Central Naugatuck Valley Region
Congestion Management System Report: 2008

Council of Governments of the Central Naugatuck Valley

September 2008

Approved by the Council of Governments: November 14, 2008

TITLE:	CONGESTION MANAGEMENT SYSTEM REPORT: 2008
AUTHOR:	Council of Governments of the Central Naugatuck Valley
SUBJECT:	Identification and evaluation of congestion in the Central Naugatuck Valley Region's transportation system
DATE:	September 2008
LOCAL PLANNING AGENCY:	Council of Governments of the Central Naugatuck Valley
SOURCE OF COPIES:	Council of Governments of the Central Naugatuck Valley 60 North Main Street, 3rd Floor Waterbury, CT 06702
SERIES NO.:	N/A
NUMBER OF PAGES:	34

ABSTRACT: The report identifies and evaluates congestion within the Central Naugatuck Valley Region by estimating travel speeds for selected major corridors with high V/C ratios. A GPS receiver was used to collect travel speeds along the study corridors during peak periods.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Page

Introduction

The *2008 Congestion Management System Report* (CMS) summarizes the results of COGCNV's traffic congestion monitoring for 2007-2008. It serves as a tool to identify deficiencies within the system and, in turn, to develop priorities for the region's *Long Range Transportation Plan* and the *Transportation Improvement Program*. The regional CMS analysis began with the *2006 Congestion Management System Report* in order to establish a framework for evaluating the region's highway system.

The CMS evaluates congestion problems within the Central Naugatuck Valley Region and supplements statewide traffic data developed by the Connecticut Department of Transportation (ConnDOT). ConnDOT provides an annual update of its *Congestion Screening and Monitoring Report*, which contains statistics and forecasts of congestion levels on state-maintained highways.

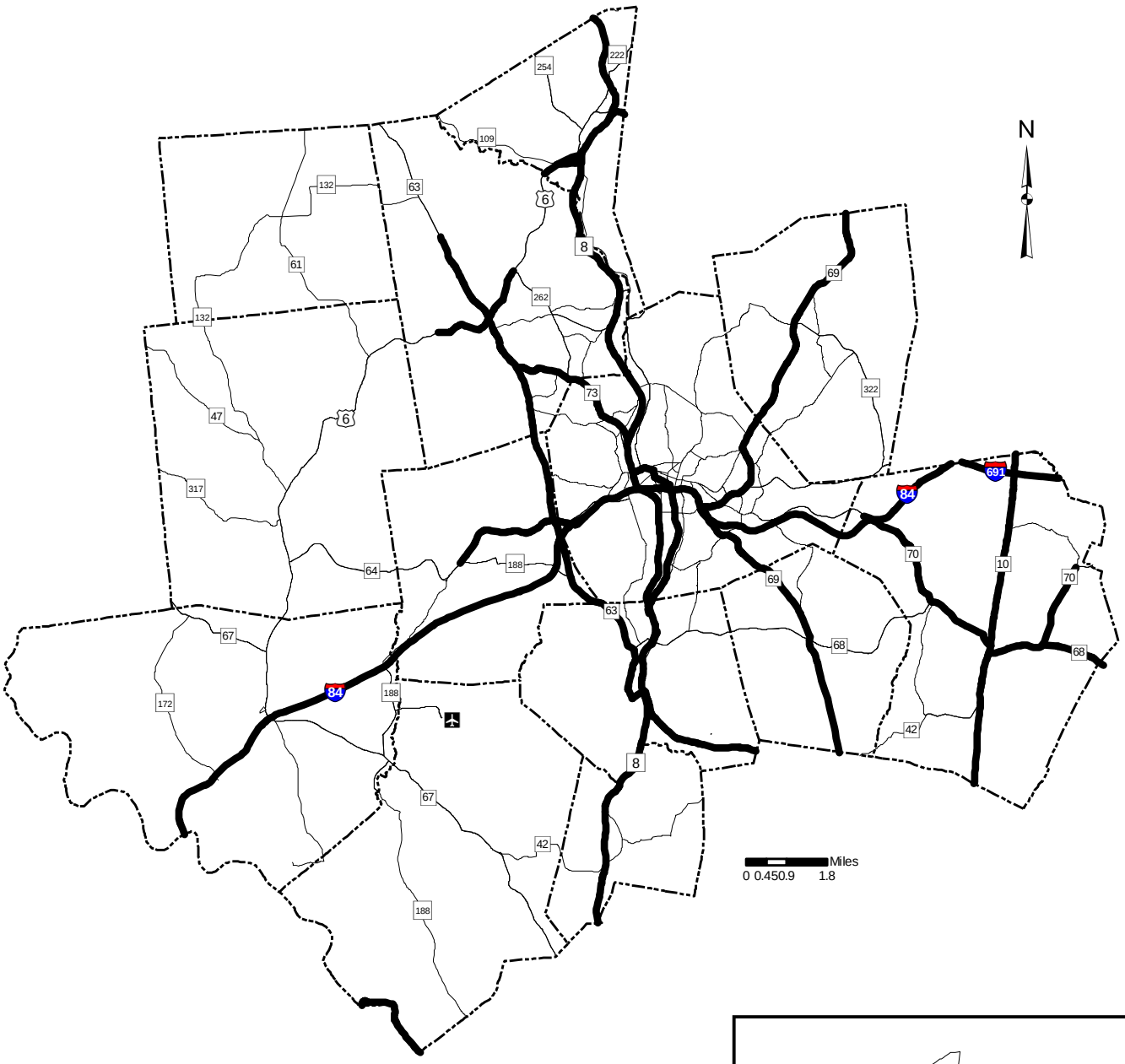
Defining the Congestion Management System Network

The 2008 CMS Report includes only highway travel. Other modes, including transit, pedestrian, and bicycle travel, may be addressed through future studies. Figure 1 shows the highway network studied in the CMS along with the arterial highways that assist in regional mobility. Only roads with a functional classification of principal arterial are analyzed in the report.

Highway functional classification is a system of categorizing road types using guidelines established by the Federal Highway Administration (FHWA). Principal arterials are the highest classified road type and carry the majority of traffic entering and leaving urban areas and the majority of traffic desiring to bypass urban centers. In the CNVR, the network of principal arterials consists of three limited-access highways (Route 8, Interstate 84, and Interstate 691) and segments of major state routes that facilitate travel between major destinations and through urban areas.

The network of principal arterials extends for 110 miles within the region, including 47 miles of limited-access highways. Table 1 lists the principal arterials within the CNVR and their respective mileage. For the purpose of the CMS, only those segments of the state routes that are classified as principal arterials are included in the measurements.

Figure 1: Principal Arterial Road Segments in the CNVR



CNVR Highway Network

- Town Boundaries
- Other Major Highways
- Principal Arterial Segments

Source: ConnDOT functional classification 2005

Table 1. Routes with Principal Arterial Segments in the Central Naugatuck Valley Region

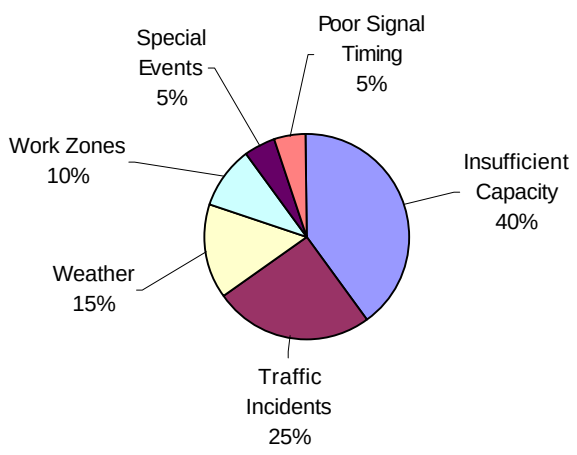
Route	Towns	Miles
6	Thomaston, Watertown	4.16
8	Beacon Falls, Naugatuck, Thomaston, Waterbury, Watertown	22.23
10	Cheshire	7.45
34	Oxford	2.04
63	Middlebury, Naugatuck, Waterbury, Watertown	15.17
64	Middlebury, Waterbury	3.35
68	Cheshire	1.31
69	Prospect, Waterbury, Wolcott	14.91
70	Cheshire	7.49
73	Waterbury, Watertown	3.46
I-84	Cheshire, Middlebury, Southbury, Waterbury	21.89
I-691	Cheshire	2.47
810	Thomaston	0.43
846	Waterbury	0.15
847	Naugatuck, Waterbury	3.89

Source: ConnDOT Functional Classification 2005

Identifying Congested Segments within the CMS Network

FHWA defines congestion as "the level at which transportation system performance is no longer acceptable due to traffic interference." FHWA reports that forty percent of all delay is caused by insufficient capacity or physical "bottlenecks."[1] Incidents such as crashes and disabled vehicles account for 25% of all delay. Inclement weather, poor signal timing, work zones, fluctuations in normal traffic, and special (non-recurring) events are also causes of delay. Figure 2 represents the distribution of each of these causes, excluding fluctuations in normal traffic.

Figure 2: Causes of Congestion



[1] Congestion Mitigation, FHWA, Office of Operations, Publication number FHWA-OP-04-047

Of the seven major causes of congestion, COGCNV focuses its recommendations on reducing delay caused by traffic incidents, poor signal timing, and insufficient capacity. COGCNV is least able to develop recommendations that will reduce delay caused by work zones, weather, fluctuations in normal traffic, and special events.

Incidents

According to FHWA, incidents such as crashes, disabled vehicles, and even roadside distractions account for 25% of all travel delays. COGCNV staff, using data from ConnDOT, monitors accidents on the highway system to identify high frequency accident locations that may be recommended for improvements.

The level of incident response to disabled vehicles or collisions may alleviate or aggravate the problem. COGCNV staff has worked with state and regional groups to improve incident response. Staff has participated in the Statewide Incident Management Task Force (SIMTF), which developed the Unified Response Manual as a guide for reducing response and clearance times on limited-access highways throughout the state. Within the region, the CNV Emergency Planning Committee acts as our incident management team. The committee is responsible for organizing regional exercises and disseminating best management practices to local emergency responders.

Poor Signal Timing

According to FHWA, 5% of all delay results from poor signal timing. Signal schemes and phasing are often outdated and do not account for increased volumes or changes in traffic patterns. The COGCNV report, *Central Naugatuck Valley Region Intersection Analysis: 2004,* identifies poor performing intersections and recommends improvements. Staff will continue to monitor the intersections included in the study and identify other intersections that are causing significant delay in the highway network.

Insufficient Capacity

The region's *Long Range Transportation Plan: 2007-2035* identifies highway segments on state roads with insufficient capacity, based on volume-to-capacity (V/C) ratios provided by ConnDOT. Insufficient capacity is the primary method of identifying highway corridors that warrant further monitoring.

Volume-to-Capacity Ratio
V/C ratio is defined as the peak hour traffic volume divided by a road segment's hourly vehicle capacity. Road segments with V/C ratios of 1.0 or higher have traffic volumes that meet or exceed the road's hourly capacity during peak periods. Roadways begin to reach capacity at V/C ratios of 0.9. System failure and unstable conditions occur as V/C ratios approach 1.0, leading to longer delays and "stop and go" conditions.

When no traffic is present, the V/C ratio is zero, and traffic flows unimpeded at the free flow speed (FFS). The free flow speed is the average speed that a vehicle travels under low-volume conditions. On urban streets, delay at signalized intersections is excluded. The free flow speed varies based on road type, design, condition, land use, and location.

Monitoring System Performance

Data Collection & Processing

In 2007 and 2008, COGCNV staff collected travel time and speed data for the region's three expressways and principal arterial routes that have segments with V/C ratios above 1.0, as determined by ConnDOT's *Congestion Screening and Monitoring Report*.[2] These segments were identified in the *Long Range Transportation Plan 2007-2035* and expanded to create study corridors for the report. Figure 3 shows state road segments that are approaching or exceeding capacity.

Although not included among these corridors, speed data was also collected along Huntingdon Avenue, Homer Street and Chase Avenue. This route contains the highest priority non-interstate highway projects in the regional Transportation Improvement Program. Lakewood Road was added to this route to complete the connection between Route 8 and the commercial corridor on Route 69. A review of the travel speed data can be found in Appendix A.

Speed data and travel times were recorded with a GPS receiver as staff drove along each corridor during morning and evening peak hours. Peak hours for each road were identified using traffic data from ConnDOT's *Traffic Count Locator* program. Each route was traveled at least three times in each direction in the morning and evening. Technical information on the data collection and processing is included as Appendix B.

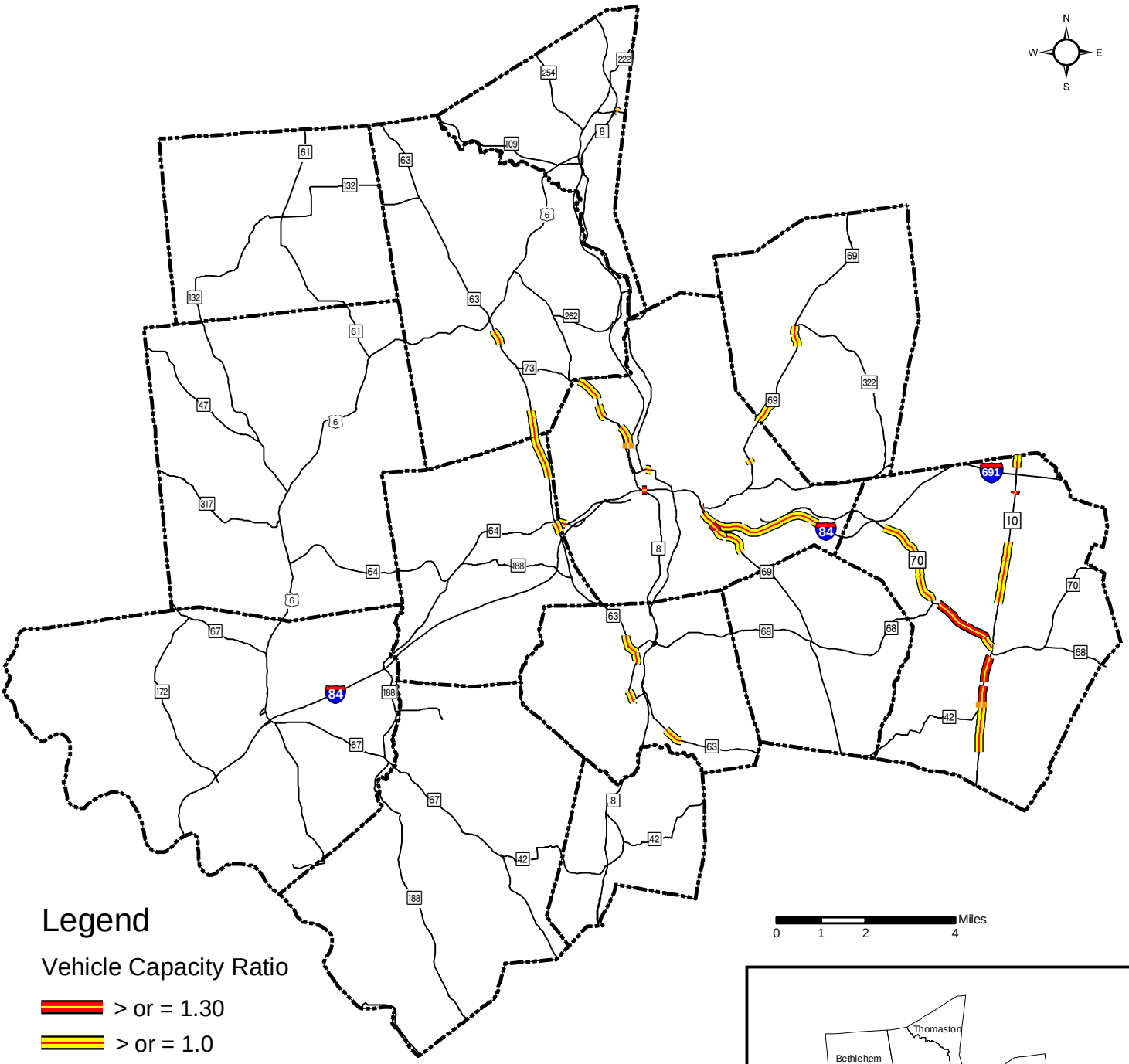
The data was sorted and analyzed using GIS (geographic information system) software that computed the average travel speeds for each route, broken down into segments. In the previous *CMS* report, average travel speeds were calculated and mapped for each corridor.

A new method was developed for this report in which average travel speed calculations are compared with free flow speeds (FFS). For each segment, an estimated FFS was determined using guidelines from the *Highway Capacity Manual*. The corresponding map for each route shows the percent difference between free flow speeds and average travel speeds.

All estimates of average daily traffic (ADT) and volume-to-capacity ratios are from ConnDOT's *Congestion Screening and Monitoring Report: 2007*. ADT estimates for Huntingdon, Homer, Chase, and Lakewood Road were collected by ConnDOT in 2005.

[2] Short segments at Route 6 east of Route 8 in Thomaston, Route 64 east of Route 63 in Waterbury, and SR 847 (West Main St) near Sperry St in Waterbury did not warrant travel time and speed analysis. I-691 was included as it is part of the region's expressway network, although it has no segments with V/C ratios > 1.0.

Figure 3: Most Congested Road Segments in the CNVR CMP Network: 2006



Source: ConnDOT 2006 Congestion Screening and Monitoring Report

Evaluating System Performance

Route 8

Route 8 has the characteristics of an urban freeway throughout most of the region, with segments in Thomaston and Watertown that are considered rural. Traffic volumes in the region range from 20,000 vehicles per day in Thomaston to 79,400 at the I-84 interchange. The free flow speed fluctuates between 62 mph in the urban core and 70 mph in rural areas, but remains at 64 mph along most of the route. The limited number of lanes, reduced shoulder widths, and interchange frequency leads to lower free flow speeds.

The speed data for Route 8 in the CNVR is highlighted below:

- Most segments of Route 8 in the region operate at or above free flow speed with average travel speeds around 65 to 66 mph during both peak periods.
- Average speeds in either direction are slower at the Route 73 junction and in the vicinity of I-84 than on the entire length of Route 8 in the CNVR.
- Minor delays also occur in Naugatuck and Beacon Falls.

Speed data for both Northbound and Southbound Route 8 traffic is presented in Tables 2 and 3. The data is shown on maps of Route 8 in Figures 4 and 5.

Table 2: AM Peak Period Speed Data for Route 8 Northbound and Southbound Segments

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Northbound	Average Speed Southbound
Rte. 8 in CNVR	22.2	40-65	60-70	66.5	66.4

Source: COGCNV travel time and speed data collection: 2007-2008

Table 3: PM Peak Period Speed Data for Route 8 Northbound and Southbound Segments

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Northbound	Average Speed Southbound
Rte. 8 in CNVR	22.2	40-65	60-70	64.6	64.8

Source: COGCNV travel time and speed data collection: 2007-2008

Figure 4: Route 8 Morning Peak 2007-2008

Percent Reduction in Speed

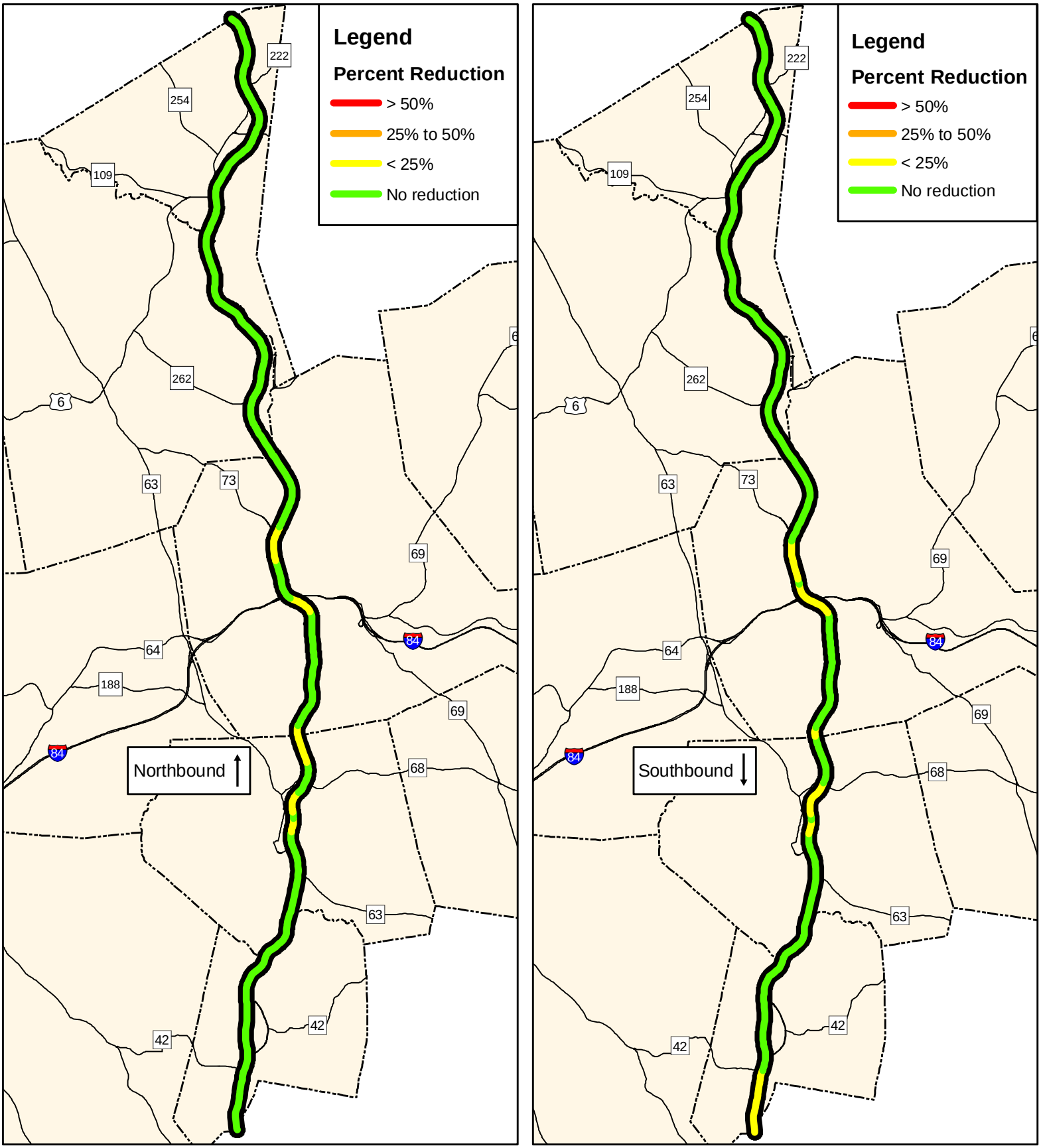
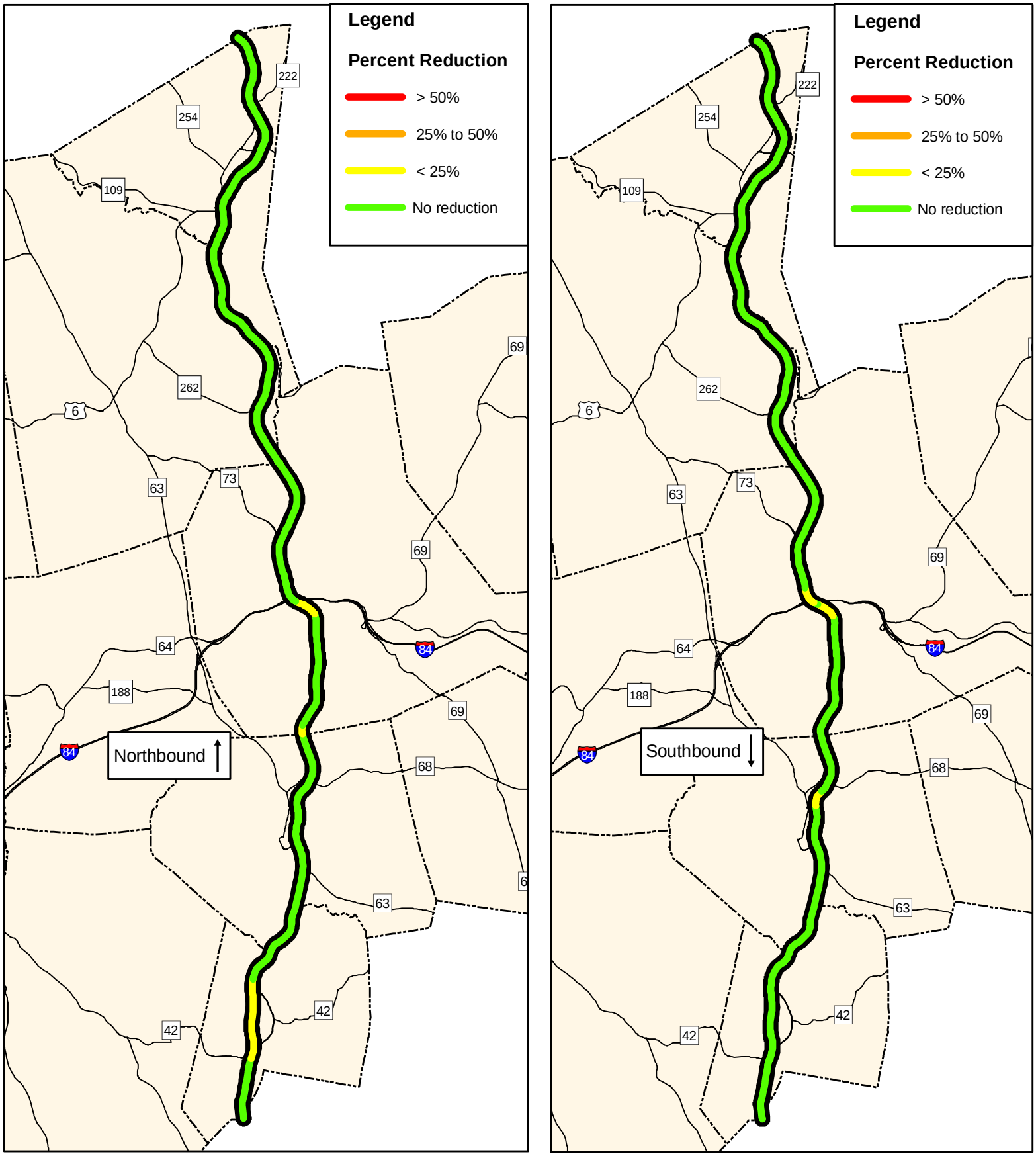


Figure 5: Route 8 Evening Peak 2007-2008

Percent Reduction in Speed



I-691

I-691 is included in the study as one of the three expressways in the region. According to ConnDOT's V/C estimates, the highway has not yet reached capacity in this area. Traffic volumes on I-691 in Cheshire range from 14,300 to 55,100 vehicles per day. In Cheshire, I-691 is considered urban, but has the characteristics of a rural freeway. The estimated free flow speed for I-691 is 66 mph.

The speed data for I-691 in Cheshire is highlighted below:

- During the morning peak, traffic flows at or above free flow speed. During the evening peak, traffic was slightly below the free flow speed with westbound traffic experiencing more of a delay.
- The slowest average speed was 56 mph. It occurred during the evening peak near the I-84 East onramp to I-691.

Speed data for both eastbound and westbound traffic is presented in Tables 4 and 5. The data is shown on maps of I-691, Route 10, and Route 70 in Figures 6 and 7.

Table 4: AM Peak Period Speed Data for I-691 Eastbound and Westbound Segments

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Eastbound	Average Speed Westbound
I-691 in CNVR	2.47	65	66	67.2	68.1

Source: COGCNV travel time and speed data collection: 2007-2008

Table 5: PM Peak Period Speed Data for I-691 Eastbound and Westbound Segments

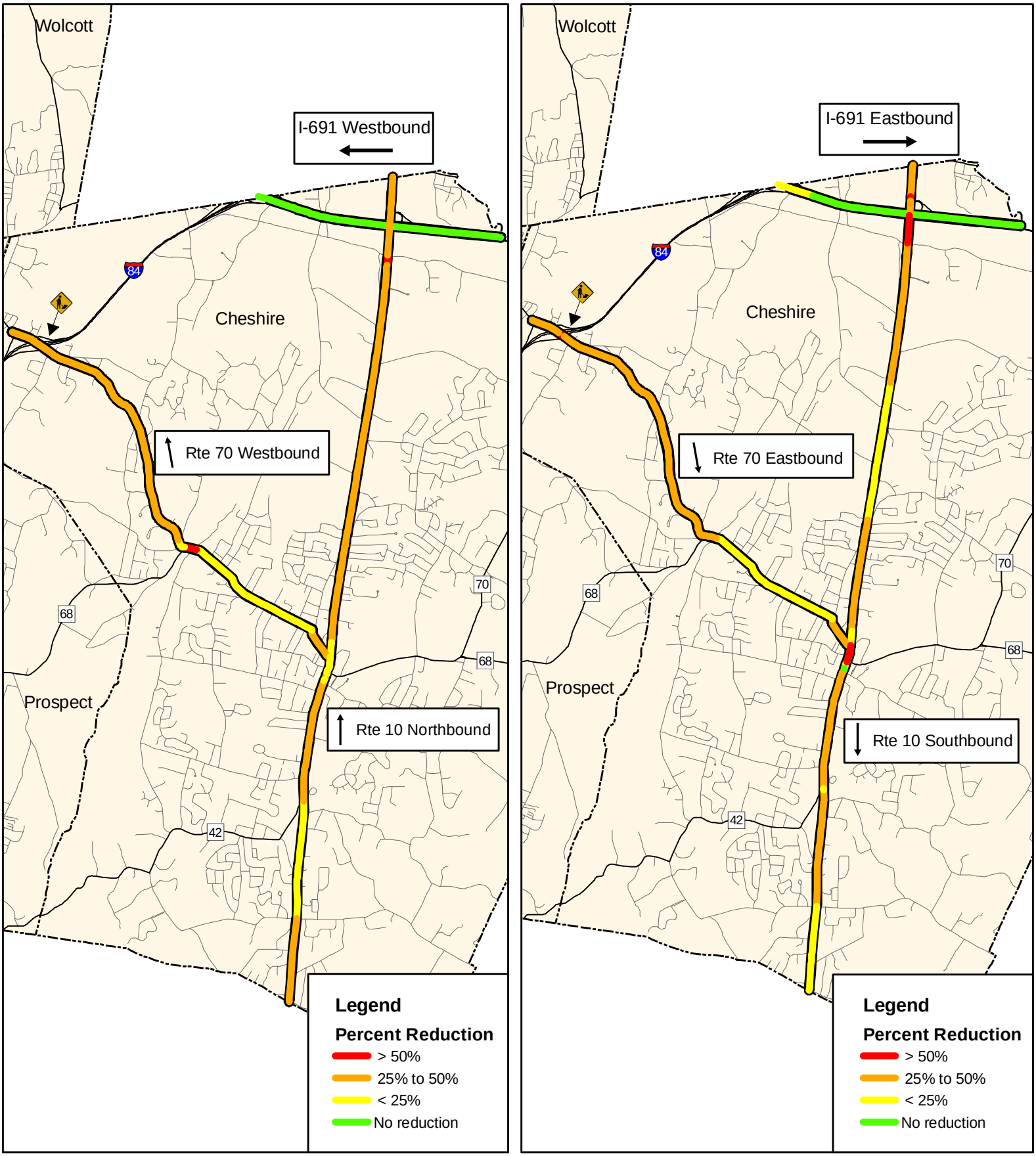
Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Eastbound	Average Speed Westbound
I-691 in CNVR	2.47	65	66	62.6	60.0

Source: COGCNV travel time and speed data collection: 2007-2008

The data indicates that congestion is focused in the area of the interchange with I-84. COGCNV staff observed that congestion on the ramps to and from I-84 is a common occurrence during the evening peak. Average speeds in that area were still within a narrow range and less than 10 mph slower than the free flow speed. Otherwise, travel along I-691 is typically free flow, even during peak periods.

Figure 6: Route 10, 70, and I-691 Morning Peak 2007-2008

Percent Reduction in Speed

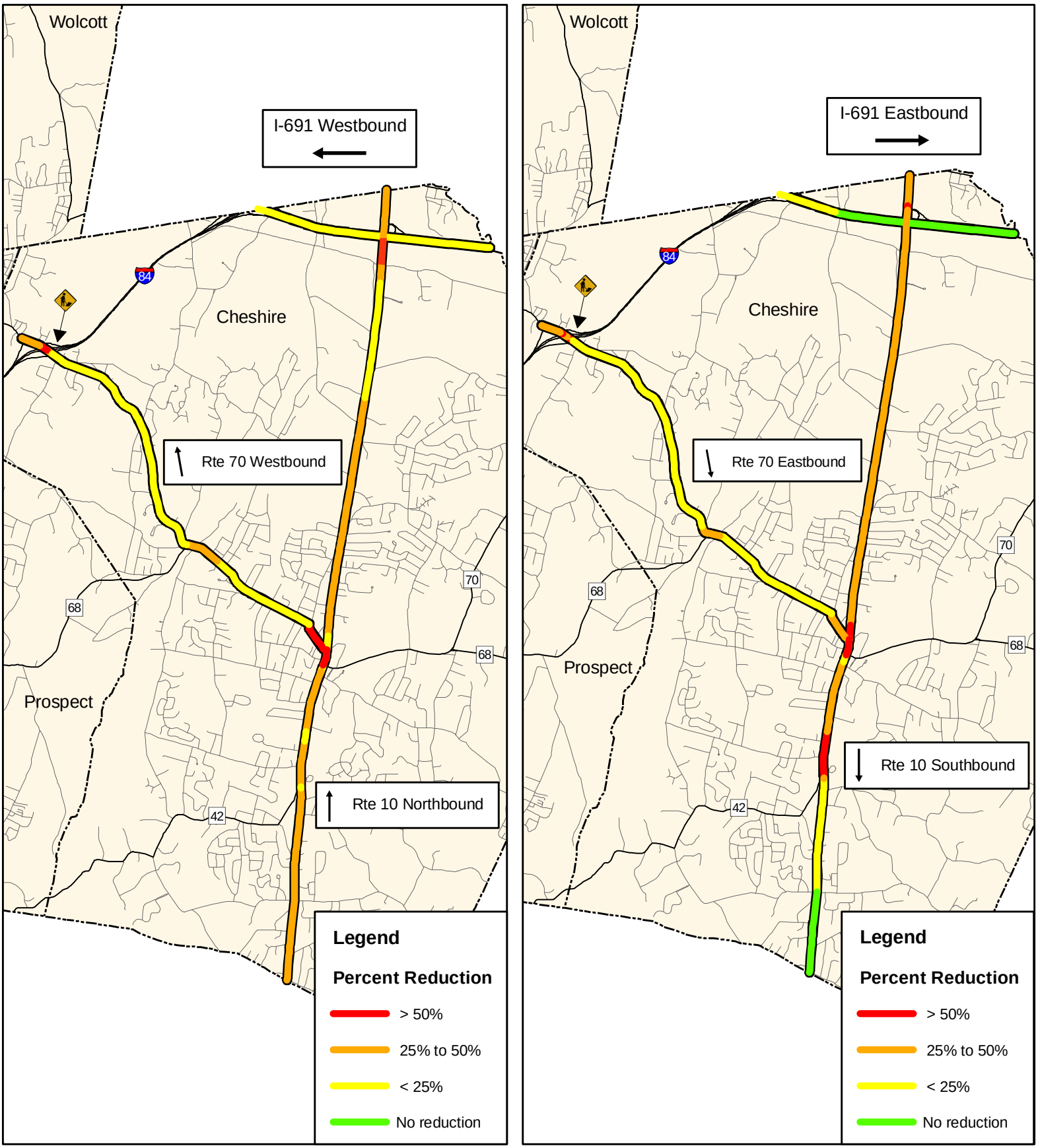


0 0.5 1 Miles

COUNCIL OF GOVERNMENTS
CENTRAL NAUGATUCK VALLEY

Figure 7: Routes 10, 70, and I-691 Evening Peak 2007-2008

Percent Reduction in Speed



0 0.5 1 Miles

COUNCIL OF GOVERNMENTS
CENTRAL NAUGATUCK VALLEY

I-84

Traffic volumes along I-84 vary greatly across the region, from a 2006 ADT estimate of 55,100 in Southbury to 125,700 in Waterbury. Free flow speeds along I-84 in the CNVR range from 60 to 68 mph. Estimates of free flow speed are reduced in some areas because of the limited number of lanes, reduced shoulder widths, and interchange densities. The construction project between Cheshire and Waterbury is scheduled to be completed in November 2008. The upgrade will continue through the east side of Waterbury from Pierpont Road to Route 69. The upgrade projects in Waterbury and Cheshire are expected to improve the level of service on this section of I-84.

The speed data for I-84 in the CNVR is highlighted below:

- Eastbound traffic encounters more of a delay than westbound traffic, particularly during the evening peak period.
- During the morning peak period, average eastbound travel speeds are below 25 mph from the Washington Street/Route 69 overpass to the exit for Austin Road, and from the Waterbury-Cheshire town line to the exit for Route 70.
- During the evening peak period, eastbound delays are most severe in Waterbury between the South Main Street overpass and the exit for Harper's Ferry Road, where the highway transitions from three lanes to two.
- Westbound delays are more common from the Route 70 interchange the Waterbury-Cheshire town line.

Speed data for eastbound and westbound I-84 traffic is presented in Tables 6 and 7. The data is also shown on maps of I-84 in Figures 8 and 9.

Construction Impact

Construction between the Austin Road interchange and the Cheshire-Southington town line contributed to some of the observed delay. While construction activities only accounted for part of the delay during data collection, lane closures, temporary work zones, and other limitations restricted the flow of traffic during peak hours.

Table 6: AM Peak Period Speed Data for I-84 Eastbound and Westbound:

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Eastbound	Average Speed Westbound
I-84 in CNVR	21.89	50-65	60-68	53.6	59.8

Source: COGCNV travel time and speed data collection: 2007-2008

Table 7: PM Peak Period Speed Data for I-84 Eastbound and Westbound

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Eastbound	Average Speed Westbound
I-84 in CNVR	21.89	50-65	60-68	55.2	57.6

Source: COGCNV travel time and speed data collection: 2007-2008

Truck Traffic

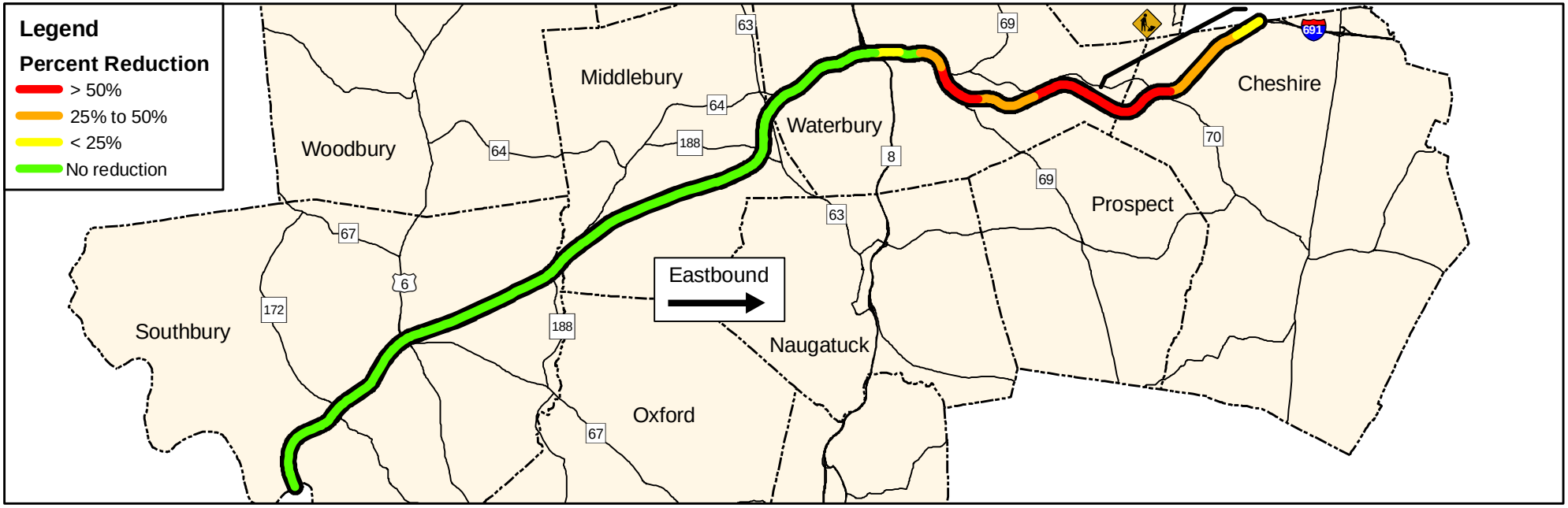
According to ConnDOT's *Congestion Screening and Monitoring Report*, heavy trucks account for 13.6% of all vehicles on I-84 in the CNVR, adding an estimated 232 hours of delay annually. This figure is comparable to other major freight corridors in the state, where trucks typically make up between 13.5% and 14.8% of traffic.

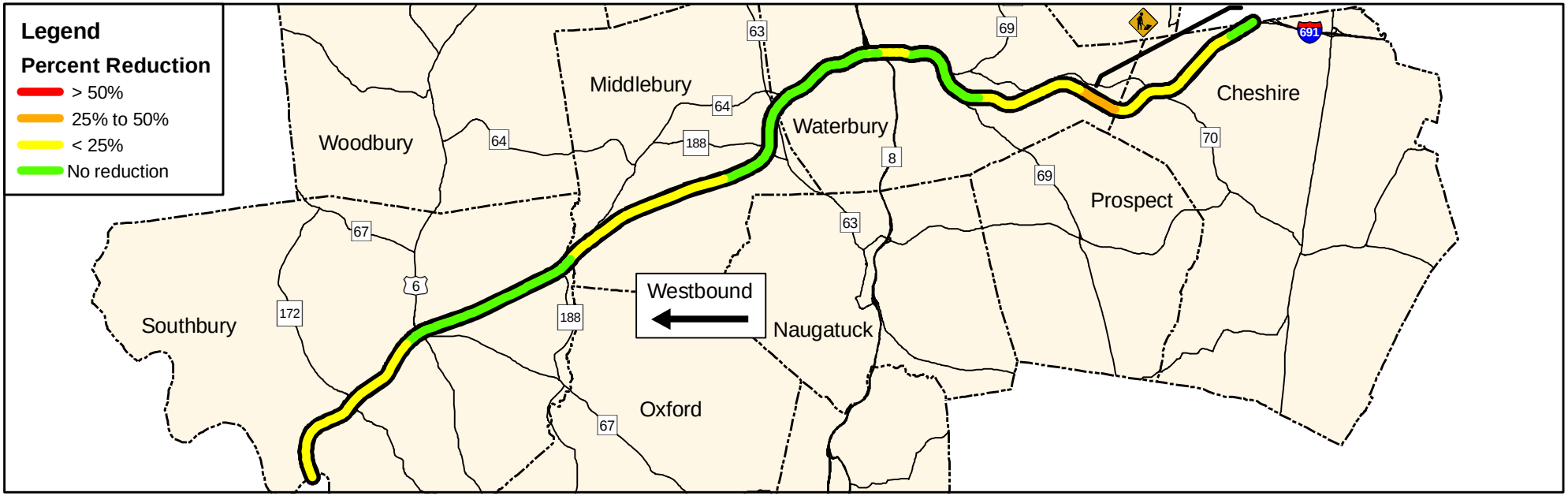
Present Conditions

The most severe congestion is located on the east side of Waterbury between the Washington Street/Route 69 overpass and Austin Road. This section has not been upgraded, and has only two lanes in either direction east of Hamilton Avenue. Travel speed data confirms the severity of congestion in this area, which results in eastbound speeds that average 27 mph below the free flow rate; or between 33 to 38 mph. Westbound speeds, however, average only 7 mph below the free flow rate; or 53 to 59 mph.

Figure 8: I-84 Morning Peak 2007-2008

Percent Reduction in Speed



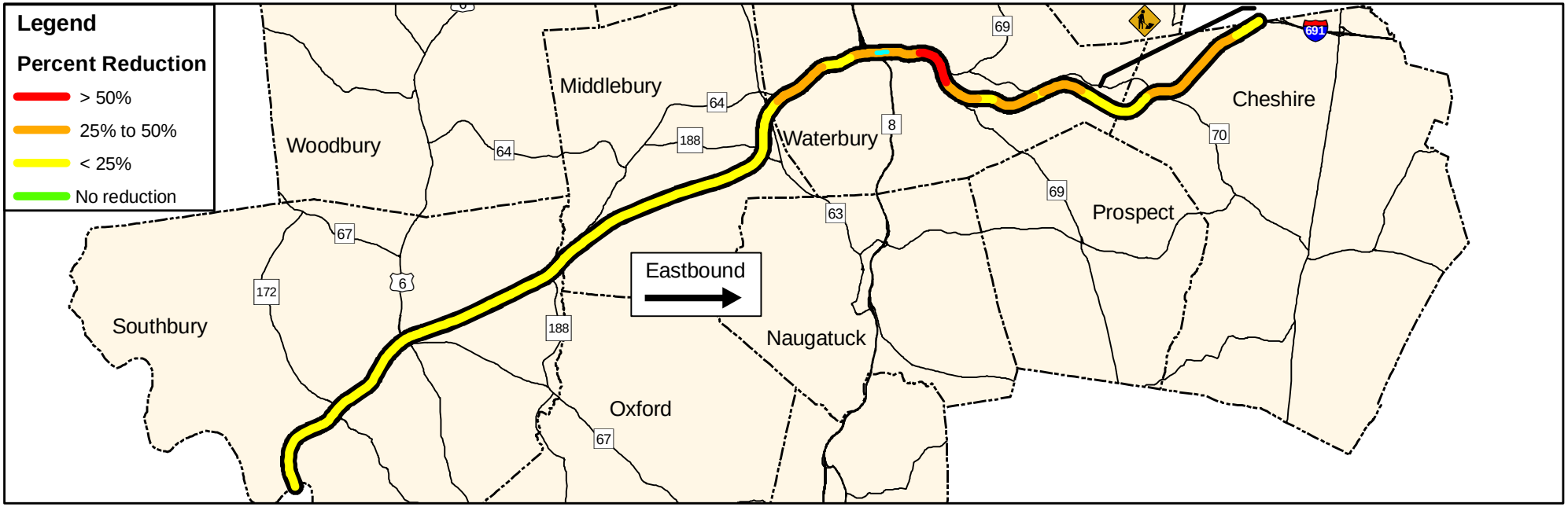


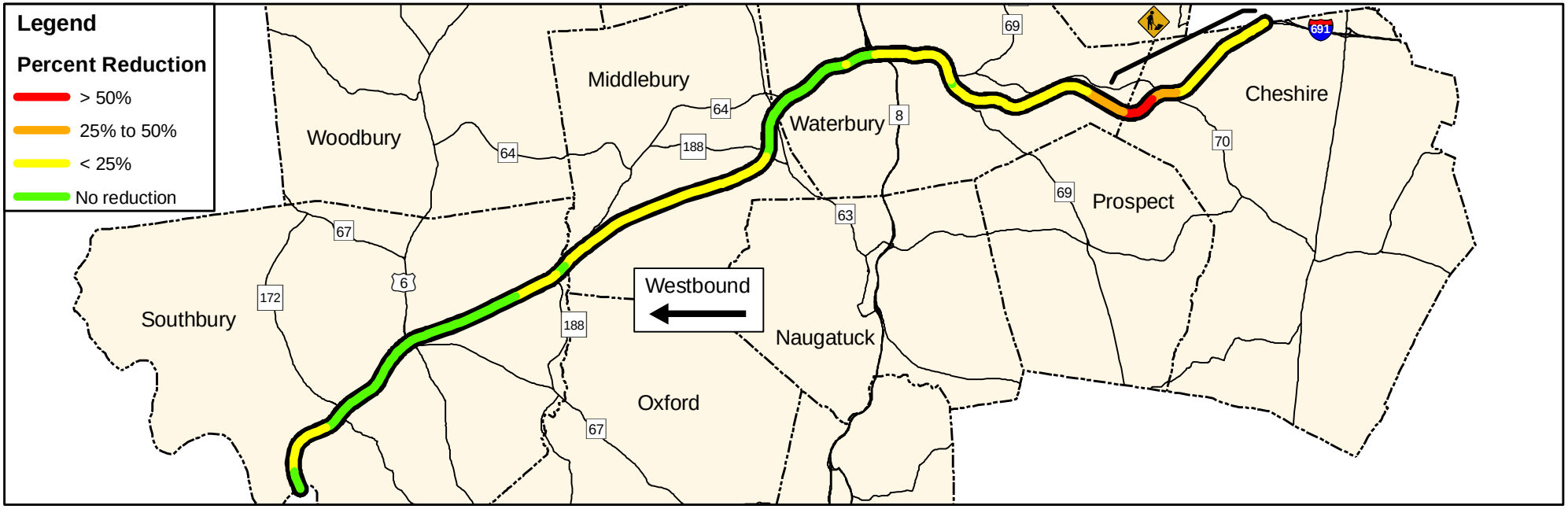
0 2.5 5 Miles

COUNCIL OF GOVERNMENTS
CENTRAL NAUGATUCK VALLEY

Figure 9: I-84 Evening Peak 2007-2008

Percent Reduction in Speed





0 2.5 5 Miles

COUNCIL OF GOVERNMENTS
CENTRAL NAUGATUCK VALLEY

Route 10

Route 10 is a major north-south highway that runs through Cheshire and connects the region with other urban and commercial centers. According to ConnDOT's estimates, some of the most congested road segments in the region are located along Route 10, where V/C ratios are well over 1.0, and traffic volumes reach 30,700 vehicles per day. Free flow speeds on Route 10 range from 30 mph through the center of Cheshire to 50 mph in less developed areas. Insufficient capacity, high signal density, and dense development are the greatest factors contributing to delay along this route. The peak hour speed data for Route 10 segments is highlighted below:

- The entire length of Route 10 in Cheshire experiences speed reductions over 25% in at least one direction.
- During the morning peak, the most significant delays occur near the I-691 interchange, at East Johnson Avenue, and at the junction with Route 68/70.
- During the evening peak, the most significant delays occurr at the I-691 interchange, the junctions with Route 68/70, and the Route 42 intersection.
- During the peak periods in both directions, the average travel speed is 30 mph.

Speed data for northbound and southbound traffic is represented on maps of Route 10, Route 70, and I-691 in Figures 6 and 7. The data is also presented in Tables 14 and 15.

Table 8: AM Peak Period Speed Data for Route 10 Northbound and Southbound Segments

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Northbound	Average Speed Southbound
Rte. 10 in Cheshire	7.5	25-45	30-50	30.0	30.2

Source: COGCNV travel time and speed data collection: 2007-2008

Table 9: PM Peak Period Speed Data for Route 10 Northbound and Southbound Segments

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Northbound	Average Speed Southbound
Rte. 10 in Cheshire	7.5	25-45	30-50	29.6	30.1

Source: COGCNV travel time and speed data collection: 2007-2008

Route 70

Route 70 is a major east-west arterial through Cheshire that connects I-84 with Route 10. According to ConnDOT's estimates, some of the most congested road segments in the region are located along Route 70, where V/C ratios are well over 1.0, and traffic volumes reach 20,200 vehicles per day. Since all of these segments are located between I-84 and Route 10, data collection was limited to this 4.5 mile section. Free flow speeds on Route 70 range from 35 to 50 mph. The peak hour traffic speed data for Route 70 segments is highlighted below:

- Delay occurs most frequently at the I-84 interchange and the junction with Route 10. During the morning peak, westbound traffic also experiences significant delay at the west junction with Route 68 (Prospect Road).
- During the morning peak period, the average speed is 32 mph for both northbound and southbound traffic, with a minimum average speed around 15 mph.
- During the evening peak period, the average speed is 35 mph for both northbound and southbound traffic, with a minimum average speed around 12 mph.

Speed data for the studied portion of Route 70 is presented in Tables 10 and 11. The data is shown on maps of Route 10, Route 70, and I-691 in Figures 6 and 7.

Table 10: AM Peak Period Speed Data for Route 70 Eastbound and Westbound Segments

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Northbound	Average Speed Southbound
Route 70 from I-84 to Rte. 10	4.5	30-40	35-50	31.8	31.6

Source: COGCNV travel time and speed data collection: 2007-2008

Table 11: PM Peak Period Speed Data for Route 70 Eastbound and Westbound Segments

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Northbound	Average Speed Southbound
Route 70 from I-84 to Rte. 10	4.5	30-40	35-50	35.4	33.6

Source: COGCNV travel time and speed data collection: 2007-2008

Construction Impact

Construction in the area of the I-84 interchange at Exit 26 contributed to some of the observed delay. With recent improvements made to the interchange, the intersections at the bottom of the ramps should experience better traffic flow.

Route 73

Route 73 runs 3.5 miles from Route 8 in Waterbury to Route 63 in Watertown. For 41% of the route, the V/C ratio is 1.0 or greater, indicating "bottleneck" conditions. Free flow speeds on Route 73 range from 35 to 40 mph based on the highway design and development along each segment. ConnDOT estimates 2006 ADT volumes between 9,000 and 27,200 vehicles. To the south of Eastern Avenue in Waterbury, ADT figures were above 18,000 vehicles.

The peak hour traffic speed data for Route 73 segments is highlighted below:

- Average travel speeds on Route 73 range from 31 to 33 mph during peak periods. Minor delays occur in both directions, typically within 10 mph of the free flow speed.
- The area between Buckingham Street and Davis Street in Oakville experiences the most congestion. An average speed of 12 mph was recorded at the segment near Hillside Avenue.
- Construction caused additional delay between Irvington Avenue and E. Aurora Street during the study period. It is difficult to determine the degree of congestion along this segment under normal conditions. The redesign of the Tompkins Street and Watertown Avenue (SR 846) intersections is expected to increase capacity in the corridor and improve safety and mobility.

Speed data for eastbound and westbound Route 73 traffic is presented in Tables 12 and 13. This data is also shown in Figures 10 and 11.

Table 12: AM Peak Period Speed Data for Route 73 Eastbound and Westbound Segments

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Eastbound	Average Speed Westbound
Length of Rte. 73	3.46	25-40	35-40	31.2	31.2

Source: COGCNV travel time and speed data collection: 2007-2008

Table 13: PM Peak Period Speed Data for Route 73 Eastbound and Westbound Segments

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Eastbound	Average Speed Westbound
Length of Rte. 73	3.46	25-40	35-40	31.1	29.6

Source: COGCNV travel time and speed data collection: 2007-2008

Figure 10: Route 73 Morning Peak 2007-2008

Percent Reduction in Speed

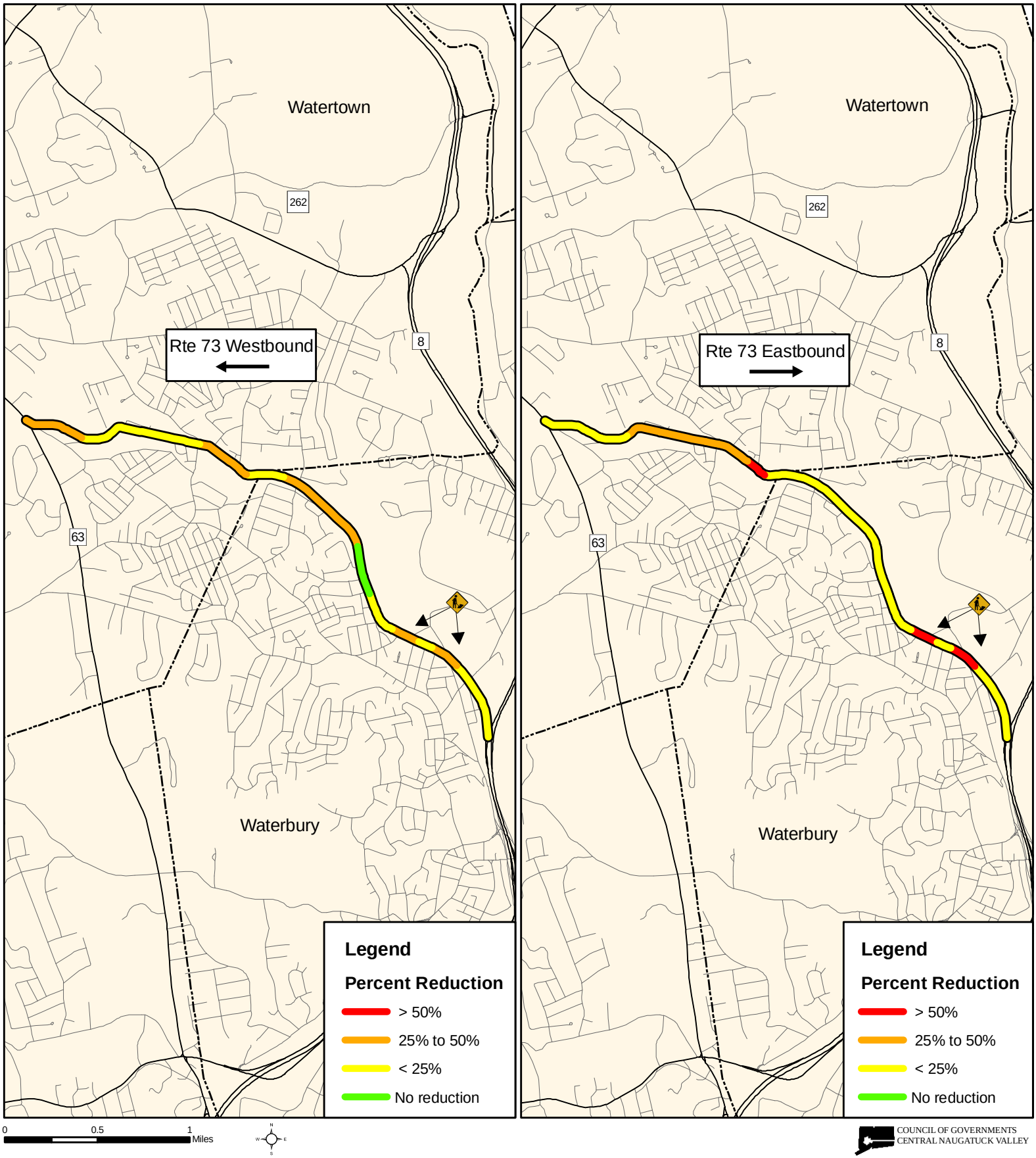
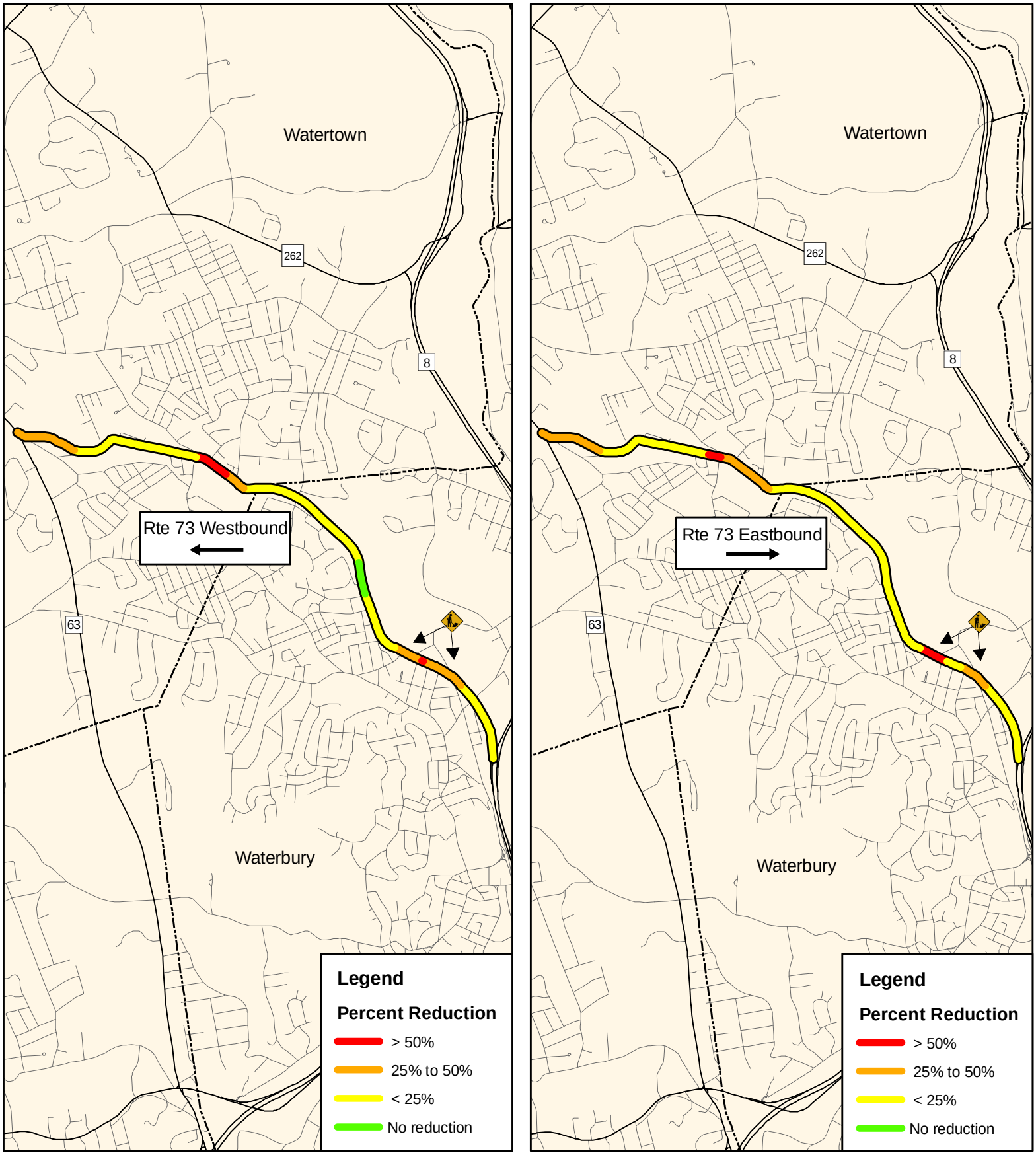


Figure 11: Route 73 Evening Peak 2007-2008
Percent Reduction in Speed



0 0.5 1 Miles

COUNCIL OF GOVERNMENTS
CENTRAL NAUGATUCK VALLEY

Route 69

Route 69 runs through the region for 15 miles from the Bethany-Prospect town line to the Wolcott-Bristol town line. It is classified as an urban principal arterial road throughout the region.

Travel speed data was collected for the 9.4 mile segment of Route 69 between the junction with Route 68 in Prospect and the junction with Route 322 in Wolcott. This stretch of roadway contains all of the route's most congested segments in the region, including those with V/C ratios approaching 1.0 (see Figure 3). The V/C ratio over 24% of the studied corridor is 1.0 or greater, indicating "bottleneck" conditions.

Along the study corridor, ADT ranged from 7,100 to 27,000 in 2006. Free flow speeds range from 30 mph in the urban core to 50 mph in less developed areas with few access points. Speeds are limited by the presence of on-street parking, signal density, and number of access points (driveways and intersections).

The peak hour traffic speed data for Route 69 is summarized below:

- Average travel speeds are around 34 mph during the morning peak period in both directions, and around 31 mph during the evening peak period in both directions.
- In Waterbury, most sections between Harper's Ferry Road/Pearl Lake Road and Sharon Road experience serious delays in at least one direction.
- The slowest average speed (5 mph) was recorded during the morning peak at the E. Main Street intersection in Waterbury.
- Delays in Prospect are most common during the evening in the southbound direction, particularly near the Route 68 intersection. Delays in Wolcott are minimal and focused near the Route 322 intersection.

Speed data for northbound and southbound traffic is presented in Tables 14 and 15. This data is also shown in Figures 12 and 13.

Table 14: AM Peak Period Speed Data for Route 69 Northbound and Southbound Segments

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Northbound	Average Speed Southbound
Length of Rte. 69	9.41	25-40	30-50	33.9	34.4

Source: COGCNV travel time and speed data collection: 2007-2008

Table 15: PM Peak Period Speed Data for Route 69 Northbound and Southbound Segments

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Northbound	Average Speed Southbound
Length of Rte. 69	9.41	25-40	30-50	31.0	31.9

Source: COGCNV travel time and speed data collection: 2007-2008

Figure 12: Route 69 Morning Peak 2007-2008

Percent Reduction in Speed

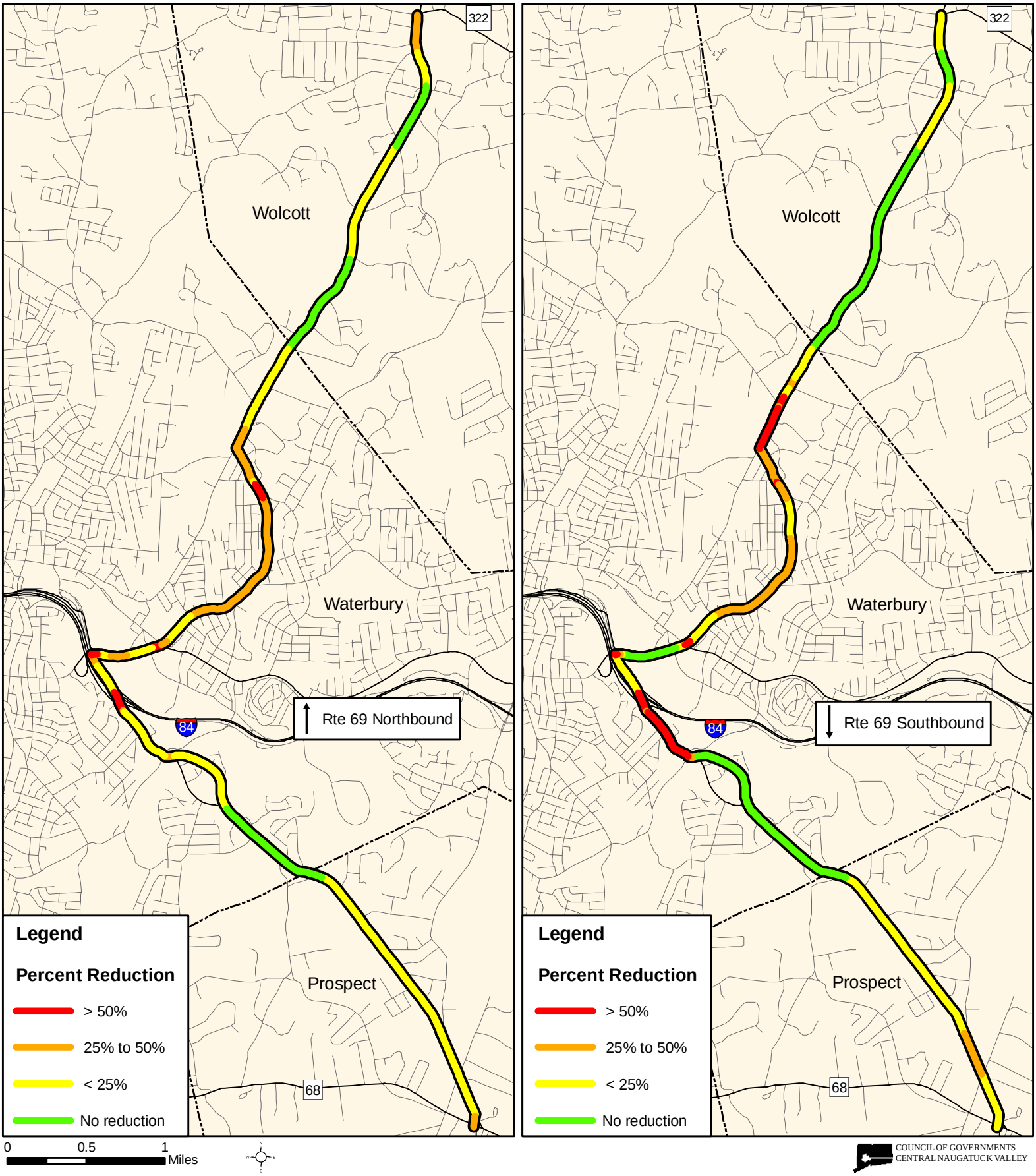
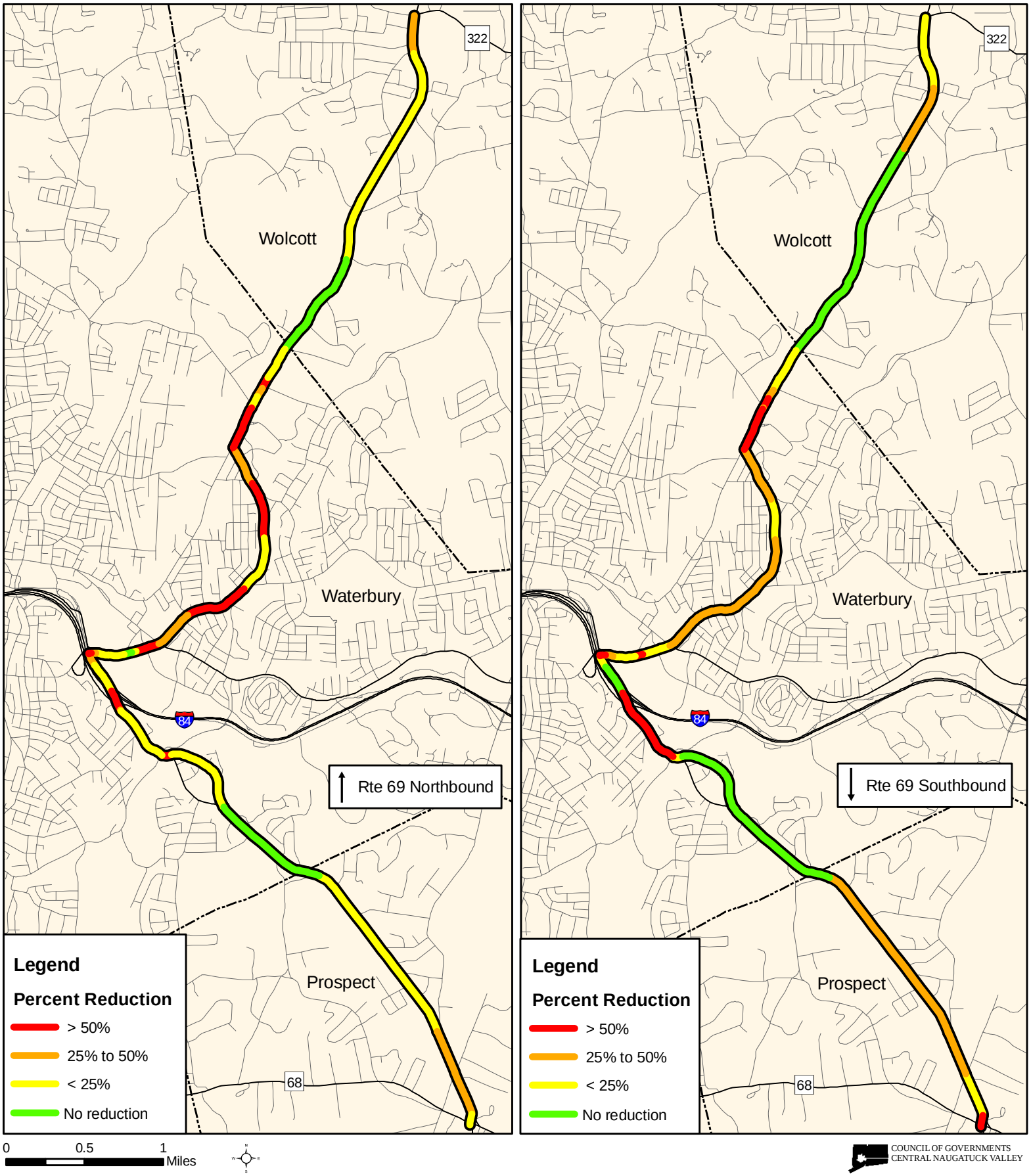


Figure 13: Route 69 Evening Peak 2007-2008

Percent Reduction in Speed



Route 63

Route 63 runs through the region for 18 miles from the Bethany-Naugatuck town line to the Watertown-Morris town line. It is classified as an urban principal arterial road until it reaches Plungis Road in Watertown, where it becomes a rural minor arterial.

Travel speed data was collected for the 13 mile segment between the Bethany-Naugatuck town line and the junction with U.S. Route 6 in Watertown. This stretch of roadway contains a number of segments with estimated V/C ratios above 1.0 (see Figure 3). The V/C ratio over 27% of the studied corridor is 1.0 or greater, indicating "bottleneck" conditions.

Free flow speeds on Route 63 range from 30 mph in the urban centers to 50 mph in less developed areas with fewer access points (driveways and intersections). Speeds are limited in areas with more access points, on-street parking, and pedestrian crossings. ConnDOT estimates 2006 ADT volumes between 8,300 to 22,500 vehicles. Traffic volumes are greatest around Cross Street in Naugatuck and Route 73 in Watertown.

The peak hour traffic speed data for Route 63 segments is highlighted below:

- Average travel speed is around 34 to 35 mph during both peak periods
- The slowest average speed (6 mph) was recorded during the evening peak at S. Main Street (SR 709)/Route 8 in Naugatuck near the Route 8 interchange (exit 26).
- The most severe delays occur at Route 64 in Middlebury, Bunker Hill Road in Watertown, and S. Main Street (SR 709) in Naugatuck.
- Moderate delays are also found between Route 73 and Route 6 in Watertown, between Park Road and Route 64 in Middlebury, in downtown Naugatuck, and between Cross Street and Candee Road in Naugatuck.

Speed data for Northbound and Southbound traffic is presented in Tables 16 and 17. This data is also shown in Figures 14 and 15.

Table 16: AM Peak Period Speed Data for Route 63 Northbound and Southbound Segments

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Northbound	Average Speed Southbound
Length of Rte. 63	13.0	25-50	30-50	34.9	35.2

Source: COGCNV travel time and speed data collection: 2007-2008

Table 17: PM Peak Period Speed Data for Route 63 Northbound and Southbound Segments.

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Northbound	Average Speed Southbound
Length of Rte. 63	13.0	25-50	30-50	34.2	34.2

Source: COGCNV travel time and speed data collection: 2007-2008

Figure 14: Route 63 Morning Peak 2007-2008

Percent Reduction in Speed

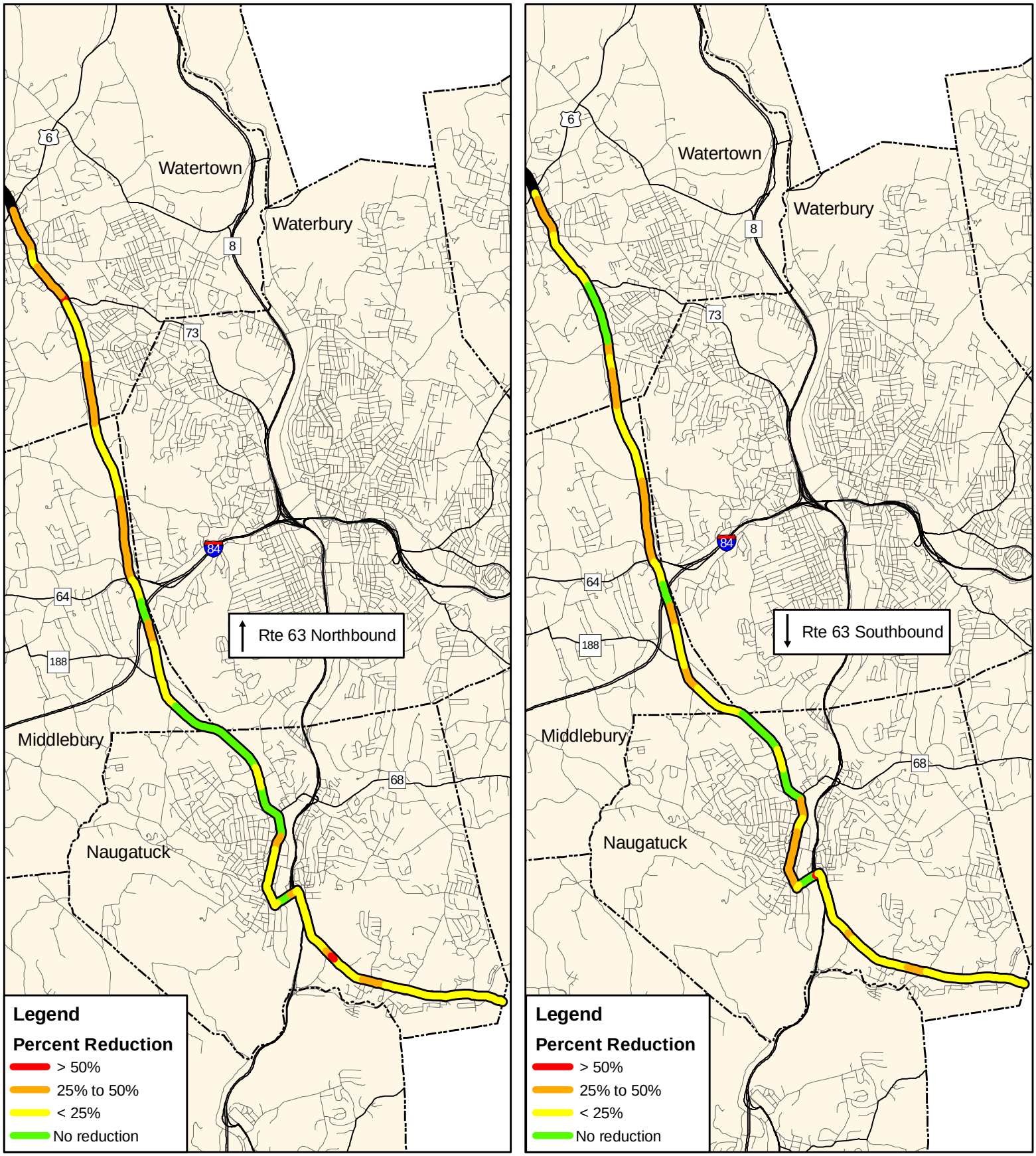
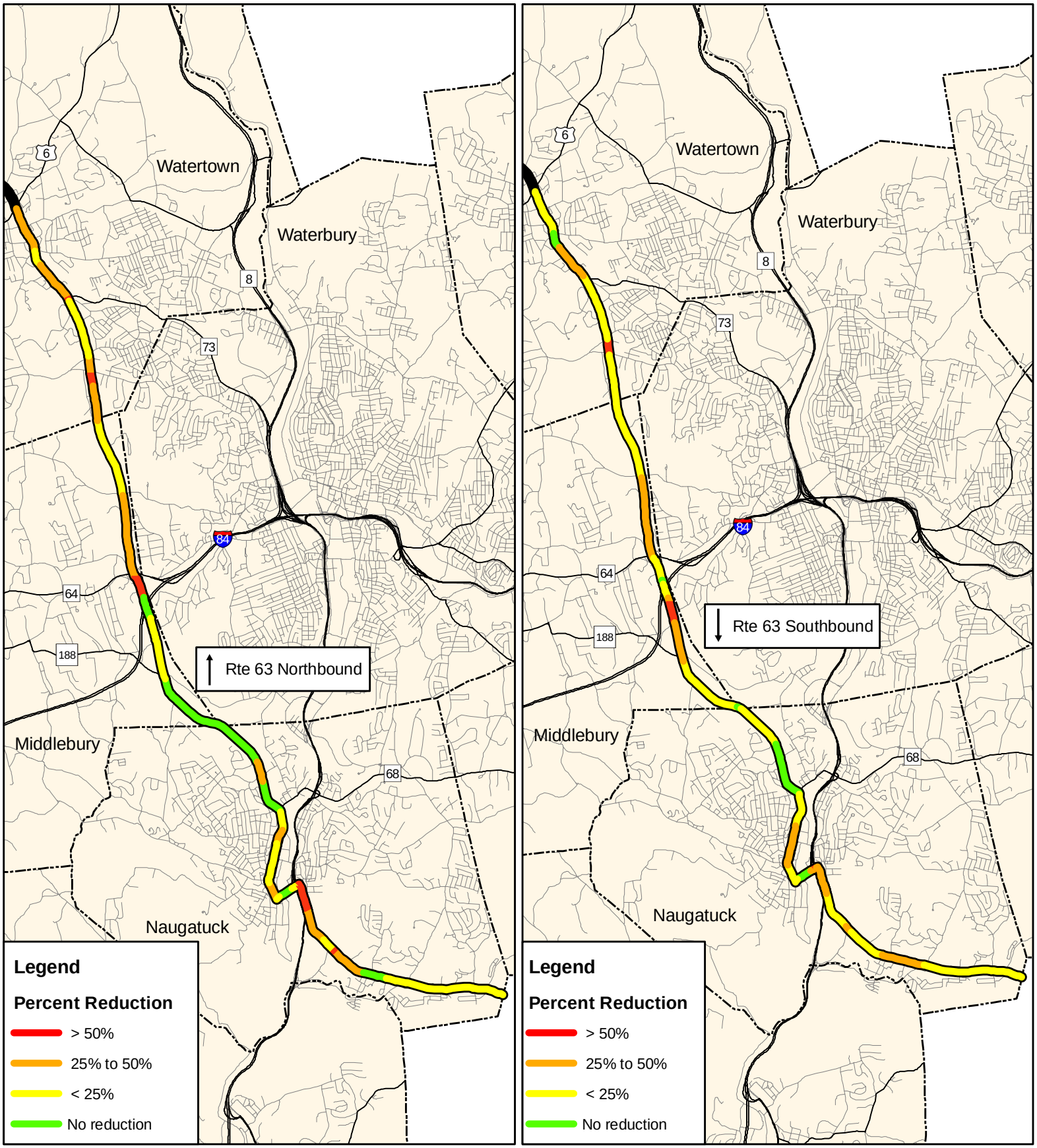


Figure 15: Route 63 Evening Peak 2007-2008

Percent Reduction in Speed



Conclusions

Most of the highway corridors analyzed in this report were found to have travel speeds below the free flow speed during peak hours. The corridors were selected because they were identified in the region's *Long Range Transportation Plan* as highways with congested segments, having V/C ratios above 1.0.[3]

To summarize the findings of the CMS analysis, this section identifies bottlenecks — the locations and segments with the slowest speeds — within the study corridors:

Route 8

- There are no serious bottlenecks along Route 8. Similar results were found in the previous CMS report.

I-691

- There are no serious bottlenecks along I-691, although slowdowns are common at the interchange with I-84.

I-84

- The most severe bottlenecks occur between the Washington Street overpass in Waterbury and Route 70 in Cheshire. During the evening peak period, eastbound traffic can be backed up as far as the South Main Street overpass

Route 10

- Moderate delays are common along the entire route through Cheshire.
- The most severe bottlenecks occur near the I-691 interchange, the junctions with Routes 68/70, and the junction with Route 42.

Route 70

- The most severe delays occur at the I-84 interchange, the west junction with Route 68 (Prospect Road), and the junction with Route 10.

Route 73

- The most severe bottlenecks occur in Oakville between Buckingham Street and Davis Street and near the junction with Route 63.
- Delays can also occur near the Steele Brook Shopping Center and Falls Avenue.

Route 69

- The most severe bottlenecks occur between Harper's Ferry Road and E. Main Street and between Manor Avenue and Sharon Road in Waterbury. Serious delays can also occur at the junction of Route 68 in Prospect.

[3] See note on page 5.

Route 63

- The most severe bottlenecks occurred at the Route 64 intersection in Middlebury, at Bunker Hill Road in Watertown, and at S. Main Street (SR 709)/Route 8 in Naugatuck.
- Moderate delays can also occur near the intersection with Cross Street in Naugatuck.

The road sections that were identified as seriously congested should be considered for future traffic studies and improvements.

Appendix A
Additional Routes

Huntingdon, Homer, Chase and Lakewood Road

The route along Huntingdon Avenue, Homer Street, Chase Avenue and Lakewood Road is classified as a minor arterial, serving as a major east-west connection between Routes 8 and 69. The study area, which includes only a portion of Huntingdon Avenue, runs for 2.8 miles with a brief overlap of North Main Street at its intersection with Chase Avenue. In 2005, ADT along the corridor ranged from 18,700 on Lakewood Road to 30,200 vehicles on Huntingdon.

This corridor is primarily commercial/retail development with some residential properties. Several factors lead to delay along this route, including limited capacity, numerous driveways, and lack of turning lanes at signalized intersections. While the posted speed limit along the entire route is 25 mph, a free flow speed of 35 mph was used in the analysis.

The peak hour traffic speed data is highlighted below:

- Average travel speeds over Huntingdon, Homer, and Chase range from 22 to 25 mph during peak periods.
- The most severe delay occurs along Huntingdon Avenue and Homer Street and on Chase Avenue between Hill Street and the junction with North Main Street.
- Average travel speeds on Lakewood Road range from 29 to 32 mph during peak periods, with the most severe delay occurring between Sherman Avenue and Route 69.

Speed data for eastbound and westbound traffic is presented in Tables 18 and 19. This data is also shown in Figures 16 and 17.

Table 18: AM Peak Period Speed Data for Huntingdon Avenue, Homer Street, Chase Avenue, and Lakewood Road Eastbound and Westbound Segments

Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Eastbound	Average Speed Westbound
Huntingdon Avenue	0.31	25	35	19.5	15.0
Homer Street	0.35	25	35	26.1	27.4
Chase Avenue	0.93	25	35	25.4	28.5
Huntingdon, Homer, Chase	1.6	25	35	25.0	24.0
Lakewood Rd	1.2	25	35	29.6	28.7

Source: COGCNV travel time and speed data collection: 2007-2008

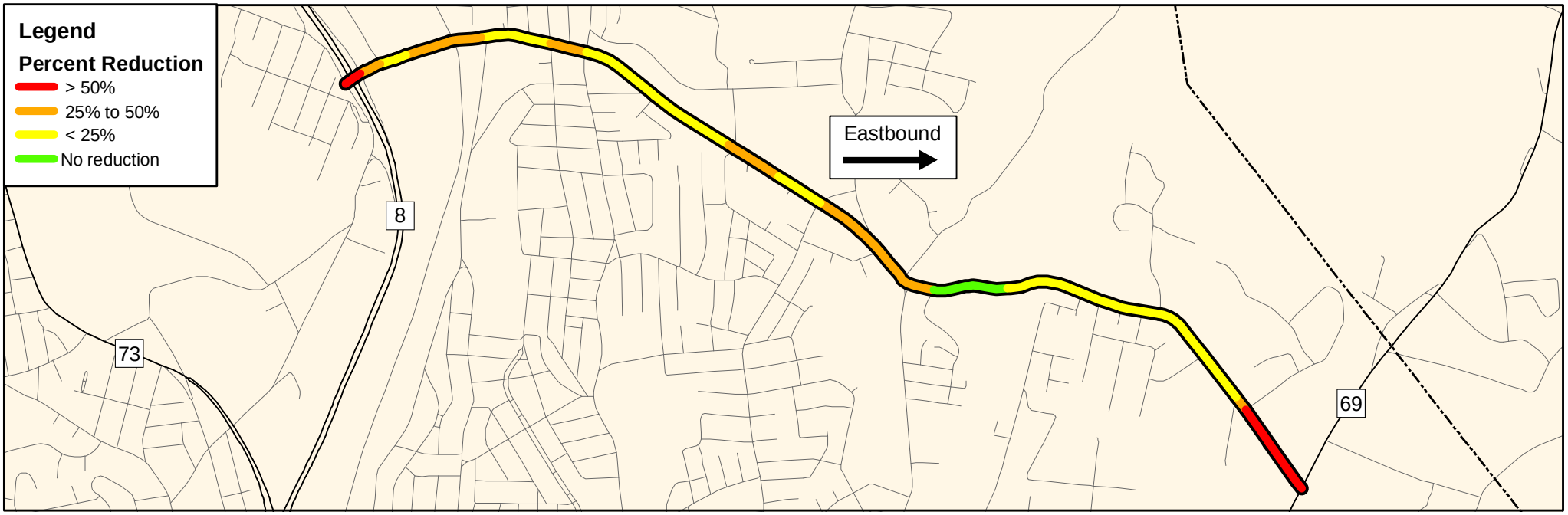
Table 19: PM Peak Period Speed Data for Huntingdon Avenue, Homer Street, Chase Avenue, and Lakewood Road Eastbound and Westbound Segments

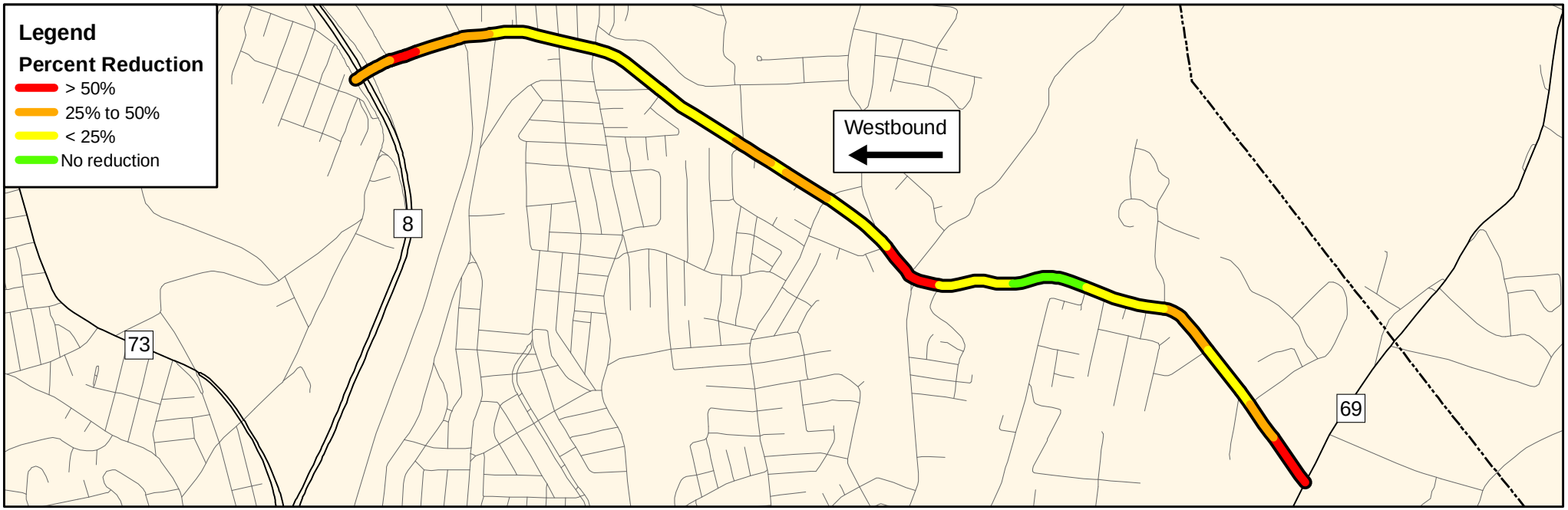
Segment Description	Length	Speed Limit	Free Flow Speed	Average Speed Eastbound	Average Speed Westbound
Huntingdon Avenue	0.31	25	35	24.0	10.4
Homer Street	0.35	25	35	18.0	18.2
Chase Avenue	0.93	25	35	23.2	26.1
Huntingdon, Homer, Chase	1.6	25	35	21.7	21.9
Lakewood Rd	1.2	25	35	32.3	29.8

Source: COGCNV travel time and speed data collection: 2007-2008

Figure 16: Huntingdon, Homer, Chase and Lakewood Road Morning Peak 2007-2008

Percent Reduction in Speed





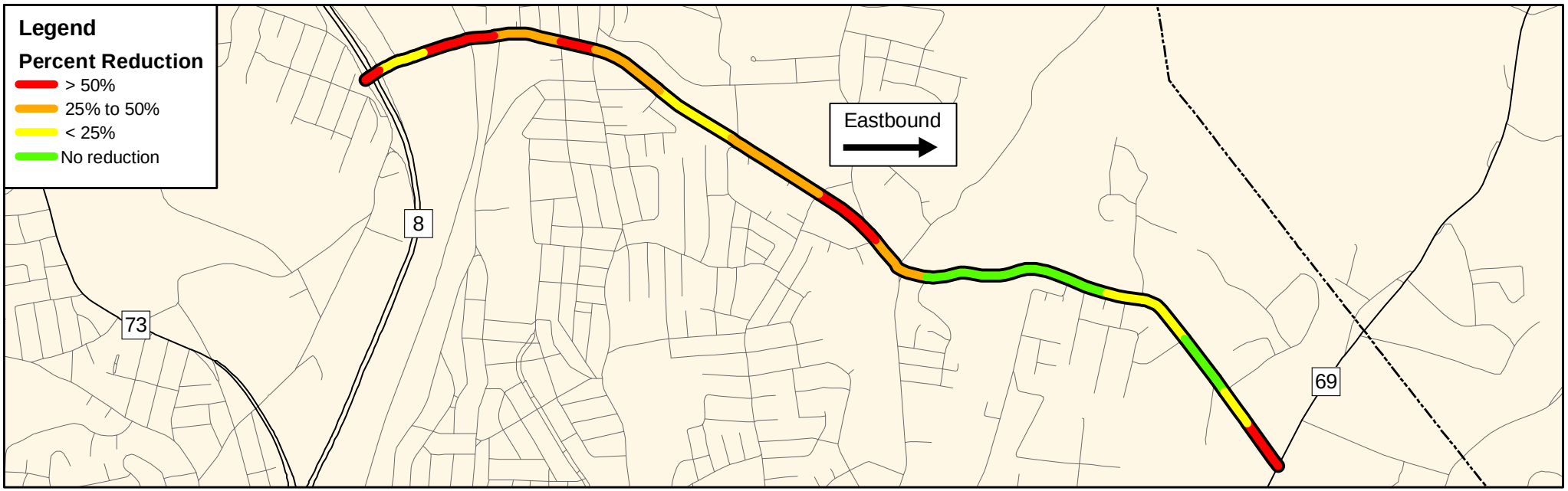
0 0.25 0.5 Miles

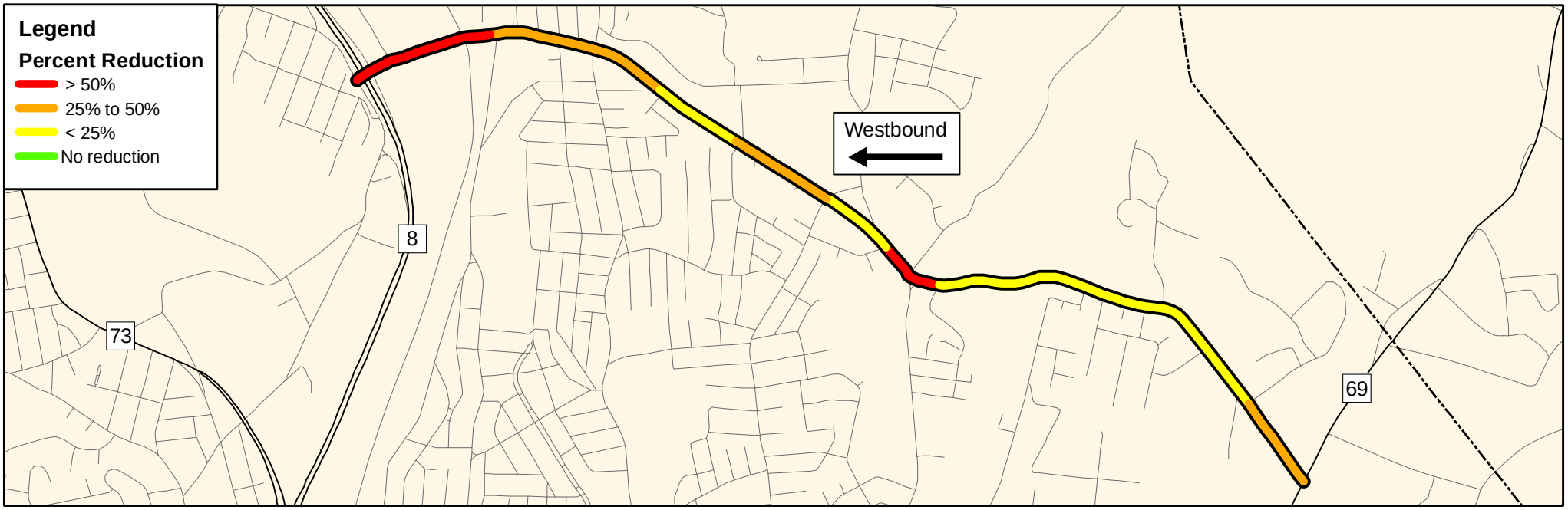
N W E S

COUNCIL OF GOVERNMENTS
CENTRAL NAUGATUCK VALLEY

Figure 17: Huntingdon, Homer, Chase and Lakewood Road Evening Peak 2007-2008

Percent Reduction in Speed





0 0.25 0.5 Miles

N W E S

COUNCIL OF GOVERNMENTS
CENTRAL NAUGATUCK VALLEY

Appendix B
Data Collection and Processing

Equipment

Trimble Juno ST
GPS Receiver

Data Collection

ESRI's ArcPAD software was installed directly onto the GPS receiver so that incoming positional information was collected by the GPS receiver and stored directly on the handheld as a point shapefile using ArcPAD's tracklog feature. The tracklog was set to record a point every second. ArcPAD automatically calculated the speed over ground (SOG) for each point, the date and time of collection, and a measure of the point's positional accuracy (PDOP). Each highway segment was driven a minimum of three times in each direction during both the morning and the afternoon peak periods, and a separate tracklog was created during each trip. Data was downloaded from the GPS receiver to a desktop computer using ActiveSync software.

Data Processing

Each tracklog was opened in ArcMap, clipped to remove extraneous points, and saved as a geodatabase feature class using the Connecticut State Plane NAD83 coordinate system. Once all data collection was completed, each *point* file for a given highway, direction, and time were spatially joined to a road *line* shapefile. The resulting *line* file contained average speeds over ConnDOT milepoint segments. The spatial join operation automatically performed a summary of the selected numeric attributes of points that were closest to each line segment. The attributes were summarized to record the average, maximum, and minimum values for the *speed over ground (SOG)* field.

Finally, the joined *line* files were aggregated based on direction and time for each highway, generating overall average speeds for individual segments as well as the full road lengths.