Greater Hickory Metropolitan Planning Organization

2024 Congestion Management Report

Western Piedmont Council of Governments

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July 2024

Introduction

The Congestion Management Process (CMP) is a systematic approach to congestion management, required in metropolitan transportation planning by federal code. Through a federally prescribed process, the Congestion Management Process in the region manages new and existing transportation systems for relieving congestion and maximizing the safety and mobility of people and goods. The tool used to evaluate the implementation of the Congestion Management Process is the Congestion Management Report. The Congestion Management Report is conducted biannually and assesses the quantitative performance of the transportation system in two manners: 1) A regional system level analysis of existing congestion data and predictive trends 2) A segment level analysis of roadway performance and potential solutions to operational deficiencies.

This Congestion Management Report will be the first completed by the Greater Hickory Metropolitan Planning Organization and will thus set the standard against which future Congestion Management Reports will be assessed. The Greater Hickory Metropolitan Area has experienced high degrees of variability in commuting patterns and congestion outcomes in the last several years. The COVID-19 pandemic rapidly and significantly changed the commuting patterns expected in the Greater Hickory Metropolitan Area. As a result, this report will address the following primary objectives:

1. **Assess and compare regional pre and post pandemic delay.** Total Regional delay significantly decreased during the COVID-19 pandemic. While Vehicle Miles Traveled (VMT) have returned to pre-pandemic levels, delay continues to remain below pre-pandemic level.
2. **Discuss changes in regional commuting patterns and their influence on system performance.** Commuting patterns play a significant role in the determination and prediction of peak hour delay. COVID-19 significantly changed the workplace, and as a result commuting patterns. Cross-County and Extra-Regional commuting patterns continue to trend upwards.
3. **Assess System Performance at Segment Level.** A primary objective of the Congestion Management Process is the identification and implementation of segment level solutions. This report will analyze roadway segment performance and identify potential solutions.

The Pandemic and Delay

COVID-19 significantly altered the way people work – and ultimately, the way people commute. 2019 total regional delay data, the primary congestion performance measure at the regional system level, represents the final reporting period prior to the pandemic; the most accurate depiction of the delay prior to COVID. In 2019, the Greater Hickory Region experience roughly 3.82 million hours of total delay. 2020 total regional delay data represents the immediate impact of COVID-19 on system demand and delay – a 45% decrease in total delay. While commuting patterns may have shifted in 2020, this significant decrease in delay is likely attributed to reduced travel during the peak of COVID-19. 2021 resulted in an increase in total delay when compared to 2020. However, 2022 data reflects that total regional delay has not recovered to pre-pandemic levels despite VMT (Vehicle Miles Traveled) recovery and the lifting of the majority of restrictions. Since the COVID-19 pandemic, the Greater Hickory Region has experienced 2.32M hours of delay per year on average – a 39.5% decrease in delay when compared to 2019. **Reduced delay despite recovering VMT and a normalizing post-COVID-19 environment suggest that COVID-19 produced significant changes to travel patterns.**

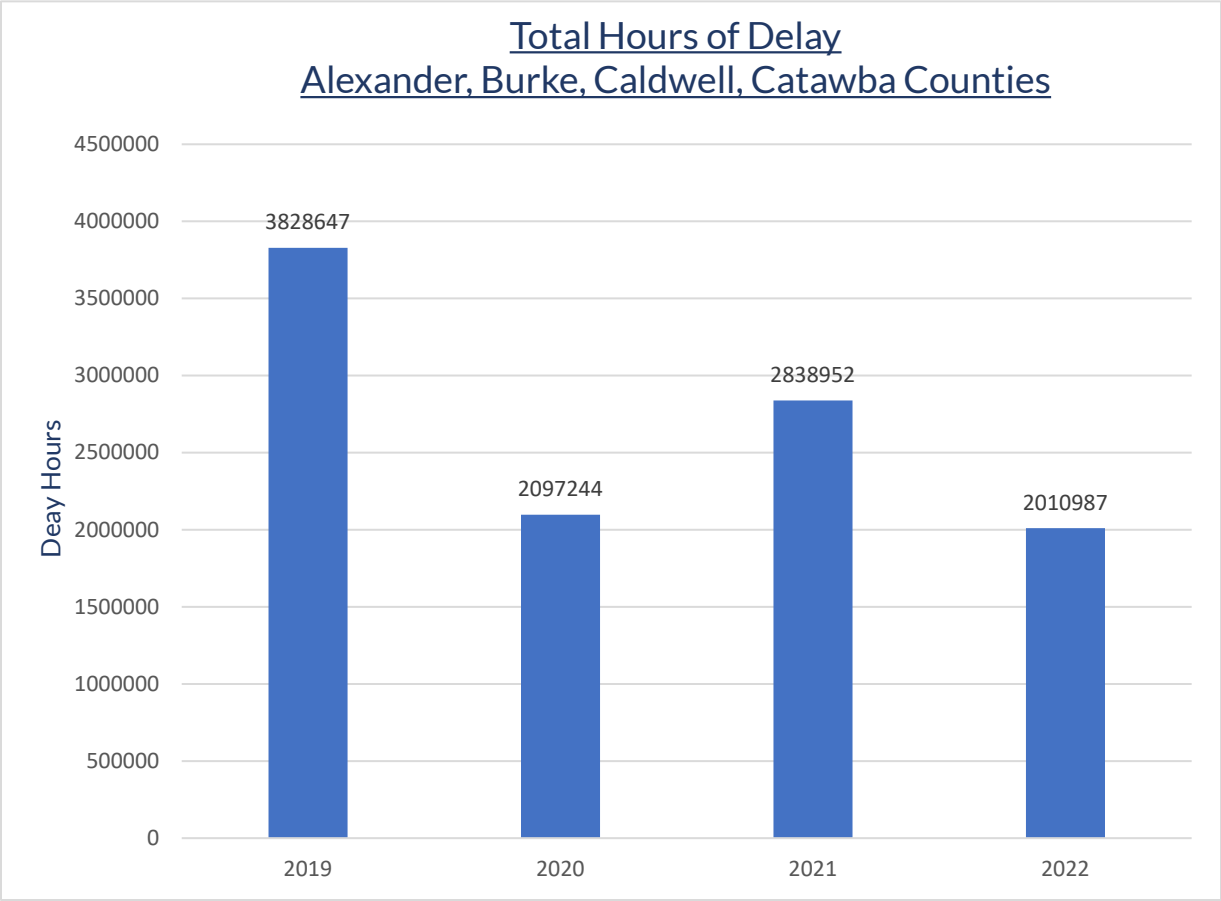

Figure 1 Source: RITIS Probe Data Analytics Suite

How the Pandemic Impacted Commuting Patterns

The COVID-19 pandemic had a profound effect on commuting patterns and congestion, through the effect it has had on how, where, and when American's work. COVID-19 forced the workforce out of the office and into their homes. Companies responded to the pandemic with work-from-home policies, forcing the workforce to adapt and produce from their homes. These changes resulted in acute decreases in commuting and as a result, congestion (2020). As the spread of COVID-19 became more and more controlled, many companies began to return to normal office operations. This return to work as normal was met with considerable resistance, and played a role in the "Great Resignation" of 2021, with many looking to retain their work from home availability. To remain competitive, many workplaces have maintained telework and flexible work schedule policies in place post COVID-19. There are two distinct commuting pattern impacts caused by post COVID-19 continued work-from-home and flexible work schedules: **1) Telework and flex schedules reduce peak hour travel, as fewer workers commute daily to the office. 2) Telework and flexible work redistributes trips to non-peak hours.** Employees working from home or on a flex schedule exhibit higher levels of trip diversity and leisure trips. Regionally, working from home continues to grow. In 2019, an estimated 3.3% of employed Hickory MSA residents worked predominantly from home. In 2022, an estimated 5.4% of employed Hickory MSA residents worked from home.

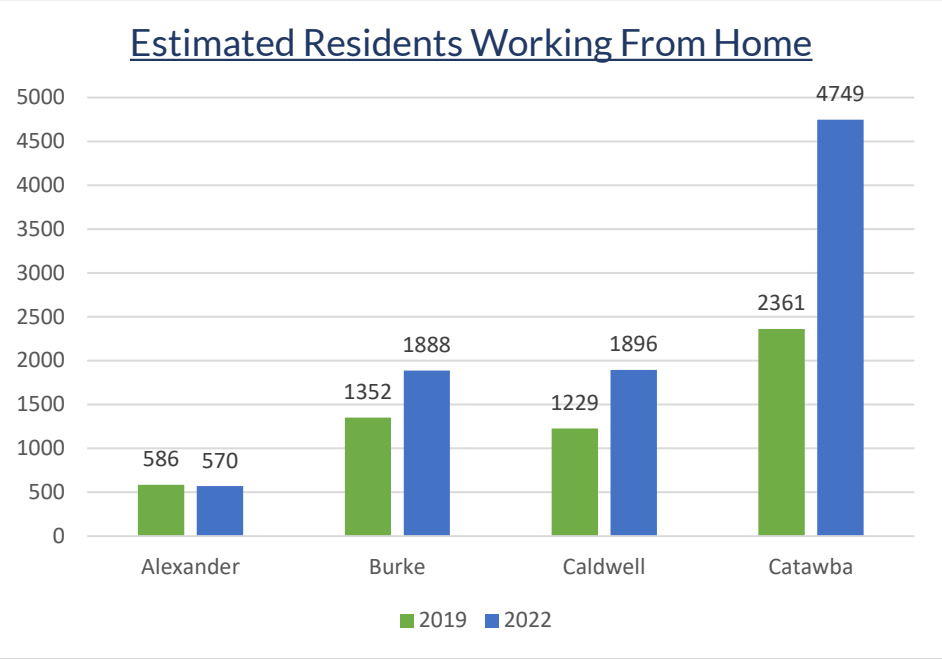

Figure 2 Source: US Census Bureau American Community Survey

Regionally, working from home continues to grow. In 2019, an estimated 3.3% of employed Hickory MSA residents worked predominantly from home. In 2022, an estimated 5.4% of employed Hickory MSA residents worked from home. COVID-19 also had impacts on alternative modes of transportation. **From 2019 to 2022, the number of Hickory MSA residents commuting via Public Transportation decreased 21.5% (353-277).**

The Future of Working from Home and Commuting Patterns

Remote work in the Greater Hickory Metropolitan Area surged by 167% from 2010-2022. This increase aligns not only with the impact of COVID-19 but also with the entrance of Generation Y and Generation Z into the workforce. These generations, attracted technology in the workplace and the work-life balance stemming from flexible hours and remote work, have played an influential role in remote work trends. While projecting work-from-home trends may suggest a potential slowing in the next decade as Generation and Generation X continue to lead the workforce, a shift could be anticipated in the 2040 and 2050 horizons. Planners must recognize the potential for virtual workplace expansion as Millennials and Generation Z assume leadership roles. The workplace changes resulting from generational shift may be exacerbated by technologic advancement. It is likely that future telework technologies will far outperform current virtual workplace technology, further supporting the virtual workplace. GHMPO planners should consider this commuting pattern potential in the transportation planning process.

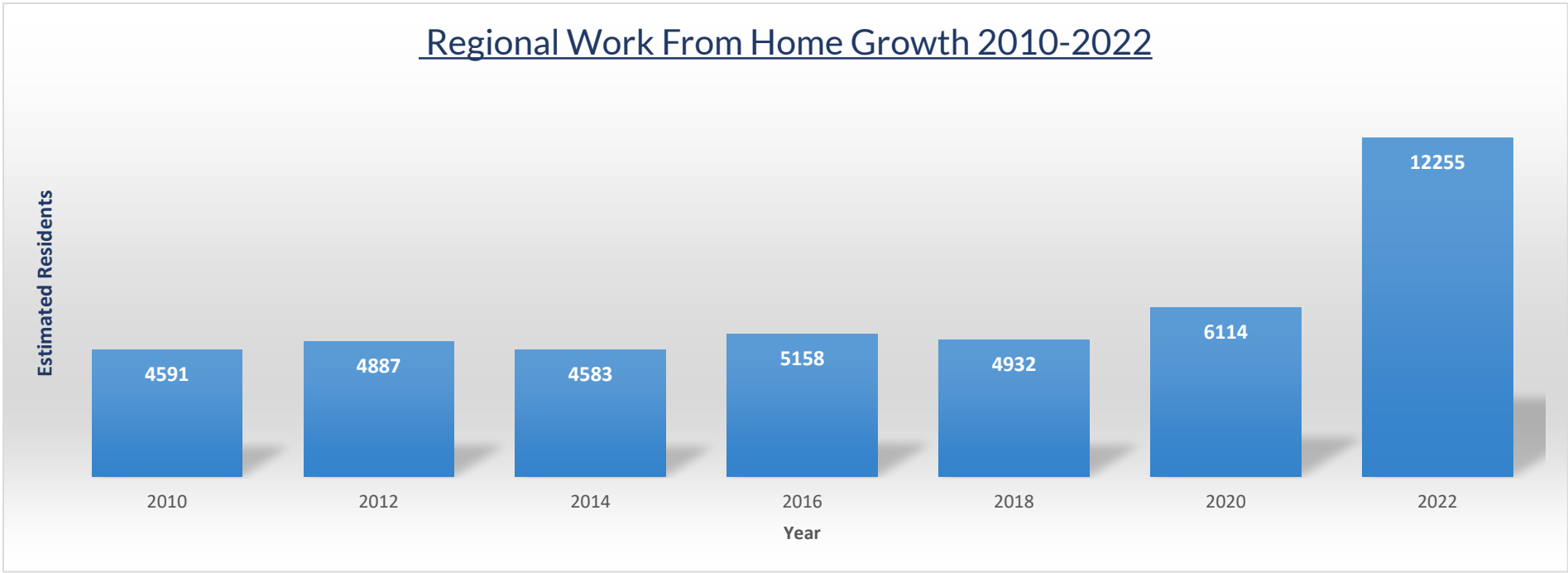

Figure 3 Source: US Census Bureau, American Community Survey

Cross-County Commuting Patterns

The Hickory MSA and Greater Hickory Region, as a whole, continue to see increase in cross-county and extra-regional commuting. Data for this section on commuting is sourced through the Longitudinal Employer Household Dynamics data set provided by the US Census Bureau. It is important to note, especially in reference to extra-regional commuting, that these data reflect general employee and employer locations, but do not necessarily imply daily commuting to that location. In this aspect, the virtual workplace continues to contribute to changes in commuting trends.

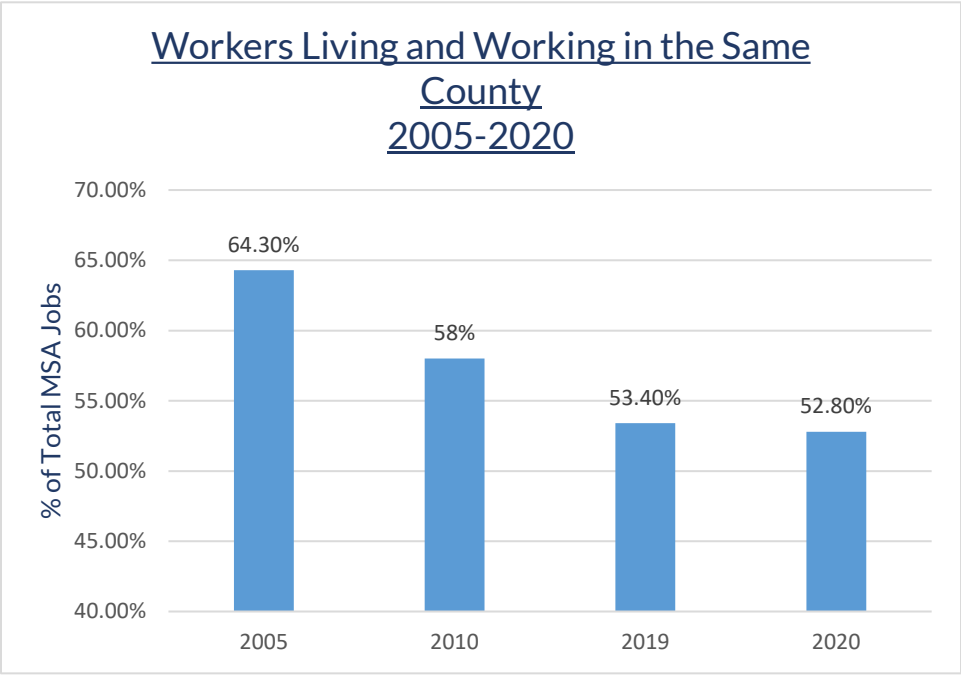

Figure 4 Source: US Census Bureau, LEHD Data

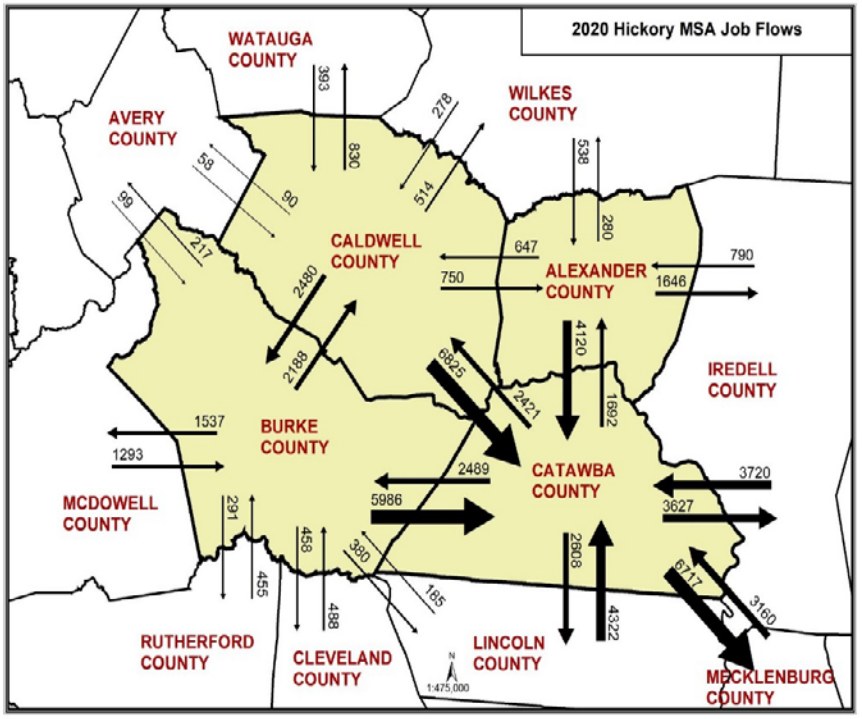

Figure 5 Source: US Census Bureau, LEHD Data

In reference to congestion and demand forecasting, increasing cross-county and extra-regional commuting patterns suggest increased demand potential for interstate and arterial commutes. **If current trends continue, the region will become increasingly reliant on the level of service that can be provided by I-40, US-321, NC-16, and US-64.**

Assessing Causes of Delay

Causes of delay have decreased proportionately to the reduction in overall delay observed during and post-pandemic. In the Greater Hickory Metropolitan Area, Congestion caused by traffic signals till contributes more delay time than any other singular cause. Many of the segment level analyses in Appendix B include the optimization of signal timing as a recommended interim improvement. Notably, recurrent congestion (congestion caused by predictable high demand) decreased significantly from 2019-2022. The size in reduction compared the reduction in signal delay supports that additional behavioral change, as well as reduced demand, contribute to the reduction.

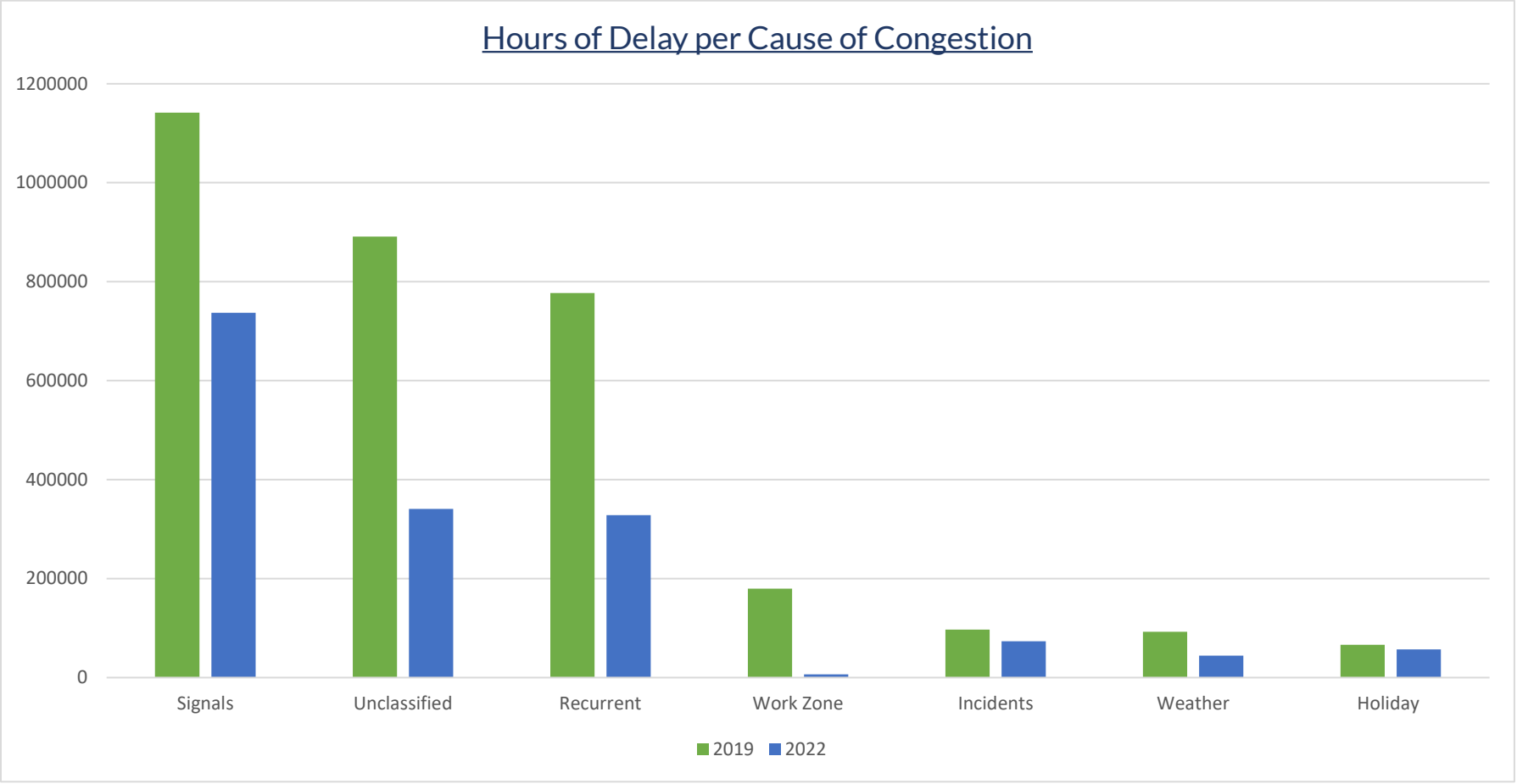

Figure 6 Source: RITIS Probe Data Analytics Suite

Assessing Congestion at the Segment Level

The ultimate goal of Congestion Management is the reduction of system wide congestion. The transportation systems overall performance is a composition of the performance of over 950 individual road segments across Alexander, Burke, Caldwell, and Catawba counties. **Delay is not distributed proportionately across all road segments, and the purpose of the Congestion Management Process and report is to implement a data-driven method to identify, monitor, and improve the performance of segments that create regionally significant amounts of delay.** To identify and monitor poor performing segments of roadway, the Congestion Management Report uses measures that assess both recurring and non-recurring congestion. **Recurring congestion** is the result of system demand exceeding system capacity. Simply, too many vehicles for the roadway. **Non-recurring congestion** on the other hand, is congestion directly caused by a singular event. Common causes of non-recurring congestion include vehicle accidents, vehicle breakdowns, inclement weather, and other special events. To assess recurring congestion, Planning Time Index and Travel Time Index are used. To measure non-recurring congestion, Severity Index and Number of Accidents are used, as vehicle accidents represent a large portion of non-recurring congestion events.

Planning Time Index is a measure of system reliability. Planning time represents the total time a traveler should pan to ensure on-time arrival. The 95th percentile travel time is used for the calculation, meaning that if a traveler allows the appropriate buffer time, they will arrive on-time in 95% of the trips. For example, a PTI of 1.60 means that for a trip that takes 15 minutes in light traffic, 24 total minutes should be allowed for the trip.
Travel Time Index represents actual travel time as a percentage of the ideal (free flow) travel time. The index is the ratio of the travel time during the peak period to the time required to make the same trip at free flow speeds. A TTI of 1.3, for example, indicates a 20-minute free-flow trip requires 26 minutes during the peak period.
Severity Index represents the severity of accidents at a specific intersection. Severity index is equal to equivalent property damage only (EPDO) divided by the number of crashes. EPDO uses assigned values to quantify the severity of injuries sustained in car crashes.
Number of Accidents simply represents the number of accidents over a prescribed reporting period at an individual intersection or segment area. Using this data, MPO staff can rank intersections across the region based upon the number of accidents across a set reporting period.
Bottleneck Ranking is used to account for delay volume within each segment. Bottlenecks In the region are measured by Total delay, or the total amount of vehicle delay caused by a segment throughout the year.

Regional Segment Ranking

Based on the weighting for Planning Time Index, Travel Time Index, Accident Severity Index, Number of Accidents, and Bottleneck Ranking, established by the Congestion Management Process (CMP), the Greater Hickory Metropolitan Planning Organization has analyzed and scored each road segment identified in the CMP network of study. The 10 highest scoring segments and their respective methodology scores are below. For the complete list, see the scoring Appendix A.

Road Segment	Score / 50
1. MCDONALD PARKWAY S @ I-40	33
2. NC 18 N @ Bush Drive / I-40	29
3. US 64 W @ I-40	29
4. US 70 W @ US-70 / E Union Street	27
5. US 321 N/S @ Mission Road / Lower Cedar Valley Road	26
6. US 70W @ US 70-BR/E Union Street	25
7. US 321 S @ US 64/NC 90/NC 18	25
8. US 321 @ Mount Herman Road	25
9. NC 16 @ US 64 (Taylorsville)	22
10. NC 18S @ Bush Drive / I-40	22

Identifying Segment Level Solutions

The identification of poor performing road segments through recurring and non-recurring congestion data allows planners and engineers to analyze and target the shortcomings of identified road segments with actionable solutions. During the development of this Congestion Management Report, GHMPO and NCDOT Congestion Management Unit staff worked together to produce solutions and strategies that could produce submittals to the Strategic Prioritization Process, LAPP, and other competitive infrastructure improvement funding opportunities. Full descriptions for each road segment can be found in Appendix B.

Road Segment	STIP Project Funded	STIP Project Carryover or New Submittal	MTP/CTP Project	Improvements under study or recommended by NCDOT
MCDONALD PKWY S @ I-40				X
I-40W @ US-321`(Exit 123)		X	X	X
I-40 @ Oxford School (Exit 138)			X	X
I-40 W@ 125 (LR BLVD)	X		X	
I-40 @ 126 (McDonald)		X	X	
NC 16 @ NC-16 BUS		X	X	X
NC 16 @ US-64		X	X	
US 321 @ 2nd Ave	X		X	
I-40W @ Jamestown Road/Exit 100		X	X	X
I-40E @ Carolina Street / Exit 111		X	X	
US-70W @ US-70-BR/E Union Street				X
US-70E @ Drexel Rd/S Main Street				X
I-40E @ Old NC 10/Exit 118	X		X	
US-70W @ US-70/E Union Street				X
US-321S @ US-64/NC-90/NC-18			X	
NC-18N @ Bush Drive/I-40				X
I-40W @ Center St/Exit 119	X		X	
US-64W @ I-40 (Morganton)	X		X	X
US-70BR-W @ Huff man St/Center St				X

Road Segment	STIP Project Funded	STIP Project Carryover or New Submittal	MTP/CTP Project	Improvements under study or recommended by NCDOT
US-321N @ US-64/NC-90/NC-18			X	
NC-18S @ Bush Drive / I-40				X
I-40W @ N Oxford Street/Exit 135			X	
I-40E @ US-70A/Exit 130		X	X	
I-40W @ Mineral Springs Mountain Road/Exit 112		X	X	
I-40W @ Malcolm BLVD/Exit 113		X	X	
US-321 @ Maizel Rd/New Farm Road		X		
South Center Street @ US-70			X	X
NC-127 @ 2nd Ave	X		X	
US-321 @ Mount Herman Road	X		X	
US 321 @ Mission Road / Lower Cedar Valley Road	X		X	

This report the 30 most significantly congested road segments within the Greater Hickory Planning Area. Of the 30 identified segments, 8 (26%) are addressed in currently funded STIP projects. 10 (33%) of identified segments are addressed in a project currently competing for funding in prioritization. 18 (54.5%) of the identified segments are in the STIP Process. 22 (73%) of the identified segments are addressed within an adopted MTP or CTP Project Proposal. Additionally, of the 30 identified road segments, 10 (33%) are either under current review by the Congestion Management Unit, or have interim improvement recommendations, identified jointly by NCDOT and GHMPO, documented within this report. **All 30 identified segments have identified potential solutions documented within this report.**

Addressing Congestion in a 3C Manner: Key Takeaways and Goals

The 2024 CMP Report provides a performance benchmark for both regional system and roadway segment level performance. Subsequent CMP Reports should maintain regional performance measure continuity, which will allow the region to continuously assess the transportation systems performance. GHMPO staff should also ensure that segment level performance data is maintained, and roadway improvements at identified segments are documented. This data will allow the region to assess both the success of the individual improvement, and the avenues in which improvements can be implemented.

The CMP Reports segment level analysis suggests a clear link between the congestion management process and the MTP/CTP and Prioritization process, as evidenced by nearly 80% of congested roadway segments being identified in the STIP or MTP/CTP. GHMPO Staff should continue to Implement CMP recommendations in the Transportation Planning Process, including the incorporation of project proposals for the 7 roadway segments not addressed by documented project proposals in the next MTP/CTP update.

While many roadway segments are addressed in documented project recommendations, many of these projects are capital intensive. GHMPO Staff should continue to work with NCDOT to identify opportunities to implement cost effective interim improvements, and explore funding sources to implement the segment specific interim improvement strategies identified within this report, which include signage improvements, signal timing optimization, interim signalization, and interim access management.

Regional Commuting Pattern Trends will continue to reflect increase interstate and arterial demand. GHMPO Staff should frequently monitor congestion data along commuting corridors: I-40, US-321, NC-150, NC-16, and US-64. GHMPO staff should continue to monitor the competitiveness of documented MTP/CTP/Prioritization projects designed to increase capacity and prioritize throughput within these corridors As these corridors develop, the GHMPO should continue to explore and incorporate proposals that prioritize travel-time savings and travel-time reliability.

While less likely to influence regional delay totals, residential development in regional Growth Areas present opportunities for increased demand in new locations. As trip-generators like housing developments emerge, GHMPO should work with regional planning partners to identify potential collector road and intersection deficiencies.

Appendix A: Complete Segment Scoring

Table 1 Source: NCDOT TEAAS, Jan-Dec 2022. PDA Suite Jan-Dec 2022.

Road Segment	Score / 50
1. MCDONALD PARKWAY S @ I-40	33
2. NC 18 N @ Bush Drive / I-40	29
3. US 64 @ I-40	29
4. US 70 W @ US-70 / E Union Street	27
5. US 321 N/S @ Mission Road / Lower Cedar Valley Road	26
6. US 70 @ US 70-BR/E Union Street	25
7. US 321 S @ US 64/NC 90/NC 18	25
8. US 321 N/S @ Mount Herman Road	25
9. NC 16 @ US 64 (Taylorsville)	22
10. NC 18S @ Bush Drive / I-40	22
11.NC 16 @ NC 16 Business (Conover)	21
12.US-70 BR-W @ Huffman Street Center Street	21
13.I-40 @ US 321	20
14.US-70E @ Drexel Road / S Main Street	20
15.US 321 N @ US 64 / NC 90 / NC 18	19
16.I-40 @ Exit 124 (LR BLVD)	18
17.NC 127 @ 2nd Avenue NW	15
18.US 321 @ 2nd Avenue NW	13
19.I-40 @ Jamestown Road / Exit 100	13
20.I-40 @ Carolina Street / Exit 111	13
21.I-40 @ Old NC 10 / Exit 118	9
22. I-40 @ Center Street / Exit 119	9
23.US 321 @ Maizel Road / New Farm Road	9

24.I-40 @ Oxford	7
25.I-40 @ Exit 126	6
26.I-40 @ N Oxford Street/ Exit 135	6
27.I-40 @ US-70A / Exit 130	6
28.I-40 @ Mineral Springs Mountain Road / Exit 112	6
29.I-40 @ Malcolm BLVD Exit 113	6
30.South Center Street @ US 70	6

Table 2 Source: NCDOT TEAAS, Jan-Dec 2022. PDA Suite Jan-Dec 2022.

Appendix B: Segment Level Discussion and Recommendations

Alexander County Segment Level Analysis

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
NC 16 @ US 64	Not Ranked	2.3	1.5	18	2.23

- **Delay Analysis**: This interchange in Taylorsville presents delay data which suggests possible congestion along NC-16 throughout the interchange. It is likely that this delay is a result of premature slowing of vehicles as they enter the "downtown" area of Taylorsville. The interchange design is sound.
- **Recommendations:** Minor improvements could include speed-limit modifications through the segment area, primarily through the extension of the 35 MPH zone. Signal timing is likely to be sound, but could be addressed if delay continues.
- **Documented Project Proposals:** Former STIP project and current submittal U-6151 proposes the modernization of NC-16 from US-64 to the Catawba River. While this project may have minimal improvements to performance of the interchange, it does present an opportunity for more thorough analysis of the interchange.

Burke County Segment Level Analysis

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
I-40W @ Jamestown Road (Exit 100)	8	1	1	N/A	N/A

- **Delay Analysis:** Congestion presented at I-40 Exit 100 is due in large part to antiquated interchange design and ramp length, including local road access to the I-40 West on-ramp, creating ramp congestion during peak hour traffic.
- **Recommendations:** Interchange redesign is necessary to completely address causes of delay. NCDOT's Congestion Management unit will continue to monitor this area for potential interim improvements.
- **Documented Project Proposals:** STIP Project I-5874 was identified to redesign the interchange and construct a new interchange to NCDOT Standards. Design alternates include a possible roundabout interchange, with roundabouts servicing traffic at each leg of the interchange, and a partial cloverleaf alternate. I-5874 is currently funded for Preliminary Engineering only, and is currently competing in Prioritization 7.0. 2050 CTP Project BURK-HS-09-CTP also proposes the widening of I-40 from 4 to 6 lanes, which would require interchange improvements and reduce delay.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
I-40E @ Carolina Street (Exit 111)	6	1.1	1	N/A	N/A

- **Delay Analysis:** Congestion presented at I-40 Exit 111 can be attributed to the level of conflict created by an outdated interchange design. The east-bound on ramp, in combination with Carolina Street and Abees Grove Church Road, creates an awkward interchange experience. The westbound off-ramp is shortened due to its intersection with Abees Grove Church Road, creating an increased potential for on-ramp queueing and delay on I-40. The east bound on/off ramp system is also awkward, with very short ramp lengths.
- **Recommendations:** This area continue to be analyzed for a potential modernization project to implement interim improvements, as a modernization submittal may be more cost-effective, and more competitive, than I-5008.
- **Documented Project Proposals:** This segment is a candidate for redesign, with STIP project I-5008. However, this project is funded for Preliminary Engineering only, and is currently competing in Prioritization 7.0. 2050 CTP Project BURK-HS-09-CTP also proposes the widening of I-40 from 4 to 6 lanes, which would require interchange improvements and reduce delay.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
I-40W @ Mineral Springs Mountain Road (Exit 112)	Not Ranked	1.1	1	6	1

- **Delay Analysis:** Congestion presented at I-40 Exit 112 is marginally supported by congestion data, with a cumulative congestion score of 6 out of a possible 50 points. This congestion may be caused in part by the local access road on the I-40 ramp, and overall interchange design.
- **Recommendations:** This interchange is a candidate for redesign. MPO and NCDOT staff should continue to monitor the competitiveness of this project as a STIP submittal.
- **Documented Project Proposals:** STIP Project I-5975 is identified as a potential solution, but is currently competing in Prioritization. 2050 CTP Project BURK-HS-09-CTP also proposes the widening of I-40 from 4 to 6 lanes, which would require interchange improvements and reduce delay.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
I-40W @ Malcolm Boulevard (Exit 113)	Not Ranked	1	1	N/A	N/A

- **Delay Analysis:** Congestion presented at exit 113 is marginally supported by congestion data. Overall, this interchange appears to be in good condition, with the exception of the two-way ramp condition.
- **Recommendations:** Removal of the two-way ramp access, and potential redesign should address potential for excessive delay.
- **Documented Project Proposals:** NCDOT Division 13 has submitted a project to compete in Prioritization which addresses the two-way ramp. The GHMPO should consider including this project in the next Metropolitan Transportation Plan Update. 2050 CTP Project BURK-HS-09-CTP also proposes the widening of I-40 from 4 to 6 lanes, which would require interchange improvements and reduce delay.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
US-70W @ US-70 BR/East Union	4	2	1.4	13	N/A

- **Delay Analysis:** Multiple segments within this intersection area are well supported by Congestion Data, with two segments scoring 27 and 25 out 50 points. This congestion is largely due to high volumes of traffic accessing Morganton through the intersection, and possibly high-levels of non-recurring congestion due to minor accidents.
- **Recommendations:** It is recommended that signal timing be analyzed for possible improvements. Long-term solutions will require a large redesign of the intersection, possibly including a bypass of the intersection.
- **Documented Project Proposals:** This intersection is not currently addressed in a STIP project submittal, or MTP/CTP Proposal. GHMPO Staff should consider the inclusion of long-term proposals, including a possible intersection redesign in the MTP, or a potential bypass system in the CTP.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
US-70E @ Drexel Road/South Main Street	11	2	1	7	3.11

- **Delay Analysis:** Congestion throughout this intersection area is due in large part to poor access management. Several businesses have unrestricted access to the intersecting roadways, creating multiple conflict points and decreasing operation efficiency, as well as increasing the conflict experienced by drivers utilizing this area of roadway. The unrestricted access is likely to result in traffic slowing and queueing, and increased accident volumes.
- **Recommendations:** There is an access management/control project currently on hold through NCDOT Congestion Management, which would limit access and decrease potential conflict. Other interim improvements include curb bollards, and cautionary signaling. Longer-term improvements include a possible mini-roundabout. This project also highlights the necessity for intentional land use planning and design, and the consideration of transportation impacts incurred through development.
- **Documented Project Proposals:** This intersection is not currently addressed in a STIP Project Submittal or MTP/CTP Proposal. While NCDOT Congestion Management has initiated a project to address the intersection, GHMPO staff should identify the potential for other interim improvements and opportunities to fund said improvements. GHMPO Staff should also consider the inclusion of an MTP/CTP proposal to address the project area in accordance with NCDOT design recommendations.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
I-40 @ Old NC 10 (Exit 116)	19	1.1	1	13	3.85

- **Delay Analysis:** Congestion at this interchange is marginally supported by congestion data. Operationally, the congestion could be caused by the short ramp lengths and potential queuing at peak hours, and the two-way ramp conditions.
- **Recommendations:** This interchange is a candidate for redesign. However, a complete redesign is capital intensive. GHMPO Staff should explore submittal alternatives.
- **Documented Project Proposals:** STIP project I-5971 (also identified in the 2050 MTP) was identified as a long term solution to the antiquated interchange design, but is currently only funded for Preliminary Engineering and is currently competing in Prioritization 7.0. 2050 CTP Project BURK-HS-09-CTP also proposes the widening of I-40 from 4 to 6 lanes, which would require interchange improvements and reduce delay.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
NC 18 N/S @ Bush Drive/I-40	10/12	2.1/2.1	1.5/1/4	23	1.23

- **Delay Analysis:** Congestion at this interchange is strongly supported by congestion data. This segment area was recently improved. However, congestion data supports the need for continued monitoring and improvement.
- **Recommendations:** Recommended improvements include possible improvements at the fourth leg of the interchange, including a complete redirect of traffic at the fourth leg. Long term, this segment area may need a redesign to better accommodate increasing volume. GHMPO Staff should continue to monitor this segment area and work with NCDOT Congestion Management to formulate potential interim solutions.
- **Documented Project Proposals:** This segment area is not currently addressed in a STIP Project Submittal or MTP/CTP Proposal. GHMPO staff should work with NCDOT to formulate an agreed upon interim improvement to be submitted for Prioritization, and included in the MTP.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
US-64 @ I-40 (Exit 103)	7	2.1	1.7	18	1.41

- **Delay Analysis:** Congestion data at this segment area support the occurrence of very high levels of congestion. Businesses have largely unrestricted access to the US-64 corridor in this area, creating multiple conflict points and decreasing operation efficiency, as well as increasing the conflict experienced by drivers utilizing this area of roadway. The unrestricted access is likely to result in traffic slowing and queueing, and increased accident volumes.

- **Recommendations:** The interchange improvements currently submitted in Prioritization may resolve delay issues in proximity to the interchange. However, it is likely that this area of the US-64 corridor may continue to present congestion data due to a lack of access management and conflict experienced by drivers. GHMPO and Land-Use planning staff should consider potential land-use policy to improve connectivity among businesses within the corridor, and prevent further access management issues.
- **Documented Project Proposals:** STIP Project I-5009 (identified in the MTP/CTP) is currently competing in prioritization. 2050 CTP Project BURK-HS-09-CTP also proposes the widening of I-40 from 4 to 6 lanes, which would require interchange improvements and reduce delay.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
US-70 BR @ Huffman St/Center Street	18	3	1.4	N/A	N/A

- **Delay Analysis:** Congestion at this segment area is due in large part to the awkward intersection of the roadways, which create a false-5 point intersection with the WB Couplet of US-70 BR.
- **Recommendations:** Short-term improvement may be made at this intersection through increased signage. Long-term, this intersection could be a candidate for a roundabout or other total redesign project.
- **Documented Project Proposals:** This segment area is not currently addressed in a STIP Project Submittal or MTP/CTP Proposal. GHMPO Staff should continue to work with NCDOT staff to identify an agreed upon solution for inclusion in the MTP/CTP and submittal for prioritization.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
I-40W @ Center Street (Exit 119)	20	1	1	7	3.11

- **Delay Analysis:** Congestion at this segment is marginally supported by data. Congestion could be influenced by freight mobility shortcomings. Overall, this interchange meets NCDOT standards and is in good condition.
- **Recommendations:** This segment area is addressed by a bridge replacement project. GHMPO Staff should continue to monitor this interchanges congestion data following the completion of the bridge replacement project.
- **Documented Project Proposals:** This segment area is addressed by a bridge replacement project. GHMPO staff should continue to monitor this interchange, and if necessary, consider potential proposals for inclusion in the MTP/CTP. 2050 CTP Project BURK-HS-09-CTP also proposes the widening of I-40 from 4 to 6 lanes, which would require interchange improvements and reduce delay.

Caldwell County Segment Level Analysis

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
US 321 N/S @ US-64/NC-90/NC18	16/13	1.9/2	1.5	6	2.23

- **Delay Analysis:** The US 321 corridor carries considerable volumes of traffic throughout the Greater Hickory Region. US-64/NC 90/NC 18 carries considerable traffic through Caldwell County and the Lenoir area. Congestion at this segment area is due to the volume of traffic negotiating a signalized intersection. While actual experienced delay for individual trips may not be excessive, the volume of traffic contributes to this segments bottleneck ranking and total delay.
- **Recommendations:** Long term solutions are complicated due to the land use implications of potential solutions. Any long term solutions, which would most likely include interchange construction or bypass, must consider the prioritization of US 321 traffic, the economic impact of alternating traffic flows on the City of Lenoir, and the land use implications of potential interchange designs. Regional partners will be essential to the design process, and the decision making process regarding the classification/characterization of US 321. As the US-321 corridor develops with Reduced Conflict Intersections and increased throughput, the severity of the bottleneck at this intersection will increase.
- **Documented Project Proposals:** This segment area is addressed by CALD-HD-24-CTP, Southeast Boulevard, in the 2050 Comprehensive Transportation Plan. This proposal suggests the construction of a loop bypass of US-321 from the existing Southwest Boulevard to NC-18 via Alfred Hartley Road and new location. GHMPO staff should collaborate with NCDOT and regional planning partners to assess the feasibility of this proposal, and consider the inclusion of alternates in the MTP/CTP. Ultimately, the need for an agreed upon project submittal for Prioritization will continue to increase if commuting trends and current project plans continue.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
US-321 @ Maizel Farm Road/New Farm Road	17	1.4	1.1	10	2.48

- **Delay Analysis:** Congestion in this segment area is strongly supported by data and is reflective of the volumes of traffic negotiating a signalized intersection. While actual experienced delay for individual trips may not be excessive, the volume of traffic contributes to this segments bottleneck ranking and total delay.
- **Recommendations:** Long term solutions for this project will require this intersection to be upgraded to an interchange or grade separated intersection.
- **Documented Project Proposals:** This segment area is addressed by a STIP Project Submittal currently competing in Prioritization 7.0, which proposes an upgrade to an interchange.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
US-321 @ Mount Herman Road	2	1.3	1.1	5.79	47

- **Delay Analysis:** Congestion at this segment area is strongly supported by congestion data. This segments recurring congestion is comparable in both severity and cause to other intersections along the US-321 corridor in Caldwell County. Notably, this segment area may experience high levels of non-recurring congestion – due to high accident volume and severity.
- **Recommendations:** Given the need for both safety and free-flow improvements, this segment area will benefit from the construction of a reduced conflict intersection.
- **Documented Project Proposals:** This segment area is addressed by a funded STIP Project, U-4700CA will construct a reduced conflict intersection with construction programmed for 2024. This proposal was also identified in the 2050 MTP.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
US-321 @ Mission Road	5	1.3	1.1	29	13.75

- **Delay Analysis:** Congestion in this segment area is similar to congestion presented at US-321 @ Mount Herman Road. This segments recurring congestion is comparable in both severity and cause to other intersections along the US-321 corridor in Caldwell County. To a lesser extent than US-321 @ Mount Herman Road, this segment area may experience high levels of non-recurring congestion – due to high accident volume and severity.
- **Recommendations:** Given the need for both safety and free-flow improvements, this segment area will benefit from the construction of a reduced conflict intersection.
- **Documented Project Proposals:** This segment area is addressed by a funded STIP Project, U-4700CC will construct a reduced conflict intersection with construction programmed for 2024. This proposal was also identified in the 2050 MTP.

Catawba County Segment Level Analysis

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
McDonald PKWY S @ I-40	1	4.3	2.6	9	3.47

- **Delay Analysis:** Congestion at this segment area is strongly supported by congestion data. Delay on McDonald Parkway is likely the result of suboptimal signal timing. However, addition queuing could be caused by a lack of signal capacity.
- **Recommendations:** This segment area would likely benefit from signal timing optimization and ramp improvement. NCDOT Congestion Management is currently reviewing ramp capacity on the interchange.
- **Documented Project Proposals:** This segment area is currently addressed in an MTP/CTP project and STIP Project Submittal currently competing in Prioritization. I-5991A proposes the widening of I-40 from 4 to 6 lanes. This project, if funded, would present an opportunity for interchange improvements like ramp improvement. However, I-5991A is capital intensive. GHMPO staff should collaborate with NCDOT to produce an interchange specific interim solution for inclusion in the MTP/CTP and Prioritization.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
I-40W @ US-321 (Exit 123)	3	2	1.1	10	3.96

- **Delay Analysis:** Congestion at this segment area is strongly supported by data during peak hours. Accident severity index suggests that non-recurring congestion may also be an issue at this interchange.
- **Recommendations:** NCDOT Congestion Management currently has a safety project to reduce accident frequency on interchange ramps in queue.
- **Documented Project Proposals:** This segment area is currently addressed by two MTP/CTP Projects and STIP Submittals. Exit 123 serves as a terminus for both projects (STIP Project I-5991A, MTP Project MULT-HS-03). Both submittals propose widening I-40 from 4 to 6 lanes. This project presents an opportunity for interchange improvements and improved free-flow on I-40.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
I-40 @ Oxford School Road (Exit 138)	25	1.1	1	8	1.92

- **Delay Analysis:** Congestion at this segment area is likely caused by the number of conflict points within the interchange. However, congestion data suggests that existing congestion may not be excessive enough to necessitate a total interchange redesign at this time.

- **Recommendations:** In the interim, this interchange could benefit from additional signage to improve flow. This interchange may be a candidate for improvement through a bridge replacement. GHMPO Staff and NCDOT Congestion Management should collaborate to establish proposed improvements which could be synergized within a Bridge replacement project. Long term solutions may dual roundabouts at interchange terminals.
- **Documented Project Proposals:** This segment area is currently addressed by an MTP project (MULT-HS-04) which proposes the widening of I-40 from 4 to 6 lanes from Exit 132 to the Iredell County line. GHMPO staff should consider the inclusion of an interchange specific project in the next update on the MTP/CTP.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
I-40 @ LR Boulevard (Exit 125)	23	2.5	1.2	24	3.16

- **Delay Analysis:** Congestion at this segment area is largely due to interchange deficiencies created by conflict at on and off ramps and suboptimal lane continuity on Lenoir-Rhyne Boulevard.
- **Recommendations:** Queuing and congestion can be reduced at this interchange through the construction of a loop on ramp, turning-movement restrictions, and increased lane continuity.
- **Documented Project Proposals:** This segment area is addressed by a funded STIP project identified in the MTP/CTP, I-5716. Construction is currently programmed for 2026.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
I-40 @ McDonald Parkway (Exit 126)	NR	1.5	1	9	3.47

- **Delay Analysis:** Congestion at this segment area is strongly supported by congestion data. Delay on McDonald Parkway is likely the result of suboptimal signal timing. However, addition queuing could be caused by a lack of signal capacity.
- **Recommendations:** This segment area would likely benefit from signal timing optimization and ramp improvement. NCDOT Congestion Management is currently reviewing ramp capacity on the interchange.
- **Documented Project Proposals:** This segment area is currently addressed in an MTP/CTP project and STIP Project Submittal currently competing in Prioritization. I-5991A proposes the widening of I-40 from 4 to 6 lanes. This project, if funded, would present an opportunity for interchange improvements like ramp improvement. However, I-5991A is capital intensive. GHMPO staff should collaborate with NCDOT to produce an interchange specific interim solution for inclusion in the MTP/CTP and Prioritization.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
NC-16 @ NC-16 Business/ Thornburg	22	2.2	1.6	8	>1

- **Delay Analysis:** Congestion in this segment area is largely contributed to the awkward proximity of the Exit 132 interchange and the intersection of Thornburg and NC 16. AM peak hour queuing is common in the Thornburg LHTL accessing the I-40W on ramp. PM peak hour queuing is common on the I-40E off-ramp. While accident volumes are relatively low, there is a Highway Safety Improvement Program Study currently under review, which suggests that non-recurring congestion may also be a frequent cause of delay.
- **Recommendations:** Interim improvements at this segment area could include additional signage to direct traffic flow at conflict points, and signal timing review to limit queuing in the Thornburg LHTL accessing the I-40W ramp. To address PM peak hour queuing on the I-40E off-ramp, NCDOT Congestion Management is currently reviewing the demand for dual left-turn lanes. Span-wire signs could direct LHT movement into the left lane, and RHT movements into the right lane, decreasing queue in the RHTL, which currently allows both LHT and RHT movements. Long term, GHMPO should work with NCDOT to identify specific interchange improvements that can be submitted as standalone projects, or incorporated into the designs of the projects listed below.
- **Documented Project Proposals:** This segment area is currently addressed by three MTP/CTP Projects and two STIP submittals. CATA-HR-08, currently competing in Prioritization, modernizes NC-16 from Thornburg to the Catawba River. This project presents an opportunity for improvement at the intersection of NC-16 and Thornburg. I-5991B, also competing currently, proposes the widening of I-40 from Exit 128 to Exit 132. Finally, CTP Project MULT-HS-04 proposes the widening of I-40 from Exit 132 to the Iredell County Line. Each of these projects present an opportunity for further analysis of potential improvements at this segment area.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
US-321 @ 2nd Avenue NW	9	1.3	1.1	13	2.14

- **Delay Analysis:** Congestion at this segment area is consistent with congestion observed along the US-321 corridor from Hickory to Lenoir – a simple function of traffic volume and facility/signal capacity.
- **Recommendations:** Delay at this intersection will be remedied through the construction of a Reduced Conflict Intersection.
- **Documented Project Proposals:** This segment area is addressed by funded STIP Project U-4700A, which widens US-321 to 6 lanes and redesigns intersections from North of US 70 in Hickory to US-321A. Construction is currently programmed for 2026.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
I-40 @ N Oxford Street (Exit 135)	NR	1	1	8	1.92

- **Delay Analysis:** Congestion at this segment appears to predominantly occur on the interchange ramps at peak hour. North Oxford Street and I-40 do not present significant delay data. These data characteristics suggest that traffic flow on and off of ramps may be delayed by peak hour traffic on North Oxford Street, as all terminals currently are not signalized.
- **Recommendations:** This segment area could be addressed through a bridge replacement project. Signalization at this intersection may be unnecessary due to overall low volumes and delay being limited to peak hours. However, roundabouts at each terminal could reduce ramp delay. GHMPO Staff should collaborate with NCDOT Congestion Management to document a proposal to potentially be included within a bridge replacement project, and consider including the proposal in the MTP/CTP.
- **Documented Project Proposals:** This segment area is addressed by two CTP projects. CATA-HD-16 proposes the widening of North Oxford Street, the primary North-South corridor for Claremont and the only access to I-40, from I-40 to US-70. MULT-HS-04 proposes the widening of I-40 from 4 to 6 lanes from Exit 132 to the Iredell County Line. GHMPO staff should consider expanding CATA-HD-16 to include specific interchange improvements.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
I-40 @ US-70A (Exit 130)	NR	1.1	1	5	2.48

- **Delay Analysis:** Congestion at this segment area is largely contributed to false capacity on 1st ST SW. Both off ramps access 1st ST W as a four-lane roadway. However, the additional lanes terminate in close proximity to the interchange, causing unexpected merging movements and potential for queueing and conflict.
- **Recommendations:** Improvements in this segment area should predominantly take place in the form of improved lane continuity on 1st ST W.
- **Documented Project Proposals:** This segment area is currently addressed by 1 MTP/CTP Project and STIP Project Submittal. I-5991B, currently competing in prioritization, proposes the widening of I-40 from 4 to 6 lanes from Exit 128 to Exit 132. This interchange would likely require upgrade to accommodate additional through capacity on I-40. GHMPO staff should develop a standalone proposal to address 1st ST W continuity.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
South Center Street @ US-70	NR	1	1	10	2.48

- **Delay Analysis:** Congestion at this segment area is likely attributed to signal delay at US-70. However, this is a proposed HSIP location, which suggests there may be safety concerns and incidents causing non-recurring delay.

- **Recommendations:** GHMPO Staff should monitor potential HSIP outcomes and consider incorporating HSIP findings and project potential into the MTP/CTP.
- **Documented Project Proposals:** This segment area is currently addressed by CATA-HD-35, identified in the 2050 CTP, which proposes upgrading Center Street from US-70 to 8th Avenue Drive SE. GHMPO Staff should incorporate potential intersection improvements into this proposal.

Segment Title	Bottleneck Ranking	Peak Planning Time Index	Peak Travel Time Index	Number of Accidents	Accident Severity Index
NC 127 @ 2nd Ave SE	NR	1.9	1.4	41	2.26

- **Delay Analysis:** Congestion at this segment area is likely attributed to the need for dedicated turning lanes to allow for optimal throughput and mobility. Accident volume is notable, and suggests that total delay may be considerably compounded by non-recurring congestion.
- **Recommendations:** The construction of turn lanes should address congestion at this segment area.
- **Documented Project Proposals:** This segment area is addressed by funded STIP Project U-5777, which constructs turn lanes from 1st Avenue SE to 2nd Ave SE. Construction is programmed for 2025.

Appendix C: Regional System Performance Data

Regional Measure	2019	2022
Total Delay (Hours)	3,828,647	2,010,987
Percentage of Employed MSA Residents Teleworking	3.3%	5.4%
Number of Employed MSA Residents Utilizing Public Transit for Commute to Work	353	277
Percentage of Identified Segments Addressed in Funded STIP Projects		26%
Percentage of Identified Segments Addressed in Prioritization Submittal		33%
Percentage of Identified Segments Addressed in MTP/CTP Proposal		73%
Average Peak PTI of Top 30 Segments		1.73
Average Peak TTI of Top 30 Segments		1.25