve in order to survive? That fundamental question, and the tenuous balance it forces us to strike, is at the heart of our vision for the future of getting around Nashville. Addressing these concerns was already complicated; now we also face the ongoing health and economic crises. It is in this adversity that the true scale of Nashvillians' grit, perseverance, and imagination will be measured.

Equity & Trust in Government

Our transportation system needs to provide everyone, regardless of their ability to drive or their economic means, safe access to work, education, and other destinations so that equitable opportunity for economic independence and prosperity is available to all. All of this while the national movement for racial equality seeks change that addresses past injustices, including our investments in mobility and use of public spaces. Equity goes beyond jobs, attainable housing, and educational opportunities. It also means ensuring that our streets treat all modes of travel with equal care.

Nashville originally developed at a walkable scale. Access brought by streetcars later made walkable suburbs possible. When the personal automobile arrived, though, we raced to accommodate them. This happened often at the expense of those who depended on walkable streets and reliable public transportation to work and live. We had plenty of company as the same story played out city by city across the nation. In building this car-focused pattern, especially in the case of the interstate system and urban renewal, we physically divided black neighborhoods, disrupted black-owned businesses, and generally disproportionately impacted and marginalized communities. More than 50 years later, skepticism and distrust remain in our impacted communities.

Our car-centric development pattern still colors much of Nashvillians' car-centric behaviors as well as the functions of streets buses use to

connect their riders. For example, many of our arterials are lined with excessive driveways, pull in parking, and vast parking lots that reduce their efficiency and safety. While redevelopment has shifted that paradigm – building sidewalks and bringing active storefronts to the edge of the sidewalk – the positive change comes as patchwork, and many feel that government is overlooking what's needed or not prioritizing needs.

Many residents, after the last decade's growth, feel a sense of loss – that growth has left them behind without offering benefits. As driving costs grow and congestion makes travel time less reliable and creates stress, our people need more options to get where they need to go. Neighbors grow upset at the lack of sidewalks on their residential streets despite new homes being built and more people in the area. Bus riders wait at stops in ditches without street lighting or shelters while watching cars race by. Meanwhile, lower income families experience the cost burden and inconveniences of available transportation options especially hard, limiting their access to employment, education, and attainable housing enjoyed by families of higher means. Engendering our people's trust in government takes us ensuring that new growth makes us all beneficiaries.

Beyond physical infrastructure, operating for years without a dedicated funding source for transit and other transportation system infrastructure has meant, compared to peer cities, fewer routes, lower bus frequency, and fewer Nashvillians with comfortable and safe transit near where they live and work. This exacerbates an already inequitable society by creating barriers to education, work and climbing out of poverty.

Outdated Street Designs

We are losing too many precious lives to crashes on our roadways. In 2019, we broke records for pedestrian and car crash fatalities. Between 2010 and 2019, 150 people died while walking on our streets and another three while biking. Meanwhile, car crashes killed 530 people in Davidson County.

After years of under funding infrastructure, safety upgrades, and low investment in complete streets along arterials, Nashville is falling short. *WalknBike*, Nashville's bicycle and pedestrian master plan that was completed in 2017, identifies 1,800 total miles of missing sidewalks, nearly 33 miles of missing sidewalks in priority areas that connect to transit and schools or high-crash areas. Filling the 33-mile gap has an estimated price tag of $174 million, making long-term funding challenging while further entrenching car-centric attitudes and behaviors. *WalknBike* also identified 153 miles of missing priority bikeways to mandate that 2.12% of all trips are made by bicycle.

Nashville streets designs have evolved in recent years to accommodate more users and focus on creating complete streets. The fact remains that as streets are currently built, too few streets accommodate the growing needs of all Nashvillians of abilities. Indeed, access to public resources and business remains an obstacle for the disabled. Even on streets with sidewalks, utility poles, mailboxes, dumpsters, driveways with parked cars, and other blockages which impede the travel of those in wheelchairs and assisting devices are a common sight. Retrofitting old sidewalks for ADA compliance, as well as building new sidewalks in general, is complicated by tight urban rights-of-way. Finding room to

accommodate the furnishing zone space for maintaining a clear path of travel requires buying more right-of-way from private owners – an often costly and time-consuming effort.

Longer & Less-reliable Commutes

Nearly 80% of Nashvillians drive alone to work. Today's commuters travel farther and spend more time in traffic than ever before – a daily average of 25 minutes.[4] Overall, our drivers annually lose nearly 90 hours in traffic. That's a cost of $1,221 per driver.[5]

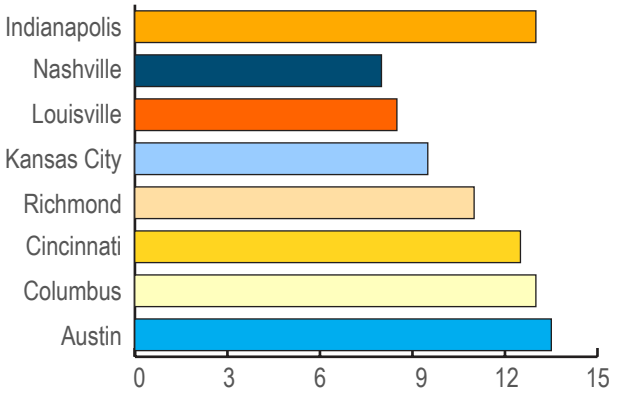
Our longest travel delays for all modes, hands down, occur along the I-24 East corridor where volume has increased by more than 60% since 2005. Like other corridors, WeGo's buses fight the same traffic as freight and cars on Murfreesboro Pike and I-24. Existing high occupancy vehicle (HOV) lanes available on I-24 from I-840 in Rutherford County north to I-40 permit buses and carpooling. Theoretically, the 7:00 a.m. to 9:00 a.m. northbound and 4:00 p.m. to 6:00 p.m. southbound HOV lanes presence should improve trip-time reliability for both modes. Lack of HOV lane enforcement removes this opportunity, allowing HOV lanes to operate as general travel lanes during peak hours.

Without significantly shifting our mode split, by 2040 traffic volume will grow by more than 86% and miles driven in congested conditions will increase by 162%.[6] Commute times will more than double and freight traffic will grow by 141% by 2040 without an intervention.[7] We've tried to solve this problem with previous investments in roadway capacity. Many still want that. However, data-driven research tells us that a road widening-only strategy only induces demand, encouraging more people to drive due to the perceived amount of new traffic capacity, often at great costs to the communities they serve. A wider road after expansion quickly attracts so many drivers from other more congested routes that it wipes out the benefits of the investment.

Public transit in Nashville was already struggling long before the pandemic as Metro and its local and state partners failed to provide dedicated funding for new transit facilities and vehicles. The lack of a targeted funding source creates annual unpredictable challenges as the transit agency competes for limited revenue with MNPS, MNPD, Metro Parks, and other municipal departments. As WeGo is unable to meet growing demands of our growing neighborhoods, the transit agency must make difficult decisions to reduce and/or cut services. Limited local funding also prevents the transit agency from competing for state and federal grants due to the lack of local funding matches. Less money directly earmarked for transit overall means less reliable and convenient services for Nashvillians. Continued deferred funding and lack of financial support from local and state governments for transit means that Nashvillians will drive not because they want to, but because they must.

The current system does not serve Nashvillians efficiently or usefully as most transit riders must ride buses to WeGo Central in Downtown Nashville in order to transfer to get to their ultimate destination. Service is not frequent, meaning that riders wait longer for each bus to reach their stop. As traffic congestion grows, reliability on transit drops and service slows for customers. It also increases WeGo's operating

Fig. 21: Comparison of 2019 annual revenue miles per capita among peer and aspirational cities



Source: WeGo Public Transit, American Public Transportation Association

costs and makes it harder for new customers to justify using transit ("why take transit if I just get stuck in the same traffic?"). Even in more urban areas near our frequent service routes, lack of sidewalks and crosswalks create significant barriers to and dangerous conditions for accessing transit. While not directly a part of the Better Bus service plan, accompanying efforts by Metro to improve the pedestrian experience on major corridors and adjacent neighborhoods, will be critical to improving access to transit.

Finally, WeGo faces similar struggles with the perception of safety during the COVID-19 era as riders who normally would ride transit do not want to put their health at risk. While ridership has declined with many riders staying at home, ridership is not the only measure of transit's success. Even during the pandemic, transit has continued to play a critical role in connecting essential workers to jobs. To date, there has been little to no evidence of significant spread of the virus related to transit. Many places with much higher transit ridership than Nashville have been able to control the spread of virus while maintaining significantly higher transit ridership.

While multimodal improvements hinge on our success to overcome the pandemic and limited funding, traffic management holds promise. A prime example is TDOT's I-24 SMART Corridor investment in physical, technological, and operational improvements that will improve access and capacity while also increasing the speed of first responders and emergency vehicles to assist with faster lane clearances following vehicular crashes. The project will also install ramp metering to ease the merging of vehicles and emergency pull offs that will ensure that drivers traveling along the route have safe areas to exit without impeding moving traffic. Still, more is needed to improve and maintain travel time and reliability between Nashville and Murfreesboro.

Additionally, investments in expanding the number of lanes within the median of I-440 further improves the reliability and speed of moving traffic, resolving long-overdue congestion relief without causing impacts to adjacent residential areas. Completion of the Interstate 440 widening project greatly expands the capacity of vehicular travel from West Nashville to Interstate 24, relieving traffic from surface streets particularly along Woodmont Boulevard and Thompson Lane however, challenges remain in reconnecting neighborhoods divided by the Interstates.

More broadly, construction of routes such as the Downtown Loop, which serves as the confluence of I-40, I-65, and I-24, in the 1960s and 1970s severed street connections that previously linked Downtown Nashville with neighborhoods in, Buena Vista, McFerrin Park, Watkins Park, East End, Chestnut Hill, Edgehill, among others. While construction of the Interstates facilitated easier commuting from the urban core to the growing suburbs, closures of several streets created

bottlenecks in which Nashvillians traveling by car, bus, bicycle, and other modes compete with one another for limited space, a challenge felt especially hardest during the evening rush hour. Not only did the placement of the Interstates create difficulties in maneuvering into and out of downtown and Midtown, it also established new barriers separating predominantly black communities from enjoying in the prosperity of the growing city.

Lastly, many commuters lack awareness of options beyond driving alone. Transportation demand management efforts – like Nashville Connector, TMA Group's Van Star, and MoveVU at Vanderbilt – need more allies to raise public awareness to let commuters know that more sustainable commute options are available now. Our response to the COVID-19 pandemic shifted an unprecedented number of jobs from offices to homes, forcing employers to invest in technology to facilitate. Many employers and employees alike now recognize the many benefits of such an arrangement. With commute times being replaced with healthy and productive activities, employees may be reluctant to return to long commutes. Considering our growth and traffic projections, coupled with data on the productivity and other benefits of telework, employers may consider allowing employees to continue to work from home one or more days a week.

Economic & Population Growth

Davidson County's population soared to 694,144 in 2019 – adding 67,463 new net residents in nine years.[8] Projections show we will exceed 804,488 by 2040.[9] Prior to COVID-19, we had experienced an 18.4% increase in jobs – 76,000 new jobs to reach nearly 490,000 jobs. Daytime population increased to a total of 884,320[10], a statistic that accounts for Davidson County residents who leave the county each day for work in local job markets in Williamson, Wilson, Sumner, and Rutherford counties.

While welcomed in many ways, growth does have impacts that Metro must confront head on. Ensuring we can still move freely from place to place is central to protecting the general welfare of our community. To make matters more complicated, changing demographic patterns in Nashville also constitute evolving community preferences for mobility.

Better transit and more sidewalk connectivity are increasingly sought by retired Baby Boomers when driving themselves is no longer feasible. Similarly, Millennials and Gen Z desire living within walking and biking distance of work and school. They support frequent transit service much more than previous generations. Gen Xers increasingly look to better walkability and safe access to parks and community centers as their families grow and mature. This generation is expected to take the mantle of the aging Baby Boomers as they open businesses, raise families, shaping political decisions moving forward.

This phenomena of the changing commuting and recreational needs is reflected in the new development pattern of housing being densely packed, closer to the urban core, and with less square footage relative to a conventional suburban single-family house with a large yard. Nashville, like other growing American cities, will continue to attract more infill accessory dwelling units, stacked flats, and townhouses – each presenting new opportunities and challenges to our transportation system.

Despite Nashville's overall income growth, more and more of our residents cannot find housing they can afford that meets their needs due to the home real estate demand/supply imbalance caused by rapid growth. We grew so quickly that our housing supply couldn't keep up. Median home values have grown more dramatically than household incomes. In Davidson County, 46% of our residents live within a quarter mile of a bus stop. Almost 70% of jobs are also within a quarter mile of a bus stop. However, only 11% of residents and 34% of jobs are within a quarter mile of frequent service (every 15 minutes or better).[11]

Transit providers and planners generally consider a quarter mile the distance typical transit riders will walk to a bus stop, though many will walk farther for frequent service. As close-in neighborhoods become less and less affordable and people seek housing in lower-density areas farther out, it often becomes harder for people to access transit. Funding for the Better Bus program will address many of these issues, but an even more effective and sustainable strategy would be increased investment in affordable housing near major corridors with frequent transit.

One of the most consequential outcomes of Nashville's development boom has been rapid change within core neighborhoods, including the corridors that connect them. Neighborhood character and historic institutions shifted with the changing times and evolution of communities with new commerce, workers, and families. Part and parcel come the effects of gentrification that nudges long-time residents from their historic neighborhoods with higher rents and property values. Many relocate to older suburban areas without quality sidewalks (or have no sidewalks at all) and less direct access to reliable public transportation. Under this scenario, people trade housing costs for transportation costs, in terms of money, time, and quality of life.

Balancing Competing Demands on Our Streets

Nashvillians now demand more of our streets than at any point in the city's history. People moving in cars, delivery trucks, buses, bicycles, scooters, and walking all compete for scarce space. They need the space to park and store vehicles, drop off and pick up passengers, and reclaim space for trees and for small parks and plazas. To further exacerbate the issue, private companies use the public right of way for financial means using transpotainment vehicles, valet stands, food deliveries, and soon straight out of science fiction, autonomous delivery robots which threaten to increase congestion and delays for Nashvillians. Since there is no room to accommodate everything, communities must work together to prioritize sharing of our streets.

The successful design of public rights of way into a supportive public realm for all results in a safer and more pleasant community. Good design can help lower traffic and pedestrian-related injuries, increase walkability, increase the use of bicycles and other forms of active transportation, and provide enhanced access to transit. During the community engagement phase of *NashvilleNext*, Nashvillians expressed a clear desire to add reliable transportation options like transit, walking, and biking to our current auto-oriented environment.

Freight movement that moves through the city via the Cumberland River, interstates and other roads, and rail also creates challenges. Where it

was once straightforward, transportation planners are now evaluating how freight enters the densest parts of the city, considering regulations, both by vehicle size and by time of day.

Overall, for the greater part of our city's history, Nashville's streets have operated as a wild west, in which any use of the street is tolerated without the thought of how it would impact other users of the public right of way. This laissez faire approach was okay when Nashville was a less-bustling town. Given today's demand for space on our streets to maximize the movement of people and goods, this approach is no longer realistic. Nashvillians welcome tourism, but not at the expense of frustrating traffic snarls caused by pedal taverns and other transpotainment vehicles during rush hour. Nor is it appropriate to surrender entire block faces for free on-street parking rather than install dedicated bus lanes that would have the ability to provide reliable, frequent transit service.

Health

Public health and transportation are inextricably linked. Opportunities for active transportation provide a critical ingredient for a healthy population. A community's transportation system impacts many health factors, including the prevalence of chronic disease, exposure to vehicle emissions, and injuries and fatalities due to crashes. Simply put, when we drive more, we exercise less, we feel the effects of traffic stress, and we cause more pollution from car exhaust for all to inhale. For many Nashvillians, life is made up of multiple daily car trips sitting sedentary behind the wheel waiting for the light to change or waiting for traffic to clear up. Those who are not able to drive or cannot afford a personal vehicle experience an inequitable burden of risk having to navigate on two feet a city made for four or more wheels. They often risk their lives to cross multi-lane, high speed roads without sidewalks just to get to work, school or the grocery store.

Partly due to an environment that is not built for active transportation, 58% of Davidson County adults are obese or overweight and 24.8% of adults do not exercise.[12] Physical inactivity is associated with increased risk of many health problems, particularly obesity, diabetes, heart disease, and mental health.[13] Poor diet and physical inactivity is the second-highest cause of preventable death in the U.S., behind only tobacco use.[14]

Studies show that better walking and bicycling options help people meet recommended physical activity levels.[15] In Nashville, it also gives us access to health facilities and world-class parks and greenways. Better access to parks via bike lanes, sidewalks and greenways would help connect the 60% of Davidson County residents who live more than a half mile from a park, which may also lower the obesity rates.[16]

More walking and biking trips in place of driving cars would mean less air pollution. As of 2018, 28% of U.S. greenhouse gas emissions were attributed to the transportation sector[17] and personal vehicles accounted for 62% of all transportation emissions. Replacing automobile trips with biking/walking trips improves air quality and decreases public health concerns such as asthma where in Davidson County more than 38,000 adults and almost 12,000 children suffer from the disease.[18]

Deteriorating Infrastructure & Cost of Upkeep

While building new infrastructure gets most of the attention, the ongoing maintenance of existing roads, bridges, and sidewalks often goes underfunded. Multiple organizations share planning, funding, maintenance, and operations responsibilities for more than 2,600 lane miles of roadway in Nashville.

Of the 1,119 bridges on the public road system in Davidson County, TDOT owns the vast majority. Metro owns and maintains 326 bridges. In 2020, Metro Public Works' analysis of bridge and culvert conditions show that five bridges and 792 culverts are rated "poor" condition. While annual bridge maintenance costs range between $6-8 million, Metro's budget typically only provides roughly half that figure. This means maintenance is often deferred even as we anticipate higher traffic volumes.

Our sprawling car-focused development pattern exacerbates both the costs of new construction and maintenance. A 2015 joint study by the Victoria Transport Policy Institute and the London School of Economics estimated the cost of sprawl in the United States at over $1 trillion. This is because low-density development yields lower tax revenue, demands more water, road, and utility infrastructure, and results in more daily miles driven per person. The remedy does not need to be high density everywhere, but targeted density along transit lines to provide non-driving options, and thoughtful mixed-density developments with easy connections to transit.

Obsolete Traffic Signals & Management Systems

A major source of multimodal travel deficiencies is the outdated and under built traffic signal system administered by the Nashville Traffic Control Center (NTCC). Under the NTCC, which is housed under Metro Public Works, the group is responsible for:

- 865 traffic signals on local and state routes
- 440 flashing beacons at school zones, unsignalized midblock pedestrian crossings, and fire halls
- 20 reversible lane signals located along Hermitage Avenue and James Robertson Parkway
- An ever-growing list of pedestrian-actuated signals and beacons at crosswalks

Signal staff must cover a geographic area of approximately 526 square miles, much of which is highly populated in a dense urban environment. It is often congested, especially in the peak hours and during special events, much like our peer cities that were evaluated. To effectively manage their assets across this area, many peer agencies use remote monitoring and control to maximize their limited resources and enhance response times.

Historically, funding has been lacking and inconsistent for traffic signal infrastructure maintenance and upgrades. Insufficient staffing, sporadic and unreliable capital funding, and deferred maintenance have degraded our existing traffic signal infrastructure. From 2016 to 2019, Metro Public Works undertook a controller upgrade project that upgraded nearly all of Metro's signal controllers. Metro's previous

signal controllers were manufactured in the late eighties and early nineties and used an obsolete technology with limited capabilities. While the controller upgrade project moved Metro forward, most of our existing signal infrastructure still requires significant capital investments in order to provide active traffic management and reliable operations and communication.

Difficulty Serving Rapidly Growing Areas

Previously quiet, rural communities in southeast Davidson County and elsewhere have experienced rapid residential growth in recent decades. Many of these new neighborhoods must rely on two-lane country roads for access to jobs and services. As undeveloped areas fill in, they stress the network since these roads were not designed to carry suburban traffic volumes. It often leads to frustrating traffic backups and safety conditions that are not idea.

While these new subdivisions may have wide streets lined with sidewalks internally, they connect to narrow roads that lack a complete network of sidewalks or bike lanes, with outdated drainage systems, inadequate street lighting, and high posted speed limits. Our neighborhoods deserve better.

Metro has rarely, in recent decades, dedicated funds to construct new arterial and collector roadways in these areas. Metro leans on developers to deliver new infrastructure that mitigates impacts of each individual development as they are built. While this works well enough for accommodating infill in established areas or along our corridors, it often leads to growth outpacing capacity in areas of new greenfield development.

Currently, State law prohibits Metro from collecting contributions from developers for larger, longer-term projects that address the cumulative impact of multiple projects. Developers can only be required to build improvements that address the impacts they have on the transportation system. These are typically smaller improvements, such as turn lanes or traffic signals. This means new development does not typically create the fundamental infrastructure improvements needed to keep pace with development, such as upgrading the full length of a major road from a rural to an urban cross section.

New Infrastructure Takes Time to Design & Build

A common question that is asked repeatedly by the general public, news outlets, developers, and basically everyone, is “why does it take so long for Metro to get things done?” While the costs of construction and resources which prolong the rollout of planned infrastructure and services are beyond our collective control, our decentralized structure of governance certainly is something Metro could control. Currently, traffic engineers, transportation planners, researchers, financial managers, public information specialists, urban foresters, and other staff are spread across multiple Metro departments and intergovernmental agencies within offices scattered throughout Davidson County. Other communities such as Seattle, Boston, and Denver, addressed similar issues by creating new departments that focused specifically on transportation. They focus full time on the growing needs of our mobility infrastructure and to spearhead new initiatives that improve the lives of all Nashvillians.

Business Community's Challenges & Support

Nashville's economic prosperity stands in contrast to our inability to craft a cohesive mass transit system, sidewalk network, and bikeway routes. The challenges of Middle Tennessee's under investment in transportation infrastructure and programming is not lost on the business community. Increasingly, the working-age population (most predominantly amongst Millennials and Gen-Z) want to live in walkable communities with safe access to reliable, time-competitive, frequent public transit. Indeed, creating a transit network with dedicated lanes, frequent service with 10-minute or less headways, and routes which reduce barriers for riders from all backgrounds is a common goal shared throughout Middle Tennessee.

As such, business groups, including the Nashville Area Chamber of Commerce, coalesced around crafting partnerships and educating the public on the value added by a dedicated funding stream for transit. Organizations, universities, hospitals, corporations, and non-profits have increasingly joined forces under the umbrella of Connect Mid-TN, the Transit Alliance, and Moving Forward to continue the momentum of helping to create a 21st century transit system.

PART 4

Engaging the community

When Mayor Cooper set out to create a new transportation plan for Nashville, he did so aware that Nashvillians had participated by the thousands during the preparation of NashvilleNext and other strategic plans under its umbrella.

He also knew well issues surrounding previous attempts to fund transportation ideas. Nashvillians have time and again voiced their concerns over the growing city; rising inequality and household costs, coupled with rising commute times. Indeed, traffic-related issues from the lack of sidewalks for their children to walk to school to unsynchronized traffic signals won the day.

Mayor Cooper positioned this process to work more as applying lessons learned from previous efforts – good and bad. The major focus, however, is on listening to what Nashvillians have to say. Since the previous transportation efforts, we have learned that with broad participation and right-sizing solutions, our community can face our issues and apply solutions. As such, the approach for the Metro Nashville Transportation Plan differs greatly from previous transportation initiatives in the following ways:

- Decisions are made across Metro Departments and partner stakeholders
- Information and project selection have been led in concert among the Mayor's Office and Metro councilmembers with community and stakeholder inputs directly reflected in the recommendations.
- Improvements will improve existing infrastructure while also expanding mobility options throughout Davidson County.
- Ensuring that the investment in previous efforts, studies, and plans are leveraged are leveraged so that the value of those is recognized in this new plan.

Public Input from Metro Planning Studies

The mobility investments presented in this plan are fully nested a cascading framework of policies and planned investments *NashvilleNext*, the region, and state overall framework of policies and planned investments. It does not start from scratch. Recognizing that many of the pieces of a city mobility plan have been studied numerous times by local, regional, and state agencies, the Metro Nashville Transportation Plan pulls together their recommendations to form a holistic, achievable program that will improve mobility in Nashville.

Thousands participated to develop the city's overall vision described in *NashvilleNext*, in addition to subsequent strategic plans for bicycle and pedestrian, parks and greenways, and regional public transit. The foundation for each strategic plan was *NashvilleNext*, ensuring alignment of city priorities. Collectively, these plans accommodate population, job and tourism growth and lay the foundation for the Metro Nashville Transportation Plan. In order to create a plan that's right sized for Nashville in 2020, input from the public listening sessions helped set priorities amongst the scores of new investments recommended in adopted studies and plans.

A clear message woven throughout *NashvilleNext*, *nMotion*, and *WalknBike* is ensuring Nashvillians can access opportunity via expanded mobility options, including public transportation, that link our city's areas most ready for growth. Future affordable housing and job growth will concentrate within major centers like Downtown and Midtown, and along major corridors like West End Avenue and Gallatin, Dickerson, Murfreesboro, Clarksville, Nolensville, and Charlotte Pikes. *NashvilleNext* envisions building a high-capacity transit system to make necessary densities achievable without disruption to quality of life while recognizing that vision relies on a dedicated financial commitment to improving transit.

Since adoption of *NashvilleNext* in 2015, Metro Planning Department staff has completed and launched several corridor and local area studies to implement land use policies along our high capacity transit corridors. Each provided opportunities for future transit-supportive land use mixes and outlined infrastructure investments to support a more walkable community. Communities participating in recent corridor and local area studies have expressed several common themes. These community themes laid the foundation for this strategy. They outlined action items that must be addressed to ensure that Nashvillians' voices are being heard and that a modern transportation network works for everyone. Themes included:

- Most concerns arising from new development are related to traffic and parking: The availability of parking being threatened by new neighbors and businesses, congestion-caused delays, vehicular speeding along residential streets, limited access management that increases conflicts between cars and people walking/biking, and the idea that new street connectivity will generate "cut through traffic."
- Common understanding that building additional capacity for automobile lanes on existing roads mainly encourages more people to drive.
- The construction of additional density for new housing and commercial development should be placed where transit and sidewalk infrastructure are already built or where new

development can help build out a complete sidewalk network.

- Constructing greenways is not only beneficial for recreation and the natural environment, but also for serving as opportunities to promote sustainable mobility choices.
- Bikeways serve a critical role in our communities if routed effectively to where people are and want to go. Protected bikeways that are designed for low stress, comfortable travel for all users should take precedent.
- Traffic calming in our neighborhoods is more important than ever.
- Higher posted speed limits along our pikes and commercial corridors is directly related to crashes and reinforces perceptions of “weak places” in need of improvement.
- A lack of safe pedestrian crossings across our busiest streets through the utilization of crosswalks and signalized intersections/ crossings is unsafe and impedes the use of mass transit and economic development.

Community & Stakeholder Listening Sessions

Beginning in January of 2020, under the leadership of Mayor Cooper’s team, Metro launched the first in a series of eleven community listening sessions and intended to capture as much input as possible in community centers located throughout Davidson County. The events shown in the sidebar entitled "Community Listening Sessions" were held in which Metro staff and partners were able to solicit feedback in an information-gathering, in-person format:

COMMUNITY LISTENING SESSIONS

Jan. 9 – Antioch
Southeast Community Center

Jan. 16 – Donelson
Fifty Forward Donelson

Jan. 23 – Bordeaux/
Bordeaux Library

Jan. 28 – North Nashville
Lee Chapel AME Church

Jan. 30 – Joelton
First Baptist Church of Joelton

Feb 6 – West Nashville
West Police Precinct

Feb. 11– Bellevue
Bellevue Library

Feb. 18 – Downtown
Downtown Library

Feb. 20 – Green Hills
Church of Christ of Green Hills

Feb. 24 – South Nashville
Plaza Mariachi

Feb. 27 – East Nashville/ Madison
Studio 615

All were invited to participate in three separate activities that were held at each of the sessions in which attendees were able to come and go as they pleased:

- Project priorities – Attendees were given $20 of "play" currency to spend on their transportation priority options that included Safety/Vision Zero, Bikeways, Signals/Traffic Operations, Transit, Greenways, Working with TDOT on Interstates/State Routes and Freight Movement, Sidewalks, Traffic Calming, and establishing a State of Good

LISTENING SESSION EXERCISE – PRIORITY SPENDING CATEGORIES

Bikeways – Projects that enable the construction of facilities such as bicycle lanes which provide safe and comfortable routes for users of all abilities as outlined in Priority Biking Network in WalknBike

Greenways – Projects that enable the expansion of the greenway network and improvements to existing facilities as outlined in Plan to Play

Signals/Traffic Operations – Projects that fund the improvement of existing signalized intersections, warning beacons, and pedestrian crossings as well as the construction of new facilities

Safety/Vision Zero – Projects that specifically provide targeted interventions to reduce the incidence of fatalities and injuries for people walking, bicycling, and/or driving

State of Good Repair for Road & Bridge Maintenance – Projects that prioritize the upkeep and reduction of wear and tear for existing infrastructure

Traffic Calming – Projects that support Metro's Neighborhood Traffic Calming Program to prioritize the construction of facilities that reduce and mitigate the amount of speeding vehicles in residential areas

Transit – Projects that support short- and long-term infrastructure and programming needs for transit as specified in nMotion

Working with TDOT on Interstates/State Routes and Freight Movement – Projects that provide spot improvements for access to state routes and interstates as well as upgrades to facilities that support the movement of goods through Davidson County

Sidewalks – Projects that enable the construction of sidewalks in more places and improve ADA needs on existing sidewalks as outlined in the Priority Sidewalk Network in WalknBike

Repair for Road and Bridge Maintenance (see Listening Session Exercise – Priority Spending Categories table below).

- Open-ended questions – Participants responded to “What would a transit system need to offer for you to choose to ride WeGo Public Transit” over their current mode of travel as well as their perspective on “what a transportation system that works for everyone” looks like.
- Maps of the entire County as well as applicable council districts were provided in which attendees offered place-specific comments, identified areas of concern, and chimed in on specific infrastructure issues that they wanted to bring to Metro’s attention.

A clear pattern emerged from the public listening sessions as Nashvillians gravitated towards similar competing transportation priorities (Fig. 22) Improving public transit was top priority at all but one listening session. Even more noteworthy, participants from every corner of Davidson County strongly advocated for more public funding for transit regardless of how far from the urban core they lived and/or worked. More resources for transit was supported strongly by Nashvillians living/working in Antioch, Green Hills, and downtown. Nashvillians also vocalized support for more funding for the construction of sidewalks most notably in Bordeaux, Green Hills, and West Nashville indicating high demand for more sidewalks in suburban communities. Maintaining systems in a state of good repair and maintenance for roads and bridges was also prioritized, particularly in Joelton, Bordeaux, North Nashville, and Bellevue.

STAKEHOLDER GROUPS LISTENING SESSIONS

Mayor's Office held or has planned listening sessions with each organization below.

A Voice for the Reduction of Poverty
American Muslim Society
Creatives Day
Crossings Nashville Action Partnership
Disability Coalition
Downtown Honky Tonks
Downtown Musician's
Downtown Partnership
Greater Nashville Realtors
Greenways for Nashville
iHeart Media
Interdenominational Ministers Fellowship
Latino Stakeholders with Conexion Americas
Metro Arts Commission
Metro Nashville Police Dept. Command Staff
Metro Nashville Public Schools
Kurdish community
Moving Forward general membership
Moving Forward’s coordinating cte.
American Muslim Society
NAIOP
Nashville Area Chamber of Commerce
Nashville Business Council
Nashville International Airport
Nashville Organized for Action & Hope
Nashville Predators
Neighbor 2 Neighbor
One Nashville
Stand Up Nashville
Tennessee Titans
The District
The Equity Alliance
Transit Alliance of Middle Tennessee
Walk Bike Nashville
WeGo Youth Action Team
Worker's Dignity (Music City Riders)

Fig. 22: Listening session prioritization exercise results by location

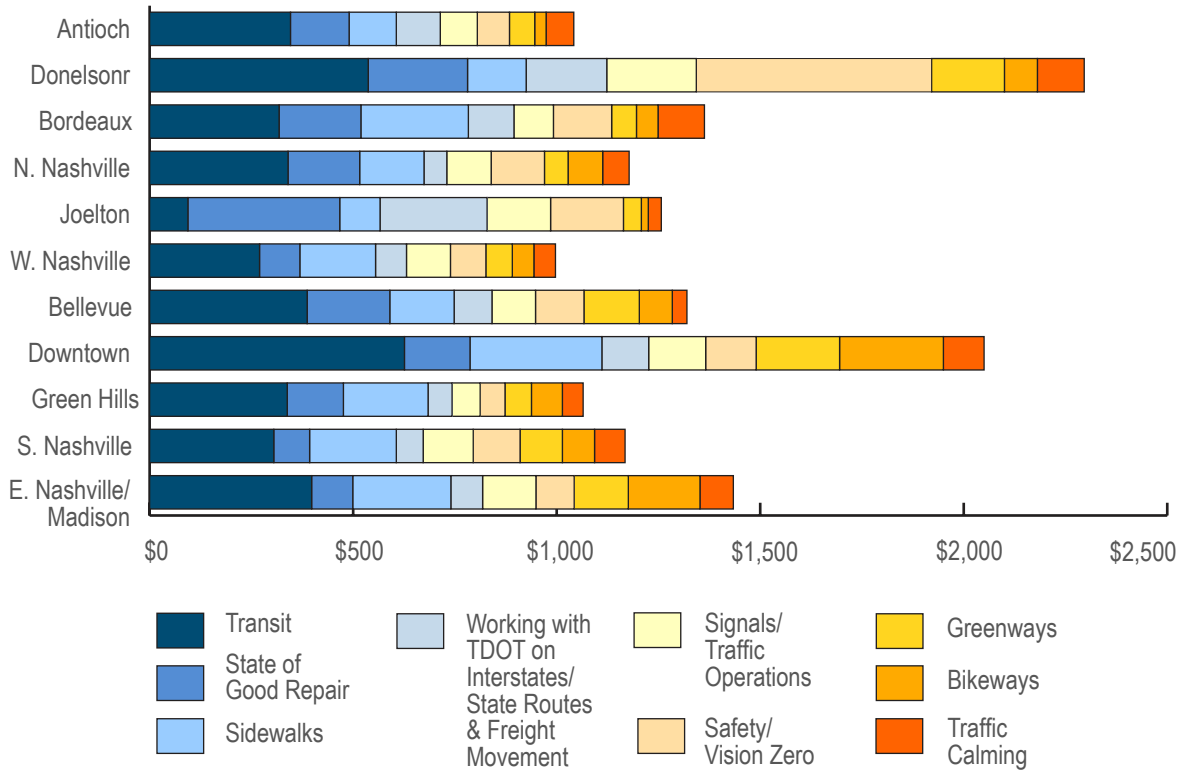


Fig. 23: Results from online exercise

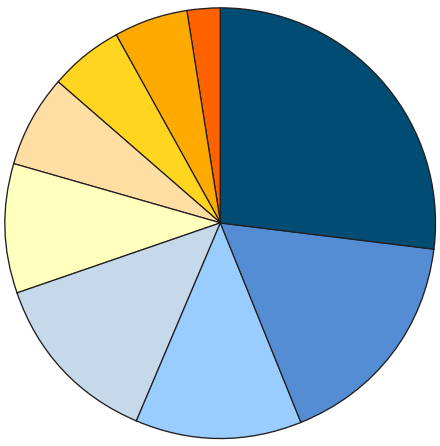
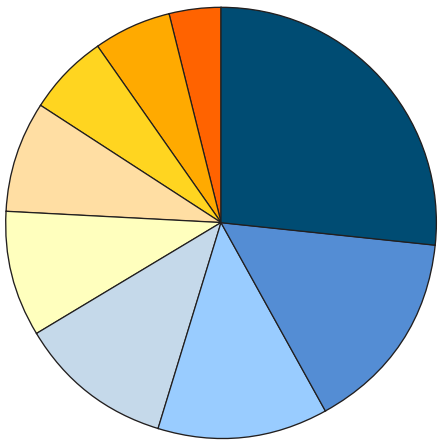


Fig. 24: Total from listening sessions and online exercises



2019	August/ September	• *Mayor Cooper Sworn In*
	October	• *Plan starts*
	November	• *Councilmember listening sessions*
	December	• *Councilmemeber listening sessions* • *Stakeholder Meetings* • *Traffic signal study*
2020	January	• *Stakeholder Meetings* • *Analysis of existing plans, programs and projects, including preliminary scope estimate and scope validation* • *Traffic signal study*
	February	• *Community Listening Sessions* • *Traffic signal study*
	March	• *Additional online community participation* • *Traffic signal study*
	April	• *Stakeholder listening sessions begin* • *Metro Council Budget* • *Financial strategies development* • *Traffic signal study*
	May	• *Stakeholder listening sessions* • *Metro Council Budget* • *Financial strategies development* • *Traffic signal study*
	June	• *Financial strategies development*
	July	• *Financial strategies development*
	August	• *Draft Document Complete* • *Project coordination with Metro Councilmembers*
	September	• *Mobility Plan released to the public*
	October	• *HUB survey for public comment*
	November	• *Schedule for plan action to be developed*
	December	

Online Survey

Additionally, digital versions of the public listening sessions in survey format were distributed to groups and organizations from throughout the County with a total of 2,608 respondents echoing their needs for a 21st century transportation system. The survey was open to the community beginning in February of 2020 and open through the summer. Transit ranked first among the survey respondents, which matched input from the listening sessions. Maintaining roads and bridges ranked second. Funding for projects working with TDOT on interstates/state routes and freight movement ranked third, followed closely by sidewalks. This input is also summarized in Fig. 23.

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PART 5

A Plan that Works for Everyone

A modern, 21st Century transportation system links communities, people and opportunities for economic success. We use it to access both civic life and vital city services. With complete streets, those that accommodate safe travel for walking, biking and driving, it brings new vitality and new life to streetscapes making safe public spaces for the most vulnerable residents.

Nashvillians should be equipped with the necessary tools to succeed at every opportunity. We all rely on our streets and sidewalks to get to jobs, schools and homes. Implementation of the Metro Nashville Transportation Plan will deliver a more equitable, responsive, resilient and reliable transportation system to get Nashvillians where they need to go. A variety of demographic, social, and economic factors result in people having different experiences while using the same mode of transportation or mobility service. Equity is not an afterthought or standalone task, but a key consideration at each stage of a project – in visioning, community outreach, technical analysis, and presentation of results.

Recovery & Restoration

While the triple whammy of the tornado, pandemic, and recession that followed have stretched the city to the limit, it's not the first time we've faced and overcome adversity. In addition to the Civil War, the Great Depression, and both World Wars, Nashvillians have faced an influenza pandemic, fires, floods and tornados.

The East Nashville fire of March 1916 engulfed 35 blocks, destroying more than 600 buildings and leaving 3,000 homeless. Troops returning home from World War I in 1918 brought Spanish Flu home with them. Mass gatherings such as theaters, movie houses, churches, and schools all shut down as eventually one in four Nashvillians (total population was approximately 120,000 in 1918) ultimately tested positive and more than 1,300 perished.

A New Year's Day flood in 1927 killed two and left more than 10,000 homeless. An F3-rated tornado in 1933 killed 11 people and caused extensive damage.[19] Another F3-rated tornado in 1998

damaged office towers in downtown as well as extensive damage in East Nashville and points east, caused $100 million in property damage, injured 60 people and killed one.[20] Lastly, the catastrophic flooding of May 2010 inundated large swaths of the city and killed 10 people.[21]

Throughout these tragic events, Nashvillians from all walks of life came together and rebuilt a stronger, more resilient city. In response to the 1916 fire, college students from Fisk worked to secure housing for black and white victims.[22] From the ashes, the city created a new park and also invested in fire prevention.[23] After the devastating 1927 flood, the U.S. Army Corps of Engineers constructed new dams to manage water flow.

The 1998 tornado recovery effort ushered in a new and prosperous era in East Nashville. And finally, after the May 2010 flood, Nashvillians volunteered in droves to assist with an inspirational recovery effort. Rebuilding revved up the local economy, leading to a surge of prosperity unseen previously. Meanwhile, Metro started purchasing flood-damaged homes and repurposed the land for greenspace to assist in flood mitigation.

Our city's perseverance and strength in times of trouble have nurtured a culture of neighbors helping neighbors and a community striving for a better tomorrow. While Nashville is currently experiencing another round of rebuilding and recovery, our people have already proven that defeat is not an option. They're confident that Nashville will, once again, channel the tragedy of a cataclysmic event for positive purpose.

Equitable Transportation Network

Delivering an equitable transportation network is about focusing our efforts to improve the way the transportation system works for every Nashvillian every day. As we rebuild, it is tempting to fall into previous behaviors of reacting instead of preparing for the unknown. However, we should not repeat the mistakes of prior generations. Our recovery cannot succeed if we prioritize simply building infrastructure over responding to the well-being and justice of the underrepresented. Mistakes such as the levelling of historic black communities for convenient interstates or the disparities of funding and political support for suburban commuter rail systems over intercity bus networks haunt us now.

It is not surprising that some of the most important moments in the fight for equal rights throughout this country's history have taken place on buses, bridges, and streets. A transportation system that does not work for those at the fringes of our society works for no one. Similarly, as put forth in the 8 80 Cities movement[24], if we build our public spaces and transportation system to work for both eight-year-olds and 80-year-olds, then they will work for everyone, regardless of age, ability or income level.

When we provide equitable access to jobs, affordable housing, healthcare, social activities, and education to our community, we offer access to opportunity for all. Without accessible transportation options we limit people's ability to prosper. Our neighbors who are either unable to drive or do not have reliable access to a car feel this the most by pay a higher percentage of their incomes on housing and transportation. They're

also more likely than the general population to be killed or seriously injured by people driving.

Ensuring transportation equity includes addressing unequal and inadequate access to high quality, reliable, safe and affordable transport options. Our transportation system should protect children and seniors from traffic violence by building a better sidewalk network that gives everyone real choices about how to get where they need to go, whether by bus or bike, car or scooter, wheelchair or stroller. Along with that, strategies to ensure affordable housing close to jobs is necessary in addressing the "drive until you qualify" issue of having to move farther and farther from the urban core to be able to find affordable housing opportunities. The additional driving time and the necessity of each person in a household needing a personal vehicle means less income and time is available for family responsibilities and efforts to better financial circumstances.

Safety

Three percent of the workers and 6% of households do not have access to a vehicle and may be more dependent on walking and bicycling to get around.[25] The Nashville Area Metropolitan Planning Organization conducted a health and equity analysis to understand areas where higher-need populations reside. The 2040 Regional Transportation Plan expressed its commitment to prioritize transportation projects that incorporate health, safety, and social equity considerations and that allow communities to grow sustainability. These factors include the following measures:

- Households in poverty
- Unemployed population
- Households without access to a vehicle
- Aging population (greater than 65 years of age)

People who are low-income, over the age 65, or do not own a car tend to have poorer health outcomes.[26] Additionally, they are at the same time, the most dependent on transit, pay the most for it, and are most at risk of death and serious injury from transportation, overall. Transportation is intrinsically both a measure of, and an indicator of equity.

This plan creates a pathway for improvements to the transportation network that increases resources for public transit, bikeways, and pedestrian infrastructure to support those who may not have access to a personal vehicle. The City will continue to build its streets and provide access to all Nashvillians regardless of their income or ability to attain.

Finally, the City needs to make improvements to some of its most dangerous intersections, locations which are the source of countless vehicle-to-vehicle and vehicle-to-person walking crash incidents. Metro Public Works, in partnership with the Mayor's Office, created a list of the 15 most-dangerous intersections to prioritize resources to targeted safety interventions. Several projects are underway through strategic interventions such as the replacement of traffic signals, sidewalk construction, improving street lighting, and the repaving of roadways.

Despite the limited levels of funding, Metro has made great strides by making targeted, small scale improvements and will continue to do so with the Vision Zero Action Plan initiative estimated to be completed in 2021

Access to Jobs, Housing, & Services

Equity impacts are not only connected to health; they directly correlate to how easily people are able to access housing, jobs, and other needs such as school, childcare, fresh grocery options, and parks. People must often choose between exorbitant housing costs or transportation costs. As gentrification pushes long-time residents out of urban neighborhoods and into cheaper housing at the city's periphery, they spend more money and time to reach jobs they need.

Reliable Transit System that Treats Everyone with Dignity

One of the most fundamental methods of transforming how Nashvillians see and connect with transit is by focusing on the dignity of transit riders. Bus stops with no shelters or sidewalks, signs next to only ditches, and bus routes whose times and frequencies are inconsistent day-to-day hurt the people using transit and soils the public's image of transit generally. This reduces transit's competitiveness with driving and inhibits WeGo's ability to attract new riders and maintain the dignity of current riders.

Building Out the Street Network in Growth Areas

Metro uses its Major and Collector Street (MCSP) plan to guide build out of its roadway network through review and permitting of private development. The MCSP provides a context-sensitive approach for each segment within its network by identifying right of way needs and building setbacks for new construction. It also identifies the location of needed arterial and collector connectivity.

For the city to accommodate all our new neighbors, businesses, and visitors, we must fully program and build out our roadway network with complete streets. Metro has continued to investigate innovative strategies to upgrade public roads in ways that help growth pay for itself. Nashvillians should not be solely on the hook for costly infrastructure needs. Partnerships that leverage private development to provide for improvements such as sidewalks, transit stops, traffic signals, and bikeways are encouraged.

The City also has made great strides through its coordination with GNRC and TDOT for new multimodal transportation projects such as for new sidewalks along Dickerson Pike and new capacity upgrades to roads including Nolensville Pike and Burkitt Road. In coordination with regional planning efforts like the Regional Transportation Plan, the Congestion Management Plan, and the state plan to deliver projects promised by the IMPROVE Act, Metro has opportunities to address multimodal capacity needs on state routes.

Complete & Green Streets

While our streets are all public resources that get us from one place to another, each street serves different land use and locational needs. Designing streets based on their contexts and how they relate to the greater multimodal network are key principles for "complete streets," which are public rights of way that provide safe and accessible movement for all users regardless of their mode of travel.

In addition to considering the use of the street for people walking, biking, riding transit, carpooling, and driving alone, several neighborhoods throughout Nashville experience occasional flooding and/or feature waterways which are in poor, polluted condition. As such, it is also critical that our streets take into consideration infrastructure that reduces flooding, restores our creeks and rivers, and support wildlife conservation through the construction of "green streets."

Green and Complete Streets promote access, mobility and health for all people, regardless of their age, physical ability, or mode of transportation. They fairly balance the accommodation of all users of the transportation system, by prioritizing the needs of people who walk, bike, take transit, drive, transport freight, operate emergency vehicles, or own adjacent land, in that order. Nashville has had a Green and Complete Streets Executive Order in effect beginning in 2016 under Mayor Dean and renewed under Mayor Barry, with a goal of designing Nashville streets to prioritize the needs of the most vulnerable people first. Furthermore, they should improve environmental quality through the inclusion of green-street elements such as street trees, swales, native plants and grasses, that reduce stormwater runoff, optimize stormwater quality, and enhance natural environments. Access Nashville 2040 and its component plans, including, but not limited to the Major and Collector Street Plan, has been adopted by the Planning Commission as a component of the General Plan.

Metro Departments are instructed to implement Nashville's Complete Streets Policy to accommodate all users, regardless of age, ability, or mode of transportation in all contexts and community character types, prioritizing those who are most vulnerable.

While green and complete street designs may differ in various contexts, the goal of prioritizing people who are most vulnerable remains constant—and should be prioritized over moving private vehicles and subsidizing areas for them to be parked. Indeed, there is a growing nationwide movement to foster the improvement of public streets not just for all users by mode and/or the natural environment, but also through the lens of equity and environmental justice. To ensure that no person is left behind or that capital projects negatively affect vulnerable populations, several states and communities require environmental review of projects depending on the scale of their impact.

Overall, the Green and Complete Streets Executive Order has been effective in reshaping new streets in Nashville, such as the 28th/31st Avenue connector, the Division Street extension, and Deaderick Street, to name a few. But major gaps in wider and more uniform application still exist. An opportunity exists to strengthen the policy guidance to also incorporate environmental justice impact mitigation to ensure that new capital projects meet equity targets. Green and

complete streets should guide all transportation decisions in Nashville. Doing so will reshape transportation itself in the city, further increase economic prosperity for all, and save lives.

Managing Traffic Demand

Decades of experience have shown that road-widening-only improvement programs often fail to relieve congestion over time. Having more drivers on the road makes it harder to walk and bike. By managing demand, we can shift trips from driving alone in rush hour to carpooling, public transit, and telecommuting or even encouraging work trips during off peak hours. The combination of infrastructure investment and supportive programs and policies has yielded great results in cities such as Seattle and Denver—and can here in Nashville as well.

Nashville Connector, a free Metro resource to connect commuters and employers to sustainable commute options through marketing, behavior changes and development review has given life to managing transportation demand in Nashville. Successful demand management employs multiple efforts at once – private sector engagement and participation, parking reform, transit improvements, transportation demand management supportive policies, and alignment of land use and transportation planning with capital spending.

Nashville Connector, in collaboration with the Nashville Area Chamber of Commerce and the Downtown Partnership, engages the private sector through working with large employers to assess commuting habits and make recommendations on shifting trips to non-drive alone based on home and work locations. After struggling with increasing parking costs, recruitment and retention issues and employee requests for better commute options, most employers are happy to have help in establishing transportation benefits programs. They are eager to connect with WeGo Public Transit's Easy Ride program, the TMA Group's Van Star program and other strategies. The annual Commuter Challenge gives employers an opportunity to jump in and try new modes in a friendly competition.

Vanderbilt University, Middle Tennessee's largest employer launched MoveVU in 2019 with a goal of reducing the current drive alone rate of the university students and employees from 77% to 55% by 2025. Gaining consensus on a bold and ambitious but realistic mode-shift goal helps to motivate and mobilize community leaders, decision makers and commuters around a common vision while providing a visual tool to measure progress. Davidson County's drive alone rate was 78.8% in 2018.[27] A reasonable goal to work towards by 2023 would be reducing this percentage to 77.5% with an ideal goal being to reduce it to 66.4% but this would require investment in transit and an aggressive TDM program. These goals were derived from Census ACS Worker Counts for 2018 and were based on comparisons with peer cities.

In order to reduce and maintain a lower drive alone rate, the commuter experience must be convenient, affordable, enjoyable and safe. Nashville Connector, housed in the Metro Planning Department, works closely with land development and Metro Public Works staff to ensure that new development is built and designed to advance multimodal connectivity and to encourage future active transportation.

Balancing our transportation system is critical in order to deliver on the needs and issues voiced in

the Mayor's Transportation Listening Sessions. It is not economically, financially, environmentally or geographically sustainable to continue to invest in a transportation system that prioritizes driving to the detriment of all other modes and TDM has helped many communities make this important and necessary cultural shift.

Parking Management

We can meet multiple community goals through better parking management. Emerging technologies and shifting consumer preferences have allowed cities to develop healthy parking systems that generate revenue and reduce congestion. There are many strategies that have been successfully used to manage parking wisely rather than letting parking dictate community form and function.

Contrary to conventional wisdom, parking is not actually free. Employers, developers, property owners, and renters pay these fees. Taxpayer dollars often subsidize parking. According to a 2020 Victoria Transport Policy Institute study the average construction cost of a basic parking structure in 2015 in Nashville cost almost $17,000 per space with an average nationwide cost ranging from $24,000 to $34,000 per space plus the cost of operation and maintenance. At the same time, Downtown Nashville's average monthly parking rate has approached $200 per month. This often inflates development and housing costs — exacerbating an already acute affordability crisis.

We need parking policies that minimize, rather than maximize, the number of parking spaces, especially in Downtown, Midtown, and Music Row. Nashville Connector encourages incoming developments to provide active transportation amenities, connections to transit, greenways and sidewalks and adopt longer term strategies such as decoupling parking from housing costs. Working with the development community to address the issue of market demand and financial lenders requiring excessive parking embedded in new development projects is also needed in Nashville as we transform from a community that has prioritized the car to one that has a strong market demand, financing opportunities and supportive public policy for walkable, bike friendly and transit connected developments.

Nashville employers often provide parking at no cost to employees as part of a benefit package. Replacing the employee parking benefit with a transportation benefit of the same value is a compelling way to encourage walking, bicycling or taking transit to work. Even better for employees is for their employer to join WeGo Public Transit's Easy Ride program or subsidize a vanpool program. With less need for parking, employers can replace some spots with secure indoor bike storage, showers and lockers and other amenities to encourage active transportation.

In tandem with TDM initiatives with employers, Nashville is currently working on updating and modernizing its on-street parking system and curb space. As Nashville has evolved into a major tourist destination as well as a home for corporate headquarters and large employers, pedestrian and vehicular mobility have been choked by an increasing number of user groups competing for curb space. Pedestrians, cyclists, scooters, buses, rideshare vehicles, valets, delivery trucks and service vehicles all compete for valuable space causing congestion and frustration. Replacement of parking meters with valet zones for businesses as well as low parking fines for on street parking and parking meter violations have resulted in a loss of revenue to

Metro and enforcement issues. Several strategies are underway to address this issue including updating existing parking meter contracts and partnering with technology providers to bring the latest digital tools to Nashville.

TDM Ordinance & Evaluation

Nashvillians want the freedom to move about easily by driving, walking, rolling, cycling or taking a bus. Obtaining such a goal requires that we establish clear, consistent and predictable land development review policies designed to mitigate the traffic impact generated by new development. These policies would include incorporating measures to enhance mobility into site design and ongoing building management as well as requiring existing large employers to increase employee non-drive alone trips to work.

Our most recently documented drive alone rate from 2018 is close to 80%[28] which could be reduced by adopting a Trip Reduction Ordinance (TRO). TROs have been used successfully nationwide to address congestion and parking issues, improve air quality, and encourage sustainable and connected communities.

Nashville has taken the first steps towards this by implementing the Traffic Impact Study Guidelines, endorsed in 2004, that require developments that generate 1,000 or more peak hour trips to complete a TDM plan. Although this has been on the books since 2004, it was not implemented until Nashville Connector was established in 2018. Since then, more than 30 new developments have been reviewed by TDM and Public Works staff to include TDM recommendations. Other developments are reviewed as part of the land development process and if a developer is requesting more than existing regulations permit, staff may request TDM measures as a condition of the approval.

Using lessons learned, we would benefit from adopting a Trip Reduction Ordinance that outlines a clear policy that is applied consistently and fairly to all new development as well as existing large employers to help them reduce single occupancy vehicle trips generated by their development by incorporating strategies to encourage active and sustainable trip options.

According to Establishing an Effective Commute Trip Reduction Policy in Massachusetts,[29] a 2014 report published by A Better City, common measures used in successful programs included requiring developers or employers to document TDM strategies that they will use to reduce their SOV mode share and a staff focus on working to help businesses comply rather than enforcing strict penalties.

Common factors that the most successful programs share include having broad support from state and local leaders with everyone working towards meeting a goal of reducing congestion and improving air quality, adequate staffing to work with employers, developers and other departments, a streamlined process appropriate for the local community and an evaluation process to track employer and development progress towards meeting mode share goals.

Curbside Management

Overall, for the greater part of our city's history, Nashville's street curbs have operated as a wild west. This laissez faire approach was okay when Nashville was a small, sleepy town but given the amount of traffic on our streets and

needs to maximize the movement of people, this approach is no longer realistic. Nashvillians always welcome our guests from out of town and ensure that they have the best possible time when visiting us, however that does not mean that pedal taverns and other transpotainment vehicles should be allowed on our streets during rush hour. Nor is it appropriate to surrender entire block faces for free on-street parking rather than install dedicated bus lanes that would have the ability to provide reliable, frequent transit service.

An appropriate strategy for regulating curbside access, or curbside management, should follow these guiding principles:

- Align with broader planning goals within *NashvilleNext* as they pertain to Ensuring Opportunity for All, Expanding Accessibility, and Creating Economic Prosperity;
- Prioritize the throughput of people instead of the movement and storage of cars;
- Meet the transportation network goals established in *nMotion* and *WalknBike*;
- Vary by adjacent land use context and time of day; and
- Use pricing to incentivize what we want and disincentivize what we don't want.
- Continue work towards a public-private partnership in which parking meter equipment can be modernized with minimal public expenditure.

Leveraging Investments with Opportunities

Transit Ready

Transformative investments in transit infrastructure requires more than new travel lanes, sidewalks, crosswalks, and stations. For the transit to succeed, development along the routes need supportive development patterns that allow for more housing, mixed use, and opportunities to coordinate investments in transit with housing and other quality of life improvements. Doing so increases ridership and reduces auto traffic, ensuring the biggest public benefit from these major investments.

Therefore, being transit ready is key for the Murfreesboro Pike Bus Rapid Transit and Clarksville Pike Rapid Bus investments. So how do these corridors currently stack up? Both corridors have land use policy generally supportive of mixed use and other transit supportive development. However, more work is needed to ensure that the regulatory framework for redevelopment is appropriate. Existing suburban zoning districts, in place for decades, limit opportunities for walkable, transit supportive development. As projects advance, they will include public engagement about the future development patterns along the corridor, which will include analysis of existing zoning for the area and the potential opportunities that come with rezoning. Below, highlights and key opportunities for affordability are identified for the two transit investments. Additional analysis is available in the technical appendix.

Murfreesboro Pike Bus Rapid Transit Corridor

Described in detail in Part 1, the Murfreesboro Pike Bus Rapid Transit project would link Downtown Nashville to the Global Mall at Hickory Hollow with predominantly dedicated transit lanes running along Lafayette Avenue, Murfreesboro Pike, and Bell Road. With this investment will come significant opportunities to encourage redevelopment along the corridor to create welcoming, vibrant areas around each station and to maintain and supporting housing that is attainable for all Nashvillians. Major opportunities exist at potential station locations at intersections with Thompson Lane and Bell Road, as well as at the Global Mall.

Quality of life opportunities

Sidewalk and bike lanes are spotty along this route. However, with BRT investment would come new pedestrian infrastructure to provide safe routes to transit stations. Only a small portion is built out with sidewalks now. New investment can be leveraged to address sidewalk connectivity off the corridor, address flooding issues associated with Mill Creek, make use of the proposed Browns Creek segment of the Central City Greenway, provide park opportunities in areas that lack usable public greenspace, and provide improved, reliably access among Downtown, Trevecca Nazarene University, Nashville International Airport, the Dell campus, and Global Mall at Hickory Hollow, including the library, community center, and Nashville State campus.

Property owners and developers have begun proposing projects with new amenities along this corridor. These proposals, and some recent projects, are creating walkable, mixed use places that support the surrounding community. The large, suburban sites that characterize major intersections on the corridor are opportunities to bring additional community services and gathering spaces to neighborhoods with aging commercial districts.

Key opportunities for affordability

While large suburban undeveloped or underutilized sites offer opportunities for new growth in general, they also provide opportunities for meeting housing needs for transit customers that rely on access to reach work, school, or other services. In addition, Nashville has ongoing efforts to improve and expand affordability close to the urban core. Ongoing efforts and new opportunities include:

- Envision Napier-Sudekum reconstruction that will add new market-rate housing but will not reduce the overall number of units available for low income families.
- MDHA Promise Zone covers Murfreesboro Pike out to the Airport.
- Global Mall at the Crossings (potential public-private partnership).
- Preservation of existing aging apartments to ensure affordable opportunities remain while new development occurs.

Clarksville Pike Rapid Bus Corridor

Described in detail in Part 1, the Clarksville Pike Rapid Bus project would link Downtown Nashville to Buchanan Street, the planned North Nashville Neighborhood Transit Center, and the Bordeaux Public Library with rapid bus service running along Rosa Parks Boulevard, Garfield Street, Buchanan Street, Dr. D.B. Todd, Jr. Boulevard, and Clarksville Pike. Opportunities to leverage

redevelopment along the corridor places special emphasis on maintaining and supporting housing that is attainable for all Nashvillians. Areas along the corridor located south of the Cumberland River do have some redevelopment constraints due to the depth of available land fronting the route. North of the river has more opportunities and, in recent years, has seen renewed interest from housing developers that support the community's effort to build a market for additional retail and services.

Quality of life opportunities

The Buchanan Street portion of the rapid bus route is a distinctive arts and black-owned business district that has been evolving over the last decade. While many competing ideas exist about how it should move forward, rapid bus offers an opportunity to facilitate that conversation during development of this project. Nearby, the McGruder Center is a social service hub that has recently begun expanding its services.

In addition, North of the river, programming Mullins Park could be a quality of life improvement and a catalytic investment, particularly for Fairview Center on Clarksville Pike and the western portion of the Haynes Trinity small area plan.

Key opportunities for affordability

North Nashville also has several ongoing investments and programs to support affordability.

- The North Nashville Promise Zone reaches to the river.
- Clarksville/26th Barnes Fund affordable housing project being developed at Clarksville Pike/26th Avenue North
- Some Metro sites, such as the North Police Precinct could be an opportunity for creative incorporation of housing to its existing configuration or through redevelopment, subject to community support.

Technology & Partnerships

The more types of vehicles we add to our system, and the more we tie land use to transportation, the greater the need for supportive technology solutions. Many vehicles come equipped with sensors and automatic functions such as self-parking – likewise, our built environment needs to be modernized to prepare for the growing congestion of our streets. Embracing technology to improve bus boarding, fare collection, and pedestrian crossings is critical to increase the throughput of people using roads which will be over capacity in the coming years. If we cannot leverage new innovative systems as well as regional and national partnerships, Nashville is doomed to face its problems alone within an ever-connecting world.

In the coming decades, as vehicles become increasingly connected and autonomous, these investments in technology will allow for real-time communication between on-street infrastructure and the people using it, saving time, and again, saving lives. This scenario only works, however, with an unflinching commitment to transparency between partner agencies and the citizens that we collectively serve.

Signal Modernization & IT/5G Capabilities

Internal-facing improvements include updating, upgrading, and/or replacing signals and equipping infrastructure with fiber and 5G capabilities. However, preparing this framework is a major undertaking because currently many of these components are very outdated. Metro Public Works utilizes a combination of Time Based Coordination (TBC) and Time of Day strategies to manage traffic at its signalized intersections, processes which are slowly being phased out in favor more advanced systems nationwide.

Furthermore, Nashville's reliance on twisted-pair copper communication cables is problematic given its age and inability to transmit large bundles of information as quickly as newer communication systems such as fiber optic cables and 4G/5G cellular communications. The City currently has no functional CCTV cameras dedicated to monitoring traffic operations that are communicating back to the NTCC. When compared to its peers, the City has the lowest percentage of active functional CCTV cameras for the purposes of monitoring.

When considering traffic management strategies for a diverse city like Nashville, the safety and operational performance for all roadway users must be considered when allocating funding and setting transportation priorities. Multimodal considerations must include motorists, pedestrians, bicyclists, and slow-moving vehicles inside the downtown core such as scooters, golf carts, and pedal taverns. In recent years, capital funding for non-motorized modes (sidewalks and bikeways) has significantly outpaced spending for traffic control equipment and maintenance. Without question, Nashville has a lot of ground to make up in sidewalk construction, but the lack of investment in the signal system has put our city behind in an area where technology has changed rapidly.

A modern and resilient traffic management system will increase safety, travel time reliability, and operational performance for all users. Some examples include:

- A traffic signal system with upgraded detection can be used to monitor bicycle and pedestrian usage which can help engineers plan and implement better bike and pedestrian facilities where needed.
- A more responsive signal system can facilitate additional pedestrian street crossings while minimizing delay to vehicles.
- Effective traffic progression can maximize the capacity of an existing corridor. In some cases, this may allow for a reduction in street width that can then be returned to non-auto uses while maintaining or improving vehicle flow.
- Monitoring major corridors can help set operational parameters aimed at keeping speeds at an appropriate level – a safety benefit for all road users.
- Special bike signals can be used to provide dedicated intersection access for this vulnerable type of user.

Real-time Transit Information

We must upgrade infrastructure on and under streets, as well as the communication tools used by specialists to diagnose and communicate real-time with partners at the local, regional, and state level, as well as with the general public. Identifying, communicating, and eventually predicting where crashes will take place, allows for more target interventions and will also literally save lives.

Being able to understand traffic patterns—including how they are affected by weather, special events, crashes, etc.—will also allow WeGo, Nashville's transit provider, to more accurately communicate real-time transit information to riders. Armed with real-time bus arrival

times, WeGo riders can move more freely and reach jobs, services, and other necessities of life in a more reliable, timely manner.

Transparency

New innovations in our transportation systems enable our community to report data and project reporting in real-time, making it easier for neighbors to work with Metro. Recently, the City's ability to collect more data is leading to more cost savings, stronger reporting online in the form of project detailing and tracking, and formalized context-sensitive approaches rather than applying a one-size fits all strategy. We can standardize our outreach to neighborhoods as well as how information is relayed to the development community.

Metro is currently in the process of establishing a new construction manual which will dictate how public capital projects are designed based on best practices and new federal guidelines. As Metro further enhances its construction details to make sure that development is building the infrastructure that the City needs, Metro must ensure that public investments are setting the bar moving forward.

Most importantly, Metro Public Works' new construction manual will also create new opportunities for Nashvillians to engage with city staff for input and project tracking, which in turn increases accountability for projects to meet goals of each respective initiative using performance measures. By reorganizing its operations and department resources, Nashville will in turn, craft performance measures based on metrics for equity and project delivery.

Sustainability & Climate Action

In February of 2020, Mayor John Cooper announced a 48-member Sustainability Advisory Committee to advise his administration on sustainability and help advance related proposals through legislation, executive orders, and other policy changes. The Committee is working with Metro staff to produce Climate Action and Adaptation Plans that will fulfill Metro's requirements under Mayor Cooper's renewed commitment to the Global Covenant of Mayors for Climate & Energy—the world's largest cooperative effort among mayors and city officials to reduce greenhouse gas emissions, track progress, and prepare for the impacts of climate change.

Six subcommittees have reviewed and augmented, as appropriate, Metro's previous work to develop and implement sustainability plans and recommendations for the city—including Livable Nashville, *NashvilleNext*, the Green Ribbon Committee Report, and Plan To Play. These subcommittees are organized around the core components of a climate action plan—mobility, energy, waste reduction, green buildings, natural resources, and adaptation/resilience.

The Mobility Subcommittee outlines recommendations for how the local transportation sector must reduce its share of greenhouse-gas emissions in order to reach Nashville's stated goal of an 80 percent reduction in community-scale emissions (from a 2017 baseline) by the year 2050.

With a vision towards cleaner air, healthier communities, and improved access to jobs and opportunities, the Mobility section of the Climate

Plan outlines policies and priority actions to increase the quality, availability and safety of transportation options necessary to meeting the emissions reduction goals. From investing in transit to ensuring new development prioritizes multimodal connectivity, the over arching goal is to reduce vehicle miles traveled (VMT) by reducing our drive alone rate and shifting remaining car trips to electric vehicles. It is recommended that a mode shift goal with mode share targets as well as Electric Vehicle adoption rate targets be adopted and updated at least every five years by Nashville and surrounding counties with regional land use planning and coordination around meeting these goals. The committee's work and recommendations around nine main strategies that will help us reach mode shift goals are detailed in the Appendix.

Strong State & Regional Partnerships

Lastly, it is critical that we do not face our challenges alone. Strong regional coordination and adjacent-local-government partnerships enable the opportunity for Metro to partner and use shared resources. It is too important that we do not leave cards on the table. Metro must work hand in hand with the State of Tennessee, surrounding counties, and the Greater Nashville Regional Council to work on programs and initiatives that may overlap. This is important to ensure that work is not being repeated and to leverage ongoing studies and capital projects. Metro staff have a strong working arrangement with state and regional agencies, serving as flag bearers for the region's Unified Transportation Plan which will allocate coordinated studies and funding from federal resources. By working together, we work stronger. Cities that operate as islands miss out on U.S. Department of Transportation grant opportunities and regions that do not grow strategically leave residents in the middle of competing, incomplete prioritizes.

TDOT is in the process of identifying how best to address growing congestion and mobility needs within the five-County Middle Tennessee Region (Davidson, Rutherford, Sumner, Williamson, and Wilson counties). There are a number of project concepts that relate to better managing our roadways in and around the Inner Loop, as well as along major commuting corridors (such as West End Avenue, Charlotte Avenue, Gallatin Pike, Nolensville Pike, 8th Avenue South/Franklin Pike, Lebanon Pike, and Murfreesboro Pike) that serve and support Nashville-Davidson County as well as the region's surrounding counties.

The concepts of the plan focus on management solutions relative to freeways, arterials, and transit. TDOT rooted our evaluation with existing and proposed plans. Additionally, TDOT also reviewed current project commitments identified within the IMPROVE Act to see what projects from the IMPROVE Act could be leveraged to best respond to the region's growing congestion and mobility needs.

PART 6

What Needs to Be Done

We need a back-to-basics approach to guide our decision-making as they relate to shortcomings in our existing transportation network as well as back-to-back calamities.

This is especially so given the hardships Nashvillians currently face. Embracing innovation to streamline parking and traffic management, fortifying programs that foster equity and environmental justice, and breaking down barriers between agencies will bring Nashville to a new period of prosperity. Echoing these big picture ideas, it is critical that this plan remain grounded in a clear set of priorities to meet our city's goals of modernizing our transportation system. All in all, this document sets forth the following core priorities which serve as a foundation on which recommended projects and funding strategies will aim to build upon to meet Nashvillians' needs of both today and tomorrow.

Core Priorities

- Establishing a new Department of Mobility and Infrastructure;
- Launching the Nashville Vision Zero Action Plan;
- Sorting out our signalized intersections and curbsides;
- Creating a transit system that is frequent, reliable, and predictable;
- Emphasizing streets for Nashvillians, not just their cars;
- Expanding a greenway network to go to where the people are; and
- Working with regional partners outside of Davidson County

Department of Mobility & Infrastructure

Why a New Department?

Currently, multiple departments across Metro government house transportation activities including public works, planning, parks, and finance. This results in a lack of consistent organization and priority of effort that is essential to the performance of transportation infrastructure. Following the success of staff reorganizations in communities such as Seattle, Boston, Washington, and Denver, it is time for

Metro Nashville-Davidson County to establish a new Department of Mobility and Infrastructure (DOMI), independent of Planning, Public Works, and WeGo Public Transit, to focus full time on the growing needs of our mobility infrastructure and to spearhead new initiatives that improve the lives of all Nashvillians.

Supporting Superior Management & Accountability

The organizational approach will include the key functions of a modern transportation organization with development and delivery and operations and asset management portfolios. Under each portfolio the key functions of plan, design, and delivery as well as operate, maintain, regulate, and enforce creates the structure needed to deliver best value to our residents and businesses. Additionally, it creates a structure for coordination with partner departments and organizations, such as WeGo Public Transit, and the critical measurement of departmental performance supporting superior management and accountability.

The proposed organizational structure contemplates an overall realignment of staff within Metro Public Works and the transfer of certain staff from Planning. At this time, Parks would retain the greenways and trails component due to their maintenance obligations but with additional support from the newly formed DOT in the development and delivery of those assets. As a unique organizational entity with a separate governance structure, WeGo would remain separate but necessary coordination and integration would be accomplished through the newly formed DOT. Further, clear roles and responsibilities enhance the Department's position in recruitment and development of existing talent.

Lastly, the transportation activities of Metro need not only a new home, but a new culture. Support, encouragement, alignment, continuing skill development, and an aspiration of communicating to our vendors that Metro requires your sharpest minds and sharpest pencils (best solutions, best price) will be achieved through a new department focused on transportation. Additionally, the new organization provides platforms that presently do not exist for innovation, a stronger and more effective commitment to complete streets and active transportation as well as enhancement of event traffic management.

A transportation-focused department will also serve as an accountable single point of communication enhancing our competitiveness in leveraging partnership funding at the State and Federal level as well as the development of public private partnership opportunities. These are among the same reason why other previously mentioned Metro peers have also recently formed DOT organizations.

Preparing for Our Future

Metro will continue to develop our transportation planning program in order to help us understand where we need to make improvements from a system wide perspective – for small areas and countywide. We need to approach building out, especially areas transforming from rural to suburban, from an interrelated systems or network planning perspective. For facility planning, as was the case for the traffic management center analysis, we must identify capacity of current infrastructure to meet our needs now, tomorrow and for years to come,

especially in areas where growth has outpaced infrastructure. This comes from reviewing base conditions, understanding entitlements already available for private development and knowing how those impact the overall system's performance. By understanding impacts of existing and approved development, we set a base line for measuring additional needs for the area and developing initiatives to identify needed capital improvements. We can accomplish this by focusing strategically on high-growth areas, notably in Cane Ridge, Antioch/Priest Lake, Hermitage, and Old Hickory.

Metro will continue to consider ways to deliver these needed investments provided by developers through requirements of zoning and subdivision of property. Through improved coordination and refinement of our traffic impact scoping procedures incorporating best practices, Nashville will continue to take steps to ensure that new developments create Transportation Demand Management plans as part of their proposals designed to mitigate single occupant trips in cars in favor of more transit, walking, bicycling, and carpooling.

Vision Zero

For too long we have accepted traffic deaths and injuries as a normal part of modern life and resort to simply hoping that ourselves or our loved ones are not one of the unlucky victims of this system. Vision Zero does not accept loss of life and long-term injuries as a routine and expected part of modern transportation. It educates communities on the financial and emotional costs to victims as well as the public healthcare and emergency response costs. The Vision Zero movement began in Sweden in the 1990s with the goal of eliminating all traffic fatalities and severe injuries. It has sought changes in education, engineering and enforcement. Joining many cities across the nation, Mayor Cooper announced his administration's commitment to Vision Zero in January 2020. Metro is developing an action plan to map out a strategy for eliminating deaths due to traffic violence.

Severe Injuries & Fatalities

Nashvillians continue to drive cars for most of their trips—both short and long. We also have a fragmented sidewalk and bikeway network. A simple walk to the bus stop or grocery store is often dangerous because of a lack of sidewalks, high speed traffic, wide roads, infrequent crosswalks, oversized city blocks and intersections designed for cars rather than people. Preventable loss of life on our roadways is not acceptable.

Vision Zero offers adoptable, powerful strategies that reduce unnecessary deaths and injuries. Vision Zero offers a holistic view of crashes to identify where and how design or policy decisions contributed. Metro's Vision Zero Action Plan will tell a complete story of traffic fatalities and injuries after analysis of crash data from multiple sources. Metro will gain a complete and accurate understanding of crash patterns, trends, demographic characteristics, locations, modes and any other contributing factors.

High Injury Network

Our Vision Zero Action Plan will address our most urgent safety concerns and provide a prioritized guide for future investments in infrastructure in the highest-frequency crash locations. This

high injury network definition will come from typical crash data collection in addition to public engagement that will seek out communities that may not report crashes. It will also identify places where data concludes are safe only because residents avoid them because they consider them too dangerous for walking or cycling.

Street Redesigns, Countermeasures, & Reducing Speed

More awareness is needed in Nashville about the impact of vehicular speed on pedestrians that are hit by a vehicle – at 20 mph, nine out of ten pedestrians will survive; at 30 mph, five out of ten survive and at 40 mph only one out of ten pedestrians will survive. Our Vision Zero Action Plan will outline effective countermeasures to address safety and reduce crashes. Vision Zero emphasizes the role roadway design and policies have in contributing to crashes. Street design should involve the contribution of multiple disciplines working in concert to end traffic deaths.

No street design will prevent drivers, cyclists, and pedestrians from bad decision-making 100 percent of the time. That said, our roads and policies should ensure that those mistakes do not result in severe injuries or death. Strategies could include dedicated travel lanes for transit, a dedicated source of transit funding, protected bike lanes, signal-protected pedestrian crosswalks, traffic calming, appropriate road lane widths, coordination between land use and transportation planning and other efforts to put people first in transportation.

Traffic Management & Congestion

Our city's growth demands smart, congestion-mitigating investments. Moving Nashville into the 21st century means ensuring that congestion mitigation investments balance the needs of all modes of travel. The days of prioritizing cars above all else have passed. We now must look to travel time predictability and vehicle miles traveled to measure success.

Signals & Operations

Nashville's network of traffic signals should be able to communicate with one another, not only responding to local traffic changes, but expanding those changes throughout the network. Doing this means upgrading the signals and building an operations center to manage a signal network in real time. These upgrades, while important for efficiently moving people in cars, should also have a Vision Zero focus, prioritizing the safe and efficient movement of people not in cars. This includes improving the reliability and predictability of transit on the highest-frequency routes, particularly. Returns on investment in this area can be quantified by signal performance measures.

Curbside Management

Curb space is one of the greatest assets that cities possess. It is as valuable as the properties and buildings that it fronts, but historically has not been equally prioritized, managed, and priced. This has led to a confusing patchwork of parking, valet, loading, travel lanes, and bike lanes, with demand continuing to increase from those uses

as well as transit lanes and stops, micromobility devices, pedestrian plazas, and trees. We are in desperate need of a coordinated strategy to move from an application-based strategy to one that prioritizes and prices this space according to goals for the city, and has the flexibility and nuance required to respond to equally nuanced environments. Technology will be key in achieving this, in communicating, adapting to changing demands, and enforcing.

Curbside Management is gaining interest from city leaders nationwide for several reasons – increasing competition from new technology enabled transportation mobility options (ride hail companies, micromobility, etc.); curbs are mostly in local control so can be used as a powerful tool to advance mobility and livability goals; curbs are a source of revenue; and the evolution and availability of digital platforms to provide dynamic management of curbs in real time. For example, in 2020 Nashville was selected, along with Aspen, Omaha, and West Palm Beach to partner with curb management platform Coord to pilot a Smart Zone program to better coordinate curbside loading and unloading while promoting safety, efficiency and local economic activity.

Along with the Coord Pilot, Metro is also undertaking a Downtown Neighborhood Traffic Project that will address curbside management, transit routing and flow in addition to a Smart Parking initiative to modernize Metro's parking system. Leading 21st century peer cities have been actively modernizing and managing their on-street parking systems using comprehensive, real-time data analytics through emerging smart mobility tools to inform better urban planning decisions and assess curb space value and use. Nashville, however, currently lacks many of the customer service features associated with modern parking operations. Recently, an analysis was completed that showed potential lost parking revenue to Metro totaling almost $2,000,000 so efforts are underway to explore digitally enabled economic incentives and different pricing strategies to encourage desired parking habits.

Reliable & Frequent Transit

Nashvillians, for the most part, rely on privately owned personal vehicles, rides from friends and families, and rideshare to get around. The regional plan for public transportation, *nMotion*, identified an ambitious transit vision that concentrated new high capacity transit investments on major corridors identified in *NashvilleNext*, in addition to investments in traditional bus service. *NashvilleNext* and *nMotion* identified Murfreesboro Pike and Clarksville Pike as future high capacity transit corridors. Both are included in the Metro Nashville Transportation Plan. Traditional bus service improvements included new crosstown routes and providing transit centers to serve as hubs for route transfers. Many of the bus improvements are planned with the implantation of WeGo's Better Bus.

Better Bus Implementation

A common complaint about public transportation throughout Nashville is the idea that the WeGo bus network which operates as a hub and spoke model is archaic. Riders cite the necessity of having to go to WeGo Central downtown to transfer to get to their ultimate destination rather than having the ability to utilize crosstown routes to avoid constrained downtown bottle neck

traffic. Acknowledging similar issues throughout Davidson County, WeGo has launched a network redesign called the Better Bus Program, which seeks to modernize the system by simplifying routes, increasing crosstown connections that avoid downtown altogether, improving service spans for later hours each day, and alternating visual communications to reduce rider confusion. Better Bus is described in detail in Part 1 of this plan. As an implementation mechanism outlined in *nMotion*, WeGo is updating their service maps and route classifications by frequency of service rather than by type to more readily convey system performance and travel times for bus riders. This plan will further elaborate specific projects as the Better Bus Program moves forward with dedicated funding for transit.

Overall, implementing the Better Bus Program allows us to give current and future riders some of the things they've been asking for since *nMotion* (and before).

- An All-Day All-Week Network. WeGo service does not run late enough at night, and in some cases, it doesn't run early enough in the morning. Our current system is also still mostly focused on weekday peak commuters with large drop offs in service levels during evenings and on weekends. The first thing increased investment in service allows WeGo to do is provide buses earlier and later and upgrading evening and weekend service. This means people will have an easier time accessing jobs beyond 'typical' commute hours. It also makes it easier for people trying to access school, shopping, events and entertainment, and any other destinations across the city.
- Expansion of Frequent Service. The 23-Dickerson Road, 7-Hillsboro, and the inner part of 4-Shelby get added to the frequent transit network (running every 15 minutes or better on weekdays, every 20 minutes or better on weekends). The two top corridors (Gallatin and Murfreesboro) also get frequency upgrades to 10-minute service during the busiest times. Frequent service is critical to making transit appealing, competitive and convenient. Making these routes more frequent gets people where they are going faster (less time waiting for a bus).
- New Connections. Aside from requests for better span and frequency, one of the most common things WeGo gets asked about is crosstown routes and the ability to transfer without going downtown. Better Bus is a first step toward a more decentralized system as it provides several new connections through route extensions (in coordination with new transit centers), improved service on existing crosstown routes, and a new Trinity Ln crosstown route. Again, this amounts to faster service and better access as more people will have the option of getting where they are going without needing to go out of their way to transfer downtown.

Signal Priority

In partnership with the overhaul of traffic signals improvements along Murfreesboro Pike from Charles E. Davis Boulevard to Bell Road and along Bell Road to the Global Mall at the Crossings, WeGo assisted TDOT and Metro Public Works with signalized timing upgrades that give buses priority over other traffic to move through congested intersections. The project is the first of its kind to analyze improvements to signalized intersections along the entirety of a single bus transit corridor. It includes upgrading

timings, installing special signals for buses, and constructing bus-only lanes for transit vehicles to overtake private automobiles and freight. The Murfreesboro Pike Transit Signal Priority project reinforces the narrative that Nashville is elevating the transit conversation. Moving forward, DOMI will reconfigure other pikes and arterial streets with transit signal priority projects emulating the success of the Murfreesboro Pike redesign to further implement the recommendations of *nMotion* and the Transit Design Guidelines.

Transit Readiness

Even with our recent improvements to transit service and access such as Transit Signal Priority infrastructure along Murfreesboro Pike, Complete Streets pilot projects along Gallatin and Murfreesboro Pikes, and extensive public-private partnerships such as the North Nashville transit center, we continue to lag our peers.

Corridor Planning & Street Projects

It is common to find bus stops in off-road ditches, isolated without sidewalks at the edge of six lane roads, and oftentimes notated solely as a sign bolted onto a light pole. When we treat the bus as a fringe benefit and do not include transit agencies in our street construction decision making, we should not be surprised that our transit systems under perform and only attract riders with limited or no other options to get around.

Cities make the unfortunate mistake of galvanizing studies, political support, and media attention on high end projects such as light rail and commuter rail systems when in fact, buses operating at a higher frequency and/or in their own separate lanes achieve more efficient results. Nashville, for the last few decades, has sought to pursue projects which attract the elusive “choice rider” or the type of transit users who have alternate transportation modes to get around but choose to ride transit for whatever reason. Public policy as a result has ignored and otherwise assumed that “captive riders,” transit users who have no other means of transport, will ride buses no matter how delayed buses may be or how often they are mired in mixed traffic. A changing of approach in which bus corridor planning mirrors the strategies employed for capital rail transit projects is needed.

Transit & Land Use Alignment

NashvilleNext, the countywide general plan, sets our 25-year growth trajectory. It has established a framework to conduct more granular guidance at the neighborhood and corridor scale. Since the Planning Commission first adopted *NashvilleNext* in 2015, the Planning Department has worked in conjunction with other Metro Departments, state entities, and area non-profits, to periodically lead joint land use and transportation plans that recommend additional actions that fine-tune the community’s needs. Planning studies such as the Dickerson South Corridor Study illustrate our community’s evolving priorities. They do not just focus growth in parts of town with ready access to transit but also by ensuring that development is designed to address transit stops and shelters while also embracing TDM strategies to get future Nashvillians and businesses to use transit while reducing the amount of parking and automobile traffic generation.

The project development process, including environmental review, required for transit capital

investments will include further refinements to land use policies around each station area to encourage new businesses, housing, and community amenities. The Planning Department staff will work with Councilmembers and the community to ensure development meets the need for transit while providing an appropriate transition from the corridor to nearby residential neighborhoods

WeGo Public Transit Design Guidelines

Published in 2018, WeGo's Transit Design Guidelines provide a baseline of requirements for new stops, shelters, transit hubs, and amenities. The intent is to ensure higher quality transit improvements become the norm rather than the exception. WeGo and the new Metro DOMI will implement these guidelines during review of private development requests and to conduct complete street redesign projects.

Improving the transit system experience with implementation of WeGo's guidelines happens with bus route corridor-length investments. One example is occurring in a historically low-income and immigrant community served by the Nolensville Pike route, which is also one of WeGo's most active. Targeted Nolensville Pike rapid bus corridor improvements include new bus boarding islands, shelters with lighting, and amenities that promote safety and comfort.

A core component of the Nolensville Pike rapid bus corridor is the placement of the consolidated stops. With this, WeGo reorganizes and consolidates stops to evenly spaced intervals rather than making block-by-block stops which is become especially crucial for the safety of users.

Similar improvements can occur elsewhere within the system with a dedicated funding stream for transit. This plan both recommends moving forward the vision of *nMotion* while providing tools to ensure that new development does its part.

Housing Affordability

General housing affordability strategy with investments in affordable housing initiatives in concert with new infrastructure improvements and/or amenities like greenways or parks will be critical to make sure that no Nashvillians are left behind or priced out of their neighborhoods. A strategy for this should be informed by the work of the Transit and Affordability Task Force's final report presented in 2018. Approximately 3% of the of the cost of major investments of the Murfreesboro Pike and Clarksville Pike transit corridors as well as the Jefferson Street interstate cap would go to the construction of affordable housing in adjacent areas to balance investment while also maintaining options for household affordability.

Opportunities exist to leverage resources from new development to further the infrastructure needs of our neighborhoods. The more public benefits such as new sidewalks and traffic signals arising from new multifamily development and higher intensity mixed use properties, the more funding Metro will be able to set aside for increased funding to community resources such as the Barnes Fund.

Streets for Nashvillians

The car has been the predominant mode of transportation since the 1930s but today new modes, as transformational to our lifestyles and culture as the car was, are emerging. For Nashville to be a leader in this micromobile and innovative future, a complete paradigm and mind shift is needed to invest in and recognize the immensely more livable future that could be created if we are open to it.[30] Furthermore, Nashville will never be an equitable city if it does not revamp its streets to allow for the safe travel of all users including those with disabilities and physical limitations such as the elderly.

Sidewalks

WalknBike set forth a new direction for Nashville through the creation of the Priority Sidewalk Network, which enables staff to rank sidewalk construction projects in an unbiased manner. Projects which score highest based on factors such as proximity to mass transit, schools, at high crash locations, and streets with partially built sidewalks segments receive preferential treatment. While Metro Council has generously allocated an extraordinary amount of resources towards this endeavor, funding for sidewalk construction quickly dries up given the stormwater, topographical, and utility conflicts which are presented in each scenario. This plan calls for a dedicated funding source to ensure that sidewalk funding remains constant and that staff can concentrate on getting projects done rather than advocate for more resources than may fluctuate year-to-year.

Meanwhile, Metro completed an ADA Transition Plan in 2019 that establishes new guiding principles and strategies in order to rehabilitate streets and new infrastructure for Nashvillians of all abilities. While the Transition Plan is less than one year old, much work has already been completed with regards to improving sidewalks with wider space for the movement of wheelchairs. The Plan also crafts solutions such as the installation of furnishing zones which facilitate the placement of mailboxes and other obstacles that could prevent Nashvillians from walking and rolling safely. In partnership with the U.S. Department of Justice, Metro will ensure that all new street infrastructure from sidewalks to the entrances of buildings to provide equal access to all Nashvillians. While several streets have been reconstructed to accommodate new ramps, sidewalk upgrades, and obstacle clearance, more work is to be done leveraging sidewalk repair funding as well as resources prioritized utilizing through Metro's Pedestrian Benefit Zone program. Metro has also hired a new ADA Title II Coordinator who ensures that our streets comply with federal requirements.

Bikeways

Nashville has made great inroads to construct a low stress bikeway network, placing more emphasis on projects which provide physical separation from moving vehicles. Projects are now more comprehensive across departments, incorporating access to greenway trailheads, and connecting neighbors to one another one-by-one, establishing a seamless cross-town network. Formulation of the *WalknBike* Plan was a game changer due to the adoption of a full system with comfortable routes that serve as backbones tying directly to traffic calmed streets that make it easier and safer for Nashvillians to ride from their homes. On many streets, facilities on our streets which solely use white paint are not good enough

and Nashvillians have spoken time and again how badly bikeway facilities should be designed safe enough for children and inexperienced people to ride their bikes and scooters in.

Of utmost importance is the construction of low stress bikeways within our urban core. Indeed, denser built environments tend to support trips by bicycle as access to opportunities is more common in mixed use, high intense land uses. As such, it is a priority of this plan to build out the network outlined in *WalknBike*, targeting investments to complete Nashville's core protected bike lane routes, Commerce Street being the first of many that will tie new high-rise development downtown with surrounding neighborhoods. 3rd Avenue South, Woodland Street, and Union Street are of critical importance in the immediate future if Nashvillians are serious about reducing single occupant car trips and making sure that our roads perform at their most efficient.

Traffic Calming

One of the most popular new programs to emerge in recent years is Metro's Traffic Calming request system in which neighborhood associations and councilmembers work together in concert with Metro Public Works, which reviews each request while providing data collection and speed studies. Projects are scored and prioritized with several experiencing new construction of speed cushions, traffic circles, chicanes, and lane modifications to reduce speeding in residential areas.

Despite the amount of traffic calming countermeasures, many neighborhoods throughout Nashville have not received targeted interventions. Continued investment in the traffic calming program is critical to ensure that Nashvillians and their families can lead safe, productive lives without fear of irresponsible people speeding in their cars.

Micromobility

Micromobility, a term referring to small battery-powered "vehicles", such as e-bikes and scooters, if planned for and taken seriously, has the potential to significantly reduce congestion through providing quick, inexpensive and emissions free transportation options for shorter trips, including first and last mile trips. Scooters have been considered unsafe to riders and pedestrians, but with appropriate infrastructure in place, they could be safer than vehicles.

According to the FHA's National Household Travel Survey of 2017, nearly half of all vehicle miles traveled by car were trips of three miles or less.[31] For these shorter trips, embracing micromobile devices would have the potential to create a more efficient movement of people than using cars. According to a NACTO calculation, 7,500 bicycles per hour can move through a 10-foot lane at peak conditions compared to only 600 to 1,600 cars.[32]

Greenways

Not only are departments such as Planning and Public Works in lock step, Metro Parks has had a seat at the table for new infrastructure to make sure that Nashvillians have equal access to parks and that our open spaces support air quality and sustainability goals. In coordination with the

Mayor's Office, key projects and strategies have been elevated to the surface by the Greenways and Open Space Commission as well as Greenways for Nashville.

Plan to Play, Metro Parks' long-range plan for new parks, greenways, and open spaces, sets forth new guiding principles with direct ties to *NashvilleNext*:

- Parks are open to all to ensure equitable access and inclusion for every Nashvillians
- Parks are as relevant and diverse as the community they occupy
- Parks support the integration of health and wellness in everyday life
- Park infrastructure reflects the best of the best through its management of natural resources
- Parks and programs are built from the ground up efficiently, cost-effectively, and by balancing the needs of various interests and stakeholders
- All parks are safe and clean
- Parks represent the creative spirit of Nashvillians, the natural beauty of the environment, and celebrate our culture
- Nashvillians have a seat at the table with regards to decision-making related to parks
- Parks are a foundation for economic opportunity, public health, climate resilience, and quality of life

New greenway projects will be guided by these principles, being built in areas of Nashville that need it the most for equitable access to jobs and housing, in addition to serving as connectors that link neighborhoods long divided by the interstates, railroad lines, and high-speed arterials. Projects such as the Central City and 440 Greenways will be key components of building a transportation system that works for all.

State & Regional Coordination

Working with regional partners outside of Davidson County is key to our future success. Metro works with both our neighboring counties and cities individually as well as through the Greater Nashville Regional Council (GNRC) – specifically with the Nashville Area Metropolitan Planning Organization (MPO) that is part of the agency. Additionally, Metro coordinates with the Tennessee Department of Transportation on their short- and long-range planning efforts, in addition to implementation of the Improve Act. Regional and state coordination with these agencies is further described below.

Greater Nashville Regional Council

Middle Tennessee's transportation system includes a vast network of roads, bus routes, rail lines, sidewalks, and bicycle lanes. GNRC serves as the MPO and lead planning agency across Davidson, Maury, Robertson, Rutherford, Sumner, Williamson, and Wilson counties. This brings together representatives from the U.S. Dept of Transportation, TDOT, local and regional public transit agencies, city and county mayors, and local planning and engineering efforts with community and business advocates to allocate investments into the transportation system.

GNRC's Transportation Policy Board has the authority to plan, prioritize, and select transportation projects for federal funding appropriated by the United States Congress by the Federal Highway Administration and Federal Transit Administration.

Regional Transportation Plan

The Regional Transportation Plan (RTP), spans the next quarter-century and represents the transportation goals of city and county governments, transit agencies, and TDOT. Its purpose is to identify the partners intent to invest federal grants for improvements. GNRC is currently leading an update to the RTP.

Transportation Improvement Program FY2020-2023

A Transportation Improvement Program (TIP) is a publicly adopted four or five-year work program that lists regional and federally funded projects by phase and year of implementation. Any project included in the TIP must be consistent with or be selected from an adopted long-range transportation plan. The TIP must be fiscally constrained to a budget that includes anticipated revenues from current sources of funding. The plan represents the region's top priorities for state funding. Based on current funding levels authorized by U.S. Congress from federal transportation grants that are distributed by formula to states and metropolitan planning areas. Projects located in Davidson County that are included in the TIP FY2020-2023, including all amendments as of September 2020, are listed in the Technical Appendix.

Other MPO plans and studies

In addition to the RTP and TIP, Metro also coordinates with GNRC through studies such as the in progress South Corridor Study looking at the potential for high-capacity transit linking Maury and Williamson counties to Downtown Nashville. Previous studies included similar corridor studies of the northeast, northwest, and southeast corridors of the region.

State of Tennessee

Improve Act

Signed into law by former Governor Bill Haslam in 2017, the Improve Act is a TDOT program which authorizes the state of Tennessee to update several state taxes, in order to allow Local Governments to receive a portion of funding for local road projects. The Improve Act is to go toward funding 962 road and bridge projects across the state. Some of the largest projects serve the Greater Nashville Area, including those listed within Davidson County that are listed in the appendix. Though not listed in the appendix, the program included $50 million for the reconstruction of I-440 that TDOT completed in summer 2020. Metro Government will continue closely coordinate with TDOT throughout the design and construction of the projects in Davidson County.

PART 7

Measuring Success

With limited funding available measuring performance is used to engage the public in these difficult decisions.

Measuring success allows for a better use of limited resources and allows decision makers and the public to see where funding is going, why, and how it's performing. It's also a way to create partnerships that can help identify priorities and build confidence in the idea of raising and investing more money in the system. Metro will use the performance measures below to track progress toward attaining goals and objectives to ensure short- to long-term, alignment with *NashvilleNext* and applicable Metro departments/ agencies.

Achieving Geographic Balance

Estimates of the Metro-wide impact of the plan were calculated by the Metro Planning Department staff and address the following types of projects in the proposed program:

- Bridges: Metro Public Works Department (MPW) staff provided bridge locations with condition data. Of those, the 5 bridges assessed as "poor" condition were included.
- Culverts; MPW provided culvert locations with condition data. Of those, 792 culverts rated as "poor" condition were included.
- Sidewalks: 70 miles in the Priority Sidewalk network identified by *WalknBike*.
- Bikeways: 200 miles in the Priority Bikeway network identified by *WalknBike*.
- Better Bus Network: routes that will have improved service by the Better Bus program.
- Traffic calming requests: backlog of 150+ neighborhood requests (each with multiple streets identified) and growing.
- Additionally, corridor projects were included:
  - Murfreesboro transit corridor
  - Clarksville transit corridor
  - Charlotte innovation corridor
  - Gallatin innovation sustainability corridor
  - Jefferson Street caps

From mapping these geographically specific improvements, two estimates were created.

- Measuring all projects. The plan would place 92% of the Metro Nashville population within 0.5 miles of an improvement and 94% of employment within 0.5 miles of an improvement.
- Measuring all projects estimate excluding culverts. Because of the large number of culverts oriented to the rural parts of the county, these were excluded. Other project types were included because of the degree of overlap, particularly with the Better Bus Network. The plan would place 92% of the Metro Nashville population within 0.5 miles of an improvement and 94% of employment within 0.5 miles of an improvement.

Achieving Equity

The transportation networks that we all depend on each day have created and continue to exacerbate inequalities that make it more difficult for low-income people, people of color, and people with disabilities to get where they need to go, and can put them at greater risk. This transportation plan relies on three frameworks when contemplating on how it will advance a transportation system that supports equal access to opportunity for all users: procedural equity, distributional equity, and structural equity.

Procedural Equity

Procedural equity requires that those who are most burdened by an out-of-balance transportation system are identified and engaged in the planning process. Decision-making power regarding transportation planning must be shifted to frontline communities, or those who have been most affected by historical under investment, or our current system, which is over-reliant on trips by private car, to ensure that the solutions developed are effective and long-lasting. Steps to advance procedural equity include forming advisory committees (such as a proposed Vision Zero Taskforce), an equity-in-design screening tool to evaluate policies and specific capital projects through an equity lens, defining equity metrics and objectives to track progress (i.e., reductions in particulate air pollution, increases in access to the most affordable transport modes, walk/bike/transit), and conducting community engagement with a focus on underserved or vulnerable communities.

The components of this plan have been informed by targeted, one-on-one discussions with Nashville's most prominent equity experts and advocacy groups, including: IMF, One Nashville, NOAH, Music City Riders United, The Equity Alliance, the Mayor's Youth Council / WeGo Youth Council, Nashville Rising, MDHA, Metro Social Services, and members of the Latino, Kurdish, Muslim, and African immigrant communities.

Distributional Equity

Distributional equity is necessary to ensure that the benefits and burdens associated with a transportation program are allocated equitably across the city's communities. Emphasizing fair and just distribution of outcomes is especially important as climate change threatens to widen existing inequalities. Low-income areas of Nashville have tended to lack access to trees and green space, high-quality transit service, jobs, and sidewalks, making them more vulnerable to climate hazards and traffic violence. Prioritizing investment in low-income and underserved areas will help Nashville to reduce these existing

vulnerabilities and minimize exacerbation of health, economic, and racial disparities. These disparities are felt in numerous ways--from a lack of home or renter insurance to recover from extreme weather events, to increased asthma/COPD cases, to a higher probability of living in a food desert.

The transportation plan also proposes a robust portion of contracts be awarded to Minority and Women-Owned businesses during procurement processes for any associated capital projects, according to standards outlined in Metro's landmark 2019 Equal Business Opportunity ordinance for contractors.

At an annual cost of approximately $8,000 to own/operate/maintain a private vehicle, cars are the most expensive mode of transportation, accounting for the second-highest household expenditure for Nashvillians after their rent or mortgage payment. Our overall cost of housing and transportation combined puts Nashville behind many of its peer cities in affordability indexes. By investing substantially in the WeGo bus system, walking and biking infrastructure, and safety projects to protect our most vulnerable street users, Nashville will de facto become a more just and equitable city as more of our citizens can realistically get around without a car.

The plan also seeks to address pressures resulting from transportation-capital investment that can potentially lead to gentrification and disproportionate burdens. Among other equity-supporting strategies, the Transit and Affordability Taskforce recommendations from the Let's Move Nashville initiative recommend a 2% set-aside baked into each capital project to help incentivize the construction of affordable housing and commercial space along designated high-capacity transit corridors (Murfreesboro and Clarksville Pikes).[33]

Structural Equity

Structural equity requires recognizing and addressing past decision-making processes that have resulted in social challenges and strained or poor access to opportunities and quality-of-life. This transportation plan proposes a visionary project proposal to help Historic North Nashville heal from the negative impacts of bifurcation resulting from the construction of I-40/I-65 in the 1970s.

The negative community consequences of the Interstate's construction were predicted by community members there and have been validated by numerous academic studies and professional planners in the years since. Such an intervention could yield safety and placemaking benefits, generating economic value for neighbors and bridge users. To minimize the potential for displacement of existing, lower-income residents of North Nashville, the plan proposes a 2% set-aside from the total project cost to incentivize the construction of affordable housing and commercial space in the surrounding neighborhood.

Equity by Design

It is Metro Nashville's intention to advance a people first transportation plan. During these challenging times plans, we are sharpening our aim toward a performance-driven transportation system that is efficient, effective and accountable in planning, design and implementation is essential. Equity in our system performance is well supported by including equity in the design of each project that makes up the system.

The following questions, noting how the project design and implementation will support and be measured, creates that equity in design. If any question is not applicable, we must explain why.

Accessibility

- Are there schools in the vicinity? If so, which ones and how will this project improve mobility and accessibility?
- Improved access to health care?
- Improved access to educational facilities?
- Will wayfinding be incorporated to enhance visitor experience?

Populations of Varying Age

- How are youth populations served?
- How are senior populations served?

Safety

- How does the project design enhance security for all through lighting, median breaks or turnarounds or other measures as applicable?
- How does the project design serve land uses or economic development projects as noted in *NashvilleNext*, *Access 2040*, *WalknBike*, *Plan to Play*, and *nMotion* or MDHA coordination?
- How is pedestrian movement and safety enhanced?
- How is cycle movement and safety enhanced?

Connectivity

- How are potential gentrification impacts considered and mitigated?
- Are there special needs populations in the area and how will the project design accommodate those and enhance connectivity?
- Is there transit service in the area? How does the project enhance the connection?
- How are economically disadvantaged communities better connected to employment areas/centers?
- How is the network connectivity enhanced through the project?

Outreach

- How will community outreach be adapted to innovatively reach all?
- Specific language access measures in outreach and design?

Environmental

- How is stormwater management addressed?
- How is sustainability specifically addressed?
- How are sources of pollution considered with impacts to vulnerable and disproportionately burdened communities?

Endnotes

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APPENDIX

A

Technical Appendix

The Metro Nashville Transportation Plan Technical Appendix includes the following:

1. Project List by Council District
2. Opportunistic Financial Strategies by InfraStrategies
3. Nashville Mobility Management Center Assessment, Peer Review and Recommendations by Arcadis
4. Cost Benefits Analysis by HDR
5. MPO TIP FY2020-2023 Project List for Davidson County
6. Improve Act Project List for Davidson County
7. Regional partnering opportunities by HDR
8. Sustainability Task Force – Mobility Subcommittee Findings
9. Analysis of Murfreesboro and Clarksville transit corridors by Metro Planning
10. Planning effort summaries
11. Plan Methodology Memo by HDR

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Appendix 1 – Project List by Council District

Metro Nashville Transportation Plan

December 2020

Project Lists by Council District

This appendix presents a full list of projects organized by Metro Council Districts that are included in the buckets of projects in Part 1 of the Metro Nashville Transportation Plan.

Council District 1

Metro Public Works Paving Needs:
Old Clarksville Pike

Poor Culverts: 129 Projects.

Traffic Calming: 7 applications for 3 streets.
Hydes Ferry Road.
Union Hill Road.
Viking Road.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 2 routes.
Route 14: Whites Creek.
Route: 22: Bordeaux.

Priority Sidewalk Network: 2 projects.
Ashland City Highway from Cato Road to Hydesdale Lane. 1.1 miles.
Kings Lane from Shady Dale Road to Clarksville Pike. .6 miles.

Priority Bike Network: 1 Bikeway segment.
Ashland City Highway.

Clarksville Pike Rapid Bus: Yes.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 2

Metro Public Works Paving Needs: 2 projects.

Ewing Drive.
Hart Street/Lemuel Road.

Poor Culverts: 29 Projects.

Poor Bridges: 1 Project.

Great Circle Road over Metro Center Lake between Mainstream Drive and Athens Way.

Traffic Calming: 20 applications for 13 streets.

Clay Street.
Fern Ave.
Hillhurst Drive.
Hydes Ferry.
Katie Ave.
Moormans Arm.
Rowan Drive.
W Nocturne Drive.
Weakley Ave.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 10 routes.

Route 8: 8th Avenue South.
Route 9: Metrocenter.
Route 14: Whites Creek.
Route 21: Wedgewood.
Route 22: Bordeaux.
Route 23: Dickerson Road.
Route 25: Midtown.
Route 41: Golden Valley.
Route 42: St. Cecelia - Cumberland.
Route 77: Thompson.

Priority Sidewalk Network: 3 projects.

Athens Way from Ponder Place to Dominical Drive. .2 miles.
Rosa L Parks Boulevard. 1.2 miles.

CD2 cont.

Priority Bike Network: 18 Bikeway segments.

18th Ave N/Kellow Street/10th Ave N.
Ashland City Highway.
Baptist World Center Drive.
Cass Street.
Clarksville Pike.
County Hospital Road.
Dominican Drive.
Fern Ave.
Hart Lane.
Heiman Street/14th Ave N.
Hillhurst Drive.
Mainstream Drive.
McKinney/24th.
Tucker Road.
Vashti Street.
W Trinity Lane x 2.
Whites Creek Pike.

Clarksville Pike Rapid Bus: Yes.

Council District 3

Metro Public Works Paving Needs: 1 project.

Creekwood Drive/Parkway Drive.

Poor Culverts: 101 Projects.

Poor Bridges: 1 Projects.

Old Hickory Boulevard over Earthman Fork Creek between Shellbark Drive and Whites Creek Pike.

Traffic Calming: 8 applications for 3 streets.

Bellshire Drive.
Union Hill Road.
Westchester Drive.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 4 routes.

Route 14: Whites Creek.
Route 23: Dickerson Road.
Route 35: Rivergate.
Route 43: Hickory Hills.

Priority Sidewalk Network: 2 projects.

Bellshire Drive from Brick Church Pike to Dickerson Pike. 1 mile.
Spears Road from Richmond Hill Drive to Moorewood Drive. .5 miles.

Priority Bike Network: 2 Bikeway segments.

Moorewood Drive.
Whites Creek Pike

Please note all projects are subject to funding availability and project readiness criteria.

Council District 4

Poor Culverts: 15 Projects.

Traffic Calming: 32 applications for 8 streets totaling 3.4 miles.

Bradford Hills Drive: .6 miles.
Bryce Road: .4 miles.
Cobble Street: .4 miles.
Highland Way: .4 miles.
Hitching Post Lane: .3 miles.
Holt Hills Drive: .3 miles.
Valley View Road.: .5 miles.
Wexford Downs Lane: .5 miles.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 2 routes.

Route 72: Grassmere-Edmondson.
Route: 73: Bell Road.

Priority Sidewalk Network: 2 projects.

Cloverland Dr from Cloverland Park Dr to Grand Oak Way. 1.3 miles.
San Marcos Dr from Hill Rd Cir to Woodhurst Dr. .56 miles.

Additional Roadway Project:

Roundabout at intersection of Edmonson Pike and Mt. Pisgah Road/Banbury Station

Please note all projects are subject to funding availability and project readiness criteria.

Council District 5

Metro Public Works Paving Needs: 3 projects.

East Trinity Lane x 2.
Stainback Ave.

Poor Culverts: 6 Projects.

Traffic Calming: 43 applications. Streets Include:

Delmas Ave.
Douglas Ave.
Dozier Place
Fern Ave.
Grace Street.
Jones Ave.
Joseph Ave.
Mansfield Street.
Marie Street.
McClurkan Ave.
Meridian Street.
Montgomery Ave.
N 6th Street.
Rosedale Ave.
Strouse Ave.
Thomas Ave.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 8 routes.

Route 14: Whites Creek.
Route 23: Dickerson Road.
Route 28: Meridian.
Route 34: Opry Mills.
Route 35: Rivergate.
Route 41: Golden Valley.
Route 43: Hickory Hills.
Route 56: Gallatin Pike.

Priority Sidewalk Network: 3 projects.

Dickerson Pike from Ligon Ave to Trinity Lane. 1.4 miles.
Elvira Ave from Gallatin Pike to Thomas Ave. .5 miles.
McClurkan Ave from Inga Street to Gallatin Ave. .4 miles.

CD 5 cont.

Priority Bike Network: 16 Bikeway segments.

- Cleveland St.
- Cowan St.
- Douglas Ave.
- East Trinity Lane.
- Fern Ave.
- Jefferson St.
- Laurent.
- Lischey/N 6th St./Jones.
- McFerrin Ave.
- Meridian St.
- North 1st St.
- S 7th Street/N 8th St.
- Scott Ave./Litton Ave.
- Spring St./N 1st St.
- West Eastland Ave.
- West Trinity Lane.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 6

Metro Public Works Paving Needs: 1 project.

Sevier Street.

Poor Culverts: 2 Projects.

Traffic Calming: 42 applications. Streets Include:

Boscobel Ave.
Chapel Ave.
Davidson St.
Groves Park Rd.
Lillian St.
Mitchell Rd.
N 17th St.
Ordway Pl.
Preston Dr.
S 10th St.
S 11th St.
S 12th St.
S 14th St.
S 15th St.
Straightway Ave.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 8 routes.

Route 4: Shelby
Route 14: Whites Creek.
Route 23: Dickerson Road.
Route 34: Opry Mills.
Route 35: Rivergate.
Route 41: Golden Valley.
Route 43: Hickory Hills.
Route 56: Gallatin Pike.

Priority Sidewalk Network: 3 projects.

Gallatin Ave from Sharpe Ave to Greenwood Ave. .1 miles.
N 12th St from Calvin Ave to 195ft south of Stratton Ave. .03 miles.
Straightway Ave from Little Ave to Porter Rd. .7 miles.

CD 6 cont.

Priority Bike Network: 22 Bikeway segments.

Eastland Ave.
Fortland Dr.
Jefferson St.
N 11th St.
N 14th St.
Porter Road
Private x2.
S 14th St.
S 17th St.
S 19th St.
S 5th St.
S 7th St.
S 7th Street/N 8th Street.
S. 10th St.
Scott Ave./Litton Ave.
Shelby Ave
Straightway Ave.
Woodland Ave.

Council District 7

Metro Public Works Paving Needs: 7 projects.

E Trinity Ln.
Forest Park Rd.
Goode Ct./Morganmeade Dr.
McGinnis Dr./Shadow Ln./Moss Rose Dr.
Morganmeade Dr./McGinnis Dr./Moss Rose Dr.
Moss Rose Ct.
Moss Rose Dr/McGinnis Dr./Cooper Ln.

Poor Culverts: 18 Projects.

Traffic Calming: 60 applications. Streets Include:

Ardee Ave.
Brush Hill Dr.
Chapel Ave.
Delmas Ave.
Dozier Pl.
Hanover Rd.
Howard Ave.
Iverson Ave.
Joyce Lane
Litton Ave.
Malquin Dr.
Maynor Ave.
McAlpine Dr.
McChesney Ave.
Northview Ave.
Otay St.
Richmond Dr.
Strouse Ave.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 4 routes.

Route 4: Shelby
Route 34: Opry Mills.
Route 56: Gallatin Pike.
Route 76: Madison.

CD7 cont.

Priority Sidewalk Network: 10 projects.

Broadmoore Dr. .3 miles.
Due West Ave. .7 miles.
Elvira Ave. .5 miles.
Gallatin Pk x 5. 3.2 miles total.
Straightway Ave. .6 miles.
Tammany Dr. .3 miles total.

Priority Bike Network: 12 Bikeway segments.

Brush Hill Rd./Moss Rose Dr.
E Trinity Ln.
Forest Park Rd.
Greenfield Ave./Murray Pl.
Hart Ln.
Litton Ave./Scott Ave.
Neelys Bend Rd. x 2
Porter Rd. x 2
Rosebank Ave.
Straightway Ave./N 14th St.

Council District 8

Metro Public Works Paving Needs: 4 projects.

Ewing Drive.
Cheron Dr.
Due West Ave N.
Freda Villa.

Poor Culverts: 32 projects.

Poor Bridges: 1 project.

Due West Ave over CSX RR between Gibson St. and Gallatin Pk.

Traffic Calming: 37 applications. Streets Include:

Burrus St.
Edwards Ave.
Freda Villa.
Hillhurst Dr.
Grinstead Pl.
Iverson Ave.
Jones Ave.
Lemont Dr.
Oakland Acres Dr.
Port Dr.
Saunders Ave.
W Marthona Rd.
Westchester Dr.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 8 routes.

Route 23: Dickerson Rd.
Route 28: Meridian.
Route 34: Opry Mills.
Route 35: Rivergate.
Route 41: Golden Valley.
Route 43: Hickory Hills.
Route 56: Gallatin Pike.
Route 76: Madison.

Priority Sidewalk Network: 10 projects.

Bellshire Dr. 1 mile.
Broadmoore Dr. .3 miles.

CD 8 cont.

Dickerson Pk. X 5. 4.2 miles total.
Gallatin Pk. X 2. 1.4 miles total.
Woodyhill Dr. .5 miles.

Priority Bike Network: 7 bikeway segments.

Hart Ln.
Heritage Dr.
Hillhurst Dr.
Jones Ave.
Nellys Bend Rd.
Old Hickory Blvd.
Saunders Ave.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 9

Metro Public Works Paving Needs: 2 projects.

Forest Park Rd.
Nix Dr.

Poor Culverts: 22 Projects.

Traffic Calming: 13 applications. Streets Include:

Anderson Ln.
Archwood Dr.
Hickory St.
Maple St.
May Dr.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 2 routes.

Route 56: Gallatin Pike.
Route 76: Madison.

Priority Sidewalk Network: 5 projects.

Gallatin Pk. .6 miles.
Harris St. .1 miles.
Hickory St. .3 miles.
Old Hickory Blvd. 1.4 miles.
State Route 45. .7 miles.

Priority Bike Network: 5 Bikeway segments.

Bixler Ave./Roosevelt Ave.
Delaware Ave.
Forest Park Rd.
Neelys Bend Rd.
Old Hickory Blvd.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 10

Poor Culverts: 24 Projects.

Poor Bridges: 1 Projects.

Lickton Pk over Shanes Fork Creek between Old Springfield Pk and Old Walkers Creek Rd.

Better Bus routes: 2 routes.

Route 35: Rivergate.
Route 56: Gallatin Pk.

Priority Sidewalk Network: 4 projects.

Conference Dr. .2 miles.
Gallatin Pk. X 2. 1.7 miles total.
Spring Branch Dr. .8 miles.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 11

Metro Public Works Paving Needs: 4 projects.

Hidden Hill Dr. x 2.
Rayon Dr.
Terry Pl.

Poor Culverts: 11 Projects.

Traffic Calming: 11 applications. Streets Include:

Brandywine Dr.
Montchanin Rd.
Rising Sun Ln.
Tyler Dr.
Willow Bough Ln.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 1 route.

Route 6: Lebanon Pk.

Priority Sidewalk Network: 2 projects.

Fowler St. .63 miles.
Old Hickory Blvd. 1.4 miles.

Priority Bike Network: 7 Bikeway segments.

Andrew Jackson Pkwy.
Merritt St. x 2.
Rachel's Ln/Lebanon Pk.
Riverway Dr./Merritt St./Elliston St./Park Circle/Elliot Dr.
Robinson Rd.
Shute Ln.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 12

Metro Public Works Paving Needs: 2 projects.

Netherlands Dr.
Valley Grove Dr.

Poor Culverts: 8 Projects.

Traffic Calming: 13 applications. Streets Include:

Leona Pass/Sever Points Trce.
Market Square/Welsenboro Cir.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 1 route.

Route 6: Lebanon Pk.

Priority Sidewalk Network: 2 projects.

Central Pk. 1.2 miles.
Jacksons Valley Dr. .4 miles.

Priority Bike Network: 2 Bikeway segments.

Andrew Jackson Pkwy.
Bell Rd.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 13

Poor Culverts: 12 Projects.

Traffic Calming: 10 applications. Streets Include:

Fitzpatrick Rd.
Harborwood Cir.
Harborwood Dr.
Kipling Dr.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 4 routes.

Route 18: Airport
Route 52: Nolensville Pk.
Route 55: Murfreesboro Pk.
Route 77: Thompson.

Priority Sidewalk Network: 3 projects.

E Thompson Ln. .5 miles.
Murfreesboro Pk. 1.5 miles.
Vultee Blvd. .8 miles.

Murfreesboro Bus Rapid Transit: Yes.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 14

Metro Public Works Paving Needs: 3 projects.

Ironwood Dr.
Jonesboro Ct.
Jonesboro Dr.

Poor Culverts: 20 Projects.

Traffic Calming: 1 application. Street(s) Include:

Plantation Dr.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 1 route.

Route 6: Lebanon Pk.

Priority Sidewalk Network: 2 projects.

Ironwood Dr. 1.3 miles.
Stewarts Ferry Pk. .9 miles.

Priority Bike Network: 2 Bikeway segments.

Bell Rd.
Dodson Chapel Rd.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 15

Metro Public Works Paving Needs: 6 projects.

Elm Tree Dr.
Mapleleaf Dr.
McGavock Pk. x 4.

Poor Culverts: 14 Projects.

Traffic Calming: 24 applications. Streets Include:

Colonial Cir.
Emery Dr.
Fairway Dr.
Lakeland Dr.
Maplecrest Dr.
Pennington Bend Rd.
Revere Pl.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 4 routes.

Route 6: Lebanon Pk.
Route 18: Airport.
Route 34: Opry Mills.
Route 55: Murfreesboro Pk.

Priority Sidewalk Network: 6 projects.

Bluefield Ave. .6 miles.
Lebanon Pk. X 3. 1.7 miles total.
Old Lebanon Pk. .4 miles.
Spence Ln. 1.3 miles.

Priority Bike Network: 1 Bikeway segment.

Two Rivers Pkwy. /McGavock Pk./Lebanon Pk.

Murfreesboro Bus Rapid Transit: Yes.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 16

Metro Public Works Paving Needs: 2 projects.

Pavillion Blvd.
Plus Park Blvd.

Poor Culverts: 20 Projects.

Traffic Calming: 27 applications. Streets Include:

Antioch Pike.
Collier Ave.
Louise Dr.
McCall St.
Morton Ave./Wingate Ave.
Patterson St.
Peachtree St.
Raymond St.
Veritas St.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 5 routes.

Route 8: 8th Ave South.
Route 21: Wedgewood.
Route 52: Nolensville Pike.
Route 55: Murfreesboro Pk.
Route 77: Thompson.

Priority Sidewalk Network: 17 projects.

Collier Ave. .4 miles.
E Thompson Ln. x 2. 1 mile total.
Elizabeth St. .1 miles.
Lawndale Dr. x 2. 1.1 miles.
Murfreesboro Pike. x 2. 2 miles.
Nolesville Pike. .9 miles.
Pavilion Blvd. .1 miles.
Plus Park Blvd. .7 miles.
Powell Ave. .7 miles.
Spence Ln. 1.2 miles.
Tanksley Ave. x 2. .6 miles total.
Vultee Blvd. .8 miles.
Woodmont Blvd. 1.2 miles.

CD 16 cont.

Priority Bike Network: 7 Bikeway segments.

Antioch Pike. x 2.
E Thompson Ln.
Glenrose Ave./Foster Ave.
Hartford Dr./Whitsett Rd./Sterling Boone Dr.
Thompson Ln.
Wingate Ave.

Murfreesboro Bus Rapid Transit: Yes.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 17

Metro Public Works Paving Needs: 5 projects.

12th Ave S
Acklen Ave.
Fairfield Ave.
Southgate Ave.
Wedgewood Ave.

Poor Culverts: 6 Projects.

Traffic Calming: 27 applications. Streets Include:

18th Ave S.
3rd Ave S.
Clayton Ave.
Humphreys St.
Martin St.
Moore Ave.
S Douglas Ave.
Vaulx Ln.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 11 routes.

Route 7: Hillsboro.
Route 8: 8th Avenue South.
Route 17: 12th Ave South.
Route 18: Airport.
Route 21: Wedgewood.
Route 25: Midtown.
Route 35: Rivergate.
Route 52: Nolensville Pike.
Route 55: Murfreesboro Pk.
Route 77: Thompson.
Route 93: Star West End Shuttle.

Priority Sidewalk Network: 6 projects.

4th Ave S. .05 miles.
8th Ave S. .03 miles.
Crenshaw St. .09 miles.
Fort Negley Blvd. .2 miles.
Murfreesboro Pike. .05 miles.
Woodmont Blvd. 1.3 miles.

CD 17 cont.

Priority Bike Network: 26 Bikeway segments.

12th Ave S.
19th Ave S./Chet Atkins Pl.
1st Ave S./Factory St.
2nd Ave S./4th Ave S.
6th Ave S.
8th Ave S. x 2.
9th Ave S./Bradford Ave./Lawrence Ave.
Bransford Ave.
Cedar Ln./Kirkwood Ave.
Chestnutt St./Edgehill Ave.
Claiborne Ave./Green St.
Edgehill Ave.
Fairfield Ave.
Glenrose Ave.
Hackworth St.
Lafayette St.
Martin St.
Polk Ave.
S Douglas Ave. x 2.
Sweetbriar Ave./Montose Ave.
Vaulx Ln.
Walsh Rd.
Wharf Ave.
Whitney St.

Murfreesboro Bus Rapid Transit: Yes.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 18

Metro Public Works Paving Needs: 5 projects.

31st Ave S.
Acklen Ave.
Blakemore Ave.
Kirkwood Ave.
Wedgewood Ave.

Traffic Calming: 13 applications. Streets Include:

15th Ave S.
Ashwood Ave.
Beechwood Ave.
Blair Blvd.
Fairfax Ave.
Linden Ave.
Sweetbriar Ave.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 8 routes.

Route 3: West End - White Bridge.
Route 5: West End - Bellevue
Route 7: Hillsboro.
Route 17: 12th Ave South.
Route 21: Wedgewood.
Route 25: Midtown.
Route 35: Rivergate.
Route 93: Star West End Shuttle.

Priority Sidewalk Network: 2 projects.

Calhoun Ave. .1 miles.
Orleans Dr. .1 miles.

Priority Bike Network: 14 Bikeway segments.

Acklen Ave.
24th Ave S./Jess Neely Dr./Natchez Trce.
20th Ave S./Hazelwood Dr./Primrose Ave.
Sweetbriar Ave./Montrose Ave.
Cedar Ln./Kirkwood Ave.
Brightwood Ave./Gale Ln.

CD 18 cont.

21st Ave S.
Blakemore Ave./31st Ave S.
Acklen Ave.
Belmont Blvd. x2.
Woodlawn Dr.
Chesterfield Ave./Marlborough Ave.
Blair Blvd.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 19

Metro Public Works Paving Needs: 3 projects.

12th Ave S.
Fairfield Ave.
Rutledge St.

Poor Culverts: 2 Projects.

Traffic Calming: 9 applications. Streets Include:

11th Ave N.
18th Ave S.
5th Ave N.
Garfield St.
Monroe St.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 26 routes.

*Note: because of the presence of Music City Central in CD19, 26 separate routes are present.
Routes: 18, 19, 22, 23, 25, 28, 29, 3, 34, 35, 38, 4, 41, 42, 43, 5, 50, 52, 55, 56, 6, 64, 7, 8, 9, 93.

Priority Sidewalk Network: 5 projects.

16th Ave N. .1 miles.
7th Ave S. .1 miles.
Hynes St. .03 miles.
Mansion St. .04 miles.
Spence Ln. 1.2 miles.

Priority Bike Network: 45 Bikeway segments.

*Note: because CD includes the downtown core, nearly every major street in the area has a proposed Bike Facility of some type. These include 20 Major Separated Bikeways.

Jefferson Street Interstate Cap: Yes.

Murfreesboro Bus Rapid Transit: Yes.

Clarksville Pike Rapid Bus: Yes.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 20

Metro Public Works Paving Needs: 2 projects.

American Rd.
Premier Dr.

Poor Culverts: 21 Projects.

Traffic Calming: 13 applications. Streets Include:

Indiana Ave.
Morrow Rd.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 3 routes.

Route 3: West End - White Bridge.
Route 19: Herman.
Route 50: Charlotte Pike.

Priority Sidewalk Network: 2 projects.

Obrien Ave. 0.4 miles.
Tennessee Ave. 0.5 miles.
Thunderbird Dr. (from Annex to Westboro) 4,875 ft.
Deal Ave. (fronting Charlotte Park from Nall Ave. to Eastboro Dr.) 1,450 ft.
Westboro Dr. (from Charlotte Pike to Robertson Ave.) 5,200 ft.
46th Ave. N. (from Georgia Ave. to Michigan Ave.) 1,200 ft.
Fill in gaps: 51st Ave. 1,480 ft.
Morrow Rd. (from Georgia Ave. to Tennessee Ave.) 2,575 ft.
Fill in gaps: Robertson Ave. 300 ft.
*Annex Ave. (Thunderbird Dr. to shopping center) construction expected within three to six weeks)
*Oceola Ave. gap near Burgess awaiting NTP
*James Ave. (Robertson Ave. to Morrow Rd.) design complete; ROW 2021
*Annex Ave. (Continental to Thunderbird Dr.) ROW 2021

**Projects underway*

CD 20 cont.

Priority Bike Network: 4 segments.

James Ave.
Thunderbird Dr.
Waco Dr.
Nall Ave.
Deal Ave.
Maxon Ave.
Indiana Ave.
Morrow Rd.
49th Ave. N.
44th Ave. N.
Urbandale Ave.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 21

Metro Public Works Paving Needs: 2 projects.

28th Ave N.
31st Ave S.

Poor Culverts: 1 Projects.

Traffic Calming: 11 applications. Streets Include:

15th Ave N.
16th Ave N.
23rd Ave N.
39th Ave N.
Clare Ave.
Clay St.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 11 routes.

Route 3: West End - White Bridge.
Route 5: Bellevue
Route 9: Metrocenter.
Route 19: Herman.
Route 21: Wedgewood.
Route 22: Bordeaux.
Route 25: Midtown.
Route 29: Jefferson.
Route 42: St. Cecilia - Cumberland.
Route 50: Charlotte Pike.
Route 93: Star West End Shuttle.

Priority Sidewalk Network: 10 projects.

19th Ave N. .2 miles.
30th Ave N. .1 miles.
31st Ave N. .5 miles.
Alameda St. .1 miles.
Athens Way. .2 miles.
Clifton Ave. .1 miles.
Clover St. .1 miles.
Formosa St. .1 miles.
Rosa L. Parks Blvd. 1.2 miles.
State St. .1 miles.

CD 21 cont.

Priority Bike Network: 14 Bikeway segments.

20th Ave N.
21st Ave N.
31st Ave N
Albion St.
Buchanan St.
Church St.
Clarksville Pike.
Clifton Ave.
Division St.
Dr. D B Todd Jr Blvd.
Heiman St.
Indiana Ave.
Jefferson St.
Patterson St.

Jefferson Street Interstate Cap: Yes.

Clarksville Pike Rapid Bus: Yes.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 22

Poor Culverts: 19 Projects.

Traffic Calming: 4 applications. Streets Include:

Carriage Dr.
Cross Timbers Dr.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 2 routes.

Route 5: West End - Bellevue.
Route 50: Charlotte Pike.

Priority Sidewalk Network: 2 projects.

Highway 70 S. .5 miles.
Old Hickory Blvd. .9 miles.

Priority Bike Network: 2 Bikeway segments. Routes include:

Colice Jean Rd.
Cross Timbers Dr.

Council District 23

Poor Culverts: 58 Projects.

Traffic Calming: 11 applications. Streets Include:

Bresslyn Rd.
Carnavon Pkwy.
Hickory Valley Rd.
Melinda Dr.
Newberry Rd.
Newberry Rd.
Wilsonia Ave.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 2 routes.

Route 5: West End - Bellevue.
Route 50: Charlotte Pike.

Priority Sidewalk Network: 2 projects.

Old Hickory Blvd. .9 miles.
Percy Warner Blvd. .5 miles.

Priority Bike Network: 2 include:

Brook Hollow Dr./Vaughns Gap Rd.
Fleetwood Dr.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 24

Metro Public Works Paving Needs: 1 project.

42nd Ave N.

Poor Culverts: 6 Projects.

Traffic Calming: 39 applications. Streets Include:

37th Ave N.
42nd Ave N.
Aberdeen Rd.
Cherokee Rd.
Elkins Ave.
Hickory Valley Rd.
Knob Rd.
Lynnbrook Rd.
Nebraska Ave.
Park Ave.
Wilson Blvd.
Woodlawn Dr.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 4 routes.

Route 3: West End - White Bridge.
Route 5: West End - Bellevue.
Route 19: Herman.
Route 50: Charlotte Pike.

Priority Sidewalk Network: 5 projects.

Charlotte Pike. .2 miles.
Harding Pk. .7 miles.
Neartop Dr. .3 miles.
OBrien Dr. .4 miles.
Woodmont Blvd. .8 miles.

Priority Bike Network: 13 Bikeway segments.

23rd Ave S./Golf Club Ln./Kenner Ave.
40th Ave N.
51st Ave N.
Acklen Park Dr./Poston Ave.
Bowling Ave./Aberdeen Rd.

CD 24 cont.

Chamberlin St.
Cherokee Rd.
Chesterfield Ave./Marlborough Ave.
Knob Rd.
Long Blvd.
Nebraska Ave./51st Ave N.
Sugartree Rd./Lynnbrook Rd.
Whitland Ave./Mayfair Rd.

Planning study: 1 study.
West End Ave Community Corridor Study to be coordinated with Planning. Will inform plan/project list updates upon completion.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 25

Metro Public Works Paving Needs: 1 project.

Lombardy Ave.

Poor Culverts: 26 Projects.

Traffic Calming: 59 applications. Streets Include:

23rd Ave S.
Belmont Park Ter.
Caldwell Ln.
Casstleman Dr.
General Bate Dr.
Golf Club Ln.
Greybar Ln.
Overhill Dr./Hobbs Rd.
Stokes Ln.
Stokesmont Dr.
Valley Brook Rd.
Woodmont Ln.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 3 routes.

Route 7: Hillsboro.
Route 8: 8th Avenue South.
Route 17: 12th Avenue South.

Priority Sidewalk Network: 8 projects.

Castleman Dr. .5 miles.
Cleghorn Ave. .3 miles.
Crestmoore Rd. .2 miles.
Graybar Ln. .1 miles.
Hillsboro Pike x 2. 1.3 miles total.
Woodmont Blvd x 2. 2.1 miles.

Priority Bike Network: 14 Bikeway segments.

Abbott Martin Rd.
Amanda Ave./Brightwood Ave.
Belmont Blvd.
Belmont Park Ter./N Observatory Ln.

CD 25 cont.

Benham Ave./Warfield Dr.
Glen Echo Rd./Greybar Ln./McNairy Ln.
Granny White Pk.
Kenner Ave./Golf Club Ln.
Lynnbrook Rd./Sugartree Rd.
Shackleford Rd. x 2.
Sugartree Pl./Warfield Ln.
Woodlawn Dr.
Woodmont Blvd.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 26

Poor Culverts: 17 Projects.

Traffic Calming: 35 applications. Streets Include:

Binkley Dr.
Blackman Rd.
Crieve Rd.
Danby Dr.
Eisenhower Dr.
Farrell Pkwy.
Lynn Dr.
Lynn Dr.
Scotwood Dr.
Stillwood Dr.
Timberhill Dr.
Trousdale Dr.
Veritas St.
Wauford Dr.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 2 routes.

Route 52: Nolensville Pike.
Route 72: Grassmere-Edmondson.

Priority Sidewalk Network: 5 projects.

Corning Dr. .3 miles.
Linbar Dr. .6 miles.
Nolensville Pike x 2. 1.3 miles total.
San Marcos Dr. .6 miles.

New/Larger Shelters:

Harding Place & Tampa Drive Westbound.
Harding Place & Tanglewood Ct. Westbound.
Walmart Station Inbound (Nolensville & Harding).
Walmart Station Outbound (Nolensville & Harding).

Please note all projects are subject to funding availability and project readiness criteria.

Council District 27

Poor Culverts: 9 Projects.

Traffic Calming: 21 applications. Streets Include:

Brewer Dr.
Cherrywood Dr.
McMurray Dr.
Northcrest Dr.
Northcrest Dr.
Ocala Dr.
Westcrest Dr.
Whispering Hills Dr.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 3 routes.

Route 52: Nolensville Pike.
Route 72: Grassmere-Edmondson
Route 73: Bell Rd.

Priority Sidewalk Network: 4 projects.

Edmondson Pike. .8 miles.
McMurray Dr. .3 miles.
Nolensville Pike. .8 miles.
Whispering Hills Dr. 1.2 miles.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 28

Poor Culverts: 10 Projects.

Better Bus routes: 3 routes.

Route 38: Antioch.
Route 52: Nolensville.
Route 55: Murfreesboro Pike.

Priority Sidewalk Network: 3 projects.

Mt View Rd. .9 miles.
Murfreesboro Pike x 2. .9 miles total.

Murfreesboro Bus Rapid Transit: Yes.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 29

Poor Culverts: 8 Projects.

Traffic Calming: 14 applications. Streets Include:

Castlegate Dr.
Flintlock Ct.
Forest View Dr.
Lake Terrace Dr.
Longhunter Ct.
Mossdale Dr.
Nashboro Blvd.
Owendale Dr.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 2 routes.

Route 38: Antioch.
Route 55: Murfreesboro Pike.

Priority Sidewalk Network: 3 projects.

Murfreesboro Pike x 2. 1.1 miles.
Smith Springs Rd. 1.1 miles.

Priority Bike Network: 1 Bikeway segment.

Bell Rd.

Murfreesboro Bus Rapid Transit: Yes.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 30

Metro Public Works Paving Needs: 1 total project.

Lombardy Ave.

Poor Culverts: 11 Projects.

Traffic Calming: 12 applications. Streets Include:

Chambers Dr.
Creekside Dr.
E Ridge Dr.
Faulkner Dr.
Keeley Dr.
Margo Ln.
Ocala Dr.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 2 routes.

Route 52: Nolensville Pike.
Route 72: Grassmere=Edmondson.

Priority Sidewalk Network: 5 projects.

Edmondson Pike. .8 miles.
Linbar Dr. .6 miles.
McMurray Dr. .3 miles.
Nolensville Pike x 2. 1.1 miles.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 31

Metro Public Works Paving Needs: 1 project.

Cane Ridge Rd.

Poor Culverts: 14 Projects.

Poor Bridges: 1 Project.

Cedarmont Dr over Whittmore Branch between Cedar Dr. to Cedar Valley Dr.

Traffic Calming: 39 applications. Streets Include:

Autumn Crossing Way.
Autumn Oaks Dr.
Blairfield Dr.
Chandler Cove Way.
Concord Hills Dr.
Hidden Creek Dr.
Hidden Creek Dr.
Oakfield Grv.
Ocala Dr.
Stecoah St.
Sunnywood Dr.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 1 route.

Route 73: Bell Road.

Priority Sidewalk Network: 2 projects.

Blue Hole Rd. .7 miles.
Tusculum Rd. .7 miles.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 32

Metro Public Works Paving Needs: 1 project.
Cane Ridge Rd.

Poor Culverts: 6 Projects.

Traffic Calming: 10 applications. Streets Include:
Asheford Trace.
Murphywood Crossing.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 2 routes.
Route 55: Murfreesboro Pike.
Route 73: Bell Road.

Priority Sidewalk Network: 8 projects.
Blue Hole Rd. .7 miles.
Crossing Blvd. .8 miles.
Hickory Hollow Ln. .1 miles.
Hickory Hollow Pkwy. X 2. 2.0 miles.
Mt View Rd. .9 miles.
Murfreesboro Pike. .6 miles.
Rural Hill Rd. .3 miles.

Priority Bike Network: 1 Bikeway segment.
Bell Rd.

Murfreesboro Bus Rapid Transit: Yes.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 33

Metro Public Works Paving Needs: 1 project.

Cane Ridge Rd.

Poor Culverts: 14 Projects.

Better Bus routes: 1 route.

Route 38: Antioch

Priority Sidewalk Network: 2 projects.

Anderson Rd. .7 miles.

Windsor Green Dr. .9 miles.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 34

Poor Culverts: 25 Projects.

Traffic Calming: 27 applications. Streets Include:

Castleman Dr.
Colewood Dr.
Estes Rd.
Hobbs Rd.
Lindawood Dr.
Otter Creek Rd.
Page Rd.
Sneed Rd.
Trimble Rd.
Vailwood Dr.
W Tyne Dr.
Wallace Ln.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 1 route.

Route 5: West End - Bellevue.

Priority Sidewalk Network: 2 projects.

Castleman Dr. .5 miles.
Cross Creek Rd. .2 miles.

Priority Bike Network: 2 segments.

Warfield Ln.
Warfield Dr.

Please note all projects are subject to funding availability and project readiness criteria.

Council District 35

Poor Culverts: 76 Culvert Projects.

Traffic Calming: 4 applications. Streets Include:

Harpeth Knoll Rd.
Millbrook Dr.
Stonemeade Dr.

Please note the traffic calming shapefile may contain duplicates. There are over 600 total applications.

Better Bus routes: 1 route.

Route 50: Charlotte Pike.

Priority Sidewalk Network: 2 projects.

Highway 100. 1 mile.
Old Harding Pike. 1.1 miles.

Priority Bike Network: 2 Bikeway segments.

Highway 100.
River Bend Rd.

Please note all projects are subject to funding availability and project readiness criteria.

Appendix 2 – Financial Strategies by InfraStrategies

Metro Nashville Transportation Plan

December 2020

METRO NASHVILLE'S TRANSPORTATION PLAN

August 2020

City of Nashville and the Nashville
Metropolitan Transportation Authority (MTA)

InfraStrategies

AGENDA

1. Metro Nashville's Transportation Plan
2. Financial Strategies for Transportation
3. Affordable Housing in Nashville

InfraStrategies

1.
METRO NASHVILLE'S TRANSPORTATION PLAN

InfraStrategies

METRO NASHVILLE'S TRANSPORTATION PLAN

Traffic, Multimodal & Safety

- Sidewalks (current backlog/prioritization)
- State of Good Repair (resurfacing, potholes, bridges, ADA)
- Restoration, Resiliency, and Partnership Program
- MLK/Charlotte Ave Innovation/Health Corridor
- Safety, Vision Zero, and Traffic Calming
- Active Transportation, Bikeways, and Greenways
- Transportation Management System and Signals Upgrade
- Jefferson Street Multimodal Cap/Connector

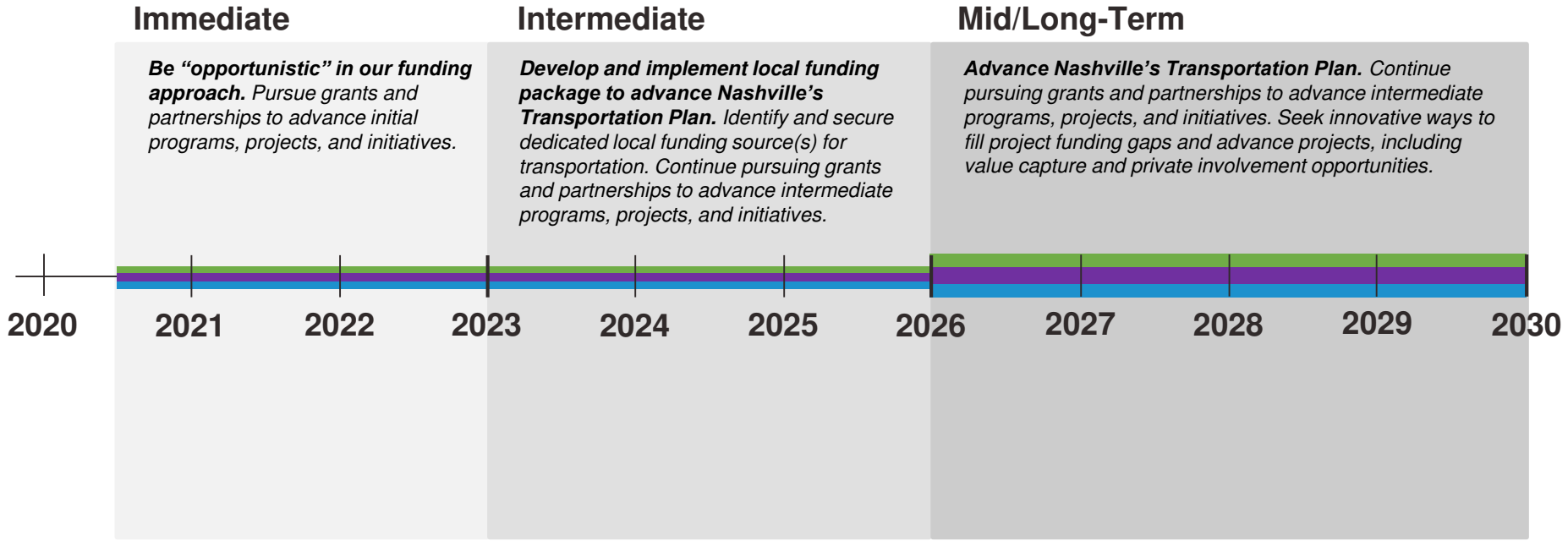
Transit

- Neighborhood and Regional Transit Centers (11)
- Better Bus Service Expansion Program
- Downtown Transit Priority
- Bus Stop and Shelter Improvements
- Best Value Fare Capping Program
- Murfreesboro Pike Bus Rapid Transit Project
- Clarksville Pike Rapid Bus Project

Affordable Housing

- Completion and Integration of Affordable Housing Inventory (underway)
- Integration of Affordable Housing Strategies in Key Corridors

METRO NASHVILLE'S TRANSPORTATION PLAN TIMELINE



INITIAL TRANSPORTATION PROGRAM (2021-23)

Traffic, Multimodal & Safety

- Consideration of Nashville DOT
- Ongoing Sidewalk Project Program
- Ongoing State of Good Repair Projects
- MLK/Charlotte Ave Innovation and Health Corridor
- Vision Zero Action Plan and Ongoing Safety Improvements
- Traffic Management Center

Transit

- Green Hills/Hillsboro Transit Center
- North Nashville/Clarksville Pike Transit Center
- Better Bus Service Expansion Program Development
- Nolensville Pike Bus Stop Improvements
- Expand Current Undersized Bus Shelters
- New Bus Shelters
- Best Value Fare Capping Program Development

Affordable Housing

- Completion and Integration of Affordable Housing Inventory (underway)
- Integration of Affordable Housing Strategies in Key Corridors

INITIAL PROGRAM (2021-23): BE "OPPORTUNISTIC"

May 18, 2020:
Submitted BUILD Grant Application for North Nashville Transit Center

Aug-Sept 2020:
Introduce Mayor's Plan
Hold Meetings with Council Members
Present Plan to Council

Aug 31, 2020:
Submit ATCMTD Grant Application for MLK/Charlotte Ave Innovation and Health Corridor in Partnership with TDOT

Oct 2020:
Hold Community Conversations

Initial Program (2021-23)

- Consideration of Nashville DOT
- Ongoing Sidewalk Project Program
- Ongoing State of Good Repair Projects
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- New Bus Shelters
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2.
FINANCIAL STRATEGIES FOR TRANSPORTATION

NASHVILLE'S TRANSPORTATION FUNDING TOOL BOX

Federal

- USDOT Better Utilizing Investments to Leverage Development (BUILD) Grants
- USDOT Infrastructure For Rebuilding America (INFRA) Grants
- USDOT ITS4US Complete Trip Grants
- USDOT Transportation Infrastructure Finance and Innovation Act (TIFIA) Loans*
- FRA Railroad Rehabilitation and Improvement Financing (RRIF) Loans*
- FHWA Formula Funds
- FHWA Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) Grants
- FTA Capital Investment Grant (CIG) Program
- FTA Bus and Bus Facilities Grants
- FTA Lo and No-Emissions Grants
- FTA Formula Funds
- FTA Transit-Oriented Development (TOD) Grants
- FTA Integrated Mobility and Innovation (IMI) Grants
- FEMA Building Resilient Infrastructure and Communities Grants (BRIC)
- HUD Community Development Block Grants

State

- TDOT Public Transit Capital Grants
- TDOT Multimodal Access Grants
- IMPROVE Act Funds

Local

- Local Option Sales Tax
- Local Property Tax
- Local Vehicle Wheel Tax
- Local Rental Vehicle Tax
- Local Option Sales Surcharge (IMPROVE)
- Local Motor Vehicle Surcharge (IMPROVE)
- Local Rental Vehicle Surcharge (IMPROVE)
- Local Hotel Occupancy Surcharge (IMPROVE)
- Local Business Surcharge (IMPROVE)
- Residential Development Surcharge (IMPROVE)
- General Obligation (GO) Bonds*
- Revenue Bonds*
- Grant Anticipation Notes (GANs)*
- Local Contracted Vehicle Tax
- Local Alcohol Beverage Privilege Tax
- Local Wholesale Beer/Liquor Tax
- Local Ride Hailing Tax
- Local Motor Fuel Sales Tax
- Local Parking Tax
- Congestion Pricing
- Local Entertainment/Meal Tax

Value Capture & Private Involvement

- Tax Increment Financing – Transit Oriented Redevelopment District (TORD)*
- Special Assessment Districts – Central Business Improvement District (CBID)
- Payments in Lieu of Taxes (PILOTs)
- Naming Rights and Sponsorships
- Land Donations
- Joint Development
- Air Rights
- Private/Developer Contributions
- Private Financing*
- Private Equity*

** Denotes financing mechanisms*

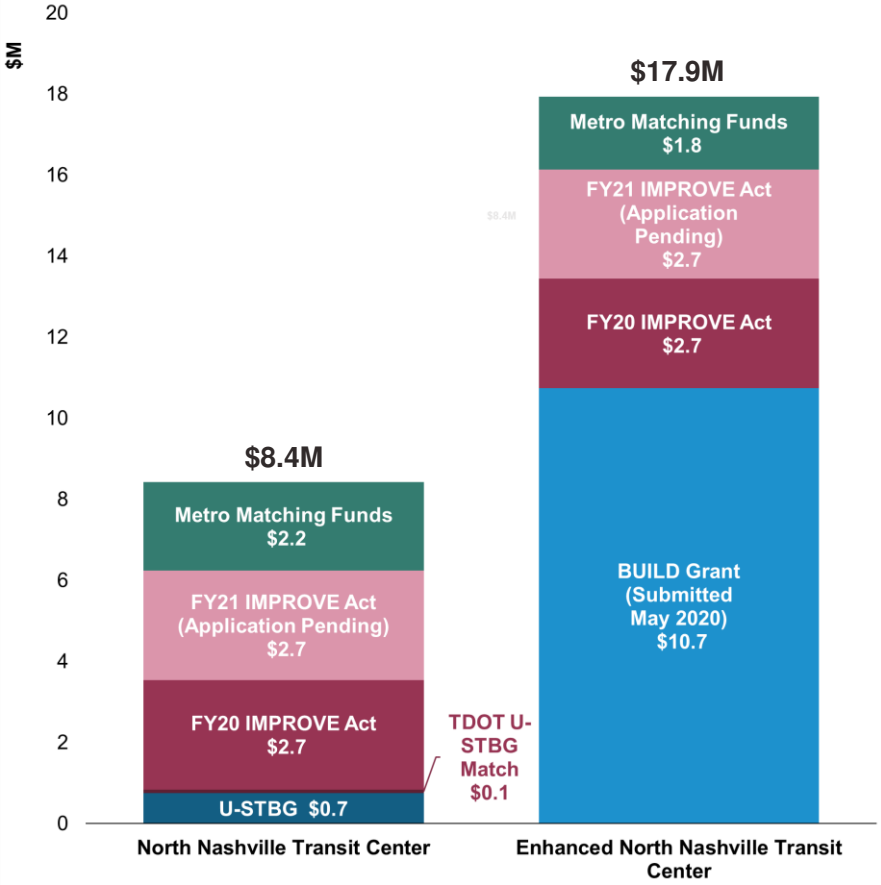
Note: Potential Federal and State Partners include the United States Department of Transportation (USDOT), Federal Railroad Administration (FRA) Federal Highway Administration (FHWA), Federal Transit Administration (FTA), United States Department of Housing and Urban Development (HUD), and Tennessee Department of Transportation (TDOT)

NORTH NASHVILLE TRANSIT CENTER

A new neighborhood mobility center designed specifically to create and enhance multimodal transportation options and connections in North Nashville, an economically disadvantaged community within the Nashville Metropolitan area. Once completed, this transit center will greatly improve access to job opportunities and workforce skills training for residents, as well as provide better access to health care and other needed services.

	North Nashville Transit Center		Enhanced North Nashville Transit Center	
	2020 $M	%	2020 $M	%
Project-Specific	-	-	-	-
Local	$2.2	26%	$1.8	10%
State	$5.5	65%	$5.4	30%
Federal	$0.7	9%	$10.7	60%
Total	**$8.4**	**100%**	**$17.9**	**100%**

Note: Totals may not sum due to rounding.

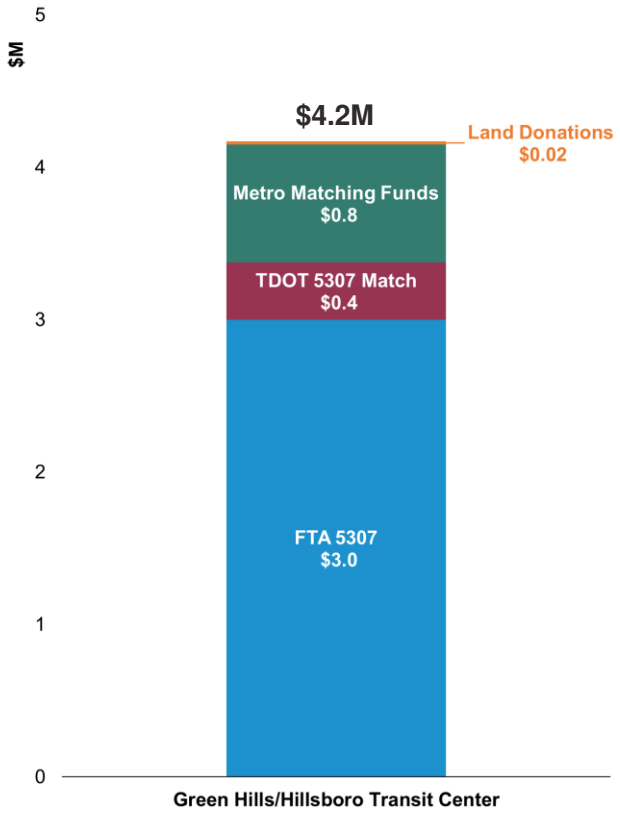


GREEN HILLS/HILLSBORO TRANSIT CENTER

A new transit center planned in front of Hillsboro High School will offer expanded capacity for buses as well as new amenities, such as larger shelter areas, and improved lighting. The project, a collaboration between WeGo Transit and Metro Nashville Public Schools, is planned in conjunction with the $89 million renovation of Hillsboro High School.

	Green Hills/ Hillsboro Transit Center	
	2020 $M	%
Project-Specific	$0.02	<1%
Local	$0.8	19%
State	$0.4	9%
Federal	$3.0	72%
Total	**$4.2**	**100%**

Note: Totals may not sum due to rounding.

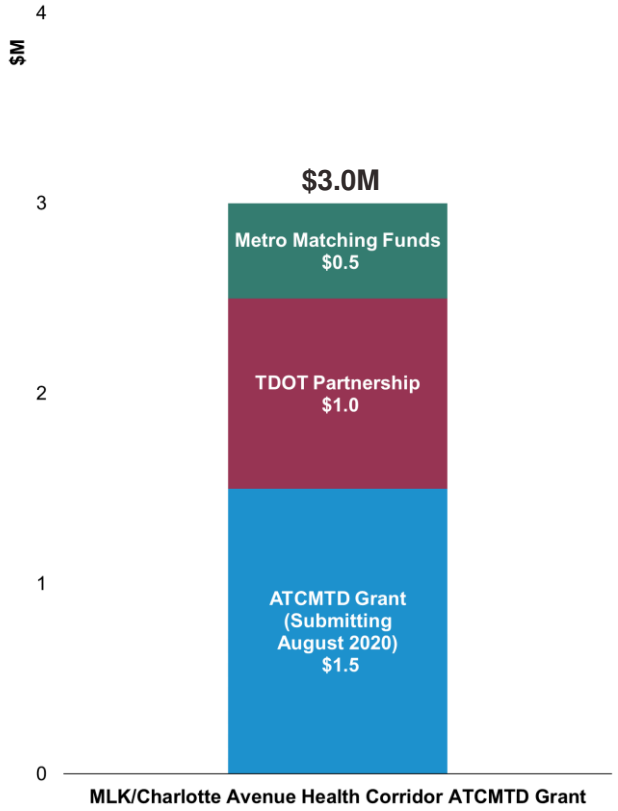


MLK/CHARLOTTE AVENUE HEALTH CORRIDOR

The MLK/Charlotte Avenue fronts the State's Capital building and continues as a densely developed corridor with 88,000 jobs and 16,000 residents living within a half mile of the corridor. Several large medical complexes, Centennial Park, and Art Center occupy the corridor and most notably, Vanderbilt University, with 12,000 students and 8,000 faculty and staff are within a half mile of the corridor. The existing development and diversity of uses as well as potential partnership with Vanderbilt University engineering make this an optimum location for pilots demonstrating how technology can improve and balance mobility needs, which is a noted goal for the Charlotte Avenue Corridor Study completed in October 2018. Additionally, as was done in Chattanooga, honoring Dr. King with a corridor that advances our future mobility is a fitting action.

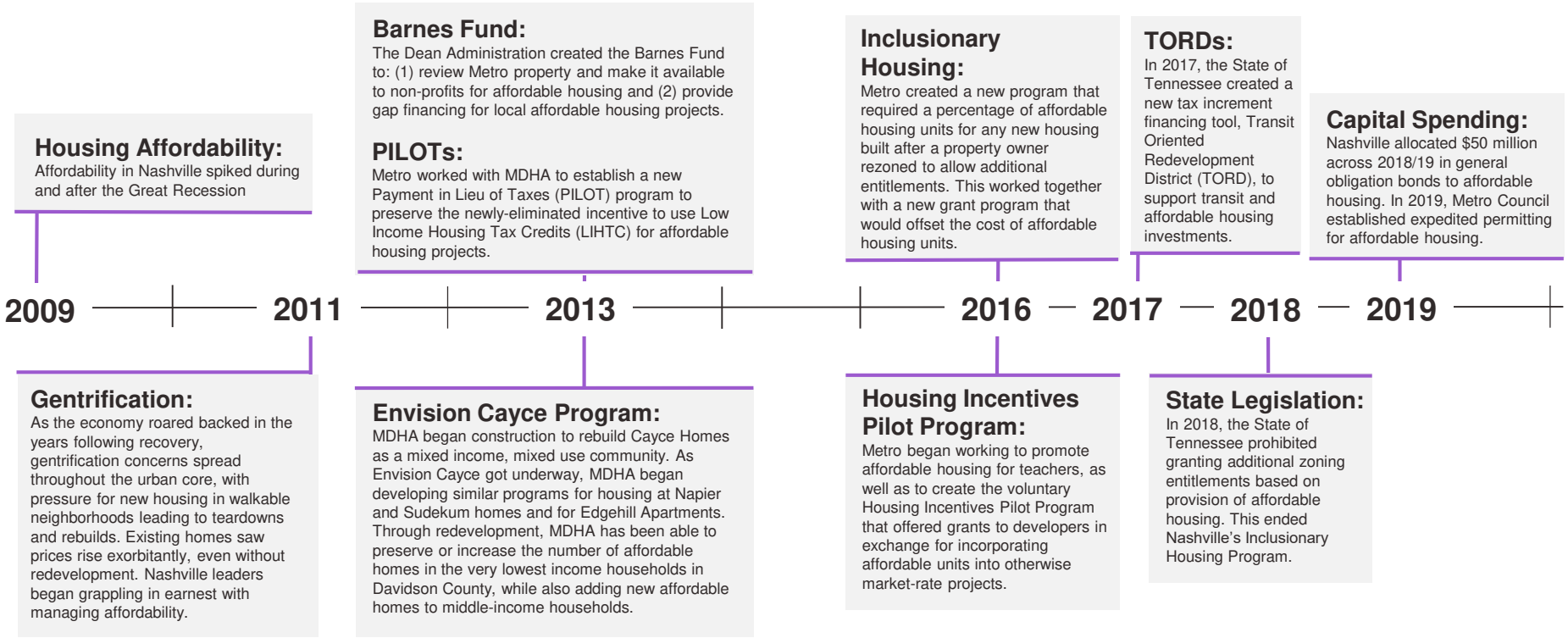
	MLK/Charlotte Avenue Health Corridor ATCMTD Project	
	2020 $M	%
Project-Specific	-	-
Local	$0.5	17%
State	$1.0	33%
Federal	$1.5	50%
Total	**$3.0**	**100%**

Note: Totals may not sum due to rounding.

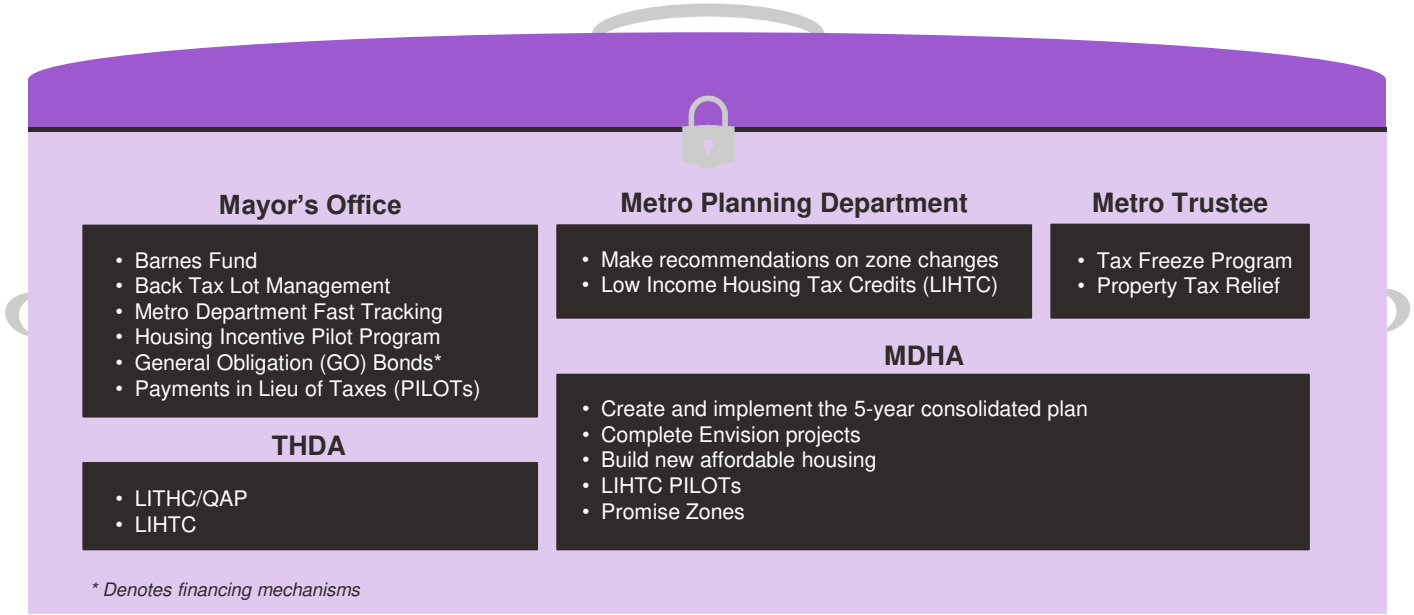


3.
AFFORDABLE HOUSING IN NASHVILLE

AFFORDABLE HOUSING IN NASHVILLE



NASHVILLE'S AFFORDABLE HOUSING TOOL BOX



THANK YOU!

Initial Program (2021-23)

- Consideration of Nashville DOT
- Ongoing Sidewalk Project Program
- Ongoing State of Good Repair Projects
- MLK/Charlotte Ave Innovation and Health Corridor
- Vision Zero Action Plan and Ongoing Safety Improvements
- Traffic Management Center

Metro Nashville's Transportation Plan

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- Murfreesboro Pike Bus Rapid Transit Project
- Clarksville Pike Rapid Bus Project

Appendix 3 – Nashville Mobility Management Center Assessment, Peer Review and Recommendations by Arcadis

Metro Nashville Transportation Plan

December 2020

ARCADIS Design & Consultancy for natural and built assets

Metro Nashville - Davidson County
Department of Public Works Engineering Division

NASHVILLE MOBILITY MANAGEMENT CENTER (NMMC)

Assessment, Peer Review and Recommendations

June 15, 2020

CONTENTS

APPENDICES

DOCUMENT PURPOSE

Mayor John Cooper, the presiding Mayor of Nashville, has made developing a people-first transportation plan one of the top priorities of his administration. Mayor Cooper's administration plans to invest in common sense solutions to manage and provide consistent travel times on Metro Nashville's roadways. This includes implementing real-time active traffic management using smart and connected traffic signals to better serve traffic based on real-time detection and management of demand. Mayor Cooper plans to create a Nashville Department of Transportation to effectively execute an ambitious transportation demand management (TDM) program that is both resilient and sustainable. Implementation of these programs will elevate Nashville to a level in-line with or above its peers. The existing Nashville Mobility Management Center (NMMC) has very limited capabilities due to staffing shortages and obsolete signal infrastructure. Arcadis, with input from Neel-Schaffer, conducted a high-level assessment of the existing traffic signal infrastructure and communications network. This assessment will help determine what upgrades and operational strategies are needed to allow for a fully functioning NMMC including the additional staff required for proper operation and maintenance of the infrastructure. We examined Metro Nashville Public Works' (MNPW) functional capabilities in comparison to nine peer transportation management agencies across the country to gauge current operations and identify recommendations for improvement.

The assessment included the following steps:

1. Peer agency identification and selection
2. Functional requirements
3. Concept of operations
4. Maintenance program
5. Interviews with peers and MNPW Staff
6. Summarization of interview findings

Peer MMCs interviewed included:

- Georgia Department of Transportation – Regional Traffic Operations Program (RTOP) (Shahram Malek)
- Cobb County, GA (Brook Martin)
- City of Atlanta (Desmond Cole)
- Charlotte, NC (Charles Abel)
- Los Angeles, CA (Erik Zambon)
- Utah DOT (Mark Taylor)
- Anaheim, CA (John Thai)
- Orlando, FL (Mark Tobin)
- Denver, CO (Michael Finochio)

The recommendations presented in this document may be used by MNPW as a roadmap that will allow for the implementation of a program to actively manage Nashville's traffic.

METRO NASHVILLE TRAFFIC CONTROL ASSETS

Metro Nashville Public Works (MNPW) operates and maintains traffic signals, reversible lane signals, and flashing beacons located throughout Davidson County, an area of approximately 526 square miles. These assets are outlined in the following text:

Traffic Signals

Metro is responsible for maintaining and operating 865 traffic signals located within Davidson County. These signals are located on both local and state routes within the county. The Tennessee Department of Transportation (TDOT) does not currently own or maintain any traffic signals in the state of Tennessee. TDOT provides funding for new signals or signal modifications on state routes but relies on the local agency to manage, operate, and maintain them once construction is complete.

Flashing Beacons (School Flashers / Intersection Warning)

MNPW signal staff are responsible for maintaining 440 flashing beacons. These beacons are located at school zones, unsignalized midblock pedestrian crossings, and fire halls. They also provide advance warning for intersection, curve, and speed reduction conditions. These devices require active periodic attention for proper operation, including equipment maintenance, updating the school zone clocks for changes in the school calendars, and replacing batteries in the solar powered units.

Reversible Lane Signals

MNPW signal staff are also responsible for operating and maintaining approximately 20 reversible lane signals located on James Robertson Pkwy and Hermitage Ave, near the central business district. These devices require periodic equipment maintenance for proper operation. MNPW also modifies the timing of the reversible lane signals for special events downtown.

PEER REVIEW, TOOLS, AND TECHNOLOGIES

Through the interviews Arcadis conducted with the selected peer agencies, valuable comparisons between Metro and its peers were drawn specifically relating to the staffing, technologies, and strategies used in operation, management, and maintenance of traffic assets. A summary of the interview findings along with the questionnaire used for the interviews are included in *Appendix A* and *Appendix B* of this document.

MNPW signal staff must cover a geographic area of approximately 526 square miles, much of which is highly populated in a dense urban environment. Metro's urban arterials are often congested, especially in the peak hours and during special events, which has similar attributes to Metro's peers that were evaluated. To effectively manage their assets across this area, many peer agencies use remote monitoring and control to maximize their limited resources and enhance response times.

Historically, funding has been lacking and inconsistent for MNPW traffic signal infrastructure maintenance and upgrades. The existing signal infrastructure has degraded due to insufficient staffing, sporadic and unreliable capital funding, and deferred maintenance. From 2016 to 2019, MNPW undertook a controller

upgrade project that upgraded nearly all signal controllers in the Metro area. Metro's previous signal controllers were manufactured in the late 80s and early 90s and used an obsolete technology with limited capabilities. While the controller upgrade project was a huge leap forward for Metro Nashville, a majority of the existing signal infrastructure still requires significant capital improvements to be able to provide active traffic management and reliable operations and communication. The following example describes the majority of the existing traffic signals:

> The signal controller was recently replaced and is state-of-the-art. However, communication back to the NMMC is done via an unreliable and obsolete existing twisted pair copper signal interconnect cable that was installed 20+ years ago. The intersection lacks mainline vehicle detection and the existing side street and mainline left-turn vehicle detection loops are likely inoperable. The lack of mainline detection severely limits the type of signal operation modes that can be selected by MNPW leading to operational inefficiencies that result in excessive and unnecessary delays. The antiquated signal cabinet and signal heads are wired with non-standard and now obsolete single strand wire which can break over time, creating an electric short which usually results in the traffic signal going to flash mode, jeopardizing safety and reliability. The benefits MNPW received from replacing the controller, although valuable, are marginalized due to supporting infrastructure being obsolete.

When Metro is compared to its peers in terms of signal equipment and communications, it falls short of where it needs to be. It is clear that if Metro is to achieve the desired active operation and management of its traffic signals, reliable communication, and signal upgrades such as detection and signal wiring are requirements that must be considered as essential to realizing this objective.

NMMC CAPABILITIES IN MONITORING AND CONTROL

Currently, MNPW can access most of their signal controllers via Centracs, a central signal system software provided by Econolite, the signal controller manufacturer. Communication to the signals is provided via a combination of twisted pair copper interconnect, cell modems, DSLs, and some fiber optic trunk lines. Due to its age, the majority of the twisted pair copper interconnect communication network is unreliable. The twisted pair copper interconnect is up to 40 years old in some locations and has degraded over time. In addition, some of MNPW's communication issues can be traced to communication lines that were damaged during numerous construction projects, a byproduct of Nashville's tremendous growth in the last 20 years. The existing NMMC consists of a desktop computer and a flat screen TV located in MNPW's signal shop. It is currently used for monitoring the status of the signal controllers via Centracs. It is used as a resource for trouble shooting signal equipment malfunctions and investigating citizen complaints. Metro currently has no functional closed-circuit television (CCTV) cameras capable of monitoring traffic operations that are communicating back to the NMMC. In comparison to its peers, Metro has the lowest percentage of active functional CCTV cameras for the purposes of monitoring.

For the NMMC to be fully functioning, it should be located in a dedicated room with the proper equipment. This includes reliable communication to the existing roadside infrastructure, video display walls, computing hardware, and the installation of new infrastructure along major corridors. This should include CCTV cameras and detection upgrades at major intersections to allow field monitoring. MNPW will need to hire additional staff to operate the NMMC because they currently do not have the available resources. The existing NMMC's deficiencies prevent full time monitoring and control of their signal systems and the

use of more advanced control strategies. These strategies include traffic responsive and adaptive operation to monitor and effectively manage Nashville's ever-increasing traffic volumes, special events, and the demand that such growth is placing on Metro's transportation facilities.

WORKFORCE AND STAFFING COMPARISON

It appears that the MNPW Traffic Signal staff responsible for the day-to-day maintenance of these assets are considerably understaffed compared to their peers. Metro's single Traffic Engineer is responsible for more than 865 signals versus the desired industry average of 75-100 signals per engineer, as recommended by ITE and FHWA. To effectively manage traffic congestion, Metro Nashville should have between five (5) and ten (10) full-time traffic engineers. With regard to traffic signal technicians, for system operations and maintenance roles, the rule of thumb is one signal technician for every 40-50 traffic signals (see chapter 8 section 8.4 staffing needs of this FHWA document: http://www.ops.fhwa.dot.gov/publications/fhwahop08024/chapter8.htm).

Metro Nashville's traffic signal maintenance staff currently consists of 14 technicians, 1 tech specialist, and one superintendent that are responsible for the maintenance of Metro Nashville's traffic signals, flashing beacons, and reversible lane controllers. With 865 signals to maintain, MNPW should have approximately 17 to 22 signal technicians to properly maintain their traffic signals. This estimate does not include the maintenance of Nashville's 440 flashing beacons or 20 reversible lane controllers. Additional staff will need to be allocated to maintain these assets. Due to the record low unemployment in Nashville, it has been difficult for Metro to retain experienced staff who can command a higher salary working in the private sector. Replacement staff are less experienced and have limited to no knowledge of traffic signal standards, electronics, the interworking of an advanced traffic control system, and a sophisticated fiber and wireless communication system. Some of these positions may require a background or working knowledge of information technology (IT) systems and systems architecture and/or in intelligent transportation systems (ITS) with continuous training and certifications to maintain capabilities and the industry standards of care and maintenance. It should be noted that Metro Nashville Information Technology Services (Metro ITS) maintains the enterprise communication network that provides connectivity to all departments in the Metro government including MNPW. When additional traffic assets are deployed, additional Metro staff will be required by both MNPW and Metro ITS. MNPW will require technical staff for supporting Intelligent Traffic System applications and hardware. Metro ITS will require additional staff for the maintenance and expansion on the Enterprise Network and fiber plant which includes transport for MNPW traffic data.

STANDARD OPERATING PROCEDURES

Part of this assessment included conducting a review and peer comparison of the standard operating procedures (SOPs) that are needed for planning, assigning, and performing the daily activities of a MMC and signals system.

SOPs are a best practice because they document how various activities need to be performed based on the industry standard, agency preferences, and tested and proven processes that yield consistent results as personnel change. SOPs should be living and evolving documents that define required documentation to effectively maintain change control. This will ensure that the knowledge remains with Metro as staff

changes due to attrition, promotions, position changes, or voluntary and involuntary departures. Without established and regularly updated standards and proper documentation control, Metro will have no certainty that each time something fails, the implemented solution maintains the full integrity of the overall system.

Based on the review, creation of SOPs or change management systems are needed.

TRAFFIC CONTROL STRATEGIES

Part of this assessment included analyzing the different types of traffic control strategies available and recommending improvements where needed. This assessment will cover the four main types of traffic control strategies including Time Based Coordination (TBC), Time of Day (TOD), Traffic Responsive, and Adaptive Signal Control Technology (ASCT). MNPW currently uses a combination of Time Based Coordination (TBC) and Time of Day (TOD) strategies to manage traffic in Metro Nashville.

Time Based Coordination (TBC)

Time Based Coordination is a traffic control strategy that uses a common time reference to achieve signal coordination. All signal controllers in the coordination group must use the same time reference point to achieve coordination with time-based coordination. Each controller references their offset to the same background cycle, a cycle of the same duration that starts at the same time for all controllers. This can be achieved by a master controller or central software transmitting a synchronization pulse or message to all controllers at a preset time, usually daily at midnight. The frequency of the pulses sent by the master or central software to the local controllers varies by controller manufacturer. If the communications link fails between the master or central software and the local controller, signal coordination will be lost.

Modern signal controllers, like the controllers recently installed by MNPW, use TBC as the means of synchronizing the start of the background cycle in all controllers. Each signal controller uses a time-of-day clock to enable it to know the current time to the nearest second. The offset reference time is a specific time of the day, such as midnight that the controller considers the background cycle to have started. The signal controller can determine, at any time during the day, where it is in the background cycle by calculating the number of seconds since the offset reference time and dividing by the cycle length. The remainder is used to calculate when the current background cycle started. When the offset time is added to the background cycle zero point, the local cycle zero point can be determined.

One advantage to TBC is that it works with a mix of signal controller types (manufacturer brands) and central software. However, it only works if the clocks in all controllers in the coordinated group are synchronized to the same time. As previously stated, MNPW recently upgraded all their signal controllers to the same type and manufacturer. The clocks in these controllers (like all other brands) tend to drift over time and need to be reset periodically. MNPW's controllers are connected to a central software that resets the clock automatically. Metro Nashville uses several different methods to provide the connection back to the central software including twisted pair copper signal interconnect cable, cell modems, DSLs, and fiber optic signal interconnect cable. Unfortunately, the communications to the signal controllers using the copper twisted pair signal interconnect cable is unreliable due to the cable's age, sensitivity to environmental conditions, and deteriorated condition. These signal controllers often have trouble communicating back to the central software and drop offline for periods of time. This leads to inefficient

operation (no coordination between signals) because the clocks are not being synched. This lack of synchronization is also a maintenance issue because signal staff are not able to check the status of the controllers remotely when they are offline. Additional information on traffic signal communications will be provided in a subsequent section.

Time of Day (TOD)

Another traffic control strategy is Time of Day operation. When operating in TOD operation, the timing plan for varying volume levels and directional preferences is selected based on the time of day, day of week, and week of year. The number of timing plans required is influenced by several factors but largely depends on the traffic variability throughout the year, week, and day. When operating in TOD operation, the signal controllers change timing plans based on a preprogrammed time of day plan. The day plan may be different for each day of the week or the same. Often there is one day plan for weekday traffic and one for weekend traffic. Depending upon the observed fluctuations in traffic patterns on the corridor, the traffic engineer may choose to program the time of day programming by weekday (Monday-Thursday), Friday, Saturday, and Sunday. The week plan is typically the same all year, but it can be altered to accommodate seasonal traffic variations such as holiday traffic around a major retail area. If traffic patterns are very consistent, this is an effective form of traffic control. However, if traffic patterns change due to a special event such as a traffic incident, planned special event, or a holiday, the signal controllers are unable to change timing plans to respond to traffic fluctuations. This leads to inefficient operation when traffic patterns are abnormal (exceptionally light or heavier than normal). Over time, traffic volumes change and render fixed TOD signal timing plans less effective. FHWA recommends that traffic signal timing should be reviewed every three to five years and more often if there are significant changes in traffic volumes or roadways conditions. MNPW currently uses TOD operation for a majority of their signals. MNPW completed a county wide retiming study and controller upgrade project from 2016 to 2019. Since a good portion of the plans were implemented in 2016, they will need to be updated soon. Due to Nashville's unprecedented growth, volumes have increased significantly since 2016, so the signal timing plans have become less effective since their initial installation. Much of Nashville's congestion involves commuter demand from adjacent counties. Improving capabilities and increasing resources to manage this demand, i.e. parallel and alternative corridors, is imperative to effectively manage changing traffic conditions. With TOD operation, when there is an incident on a parallel route and traffic patterns divert to avoid the incident, the signal controllers are unable to change plans to accommodate the increase in traffic volumes. For example, when there is a partial or full closure on I-40 due to an incident in west Nashville, motorists often divert to Charlotte Ave to avoid it. Since the signal controllers are operating in TOD operation, they are unable to react to the dramatic but temporary (depending upon the duration of the incident) shift in traffic patterns.

Traffic Responsive

Traffic responsive plan selection systems are one of the most efficient traffic control strategies because they select a coordination plan to match actual traffic conditions. Realtime field data from the system detectors allow traffic responsive algorithms to select a preconfigured signal timing plan from a library of plans. The current timing plan must have been operating for a minimum amount of time before a new plan can be implemented, and the new timing plan must typically be a certain percentage improvement over

the currently running plan. These thresholds can be field adjusted for each corridor to ensure optimal efficiency. If the system determines a different plan is necessary, the signals in the group are directed to begin using the new plan at the same time in order to ensure that coordination is reestablished promptly.

Most traffic signal systems allow traffic responsive plan selection to be implemented on a time-of-day basis. Typically, the schedule includes a baseline plan that is initiated during a corresponding time-of-day period. If vehicle detection data reveals that the scheduled plan is responding inefficiently to the observed traffic patterns, the system switches the scheduled plan to a more suitable alternative. Traffic responsive operation can be directed manually or scheduled as a special event override of the normal time-of-day schedule.

To provide optimal traffic responsive operation, signal timing plans for traffic responsive systems should be configured to cover a wide range of field scenarios. Each plan must be programed into the controllers prior to field operation, and then fine-tuned for the field conditions they are meant to serve. It is not necessary to have a comprehensive set of timing plans for traffic responsive systems to operate. However, if the system has numerous plans to choose from, the likelihood of the system being able to select a plan that matches the actual field conditions dramatically increases, making traffic responsive operation a highly effective solution. It is also important to note that traffic responsive plan selection systems do not calculate new plans (or patterns) on their own, such as the case in adaptive control.

None of the signals in Metro Nashville's control currently operate traffic responsive operation, though the signal controllers are capable of operating in this mode. Since most of the corridors were retimed between 2016 and 2019, there is already a "library" of recent plans for the controller to choose from. Although additional plans will likely be needed to provide optimal traffic responsive operation. Unfortunately, a significant existing limitation and barrier to implementing traffic responsive operation is Metro Nashville's lack of mainline vehicle detection and reliable system communication.

Adaptive Signal Control Technology (ASCT)

Another traffic control strategy is Adaptive Signal Control Technology systems. ASCT systems use vehicle detection data and algorithms to adjust signal timing parameters to match current traffic conditions. The main difference between traffic responsive operation and ASCT systems is that adaptive systems do not have predetermined timing plans to select from. Instead, they adjust various timing parameters based on the actual traffic conditions. Limits for each parameter are set by the user as desired. These systems "learn" the traffic patterns over time and adjust to them as needed. In theory, ASCT's continual adjustment of signal timing parameters provides incremental benefits over time-of-day plans. However, if a signal system running traffic responsive is equipped with a large library of plans to address highly variable conditions, the benefits of operating ASCT instead of traffic responsive are minimal. Over time, traffic volumes change and render fixed signal timing plans less effective. ASCT systems are most beneficial for corridors with highly variable traffic volumes and non-saturated traffic conditions. When an adaptive system detects saturated conditions, it reverts back to operating the preprogrammed timing plans in the signal controllers. Most of the corridors in Metro Nashville routinely experience saturated conditions during the peak hours, making them nonideal candidates for adaptive signal operation.

Additionally, ASCT systems are very complex and require constant supervision and greater levels of maintenance when compared to traditional signal systems. Upon the installation of an adaptive system, agencies must hire additional trained staff or allocate existing staff and train them to maintain the system. Highly skilled staff are essential to keeping adaptive systems working at a high level of performance.

ASCT systems also require extensive vehicle detection to gather the data needed for their extensive algorithms. The types of vehicle detection needed includes stop bar detectors, setback detectors, mid-block detectors, and upstream detectors. Detection is needed for all phases and lane-by-lane which some detection units may not be capable of providing. Installing this level of detection requires a significant upfront capital cost and extensive ongoing maintenance to keep the system operating at optimal conditions. A robust communication network is also required for the system to communicate with the numerous detection units.

While ASCT is beneficial in certain applications, there are many other dependable traffic control methods that improve traffic operations without the expense, complexity, and personnel requirements associated with ASCT. None of the signals in Metro's control are currently running ASCT. The controllers that were replaced between 2016 and 2019 are capable of operating ASCT. As stated earlier, adaptive signal operation cannot be implemented until extensive detection upgrades are made, including stop bar, advance, mid-block, and upstream detectors, and reliable communication is installed to all field devices. Metro would need to hire additional staff to maintain any adaptive system because they are significantly understaffed. ASCT systems are most beneficial for corridors with highly variable traffic volumes and non-saturated traffic conditions. Most of the corridors in Metro Nashville routinely experience saturated conditions during the peak hours making them non-ideal candidates for adaptive signal operation.

COMMUNICATION STRATEGIES

This assessment includes the types of communication strategies available to provide communication between field devices (signal controllers, CCTV cameras, etc) and the NMMC. Reliable communication between field devices and the NMMC is vital to enable signal coordination, monitoring of field equipment status, reporting of equipment malfunctions, providing transit signal priority, and support of traffic probe-based incident detection equipment. MNPW's current ITS infrastructure is limited to a number of directly connected signals and closed loop signal systems using cell modems or Digital Subscriber Lines (DSL) to provide communication back to the central system. The primary communications media between the directly connected signals is twisted pair copper cable; fiber optic cable is used at some locations. The copper twisted pair and fiber optic cables include both aerial and underground installations. The copper twisted pair has exceeded its service life but has not been replaced due to lack of capital funding. The existing communication network is a piecemeal system, with significant gaps, built over time using the limited staffing and capital improvement funding available.

Twisted Pair Copper Communication Cable

This form of communication is now antiquated and cannot transmit the bandwidth of data required for modern communication networks. It has been replaced by modern technologies such as fiber optic cable and cellular communications. Each pair of a twisted pair copper cable is made by putting two separate insulated wires together in a twisted pattern and running them parallel to each other, which helps to

reduce crosstalk or electromagnetic induction between pairs of wires. The cable may contain multiple pairs of wire depending upon the communication needs of the installation.

MNPW's existing traffic signal communication network is comprised of a single central system providing direct connections, as well as multiple closed loop systems around the perimeter of the county. This system is made up of multiple sections of 19-gauge pairs bundled in 6, 12, 25, and 50 pair cables. Data collected during the 2007 Metro Nashville ITS Communications Plan revealed that the existing communications network provides 100+ miles of coverage in Davidson County. Metro ITS has deployed Meraki cellular units to connect these isolated closed loop systems to Metro's enterprise network. When the signal controllers were upgraded from 2016 to 2019, switches were installed in each cabinet with existing copper interconnect to allow for ethernet over copper communications. Most of the twisted pair copper interconnect communication network is unreliable due to its age. The twisted pair copper interconnect is up to 40 years old in some locations and has degraded over time. In addition, some of MNPW's communication issues can be traced to communication lines that were damaged during numerous construction projects, a byproduct of Nashville's tremendous growth in the last 20 years. Due to unreliable or missing grounding, copper twisted pair is prone to channeling lightning strikes, which typically result in damage to traffic signal electronics.

Fiber Optic Communication Cable

Single Mode Fiber Optic Cables are now the standard for modern communication networks because of the large amount of data they can transmit. Data is transmitted through a fiber optic cable by light pulses via its center glass core. The only limit to the bandwidth of data that can be transferred via fiber optic cable is the processing capabilities of the devices on either end of the cable. To support CCTV camera surveillance from a mobility management center, a direct fiber optic connection is beneficial because it can provide ample bandwidth to provide a quality video and responsive pan-tilt-zoom CCTV camera operation. Each camera can require substantial bandwidth and with multiple cameras on a single corridor, a direct fiber connection is the best form of communication to handle these data requirements.

The initial capital cost to install new fiber optic lines is very expensive. The timeline from preliminary design of a fiber optic network to final construction is often several years. Permits must be acquired to aerially attach fiber optic cables to the electric utility provider's poles. Most of MNPW's existing twisted pair copper cables are attached aerially to Nashville Electric Service's (NES) poles. Even though MNPW already has existing pole attachments on most arterial routes within Davidson County, NES now treats all cable installations as new attachments. Therefore, MNPW must bring the existing pole up to current NES standards before additional lines can be attached. Previously, MNPW was permitted to replace existing communication lines by reusing their existing pole attachments without having to go through the NES pole make-ready process. The NES pole make-ready process is cumbersome and expensive, further hindering the timeline for installation of new fiber optic lines. Also, permits and agreements must be acquired to cross railroad rights-of-way and jurisdictional boundaries (aerially or underground), which require substantial time and effort. However, once the fiber is installed, the annual operating and maintenance cost of the system is relatively low when compared to cellular communications. A dedicated fiber network can also be shared between multiple city departments which can help spread the capital costs between multiple funding sources. A fiber optic network is more secure than a cellular communication network.

4G/5G Cellular Communications

MNPW currently has over 250 cell modems deployed in the field to provide communications between their signal controllers and their central monitoring software, Centracs. Some cell modems provide communication to a single signal controller, while others provide communication to a closed loop system with up to 15 interconnected signal controllers. The signals in the closed loop system are connected via antiquated twisted copper pair, which is not reliable due to its age and deteriorated condition. Communication is reliable to the location where the cell modem is located, but it is inconsistent with controllers down the line due to poor propagation through the deteriorated cable.

The initial capital costs to install cell modems are fairly low, especially when compared to initial capital costs required to install fiber optic cables. Cell modems can be installed in as little as a few hours, providing reliable communication almost instantly if cell coverage is available. However, cell modems require a monthly subscription that must be factored into yearly operating costs. These monthly fees will continue for the life of the device. Depending upon the data plan selected, yearly operating costs can be quite expensive, especially with 250+ cell modems. Additional cell modems would be needed to provide consistent communication to all signal controllers. Often it is easier for signal agencies to secure one-time grants for capital improvements than it is to obtain dedicated funding on a yearly basis for their operating budgets. If additional cell modems are installed, future budgets must allocate funding for the subscription fees. Cell modems cannot provide the bandwidth provided by direct fiber optic connection. CCTV camera operation can be supported via 4G cell modems, but only for sporadic use.

MULTIMODAL CONSIDERATIONS

When considering transportation management strategies for a diverse city like Nashville, the safety and operational performance for all roadway customers must be considered when allocating funding and setting transportation priorities. Multimodal considerations must include motorists, pedestrians, bicyclists, and slow-moving vehicles inside the downtown core such as scooters, golf carts, and pedal taverns. In recent years, capital funding for non-motorized modes (sidewalks and bikeways) has significantly outpaced spending for motorized vehicle operations. Without question, Nashville has a lot of ground to make up in sidewalk construction, but the lack of investment in the signal system has put our city behind in an area where technology has changed rapidly.

A modern and resilient transportation management system will increase safety, travel time reliability, and operational performance for all transportation customers. Some examples include:

- A traffic signal system with upgraded detection can be used to monitor bicycle and pedestrian usage, which leads to better planning and implementation of bicycle and pedestrian facilities where needed.
- A more responsive signal system can facilitate additional pedestrian street crossings while minimizing delay to vehicles.
- Effective traffic progression can maximize the capacity of an existing corridor. In some cases, this may allow for a reduction in street width that can then be returned to non-auto uses while maintaining or improving vehicle flow.
- Monitoring major corridors can help set operational parameters aimed at keeping speeds at an appropriate level – a safety benefit for all transportation customers.

- Special bicycle signals can be used to provide dedicated intersection access for this vulnerable type of user.

HIGH LEVEL CONCEPT OF OPERATIONS

Field Assets

Arcadis recommends a thorough and comprehensive inventory and evaluation of Metro Nashville's traffic control, communications, and monitoring assets which MNPW is currently responsible for in Davidson County and other agencies in Davidson County such as the Cities of Berry Hill and Forest Hills. This inventory and evaluation is essential to systematically identify deficiencies and to assign priorities based on the severity of the need and its impact on achieving the program goals. A field inventory of Nashville's field assets was completed in 2006-2007 for the planning of the Metro Nashville Public Works' ITS Communication Plan. This plan was neither funded nor constructed. By using this field inventory report as a starting point, the time and resources required to complete the 2020 field inventory can be reduced.

Once the current inventory is complete, Metro Nashville can associate a realistic dollar value with groups of deficiencies and develop an action plan to address the short-, mid-, and long-term needs and begin to develop projects and program them in the region's transportation improvement program (TIP) for funding.

NMMC Configuration

The existing NMMC consists of a desktop computer and a flat screen TV located in MNPW's signal shop. It is currently used for monitoring the status of the signal controllers via Centracs management software. This platform is used as a resource for trouble shooting signal equipment malfunctions and investigating citizen complaints. Metro currently has no functional CCTV cameras capable of monitoring traffic operations that are communicating back to the NMMC. When compared to its peers, Metro has the lowest percentage of active functional CCTV cameras for the purposes of monitoring.

For the NMMC to be effective, it needs a dedicated space that can configured with proper electronics, workstations, and staffing to deliver the capabilities and functionality required to actively and best manage traffic operations, assets, and service delivery. A dedicated space was set aside at the Howard School building for the NMMC in 2007. That space has since been used by other departments since MNPW did not have the necessary funds nor staff to develop the envisioned NMMC. Metro department officials will need to decide how the space can be returned to MNPW or collocated. The MMC will need video, communication, and traffic control electronics and advanced traffic management system (ATMS) software in addition to workstations and conferencing facilities for use during normal operation and emergency/event management activities. Establishing reliable communication to the signal infrastructure along major corridors and significant equipment upgrades, including CCTV cameras and detection, will be key in the success and effectiveness of the new NMMC.

Due to recent world events associated with the COVID-19 outbreak, the importance of remote operation capabilities of MMC's has been amplified. The NMMC should be configured to allow for remote operation when needed. For a Mobility Management Center to be operated virtually, it must be supported with the

appropriate communication and IT infrastructure. If remote operation is considered when initially configuring the NMMC, Metro Nashville will be prepared for virtual operation should the need arise.

NMMC Functionality

The existing NMMC's deficiencies and lack of detection prevents the implementation of more advanced control strategies, such as traffic responsive and adaptive operation to address the needs caused by the ever increasing traffic volumes and special events, as well as the impact that such growth is placing on Metro's transportation facilities. As stated earlier, the NMMC needs substantial capital investments and additional staff to become an effective hub for managing Metro's traffic control assets. Based on our review, interview with Metro's traffic staff, and interviews with peer agencies, Arcadis found an immediate need to hire additional knowledgeable engineering staff who are properly trained, certified, have the expertise/ability to staff and operate a sophisticated system, and who can understand/interpret the data into information that leads to actions. Improvements in staffing and training would have a direct and positive impact on traffic operations and on the Metro's mobility, safety, and environmental sustainability.

Staffing

Based on the findings of the peer review survey, MNPW is severely understaffed in all roles including traffic engineers, signal technicians, and communication specialists. Traffic engineers in the agencies surveyed are responsible for an average of 101 traffic signals. MNPW has one traffic engineer in charge of over 865 traffic signals. MNPW would need to hire eight (8) additional traffic engineers to match the average of the peer agencies surveyed.

Each MNPW signal technician is responsible for 62 traffic signals while the average of local agencies surveyed is 49 traffic signals. MNPW would need to hire four (4) additional signal technicians to match the average of the agencies surveyed.

MNPW will need to hire four (4) to nine (9) MMC operators to staff the NMMC. They currently do not have any staff dedicated to the MMC operation.

Metro ITS will need to hire 1 to 3 ITS Engineers to manage the complex communication networks required for proper communications between field devices and the MMC.

Due to current budget constraints, it is not presently realistic to assume that MNPW will be able to hire additional staff to meet the average of the peer agencies surveyed for each role. However, introduction of any additional staff could have a tremendous positive impact on MNPW's ability to manage traffic and its assets.

NMMC Control Strategies

MNPW's newly upgraded signal controllers and associated central software are capable of operating several traffic control strategies. MNPW currently uses a combination of TBC and TOD strategies to manage traffic in Metro Nashville. We recommend implementing traffic responsive operation so that the signal controllers are able to react to changes in traffic patterns. Since most of Nashville's corridors were retimed between 2016 and 2019, there is already a "library" of plans for the controller to choose from although additional plans will likely be needed to provide optimal traffic responsive operation. Mainline

detection and reliable communication will need to be installed to implement traffic responsive operation. Once installed, system detection could be used to proactively detect changes in traffic patterns due to traffic incidents, road construction, and special events, and select the most suitable plan from the available library of plans. CCTV cameras could be used to confirm irregular events picked up by the system detection and allow operators to make timing adjustments as needed. Additionally, the remote monitoring through the systems and CCTV cameras will allow MNPW staff to more effectively and efficiently address malfunctions, citizen concerns, and dispatch of appropriate resources in addressing maintenance issues.

Operational Practices

The following are immediate and short-term recommendations regarding operational practices that have proven successful among peers. (Approximate cost: $ low to $$$$ high)

- $ - Maintain logs and review of these daily logs to identify failure patterns.
- Upgrade existing vehicle detection to all traffic control assets to manage the demand effectively and efficiently.
    - $ - Phase one - address all inoperable vehicle detection with radar detection.
    - $$ - Phase two - install mainline detection at critical intersections on key corridors.
    - $$ - Phase three - install system detection on vital corridors to allow volume and speed detection for implementation of traffic responsive operation.
    - $$ - Phase four - upgrade remaining intersections to non-intrusive detection for improved operations and maintainability. If the existing loops or video detection are working, they will not be replaced until they fail or reach the end of their service life.
- $$ - Develop a consolidated communication plan using the current Metro ITS Master Fiber Plan and the Metro Nashville Public Works ITS Communication Plan developed in 2007.
- Installation and maintenance of reliable communication to all traffic control assets within MNPW's jurisdiction.
    - $$ - Phase one should be accomplished via cell modems.
    - $$$$ - Phase two is to design and install fiber optics plant. If facilitated by Metro ITS, the fiber can be designed as an expansion of their enterprise network benefiting several Metro Nashville departments, in addition to allowing access to multiple funding sources.
- Upgrade traffic control assets that have reached the end of their service life.
    - $ - Phase one to replace equipment creating frequent maintenance or operational issues (replace signal cabinet, rewire intersection, etc).
    - $$$ - Phase two is upgrade/replace traffic assets that are beyond their expected service life (full signal build).
- Installation and maintenance of traffic monitoring assets along all key corridors.
    - $ - CCTV cameras
    - $ - Travel time sensors
    - $$ - DSRC or C-V2X
- $$$ - Design and full build-out of the NMMC at the Howard School Building location.
- $ - Develop and document Standard Operating Procedures (SOPs).

Equipment Maintenance Practices

MNPW currently performs preventive maintenance annually for each traffic signal under their control. Signal technicians on the night crew are responsible for preventive maintenance. They must inspect approximately 3.5 intersections per night to stay on schedule. This number is determined by dividing the total number of traffic signals (865) by 250 working days a year. The signal technicians on the night crew often get called out to fix equipment failures and signal knockdowns, making it difficult for them to adhere to their preventive maintenance schedule. We recommend dedicating signal technicians to solely performing preventive maintenance and establishing a program to formally document when maintenance was performed at each signal. The following are recommendations regarding maintenance practices that have proven successful among peers.

- Establish a preventive maintenance program that follows similar practices established by the Georgia DOT Regional Traffic Operations Program (RTOP). This includes preventive maintenance of existing field equipment following the schedule included in *Appendix C* of this document.

Collaboration with Other Agencies

In recent years, there has been a great deal of collaboration between internal Metro Nashville departments, which has been financially and operationally beneficial. As previously stated, the initial capital costs to install fiber optic cables for communications are substantial. The cost of installing a trunk line with a larger fiber count is minimal when compared to a smaller cable. Most of the costs for a fiber project derive from utility make-ready and installation costs. MNPW could spread their capital improvement funds by teaming with other Metro agencies such as Metro ITS, Metro Nashville Police (MNPD), and Metro Nashville Fire to share a communications network that benefits all parties involved.

MNPD has an extensive communications network, including CCTV cameras, that has been designed, installed, and maintained by Metro ITS. MNPW currently has an MOU with MNPD allowing MNPW to use MNPD's cameras, limiting duplication of surveillance devices. Emergency services could also benefit from the CCTV cameras installed by MNPW to monitor traffic, providing them additional surveillance coverage. There is also potential for Metro emergency services staff and MMC operators to be collocated in the NMMC to allow coordinated responses between agencies when needed.

There are opportunities for MNPW to collaborate with external agencies within Davidson County, including the Cities of Berry Hill and Forrest Hills. The traffic signals within these agencies' jurisdictions are not under MNPW's control. As Davidson County continues its exponential growth, the need to provide seamless traffic management on corridors crossing jurisdictional boundaries will increase. Coordination will also be beneficial with traffic agencies in neighboring counties. Much of the congestion in Nashville involves commuter demand from adjacent counties. By working with these agencies to manage traffic, the transportation network will operate seamlessly across the region.

RECOMMENDATIONS

Staffing

MNPW is severely understaffed when compared to its peers. Short term, there is a tremendous need to hire additional traffic engineers, signal technicians, and control center operations staff. Long term, additional signal timing engineers and ITS engineer(s) will be needed. It is highly recommended that the MNPW conduct a comprehensive review of its Traffic Engineering staffing plan, job descriptions, and position needs and requirements. Items that should be considered are:

- **Type**: Degreed engineers and trained technicians in intelligent transportation systems (ITS) and traffic
- **Number**: Distribution and number of staff required for the various activities, such as:
    - Design and consultant plan review
    - Timing and field operations
    - MMC operations
    - Maintenance
        - Traffic signals
        - Installation
        - Maintenance
        - Preventive maintenance
        - Flashing beacons (school and advance intersection warning)
        - Reversible lane controllers
- **Licensure/Certification**: Individuals shall be required to have significant experience in ITS and traffic signal hardware through professional engineering licensure/registration or engineer in training certification, or should have their International Municipal Signal Association (IMSA) certification in order to work on Metro traffic signals.

Needs Assessment

Arcadis recommends a thorough and comprehensive needs assessment, including full inventory to identify deficiencies and deferred maintenance. Along with the field inventory effort, a consolidated communication plan should be developed using the current Metro ITS Master fiber plan and the Metro Nashville Public Works ITS Communication plan created in 2007. Once these efforts have been completed, Metro Nashville can associate a realistic dollar value to address the infrastructure deficiencies, develop a plan to address the short-, mid-, and long-term needs, and begin to develop projects and program them in the region's TIP for funding.

Demonstration Project

A demonstration project is proposed to kickstart the transformation of Metro Nashville's traffic assets and traffic control strategies and serve as a model mobility management program. To garner support for initial and future transportation funding dollars, citizens and Metro Council Members must be able to see and experience the benefits of a truly "smart" corridor. After discussing potential project corridors with the

MNPW traffic staff, Charlotte Ave was selected for the demonstration project. Charlotte Ave is a prime candidate due to the availability of existing fiber along a portion of the route, condition of traffic assets, and its importance as a multimodal corridor. The limits of the project were tentatively selected to begin at 7th Ave N and terminate at White Bridge Pike, which includes a total of 39 signalized intersections. The project will include mainline and system detection upgrades, travel time detection devices, DSRC/C-V2X units, CCTV cameras, fiber communication, and partial and full signal rebuilds as funding and schedules allow.

Startup of NMMC

Based on our review and interviews with MNPW traffic staff, several tasks must be completed before commencing the building and staffing of the NMMC. The NMMC will not be effective unless reliable communication to all field assets is in place. Field assets that are beyond their expected service life must be replaced to provide reliable operation. System detection and CCTV cameras must be installed on key corridors to allow for detection of changes in traffic patterns and for corridor surveillance. Once these tasks have been completed, a MMC layout analysis and design should be performed to ensure the NMMC is configured to meet the current and future needs of MNPW. Experienced traffic signal engineers must be hired that can staff and operate a sophisticated system, and who can understand/interpret the data into information that leads to actions. The completion of the NMMC is the final step of the framework needed to allow for a resilient mobility management program in Metro Nashville. The necessity for a complete traffic management facility is apparent today and its need to exist and expand will only increase as Metro Nashville continues to grow.

Program Estimated Capital Costs

The values below are high-level planning estimates meant to serve as a menu for MNPW staff to develop future program capital budgets. The current needs will exceed funding for the foreseeable future. Staff must select from the menu of items to fund the highest priority needs based on the available budget for each year. Funding for both capital and operational programs should be increased in a balanced approach to allow for an effective mobility management program. The benefits of a huge influx of capital funding will be marginalized if additional staff are not available to manage the new assets. Similarly, hiring several new staff without any capital investment would not be an effective use of funds.

Table 1. Example Three-Year Capital Budget

Item	Year 1	Year 2	Year 3	Total
Full detection upgrade	$660,000	$990,000	$990,000	$2,640,000
Partial Detection Up-grade	$500,000	$500,000	$500,000	$1,500,000
Communication	$500,000	$650,000	$650,000	$1,800,000
Mobility Management Center (MMC)	$1,500,000	$0	$0	$1,500,000
Timing and Traffic Responsive	$600,000	$750,000	$750,000	$2,100,000
CCTV cameras	$450,000	$450,000	$450,000	$1,350,000
CAV and New Technology	$400,000	$400,000	$400,000	$1,200,000
Intersection Rewiring	$1,000,000	$1,000,000	$1,000,000	$3,000,000
Total	**$5,610,000**	**$4,740,000**	**$4,740,000**	**$15,090,000**

- Full intersection detection upgrade – $30K x 22 intersections per year = $660K Year 1, 33 intersections per year – Years 2 & 3
- Partial detection upgrade – $20K x 25 intersections per year = $500K per year
- Communications – $500k per node in Year 1, $650k Years 2 & 3
- MMC – $1.5 million in Year 1
- Timing development and TR implementation – $3K per intersection x 200 intersections per year = $600K, 250 intersections per year = $750K (Years 2 & 3)
- CCTV installations – $6K per node x 75 locations per year = $450K

- Connected vehicle and new technology testing – $10K per location x 40 locations per year = $400K
- Intersection rewiring – $50K per intersection x 20 intersections per year = $1 million

Program Estimated Operational Costs

The values below are high-level planning estimates meant to serve as a guide for MNPW staff when developing future program operational budgets. As stated above, funding for both capital and operational programs should be increased in a balanced approach to allow for an effective mobility management program. The benefits of a huge influx of capital funding will be marginalized if additional staff are not available to manage the new assets. Similarly, hiring several new staff without any capital investment would not be an effective use of funds.

Table 2. Example Three-Year Operational Budget

Item	Year 1	Year 2	Year 3	Total
Traffic Engineer	$100,000	$200,000	$400,000	$700,000
Signal Technician	$100,000	$200,000	$250,000	$550,000
MMC operator	$0	$0	$350,000	$350,000
Metro ITS Engineer	$100,000	$200,000	$300,000	$600,000
Cellular modem data plans	$8,500	$17,000	$25,500	$51,000
Equipment Software Licenses	$50,000	$50,000	$75,000	$175,000
Total	**$358,500**	**$667,000**	**$1,400,500**	**$2,426,000**

- Hire Traffic Engineer – $100K/year per engineer – Add one position Year 1, add additional position Year 2, add two additional positions Year 3
- Hire Signal Technician – $50K/year per technician – Add two positions Year 1, add two additional positions Year 2, add one additional position Year 3
- Hire MMC operator – $70K/year per operator – Add five positions in Year 3, assuming MMC is commissioned at that time
- Hire ITS Engineer – $100K/year per engineer – Add one position Year 1, add additional position Year 2, add two additional positions Year 3
- Modem Data plan – $34 per month – Install 250 cell modems per year – $8,500 per year
- Equipment Software Licenses – $50k in Year 1, $50k in Year 2, and $75k in Year 3

ADDITIONAL DETAILS ON STAFF POSITIONS & ROLES

MNPW will need a variety of staff positions and roles to adequately operate and maintain its traffic signal system. The number and roles of each position described below are based on information from similar peer agencies in addition to relevant Institute of Transportation Engineers (ITE) and Federal Highway Administration (FHWA) literature.

Some of the positions and their respective roles include:

- Traffic Signal Engineer: Responsible for the day-to-day operations of the signal system. Their tasks may include:
  - Responding to public comments
  - Approving new signal turn-ons
  - Assisting in the MMC
  - Evaluating signal timing on existing arterials
  - Managing signal operations staff
  - Coordinating with the signal design and maintenance supervisors
  - Advising NMMC operators on traffic signal operation strategies and active changes
- Traffic Signal Technician/Analyst: Assists the Traffic Signal Engineer with their day-to-day operations. Focus areas include:
  - Signal timing
  - New signals
  - The MMC
- Intelligent Transportation Systems (ITS) Engineer: Responsible for the implementation of ITS projects. Their tasks may include:
  - Responding to public comments
  - Evaluating new products
  - Assisting in the MMC
  - Managing ITS contractors and vendors
  - Coordinating with signal design and maintenance supervisors
- Traffic Signal Maintenance Technician: Generally responsible for troubleshooting and maintenance of the physical traffic signal equipment.
- Electronic Specialist: Responsible for the complex electronic equipment at the heart of the signal system. Their tasks may include:
  - Closed circuit television system repair, field and central system
  - Fiber optic cable system testing, repair, termination
  - Traffic control center systems maintenance and repair
  - Traffic signal controller electronics testing repair and inventory
  - Other ITS devices repair
- MMC Operators: Responsible for observing the traffic conditions, responding to incidents that occur in the field, and providing support to emergency services and even working with police on security efforts. Their role is critical to the rapid response and resolution of the situation.
- Public Relations Coordinator: Responsible for fielding communications with the public, coordinating with the Traffic Signal Engineer and Technician on responses, and marketing the MMC, incident management plan, and traffic signal operations to the public. Depending on

funding availability, this position could be a full-time position or these tasks might be passed on to the Traffic Signal Engineer and Technician.

The ITE Traffic Control System Operations manual suggests that a traffic signal system should have one traffic engineer per 75-100 traffic signals and one signal technician per 40-50 traffic signals or other field devices. A National Cooperative Highway Research Paper (Synthesis 245) also suggests 38 to 43 signals per technician.

The ITE manual also provides staffing guidelines for a continuously operated MMC which includes one center manager, two supervisors, and five system operators. This decision depends on funding and how much of an active role MNPW wants to engage in with active management and control of other activities along with TDOT, the MNPD, and other agencies.

Current literature provides limited guidance on staffing for complex traffic signal systems that include a multitude of components ranging from traffic signals to various detection technologies to ITS devices to incident management plans and a MMC. With the above limitations in mind, the table below, adopted from the FHWA office of operations, provides general guidelines on staffing needs for a traffic signal system as it relates to signal retiming and signal systems maintenance.

Table 3. Staffing Guidelines based on Number of Traffic Signals

Position	501 to 1000 Traffic Signals
Traffic Signal Engineer	5 to 10
Traffic Signal Analyst/Technician	3 to 5
Intelligent Transportation Systems Engineer	1 to 3
Traffic Signal Maintenance Technician	17 to 33
Electronic Specialists	4 to 9
MMC Operators	4 to 9
Public Relations Coordinator	2

APPENDIX A

Nashville Mobility Management Center Peer Review Findings Matrix

APPENDIX A – SUMMARY OF PEER REVIEW FINDINGS

The following matrix provides a high-level summary of the assets and operations for each of the peer review agencies interviewed for this study. Based on the findings of the peer review survey, MNPW is severely understaffed in all roles including traffic engineers, signal technicians, and communication specialists. Traffic engineers in the agencies surveyed are responsible for an average of 101 traffic signals. MNPW has one traffic engineer in charge of over 865 traffic signals. MNPW would need to hire eight (8) additional traffic engineers to match the average of the peer agencies surveyed.

Each MNPW signal technician is responsible for 62 traffic signals while the average of local agencies surveyed is 49 traffic signals. MNPW would need to hire four (4) additional signal technicians to match the average of the agencies surveyed.

Currently, 85% of MNPW's signals are communicating back to their Centracs management software, although much of the communication is not reliable. On average, 96% of the peer agencies' signals had communication.

MNPW coordinates with WeGo Public Transit and MNPD to manage special event traffic. Most of the agencies surveyed coordinate with their local transit agencies and emergency services.

Metro currently has no functional CCTV cameras capable of monitoring traffic operations that are communicating back to the NMMC. When compared to its peers, Metro has the lowest percentage of active functional CCTV cameras for the purposes of monitoring. The agencies surveyed had an average of 398 CCTV cameras available to them for monitoring traffic operations.

MNPW's traffic control strategy consists of Time Based Coordination and Time of Day while a majority of the peer agencies use traffic responsive and adaptive operation as well.

MNPW does not currently have active plan selection due to incidents except for some event plans for the interchange of Old Hickory Blvd and I-65, which are coordinated with City of Brentwood. All peer agencies except for the City of Atlanta currently use active plan selection for incidents.

MNPW's annual capital improvement and operational budget has not been consistent in the past and will need to be increased to support the hiring of additional staff and provide needed infrastructure upgrades. It is difficult to determine an average annual operation budget for the peer agencies surveyed because the values of their staff salaries varied. The peer agencies annual operation budgets are considerably larger because they have additional staff when compared to MNPW.

Communication and preventive maintenance practices were very similar amongst MNPW and other peer agencies.

		Nashville	Atlanta	Cobb County	Charlotte	Los Angeles	Utah	Anaheim	GDOT - RTOP	Denver	Orlando
General Information	Population of Jurisdiction	684,000	487000	757,000	872,000	4,000,000	3,161,000	352,000	N/A	716,000	286,000
	Hours of Operation	6 am-3 pm M-F	815 am-5 pm	6 am-6 pm M-F	630-930 am 330-700 pm	6 am-7 pm M-F, wkends / evenings, special events as needed	7 am-7 pm M-F, weekends/evenings as needed	7 am-6 pm, plus special events	6 am-7 pm, Emergency Operation, plus special events	5:30 AM - 7PM , plus special events	24 hrs, 7days
	# Staff - Traffic Engineers	1	7	8	16	37	10	4.5	22	6	8
	# Staff - Signal Technicians	14 Signal / 8 Const	20 sig - 2 lights	17	26	?	25	7	10 + Contractors	13	15
	# of Traffic Signals	865	1000 (130 / 870 RTOP)	555	849	4777	1253	400	720	1229	490
	# Flashing Beacons (School/Warning Flashers)	460	120	218	245	Unknown, managed by Public Works Dept.	Unknown	20	N/A	60	68
	# Signals Communicating	85%	100%	85%	92%	100%	99%	90%	100%	100%	96%
	Signal Backup Battery Systems?	some	yes	yes	No	yes	yes	No	yes	yes	yes, at 13 intersections
	You Maintain Street Lights	No	Yes	No	No	No	Managed by the Cities and it is a big issue	No	No	No	No
	Coordinate w/ Transit or Emergency Services?	Yes to Transit, MNPD manages Special Events	yes, fire	Yes	yes to both; 784 intersections	yes to both, 1,500 signals have TSP/ EVP	yes, priority is given for LRT and BRT transit	No	yes	Yes, with the Regional Transportation District (RTD) + Emerg. Services	yes to both
Functional Requirements	# of CCTV Cameras	5	200	250+	457+ 125 Police CCTV	700+	450+, and 220 RWIS	200+	284	544	150
	Travel Time and Demand Detection Monitoring?	Some BlueTOAD	no	yes, 150 BlueTOAD	no	volume, occupancy, and derived speed	no	yes	yes, BlueToads	Yes, also air quality sensors	yes, BlueMac
	TBC, TOD, TR, or Adaptive?	TBC, TBD	TOD, TBC	TBC, TOD, TR, and Adaptive	TBC, TBD	TBC, TOD, TR, and Adaptive	TOD, SCATS, TR	TBC, TOD, Adaptive	TBC, TBD, TR, and Adaptive	TBC & TOD, evaluating Adaptive	TBC, TOD and Adaptive
	How Often are Timings Adjusted?	As needed, major retiming every 4-5 years	3-5 years	3-5 years	2 years	as needed, determined by engineers or online system	3 years	4-5 years	3 years	3-5 years	annually
	Active Plan Selection Due to Incidents?	Some event plans for OHB @ I-65 / Coordinated with City of Brentwood	✗	✓	✓	✓	✓	✓	✓	✓	✓
Operations	Year Opened	1995	1976	1996	1978	1984	1999	1989	2010	2000	2001
	Use and Track Performance Measures?	no	no	no	no	yes	yes	No	yes	yes	yes
	Source of Funding	general funds	general funds	general funds	general funds	mixed (Federal/State)	general funds	general funds	federal funds	mixed (Local/Federal)	general funds
	Annual Operation Budget	$700,000 + Staff Salaries	staff salaries	$430,000	$8,500,000	staff salaries	$5,000,000	$1,400,000	$12,000,000	$120,000 + staff	$900,000 +staff
	Annual Capital Budget	varies	Varies	$330,000	$2,770,000	varies	varies	$525,000	varies	varies	varies
	Use SOPs?	yes	yes	yes	no	yes	yes	Under Development	yes	yes	yes
	Interact w/ Citizens and Public?	Twitter, Facebook, phone, & email	phone	Twitter, Facebook, phone, & email	not much, except send alerts out to media	Phone, email and LADOT's website	through 511 channels	telephone and internet	through 511 channels	Phone, email, City's PR team for news releases	phone, emails, website, twitter, SeeClickFix app
Maintenance	Preventative Maintenance Cycle for Field Equipment	12 months	none	12 months, but running ~ 18 months	cabinets 12 months, everything else 18 months	Not Provided	12 months for ground devices and 24 months for aerial	monthly visit to each intersection	Bi-monthly cabinet checks, ground level twice yearly and aerial is annually	Not Provided	12 months

APPENDIX B

Nashville Mobility Management Center Peer Review Questionnaire

Mobility Management Center (MMC)

Peer Review Questionnaire

An examination of the capabilities and functional operations models of peer Traffic Operation Centers

1. Functional Requirements
    a. Monitoring
        i. CCTV monitoring
        ii. Travel time and demand detection and monitoring
            1. Is this information actively used to change control strategies
        iii. Others such as environmental sensors
        iv. Traffic Signal System
            1. Controller communication
            2. Cabinet monitoring
        v. Street lighting
        vi. Flashing Beacons (School Zone / Intersection Warning Flashers)
            1. Approximate number of beacons
            2. Who maintains and are there separate resources?
        vii. Are there standard SOP developed
    b. Active Management
        i. TBC, TOD, TR, or Adaptive
        ii. How often do you adjust your timings and do you have a signal timing maintenance program
        iii. Active plan selection due to special events and incidents
        iv. Active management during pre-planned large events such as sporting events
2. General Information
    a. How many total signals are within the jurisdiction?
    b. How many signals are communicating back to the MMC?
        i. What are the methods of communications
    c. Number of CCTV
    d. Number of other devices
    e. Street lights – Who maintains and are there separate resources
    f. Flashing Beacons (School Zone / Intersection Warning Flashers)
        i. Approximate number of beacons
        ii. Who maintains and are there separate resources?
    g. Do you use BBS
    h. Methods of detection – loops, non-intrusive, probes, etc. (you may say all)
    i. Is any data purchased or provided by from an outside party?

3. Staffing
    a. Total number of engineers
        i. Signal operations
        ii. Signal design/studies/permits
        iii. Other engineers
        iv. MMC Operations

    b. Technicians
        i. MMC Operations
        ii. Signal maintenance
        iii. Signal Constructions
        iv. Bench Technicians
        v. Warehouse Staff
        vi. Street lighting
    c. Does the MMC coordinate with any transit or emergency agencies for signal priority?
    d. Are there interagency agreements other city departments or neighboring jurisdiction?
        i. Joint use of communication infrastructure
        ii. Joint use of signal infrastructure
        iii. Joint operation
        iv. Shared contract and resources

4. Concept of Operations Identification
    a. What is the size of the jurisdiction: population? Square miles? Linear miles of road?
    b. What are the hours of operations?
    c. What is the staffing during peak and non-peak hours, and what is the breakdown of staff in engineering, technician, operators
    d. Do you track MMC activities (performance measures) if so are they defined.
    e. How long has the MMC been in operation?
    f. What is the source of funding for the MMC?
    g. What is the total annual operating budget?
        i. How much is for operation
        ii. How much is spent on outside services (consultants)
        iii. How much is spent on maintenance
    h. What is the total annual capital budget?
    i. Is the staffed with municipal staff or is the work contracted out?
    j. Is staffing different at peak vs. non-peak hours?
    k. Does the MMC have standard operating procedures (SOPs)? Can we get a copy?
    l. How does the MMC interact with citizens and the public (i.e.: website, app)?

m. What is the reporting process for the MMC such as:
    i. Number of incidents identified
    ii. Response and active management of events
    iii. Number and type of tickets generated and handled
    iv. Number of malfunctions identified and effectiveness in response
n. How are special events handled?

5. Maintenance Program Identification
    a. How is the MMC maintained? (please describe routine and upgrade cycles)
        i. Software of all kind
        ii. Hardware – consoles, computing, electronics
        iii. Communications electronics
        iv. Visuals and displays
        v. Furnishing

6. What is your preventative maintenance cycle for the field equipment?

APPENDIX C

Nashville Aerial & Traffic Signal Preventative Maintenance Checklists

Nashville Aerial Preventative Maintenance Checklist

Metro Nashville PUBLIC WORKS

Main Street:_____ Date: _____

Side Street: _____ TECH's Name: _____

CCTV Camera Location:_____

Aerial Maintenance:

	Check all poles for damage and/or dry rot		Check overhead signs/hangers for potential damage to field wiring; adjust/relocate as needed. Note corrective action below.
	Check for the presence of down guy(s) positioning and tension		Verify the signal head heights are 17'min/19'max. Adjust if needed and note corrective action below.
	Verify attachment of all conduits on poles		Check pedestrian signal heads for proper orientation/condition; replace/repair as needed. Note corrective action below.
	Check for loose field wiring/fiber hanging from the span; re-attach as needed Note corrective action below		Document if any trim tree limbs are obscuring signal indications
	Visually inspect all signal heads and hardware & back plates		Verify that all cabling and harnesses are securely attached
	Check retroreflective tape on back plates; add tape if Non-existent. Note corrective action below.		Check that all overhead hand hole covers are present with watertight seal; reseal as needed. Note corrective action below.
	Replace burned out lenses, bulbs or LED inserts Note corrective action below and list color, phase, and head location of replacements		Clean IVDS / CCTV camera lenses / domes
	Clean signal displays		Visually inspect mounting devices on camera and poles
	Check signal head electrical connections; tighten all terminals/tape as needed		Verify CCTV functions/operation by calling NTCC operator to check camera.
	Are signals aligned with travel lanes and properly aimed? Yes / No (Note Corrective action below)		Check spans along the corridor for loose fiber enclosures / snowshoes / cable and overhead loop lead-ins (assume limits to set back loops)
	Are 5-section signals aligned over lane striping or right edge of hatching? Yes / No		Check radio aerial-surge-suppression and install if non-existent. Remove surge suppression if existing in the cabinet once aerial surge has been installed.

Corrective actions taken and materials used

On back of this form, list other corrective measures that cannot be fixed during the PM visit but should be scheduled for repair.

Nashville Traffic Signal Preventative Maintenance Checklist

Metro Nashville PUBLIC WORKS

Main Street:_____ **Date:**_____

Side Street: _____ **TECH's Name:** _____

CCTV Camera Location:_____

Ground Level Maintenance:

	Check lock operation on cabinet (Signal, CCTV and BBS)		Check cabinet to base for waterproof seal, apply sealant as needed
	Clean all cabinet inside and out		Check BBS controller Online / Offline
	Check operation of cabinet fan and light		Inspect condition of BBS wiring and batteries Document battery % capacity if known
	Replace cabinet filters		Visual inspect pavement condition and sealant around loops / leads
	Circle phases in use 1 2 3 4 5 6 7 8 9 OLA OLB OLC OLD		Visual inspect pull box lids for damage / water intrusion
	Circle lanes of detection in use 1 L R C, 2 L R C, 3 L R C, 4 L R C, 5 L R C, 6 L R C, 7 L R C, 8 L R C		Check all steel poles for proper grounding
	Check for controller Data Key Yes / No		Check all vehicle signal indications
	Circle Failed / Faulted detectors 1 L R C, 2 L R C, 3 L C R, 4 L R C, 5 L R C, 6 L R C, 7 L R C, 8 L R C		Type of vehicle indications: LEDs, Incandescent bulbs, Combination
	Circle additional type of detection and phase in use: Video / Radar - 1 2 3 4 5 6 7 8		Are 5-section heads aligned over lane striping or right edge of hatching? Yes / No
	Communications: Online / Offline		Are signals aligned with travel lanes? Yes / No
	Type of interconnect: Fiber SM / Fiber MM / Copper / Wireless / Other		Check all pedestrian signal indications
	Tighten screws and lugs including electrical connections		Type of pedestrian indications: Count Down, LEDs, Incandescent bulbs, Combination
	Verify that all cabinet field wires are properly labeled		Peds in use P-2, P-4, P-6, P-8, P-9, other
	Apply ant / rodent control if needed		Check all pedestrian push button operation
	Review cabinet log for previous detector resets and troubleshoot faulted loops		Check pedestrian sign/button assembly for proper orientation and alignment
	Log PM inspection in the cabinet log sheet/ book		Check for presence of R1-2 Yield signs behind channelized islands
	Test cabinet grounding (<25 ohms) and note value		
	Cabinet type: Pole Mount / Base Mount Serial#:		Controller type: Econolite Cobalt Serial#:

NOTES:

Arcadis U.S., Inc.

3200 West End Avenue

Suite 500

Nashville TN | 37203

Tel 629 255 0018

www.arcadis.com

Appendix 4 – Cost Benefits by HDR

Metro Nashville Transportation Plan

December 2020

Source: The Tennessean

Metro Transportation Plan

Benefits of Conceptual Transportation Investments

DRAFT
09/25/2020

Metro Transportation Plan

Traffic, Multimodal & Safety

- Sidewalks (current backlog/prioritization)
- State of Good Repair
- Jefferson Street Multimodal Cap / Connector
- Restoration, Resiliency & Partnership Funds
- Safety/Vision Zero/Traffic Calming
- Active Transportation/Bikeways/Greenways
- Traffic Management Systems/Signal Upgrades

Transit

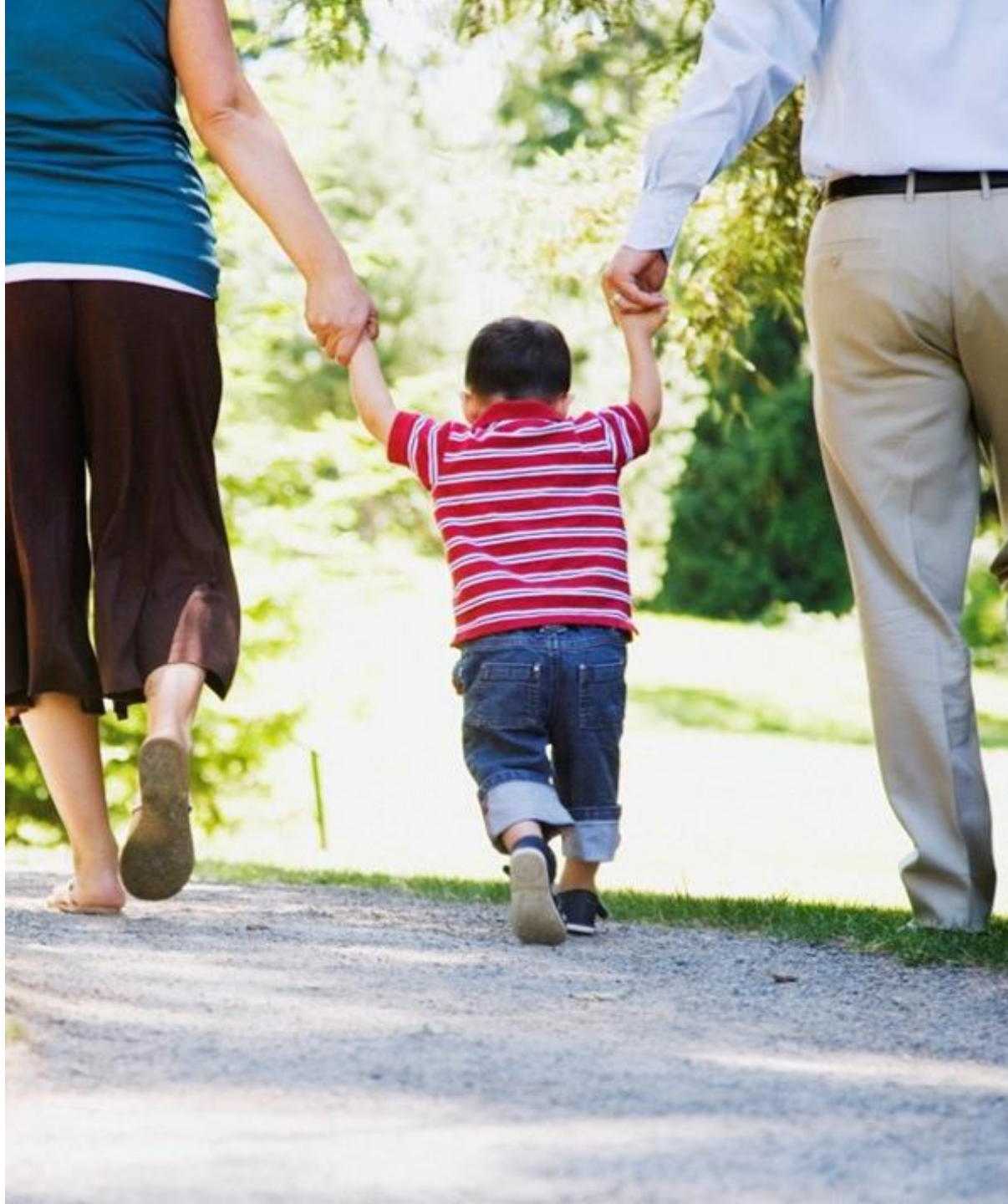
- Better Bus Service Enhancements/Redesign
  - Neighborhood and Regional Transit Centers
  - Downtown Transit Priority
  - Bus stop and shelter improvements
  - Best Value Fare Capping Program
- Murfreesboro Pike Bus Rapid Transit
- Clarksville Pike Rapid Bus
- WeGo Star Improvements

Traffic, Multimodal & Safety Improvements

Sidewalks - $200M in Funding

Current backlog & prioritization

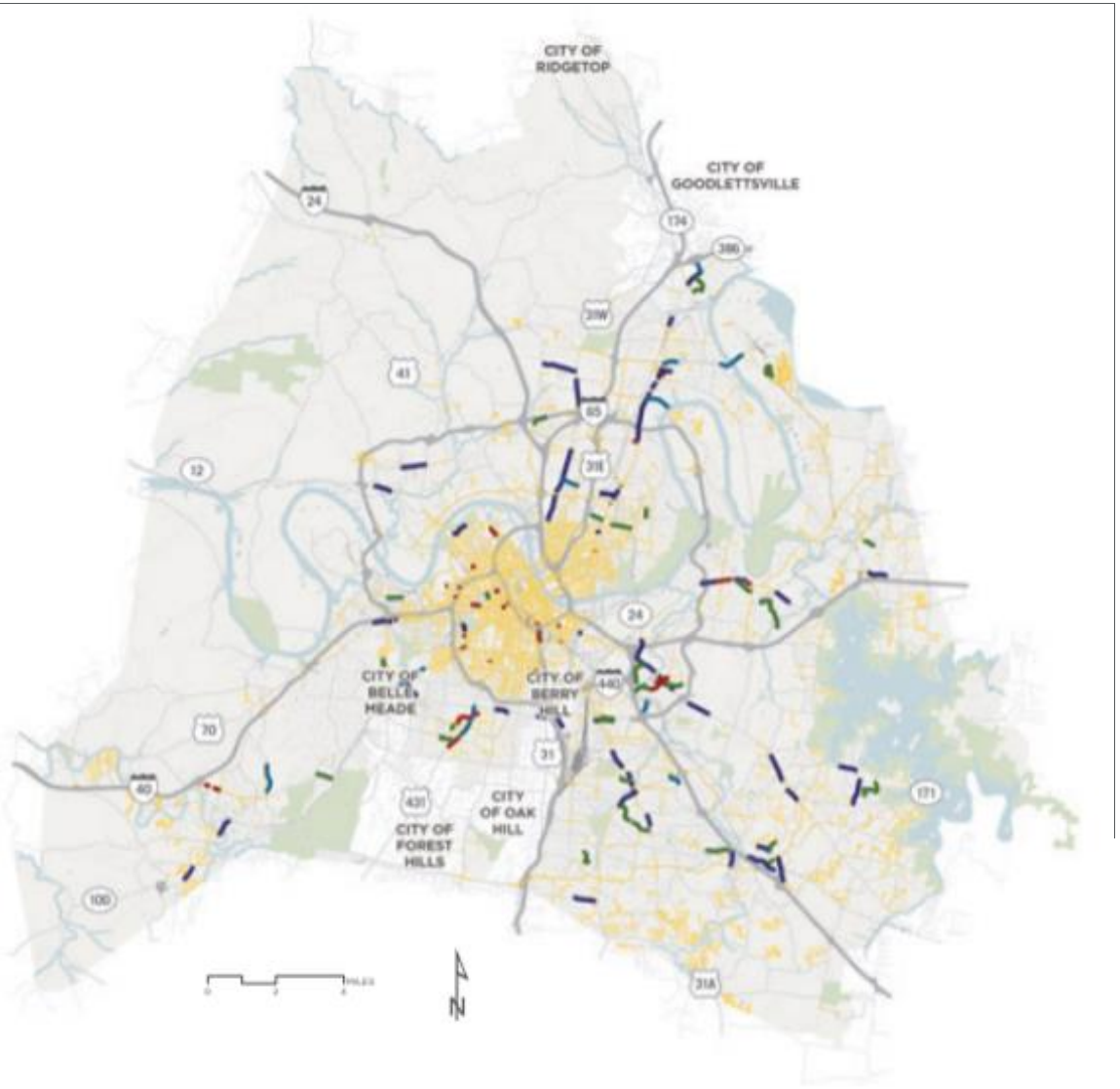
- Will address 80% of new priority sidewalk needs across Davidson County and 40 miles of sidewalk
- Consistent with WalknBike Plan



Sidewalks

Potential benefits

- Improved public safety by providing new pedestrian facilities in Davidson County neighborhoods where sidewalks do not currently exist
- Health benefits for new walkers
- Improved connectivity to pedestrian network



Source: WalknBike Plan, pg. 135

State of Good Repair - $200M in Funding

- Cover current gap in fully funding the annual paving & sidewalk repair budgets
  - Address the backlog of paving needs and needed culvert/bridge repairs
    - 1,800 lane miles of paving
    - High priority culverts/bridges addressed, including 5 weight-restricted bridges
  - Bring approximately 30% of non-ADA compliant sidewalks into compliance across neighborhoods
    - 120 miles of ADA-compliant sidewalks

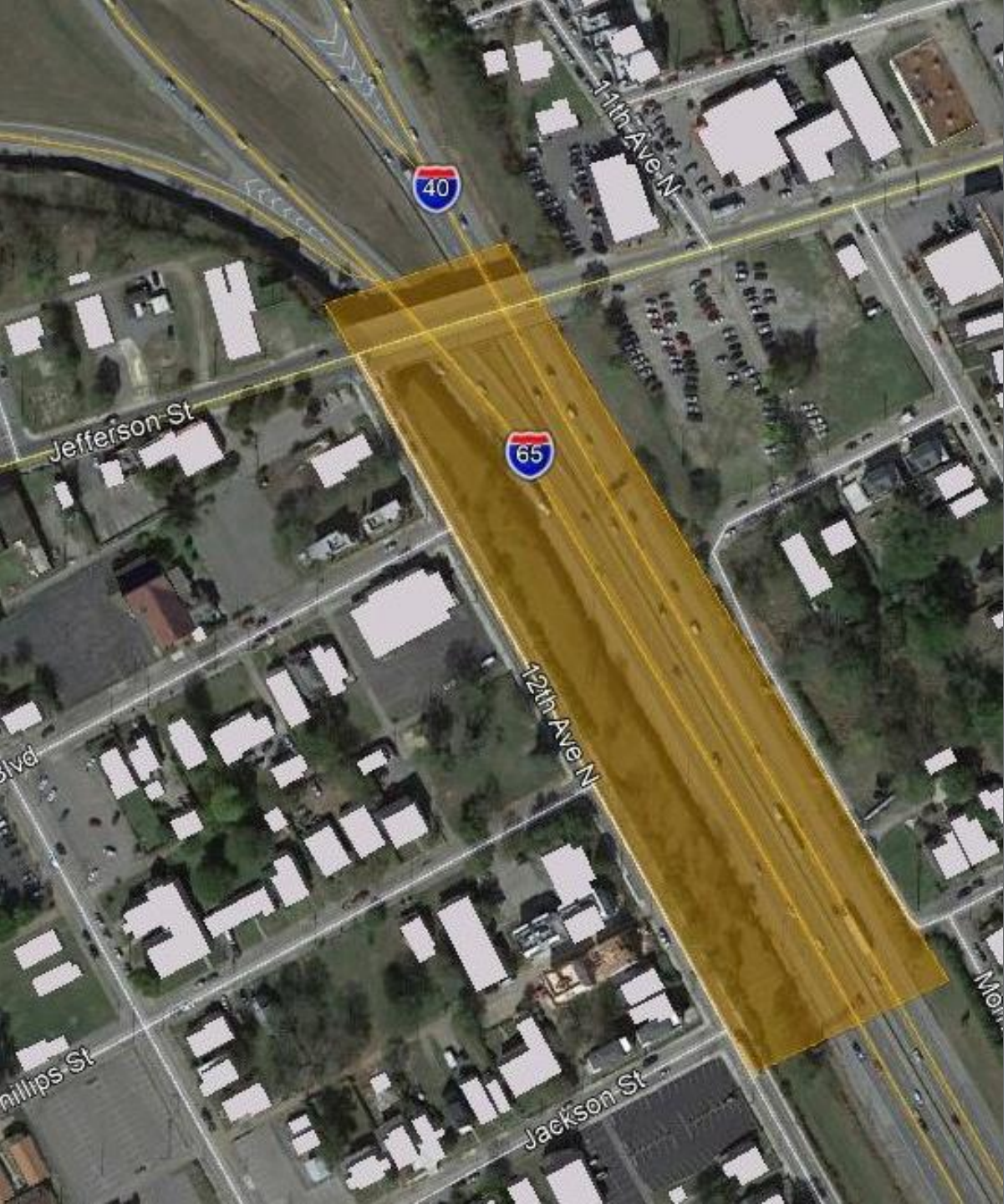
STATE OF GOOD REPAIR

Potential benefits

- Paving
  - Potential to reduce longer term O&M for roadways
- Culverts/Bridges
  - Reduced travel time and vehicle operating costs associated with truck detours to avoid weight-restricted structures
- ADA-compliant sidewalks
  - Improved accessibility
  - Public safety

Source: The Tennessean

Source: Alta Planning



Jefferson Street Multimodal Cap/Connector - $175M in Funding

- 8-acre cap over I-65/I-40 to reconnect the neighborhoods that were divided by the construction of I-16/I-40
  - Jefferson Street bridge over I-40 carries approximately 14,000 vehicles/day
  - Bridge built in 1967, last inspected in 2013 – good condition
  - Narrow, cracked sidewalks and 24' wide travel lanes create hostile pedestrian environment on this bridge

Source: Google Earth/HDR

Jefferson Street Multimodal Cap/Connector

Potential benefits

- Provides opportunities to reconnect bifurcated neighborhoods
- Expands access to social and economic activities
- Creates opportunity for affordable mixed-use office, retail and housing development
- Yields opportunity for micromobility investments and safety improvements
- Generates economic value through placemaking investments with social connectivity, green space, and mixed-use investments

Source: USDOT Ladders of Opportunity Every Place Counts Design Challenge

Klyde Warren

Dallas, TX

- $110M project catalyzed $1 billion in new development in downtown Dallas
- Estimated $2.5B economic impact in Dallas
- Construction funded by P3, privately operated
- Connects Dallas' Uptown neighborhood with Arts District and downtown business center
- 6,000 SF restaurant, performance stage
- Connects with M-Line streetcar

Cap at Union Station

Columbus, OH

- $7.8M retail development project spurred 9 retail shops and restaurants, 25,496 SF of leasable space
- P3 – one of the first speculative retail projects built over highway
- Connects Columbus downtown with Short North arts and entertainment district (1990s redeveloped)
- Appeased FHWA by leasing platform to developer for $1 per year; if buildings sold, city receives 10% of the sale
- ODOT can close down and evacuate the Cap in case of emergencies

Capitol Crossing

Washington, DC

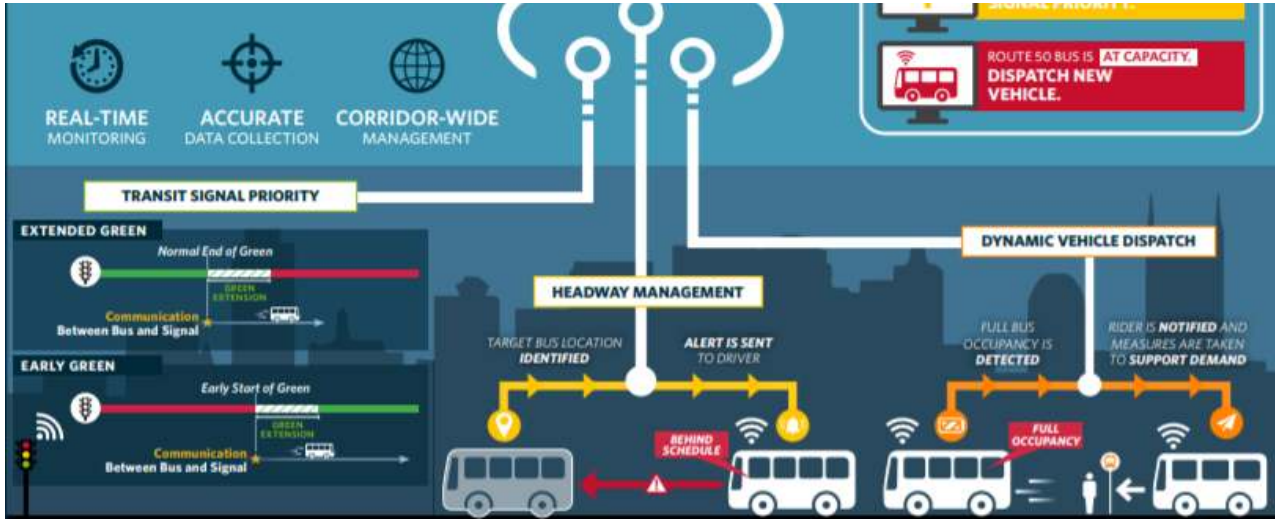
- $200M platform over I-395 spurring $1.2B multi-phase development of 2.2 million SF
- Economic impact of 8,000 permanent jobs and $40M in tax revenue
- Privately funded
- Connects Capitol Hill and East End
- 50/150 residential units affordable housing
- DC's first "eco-district"

Cap Projects Often Involve Public Private Partnerships

- May reduce the public's financial investment
- Incentives to developers may include tax rebates, reduction of City fees and utility fees, reduced parking requirements, etc.
- Helps to diversify interest in the area
- May inspire other housing and mixed-use developments in the area

Restoration & Resiliency, State Routes, Partnership Funding, and Innovation & Sustainability Corridors (MLK/Charlotte, Gallatin) - $117M in Funding

- Supports ongoing infrastructure restoration and resiliency efforts in areas hardest hit by recent storm events
- Supports future partnerships with TDOT on needed State Route/Interstate improvements
- $7M for MLK/Charlotte Avenue Innovation Corridor & Gallatin Sustainability Corridor

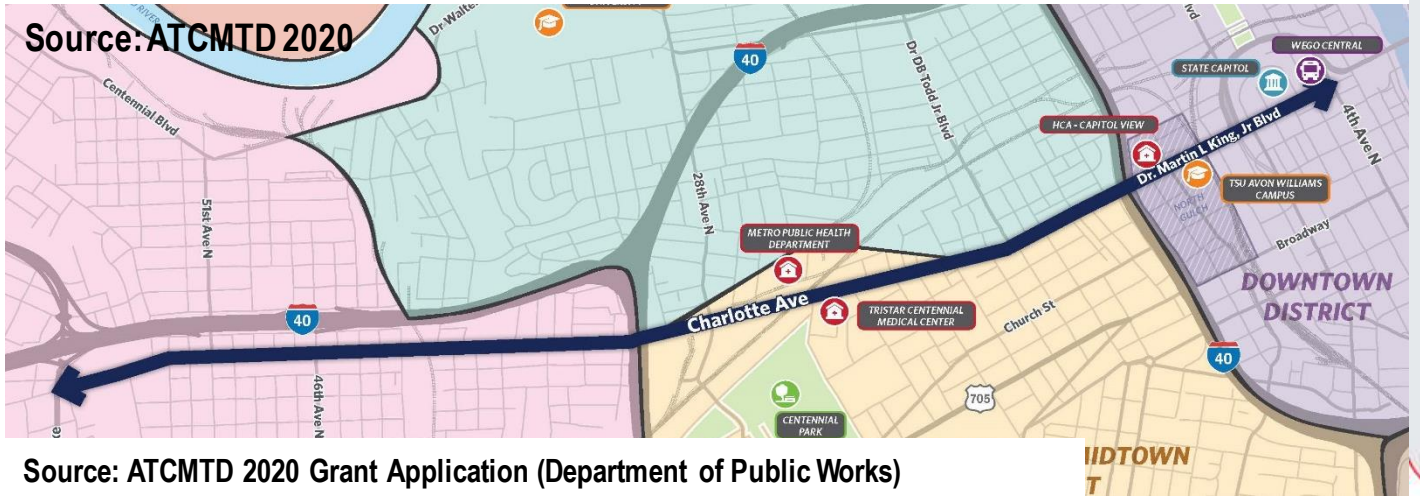


Innovation & Sustainability Corridors (MLK/Charlotte, Gallatin) - $7M in Funding

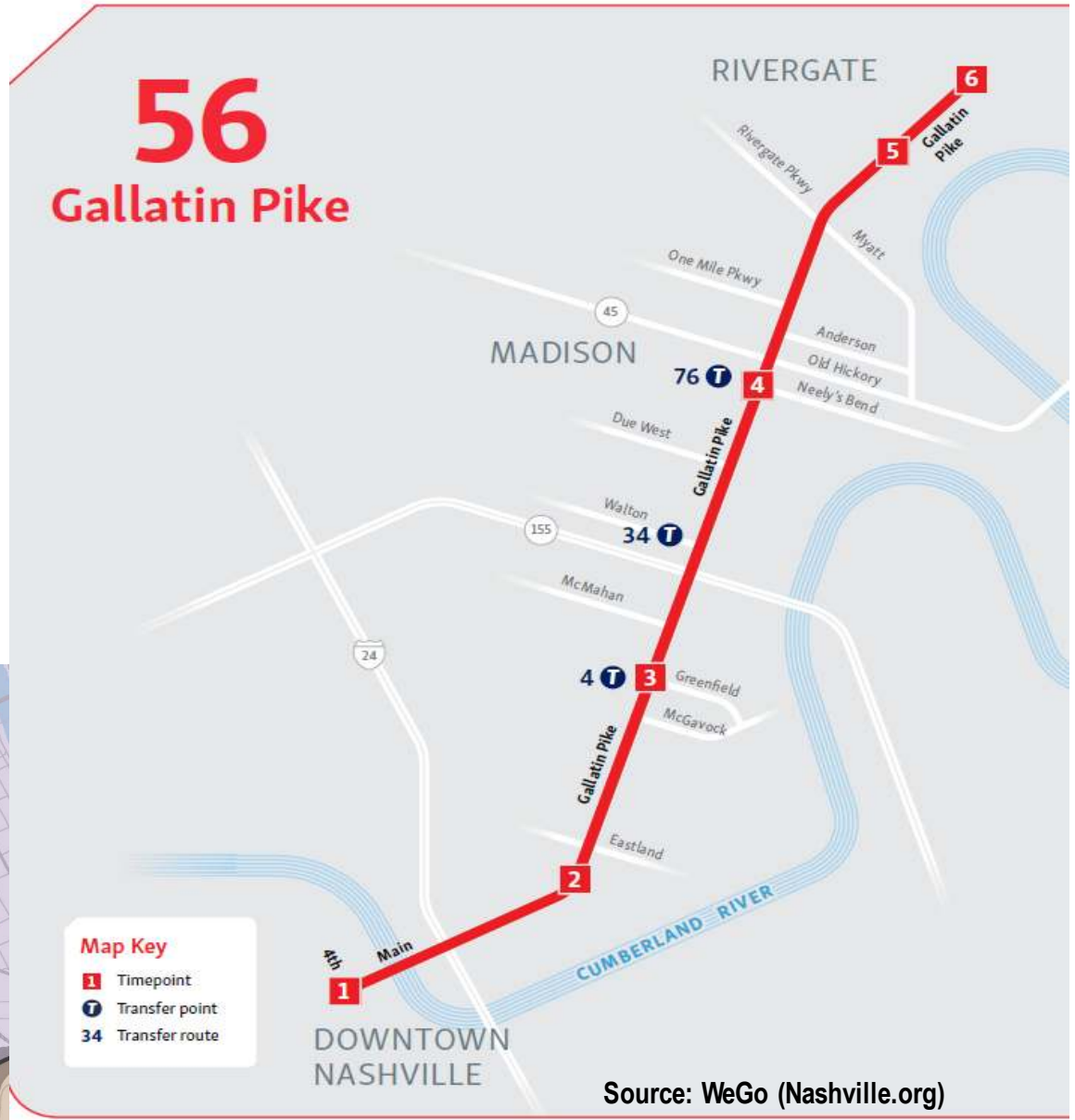
Source: WeGo

Project elements may serve as "living lab" for technology and sustainability pilots through:

- Smart signals and crosswalks
- Connected, Autonomous, Electric Vehicles (CAEVs)
- Green and solar powered infrastructure
- Transit, bike and pedestrian improvements
- Solar powered facilities and cool street pavement
- Native plant landscaping and stormwater management



Source: ATCMTD 2020 Grant Application (Department of Public Works)

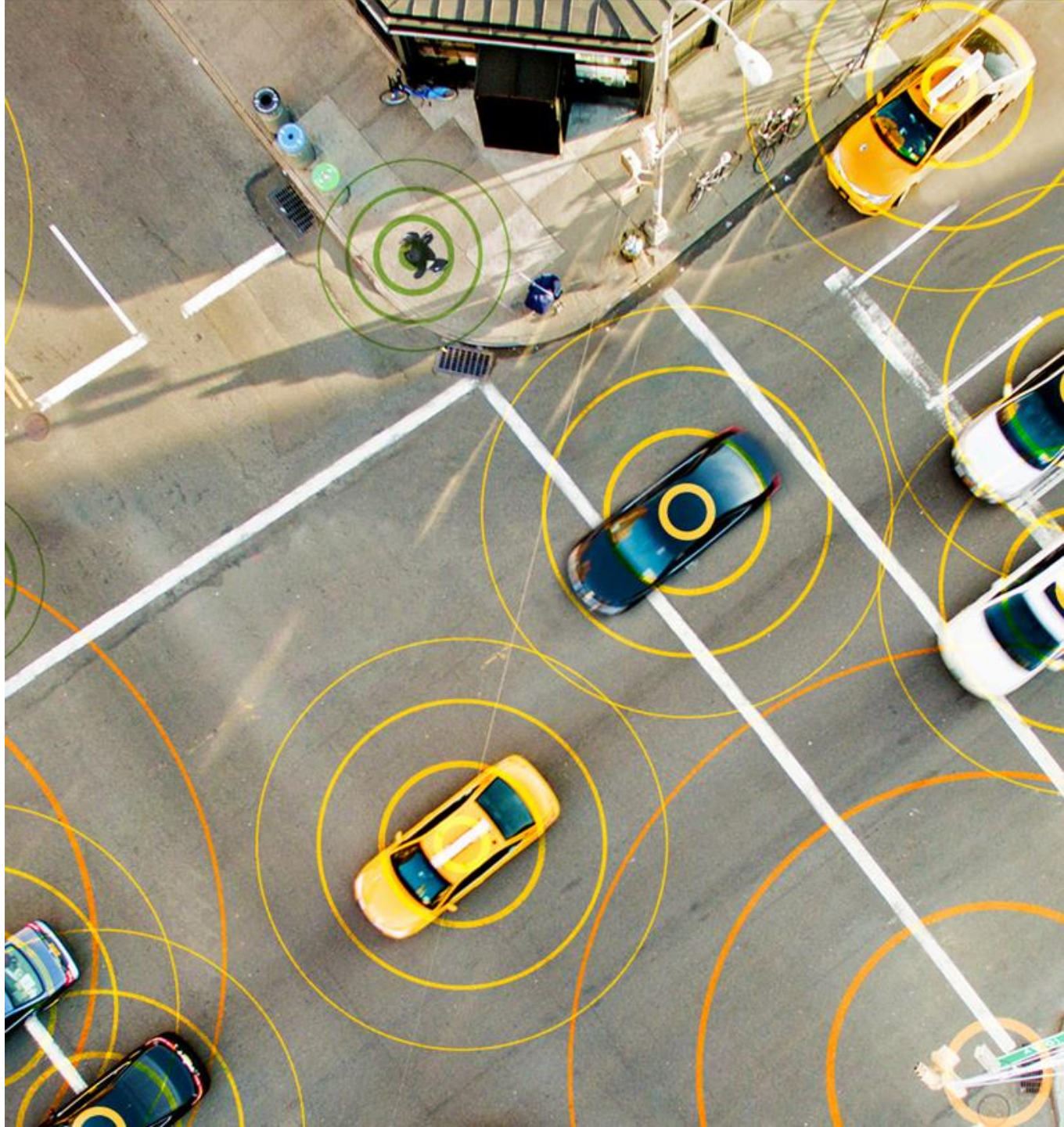


Source: WeGo (Nashville.org)

MLK/Charlotte, Gallatin

Potential benefits

- **Crash reduction due to technology improvements and AVs, eliminating:**
  - One fatality → $9.6 million in public benefits
  - One severe injury → $2.5 million in public benefits
  - One Property Damage Only crash → $4,000 in public benefits
- **Time and fuel savings associated with technology improvements:**
  - Reducing a single commuter's time by 10 minutes/day saves a workweek of time (40 hours/year)
  - Mode shift to transit can save a household nearly $10K by living with one less car
- **Benefits of reduced emergency response time generated**
- **Green infrastructure may reduce energy costs and lower temperatures**



Example Project

NORTH AVENUE SMART CORRIDOR

Atlanta, GA

- Dynamic adaptive signal control
- Video detection systems
- Thermal imaging and video cameras for pedestrian and bicycle detection
- Vehicle to infrastructure communications
- Restriping to support crash reduction and future acceptance of autonomous vehicles
- Emergency preemption

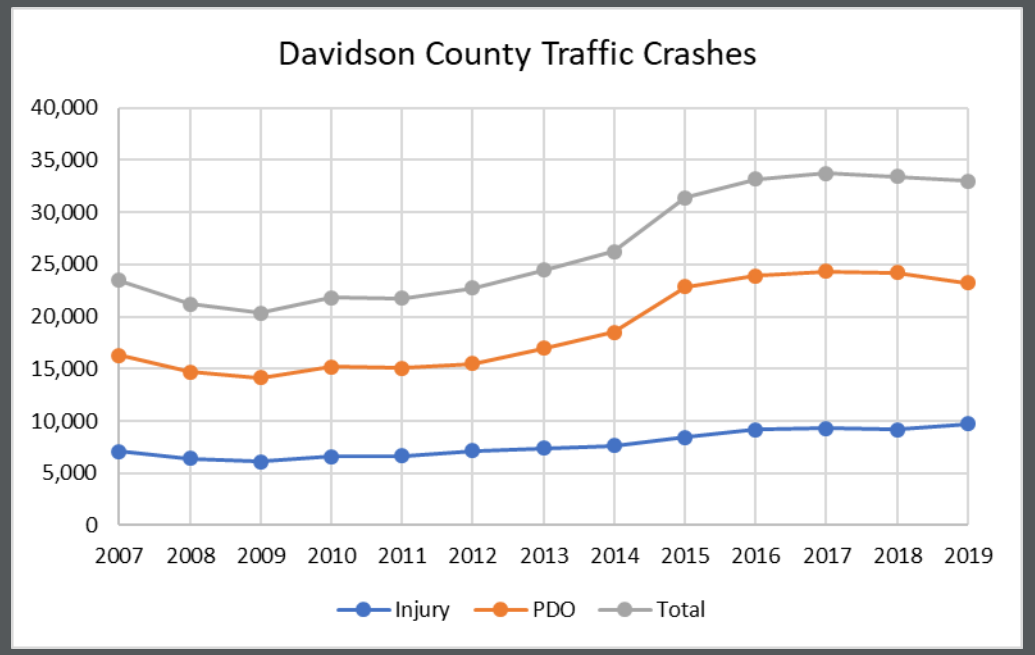
Safety / Vision Zero / Traffic Calming - $75M in Funding

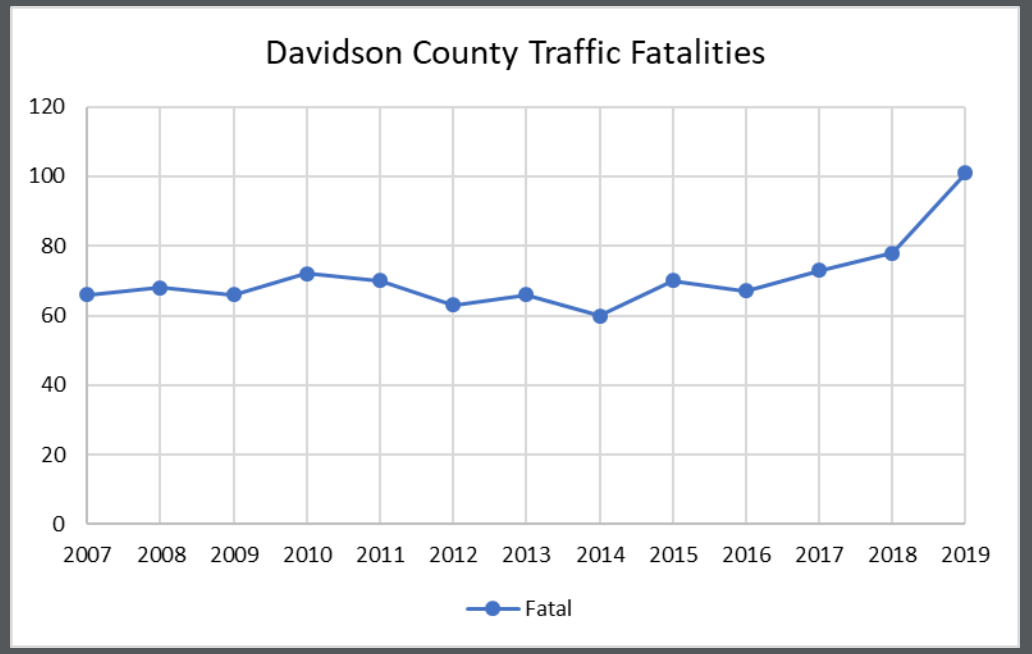
- Fully fund current traffic calming requests and ongoing maintenance of traffic calming devices
- Support Vision Zero Action Plan addressing highest accident locations and safety initiatives
- Address10-15 major arterial issues per year
- Improve intersections

Image source: Rutgers Center for Advanced Infrastructure and Transportation

Automotive Safety

- Traffic crashes in Davidson County trended upwards from 2009 – 2016
  - Total and injury crashes have remained at elevated plateau since 2016
- Traffic fatalities have been trending upward since 2014 in Davidson County
  - Significant increase in traffic fatalities in 2019, up to 101 fatalities in the year
- Through the first half of 2020, Davidson County has recorded:
  - 11,579 Traffic Crashes
  - 3,565 Injury-Causing Crashes
  - 45 Traffic Fatalities





Automotive Safety Improvements

Potential intersection improvements and benefits

Offset Left Turn Lanes: Provide an offset so that sightlines are improved for turning vehicles.

Representative Crash Reduction Factors: **32%** to **38%**

Refreshed Approach Striping: Improved painted channelization of lanes on approach to intersections.

Representative Crash Reduction Factor: **57%**

Left Turn Phasing: Provide a dedicated green light to left-turning vehicles.

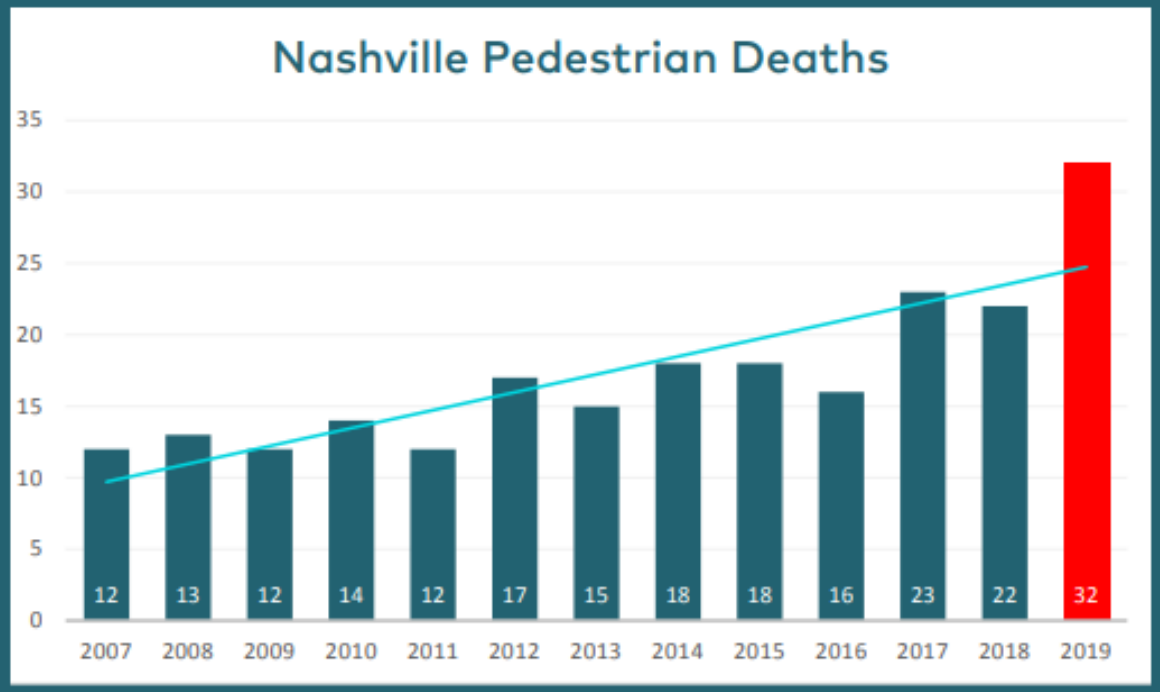
Representative Crash Reduction Factors: **99%** (fully protected) **16%** (permissive/protected)

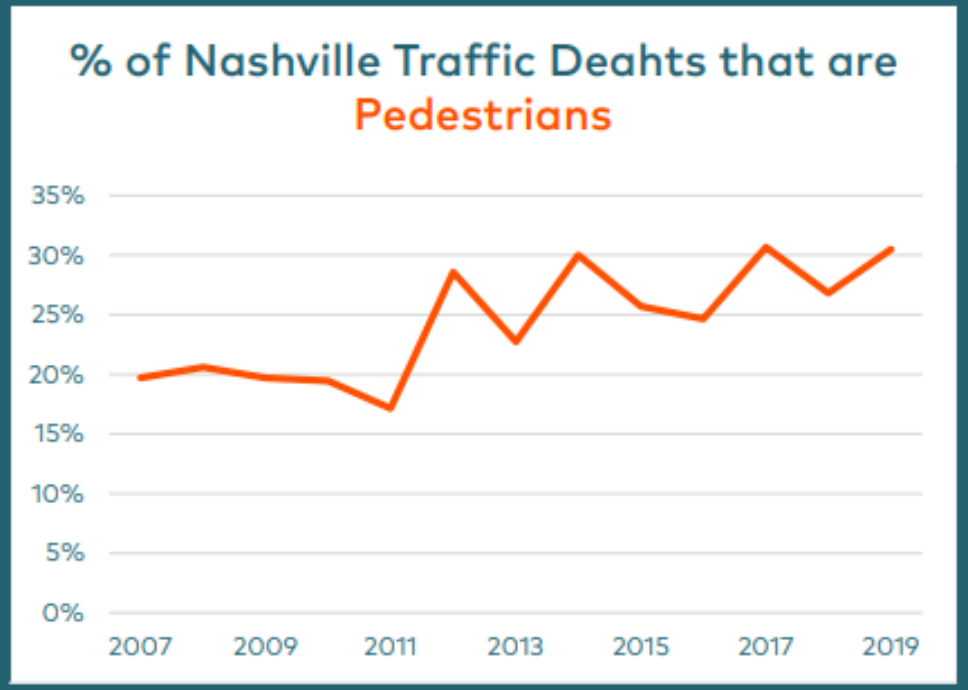
Flashing Yellow Arrow Signals: Clarifies safe timing of left turns relative to yield-on-green indications.

Representative Crash Reduction Factors: **25%** to **37%**

Potential Traffic Calming Improvements / Speed Enforcement: Reduced Speed Limit: Set posted speed limit 5 mph below engineering recommendations.

Representative Crash Reduction Factor: **56%**





Pedestrian Safety

- Pedestrian deaths in Nashville are steadily increasing over time
  - 16 Deaths in 2016
  - 23 Deaths in 2017
  - 22 Deaths in 2018
  - 32 Deaths in 2019
- First four months of 2020 had 125 crashes involving pedestrians and 10 pedestrian fatalities in Nashville
  - 1/3 increase over same period in 2019

Pedestrian Safety Improvements

Potential pedestrian infrastructure improvements and benefits

Install Sidewalk: Provide infrastructure for pedestrians to avoid walking along roadway.

Representative Crash Reduction Factors: **65%** to **89%**

Raised Median / Pedestrian Refuge Area: Provide protected area in median for crossing pedestrians.

Representative Crash Reduction Factors: **26%** to **29%**

Pedestrian Crossing Signals: Add pedestrian crossing countdown timers or adjust light timing to give pedestrians a leading interval "head start" in crossing roadway.

Representative Crash Reduction Factors: **15%** to **70%** (countdown timer); **9%** to **28%** (leading pedestrian interval)

Nashville Mayor announced a commitment to Vision Zero.

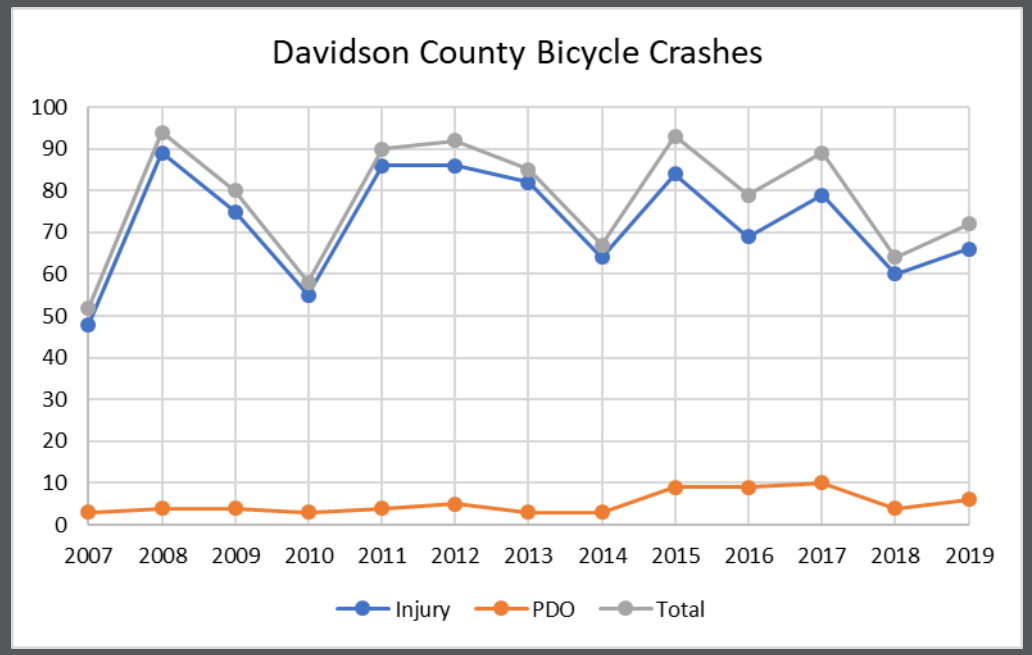
January 2020

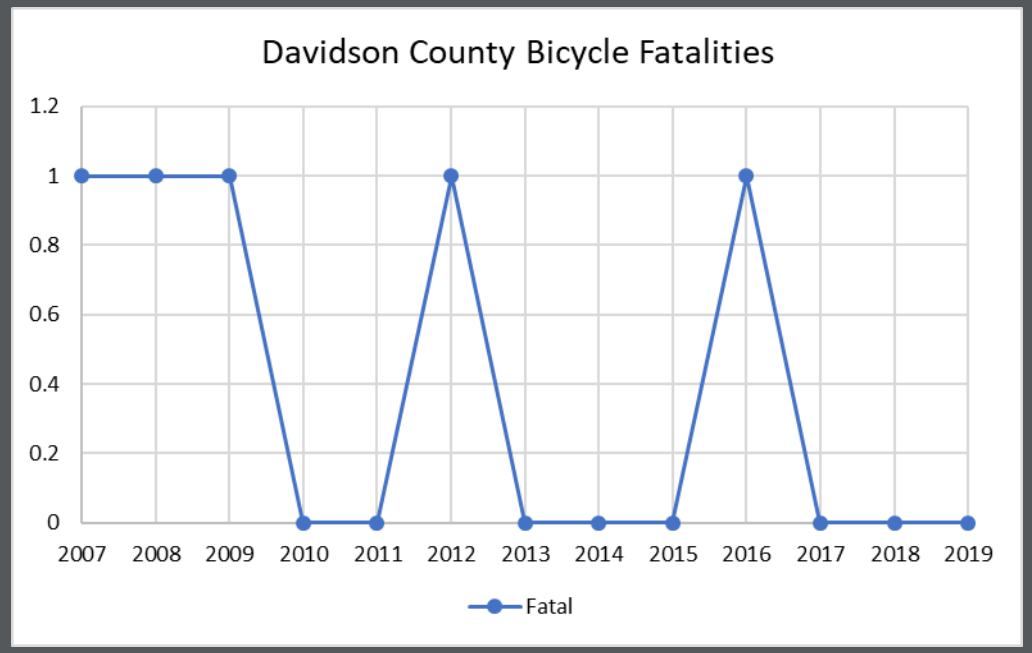
Pedestrian Hybrid Beacon: stall "High-Intensity Activated Crosswalk Beacons" that stop traffic for crossing pedestrians.

Representative Crash Reduction Factors: **29%** to **55%**

Bicyclist Safety

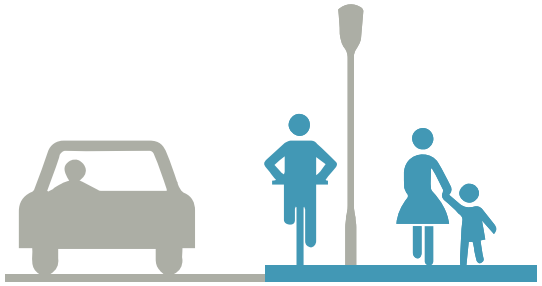
- Davidson County has averaged 72 injury-causing bicycle crashes per year since 2007
  - Injury crash count has been volatile year-to-year, but has slightly trended down since 2015
- In every year since 2007, either zero or one bicycle fatality has been recorded
- Through the first half of 2020, Davidson County has recorded:
  - 30 Injury-Causing Bicycle Crashes
  - 0 Bicycle Fatalities





Bicycle Safety Improvements

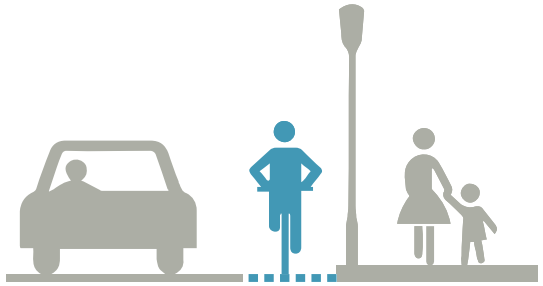
Potential intersection improvements and benefits



CLASS I

Dedicated bicycle / multi-use paths outside of the roadway, fully separated from automotive traffic.

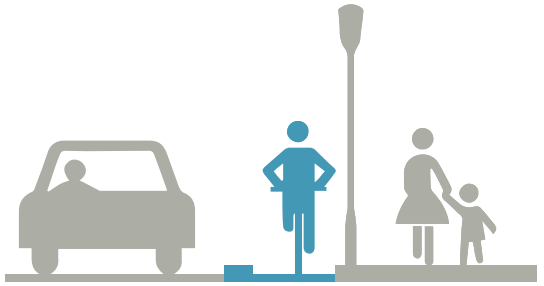
Representative Crash Reduction Factor: 25%



CLASS II

Striped bicycle lanes in roadway alongside automotive traffic.

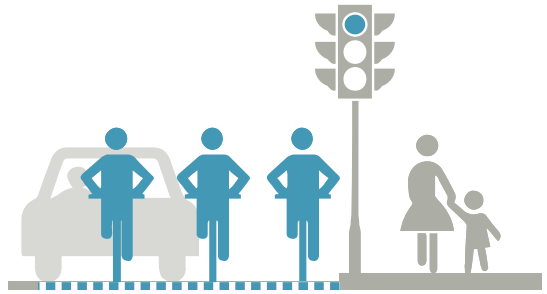
Representative Crash Reduction Factor: 36%



CLASS IV

Buffered bicycle lanes in roadway separated from automotive traffic.

Representative Crash Reduction Factor: 45%



BICYCLE BOX

Advanced stop bar that leaves dedicated space for cyclists at intersection.

Representative Crash Reduction Factor: 36%

Active Transportation / Bikeways / Greenways - $35M in Funding

- Funds approx. 7 miles of new bikeway/year, growing our network by 20% over 5 years
- Funded projects identified in WalknBike Plan
  - 34 planned WalknBike bikeway projects spanning over 100,000 feet.
  - 19 projects directly and 10 projects indirectly impact key pedestrian areas around Nashville.

Active Transportation / Bikeways / Greenways

Potential benefits

- Approximately $500K annually of journey quality benefits expected for bikeway projects by 2025
  - Benefits are derived from pedestrian counts provided by the city of Nashville.
  - Benefits are for current users and population growth. Does not include mode shifters.
- Cyclist Journey Quality Benefits = $6M
  - 20 years through 2040, using 4% discount rate

Nashville Mobility Management Center - $15M in Funding

- Implement the recommendations of the Traffic Management System Evaluation currently underway
- Smart and connected traffic signals
- System Detection and CCTV Cameras
- Adequately staffed Mobility Management Center
- Resilient and Sustainable
- Manage and provide consistent travel times

Traffic Management Systems / Signal Upgrades

Project elements

$30K	$200K	$1.5M	$500K
Full Intersection Detection Upgrade	**Partial Detection Upgrade**	**TCC**	**Communications**
20 Intersections per year	10 Intersections per year	4 Staff each year upon commissioning	Per mode, per year
$600K per year	$250K per year	$250K per year	$250K per year

Traffic Management Systems / Signal Upgrades

Project elements

$3K	$6K	$10K	$50K
Timing development and TR implementation (per intersection)	**CCTV installations** (per node)	**Connected vehicle and new technology testing** (per location)	**Intersection rewiring** (per intersection)
200 Intersections	50 Locations per year	20 Locations per year	20 Intersections
$600K per year	$300K per year	$200K per year	$1.4M per year

Traffic Management Systems / Signal Upgrades

Potential benefits

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Representative Crash Reduction Factors: **32%** to **38%**

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Left Turn Phasing: Provide a dedicated green light to left-turning vehicles

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Flashing Yellow Arrow Signals: Clarifies safe timing of left turns relative to yield-on-green indications

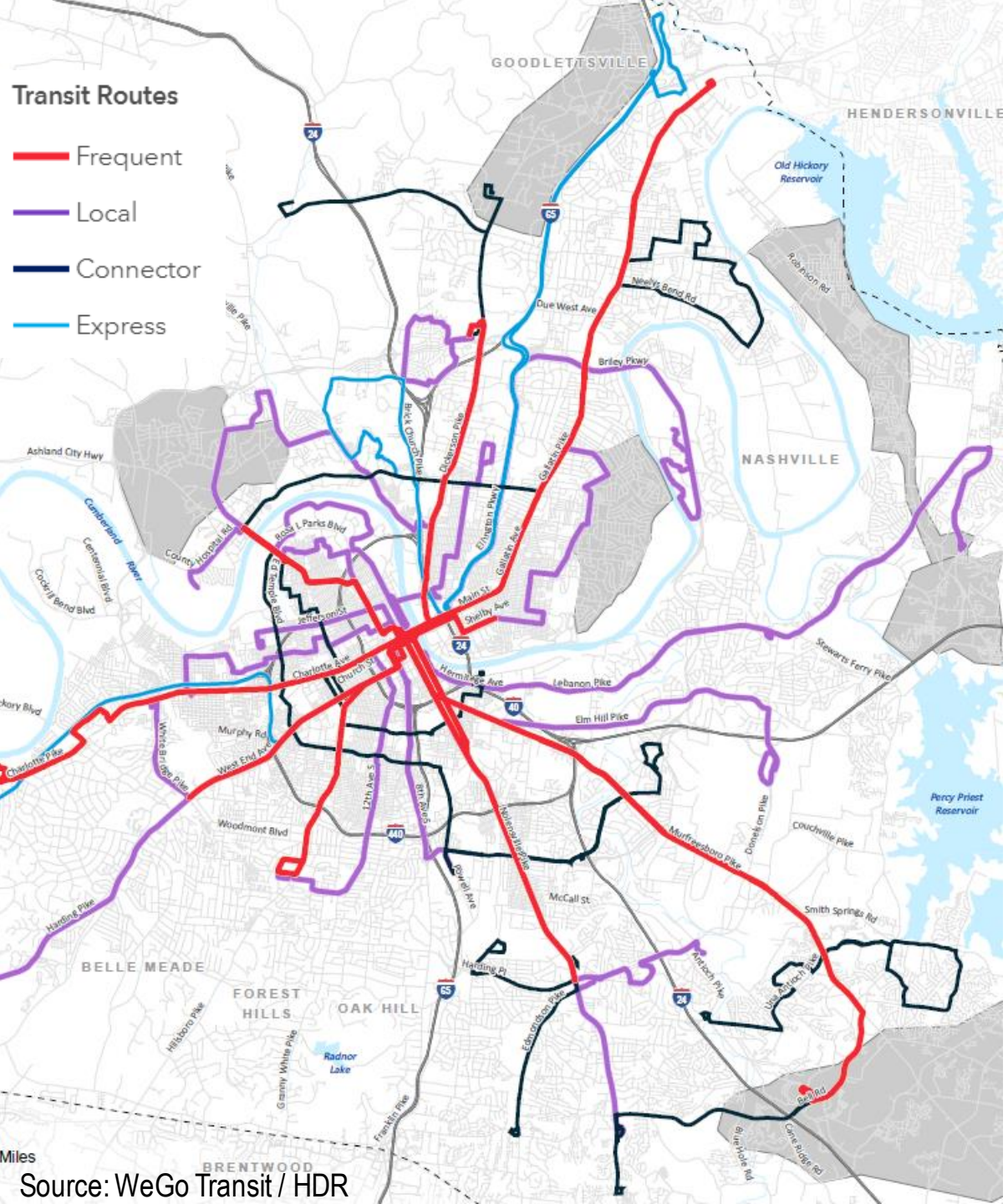
Representative Crash Reduction Factors: **25%** to **37%**

Potential Traffic Calming Improvements / Speed Enforcement: Reduced Speed Limit: Set posted speed limit 5 mph below engineering recommendations.

Representative Crash Reduction Factor: **56%**

Transit

Source: WeGo



Source: WeGo Transit / HDR

Better Bus - $209.6M in Funding

- Longer Service Spans
- Improved Weekend and Evening Service Frequency
- 95% of current riders would see improvement in their service
- Several routes extended to serve emerging Neighborhood Transit Centers
- New and Improved Crosstown and Neighborhood Connections
- Access / Access on Demand for persons with disabilities
- First Mile/Last Mile Mobility Zones providing discounted on-demand trips
- Fare Capping/Best Value Pricing

Better Bus Enhancements/Redesign

Potential monetized annual benefits

$148,200
2040 Air Pollution Reduction

$985,100
2040 Safety Improvement Savings

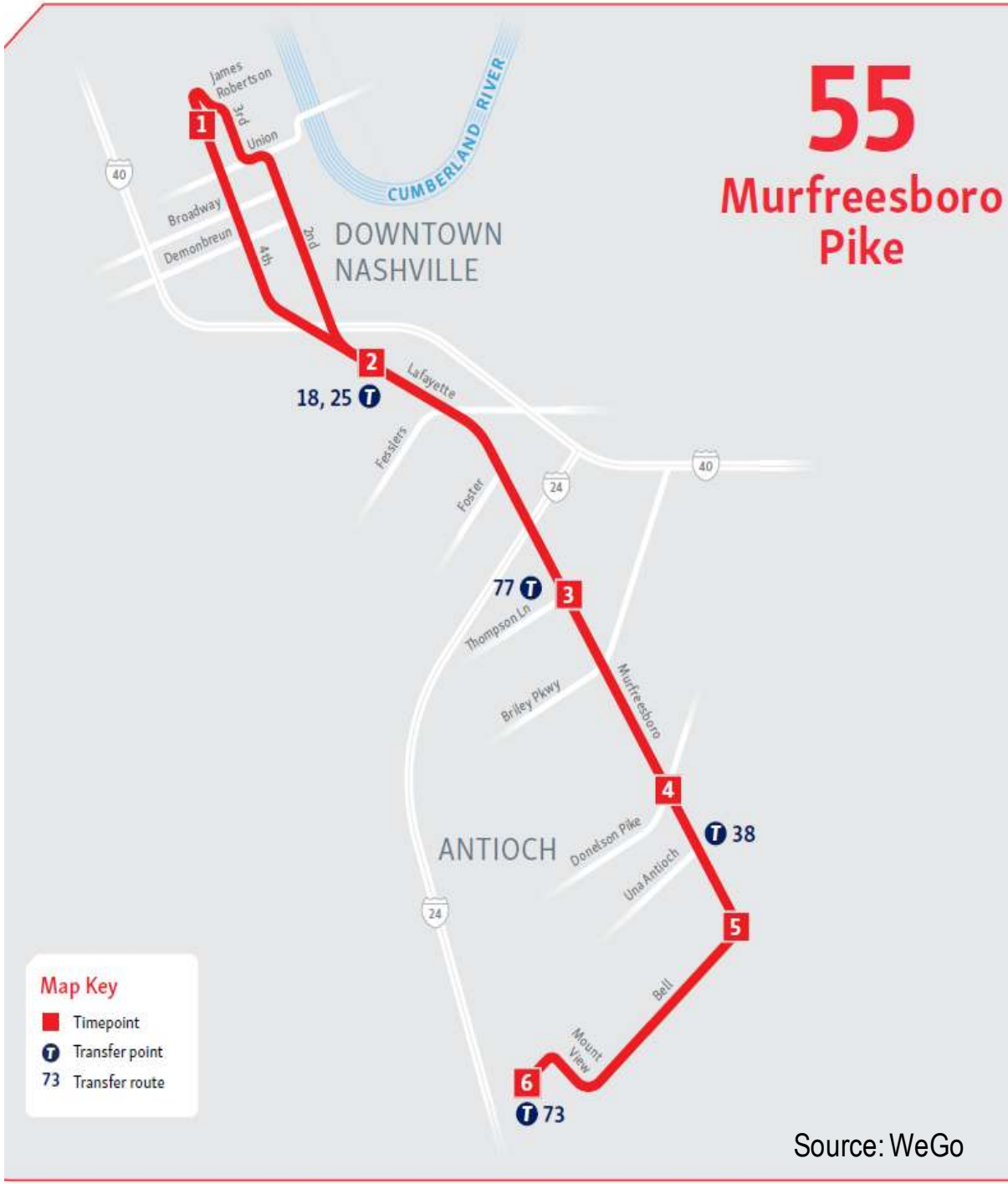
$6,500
2040 Pavement Maintenance Savings

Assumptions:

BRT Medium, 10 min peak frequency, 18 MPH Average operating speed, No TOD assumed.

Murfreesboro Pike BRT - $413.3M in Funding

- 12 miles – Follows exiting Route 55
- Originates at Hickory Hollow in Antioch and terminates at SoBro Transit Hub (4th Ave and Ash St) in Downtown
- Bus will run in dedicated lanes and will feature:
  - Iconic stations
  - Platform-level boarding
  - Off-board fare collection
- Project will include roadway, safety, ITS and pedestrian crossing/sidewalk improvements

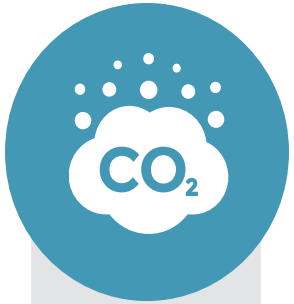


Source: WeGo

Murfreesboro Pike Bus Rapid Transit

Potential monetized annual benefits

$38,000
2040 Air Pollution Reduction



$252,000
2040 Safety Improvement Savings

$1,700
2040 Pavement Maintenance Savings

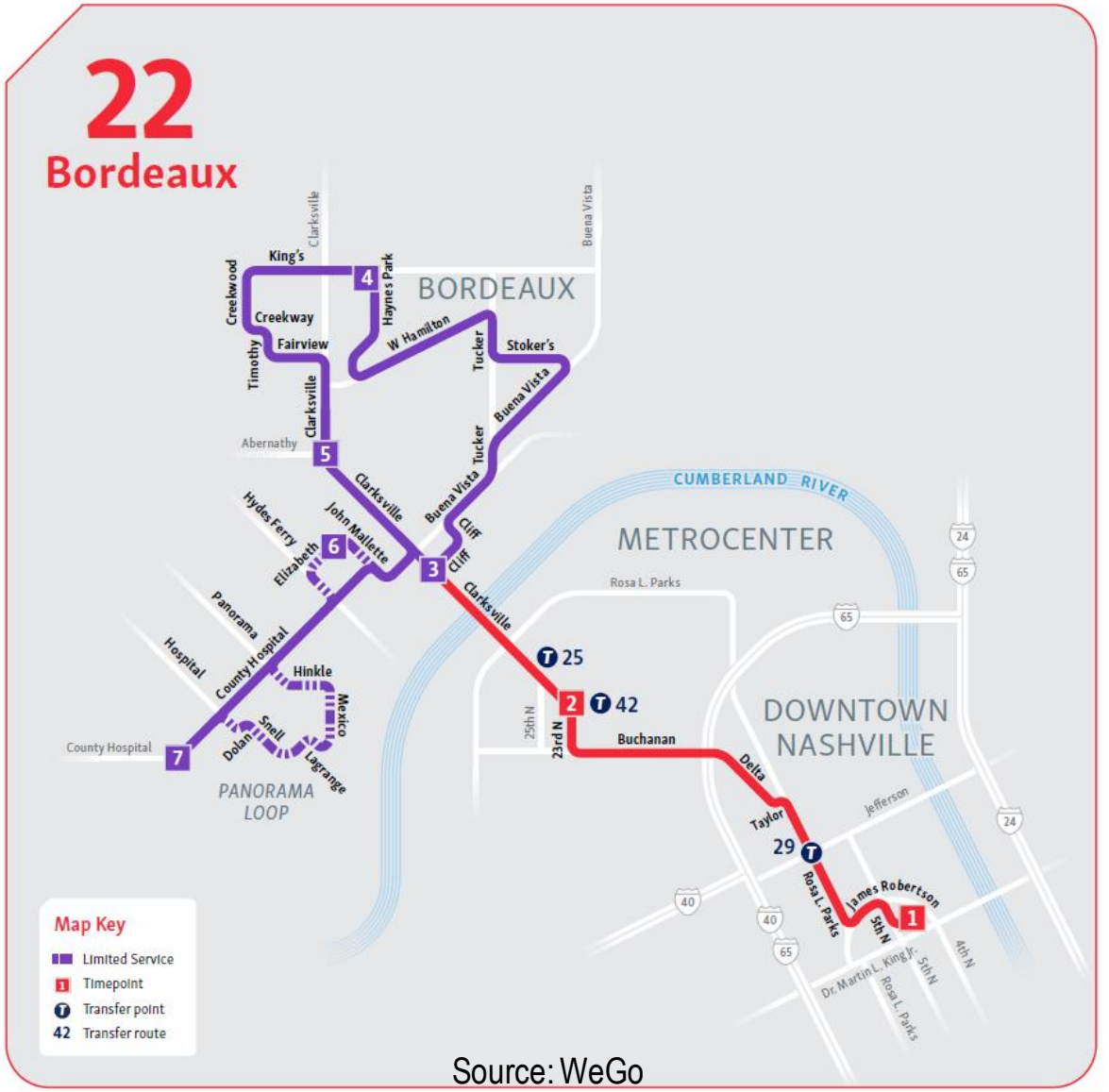
$2.7M
2040 Travel Time Savings

Assumptions:

Gold standard BRT, 10 min peak frequency, 30 MPH Average operating speed, TOD effect added.

Clarksville Pike Rapid Bus - $92.9M in Funding

- 7 miles – originates at Kings Ln in Haynes Park and terminates at WeGo Central
- Bus will operate along Route 22 and serve Haynes Park, Bordeaux, and North Nashville neighborhoods
- Connects with North Nashville Neighborhood Transit Center at 26th Ave
- Project will include improved mobility options and amenities

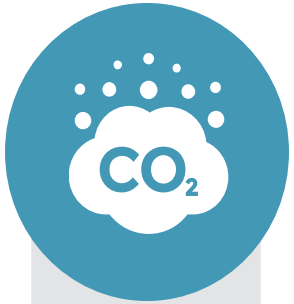


Source: WeGo

Clarksville Pike Rapid Bus Project

Potential monetized annual benefits

$5K
2040 Air Pollution Reduction



$37K
2040 Safety Improvements Savings

$240
2040 Pavement Maintenance Savings

$1.3M
2040 Travel Time Savings

Assumptions:

BRT Medium, 10 min peak frequency, 18 MPH Average operating speed, No TOD assumed.

WeGo Star Commuter Rail - $145.31M in Funding

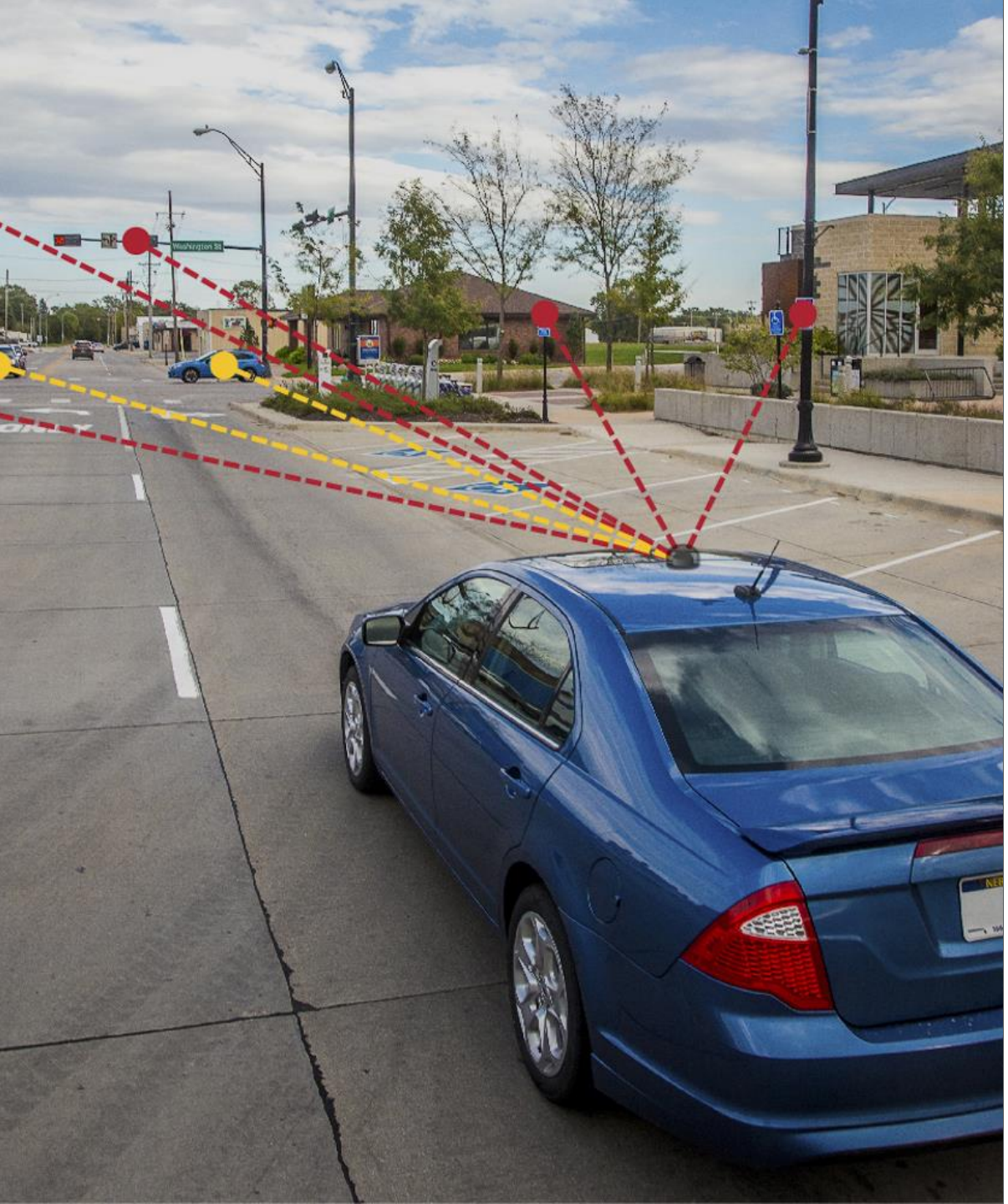
- Supports operation of more trips on the Star
- Includes installation in “Positive Train Control” (PTC) system, which allows increased service frequency and span of service
- May support the implementation of quiet zones and infill stations at Central Pike, Golden Bear Pkwy, and Wilson Co. Expo Center

WeGo Star

Potential benefits

- Sample TOD experiences:
  - Meridian, MS
    - $6.6 million Union Station revitalization
    - $135M in private development, including low- to middle-income, transit-accessible housing
  - Brunswick, ME
    - $25M in private development
    - 97 new full-time jobs have been added from existing business
  - Normal, IL
    - $49.5M in project costs
    - $120M in private investment

Any Questions?

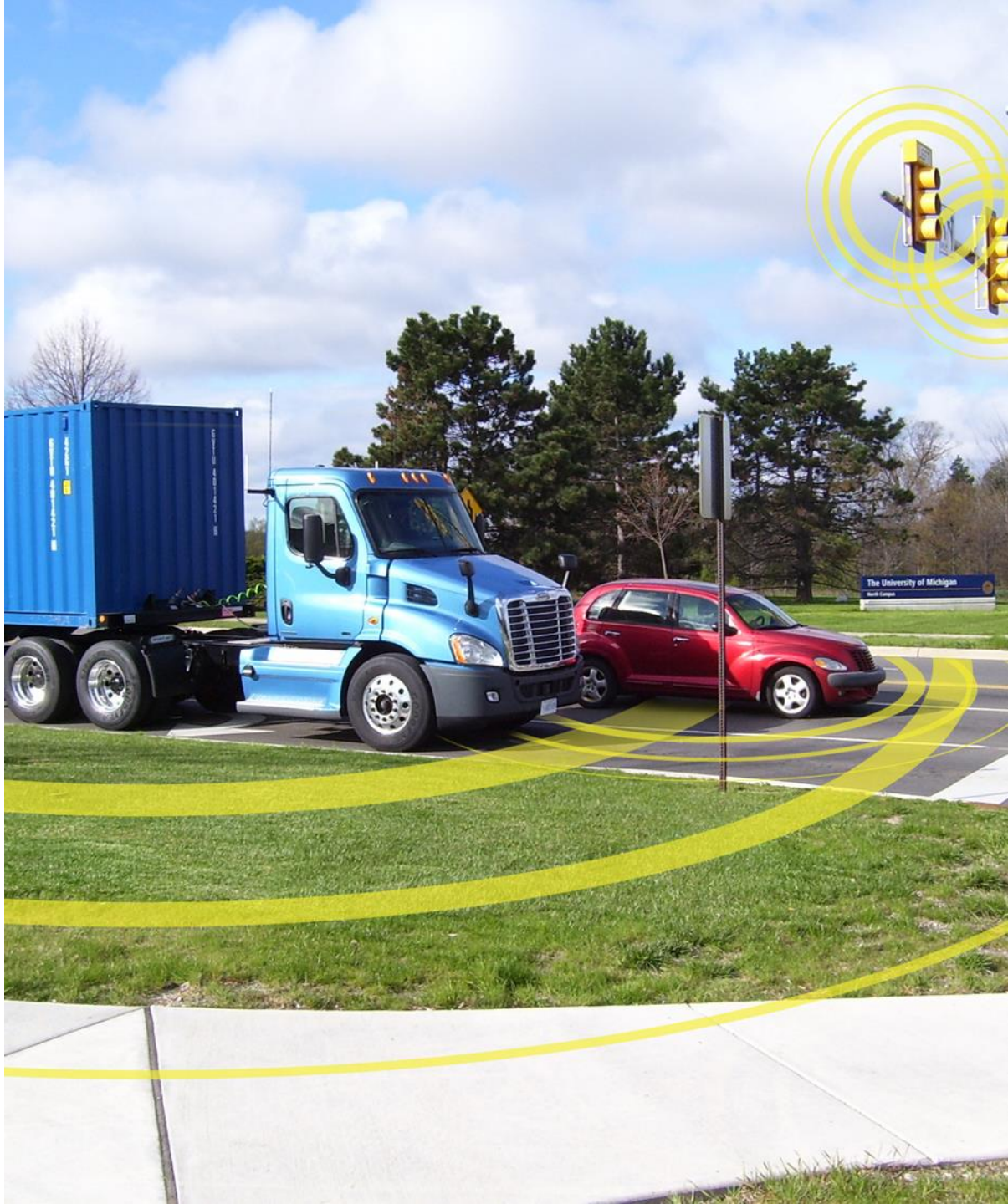


Tampa-Hillsborough Expressway

- Technology
  - DSRC technology and 40 RSU's deployed on city streets and reversible express lanes enables communication between:
    - 1,600 cars
    - 10 buses
    - 10 trolleys
    - 500 pedestrians
- Goals:
  - Increase vehicle to vehicle communication
  - Relieve Congestion
  - Reduce collisions
  - Prevent wrong way entry
  - Enhance pedestrian safety
  - Enhance pedestrian safety
  - Speed bus operations
  - Reduce conflicts between high-volume, mixed-traffic in the area

New York City

- Technology
  - DSRC technology and 500 RSU's and 8,000 OBU's installed three highly trafficked areas
    - 310 signalized intersections
    - 5,800 cabs
    - 1,250 transit authority buses
    - 400 commercial fleet delivery trucks
    - 500 city vehicles
- Goals:
  - Pilot program to collect and study data from key urban area intersections
  - Address challenges like short-radius curves, weight limits and minimum bridge clearance
  - Support system management functions



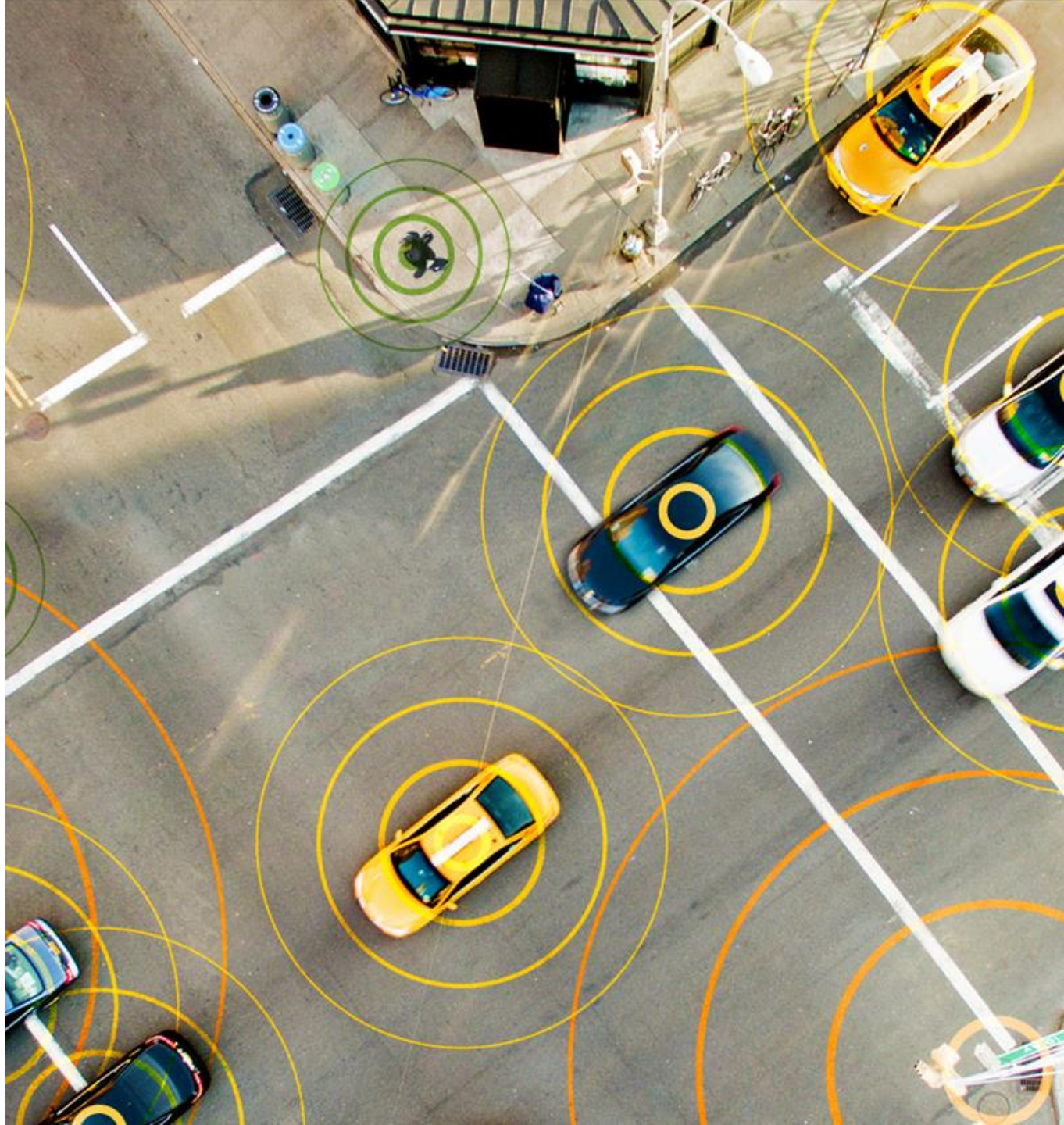
Marietta, GA

- Technology
  - DSRC and cellular technology deployed
    - 120 traffic signals
    - TravelSafely mobile application means that anyone within the 23-mile city area can utilize the network
    - OBU's installed on city emergency response vehicles
- Goals:
  - Emergency vehicle response times
  - School & work zone alerts
  - Signal prioritization
  - Crash reductions
  - Pedestrian safety

Restoration, Resiliency & Partnership Funds

Emergency vehicle response

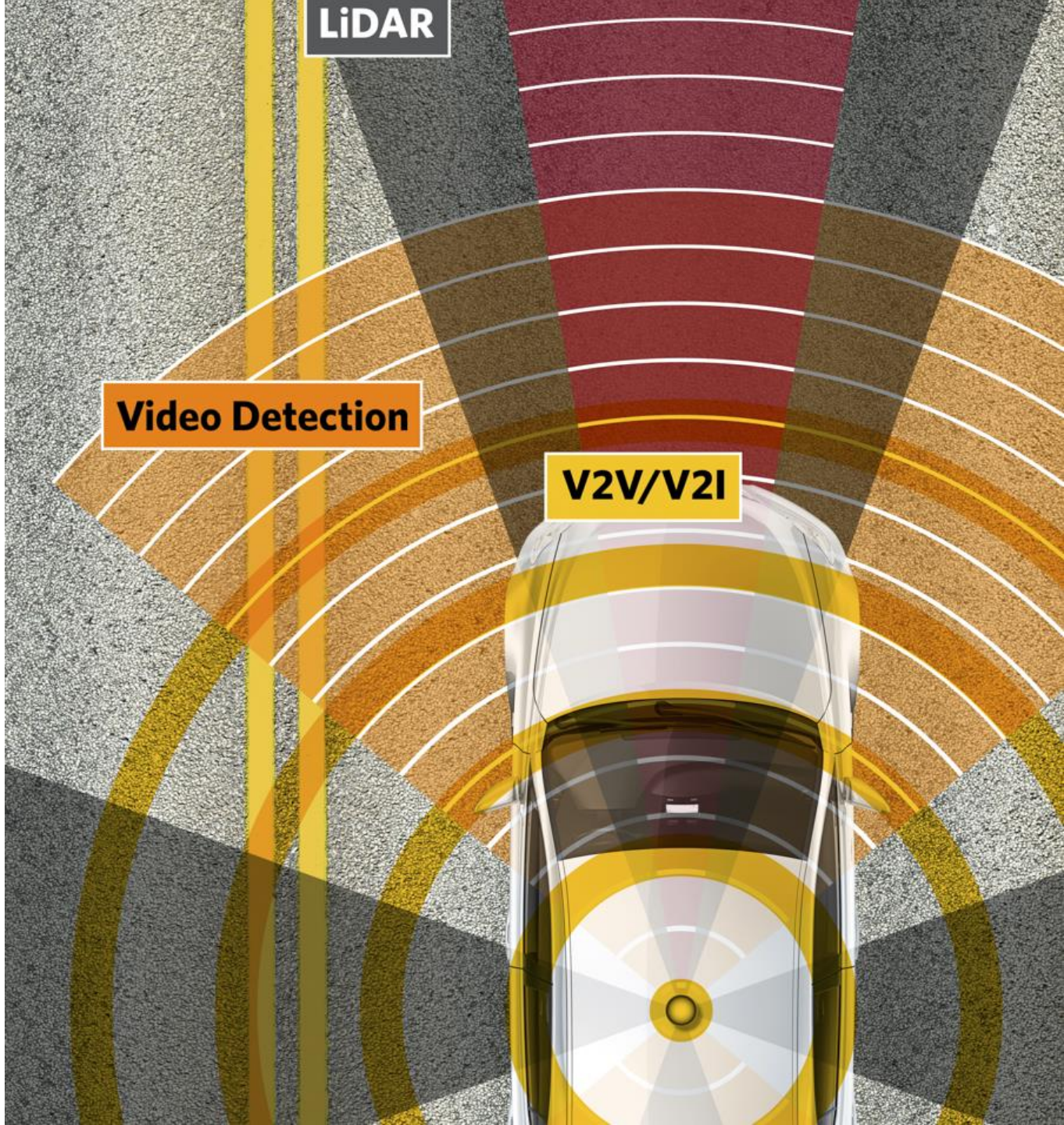
- Emergency vehicles equipped with on-board units connect to CV network supported by roadside units.
- Most benefits realized at signalized intersections where signal prioritization and pre-emption can improve travel speed and overall response times.
- Mobile applications like TravelSafely also provides motorists, cyclists and pedestrians with information about approaching emergency vehicles, including direction.



Connected Vehicle Network Benefits

Safety

- Reduced crashes due to congestion alleviation
- Reduced emergency vehicle response times due to signal prioritization
- Alerts for wrong way driving, approaching EV, school or workzone, and approaching traffic signal
- Enhanced health precautions for transit passengers by providing vehicle occupancy data



Connected Vehicle Network Benefits

Mobility

- Improved average travel times due to signal prioritization and congestion alleviation
- Improved reliability
- Greater transited customer flexibility
- Improved journey benefits
- Increased transit ridership due to better reliability and quality of experience

Connected Vehicle Network Benefits

Environment

- Transit signal priority will lead to some reduction in breaking and speeding
- Reduced emissions
- Reduction in noise impacts

Future planning

- CV technology will enable collection of data to meet evolving needs

Safety Related Benefits

Anticipated Crash Reduction 25%-50% with improvements:

- Offset Left Turn Lanes
- Refreshed Approach Striping
- Left Turn Phasing
- Flashing Yellow Arrow Signals
- Traffic Calming Improvements / Speed Enforcement
- Newly installed sidewalks
- Raised Median/Pedestrian Refuge Area
- Pedestrian Crossing Signals
- Pedestrian Hybrid Beacon
- Intersection Improvements for Bicyclists

Connected Vehicles (CV)

- Deployment of CV technology at intersections leads to better signal operation and:
  - Reduced congestion
  - Improved transit service
  - Fewer crashes
  - Improved emergency vehicle response times
- Network allows enhanced real-time monitoring of transit conditions and upgrades traffic signaling
- Dynamic management allows prioritization for behind-schedule transit vehicles and asymmetrical directions demand at intersections

Appendix 5 – TIP FY2020-23 Project List – Davidson Co.

Metro Nashville Transportation Plan

December 2020

Transportation Improvement Program for FYs 2020-2023

Projects with Location = Davidson County

ID#	Project Name	Improvement Type	County	Total Cost	Lead Agency
2004-005	Jefferson Street Intersections	Intersection	Davidson County	$3,870,000.00	Metro Nashville

Year	Phase	Total	Federal	State	Local
2020	PE-D	$270,000.00	$0.00	$0.00	$270,000.00
2020	ROW	$2,100,000.00	$1,680,000.00	$0.00	$420,000.00
2021	CONSTRUCTION	$1,500,000.00	$1,200,000.00	$0.00	$300,000.00

ID#	Project Name	Improvement Type	County	Total Cost	Lead Agency
2008-14-030	Various intersection improvements (FAUB routes)	Intersection	Davidson County	$8,593,750.00	Metro Nashville

Year	Phase	Total	Federal	State	Local
2020	ROW	$1,406,250.00	$1,125,000.00	$0.00	$281,250.00
2020	PE-D, PE-N	$556,000.00	$444,800.00	$0.00	$111,200.00
2021	CONSTRUCTION	$5,000,000.00	$4,000,000.00	$0.00	$1,000,000.00

ID#	Project Name	Improvement Type	County	Total Cost	Lead Agency
2008-15-048	Transit Miscellaneous Capital Support	Transit Capital	Davidson County	$4,863,910.00	Nashville MTA

Year	Phase	Total	Federal	State	Local
2020	IMPLEMENTATION	$3,513,910.00	$2,811,128.00	$351,391.00	$351,391.00
2021	IMPLEMENTATION	$450,000.00	$360,000.00	$45,000.00	$45,000.00
2022	IMPLEMENTATION	$450,000.00	$360,000.00	$45,000.00	$45,000.00
2023	IMPLEMENTATION	$450,000.00	$360,000.00	$45,000.00	$45,000.00

ID#	Project Name	Improvement Type	County	Total Cost	Lead Agency
2008-15-049	MTA - Administration Building Rehabilitation (Nestor)	Transit Capital	Davidson County	$3,506,450.00	Nashville MTA

Year	Phase	Total	Federal	State	Local
2020	CONSTRUCTION	$2,550,000.00	$2,040,000.00	$255,000.00	$255,000.00

ID#	Project Name	Improvement Type	County	Total Cost	Lead Agency
2008-15-052	Paratransit Buses Purchase and Replacement	Transit Capital	Davidson County	$11,135,866.00	Nashville MTA

Year	Phase	Total	Federal	State	Local
2020	IMPLEMENTATION	$3,760,866.00	$3,008,692.00	$376,087.00	$376,087.00
2021	IMPLEMENTATION	$2,375,000.00	$0.00	$0.00	$2,375,000.00

2022	IMPLEMENTATION	$2,500,000.00	$0.00	$0.00	$2,500,000.00
2023	IMPLEMENTATION	$2,500,000.00	$0.00	$0.00	$2,500,000.00

2008-15-054	Bus Purchase and Replacement	Transit Capital	Davidson County	$62,982,809.00	Nashville MTA

Year	Phase	Total	Federal	State	Local
2020	IMPLEMENTATION	$2,924,809.00	$2,339,847.20	$0.00	$584,961.80
2020	IMPLEMENTATION	$15,048,000.00	$9,028,800.00	$4,514,400.00	$1,504,800.00
2020	IMPLEMENTATION	$12,510,000.00	$0.00	$0.00	$12,510,000.00
2020	IMPLEMENTATION	$2,500,000.00	$2,000,000.00	$0.00	$500,000.00
2021	IMPLEMENTATION	$10,000,000.00	$0.00	$0.00	$10,000,000.00
2022	IMPLEMENTATION	$10,000,000.00	$0.00	$0.00	$10,000,000.00
2023	IMPLEMENTATION	$10,000,000.00	$0.00	$0.00	$10,000,000.00

2008-17-057	Automatic Travelers Information System (ATIS), Intelligent Transportation Systems (ITS) Communication & Closed Circuit Television (CCTV)	ITS	Davidson County	$2,488,841.00	Metro Nashville

Year	Phase	Total	Federal	State	Local
2020	PE-N	$125,000.00	$100,000.00	$0.00	$25,000.00
2020	PE-D	$472,767.00	$378,214.00	$0.00	$94,553.00
2020	CONSTRUCTION	$1,891,074.00	$1,512,859.00	$0.00	$378,215.00

2011-110-141	Main Street (US41)/Long Hollow Pike (SR174)/Rivergate Pkwy	Road Upgrades	Davidson County	$11,691,250.00	Goodlettsville

Year	Phase	Total	Federal	State	Local
2020	CONSTRUCTION	$7,906,250.00	$6,325,000.00	$0.00	$1,581,250.00

2011-15-133	Bus Stop Improvements and Passenger Amenities	Transit Capital	Davidson County	$1,050,000.00	Nashville MTA

Year	Phase	Total	Federal	State	Local
2020	IMPLEMENTATION	$250,000.00	$200,000.00	$25,000.00	$25,000.00
2021	IMPLEMENTATION	$250,000.00	$200,000.00	$25,000.00	$25,000.00
2022	IMPLEMENTATION	$250,000.00	$200,000.00	$25,000.00	$25,000.00
2023	IMPLEMENTATION	$300,000.00	$240,000.00	$30,000.00	$30,000.00

2011-15-135	Fare Collection System	Transit Capital	Davidson County	$600,000.00	Nashville MTA

Year	Phase	Total	Federal	State	Local

2020	PURCHASE	$150,000.00	$120,000.00	$15,000.00	$15,000.00
2021	PURCHASE	$150,000.00	$120,000.00	$15,000.00	$15,000.00
2022	PURCHASE	$150,000.00	$120,000.00	$15,000.00	$15,000.00
2023	PURCHASE	$150,000.00	$120,000.00	$15,000.00	$15,000.00

2011-15-137	Transit Preventative Maintenance - MTA	Transit Capital	Davidson County	$67,593,750.00	Nashville MTA

Year	Phase	Total	Federal	State	Local
2020	IMPLEMENTATION	$12,000,000.00	$9,600,000.00	$1,200,000.00	$1,200,000.00
2020	IMPLEMENTATION	$3,750,000.00	$3,000,000.00	$0.00	$750,000.00
2020	IMPLEMENTATION	$5,000,000.00	$4,000,000.00	$0.00	$1,000,000.00
2021	IMPLEMENTATION	$12,000,000.00	$9,600,000.00	$1,200,000.00	$1,200,000.00
2021	IMPLEMENTATION	$3,043,750.00	$2,435,000.00	$0.00	$608,750.00
2022	IMPLEMENTATION	$12,000,000.00	$9,600,000.00	$1,200,000.00	$1,200,000.00
2022	IMPLEMENTATION	$3,606,250.00	$2,885,000.00	$0.00	$721,250.00
2023	IMPLEMENTATION	$12,000,000.00	$9,600,000.00	$1,200,000.00	$1,200,000.00
2023	IMPLEMENTATION	$4,193,750.00	$3,355,000.00	$0.00	$838,750.00

2011-15-160	Transit Asset Management	Transit Capital	Davidson County	$1,250,000.00	Nashville MTA

Year	Phase	Total	Federal	State	Local
2021	IMPLEMENTATION	$100,000.00	$80,000.00	$10,000.00	$10,000.00

2011-16-092	Harding Place Sidewalk Enhancement	Sidewalks	Davidson County	$12,239,661.00	Metro Nashville

Year	Phase	Total	Federal	State	Local
2020	CONSTRUCTION	$3,500,000.00	$2,800,000.00	$0.00	$700,000.00

2011-19-020	Conference Drive Enhancements	Streetscaping	Davidson County	$410,000.00	Goodlettsville

Year	Phase	Total	Federal	State	Local
2020	CONSTRUCTION	$266,250.00	$213,000.00	$0.00	$53,250.00

2014-110-044	Donelson Pike (SR-255) Relocation	Reconfiguration	Davidson County	$82,500,000.00	TDOT

Year	Phase	Total	Federal	State	Local
2021	CONSTRUCTION	$40,000,000.00	$0.00	$40,000,000.00	$0.00
2022	CONSTRUCTION	$30,000,000.00	$0.00	$30,000,000.00	$0.00

2014-111-026	Complete Streets Implementation on BRT Lite Corridors - Gallatin Pike	Multi-Modal Upgrades	Davidson County	$6,760,000.00	Metro Nashville

Year	Phase	Total	Federal	State	Local
2020	PE-D	$500,080.00	$400,064.00	$0.00	$100,016.00
2021	ROW, CONSTRUCTION	$5,930,000.00	$4,744,000.00	$0.00	$1,186,000.00

2014-111-027	Complete Streets Implementation on BRT Lite Corridors - Murfreesboro Pike	Multi-Modal Upgrades	Davidson County	$4,102,500.00	Metro Nashville

Year	Phase	Total	Federal	State	Local
2020	PE-D, ROW	$237,500.00	$190,000.00	$0.00	$47,500.00
2020	ROW	$450,000.00	$360,000.00	$0.00	$90,000.00
2021	CONSTRUCTION	$3,300,000.00	$2,640,000.00	$0.00	$660,000.00

2014-111-051	Dickerson Pike (US-41/31W)/ CSX Underpass Reconstruction	Reconstruction	Davidson County	$7,800,000.00	TDOT

Year	Phase	Total	Federal	State	Local
2021	PE-D	$200,000.00	$160,000.00	$40,000.00	$0.00
2021	PE-N	$100,000.00	$80,000.00	$20,000.00	$0.00

2014-15-005	Expansion of Rapid Bus Service Infrastructure	Transit Capital	Davidson County	$7,250,000.00	Nashville MTA

Year	Phase	Total	Federal	State	Local
2020	IMPLEMENTATION	$2,500,000.00	$2,000,000.00	$250,000.00	$250,000.00
2021	IMPLEMENTATION	$1,500,000.00	$1,200,000.00	$150,000.00	$150,000.00
2022	IMPLEMENTATION	$2,000,000.00	$1,600,000.00	$200,000.00	$200,000.00
2023	IMPLEMENTATION	$1,250,000.00	$1,000,000.00	$125,000.00	$125,000.00

2014-15-009	WeGo Central Renovation	Transit Capital	Davidson County	$5,511,605.00	Nashville MTA

Year	Phase	Total	Federal	State	Local
2020	CONSTRUCTION	$1,625,000.00	$1,300,000.00	$162,500.00	$162,500.00
2020	IMPLEMENTATION	$3,000,000.00	$3,000,000.00	$0.00	$0.00
2021	CONSTRUCTION	$386,605.00	$309,284.00	$38,660.00	$38,661.00
2022	CONSTRUCTION	$500,000.00	$400,000.00	$50,000.00	$50,000.00

2014-16-002	Lebanon Pike Sidewalk Improvements	Sidewalks	Davidson County	$3,800,000.00	Metro Nashville

Year	Phase	Total	Federal	State	Local

2020	CONSTRUCTION	$1,800,000.00	$1,440,000.00	$0.00	$360,000.00
2020	ROW	$1,300,000.00	$1,040,000.00	$0.00	$260,000.00

2014-16-003	Dickerson Pike Sidewalk Improvements	Sidewalks	Davidson County	$6,150,000.00	Metro Nashville

Year	Phase	Total	Federal	State	Local
2020	CONSTRUCTION	$3,400,000.00	$2,720,000.00	$0.00	$680,000.00

2015-111-069	North Nashville Transit Center	Multi-Modal Upgrades	Davidson County	$936,120.00	Nashville MTA

Year	Phase	Total	Federal	State	Local
2020	PE-D	$187,220.00	$149,776.00	$0.00	$37,444.00
2020	ROW	$299,560.00	$239,648.00	$0.00	$59,912.00
2021	CONSTRUCTION	$449,340.00	$359,472.00	$0.00	$89,868.00

2015-17-217	Berry Hill ITS Traffic Signal Coordination Project	ITS	Davidson County	$1,845,000.00	Berry Hill

Year	Phase	Total	Federal	State	Local
2020	PE-D, CONSTRUCTION, PE-N	$1,761,000.00	$1,761,000.00	$0.00	$0.00

2017-12-012	Charlotte Pike (SR-24) Widening Phase 1	Road Widening	Davidson County	$19,300,000.00	TDOT

Year	Phase	Total	Federal	State	Local
2020	PE-N	$700,000.00	$560,000.00	$140,000.00	$0.00
2021	PE-D	$300,000.00	$240,000.00	$60,000.00	$0.00

2017-15-042	MTA Building Rehabilitation (Myatt)	Transit Capital	Davidson County	$4,650,650.00	Nashville MTA

Year	Phase	Total	Federal	State	Local
2020	CONSTRUCTION	$250,000.00	$200,000.00	$25,000.00	$25,000.00

2017-16-049	Opry Mills Multi-Use Path	Greenway	Davidson County	$7,914,320.00	Metro Nashville

Year	Phase	Total	Federal	State	Local
2020	PE-D, PE-N	$350,000.00	$0.00	$0.00	$350,000.00
2020	CONSTRUCTION	$6,314,320.00	$0.00	$0.00	$6,314,320.00
2020	CONSTRUCTION	$1,250,000.00	$1,000,000.00	$0.00	$250,000.00

2017-19-026	Nashville Complete Trips: Transportation Demand Management Program	Education & Outreach	Davidson County	$1,480,855.00	Metro Nashville

Year	Phase	Total	Federal	State	Local
2020	TRAINING	$507,835.00	$406,268.00	$0.00	$101,567.00
2020	TRAINING	$521,935.00	$417,548.00	$0.00	$104,387.00

2017-19-800	Regional Planning Offices and Community Meeting Center	Community Asset	Davidson County	$5,000,000.00	MPO

Year	Phase	Total	Federal	State	Local
2020	IMPLEMENTATION	$5,000,000.00	$4,000,000.00	$0.00	$1,000,000.00

2018-111-075	Pedestrian Signal Priorities	Multi-Modal Upgrades	Davidson County	$1,650,000.00	Metro Nashville

Year	Phase	Total	Federal	State	Local
2020	CONSTRUCTION	$1,650,000.00	$1,320,000.00	$0.00	$330,000.00

2018-16-069	Franklin Pike (US31/SR-6) Multimodal Path	Sidewalks	Davidson County	$1,000,000.00	Oak Hill

Year	Phase	Total	Federal	State	Local
2020	PE-D, PE-N	$300,000.00	$240,000.00	$0.00	$60,000.00

2018-16-070	East Nashville Backbones	Multi-Modal Upgrades	Davidson County	$1,614,375.00	Metro Nashville

Year	Phase	Total	Federal	State	Local
2020	PE-D	$334,125.00	$267,300.00	$0.00	$66,825.00
2020	CONSTRUCTION	$1,280,250.00	$1,024,200.00	$0.00	$256,050.00

2018-16-071	8th Avenue (US31/SR-6) Connectivity Project	Sidewalks	Davidson County	$1,950,000.00	Berry Hill

Year	Phase	Total	Federal	State	Local
2020	PE-D, PE-N	$750,000.00	$600,000.00	$0.00	$150,000.00
2020	CONSTRUCTION	$1,200,000.00	$960,000.00	$0.00	$240,000.00

2018-19-076	Active Neighborhoods Program	Education & Outreach	Davidson County	$1,000,000.00	Metro Nashville

Year	Phase	Total	Federal	State	Local
2020	IMPLEMENTATION	$474,796.00	$379,837.00	$0.00	$94,959.00

2019-12-100	Charlotte Avenue (SR-24) Widening, from I-40 to American Rd.	Road Widening	Davidson County	$44,300,000.00	TDOT

Year	Phase	Total	Federal	State	Local
2023	PE-D	$50,000.00	$40,000.00	$10,000.00	$0.00
2023	PE-N	$50,000.00	$40,000.00	$10,000.00	$0.00

2019-12-105	I-24 Widening, From Old Hickory Blvd to I-65	Road Widening	Davidson County	$74,000,000.00	TDOT

Year	Phase	Total	Federal	State	Local
2022	PE-D	$1,000,000.00	$800,000.00	$200,000.00	$0.00
2022	PE-N	$1,000,000.00	$800,000.00	$200,000.00	$0.00

2019-12-106	I-40 Widening, from McCrory Lane to SR-1/US-70S	Road Widening	Davidson County	$43,000,000.00	TDOT

Year	Phase	Total	Federal	State	Local
2022	PE-D	$1,000,000.00	$800,000.00	$200,000.00	$0.00
2022	PE-N	$1,000,000.00	$800,000.00	$200,000.00	$0.00

2019-14-086	Nolensville Pike (SR-11/US41A) and McNally Drive Intersection Improvements	Multi-Modal Upgrades	Davidson County	$980,005.00	Metro Nashville

Year	Phase	Total	Federal	State	Local
2020	PE	$103,000.00	$0.00	$97,850.00	$5,150.00
2020	ROW	$5,000.00	$0.00	$4,750.00	$250.00
2020	CONSTRUCTION	$872,006.00	$0.00	$828,405.00	$43,601.00

2019-14-102	I-24 Ramp Improvements at Exits 35, 40, 57, 59, and 60	Interchange	Davidson County	$25,500,000.00	TDOT

Year	Phase	Total	Federal	State	Local
2023	PE-D	$250,000.00	$200,000.00	$50,000.00	$0.00
2023	PE-N	$250,000.00	$200,000.00	$50,000.00	$0.00

2019-32-092	I-65 Widening from SR-257 to SR-25	Road Widening	Davidson County	$79,800,000.00	TDOT

Year	Phase	Total	Federal	State	Local
2020	PE-N	$500,000.00	$400,000.00	$100,000.00	$0.00

2020	PE-D	$500,000.00	$400,000.00	$100,000.00	$0.00

Appendix 6 – IMPROVE Act Project List – Davidson Co.

Metro Nashville Transportation Plan

December 2020

Improve Act Project List for Davidson County

Project Route	Project Name/Description	Improve Act Investment
I-24	I-24 Ramp Improvements exits 35, 40, 57, 59, and 60	$25M
I-65	From near Rivergate Pkwy. to near SR-41 (US-31W) (Section 1 of 4, of I-65 Corridor Project)	$59M
I-24	(Downtown Loop) I-24, including south of Fern Ave. to Trinity Ln.	$55M
US-431/7-/70S (SR-1)	Broadway Bridge over Broadway/11th Ave. South & CSX railroad	$5.015M
I-440	From I-40 to I-24	$50M
I-40	SR-255 (Donelson Pike) Relocation from taxiway bridges over existing Donelson Pike to I-40	$57.5
US-31W (SR-11)	(Dickerson Pike) From Fannin Drive to Old Stone Bridge Road to Include the CSX Railroad Overpass Structure	$7.5M

Appendix 7 – Regional Partnering Opportunities by HDR

Metro Nashville Transportation Plan

December 2020

Memo

Date: Friday, March 13, 2020

Project: Transportation Plan Support

To: Faye DiMassimo

From: Jim Czarnecky

Subject: Potential Multi-Jurisdictional Partnership Opportunities for Transportation Projects

INTRODUCTION

HDR has been asked to identify multijurisdictional transportation projects where the City of Nashville could potentially partner with adjoining counties and cities, TDOT, MTA/RTA, and the U.S. DOT modal agencies to advance various transportation projects for mutual benefit. We reviewed several publicly available transportation planning and programming documents to identify candidate projects with a focus on capital projects that may be feasible within the next 5- to 15-year time frame and provide larger-scale benefits.

This initial list of projects is based on readily available information and is organized by county for ease of reference with respect to prospective regional funding partners. Brief descriptions of the projects are provided below within the context of the potential partnerships. The information is provided for discussion purposes only, and HDR makes no claim as to the feasibility or future viability of these projects, opinions of cost where given, or the interest of potential partners noted.

The projects discussed in this memo assume the City of Nashville/Davidson County and its affiliated agencies and departments would be active partners. In some cases, as with the park and ride facilities and commuter bus service, it is understood that the financial contributions and benefits may not be proportional, but would help address some of our regional transportation issues and common goals.

SOURCES OF PROJECT INFORMATION

The following matrix presents a list of potential multi-jurisdictional projects that may demonstrate the need for regional partnerships to solve some of our most challenging transportation issues. As requested, our effort was limited to a review of past and ongoing planning and programing documents. The source documents HDR reviewed are also shown in the matrix below. In many cases, the source documents did not reveal specific applicable projects to be considered by are included here for ease of reference.

Counties	Projects	Source Plan / Document																										
		nMotion	East-West Connector	Northwest Corridor Transportation Study	South Corridor Transportation Study	Southeast Corridor Transit Alternatives	Downtown Multimodal Mobility Study	I-24 Statewide Corridor Study	Northeast Corridor Mobility Study	SR-386 Conceptual Study	MTA Capital Plan	WeGo Star Study	RTA Park & Ride Strategic Investment Plan	RTA 2020-2024 Capital Investment Plan	Downtown Interstate Loop Study	SE Transportation & Land Use Study	Middle Tennessee Vision for Freight	SR 109 Access Management Study	GNRC Congestion Management Improvements	GNRC 2016-2040 Regional Transportation Plan	South Corridor Transportation Study (On-Going)	GNRC 2020-2023 Transportation Improvement Program	TDOT Regional Congestion Study (On-Going)	TDOT 3 Year Plan	TDOT IMPROVE Act
Cheatham	Bus On Shoulder from Clarksville to Nashville	x	No Specific Relevant Projects Identified	x		No Specific Relevant Projects Identified	No Specific Relevant Projects Identified	x	No Specific Relevant Projects Identified	No Specific Relevant Projects Identified	No Specific Relevant Projects Identified				No Specific Relevant Projects Identified	No Specific Relevant Projects Identified	No Specific Relevant Projects Identified	No Specific Relevant Projects Identified	No Specific Relevant Projects Identified					
Cheatham	Commuter Rail to Clarksville via Ashland City	x		x																				
Cheatham	Park and Ride Lot along I-24 to service Route 94	x						x					x	x										
Cheatham	I-40 Intelligent Transportation Systems (ITS) Expansion																						x	x
Dickson	I-40 Intelligent Transportation Systems (ITS) Expansion																						x	x
Robertson	Freeway Bus Rapid Transit and/or BOS along I-65 (North)	x																						
Robertson	I-65 North Intelligent Transportation Systems (ITS) System																							x
Robertson	Park and Ride Lot along I-65 to Establish New Service	x											x	x										
Rutherford	Park and Ride Lot along I-24 to service Route 84							x					x	x							x			
Sumner	Freeway Bus Rapid Transit and/or BOS along I-65 North	x																						
Sumner	Park and Ride lot(s) along I-65 (North) near Whitehouse	x											x	x										
Williamson	Park and Ride Lot along I-65 (South) to Service Routes 91 and 95	x											x	x							x			
Williamson	I-40 Intelligent Transportation Systems (ITS) Expansion																						x	x
Williamson	Freeway BRT and/or BOS along I-65 (South)	x																						
Williamson	Potential Future South Corridor Transportation Projects				x																x			
Wilson	WeGo Star Improvements	x										x		x							x			
Wilson	I-40 Intelligent Transportation Systems (ITS) Expansion																						x	x
TDOT / Regionwide	Bike, Pedestrian, and Greenway Concepts																			x				
TDOT / Regionwide	Downtown Interstate "Inner Loop" Concepts														x									
TDOT / Regionwide	TDOT's Regional Congestion Study Concepts																					x		

Cheatham County

Northwest Corridor Transportation Study Locally Preferred Alternatives (LPAs)
This project was completed by the Regional Transportation Authority of Middle Tennessee (RTA) in October 2017, which seeks to establish improved commuter transit services in the corridor. The project identified two LPAs to be phased in over time as follows:

- **Bus on Shoulder from Clarksville to Nashville**
  The proposed Bus-on-Shoulder (BOS) solution targeted a 5- to 10-year implementation timeline. The 94 service would utilize the shoulder along I-24 from Nashville to Clarksville and stop at the existing park and ride (PnR) lots. This would allow a professional driver to utilize the shoulder to operate the buses, traveling at approximately half the posted highway speed. This would allow the bus to bypass congestion and slow traffic, provide commuters a travel time advantage, and offer a more reliable express bus service. Other improvements would include queue jump lanes at exits, as well as transit signal priority or combinations thereof. Capital costs were estimated at between $24M to $48M, which includes hardening the shoulders to accommodate the vehicles and improve the existing PnR lots.

  State legislation passed in 2016 allows operation of BOS. However, it is our understanding that FHWA has withheld support in the past for implementation of BOS because the HOV lanes, which the FHWA helped to fund, are currently under-enforced. If BOS should advance, potential opportunities exist to partner among multiple entities, including TDOT, the RTA, Metro Nashville, the City of Clarksville, Clarksville Transit, Cheatham County, Montgomery County, Robertson County, the Federal Transit Administration (FTA), and Federal Highway Administration (FHWA).

- **Commuter Rail from Nashville to Clarksville via Ashland City**
  This is a longer term, 15+ year project concept from the Northwest Corridor Transportation Study, which seeks to establish commuter rail service along the existing Nashville and Western Railroad now owned by the RJ Corman Railroad Group, extending northward to Clarksville in Montgomery County. The study proposed commuter rail service (regular route stopping at all stations as well as express service with limited stops) from Nashville to Clarksville with an intermediate stop in Ashland City and other locations using diesel multiple unit (DMU) equipment along a 42-mile line. Approximately half of the line has existing tracks. New right-of-way and new tracks would be required north of Ashland City. Also, the Nashville terminal station and routing would need further analysis to determine the terminal station location in Nashville. Capital costs were estimated to be $525M.

  If this project were to advance, partnerships among multiple entities could include the RTA, Metro Nashville, the City of Clarksville, Ashland City, Cheatham County, Montgomery County, the Cheatham County Rail Authority, RJ Corman, FTA, and the Federal Railroad Administration (FRA).

Park and Ride Lot along I-24 for Route 94

The Nashville Metropolitan Transit Authority (MTA) and the Regional Transportation Authority of Middle Tennessee (RTA) nMotion Transit Plan highlighted the importance of PnR lots and recommended the RTA develop purpose-built PnR lots at strategic locations. As a follow-on to nMotion, RTA published the RTA Park and Ride Strategic Investment Plan in January 2020. This plan identified and prioritized corridors in need of additional and stable PnR facilities, which included a PnR lot along I-24 to enhance the express bus service from downtown Nashville to Clarksville.

This corridor is currently served by bus route 94. The following strategies are recommended in the study and provide potential partnership opportunities with Montgomery County, Cheatham County, City of Clarksville, and Clarksville Transit.

- **Strategy 1:** Consider a permanent site near the Pleasant View PnR that has better highway access than the existing location.
- **Strategy 2:** As demand grows for Route 94 and the existing PnR site at Exit 11 reaches capacity, extend the route to either Exit 4 or US 79/SR 374 and establish a new PnR lot.
- **Strategy 3:** Any service extension to Clarksville (Exit 4 or US 27/SR 374) should have connections to Clarksville Transit System for distribution/circulation in the Clarksville area.

I-40 Intelligent Transportation Systems (ITS) Expansion
This project would potentially extend from Dickson County through Williamson and Cheatham Counties and into Davidson County. See the project discussion under the Dickson Section of this memo.

Dickson County

I-40 Intelligent Transportation Systems (ITS) Expansion
The Improve Act identified several corridors throughout Middle Tennessee for the expansion of ITS systems. The expansion along I-40 is from US 70S (Exit 196 to I-840), and from SR 225 (Exit 216) to US 70 (Exit 239). This takes the potential system from Dickson County to Davidson County. This could entail a system of deployed ITS devices, potentially using the I-24 SMART corridor pilot as a model. Devices could include dynamic message signs (DMS), cameras, speed detectors, emergency pull-off areas, ramp metering, etc. Potential partners may include TDOT, Dickson County, Williamson County, Cheatham County, and the FHWA. The terminus near I-840 is in Dickson County.

Robertson County

Freeway Bus Rapid Transit and/or BOS along I-65 (North)
The MTA/RTA nMotion Transit Plan identified Freeway BRT and Bus-on-Shoulder along I-65 N. BOS service would use freeway shoulders when general traffic lanes are congested, providing transit customers with shorter travel times and more reliable service. It is our understanding that FHWA will not support the implementation of BOS with the currently unenforced HOV lanes, which they helped to fund. Further, the Tennessee Highway Patrol (THP) is reluctant to enforce the HOV lanes due to safety concerns related to pulling over vehicles in violation of the rules. Proven technology for electronic enforcement is available; however, state legislation would need to be modified to permit its use. Corridors identified in nMotion include the following:

- **Freeway BRT:** Routes 87 (Gallatin), 89 (Springfield), and 92 (Hendersonville) that will utilize Ellington Parkway, SR 386 and I-65 N when applicable.
- **Bus-on-Shoulder:** Route 85 (White House) would use I-65 N shoulders if put in service.

Potential partnerships may include Robertson County, Sumner County, Gallatin, Springfield, Hendersonville, White House, TDOT, RTA, and FHWA.

I-65 North Intelligent Transportation Systems (ITS) System
The Improve Act identified several corridors throughout Middle Tennessee for the expansion of ITS systems. The expansion along I-65 is identified from Nashville southward. The I-24 SMART Corridor pilot project is ongoing and could serve as a model for the I-65 corridor. This could be a cooperative undertaking of TDOT, Robertson County, Davidson County, local jurisdictions, and the FHWA. Potential

devices and partners would be similar to those discussed above for I-40. Potential partners include Robertson County, TDOT, and FHWA.

Park and Ride Lot along I-65 to Establish New Service

The RTA Park and Ride Strategic Investment Plan (as referenced prior in this memo) identified and prioritized corridors in need of commuter express bus service. The document highlighted a potential need for express bus service from Exits 108 or 104 in the White House area south along I-65 to Nashville.

Express routes to White House does not exist, but nearby routes include the 92 Hendersonville Express and 87 Gallatin Express. The study recommended:

- **Strategy 1:** As support for a new service in this corridor increases, identify sites at either Exit 104 or 108 for possible PnR locations.
- **Strategy 2:** After the initial service startup, a second PnR lot can be added when warranted.

Potential partners include the City of White House, Sumner County, Robertson County, TDOT, and FHWA.

Rutherford County

Park and Ride Lot along I-24 to service Route 84

The RTA Park and Ride Strategic Investment Plan (as referenced prior in this memo) identified and prioritized new potential corridors in need of commuter express bus service. This plan identified the need for a PnR lot along I-24 to enhance the existing express bus service from downtown Nashville to Murfreesboro.

This corridor is currently served by the 84, 86, and 96 bus lines. The following strategies are recommended in the study and provide potential partnership opportunities with Rutherford County, Murfreesboro, Smyrna, La Vergne, Murfreesboro Transit, TDOT, and FHWA.

- **Strategy 1:** Work with City of Murfreesboro to provide Route 84 PnR spaces at the City's proposed new transit center.
- **Strategy 2:** Identify an additional PnR site at either Exit 76 or 80 as a second lot served by Route 84X and more accessible to Murfreesboro's growing population on the west side of I-24.
- **Strategy 3:** Identify a site at Exit 62, 64, or 66 for an additional PnR lot on Route 86 that could eventually replace the existing Stars and Strikes location in Smyrna.
- **Strategy 4:** RTA services in the I-24 corridor should also be designed to utilize infrastructure improvements and technologies that are included in TDOT's I-24 SMART Corridor project**.**

Sumner County

Freeway Bus Rapid Transit and/or BOS along I-65 North

Potential partnerships may include Robertson County, Sumner County, Gallatin, Springfield, Hendersonville, White House, TDOT, RTA, and FHWA. See the discussion of this project located under the Robertson County section of this memo.

Park and Ride lot(s) along I-65 (North) near White House

The RTA Park and Ride Strategic Investment Plan (as referenced prior in this memo) identified and prioritized new potential corridors in need of commuter express bus service. This plan identified the

need for two PnR lots along I-65 N to enhance the express bus service from downtown Nashville to Goodlettsville and White House.

This corridor is not currently served by an RTA route. The following strategies are recommended in the study and provide potential partnership opportunities with Robertson, Sumner and Davidson Counties, White House, RTA, TDOT, and FHWA.

- **Strategy 1:** As support for new service in this corridor increases, identify sites at either Exit 104 or 108 for possible PnR service.
- **Strategy 2:** After the initial service startup, a second PnR lot can be added when warranted.

Williamson County

Park and Ride Lot along I-65 (South) to Service Routes 91 and 95

The RTA Park and Ride Strategic Investment Plan (as referenced prior in this memo) identified the need for two PnR lots along I-65 S to enhance the express bus service from downtown Nashville to Franklin and Spring Hill. This corridor is currently served by the 91X and 95X RTA routes. The following strategies are recommended in the study and provide potential partnership opportunities with Williamson County, Franklin, Spring Hill, RTA, TDOT, and FHWA.

- **Strategy 1:** Replace the Spring Hill Kroger PnR with a new facility at the planned new Buckner Road interchange.
- **Strategy 2:** Find a site in the vicinity of I-65 and Moore's Lane to eventually replace the Williamson County Agricultural Center site. The selected location should also be served by Franklin Transit to facilitate reverse commute trips.
- **Strategy 3:** Extend Route 95 to Columbia and establish the PnR facility at US 31 and US 412.
- **Strategy 4:** Work with the City of Brentwood to add a second stop for Route 91 at one of the Brentwood interchanges.

I-40 Intelligent Transportation Systems (ITS) Expansion

This project would potentially extend from Dickson County through Williamson and Cheatham Counties and into Davidson County. See the project discussion under the Dickson Section of this memo.

Freeway BRT and/or BOS along I-65 (South)

The nMotion plan calls for the implementation of freeway BRT along the I-64 corridor from Columbia to Nashville. This service would also benefit Spring Hill, Franklin, and Cool Springs with stations in close proximity. BRT vehicles would operate in dedicated bus lanes, HOV lanes or managed lanes. The following routes would utilize the freeway BRT infrastructure:

- **Freeway BRT:** Routes 90 (Cool Springs – not currently in service), 91 (Franklin), 95 (Spring Hill), and 97 (Columbia – not currently in service).

Should this type of project advance, potential partners may include Williamson County, Columbia, Spring Hill, Franklin, Cool Springs, TDOT, FHWA, and FTA.

Potential Future South Corridor Projects

The South Corridor Study by GNRC will build on the regional interest to connect Davidson, Williamson, and Maury Counties. This ongoing study will transform recent transportation plans into readily

implementable projects that can modernize area roadways and address growing traffic congestion and safety concerns. The GNRC has established goals to connect the Franklin Transit Authority and Mule Town Trolley with WeGo, as well as identify future investments on I-65 S and State Route 6.

Wilson County

WeGo Star Improvements

The RTA of Middle Tennessee completed the WeGo Star Planning Study in October 2019 and presented the results of the study to the Board of Directors in January 2020. The study identified incremental commuter rail improvements that include 1) track improvements to facilitate additional peak period and peak direction service; 2) the extension of service to the Wilson County Exposition Center; 3) the addition of Positive Train Control (PTC) to allow for the concurrent growth of commuter rail and freight rail service in the corridor.

The current service extends from downtown Nashville to the City of Lebanon in Wilson County and is currently funded jointly and proportionately between the two counties. All of the improvements being considered would benefit both Davidson and Wilson Counties and would require additional capital and annual operating funding. The noted capital improvements are included in the FY2020-2024 RTA Capital Investment Plan to guide future project development activity and to allow staff to seek funding opportunities. Potential partners include the counties, potentially the cities, RTA, FTA, FRA, and the customers of the railroad.

I-40 Intelligent Transportation Systems (ITS) Expansion

This project would potentially extend from Dickson County through Williamson and Cheatham Counties and into Davidson County, with approximately 17 miles of this ITS expansion occurring in Wilson County. See the project discussion under the Dickson Section of this memo.

Potential Forthcoming Opportunities to Partner with TDOT and/or Middle Tennessee Jurisdictions

Bike, Pedestrian, and Greenway Concepts

The Greater Nashville Regional Council (GNRC), in its 2016-2040 Regional Transportation Plan, has emphasized the need for safer and more walkable streets in the Middle Tennessee Region. Investments in pedestrian and bicycle infrastructure can enhance local commerce, foster healthier lifestyles and serve as a foundation for future transit expansion. Based on current federal transportation funding, the Nashville area is expected to receive approximately $1.0 billion over the next 25 years in roadway reconstruction and multi-modal upgrades, which include streetscaping and enhanced safety for pedestrians and cyclists. With a regional program, pedestrian, bicycle and greenway projects could span across Middle Tennessee and reveal several multi-jurisdictional opportunities.

Downtown Interstate 'Inner Loop' Concepts

The Greater Nashville Regional Council (GNRC), TDOT, Metro Nashville, Downtown Nashville Partnership, and the Nashville Civic Design Center are currently conducting a study to develop a shared vision for continued improvements to the U.S. Interstate 24/40/65 loop ("Inner Loop") around downtown Nashville. The goal of this study is to determine a preferred method of improvement to the

inner loop by establishing funding, short-term relief for local access and circulation, phased implementation of major upgrades, and incorporating transit and technology.

The outcome of this major initiative will likely provide partnership opportunities with TDOT, FHWA, MTA and others, and has the potential to significantly affect mobility in and around Nashville.

Appendix 8 – Mayor Cooper's Sustainability Task Force Mobility Subcommittee Findings Summary

Metro Nashville Transportation Plan

December 2020

Mobility Subcommittee Report
Mayor's Sustainability Committee – 2020

The vision for mobility in Nashville in 2050 is to significantly reduce the overall Vehicle Miles Traveled (VMT) by reducing our drive alone rate and shifting remaining car trips to electric vehicles. To reach this goal, the Mayor should support Metro Council adoption of incremental mode share targets, which increase over time and include carve-outs for specific sustainable commute modes (e.g. walking, biking, and transit).

Milestones could include reducing our drive alone rate from 79% to 70% by 2025 to 54% by 2035 and 40% by 2050; simultaneously Metro will increase our EV adoption rate from 3% to 10% by 2025 to 20% by 2035 and up to 40% by 2050. All remaining vehicles in 2050 must be electric. Evaluation will be key to reaching these goals. Targets should be updated at least every five years and strong land use planning and coordination with surrounding counties will be critical to reaching these goals.

The Mobility Subcommittee's recommendations are divided into nine main strategies summarized below:

1. Empower Nashvillians of All Ages and Abilities to Bike
2. Develop Vision Zero Program: Make our streets safer for walking and bicycling
3. Expand Access to Shared Urban Mobility Devices
4. Move More People by Investing in WeGo, Implementing Better Bus, and Committing to High Capacity Transit Corridors
5. Improving Mobility through Land Use Policies and Practices: Transit Supportive Development Ordinance
6. Organize Metro Institutions and Processes to Deliver a Better Multimodal Transportation System
7. Develop Comprehensive and Mandatory Transportation Demand Management (TDM) Policies and Programs
8. Reduce Emissions from Freight/Movement of Goods
9. Invest in "Green" Transportation Vehicles and Infrastructure

In order to quickly make progress on the recommended strategies, the Mayor should commit to these high-priority action items:

1. Focus on providing safe multimodal transportation led by a Metro DOT. Milestones to include **reducing our drive alone rate from 79% to 70% by 2025** and begin shift remaining car trips to EVs
2. Identify and secure **Dedicated Funding** by 2024. Commit GF dollars to transit, sidewalks, bikeways, and traffic calming (incl $34 million to WeGo) to help reduce drive alone trips.
3. Complete 50% of the 71 miles of the **Priority Sidewalk Network** by 2025. Prioritize transit-dependent populations and complete new sidewalks in areas that need them most first.
4. Complete the 91-mile priority **bike network** by investing $8 million per year for five years and complete the 23-mile CityCentral Greenway to help reduce drive alone trips and provide mobility options.
5. Work with Metro Council to **pass Transportation Demand Management (TDM) legislation**. Ensure it is on-par with peer cities and requires major developers to reduce drive alone trips.

6. Transition Metro vehicle, transit, and school bus fleet **to electric or other low-emissions technologies**. Provide and maintain critical infrastructure to support EVs.
7. Guided by NashvilleNext, **invest in multimodal development** in the core, centers and transit corridors in ways that meet the needs of residents by providing affordable housing, access to jobs, education, etc. while reducing sprawl.

The subcommittee commends the Mayor's Office on its recently released $1.5 billion transportation plan that outlines the steps and milestones to implement an advanced transportation plan. It includes financial strategies and a path to dedicated funding to achieve our long-term transportation, economic development, equity, and sustainability goals. It also recognizes the importance of land use planning and the need for more affordable housing. It is a critical first step towards achieving our goals, but more is needed.

The need for a dedicated funding source for public transportation is critical to making progress. **Nashville is one of only three cities among the top 50 in population that lacks a dedicated funding source for public transportation.** Each year, WeGo Public Transit must compete for resources with dozens of other priorities. As a result, planning for enhancements to service and infrastructure cannot happen in a reliable manner. While a dedicated funding voter referendum may not be immediately achievable, it will be important for there to be mayoral and council commitments from the general fund for transportation infrastructure, so that we can continue to make progress towards our goals, including preparations for a future referendum.

Funding and implementing a transit system is key, coupled with strong land use planning. Land use and transportation policies must be updated quickly to avoid infrastructure that does not support a multimodal future (e.g. housing without sidewalks, developments without high quality bus stops, car-oriented street networks, etc.). For more information, please reference the Land Use Chapter.

As Nashville improves our transportation infrastructure, we need to be more equitable in the distribution of improvements across our city whether it is sidewalks, bikeways, new transit infrastructure, etc. The mayor should establish a joint Metro housing and transportation committee. This group would determine ways to increase affordable and workforce housing around transit centers and along transit routes. Metro should also create an equity-screening tool that helps prioritize infrastructure investments and ensures more equitable distribution of infrastructure and services. Existing modal masterplans should also be screened for equity.

In closing, our subcommittee would like to thank the local experts and Metro liaisons who helped us develop these recommendations. Our process began with reviewing *NashvilleNext* and other reports including Metro's modal plans (*nMotion, WalknBike, Plan to Play,* etc.) and best practices from over a dozen peer city climate action plans. We estimate that our group and guests have spent over 300 hours on research, discussing mobility issues, and developing our recommendations. From April to June, we had 14 weekly meetings with roughly 12 to 15 people at each meeting along with special guests.

FOR REFERENCE

Mayor's Sustainability Advisory Committee
Mobility Subcommittee Half-Page Narrative
Co-Chairs: Erin Hafkenschiel and Mary Vavra
Committee Members: Sue Ballard de Ruiz, Michael Connolly, Mark Deutschmann, Brian Gant, Gary Gaston, and Nora Kern

In 2017, the transportation sector became the largest contributor to the nation's greenhouse gas emissions, surpassing electricity generation for the first time. The vast majority of our transportation emissions (60%) come from personal vehicles and an additional 23% come from freight trucks[1]. Emissions from driving in Nashville have risen 88% since 1990 (9% per capita). The United States must find a way to reverse this dangerous trend in order to meet our carbon reduction goals and to avoid catastrophic climate change.

***The two most important strategies to achieve our climate goals are to reduce our vehicle miles traveled and to increase our electric vehicle adoption rate**. In order to reduce vehicle miles traveled, we must shorten trips and reduce drive alone trips by: 1) identifying and securing dedicated funding for transit to build a robust transit system, 2) expanding the sidewalk and pedestrian infrastructure countywide, and 3) completing the low-stress bicycle network and expanding greenways. Transportation infrastructure is undoubtedly expensive, but it is a critical investment for economic development, racial justice, public health, and, of course, sustainability. Fortunately, investing in protected bike lanes is one of the most cost-effective investments a city can make. Nashville could complete its entire 91-mile priority bike network by investing $8 million per year for five years. One of the most important first steps in increasing electric vehicle adoption is for Metro Nashville to set an example and convert its transit, metro vehicle, and school bus fleet to electric or other low-emissions technologies.*

Finally, transportation and land use are inextricably connected; there is no way we can shorten trips or reduce drive alone rates if we do not adhere to the land use policies in NashvilleNext and change transportation practices that require car-oriented developments. Metro Nashville must enforce policies and practices that discourage sprawling developments and the use of single occupancy vehicles. The city should encourage more density in the urban centers and urban core by increasing allowable density, streamlining permitting processes and investing in infrastructure, such as building transit centers with a connected network as outlined in nMotion as well as making other improvements such as upgrades to urban sewer lines. School siting and adjacent infrastructure also has an outsize impact on development patterns and localized congestion. Another low-cost measure Metro could enact immediately is forming a district-wide Safe Routes to Schools (SRTS) task force to lead SRTS activities and pass MNPS-wide SRTS policies that improve and promote SRTS. By focusing on safe walking, biking, transit ridership and employing land use tools and best practices throughout the county, Nashville can provide a supportive framework for more sustainable and healthier neighborhoods diverse in both use and in population.

1

Mobility

Vision: Increase the quality, availability, and safety of transportation options for cleaner air, healthier commutes, and better access to jobs and opportunities.
Targets: Reduce Metro's Vehicle Miles Traveled (VMT) by 40% by 2050 and increase Electric Vehicle (EV) adoption rate up to 40% by 2050.

Policy Focus
Empower Nashvillians of All Ages and Abilities to Bike
Develop Vision Zero Program: Make our streets safer for walking and biking
Expand Access to Shared Urban Mobility Devices
Move More People by Investing in WeGo, Implementing Better Bus, and Committing to High Capacity Transit Corridors
Improve Mobility through Land Use Policies and Practices
Organize Metro Institutions and Process to Deliver a Better Multimodal Transportation System
Develop Comprehensive and Mandatory Transportation Demand Management (TDM) Policies and Programs
Reduce Emissions from Freight/Goods Movement
Invest in "Green" Transportation Vehicles and Infrastructure

Priority Actions

1) Focus on providing safe multimodal transportation led by a Metro DOT. Milestones to include **reducing our drive alone rate from 79% to 70% by 2025** and begin shift remaining car trips to EVs
2) Identify and secure **Dedicated Funding** by 2024. Commit GF dollars to transit, sidewalks, bikeways, and traffic calming (incl $34 million to WeGo) to help reduce drive alone trips.
3) Complete 50% of the 71 miles of the **Priority Sidewalk Network** by 2025. Prioritize transit-dependent populations and complete new sidewalks in areas that need them most first.
4) Complete the 91-mile priority **bike network** by investing $8 million per year for five years and complete the 23-mile CityCentral Greenway to help reduce drive alone trips and provide mobility options.
5) Work with Metro Council to **pass Transportation Demand Management (TDM) legislation**. Ensure it is on-par with peer cities and requires major developers to reduce drive alone trips.
6) Transition Metro vehicle, transit, and school bus fleet **to electric or other low-emissions technologies**. Provide and maintain critical infrastructure to support EVs.
7) Guided by NashvilleNext, **invest in multimodal development** in the core, centers and transit corridors in ways that meet the needs of residents by providing affordable housing, access to jobs, education, etc. while reducing sprawl.

Leadership initiative: Convene Metro Affordable Housing and Transportation Taskforce to develop policies that lead to more transit-oriented, compact development and more affordable housing in Davidson County that is accessible to transit.

Equity: Develop an equity-screening tool that is used for every major Metro modal plan and ensures infrastructure investments are distributed equitably.

Lock-In Effects to Avoid: A lack of dedicated funding is causing Metro to fall further behind peer cities. Restrict the purchase of new fossil fuel-powered vehicles. Provide and maintain adequate EV infrastructure

Appendix 9 – Analysis of Murfreesboro Pk. & Clarksville Pk. transit corridors by Metro Planning

Metro Nashville Transportation Plan

December 2020

Analysis of Murfreesboro and Clarksville transit corridors by Metro Planning

MURFREESBORO PIKE

Segment	Policy readiness	Infrastructure	Opportunities/Affordability
Downtown to I-24	Urban Corridor policy is supportive of transit. No UDO, base policy only. Lot depths and sizes are reasonable. Within a Promise Zone.	Aside from Chestnut Hill and Napier Sudekum, the area is largely industrial, with limited sidewalks. The sidewalk network would generally accompany redevelopment. However, there are more large lots here than in other comparably urban areas. Connection to the Browns Creek segment of the Central City Greenway, with additional connections to Midtown (Chestnut/Edgehill).	Envision Napier Sudekum has not begun construction but is a critical opportunity with MDHA. Trevecca Nazarene University is also home to an important affordable housing development.
I-24 to Airport	Suburban Corridor policy is generally supportive of transit. No UDO, base policy only. Lot depths and sizes are reasonable, with some limitations. Office Concentration near Vultee Blvd could be improved, if not too close to the airport. Within a Promise Zone.	Very little sidewalk network or road connectivity off the corridor. Mill Creek floods frequently. Some has been purchased for greenway.	Some older suburban apartment buildings.

Segment	Policy readiness	Infrastructure	Opportunities/Affordability
Airport to Bell Road	Office Concentration at Donelson Pk. and Harding Pl. – may be the best fit close to the airport, due to height restrictions in the airport overlay. North Murfreesboro UDO. Suburban Mixed Use Corridor policy is supportive but will likely be difficult to transition to mixed use or additional density without substantial additional work.	Very little sidewalk network or road connectivity off the corridor Long term need direction on the Harding Place extension. A critical element to this area, without a clear future. Parkland deficient area.	Large suburban sites offer a redevelopment opportunity. Some of these are on their second life.
Bell Road	Urban Community Center policy – strong anchor. Suburban Residential Corridor – supports existing apartment development. Could support redevelopment of residential, but no commercial services.	Very little sidewalk network or road connectivity off the corridor. Need for walkable blocks and improved connectivity. Apartments add density without walkability.	Global Mall – opportunity site for P3, with existing public anchors (Metro and Nashville State).

CLARKSVILLE PIKE

Segment	Policy readiness	Infrastructure	Opportunities/Affordability
South of Cumberland River	Urban Corridor policy is supportive of transit. No UDO, base policy only. Much of the corridor has narrow and small lots. Within a Promise Zone.	Walkable block structure, portions of which have a complete sidewalk network. Additional park or programming for Elizabeth Park would fill a small park deficient area.	26th & Clarksville: Large Barnes Fund/Urban Housing Solutions project. Cumberland View public housing is close as well. At one point, MDHA was seeking to conduct an Envision Process here. Buchanan St is a key corridor, emerging as a distinctive arts and black-owned business district, with many competing ideas about how it should move forward. McGruder Center is a social service hub.
Cumberland River to Whites Creek	Suburban Corridor and Center policy is generally transit supportive, though less intense than urban policies. Some larger redevelopment and infill sites. No UDO, base policy only. Buena Vista Pk./Trinity Ln. is expected to intensify substantially and transform to an urban corridor. Surrounding residential areas have Evolving policy.	Hybrid suburban/urban block structure, sidewalks only on a few key corridors.	Community conversations in Bordeaux have primarily focused on expanding retail and services, with some recognition of the need for additional housing to accomplish that.

Segment	Policy readiness	Infrastructure	Opportunities/Affordability
Whites Creek to Kings Lane	Suburban Corridor and Center policy is generally transit supportive, though less intense than urban policies. Some larger redevelopment and infill sites. Clarksville Pike UDO covers this portion. Surrounding residential areas have some Evolving policy that transition to Maintenance.	Suburban block structure with very limited sidewalk network. Primarily drainage ditches along the corridor.	Programming Mullins Park could be a quality of life improvement and a catalytic investment.

Appendix 10 – Planning effort summaries

Metro Nashville Transportation Plan

December 2020

Planning effort summaries

METRO'S RELATED PLANNING EFFORTS

Mobility investments presented in the Mayor's Plan are fully nested within NashvilleNext, the region, and state overall framework of policies and planned investments. It does not start from scratch. In order to create a plan that's right sized for Nashville in 2020, it used the public listening sessions to help prioritize among the scores of new investments recommended in adopted studies and plans

A clear message woven throughout ***NashvilleNext*** is ensuring Nashvillians can access opportunity via with expanded mobility options, including public transportation that links our city's areas most ready for growth. Future housing and job growth will concentrate within major centers like Downtown and Midtown, and along major corridors like West End Avenue and Gallatin, Murfreesboro, Clarksville, Nolensville, and Charlotte pikes. NashvilleNext envisions building a high-capacity transit system to make necessary densities achievable without disruption to quality of life. Realizing the vision relies on a dedicated financial commitment to improving transit.

Access Nashville 2040, a component of *NashvilleNext,* identifies a comprehensive framework for the city's multimodal transportation future, providing a coordinated approach to improving our transportation network through 2040

Major and Collector Street Plan (MCSP), a part of *Access Nashville 2040*, guides public and private investment in the major streets that make up the backbone of the city's transportation system. Emphasis is placed on designing streets that serve all people and reflect the character of the neighborhoods and centers through which users pass.

WalknBike*, Nashville's bicycle and pedestrian master plan,* identified priority bicycle and pedestrian networks that form the basis for investment in these modes through 2040, recognizing their importance in connecting neighborhoods to the high-capacity transit corridors.

Plan to Plan, *Nashville's parks, recreation and greenway master plan* recommended multi-use paths, greenways, that connect parks, communities and jobs.

Community Plan updates, small area plans, and corridor studies. Lastly, communities have been engaged along multiple corridors and small areas (see table below) to further refine land use and design policies to support future growth, while advancing the goals of each strategic plan. Developing these plans gave communities an opportunity to align land use and mobility policy in support of overarching goals and strategies defined by NashvilleNext, nMotion, WalknBike, and Plan to Play.

Small area or corridor plan	Adoption	Major corridors included
W Trinity/Katie Hill/Haynes	2018	W Trinity Ln
Highland Heights	2018	Dickerson Pk, E Trinity Ln, & Douglas Ave
Lebanon Pk Corridor	2018	Lebanon Pk, from Spence Ln to Briley Pkwy
Charlotte Ave Corridor	2018	Charlotte Ave, from White Bridge Pk to I-440
Music Row	2019	Broadway, 16th Ave S, and 17th Ave S

Wedgewood-Houston/Chestnut Hill	2019	Lafayette Ave, 2nd Ave S, 4th Ave S, & Wedgewood Ave
Dickerson South Corridor	2020	Dickerson Pk – Spring St to Pages Branch
Dickerson North Corridor	Underway	Dickerson Pk – Pages Branch to Skyline Ridge Dr

STATE AND REGIONAL PLANNING EFFORTS

We cannot solve our region's mobility challenges on our own. We can only accomplish that by coordinating with our neighboring cities and counties in Middle Tennessee. Multiple agencies must align their vision and work program to achieve success. As such, Metro, GNRC (MPO/TPB), and TDOT have developed numerous plans that study regional mass transit opportunities and other mobility needs. These studies have been conducted by Metro, GNRC, and TDOT. One conceptualized a streetcar on West End. Another planned for a dedicated-lane Bus Rapid Transit (BRT) on West End to East Nashville (East-West Connector or the AMP). Others included BRT on Gallatin Pike, a city urban light rail system, commuter rail, regional HOV lane development, and expanded regional park-and-rides. While the region's vision for the future is clear, how it will find money to fund it is not.

nMotion, *the regional plan for public transportation,* identified an ambitious transit vision that concentrated new high capacity transit investments on major corridors identified in NashvilleNext, in addition to investments in traditional bus service. Mobility projects have been studied over and over on the same streets, and we have failed to implement many of the projects conceptualized in these plans. Given past planning efforts and the city's exponential development, residents want better options to get around town. Nashville-Davidson County voters turned down the Let's Move funding mechanism that included several of nMotion's high-dollar investment recommendations, notably the five light rail corridors.

- Clarksville Pike: proposed for rapid bus and includes North Nashville Neighborhood Transit Center, both of which are priorities in this plan.
- Murfreesboro Pike: proposed for high-capacity transit as light rail. This plan identifies it as bus rapid transit, which serves the same function as light rail by providing dedicated lanes for travel, similar station placement, and similar redevelopment opportunities.

Middle Tennessee Connected programs federal investment in mobility across the region for FY2016-2020. Note that GNRC is currently preparing the next update to this plan. The plan emphasized the need for safer and more walkable streets, understanding that investments in pedestrian and bicycle infrastructure can enhance local commerce, foster healthier lifestyles and serve as a foundation for future transit expansion. Based on current federal transportation funding, the Nashville area is expected to receive approximately $1.0 billion over the next 25 years in roadway reconstruction and multi-modal upgrades, which include streetscaping and enhanced safety for pedestrians and cyclists.

GNRC has also funded studies along major transportation corridors identified by the regional transit plan to define a locally preferred alternative and better understand the wide range of development patterns and other investments in infrastructure needed to ensure long-range success. The ***South Corridor Study*** is the latest such study and is currently in progress with the goal of identifying a series of short-, mid-, and long-term recommendations to implement the vision for rapid transit between Nashville and Williamson and Maury counties along the I-65, US 31 and CSX corridors.

The ***Southeast Area Transportation and Land Use Study*** prepared by the MPO in 2016 identified a locally preferred alternative transit investment as part of this study of growth and development in southeastern Davidson County and north and central Rutherford County. While the plan identified many improvements for roadways and transit, the most relevant outcome to the Metro Nashville Transportation Plan project list is the proposed Murfreesboro Pike Rapid Transit Line recommended for the urbanized portion Davidson County along the Lafayette Street/Murfreesboro Pike/Bell Road corridor between Downtown Nashville and Murfreesboro. The study did not recommend a specific mode (e.g. bus rapid transit, light rail, etc.). This project would serve the preferred vision for growth and development in the study area along with the other multimodal transportation improvements identified as necessary to support long-term success. While not an exact match, the study clearly established need and purpose for a major transit investment that is in alignment with the proposal included in the Metro Nashville Transportation Plan for Murfreesboro Pike Bus Rapid Transit. This study documents additional vetting for improving transit service along this corridor. Additionally, the locally preferred alternative identified complementary rapid transit service to the area for regional travelers along the I-24 corridor between Nashville and Murfreesboro. Transit improvements will require a calculated approach in order to match land use and density changes as they occur in Metro Nashville.

The ***Northwest Corridor Transit Study*** prepared by the MPO in 2016 identified a three-phased locally preferred alternative for bringing higher-capacity, higher-speed transit services to the Northwest Corridor between Nashville and Clarksville. The short-term phase will improve upon the existing 94X Express Bus service within the corridor. This could be expanded to add more hours and trips. The medium-term phase would look to add travel time advantage along the corridor as well as the arterials from it leading to the main transit terminal station. The most relevant outcome to the Metro Nashville Transportation Plan project list is in the long-term phase that invests in commuter rail in the existing and new NWR rail corridor from Nashville to Clarksville.

This project would establish commuter rail service operated with diesel multiple unit vehicles providing weekday service with peak-period trains operating in an express mode serving four to five stations with multiple cars, with a train every 20 minutes. During the day, a single-car train would operate in “local” mode in Nashville/Davidson County only along five to six stations, with trains running every 40 minutes. While not an exact match to the Clarksville Pike Rapid Bus project, the study clearly established need and purpose for a major transit investment. The route would link Bordeaux, Ed Temple, Heiman Street and the Farmers Market, much like the Clarksville Pike Rapid Bus project. Rapid bus is a potential first step toward achieving the larger vision within the Northwest Corridor and the Metro Nashville Transportation Plan.

TDOT’s **Regional Congestion Study Concepts** (In Progress), part of their Congestion Management Plan, will assess freeways within the Nashville MPO region in consideration of bus on shoulder (BOS), express lanes, HOV lanes, HOT lanes, reversible lanes, etc. Consideration may also be given to ITS and transit solutions within the context of the above-mentioned concepts. This will help TDOT better understand the scale of congestion in the region, and the conditions that are driving the current study.

GNRC, TDOT, Metro Nashville, Downtown Nashville Partnership, and the Nashville Civic Design Center are currently conducting a study to develop a shared vision for continued improvements to the U.S. Interstate 24/40/65 loop (“Inner Loop”) around Downtown Nashville. The goal of the Downtown Interstate ‘Inner Loop’ Study is to determine a preferred method of improvement to the inner loop by

establishing funding, short-term relief for local access and circulation, phased implementation of major upgrades, and incorporating transit and technology. TDOT also completed the *I-65 Corridor Study* that looked at the interstate from Alabama to Kentucky state lines. TDOT recently initiated a similar study for I-40.

LOCAL ADVOCACY FOR MOBILITY OPTIONS

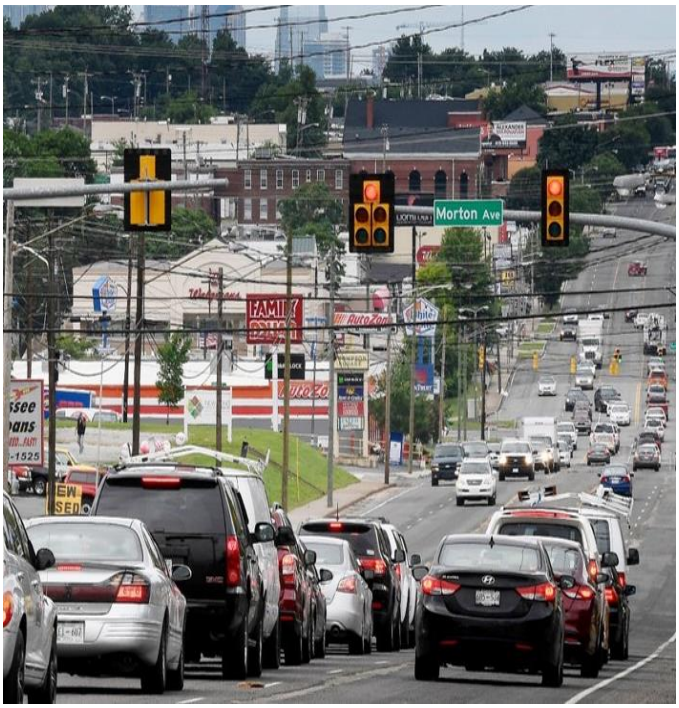
Nashville would not be the community it is today were it not for the countless number of advocacy groups and unions that fight for progress in our built environment and transportation system. During times of great adversity, Nashvillians time and time again step up to the plate to ensure that opportunity is available to all, that our treasured natural and historic resources are celebrated rather than paved over, and that Metro Government is held accountable when it comes to helping those who cannot help themselves. Over the past few years, several non-profit groups have provided action plans and reporting programs and the following list is merely the tip of the iceberg of existing documents which have inspired Metro staff with the creation of this document and the ensuing recommendations outlined in Part 5:

- Bus Route Report Card, 2019 (Music City Riders United)
- Impossible Crossings Report, 2018 (Walk Bike Nashville)
- Impossible Crossings and Transit, 2018 (Walk Bike Nashville)
- Moving the Music City Report Card (Walk Bike Nashville)
- Envision Nolensville Pike, 2016 (Salahadeen Center, Conexión Americas, and GNRC)
- Plan of Nashville (Nashville Civic Design Center)
- Every Place Counts Challenge (Metro, TDOT and U.S. DOT).

Appendix 11 – Plan Methodology Memo by HDR

Metro Nashville Transportation Plan

December 2020



Methodology

Nashville Transportation Plan Benefits Analysis

Technical Memo

Nashville, TN

October 16, 2020

Contents

Tables

Figures

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1 Introduction

This study is intended to provide information that can be used to better understand and articulate the potential benefits of the conceptual elements identified in the Metro Nashville Transportation Plan (the Transportation Plan). A description of the Transportation Plan elements and the associated costs were provided by Metro. Most of the projects within the Transportation Plan will need to advance through planning and engineering to more fully define their scope and costs. Because of the highly conceptual nature of the Transportation Plan, the HDR team used a combination of qualitative and quantitative information to evaluate its key initiatives, which include:

- Upgrading the bus system;
- Tackling traffic and modernization of the traffic management system;
- Investing in neighborhood infrastructure including sidewalks, bikeways, and greenways;
- Improving safety and advancing the Mayor's Vision Zero Action Plan; and
- Exploring the creation of a Nashville Department of Mobility and Infrastructure to enhance efficient, effective management, performance, and accountability.[1]

It should be noted that some Transportation Plan components will continue to be refined over time. As this occurs, project details (e.g., exact location, impact on traffic) could be used to update the benefits provided in this technical report. As more detail related to the proposed projects becomes available, qualitative, quantitative, and monetizable benefits can be refined and added. Even at this conceptual stage, however, the results of the analysis suggest that the investments proposed in the Transportation Plan are anticipated to:

- Enhance public safety;
- Promote a state of good repair;
- Improve neighborhood connectivity;
- Support health through active transportation facility improvements;
- Offer the opportunity for equitable, mixed used development;
- Increase green space; and
- Support innovation.

[1] "Metro Nashville Transportation Plan," September 2020.

The first section of this report describes the general methodology used to estimate benefits, as well as the transit ridership forecasting approach. Separate, more detailed discussions are provided for the transit and traffic/multimodal/safety projects, as the benefits associated with these categories of projects may be different.

2 Methodology

2.1 Types of Benefits Included in the Analysis

Transportation projects can impact a community in several ways, some of which can be quantified. Benefits attributable to transportation investment often include improved accessibility, the potential to decrease transportation costs (including travel time, vehicle operating costs, accident and pollution damages), enhanced connectivity, among others.

While details related to many of the projects identified in the Transportation Plan are still being developed, there are numerous benefits expected to be generated by these investments. The following provides a qualitative and quantitative assessment of the projects described in the following section. Where possible, benefits are monetized based on United States Department of Transportation (USDOT) guidance related to benefit-cost analysis (BCA).[2] This is often helpful when trying to understand the value of the project, relative to the costs.

2.1.1 Qualitative Benefits

Qualitative benefits are identified, based on previous Metro experience associated with similar transportation investments, along with the experiences of other communities. In addition, relevant plans and studies were reviewed to understand the anticipated impact of the projects included in the Metro Nashville Transportation Plan.

2.1.2 Quantitative Benefits

In many cases, funding the projects included in the Transportation Plan will result in quantifiable outputs. For example, implementation will address 80 percent of new priority sidewalk needs across Davidson County. These types of quantifiable measures are provided for the project categories included in the Transportation Plan. Sources include City databases and expertise, as well as third-party studies related to the transportation investment.

[2] USDOT, Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2020.

2.1.3 Monetizable Benefits

USDOT guidance and industry standards were utilized to monetize the benefits of Transportation Plan projects, where possible. Data and information limitations determine which benefits can be valued using benefit-cost approaches. In general, the benefits estimation adheres to the following:

- An understanding of the existing and future conditions under the Build and No-Build scenarios;
- Measuring benefits in dollar terms, whenever possible, and in a common unit of measurement;
- Using USDOT guidance for the valuation of travel time savings, vehicle operating costs, safety benefits, and reductions in air emissions, while relying on industry best practice for the valuation of other effects; and
- Applying an industry-accepted discount rate of four percent when calculating the Net Present Value of an investment.

2.2 Transit Ridership Forecasting Methodology

A key requirement to quantify and monetize the benefits associated with the transit improvements listed above is developing ridership estimates. Following is a list of the elements of the Transportation Plan projects that were analyzed as a part of this study:

- Bus Rapid Transit (BRT) service on Murfreesboro Corridor
- BRT service on Clarksville Pike
- Phase 1 Service improvements on WeGo STAR Commuter Rail
- Better Bus program involving:
    - Frequency improvements
    - Better shelters
    - Improved sidewalks and transit accessibility
    - New and improved transit centers
    - Expanded duration of service
    - Better service connections
    - Mobility on demand service
    - Expanded and improved service for persons with disabilities.

Ridership forecasts for each of the above projects were estimated for the year 2040. It should be emphasized these are high-level forecasts generated using a simple sketch planning technique that involves the application of transportation elasticity factors. The general approach

consists of updating the existing transit demand in the corridor using elasticities to account for an increase in transit service levels, improvements in transit travel times, attractiveness of the BRT transit mode, increase in projected population and employment and effect of transit oriented development (TOD). A simple definition of elasticity is provided below.

2.3 Definition of Elasticity

In economics, price sensitivity to demand is measured using elasticities, defined as the percentage change in consumption resulting from a 1 percent change in price, all else held constant. This can be applicable to transportation demand also. For example, if the elasticity of transit ridership with respect to transit fares is –0.5, this means that each 1 percent increase in transit fares will most likely cause a 0.5 percent reduction in ridership, so a 10 percent fare increase will cause ridership to decline by 5 percent. The converse is also true, that is a 10 percent reduction in fares can cause a 5 percent increase in ridership. The negative sign indicates the reciprocal behavior of the demand and supply variables. Similarly, travel time elasticity or transit headway elasticity can be applied to estimate the potential changes in ridership attributable to changes in travel times or headways.

Our process involved computing the current number of buses (or trains in the case of WeGo Star) available during the peak periods in the corridor, comparing that to the proposed number of buses or trains, computing percent increase in service and applying a service elasticity to determine the corresponding percent increase in ridership demand and finally applying the percent increase to the current ridership in the corridor to reflect the new demand attributable to the proposed service improvement. A similar computation was performed if there was an improvement in travel times. The final number was adjusted further for population and employment growth in 2040.

Ridership forecasts were computed as a range (e.g. lower bound and upper bound). For lower bound estimates, elasticity factors representing the lower end of the industry average was used. For upper bound estimates, higher end was used.

Several assumptions were made in estimating the ridership forecasts. Some key ones are listed below.

- Strict enforcement of High-Occupancy Vehicle (HOV) lanes would be in place by 2040. Average operating speeds for BRT range between 30 miles per hour (mph) and 35 mph depending on the extent of freeway versus local road operation;
- 2040 highway congestion is proportional to demographic growth;
- Higher service elasticities would apply for BRT with premium service;
- For lower bound estimates, a travel time elasticity of 0.35 and service elasticity (as described above) of 0.4 was used;
- For upper bound estimates, a travel time elasticity of 0.45 and service elasticity of 0.5 was used;

- The increase in ridership due to TOD effect would be about 10 percent (based on studies HDR conducted in CA as well as in literature);
- Parking supply at Park-n-Ride (PNR) facilities will be unlimited;
- Monthly to daily ridership conversion is based on proportions of weekend day and weekday ridership seen in the industry; and
- TOD effect was not included for Commuter Rail and Better Bus projects.

It was assumed most of the ridership increase due to service improvements would be coming from the auto mode. Based on this assumption, an estimate of the vehicle miles traveled (VMT) reduction for each project was made. The monetized value of the reduction in air pollution and accidents/injuries resulting from the VMT reduction was estimated using formulas established by the Federal Transit Administration (FTA).

The tables below present a summary of 2040 ridership forecasts, VMT reductions and monetized value of air quality and safety benefits. As shown below, ridership for the entire NMATA System is expected to grow 42 percent from 2019 to 2040, assuming the upper bound ridership estimate.

Table 1: 2040 Daily Ridership Forecasts

Corridor	Current Routes	Proposed Technology / Facility Type	2019 Daily Ridership	2040 Ridership (lower bound)	2040 Ridership (upper bound)
US41-A Clarksville	22,25	BRT light / Arterial Operation	1,904	2,400	2,700
I-40 E	Commuter Rail (Nashville - Lebanon)	Commuter Rail	1,186	1,800	1,900
US41 (Murfreesboro)	55	BRT Gold / Freeway Operation	3,480	5,000	5,600
Whole NMATA System	Better Bus	Better Bus service	26,971	34,600	38,400

Table 2: Total Systems Level Benefits

Estimate	Value
2040 Auto trips diverted to transit	4,144
2040 Daily VMT reduction	23,652
2040 Annual Monetized value of air pollution reduction	$264,259
2040 Annual Monetized value of safety improvements	$1,757,181

Note: The 2019 ridership is based on 3-month average of October – November data from MTA

2.4 Transit Economic Benefits Methodology

For each of the proposed transit improvements, an assessment of benefits was conducted. In some cases, qualitative and quantitative benefits could be assembled but monetizing benefits was not possible. In other cases, benefits associated with pavement maintenance, safety, emissions and travel time were monetized using industry-accepted standards, USDOT and FTA guidance related to benefit-cost analysis.

Generally, transit improvements support a mode shift from automobile travel to transit. People make this decision based on several factors. For example, a higher-quality or more frequent service may induce some drivers to take transit. Dedicated transit routes may result in time savings, as compared to driving. Sometimes transportation costs are a factor. These types of considerations may result in a reduction in VMT, generated when someone who currently drives chooses to take transit instead.

The ridership estimates detailed previously reflect these types of considerations. When combined with assumptions related to average trip length, travel speeds, and so forth, VMT changes can be calculated. This is then used to estimate the benefits listed previously. The key assumptions for each benefit type are provided below.

2.4.1 Travel Time Savings

Travel time savings benefits are calculated for the Murfreesboro Pike and Clarksville Pike Bus Rapid Transit projects, based on USDOT guidance. Specifically, the anticipated time savings per rider for each service are multiplied by the number of riders to calculate the total travel time saved. This is then combined with a bus travel time value of $16.60 per hour.

Although it is expected that the transit alternative will induce some drivers to take transit, our methodology conservatively estimates only travel time savings associated with existing (i.e., No-build) transit riders. As a result, the value of these benefits is conservative.

Because of data limitations, travel time savings are not monetized for the Better Bus or WeGo Star improvements.

2.4.2 Pavement Maintenance Savings

Pavement maintenance savings benefits are monetized for all four transit improvements. Per-mile pavement maintenance cost assumptions are sourced from the Addendum to the 1997 Federal Highway Cost Allocation Study Final Report (May 2000) and adjusted to $2018 using

Bureau of Economic Analysis (BEA) Implicit Price Deflators for GDP, consistent with USDOT guidance ($0.0014 per mile).

The per-mile pavement maintenance cost savings is applied to the change in VMT associated with each service improvement, to estimate the pavement maintenance savings generated by each transit improvement.

2.4.3 Emissions Reduction Benefits

The reduction in VMT associated with each transit improvement project would result in reductions in air pollutants. To calculate the reductions in air pollutants, emission factors (Grams per VMT) used by FTA for their New Starts and Small Starts project evaluation for different pollutants were utilized. The daily reduction in air pollutants were then converted to a dollar value using a monetizing factor recommended by the FTA. Daily benefits were converted to annual benefits using an Annualization Factor of 305.

2.4.4 Safety Benefits

To calculate the benefits associated with VMT reductions, two factors were applied to the daily VMT: one for reduction in fatalities and other for reduction in injuries. Once the reductions were estimated, they were then converted to dollar values, using monetization values as shown below, and consistent with FTA guidance.

Table 3: Parameters and Values Used for Transit Benefits

Parameter	Value	Unit
Fatality Factor	0.013	Per million VMT
Injury Factor	0.195	Per million VMT
Value of Life	$9,100,000	Per life
Value of Injury	$490,000	Per injury

Sources:
https://www.transportation.gov/sites/dot.gov/files/docs/2016%20Revised%20Value%20of%20a%20Statistical%20Life%20Guidance.pdf; https://www.transit.dot.gov/funding/grant-programs/capital-investments/new-starts-templates-part-1

3 Traffic/Multimodal/Safety Benefits

The Transportation Plan identifies several potential improvements that would improve traffic flow, as well as promote safety and transportation choice. Specifically, it supports a state of good repair, but also proposes innovative projects such as the Jefferson Street Multimodal Cap /Connector, which may generate health and safety benefits if pedestrian and cyclist facilities are included in the cap's design.

A significant portion of the current sidewalk repair backlog of sidewalks, as well as new sidewalk projects identified in the WalkNBike Plan, are also addressed through this plan. Other projects include those intended to improve roadway condition, bridges and culverts, as well as support restoration and resiliency efforts. Public safety improvements are included, along with projects that support specific Vision Zero efforts and traffic calming. Finally, the Transportation Plan includes new active transportation facilities as well as traffic management improvements.

The following provides a description of each of the Transportation Plan categories, the funding allocated to each category, and the benefits that are expected to be generated by those investments.

3.1.1 Sidewalks

The Transportation Plan would address priority sidewalk needs across Davidson County, recommending $200 million to support these important projects.

According to the WalkNBike Plan, there are 1,900 miles of missing sidewalks in areas of greatest need in Nashville-Davidson County.[3] This investment will help "fill in the gaps" by providing safe pedestrian facilities in Davidson County neighborhoods where sidewalks do not currently exist.

These improved facilities are expected to encourage new walkers, some of whom may not be physically active at this time; increasing walking is one practical way to improve public fitness and health. As a result, it is expected that health benefits associated with walking will be realized through this investment. Although the health benefits to new walkers is a benefit for which there are approaches to monetize, there is presently insufficient data to estimate this benefit.

It is important to note that this $200 million investment is expected to address 80 percent of the current priority sidewalk needs across Davidson County. This is anticipated to be equivalent to building about 40 miles of new sidewalks.

3.1.2 State of Good Repair

The Transportation Plan recommends $200 million to support resurfacing and pothole projects, as well as bridge repair and restoration efforts. In addition, sidewalk improvements that comply with the American with Disabilities Act (ADA) are also included in the Transportation Plan. This

[3] WalkNBike Plan, https://www.nashville.gov/Public-Works/WalknBike.aspx.

funding will cover the current gap in fully funding the annual paving and sidewalk repair budgets, and it addresses the backlog of paving needs and needed culvert and bridge repairs.

Specifically, the funds will support 1,800 lane-miles of paving. By addressing these paving needs, it is likely that longer term operations and maintenance expenses will be reduced. In addition, the funds address high priority culverts and bridges; notably five currently weight-restricted bridges. By addressing these bridges, truck detours to avoid these structures will be eliminated. This means a reduction in travel time associated with those detours, as well as fewer VMT. A reduction in VMT is anticipated to reduce overall emissions, as well as crashes.

In addition to the paving, sidewalk repair, bridge and culvert work, these funds will also bring approximately 30 percent of sidewalks that are not currently in compliance with ADA into compliance. This investment will result in an additional 120 miles of ADA-compliant sidewalks, improving connectivity for our disabled populations and improving pedestrian safety for all Metro travelers.

3.1.3 Jefferson Street Multimodal Cap/Connector

The Transportation Plan recommends $175 million to build an 8-acre cap/connector from Jefferson to Jackson Streets and covering I-65/40. This investment provides an opportunity to reconnect bifurcated neighborhoods, expanding access to social and economic activities on both sides of the roadway.

Figure 1: Jefferson Street Interstate Cap

Source: USDOT Ladders of Opportunity; Every Place Counts Design Challenge, Summary Report

Depending on the final design of the cap/connector, there is also an opportunity for new affordable mixed-use office, retail and housing development. Similar projects across the country have resulted in significant levels of development. The 5.2-acre Klyde-Warren lid in Dallas, Texas, opened in October 2012 and since then has welcomed more than six million visitors, creating more than $2 billion in economic development, and increased property value in the

area around the Park.[4][5][6] The 7-acre Capitol Crossing in Washington, DC, has also experienced significant development, $1.2 billion over multiple phases.[7]

Placemaking investments associated with this type of infrastructure may increase green space and offer improved social connectivity options. Finally, the investment yields an opportunity for micromobility investments and safety improvements.

3.1.4 Restoration and Resiliency, State Routes, Partnership Funding, and Innovation & Sustainability Corridors

The Transportation Plan identifies $117 million to support a number of different projects, including the MLK, Jr. Ave/Charlotte Pike and Gallatin Pike, ongoing infrastructure restoration and resiliency efforts in areas hardest hit by recent storm events, and future partnerships with the Tennessee Department of Transportation (TDOT) on needed State Route/Interstate improvements.

3.1.4.1 INNOVATION & SUSTAINABILITY CORRIDORS

Two Innovation & Sustainability Corridors would be supported by $7 million of the $117 million allocated for this category of improvements. Transit, bike and pedestrian improvements would be made in these corridors, supporting active transportation and increased mode choice. Project elements also may serve as a "living lab" for technology and sustainability pilots through the addition of smart signals and crosswalks, as well as Connected, Autonomous, Electric Vehicles (CAEVs). Green and solar powered infrastructure is also an option in these corridors, as well as cool street pavement, native plant landscaping, and stormwater management.

[4] https://www.klydewarrenpark.org/about-the-park/press-room/press-releases/2018/klyde-warren-park-completion-project-announced.html

[5] https://www.architectmagazine.com/project-gallery/capitol-crossing-dc

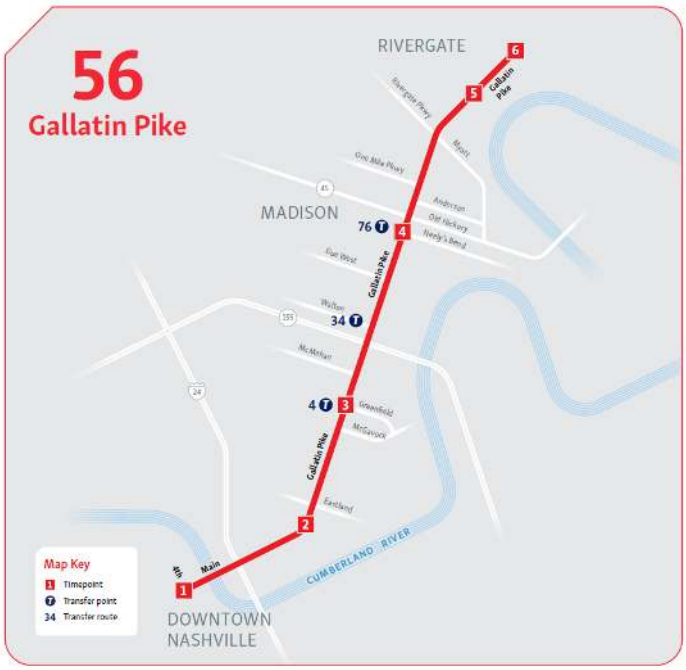
[6] https://dmped.dc.gov/release/capitol-crossing-what-expect-one-dcs-largest-revitalization-projects

[7] https://capitolcrossingdc.com/project/

Figure 2: Existing MTA Route 50 Charlotte Pike

Source: MTA (https://nashvillemta.org/maps/route50.pdf)

Figure 3: Existing MTA Route 56 Gallatin Pike



Source: MTA (https://nashvillemta.org/maps/route56.pdf)

Technology improvements and autonomous vehicles show promise in supporting public safety by reducing the number of crashes in these corridors. The elimination of one fatality generates $9.6 million in public benefits, based on USDOT guidance. Each severe injury avoided provides

$2.5 million in public benefits, and the elimination of a single Property Damage Only crash results in $4,000 in public benefits.[8]

Increased transit access and technology implementation also may alleviate some congestion. Simply reducing a single commuter's time by 10 minutes/day saves a workweek of time (40 hours) annually. Mode shift to transit can save a single household nearly $10,000 by living with one less car.

It is worth noting that the corridors are conceptually designed. Further design is likely to involve additional data estimation and collection related to anticipated mode shift to transit, changes in VMT, and travel time, as well as safety implications. This additional information will allow the single benefits described above (e.g., $9.6 million per fatality avoided) to be applied across larger populations, generating millions and potentially billions in public benefits as a result of this $7 million investment.

These potentially significant benefits do not include other positive impacts associated with this investment. For example, deployment of CV technology at intersections leads to better signal operation and reduced congestion. Real-time monitoring of transit conditions and upgraded traffic signaling can support better signal operation and reduced congestion. Some communities have even benefited from reduced emergency response time, due to connected vehicles.

Congestion reduction can lead to reduced travel times for all users of the roadways; reducing a single driver's time by 10 minutes per day saves 40 hours of time per year. This time savings has a monetary value, arguably even more significant for emergency vehicles accessing the city's medical facilities. Dynamic management also allows prioritization for behind-schedule transit vehicles and asymmetrical directions demand at intersections. The result is the potential for improved transit service, as well as fewer crashes, along with the possibility of reduced vehicular congestion.

Finally, there is the opportunity to incorporate green infrastructure into the corridors. These investments could reduce energy costs and lower temperatures in the area, but the full magnitude of these benefits will be better understood as design of these corridors progresses.

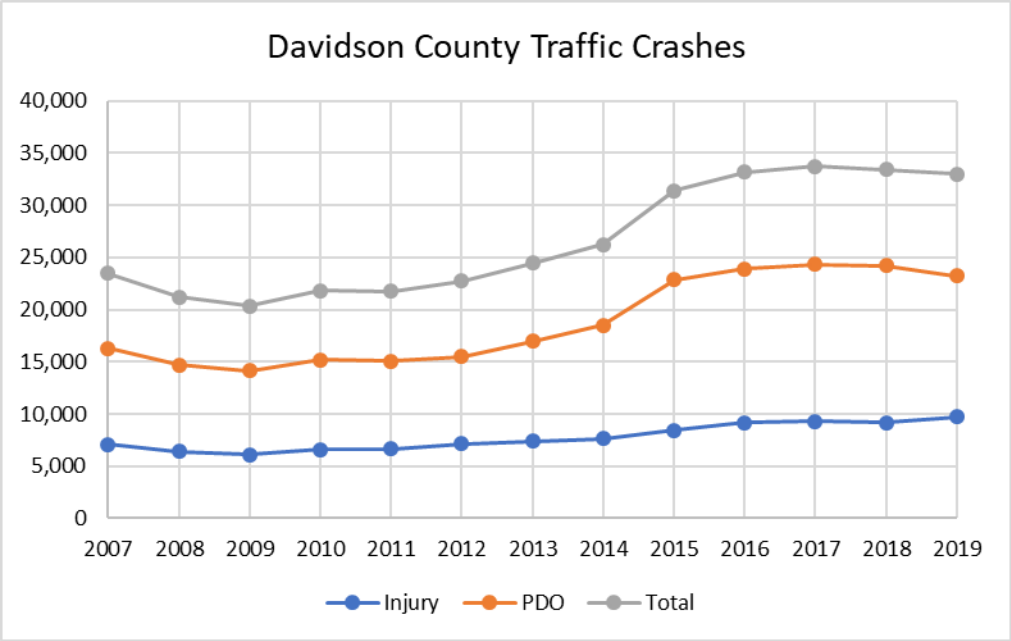
3.1.5 Safety/Vision Zero/Traffic Calming

The $75 million in funding identified in the Transportation Plan would help address current traffic calming requests and ongoing maintenance of traffic calming devices. It also supports the Vision Zero Action Plan, currently under development, which addresses the highest accident locations and safety initiatives. The funding will also support 10 to 15 major arterial issues per year, and it will support intersection improvements across the Metro area.

[8] USDOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, https://www.transportation.gov/office-policy/transportation-policy/benefit-cost-analysis-guidance-discretionary-grant-programs-0

The figure below shows that traffic crashes in Davidson County trended upwards from 2009 to 2016, remaining at an elevated plateau since 2016.

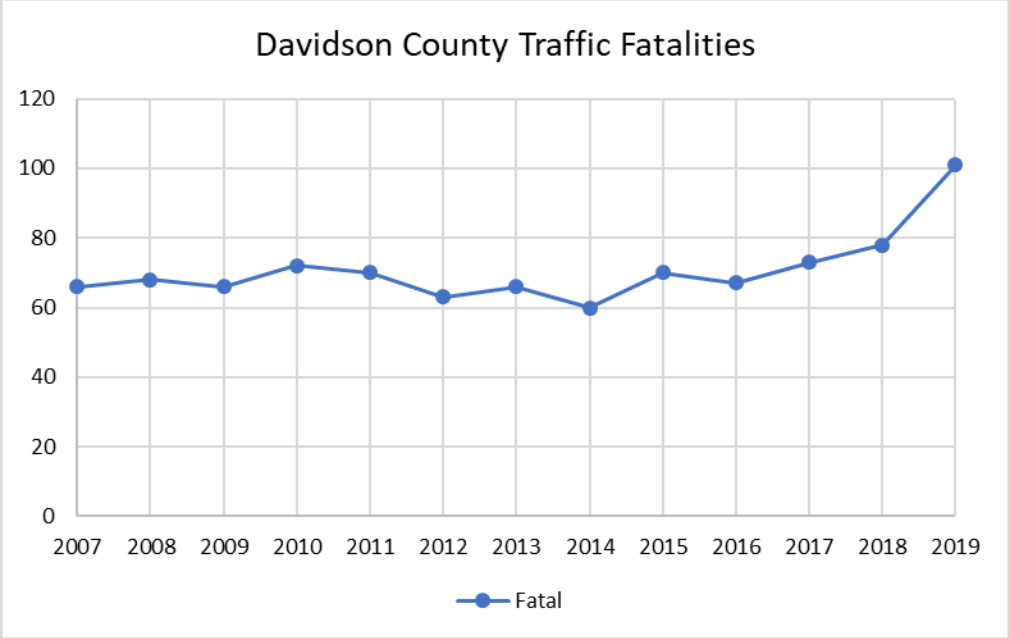
Figure 4: Davidson County Traffic Crashes



Source: https://www.tn.gov/content/dam/tn/safety/documents/CrashType.pdf

Traffic fatalities have been trending upward since 2014, with a significant increase in 2019, up to 101 fatalities in the year.

Figure 5: Davidson County Traffic Fatalities



Source: https://www.tn.gov/content/dam/tn/safety/documents/CrashType.pdf

Through the first half of 2020, Davidson County has recorded:

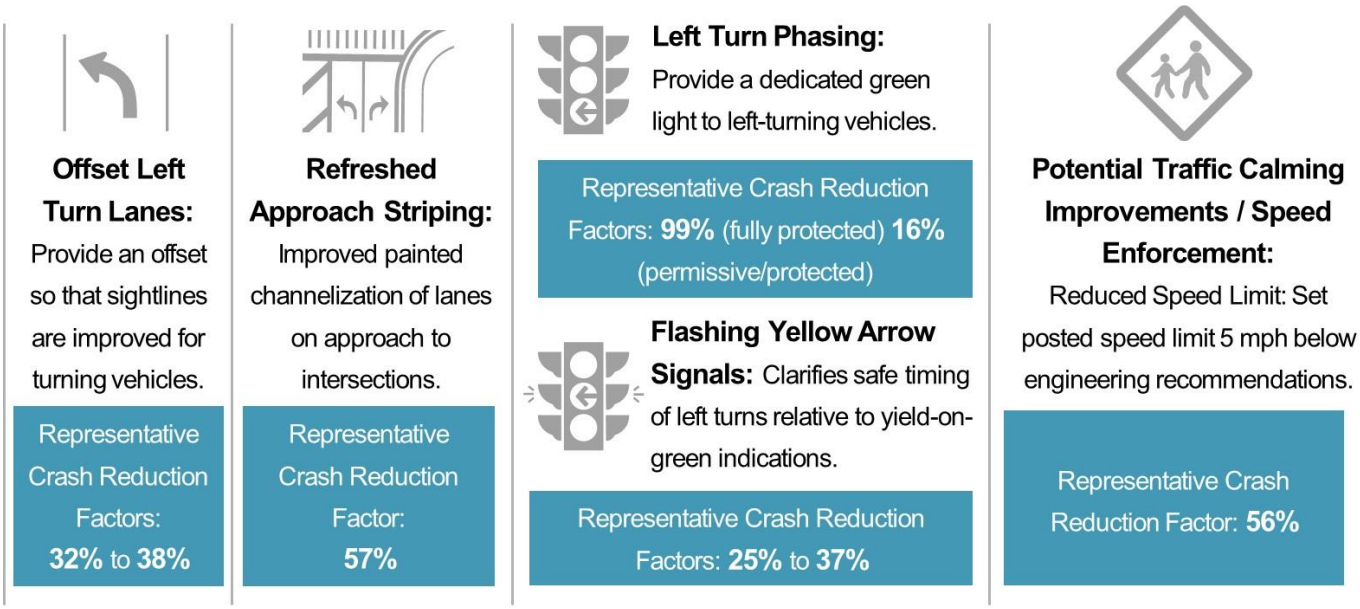
- 11,579 Traffic Crashes;
- 3,565 Injury-Causing Crashes; and
- 45 Traffic Fatalities.

These statistics reflect the importance of addressing transportation safety through the types of projects that would be supported by this funding. As presented in the figure below, it is expected that the traffic calming, Vision Zero, and safety-related investments funded by the Transportation Plan will result in a reduction in automobile crashes.

A "Crash Reduction Factor" (CRF) is the percentage crash reduction that would be expected after implementing a given countermeasure at a specific site. If an improvement with a CRF of 32 percent is implemented at a given intersection, then crashes at that intersection would be expected to decrease by 32 percent. As presented in the figure, for example, refreshed approach striping alone could reduce crashes by 57 percent.

As the projects continue to be defined, more data will become available, and the application of these CRFs will allow the estimation of total safety benefits associated with these investments.

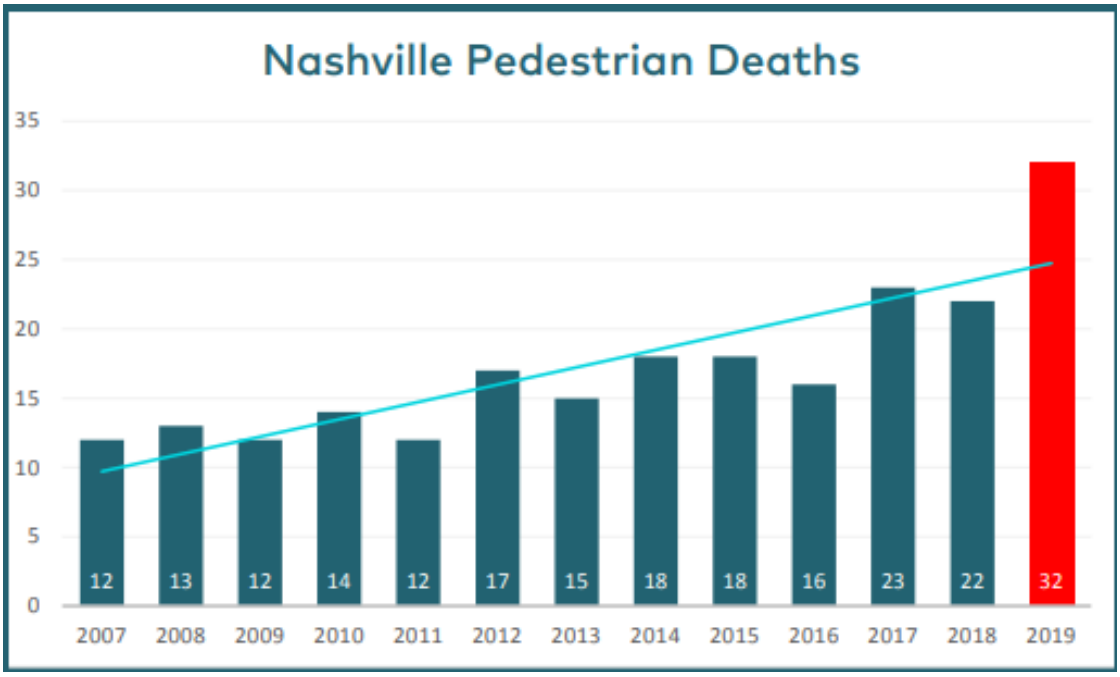
Figure 6: Potential Benefits of Automotive Safety Improvements



Source: FHWA "Crash Modification Factors Clearinghouse" (http://www.cmfclearinghouse.org/)

In addition to supporting safety as it pertains to automobile traffic, the funding will be used to make pedestrian facilities safer. As shown in the figure below, pedestrian fatalities are increasing over time. There were 16 deaths in 2016, but there were twice as many in 2019.

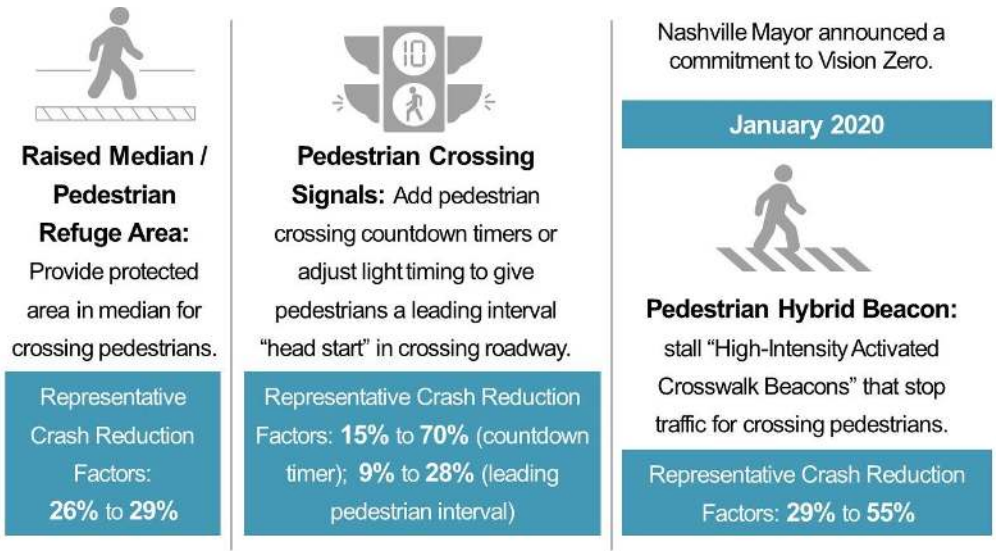
Figure 7: Nashville Pedestrian Deaths



Source: WalkNBike Nashville Pedestrian Safety fact sheet

Although not shown in the figure above, the first four months of 2020 had 125 crashes involving pedestrians. Those crashes resulted in 10 pedestrian fatalities. The potential impacts of the pedestrian improvements envisioned for the Transportation Plan are presented below; for example, a raised median/pedestrian refuge area is expected to reduce crashes by 26 to 29 percent.

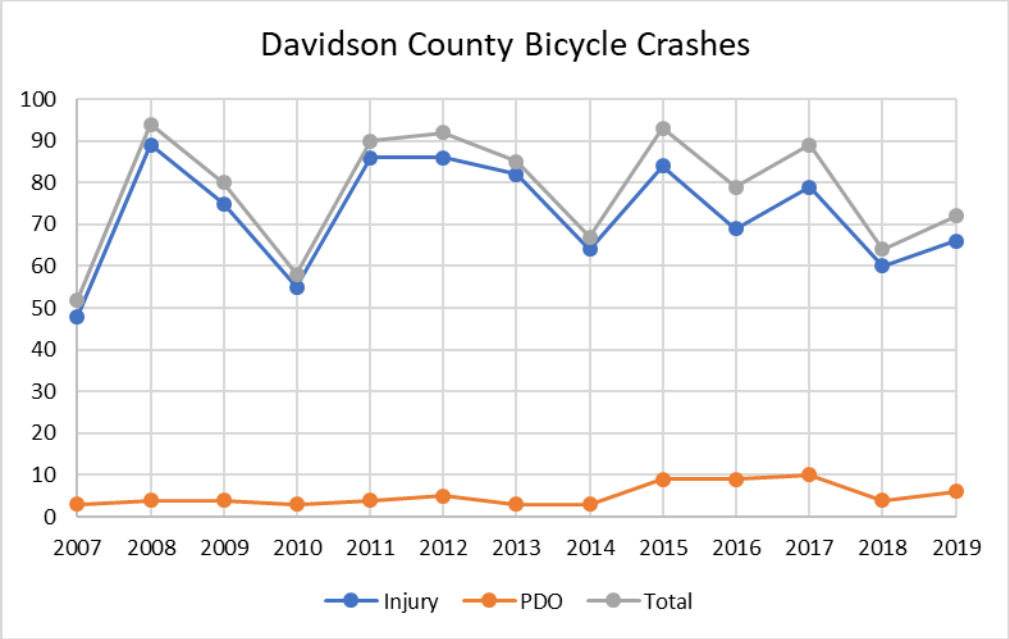
Figure 8: Potential Benefits of Pedestrian Safety Improvements



Source: FHWA "Crash Modification Factors Clearinghouse" (http://www.cmfclearinghouse.org/)

Total bicycle crashes range from 50 to more than 90 per year, with an average of 72 since 2007. The first half of 2020 has experienced 30 injury-causing bicycle crashes, on track to be slightly lower than the County average.

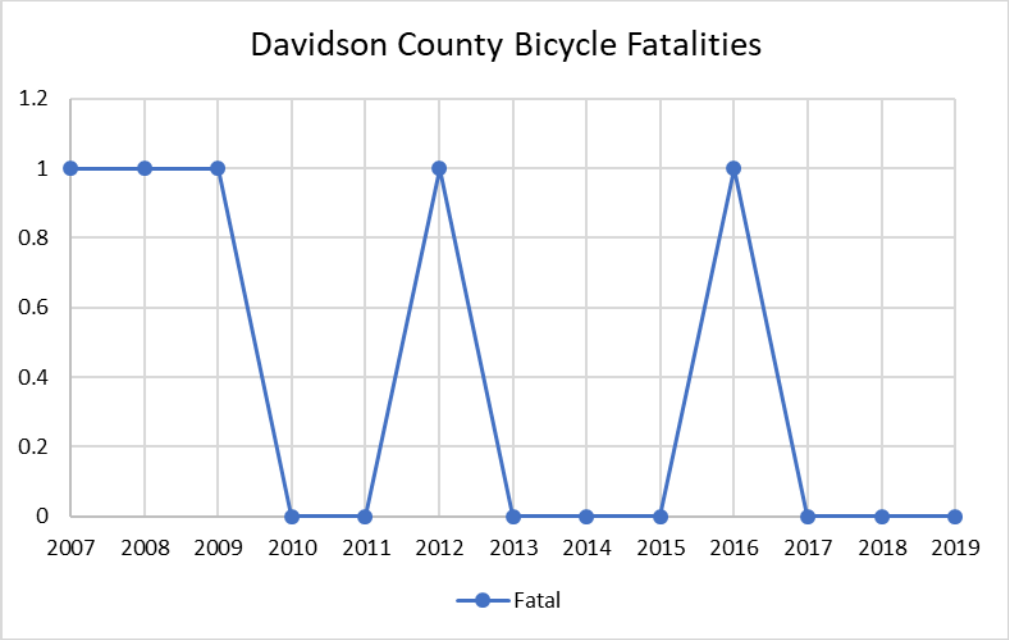
Figure 9: Davidson County Bicycle Crashes



Source: https://www.tn.gov/content/dam/tn/safety/documents/Bicyclists.pdf

Since 2007, there has been zero to one bicycle fatality per year in Davidson County. Even more promising, there have been no bicycle fatalities since 2017, with the first half of 2020 maintaining this low level.

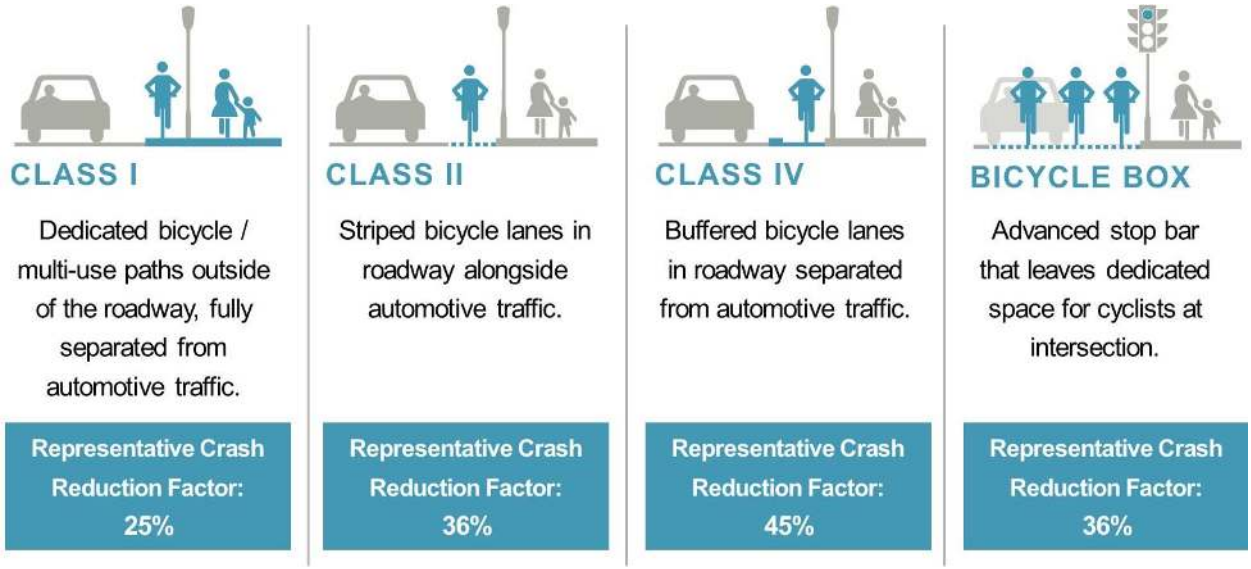
Figure 10: Davidson County Bicycle Fatalities



Source: https://www.tn.gov/content/dam/tn/safety/documents/Bicyclists.pdf

Improving bicycle facilities will further support safety for cyclists. Investments in cycling facilities are expected to include dedicated paths outside of the roadway that are fully separated from automobile traffic, striped and/or buffered bicycle lanes in roadways, and bicycle boxes that provide dedicated space for cyclists. As shown below, these types of improvements generally reduce crashes by 25 to 45 percent, depending on the nature of the investment.

Figure 11: Potential Benefits of Bicycle Facility Improvements



3.1.6 Active Transportation/Bikeways/Greenways

Building on the improvements discussed previously, the Transportation Plan will provide $35 million specifically for active transportation projects. These funds will support approximately seven miles of new bikeway each year, growing Metro's network by 20 percent over five years. Specific greenway needs are to be determined, but building new facilities is expected to generate cyclist "Journey Quality" benefits. These represent the value that cyclists realize by riding on dedicated bike facilities rather than in mixed traffic.

Nashville conducted daily cyclist counts in 28 locations throughout the city in 2015, and this data was used to develop forecasts of cyclist counts over time, using an annual population growth of two percent. These forecasts were then used to estimate journey quality benefits generated when cyclist facilities are improved.

Install Sidewalk:
Provide infrastructure for pedestrians to avoid walking along roadway.

Representative Crash Reduction Factors:
65% to **89%**

The Metro Nashville Transportation Plan provides funding to build 48 miles of new sidewalks and 35 miles of new bikeways over 5 years from 2021-2025, or 9.6 miles and 7 miles per year, respectively. The bikeway projects are expected to provide facilities to cyclists where there currently are none. Existing cyclists are expected to experience improved journey quality associated with an improved travel experience.

We would also expect some riders to be induced to ride because of the improved bike facilities. However, the estimation of journey quality benefits does not include increases in ridership due to mode shifting. As a result, our estimates are conservative.

Cyclist counts from the 28 locations were assigned to bike projects from the WalknBike program to create a representative sample of expected bikeway demand. Using this sample, we calculated average expected cyclist traffic per mile of new bikeway. Based on the cyclist traffic forecasts, benefits per mile were calculated using a methodology employed by the California Department of Transportation (CalTrans). Per the methodology, cyclists experience a value of time equivalent to $30.40 per hour of cycling, travel at an average speed of 11.8 mph and have a journey quality parameter of 0.57, which reflects the marginal rate of substitution for road travel (i.e., a mile-equivalent value of road travel distance versus bike facility travel distance). This average benefit per mile was then aggregated up to the 35 miles the city expects to build for total annual benefits.

The city's program would also provide amenity benefits to pedestrians in the form of street lighting, curb level, crowding, and pavement evenness. Because of data limitations, the value of these amenities is not monetized.

The net present value of benefits of the bikeway projects was calculated to be $6.3 million. This value is discounted by four percent, over a 20-year period from 2021 to 2040 to reflect the time value of money.

3.1.7 Traffic Management System/Signal Upgrades

The Transportation Plan recommends $15 million be used to fund recommendations of the Traffic Management System Evaluation currently underway. Significant reductions in travel time delay, as well as safety improvements associated with improved traffic flow and management, are anticipated. The table below shows the scheduled improvements, as well as their anticipated cost.

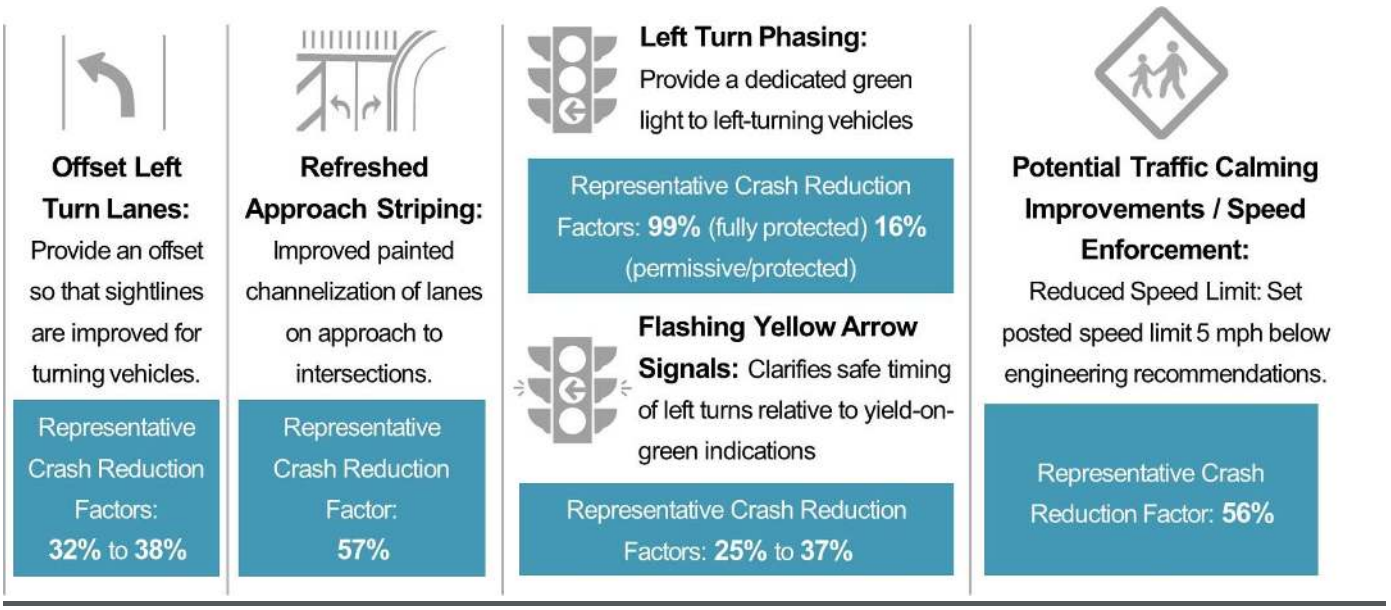
Table 4: Traffic Management System/Signal Upgrades Projects

Project	Unit Cost	Schedule	Total Cost
Full intersection detection upgrade	$30k	20 intersections/year	$600k/year
Partial detection upgrade	$30k	10 intersections/year	$200k/year
Communications	$500/node	500/year	$250k/year
TCC		1.5 million in year one and 4 staff each year upon commissioning	$250k/year
Timing development and TR implementation	$3k/intersection	200 intersections/year	$600k/year
CCTV installations	$6k/node	50 locations/year	$300k/year
Connected vehicle and new technology testing	$10k/location	20 locations/year	$200k/year
Intersection rewiring	$50k/intersection	20 intersections/year	$1M/year

Source: Metro Nashville Public Works

Many of the improvements listed above will improve the flow of traffic and enhance safety. As shown in the figure below, the improvements envisioned as part of this investment are expected to reduce crashes by 16 to 99 percent, depending on the nature of the improvement.

Figure 12: Potential Benefits of Traffic Management System/Signal Upgrade Improvements



4 Transit Benefits

Transit improvements identified in the Metro Nashville Transportation Plan are intended to improve existing transit service, as well as introduce new service and technologies to the region. The section below provides a brief description of the conceptual transit improvements envisioned by the Transportation Plan, as well as an estimate of the funding necessary to support the recommended project categories.

The section below provides a brief description of these conceptual improvements as well as an estimate of the funding necessary to support the Transportation Plan's recommended project categories.

4.1.1 Better Bus Service Enhancements/Redesign

WeGo Public Transit's "Better Bus" program is intended to build a fixed-route bus transit system that is "more convenient, competitive and reliable."[9] Establishing an all-day, all-week network that reduces travel times, as well as makes transit easier to understand and navigate, is a primary goal.

The Transportation Plan would include $209.6 million in funding to support Better Bus improvements, which include longer service hours on major bus routes, new and improved crosstown routes, improvements to frequency of bus service (particularly during evenings and weekends), and infrastructure upgrades.

Several routes will be extended to serve emerging Neighborhood Transit Centers, and shelters would also be improved. Access service for persons with disabilities would be expanded and improved, and "Mobility on Demand" zones would be established in eight outlying sections of the county to provide on-demand feeder service to individuals in less densely developed neighborhoods (see Figure 13 for Mobility on Demand zones and Better Bus routes).

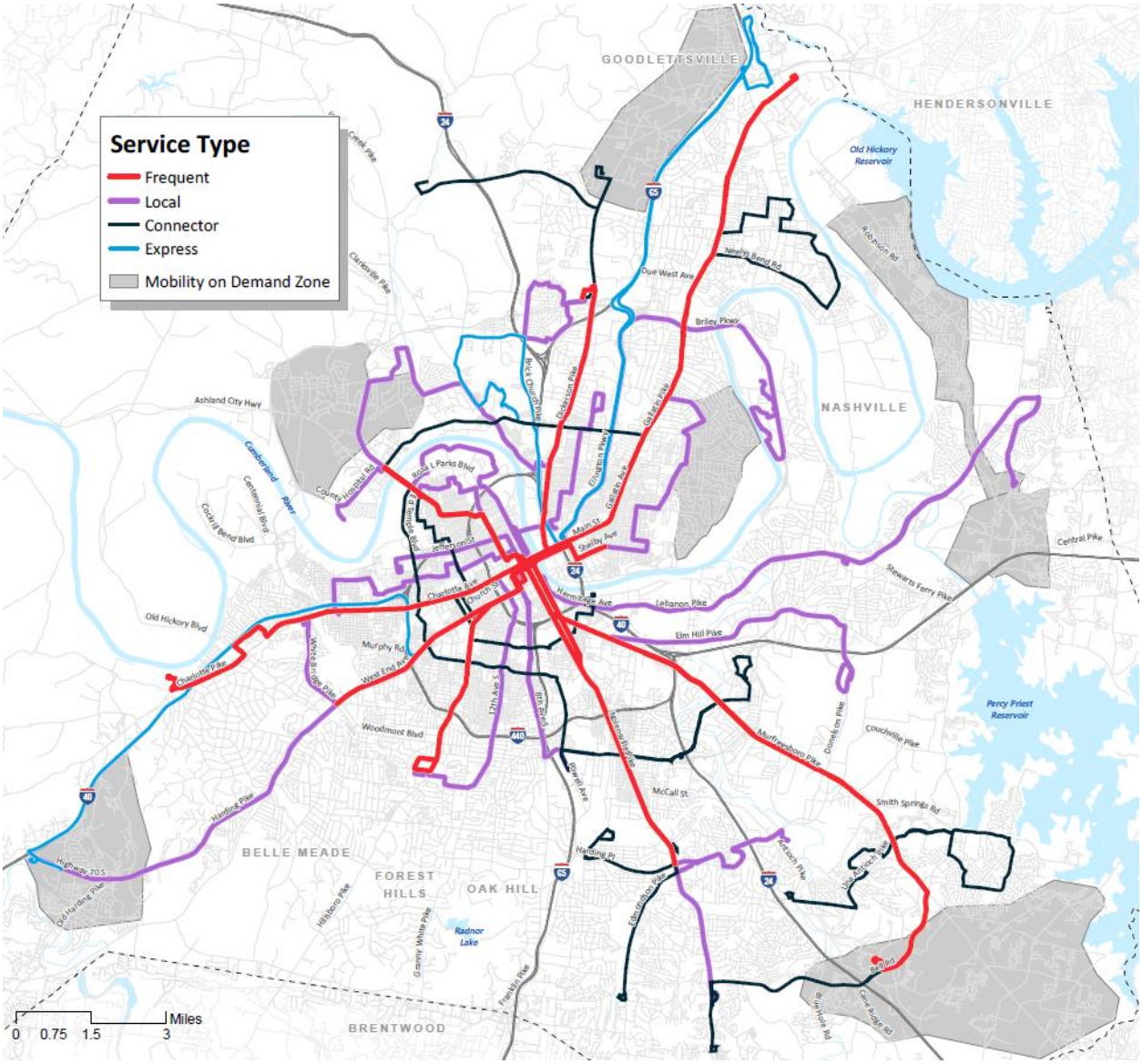
The Better Bus projects included in the Transportation Plan will benefit from $209.6 million in funding. Key features include:

- Longer service spans;
- Improved weekend and evening service frequency;
- Access / Access on Demand for persons with disabilities;
- First Mile/Last Mile Mobility Zones providing discounted on-demand trips; and
- Fare Capping/Best Value Pricing.

It is also anticipated that 95 percent of current riders will experience an improvement in their service. For example, several routes will be extended to serve emerging Neighborhood Transit Centers, and there will be new and improved crosstown and neighborhood connections included in the program of projects.

[9] Metro Nashville Transportation Plan, September 2020.

Figure 13: WeGo Better Bus Transit Network

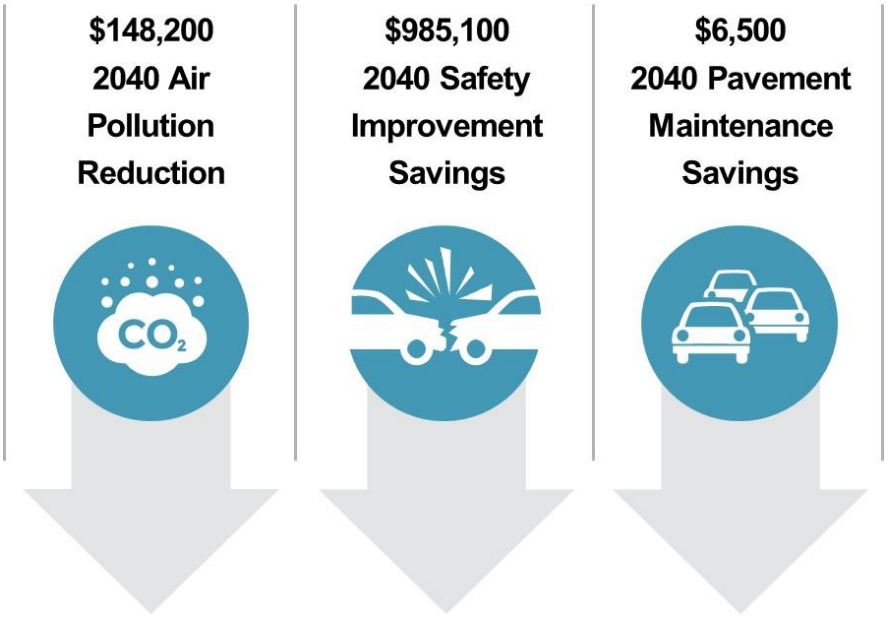


Source: WeGo

To estimate benefits associated with Better Bus, the BRT service is assumed to be of medium quality, with 10-minute peak frequency, an average operating speed of 18 mph, and no TOD. A medium quality BRT may not have 100 percent exclusive guide-way or gold standard station amenities but still provides a much better level of service, in terms of frequency and travel times compared to regular local bus service. Based on the mode shift that is expected as a result of the proposed improvements, VMT reductions were calculated.

As presented in the figure below, $148,200 in 2040 air pollution reduction benefits are estimated to be generated by the implementation of the components described previously. An additional $985,100 is estimated to be associated with safety improvements, and approximately $6,500 in pavement maintenance savings are also anticipated.

Figure 14: Potential Monetized Benefits – Better Bus Improvements



4.1.2 Murfreesboro Pike Bus Rapid Transit

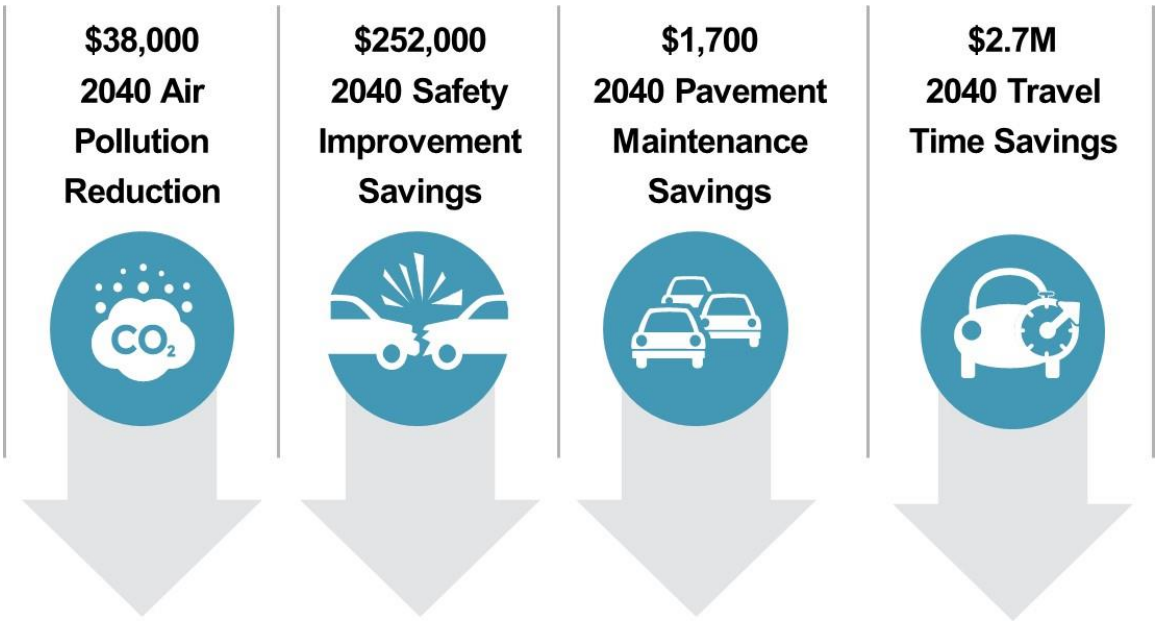
$413.3 million in funding is identified to develop a BRT service that originates at Hickory Hollow in Antioch and terminates at SoBro Transit Hub (4th Ave and Ash St) in Downtown. The bus will run in dedicated lanes and feature iconic stations, platform-level boarding, and off-board fare collection. Finally, funding will support roadway projects, as well as safety, ITS and pedestrian crossing/sidewalk improvements. The ridership analysis and benefits estimation assume a Gold Standard BRT service with 10-minute peak frequency, and operating speeds of 30 mph. TOD is assumed to occur as a result of this BRT service. The BRT service will generally follow existing MTA Route 55 Murfreesboro Pike (see Figure 15).

Figure 15: Existing MTA Route 55 Murfreesboro Pike

Source: WeGo

As shown in the figure below, this project is expected to generate $38,000 in air pollution reduction benefits, as well as $252,000 in safety benefits in 2040. Pavement maintenance costs are also expected to be reduced, but the largest category of benefits is associated with travel time savings. Specifically, it is estimated that $2.7 million in travel time savings will be generated by this BRT project in 2040.

Figure 16: Potential Monetized Benefits – Murfreesboro Pike Bus Rapid Transit



4.1.3 Clarksville Pike Rapid Bus

The Transportation Plan includes $92.9 million for service that originates at Kings Lane in Haynes Park and terminates at WeGo Central. The bus will operate along Route 22 and serve Haynes Park, Bordeaux, and North Nashville neighborhoods, and it will connect with the North Nashville Neighborhood Transit Center at 26th Ave. The funding will also include many of the amenities with a Gold Standard BRT project, minus dedicated lanes. Infrastructure upgrades are likely to include queue-jump lanes, transit signal priority, off-board fare collection, enhanced stops/stations, pedestrian safety upgrades, high-capacity buses, and fast, frequent service. The Rapid Bus service will generally follow existing MTA Route 22 Bordeaux (see Figure 17).

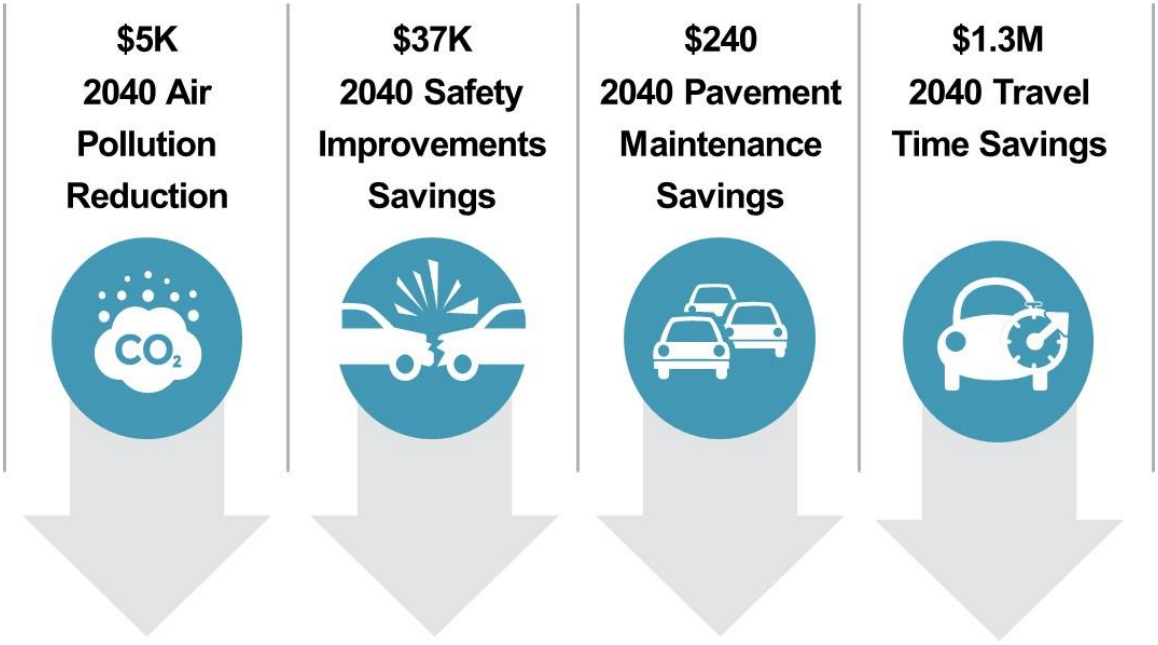
Figure 17: Existing MTA Route 22 Bordeaux

Source: WeGo

Key assumptions underlying our benefits and ridership analyses include 10-minute peak frequencies and operating speeds of 18 mph. The quality is assumed to be a medium standard, as described previously, and no TOD is assumed.

As shown below, the largest category of benefits is expected to be generated by travel time savings, $1.3 million in 2040. Other benefits are also anticipated, though their values are relatively low.

Figure 18: Potential Monetized Benefits – Clarksville Pike Rapid Bus



4.1.4 WeGo Star Improvements

$145.31 million in funding will support operation of more trips on the Star and include installation of a "Positive Train Control" (PTC) system, which allows increased service frequency and span of service. The funds may also be used to support the implementation of quiet zones and infill stations at Central Pike, Golden Bear Pkwy, and Wilson Co. Expo Center.

Case studies from across the country suggest that improved commuter rail service may support TOD. For example, in Meridian, Mississippi, the $6.6 million Union Station revitalization generated $135 million in private development, including low- to middle-income, transit-accessible housing.[10] Other communities have experienced similar development. In Brunswick, Maine, service improvements helped spur $25 million in private development and 97 new full-time jobs added to existing businesses.[11][12][13] A Normal, Illinois, rail project costing $49.5 million helped catalyze $120 million in private development.[14][15][16]

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[10] http://www.meridianms.org/index.cfm/city-departments/community-development/union-station/

[11] http://www.greatamericanstations.com/why-invest/case-studies/economic-development-brunswick-me

[12] http://www.brunswickme.org/

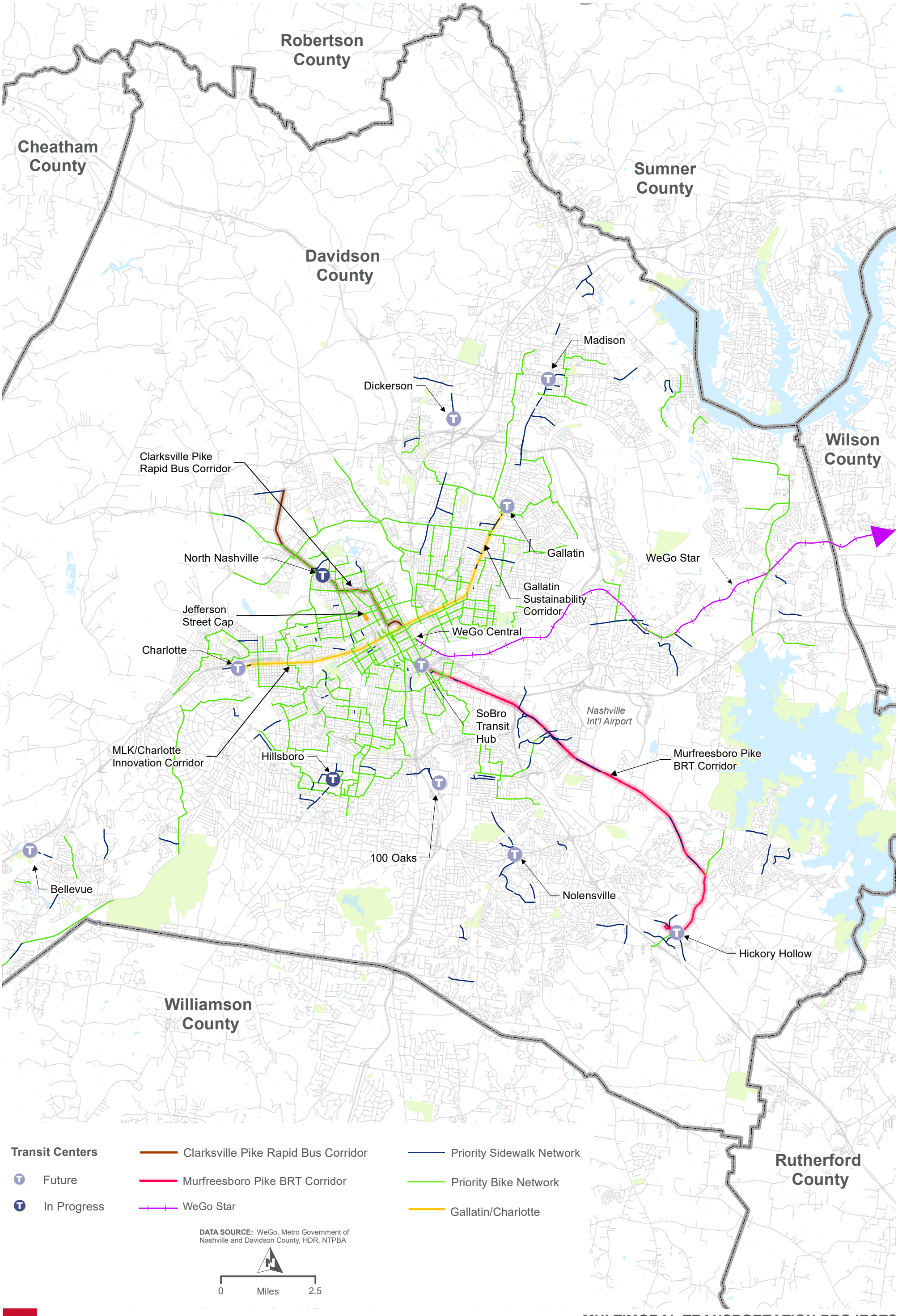
[13] http://www.greatamericanstations.com/Stations/MEI

[14] http://epa.gov/region5/sustainable/pdf/Normal-Uptown-Station-Case-Study.pdf

[15] http://www.amtrak.com/ccurl/723/622/Amtrak-BNL-station-ribbon-cutting-ATK-12-067.pdf

[16] http://t4america.org/maps-tools/local-successes/normal/

Appendix A – Multimodal Transportation Projects Map



MULTIMODAL TRANSPORTATION PROJECTS

DAVIDSON COUNTY, TN

Appendix B - Benefits Analysis Presentation

1

Source: The Tennessean

Metro Transportation Plan

Benefits of Conceptual Transportation Investments

09/25/2020

2

Metro Transportation Plan

Traffic, Multimodal & Safety

- Sidewalks (current backlog/prioritization)
- State of Good Repair
- Jefferson Street Multimodal Cap / Connector
- Restoration, Resiliency & Partnership Funds
- Safety/Vision Zero/Traffic Calming
- Active Transportation/Bikeways/Greenways
- Traffic Management Systems/Signal Upgrades

Transit

- Better Bus Service Enhancements/Redesign
  - Neighborhood and Regional Transit Centers
  - Downtown Transit Priority
  - Bus stop and shelter improvements
  - Best Value Fare Capping Program
- Murfreesboro Pike Bus Rapid Transit
- Clarksville Pike Rapid Bus
- WeGo Star Improvements

3

4

Sidewalks - $200M in Funding

Current backlog & prioritization

- Will address 80% of new priority sidewalk needs across Davidson County and 40 miles of sidewalk
- Consistent with WalknBike Plan

5

Source: WalknBike Plan, pg. 135

Sidewalks

Potential benefits

- Improved public safety by providing new pedestrian facilities in Davidson County neighborhoods where sidewalks do not currently exist
- Health benefits for new walkers
- Improved connectivity to pedestrian network

6

State of Good Repair - $200M in Funding

- Cover current gap in fully funding the annual paving & sidewalk repair budgets
  - Address the backlog of paving needs and needed culvert/bridge repairs
    - 1,800 lane miles of paving
    - High priority culverts/bridges addressed, including 5 weight-restricted bridges
  - Bring approximately 30% of non-ADA compliant sidewalks into compliance across neighborhoods
    - 120 miles of ADA-compliant sidewalks

7

STATE OF GOOD REPAIR
Potential benefits

- Paving
  - Potential to reduce longer term O&M for roadways
- Culverts/Bridges
  - Reduced travel time and vehicle operating costs associated with truck detours to avoid weight-restricted structures
- ADA-compliant sidewalks
  - Improved accessibility
  - Public safety

8

Jefferson Street Multimodal Cap/Connector - $175M in Funding

- 8-acre cap over I-65/I-40 to reconnect the neighborhoods that were divided by the construction of I-16/I-40
  - Jefferson Street bridge over I-40 carries approximately 14,000 vehicles/day
  - Bridge built in 1967, last inspected in 2013 – good condition
  - Narrow, cracked sidewalks and 24' wide travel lanes create hostile pedestrian environment on this bridge

Source: Google Earth/HDR

9

Jefferson Street Multimodal Cap/Connector

Potential benefits

- Provides opportunities to reconnect bifurcated neighborhoods
- Expands access to social and economic activities
- Creates opportunity for affordable mixed-use office, retail and housing development
- Yields opportunity for micromobility investments and safety improvements
- Generates economic value through placemaking investments with social connectivity, green space, and mixed-use investments

Source: USDOT Ladders of Opportunity Every Place Counts Design Challenge

10

Klyde Warren

Dallas, TX

- $110M project catalyzed $1 billion in new development in downtown Dallas
- Estimated $2.5B economic impact in Dallas
- Construction funded by P3, privately operated
- Connects Dallas' Uptown neighborhood with Arts District and downtown business center
- 6,000 SF restaurant, performance stage
- Connects with M-Line streetcar

Cap at Union Station

Columbus, OH

- $7.8M retail development project spurred 9 retail shops and restaurants, 25,496 SF of leasable space
- P3 – one of the first speculative retail projects built over highway
- Connects Columbus downtown with Short North arts and entertainment district (1990s redeveloped)
- Appeased FHWA by leasing platform to developer for $1 per year; if buildings sold, city receives 10% of the sale
- ODOT can close down and evacuate the Cap in case of emergencies

11

Capitol Crossing

Washington, DC

- $200M platform over I-395 spurring $1.2B multi-phase development of 2.2 million SF
- Economic impact of 8,000 permanent jobs and $40M in tax revenue
- Privately funded
- Connects Capitol Hill and East End
- 50/150 residential units affordable housing
- DC's first "eco-district"

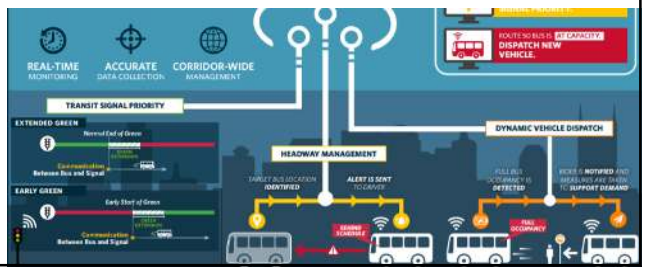
Cap Projects Often Involve Public Private Partnerships

- May reduce the public's financial investment
- Incentives to developers may include tax rebates, reduction of City fees and utility fees, reduced parking requirements, etc.
- Helps to diversify interest in the area
- May inspire other housing and mixed-use developments in the area

12

Restoration & Resiliency, State Routes, Partnership Funding, and Innovation & Sustainability Corridors (MLK/Charlotte, Gallatin) - $117M in Funding

- Supports ongoing infrastructure restoration and resiliency efforts in areas hardest hit by recent storm events
- Supports future partnerships with TDOT on needed State Route/Interstate improvements
- $7M for MLK/Charlotte Avenue Innovation Corridor & Gallatin Sustainability Corridor



13

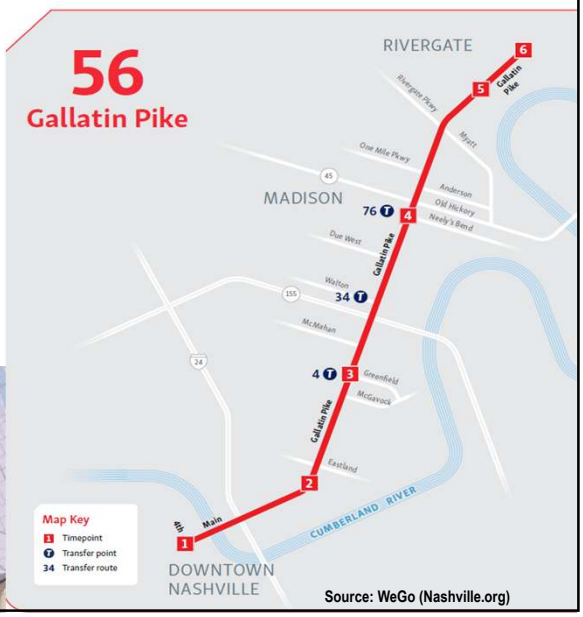
Innovation & Sustainability Corridors (MLK/Charlotte, Gallatin) - $7M in Funding

Project elements may serve as "living lab" for technology and sustainability pilots through:

- Smart signals and crosswalks
- Connected, Autonomous, Electric Vehicles (CAEVs)
- Green and solar powered infrastructure
- Transit, bike and pedestrian improvements
- Solar powered facilities and cool street pavement
- Native plant landscaping and stormwater management

Source: ATCMTD 2020 Grant Application (Department of Public Works)

Source: WeGo



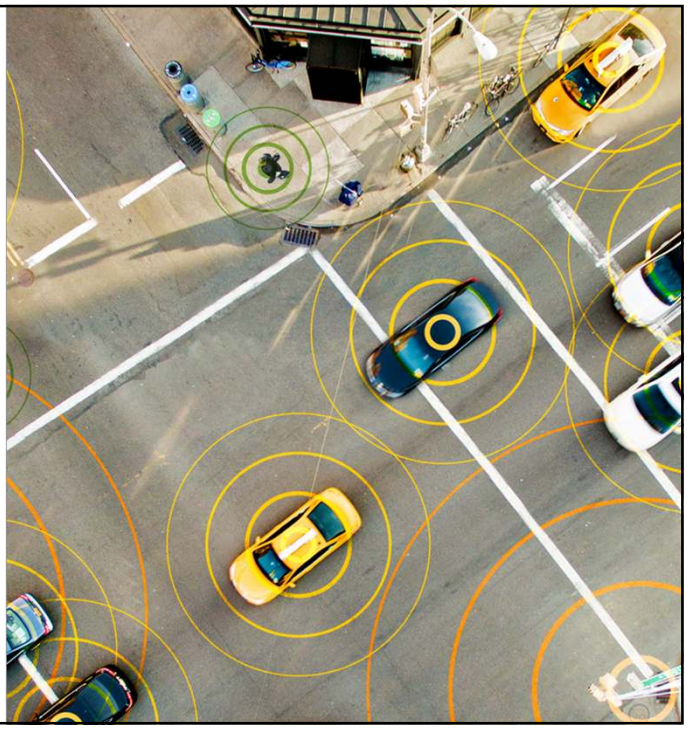
Source: WeGo (Nashville.org)

14

MLK/Charlotte, Gallatin

Potential benefits

- **Crash reduction due to technology improvements and AVs, eliminating:**
  - One fatality → $9.6 million in public benefits
  - One severe injury → $2.5 million in public benefits
  - One Property Damage Only crash → $4,000 in public benefits
- **Time and fuel savings associated with technology improvements:**
  - Reducing a single commuter's time by 10 minutes/day saves a workweek of time (40 hours/year)
  - Mode shift to transit can save a household nearly $10K by living with one less car
- **Benefits of reduced emergency response time generated**
- **Green infrastructure may reduce energy costs and lower temperatures**



15

NORTH AVENUE SMART CORRIDOR

Atlanta, GA

- Dynamic adaptive signal control
- Video detection systems
- Thermal imaging and video cameras for pedestrian and bicycle detection
- Vehicle to infrastructure communications
- Restriping to support crash reduction and future acceptance of autonomous vehicles
- Emergency preemption

16

Safety / Vision Zero / Traffic Calming - $75M in Funding

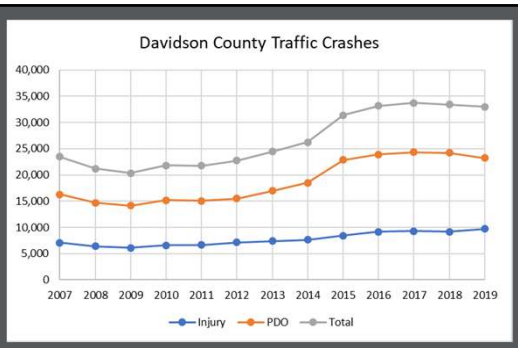
- Fully fund current traffic calming requests and ongoing maintenance of traffic calming devices
- Support Vision Zero Action Plan addressing highest accident locations and safety initiatives
- Address10-15 major arterial issues per year
- Improve intersections

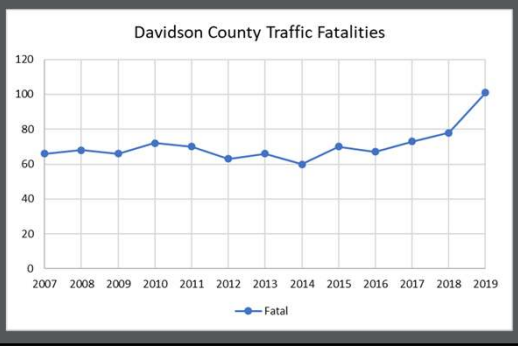
Image source: Rutgers Center for Advanced Infrastructure and Transportation

17

Automotive Safety

- Traffic crashes in Davidson County trended upwards from 2009 – 2016
  - Total and injury crashes have remained at elevated plateau since 2016
- Traffic fatalities have been trending upward since 2014 in Davidson County
  - Significant increase in traffic fatalities in 2019, up to 101 fatalities in the year
- Through the first half of 2020, Davidson County has recorded:
  - 11,579 Traffic Crashes
  - 3,565 Injury-Causing Crashes
  - 45 Traffic Fatalities





18

Automotive Safety Improvements

Potential intersection improvements and benefits

Offset Left Turn Lanes: Provide an offset so that sightlines are improved for turning vehicles.

Representative Crash Reduction Factors: **32%** to **38%**

Refreshed Approach Striping: Improved painted channelization of lanes on approach to intersections.

Representative Crash Reduction Factor: **57%**

Left Turn Phasing: Provide a dedicated green light to left-turning vehicles.

Representative Crash Reduction Factors: **99%** (fully protected) **16%** (permissive/protected)

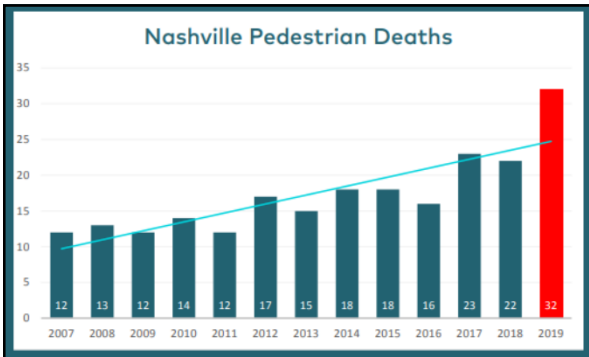
Flashing Yellow Arrow Signals: Clarifies safe timing of left turns relative to yield-on-green indications.

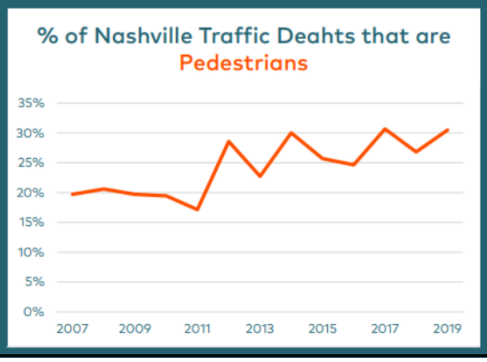
Representative Crash Reduction Factors: **25%** to **37%**

Potential Traffic Calming Improvements / Speed Enforcement: Reduced Speed Limit: Set posted speed limit 5 mph below engineering recommendations.

Representative Crash Reduction Factor: **56%**

19





Pedestrian Safety

- Pedestrian deaths in Nashville are steadily increasing over time
  - 16 Deaths in 2016
  - 23 Deaths in 2017
  - 22 Deaths in 2018
  - 32 Deaths in 2019
- First four months of 2020 had 125 crashes involving pedestrians and 10 pedestrian fatalities in Nashville
  - 1/3 increase over same period in 2019

20

Pedestrian Safety Improvements

Potential pedestrian infrastructure improvements and benefits

Install Sidewalk: Provide infrastructure for pedestrians to avoid walking along roadway.

Representative Crash Reduction Factors: **65%** to **89%**

Raised Median / Pedestrian Refuge Area: Provide protected area in median for crossing pedestrians.

Representative Crash Reduction Factors: **26%** to **29%**

Pedestrian Crossing Signals: Add pedestrian crossing countdown timers or adjust light timing to give pedestrians a leading interval "head start" in crossing roadway.

Representative Crash Reduction Factors: **15%** to **70%** (countdown timer); **9%** to **28%** (leading pedestrian interval)

Nashville Mayor announced a commitment to Vision Zero.

January 2020

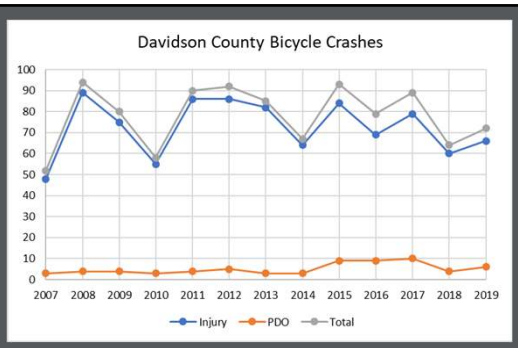
Pedestrian Hybrid Beacon: stall "High-Intensity Activated Crosswalk Beacons" that stop traffic for crossing pedestrians.

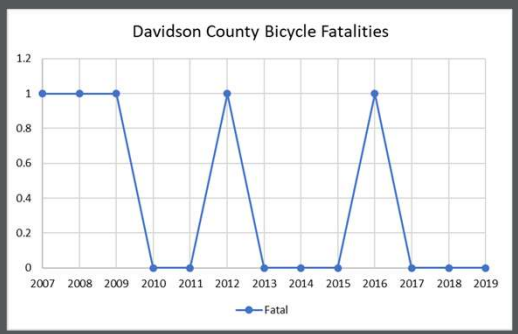
Representative Crash Reduction Factors: **29%** to **55%**

21

Bicyclist Safety

- Davidson County has averaged 72 injury-causing bicycle crashes per year since 2007
  - Injury crash count has been volatile year-to-year, but has slightly trended down since 2015
- In every year since 2007, either zero or one bicycle fatality has been recorded
- Through the first half of 2020, Davidson County has recorded:
  - 30 Injury-Causing Bicycle Crashes
  - 0 Bicycle Fatalities





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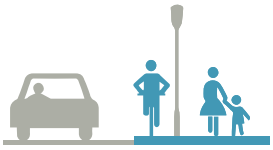
Bicycle Safety Improvements

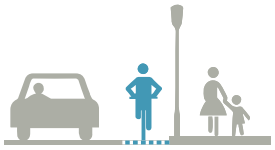
Potential intersection improvements and benefits



CLASS I

Dedicated bicycle / multi-use paths outside of the roadway, fully separated from automotive traffic.

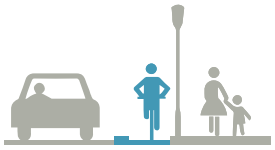
Representative Crash Reduction Factor: 25%



CLASS II

Striped bicycle lanes in roadway alongside automotive traffic.

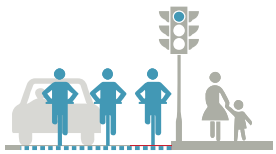
Representative Crash Reduction Factor: 36%



CLASS IV

Buffered bicycle lanes in roadway separated from automotive traffic.

Representative Crash Reduction Factor: 45%



BICYCLE BOX

Advanced stop bar that leaves dedicated space for cyclists at intersection.

Representative Crash Reduction Factor: 36%

23

Active Transportation / Bikeways / Greenways - $35M in Funding

- Funds approx. 7 miles of new bikeway/year, growing our network by 20% over 5 years
- Funded projects identified in WalknBike Plan
  - 34 planned WalknBike bikeway projects spanning over 100,000 feet.
  - 19 projects directly and 10 projects indirectly impact key pedestrian areas around Nashville.

24

Active Transportation / Bikeways / Greenways

Potential benefits

- Approximately $500K annually of journey quality benefits expected for bikeway projects by 2025
  - Benefits are derived from pedestrian counts provided by the city of Nashville.
  - Benefits are for current users and population growth. Does not include mode shifters.
- Cyclist Journey Quality Benefits = $6M
  - 20 years through 2040, using 4% discount rate

25

Nashville Mobility Management Center - $15M in Funding

- Implement the recommendations of the Traffic Management System Evaluation currently underway
- Smart and connected traffic signals
- System Detection and CCTV Cameras
- Adequately staffed Mobility Management Center
- Resilient and Sustainable
- Manage and provide consistent travel times

26

Traffic Management Systems / Signal Upgrades

Project elements

$30K Full Intersection Detection Upgrade	$200K Partial Detection Upgrade	$1.5M TCC	$500K Communications
20 Intersections per year	10 Intersections per year	4 Staff each year upon commissioning	Per mode, per year
$600K per year	$250K per year	$250K per year	$250K per year

27

Traffic Management Systems / Signal Upgrades

Project elements

$3K Timing development and TR implementation (per intersection)	$6K CCTV installations (per node)	$10K Connected vehicle and new technology testing (per location)	$50K Intersection rewiring (per intersection)
200 Intersections	50 Locations per year	20 Locations per year	20 Intersections
$600K per year	$300K per year	$200K per year	$1.4M per year

28

Traffic Management Systems / Signal Upgrades

Potential benefits

Offset Left Turn Lanes: Provide an offset so that sightlines are improved for turning vehicles.

Representative Crash Reduction Factors: **32%** to **38%**

Refreshed Approach Striping: Improved painted channelization of lanes on approach to intersections.

Representative Crash Reduction Factor: **57%**

Left Turn Phasing: Provide a dedicated green light to left-turning vehicles

Representative Crash Reduction Factors: **99%** (fully protected) **16%** (permissive/protected)

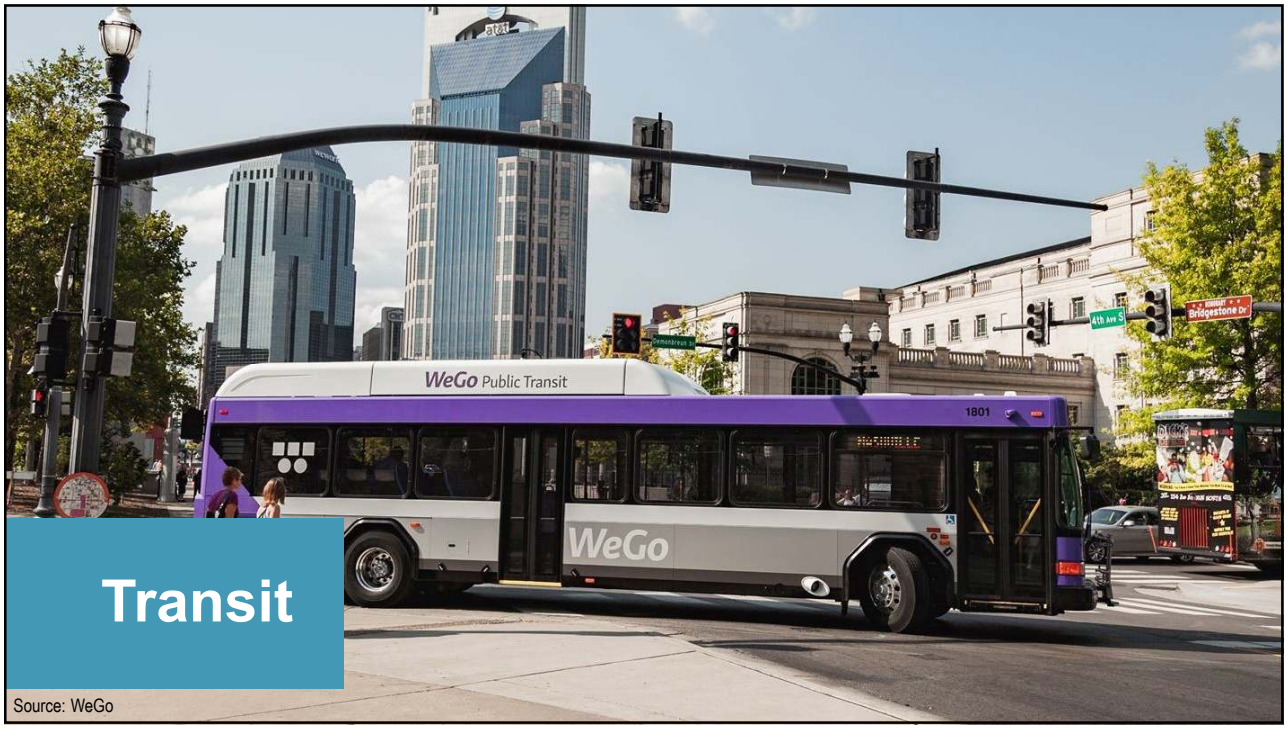
Flashing Yellow Arrow Signals: Clarifies safe timing of left turns relative to yield-on-green indications

Representative Crash Reduction Factors: **25%** to **37%**

Potential Traffic Calming Improvements / Speed Enforcement: Reduced Speed Limit: Set posted speed limit 5 mph below engineering recommendations.

Representative Crash Reduction Factor: **56%**

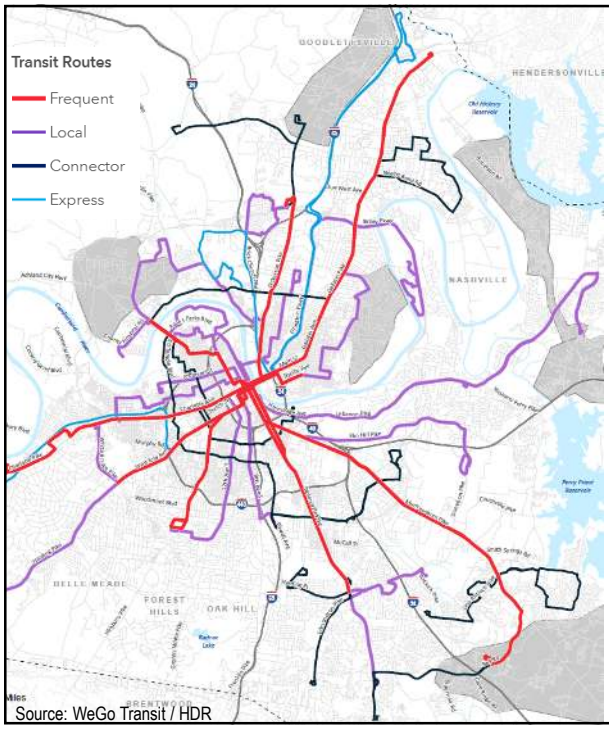
29



Transit

Source: WeGo

30



Better Bus - $209.6M in Funding

- Longer Service Spans
- Improved Weekend and Evening Service Frequency
- 95% of current riders would see improvement in their service
- Several routes extended to serve emerging Neighborhood Transit Centers
- New and Improved Crosstown and Neighborhood Connections
- Access / Access on Demand for persons with disabilities
- First Mile/Last Mile Mobility Zones providing discounted on-demand trips
- Fare Capping/Best Value Pricing

31

Better Bus Enhancements/Redesign

Potential monetized annual benefits

$148,200
2040 Air Pollution Reduction

$985,100
2040 Safety Improvement Savings

$6,500
2040 Pavement Maintenance Savings

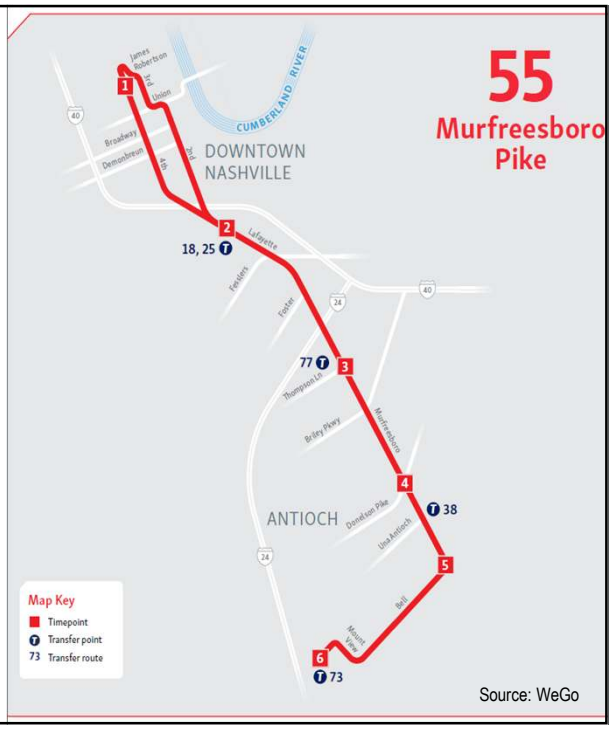
Assumptions:

BRT Medium, 10 min peak frequency, 18 MPH Average operating speed, No TOD assumed.

32

Murfreesboro Pike BRT - $413.3M in Funding

- 12 miles – Follows exiting Route 55
- Originates at Hickory Hollow in Antioch and terminates at SoBro Transit Hub (4th Ave and Ash St) in Downtown
- Bus will run in dedicated lanes and will feature:
  - Iconic stations
  - Platform-level boarding
  - Off-board fare collection
- Project will include roadway, safety, ITS and pedestrian crossing/sidewalk improvements



33

Murfreesboro Pike Bus Rapid Transit

Potential monetized annual benefits

$38,000
2040 Air Pollution Reduction

$252,000
2040 Safety Improvement Savings

$1,700
2040 Pavement Maintenance Savings

$2.7M
2040 Travel Time Savings

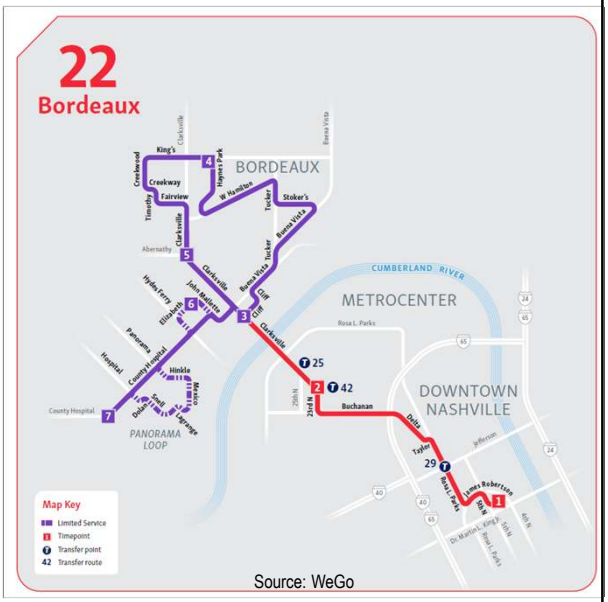
Assumptions:

Gold standard BRT, 10 min peak frequency, 30 MPH Average operating speed, TOD effect added.

34

Clarksville Pike Rapid Bus - $92.9M in Funding

- 7 miles – originates at Kings Ln in Haynes Park and terminates at WeGo Central
- Bus will operate along Route 22 and serve Haynes Park, Bordeaux, and North Nashville neighborhoods
- Connects with North Nashville Neighborhood Transit Center at 26th Ave
- Project will include improved mobility options and amenities



35

Clarksville Pike Rapid Bus Project

Potential monetized annual benefits

$5K
2040 Air Pollution Reduction

$37K
2040 Safety Improvements Savings

$240
2040 Pavement Maintenance Savings

$1.3M
2040 Travel Time Savings

Assumptions:

BRT Medium, 10 min peak frequency, 18 MPH Average operating speed, No TOD assumed.

36

WeGo Star Commuter Rail - $145.31M in Funding

- Supports operation of more trips on the Star
- Includes installation in “Positive Train Control” (PTC) system, which allows increased service frequency and span of service
- May support the implementation of quiet zones and infill stations at Central Pike, Golden Bear Pkwy, and Wilson Co. Expo Center

37

WeGo Star

Potential benefits

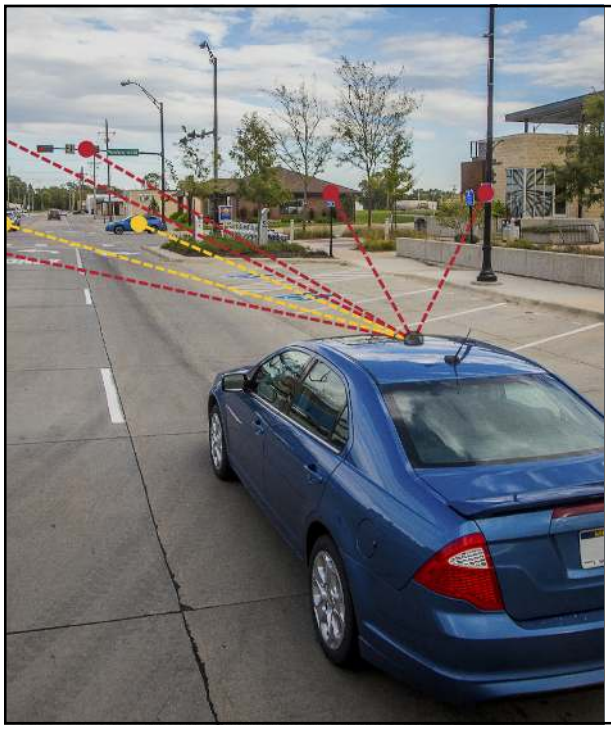
- Sample TOD experiences:
  - Meridian, MS
    - $6.6 million Union Station revitalization
    - $135M in private development, including low- to middle-income, transit-accessible housing
  - Brunswick, ME
    - $25M in private development
    - 97 new full-time jobs have been added from existing business
  - Normal, IL
    - $49.5M in project costs
    - $120M in private investment

38

Any Questions?

39

40



Tampa-Hillsborough Expressway

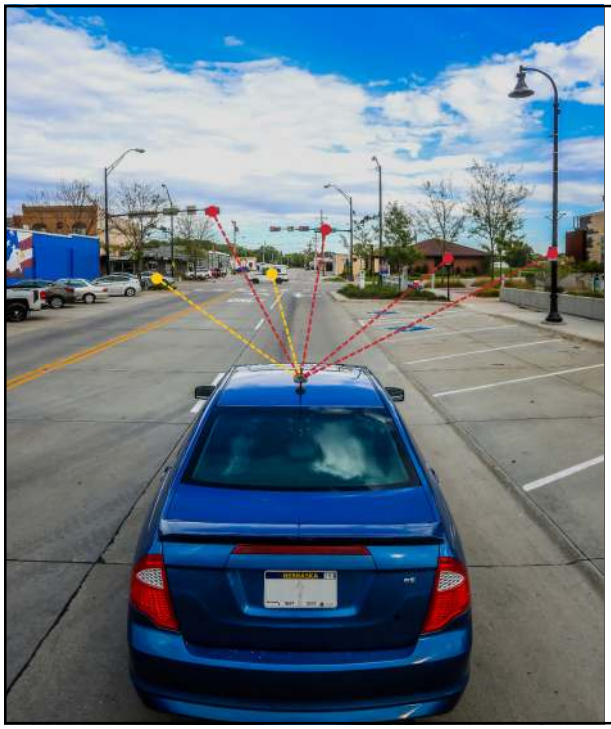
- Technology
  - DSRC technology and 40 RSU's deployed on city streets and reversible express lanes enables communication between:
    - 1,600 cars
    - 10 buses
    - 10 trolleys
    - 500 pedestrians
- Goals:
  - Increase vehicle to vehicle communication
  - Relieve Congestion
  - Reduce collisions
  - Prevent wrong way entry
  - Enhance pedestrian safety
  - Enhance pedestrian safety
  - Speed bus operations
  - Reduce conflicts between high-volume, mixed-traffic in the area

41

New York City

- Technology
  - DSRC technology and 500 RSU's and 8,000 OBU's installed three highly trafficked areas
    - 310 signalized intersections
    - 5,800 cabs
    - 1,250 transit authority buses
    - 400 commercial fleet delivery trucks
    - 500 city vehicles
- Goals:
  - Pilot program to collect and study data from key urban area intersections
  - Address challenges like short-radius curves, weight limits and minimum bridge clearance
  - Support system management functions

42



Marietta, GA

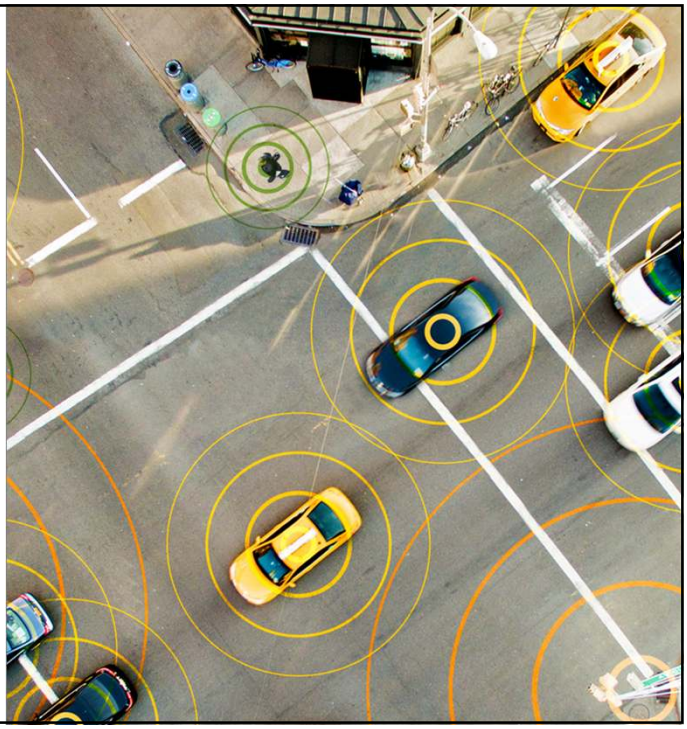
- Technology
  - DSRC and cellular technology deployed
    - 120 traffic signals
    - TravelSafely mobile application means that anyone within the 23-mile city area can utilize the network
    - OBU's installed on city emergency response vehicles
- Goals:
  - Emergency vehicle response times
  - School & work zone alerts
  - Signal prioritization
  - Crash reductions
  - Pedestrian safety

43

Restoration, Resiliency & Partnership Funds

Emergency vehicle response

- Emergency vehicles equipped with on-board units connect to CV network supported by roadside units.
- Most benefits realized at signalized intersections where signal prioritization and pre-emption can improve travel speed and overall response times.
- Mobile applications like TravelSafely also provides motorists, cyclists and pedestrians with information about approaching emergency vehicles, including direction.

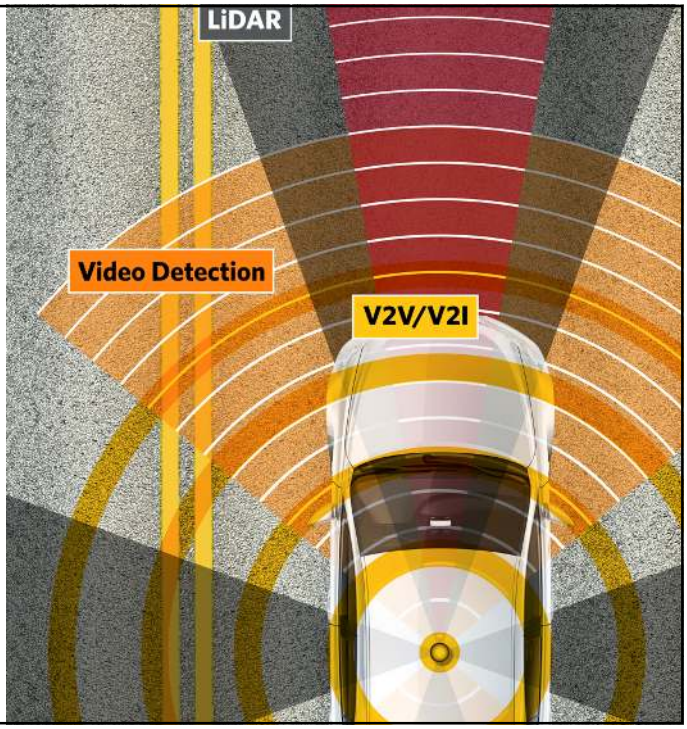


44

Connected Vehicle Network Benefits

Safety

- Reduced crashes due to congestion alleviation
- Reduced emergency vehicle response times due to signal prioritization
- Alerts for wrong way driving, approaching EV, school or workzone, and approaching traffic signal
- Enhanced health precautions for transit passengers by providing vehicle occupancy data



45

Connected Vehicle Network Benefits

Mobility

- Improved average travel times due to signal prioritization and congestion alleviation
- Improved reliability
- Greater transited customer flexibility
- Improved journey benefits
- Increased transit ridership due to better reliability and quality of experience

46

Connected Vehicle Network Benefits

Environment

- Transit signal priority will lead to some reduction in breaking and speeding
- Reduced emissions
- Reduction in noise impacts

Future planning

- CV technology will enable collection of data to meet evolving needs

47

Safety Related Benefits

Anticipated Crash Reduction 25%-50% with improvements:

- Offset Left Turn Lanes
- Refreshed Approach Striping
- Left Turn Phasing
- Flashing Yellow Arrow Signals
- Traffic Calming Improvements / Speed Enforcement
- Newly installed sidewalks
- Raised Median/Pedestrian Refuge Area
- Pedestrian Crossing Signals
- Pedestrian Hybrid Beacon
- Intersection Improvements for Bicyclists

48

Connected Vehicles (CV)

- Deployment of CV technology at intersections leads to better signal operation and:
  - Reduced congestion
  - Improved transit service
  - Fewer crashes
  - Improved emergency vehicle response times
- Network allows enhanced real-time monitoring of transit conditions and upgrades traffic signaling
- Dynamic management allows prioritization for behind-schedule transit vehicles and asymmetrical directions demand at intersections

49