Congestion Management Process (CMP) Report

DURHAM • CHAPEL HILL • CARRBORO
DCHC
METROPOLITAN PLANNING ORGANIZATION
PLANNING TOMORROW'S TRANSPORTATION

prepared for

Durham-Chapel Hill-Carrboro MPO

prepared by

Baseline Mobility Group, Inc.

In association with

Kittelson & Associates, Inc.

April, 2024

Congestion Management Process

2024 State-of-the-Systems Report

prepared for

Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC MPO)

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4.0 Priority Corridors

The Congestion Management Process (CMP) is a systematic, data-driven approach to improve the performance of the transportation network by mitigating congestion and ensuring the reliable movement of people and goods. In essence, the goal is to connect people to places using different modes of travel and enhance safety and economic efficiency of the region. This section presents the development and ranking of the 2024 priority corridors for the MPO's Congestion Management Process (CMP), and development of a project prioritization method for the CMP projects.

The purpose of defining a set of priority corridors is to focus future transportation system management, operations, and maintenance activities on critical corridors to protect or enhance multimodal mobility in the region. Together, these priority corridors act as the CMP network to foster development of congestion mitigation strategies that can improve roadway reliability and person throughput. In essence, the goal of this CMP network is to promote mobility, connectivity, multimodal travel, and freight movements in the MPO region. The 2024 CMP corridors were developed and ranked to receive priority consideration for funding given their importance in moving people and freight, and in serving the Complete Streets policy objectives of the Durham-Chapel Hill-Carrboro (DCHC) MPO region.

The 2024 CMP corridors are listed in Table 4.1and illustrated in Figure 4.1. The 22 CMP corridors were developed by starting from the list of 2019 corridors that the DCHC MPO previously monitored, and by enhancing the list to consider recent network changes (such as the completion of the I-885 corridor), changes in travel pattern due to COVID pandemic, and recommendations from the MPO members.

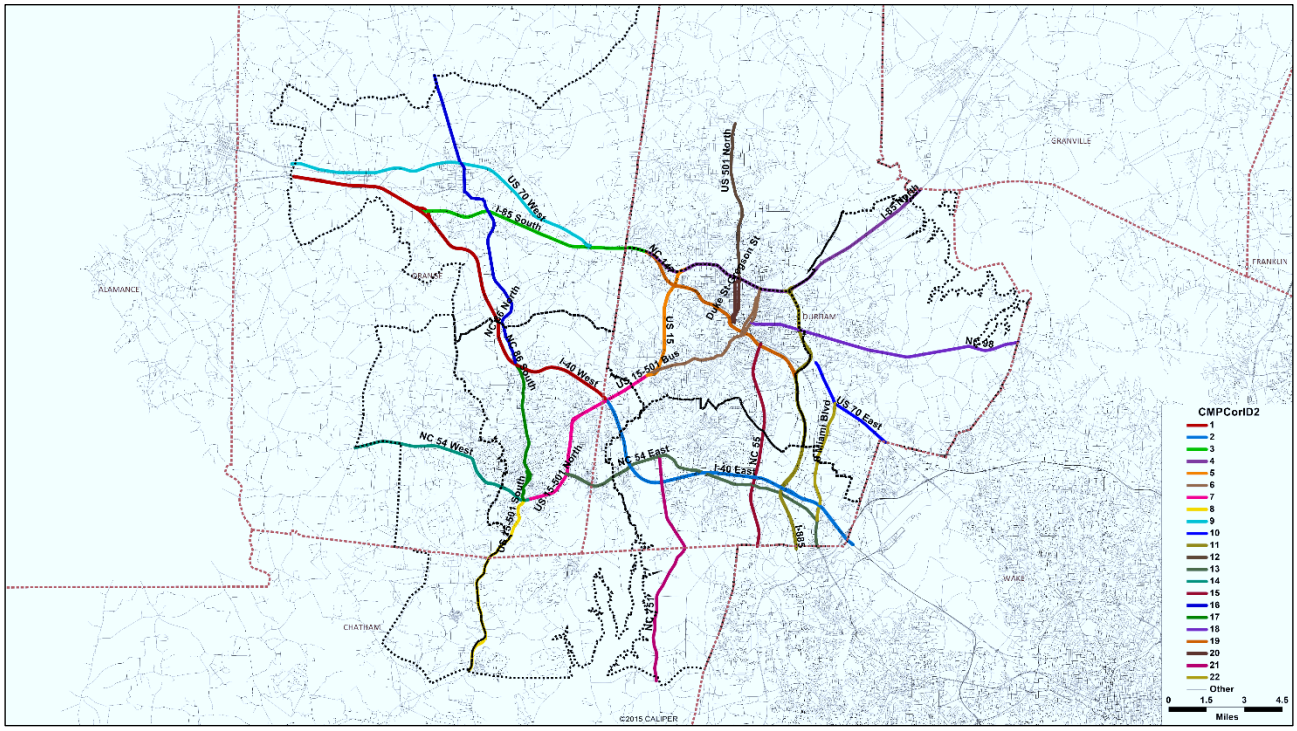
The 22 CMP corridors includes the region's interstate highways (such as I-40, I-85, and I-885) and other critical arterial roads that connect household population with the region's major employment centers (such as downtown Durham and Research Triangle Park), the university campuses (i.e., Duke University, University of North Carolina at Chapel Hill, and North Carolina Central University), the sprawling hospital campuses (i.e., Duke Hospitals and UNC Hospitals), major shopping centers (such as the South Square and Southpointe malls), and the Raleigh-Durham International Airport (RDU). These 22 CMP corridors were analyzed and ranked using different performance measures. This corridor analysis and ranking method is described in the next section.

Table 4.1 CMP Priority Corridors

Corridor ID	Corridor Name	From	To	Length (miles)
1	I-40 West	US 15-501 (Exit 270)	MPO Boundary in Mebane (Exit 157)	17.3
2	I-40 East	US 15-501 (Exit 270)	MPO Boundary near RDU Airport (Exit 283)	12.8
3	I-85 South	NC 147 near Durham-Orange County Line (Exit 172)	I-40 (Exit 163)	9.2
4	I-85 North	NC 147 near Durham-Orange County Line (Exit 172)	MPO Boundary at Durham-Granville County Line	12.7
5	US 15	US 15-501 Business (Exit 105)	I-85 (Exit 108)	4.8
6	US 15-501 Bus	US 15-501	I-85 (Exit 177)	6.9

Corridor ID	Corridor Name	From	To	Length (miles)
7	US 15-501 North	US 15-501 Business (Exit 105)	NC 86 in Chapel Hill	7.7
8	US 15-501 South	NC 54 in Chapel Hill	MPO Boundary in Chatham County	7.6
9	US 70 West	I -85 (Exit 170)	MPO Boundary in Mebane	13.1
10	US 70 East	I-885 (Exit 288)	MPO Boundary at Durham-Wake County Line	4.3
11	I-885	I-85 (Exit 178)	MPO Boundary at Durham-Wake County Line	11.3
12	US 501 North	I-85 (Exit 176)	Bywood Dr in North Durham	6.2
13	NC 54 East	US 15-501 in Chapel Hill	MPO Boundary at Durham-Wake County Line	14.5
14	NC 54 West	NC 86 in Chapel Hill	MPO Boundary in Carrboro	7.5
15	NC 55	NC 147 (Exit 2)	MPO Boundary at Durham-Wake County Line	8.2
16	NC 86 North	I-40 (Exit 266)	MPO Boundary in North Hillsborough	12.7
17	NC 86 South	I-40 (Exit 266)	US 15-501 / NC 54 in Chapel Hill	6.2
18	NC 98	North Roxboro St in Downtown Durham	MPO Boundary at Durham-Wake County Line	10.9
19	NC 147	I-885	I-85	7.8
20	Duke St-Gregson St	NC 147 in Downtown Durham	I-85 (Exit 176)	1.9
21	NC 751	NC 54 in Durham	MPO Boundary in Chatham County	9.4
22	S Miami Blvd	NC 54 in Durham	US 70	4.8

Figure 4.1 CMP Priority Corridors



4.1 Corridor Ranking

The CMP corridors were analyzed and ranked using a set of performance measures. These corridor performance measures reflect a subset of metrics that have been analyzed and presented in the existing conditions chapter.

The CMP corridor-level analysis focused on aggregating data for the 22 CMP corridors related to safety, roadway capacity utilization, travel time reliability, transit passenger flow, transit ridership at bus stops and stations, pedestrian and bicycle activity in urban areas. The corridor level performance measures were compared across the 22 corridors to define quartile values for each performance measure. Each corridor is scored against each performance measure based on a 4-point scale based on which performance quartile it belonged to. This scoring method is defined below:

1. Safety priority score based on severe crash rate
    - Severe crash rate is calculated based on fatal and injury crashes per million VMT over a 5-year period
    - Safety priority score 1 (High), 2 (High-Medium), 3 (Low-Medium), or 4 (Low) is assigned based on crash rate quartile
2. Traffic priority score based on Level of Service (LOS) and Level of Travel Time Reliability (LOTTR)

- Imputed existing condition average corridor LOS based on AADT
- Imputed existing condition average corridor LOTTR
- Traffic priority score 1 (High), 2 (High-Medium), 3 (Low-Medium), or 4 (Low) is assigned based on LOS and LOTTR quartiles

3. Multimodal/Complete Streets priority score based on transit ridership and ped-bike activity
    - Estimated the total number of existing transit passenger flow, annual transit stop boarding/alighting, and pedestrian-bicycle trips for each corridor
    - Multimodal/Complete Streets priority score 1 (High), 2 (High-Medium), 3 (Low-Medium), or 4 (Low) is assigned based on existing year transit passenger flow, bus stop activity, and bike-pedestrian activity quartiles
4. Overall implementation priority score is computed based on rounded weighted average of the above three scores using 50-20-30 weights for safety, traffic, and multimodal, respectively

The results of this corridor ranking analysis are presented next in the following tables:

- Table 4.2 Safety Priority Score and Ranking
- Table 4.3 Traffic LOS and Travel Time Reliability Scores and Ranking
- Table 4.4 Multimodal and Complete Streets Scores and Ranking
- Table 4.5 Overall Corridor Score and Ranking
- Table 4.6 Overall Corridor Score and Ranking – Sorted by Ranking

The safety analysis (Table 4.2) reveal that six corridors received the safety priority score of 1 (High), five corridors received the score of 2 (High-Medium), five corridors received the score of 3 (Low-Medium), and the remaining six corridors received the score of 4 (Low). The six high safety priority corridors are listed below:

1. Corridor 6 - US 15-501 Bus from US 15-501 to I-85 (Exit 177)
2. Corridor 7 - US 15-501 North from US 15-501 Business (Exit 105) to NC 86 in Chapel Hill
3. Corridor 12 - US 501 North from I-85 (Exit 176) to Bywood Dr in North Durham
4. Corridor 15 - NC 55 from NC 147 (Exit 2) to MPO Boundary at Durham-Wake County Line
5. Corridor 18 - NC 98 from North Roxboro St in Downtown Durham to MPO Boundary at Durham-Wake County Line
6. Corridor 20 - Duke St-Gregson St from NC 147 in Downtown Durham to I-85 (Exit 176)

Out of these six corridors the Duke St-Gregson St corridor from NC 147 in Downtown Durham to I-85 (Exit 176), and the US 15-501 Business corridor from US 15-501 to I-85 (Exit 177) had the highest observed severe crash rates in the region.

The traffic LOS and travel time reliability analysis (Table 4.3) reveal that one corridor received the traffic priority score of 1 (High), four corridors received the score of 2 (High-Medium), twelve corridors received the score of 3 (Low-Medium), and the remaining five corridors received the score of 4 (Low). The five high or high-medium traffic priority corridors are listed below:

1. Corridor 2 - I-40 East from US 15-501 (Exit 270) to MPO Boundary near Airport (Exit 283)
2. Corridor 7 - US 15-501 North from US 15-501 Business (Exit 105) to NC 86 in Chapel Hill
3. Corridor 10 - US 70 East from I-885 (Exit 288) to MPO Boundary at Durham-Wake County Line
4. Corridor 13 - NC 54 East from US 15-501 in Chapel Hill to MPO Boundary at Durham-Wake County Line
5. Corridor 19 - NC 147 from I-885 to I-85

The multi-modal and complete streets analysis (Table 4.4) reveal that four corridors received the multimodal/complete streets priority score of 1 (High), six corridors received the score of 2 (High-Medium), six corridors received the score of 3 (Low-Medium), and the remaining six corridors received the score of 4 (Low). The four high multimodal/complete streets priority corridors are listed below:

1. Corridor 2 - I-40 East from US 15-501 (Exit 270) to MPO Boundary near Airport (Exit 283)
2. Corridor 5 - US 15 from US 15-501 Business (Exit 105) to I-85 (Exit 108)
3. Corridor 13 - NC 54 East from US 15-501 in Chapel Hill to MPO Boundary at Durham-Wake County Line
4. Corridor 17 - NC 86 South from I-40 (Exit 266) to US 15-501 / NC 54 in Chapel Hill

With all scores combined together with assigned weights of 50 for safety, 20 for traffic and 30 for multimodal/complete streets performance measures, the following nine CMP corridors received the "High-Medium" ranking:

1. Corridor 5 - US 15 from US 15-501 Business (Exit 105) to I-85 (Exit 108)
2. Corridor 6 - US 15-501 Bus from US 15-501 to I-85 (Exit 177)
3. Corridor 7 - US 15-501 North from US 15-501 Business (Exit 105) to NC 86 in Chapel Hill
4. Corridor 12 - US 501 North from I-85 (Exit 176) to Bywood Dr in North Durham
5. Corridor 13 - NC 54 East from US 15-501 in Chapel Hill to MPO Boundary at Durham-Wake County Line

6. Corridor 15 - NC 55 from NC 147 (Exit 2) to MPO Boundary at Durham-Wake County Line
7. Corridor 17 - NC 86 South from I-40 (Exit 266) to US 15-501 / NC 54 in Chapel Hill
8. Corridor 18 - NC 98 from North Roxboro St in Downtown Durham to MPO Boundary at Durham-Wake County Line
9. Corridor 20 - Duke St-Gregson St from NC 147 in Downtown Durham to I-85 (Exit 176)

A map of the priority-ranked corridors is illustrated in Figure 4.2. It should be noted that none of the corridors received the "High" overall score based on current available data that were analyzed for this study and the relative weights assigned to each performance measure. Hence, these corridor ranking is subject to change in the future as more recent traffic, safety and transit data become available.

Table 4.2 Safety Priority Score and Ranking

ID	Corridor Name	From	To	Length (miles)	Fatal Crashes (2017-2021)	A Type Injury Crashes (Disabling) (2017-2021)	B Type Injury Crashes (Evident) (2017-2021)	C Type Injury Crashes (Possible) (2017-2021)	Total Fatal and Injury Crashes (2017-2021)	Severe Crash Rate (2017-2021) (Crashes per Million VMT)	Safety Priority Score	Safety Priority Ranking
1	I-40 West	US 15-501 (Exit 270)	MPO Boundary in Mebane (Exit 157)	17.3	8	11	91	329	439	0.46	4	LOW
2	I-40 East	US 15-501 (Exit 270)	MPO Boundary near RDU Airport (Exit 283)	12.8	5	24	206	489	724	0.59	4	LOW
3	I-85 South	NC 147 near Durham-Orange County Line (Exit 172)	I-40 (Exit 163)	9.2	5	21	56	173	255	0.80	3	LOW-MEDIUM
4	I-85 North	NC 147 near Durham-Orange County Line (Exit 172)	MPO Boundary at Durham-Granville County Line	12.7	7	16	120	280	423	0.70	3	LOW-MEDIUM
5	US 15	US 15-501 Business (Exit 105)	I-85 (Exit 108)	4.8	3	3	38	97	141	0.71	3	LOW-MEDIUM
6	US 15-501 Bus	US 15-501	I-85 (Exit 177)	6.9	1	10	99	321	431	3.67	1	HIGH
7	US 15-501 North	US 15-501 Business (Exit 105)	NC 86 in Chapel Hill	7.7	2	9	84	402	497	2.03	1	HIGH
8	US 15-501 South	NC 54 in Chapel Hill	MPO Boundary in Chatham County	7.6	3	4	41	92	140	0.48	4	LOW
9	US 70 West	I -85 (Exit 170)	MPO Boundary in Mebane	13.1	5	10	50	122	187	1.09	2	HIGH-MEDIUM
10	US 70 East	I-885 (Exit 288)	MPO Boundary at Durham-Wake County Line	4.3	7	18	64	190	279	1.24	2	HIGH-MEDIUM
11	I-885	I-85 (Exit 178)	MPO Boundary at Durham-Wake County Line	11.3	4	10	55	97	166	0.37	4	LOW

ID	Corridor Name	From	To	Length (miles)	Fatal Crashes (2017-2021)	A Type Injury Crashes (Disabling) (2017-2021)	B Type Injury Crashes (Evident) (2017-2021)	C Type Injury Crashes (Possible) (2017-2021)	Total Fatal and Injury Crashes (2017-2021)	Severe Crash Rate (2017-2021) (Crashes per Million VMT)	Safety Priority Score	Safety Priority Ranking
12	US 501 North	I-85 (Exit 176)	Bywood Dr in North Durham	6.2	9	9	90	311	419	1.69	1	HIGH
13	NC 54 East	US 15-501 in Chapel Hill	MPO Boundary at Durham-Wake County Line	14.5	3	22	106	315	446	1.17	2	HIGH-MEDIUM
14	NC 54 West	NC 86 in Chapel Hill	MPO Boundary in Carrboro	7.5	1	5	24	42	72	0.53	4	LOW
15	NC 55	NC 147 (Exit 2)	MPO Boundary at Durham-Wake County Line	8.2	8	21	138	282	449	1.58	1	HIGH
16	NC 86 North	I-40 (Exit 266)	MPO Boundary in North Hillsborough	12.7	1	9	39	110	159	0.82	3	LOW-MEDIUM
17	NC 86 South	I-40 (Exit 266)	US 15-501 / NC 54 in Chapel Hill	6.2	2	5	34	143	184	1.38	2	HIGH-MEDIUM
18	NC 98	North Roxboro St in Downtown Durham	MPO Boundary at Durham-Wake County Line	10.9	11	20	143	293	467	2.01	1	HIGH
19	NC 147	I-885	I-85	7.8	5	8	78	223	314	0.96	3	LOW-MEDIUM
20	Duke St-Gregson St	NC 147 in Downtown Durham	I-85 (Exit 176)	1.9	3	4	44	116	167	5.09	1	HIGH
21	NC 751	NC 54 in Durham	MPO Boundary in Chatham County	9.4	1	7	31	56	95	0.51	4	LOW
22	S Miami Blvd	NC 54 in Durham	US 70	4.8	4	7	65	123	199	1.18	2	HIGH-MEDIUM

Table 4.3 Traffic LOS and Travel Time Reliability Scores and Ranking

ID	Corridor Name	From	To	Length (miles)	Average 2019 V/C Ratio	LOS Priority Score	LOS Priority Ranking	LOTTR 2019 Worst Peak	2019 Unreliable Miles, %	LOTTR Priority Score	LOTTR Priority Ranking	Traffic Priority Score	Traffic Priority Ranking
1	I-40 West	US 15-501 (Exit 270)	MPO Boundary in Mebane (Exit 157)	17.3	0.74	1	HIGH	1.13	1.4%	4	LOW	3.0	LOW-MEDIUM
2	I-40 East	US 15-501 (Exit 270)	MPO Boundary near RDU Airport (Exit 283)	12.8	0.97	1	HIGH	1.68	40.2%	1	HIGH	1.0	HIGH
3	I-85 South	NC 147 near Durham-Orange County Line (Exit 172)	I-40 (Exit 163)	9.2	0.60	2	HIGH-MEDIUM	1.07	11.3%	4	LOW	3.0	LOW-MEDIUM
4	I-85 North	NC 147 near Durham-Orange County Line (Exit 172)	MPO Boundary at Durham-Granville County Line	12.7	0.58	3	LOW-MEDIUM	1.04		4	LOW	4.0	LOW
5	US 15	US 15-501 Business (Exit 105)	I-85 (Exit 108)	4.8	0.62	2	HIGH-MEDIUM	1.08		4	LOW	3.0	LOW-MEDIUM
6	US 15-501 Bus	US 15-501	I-85 (Exit 177)	6.9	0.48	4	LOW	1.37	19.0%	2	HIGH-MEDIUM	3.0	LOW-MEDIUM
7	US 15-501 North	US 15-501 Business (Exit 105)	NC 86 in Chapel Hill	7.7	0.76	1	HIGH	1.45	24.5%	2	HIGH-MEDIUM	2.0	HIGH-MEDIUM
8	US 15-501 South	NC 54 in Chapel Hill	MPO Boundary in Chatham County	7.6	0.69	2	HIGH-MEDIUM	1.29	1.1%	4	LOW	3.0	LOW-MEDIUM
9	US 70 West	I -85 (Exit 170)	MPO Boundary in Mebane	13.1	0.51	4	LOW					4.0	LOW
10	US 70 East	I-885 (Exit 288)	MPO Boundary at Durham-Wake County Line	4.3	0.64	2	HIGH-MEDIUM	1.43	38.6%	1	HIGH	2.0	HIGH-MEDIUM
11	I-885	I-85 (Exit 178)	MPO Boundary at Durham-Wake County Line	11.3	0.60	3	LOW-MEDIUM	1.22	28.4%	2	HIGH-MEDIUM	3.0	LOW-MEDIUM
12	US 501 North	I-85 (Exit 176)	Bywood Dr in North Durham	6.2	0.69	1	HIGH	1.32	3.7%	4	LOW	3.0	LOW-MEDIUM

ID	Corridor Name	From	To	Length (miles)	Average 2019 V/C Ratio	LOS Priority Score	LOS Priority Ranking	LOTTR 2019 Worst Peak	2019 Unreliable Miles, %	LOTTR Priority Score	LOTTR Priority Ranking	Traffic Priority Score	Traffic Priority Ranking
13	NC 54 East	US 15-501 in Chapel Hill	MPO Boundary at Durham-Wake County Line	14.5	0.70	1	HIGH	1.43	19.2%	2	HIGH-MEDIUM	2.0	HIGH-MEDIUM
14	NC 54 West	NC 86 in Chapel Hill	MPO Boundary in Carrboro	7.5	0.41	4	LOW	1.21	0.5%	4	LOW	4.0	LOW
15	NC 55	NC 147 (Exit 2)	MPO Boundary at Durham-Wake County Line	8.2	0.56	3	LOW-MEDIUM	1.39	17.3%	3	LOW-MEDIUM	3.0	LOW-MEDIUM
16	NC 86 North	I-40 (Exit 266)	MPO Boundary in North Hillsborough	12.7	0.52	3	LOW-MEDIUM					3.0	LOW-MEDIUM
17	NC 86 South	I-40 (Exit 266)	US 15-501 / NC 54 in Chapel Hill	6.2	0.44	4	LOW	1.25	24.8%	2	HIGH-MEDIUM	3.0	LOW-MEDIUM
18	NC 98	North Roxboro St in Downtown Durham	MPO Boundary at Durham-Wake County Line	10.9	0.49	4	LOW	1.38	15.9%	3	LOW-MEDIUM	4.0	LOW
19	NC 147	I-885	I-85	7.8	0.72	1	HIGH	1.55	20.3%	2	HIGH-MEDIUM	2.0	HIGH-MEDIUM
20	Duke St-Gregson St	NC 147 in Downtown Durham	I-85 (Exit 176)	1.9	0.52	4	LOW					4.0	LOW
21	NC 751	NC 54 in Durham	MPO Boundary in Chatham County	9.4	0.57	3	LOW-MEDIUM					3.0	LOW-MEDIUM
22	S Miami Blvd	NC 54 in Durham	US 70	4.8	0.69	2	HIGH-MEDIUM	1.40	16.3%	3	LOW-MEDIUM	3.0	LOW-MEDIUM

Table 4.4 Multimodal and Complete Streets Scores and Ranking

Corridor ID	Corridor Name	From	To	Length (miles)	Estimated Transit Passenger Flow in 2020	Multimodal Score	Annual Transit Boardings and Alightings and Ped-Bike Trips in 2019	Complete Streets Score	Multimodal/ Complete Streets Score	Multimodal/ Complete Streets Ranking
1	I-40 West	US 15-501 (Exit 270)	MPO Boundary in Mebane (Exit 157)	17.3	500	3			3	LOW-MEDIUM
2	I-40 East	US 15-501 (Exit 270)	MPO Boundary near RDU Airport (Exit 283)	12.8	2200	1			1	HIGH
3	I-85 South	NC 147 near Durham-Orange County Line (Exit 172)	I-40 (Exit 163)	9.2	200	4			4	LOW
4	I-85 North	NC 147 near Durham-Orange County Line (Exit 172)	MPO Boundary at Durham-Granville County Line	12.7	100	4			4	LOW
5	US 15	US 15-501 Business (Exit 105)	I-85 (Exit 108)	4.8	1800	1			1	HIGH
6	US 15-501 Bus	US 15-501	I-85 (Exit 177)	6.9	1400	2	98,617	2	2	HIGH-MEDIUM
7	US 15-501 North	US 15-501 Business (Exit 105)	NC 86 in Chapel Hill	7.7	3700	1	13,344	3	2	HIGH-MEDIUM
8	US 15-501 South	NC 54 in Chapel Hill	MPO Boundary in Chatham County	7.6	600	3	12,220	3	3	LOW-MEDIUM
9	US 70 West	I -85 (Exit 170)	MPO Boundary in Mebane	13.1	50	4	838	4	4	LOW
10	US 70 East	I-885 (Exit 288)	MPO Boundary at Durham-Wake County Line	4.3	600	3	11,752	4	4	LOW
11	I-885	I-85 (Exit 178)	MPO Boundary at Durham-Wake County Line	11.3	1400	2			2	HIGH-MEDIUM
12	US 501 North	I-85 (Exit 176)	Bywood Dr in North Durham	6.2	300	3	44,392	3	3	LOW-MEDIUM

Corridor ID	Corridor Name	From	To	Length (miles)	Estimated Transit Passenger Flow in 2020	Multimodal Score	Annual Transit Boardings and Alightings and Ped-Bike Trips in 2019	Complete Streets Score	Multimodal/ Complete Streets Score	Multimodal/ Complete Streets Ranking
13	NC 54 East	US 15-501 in Chapel Hill	MPO Boundary at Durham-Wake County Line	14.5	3000	1	198,961	1	1	HIGH
14	NC 54 West	NC 86 in Chapel Hill	MPO Boundary in Carrboro	7.5	1300	2	157,560	1	2	HIGH-MEDIUM
15	NC 55	NC 147 (Exit 2)	MPO Boundary at Durham-Wake County Line	8.2	400	3	97,038	2	3	LOW-MEDIUM
16	NC 86 North	I-40 (Exit 266)	MPO Boundary in North Hillsborough	12.7	200	4	861	4	4	LOW
17	NC 86 South	I-40 (Exit 266)	US 15-501 / NC 54 in Chapel Hill	6.2	3000	1	3,291,736	1	1	HIGH
18	NC 98	North Roxboro St in Downtown Durham	MPO Boundary at Durham-Wake County Line	10.9	1000	2	181,058	1	2	HIGH-MEDIUM
19	NC 147	I-885	I-85	7.8	2000	1	9,772	4	3	LOW-MEDIUM
20	Duke St-Gregson St	NC 147 in Downtown Durham	I-85 (Exit 176)	1.9	1200	2	48,138	2	2	HIGH-MEDIUM
21	NC 751	NC 54 in Durham	MPO Boundary in Chatham County	9.4	100	4			4	LOW
22	S Miami Blvd	NC 54 in Durham	US 70	4.8	300	3			3	LOW-MEDIUM

Table 4.5 Overall Corridor Score and Ranking

Corridor ID	Corridor Name	From	To	Length (miles)	Safety Priority Score	Traffic Priority Score	Multimodal/ Complete Streets Score	Overall Score (weighted) (see Note)	Overall Ranking
1	I-40 West	US 15-501 (Exit 270)	MPO Boundary in Mebane (Exit 157)	17.3	4	3	3	4	LOW
2	I-40 East	US 15-501 (Exit 270)	MPO Boundary near RDU Airport (Exit 283)	12.8	4	1	1	3	LOW-MEDIUM
3	I-85 South	NC 147 near Durham-Orange County Line (Exit 172)	I-40 (Exit 163)	9.2	3	3	4	3	LOW-MEDIUM
4	I-85 North	NC 147 near Durham-Orange County Line (Exit 172)	MPO Boundary at Durham-Granville County Line	12.7	3	4	4	4	LOW
5	US 15	US 15-501 Business (Exit 105)	I-85 (Exit 108)	4.8	3	3	1	2	HIGH-MEDIUM
6	US 15-501 Bus	US 15-501	I-85 (Exit 177)	6.9	1	3	2	2	HIGH-MEDIUM
7	US 15-501 North	US 15-501 Business (Exit 105)	NC 86 in Chapel Hill	7.7	1	2	2	2	HIGH-MEDIUM
8	US 15-501 South	NC 54 in Chapel Hill	MPO Boundary in Chatham County	7.6	4	3	3	4	LOW
9	US 70 West	I -85 (Exit 170)	MPO Boundary in Mebane	13.1	2	4	4	3	LOW-MEDIUM
10	US 70 East	I-885 (Exit 288)	MPO Boundary at Durham-Wake County Line	4.3	2	2	4	3	LOW-MEDIUM
11	I-885	I-85 (Exit 178)	MPO Boundary at Durham-Wake County Line	11.3	4	3	2	3	LOW-MEDIUM
12	US 501 North	I-85 (Exit 176)	Bywood Dr in North Durham	6.2	1	3	3	2	HIGH-MEDIUM
13	NC 54 East	US 15-501 in Chapel Hill	MPO Boundary at Durham-Wake County Line	14.5	2	2	1	2	HIGH-MEDIUM
14	NC 54 West	NC 86 in Chapel Hill	MPO Boundary in Carrboro	7.5	4	4	2	3	LOW-MEDIUM

Corridor ID	Corridor Name	From	To	Length (miles)	Safety Priority Score	Traffic Priority Score	Multimodal/ Complete Streets Score	Overall Score (weighted) (see Note)	Overall Ranking
15	NC 55	NC 147 (Exit 2)	MPO Boundary at Durham-Wake County Line	8.2	1	3	3	2	HIGH-MEDIUM
16	NC 86 North	I-40 (Exit 266)	MPO Boundary in North Hillsborough	12.7	3	3	4	3	LOW-MEDIUM
17	NC 86 South	I-40 (Exit 266)	US 15-501 / NC 54 in Chapel Hill	6.2	2	3	1	2	HIGH-MEDIUM
18	NC 98	North Roxboro St in Downtown Durham	MPO Boundary at Durham-Wake County Line	10.9	1	4	2	2	HIGH-MEDIUM
19	NC 147	I-885	I-85	7.8	3	2	3	3	LOW-MEDIUM
20	Duke St-Gregson St	NC 147 in Downtown Durham	I-85 (Exit 176)	1.9	1	4	2	2	HIGH-MEDIUM
21	NC 751	NC 54 in Durham	MPO Boundary in Chatham County	9.4	4	3	4	4	LOW
22	S Miami Blvd	NC 54 in Durham	US 70	4.8	2	3	3	3	LOW-MEDIUM

Note: The weighted overall score applied 50-20-30 weights to the Safety, Traffic, and Multimodal/Complete Streets performance scores respectively. These weights were defined based on feedback from the MPO's CMP committee members.

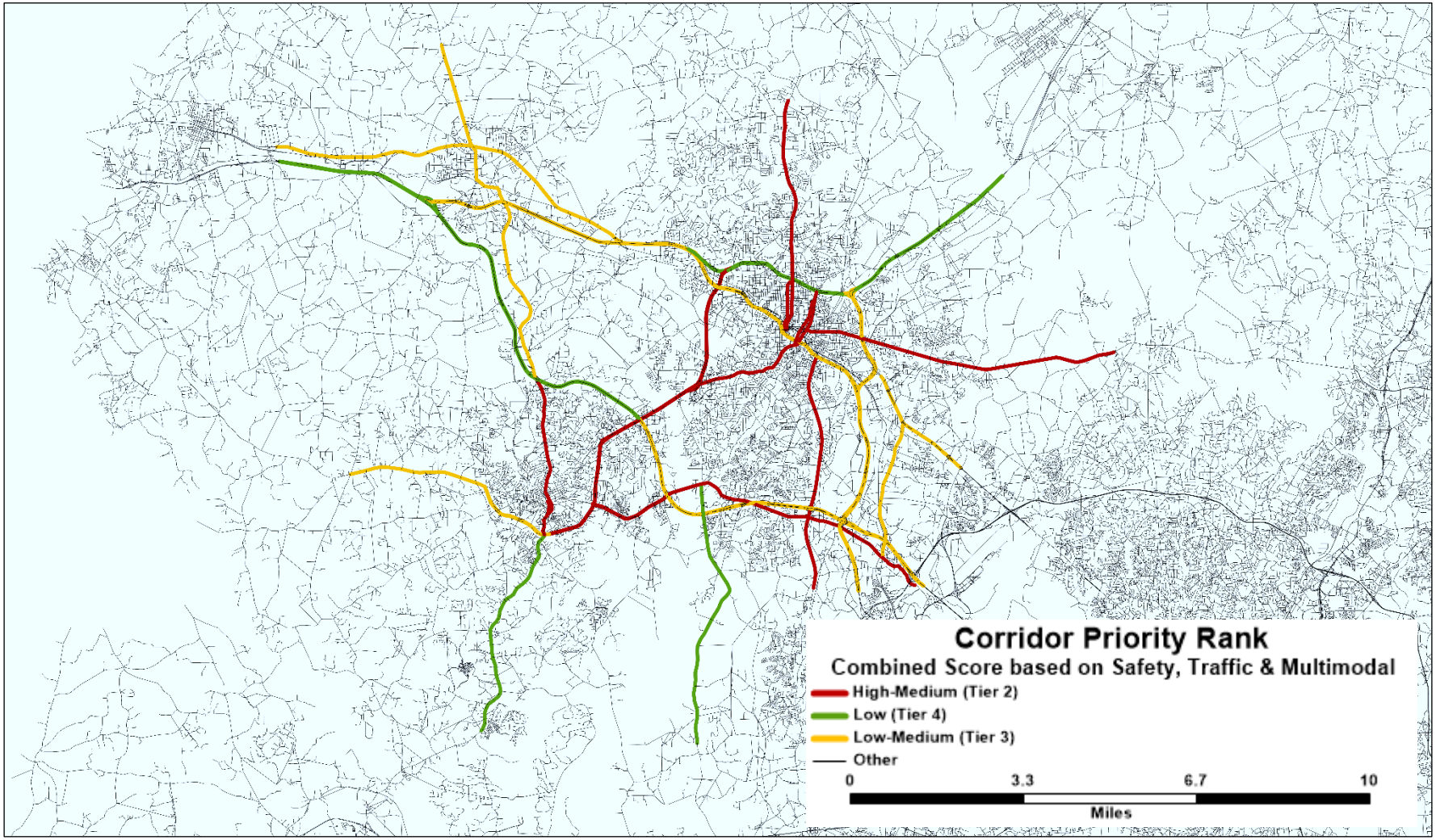
Table 4.6 Overall Corridor Score and Ranking – Sorted by Ranking

Corridor ID	Corridor Name	From	To	Length (miles)	Safety Priority Score	Traffic Priority Score	Multimodal/ Complete Streets Score	Overall Score (weighted) (see Note)	Overall Ranking
5	US 15	US 15-501 Business (Exit 105)	I-85 (Exit 108)	4.8	3	3	1	2	HIGH-MEDIUM
6	US 15-501 Bus	US 15-501	I-85 (Exit 177)	6.9	1	3	2	2	HIGH-MEDIUM
7	US 15-501 North	US 15-501 Business (Exit 105)	NC 86 in Chapel Hill	7.7	1	2	2	2	HIGH-MEDIUM
12	US 501 North	I-85 (Exit 176)	Bywood Dr in North Durham	6.2	1	3	3	2	HIGH-MEDIUM
13	NC 54 East	US 15-501 in Chapel Hill	MPO Boundary at Durham-Wake County Line	14.5	2	2	1	2	HIGH-MEDIUM
15	NC 55	NC 147 (Exit 2)	MPO Boundary at Durham-Wake County Line	8.2	1	3	3	2	HIGH-MEDIUM
17	NC 86 South	I-40 (Exit 266)	US 15-501 / NC 54 in Chapel Hill	6.2	2	3	1	2	HIGH-MEDIUM
18	NC 98	North Roxboro St in Downtown Durham	MPO Boundary at Durham-Wake County Line	10.9	1	4	2	2	HIGH-MEDIUM
20	Duke St-Gregson St	NC 147 in Downtown Durham	I-85 (Exit 176)	1.9	1	4	2	2	HIGH-MEDIUM
2	I-40 East	US 15-501 (Exit 270)	MPO Boundary near RDU Airport (Exit 283)	12.8	4	1	1	3	LOW-MEDIUM
3	I-85 South	NC 147 near Durham-Orange County Line (Exit 172)	I-40 (Exit 163)	9.2	3	3	4	3	LOW-MEDIUM
9	US 70 West	I -85 (Exit 170)	MPO Boundary in Mebane	13.1	2	4	4	3	LOW-MEDIUM
10	US 70 East	I-885 (Exit 288)	MPO Boundary at Durham-Wake County Line	4.3	2	2	4	3	LOW-MEDIUM
11	I-885	I-85 (Exit 178)	MPO Boundary at Durham-Wake County Line	11.3	4	3	2	3	LOW-MEDIUM
14	NC 54 West	NC 86 in Chapel Hill	MPO Boundary in Carrboro	7.5	4	4	2	3	LOW-MEDIUM

Corridor ID	Corridor Name	From	To	Length (miles)	Safety Priority Score	Traffic Priority Score	Multimodal/ Complete Streets Score	Overall Score (weighted) (see Note)	Overall Ranking
16	NC 86 North	I-40 (Exit 266)	MPO Boundary in North Hillsborough	12.7	3	3	4	3	LOW-MEDIUM
19	NC 147	I-885	I-85	7.8	3	2	3	3	LOW-MEDIUM
22	S Miami Blvd	NC 54 in Durham	US 70	4.8	2	3	3	3	LOW-MEDIUM
1	I-40 West	US 15-501 (Exit 270)	MPO Boundary in Mebane (Exit 157)	17.3	4	3	3	4	LOW
4	I-85 North	NC 147 near Durham-Orange County Line (Exit 172)	MPO Boundary at Durham-Granville County Line	12.7	3	4	4	4	LOW
8	US 15-501 South	NC 54 in Chapel Hill	MPO Boundary in Chatham County	7.6	4	3	3	4	LOW
21	NC 751	NC 54 in Durham	MPO Boundary in Chatham County	9.4	4	3	4	4	LOW

Note: The weighted overall score applied 50-20-30 weights to the Safety, Traffic, and Multimodal/Complete Streets performance scores respectively.

Figure 4.2 Ranking of the CMP Priority Corridors



4.2 Project Prioritization Methodology

The current study developed a project prioritization methodology based on the Congestion Management Process (CMP) goals and objectives that were adopted by the Durham-Chapel Hill-Carrboro (DCHC) MPO. The CMP goals and objectives utilized in developing the project prioritization method are summarized in Table 4.7, along with the assigned evaluation weights. The evaluation weights were defined based on survey results from the joint DCHC MPO and Capital Area MPO's 2050 Metropolitan Transportation Plan (MTP) Goals Survey that were carried out in early 2020. The MTP Goals Survey results revealed a strong preference to several policy goals and objectives that encouraged walking/bicycling, increased transit service, and denser land uses in the region. These policy preferences are broadly reflected in the recommended CMP project prioritization methodology. However, they can be further refined based on future data analysis and feedback from the MPO's policy board.

To measure outcomes for each CMP objective, multiple performance measures were defined for each CMP objective and weights were subdivided based on available total policy weight for a specific CMP objective. For example, the following three performance measures (labeled as A1.1, A1.2 and A1.3) were defined to monitor outcome towards the CMP objective A1 - Maintain reasonable person-trip and freight mobility, and corridor/system reliability for all transportation modes:

- A1.1 - Percent of Reliable person-miles, i.e. LOTTR by Interstate & National Highway System; with a policy of weight of 25 out of 1,000 total points
- A1.2 - Truck travel time reliability index; with a policy of weight of 15 out of 1,000 total points
- A1.3 – Level of Service (LOS); with a policy of weight of 10 out of 1,000 total points

Similarly, the following performance measure (labeled as C1.1) was defined to monitor outcome towards the CMP objective C1 - Provide all residents with active transportation choices:

- C1.1 - Bicycle Level of Traffic Stress (LTS); with a policy of weight of 50 out of 1,000 total points

The full list of recommended performance measures and evaluation weights are summarized in Table 4.8. While the DCHC MPO has traditionally integrated congestion into the project selection process, more transparency is needed to show how the CMP factors into project selection. The specific linkage between projects that directly support the CMP goals and objectives and how these are integrated into the overall STIP and MTP programming process is not expressly evaluated as part of this study. This will need to be addressed in detail in a future update of this CMP Plan or as part of the next MTP update. Alternatively, the DCHC MPO can apply the recommended project prioritization method to a list past funded multimodal STIP projects in the region to fine tune and adjust the scope of the performance measures and their corresponding evaluation weights. This analysis will help the MPO understand how to prioritize project and program spending, and which CMP metrics are most useful for monitoring the effectiveness of implemented strategies in enhancing the multimodal mobility conditions of the region.

Table 4.7 DCHC CMP Goals and Objectives

CMP Goal ID	CMP Goal Description	CMP Objective ID	CMP Objective Description	CMP Policy Evaluation Weight (see Note)
A	Reliability and Efficiency	A1	Maintain reasonable person-trip and freight mobility, and corridor/system reliability for all transportation modes	50
A	Reliability and Efficiency	A2	Increase efficiency of existing transportation corridor/system through strategies such as Transportation Demand Management (TDM), Intelligent Transportation Systems (ITS)	50
A	Reliability and Efficiency	A3	Improve Incident Management by reducing incident clearance times on the transit, arterial and Protecting the Human and throughway networks through improved traffic incident detection and response	50
			Subtotal A	150
B	Safety	B1	Achieve zero deaths and serious injuries on our transportation system	350
			Subtotal B	350
C	VMT Reduction & Transportation Choices	C1	Provide all residents with active transportation choices	50
C	VMT Reduction & Transportation Choices	C2	Enhance transit services, amenities and facilities	150
C	VMT Reduction & Transportation Choices	C3	Improve bicycle and pedestrian facilities	150
			Subtotal C	350
D	Connectivity	D1	Increase mobility options for all communities -- particularly communities of concern	50
D	Connectivity	D2	Achieve zero disparity of access to jobs, education, and other important destinations by race, income, or other marginalized groups	50
D	Connectivity	D3	Enhance connectivity of the transportation system, across and between modes for people and freight	50
			Subtotal D	150
			Total Weight	1,000

Note: The CMP policy evaluation weights were defined by reviewing the results of the 2050 MTP Goals Survey that was jointly carried out in 2020 by the DCHC and Capital Area MPOs.

Table 4.8 Project Prioritization Methodology

CMP Objective ID	Performance Measure ID	Performance Measure Description	Evaluation Weight	Project 1 Score*	Project 2 Score*	Project N Score*
A1	A1.1	% of Reliable person-miles, i.e. LOTTR by Interstate & National Highway System	25			
A1	A1.2	Truck travel time reliability index	15			
A1	A1.3	Level of Service (LOS)	10			
		A1 Subtotal	50			
A2	A2.1	Bus Average On-time Performance	25			
A2	A2.2	VMT or Number of Trips	25			
		A2 Subtotal	50			
A3	A3.1	% Incidents cleared in 30 minutes or less	50			
		A3 Subtotal	50			
B1	B1.1	No. of Bike & Ped fatalities and serious injuries	100			
B1	B1.2	No. of motorized fatalities and Rate (Per 100m VMT)	150			
B1	B1.3	No. of motorized serious injuries and Rate (Per 100m VMT)	100			
		B1 Subtotal	350			
C1	C1.1	Bicycle level of traffic stress	50			
C2	C2.1	(CMP Route) Transit Ridership and Passenger Mileage	50			
C2	C2.2	Transit Service Miles/Hours (Per Capita)	100			
C3	C3.1	Number of Bike and Ped Trips	50			
C3	C3.2	Sidewalk Coverage & Bike-Facility Coverage or Density	100			
		C Subtotal	350			
D1 and D2	D(1+2).1	Transit Job Accessibility by Community/ TAZ	25			
D1 and D2	D(1+2).2	Auto job accessibility by community/ TAZ	25			
D1 and D2	D(1+2).3	Walk Accessibility to Schools	25			
D1 and D2	D(1+2).4	Percentage of Transit non-work Trips	25			
		D1 & D2 Subtotal	100			
D3	D3.1	Coverage of Transportation Mode	15			
D3	D3.2	First & last-mile service	15			
D3	D3.3	P&R Lot Location and Bike & Ped facility to Transit Stops	20			
		D3 Subtotal	50			
		Project Priority Score – Weighted Sum		N1	N2	N3
		Project Priority Rank			-	-

***Note:** The projects are recommended to be scored in a decile scale of 1-10, with a top score of 10 for projects when performance is within 90-100% of the best performing project for a specific measure, and a low score of 1 for projects when performance is within 0-10% of the best performing project for a specific measure. No scores should be assigned when a project is not screened using a specific performance metric.

5.0 Mitigation Strategies

This section documents the mitigation strategy toolbox and the recommended mitigation strategies that were developed for the Durham-Chapel Hill-Carrboro (DCHC) Metropolitan Planning Organization (MPO) region.

A total of 20 study corridors in the DCHC MPO region were screened for transportation mobility and safety deficiencies, reviewed for reference within existing plans, and evaluated for possible mitigation strategies. These corridors were selected by the DCHC MPO for their regional importance and/or existing or anticipated mobility and safety issues.

A series of performance measures were identified for the Congestion Management Process (CMP) based on the FHWA requirements, as well as DCHC MPO and CMP steering committee feedback, and they were used to develop and assess project alternatives in accordance with the goals and objectives of the DCHC MPO CMP. A 3-stage process was utilized to objectively screen these corridors and develop recommendations using the CMP performance measures:

- Stage 1 – Identify Deficient Locations
- Stage 2 – Prioritize Locations for Improvement
- Stage 3 – Identify Mitigation Strategies

The CMP performance measures included roadway Level of Travel Time Reliability (LOTTR), roadway and intersection Level of Service (LOS), crash frequency and severity, bus ridership and performance, and pedestrian/bicycle access and connectivity.

5.1 Roadway Corridor Segments with Unreliable Travel Time

The LOTTR values were calculated for each roadway segments based on data obtained from vehicle probe data for 2019 and 2021 during the peak travel periods. The resulting LOTTR values were compared with the DCHC MPO goal of 1.5, where LOTTR values exceeding or equal to 1.5 during different peak periods (AM, Midday and PM) in either study year (2019 or 2021) were considered deficient. These deficient/unreliable roadway segments are depicted in Figure 5.1 for 2019 travel conditions and in Figure 5.2 for 2021 travel conditions.

Figure 5.1 Roadway Segments with Unreliable Travel Time in 2019

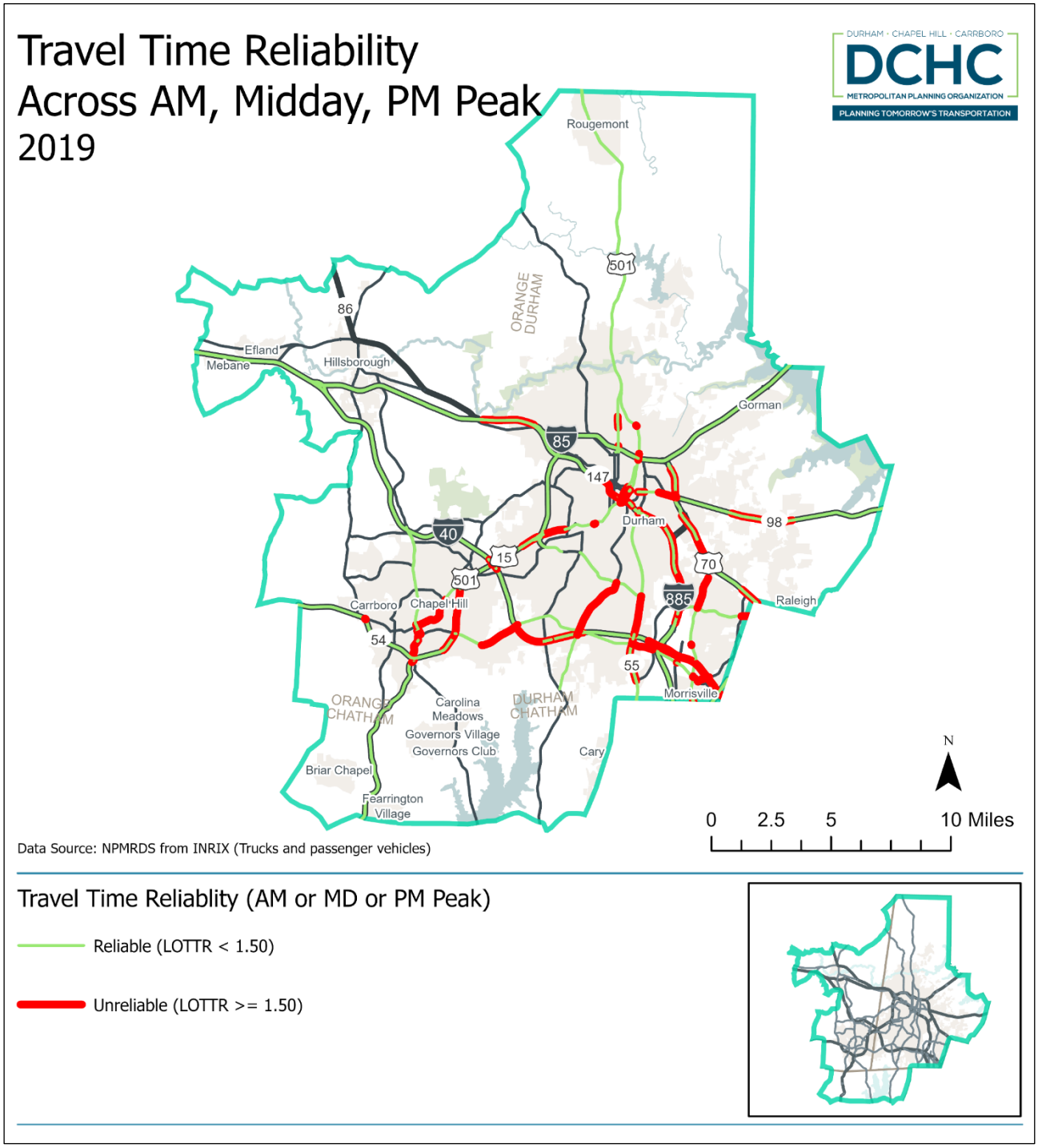
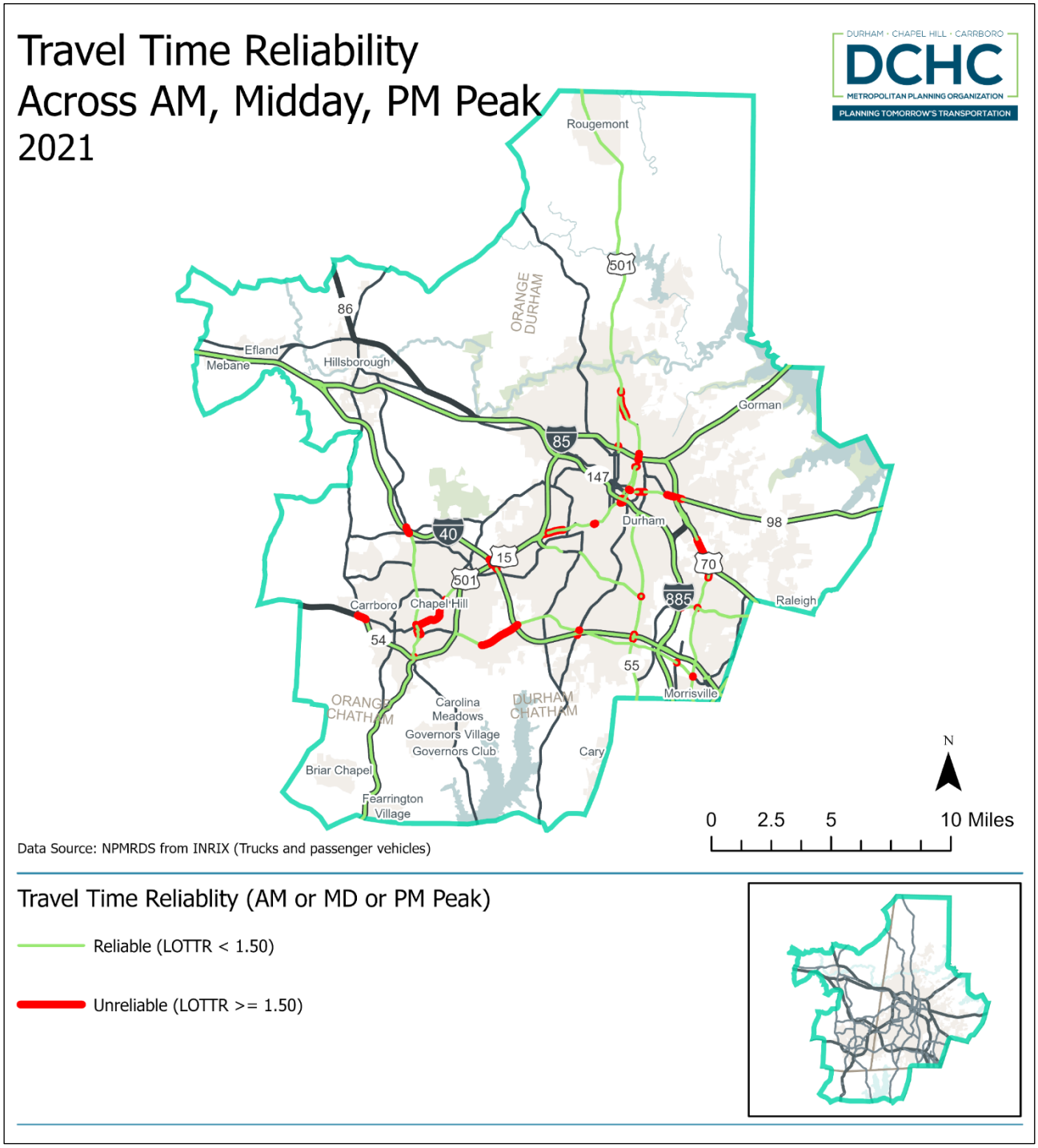


Figure 5.2 Roadway Segments with Unreliable Travel Time in 2021



The deficient roadway segments identified in the maps presented above were further prioritized for targeting mitigation improvements. Corridors with a greater percentage of their study area length exceeding a LOTTR of 1.5 were considered for mitigation improvements, and localized areas of low reliability were deemed lower priority. This was especially important for arterial corridors so that specific intersections with high delay did not artificially influence certain study corridors above those with low segment-level reliability. Table 5.1 shows a list of roadway corridors with notable LOTTR deficiencies:

Table 5.1 Roadway Segments with Notable Unreliable Travel Time

Roadway	Segment	Distance (in miles)	Cross-section	Highest Speed Limit	2019/2021 AADT Range (in thousand vehicles)	2019/2021 Peak LOTTR	Peak Period
I-40	I-885 to Wake County Line	3.71	8 to 10 Lanes	65 mph	170-195	>1.5	PM
I-40	NC 751 to NC 54	3.33	6 to 7 Lanes	65 mph	112-128	>1.5	AM
I-885/NC 147	T.W. Alexander Dr to Briggs Ave	4.46	4 to 5 Lanes	65 mph	70-76	>1.5	AM
NC 147	Duke St to Swift Ave	1.10	4 to 5 Lanes	55 mph	65-66	>1.5	PM
US 70	Miami Blvd to Pleasant Dr	1.30	4 to 5 Lanes	45 mph	42-44	>1.5	PM
US 15/501 Business	US 15/501 to NC 751	1.44	4 to 6 Lanes	45 mph	16-18	>1.5	PM
US 15/501	NC 54 to Estes Dr	1.25	4 to 5 Lanes	45 mph	38-45	>1.5	PM
NC 54	I-40 to Barbee Chapel Rd	1.74	4 to 5 Lanes	45 mph	30-44	>1.5	PM
NC 55	NC 54 to MLK Jr. Pkwy	2.02	4 to 5 Lanes	50 mph	28-37	>1.5	PM
NC 86	Downtown Chapel Hill	1.50	2 to 4 Lanes	35 mph	9-14	>1.5	AM

Note: This LOTTR analysis reflects travel time reliability issues based on probe vehicle data that are mostly automobiles and trucks. Consequently, travel time reliability issues for transit are not directly reflected here, although there is a strong correlation between auto and transit travel times. A recent study completed by the City of Durham, *GoDurham Better Bus Project*, took a deeper dive into transit travel speed and reliability data for GoDurham and have identified intersection-specific mitigation projects on several transit emphasis corridors in Durham, such as Alston Ave/Avondale Dr, Angier Ave/Driver St, West Club Blvd/Gregson St, Fayettevile St/E Main St, Geer St/Roxboro St, Hillsborough Rd/LaSalle St, Holloway St/Raynor St, Horton Rd/Denfield St/Roxboro St, and Morehead Ave/Vickers Ave/Duke St.

5.2 Intersections with Deficient Level of Service (LOS)

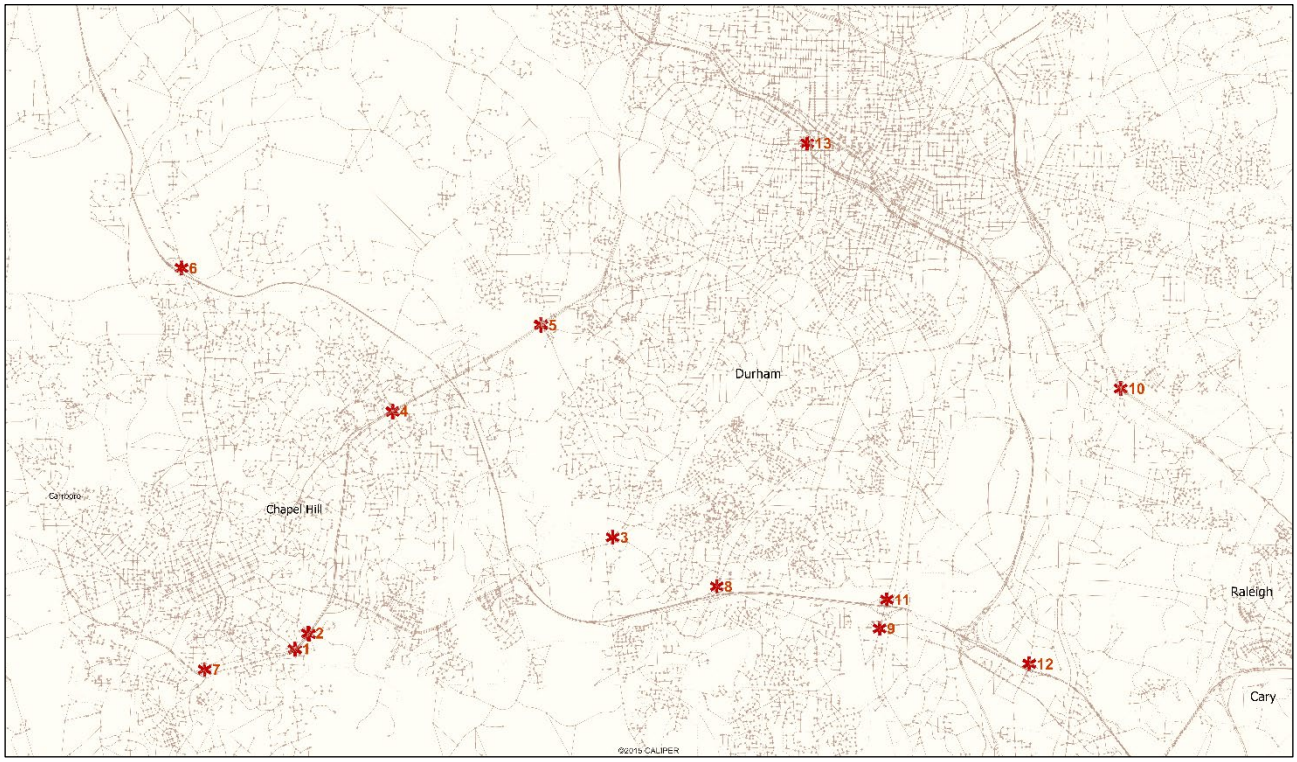
Each signalized intersection along the study corridors was reviewed from Synchro files and 2021 turning movement count data provided by the DCHC MPO. Additionally, ramp termini for the freeway corridors were also reviewed where available. While the Synchro files did not include every signalized intersection and in some cases utilized historic count data from 2019, they did provide a broad assessment of traffic operations along the arterial study corridors. Locations with overall intersection LOS E or F during an existing year peak hour were prioritized for improvement, as well as locations with existing LOS D that were anticipated to degrade to LOS E or F assuming 10% growth in traffic volumes. Table 5.2 shows the list of intersections and ramp termini along the study corridors with notable existing or expected LOS deficiencies. The locations of these deficient intersections are depicted in Figure 5.3.

Table 5.2 Intersections with Current and Expected Level of Service (LOS) Deficiency

MapID	Intersection	Jurisdiction	Existing Peak Hour Volume	Existing LOS in Peak Hour	Estimated LOS with 10% Growth
1	US 15/US 501/NC 54 at Manning Dr	Chapel Hill	4,895	F in PM Peak	-
2	US 15/US 501/NC 54 at Carmichael St/Old Mason Farm Rd	Chapel Hill	4,184	E in PM Peak	-
3	NC 751 (Hope Valley Rd) at Garrett Rd	Durham	3,603	F in PM Peak	-
4	US 15/501 at Old Durham Rd/Sage Rd	Chapel Hill	4,802	D in AM and PM Peaks	E in AM and PM Peaks
5	US 15/501 at Garrett Rd	Durham	6,005	D in PM Peak	E in PM Peak
6	I-40 Westbound Ramps at NC 86	Chapel Hill	2,815	D in PM Peak	E in PM Peak
7	NC 54 Westbound Ramps at NC 86	Chapel Hill	2,810	D in PM Peak	E in PM Peak
8	NC 54 at Fayetteville Rd	Durham	4,551	D in PM Peak	E in PM Peak
9	NC 54 at NC 55	Durham	5,414	E in AM Peak	-
10	US 70 at Miami Blvd/Mineral Springs Rd	Durham	7,085	F in AM and PM Peaks	-
11	I-40 Westbound Ramps at NC 55	Durham	4,382	E in PM Peak	-
12	I-40 Westbound Ramps at Davis Dr	Durham	3,114	D in AM Peak	E in AM Peak
13	NC 147 Southbound Ramps at Chapel Hill St	Durham	1,798	D in AM Peak	E in AM Peak

Note: see **Figure 6.3** for a map of the intersection locations.

Figure 5.3 Location of Intersections with Peak Hour LOS Deficiency



Note: see **Table 5.2** for a description of the intersection LOS deficiency.

5.3 Mitigation Strategy Toolbox

As part of this study, several effective and proven improvement strategies were identified as congestion mitigation toolbox solutions. These congestion mitigation solutions were identified and prioritized based on the multimodal policy goals and objectives of the DCHC MPO. The congestion mitigation strategy toolbox was developed to offer planning-level solutions for congested freeway and arterial corridors and deficient intersection and interchange locations in the MPO region. It should be noted that these toolbox strategies will require additional evaluation, analysis, and design, prior to implementation at a specific problem corridor or intersection location.

To fit the needs of the DCHC MPO region, the congestion mitigation strategy toolbox is organized by three corridor facility types: 1) freeway, 2) 4+ lane divided arterials, and 3) 2-4 lane undivided arterials. Each of this toolbox is intended to serve as a menu of options to offer a range of potential costs and applicability. They have been screened and prioritized from a series of discussions with DCHC MPO and CMP steering committee members. Within each corridor facility type, the mitigation strategies were classified as lower or higher priority, as well as lower or higher cost, to support additional conversations regarding feasibility and implementation. For all arterial corridors and intersections (including ramp termini and interchange areas), mitigation strategies prioritizing improvements for transit, pedestrian, and bicycle modes were emphasized.

5.3.1 Strategies for Freeways

Figure 5.4 displays the mitigation strategies for freeway corridors. The following is a brief description of each strategy:

- **Intelligent Transportation Systems (ITS) and Integrated Corridor Management** include technology, signage, and communication systems that alert travelers and managing agencies when incidents such as crashes or peak congestion occur and provide recommended detours based on dynamic travel patterns. These systems are particularly beneficial to long-distance truck traffic, and they can help manage traffic volume without increasing the capacity of the roadway.

- **Ramp Metering or on-ramp signals** refers to installing traffic-actuated signals at on-ramps that regulate the volume of traffic that can merge onto the freeway during peak hours. This improves the flow of traffic on the freeway without changing the physical capacity of the roadway and has shown to be very effective in areas with high merging volume and ramp density. Ramp metering has also been installed on other freeways in the Triangle, including I-540.

- **Bus Rapid Transit, including Bus on Shoulder** provides additional capacity with an emphasis on reducing transit travel time and improving transit reliability. Bus on shoulder is already implemented on some freeways in the Triangle, including I-40.

- **Dynamic hard shoulder running** is a strategy that allows traffic (sometimes only passenger vehicles and not trucks) to use the outside or inside shoulder during incidents or peak periods. This generally requires the installation of dynamic messaging signs above the shoulder to indicate when it is open or closed. This may also require resurfacing or even reconstructing the shoulders, which are often not built to the same standards as general-purpose lanes.

- **Modernizing ramps** at interchanges to increase acceleration and deceleration lanes on the mainline freeway, as well as providing additional queue storage space on the ramp.

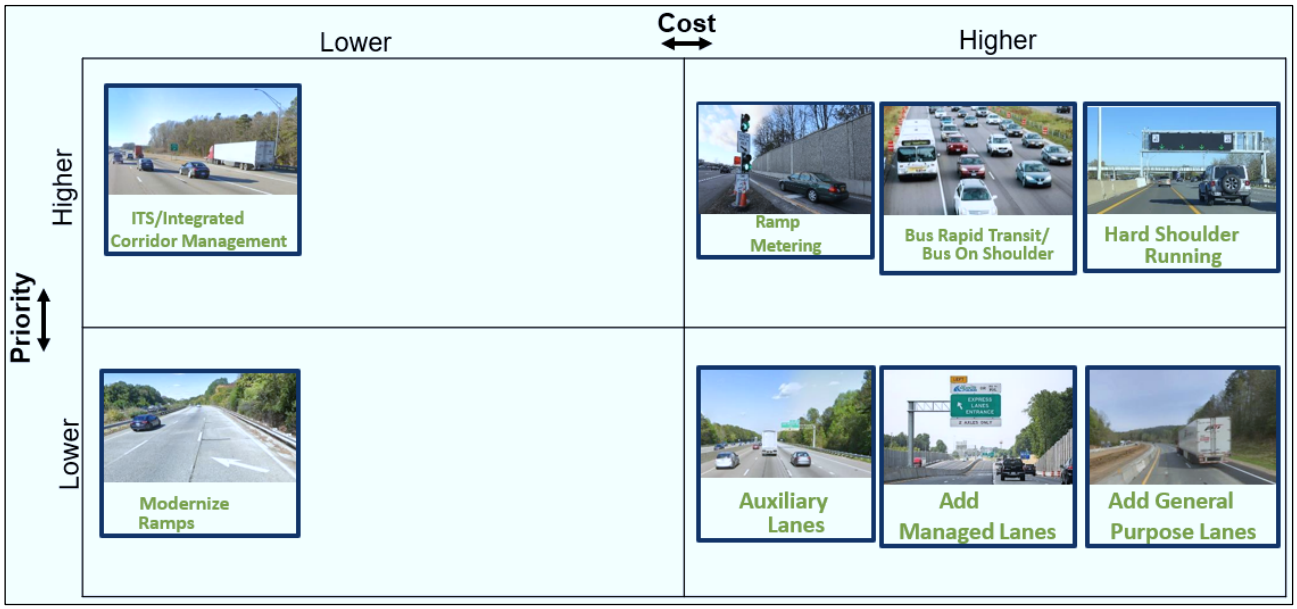
- **Adding auxiliary lanes** between on- and off-ramps to increase the capacity of the roadway between interchanges and improve the safe merging/weaving distance between vehicles.

- **Managed lanes** refer to high-occupancy vehicle (HOV), high-occupancy or toll (HOT), or express toll lanes and are intended to encourage carpooling or help offset the cost of improvements by charging a toll to use a lane that will presumably also have lower peak hour demand and therefore improved reliability. These are typically added by expanding the roadway rather than converting existing lanes to managed lanes. The DCHC MPO and local agency staff have not supported express toll lanes but are supportive of managed lanes that encouraging carpooling.

- **General purpose lanes** to increase the capacity of the roadway by adding lanes open to all vehicles. While this remains a basic method to address congestion and travel time reliability along freeways, the DCHC MPO and local agency staff have indicated that expanding roadways should be the lowest priority strategy and explored only if all other options are infeasible.

The CMP steering committee emphasized treatments that included Intelligent Transportation Systems (ITS), integrated corridor management, and travel demand management (TDM) strategies such as ramp metering, bus on shoulder, and dynamic hard shoulder running. Other strategies that are lower priority include modernizing ramps and acceleration and deceleration lanes, adding auxiliary lanes between on- and off-ramps, adding managed lanes such as HOV or express toll lanes, or adding general purpose lanes.

Figure 5.4 Freeway Corridor Mitigation Strategies



5.3.2 Strategies for 4+ Lane Divided Arterials

Figure 5.5 displays the mitigation strategies for 4+ lane divided arterial corridors. The following is a brief description of each strategy:

- **Adjusting signal timing or phasing** includes minor adjustments to existing traffic signals to improve signal timing synchronization, traffic progression, potentially mitigate conflicting vehicle turning movements, and increase intersection efficiency without expanding the roadway. The DCHC MPO and local agency staff have also expressed a desire to adjust signal timings to favor movements corresponding to transit routes.

- **Intelligent Transportation Systems (ITS) and Integrated Corridor Management** include technology, signage, and communication systems that alert travelers and managing agencies when incidents such as crashes or peak congestion occur and provide recommended detours based on dynamic travel patterns. These systems are particularly beneficial to long-distance truck traffic, and they can help manage traffic volume without increasing the capacity of the roadway.

- **Transit Improvements** include bus rapid transit, transit frequency and service improvements, and designation of transit priority corridors. These may also include strategies such as queue jumps to allow transit vehicles to bypass long vehicle queues, transit signal priority, which is a technology that increases signal green time for transit movements, and dedicated transit lanes.

- **Improving Connectivity** refers to providing additional street or sidewalk connections between land uses so that travel can be dispersed away from high-traffic roadways.

- **Shared Use Paths** are walking/bicycling paths that are physically separated from the roadway and are intended to improve user safety and encourage active transportation.

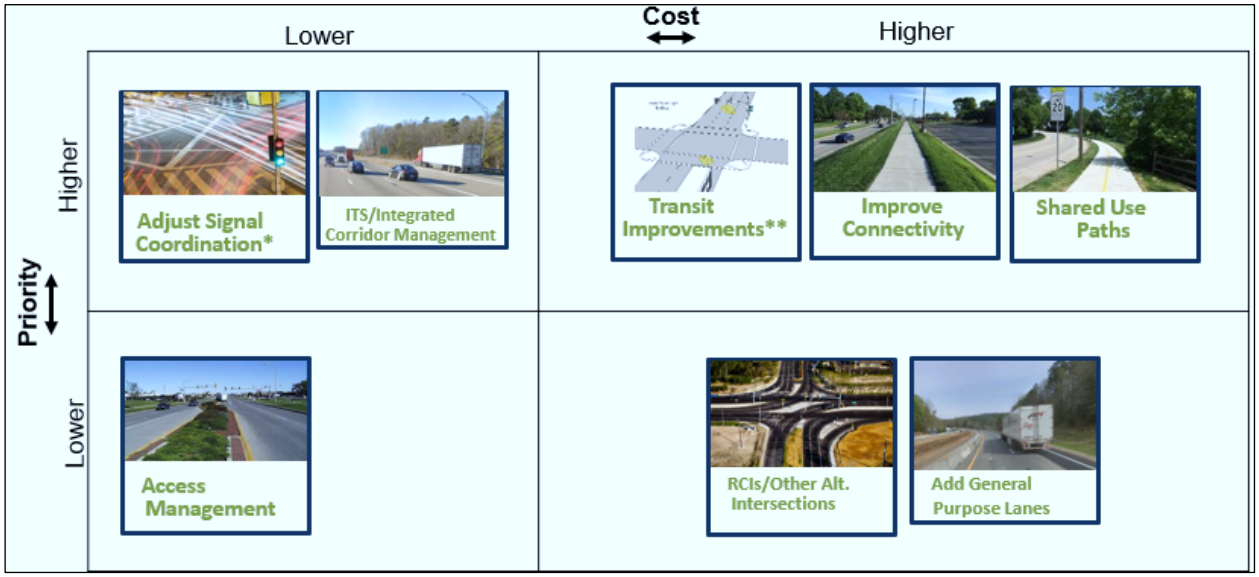
- **Access Management** includes limiting new driveways, removing or consolidating existing driveways, and discouraging full-movement driveways through the use of medians or other treatments on roadways. These strategies can improve safety and mobility by decreasing left-turning traffic, and they also reduce conflicts between turning vehicles and pedestrians/bicyclists.

- **Reduced Conflict Intersections (RCIs)** are a type of intersection that redirects side-street left turn and through movements to make a right turn and then a U-turn downstream of the main intersection. These can be either signalized or unsignalized and can help limit conflicts between vehicles and between vehicles and pedestrian/bicyclists. They can also improve capacity and traffic progression between signals. Other innovative intersection forms such as Median U-Turns, Bow-tie intersections, or hybrid configurations can accomplish the same objectives while redirecting other turning movements.

- **General purpose lanes** to increase the capacity of the roadway by adding lanes open to all vehicles. While this remains a basic method to address congestion and travel time reliability along freeways, the DCHC MPO and local agency staff have indicated that expanding roadways should be the lowest priority strategy and explored only if all other options are infeasible.

Like the freeway corridors, the CMP steering committee indicated a preference for ITS and TDM-related treatments, including improvements that encourage non-automobile transportation. These include adjusting signal timing, phasing, and coordination, ITS/integrated corridor management, transit preferential treatments, and adding contextually-designed walking and bicycling facilities such as separated paths. Lower priority treatments included access management strategies, including medians, driveway consolidations, and turn restrictions, alternative intersections including Reduced Conflict Intersections (RCIs), and adding general purpose lanes and turn lanes.

Figure 5.5 4+ Lane Divided Arterial Corridor Mitigation Strategies



* Including signal timing adjustments for multimodal trips

** Transit improvements may include BRT, service frequency increase, and transit priority corridors.

5.3.3 Strategies for 2-4 Lane Undivided Arterials

Figure 5.6 displays the mitigation strategies for 2-4 lane undivided arterial corridors. The following is a brief description of each strategy:

- **Adjusting signal timing or phasing** includes minor adjustments to existing traffic signals to improve traffic progression, potentially mitigate conflicting vehicle turning movements, and increase intersection efficiency without expanding the roadway. The DCHC MPO and local agency staff have also expressed a desire to adjust signal timings to favor movements corresponding to transit routes.

- **Intelligent Transportation Systems (ITS) and improving Incident Response systems** include technology, signage, and communication systems that alert travelers and managing agencies when incidents such as crashes or peak congestion occur and provide recommended detours based on dynamic travel patterns.

- **Transit Improvements** include bus rapid transit, transit frequency and service improvements, and designation of transit priority corridors. These may also include strategies such as queue jumps to allow transit vehicles to bypass long vehicle queues, transit signal priority, which is a technology that increases signal green time for transit movements, and dedicated transit lanes.

- **Improving Connectivity** refers to providing additional street or sidewalk connections between land uses so that travel can be dispersed away from high-traffic roadways.

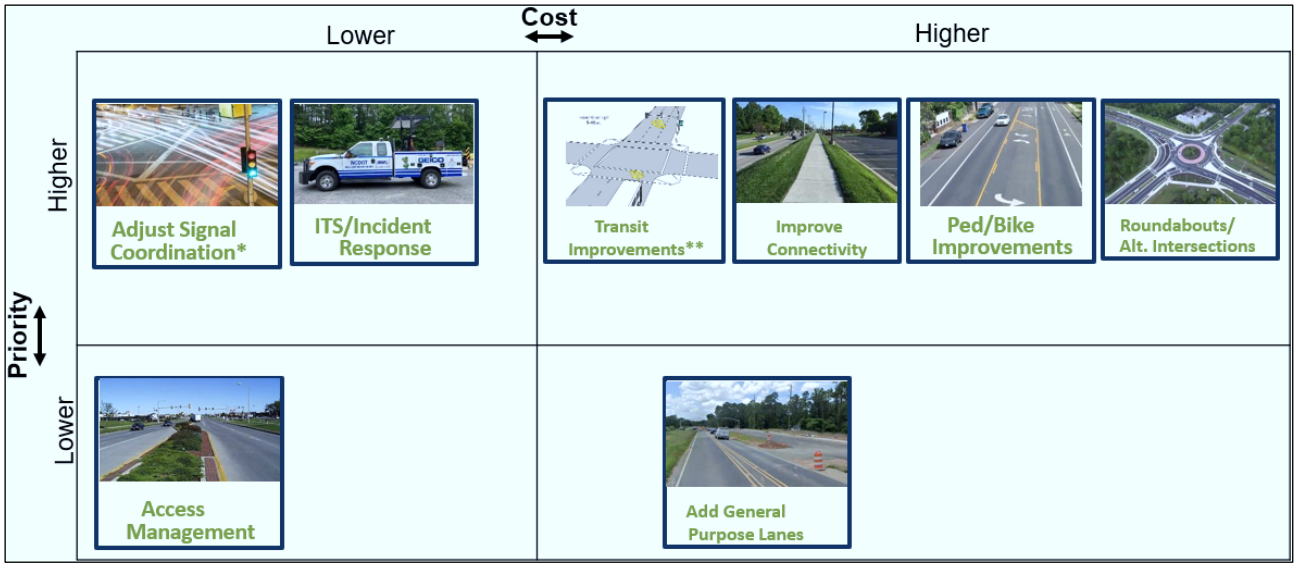
- **Pedestrian and Bicyclist Improvements** are a wide range of treatments to improve safety and encourage active transportation, including filling sidewalk gaps, improving crosswalks at intersections, adding on-street bicycle lanes or shared-use paths, or reconfiguring existing street space to provide dedicated lanes for active transportation users.

- **Roundabouts or other Alternative Intersections** can reduce traffic speeds and improve safety at intersections by changing the physical geometry of the roadway and reducing conflicts between vehicles and between vehicles and pedestrians/bicyclists. Depending upon their application, these treatments can also be used to increase intersection capacity or efficiency compared with signal or stop-control.

- **Access Management** includes limiting new driveways, removing or consolidating existing driveways, and discouraging full-movement driveways through the use of medians or other treatments on roadways. These strategies can improve safety and mobility by decreasing left-turning traffic, and they also reduce conflicts between turning vehicles and pedestrians/bicyclists.

- **General purpose lanes** to increase the capacity of the roadway by adding lanes open to all vehicles. While this remains a basic method to address congestion and travel time reliability along freeways, the DCHC MPO and local agency staff have indicated that expanding roadways should be the lowest priority strategy and explored only if all other options are infeasible.

Figure 5.6 2-4 Lane Undivided Arterial Corridor Mitigation Strategies



* Including signal timing adjustments for multimodal trips

** Transit improvements may include BRT, service frequency increase, and transit priority corridors.

5.3.4 Strategies for Interchange Areas

In addition to the mitigation strategies described above, a specific set of strategies was developed for interchange area improvements, displayed in Figure 5.7. The following is a brief description of each strategy:

- **Adjusting signal timing or phasing** includes minor adjustments to existing traffic signals to improve traffic progression, potentially mitigate conflicting vehicle turning movements, and increase intersection efficiency without expanding the roadway. The DCHC MPO and local agency staff have also expressed a desire to adjust signal timings to favor movements corresponding to transit routes.

- **Signalizing Crosswalks** provides a dedicated signal phase for pedestrian and bicyclist movements at intersections between the freeway ramps and the cross street.

- **Reducing the turning radii** for right- and left-turn movements decreases vehicle speeds and can reduce the crossing distance/exposure area at crosswalks.

- **Adding Sidewalk or Bicycling Facilities** include are a wide range of treatments to improve safety and encourage active transportation and can help fill in gaps in the walking/bicycling network around or across freeways. These may be either at-grade or above/below grade strategies.

- **Adding or Lengthening Turn Lanes** provides additional capacity improvements without a large expansion of the intersection footprint.

- **Extending the Ramp Queue Storage** can provide additional capacity on off-ramps without a large expansion of the intersection footprint.

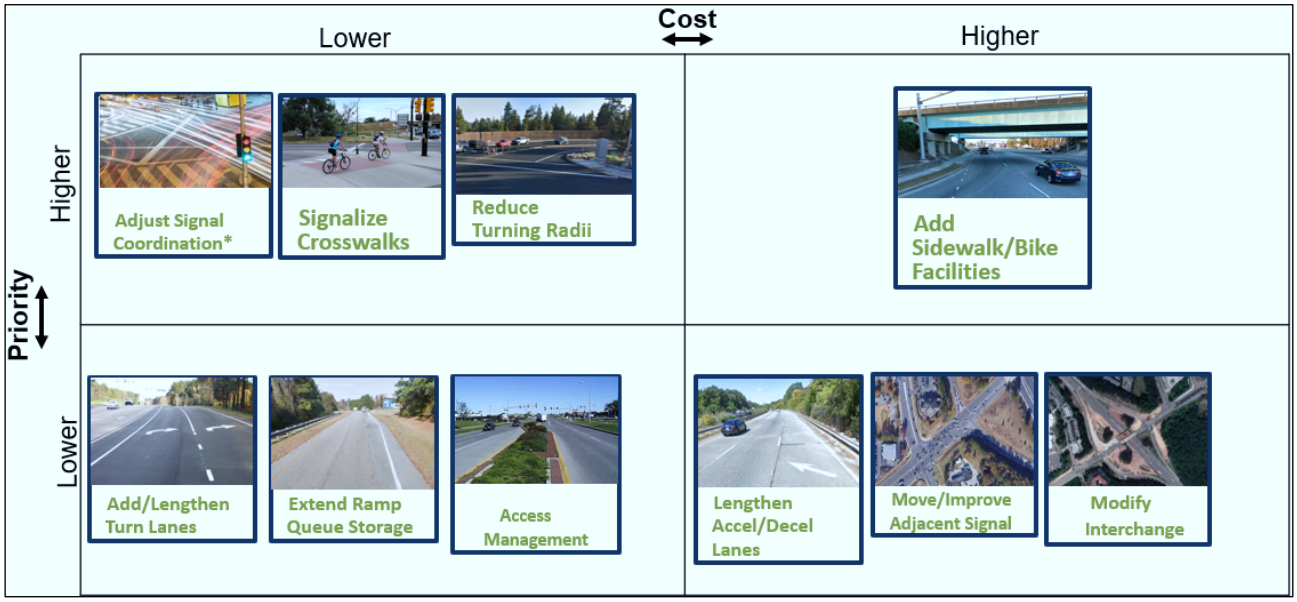
- **Access Management** includes limiting new driveways, removing or consolidating existing driveways, and discouraging full-movement driveways through the use of medians or other treatments on roadways near the interchange. These strategies can improve safety and mobility by decreasing left-turning traffic, and they also reduce conflicts between turning vehicles and pedestrians/bicyclists.

- **Lengthening acceleration/deceleration lanes** at interchanges can provide additional merge space on the freeway and help improve capacity and reduce weaving conflicts between vehicles without expanding the freeway over long distances.

- **Moving or Improving Adjacent Traffic Signals** can help reduce queue spillback into the interchange and improve traffic flow and safety at the interchange during peak period.

- **Modifying the Interchange** to provide additional ramps or converting to an alternative interchange form such as a Diverging Diamond Interchange (DDI) is another strategy to improve safety and mobility.

Figure 5.7 Interchange Area Mitigation Strategies



* Including signal timing adjustments for multimodal trips

5.4 Recommended Mitigation Strategies

The following sections discuss the recommended mitigation strategies for each of the underperforming corridors and intersections identified in the CMP assessment.

5.4.1 Recommended Improvements for Unreliable Corridor Segments

A series of mitigation strategies was applied to each of the 10 corridors identified as underperforming within the CMP assessment documented in 5.1 Roadway Corridor Segments. These corridor improvement strategies are presented in Table 5.3.

Table 5.3 Roadway Corridor Improvements

Roadway	Segment	Distance (in miles)	Current Cross-section	Highest Speed Limit	Highest 2019/2021 AADT	Potential Mitigation Strategies
I-40	I-885 to Wake County Line	3.71	8 to 10 Lanes	65 mph	195,000	• Ramp metering • Modernize ramps and extend acceleration/deceleration lanes at interchanges (Note: *Bus on Shoulder* is currently provided on I-40 from US 15/501 in Durham to Wade Ave in Raleigh)
I-40	NC 751 to NC 54	3.33	6 to 7 Lanes	65 mph	128,000	• Ramp metering

Roadway	Segment	Distance (in miles)	Current Cross-section	Highest Speed Limit	Highest 2019/2021 AADT	Potential Mitigation Strategies
						• Modernize ramps and extend acceleration/deceleration lanes at interchanges • Bus rapid transit (Note: Bus on Shoulder is currently provided on I-40 from US 15/501 in Durham to Wade Ave in Raleigh)
I-885/NC 147	T.W. Alexander Dr to Briggs Ave	4.46	4 to 5 Lanes	65 mph	76,000	• Modernize ramps and extend acceleration/deceleration lanes at interchanges (see the **Note** below) • Additional ITS/integrated corridor management (where applicable) • Bus rapid transit (Bus on shoulder for GoTriangle Routes)
NC 147	Duke St to Swift Ave	1.10	4 to 5 Lanes	55 mph	66,000	• Modernize ramps and extend acceleration/deceleration lanes at interchanges (see the **Note 1** below) • Additional ITS/integrated corridor management (where applicable)
US 70	Miami Blvd to Pleasant Dr	1.30	4 to 5 Lanes	45 mph	44,000	• Access management/redirect left-turning movements at driveways and intersections (see the **Note 2** below) • ITS/integrated corridor management (where applicable) • Bus rapid transit (Note: there are no current transit routes along US 70, but this could support reliability for future routes) • Improve parallel road/grid street connection
US 15/501 Business	US 15/501 to NC 751	1.44	4 to 6 Lanes	45 mph	18,000	• Add restricted crossing intersections (RCIs) • Add sidewalks/paths and crosswalks where missing • Bus rapid transit (transit signal priority)
US 15/501	NC 54 to Estes Dr	1.25	4 to 5 Lanes	45 mph	45,000	• Add restricted crossing intersections (RCIs) / redirect left-turning movements • Fill in sidewalks/paths and provide pedestrian/bicycle connectivity • Bus rapid transit (transit signal priority) • ITS/integrated corridor management (where applicable) • Improve parallel road/grid street connection

Roadway	Segment	Distance (in miles)	Current Cross-section	Highest Speed Limit	Highest 2019/2021 AADT	Potential Mitigation Strategies
NC 54	I-40 to Barbee Chapel Rd	1.74	4 to 5 Lanes	45 mph	44,000	• Expand to 6 lanes or redesign as a Superstreet • Add restricted crossing intersections (RCIs) / redirect left-turning movements • Extend shared-use path • Bus rapid transit (transit signal priority) • ITS/integrated corridor management (where applicable)
NC 55	NC 54 to MLK Jr. Pkwy	2.02	4 to 5 Lanes	50 mph	37,000	• Access management/redirect left-turning movements at driveways and intersections • Add sidewalks/paths and crosswalks where missing • Bus rapid transit (transit signal priority)
NC 86	Downtown Chapel Hill	1.50	2 to 4 Lanes	35 mph	14,000	• Multimodal safety improvements • Bus rapid transit (transit signal priority)

Note 1: Travel demand on several high-priority corridors has likely been affected by the completion of the East End Connector (I-885 from NC 147 to US 70) in 2022. We recommend the performance of these corridors be reassessed when mobility and safety performance data become available from late 2022 or later. Additionally, the City of Durham is currently undertaking a feasibility assessment for converting a portion of NC 147 in Downtown Durham into an at-grade facility. We recommend the CMP recommendations along this corridor and any other affected corridors be reassessed after completion of that study to align the outcomes of both studies.

Note 2: The DCHC MPO is conducting the US 70 East Corridor Study since April 2022. The study is developing a long-term plan for a 4-mile segment of US 70 between the I-885/US 70 interchange and Wake/Durham County line. The goal is to provide a framework for a safe, efficient, and equitable multimodal transportation system along the corridor. The study will likely recommend a 4-lane divided urban arterial with shared-use path corridor design, and parallel frontage roads for access, bowtie and quadrant intersections at several locations for multimodal connectivity, and grade-separated pedestrian crossings. Our US 70 CMP recommendations will need to be further evaluated within the context of an adopted multimodal design of the US 70 corridor.

5.4.2 Recommended Improvements for Deficient Intersections

For each intersection identified as underperforming, a series of operational strategies was tested within the Synchro files provided by the DCHC MPO. An effort was made to begin with low-impact changes such as signal timing/phasing modifications. Then, either conventional turn lane or widening improvements or innovative intersection modifications were tested to identify the effects on LOS improvement. In many cases, multiple alternatives were developed to limit the strategies to a range of impacts. These intersection improvement strategies are presented in

Table 5.4 Intersections Improvements

No.	Intersection	Jurisdiction	Potential Mitigation Strategies	Multimodal Improvements
1	US 15/US 501/NC 54 at Manning Dr	Chapel Hill	A. Reallocate time to southbound signal phase B. Change northbound signal phasing to permissive only instead of split phasing C. Reconfigure to modified Reduced Conflict Intersection (RCI) but still allow southbound dual left turn movement on Manning Dr*	D. Provide/confirm minimum pedestrian crossing times E. Reduce cycle length from 180 seconds to 140 seconds (Note: Mitigation C will also reduce cycle lengths and crossing distances for active transportation users)
2	US 15/US 501/NC 54 at Carmichael St/Old Mason Farm Rd	Chapel Hill	A. Change Old Mason Farm Rd eastbound/westbound approaches to single phase (permissive left turns) and change lane configuration to left + shared through/right on eastbound/westbound approaches B. Relocate Fern Ln approach and remove from intersection	C. Extend medians on major street approaches to provide pedestrian refuges/two-stage crossings D. Reduce cycle length from 180 seconds to 150 seconds (in combination with Mitigations A and/or B)
3	NC 751 (Hope Valley Rd) at Garrett Rd	Durham	A. Change left turn phasing on northbound Garrett Rd to protected movement B. Prohibit left turns on northbound Garrett Rd	C. Provide minimum pedestrian crossing times D. Provide curb extensions on northwest and southeast quadrants to reduce turning speeds E. Add pedestrian refuge islands at crosswalks to improve pedestrian crossings (Note Mitigations A and B will both reduce conflicts between turning vehicles and pedestrians)
4	US 15/501 at Old Durham Rd/Sage Rd	Chapel Hill	A. Add one through lane in either direction of US 15/501 B. Convert to Reduced Conflict Intersection (RCI)	C. Provide crosswalks on all approaches and connect to sidewalk network on Old Durham Rd D. Extend medians on US 15/501 approaches to provide pedestrian refuges/two-stage crossings E. Provide pedestrian signal heads and incorporate minimum crossing times into signal plan
5	US 15/501 at Garrett Rd	Durham	A. Increase cycle length B. Convert to Reduced Conflict Intersection (RCI) (Note: US 15/501 corridor is currently ongoing evaluation as part of two NCDOT STIP projects)	C. Provide crosswalk/pedestrian signal heads on east leg D. Update minimum pedestrian crossing times
6	I-40 Westbound	Chapel Hill	A. Increase cycle length	n.a.

No.	Intersection	Jurisdiction	Potential Mitigation Strategies	Multimodal Improvements
	Ramps at NC 86		B. Other potential interchange improvements as part of NCDOT project I-3306A	
7	NC 54 Westbound Ramps at NC 86	Chapel Hill	A. Adjust signal timing	n.a.
8	NC 54 at Fayetteville Rd	Durham	A. Add dual westbound left turn lanes B. Convert to median U-turn (redirect all left turns and provide U-turn crossovers on NC 54 east and west of the main intersection)	C. Confirm minimum pedestrian crossing times D. Extend medians on all legs to provide pedestrian refuges/two-stage crossings
9	NC 54 at NC 55	Durham	A. Add dual eastbound left turn lanes B. Install a quadrant road (utilize Residence Inn Blvd in northwest quadrant and redirect all left turns from the main intersection)	C. Reduce lane widths, extend medians, and provide pedestrian refuges/two-stage crossings on all legs (currently funded through NCDOT project HS 2005-C) (Note Mitigation B will remove left turn lanes on all legs and can therefore provide additional median space and reduce crossing distances on all legs)
10	US 70 at Miami Blvd/Mineral Springs Rd	Durham	A. Install a Displaced Left Turn (DLT) intersection (crossover northbound and southbound left turns)	B. Add crosswalks, pedestrian signal heads, and push buttons on all legs
11	I-40 Westbound Ramps at NC 55	Durham	A. Change westbound approach to right-out only B. Add southbound through lane under I-40 underpass and convert southbound right turn lane to shared-through/right	C. Add crosswalks, pedestrian signal heads, and push buttons on all legs D. Extend sidewalk/trail from south side of I-40 interchange to Meridian Pkwy
12	I-40 Westbound Ramps at Davis Dr	Durham	A. Adjust signal timing and increase cycle length to 150 seconds B. Convert west leg to right-in/right-out	C. Adjust pedestrian signal head/push button placement D. Add ADA-compliant ramps and detectable warning surfaces
13	NC 147 Southbound Ramps at Chapel Hill St	Durham	A. Convert southbound off-ramp to left + shared left/through/right and increase cycle length to 100 seconds B. Install roundabout with southbound and eastbound exclusive right turn lanes	C. Restripe crosswalks (Note Mitigation B provides additional multimodal safety improvements due to slower traffic speeds and reduced conflict points)