Introduction.

Traffic Congestion describes a transportation cost incurred by users where as a road reaches its capacity, each additional vehicle imposes more total delay on others than they bear, resulting in economically excessive traffic volumes. Congestion can be recurrent (occurring on a regular basis) or non-recurrent (for example, due to a traffic accident.) Congestion Management Process allows urban regions to identify congestion hot spots and key corridors, and to recommend solutions in dealing with congestion.

Winston-Salem Urban Area MPO is a transportation management area (TMA), defined as an urbanized area with a population of over 200,000 individuals. As a TMA, WSUAMPO is required to update the region’s Congestion Management Process (CMP) on a regular basis.

Federal Highways Administration Congestion Management Process Guidebook defines CMP as follows:

A congestion management process (CMP) is a systematic and regionally-accepted approach for managing congestion that provides accurate, up-to-date information on transportation system performance and assesses alternative strategies for congestion management that meet state and local needs.

Congestion Management Process was first introduced as part of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, under the term Congestion Management System (CMS). Congestion Management requirements were continued under the Transportation Equity Act for the 21st Century (TEA-21). The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) transitioned to the concept of treating congestion management as a process, recognizing that the CMP is not intended to be a stand-alone document, but rather part of an overall metropolitan transportation planning process.

Under the FAST Act, Congestion Management Process requirements previously in place for an urban area over 200,000 in population were retained. In addition, the FAST Act identified the following specific examples of travel demand reduction strategies for a congestion management process for MPOs that serve a TMA [23 U.S.C. 134(k)(3)]:

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3 Ibid
• Intercity bus operators
• Employer-based commuting programs such as a carpool program, vanpool program, transit benefit program, parking cash-out program, shuttle program or telework program
• Job access projects
• Operational management strategies

Congestion has a real effect on everyday lives and businesses, increasing the delay in shipments and adding hours to time spent commuting. TTI Urban Mobility Report, 2019\(^4\) indicates that congestion in the U.S. has been consistently growing from 1982 to 2017, with the following congestion-related negative impacts identified:

• In 2017, congestion caused urban Americans to travel an extra 8.8 billion hours and purchase an extra 3.3 billion gallons of fuel for a congestion cost of $166 billion.
• Trucks account for $20 billion (11 percent) of the cost, a bigger share than their 7 percent of traffic.
• The average auto commuter spends 54 hours in congestion and wastes 21 gallons of fuel due to congestion at a cost of $1,080 in wasted time and fuel.
• 2017 Congestion costs were at $179 billion based on cost of delay and additional fuel cost; 11 percent ($20 billion) of the delay cost was the effect of congestion on truck operations.
• The cost to the average auto commuter was $1,080; it was an inflation-adjusted $610 in 1982.

The Texas Transportation Institute Urban Mobility Report 2019\(^5\) also includes specific congestion metrics for Winston-Salem region and indicates that by 2017, annual total delay per commuter in the Winston-Salem region has increased to 27 hours per auto commuter, making it 167\(^{\text{th}}\) highest region by commuter delay. Based on 7,930,000 hours of total annual delay, an estimated annual congestion cost of $159,000,000 has been calculated by TTI researchers for Winston-Salem region, resulting in 2,618,000 gallons of excessive fuel consumption. This amounts to an annual congestion cost of $487 per average auto commuter in the region.

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\(^4\) Texas A&M Transportation Institute, Urban Mobility Report 2019. Retrieved from [https://mobility.tamu.edu/umr/congestion-data/](https://mobility.tamu.edu/umr/congestion-data/)
\(^5\) Ibid.
While COVID has temporarily put a pause on increase in congestion, typical travel and congestion is likely to return to its trajectory of upward climb when the post-COVID conditions normalize and economic activity is back to where it was prior to the start of the Pandemic.

The Process

In working with the Steering Committee for the Metropolitan Transportation Plan, and with additional feedback from the public input received through an online survey, the following goals and objectives have been identified for the MTP and have been carried forward into the CMP update process.
Table 1: Winston-Salem Urban Area MPO MTP 2045 Goals and Objectives

<table>
<thead>
<tr>
<th>Goals</th>
<th>Objectives</th>
</tr>
</thead>
</table>
| I. Improve mobility and accessibility for people and goods across the region | 1) Promote equitable transportation options for low-income and minority communities, and the aging population  
2) Reduce congestion on key interstates and arterial corridors  
3) Improve freight access to industrial/distribution centers and freight terminals, such as airports and railyards  
4) Support improvements to the rail infrastructure including railroad crossing improvements and intermodal facilities  
5) Improve availability of premium transit options such as express bus routes, light rail and streetcar lines  
6) Improve last mile access to public transit with enhanced pedestrian safety, bicycle and shared mobility options at major transit stops |
| II. Support smart regional growth and economic development           | 1) Improve transportation options between urban job centers and rural and suburban places  
2) Increase the number of jobs accessible within a reasonable commute travel time  
3) Enhance connections between major destinations such as employment and education centers, medical and transit facilities and neighborhoods  
4) Ensure transportation infrastructure is supportive of visitor trips and tourism |
| III. Create Vibrant, Healthy, and Resilient Communities               | 1) Improve the connectivity of walking, bicycling and greenway network  
2) Protect and strengthen a sense of place and vibrancy of downtowns and walkable mixed-use activity centers  
3) Retrofit arterial corridors and major roadways to be consistent with complete streets principles  
4) Integrate land use and transportation planning  
5) Incorporate resilience concepts into transportation projects by planning for extreme weather and stormwater impacts as part of transportation projects |
| IV. Improve safety and security of the transportation network        | 1) Prioritize safety improvements at intersection locations with high frequency of crashes and fatalities  
2) Reduce the number and severity of crashes and safety incidents on major arterial corridors  
3) Reduce the number and severity of bicycle and pedestrian crashes  
4) Enable improved safety through ITS improvements  
5) Improve transportation network connectivity and redundancy for more efficient emergency response |
V. Support transportation for tomorrow

<p>| | |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reduce Greenhouse Gas Emissions associated with transportation sector though increased use of alternative fuels, TDM strategies, transit, walking and bicycling</td>
</tr>
<tr>
<td>2</td>
<td>Support alternative fuels and autonomous and connected vehicles infrastructure improvements</td>
</tr>
<tr>
<td>3</td>
<td>Prioritize Intelligent Transportation Systems (ITS) infrastructure to address congestion and travel time reliability</td>
</tr>
<tr>
<td>4</td>
<td>Designate “feet first” areas where walkability, bicycling and transit service is prioritized ahead of mobility for autonomous vehicles</td>
</tr>
</tbody>
</table>

VI. Ensure maintenance of existing infrastructure and services

<p>| | |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ensure adequate funding to preserve and maintain the integrity of the existing transportation infrastructure</td>
</tr>
<tr>
<td>2</td>
<td>Prioritize funding to support existing transit services and transit state of good repair</td>
</tr>
<tr>
<td>3</td>
<td>Promote public-private partnerships in addressing transportation needs</td>
</tr>
</tbody>
</table>

During the May 5-May 21 timeframe, an online public survey was held as part of the Metropolitan Transportation Plan update process. During this period, a total of 419 unique responses were received. Survey participants were asked to complete various questions and tasks to gauge problem locations, areas of high demand, budget allocation, project type prioritization, and sociodemographic information.

As part of the survey, participants were asked to place interactive map markers to document their frequent destinations or areas of concern. Under “roadway/traffic” category for interactive map exercise performed as part of the survey, congestion was the most frequent choice. Figure 2 below illustrates the types of concerns noted for roadway/traffic category.
Figure 2: Public Survey Responses (May 2020) Indicating Roadway and Traffic Concerns, by Specific Type of Concern

Figure 3 below provides a map of locations for roadway concerns noted by survey participants. There are several notable concentrations for roadway congestion concerns—in the area around Bermuda Run, south and southwest of Kernersville, along Hanes Mall Boulevard, and along key east-west and north-south corridors in Winston-Salem.
Figure 3: Public Survey Responses (May 2020) Roadway Concerns Locations
Identifying Priority Congested Corridors

The MTP includes several approaches to identifying and addressing congestion along corridors and in key areas. These included an analysis of HERE data (probe and Bluetooth data) and the region’s travel demand model for the baseline year—referred to as Existing Conditions—and forecasted to 2045 with the regional travel demand model. The congested corridors are identified below, and while both methods indicate overlapping areas, their methodologies are different and provide contrasting perspectives.

Traffic congestion during the PM peak period, 4 PM-6 PM, was analyzed using real-time HERE data from 2018. Congestion appears to be most frequent and severe along key sections of major arterial corridors, many of them running in the north-south direction and connecting to I-40, US 421, and US 52. Congested arterials include segments of Silas Creek Parkway and Martin Luther King, Jr. Dr. See Figure 4 below for PM Peak congestion hotspots based on HERE data.

The PART PTRM model was used to identify priority congested corridors for the baseline 2017 and final MTP horizon year of 2045. Corridors of approximately one mile or longer with functional classifications of Principal Arterial or higher were selected if the volume over congestion (VoC) exceeded the threshold of 0.90 during the PM Peak Period (3PM-6PM). These corridors are listed in Table 3 and shown for the baseline and year 2045 in Figure 5 and Figure 6, respectively.

There are several projects within the 2045 MTP that are anticipated to reduce congestion along the identified corridors in 2045. These improvements are not able to be modeled in PTRM due to the model’s limitations. The adoption of ITS along the I-40, Silas Creek Parkway, US-52, and I-74 is likely to reduce congestion through improving incident response times, improving safety, and improved traffic flow. Additionally, the 2045 MTP includes intersection and interchange improvement projects along these corridors that—while unable to be modeled—will also likely address congestion issues. Congestion-reduction strategies are explained in greater detail below.
<table>
<thead>
<tr>
<th>2017 Congested Corridors</th>
<th>2045 Congested Corridors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salem Parkway (US 158, 421, NC 150): Reidsville Road to Hawthorne Road SW</td>
<td>Salem Parkway (US 158, 421, NC 150): Reidsville Road to Hawthorne Road SW</td>
</tr>
<tr>
<td>Clemmons Road (US 158): Twins Way to Harper Road</td>
<td>Germanton Road (NC 8, SR 1725): Oak Summit Road to Old Hollow Road</td>
</tr>
<tr>
<td>Interstate 40: E Clemmonsville Road through S Main Street (Winston-Salem)</td>
<td>Interstate 40: Jonestown Road through S Peace Haven Road</td>
</tr>
<tr>
<td>US 421: Silas Creek Parkway to I-40</td>
<td>Interstate 40: I-74 through S Main Street</td>
</tr>
<tr>
<td>Kernersville Road (SR 4315): Masten Drive to Hastings Hill Road</td>
<td>NC 801: Andrew Road to I-40</td>
</tr>
<tr>
<td>Peters Creek Parkway (NC 150): Lumber Lane to Brewer Road</td>
<td>Peters Creek Parkway (NC 150): Lumber Lane to I-40</td>
</tr>
<tr>
<td>Silas Creek Parkway (NC 67): Salem Parkway to Pennington Lane</td>
<td>Reidsville Road (US 158): Winston-Salem Northern Beltway to Old Hollow Road</td>
</tr>
<tr>
<td>Stratford Road (South) (US 158): I-40 to Kimwell Drive</td>
<td>Silas Creek Parkway (NC 67): Salem Parkway to Kirklees Road</td>
</tr>
<tr>
<td>US 52 (NC 8): US 421 to E 25th Street</td>
<td>Stratford Road (South) (US 158): W Clemmonsville Road to Idols Road</td>
</tr>
<tr>
<td></td>
<td>Stratford Road (South) (US 158): I-40 to Kimwell Drive</td>
</tr>
<tr>
<td></td>
<td>US 158: Baltimore Road to Laird Road</td>
</tr>
<tr>
<td></td>
<td>US 421 (West): Silas Creek Parkway to I-40</td>
</tr>
<tr>
<td></td>
<td>US 52 (NC 8): Waughton Street to Rams Drive</td>
</tr>
<tr>
<td></td>
<td>US 52 (NC 8): US 421 to E 25th Street</td>
</tr>
</tbody>
</table>
Figure 4 - Percent of Time Roadway Corridors are Congested during PM Peak, based on 2018 HERE Data for Tuesday-Thursday
Figure 5 - Congested Corridors for 2017 Baseline during PM Peak Period
Figure 6 - Congested Corridors for 2045 Horizon Year during PM Peak Period
Strategies for Relieving Congestion

Addressing recurring congestion in the Winston-Salem Urban Area may include but is not limited to the following strategies:

- Transportation Demand Management
- Public Transportation
- Bicycle and Pedestrian Infrastructure
- Parking Management and Pricing
- Intelligent Transportation Systems (ITS)
- Roadway Modernization, Access Management and Innovative Intersections
- Roadway Capacity Expansion

Transportation Demand Management

PART’s Commuter Operations Department manages the Transportation Demand Management (TDM) program for the greater Triad region. The department works to educate, advocate, and provide alternative transportation strategies to reduce single-occupancy vehicle trips in the Triad. The department serves as a resource for commuters interested in riding transit, carpooling, or vanpooling.

Vanpool Program

The PART Vanpool Program provides eligible groups of five or more commuters with a 7 or 15 passenger van to use to commute to and from work. The month-to-month lease includes the vehicle, insurance, maintenance, gas, and in some cases an Emergency Ride Home. The vanpool fare is determined by the size of the van and the number of miles the van travels per month. The fare is then split evenly by the number of participants. What makes the vanpool program unique is that it is operated by members of the group and travels based on the schedules developed by the group. As of calendar year 2019, the vanpool program is averaging 54 leased vans per month. This equates to more than 13 Million miles of reduced single occupancy travel on our roadways each year with a PART fleet of 65 vans.

Carpool Support
PART plays an active role in promoting carpooling in the region through a partnership with the Share the Ride NC (STRNC) statewide rideshare matching platform. STRNC, which is accessible on PART’s website, allows commuters in North Carolina to quickly and securely find other individuals who share similar commutes and work hours, and are interested in carpooling or vanpooling. Commuters simply create a profile, identify and communicate with matches, and start sharing the ride. As of January 2020, there are 177 individuals registered in the STRNC platform.

**Share the Ride NC Website, sharetheridenc.org/**

**PARTnership Program for Employers**

In 2018, the Commuter Resources Department implemented the PARTnership Program. The PARTnership is a free full-service resource for employers in the Triad. The goal of the program is to improve mobility for employees by identifying alternatives to driving alone, marketing sustainable options, and reporting results. As a member of the PARTnership, employers are eligible to take advantage of incentives such as PART’s Triad XPass Employer Discount Program. The XPass program provides a 30% discount off the cost of a PART 31-Day and 10-Ride bus pass through PART’s TouchPass Mobile & Smartcard faring system.

**Public Transportation**

*Continuing and Expanding Frequency and Service Area of Existing Public Transportation Services*

Public Transportation services bring a variety of benefits not just to users who have improved mobility options, but to the society as a whole. Todd Littman in *Evaluating Public Transit Benefits and Costs: Best Practices Guidebook* identifies the following public transit project benefits categories: improved transit service, increased transit travel, reduced automobile travel and
transit-oriented development. Under the umbrella of reduced automobile travel, the following benefits to the society at large and to the traveling public are recognized:

Reduced Automobile Travel Benefits:
- Reduced traffic congestion
- Road and parking facility cost savings
- Consumer savings
- Reduced chauffeuring burdens
- Increased traffic safety
- Energy conservation

Electronic Fare Collection and Fare Free Transit

PART launched TouchPass fare collection system-wide in August 2019. TouchPass uses electronic fare collection to replace the use of paper magstripe passes. Passengers no longer have to wait in line at the ticket window to buy a pass but can purchase their pass over the internet using the secure TouchPass system. Along with the implementation of TouchPass, PART Express added daily and monthly Fare Capping to its fare structure. The TouchPass system is administered through the Commuter Resources Department Regional Call Center. During its first year of implementation 75% of PART Express passengers were taking advantage of the TouchPass platform.

Bicycle and Pedestrian Infrastructure

Bicycle and pedestrian trips can help reduce congestion on highway corridors where it is feasible and safe to make shorter trips on foot and by bicycle. Littman (2020) notes that in urban areas, between 10-30% of trips are short trips that could be potentially shifted to active transportation; poor walking and bicycling conditions are likely to result in additional vehicular trips in the following circumstances:
- Poor walking and cycling conditions force people to drive for even short trips, for example across a driveway
- Poor walking and cycling conditions increase chauffeuring trips (special trips made to transport a non-driver)
- Poor walking and cycling conditions discourage public transit and rideshare travel (car-and vanpooling), which reduces longer vehicle trips.

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Littman notes that bicycling trips on narrow, congested roadways with faster speeds without a dedicated bicycle facility could cause additional congestion by slowing down traffic; however, where adequate on-road or off-road bicycle facilities are provided, active transportation is unlikely to cause significant congestion impacts.8

Parking Management and Pricing

Winston-Salem Urban Area MPO planning region includes a number of vibrant downtowns with a mix of land uses. As the region continue to grow and develop, managing parking in downtown areas is important to support congestion management goals while ensuring that local businesses can still thrive and their customers can access the parking they need. The transportation system is seeing an evolution from simple parking pricing and management to a curb space management approach to divide space by time and zones among on-street parking, goods delivery, ride-hailing, transit stops, bike lanes, and other elements of complete streets design creates conflicts that must be actively managed. Designs and policies along active main street corridors can have a significant impact on travel behavior and first-mile/last-mile options for passenger trips and deliveries. WSUAMPO member jurisdictions are encouraged to consider the following curbside management policy ideas and planning strategies in downtown areas:

- **Off-Street Parking and Wayfinding**: On-street and off-street parking serve different needs and can affect traffic demand on the street network. Off-street parking can influence on-street parking usage where higher turnover is desired for customers making short-term trips. Improved wayfinding to off-street parking improves the drivers experience. With higher reliance on cell phone navigation apps, drivers can consider parking options as part of their route planning, rather than after arriving at their destination. Parking lot signage and wayfinding can reduce the congestion caused by vehicles cruising for on-street parking.

- **On-Street Parking Turnover and Pricing**: Most main streets in the WSUAMPO have free on-street parking. If a jurisdiction desires higher turnover in these spaces, increasing enforcement adherence to time limits or charging a parking fee are two options. Increasing on-street parking turnover ensures adequate parking spaces are available for individuals making short trips or visiting a retail shop or restaurant. Recent technology improvements have made it more affordable for municipalities to acquire parking payment infrastructure such as multi-space meters and parking apps.

- **Loading Zones and Dual Use Zones**: Delivery vehicles of all sizes must navigate the limited spaces within historical downtowns and limited loading zones. Owners of locally owned small businesses often load out of their personal vehicles. Planning for adequate loading zones ensures space is available as deliveries increase. Dual use of zones (such as on-

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street parking and commercial loading zones) by time-of-day and day-of-week can also increase loading space capacity. Pedestrian and vehicular conflicts can be reduced by designating dual use space for ride-hailing and taxis during weekends and evenings.

- **Complete Streets at the Curb:** Bicycles, pedestrian, and transit mix at the curb with delivery trucks and on-street parking. Safety considerations such as appropriate spacing between transit stops (such as the potential Graham and Mebane circulator stops) and commercial loading zones, driveways, crosswalks, and intersections are needed to improve visibility. Bicycle facilities such as bike lanes or lane reconfigurations can create space for a variety of street uses. Streetscaping enhancements that widen sidewalks or provide pedestrian bulb outs make space for transit shelters and outdoor dining, yielding a more welcoming and pedestrian-oriented environment. ADA compliance for adequate handicap on-street parking spaces per block and curb cuts improve accessibility and safety for all users.

- **Community Prioritization and Pilot Programs:** Each main street is unique, so understanding local stakeholders’ priorities along each block helps determine how curb space should be used and managed. Pilot programs are great ways to test out new strategies before installing them. Dual use zones and bike lanes are suitable pilot projects.

### Intelligent Transportation Systems (ITS)

The 2045 MTP recommends the adoption of the Intelligent Transportation Systems (ITS) throughout the WSUAMPO area as described in the Triad Regional Intelligent Transportation Systems Strategic Deployment Plan. The Strategic Deployment Plan (SDP) “establishes the foundation for the SDP through stakeholder engagement and a regional gap assessment; follows the process into the project development, prioritization, and creation of the regional ITS architecture; and, consolidates the outputs of the SDP and provides details related to implementing a project, along with processes for maintaining and updating the SDP.”

ITS technology treatments include advanced signal technologies, enhanced surveillance, en-route traveler information, Bus on Shoulder support, ramp metering, transit signal priority, and incident response (see Table 3). These types of improvements can decrease congestion, reduce travel times, improve transit on time performance, and increase safety.

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9 Triad Regional Intelligent Transportation Systems Strategic Deployment Plan, May 2020.
### Table 3 - ITS Treatment Strategies

<table>
<thead>
<tr>
<th>Treatment Strategy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>En-Route Traveler Information Improvements</td>
<td>Real time updates broadcast to the vehicle (e.g. Dynamic Message Signs (DMS), X2V communications).</td>
</tr>
<tr>
<td>Advanced Signal Technology</td>
<td>Optimized coordination for signal operations (e.g. ATSPM, adaptive signals).</td>
</tr>
<tr>
<td>Bus on Shoulder</td>
<td>Use of the shoulder as a travel lane by buses when mainline travel speeds drop below specific thresholds.</td>
</tr>
<tr>
<td>Hard Shoulder Running</td>
<td>Use of the shoulder as a travel lane by all vehicles during specific scenarios such as peak periods or during a major incident.</td>
</tr>
<tr>
<td>Ramp Metering</td>
<td>Traffic signals operated at freeway on-ramps to control the rate and impact of vehicles entering mainline traffic.</td>
</tr>
<tr>
<td>Transit Signal Priority</td>
<td>Operational improvements that can extend the green time of a traffic signal when transit vehicles are behind schedule.</td>
</tr>
<tr>
<td>Enhanced Surveillance</td>
<td>Increased surveillance coverage to provide continuous monitoring capabilities on a roadway. Includes both blind spot and new corridor coverage.</td>
</tr>
<tr>
<td>Integrated Corridor Management</td>
<td>Management of a corridor as a system rather than as individual transportation networks.</td>
</tr>
<tr>
<td>Communication Upgrades</td>
<td>Improved communication for resiliency and redundancy through either additional connections or expanded bandwidth.</td>
</tr>
</tbody>
</table>

The 2045 MTP incorporates the recommended corridors from the Triad ITS Plan. These projects are shown in Table 4 and are included as funded in the 2035 Horizon Year. They are also shown as part of the recommended Autonomous Vehicle (AV) Corridor network in see Figure 7 (the AV and ITS concepts are also described in 2045 MTP Chapter 5.6).
Table 4 - ITS Projects in MTP

<table>
<thead>
<tr>
<th>MTP_ID</th>
<th>Facility</th>
<th>STIP ID</th>
<th>Project Description</th>
<th>Estimated Base Cost (2020 Millions USD)</th>
<th>Estimated YOE or Horizon Year</th>
<th>Future Cost in YOE (Millions USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS-ITS-Rdwy-402</td>
<td>Silas Creek Pkwy</td>
<td>N/A</td>
<td>ITS</td>
<td>$0.120</td>
<td>2035</td>
<td>$0.155</td>
</tr>
<tr>
<td>WS-ITS-Rdwy-403</td>
<td>Business 40</td>
<td>N/A</td>
<td>ITS</td>
<td>$0.578</td>
<td>2035</td>
<td>$0.748</td>
</tr>
<tr>
<td>WS-ITS-Rdwy-404</td>
<td>US 52</td>
<td>N/A</td>
<td>ITS</td>
<td>$0.304</td>
<td>2035</td>
<td>$0.393</td>
</tr>
<tr>
<td>WS-ITS-Rdwy-406</td>
<td>I-40</td>
<td>N/A</td>
<td>ITS</td>
<td>$0.380</td>
<td>2035</td>
<td>$0.491</td>
</tr>
<tr>
<td>WS-ITS-Rdwy-407</td>
<td>I-74</td>
<td>N/A</td>
<td>ITS</td>
<td>$3.097</td>
<td>2035</td>
<td>$4.008</td>
</tr>
</tbody>
</table>
Figure 7 - ITS Project and Autonomous Vehicle Corridor Networks, as Identified in MTP 2045
Roadway Modernization and Operational Improvements, Access Management and Innovative Intersections

Access Management
Access Management is a term used to describe changing land use planning and roadway design practices to limit the number of driveways and intersections on arterials and highways, constructing medians to control turning movements, encouraging clustered development, and creating more pedestrian-oriented street designs; Access Management tends to increase traffic speeds, reduce congestion delays and reduce crashes.\(^\text{10}\)

The Federal Highway Administration identifies the following Access Management techniques:

- **Access Spacing**: increasing the distance between traffic signals improves the flow of traffic on major arterials, reduces congestion, and improves air quality for heavily traveled corridors.
- **Driveway Spacing**: Fewer driveways spaced further apart allows for more orderly merging of traffic and present fewer challenges to drivers.
- **Safe Turning Lanes**: dedicated left- and right-turn, indirect left-turns and U-turns, and roundabouts keep through-traffic flowing. Roundabouts represent an opportunity to reduce an intersection with many conflict points or a severe crash history (T-bone crashes) to one that operates with fewer conflict points and less severe crashes (sideswipes) if they occur.
- **Median Treatments**: two-way left-turn lanes (TWLTL) and nontraversable, raised medians are examples of some of the most effective means to regulate access and reduce crashes.
- **Right-of-Way Management**: as it pertains to R/W reservation for future widenings, good sight distance, access location, and other access-related issues.

The goals of access management are to create a system that focuses on effective ingress and egress to a facility, efficient spacing and design to preserve the functional integrity, and overall operational viability of street and road systems.\(^\text{11}\)

Roadway Modernization and Operational Improvements
Roadway modernization attempts to maintain the transportation network while enhancing facilities that may not currently meet standards. This includes upgrades to the traveled way, signal system, transit facilities, and pedestrian/bicycle facilities to modernize transportation infrastructure for all modes. The implementation of roadway modernization allows enhancements to the transportation system that will enhance safety, improve efficiency, and

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address operational concerns without making major changes such as roadway widening or the construction of new roadway facilities.

Operational Improvements could include smaller improvements at particular intersection or interchange location to improve the traffic flow while avoiding a major widening. Examples of operational improvements could include the following project types:

- Ramp Metering
- Ramp Closures
- Congestion Pricing
- Signal Retiming
- Signal Coordination
- Reversible Lanes
- Adaptive Signals
- Raised medians
- Right/Left Turn Channelization

Innovative Intersections
The implementation of innovative intersections address complex conditions to reduce delay, enhance efficiency, and improve safety at locations where traditional countermeasures do not adequately address operational and safety concerns. Innovative intersections attempt to enhance the traveled way for all roadway users and seek to integrate all modes of transportation in the design. Innovative intersections may convey the following additional benefits compared to conventional intersection treatments:

- Improved safety
- Increased efficiency
- Increased capacity
- Shorter wait times
- Long-term cost effectiveness

The following types of at-grade innovative intersection designs may be considered when conventional treatments do not adequately mitigate existing and future transportation problems:\(^\text{12}\):

- Bowtie: left-turn movements from the mainline and side street are completed at an adjacent roundabout
- Continuous Green-T: One major street through movement passes through the intersection without stopping, and the opposite major street is typically controlled by a traffic signal. Left-turn movements from the side street use a channelized receiving lane on the major street to merge into the flow of traffic.

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- Displaced Left Turn (DLT): Left-turn movements cross to the other side of opposing through-traffic in advance of the main intersection. Left turns and opposing through movements occur simultaneously at the main intersection.
- Median U-Turn (MUT): Left-turn movements from one or both roadways make U-turns at dedicated median openings.
- Quadrant Roadway (QR): One main intersection and two secondary intersections that are linked by a connector road in any quadrant of the intersection. All left-turn movements use the secondary intersections and connector road to complete left-turn movements.
- Restricted Crossing U-Turn (RCUT): All side street movements make a right turn at the intersection. Side street left-turn and through movements turn right and make a U-turn at a dedicated downstream median opening to complete the desired movement.
- Split Intersection: Divides the major street into two one-way streets that meet the side street at separate intersections.
- Roundabout and Mini Roundabout: A circular intersection where traffic moves counterclockwise around a center island. A mini roundabout operates under the same traffic flow principles, but the center island is fully traversable for large vehicles.

The State of North Carolina has analyzed and constructed many of the above referenced intersection designs and additional innovative interchange designs across the state. As the Winston-Salem Urban Area MPO planning region grows and traffic congestion increases, innovative intersections may be needed to alleviate the growing congestion and balance the accommodations for all modes of transportation.

Roadway Capacity Expansion

Roadway widening and strategic new location roadway projects can help address significant roadway congestion problems where the other strategies considered are insufficient. While the 2045 MTP emphasizes modernization and multimodal improvements, it includes several significant capacity improvement projects. These projects are described below:

- I-40 Widening (WS-Rdwy-107) – This 2045 Horizon Year project is the addition of travel lanes from four to six on Interstate 74 from NC 65 (WNB) Ext 118 to Moore / RJR Drive Exit 122. The project would improve direct routes for both local and through traffic and provide a critical connection to the Northern Beltway. This project would also reduce VMT, VHT, and preserve the value of existing infrastructure investments and projects. Finally, the widening and additional capacity could be utilized for managed lanes when coupled with the ITS improvements noted above.
- I-74, US 52 Widening (WS-Rdwy-035) – This 2045 Horizon Year project is the expansion of travel lanes from six to eight on Interstate 40 from I-40/Salem Parkway to the connection with I-74. The project would improve direct routes for both local and through traffic. This project would also reduce VMT, VHT, and preserve the value of existing infrastructure investments and projects.
Northern Beltway (MTP project series WS-Rdwy-(69 through 74 & 80 through 84) – This project series is a new location four-lane median divided freeway facility from US 421 around the east, north, and west of Winston-Salem to US 157 (Stratford Road). This project diverts general and truck traffic off of congested routes needed by local trips. It is also anticipated to reduce congestion on Silas Creek Parkway, US 52, Us 421, NC 66, University Parkway/Cherry Street, and NC 158 (Stratford Road). The project’s Horizon Years span from the 2025 through 2045.

Monitoring Congestion Over Time

It is expected that the region will continue to monitor congestion both for priority congested corridors, and along other key freeway and principal arterial facilities over time. Tables 5 and 6 below illustrate the difference in Vehicular Miles Traveled and Vehicle Hours Traveled during PM Peak, by scenario, out to 2045. Metropolitan Transportation Plan 2045 recommended list of projects results in a decrease in the trips and travel time spent during PM peak that occurs under congested conditions (volume to capacity ratio of over 0.9), as compared with 2045 Existing plus Committed Scenario (2045 expected population and employment growth paired with improvements committed in the 2020-2029 STIP).

Table 5 PM Peak Period VMT and VHT Under Congested Conditions by County, by Scenario

<table>
<thead>
<tr>
<th>County</th>
<th>2017</th>
<th>2025</th>
<th>2035</th>
<th>2045 E+C</th>
<th>2045</th>
<th>2017</th>
<th>2025</th>
<th>2035</th>
<th>2045 E+C</th>
<th>2045</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davidson</td>
<td>1,915</td>
<td>1,958</td>
<td>2,075</td>
<td>2,385</td>
<td>1,992</td>
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<td>61</td>
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<tr>
<td>Davie</td>
<td>16,721</td>
<td>16,382</td>
<td>23,801</td>
<td>43,288</td>
<td>23,942</td>
<td>962</td>
<td>1,054</td>
<td>1,941</td>
<td>3,369</td>
<td>1,987</td>
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<tr>
<td>Forsyth</td>
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<td>383,414</td>
<td>417,366</td>
<td>756,042</td>
<td>374,226</td>
<td>8,951</td>
<td>14,214</td>
<td>16,666</td>
<td>32,899</td>
<td>17,797</td>
</tr>
<tr>
<td>Stokes</td>
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<tr>
<td>Yadkin</td>
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<td>-</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PM Period Total</td>
<td>229,195</td>
<td>401,753</td>
<td>443,241</td>
<td>801,714</td>
<td>400,160</td>
<td>9,990</td>
<td>15,329</td>
<td>18,678</td>
<td>36,342</td>
<td>19,851</td>
</tr>
<tr>
<td>% of Total</td>
<td>7.52%</td>
<td>12.18%</td>
<td>12.09%</td>
<td>19.36%</td>
<td>9.68%</td>
<td>12.60%</td>
<td>17.53%</td>
<td>19.19%</td>
<td>30.28%</td>
<td>18.09%</td>
</tr>
</tbody>
</table>
Table 6 PM Peak Period VMT and VHT Under Congested Conditions by Roadway Type, by Scenario

<table>
<thead>
<tr>
<th>Functional Class</th>
<th>PM VMT</th>
<th></th>
<th></th>
<th></th>
<th>PM VHT</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2017</td>
<td>2025</td>
<td>2035</td>
<td>2045 E+C</td>
<td>2045</td>
<td>2017</td>
<td>2025</td>
</tr>
<tr>
<td>Local Roads</td>
<td>18,781</td>
<td>24,794</td>
<td>42,456</td>
<td>64,410</td>
<td>54,106</td>
<td>1,398</td>
<td>1,833</td>
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<tr>
<td>Collectors</td>
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<td>69,534</td>
<td>74,474</td>
<td>124,320</td>
<td>88,629</td>
<td>2,439</td>
<td>3,386</td>
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<tr>
<td>Minor Arterials</td>
<td>9,304</td>
<td>9,560</td>
<td>13,350</td>
<td>19,355</td>
<td>13,656</td>
<td>487</td>
<td>534</td>
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<td>Principal Arterials</td>
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<td>68,377</td>
<td>67,852</td>
<td>109,746</td>
<td>74,327</td>
<td>2,562</td>
<td>2,864</td>
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<tr>
<td>Other Freeways or Expressways</td>
<td>72,055</td>
<td>107,430</td>
<td>92,193</td>
<td>205,109</td>
<td>99,292</td>
<td>2,149</td>
<td>3,298</td>
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<tr>
<td>Interstates</td>
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<td>115,354</td>
<td>141,120</td>
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<td>58,183</td>
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<td>2,741</td>
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<tr>
<td>Ramps</td>
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<td>6,695</td>
<td>11,796</td>
<td>12,855</td>
<td>11,968</td>
<td>618</td>
<td>673</td>
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<tr>
<td>WS - Total</td>
<td>229,195</td>
<td>401,753</td>
<td>443,241</td>
<td>801,714</td>
<td>400,160</td>
<td>9,990</td>
<td>15,329</td>
</tr>
</tbody>
</table>

WSUAMPO PM Performance Under Congested Conditions (Max VOC < .90) by Functional Classification