



BOSTON REGION METROPOLITAN PLANNING ORGANIZATION

Stephanie Pollack, MassDOT Secretary and CEO and MPO Chair
Karl H. Quackenbush, Executive Director, MPO Staff

TECHNICAL MEMORANDUM

DATE: August 18, 2016
TO: Boston Region MPO Congestion Management Process Committee
FROM: Ryan Hicks
RE: Creating Congestion Scans with INRIX Data

1 PURPOSE AND BACKGROUND

The purpose of this memorandum is to summarize the development of roadway congestion scans as part of the continuing congestion management process (CMP), which requires the duration, extent, intensity, and reliability of congestion to be measured on roadways in the Boston Region Metropolitan Planning Organization (MPO) area. Duration, intensity, and reliability are calculated using performance measures that are displayed in the Express Highway Performance and Arterial Performance Dashboards. MPO staff created these dashboards in 2014 using a 2012 INRIX dataset. However, at that time, the extent of congestion was not measured via the performance measures in the dashboards. The objective of this task is to show the extent of congestion on selected freeways and arterials in the Boston Region MPO area.

Displaying the geographic distribution of congestion can show the extent of congestion; and a visually innovative way to do this is with congestion scans. Congestion scans show how peak periods vary by roadway facility and location, and enable planners or engineers to calculate the amount of congested hours on a roadway facility. The number of congested hours that occurs on a roadway can indicate the cause of congestion at a certain location.

2 INRIX DATA

INRIX is a private company that collects and processes vehicle-probe data¹. Once data are processed, INRIX sells datasets to government organizations and other transportation entities to use for planning purposes. In 2013, the Boston Region MPO purchased a dataset from INRIX. The dataset contains records that display travel speeds for every minute of 2012 from most roadways in the Boston region, including collector roadways, arterial roadways, and freeways. INRIX data

¹ Vehicle-probe data are speed or travel time statistics that are collected in bulk from vehicle fleets (contractors) or individual travelers (volunteers) whose vehicles are equipped with global positioning system (GPS) tracking devices. The data then are averaged for a certain time period by private vendors and are made available to transportation entities for purchase.

records are provided in one-minute increments for 24 hours per day, 365 days per year. Currently MPO staff use this dataset for the CMP, Long-Range Transportation Plan (LRTP), and the Travel Demand Model.

3 METHODOLOGY

The CMP committee agreed that CMP staff should create congestion scans for 11 freeway routes and 22 arterial routes. Staff mapped all freeways that are displayed in the Express Highway Performance Dashboard through congestion scans. In addition, staff selected 22 arterial routes that have an average annual daily traffic count of 35,000 or greater as candidates for congestion scans. Most freeway and arterial routes are so long that the routes commonly need to be broken into sections for congestion scan plotting. To achieve a legible geographic display, each individual freeway congestion scan needs to be less than 25 miles long, and each arterial congestion scan needs to be less than 17.5 miles long. Any routes that are longer than the stated limits are partitioned into separate sections for congestion scan plotting.

3.1 What is a congestion scan?

A congestion scan visually displays congestion based on preset performance-measure thresholds for a corridor for up to 24 hours a day, at multiple locations. Thus, a congestion scan shows the location, intensity, and longevity of congestion within a specific corridor. A congestion scan features an X-axis, which represents the time of day over a 24-hour period, and a Y-axis, which represents the location along a roadway corridor. The typical roadway length of a congestion scan is indicated by mile markers.

For freeways, the Speed Index²-performance metric is used to gauge congestion conditions. This metric is suitable for measuring congestion on freeways as they generally experience uninterrupted traffic flow because of the absence of traffic signals. This allows for a smooth, one-to-one comparison of travel speeds to speed limits over longer Traffic Messaging Channel (TMC)³ segments.

² The Speed Index indicates congestion more accurately than travel speed alone because low travel speed may be a result of low speed limits on certain facilities. Speed Index = average speed / posted speed limit.

³ The Traffic Messaging Channel location code is a common industry convention developed and maintained by the leading electronic map database vendors to define road segments uniquely. For freeways, a TMC location is defined as the segment between two interchanges. Often, the TMC segment definition varies for arterial roadways.

For arterials, the Travel Time Index⁴ metric was used to gauge congested conditions, as depicting the true average speed on a TMC is often difficult because of interrupted traffic flow. In addition, in certain areas some arterials have low travel speeds at all times, which may indicate a false positive for congested conditions if the Speed Index is used. A solution to these problems is to compare optimum travel conditions with 24-hour travel conditions to determine the congested locations and to use the Travel Time Index performance measure.

3.2 Assumptions

- Speed Index metric used to determine congested conditions for freeways
- Travel Time Index metric used to determine congested conditions for arterials
- Average speed for each TMC is representative of the midpoint of the respective roadway link
- Speed values for each TMC are regressive between each other
- A harmonic mean is calculated to simulate acceleration and deceleration of travel speeds between TMCs, which increases the granular distinction between TMCs
- Congestion scans were calculated using only data from non-holiday Tuesdays, Wednesdays, and Thursdays in April, May, September or October, 2012
- For five-minute periods that do not have any records, staff made assumptions based on the adjacent five-minute periods (for example, if a TMC has an average speed of 12 mph at 4:05 PM and 24 mph at 4:15 PM, and there is no data for 4:10, then the values between 4:05 and 4:15 are averaged to compute the value for 4:10, which in this case would be 18 mph)
- For the purpose of this analysis, the definition of congested conditions are:
 - Speed Index must be below 0.70 for at least one-half consecutive miles of freeways, and persist for at least 15 minutes on freeway routes
 - Travel Time Index must be greater than 1.30 for at least one-half consecutive miles of arterials, and persist for at least 15 minutes on arterial routes

⁴ The Travel Time Index directly compares travel time conditions at a particular time with free-flow travel time conditions. Travel Time Index indicates how much contingency time should be considered to ensure an on-time arrival during a certain time versus optimum travel times. Travel Time Index = average travel time at a particular time / free-flow travel time.

3.3 Steps

- 1 For every route, staff derived a list of TMCs from the ArcMap shapefile that was used to create the Express Highway Performance and Arterial Performance Dashboards. Staff saved each TMC route list as a comma-separated values (csv) formatted file.
- 2 Staff uploaded the TMC route lists to Google BigQuery as csv files. All TMCs on freeway routes were included in the TMC list. Only non-center⁵ TMC segments on arterial routes were included in the TMC list.
- 3 Once the TMC lists were uploaded to BigQuery, staff used them to query the 2012 INRIX database to extract speed records. Each data record that was queried met the following criteria:
 - Represents a TMC that is on a route selected for congestion scan
 - Represents a non-holiday Tuesday, Wednesday or Thursday in April, May, September or October, 2012
 - Has a confidence score⁶ of 30⁷
 - Has a C-value⁸ of 75⁹ or greater
4. Then, the queried data for each route was downloaded into an Excel spreadsheet.

⁵ Center TMC locations are indicated by either a “P” or an “N” in the TMC code. Center TMC locations represent a roadway segment that is located at an interchange or intersection. “P” stands for positive directionality and “N” stands for negative directionality. Center TMC locations that have a “P” in their codes are aligned in either a northbound or an eastbound direction. TMC locations that have an “N” in their codes are aligned in either a southbound or a westbound direction. Non-center TMCs are indicated by a “+” or a “-” in the TMC code: a “+” stands for positive directionality and a “-” stands for negative directionality. Non-center TMC locations typically represent a roadway segment that aligns between interchanges or intersections. Non-center TMC locations that have a “+” in their codes are aligned in either a northbound or an eastbound direction. Non-center TMC locations that have a “-” in their codes are aligned in either a southbound or a westbound direction.

⁶ The confidence score is a metric that INRIX uses to indicate the source of a data record. The confidence score ranges from 10 to 30. A confidence score of 30 indicates that the data are collected in real time. A confidence score of 20 indicates that the data are both real time and historical. A confidence score of 10 indicates that the data source is exclusively historical.

⁷ A minimum confidence score requirement of 30 was determined by MPO staff because of the preference to use exclusively real-time collected data for the CMP.

⁸ The C-value is a metric that INRIX uses to indicate the reliability of a data record. C-values for data records range from 0 to 100. A low C-value indicates that there may have been a sudden change in speed at a particular location, usually caused by an incident.

⁹ The threshold of 75, as decided by MPO staff, was an optimal number where data records that are extreme outliers would be excluded, but all TMCs still would be able to retain a statistically valid sample size.

5. In each spreadsheet, staff computed formulas that contained the combined average speed of all of the days used, for every five-minute interval, for each TMC.
6. Using ArcGIS, staff determined the midpoints of each TMC by using the “future-to-point” tool.
7. All midpoints, TMC average speeds, intersections, interchanges, and traffic signals indicated on the spreadsheet, are located in relation to the roadway mile markers.
8. Staff calculated the average speeds at different points between TMCs using a harmonic mean. This shows the acceleration or deceleration of travel speeds between TMCs.
9. For freeways, speed limits were inserted into the congestion scan. For arterials, free-flow¹⁰ speed was calculated at every location and inserted into the congestion scan.
10. For freeways, Speed Index is calculated in five-minute increments for every 1/60 of a mile. For arterials, Travel Time Index is calculated in five-minute increments for every 1/60 of a mile.
11. Staff applied conditional formatting to the congestion scan. Each cell is shaded a color consistent with the ranges stated in the legend.
12. Staff added route shields, mile markers, street names, and other icons for aesthetic and indicative purposes.

3.4 Congested Hours Methodology

In creating the congestion scans, staff calculated congested hours for each roadway corridor by visually analyzing each scan and recording each time period that experiences congestion. In order for conditions to be considered congested, the Speed Index or Travel Time Index threshold must fail to meet the congestion threshold for a least 15 consecutive minutes, along a roadway segment that is at least a half mile long. The amount of congested hours for each congestion scan corridor is cited in Appendix A.

¹⁰ The Boston Region MPO definition of free-flow speed and free-flow travel time are calculated using the 85th percentile speed of all records from each respective dataset between 12:00 AM and 2:00 AM (instead of during the AM and PM peak periods).

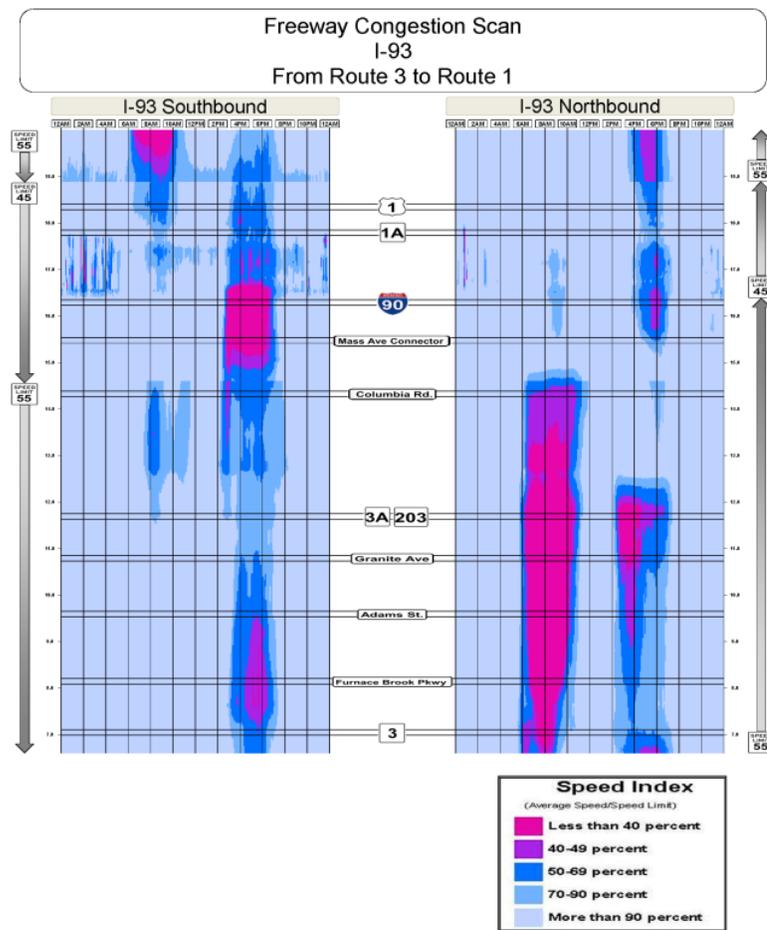
4 RESULTS

4.1 Freeway Results

Congestion Scans

Figure 1 shows an example of a freeway congestion scan (for scans for specific freeways, please refer to Appendix B). Using the Speed Index metric, the congestion scans show the congested times of a typical weekday. The speed limit is displayed beside the congestion scan. Staff analyzed peak-period length by Circumferential Corridor¹¹, as defined by the LRTP Needs Assessment.

Figure 1
Example of Freeway Congestion Scan, Typical Weekday, 2012

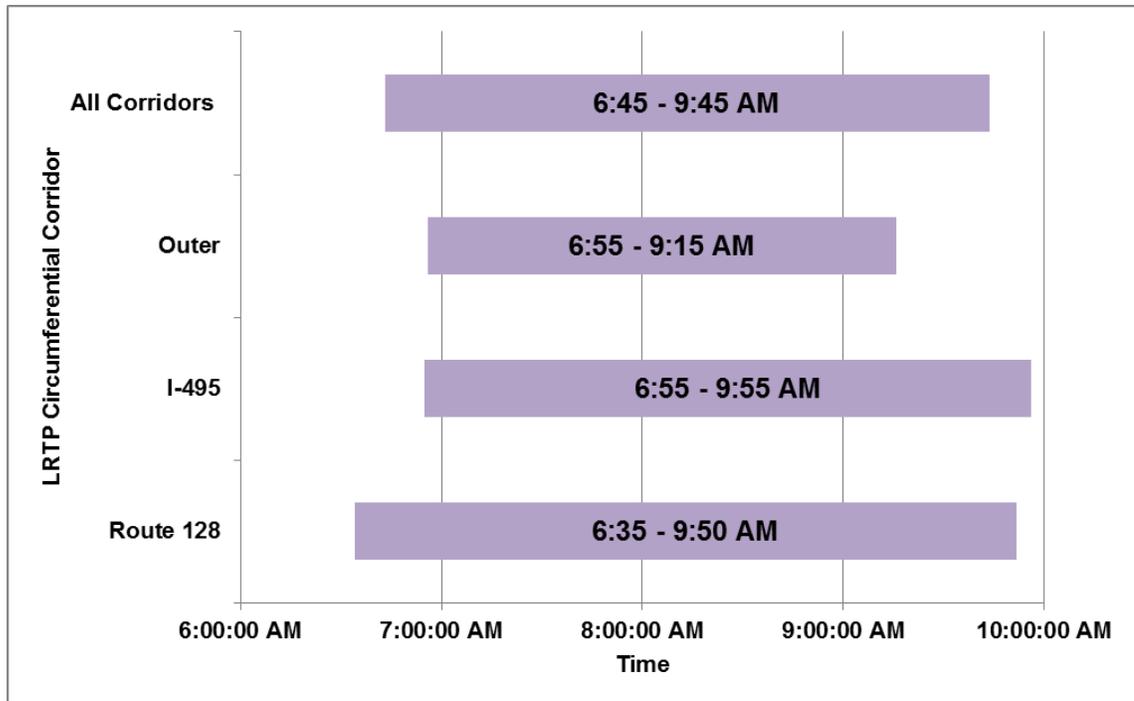


¹¹ Please refer to Figure D.1, in Appendix D, for a detailed map of the LRTP Circumferential Corridor. The Outer corridor consists of any municipality that is outside of the Boston Region MPO area. The I-495 corridor encompasses the far west portion of the MPO region, near I-495. The Route 128 corridor is represented as a ring, which includes I-95/Route 128. The Central Area Circumferential Corridor consists of Boston and its inner-ring suburbs.

Peak-Period Length

Figure 2 shows the average times in the AM peak period that freeways experience congested conditions, by Circumferential Corridor, as defined in the LRTP. The freeways located in the Outer Circumferential Corridor have the shortest AM congested period, lasting 140 minutes. Freeways that are located in the Route 128 Circumferential Corridor have the longest AM congested period, at 195 minutes. The Route 128 Circumferential Corridor’s congested period starts the earliest, at 6:35 AM.

Figure 2
Duration of Congested Conditions on Freeways, Typical Weekday,
by LRTP Circumferential Corridor, AM Peak Period, 2012



Peak-Period Length

Figure 2 shows the average times in the AM peak period that freeways experience congested conditions, by Circumferential Corridor, as defined in the LRTP. The freeways located in the Outer Circumferential Corridor have the shortest AM congested period, lasting 140 minutes. Freeways that are located in the Route 128 Circumferential Corridor have the longest AM congested period, at 195 minutes. The Route 128 Circumferential Corridor’s congested period starts the earliest, at 6:35 AM.

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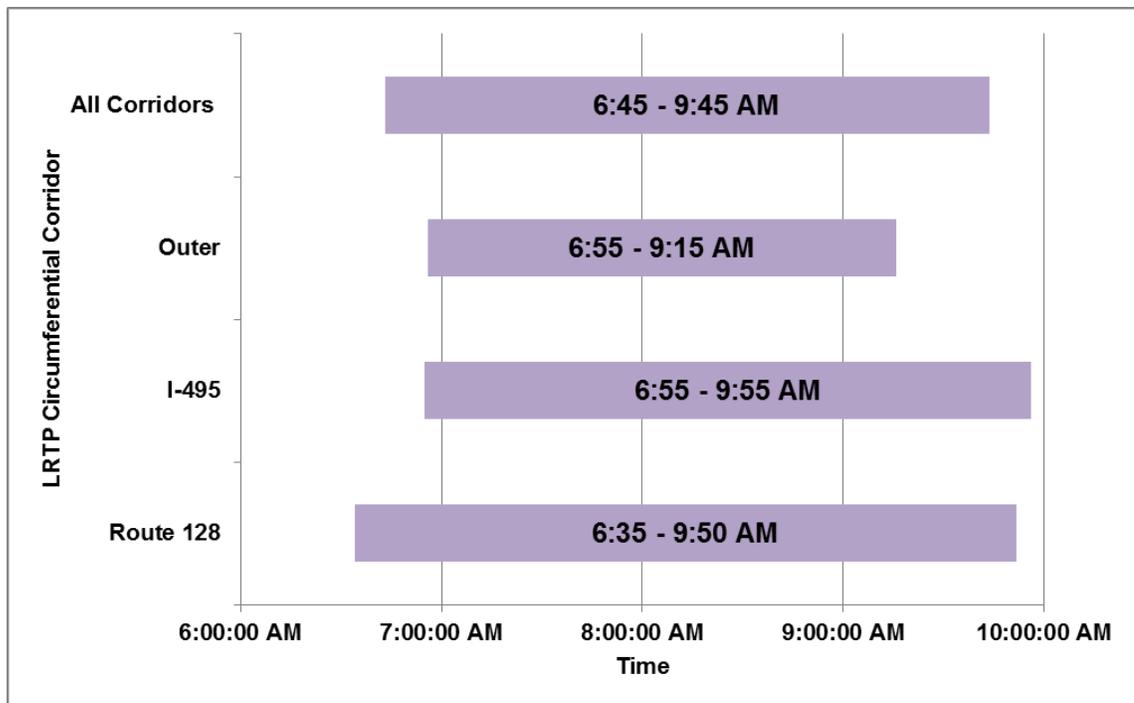
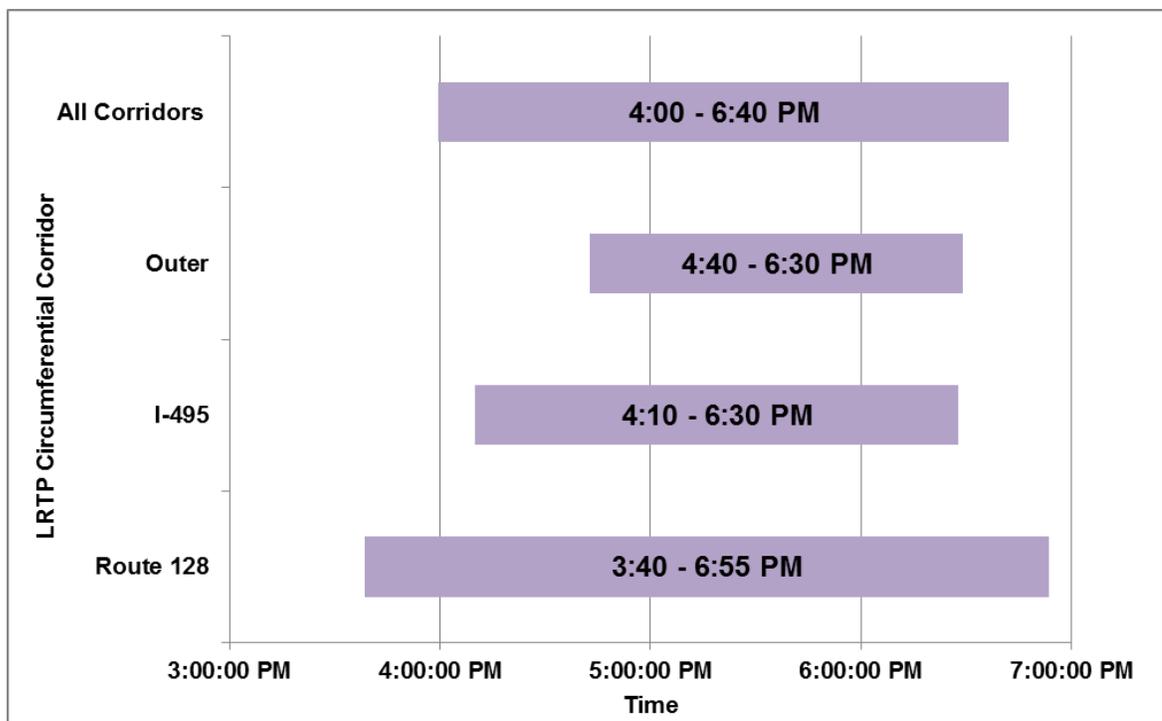


Figure 3 shows the average time in the PM peak period that freeways experience congestion by Circumferential Corridor, as defined in the LRTP. The Outer Circumferential Corridor's congested period begins the latest, at 4:40 PM. The Outer Circumferential Corridor also has the shortest average congested period on freeways, at 110 minutes; and the Route 128 Circumferential Corridor has the longest congested period, at 195 minutes. For the peak-period start times, end times, and congested hours for each individual congestion scan, please see Appendix A.

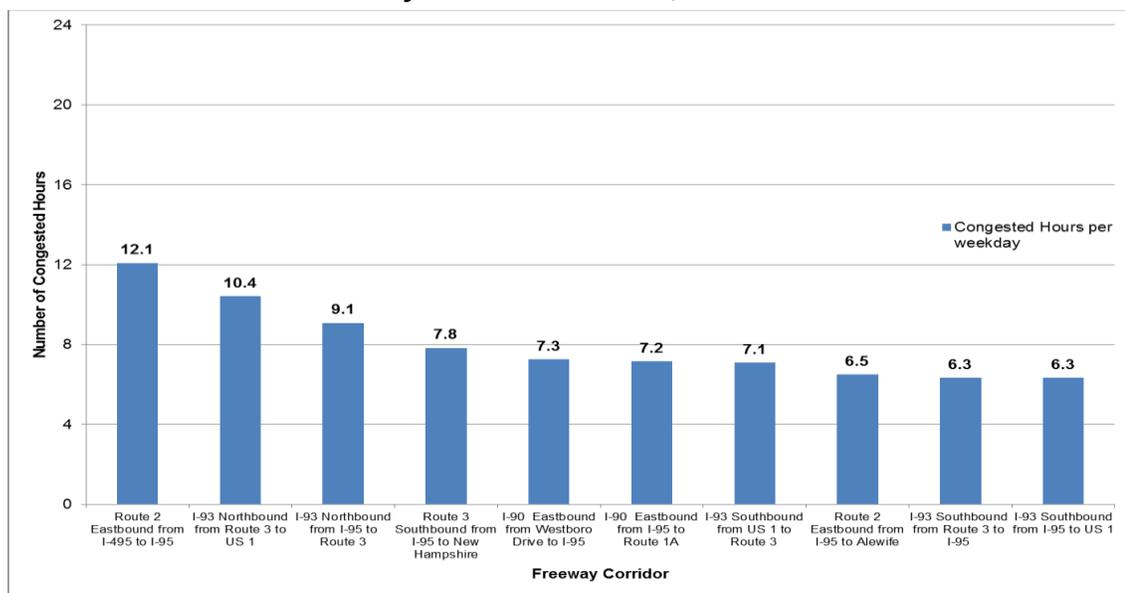
Figure 3
Duration of Congested Conditions on Freeways, Typical Weekday,
by LRTP Circumferential Corridor, PM Peak Period, 2012



Congested Hours

Figure 4 shows the top-ten freeway corridors with the most congested hours during a typical 24-hour weekday. Route 2 eastbound between I-495 and I-95 has 12.1 congested hours. Despite Route 2’s classification as a freeway, this corridor has many features that resemble an arterial, including several traffic signals and a roundabout. I-93 northbound between I-95 and Route 1/Northeast Expressway contains the freeway corridors with the second- and third-greatest congested hours. This portion of I-93 contains several unique bottlenecks including the Braintree Split and the Central Artery Tunnel. The freeway also features a reversible high-occupancy vehicle (HOV) lane, which is active only between 6:00 and 10:00 AM. Four of the top-ten corridors for congested hours are connected directly to the Central Artery Tunnel.

Figure 4
Freeway Corridors with Greatest Congested Hours per Weekday, by Travel Direction, 2012



Freeways Summary

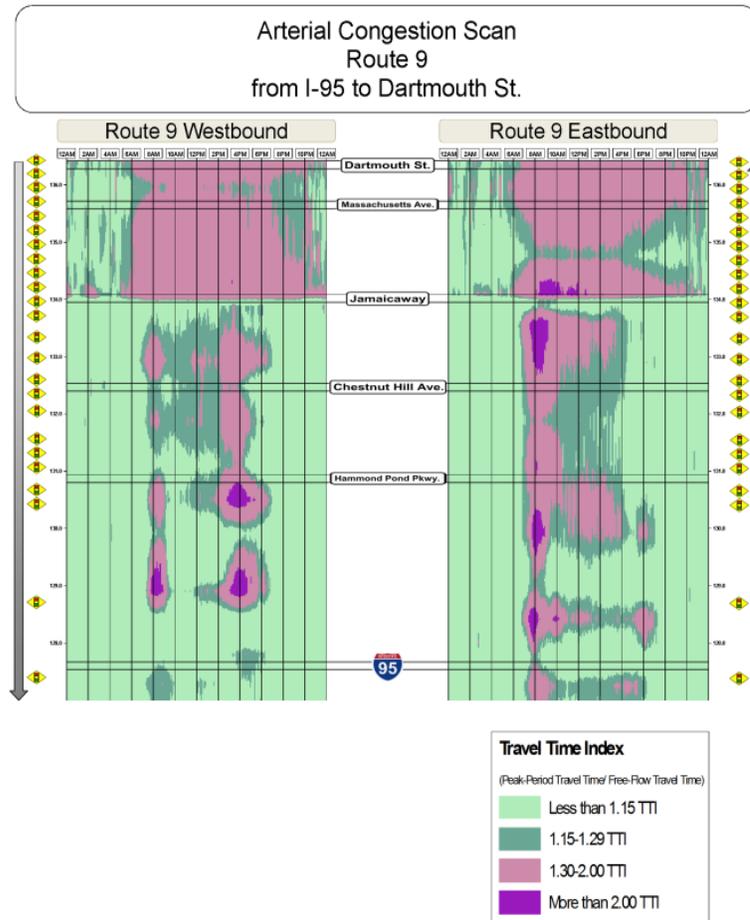
- I-93 northbound between I-95 and Route 1/Northwest Expressway experiences between 9 and 10.5 hours of congestion on a typical weekday.
- Seven of the top-ten corridors with the most congested hours are located in the Route 128 Circumferential Corridor.
- The AM and PM periods of congestion are longest in the Route 128 Circumferential Corridor. The AM and PM periods of congestion are shortest in the Outer Circumferential Corridor.

4.2 Arterial Results

Congestion Scans

Figure 5 shows an example of an arterial congestion scan (for scans for specific arterials, please see Appendix C). In order to show less distortion, staff made some adjustments. First, Travel Time Index was used to determine congested conditions instead of Speed Index. Therefore, speed limits were not displayed on arterial congestion scans. Second, center TMCs were removed from the congestion scans in order to smooth out the granularity of the visuals. The locations of signal signs, roundabout signs, or railroad signs are displayed to indicate a controlled intersection. Peak-period length was analyzed by Circumferential Corridor, as defined by the LRTP Needs Assessment. Please see Appendix D for a reference map of the Circumferential Corridors.

Figure 5
Example Arterial Congestion Scan, Typical Weekday, 2012



Peak-Period Length

Figure 6 shows the average time in the AM peak period that arterials experience congested conditions, by Circumferential Corridor, as defined in the LRTP. The I-495 Circumferential Corridor has the shortest period of congested conditions, at 165 minutes. The Central Area Circumferential Corridor has the longest congested period, at 250 minutes.

**Figure 6
Duration of Congested Conditions on Arterials, Typical Weekday,
by LRTP Circumferential Corridor, AM Peak Period, 2012**

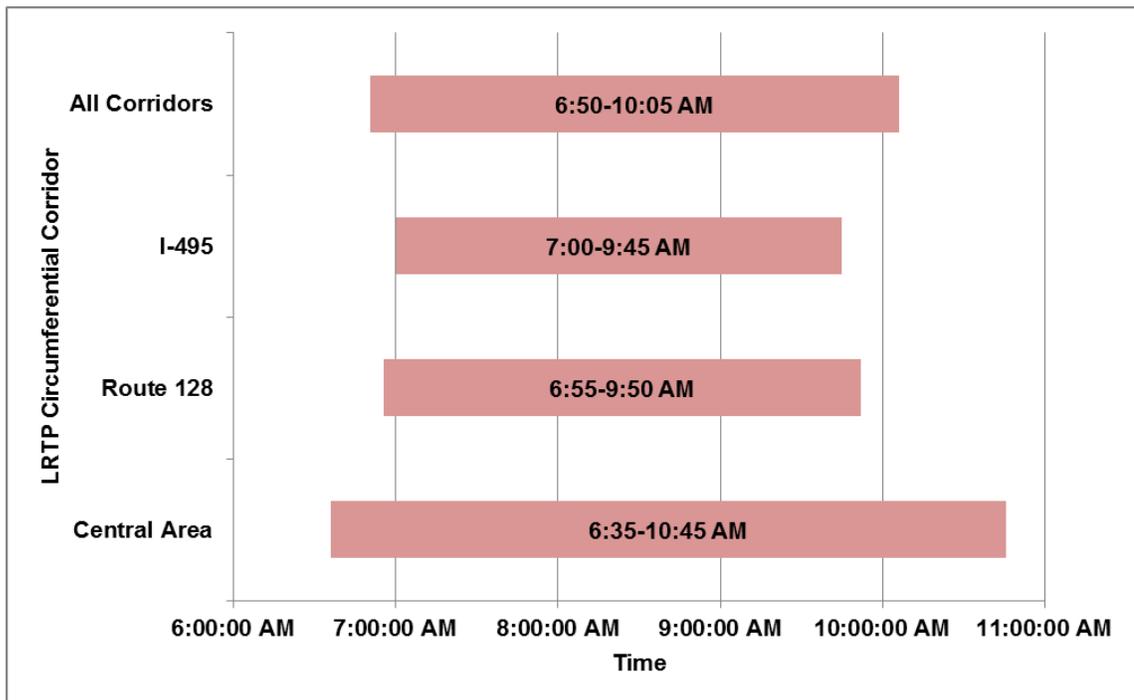
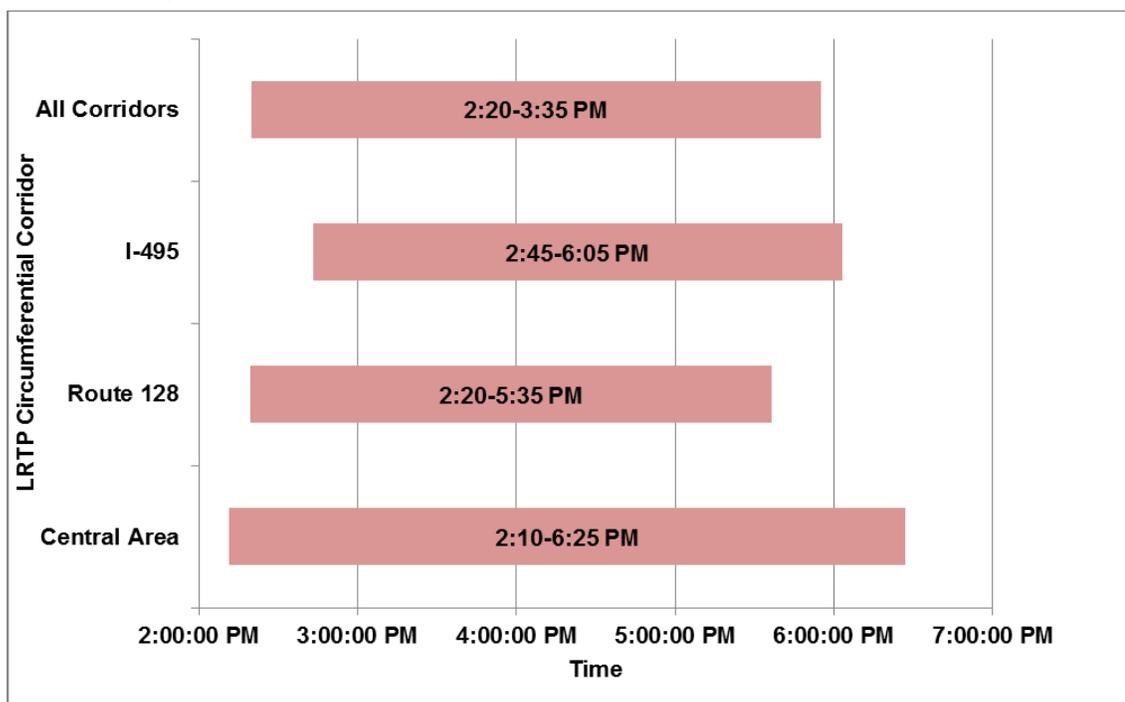


Figure 7 shows the average time in the PM peak period that arterials experience congested conditions, by Circumferential Corridor, as defined in the LRTP. The Route 128 Circumferential Corridor has the shortest congested period, at 195 minutes. The Central Area Circumferential Corridor has the longest congested period, at 255 minutes. For all arterial corridors, the congested periods begin between 2:00 and 3:00 PM. For arterial corridors, congested periods begin earlier than in freeway corridors because the arterials contain many elementary and high schools that dismiss students between 2:00 and 4:00 PM. For the peak-period start times, end times, and congested hours for each individual congestion scan, please see Appendix A.

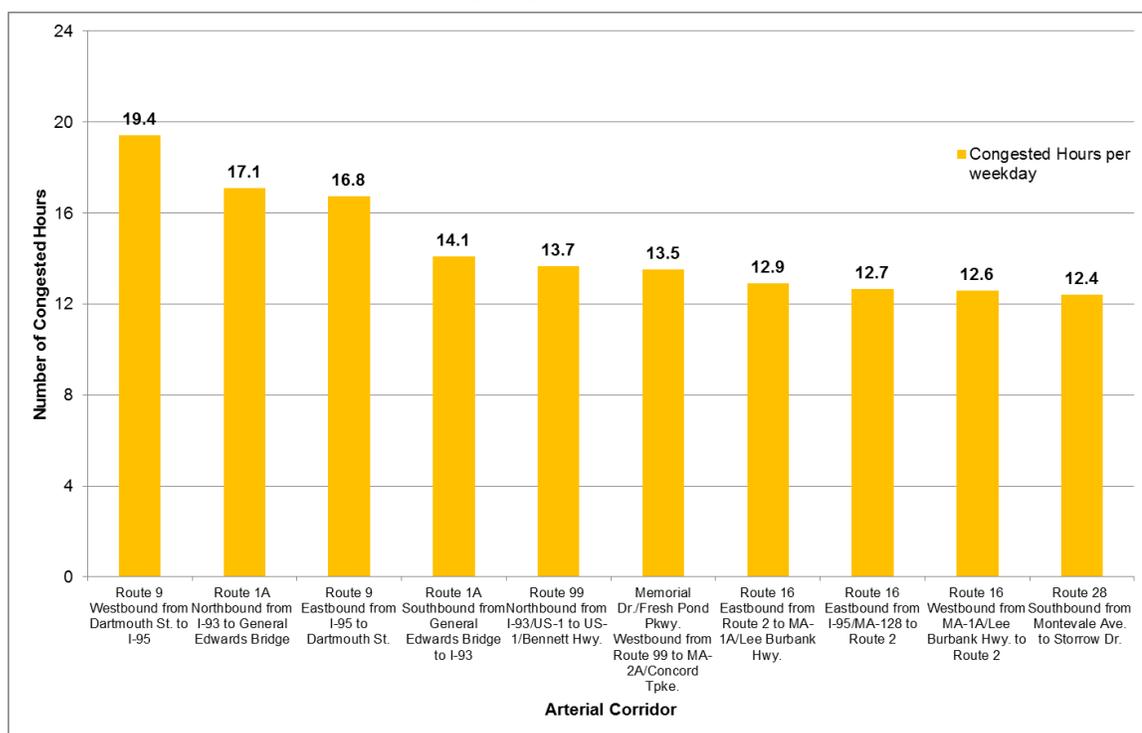
Figure 7
Duration of Congested Conditions on Arterials, Typical Weekday,
by LRTP Circumferential Corridor, PM Peak Period, 2012



Congested Hours

Figure 8 lists the ten arterial corridors with the greatest congested hours per weekday. Route 9 in both directions between I-95 and Dartmouth Street has 19.4 (westbound) and 16.8 (eastbound) congested hours per peak-period weekday. This corridor features more than 20 signals and has a streetcar (the MBTA E branch on the Green line) that runs along the median between Jamaicaaway and Massachusetts Avenue. Route 1A between I-93 and the General Edwards Bridge has the second-most congested hours among arterials. This corridor contains the Sumner tunnel, which connects downtown Boston with Boston Logan Airport.

Figure 8
Arterial Corridors with Greatest Amount of Congested Hours
per Weekday, by Travel Direction, 2012



Arterials Summary

- Of the top-ten arterial corridors with congested hours, seven are located in the Central Area Circumferential Corridor.
- The I-495 Circumferential Corridor has the shortest AM congested period and the Central Area Circumferential Corridor has the longest AM congested period.
- Even after switching the performance measure from Speed Index to Travel Time Index, and removing the center TMCs, there is still some distortion in the congestion scans
- The AM and PM congested periods for the entire Boston Region are longer on arterials than on freeways.

5 CONCLUSIONS

- The durations of congested conditions are longer on the Route 128 Circumferential and Central Area Circumferential Corridors than on the I-495 and Outer Circumferential Corridors.
- Most of top freeway corridors for congested hours are located in the Route 128 Circumferential Corridor.
- Most of the top arterial corridors for congested hours are located in the Central Area Circumferential Corridor.
- Four of the top-ten freeway corridors for congested hours are connected to the Central Artery Tunnel.

Possible Factors that Affect Periods and Hours of Congestion on Freeways

- The Route 128 Circumferential Corridor contains Downtown Boston, Logan Airport, and the Central Artery Tunnel, all of which could be factors that contribute to the length of congested periods on freeways in this corridor.
- The congested periods in commercial areas may be influenced by employer policies such as flextime, and staggered hours. These policies can lower the intensity of congestion, but extend the number of hours a roadway might experience congested conditions.

- Route 2 could have the most congested hours because of the presence of controlled intersections in this corridor. The congestion scan was skewed because the Speed Index performance measure was used instead of the Travel Time Index, despite the roadway having features similar to an arterial.
- A reason that the Outer Circumferential Corridor might experience a shorter period of congestion in the PM peak period is because many commuters in the Boston region commute outward from the Central Area Circumferential Corridor to the Outer Circumferential Corridor.

Possible Factors that Affect Periods and Hours of Congestion on Arterials

- The PM peak period for arterials begins at around 2:00 PM, likely because of school traffic.
- The AM congested period extends past 10:00 AM because there are many businesses in the Central Area Circumferential Corridor that offer flextime and staggered hours. In addition, the Boston region has a college student population that is comparably larger than similarly sized metropolitan areas. The dates selected for CMP monitoring occurred in the spring and the fall, when local universities are in session. College students often have irregular commuting patterns, which may take place during off peak hours.

RH/rh

APPENDIX A

FREEWAY AND ARTERIAL CORRIDOR CONGESTED PERIOD START TIME, END TIME AND CONGESTED HOURS INRIX DATASET, 2012

Table Name	Table Number
Freeway Corridor Congested Period Start Time, End Time and Congested Hours INRIX Dataset, 2012	A.1
Table A.2 Arterial Corridor Congested Period Start Time, End Time and Congested Hours INRIX Dataset, 2012	A.2

**Table A.1
Freeway Corridor Congested Period Start Time, End Time and Congested Hours
INRIX Dataset, 2012**

Roadway	Corridor	L RTP Circumferential Location	Direction	AM Congested Period start time	AM Congested Period end time	AM Congested Minutes	PM Congested Period start time	PM Congested Period end time	PM Congested Minutes	Congested Hours
I-290	Route 140 to I-495	Outer	Eastbound	n/a	n/a	0	n/a	n/a	0	none
I-290	I-495 to Route 140	Outer	Westbound	n/a	n/a	0	n/a	n/a	0	none
I-495	Route 25 to Route 24	Outer	Northbound	n/a	n/a	0	n/a	n/a	0	none
I-495	Route 24 to Route 25	Outer	Southbound	n/a	n/a	0	n/a	n/a	0	none
I-495	Route 24 to Route 1A	Outer	Northbound	n/a	n/a	0	n/a	n/a	0	none
I-495	Route 24 to Route 1A	Outer	Southbound	n/a	n/a	0	n/a	n/a	0	none
I-495	Route 1A to I-90	495	Northbound	8:10:00 AM	8:30:00 AM	20	n/a	n/a	0	0.33
I-495	I-90 to Route 1A	495	Southbound	n/a	n/a	0	5:25:00 PM	5:50:00 PM	25	0.42
I-495	I-90 to Route 2	495	Northbound	n/a	n/a	0	n/a	n/a	0	none
I-495	Route 2 to I-90	495	Southbound	n/a	n/a	0	5:25:00 PM	5:50:00 PM	25	0.42
I-495	Route 2 to I-93	Outer	Northbound	n/a	n/a	0	4:50:00 PM	6:15:00 PM	85	1.42
I-495	I-93 to Route 2	Outer	Southbound	7:35:00 AM	9:00:00 AM	85	5:30:00 PM	5:55:00 PM	25	1.83

**Table A.1 (CONT.)
Freeway Corridor Congested Period Start Time, End Time and Congested Hours
INRIX Dataset, 2012**

Roadway	Corridor	L RTP Circumferential Location	Direction	AM Congested Period start time	AM Congested Period end time	AM Congested Minutes	PM Congested Period start time	PM Congested Period end time	PM Congested Minutes	Congested Hours
I-495	I-93 to I-95	Outer	Northbound	n/a	n/a	0	4:30:00 PM	6:20:00 PM	110	1.83
I-495	I-95 to I-93	Outer	Southbound	7:35:00 AM	9:00:00 AM	85	n/a	n/a	0	1.42
I-90	Route I-95 to 1A	128	Eastbound	6:45:00 AM	10:55:00 AM	250	4:40:00 PM	7:40:00 PM	180	7.17
I-90	Route 1A to I- 95	128	Westbound	n/a	n/a	0	4:20:00 PM	7:40:00 PM	200	3.33
I-90	Westboro Dr. to I-95	495	Eastbound	6:35:00 AM	11:00:00 AM	265	4:45:00 PM	7:35:00 PM	170	7.25
I-90	I-95 to Westboro Dr.	495	Westbound	n/a	n/a	0	4:20:00 PM	6:00:00 PM	100	1.67
I-93	I-95 to Route 3	128	Northbound	5:50:00 AM	9:40:00 AM	230	2:50:00 PM	7:05:00 PM	315	9.08
I-93	Route 3 to I-95	128	Southbound	6:40:00 AM	9:05:00 AM	145	3:10:00 PM	7:05:00 PM	235	6.33
I-93	Route 3 to Route 1	128	Northbound	5:45:00 AM	11:00:00 AM	335	2:20:00 PM	7:10:00 PM	290	10.42
I-93	Route 1 to Route 3	128	Southbound	6:15:00 AM	10:25:00 AM	130	2:20:00 PM	7:15:00 PM	295	7.08
I-93	Route 1 to I-95	128	Northbound	7:35:00 AM	9:20:00 AM	105	3:35:00 PM	6:25:00 PM	170	4.58
I-93	I-95 to Route 1	128	Southbound	6:15:00 AM	10:25:00 AM	130	3:20:00 PM	6:30:00 PM	250	6.33

**Table A.1 (CONT.)
Freeway Corridor Congested Period Start Time, End Time and Congested Hours
INRIX Dataset, 2012**

Roadway	Corridor	L RTP Circumferential Location	Direction	AM Congested Period start time	AM Congested Period end time	AM Congested Minutes	PM Congested Period start time	PM Congested Period end time	PM Congested Minutes	Congested Hours
I-93	I-95 to New Hampshire	Outer	Northbound	7:35:00 AM	9:20:00 AM	105	4:50:00 PM	6:20:00 PM	90	3.25
I-93	New Hampshire to I-95	Outer	Southbound	6:15:00 AM	8:15:00 AM	120	n/a	n/a	0	2.00
I-95	Rhode Island to I-495	Outer	Northbound	n/a	n/a	0	n/a	n/a	0	none
I-95	I-495 to Rhode Island	Outer	Southbound	n/a	n/a	0	n/a	n/a	0	none
I-95	I-495 to I-93	495	Northbound	6:35:00 AM	9:15:00 AM	160	n/a	n/a	0	2.67
I-95	I-93 to I-495	495	Southbound	n/a	n/a	0	4:45:00 PM	6:20:00 PM	95	1.58
I-95	I-93 to Route 2	128	Northbound	6:35:00 AM	9:45:00 AM	245	3:55:00 PM	6:05:00 PM	130	6.25
I-95	Route 2 to I-93	128	Southbound	7:20:00 AM	9:30:00 AM	130	3:00:00 PM	6:35:00 PM	215	5.75
I-95	Route 2 to Route 128	128	Northbound	n/a	n/a	0	3:35:00 PM	6:55:00 PM	200	3.33
I-95	Route 128 to Route 2	128	Southbound	6:30:00 AM	9:45:00 AM	195	4:45:00 PM	6:30:00 PM	105	5.00
I-95	Route 128 to New Hampshire	Outer	Northbound	n/a	n/a	0	n/a	n/a	0	none
I-95	New Hampshire to Route 128	Outer	Southbound	n/a	n/a	0	n/a	n/a	0	none

**Table A.1 (CONT.)
Freeway Corridor Congested Period Start Time, End Time and Congested Hours
INRIX Dataset, 2012**

Roadway	Corridor	L RTP Circumferentia I Location	Direction	AM Congeste d Period start time	AM Congeste d Period end time	AM Congeste d Minutes	PM Congeste d Period start time	PM Congeste d Period end time	PM Congeste d Minutes	Congeste d Hours
Route 128	I-95 to Route 127	128	Eastbound	7:45:00 AM	8:25:00 AM	40	n/a	n/a	0	0.67
Route 128	Route 127 to I-95	128	Westbound	n/a	n/a	0	5:20:00 PM	5:55:00 PM	35	0.58
Route 2	I-95 to Route 3/Rout e 16	128	Eastbound	6:20:00 AM	10:25:00 AM	245	4:50:00 PM	7:15:00 PM	145	6.50
Route 2	Route 3/Route 16 to I-95	128	Westbound	n/a	n/a	0	n/a	n/a	0	none
Route 2	I-495 to I-95	495	Eastbound	6:20:00 AM	11:00:00 AM	400	2:00:00 PM	6:25:00 PM	325	12.08
Route 2	I-95 to I-495	495	Westbound	n/a	n/a	0	2:30:00 PM	7:15:00 PM	285	4.75
Route 2	I-190 to I- 495	Outer	Eastbound	n/a	n/a	0	n/a	n/a	0	none
Route 2	I-495 to I-90	Outer	Westbound	n/a	n/a	0	n/a	n/a	0	none
Route 24	Route 140 to I-93	Outer	Northbound	6:20:00 AM	9:05:00 AM	45	n/a	n/a	0	0.75
Route 24	I-93 to Route 140	Outer	Southbound	n/a	n/a	0	n/a	n/a	0	none
Route 3 South	Route 6 to Route 3A/Tremont St	Outer	Northbound	n/a	n/a	0	n/a	n/a	0	none
Route 3 South	Route 3A/Tremont St to Route 6	Outer	Southbound	n/a	n/a	0	n/a	n/a	0	none

**Table A.1 (CONT.)
Freeway Corridor Congested Period Start Time, End Time and Congested Hours
INRIX Dataset, 2012**

Roadway	Corridor	L RTP Circumferential Location	Direction	AM Congested Period start time	AM Congested Period end time	AM Congested Minutes	PM Congested Period start time	PM Congested Period end time	PM Congested Minutes	Congested Hours
Route 3 South	Route 3A/Tremont St. to I-93	128	Northbound	6:05:00 AM	9:35:00 AM	30	n/a	n/a	0	0.50
Route 3 South	I-93 to Route 3A/Tremont St.	128	Southbound	n/a	n/a	0	3:25:00 PM	6:55:00 PM	210	3.50
Route 1	I-93 to I-95	128	Northbound	n/a	n/a	0	2:50:00 PM	7:15:00 PM	265	4.42
Route 1	I-95 to I-93	128	Southbound	6:20:00 AM	9:50:00 AM	210	n/a	n/a	0	3.50
Route 3 North	I-95 to New Hampshire	Outer	Northbound	n/a	n/a	0	4:20:00 PM	6:40:00 PM	140	2.33
Route 3 North	New Hampshire to I-95	Outer	Southbound	6:15:00 AM	10:55:00 AM	280	4:15:00 PM	7:25:00 PM	190	7.83

Table A.2
Arterial Corridor Congested Period Start Time, End Time and Congested Hours
INRIX Dataset, 2012

Roadway	Corridor	L RTP Circumferential Location	Direction	AM Congested Period start time	AM Congested Period end time	AM Congested Minutes	PM Congested Period start time	PM Congested Period end time	PM Congested Minutes	Total Congested Hours
Route 1	I-95 to Linebrook Rd.	128	Northbound	n/a	n/a	none	n/a	n/a	none	none
Route 1	Linebrook Rd. to I-95	128	Southbound	n/a	n/a	none	n/a	n/a	none	none
Route 1	I-495 to I-95	495	Northbound	6:40:00 AM	9:40:00 AM	180	n/a	n/a	none	3.0
Route 1	I-95 to I-495	495	Southbound	n/a	n/a	none	3:55:00 PM	6:50:00 PM	175	2.9
Route 114	Sharpners Pond Rd. to Route 129	128	Eastbound	7:05:00 AM	9:00:00 AM	115	2:00:00 PM	6:05:00 PM	245	6.0
Route 114	Route 129 to Sharpners Pond Rd.	128	Westbound	n/a	n/a	none	2:00:00 PM	4:10:00 PM	190	3.2
Route 4/Route 225	Route 2 to North Rd.	128	Northbound	n/a	n/a	75	2:00:00 PM	6:35:00 PM	245	5.3
Route 4/Route 225	North Rd. to Route 2	128	Southbound	7:20:00 AM	9:15:00 AM	115	n/a	n/a	none	1.9
Route 20	Route 117 to Fenway/Beacon St./Boylston St.	128	Eastbound	7:35:00 AM	11:00:00 AM	335	2:00:00 PM	6:00:00 PM	300	10.6
Route 20	Fenway/Beacon St./Boylston St. to Route 117	128	Westbound	n/a	n/a	none	n/a	n/a	none	none

**Table A.2 (CONT.)
Arterial Corridor Congested Period Start Time, End Time and Congested Hours
INRIX Dataset, 2012**

Roadway	Corridor	L RTP Circumferential Location	Direction	AM Congested Period start time	AM Congested Period end time	AM Congested Minutes	PM Congested Period start time	PM Congested Period end time	PM Congested Minutes	Total Congested Hours
Route 20	Route 27 to Route 117	128	Eastbound	6:20:00 AM	10:15:00 AM	305	2:00:00 PM	4:10:00 PM	85	6.5
Route 20	Route 117 to Route 27	128	Westbound	n/a	n/a	none	2:50:00 PM	6:35:00 PM	225	3.8
Route 20	Bartlett St. to Route 27	495	Eastbound	6:55:00 AM	9:00:00 AM	125	n/a	n/a	none	2.1
Route 20	Route 27 to Bartlett St.	495	Westbound	n/a	n/a	none	n/a	n/a	none	none
Route 9	I-95 to Dartmouth St.	128	Eastbound	5:30:00 AM	11:00:00 AM	450	2:00:00 PM	8:00:00 PM	555	16.8
Route 9	Dartmouth St. to I-95	128	Westbound	5:05:00 AM	11:00:00 AM	475	2:00:00 PM	8:00:00 PM	690	19.4
Route 9	Route 126 to I- 95	128	Eastbound	6:20:00 AM	11:00:00 AM	400	2:00:00 PM	6:10:00 PM	295	11.6
Route 9	I-95 to Route 126	128	Westbound	n/a	n/a	70	2:00:00 PM	6:45:00 PM	345	6.9
Route 9	I-495 to Route 126	495	Eastbound	6:35:00 AM	10:10:00 AM	215	2:00:00 PM	6:40:00 PM	230	7.4
Route 9	Route 126 to I- 495	495	Westbound	n/a	n/a	none	2:00:00 PM	6:15:00 PM	300	5.0

Table A.2 (CONT.)
Arterial Corridor Congested Period Start Time, End Time and Congested Hours
INRIX Dataset, 2012

Roadway	Corridor	L RTP Circumferential Location	Direction	AM Congested Period start time	AM Congested Period end time	AM Congested Minutes	PM Congested Period start time	PM Congested Period end time	PM Congested Minutes	Total Congested Hours
Route 138	Union St. to Route 28	128	Northbound	6:30:00 AM	9:40:00 AM	190	n/a	n/a	none	3.2
Route 138	Route 28 to Union St.	128	Southbound	n/a	n/a	none	3:20:00 PM	6:15:00 PM	175	2.9
Route 3/3A	Route 3/Route 16 to Route 62	128	Northbound	8:00:00 AM	9:20:00 AM	155	2:00:00 PM	4:15:00 PM	195	5.8
Route 3/3A	Route 62 to Route 3/Route 16	128	Southbound	7:40:00 AM	8:30:00 AM	50	n/a	n/a	none	0.8
Route 3A	Route 3 to Route 139 (west)	128	Northbound	n/a	n/a	none	n/a	n/a	none	none
Route 3A	Route 139 (west) to Route 3	128	Southbound	n/a	n/a	none	n/a	n/a	none	none
Route 3A	From 139 (west) to Route 228	128	Northbound	n/a	n/a	none	n/a	n/a	none	none
Route 3A	Route 228 to From 139 (west)	128	Southbound	n/a	n/a	none	n/a	n/a	none	none
Route 3A	Route 228 to I- 93/Route 1	128	Northbound	6:15:00 AM	11:00:00 AM	285	n/a	n/a	none	4.8
Route 3A	I-93/Route 1 to Route 228	128	Southbound	n/a	n/a	none	n/a	n/a	none	none

**Table A.2 (CONT.)
Arterial Corridor Congested Period Start Time, End Time and Congested Hours
INRIX Dataset, 2012**

Roadway	Corridor	L RTP Circumferential Location	Direction	AM Congested Period start time	AM Congested Period end time	AM Congested Minutes	PM Congested Period start time	PM Congested Period end time	PM Congested Minutes	Total Congested Hours
Route 28	High St. to Route 138	128	Northbound	6:45:00 AM	9:15:00 AM	150	n/a	n/a	none	2.5
Route 28	Route 138 to High St.	128	Southbound	n/a	n/a	none	n/a	n/a	none	none
Route 28	Route 138 to Arlington St.	Center	Northbound	7:00:00 AM	9:55:00 AM	115	2:00:00 PM	4:15:00 PM	200	5.3
Route 28	Arlington St. to Route 138	Center	Southbound	7:00:00 AM	11:00:00 AM	360	2:00:00 PM	4:40:00 PM	220	9.7
Route 203	Route 9 to I- 93/Route 1	Center	Eastbound	n/a	n/a	none	3:00:00 PM	6:35:00 PM	215	3.6
Route 203	I-93/Route 1 to Route 9	Center	Westbound	7:05:00 AM	9:10:00 AM	125	n/a	n/a	none	2.1
Storrow Dr.	Route 20 to Route 28	Center	Eastbound	n/a	n/a	none	3:40:00 PM	6:20:00 PM	160	2.7
Storrow Dr.	Route 28 to Route 20	Center	Westbound	n/a	n/a	none	n/a	n/a	none	none
Memorial Drive/Fresh Pond Pkwy.	Route 2 to Route 99	Center	Eastbound	6:30:00 AM	11:00:00 AM	390	2:00:00 PM	2:20:00 PM	80	7.8
Memorial Drive/Fresh Pond Pkwy.	Route 99 to Route 2	Center	Westbound	6:00:00 AM	11:00:00 AM	420	2:00:00 PM	7:40:00 PM	390	13.5

Table A.2 (CONT.)
Arterial Corridor Congested Period Start Time, End Time and Congested Hours
INRIX Dataset, 2012

Roadway	Corridor	L RTP Circumferential Location	Direction	AM Congested Period start time	AM Congested Period end time	AM Congested Minutes	PM Congested Period start time	PM Congested Period end time	PM Congested Minutes	Total Congested Hours
Route 28	Storrow Dr. to Montevale Ave.	Center	Northbound	7:50:00 AM	11:00:00 AM	310	2:00:00 PM	7:40:00 PM	400	11.8
Route 28	Montevale Ave. to Storrow Dr.	Center	Southbound	7:00:00 AM	11:00:00 AM	360	2:00:00 PM	7:25:00 PM	385	12.4
Route 28	Montevale Ave. to Route 125	128	Northbound	n/a	n/a	none	n/a	n/a	none	0.0
Route 28	Route 125 to Montevale Ave.	128	Southbound	7:20:00 AM	8:30:00 AM	70	n/a	n/a	none	1.2
Route 99	Commerical St. to Route 1	Center	Northbound	5:50:00 AM	11:00:00 AM	430	2:00:00 PM	7:30:00 PM	390	13.7
Route 99	Route 1 to Commerical St.	Center	Southbound	n/a	n/a	100	2:00:00 PM	5:25:00 PM	245	5.8
Route 16	Route 2 to Route 1A	Center	Eastbound	6:45:00 AM	11:00:00 AM	375	2:00:00 PM	7:40:00 PM	400	12.9
Route 16	Route 1A to Route 2	Center	Westbound	6:15:00 AM	11:00:00 AM	405	2:00:00 PM	6:50:00 PM	350	12.6
Route 16	I-95/Route 128 to Route 2	128	Eastbound	7:00:00 AM	11:00:00 AM	360	2:00:00 PM	7:40:00 PM	400	12.7
Route 16	Route 2 to I- 95/Route 128	128	Westbound	6:30:00 AM	11:00:00 AM	390	2:00:00 PM	4:15:00 PM	195	9.8

**Table A.2 (CONT.)
Arterial Corridor Congested Period Start Time, End Time and Congested Hours
INRIX Dataset, 2012**

Roadway	Corridor	L RTP Circumferential Location	Direction	AM Congested Period start time	AM Congested Period end time	AM Congested Minutes	PM Congested Period start time	PM Congested Period end time	PM Congested Minutes	Total Congested Hours
Route 16	Route 126 to I-95/Route 128	128	Eastbound	7:20:00 AM	11:00:00 AM	340	2:00:00 PM	3:45:00 PM	165	8.4
Route 16	I-95/Route 128 to Route 126	128	Westbound	7:20:00 AM	11:00:00 AM	340	2:00:00 PM	6:35:00 PM	335	11.3
Route 16	North Ave./Main St. to Route 126	495	Eastbound	6:45:00 AM	9:00:00 AM	135	n/a	n/a	none	2.3
Route 16	Route 126 to North Ave./Main St.	495	Westbound	n/a	n/a	none	3:40:00 PM	4:30:00 PM	50	0.8
Route 60	Route 20 to Route 1A	128	Eastbound	6:55:00 AM	11:00:00 AM	365	2:00:00 PM	7:00:00 PM	360	12.1
Route 60	Route 1A to Route 20	128	Westbound	6:45:00 AM	9:25:00 AM	345	2:00:00 PM	7:30:00 PM	390	12.3
Route 1A	I-93 to General Edwards Bridge	Center	Northbound	5:30:00 AM	11:00:00 AM	450	2:00:00 PM	8:00:00 PM	575	17.1
Route 1A	General Edwards Bridge to I-93	Center	Southbound	6:25:00 AM	11:00:00 AM	395	2:00:00 PM	8:00:00 PM	450	14.1
Route 1A	General Edwards Bridge to Route 22	128	Northbound	n/a	n/a	none	2:00:00 PM	4:05:00 PM	175	2.9
Route 1A	Route 22 to General Edwards Bridge	128	Southbound	7:15:00 AM	8:35:00 AM	80	2:00:00 PM	2:50:00 PM	55	2.3

Table A.2 (CONT.)
Arterial Corridor Congested Period Start Time, End Time and Congested Hours
INRIX Dataset, 2012

Roadway	Corridor	L RTP Circumferential Location	Direction	AM Congested Period start time	AM Congested Period end time	AM Congested Minutes	PM Congested Period start time	PM Congested Period end time	PM Congested Minutes	Total Congested Hours
Route 1A	Route 22 to Route 133	128	Northbound	n/a	n/a	none	n/a	n/a	none	none
Route 1A	Route 133 to Route 22	128	Southbound	n/a	n/a	none	n/a	n/a	none	none
VFW Parkway/Providence Hwy.	I-95/Route 1 to Route 203	128	Northbound	7:20:00 AM	9:05:00 AM	105	n/a	n/a	none	1.8
VFW Parkway/Providence Hwy.	Route 203 to I- 95/Route 1	128	Southbound	n/a	n/a	120	2:00:00 PM	4:50:00 PM	230	5.8
Route 62	I-495 to Route 27	495	Eastbound	n/a	n/a	none	n/a	n/a	none	none
Route 62	Route 27 to I-495	495	Westbound	n/a	n/a	none	n/a	n/a	none	none
Route 62	Route 27 to Bedford St.	128	Eastbound	6:55:00 AM	8:55:00 AM	120	n/a	n/a	none	2.0
Route 62	Bedford St. to Route 27	128	Westbound	n/a	n/a	none	4:10:00 PM	6:30:00 PM	140	2.3
Route 62	Route 3 to I- 93	128	Eastbound	n/a	n/a	none	n/a	n/a	none	none
Route 62	I-93 to Route 3	128	Westbound	n/a	n/a	none	n/a	n/a	none	none

**Table A.2 (CONT.)
Arterial Corridor Congested Period Start Time, End Time and Congested Hours
INRIX Dataset, 2012**

Roadway	Corridor	L RTP Circumferential Location	Direction	AM Congested Period start time	AM Congested Period end time	AM Congested Minutes	PM Congested Period start time	PM Congested Period end time	PM Congested Minutes	Total Congested Hours
Route 62	I-93 to I-95	128	Eastbound	6:45:00 AM	9:00:00 AM	135	2:30:00 PM	4:50:00 PM	140	4.6
Route 62	I-95 to I-93	128	Westbound	7:35:00 AM	8:50:00 AM	75	2:35:00 PM	4:00:00 PM	85	2.7
Route 62	I-95 to Route 127	128	Eastbound	n/a	n/a	none	n/a	n/a	none	none
Route 62	Route 127 to I-95	128	Westbound	n/a	n/a	none	n/a	n/a	none	none
Middlesex Turnpike	Route 2A to Lexington Rd.	128	Northbound	n/a	n/a	none	3:05:00 PM	4:00:00 PM	115	1.9
Middlesex Turnpike	Lexington Rd. to Route 2A	128	Southbound	n/a	n/a	40	n/a	n/a	none	0.7
Route 126	Pulaski Rd. to Route 109	495	Northbound	n/a	n/a	none	n/a	n/a	none	none
Route 126	Route 109 to Pulaski Rd.	495	Southbound	n/a	n/a	none	n/a	n/a	none	none
Route 126	Route 109 to Route 9/Route 30	495	Northbound	6:45:00 AM	9:40:00 AM	175	n/a	n/a	none	2.9
Route 126	Route 9/Route 30 to Route 109	495	Southbound	8:20:00 AM	11:00:00 AM	280	2:00:00 PM	6:00:00 PM	300	9.7

**Table A.2 (CONT.)
Arterial Corridor Congested Period Start Time, End Time and Congested Hours
INRIX Dataset, 2012**

Roadway	Corridor	L RTP Circumferential Location	Direction	AM Congested Period start time	AM Congested Period end time	AM Congested Minutes	PM Congested Period start time	PM Congested Period end time	PM Congested Minutes	Total Congested Hours
Route 126	Route 9/Route 30 to Route 2	128	Northbound	7:45:00 AM	9:05:00 AM	80	4:00:00 PM	4:55:00 PM	55	2.3
Route 126	Route 2 to Route 9/Route 30	128	Southbound	n/a	n/a	none	n/a	n/a	none	none

APPENDIX B

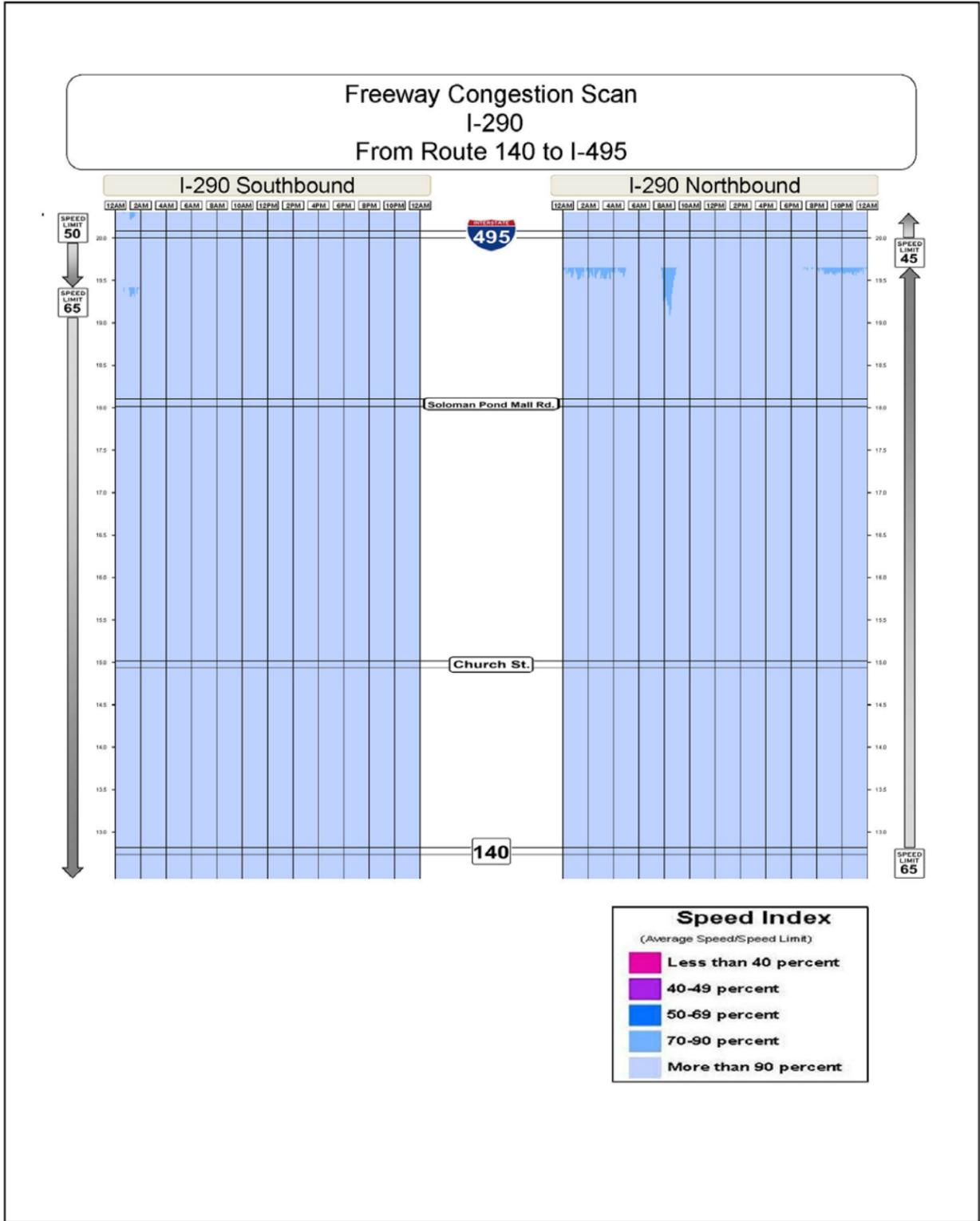
FREEWAY CONGESTION SCANS

Table Name

24-Hour Weekday Congestion Scan, Freeway Corridors

Figure Number

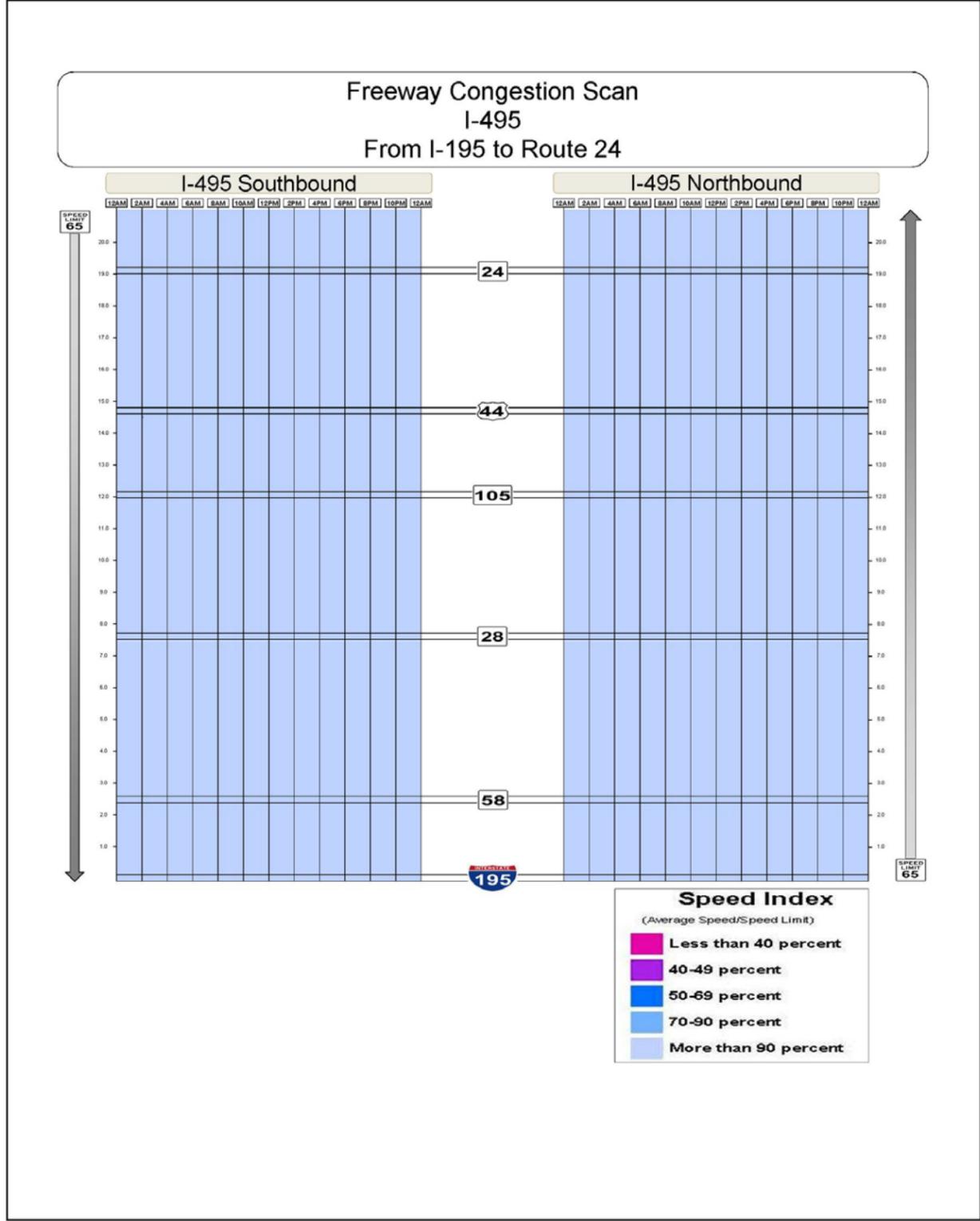
B.1-
B.27



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FIGURE B-1
24-Hour Weekday Congestion Scan
I-290 from Route 140 to I-495

Creating Congestion Scans with INRIX data

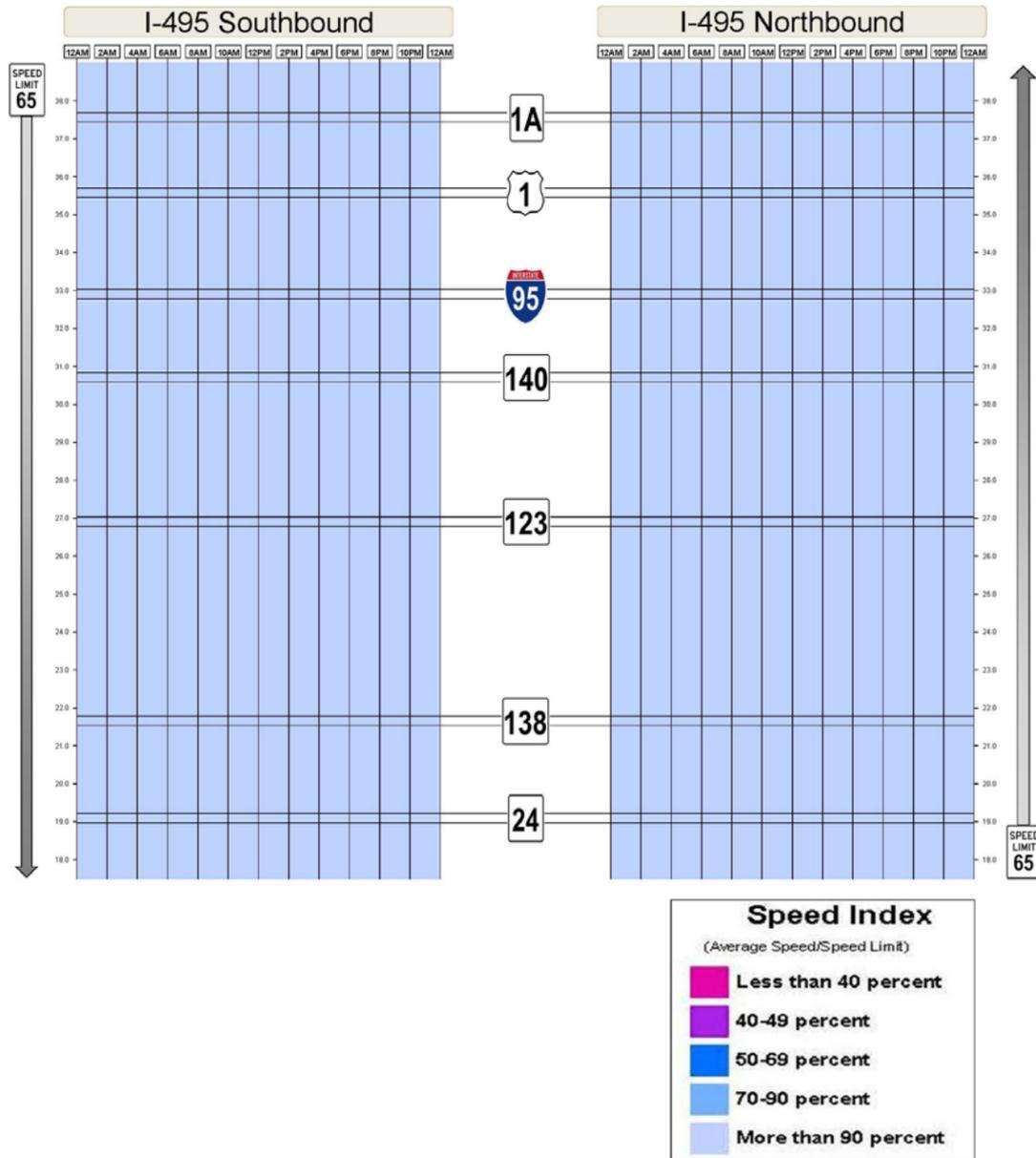


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FIGURE B-2
24-Hour Weekday Congestion Scan
I-495 from I-195 to Route 24

Creating Congestion Scans with INRIX data

Freeway Congestion Scan
I-495
From Route 24 to Route 1A

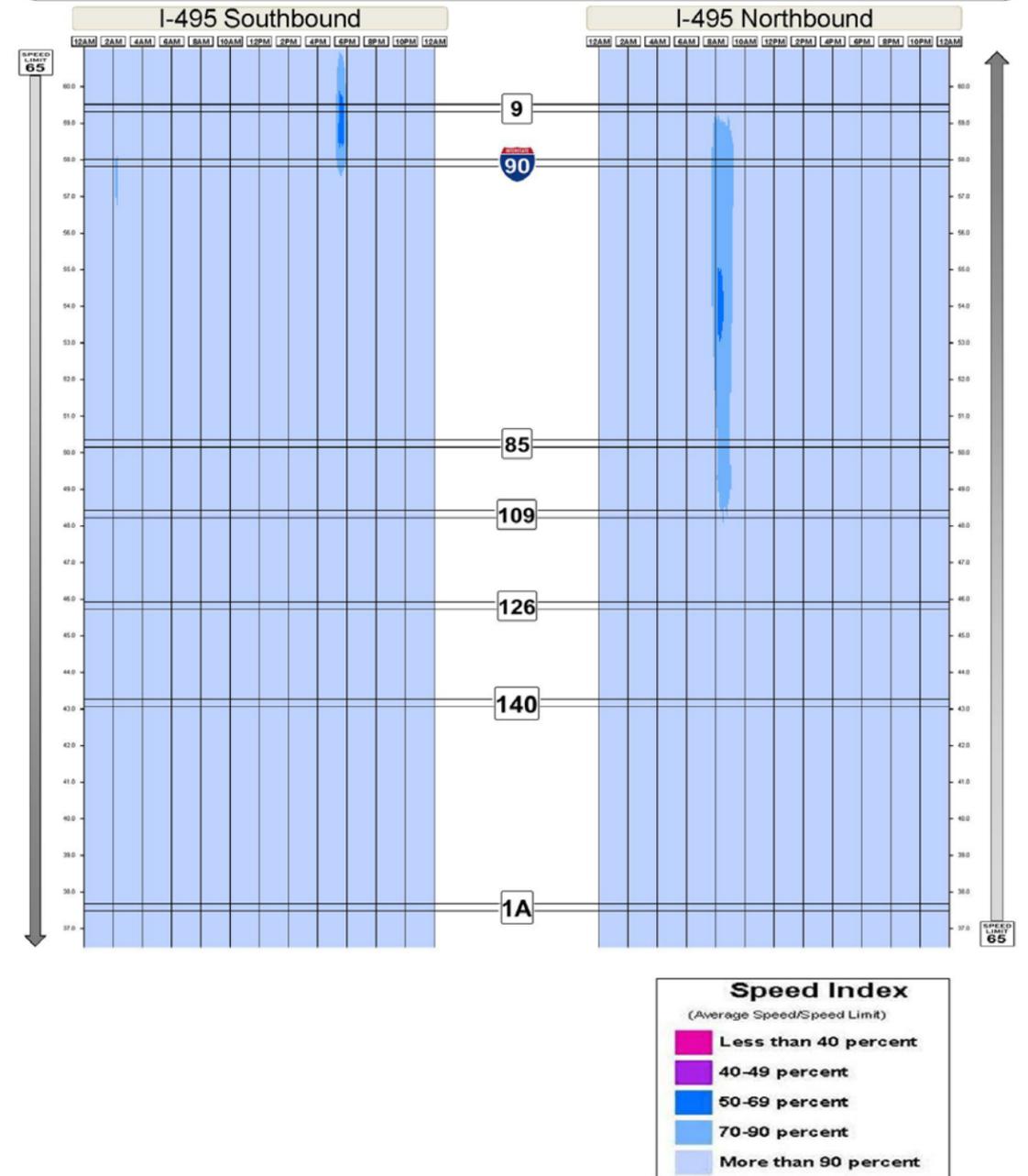


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FIGURE B-3
24-Hour Weekday Congestion Scan
I-495 from Route 24 to Route 1A

Creating
Congestion Scans
with
INRIX data

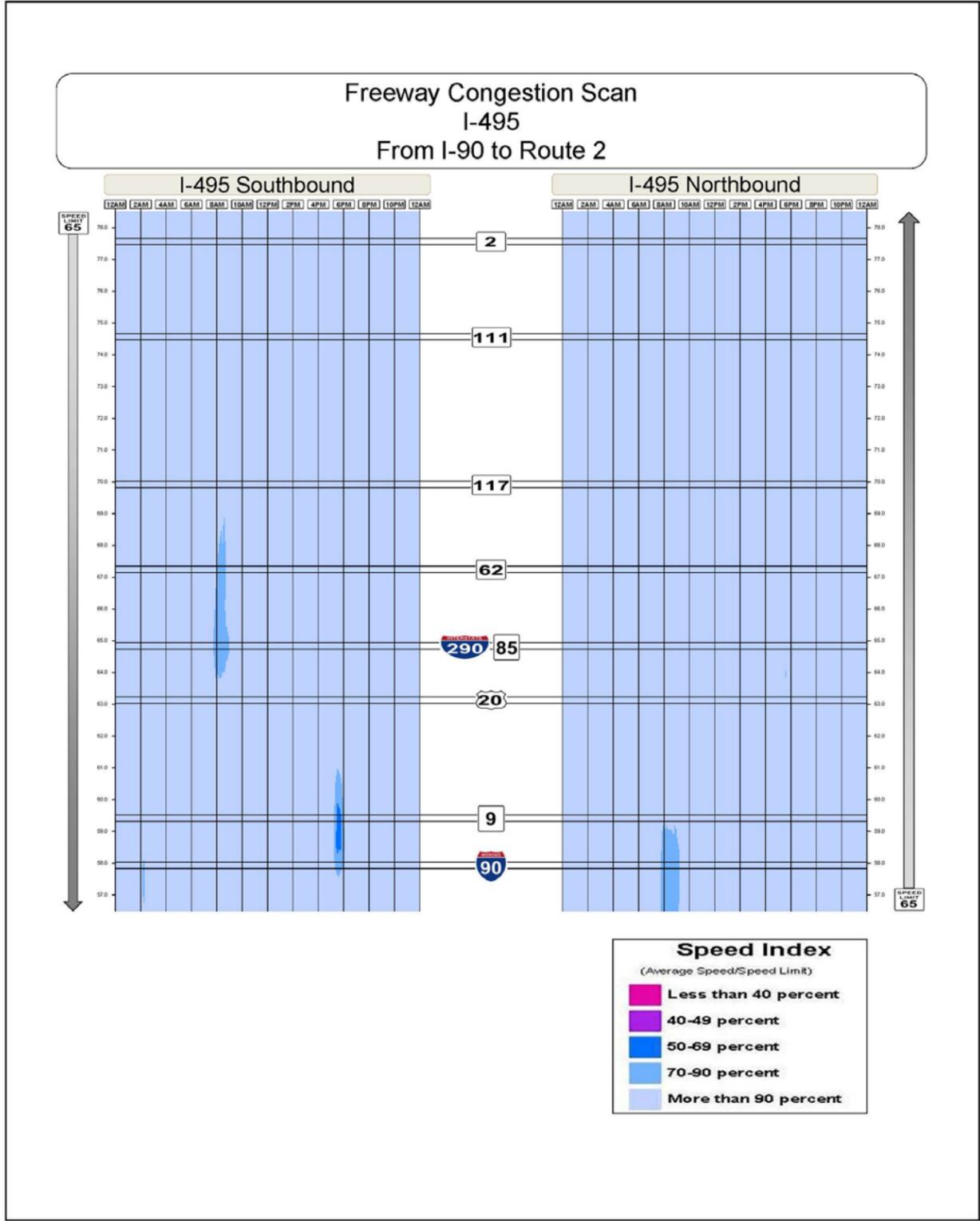
Freeway Congestion Scan
I-495
From Route 1A to I-90



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FIGURE B-4
24-Hour Weekday Congestion Scan
I-495 from Route 1A to I-90

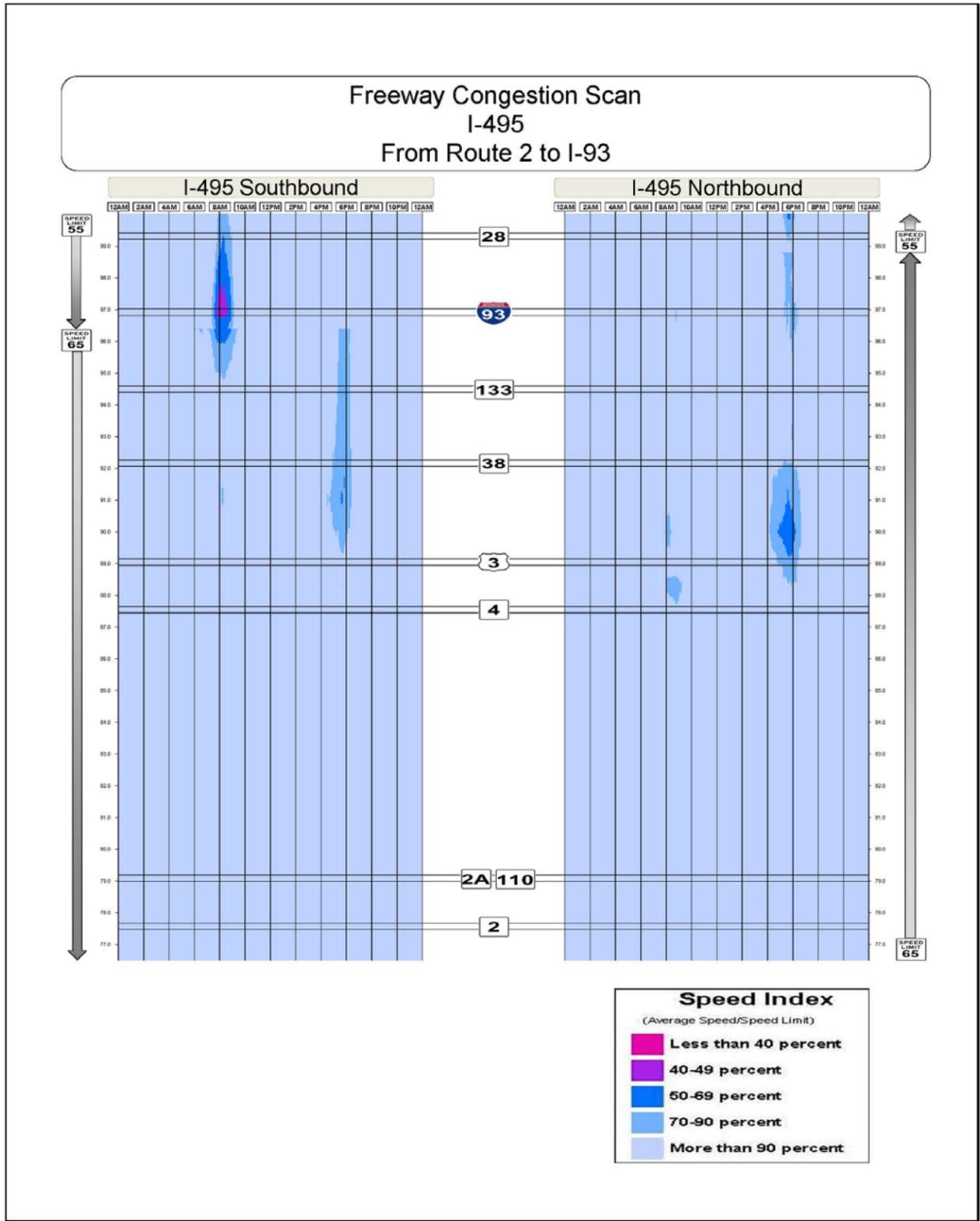
Creating
Congestion Scans
with
INRIX data



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FIGURE B-5
24-Hour Weekday Congestion Scan
I-495 from I-90 to Route 2

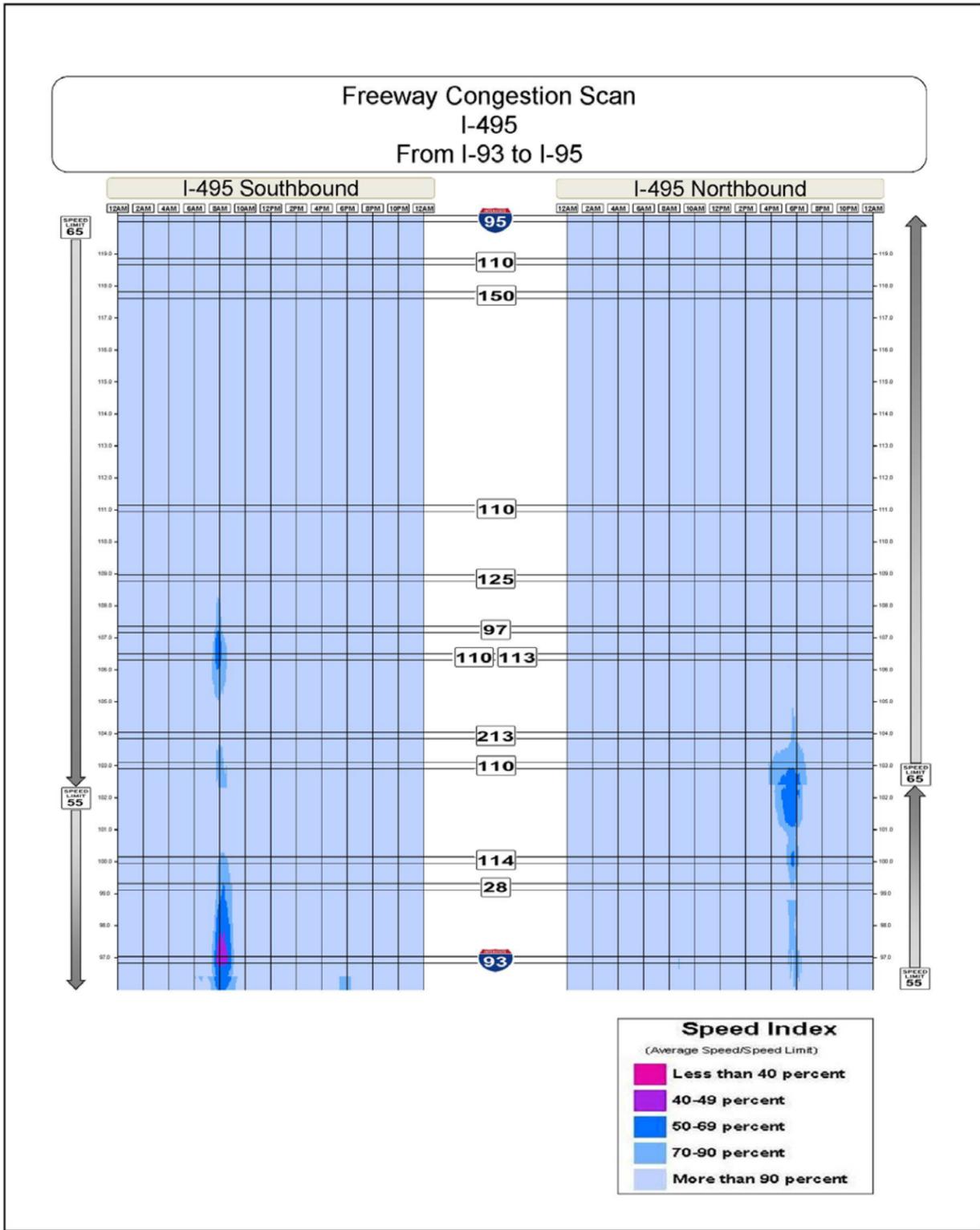
Creating Congestion Scans with INRIX data



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FIGURE B-6
24-Hour Weekday Congestion Scan
I-495 from Route 2 to I-93

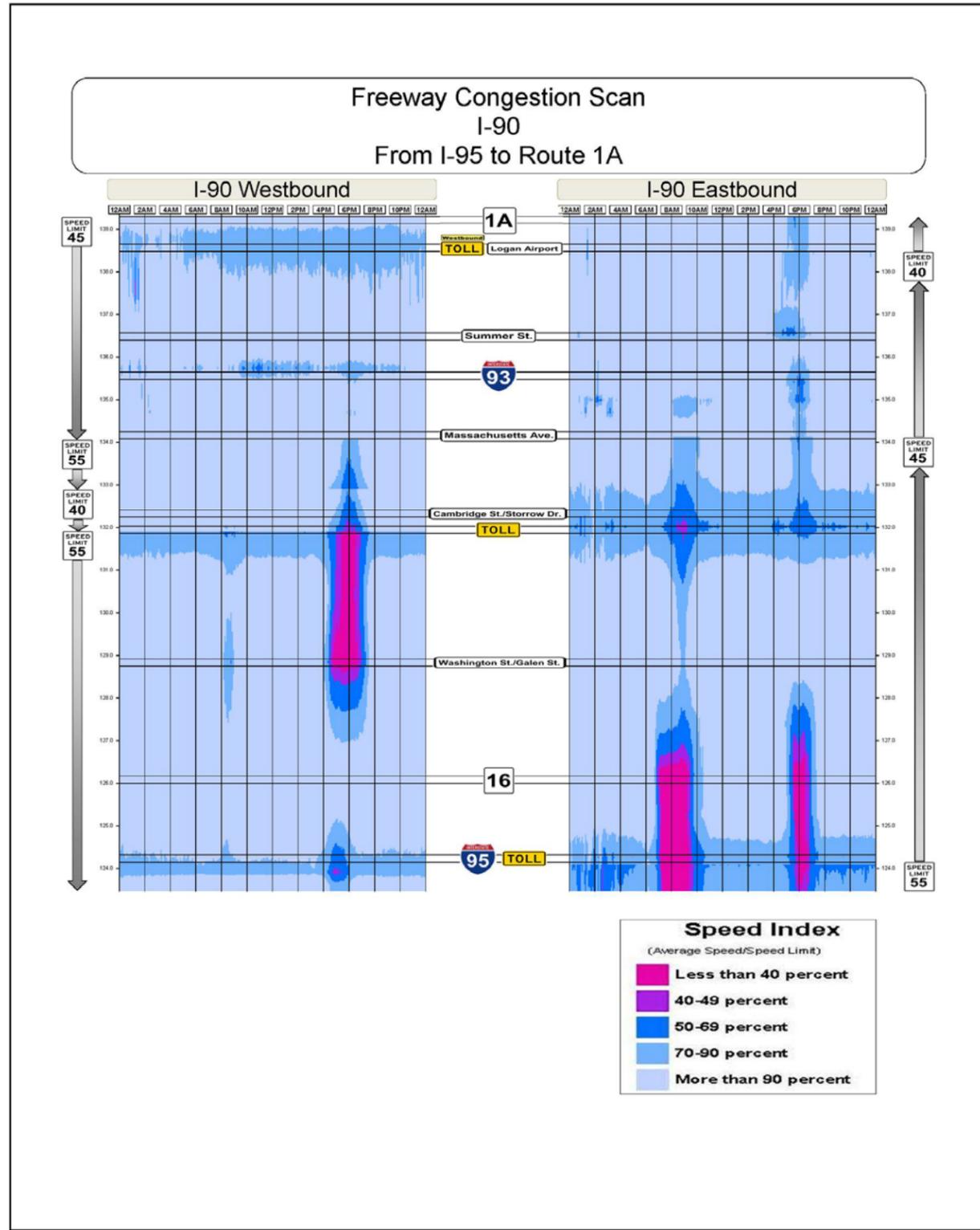
Creating Congestion Scans with INRIX data



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FIGURE B-7
24-Hour Weekday Congestion Scan
I-495 from I-93 to I-95

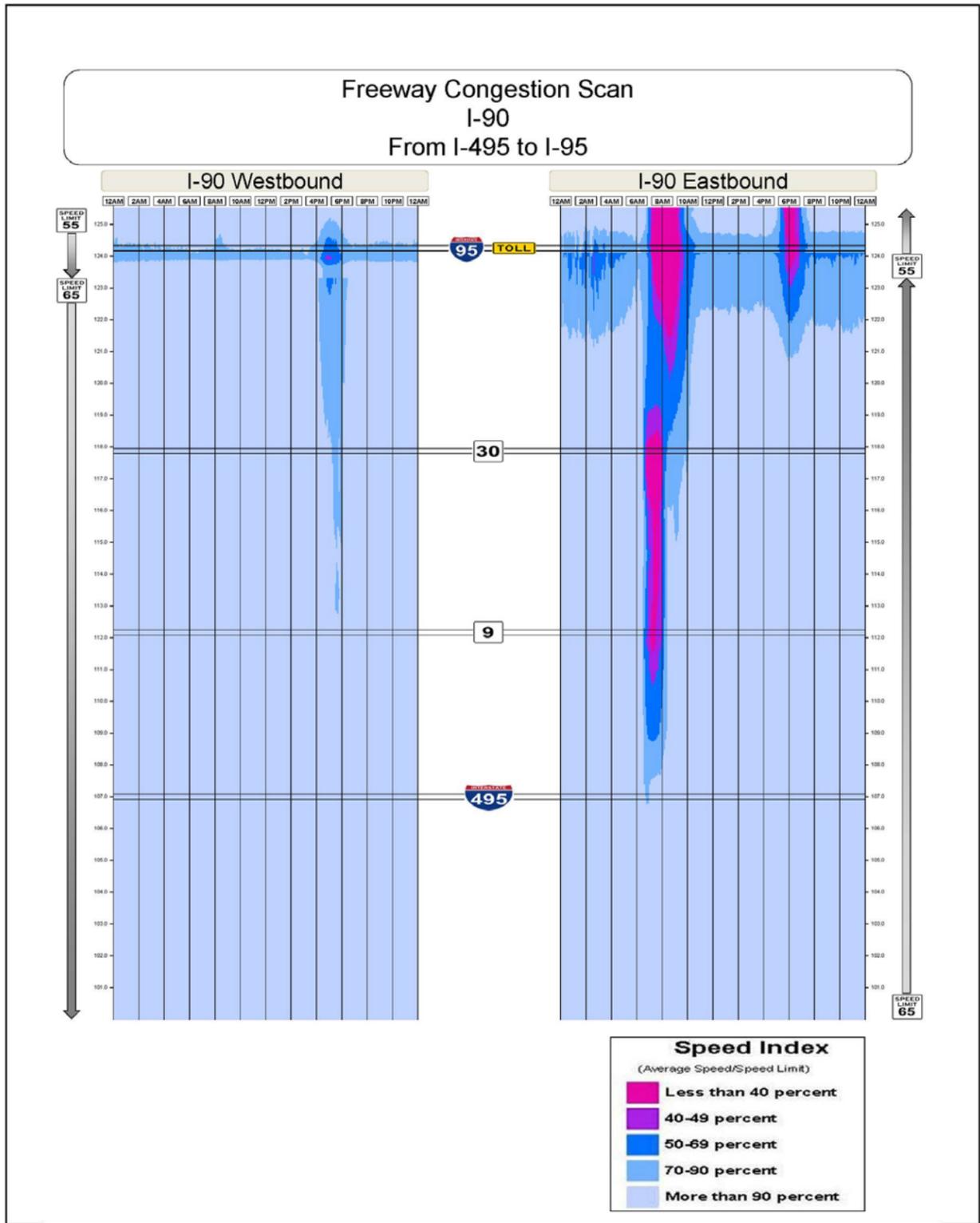
Creating Congestion Scans with INRIX data



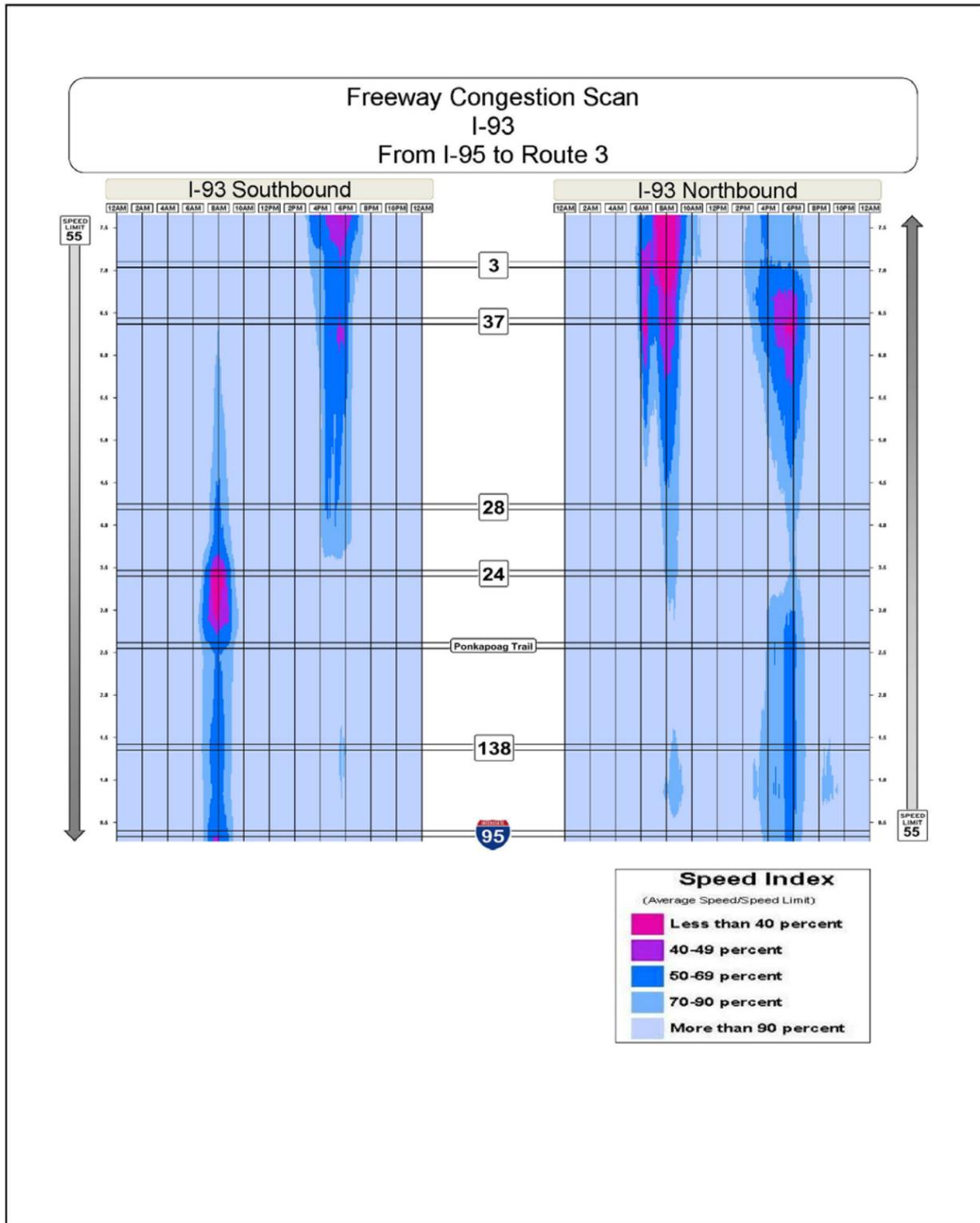
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FIGURE B-8
24-Hour Weekday Congestion Scan
I-90 from I-95 to Route 1A

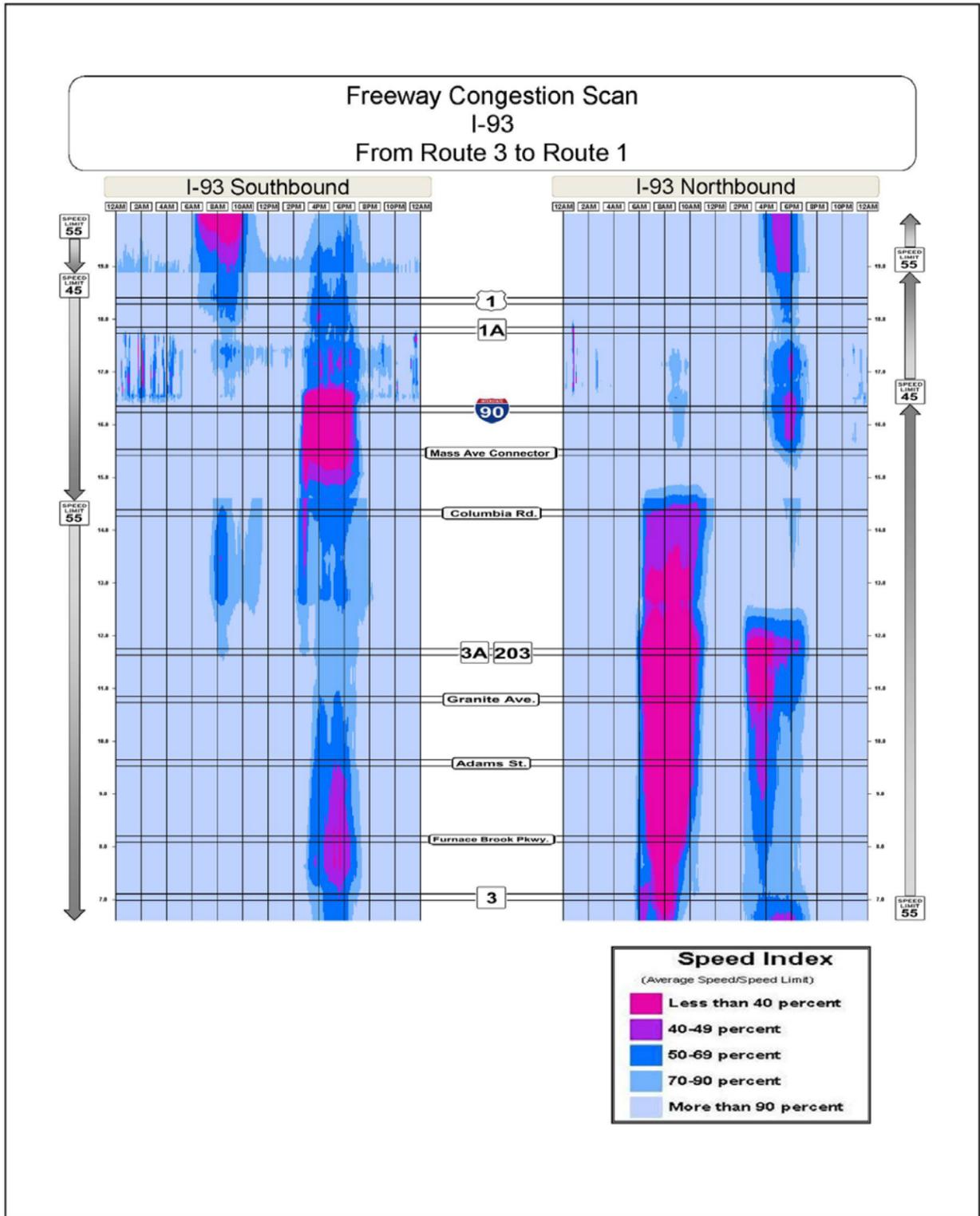
Creating Congestion Scans with INRIX data



BOSTON REGION MPO **FIGURE B-9** *Creating Congestion Scans with INRIX data*
24-Hour Weekday Congestion Scan
I-90 from I-495 to I-95



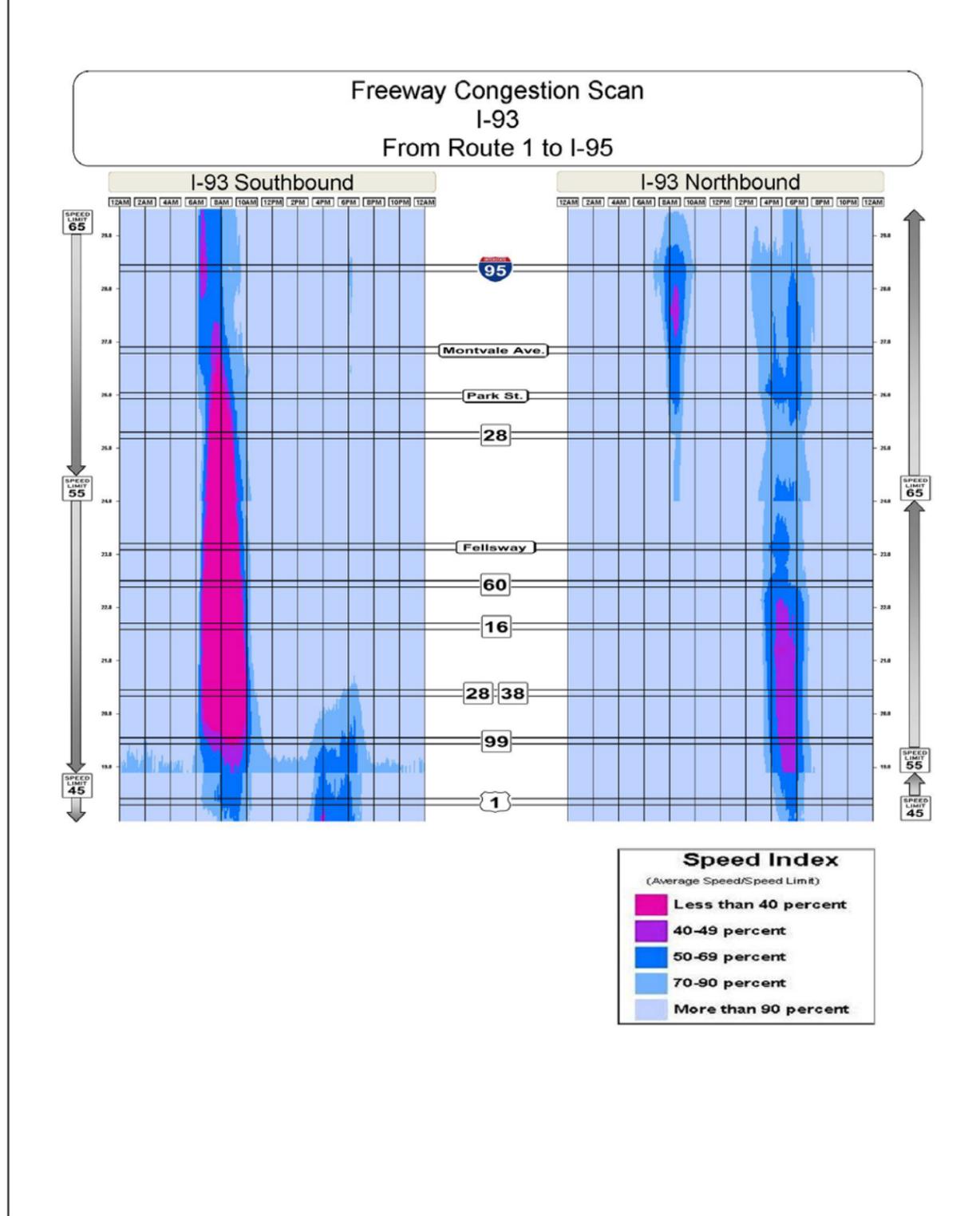
BOSTON REGION MPO **FIGURE B-10** *Creating Congestion Scans with INRIX data*
24-Hour Weekday Congestion Scan
I-93 from I-95 to Route 3



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FIGURE B-11
24-Hour Weekday Congestion Scan
I-93 from Route 3 to Route 1

Creating
Congestion Scans
with
INRIX data

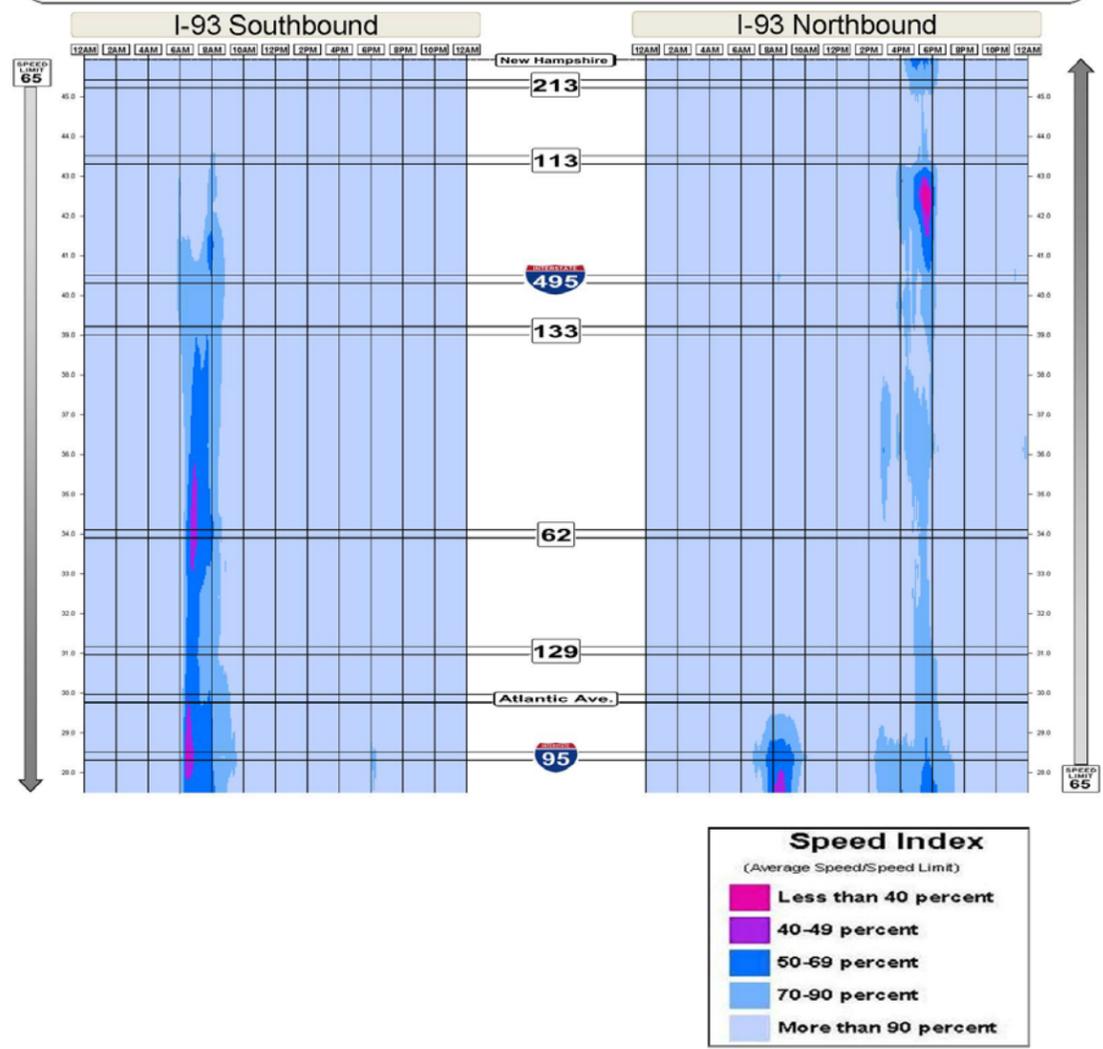


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FIGURE B-12
24-Hour Weekday Congestion Scan
I-93 from Route 1 to I-95

Creating
Congestion Scans
with
INRIX data

Freeway Congestion Scan
I-93
From I-95 to New Hampshire

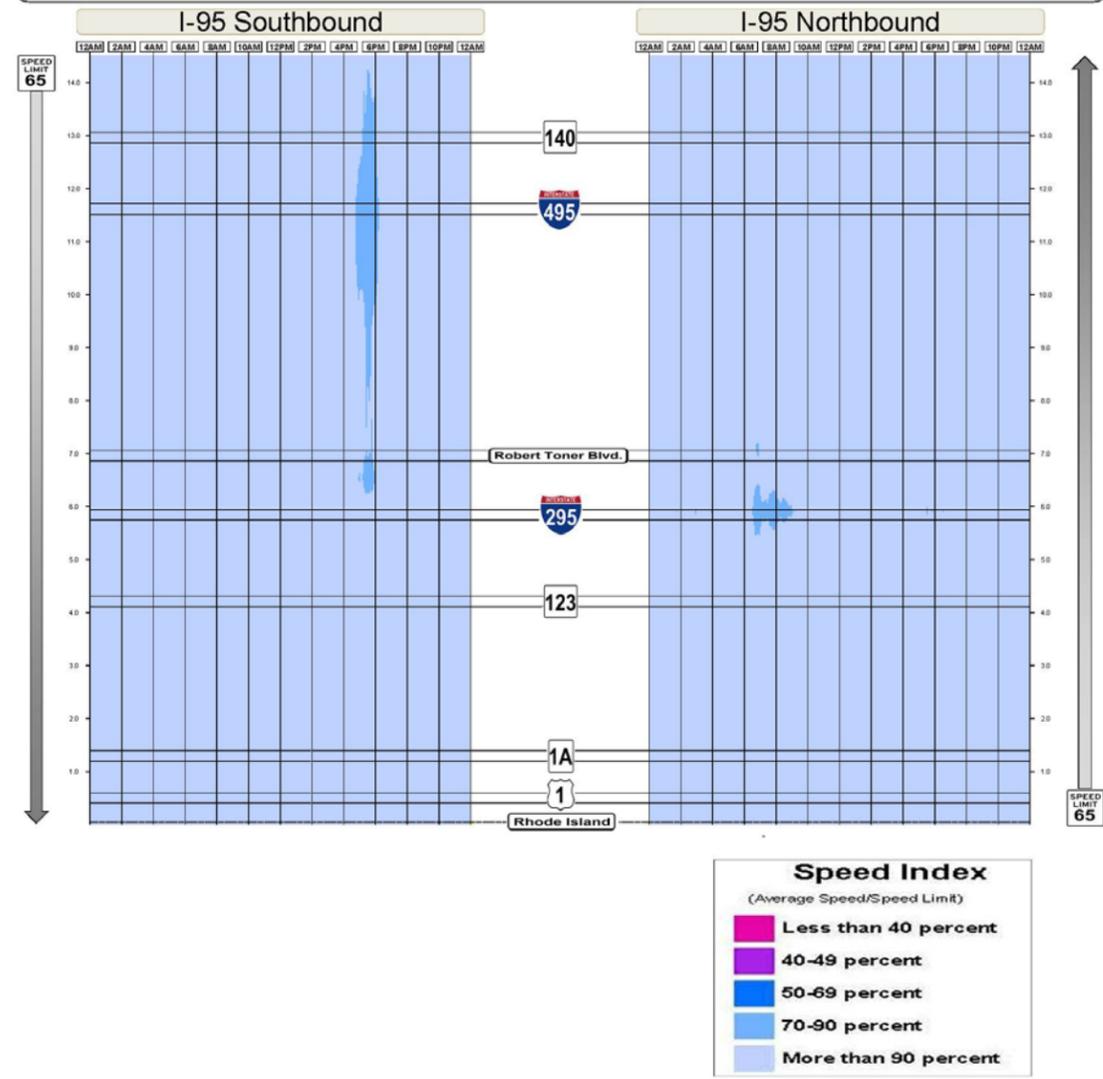


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FIGURE B-13
24-Hour Weekday Congestion Scan
I-93 from I-95 to New Hampshire

*Creating
Congestion Scans
with
INRIX data*

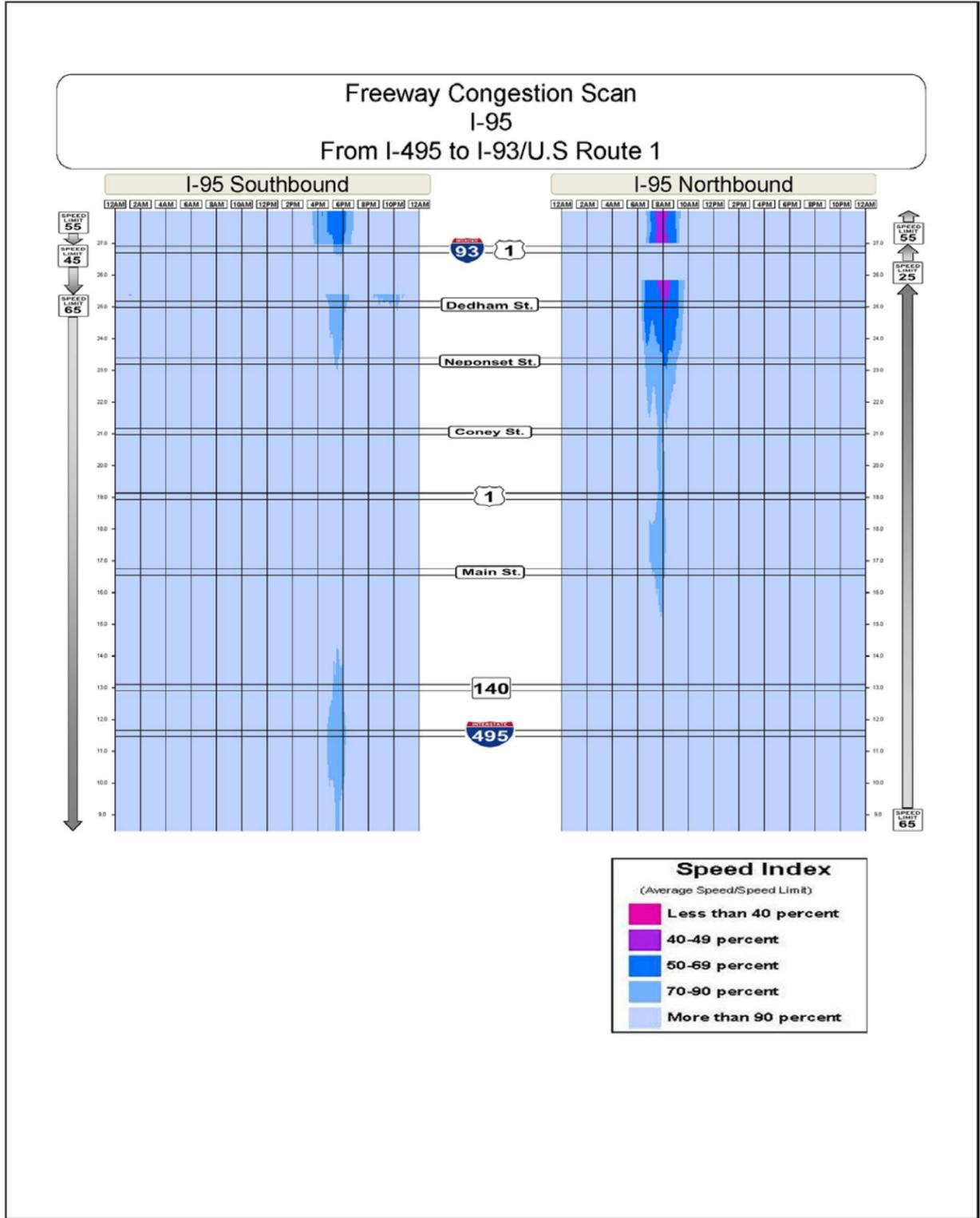
Freeway Congestion Scan
I-95
From Rhode Island to I-495



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FIGURE B-14
24-Hour Weekday Congestion Scan
I-95 from Rhode Island to I-495

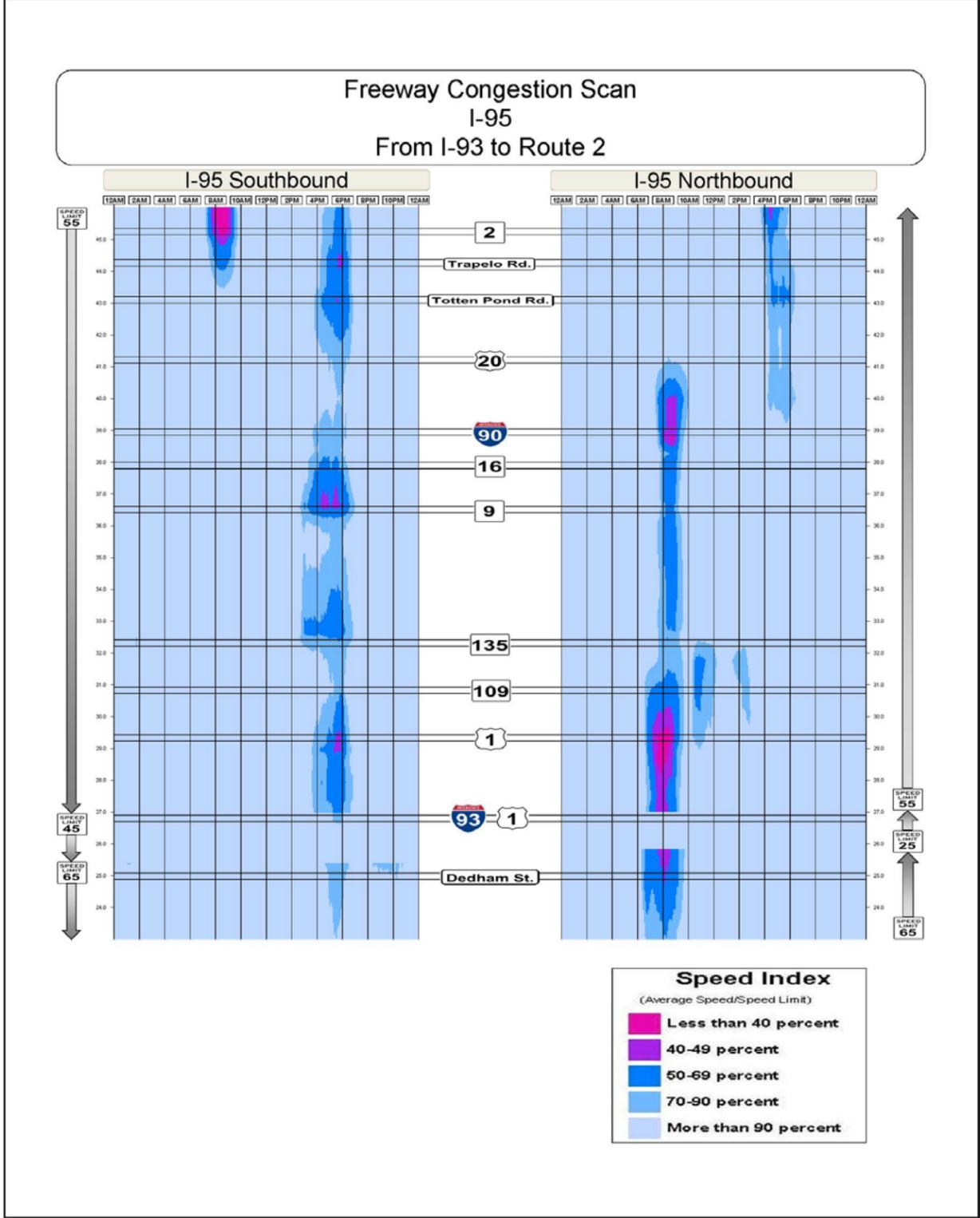
*Creating
Congestion Scans
with
INRIX data*



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FIGURE B-15
24-Hour Weekday Congestion Scan
I-95 from I-495 to I-93/Route 1

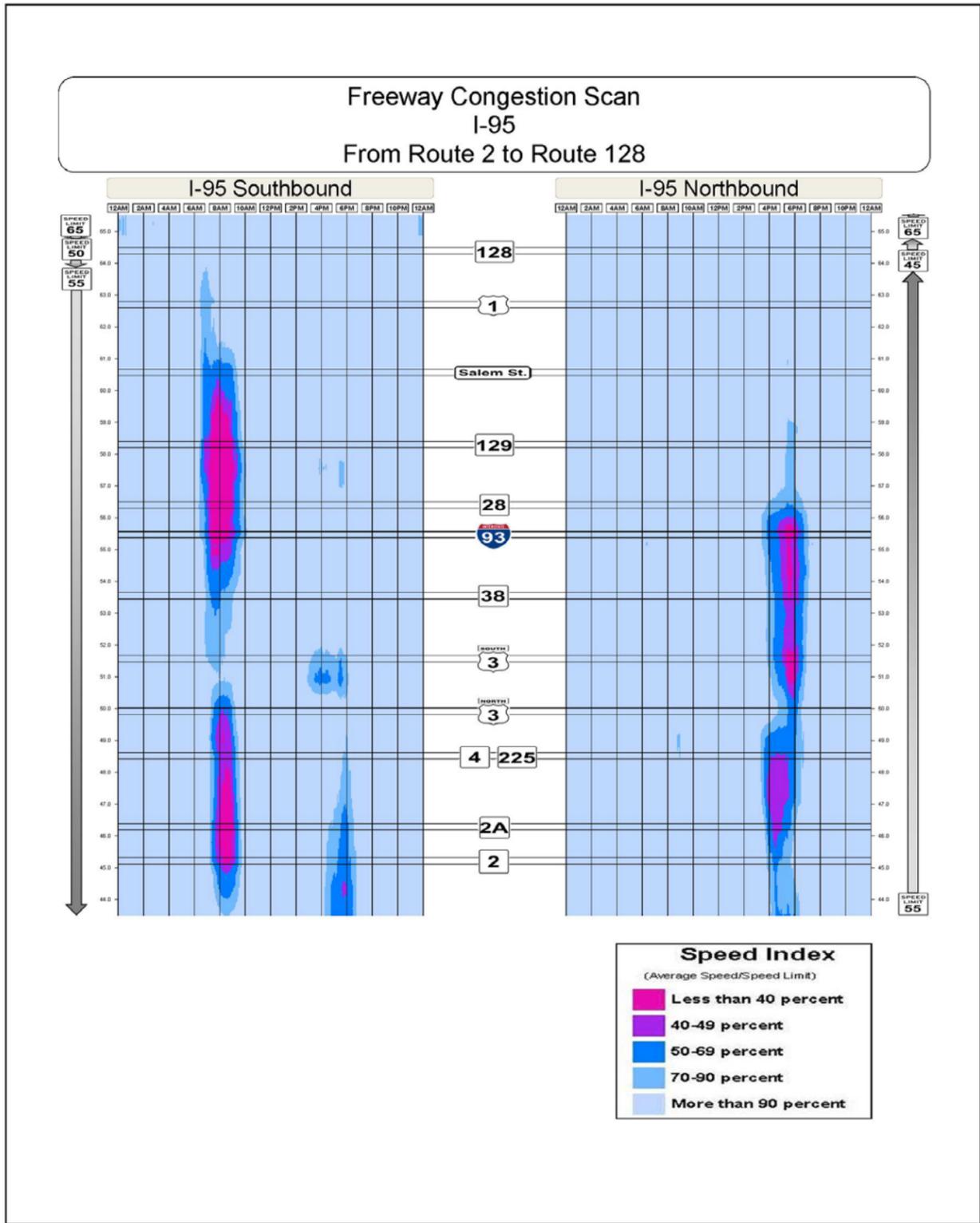
Creating Congestion Scans with INRIX data



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FIGURE B-16
24-Hour Weekday Congestion Scan
I-95 from I-93/Route 1 to Route 2

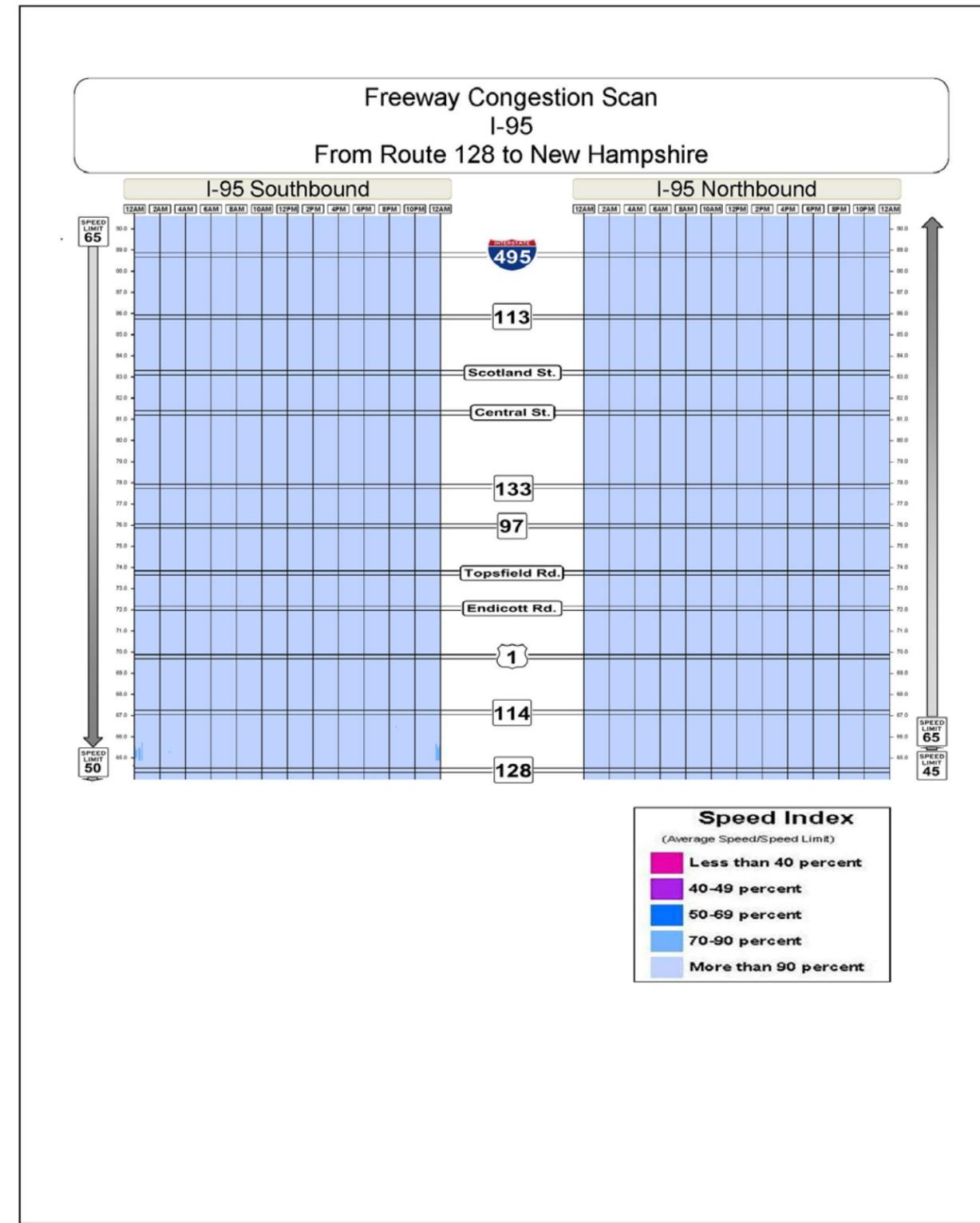
Creating Congestion Scans with INRIX data



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FIGURE B-17
24-Hour Weekday Congestion Scan
I-95 from Route 2 to Route 128

*Creating
Congestion Scans
with
INRIX data*

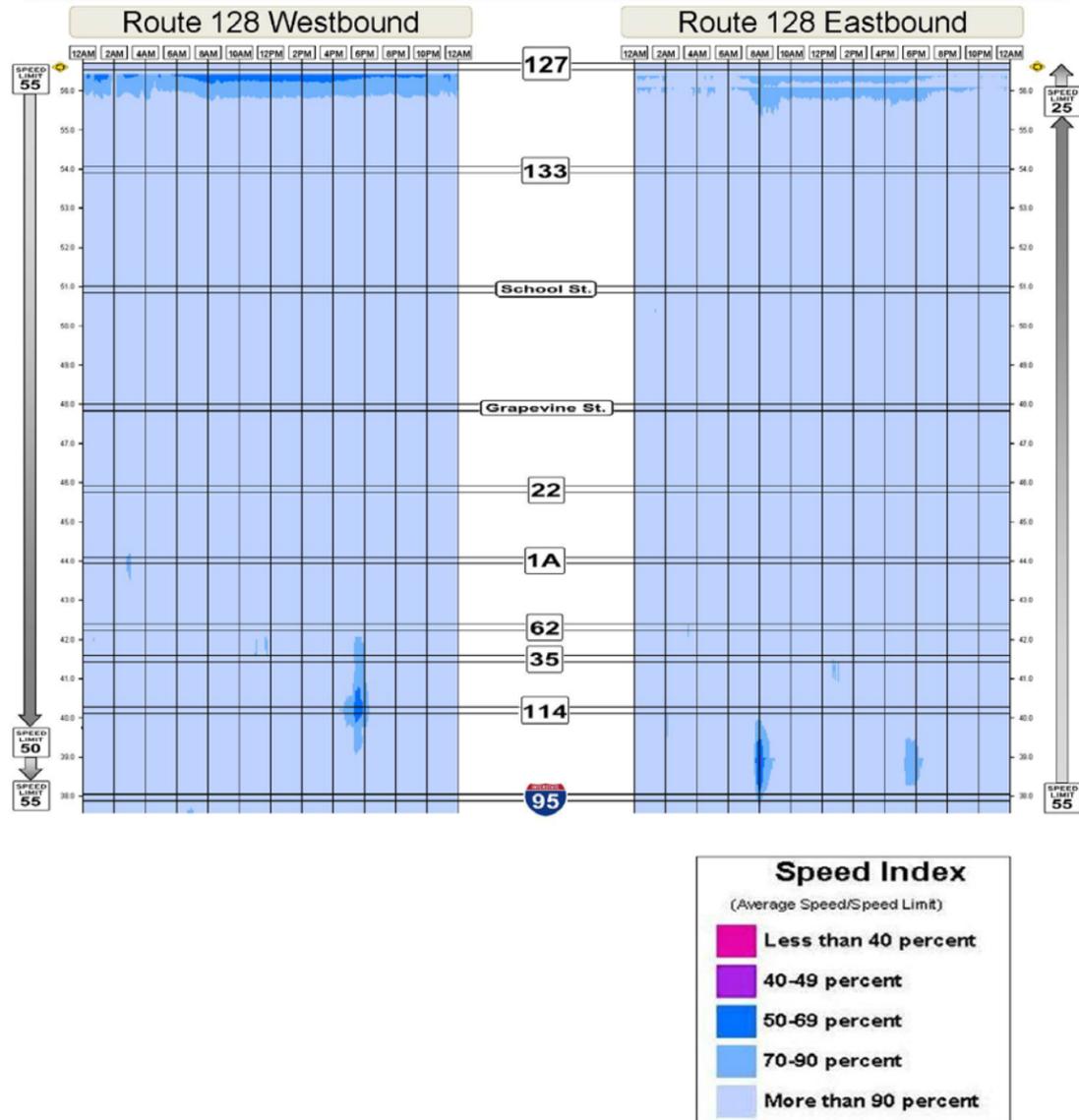


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FIGURE B-18
24-Hour Weekday Congestion Scan
I-95 from Route 128 to New Hampshire

*Creating
Congestion Scans
with
INRIX data*

Freeway Congestion Scan
Route 128
From I-95 to Route 127

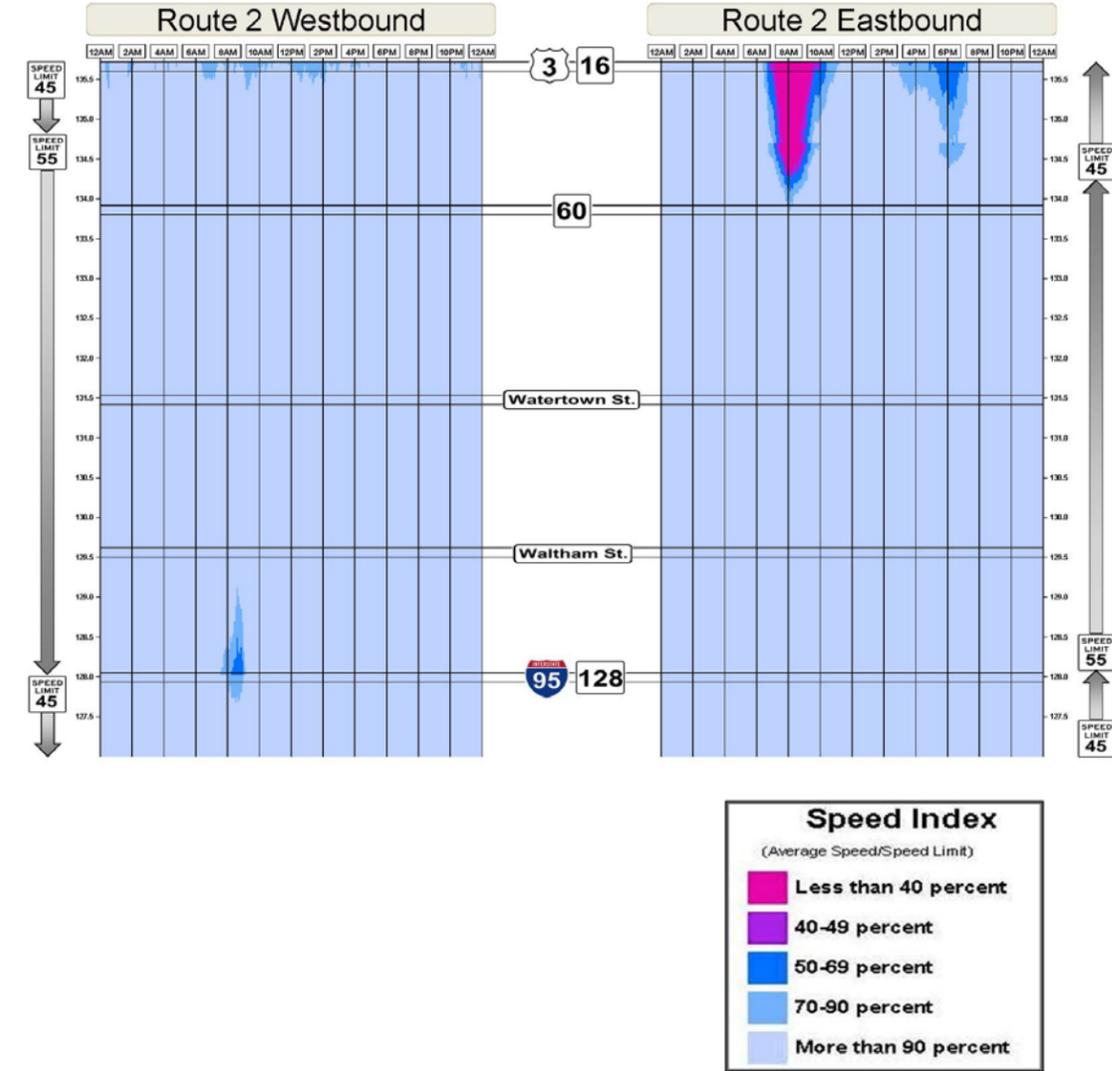


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MPO

FIGURE B-19
24-Hour Weekday Congestion Scan
Route 128 from I-95 to Route 127

Creating
Congestion Scans
with
INRIX data

Freeway Congestion Scan
Route 2
From Route 3/Route 16 to I-95

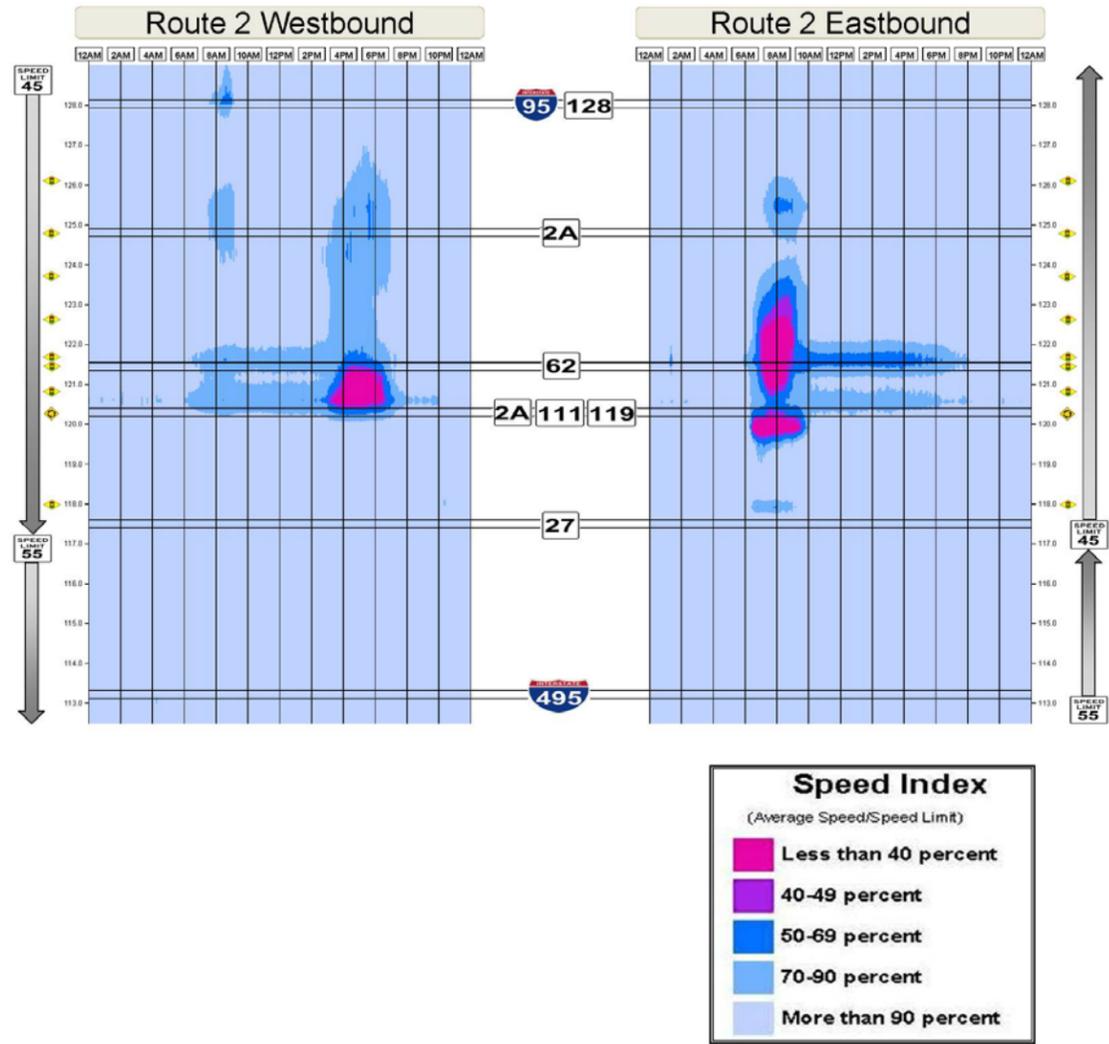


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FIGURE B-20
24-Hour Weekday Congestion Scan
Route 2 from I-95 to Route 3/Route 16

Creating
Congestion Scans
with
INRIX data

Freeway Congestion Scan
Route 2
From I-95 to I-495

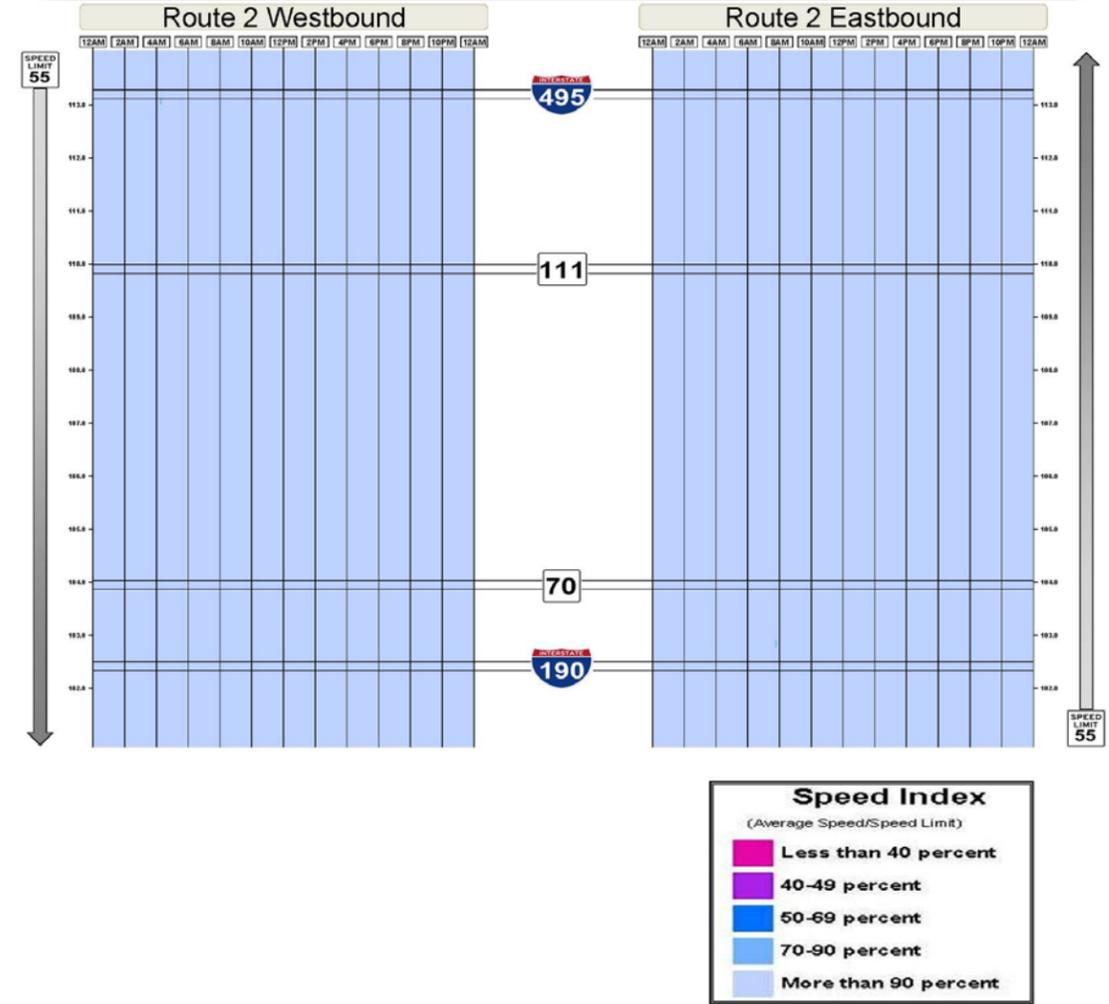


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FIGURE B-21
24-Hour Weekday Congestion Scan
Route 2 from I-495 to I-95

Creating
Congestion Scans
with
INRIX data

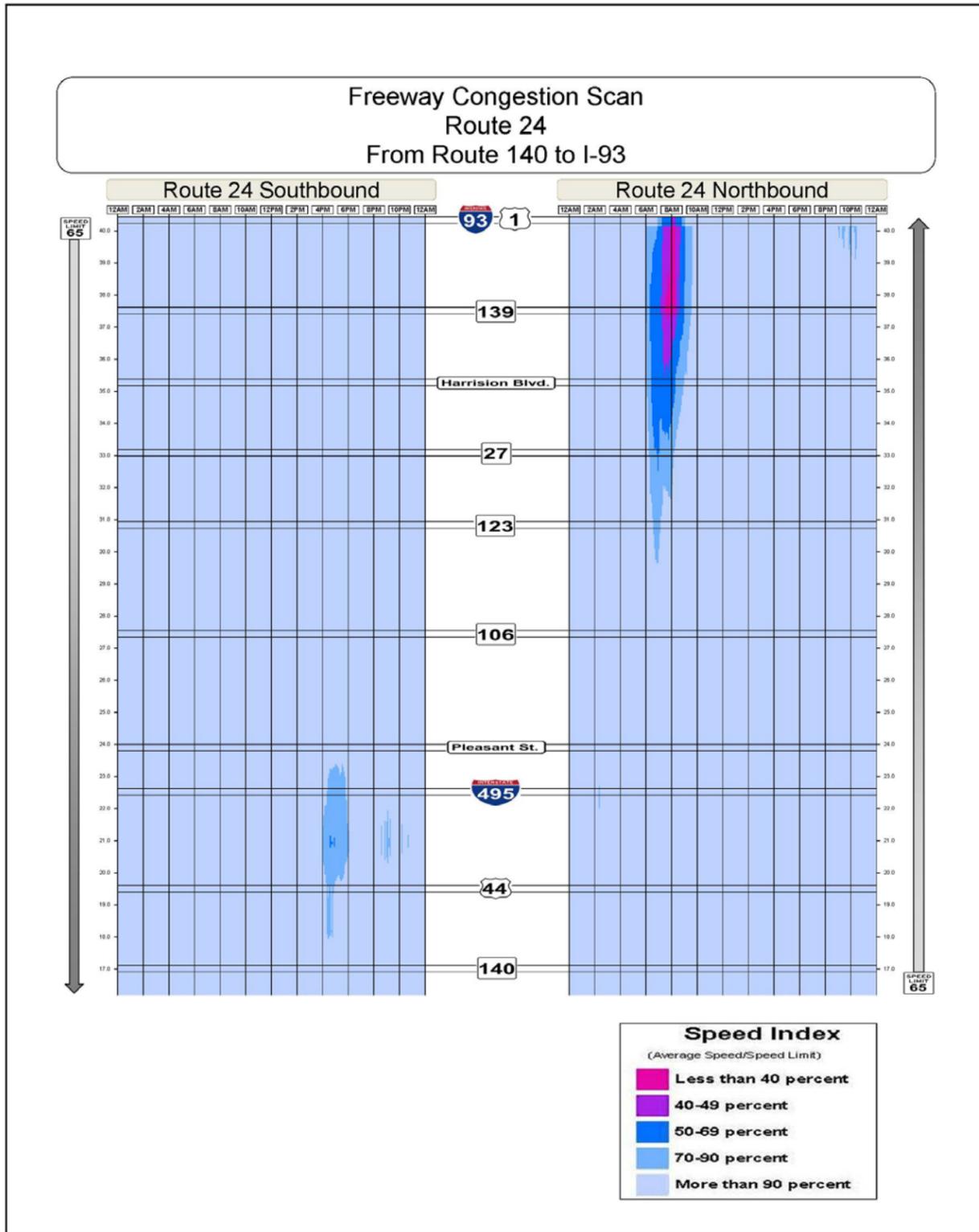
Freeway Congestion Scan
Route 2
From I-495 to I-190



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FIGURE B-22
24-Hour Weekday Congestion Scan
Route 2 from I-495 to I-190

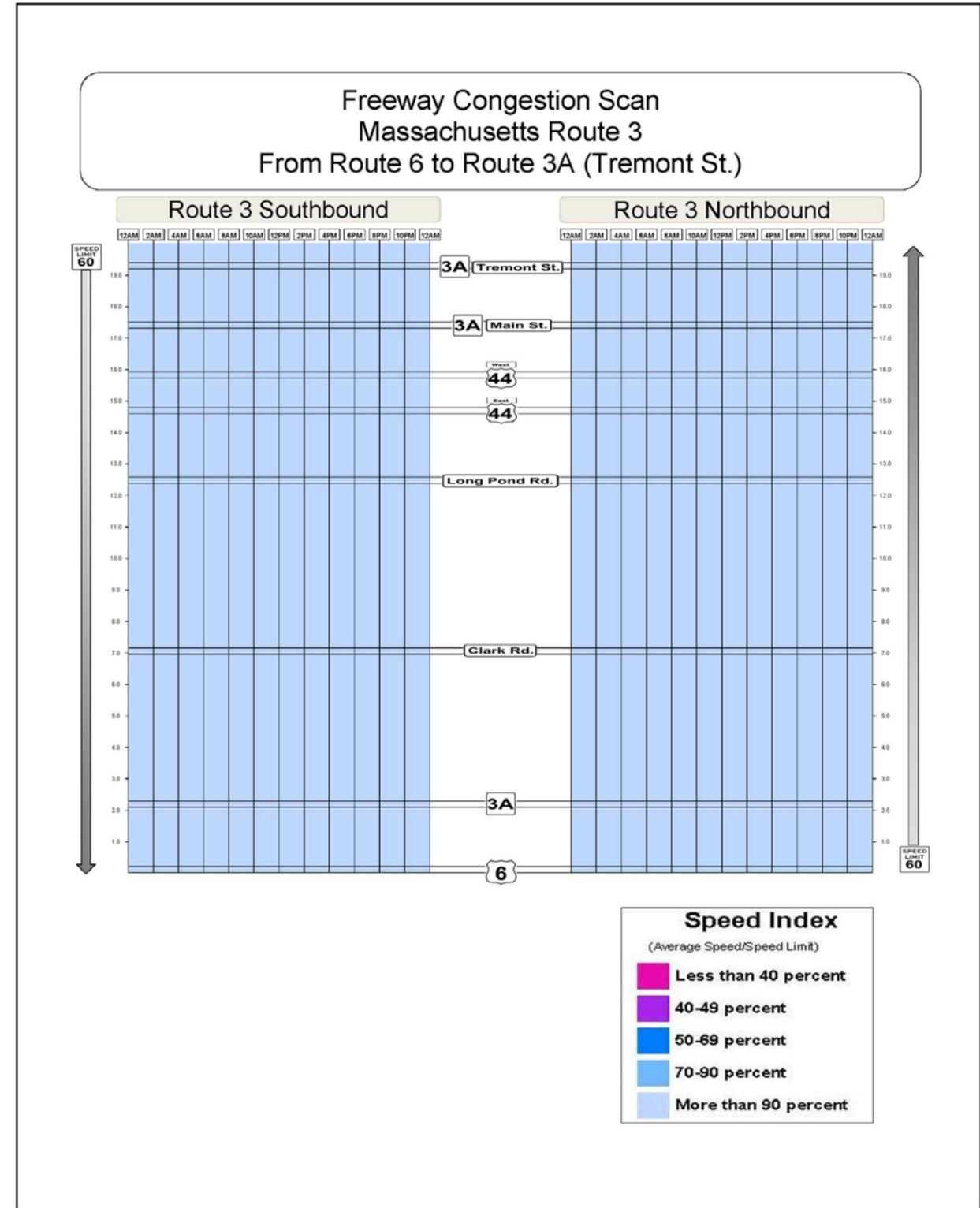
Creating
Congestion Scans
with
INRIX data



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FIGURE B-23
24-Hour Weekday Congestion Scan
Route 24 from Route 140 to I-93

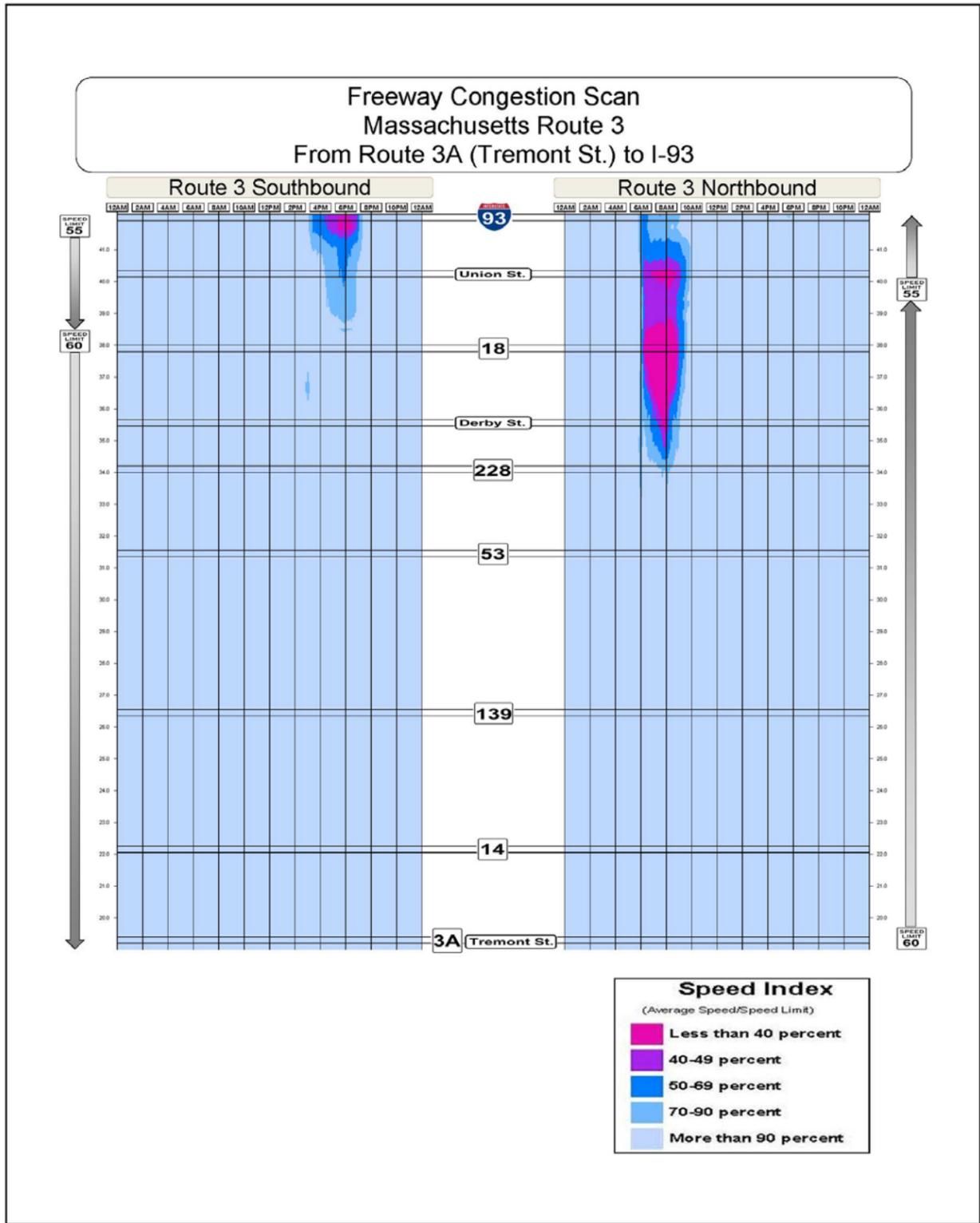
Creating Congestion Scans with INRIX data



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FIGURE B-24
24-Hour Weekday Congestion Scan
Route 3 from Route 6 to Route 3A

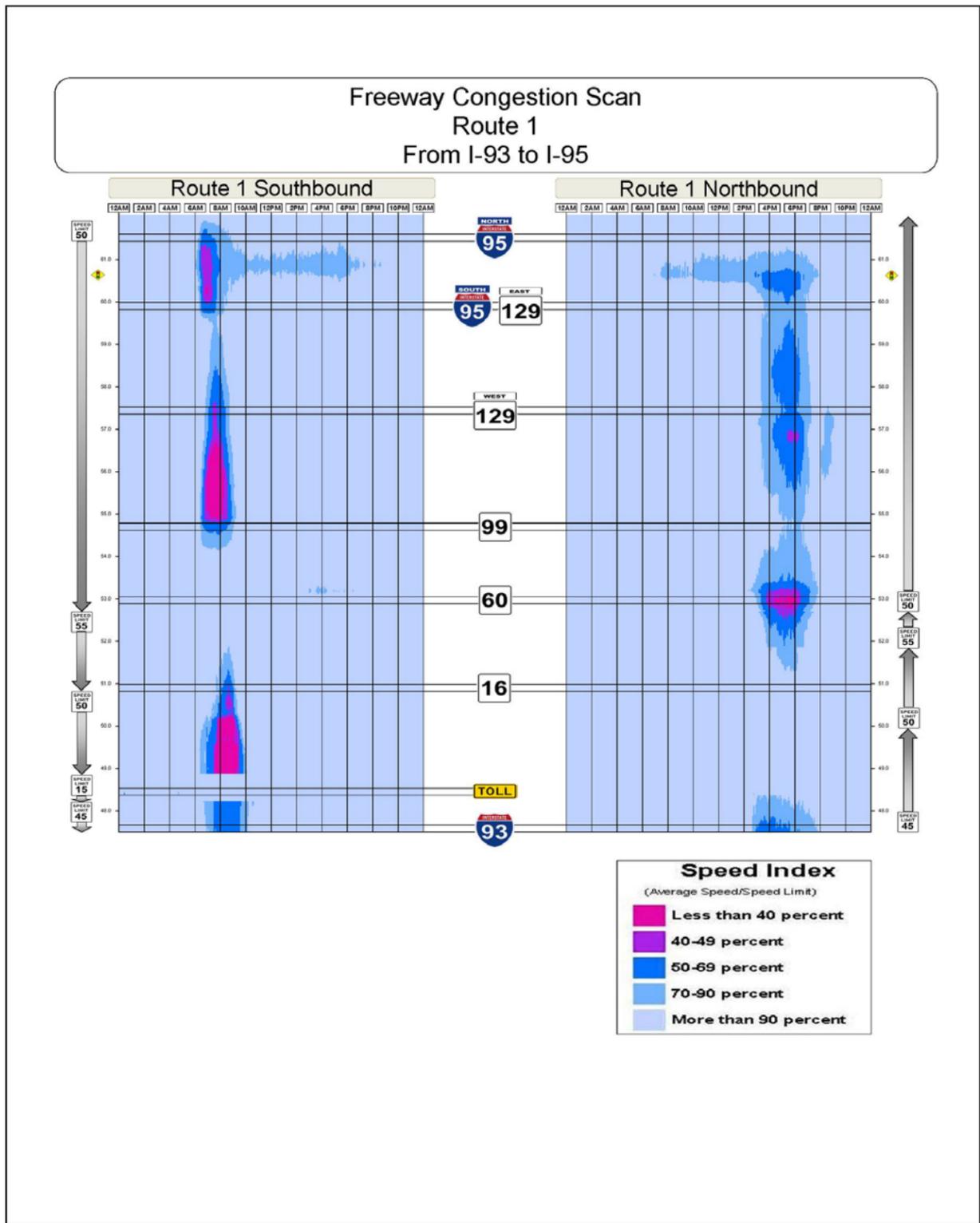
Creating Congestion Scans with INRIX data



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FIGURE B-25
24-Hour Weekday Congestion Scan
Route 3 from Route 3A to I-93

Creating Congestion Scans with INRIX data

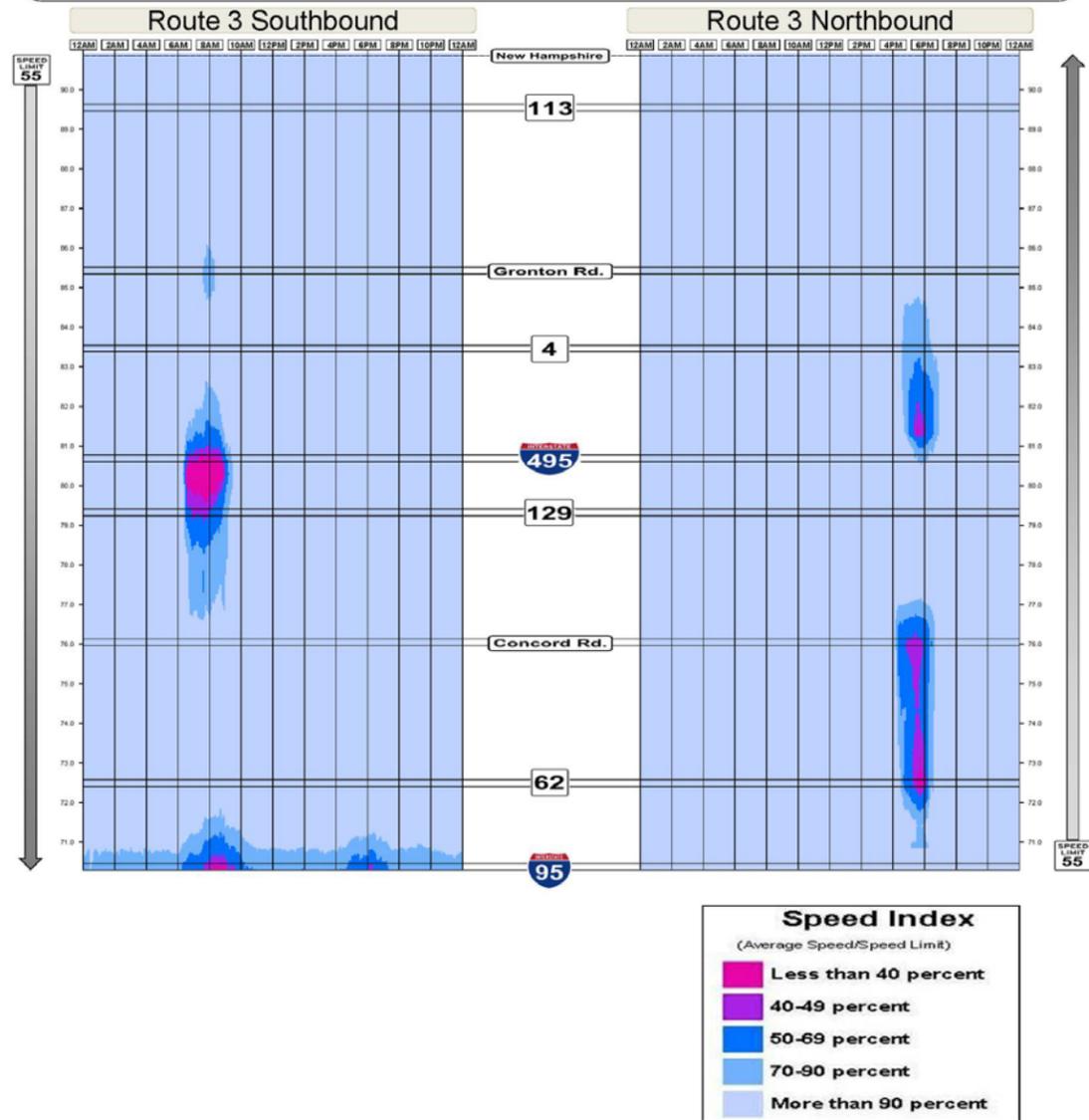


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FIGURE B-26
24-Hour Weekday Congestion Scan
Route 1 from I-93 to I-95

Creating Congestion Scans with INRIX data

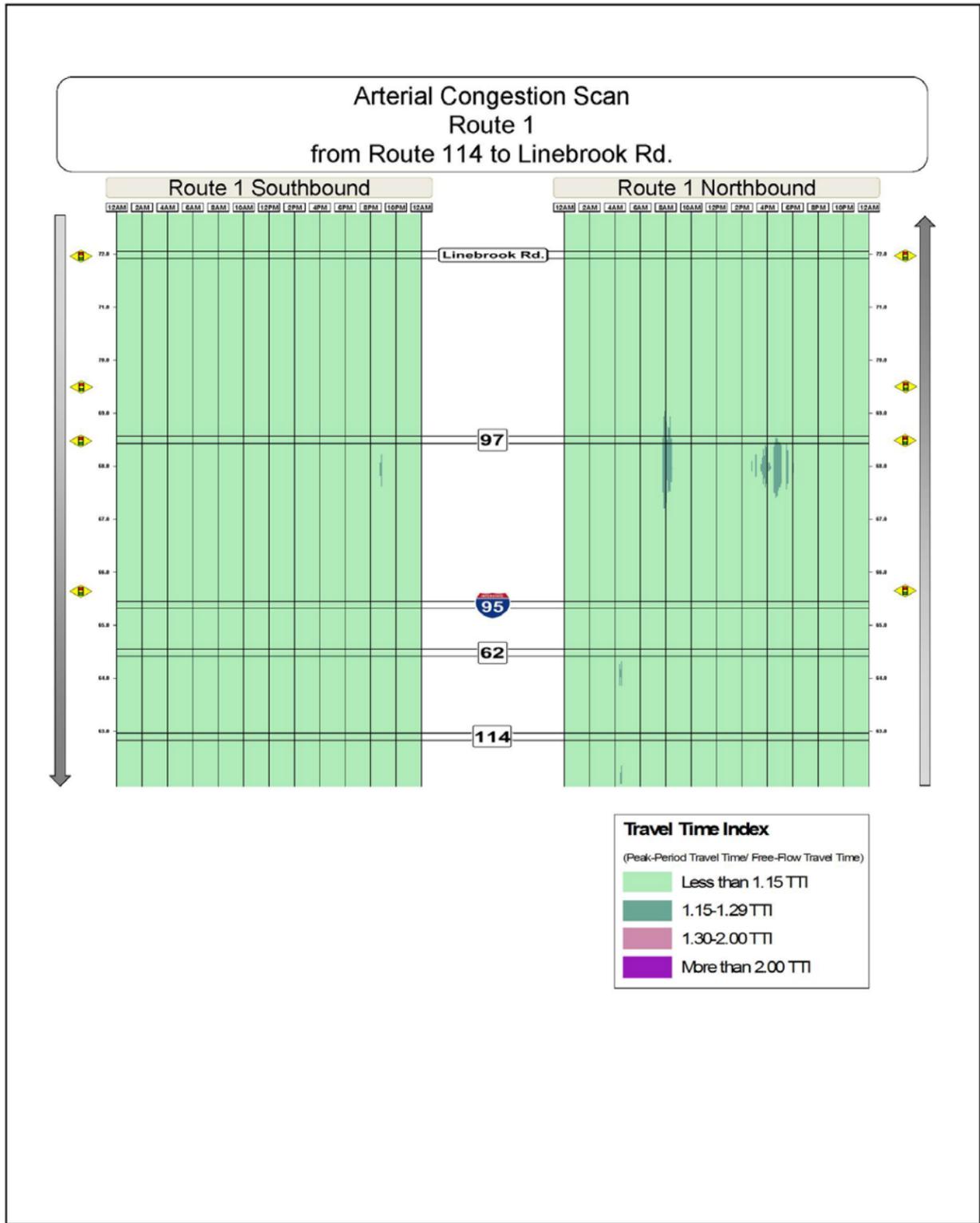
Freeway Congestion Scan
 U.S Route 3
 From I-95 to New Hampshire



APPENDIX C

ARTERIAL CONGESTION SCANS

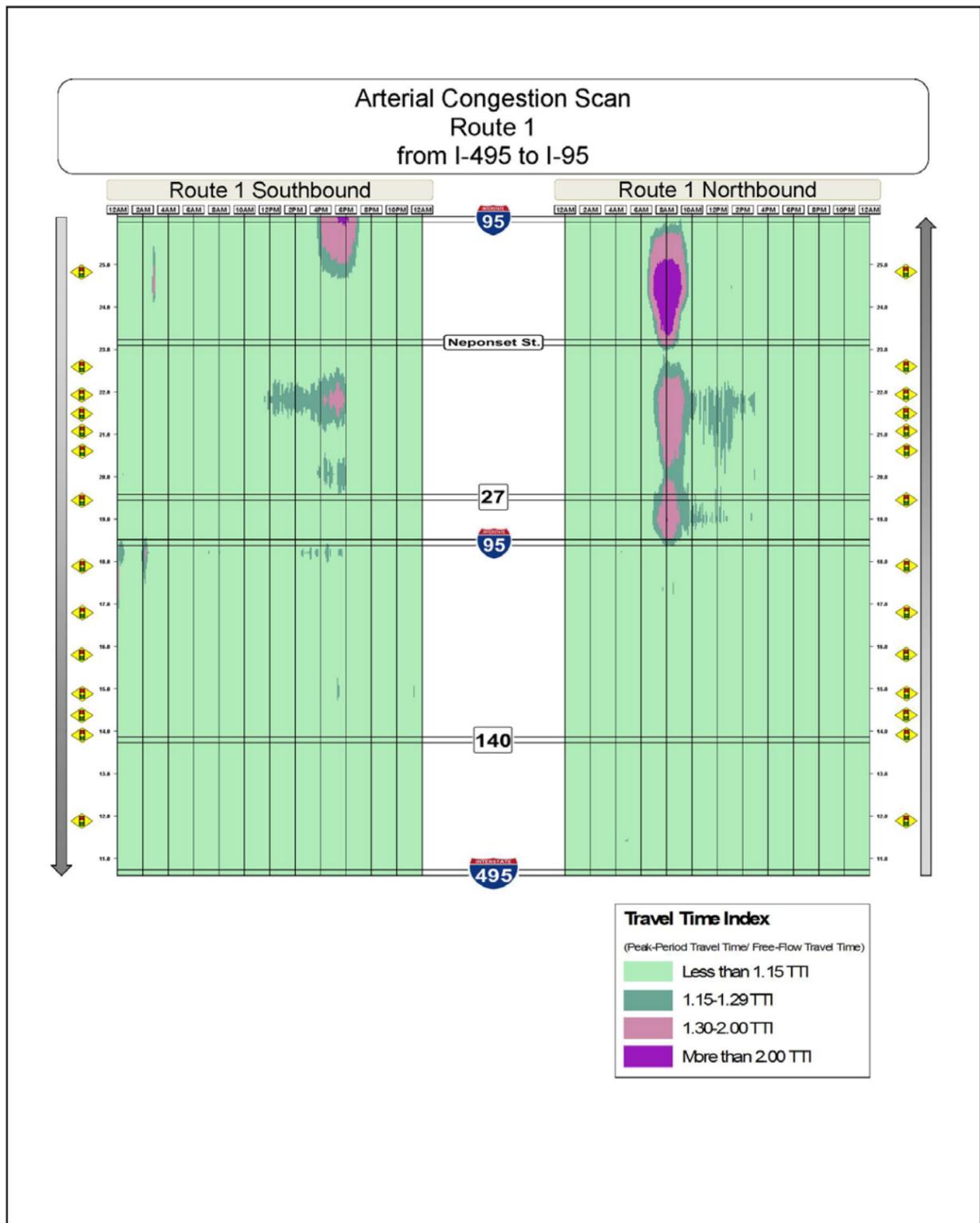
Table Name	Figure Number
24-Hour Weekday Congestion Scan, Arterial Corridors	C.1- B.41



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FIGURE C-1
24-Hour Weekday Congestion Scan
Route 1 from I-95 to Linebrook Road

Creating Congestion Scans with INRIX data

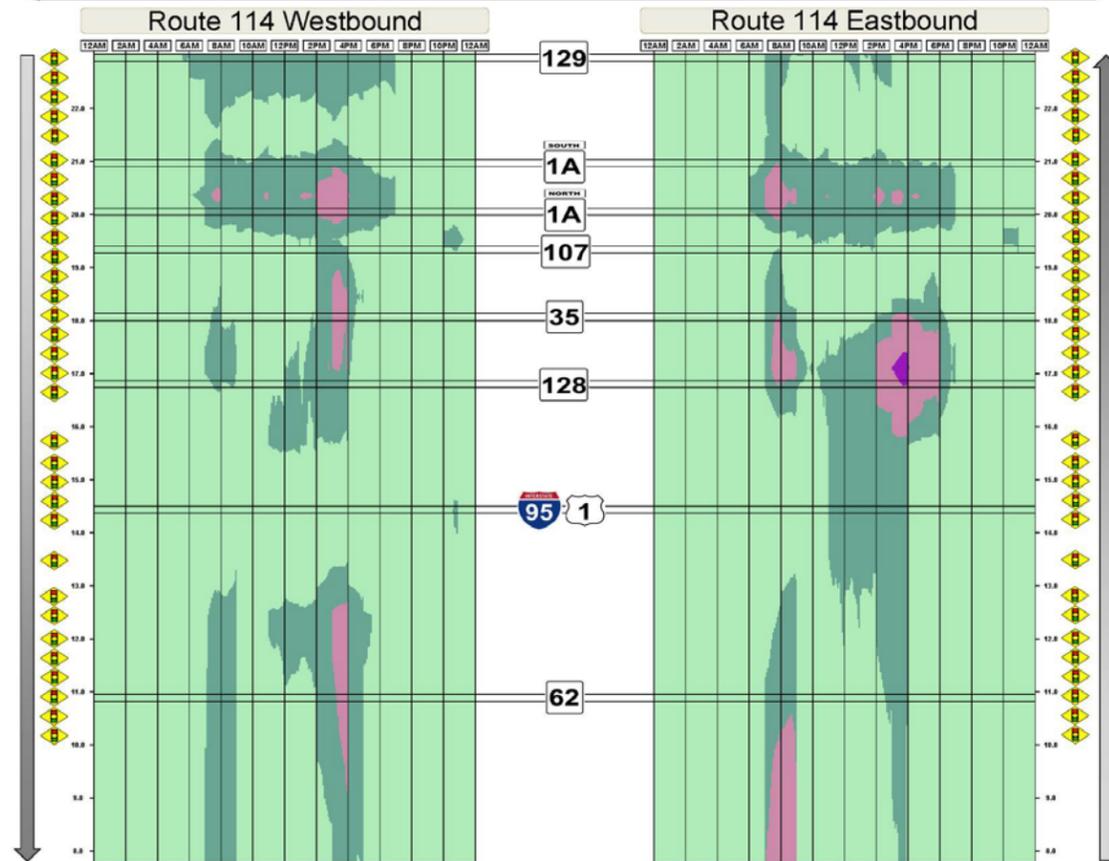


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FIGURE C-2
24-Hour Weekday Congestion Scan
Route 1 from I-495 to I-95

Creating Congestion Scans with INRIX data

Arterial Congestion Scan
Route 114
from Sharpners Pond Rd. to Route 129



Travel Time Index
(Peak-Period Travel Time/ Free-Flow Travel Time)

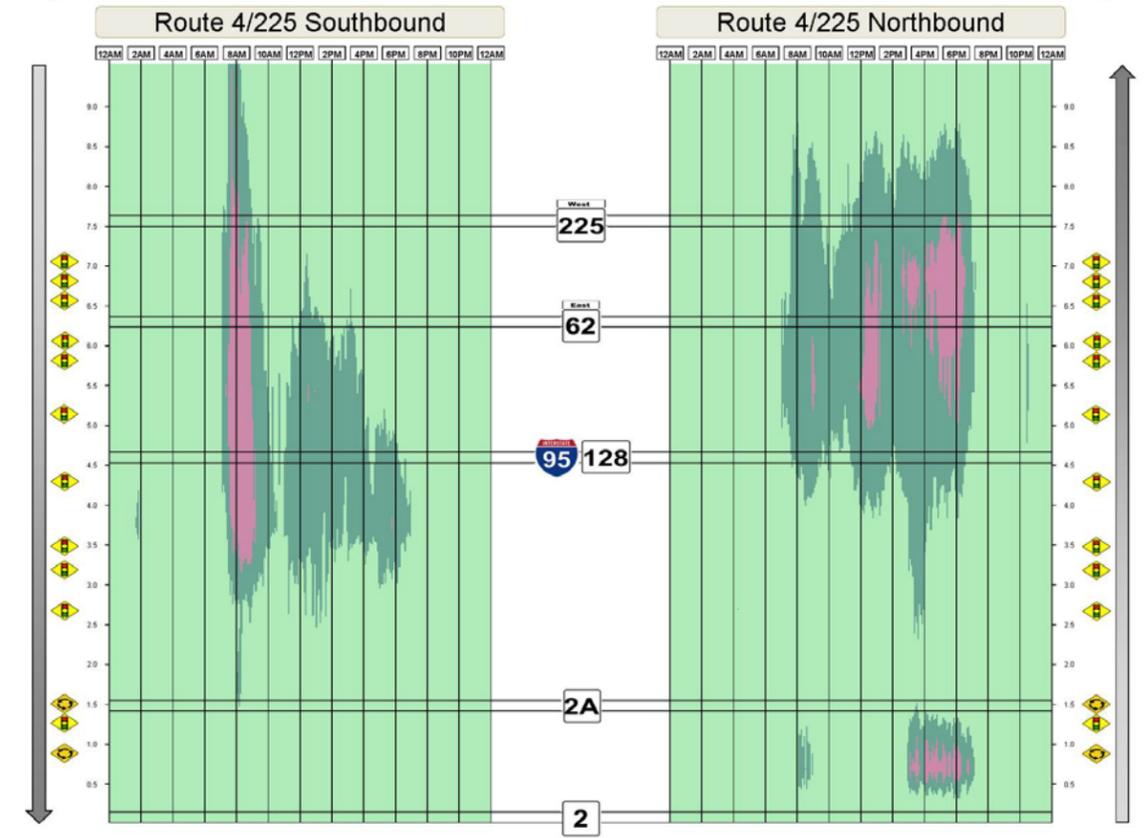
- Less than 1.15 TTI
- 1.15-1.29 TTI
- 1.30-2.00 TTI
- More than 2.00 TTI

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FIGURE C-3
24-Hour Weekday Congestion Scan
Route 114 from Sharpners Pond Road to Route 129

Creating
Congestion Scans
with
INRIX data

Arterial Congestion Scan
Route 4/225
from Route 2 to Route 225 West



Travel Time Index
(Peak-Period Travel Time/ Free-Flow Travel Time)

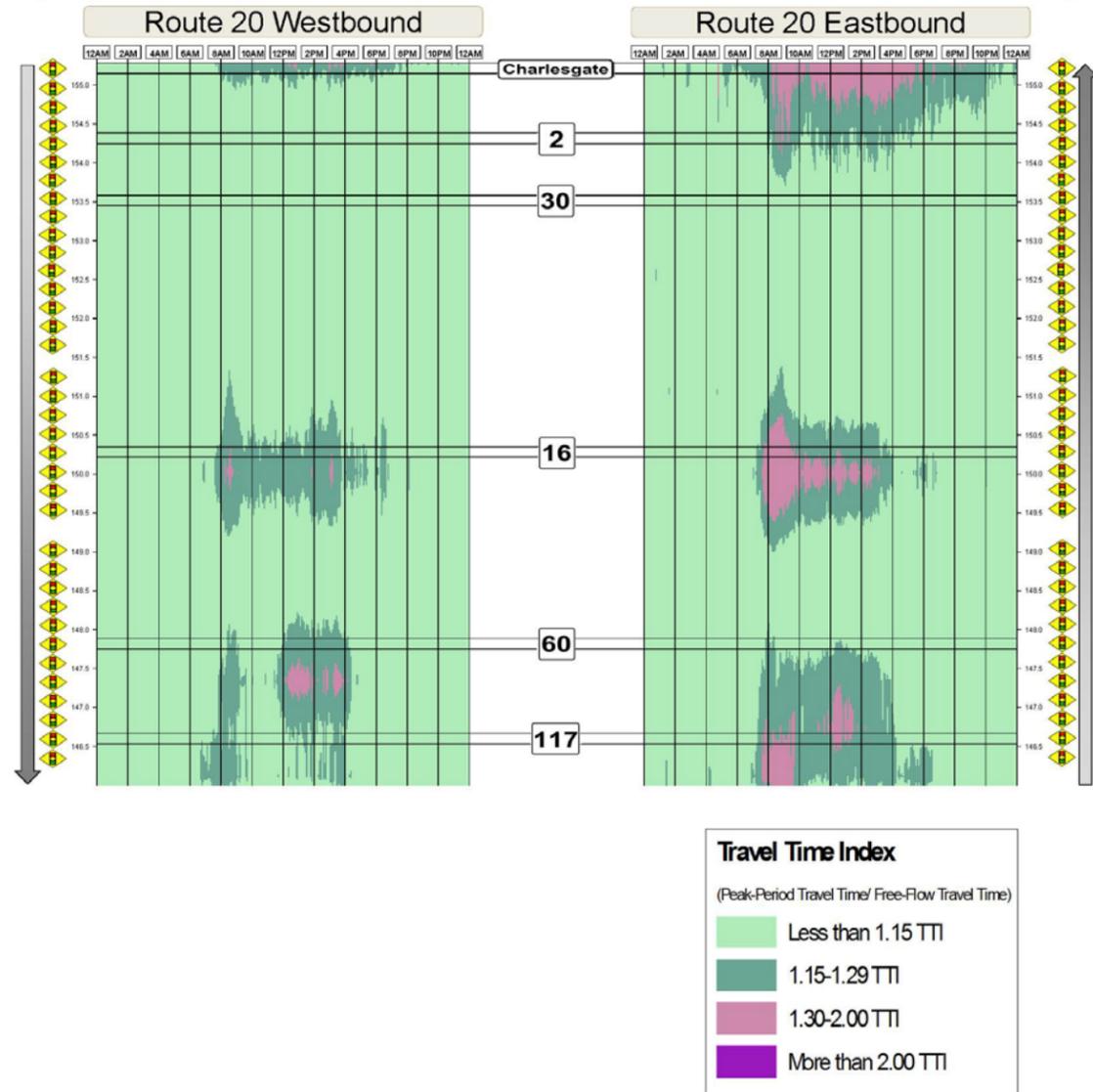
- Less than 1.15 TTI
- 1.15-1.29 TTI
- 1.30-2.00 TTI
- More than 2.00 TTI

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FIGURE C-4
24-Hour Weekday Congestion Scan
Route 4/Route 225 from Route 2 to Route 225 West

Creating
Congestion Scans
with
INRIX data

Arterial Congestion Scan
Route 20
from Route 117 to Charlesgate

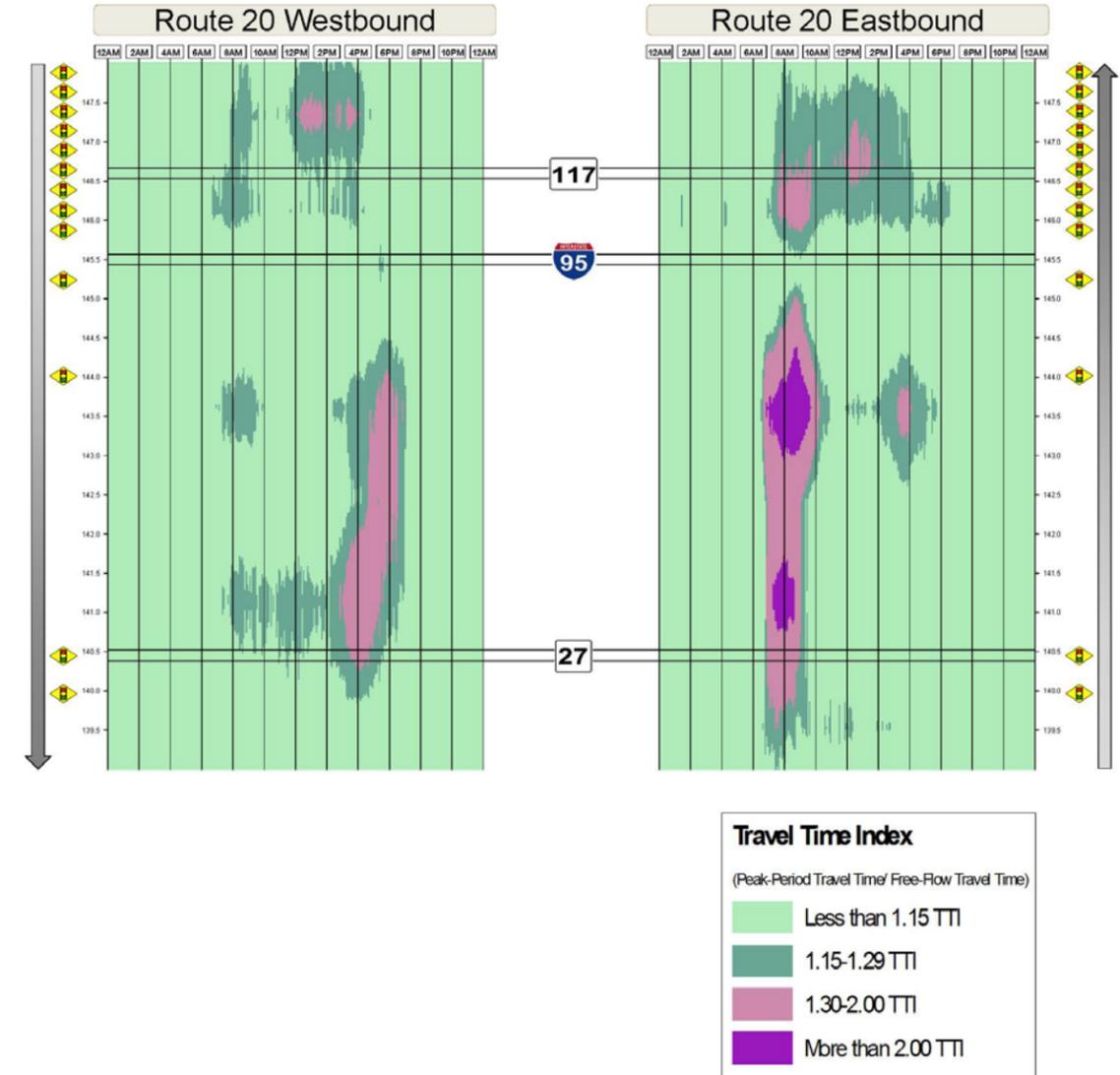


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FIGURE C-5
24-Hour Weekday Congestion Scan
Route 20 from Route 117 to Charlesgate

Creating
Congestion Scans
with
INRIX data

Arterial Congestion Scan
Route 20
from Route 27 to Route 117



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FIGURE C-6
24-Hour Weekday Congestion Scan
Route 20 from Route 27 to Route 117

Creating
Congestion Scans
with
INRIX data

Arterial Congestion Scan
Route 20
from Bartlett St. to Route 27

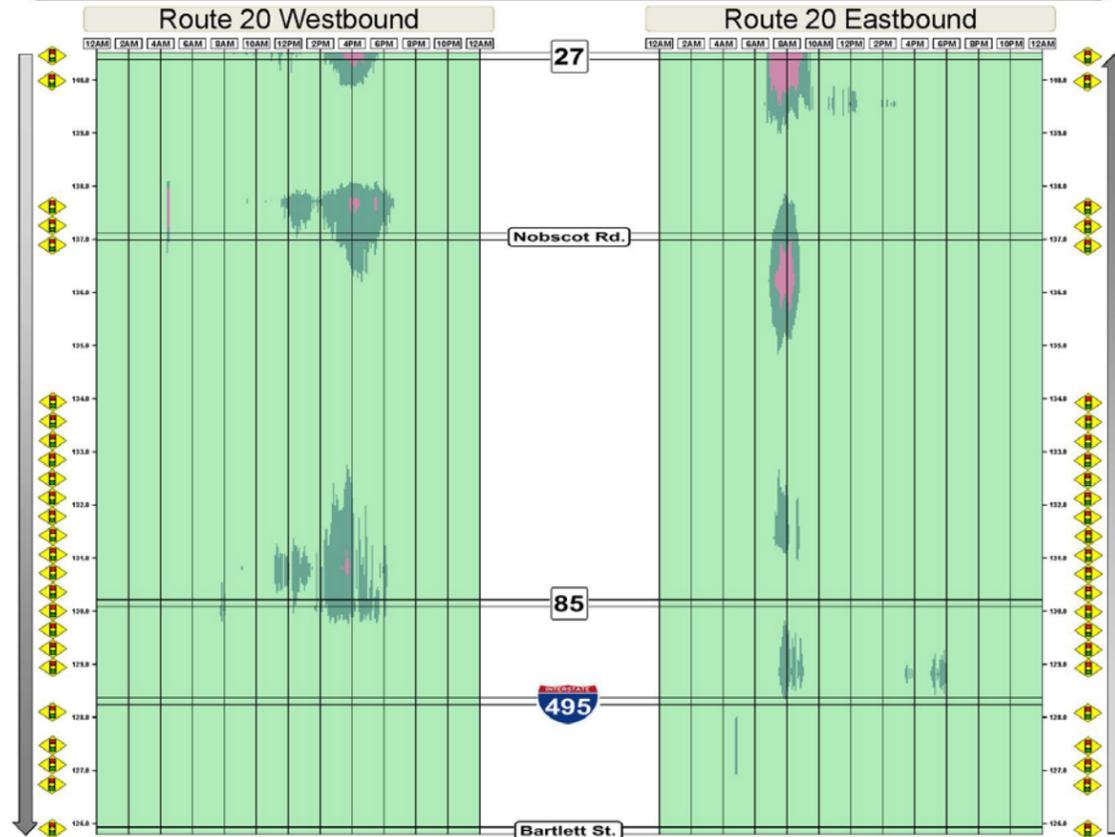


FIGURE C-7
24-Hour Weekday Congestion Scan
Route 20 from Bartlett Street to Route 27

Creating
Congestion Scans
with
INRIX data

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Arterial Congestion Scan
Route 9
from I-95 to Dartmouth St.

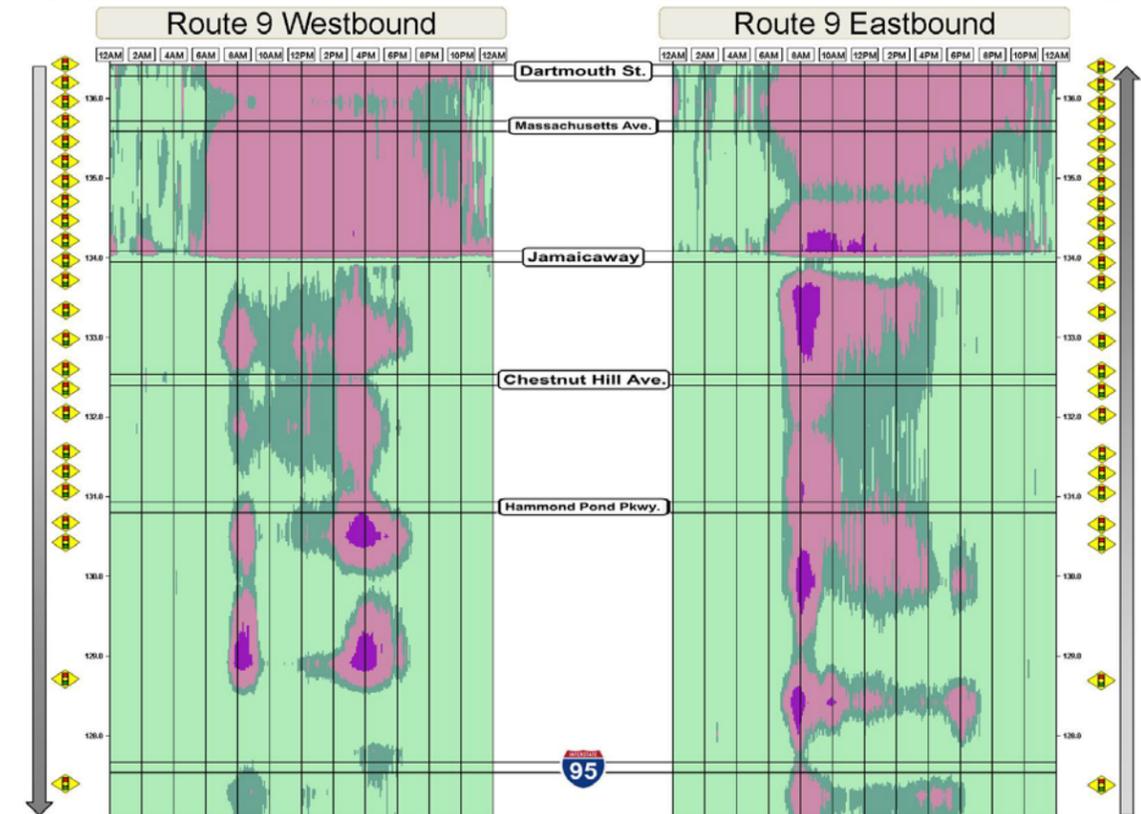
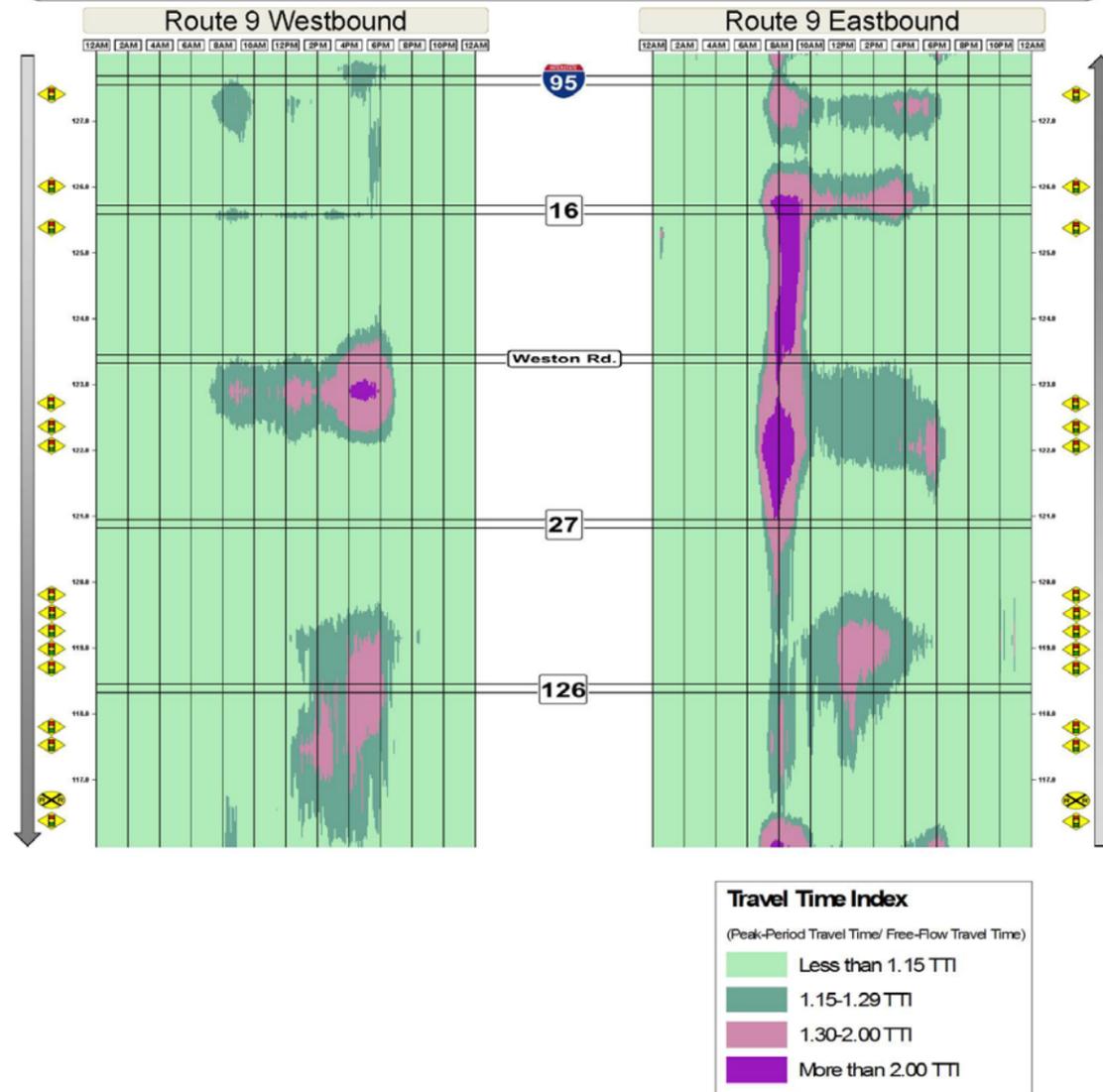


FIGURE C-8
24-Hour Weekday Congestion Scan
Route 9 from I-95 to Dartmouth Street

Creating
Congestion Scans
with
INRIX data

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Arterial Congestion Scan
Route 9
from Route 126 to I-95

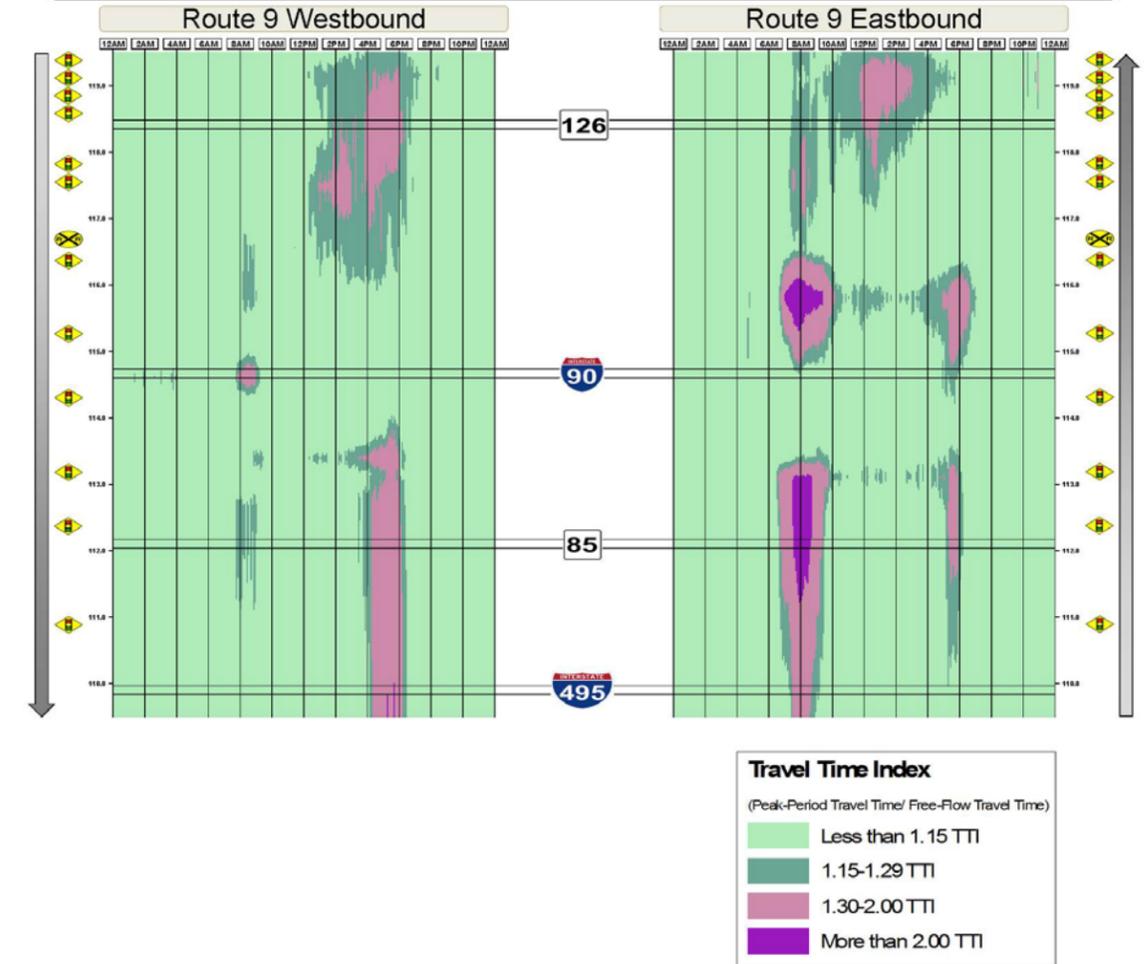


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FIGURE C-9
24-Hour Weekday Congestion Scan
Route 9 from Route 126 to I-95

Creating
Congestion Scans
with
INRIX data

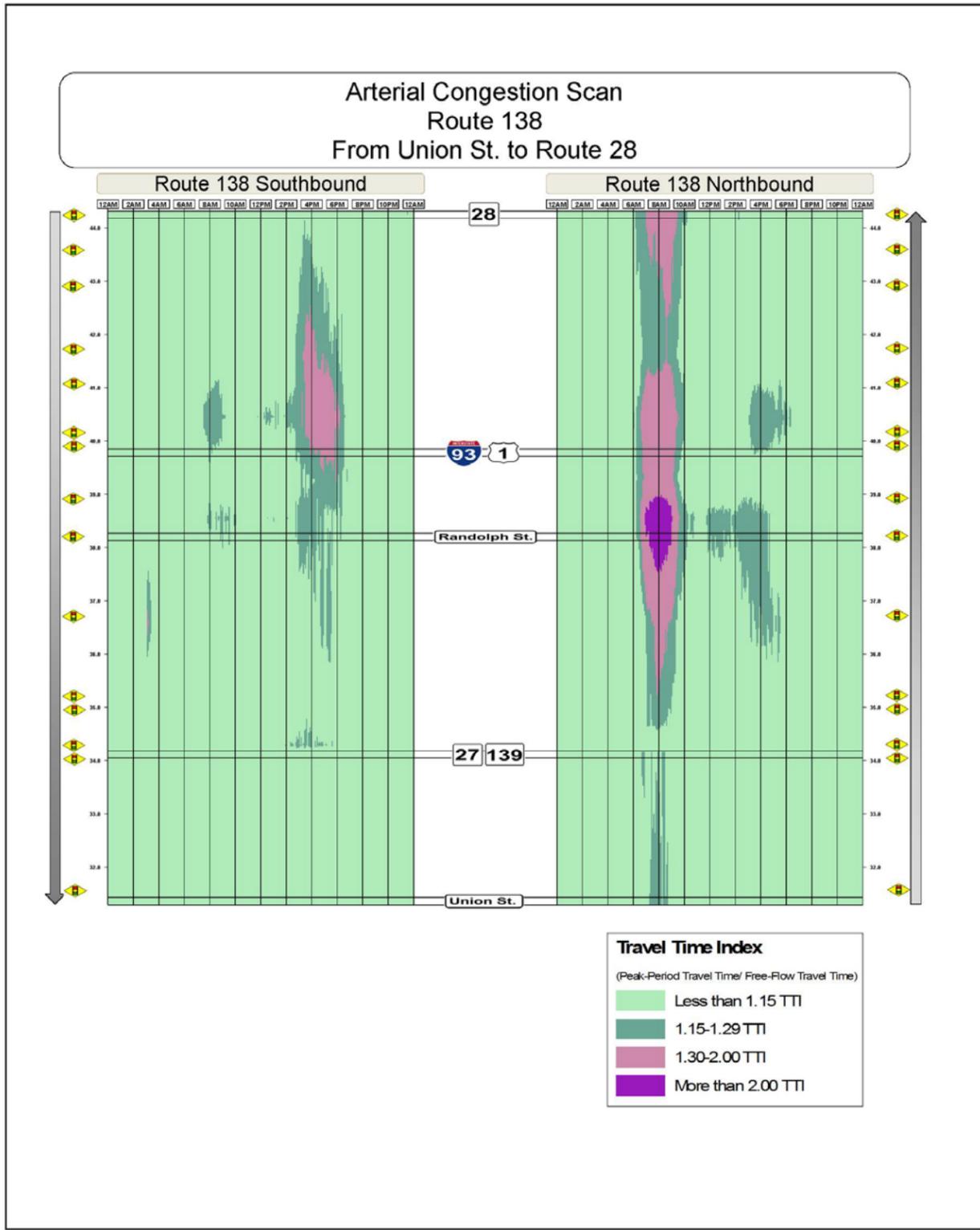
Arterial Congestion Scan
Route 9
from I-495 to Route 126



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FIGURE C-10
24-Hour Weekday Congestion Scan
Route 9 from I-495 to Route 126

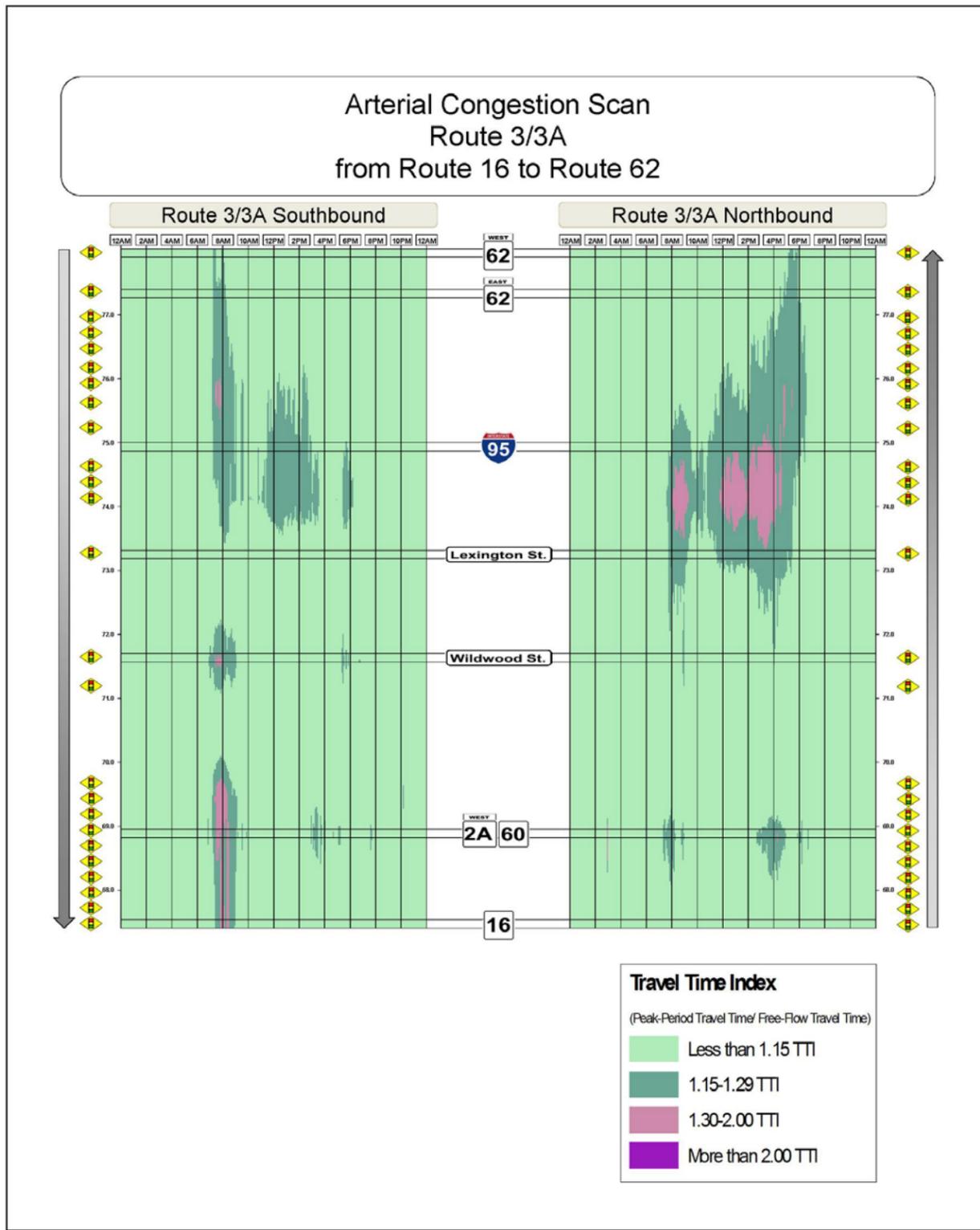
Creating
Congestion Scans
with
INRIX data



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FIGURE C-11
24-Hour Weekday Congestion Scan
Route 138 from Union Street to Route 28

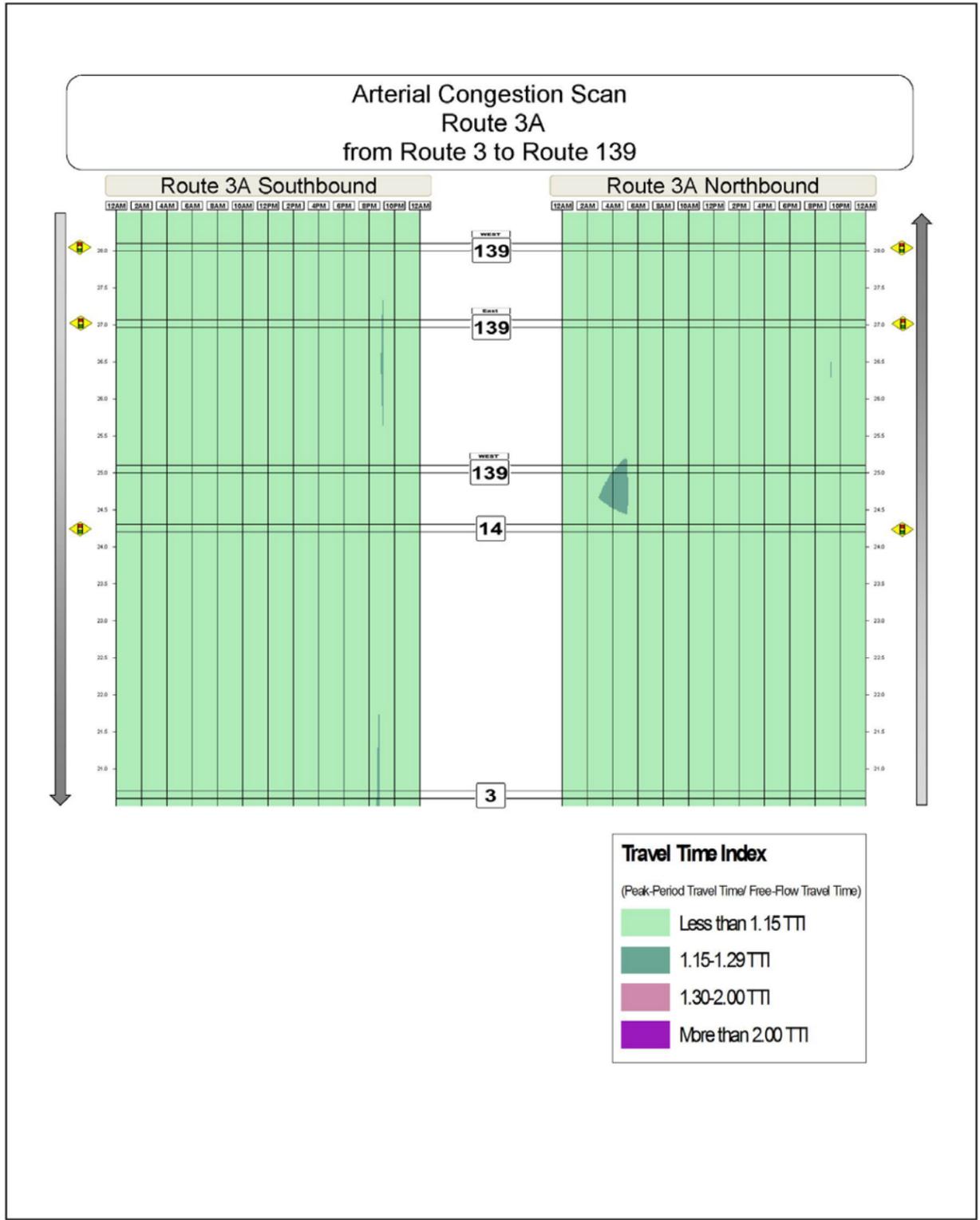
Creating Congestion Scans with INRIX data



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FIGURE C-12
24-Hour Weekday Congestion Scan
Route 3/Route 3A from Route 16 to Route 62

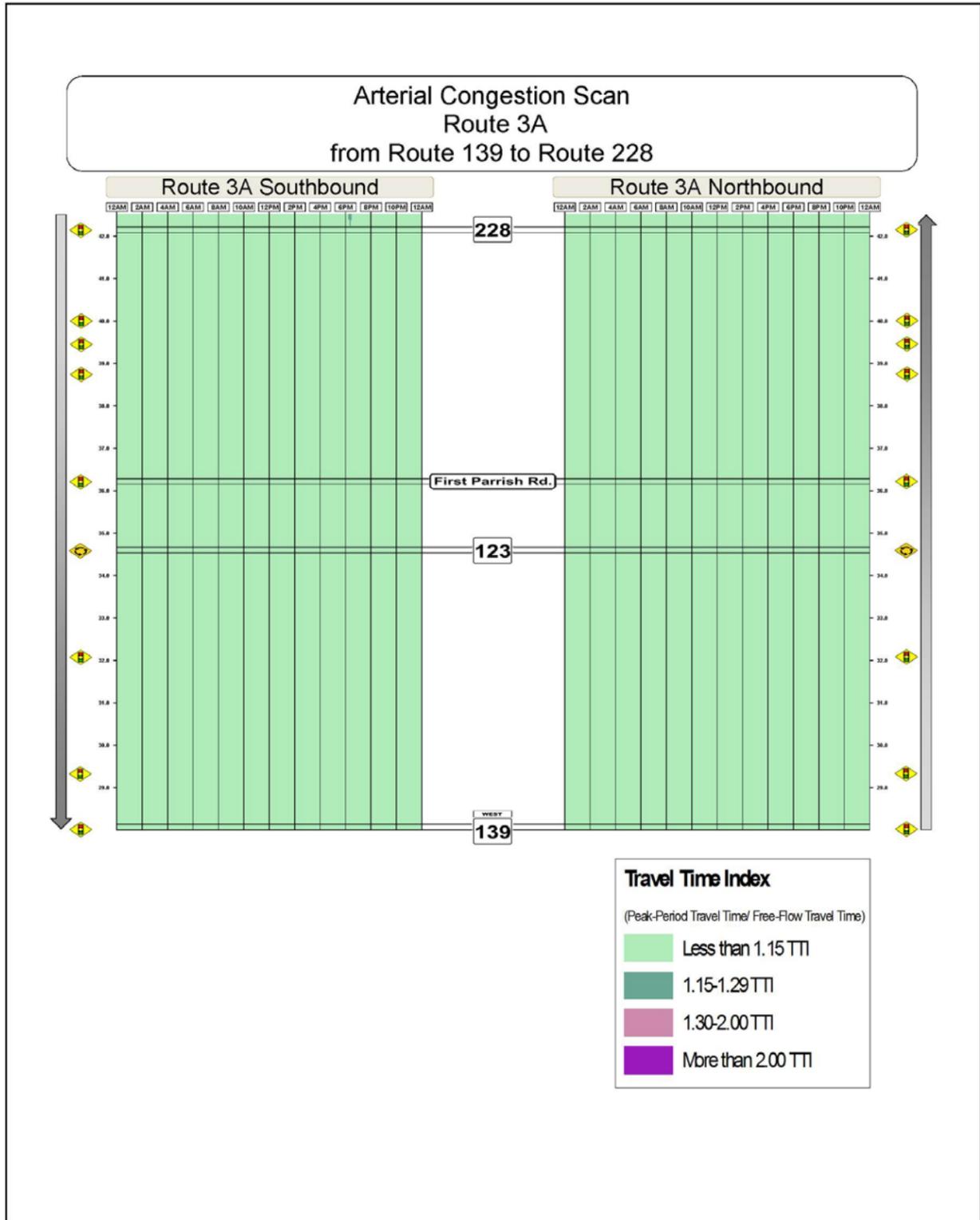
Creating Congestion Scans with INRIX data



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FIGURE C-13
24-Hour Weekday Congestion Scan
Route 3A from Route 3 to Route 139 West

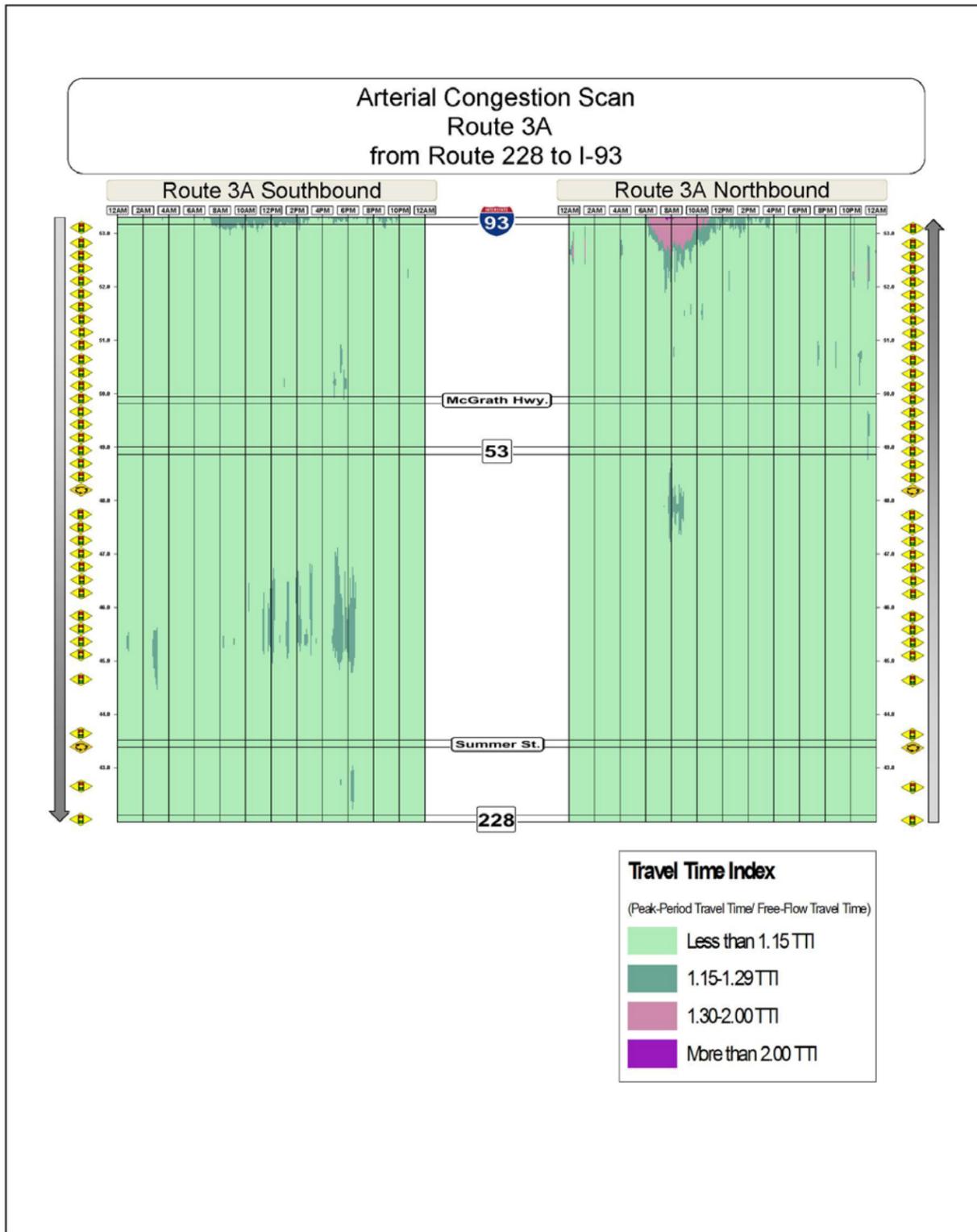
Creating Congestion Scans with INRIX data



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FIGURE C-14
24-Hour Weekday Congestion Scan
Route 3A from Route 139 West to Route 228

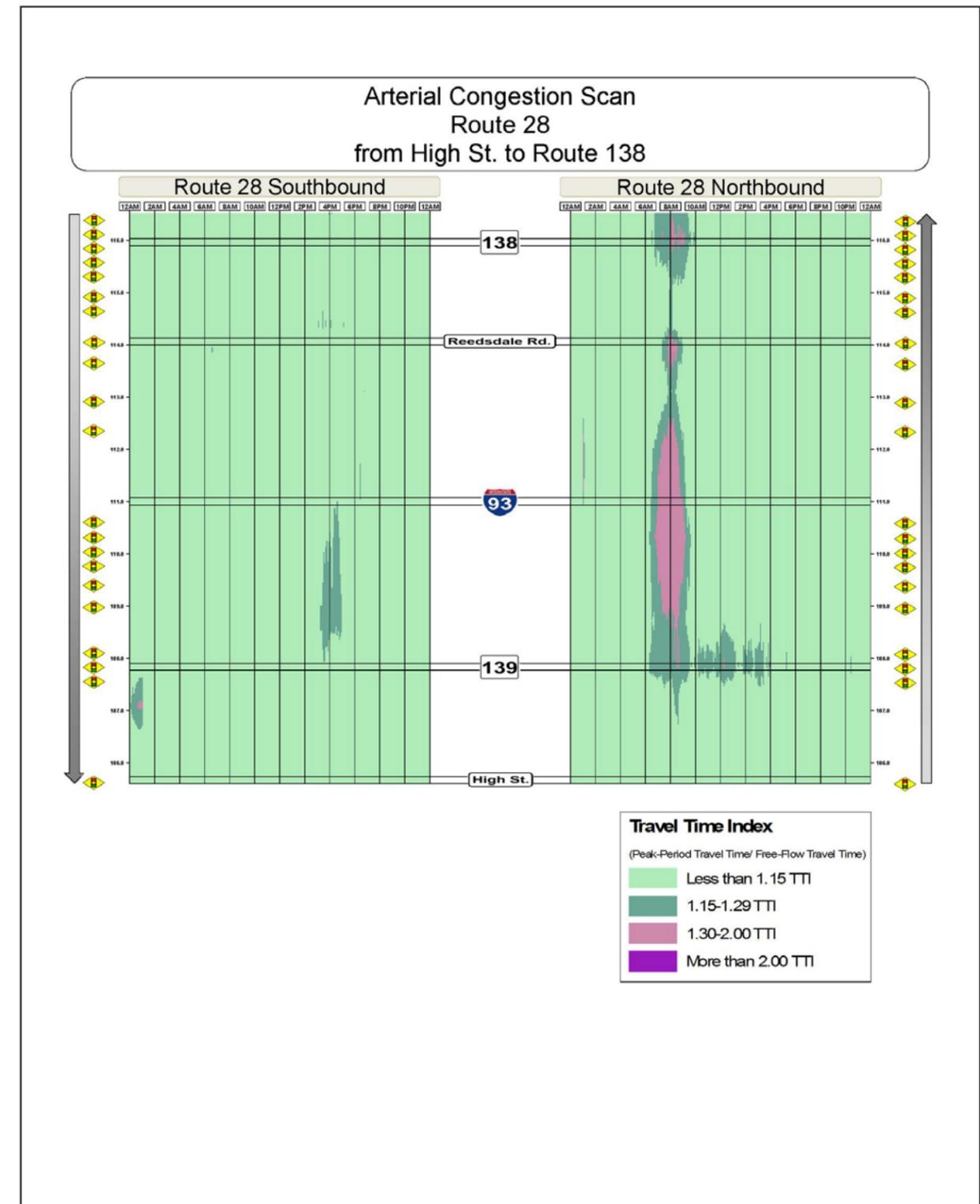
Creating Congestion Scans with INRIX data



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FIGURE C-15
24-Hour Weekday Congestion Scan
Route 3A from Route 228 to I-93/Route 1

*Creating
Congestion Scans
with
INRIX data*



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FIGURE C-16
24-Hour Weekday Congestion Scan
Route 28 from High Street to Route 138

*Creating
Congestion Scans
with
INRIX data*

Arterial Congestion Scan
Route 28
from Route 138 to Arlington St.

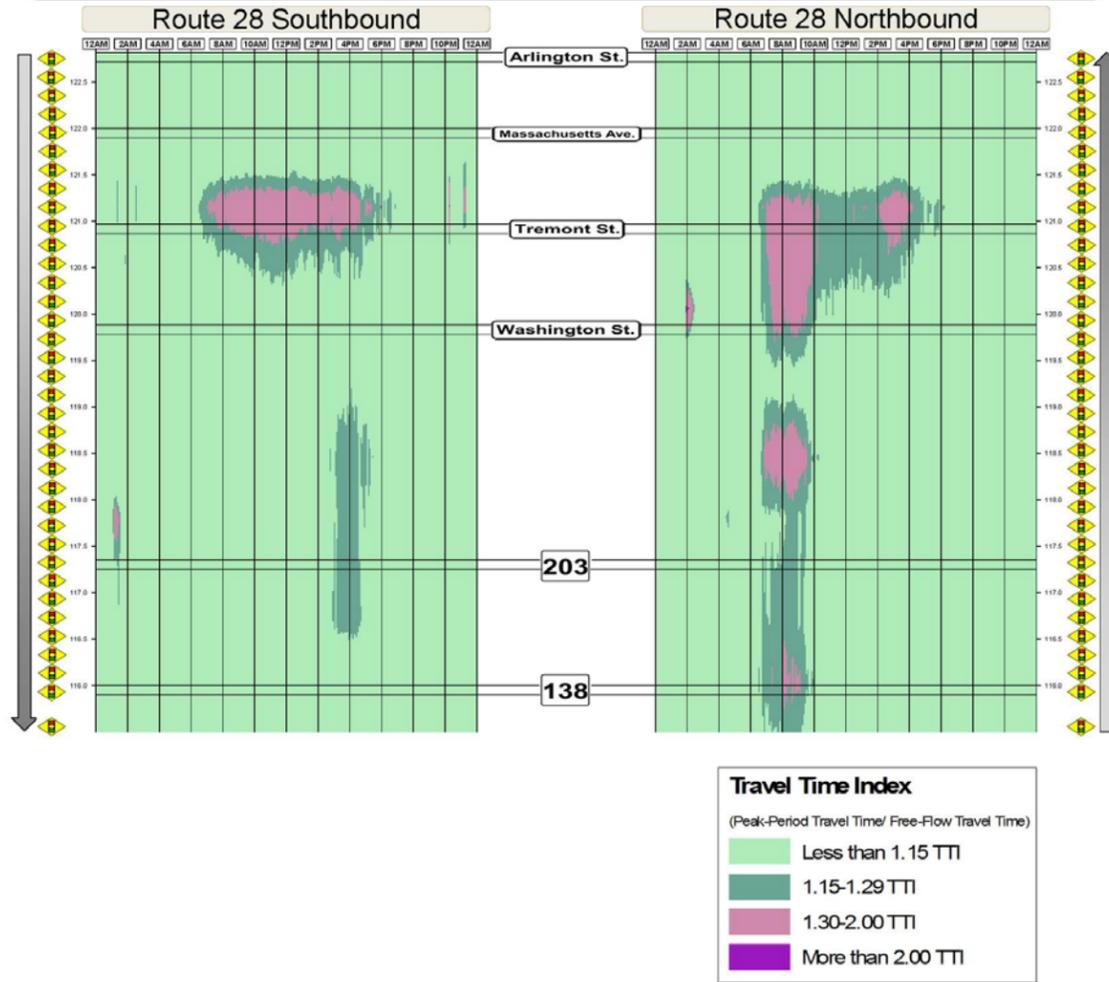


FIGURE C-17
24-Hour Weekday Congestion Scan
Route 28 from Route 138 to Arlington Street

Creating
Congestion Scans
with
INRIX data

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Arterial Congestion Scan
Route 203
from Route 9 to I-93

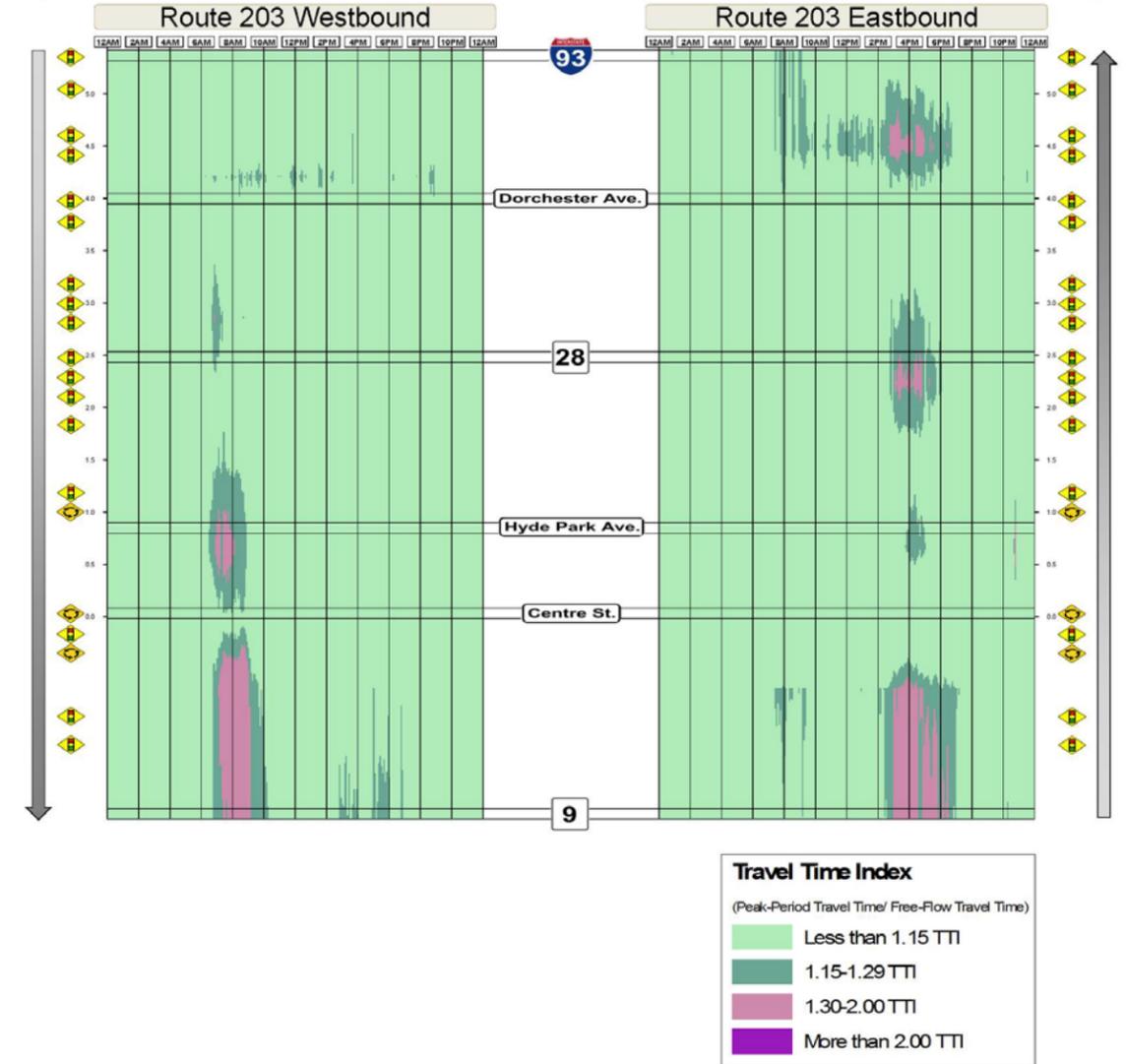
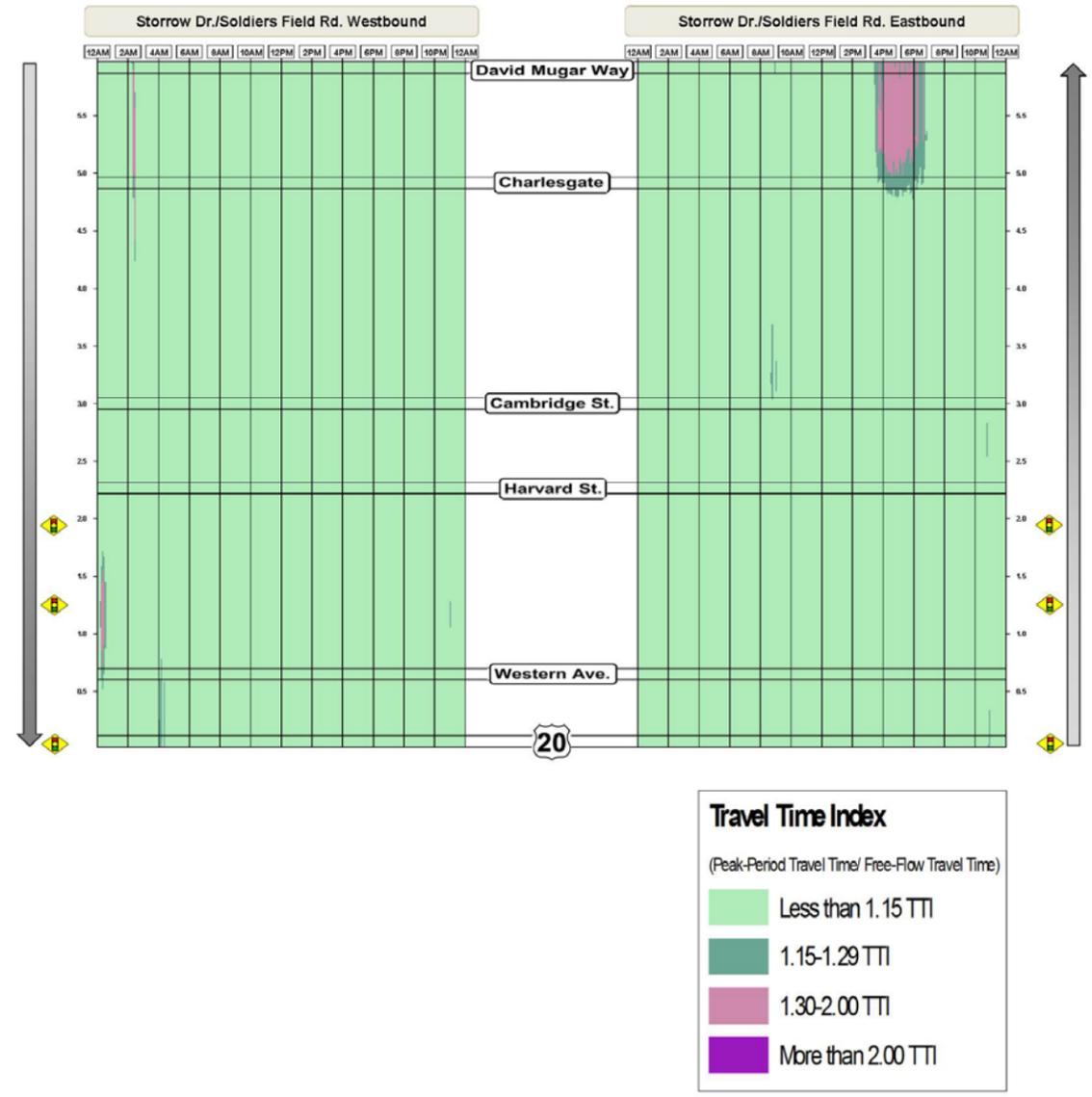


FIGURE C-18
24-Hour Weekday Congestion Scan
Route 203 from Route 9 to I-93/Route 1

Creating
Congestion Scans
with
INRIX data

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Arterial Congestion Scan
Storrow Dr./Soldiers Field Rd.
From Route 20 to David Mugar Way

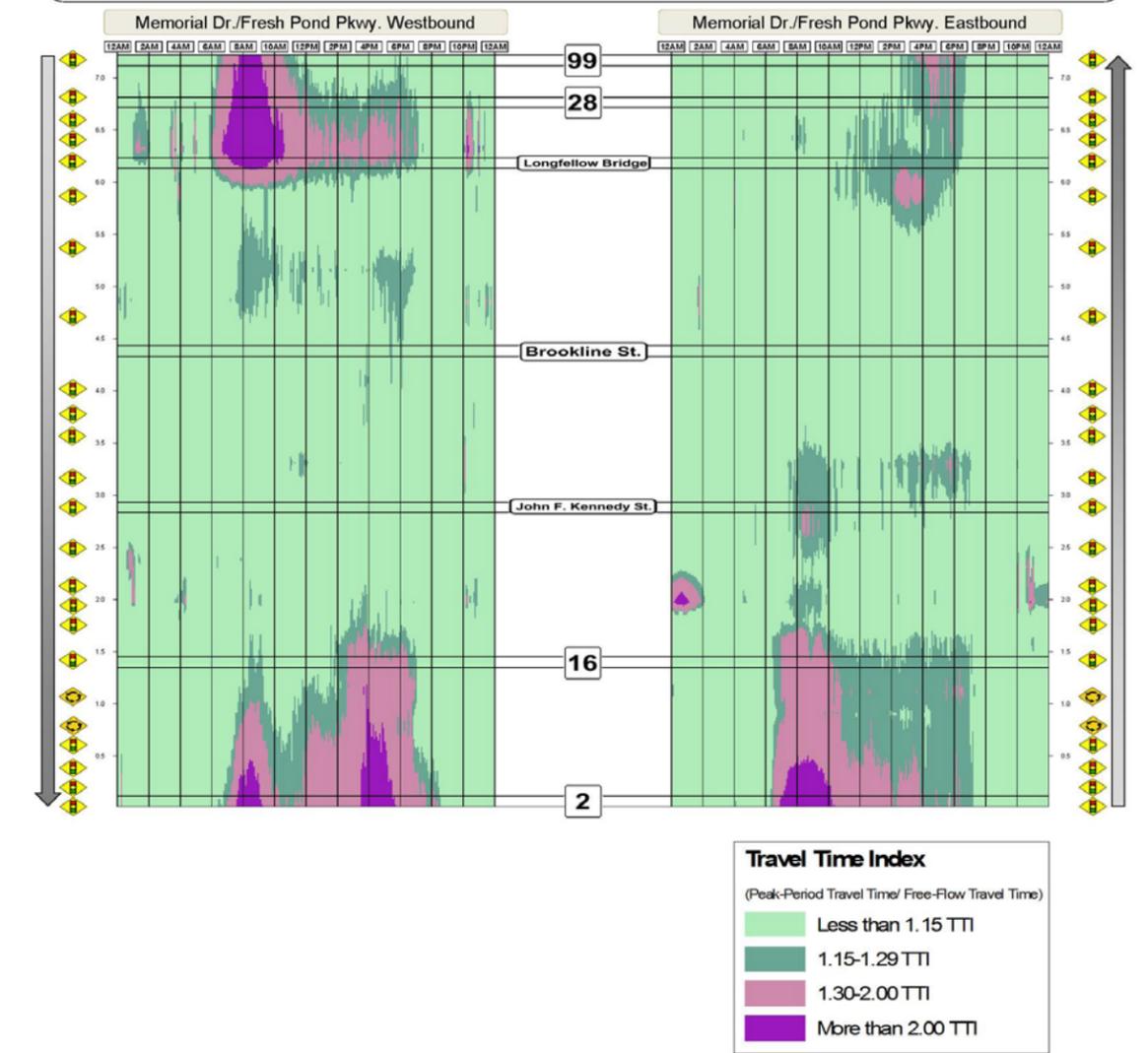


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FIGURE C-19
24-Hour Weekday Congestion Scan
Storrow Drive from Route 20 to David Mugar Way

Creating
Congestion Scans
with
INRIX data

Arterial Congestion Scan
Memorial Dr./Fresh Pond Pkwy.
from Route 2 to Route 99

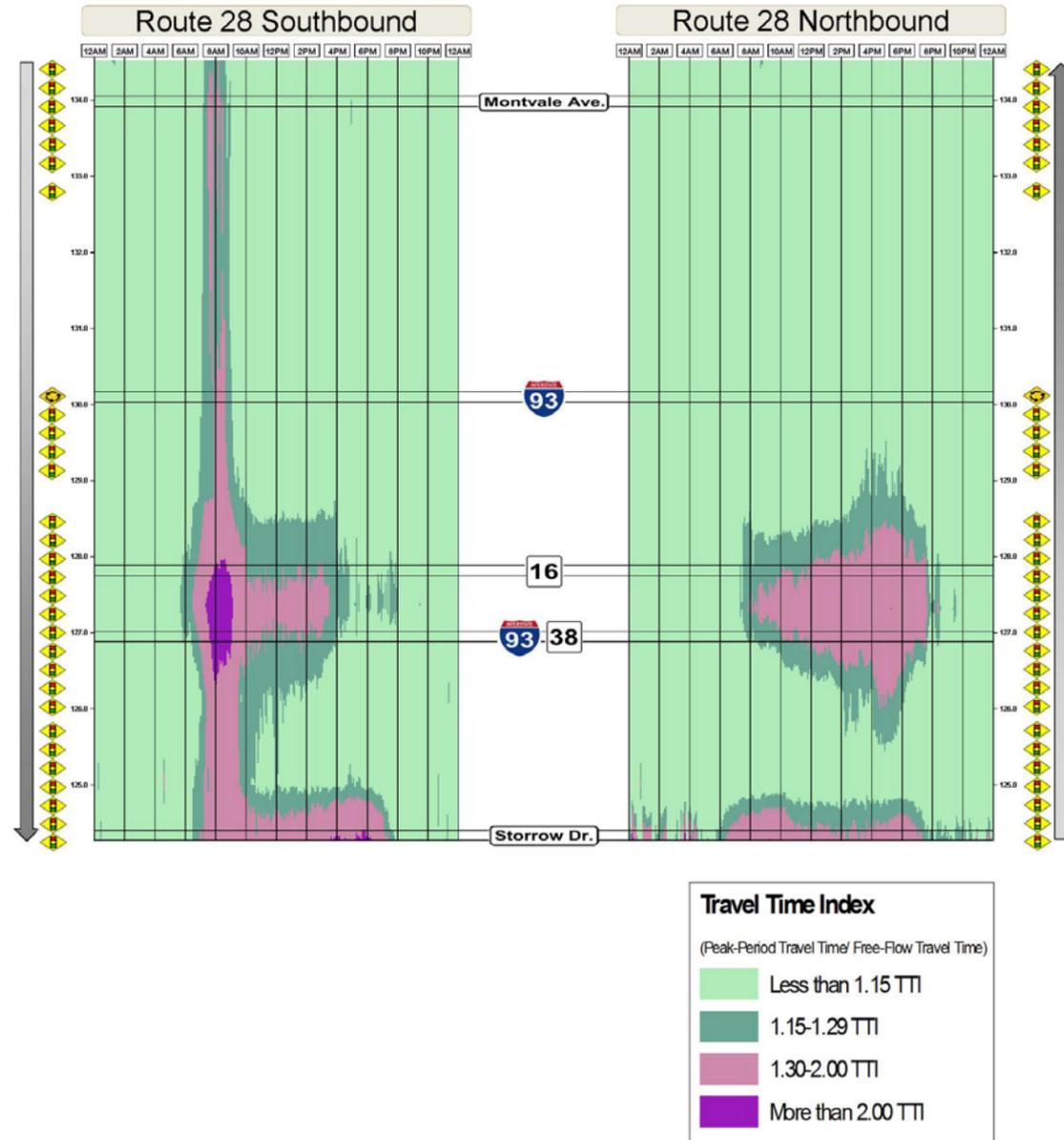


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FIGURE C-20
24-Hour Weekday Congestion Scan
Memorial Drive/Fresh Pond Parkway from Route 2 to Route 99

Creating
Congestion Scans
with
INRIX data

Arterial Congestion Scan
Route 28
from Leverett Circle to Montvale Ave.

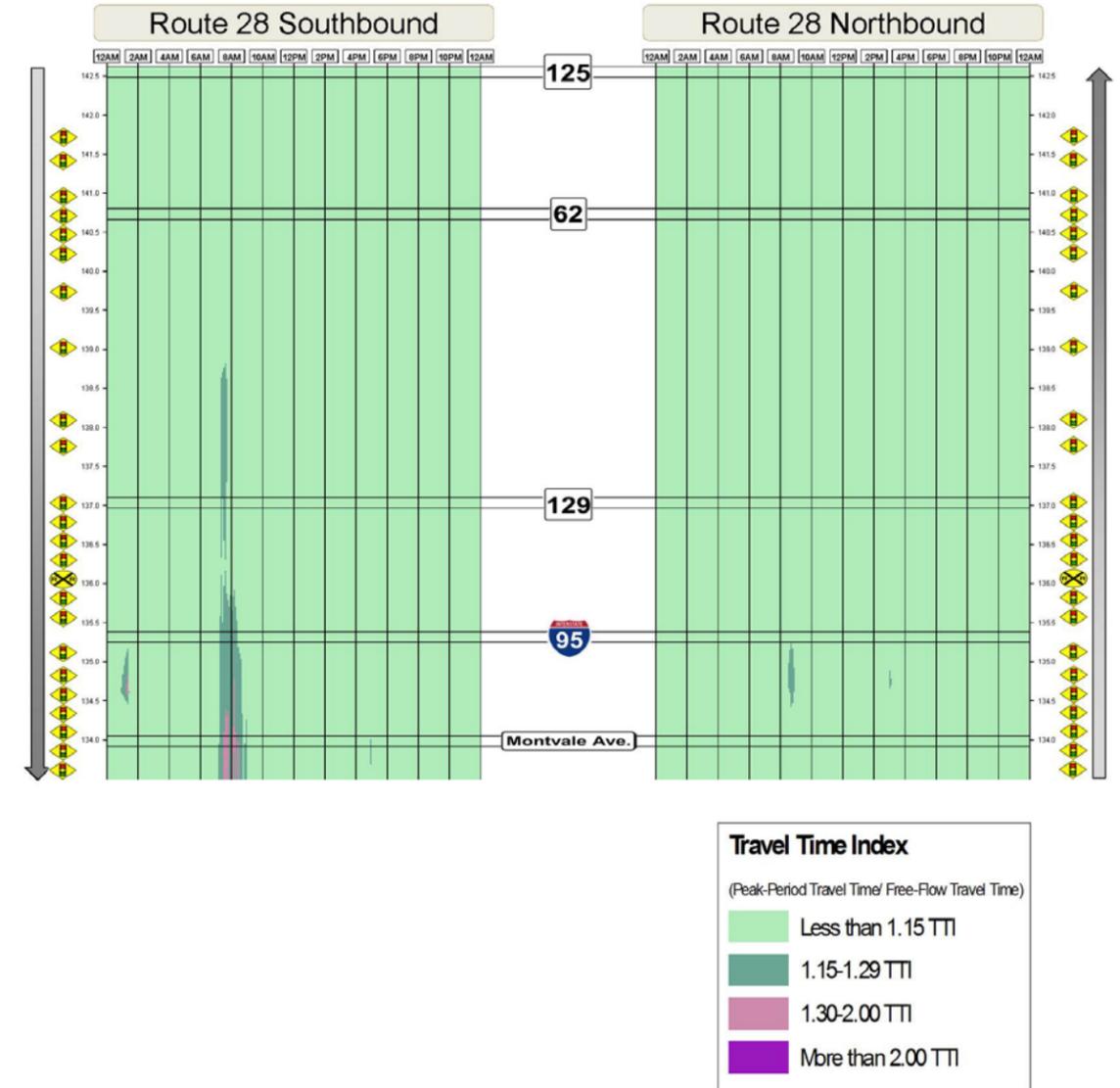


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FIGURE C-21
24-Hour Weekday Congestion Scan
Route 28 from Storrow Drive to Montvale Avenue

Creating
Congestion Scans
with
INRIX data

Arterial Congestion Scan
Route 28
from Montvale Ave. to Route 125

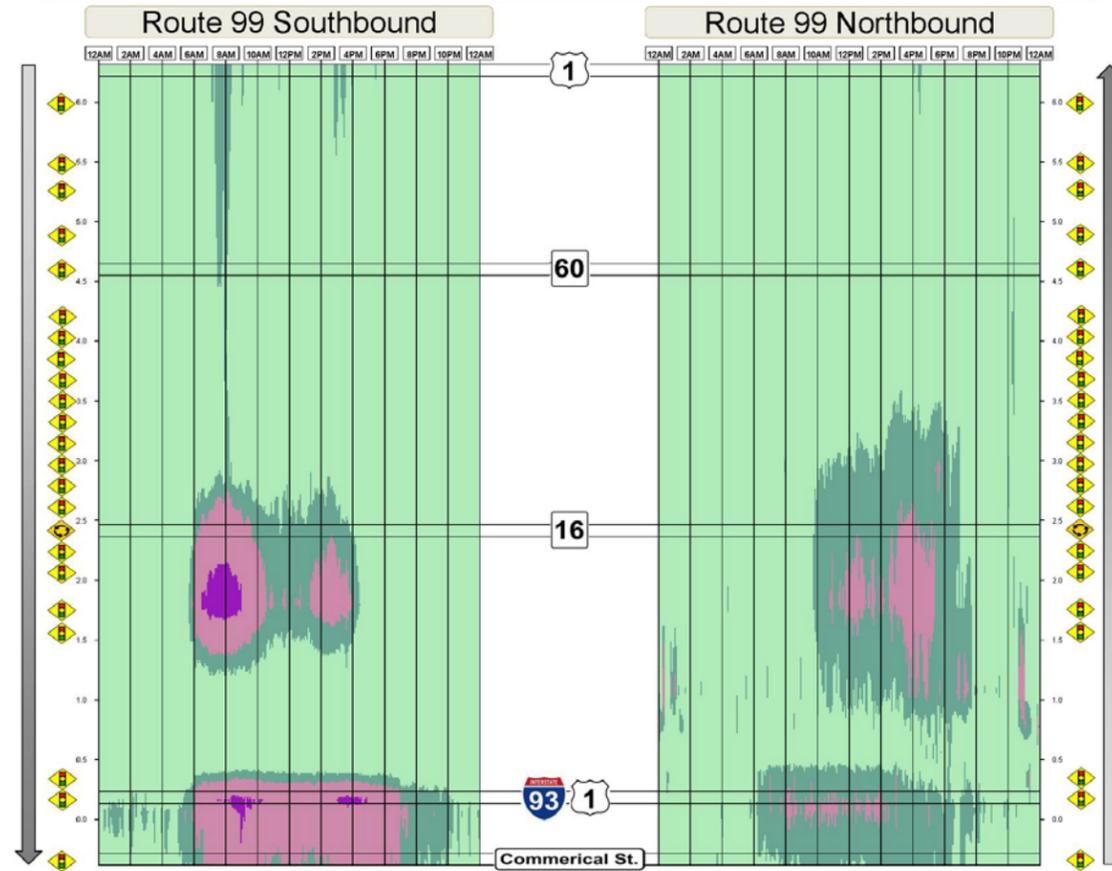


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FIGURE C-22
24-Hour Weekday Congestion Scan
Route 28 from Montvale Avenue to Route 125

Creating
Congestion Scans
with
INRIX data

Arterial Congestion Scan
Route 99
from Commerical St. to Route 1



Travel Time Index
(Peak-Period Travel Time/ Free-Flow Travel Time)

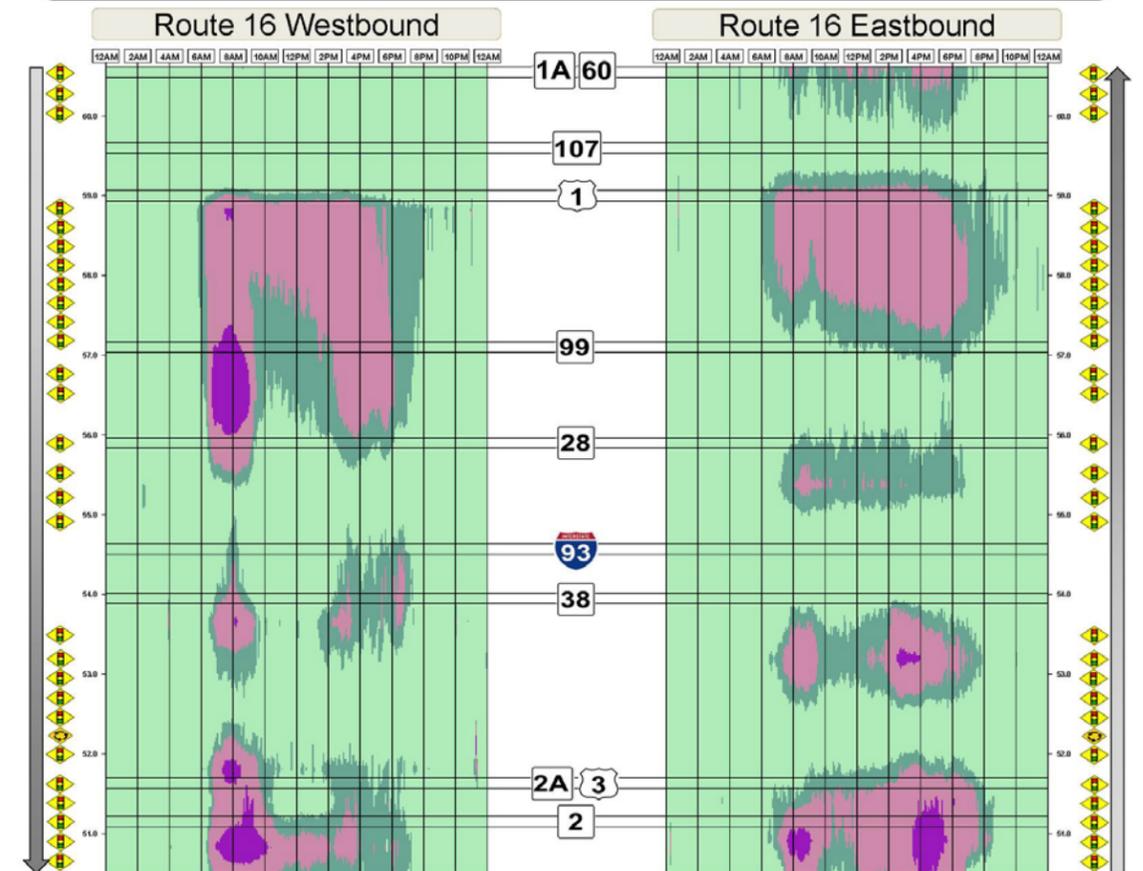
- Less than 1.15 TTI
- 1.15-1.29 TTI
- 1.30-2.00 TTI
- More than 2.00 TTI

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FIGURE C-23
24-Hour Weekday Congestion Scan
Route 99 from I-93 to Route 1

Creating
Congestion Scans
with
INRIX data

Arterial Congestion Scan
Route 16
From Route 2 to Route 1A/Route 60



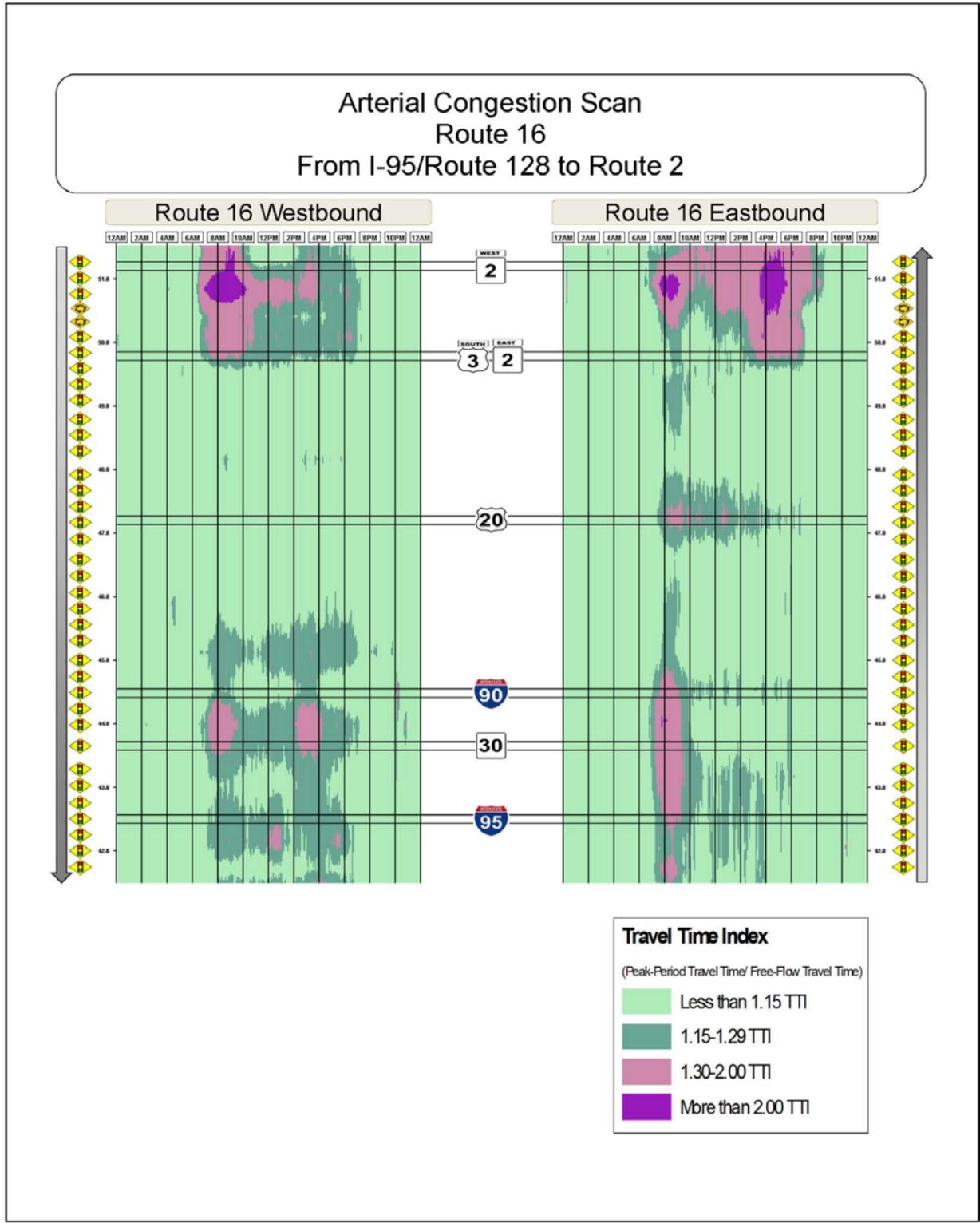
Travel Time Index
(Peak-Period Travel Time/ Free-Flow Travel Time)

- Less than 1.15 TTI
- 1.15-1.29 TTI
- 1.30-2.00 TTI
- More than 2.00 TTI

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FIGURE C-24
24-Hour Weekday Congestion Scan
Route 16 from Route 2 to Route 1A/Route 60

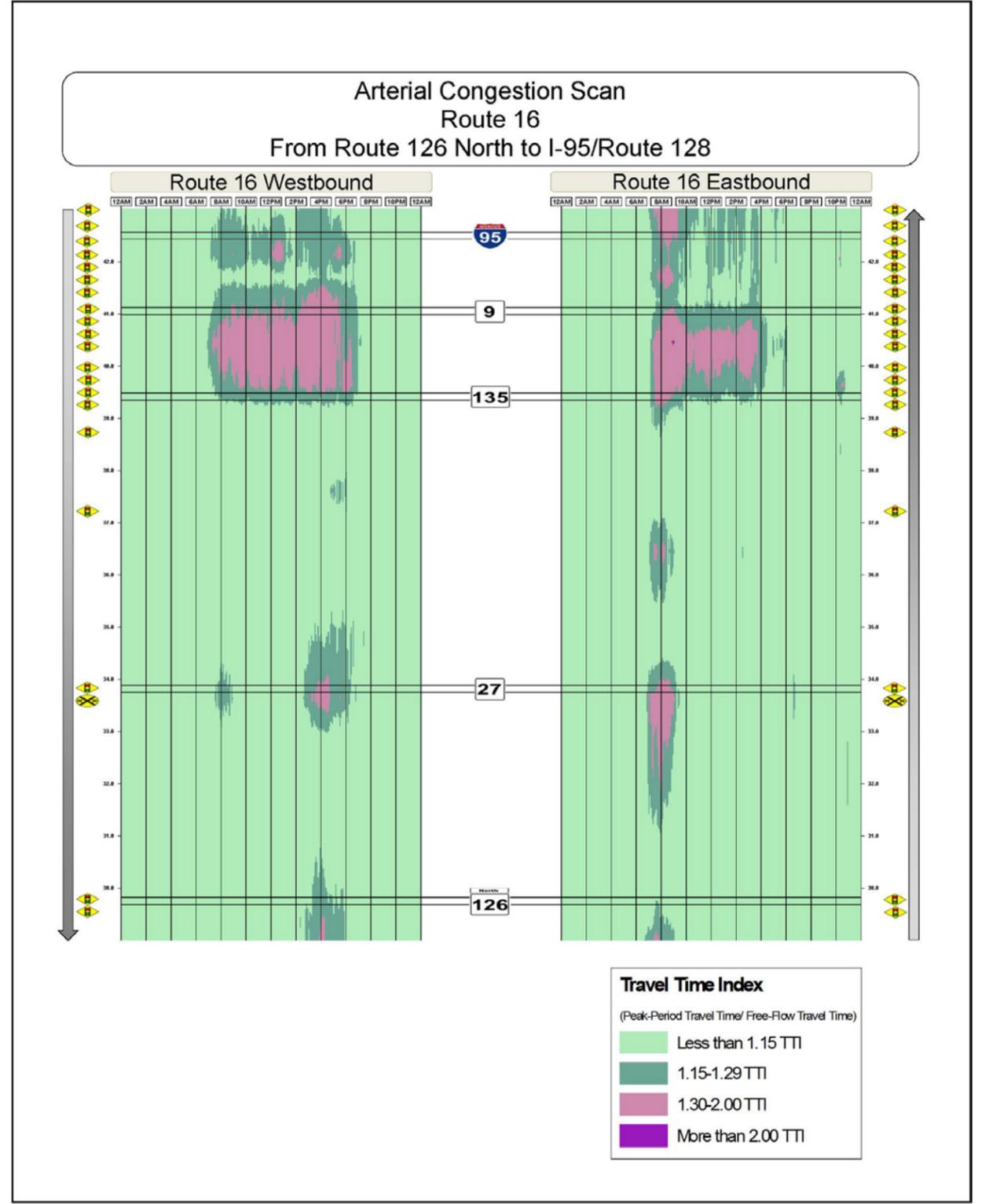
Creating
Congestion Scans
with
INRIX data



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FIGURE C-25
24-Hour Weekday Congestion Scan
Route 16 from I-95 to Route 2

Creating Congestion Scans with INRIX data



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FIGURE C-26
24-Hour Weekday Congestion Scan
Route 16 from Route 126 North to I-95/Route 128

Creating Congestion Scans with INRIX data

Arterial Congestion Scan
Route 16
From Main St./North Ave. to Route 126 North

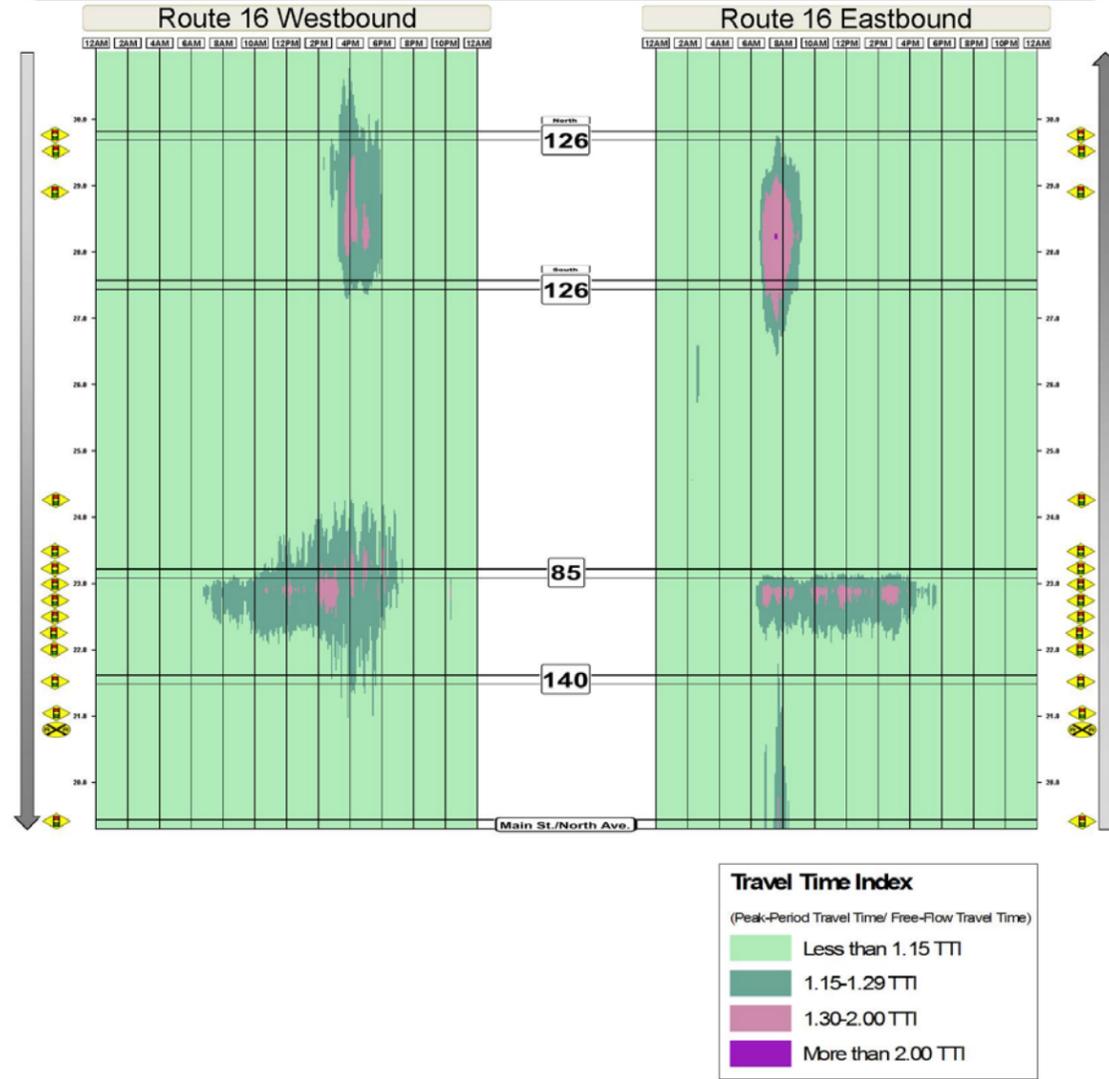


FIGURE C-27
24-Hour Weekday Congestion Scan
Route 16 from Main Street to Route 126 North

Creating
Congestion Scans
with
INRIX data

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Arterial Congestion Scan
Route 60
from Route 20 to Route 1A/Route 16

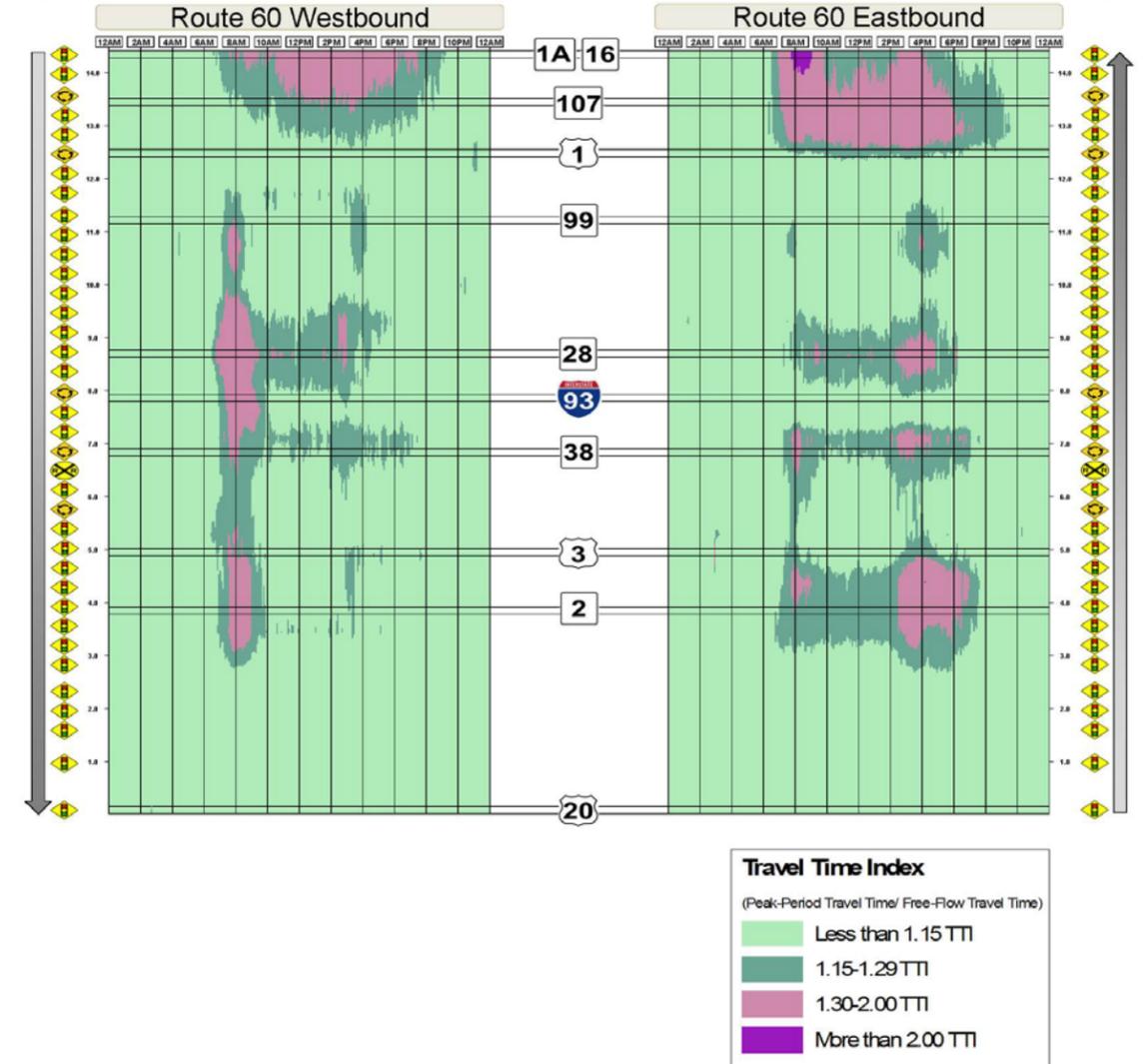
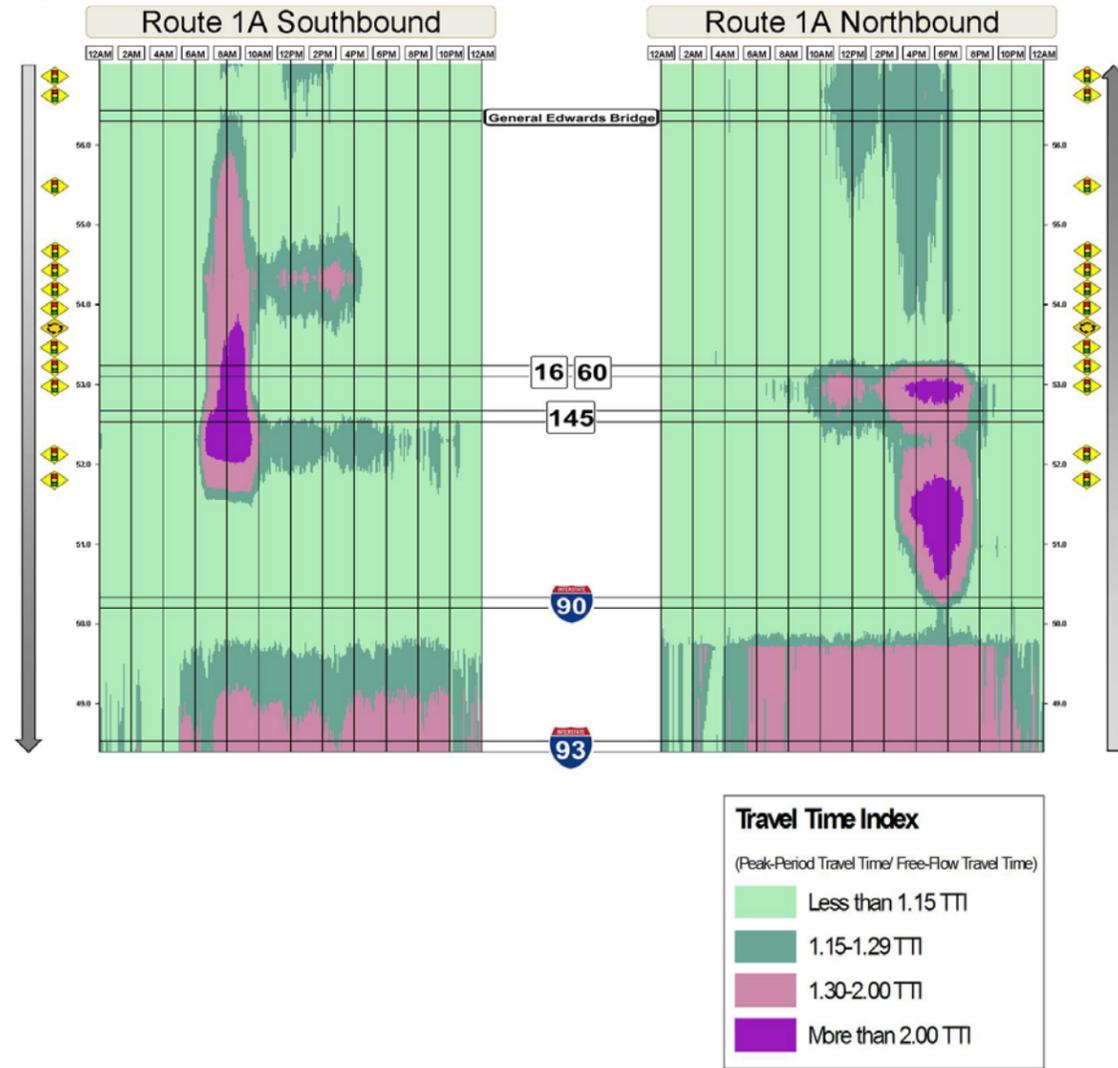


FIGURE C-28
24-Hour Weekday Congestion Scan
Route 60 from Route 20 to Route 1A/Route 16

Creating
Congestion Scans
with
INRIX data

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Arterial Congestion Scan
Route 1A
From I-93 to General Edwards Bridge

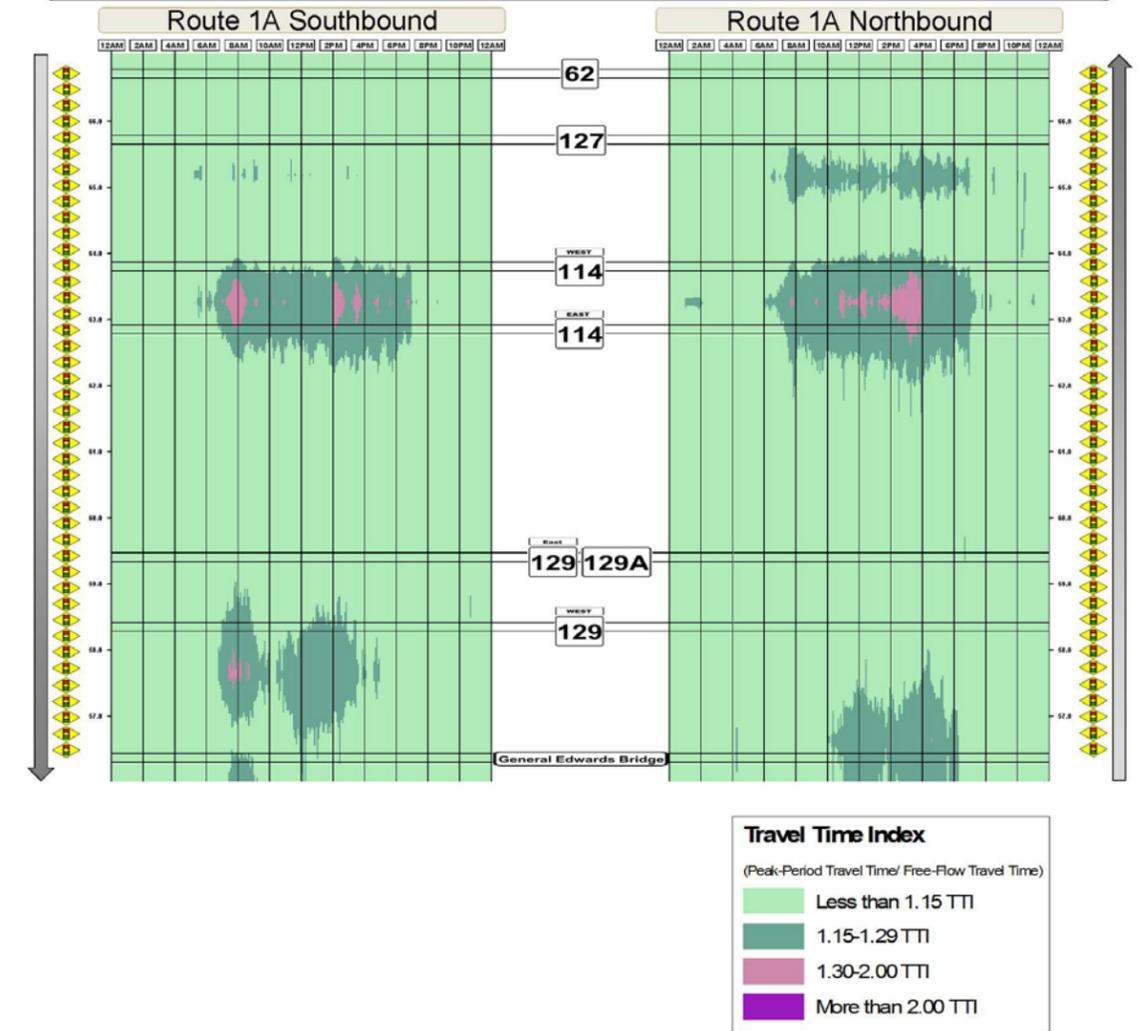


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FIGURE C-29
24-Hour Weekday Congestion Scan
Route 1A from I-93 to General Edwards Bridge

Creating
Congestion Scans
with
INRIX data

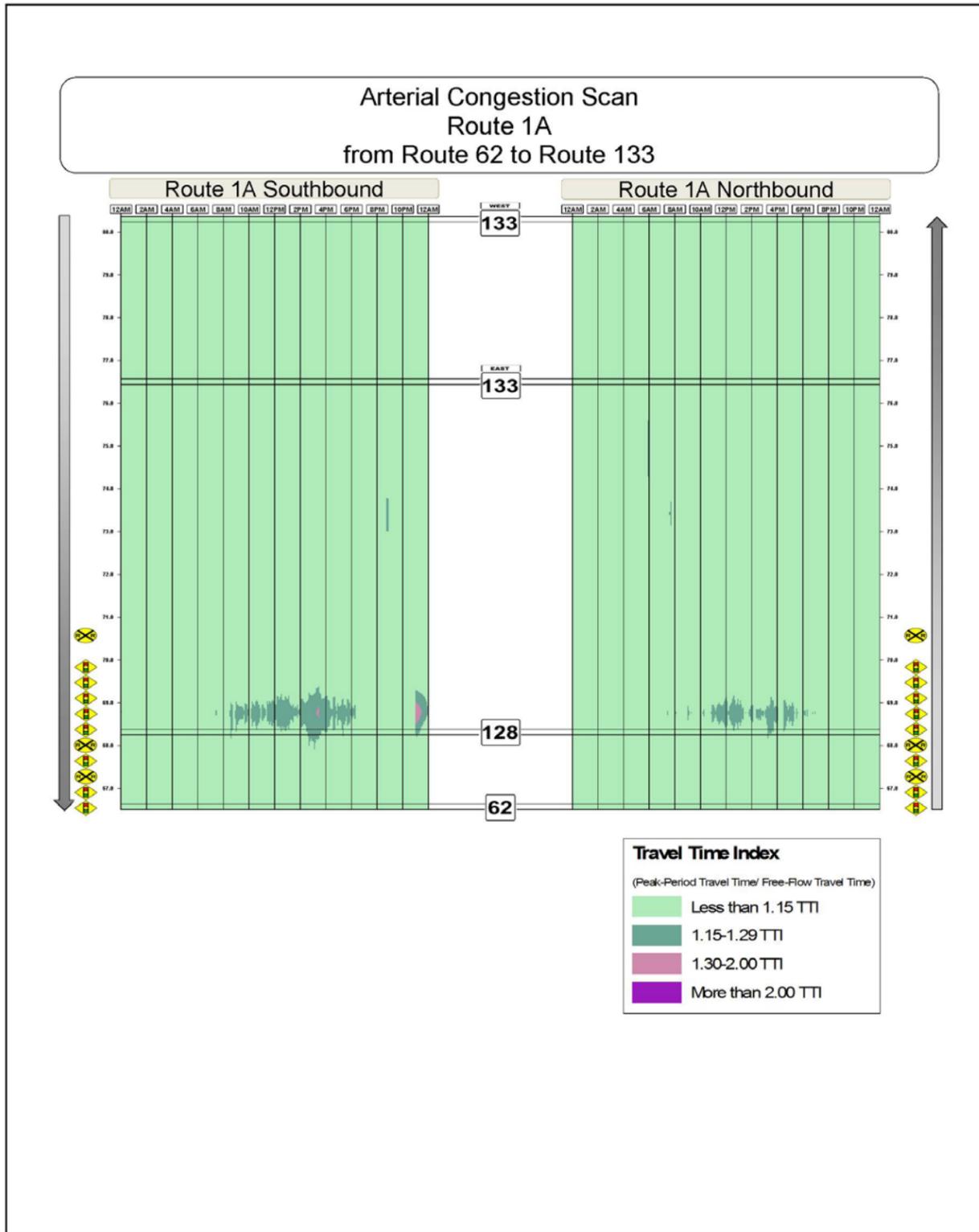
Arterial Congestion Scan
Route 1A
from General Edwards Bridge to Route 62



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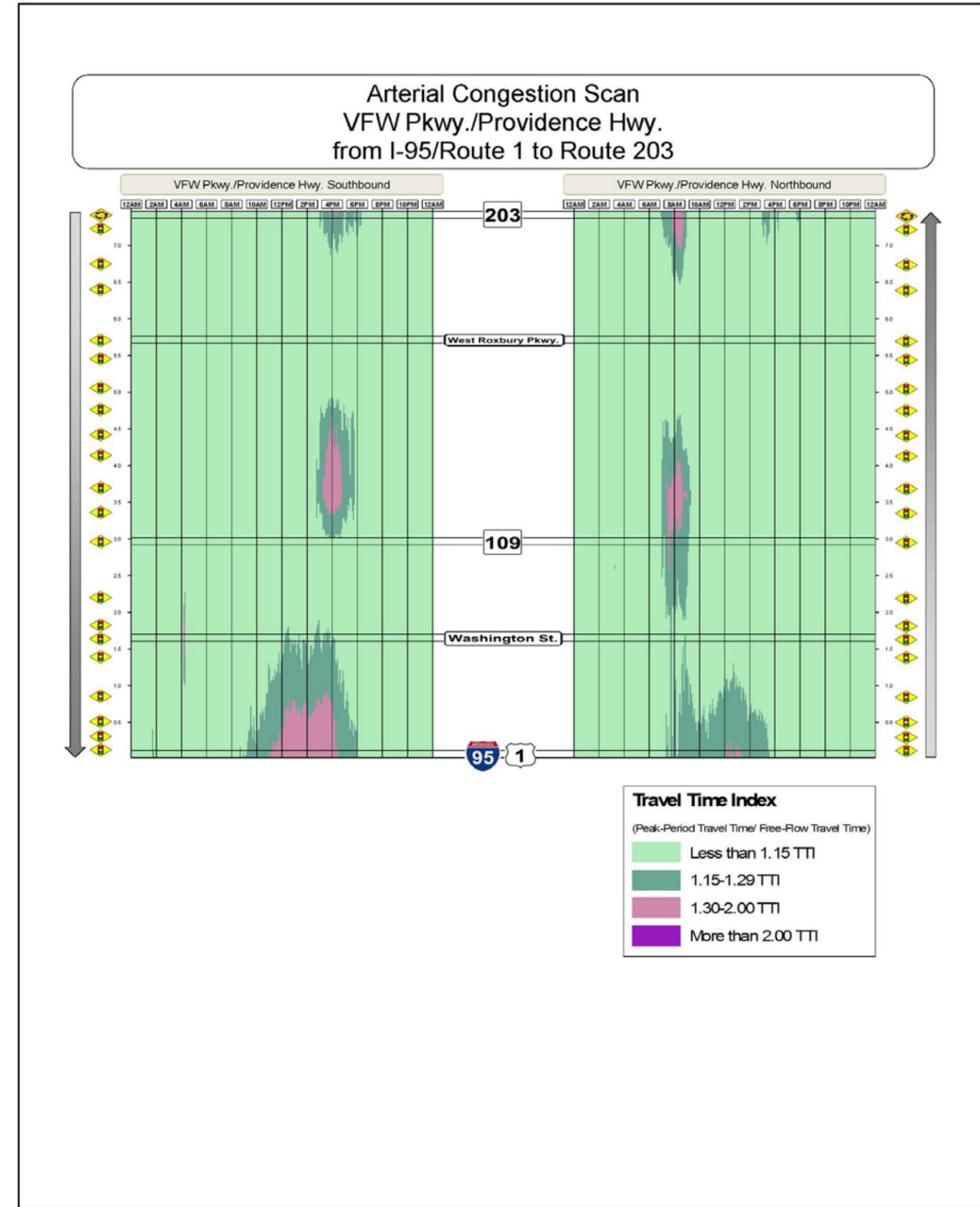
FIGURE C-30
24-Hour Weekday Congestion Scan
Route 1A from General Edwards Bridge to Route 62

Creating
Congestion Scans
with
INRIX data



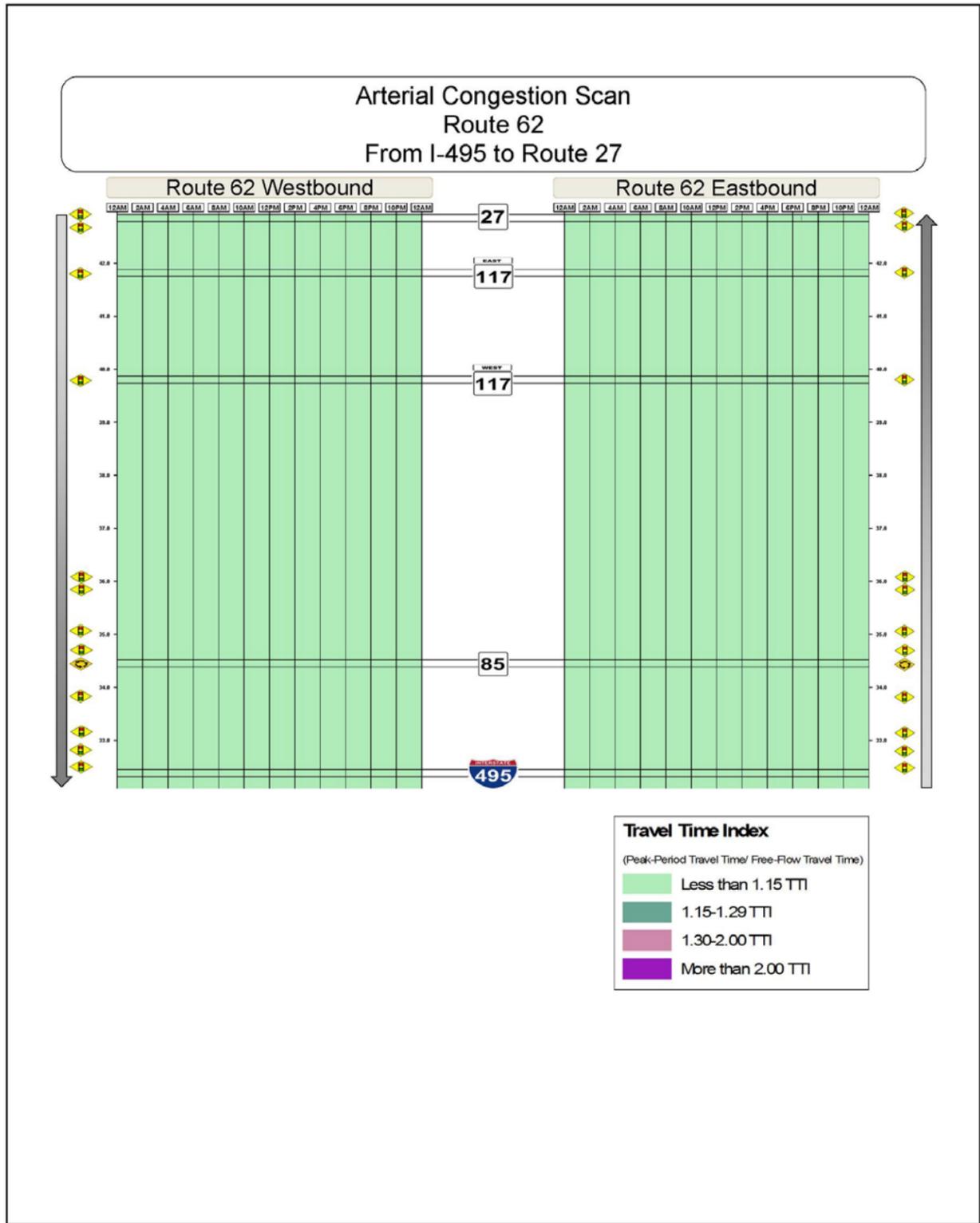
BOSTON REGION MPO **FIGURE C-31** *Creating Congestion Scans with INRIX data*

24-Hour Weekday Congestion Scan
Route 1A from Route 62 to Route 133



BOSTON REGION MPO **FIGURE C-32** *Creating Congestion Scans with INRIX data*

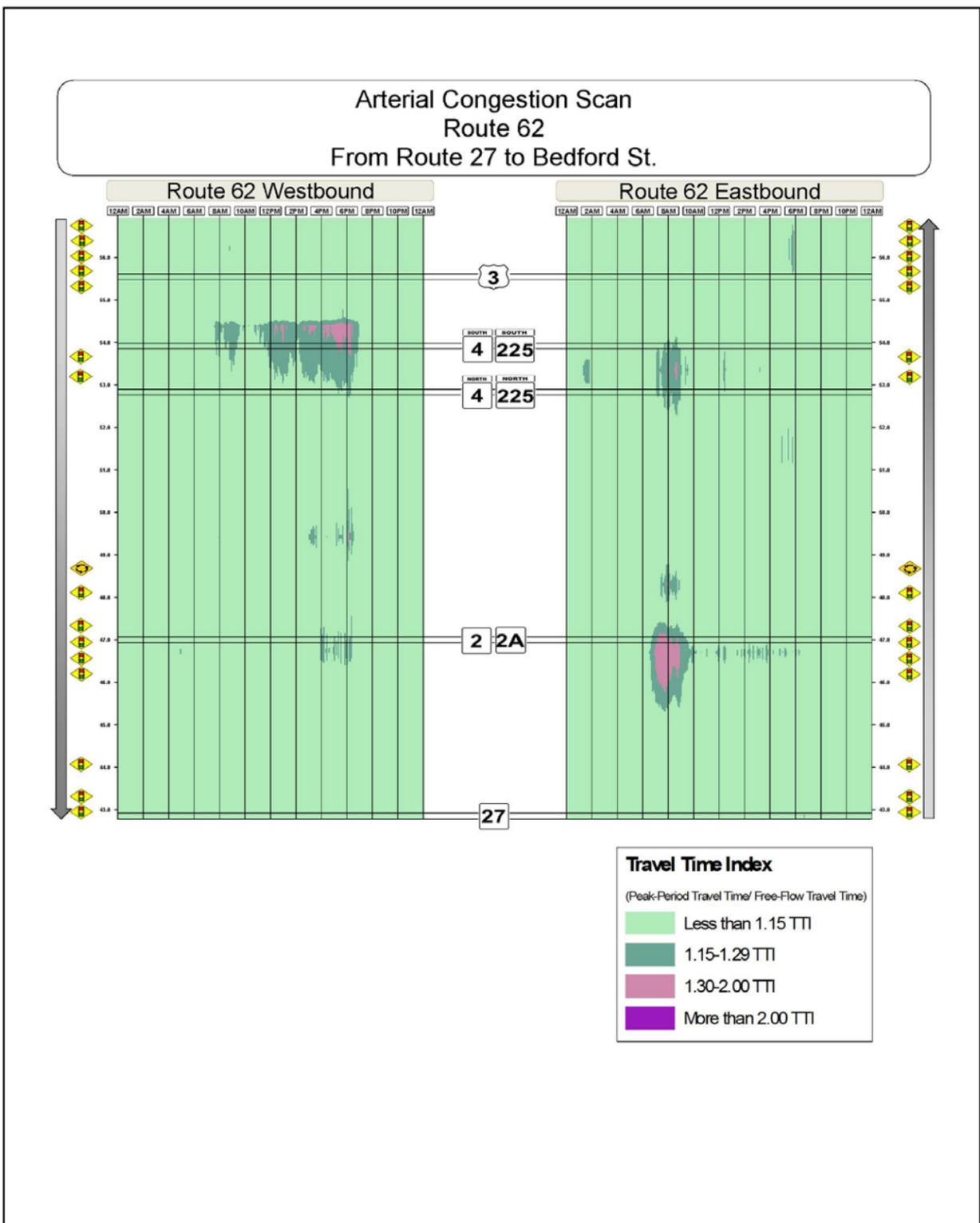
24-Hour Weekday Congestion Scan
VFW Parkway/Providence Highway from I-95 to Route 203



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FIGURE C-33
24-Hour Weekday Congestion Scan
Route 62 from I-495 to Route 27

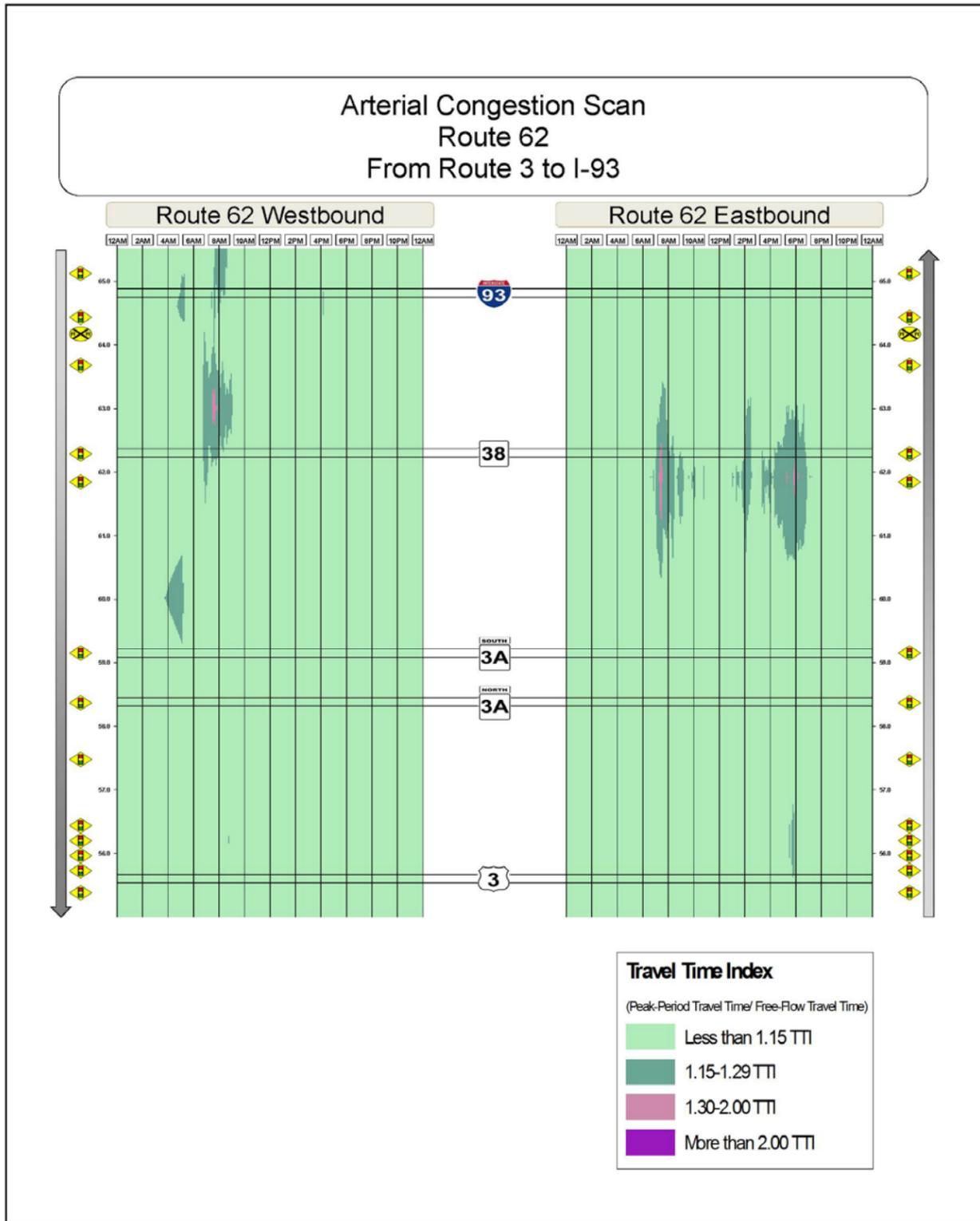
Creating Congestion Scans with INRIX data



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FIGURE C-34
24-Hour Weekday Congestion Scan
Route 62 from Route 27 to Bedford Street

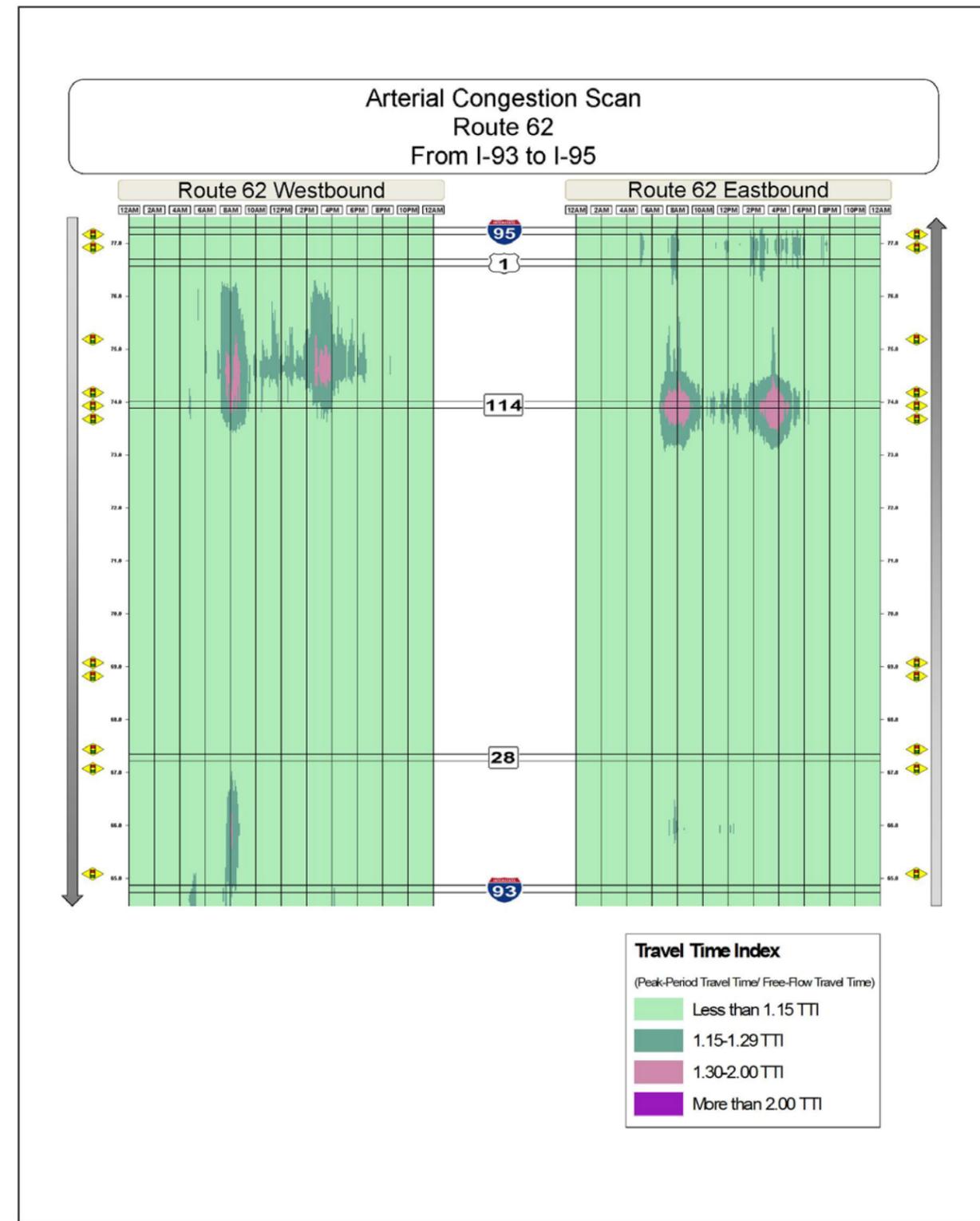
Creating Congestion Scans with INRIX data



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FIGURE C-35
24-Hour Weekday Congestion Scan
Route 62 from Route 3 to I-93

Creating Congestion Scans with INRIX data



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FIGURE C-36
24-Hour Weekday Congestion Scan
Route 62 from I-93 to I-95

Creating Congestion Scans with INRIX data

Arterial Congestion Scan
Route 62
From I-95 to Route 127

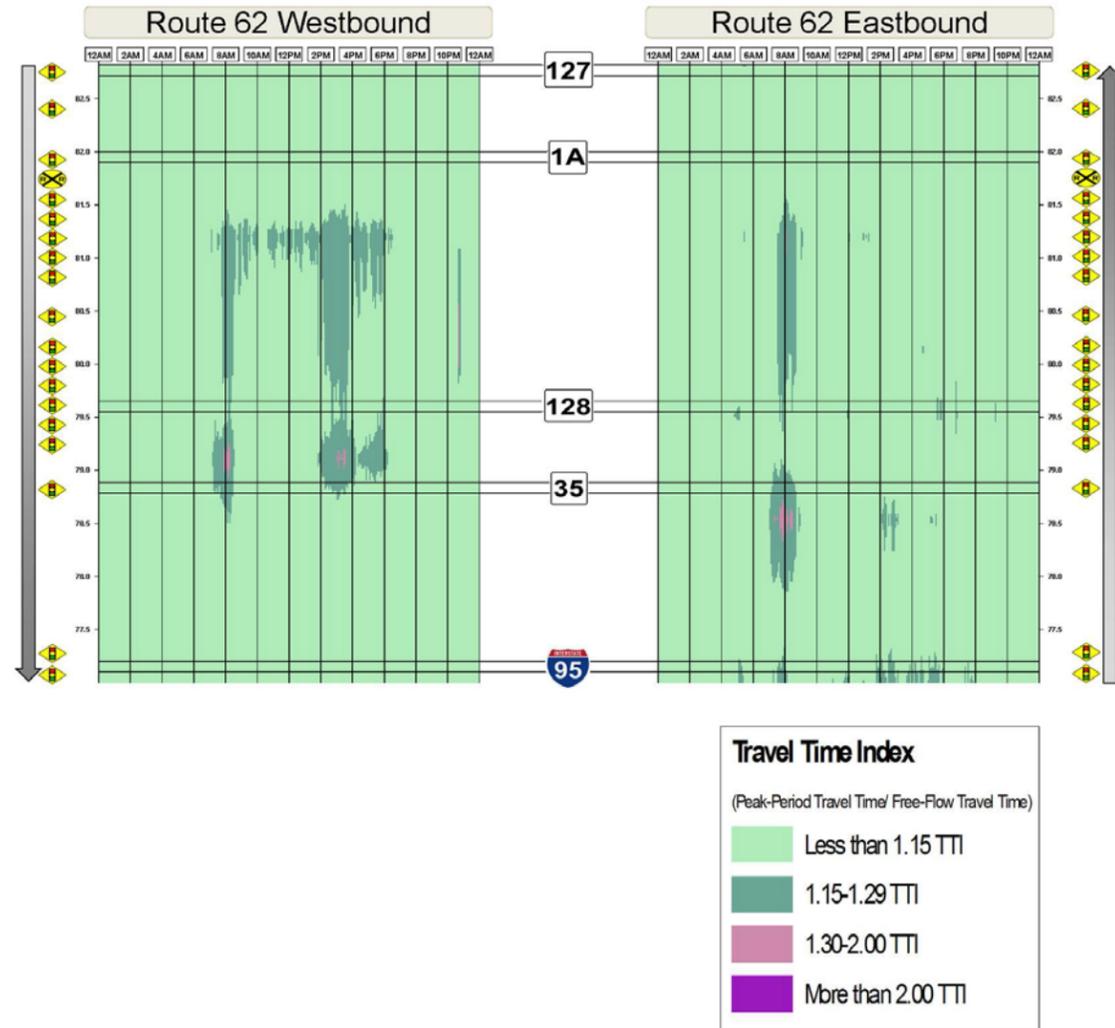


FIGURE C-37
24-Hour Weekday Congestion Scan
Route 62 from I-95 to Route 127

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Creating
Congestion Scans
with
INRIX data

Arterial Congestion Scan
Middlesex Turnpike
from Route 2A to Lexington Rd.

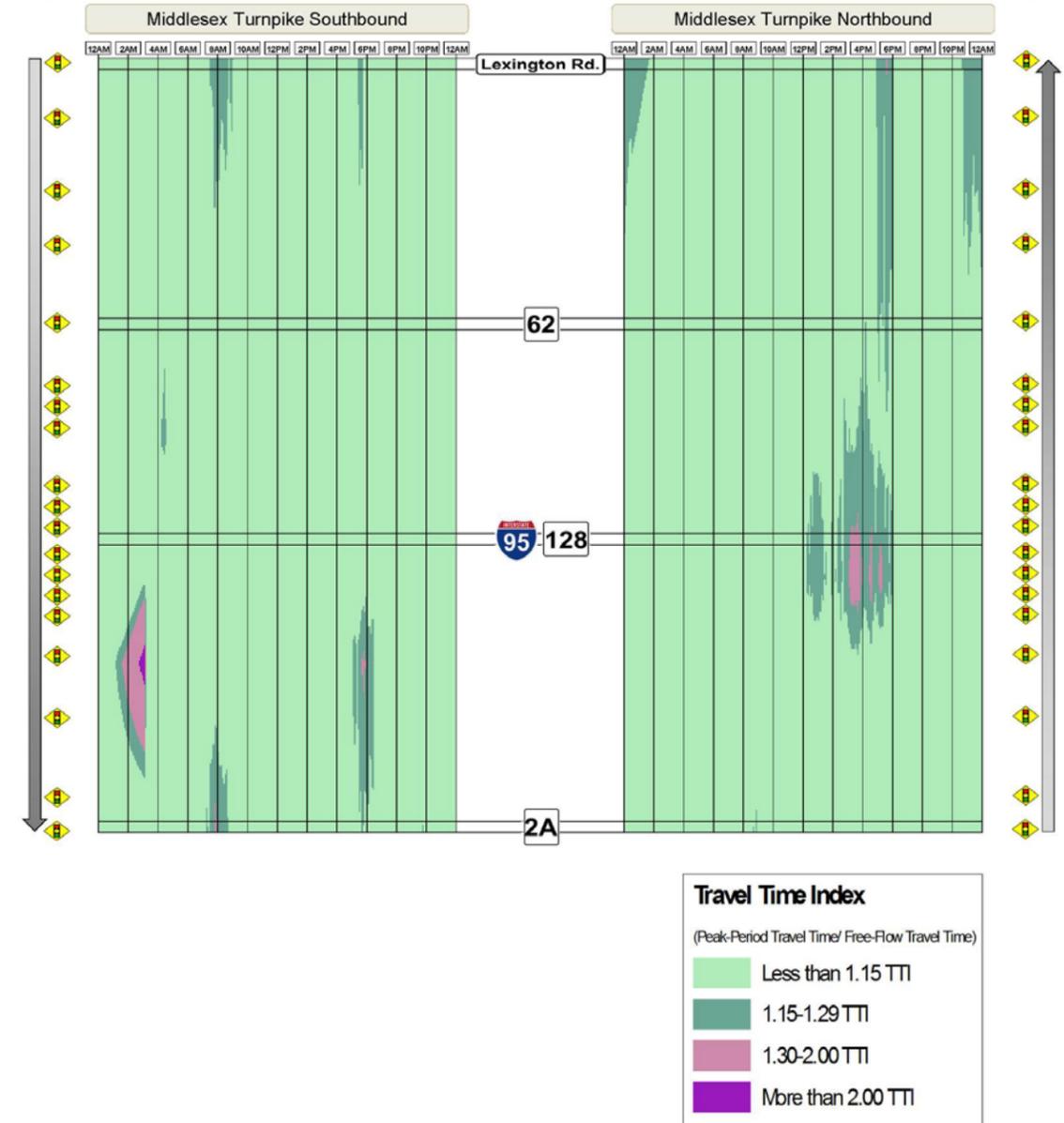
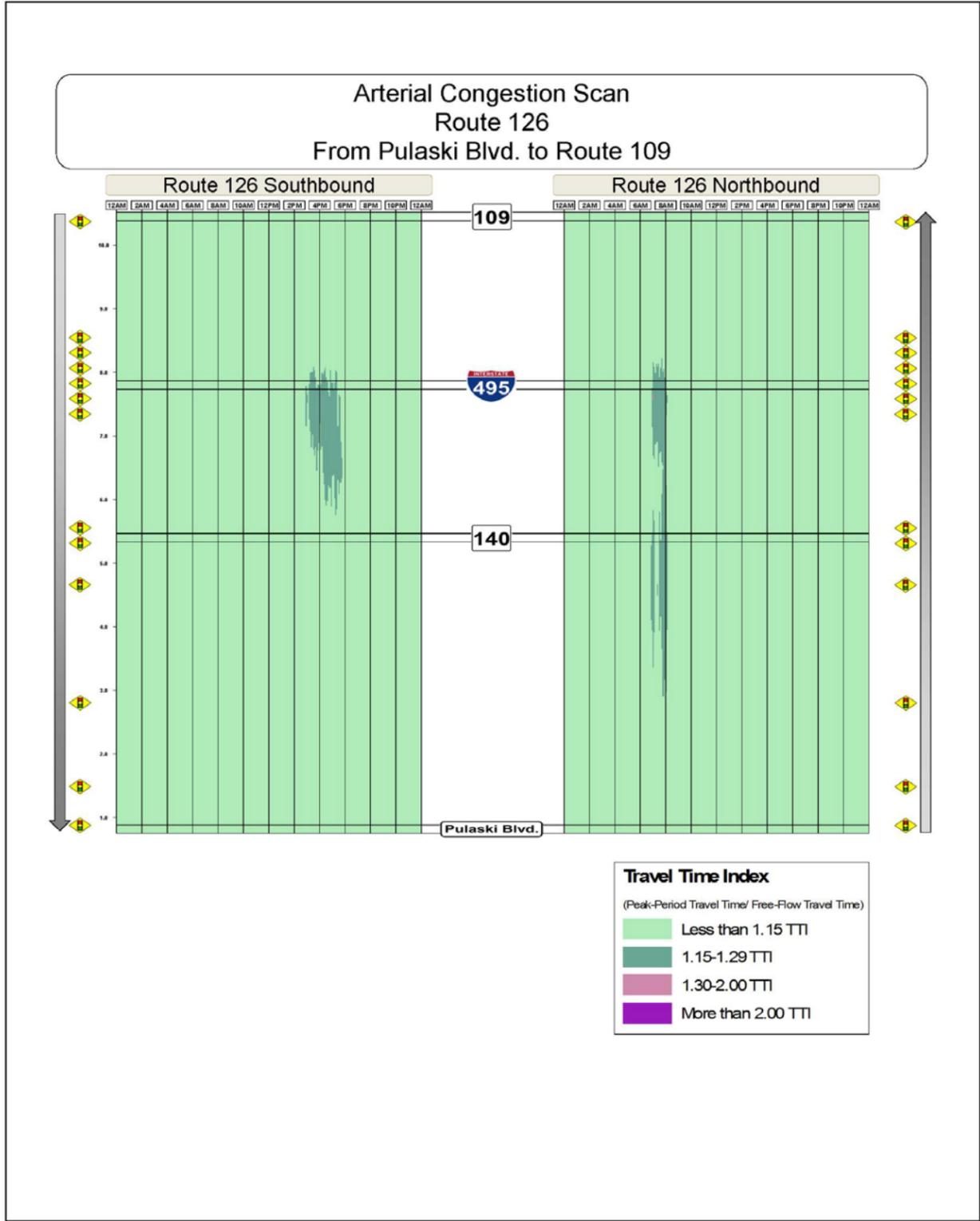


FIGURE C-38
24-Hour Weekday Congestion Scan
Middlesex Turnpike from Route 2A to Lexington Road

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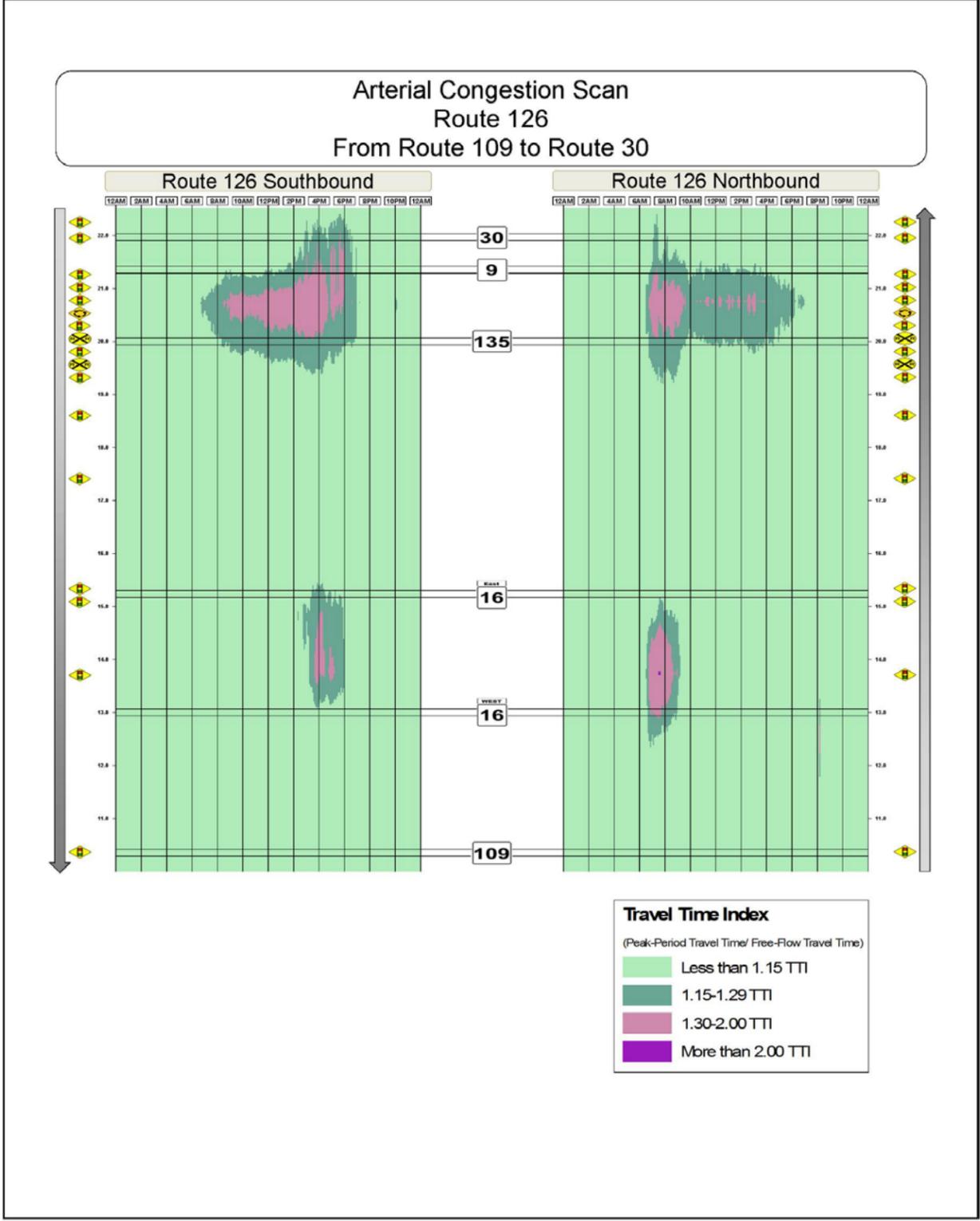
Creating
Congestion Scans
with
INRIX data



BOSTON REGION MPO

FIGURE C-39
24-Hour Weekday Congestion Scan
Route 126 from Pulaski Boulevard to Route 109

Creating Congestion Scans with INRIX data

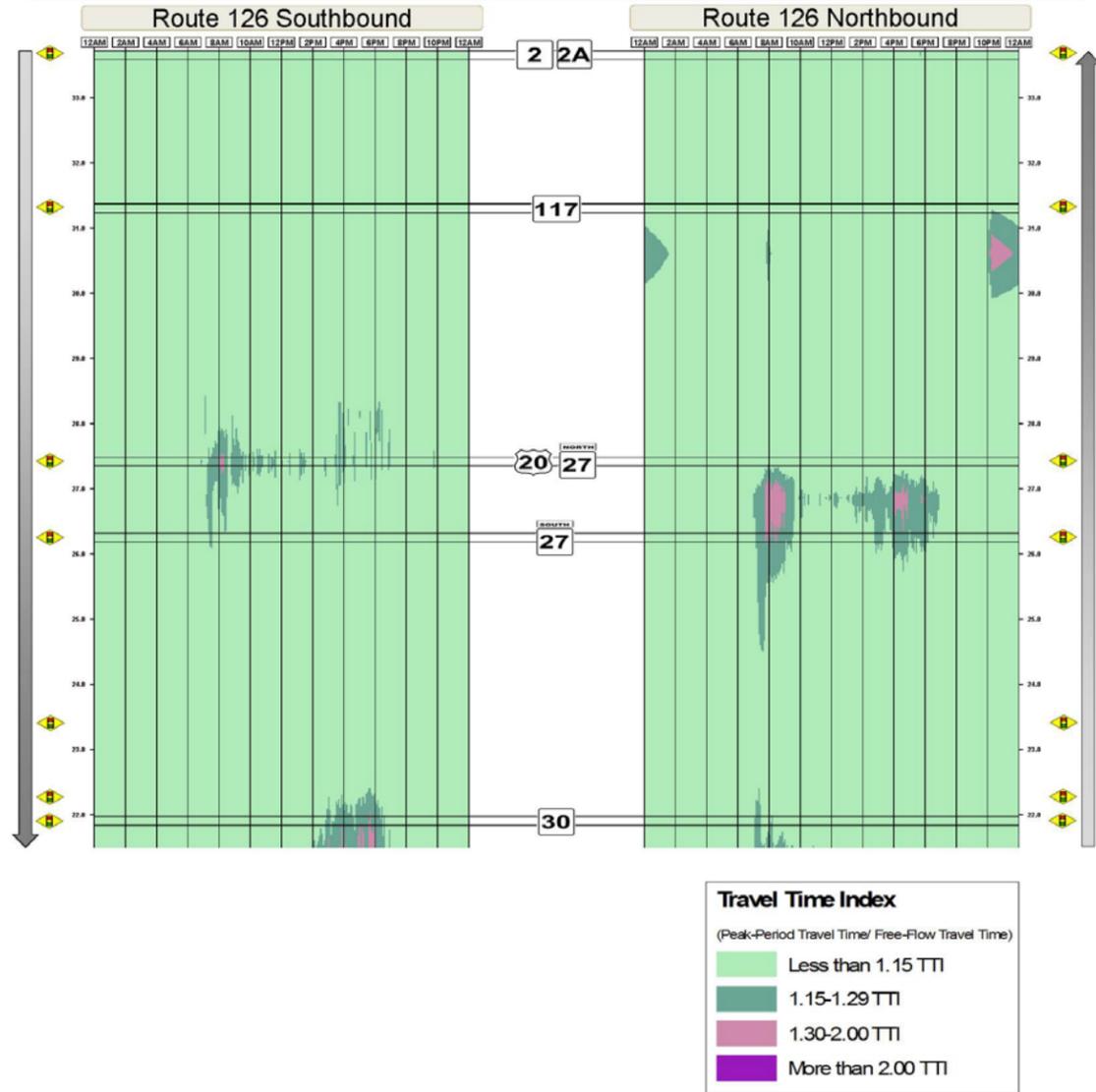


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FIGURE C-40
24-Hour Weekday Congestion Scan
Route 126 from Route 109 to Route 30

Creating Congestion Scans with INRIX data

Arterial Congestion Scan
Route 126
From Route 30 to Route 2/Route 2A



APPENDIX D

CIRCUMFERENTIAL CORRIDORS

LONG-RANGE TRANSPORTATION PLAN NEEDS

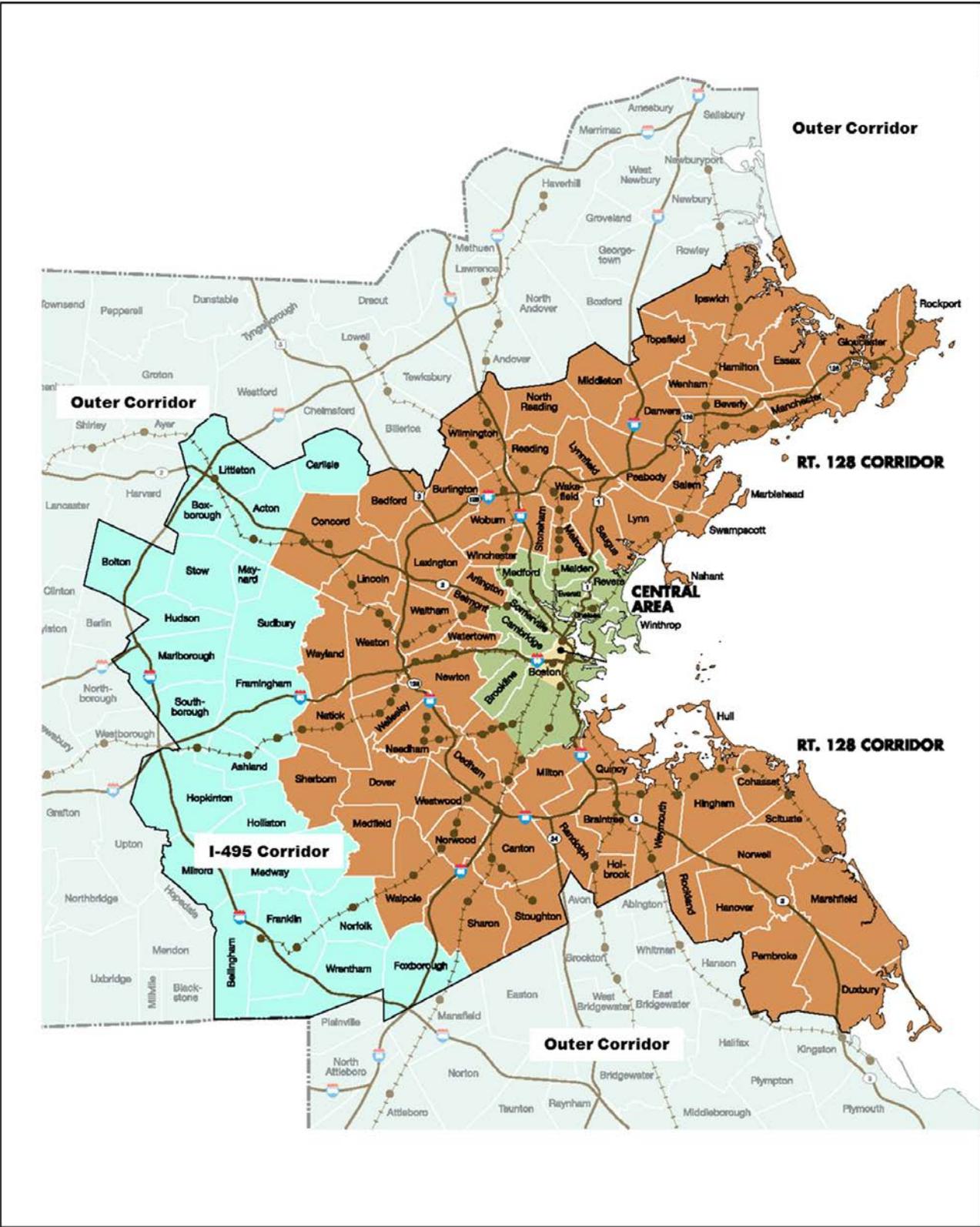
ASSESSMENT

Table Name

Circumferential Corridors Long-Range Transportation Plan Needs
Assessment

**Figure
Number**

D.1



BOSTON
REGION
MPO

FIGURE D-1
Circumferential Corridors
Long Range Transportation Plan Needs Assessment

*Creating
Congestion Scans
with
INRIX data*