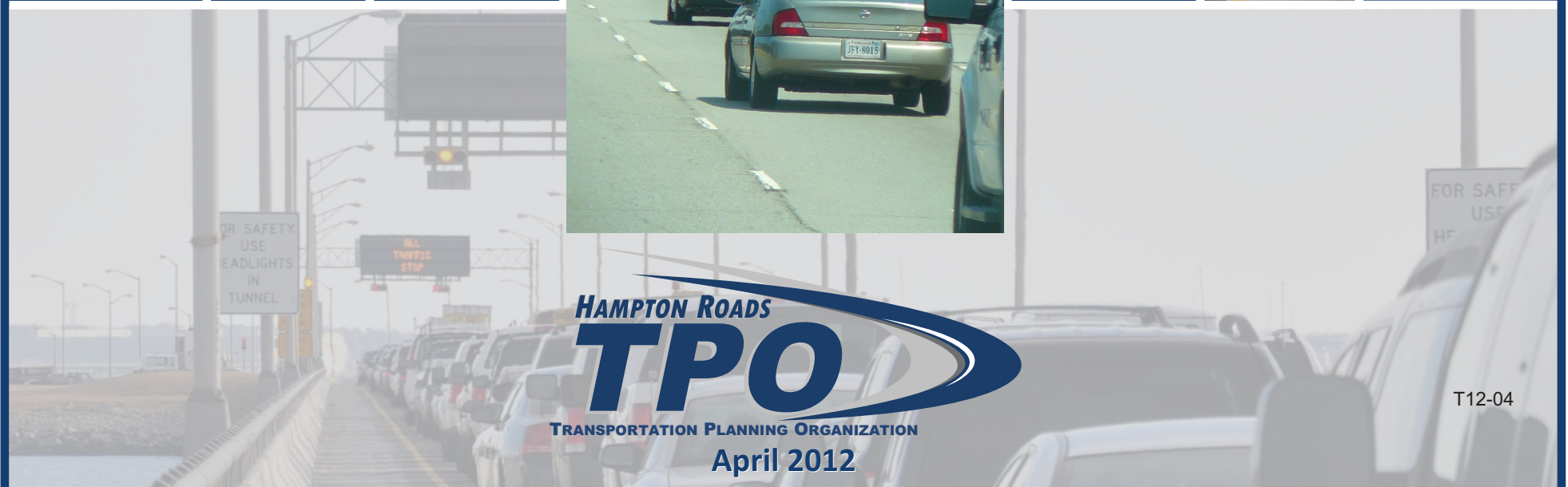
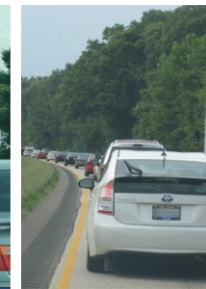
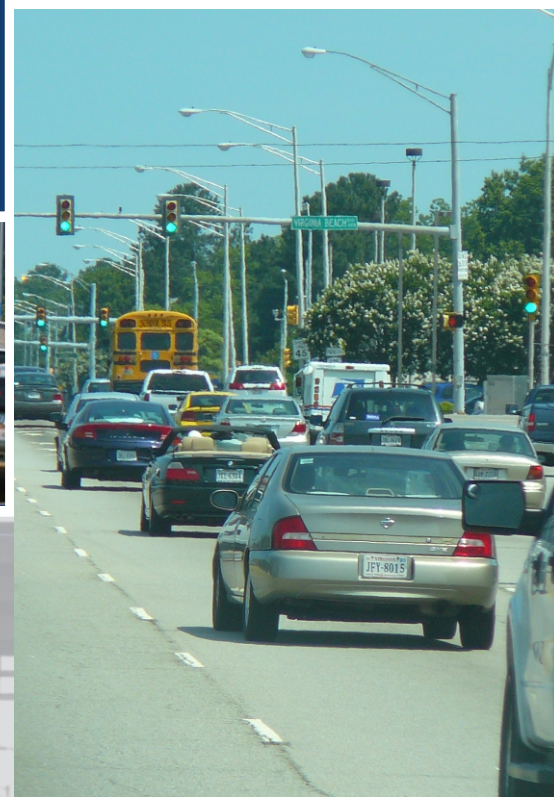
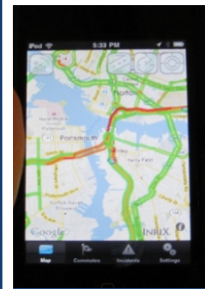


Hampton Roads Regional Travel Time/Speed Study



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HAMPTON ROADS REGIONAL TRAVEL TIME/SPEED STUDY

PREPARED BY:



APRIL 2012

TITLE:

Hampton Roads Regional Travel Time/Speed Study

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ABSTRACT

National studies have established that Hampton Roads has some of the worst roadway congestion in the country. As part of its planning efforts, the Hampton Roads Transportation Planning Organization (HRTPO) monitors regional roadway congestion through the Congestion Management Process (CMP). Historically, HRTPO staff has estimated congestion levels based on traffic volumes collected over a short time period and roadway characteristics.

In recent years, new technologies have been created that collect travel time and speed data on a continuous basis. One source of such data, provided by INRIX, provides real-time and historical travel time and speed data on an extensive statewide roadway network. This data has been purchased by VDOT and provided to Metropolitan Planning Organizations throughout the state.

HRTPO staff can use this archived data to determine roadway congestion levels based on actual travel times and speeds. In addition, the duration of congestion can be obtained from this data. This report details HRTPO's analysis of the travel time and speed data that was collected by INRIX for the year 2010.

REPORT DATE:

April 2012

GRANT/SPONSORING AGENCY:

FHWA/VDOT/LOCAL FUNDS

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EXECUTIVE SUMMARY

As part of its planning efforts, the Hampton Roads Transportation Planning Organization (HRTPO) monitors regional roadway congestion through the Congestion Management Process (CMP). Historically, HRTPO staff has estimated peak hour congestion levels on each roadway segment based on traffic volumes collected over a short time period and roadway characteristics.

In recent years, new technologies have been created that collect travel time and speed data on a continuous basis. One source of such data, INRIX, provides real-time and historical travel time and speed data on an extensive roadway network. INRIX's primary data source is millions of GPS-enabled fleet vehicles, including taxis, airport shuttles, service vehicles, and long haul trucks. Based on this data, INRIX can determine travel speeds on the nation's entire limited-access roadway network and large segments of the transportation network in the nation's 100 largest metropolitan areas.

This travel time and speed data for the year 2010 has been purchased by VDOT and provided to Metropolitan Planning Organizations throughout the state. For 1,300 miles of roadway throughout Hampton Roads, INRIX provides averaged travel time and speed data in 15-minute intervals by direction. HRTPO staff used this archived data to determine travel times and speeds, congestion levels and durations, and delays on regional roadways.

For each roadway segment, Speed Reduction Factors were calculated to determine the slowest roadways in the region. Speed Reduction Factors are defined by the Texas Transportation Institute as the ratio of the actual segment travel speeds divided by the segment free flow travel speeds. A total of 29 roadway segments throughout the region have a minimum Speed Reduction Factor of 0.40 or lower during the AM Peak Period (defined in this study as occurring between 6 am and 9 am), and 54 segments meet this threshold during the PM Peak Period (defined as occurring between 3 pm and 7 pm). Many of these segments include high profile facilities throughout the region such as



Congestion Approaching the Midtown Tunnel

JURISDICTION	FACILITY NAME	SEGMENT FROM	SEGMENT TO	DIR	HIGH PROFILE LOCATION	LOWEST SPEED REDUCTION FACTOR
PORT	I-264	DES MOINES AVE	EFFINGHAM ST	EB	DT	0.13
PORT	I-264	FREDERICK BLVD	DES MOINES AVE	EB	DT	0.14
NOR/PORT	MIDTOWN TUNNEL	MLK FWY/WESTERN FREEWAY	BRAMBLETON AVE	NB	MT	0.24
NN	ROANOKE AVE	I-664	BRIARFIELD RD	SB	-	0.25
CHES	VOLVO PKWY	KEMPSVILLE RD	VA BEACH CL	WB	-	0.25
NN	26TH ST	ROANOKE AVE	JEFFERSON AVE	WB	-	0.29
CHES	I-64	GEORGE WASHINGTON HWY	MILITARY HWY	WB	I-64 CHES	0.29
HAM	I-64	SETTLERS LANDING RD	MALLORY ST	EB	HRBT	0.30
HAM	WOODLAND RD	I-64	COUNTY ST	SB	-	0.30
VB	ATLANTIC AVE	22ND ST	21ST ST	SB	-	0.32
HAM	I-64	RIP RAP RD	SETTLERS LANDING RD	EB	HRBT	0.33
VB	INDEPENDENCE BLVD	NORTHAMPTON BLVD	SHORE DR	NB	-	0.33
SUF	COLLEGE DR	BRIDGE RD	WESTERN FREEWAY	SB	-	0.33
CHES	LIBERTY ST	22ND ST	POINDEXTER RD	EB	-	0.34
PORT	PORTSMOUTH BLVD	ELM AVE	EFFINGHAM ST	WB	-	0.34
NOR	I-264/BERKLEY BRIDGE	I-464	WATERSIDE/CITY HALL/TIDEWATER	WB	DT	0.34
PORT	ELM AVE	LONDON BLVD	SOUTH ST	SB	-	0.35
HAM	ABERDEEN RD	MERCURY BLVD	TODDS LA	SB	-	0.37
HAM	COLISEUM DR	PINE CHAPEL RD	MERCURY BLVD	NB	-	0.37
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	EB	DT	0.37
HAM/NN	ROANOKE AVE	BRIARFIELD RD	MERCURY BLVD	NB	-	0.38
NOR	I-564	ADMIRAL TAUSSIG BLVD	INTERNATIONAL TERMINAL BLVD	NB	I-64/I-564	0.38
VB	HOLLAND RD	DAM NECK RD	PRINCESS ANNE RD	NB	-	0.38
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	WB	DT	0.39
HAM	TODDS LA	NEWPORT NEWS CL	BIG BETHEL RD	EB	-	0.40
NN	MAIN ST	JEFFERSON AVE	HAMPTON CL	WB	-	0.40
VB	ATLANTIC AVE	PACIFIC AVE	LASKIN RD	SB	-	0.40
CHES	I-64	MILITARY HWY	I-264&664	WB	I-64 CHES	0.40
NOR	PRINCESS ANNE RD	HAMPTON BLVD	COLLEY AVE	WB	-	0.40

Lowest Regional Speed Reduction Factors – AM Peak Period (2010)

Data Source: INRIX. Includes all roadway segments with a Lowest Speed Reduction Factor of 0.40 or below. Speed Reduction Factor = Actual Speed/Free Flow Speed

The following abbreviations and color codes are used for high profile locations: DT=Downtown Tunnel ■, MT=Midtown Tunnel ■, HRBT=Hampton Roads Bridge-Tunnel ■, MMBT=Monitor-Merrimac Memorial Bridge-Tunnel ■, I-64 CHES=I-64 in Chesapeake including the High Rise Bridge ■, I-64/I-564=The I-64/I-564 Corridor in Norfolk ■, I-64/I-264=The I-64/I-264 Interchange area in Norfolk ■, I-64 NN=The I-64 Corridor in Newport News ■, GILM=Military Highway in Chesapeake approaching the Gilmerton Bridge ■, US17 YC=The Route 17 Corridor in Newport News and York County ■.

the approaches to the Downtown Tunnel, Midtown Tunnel, Hampton Roads Bridge-Tunnel, High Rise Bridge, and Gilmerton Bridge.

This INRIX data was also used by HRTPO staff to determine the duration of congestion, which HRTPO staff had not been able to do

JURISDICTION	FACILITY NAME	SEGMENT FROM	SEGMENT TO	DIR	HIGH PROFILE LOCATION	LOWEST SPEED REDUCTION FACTOR
NOR	I-264	WATERSIDE/CITY HALL/TIDEWATER	BRAMBLETON AVE	WB	DT	0.10
NOR	I-264/BERKLEY BRIDGE	I-464	WATERSIDE/CITY HALL/TIDEWATER	WB	DT	0.15
CHES	MILITARY HWY	BAINBRIDGE BLVD	I-464	WB	GILM	0.17
NOR	4TH VIEW ST	I-64	OCEAN VIEW AVE	WB	HRBT	0.20
NOR	BRAMBLETON AVE	HAMPTON BLVD	COLLEY AVE	WB	MT	0.21
NOR	I-64	4TH VIEW AVE	BAY AVE	WB	HRBT	0.22
HAM	ROANOKE AVE	NEWPORT NEWS CL	MERCURY BLVD	SB	-	0.23
NN	ROANOKE AVE	HAMPTON CL	HAMPTON CL	SB	-	0.23
NOR	I-64	BAY AVE	GRANBY ST	WB	HRBT	0.23
NOR	I-64	GRANBY ST	I-564/LITTLE CREEK RD	WB	HRBT	0.25
NOR	CITY HALL AVE	BOUSH ST	ST PAULS BLVD	EB	-	0.25
NOR	CHESAPEAKE BLVD	LAFAYETTE BLVD	CROMWELL DR	SB	-	0.25
CHES	I-64	BATTLEFIELD BLVD	I-464	EB	I-64 CHES	0.26
NOR	LLEWELLYN AVE	21ST ST	26TH ST	NB	-	0.27
HAM	TODDS LA	ABERDEEN RD	CUNNINGHAM DR	EB	-	0.27
NOR	38TH ST	HAMPTON BLVD	COLLEY AVE	EB	-	0.28
HAM	I-64	SETTLERS LANDING RD	MALLORY ST	EB	HRBT	0.29
NOR	HAMPTON BLVD	BRAMBLETON AVE	21ST ST	SB	MT	0.29
PORT	I-264	DES MOINES AVE	EFFINGHAM ST	EB	DT	0.30
NOR	ST PAULS BLVD	CITY HALL AVE	I-264 RAMP/MACARTHUR MALL	NB	DT	0.30
NOR/PORT	MIDTOWN TUNNEL	MLK FWY/WESTERN FREEWAY	BRAMBLETON AVE	SB	MT	0.30
NOR	ST PAULS BLVD	CITY HALL AVE	I-264 RAMP/MACARTHUR MALL	SB	DT	0.31
NN	I-664	TERMINAL AVE	I-64	EB	MMMBT	0.31
NN	MAIN ST	WARWICK BLVD	JEFFERSON AVE	WB	-	0.31
CHES	MILITARY HWY	I-464	CAMPOSTELLA RD	WB	GILM	0.32
NOR	NEWTOWN RD	I-264	VA BEACH BLVD	NB	-	0.32
NOR	ST PAULS BLVD	I-264 RAMP/MACARTHUR MALL	BRAMBLETON AVE	SB	DT	0.32
CHES	GW HWY (DEEP CREEK BRIDGE)	MOSES GRANDY TR @ HINTON AVE	I-64	SB	-	0.33
NOR	ST PAULS BLVD	WATERSIDE DR	CITY HALL AVE	NB	DT	0.33
HAM	PEMBROKE AVE	ARMISTEAD AVE	EATON ST	WB	-	0.33
NOR	COLLEY AVE	26TH ST	27TH ST	NB	-	0.35
NOR	I-64	I-564/LITTLE CREEK RD	TIDEWATER DR	EB	I-64/I-564	0.35
NOR	TIDEWATER DR	GRANBY ST	OCEAN VIEW AVE	NB	HRBT	0.36
VB	ATLANTIC AVE	PACIFIC AVE	LASKIN RD	NB	-	0.36
VB	ATLANTIC AVE	22ND ST	21ST ST	SB	-	0.36
HAM	KECOUGHTAN RD	NEWPORT NEWS CL	POWHATAN PKWY	EB	-	0.36
NN	25TH ST	26TH ST	HAMPTON CL	EB	-	0.36
HAM	POWHATAN PKWY	KECOUGHTAN RD	PEMBROKE AVE	NB	-	0.37
VB	WITCHDUCK RD	PRINCESS ANNE RD	I-264	SB	-	0.37
HAM	ABERDEEN RD	PEMBROKE AVE	I-664	SB	-	0.38
YC	GEORGE WASHINGTON HWY	VICTORY BLVD (RTE 171)	HAMPTON HWY (RTE 134)	NB	US17 YC	0.38
NOR	COLLEY AVE	26TH ST	27TH ST	WB	-	0.38
HAM	CUNNINGHAM DR	COLISEUM DR	MERCURY BLVD	SB	-	0.39
NOR	PRINCESS ANNE RD	HAMPTON BLVD	COLLEY AVE	WB	-	0.39
HAM	PEMBROKE AVE	SETTLERS LANDING RD	LA SALLE AVE	EB	-	0.39
PORT	ELM AVE	LONDON BLVD	SOUTH ST	SB	-	0.39
NN	26TH ST	ROANOKE AVE	JEFFERSON AVE	WB	-	0.39
NOR	NORVIEW AVE	CHESAPEAKE BLVD	I-64	WB	-	0.39
HAM	I-64	RIP RAP RD	SETTLERS LANDING RD	EB	HRBT	0.39
WMB	HENRY ST S	ROUTE 199	FRANCIS ST	SB	-	0.40
WMB	HENRY ST	FRANCIS ST	LAFAYETTE ST	NB	-	0.40
NOR	CHESAPEAKE BLVD	LAFAYETTE BLVD	CROMWELL DR	NB	-	0.40
NOR	I-564	INTERNATIONAL TERMINAL BLVD	I-64	WB	I-64/I-564	0.40
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	SB	DT	0.40

Lowest Regional Speed Reduction Factors – PM Peak Period (2010)

Data Source: INRIX. Includes all roadway segments with a Lowest Speed Reduction Factor of 0.40 or below. Speed Reduction Factor = Actual Speed/Free Flow Speed

with previous congestion analysis methods. HRTPO staff used congestion analysis methods and thresholds based on research done by the Texas Transportation Institute. Freeways are classified as severely congested during each 15-minute interval if the Speed Reduction Factor is less than 0.75, and non-freeways are classified as severely congested if the Speed Reduction Factor is less than 0.65.

A total of 34 roadway segments throughout Hampton Roads are severely congested for at least 9 of the 12 15-minute intervals during the AM Peak Period, and 50 roadway segments are severely congested for at least 13 of the 16 15-minute intervals during the PM Peak Period. Similar to the lowest Speed Reduction Factors, many of the roadway segments with the longest congestion durations include high profile facilities throughout the region such as the Downtown Tunnel, Midtown Tunnel, Hampton Roads Bridge-Tunnel, High Rise Bridge,

JURISDICTION	FACILITY NAME	SEGMENT FROM	SEGMENT TO	DIR	HIGH PROFILE LOCATION	NUMBER OF SEVERELY CONGESTED 15-MINUTE INTERVALS
PORT	I-264	DES MOINES AVE	EFFINGHAM ST	EB	DT	12
PORT	I-264	FREDERICK BLVD	DES MOINES AVE	EB	DT	12
NOR/PORT	MIDTOWN TUNNEL	MLK FWY/WESTERN FREEWAY	BRAMBLETON AVE	NB	MT	12
HAM	I-64	SETTLERS LANDING RD	MALLORY ST	EB	HRBT	12
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	EB	DT	12
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	WB	DT	12
NOR	MILITARY HWY	I-64	AZALEA GARDEN RD	SB	-	12
PORT	WESTERN FWY	WEST NORFOLK RD	MLK FREEWAY/MIDTOWN TUNNEL	EB	MT	12
VB	FIRST COLONIAL RD	VA BEACH BLVD	I-264	SB	-	12
NOR	MONTICELLO AVE	ST PAULS BLVD	PRINCESS ANNE RD	NB	-	12
NOR	ST PAULS BLVD	BRAMBLETON AVE	MONTICELLO AVE	NB	-	12
HAM	I-64	RIP RAP RD	SETTLERS LANDING RD	EB	HRBT	11
PORT	PORTSMOUTH BLVD	ELM AVE	EFFINGHAM ST	WB	-	11
CHES	22ND ST	LIBERTY ST	BERKLEY AVE/NORFOLK CL	EB	-	11
NOR	PRINCESS ANNE RD	LLEWELLYN AVE	MONTICELLO AVE	WB	-	11
CHES	I-64	GEORGE WASHINGTON HWY	MILITARY HWY	WB	I-64 CHES	10
NOR	I-264/BERKLEY BRIDGE	I-464	WATERSIDE/CITY HALL/TIDEWATER	WB	DT	10
HAM	MALLORY ST	I-64	COUNTY ST	WB	HRBT	10
NOR	I-464	SOUTH MAIN ST	I-264	NB	DT	10
NOR	ST PAULS BLVD	I-264 RAMP/MACARTHUR MALL	BRAMBLETON AVE	SB	DT	10
CHES	GW HWY (DEEP CREEK BRIDGE)	MOSES GRANDY TR @ HINTON AVE	I-64	NB	-	10
HAM	ABERDEEN RD	MERCURY BLVD	TODDS LA	SB	-	9
VB	HOLLAND RD	DAM NECK RD	PRINCESS ANNE RD	NB	-	9
NOR	PRINCESS ANNE RD	HAMPTON BLVD	COLLEY AVE	WB	-	9
JCC	IRONBOUND RD/SANDY BAY RD	JAMESTOWN RD	JOHN TYLER HWY	NB	-	9
NOR	ST PAULS BLVD	CITY HALL AVE	I-264 RAMP/MACARTHUR MALL	SB	DT	9
CHES	MILITARY HWY/GILMERTON BRIDGE	CANAL DR	BAINBRIDGE BLVD	EB	GILM	9
PORT	I-264	PORTSMOUTH BLVD	FREDERICK BLVD	EB	DT	9
YC	VICTORY BLVD	ROUTE 17	HAMPTON HWY (RTE 134)	WB	-	9
NOR	HAMPTON BLVD	26TH ST	27TH ST	SB	-	9
NOR	I-264	WATERSIDE/CITY HALL/TIDEWATER	BRAMBLETON AVE	WB	DT	9
VB	WITCHDUCK RD	I-264	VA BEACH BLVD	SB	-	9
PORT	M L K FREEWAY	LONDON BLVD	WESTERN FREEWAY/MIDTOWN TUNNEL	NB	MT	9
VB	BAXTER RD	PRINCESS ANNE RD	INDEPENDENCE BLVD	NB	-	9

Highest Number of Severely Congested Intervals – AM Peak Period (2010)

Data Source: INRIX. Includes all roadway segments that are severely congested for at least 9 of the 12 15-minute intervals between 6 am and 9 am.

and Gilmerton Bridge.

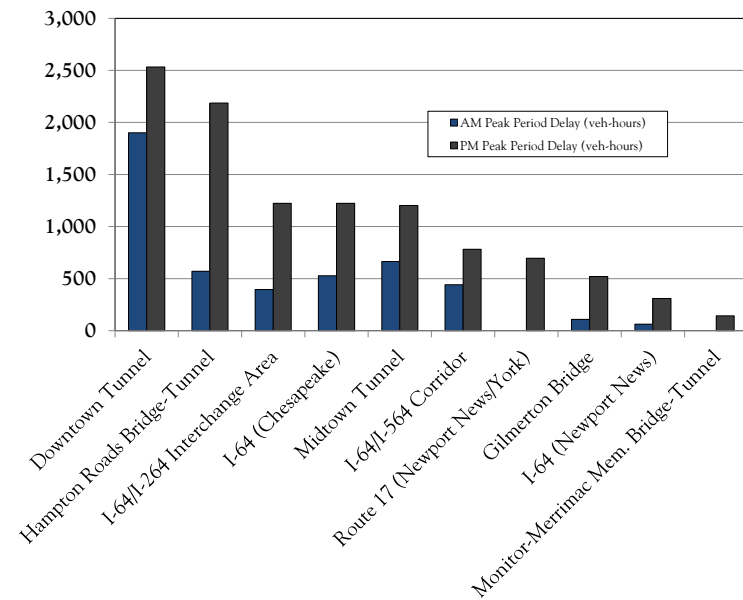
As part of this study, a number of high profile locations throughout Hampton Roads were analyzed in further detail. This includes the length, duration, and level of congestion during the AM and PM Peak Periods at each location, and the total delay during each peak period. Among the ten high profile locations (shown in the figure to the right),

the Downtown Tunnel has the highest peak period delays in both the AM and PM Peak Periods. The Midtown Tunnel has the second highest delay during the AM Peak Period, while the Hampton Roads Bridge-Tunnel has the second highest delay during the PM Peak Period. This analysis of high profile locations will allow for comparisons of congestion levels and durations as time progresses, especially as major changes are made to the regional transportation network.

JURISDICTION	FACILITY NAME	SEGMENT FROM	SEGMENT TO	DIR	HIGH PROFILE LOCATION	NUMBER OF SEVERELY CONGESTED 15-MINUTE INTERVALS
NOR	I-264	WATERSIDE/CITY HALL/TIDEWATER	BRAMBLETON AVE	WB	DT	16
NOR	I-264/BERKLEY BRIDGE	I-464	WATERSIDE/CITY HALL/TIDEWATER	WB	DT	16
NOR	4TH VIEW ST	I-64	OCEAN VIEW AVE	WB	HRBT	16
NOR	I-64	4TH VIEW AVE	BAY AVE	WB	HRBT	16
NOR	I-64	BAY AVE	GRANBY ST	WB	HRBT	16
NOR	HAMPTON BLVD	BRAMBLETON AVE	21ST ST	SB	MT	16
CHES	MILITARY HWY	I-464	CAMPOSTELLA RD	WB	GILM	16
NOR	ST PAULS BLVD	I-264 RAMP/MACARTHUR MALL	BRAMBLETON AVE	SB	DT	16
CHES	GW HWY (DEEP CREEK BRIDGE)	MOSES GRANDY TR @ HINTON AVE	I-64	SB	-	16
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	WB	DT	16
NOR	I-64	OCEAN VIEW AVE	4TH VIEW AVE	WB	HRBT	16
VB	INDIAN RIVER RD	KEMPSVILLE RD	FERRELL PKWY	WB	-	16
IW	BENNS CHURCH BLVD	ECL SMITHFIELD (RTE 644)	CHURCH ST S	SB	-	16
CHES	MILITARY HWY	BAINBRIDGE BLVD	I-464	WB	GILM	15
NOR	BRAMBLETON AVE	HAMPTON BLVD	COLLEY AVE	WB	MT	15
CHES	I-64	BATTLEFIELD BLVD	I-464	EB	I-64 CHES	15
PORT	I-264	DES MOINES AVE	EFFINGHAM ST	EB	DT	15
NOR/PORT	MIDTOWN TUNNEL	MLK FWY/WESTERN FREEWAY	BRAMBLETON AVE	SB	MT	15
NOR	NEWTOWN RD	I-264	VA BEACH BLVD	NB	-	15
NOR	ST PAULS BLVD	WATERSIDE DR	CITY HALL AVE	NB	DT	15
NN	OYSTER POINT RD	JEFFERSON AVE	CANON BLVD	WB	-	15
VB	FIRST COLONIAL RD	VA BEACH BLVD	I-264	SB	-	15
CHES	MILITARY HWY/GILMERTON BRIDGE	CANAL DR	BAINBRIDGE BLVD	EB	GILM	15
SUF	GODWIN BLVD	SUFFOLK BYPASS	KINGS FORK RD	SB	-	15
NOR	NEWTOWN RD	VA BEACH BLVD	VA BEACH CL	SB	-	15
VB	NEWTOWN RD	NORFOLK CL	DIAMOND SPRINGS RD	SB	-	15
CHES	BATTLEFIELD BLVD	JOHNSTOWN RD	CEDAR RD	NB	-	15
VB	LYNNHAVEN PKWY	I-264	VA BEACH BLVD	NB	-	15
NN	JEFFERSON AVE	DENBIGH BLVD	BLAND BLVD	NB	-	15
YC	GEORGE WASHINGTON HWY	VICTORY BLVD (RTE 171)	HAMPTON HWY (RTE 134)	SB	US17 YC	15
HAM	I-64	SETTLERS LANDING RD	MALLORY ST	EB	HRBT	14
NOR	ST PAULS BLVD	CITY HALL AVE	I-264 RAMP/MACARTHUR MALL	SB	DT	14
HAM	ABERDEEN RD	PEMBROKE AVE	I-664	SB	-	14
YC	MERRIMAC TRAIL	JAMES CITY CL	BUSCH GARDENS INTERCHANGE	NB	-	14
JCC	MERRIMAC TRAIL	NEWPORT NEWS CL @ I-64	YORK CL (SOUTH OF GROVE INT)	WB	-	14
HAM	ABERDEEN RD	MERCURY BLVD	TODDS LA	SB	-	14
VB	INDIAN RIVER RD	I-64	CENTERVILLE TNPK	EB	-	14
NN	OYSTER POINT RD	CANON BLVD	I-64	WB	-	14
PORT	ELM AVE	SOUTH ST	PORTSMOUTH BLVD	NB	-	14
VB	MILITARY HWY	PROVIDENCE RD	INDIAN RIVER RD	NB	-	14
NOR	I-64	GRANBY ST	I-564/LITTLE CREEK RD	WB	HRBT	13
VB	WITCHDUCK RD	PRINCESS ANNE RD	I-264	SB	-	13
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	EB	DT	13
VB	INDIAN RIVER RD	CENTERVILLE TNPK	KEMPSVILLE RD	EB	-	13
NOR	NEWTOWN RD	I-264	VA BEACH BLVD	SB	-	13
VB	INDIAN RIVER RD	PROVIDENCE RD	I-64	WB	-	13
NOR	GRANBY ST	THOLE ST	LITTLE CREEK RD	NB	-	13
NOR	GRANBY ST	LITTLE CREEK RD	I-564	NB	-	13
NN	WARWICK BLVD	DENBIGH BLVD	BLAND BLVD	NB	-	13
IW	BENNS CHURCH BLVD	ECL SMITHFIELD (RTE 644)	CHURCH ST S	NB	-	13

Highest Number of Severely Congested Intervals – PM Peak Period (2010)

Data Source: INRIX. Includes all roadway segments that are severely congested for at least 13 of the 16 15-minute intervals between 3 pm and 7 pm.



Peak Period Delays in Severely Congested Conditions - High Profile Locations (2010)

Data Source: INRIX.

INTRODUCTION

National studies have established that Hampton Roads has some of the worst roadway congestion in the country. As part of its planning efforts, the Hampton Roads Transportation Planning Organization (HRTPO) monitors regional roadway congestion through the Congestion Management Process (CMP). The CMP is an on-going process that identifies congestion locations, determines the causes of congestion, ranks the most congested segments, and develops transportation strategies to reduce traffic congestion and enhance safety and mobility regionwide. HRTPO also uses CMP congestion data in its Project Prioritization Process, which assists with selecting projects for the Long Range Transportation Plan (LRTP) and Transportation Improvement Program (TIP).

HRTPO staff analyzes the existing peak hour congestion levels on the regional CMP roadway network, which comprises 1,593 miles of roadway classified as minor arterials and above, as well as selected collectors. Historically, HRTPO staff has determined congestion levels based on methods included in the Highway Capacity Manual (HCM) and available data, which includes daily and peak hour traffic volumes, the number of lanes, and roadway types and classes for every roadway segment in the CMP network.

Unfortunately, with the existing methodology, congestion levels are only estimates calculated from the above datasets. In addition, the existing method only addresses the level but not the duration of congestion, which can not be easily determined using volume data.

HRTPO staff has collected travel time and speed data on a regional level in past years by driving a “probe” vehicle on each major roadway. This effort required extensive amounts of time and money, and produced limited data since it only provided one-time snapshots of travel time and speed data on each roadway segment.

Optimally, congestion levels and durations would be determined using archived travel time and speed data collected on a continuous



Congestion Approaching the Hampton Roads Bridge-Tunnel

basis throughout the region. Fortunately, in recent years, new technologies have been created that collect this data. One source of such data, INRIX, provides real-time and historical travel time and speed data on an extensive national roadway network. Statewide INRIX data has been purchased by VDOT and provided to Metropolitan Planning Organizations throughout the state.

HRTPO staff can use this archived data to determine roadway congestion levels based on actual travel times and speeds rather than estimate congestion levels based on traffic volumes and roadway characteristics. In addition, the duration of congestion can be more accurately reported using this data.

This report details HRTPO’s analysis of the travel time and speed data that was collected by INRIX for the year 2010, and represents the first time that HRTPO has analyzed a comprehensive set of travel time and speed data on a regional level. Sections detailing how the data was collected, how HRTPO staff analyzed the data, the results of the analysis, and conclusions and next steps are included in the report.

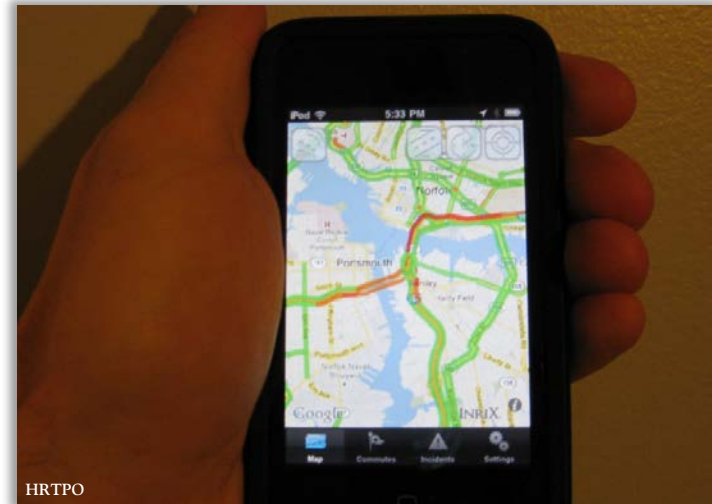
DATA COLLECTION

Collecting travel time and speed data has been limited by the technologies available. In the past, the primary devices used to collect such data were traditional sensors, such as inductive loops buried in the roadway surface, tubes laid across the roadway surface, or acoustic and radar devices mounted on the side of the roadway. These devices are limited, however, since they can generally only provide information for that particular site where they are located. In addition, many locations, particularly outside the freeway system, aren't equipped with these types of devices. These sensors must also be maintained, which is not only costly but also impacts traffic movement, especially for those sensors buried in the roadway surface.

Travel time and speed data has also been collected using other methods. One such method involves driving a “probe” vehicle equipped with a GPS device and using specialized analysis software. HRTPO staff used this method as part of a regional effort to collect travel time and speed data in 1986, 1990, 1995, 2000, and 2005. There were many limitations to this effort, including the extensive amount of time and money that was required to collect the data and only one trip was collected in each direction during the morning and afternoon peak travel periods for each roadway segment. This made it impossible to determine congestion durations based on this data source. Data was also at times impacted by abnormal traffic conditions such as crashes, inclement weather, and special events.

In recent years, new technologies have been created that greatly improve the data that can be collected on the transportation network. These technologies include devices that detect Bluetooth signals in cell phones and vehicles to determine corridor speeds, cell phone applications that collect location data which vendors use to determine travel times and speeds throughout a large area, and GPS devices that can also provide this information.

INRIX is one of the companies that uses these new technologies in order to collect transportation data. Since 2006, INRIX has collected



INRIX Phone App Showing Real-Time Traffic Information

tens of billions of discrete data points from a variety of sources throughout the United States and other countries. INRIX's primary data source is millions of GPS-enabled fleet vehicles, including taxis, airport shuttles, service vehicles, and long haul trucks. In addition, INRIX also collects data from mobile devices that have INRIX's real-time traffic application installed, traditional road sensors, and hundreds of other sources.

Each of these data points collected by INRIX includes the speed, location and direction of each probe at a reported date and time. Based on this data, INRIX can determine travel speeds on large segments of the transportation network. INRIX provides this real-time speed data, as well as historical and predictive traffic information, for over 260,000 miles of freeways and arterials throughout the nation's 100 largest metropolitan areas and nearly all of the nation's limited access roadway network.

The University of Maryland has conducted research for the I-95 Corridor Coalition to ensure the quality of the freeway data collected by INRIX. Over the two year period from July 2008 to June 2010, the

report¹ indicates that the freeway speed data collected by INRIX had an Absolute Average Speed Error (or absolute difference between each data point collected by INRIX and the data collected for the study) of 2.8 miles per hour. This was well within the guidelines established by the I-95 Corridor Coalition for their use of this data.

The Virginia Department of Transportation (VDOT) has purchased two sets of archived transportation data from INRIX, and provided this data to various organizations throughout the state including HRTPO. These sets of data are:

- **5-minute data** - The 5-minute data includes all of the travel time and speed data from 2010 in 5 minute intervals. The 5-minute data, however, only covers the freeway system and select principal arterials (**Figure 1**). The statewide 5-minute data for 2010 includes approximately 3,000 miles of roadway and encompasses 550 million records.
- **15-minute data** - The 15-minute data includes averaged travel time and speed data in 15 minute intervals for each roadway segment by day of the week. The 15-minute data not only includes freeways but principal and minor arterials as well (**Figure 2**). The statewide 15-minute data for 2010 includes approximately 7,800 miles of roadway and encompasses 100 million records. The 1,300 miles of roadway throughout Hampton Roads with 15-minute travel time and speed data are shown in **Maps 1 and 2** on pages 4-5.

This report includes an analysis of the 15-minute travel time and speed data. In the future, HRTPO will use the 5-minute data to measure the reliability of travel times and speeds on the region's freeway system.

¹ *Validation of INRIX Data: Two-Year Summary Report July 2008 – June 2010*, I-95 Corridor Coalition, September 2010.

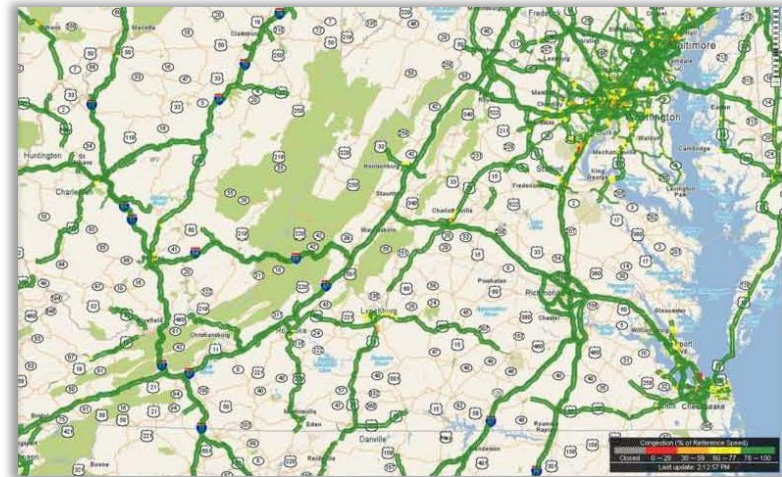


Figure 1 - Statewide 5-minute INRIX Data Coverage

Source: University of Virginia.

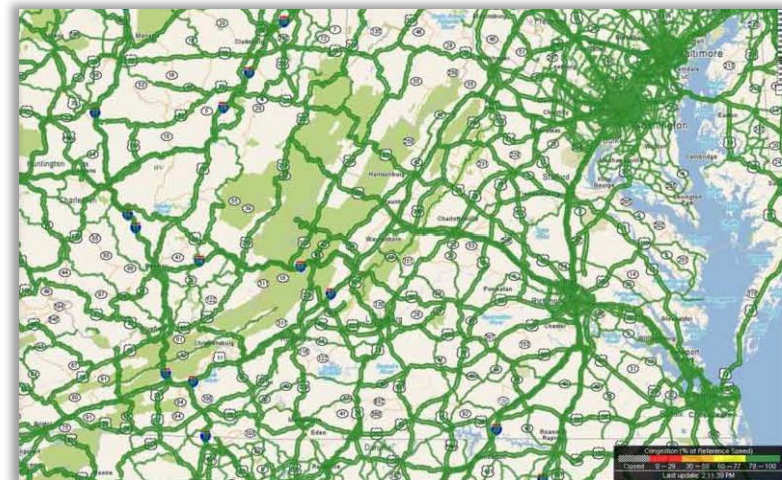
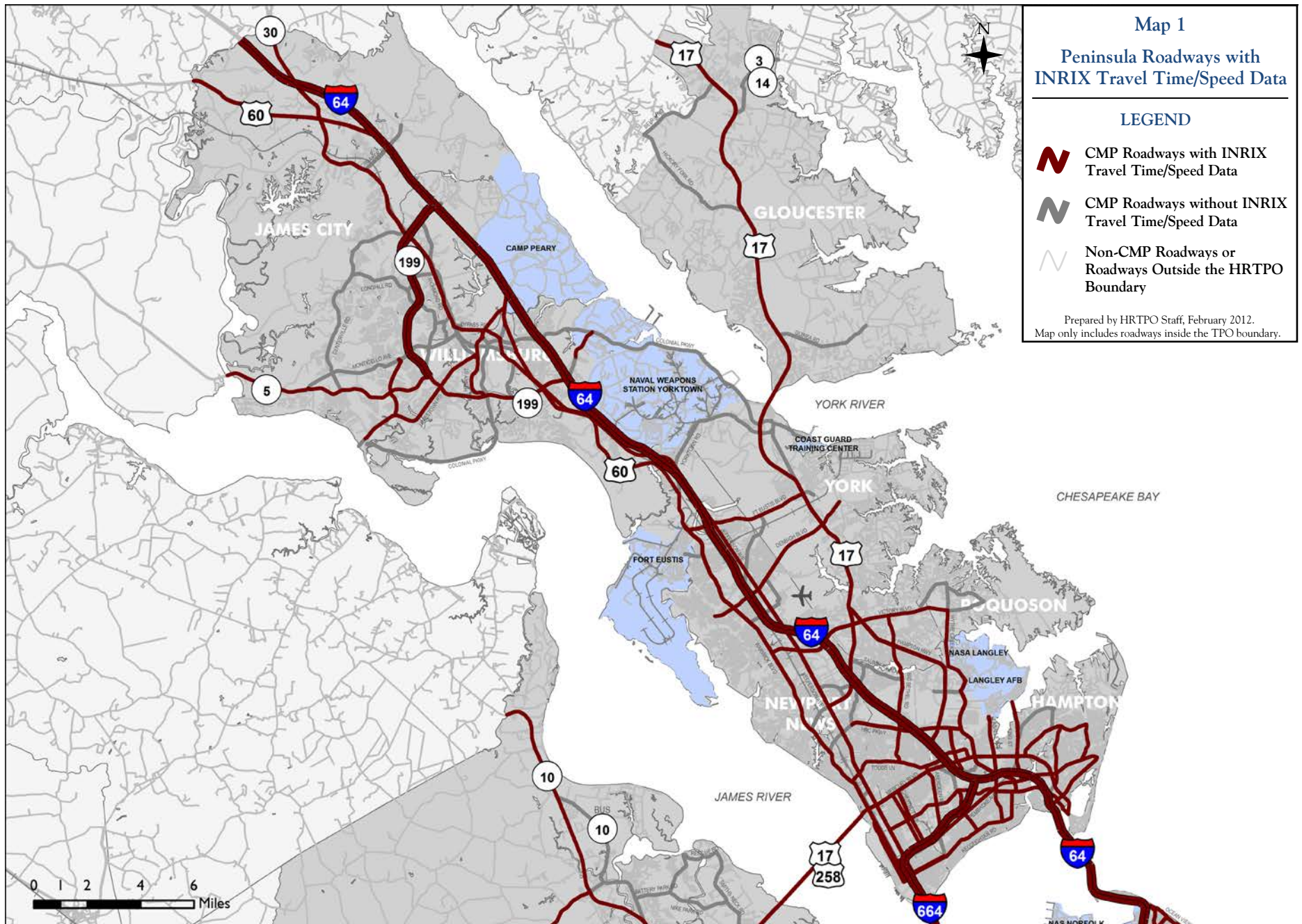
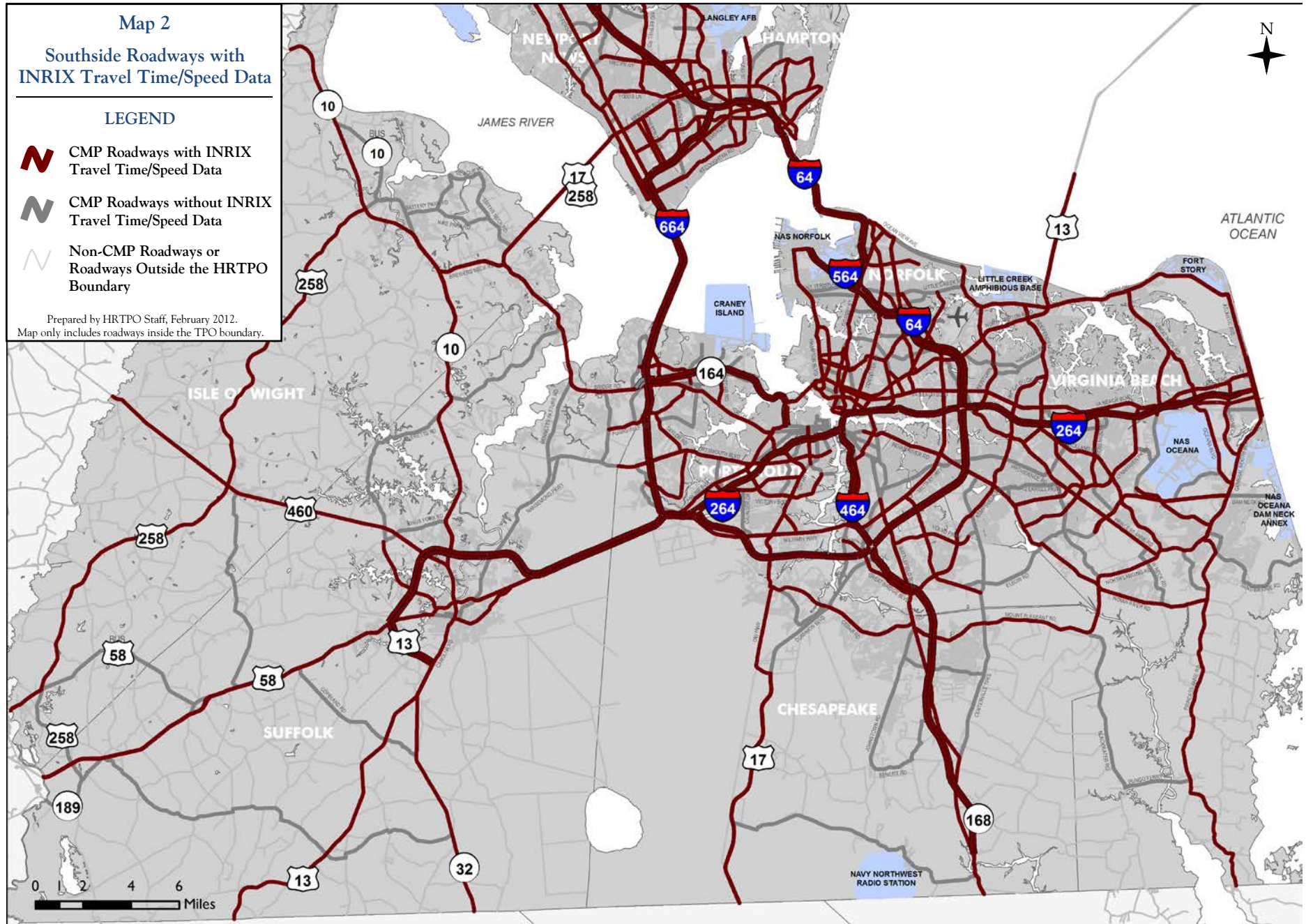


Figure 2 - Statewide 15-minute INRIX Data Coverage

Source: University of Virginia.





DATA ANALYSIS

The purpose of this study was to analyze data collected and distributed by INRIX to determine travel times and speeds, congestion levels and durations, and delays on regional roadways, which will be used by HRTPO in the Congestion Management Process and project selection in the LRTP and TIP. This section details the travel time and speed data provided by INRIX and how HRTPO staff analyzed the data.

As mentioned in the previous section, VDOT purchased statewide 15-minute archived travel time and speed data from INRIX, and provided this data to various agencies including HRTPO. INRIX provided this 15-minute data by Traffic Message Channel (TMC) location code, which are standardized identifiers developed and maintained by electronic map vendors to uniquely define road segments. TMC Codes generally represent roadway segments between interchanges or intersections with major roadways, and are unique for each direction of travel. The Hampton Roads data includes 3,418 unique TMC Codes, comprising 1,300 miles of roadway.

For each TMC Code, the INRIX data includes the average travel times and speeds in 2010 for each 15-minute period by day of the week, as well as the number of data points that were collected in each interval. HRTPO staff used the travel times listed for Tuesdays, Wednesdays, and Thursdays, and averaged them to produce one weekday value for each 15-minute period on each TMC Code in Hampton Roads. Tuesdays, Wednesdays, and Thursdays were used because they represent typical weekday conditions. Only travel time data between 5:30 am and 8:00 pm was used because many TMC Codes did not have data outside of this time period. This lack of data is due to INRIX's reliance of collecting travel time and speed data from fleet vehicles, many of which are not travelling throughout the region during the overnight hours.

In order to use this travel time data in the context of the Congestion Management Process, the TMC Code segments needed to be converted into roadway segments that match those in the CMP Database. In many

cases, the TMC Code and CMP segments were identical, requiring no conversion. In those cases where a CMP segment was comprised of multiple TMC Codes, the TMC Codes were combined to match the CMP segment. In cases where a TMC Code was comprised of multiple CMP segments, the CMP segments were linked so that each segment would have the same travel time data. Approximately 1,170 segments in the existing CMP roadway network had TMC Codes with INRIX data, comprising 1,080 miles of roadway and 71% of the total CMP network. These CMP roadways throughout Hampton Roads with associated INRIX data (which were shown in **Maps 1 and 2** on pages 4 and 5) are referred to as the Travel Time Network throughout this report.

Once the average travel time for each TMC Code was calculated and the conversion table for TMC Codes to CMP segments was completed, the next step was to produce a master spreadsheet to inventory and analyze all of this data and determine measures such as congestion and delay. This spreadsheet, which is referred to as the Regional Travel Time Database throughout this report, includes the following data for every Travel Time Network roadway segment for the average weekday in 2010, broken down by direction:

- **TMC Codes** - The Traffic Message Channel location codes that comprise each Travel Time Network roadway segment.
- **Distance** - The distance of each roadway segment, based on INRIX data.
- **Segment Travel Time** – The average amount of time it takes during each 15-minute period to travel across the Travel Time Network roadway segment.
- **Segment Travel Speed** – The average travel speed for each segment during each 15-minute period. The segment travel speed is calculated by dividing the segment distance by the travel time and converting to miles per hour.

- **Segment Free Flow Travel Time** – The travel time it takes to travel across each segment during free flow conditions. This data is provided for each TMC Code by INRIX and is based on the average travel times that occur on each TMC Code between 10 pm and 5 am.
- **Segment Free Flow Travel Speed** – The average travel speed during free flow conditions. This is calculated by dividing the segment distance by the segment free flow travel time and converting to miles per hour.
- **Speed Reduction Factor** – A speed term used by the Texas Transportation Institute (TTI). It is defined by TTI as the ratio of the segment travel speed divided by the segment free flow travel speed, both terms which are described above.
- **Slowest Interval** – This is the 15-minute interval during the AM Peak Period (defined as 6 a.m. to 9 a.m.) and the PM Peak Period (defined as 3 p.m. to 7 p.m.) when travel speeds are the slowest on each segment. The Slowest Interval travel time, travel speed, and time of day are included in the database.
- **Congestion** – This binary variable reflects whether each Travel Time Network segment is severely congested during each 15-minute interval. This was determined using the methodology that the Texas Transportation Institute implemented in the 2011 Urban Mobility Report², a study that compares congestion in metropolitan areas throughout the country. Each Travel Time Network roadway segment was determined to be severely congested if the following threshold was met in each 15-minute interval:

Freeways: Speed Reduction Factor < 0.75

Non-Freeways: Speed Reduction Factor < 0.65

- **Traffic Volume** – Traffic volumes are collected throughout the region on a regular basis by VDOT. This volume data is used by HRTPO in many transportation planning efforts including the Congestion Management Process. VDOT typically collects this volume data in both directions in 15-minute intervals over a two day period. The Regional Travel Time Database includes an average of the volume data collected by VDOT and reflects the most recent counts taken, which is generally from 2008-2010. In cases where VDOT 15-minute volume data was not available, counts taken by localities were used, or where locality counts were not available, estimates were made based on adjacent roadway segments.
- **Total Segment Delay** – Total Segment Delay was calculated for each Travel Time Network roadway segment by direction and 15-minute interval. This delay was determined using an equation included in the TTI Urban Mobility Report that bases delay on the amount of travel on each segment, the average travel speed, and the free flow speed. Total Segment Delay (in vehicle-hours) is defined as:

$$\text{Total Segment Delay} = \frac{\text{Vehicle-Miles of Travel}}{\text{Segment Travel Speed}} - \frac{\text{Vehicle-Miles of Travel}}{\text{Segment Free Flow Travel Speed}}$$

This Regional Travel Time Database provided the basis for analyzing speeds, congestion and delay throughout the region, as detailed in the next chapter.

² 2011 Urban Mobility Report, Texas Transportation Institute, September 2011.

ANALYSIS RESULTS

This section includes the results of the analysis of the Regional Travel Time Database detailed in the previous section. The analysis includes information on speeds and speed reductions, congestion levels and duration, delay, and an in-depth analysis of high profile locations throughout the region.

Speeds

As mentioned in the previous section, the Regional Travel Time Database includes the average travel speed during each 15-minute interval for each roadway segment by direction. These speeds were calculated based on the segment travel times and distances. **Appendix A** includes information on the lowest average travel speeds for each roadway segment for both the AM Peak Period (defined in this study as occurring between 6:00 am and 9:00 am) and the PM Peak Period (defined as occurring between 3:00 pm and 7:00 pm). This includes the lowest average travel speed and the time of day when this lowest travel speed occurs. **Table 1** and **Table 2** show the freeway segments throughout the region with the lowest speeds during each peak travel period, and those segments that are among the high profile locations throughout Hampton Roads (as described later in this report) are highlighted. **Table 3** and **Table 4** (on page 9) also include this information for the tunnels (and their approaches) in the region.

Speed Reduction Factors, which are defined by the Texas Transportation Institute as the ratio of the segment travel speeds divided by the segment free flow travel speeds, are also calculated in the database for each 15-minute interval for each roadway segment. This data can be used to

JURIS-DICTION	FACILITY NAME	SEGMENT FROM	SEGMENT TO	DIR	HIGH PROFILE LOCATION	LOWEST SPEED (mph)	LOWEST SPEED PERIOD
PORT	I-264	DES MOINES AVE	EFFINGHAM ST	EB	DT	7.6	7:15
PORT	I-264	FREDERICK BLVD	DES MOINES AVE	EB	DT	8.7	7:30
NOR	I-264/BERKLEY BRIDGE	I-464	WATERSIDE/CITY HALL/TIDEWATER	WB	DT	15.4	6:45
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	EB	DT	16.9	7:15
HAM	I-64	SETTLERS LANDING RD	MALLORY ST	EB	HRBT	17.3	7:15
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	WB	DT	17.3	7:00
CHES	I-64	GEORGE WASHINGTON HWY	MILITARY HWY	WB	I-64 CHES	17.9	7:15
HAM	I-64	RIP RAP RD	SETTLERS LANDING RD	EB	HRBT	19.5	7:15
NOR	I-564	ADMIRAL TAUSSIG BLVD	INTERNATIONAL TERMINAL BLVD	NB	I-64/I-564	22.9	6:00
CHES	I-64	MILITARY HWY	I-264&664	WB	I-64 CHES	24.3	7:30
NOR	I-464	SOUTH MAIN ST	I-264	NB	DT	27.9	7:30
PORT	I-264	PORTSMOUTH BLVD	FREDERICK BLVD	EB	DT	29.9	7:30

Table 1 – Lowest Freeway Speeds – AM Peak Period (2010)

Data Source: INRIX. Includes all freeway segments with a Lowest Speed of 30 miles per hour or below.

In Tables 1-8, the following abbreviations and color codes are used for high profile locations: DT=Downtown Tunnel, MT=Midtown Tunnel, HRBT=Hampton Roads Bridge-Tunnel, MMBT=Monitor-Merrimac Memorial Bridge-Tunnel, I-64 CHES=I-64 in Chesapeake including the High Rise Bridge, I-64/I-564=The I-64/I-564 Corridor in Norfolk, I-64/I-264=The I-64/I-264 Interchange area in Norfolk, I-64 NN=The I-64 Corridor in Newport News, GILM=Military Highway in Chesapeake approaching the Gilmerton Bridge, US17 YC=The Route 17 Corridor in Newport News and York County

JURIS-DICTION	FACILITY NAME	SEGMENT FROM	SEGMENT TO	DIR	HIGH PROFILE LOCATION	LOWEST SPEED (mph)	LOWEST SPEED PERIOD
NOR	I-264	WATERSIDE/CITY HALL/TIDEWATER	BRAMBLETON AVE	WB	DT	5.8	16:45
NOR	I-264/BERKLEY BRIDGE	I-464	WATERSIDE/CITY HALL/TIDEWATER	WB	DT	6.9	16:45
NOR	I-64	4TH VIEW AVE	BAY AVE	WB	HRBT	13.7	16:15
NOR	I-64	BAY AVE	GRANBY ST	WB	HRBT	14.2	17:00
NOR	I-64	GRANBY ST	I-564/LITTLE CREEK RD	WB	HRBT	14.8	17:15
CHES	I-64	BATTLEFIELD BLVD	I-464	EB	I-64 CHES	15.9	16:45
HAM	I-64	SETTLERS LANDING RD	MALLORY ST	EB	HRBT	16.6	16:00
PORT	I-264	DES MOINES AVE	EFFINGHAM ST	EB	DT	17.2	16:00
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	WB	DT	18.0	17:15
NN	I-664	TERMINAL AVE	23RD ST	EB	MMBT	18.3	15:45
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	EB	DT	19.2	16:00
NOR	I-64	I-564/LITTLE CREEK RD	TIDEWATER DR	EB	I-64/I-564	21.7	16:30
HAM	I-64	RIP RAP RD	SETTLERS LANDING RD	EB	HRBT	23.5	16:15
NOR	I-564	INTERNATIONAL TERMINAL BLVD	I-64	SB	I-64/I-564	24.0	16:30
NOR	I-64	OCEAN VIEW AVE	4TH VIEW AVE	WB	HRBT	25.1	16:00
NOR	I-64	GRANBY ST	I-564/LITTLE CREEK RD	EB	I-64/I-564	25.2	16:30
NOR	I-64	TIDEWATER DR	CHESAPEAKE BLVD	EB	I-64/I-564	25.5	16:30
NOR	I-264	BRAMBLETON AVE	BALLENTINE BLVD	WB	DT	27.9	16:45
NOR	I-64	CHESAPEAKE BLVD	NORVIEW AVE	EB	I-64/I-564	28.0	16:45
CHES	I-64	GREENBRIER PKWY	BATTLEFIELD BLVD	EB	I-64 CHES	29.2	17:00

Table 2 – Lowest Freeway Speeds – PM Peak Period (2010)

Data Source: INRIX. Includes all freeway segments with a Lowest Speed of 30 miles per hour or below.

JURIS-DICTION	FACILITY NAME	SEGMENT FROM	SEGMENT TO	DIR	HIGH PROFILE LOCATION	LOWEST SPEED (mph)	LOWEST SPEED PERIOD
PORT	I-264	DES MOINES AVE	EFFINGHAM ST	EB	DT	7.6	7:15
PORT	I-264	FREDERICK BLVD	DES MOINES AVE	EB	DT	8.7	7:30
NOR/PORT	MIDTOWN TUNNEL	MLK FWY/WESTERN FREEWAY	BRAMBLETON AVE	NB	MT	10.1	7:00
NOR	I-264/BERKLEY BRIDGE	I-464	WATERSIDE/CITY HALL/TIDEWATER	WB	DT	15.4	6:45
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	EB	DT	16.9	7:15
HAM	I-64	SETTLERS LANDING RD	MALLORY ST	EB	HRBT	17.3	7:15
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	WB	DT	17.3	7:00
HAM	I-64	RIP RAP RD	SETTLERS LANDING RD	EB	HRBT	19.5	7:15
PORT	WESTERN FWY	WEST NORFOLK RD	MLK FREEWAY/MIDTOWN TUNNEL	EB	MT	24.6	7:15
NOR	I-464	SOUTH MAIN ST	I-264	NB	DT	27.9	7:30
PORT	M L K FREEWAY	LONDON BLVD	WESTERN FREEWAY/MIDTOWN TUNNEL	NB	MT	29.7	7:00
PORT	I-264	PORTSMOUTH BLVD	FREDERICK BLVD	EB	DT	29.9	7:30

Table 3 – Lowest Tunnel Speeds – AM Peak Period (2010)

Data Source: INRIX. Includes all severely congested segments including and approaching tunnels with a Lowest Speed of 30 miles per hour or below.

determine the slowest travel speeds throughout the day on each roadway segment, and those roadways throughout the region that have the lowest Speed Reduction Factors. **Appendix A** also includes information on the lowest Speed Reduction Factors in each peak period for each roadway segment.

Maps 3-4 on pages 11-12 show the Speed Reduction Factors on congested roadways (as described in the next section) throughout the region during the AM Peak Period. **Maps 5-6** on pages 13-14 show the same information during the PM Peak Period.

Table 5 shows the roadway segments throughout Hampton Roads with the lowest Speed Reduction Factors during the AM Peak Period. A total of 29 roadway segments throughout the region have a minimum Speed Reduction Factor of 0.40 or lower during the AM Peak Period. This includes many high profile roadways including the eastbound and westbound approaches to the Downtown Tunnel, northbound Midtown Tunnel, the eastbound approach to the Hampton Roads Bridge-Tunnel, the westbound (towards Virginia Beach) approach to the High Rise Bridge, and I-564 approaching the Naval Base gates.

Table 6 on page 10 shows the roadway segments throughout the region with the lowest Speed Reduction Factors during the PM Peak Period. A total of 54 roadway segments have a minimum Speed Reduction Factor of 0.40 or lower during the PM Peak Period. Similar to the AM Peak Period, this includes many high profile locations throughout the

JURISDICTION	FACILITY NAME	SEGMENT FROM	SEGMENT TO	DIR	HIGH PROFILE LOCATION	LOWEST SPEED (mph)	LOWEST SPEED PERIOD
NOR	I-264	WATERSIDE/CITY HALL/TIDEWATER	BRAMBLETON AVE	WB	DT	5.8	16:45
NOR	I-264/BERKLEY BRIDGE	I-464	WATERSIDE/CITY HALL/TIDEWATER	WB	DT	6.9	16:45
NOR	BRAMBLETON AVE	HAMPTON BLVD	COLLEY AVE	WB	MT	7.3	16:15
NOR	HAMPTON BLVD	BRAMBLETON AVE	21ST ST	SB	MT	9.6	16:15
NOR/PORT	MIDTOWN TUNNEL	MLK FWY/WESTERN FREEWAY	BRAMBLETON AVE	SB	MT	11.0	16:30
NOR	I-64	4TH VIEW AVE	BAY AVE	WB	HRBT	13.7	16:15
NOR	I-64	BAY AVE	GRANBY ST	WB	HRBT	14.2	17:00
NOR	I-64	GRANBY ST	I-564/LITTLE CREEK RD	WB	HRBT	14.8	17:15
HAM	I-64	SETTLERS LANDING RD	MALLORY ST	EB	HRBT	16.6	16:00
PORT	I-264	DES MOINES AVE	EFFINGHAM ST	EB	DT	17.2	16:00
NOR	HAMPTON BLVD	21ST ST	26TH ST	SB	MT	17.2	16:00
NOR/PORT	MIDTOWN TUNNEL	MLK FWY/WESTERN FREEWAY	BRAMBLETON AVE	NB	MT	17.8	16:00
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	WB	DT	18.0	17:15
NN	I-664	TERMINAL AVE	23RD ST	EB	MMMBT	18.3	15:45
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	EB	DT	19.2	16:00
NOR	BRAMBLETON AVE	COLLEY AVE	BOUSH ST	WB	MT	20.4	16:30
HAM	I-64	RIP RAP RD	SETTLERS LANDING RD	EB	HRBT	23.5	16:15
NOR	I-64	OCEAN VIEW AVE	4TH VIEW AVE	WB	HRBT	25.1	16:00
NOR	I-264	BRAMBLETON AVE	BALLETINE BLVD	WB	DT	27.9	16:45

Table 4 – Lowest Tunnel Speeds – PM Peak Period (2010)

Data Source: INRIX. Includes all severely congested segments including and approaching tunnels with a Lowest Speed of 30 miles per hour or below.

JURISDICTION	FACILITY NAME	SEGMENT FROM	SEGMENT TO	DIR	HIGH PROFILE LOCATION	LOWEST SPEED REDUCTION FACTOR	LOWEST SPEED (mph)	LOWEST SPEED TIME PERIOD START
PORT	I-264	DES MOINES AVE	EFFINGHAM ST	EB	DT	0.13	7.6	7:15
PORT	I-264	FREDERICK BLVD	DES MOINES AVE	EB	DT	0.14	8.7	7:30
NOR/PORT	MIDTOWN TUNNEL	MLK FWY/WESTERN FREEWAY	BRAMBLETON AVE	NB	MT	0.24	10.1	7:00
NN	ROANOKE AVE	I-664	BRIARFIELD RD	SB	-	0.25	7.6	6:00
CHES	VOLVO PKWY	KEMPSVILLE RD	VA BEACH CL	WB	-	0.25	8.3	6:45
NN	26TH ST	ROANOKE AVE	JEFFERSON AVE	WB	-	0.29	8.1	7:30
CHES	I-64	GEORGE WASHINGTON HWY	MILITARY HWY	WB	I-64 CHES	0.29	17.9	7:15
HAM	I-64	SETTLERS LANDING RD	MALLORY ST	EB	HRBT	0.30	17.3	7:15
HAM	WOODLAND RD	I-64	COUNTY ST	SB	-	0.30	10.9	8:30
VB	ATLANTIC AVE	22ND ST	21ST ST	SB	-	0.32	7.1	8:30
HAM	I-64	RIP RAP RD	SETTLERS LANDING RD	EB	HRBT	0.33	19.5	7:15
VB	INDEPENDENCE BLVD	NORTHAMPTON BLVD	SHORE DR	NB	-	0.33	15.6	6:30
SUF	COLLEGE DR	BRIDGE RD	WESTERN FREEWAY	SB	-	0.33	11.0	8:00
CHES	LIBERTY ST	22ND ST	POINDEXTER RD	EB	-	0.34	6.1	7:30
PORT	PORTSMOUTH BLVD	ELM AVE	EFFINGHAM ST	WB	-	0.34	8.5	8:45
NOR	I-264/BERKLEY BRIDGE	I-464	WATERSIDE/CITY HALL/TIDEWATER	WB	DT	0.34	15.4	6:45
PORT	ELM AVE	LONDON BLVD	SOUTH ST	SB	-	0.35	8.0	6:00
HAM	ABERDEEN RD	MERCURY BLVD	TODDS LA	SB	-	0.37	9.9	7:30
HAM	COLISEUM DR	PINE CHAPEL RD	MERCURY BLVD	NB	-	0.37	9.9	6:00
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	EB	DT	0.37	16.9	7:15
HAM/NN	ROANOKE AVE	BRIARFIELD RD	MERCURY BLVD	NB	-	0.38	10.9	7:45
NOR	I-564	ADMIRAL TAUSSIG BLVD	INTERNATIONAL TERMINAL BLVD	NB	I-64/I-564	0.38	22.9	6:00
VB	HOLLAND RD	DAM NECK RD	PRINCESS ANNE RD	NB	-	0.38	15.8	6:30
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	WB	DT	0.39	17.3	7:00
HAM	TODDS LA	NEWPORT NEWS CL	BIG BETHEL RD	EB	-	0.40	15.0	6:45
NN	MAIN ST	JEFFERSON AVE	HAMPTON CL	WB	-	0.40	15.0	6:45
VB	ATLANTIC AVE	PACIFIC AVE	LASKIN RD	SB	-	0.40	8.0	6:45
CHES	I-64	MILITARY HWY	I-264&664	WB	I-64 CHES	0.40	24.3	7:30
NOR	PRINCESS ANNE RD	HAMPTON BLVD	COLLEY AVE	WB	-	0.40	7.2	6:30

Table 5 – Lowest Regional Speed Reduction Factors – AM Peak Period (2010)

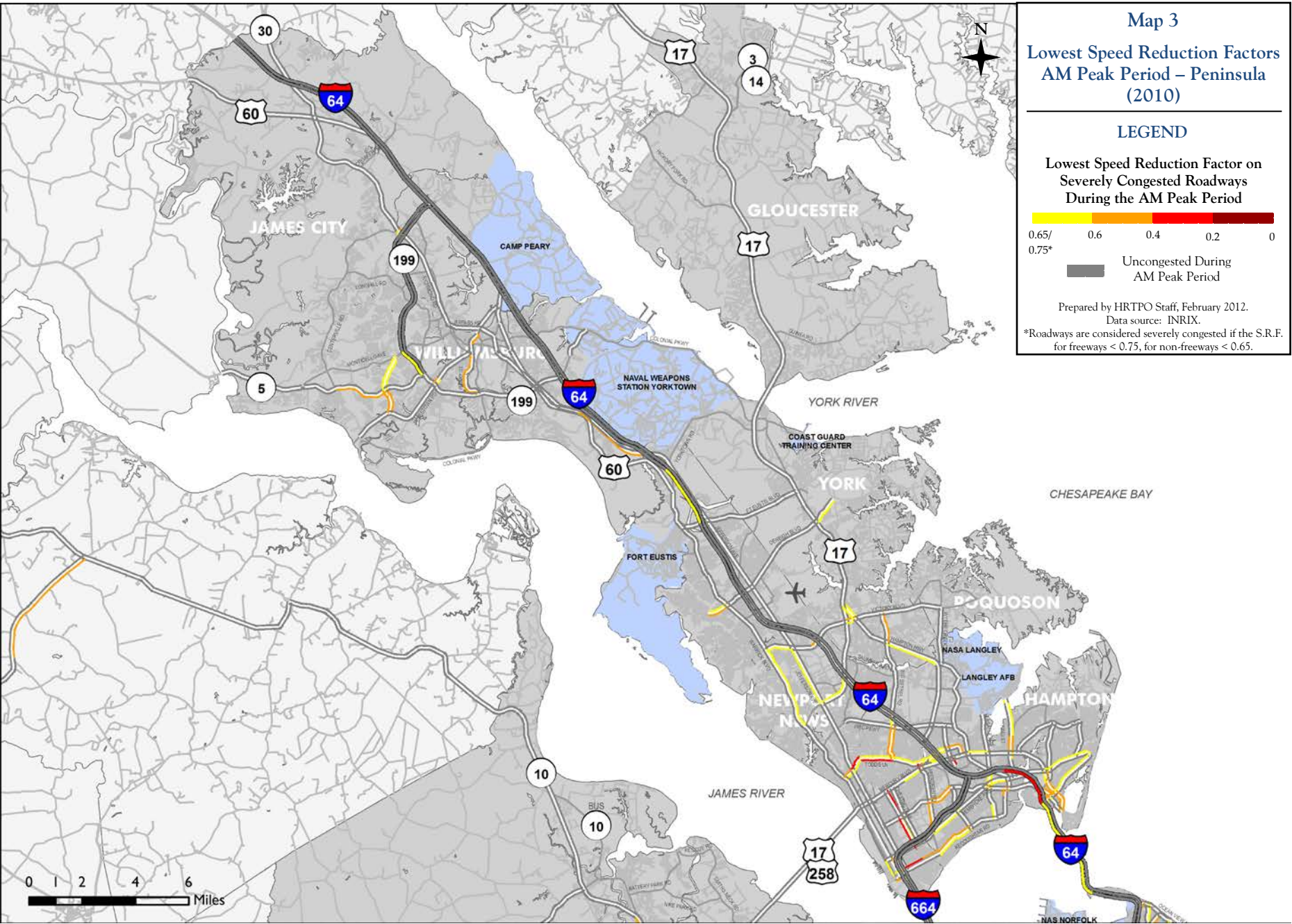
Data Source: INRIX. Includes all roadway segments with a Lowest Speed Reduction Factor of 0.40 or below. Speed Reduction Factor = Actual Speed/Free Flow Speed

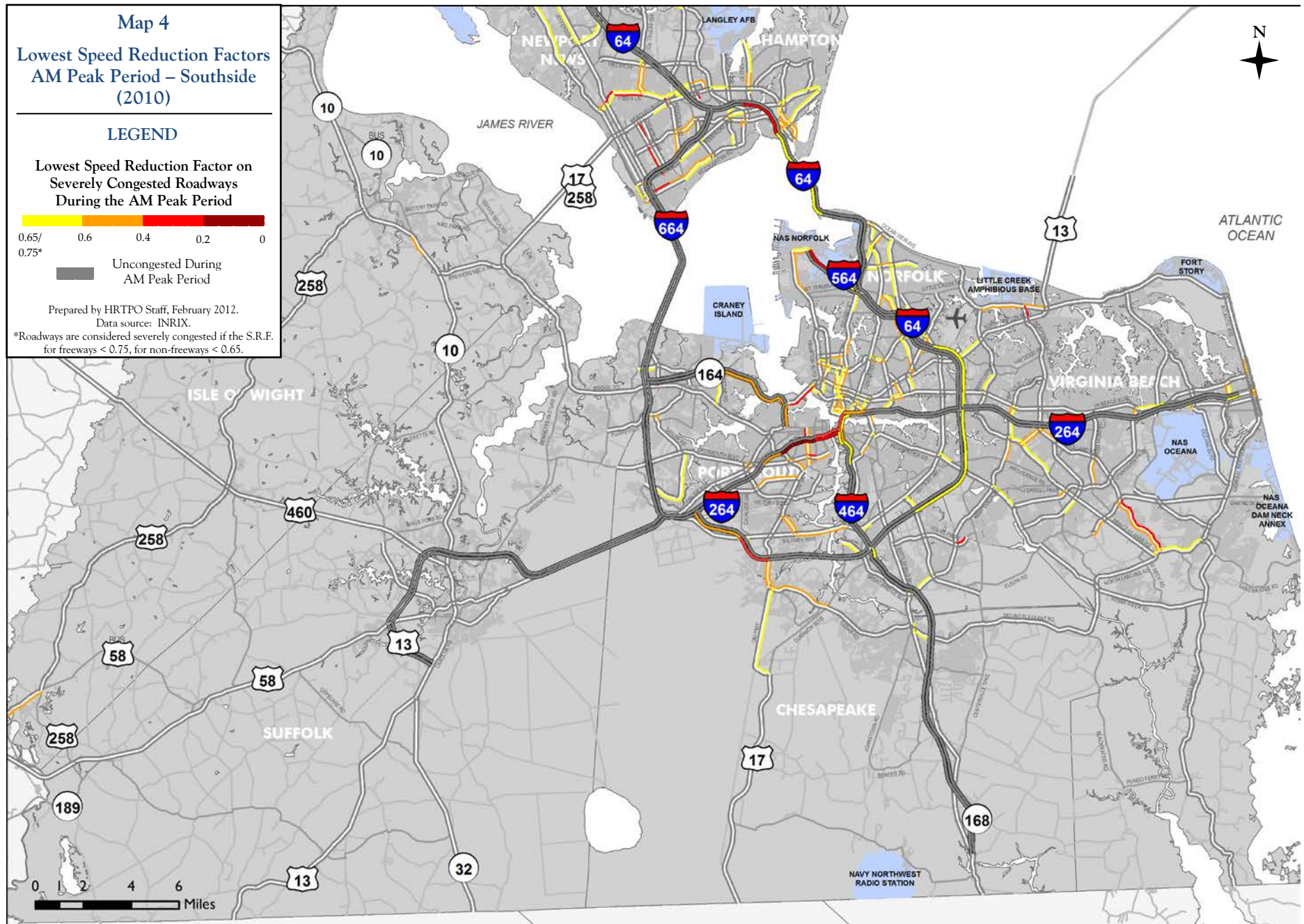
region, including the eastbound and westbound approaches to the Downtown Tunnel, the southbound approach to the Midtown Tunnel, the eastbound and westbound approaches to the Hampton Roads Bridge-Tunnel, and the southbound approach to the Monitor-Merrimac Memorial Bridge Tunnel.

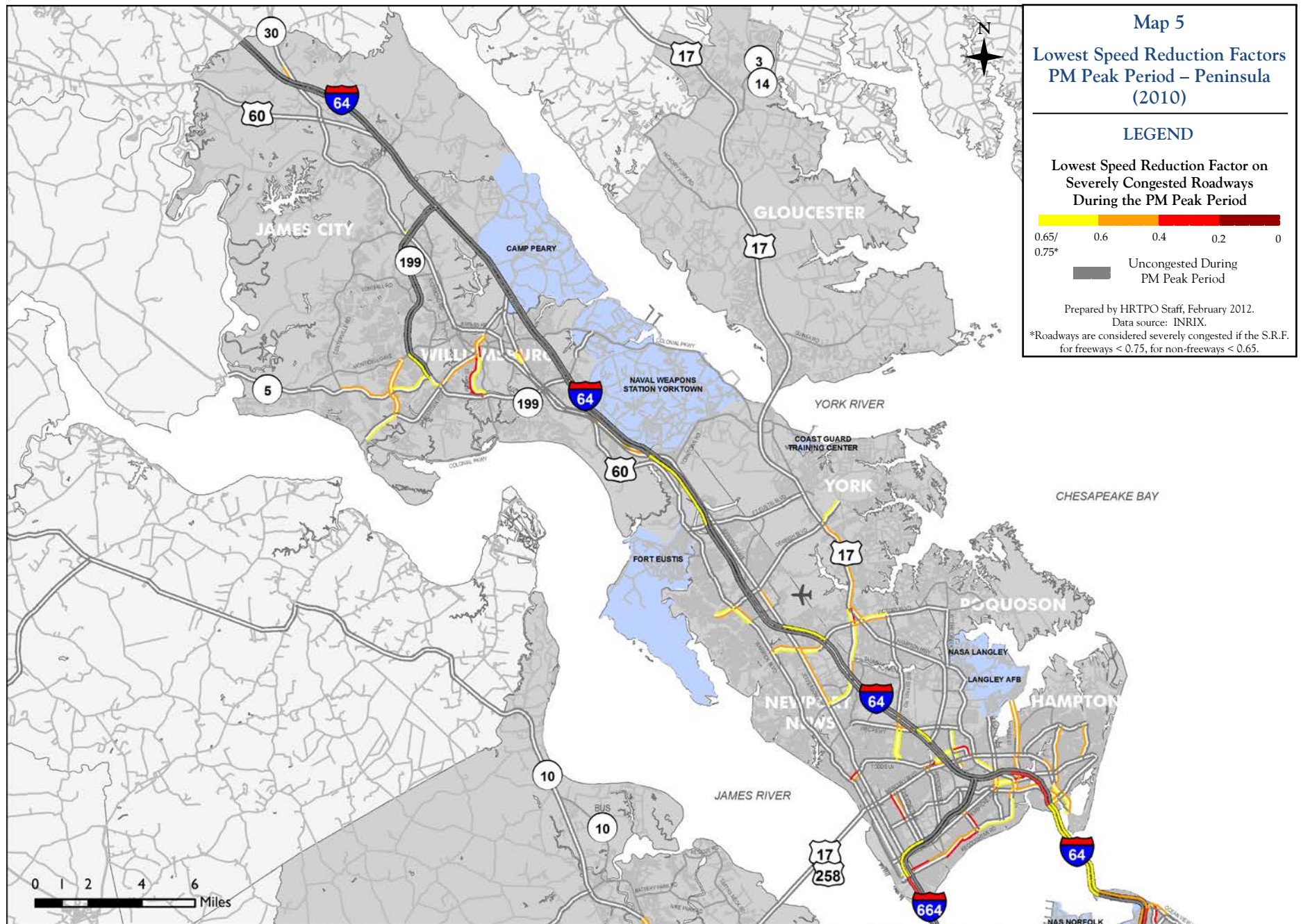
JURISDICTION	FACILITY NAME	SEGMENT FROM	SEGMENT TO	DIR	HIGH PROFILE LOCATION	LOWEST SPEED REDUCTION FACTOR	LOWEST SPEED (mph)	LOWEST SPEED TIME PERIOD START
NOR	I-264	WATERSIDE/CITY HALL/TIDEWATER	BRAMBLETON AVE	WB	DT	0.10	5.8	16:45
NOR	I-264/BERKLEY BRIDGE	I-464	WATERSIDE/CITY HALL/TIDEWATER	WB	DT	0.15	6.9	16:45
CHES	MILITARY HWY	BAINBRIDGE BLVD	I-464	WB	GILM	0.17	7.8	16:15
NOR	4TH VIEW ST	I-64	OCEAN VIEW AVE	WB	HRBT	0.20	9.3	17:45
NOR	BRAMBLETON AVE	HAMPTON BLVD	COLLEY AVE	WB	MT	0.21	7.3	16:15
NOR	I-64	4TH VIEW AVE	BAY AVE	WB	HRBT	0.22	13.7	16:15
HAM	ROANOKE AVE	NEWPORT NEWS CL	MERCURY BLVD	SB	-	0.23	6.3	18:45
NN	ROANOKE AVE	BRIARFIELD RD	HAMPTON CL	SB	-	0.23	6.3	18:45
NOR	I-64	BAY AVE	GRANBY ST	WB	HRBT	0.23	14.2	17:00
NOR	I-64	GRANBY ST	I-564/LITTLE CREEK RD	WB	HRBT	0.25	14.8	17:15
NOR	CITY HALL AVE	BOUSH ST	ST PAULS BLVD	EB	-	0.25	5.0	18:15
NOR	CHESAPEAKE BLVD	LAFAYETTE BLVD	CROMWELL DR	SB	-	0.25	5.0	17:15
CHES	I-64	BATTLEFIELD BLVD	I-464	EB	I-64 CHES	0.26	15.9	16:45
NOR	LLEWELLYN AVE	21ST ST	26TH ST	NB	-	0.27	7.0	15:45
HAM	TODDS LA	ABERDEEN RD	CUNNINGHAM DR	EB	-	0.27	10.6	17:30
NOR	38TH ST	HAMPTON BLVD	COLLEY AVE	EB	-	0.28	5.8	18:30
HAM	I-64	SETTLERS LANDING RD	MALLORY ST	EB	HRBT	0.29	16.6	16:00
NOR	HAMPTON BLVD	BRAMBLETON AVE	21ST ST	SB	MT	0.29	9.6	16:15
PORT	I-264	DES MOINES AVE	EFFINGHAM ST	EB	DT	0.30	17.2	16:00
NOR	ST PAULS BLVD	CITY HALL AVE	I-264 RAMP/MACARTHUR MALL	NB	DT	0.30	5.0	17:30
NOR/PORT	MIDTOWN TUNNEL	MLK FWY/WESTERN FREEWAY	BRAMBLETON AVE	SB	MT	0.30	11.0	16:30
NOR	ST PAULS BLVD	CITY HALL AVE	I-264 RAMP/MACARTHUR MALL	SB	DT	0.31	7.1	17:15
NN	I-664	TERMINAL AVE	23RD ST	EB	MMMBT	0.31	18.3	15:45
NN	MAIN ST	JEFFERSON AVE	WARWICK BLVD	WB	-	0.31	11.2	17:15
CHES	MILITARY HWY	I-464	CAMPOSTELLA RD	WB	GILM	0.32	13.0	17:00
NOR	NEWTOWN RD	I-264	VA BEACH BLVD	NB	-	0.32	11.2	17:00
NOR	ST PAULS BLVD	I-264 RAMP/MACARTHUR MALL	BRAMBLETON AVE	SB	DT	0.32	9.2	17:15
CHES	GW HWY (DEEP CREEK BRIDGE)	MOSES GRANDY TR @ HINTON AVE	I-64	SB	-	0.33	11.0	16:15
NOR	ST PAULS BLVD	WATERSIDE DR	CITY HALL AVE	NB	DT	0.33	6.9	16:45
HAM	PEMBROKE AVE	ARMISTEAD AVE	EATON ST	WB	-	0.33	10.0	17:45
NOR	COLLEY AVE	26TH ST	27TH ST	NB	-	0.35	9.7	15:30
NOR	I-64	I-564/LITTLE CREEK RD	TIDEWATER DR	EB	I-64/I-564	0.35	21.7	16:30
NOR	TIDEWATER DR	GRANBY ST	OCEAN VIEW AVE	NB	HRBT	0.36	15.0	17:45
VB	ATLANTIC AVE	PACIFIC AVE	LASKIN RD	NB	-	0.36	8.0	18:30
VB	ATLANTIC AVE	22ND ST	21ST ST	SB	-	0.36	8.0	15:45
HAM	KECOUGHTAN RD	NEWPORT NEWS CL	POWHATAN PKWY	EB	-	0.36	11.6	18:45
NN	25TH ST	26TH ST	HAMPTON CL	EB	-	0.36	11.6	18:45
HAM	POWHATAN PKWY	KECOUGHTAN RD	PEMBROKE AVE	NB	-	0.37	11.0	18:15
VB	WITCHDUCK RD	PRINCESS ANNE RD	I-264	SB	-	0.37	13.3	17:00
HAM	ABERDEEN RD	PEMBROKE AVE	I-664	SB	-	0.38	8.6	17:00
YC	GEORGE WASHINGTON HWY	VICTORY BLVD (RTE 171)	HAMPTON HWY (RTE 134)	NB	US17 YC	0.38	17.3	17:15
NOR	COLLEY AVE	26TH ST	27TH ST	SB	-	0.38	8.7	15:45
HAM	CUNNINGHAM DR	COLISEUM DR	MERCURY BLVD	WB	-	0.39	12.0	18:00
NOR	PRINCESS ANNE RD	HAMPTON BLVD	COLLEY AVE	WB	-	0.39	7.0	17:15
HAM	PEMBROKE AVE	SETTLERS LANDING RD	LA SALLE AVE	EB	-	0.39	10.9	17:00
PORT	ELM AVE	LONDON BLVD	SOUTH ST	SB	-	0.39	9.0	18:15
NN	26TH ST	ROANOKE AVE	JEFFERSON AVE	WB	-	0.39	11.0	17:00
NOR	NORVIEW AVE	CHESAPEAKE BLVD	I-64	WB	-	0.39	14.8	18:15
HAM	I-64	RIP RAP RD	SETTLERS LANDING RD	EB	HRBT	0.39	23.5	16:15
WMB	HENRY ST S.	ROUTE 199	FRANCIS ST	SB	-	0.40	13.0	18:45
WMB	HENRY ST	FRANCIS ST	LAFAYETTE ST	NB	-	0.40	8.0	17:30
NOR	CHESAPEAKE BLVD	LAFAYETTE BLVD	CROMWELL DR	NB	-	0.40	6.4	16:00
NOR	I-564	INTERNATIONAL TERMINAL BLVD	I-64	SB	I-64/I-564	0.40	24.0	16:30
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	WB	DT	0.40	18.0	17:15

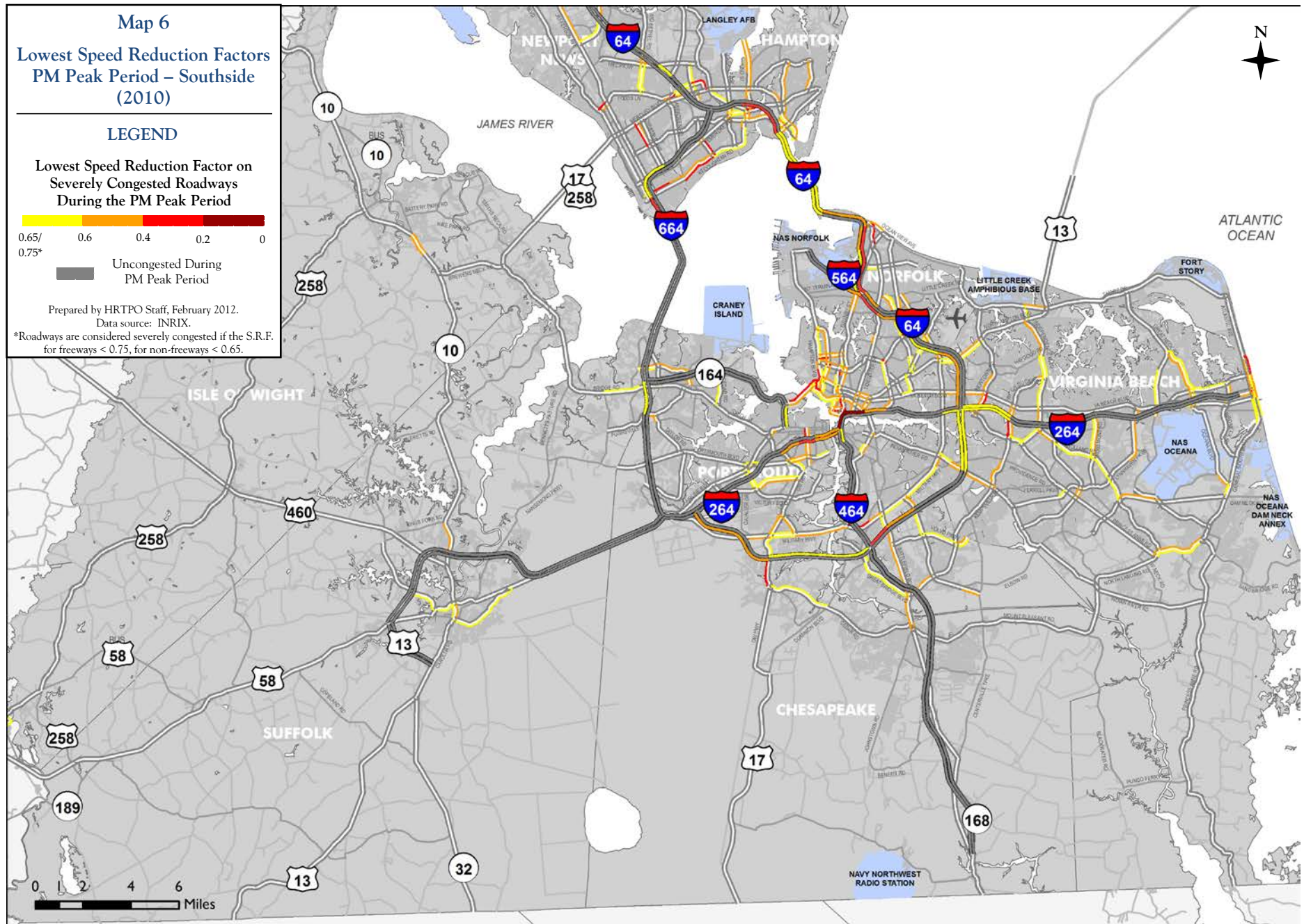
Table 6 – Lowest Regional Speed Reduction Factors – PM Peak Period (2010)

Data Source: INRIX. Includes all roadway segments with a Lowest Speed Reduction Factor of 0.40 or below. Speed Reduction Factor = Actual Speed/Free Flow Speed









Congestion Duration

Historically, HRTPO staff could estimate roadway congestion levels through the Congestion Management Process, but could not easily determine the duration of congestion on each facility. INRIX's travel time and speed data can be used not only to determine whether roadways are congested but also to determine the duration of congestion at each location.

Whether a roadway operates under severely congested conditions can be determined using Speed Reduction Factors. As stated previously, the Texas Transportation Institute (TTI) used Speed Reduction Factors in the 2011 Urban Mobility Report to determine congestion levels throughout the country. TTI classified roadways as severely congested if the following threshold was met:

Freeways: Speed Reduction Factor < 0.75

Non-Freeways: Speed Reduction Factor < 0.65

These thresholds were also used by HRTPO staff in this report to determine congestion levels for each roadway and 15-minute time interval.

The Appendices of this report include information on congestion levels and duration. **Appendix A** includes the number of severely congested periods for each Travel Time Network segment by direction for both the AM Peak Period (defined in this study as occurring between 6:00 am and 9:00 am) and the PM Peak Period (defined as occurring between 3:00 pm and 7:00 pm). **Appendix B** shows the 15-minute intervals when each roadway segment is severely congested during the AM Peak Period and PM Peak Period. **Appendix C** shows the times when each Travel Time Network segment is congested in the northbound or eastbound direction for the entire time period included in the Regional

JURISDICTION	FACILITY NAME	SEGMENT FROM	SEGMENT TO	DIR	HIGH PROFILE LOCATION	NUMBER OF SEVERELY CONGESTED 15-MINUTE INTERVALS	LOWEST SPEED (mph)	LOWEST SPEED REDUCTION FACTOR
PORT	I-264	DES MOINES AVE	EFFINGHAM ST	EB	DT	12	7.6	0.13
PORT	I-264	FREDERICK BLVD	DES MOINES AVE	EB	DT	12	8.7	0.14
NOR/PORT	MIDTOWN TUNNEL	MLK FWY/WESTERN FREEWAY	BRAMBLETON AVE	NB	MT	12	10.1	0.24
HAM	I-64	SETTLERS LANDING RD	MALLORY ST	EB	HRBT	12	17.3	0.30
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	EB	DT	12	16.9	0.37
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	WB	DT	12	17.3	0.39
NOR	MILITARY HWY	I-64	AZALEA GARDEN RD	SB	-	12	15.5	0.41
PORT	WESTERN FWY	WEST NORFOLK RD	MLK FREEWAY/MIDTOWN TUNNEL	EB	MT	12	24.6	0.45
VB	FIRST COLONIAL RD	VA BEACH BLVD	I-264	SB	-	12	11.5	0.46
NOR	MONTECELLO AVE	ST PAULS BLVD	PRINCESS ANNE RD	NB	-	12	18.6	0.58
NOR	ST PAULS BLVD	BRAMBLETON AVE	MONTECELLO AVE	NB	-	12	18.6	0.58
HAM	I-64	RIP RAP RD	SETTLERS LANDING RD	EB	HRBT	11	19.5	0.33
PORT	PORTSMOUTH BLVD	ELM AVE	EFFINGHAM ST	WB	-	11	8.5	0.34
CHES	22ND ST	LIBERTY ST	BERKLEY AVE/NORFOLK CL	EB	-	11	12.2	0.49
NOR	PRINCESS ANNE RD	LLEWELLYN AVE	MONTECELLO AVE	WB	-	11	11.2	0.53
CHES	I-64	GEORGE WASHINGTON HWY	MILITARY HWY	WB	I-64 CHES	10	17.9	0.29
NOR	I-264/BERKLEY BRIDGE	I-464	WATERSIDE/CITY HALL/TIDEWATER	WB	DT	10	15.4	0.34
HAM	MALLORY ST	I-64	COUNTY ST	WB	HRBT	10	12.0	0.47
NOR	I-464	SOUTH MAIN ST	I-264	NB	DT	10	27.9	0.48
NOR	ST PAULS BLVD	I-264 RAMP/MACARTHUR MALL	BRAMBLETON AVE	SB	DT	10	14.7	0.52
CHES	GW HWY (DEEP CREEK BRIDGE)	MOSES GRANDY TR @ HINTON AVE	I-64	NB	-	10	19.9	0.53
HAM	ABERDEEN RD	MERCURY BLVD	TODDS LA	SB	-	9	9.9	0.37
VB	HOLLAND RD	DAM NECK RD	PRINCESS ANNE RD	NB	-	9	15.8	0.38
NOR	PRINCESS ANNE RD	HAMPTON BLVD	COLLEY AVE	WB	-	9	7.2	0.40
JCC	IRONBOUND RD/SANDY BAY RD	JAMESTOWN RD	JOHN TYLER HWY	NB	-	9	19.0	0.46
NOR	ST PAULS BLVD	CITY HALL AVE	I-264 RAMP/MACARTHUR MALL	SB	DT	9	11.1	0.48
CHES	MILITARY HWY/GILMERTON BRIDGE	CANAL DR	BAINBRIDGE BLVD	EB	GILM	9	22.0	0.49
PORT	I-264	PORTSMOUTH BLVD	FREDERICK BLVD	EB	DT	9	29.9	0.49
YC	VICTORY BLVD	ROUTE 17	HAMPTON HWY (RTE 134)	WB	-	9	19.8	0.51
NOR	HAMPTON BLVD	26TH ST	27TH ST	SB	-	9	16.3	0.52
NOR	I-264	WATERSIDE/CITY HALL/TIDEWATER	BRAMBLETON AVE	WB	DT	9	30.4	0.53
VB	WITCHDUCK RD	I-264	VA BEACH BLVD	SB	-	9	19.3	0.55
PORT	M L K FREEWAY	LONDON BLVD	WESTERN FREEWAY/MIDTOWN TUNNEL	NB	MT	9	29.7	0.56
VB	BAXTER RD	PRINCESS ANNE RD	INDEPENDENCE BLVD	NB	-	9	23.3	0.60

Table 7 – Highest Number of Severely Congested Intervals – AM Peak Period (2010)

Data Source: INRIX. Includes all roadway segments that are severely congested for at least 9 of the 12 15-minute intervals between 6 am and 9 am.

Travel Time Database (5:30 am – 8:00 pm), and **Appendix D** includes this same information for the southbound or westbound direction.

Maps 7-8 on pages 18-19 show those Travel Time Network roadways that are severely congested during the AM Peak Period, and the duration of congestion in terms of the number of 15-minute intervals. **Maps 9-10** on pages 20-21 show the same information for the PM Peak Period.

Table 7 on page 15 shows the Travel Time Network roadways throughout the region that are severely congested for the longest duration during the AM Peak Period. A total of 34 roadway segments throughout Hampton Roads are severely congested for at least 9 of the 12 15-minute intervals during the AM Peak Period. This includes the eastbound and westbound approaches to the Downtown Tunnel, northbound Midtown Tunnel, the eastbound approach to the Hampton Roads Bridge-Tunnel, and eastbound Gilmerton Bridge. Eleven segments are severely congested for all 12 15-minute intervals during the AM Peak Period, including approaches to the tunnels listed above and sections of Military Highway, First Colonial Road, Monticello Avenue, and Saint Pauls Blvd.

Table 8 shows the same congestion duration information for the PM Peak Period. A total of 50 roadway segments are severely congested for at least 13 of the 16 15-minute intervals during the PM Peak Period. This includes many similar high profile locations as the AM Peak Period, including the eastbound and westbound approaches to the Downtown Tunnel, the southbound approach to the Midtown Tunnel, the eastbound and

JURISDICTION	FACILITY NAME	SEGMENT FROM	SEGMENT TO	DIR	HIGH PROFILE LOCATION	NUMBER OF SEVERELY CONGESTED 15-MINUTE INTERVALS	LOWEST SPEED (mph)	LOWEST SPEED REDUCTION FACTOR
NOR	I-264	WATERSIDE/CITY HALL/TIDEWATER	BRAMBLETON AVE	WB	DT	16	5.8	0.10
NOR	I-264/BERKLEY BRIDGE	I-464	WATERSIDE/CITY HALL/TIDEWATER	WB	DT	16	6.9	0.15
NOR	4TH VIEW ST	I-64	OCEAN VIEW AVE	WB	HRBT	16	9.3	0.20
NOR	I-64	4TH VIEW AVE	BAY AVE	WB	HRBT	16	13.7	0.22
NOR	I-64	BAY AVE	GRANBY ST	WB	HRBT	16	14.2	0.23
NOR	HAMPTON BLVD	BRAMBLETON AVE	21ST ST	SB	MT	16	9.6	0.29
CHES	MILITARY HWY	I-464	CAMPOSTELLA RD	WB	GILM	16	13.0	0.32
NOR	ST PAULS BLVD	I-264 RAMP/MACARTHUR MALL	BRAMBLETON AVE	SB	DT	16	9.2	0.32
CHES	GW HWY (DEEP CREEK BRIDGE)	MOSES GRANDY TR @ HINTON AVE	I-64	SB	-	16	11.0	0.33
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	WB	DT	16	18.0	0.40
NOR	I-64	OCEAN VIEW AVE	4TH VIEW AVE	WB	HRBT	16	25.1	0.42
VB	INDIAN RIVER RD	KEMPSVILLE RD	FERRELL PKWY	WB	-	16	21.3	0.57
IW	BENNS CHURCH BLVD	ECL SMITHFIELD (RTE 644)	CHURCH ST S	SB	-	16	26.9	0.57
CHES	MILITARY HWY	BAINBRIDGE BLVD	I-464	WB	GILM	15	7.8	0.17
NOR	BRAMBLETON AVE	HAMPTON BLVD	COLLEY AVE	WB	MT	15	7.3	0.21
CHES	I-64	BATTLEFIELD BLVD	I-464	EB	I-64 CHES	15	15.9	0.26
PORT	I-264	DES MOINES AVE	EFFINGHAM ST	EB	DT	15	17.2	0.30
NOR/PORT	MIDTOWN TUNNEL	MLK FWY/WESTERN FREEWAY	BRAMBLETON AVE	SB	MT	15	11.0	0.30
NOR	NEWTOWN RD	I-264	VA BEACH BLVD	NB	-	15	11.2	0.32
NOR	ST PAULS BLVD	WATERSIDE DR	CITY HALL AVE	NB	DT	15	6.9	0.33
NN	OYSTER POINT RD	JEFFERSON AVE	CANON BLVD	WB	-	15	17.5	0.44
VB	FIRST COLONIAL RD	VA BEACH BLVD	I-264	SB	-	15	11.8	0.47
CHES	MILITARY HWY/GILMERTON BRIDGE	CANAL DR	BAINBRIDGE BLVD	EB	GILM	15	21.6	0.48
SUF	GODWIN BLVD	SUFFOLK BYPASS	KINGS FORK RD	SB	-	15	20.8	0.53
NOR	NEWTOWN RD	VA BEACH BLVD	VA BEACH CL	SB	-	15	19.3	0.54
VB	NEWTOWN RD	NORFOLK CL	DIAMOND SPRINGS RD	SB	-	15	19.3	0.54
CHES	BATTLEFIELD BLVD	JOHNSTOWN RD	CEDAR RD	NB	-	15	17.4	0.54
VB	LYNNHAVEN PKWY	I-264	VA BEACH BLVD	NB	-	15	18.8	0.55
NN	JEFFERSON AVE	DENBIGH BLVD	BLAND BLVD	NB	-	15	24.2	0.59
YC	GEORGE WASHINGTON HWY	VICTORY BLVD (RTE 171)	HAMPTON HWY (RTE 134)	SB	US17 YC	15	25.4	0.61
HAM	I-64	SETTLERS LANDING RD	MALLORY ST	EB	HRBT	14	16.6	0.29
NOR	ST PAULS BLVD	CITY HALL AVE	I-264 RAMP/MACARTHUR MALL	SB	DT	14	7.1	0.31
HAM	ABERDEEN RD	PEMBROKE AVE	I-664	SB	-	14	8.6	0.38
YC	MERRIMAC TRAIL	JAMES CITY CL	BUSCH GARDENS INTERCHANGE	NB	-	14	23.5	0.44
JCC	MERRIMAC TRAIL	NEWPORT NEWS CL @ I-64	YORK CL (SOUTH OF GROVE INT)	WB	-	14	23.5	0.44
HAM	ABERDEEN RD	MERCURY BLVD	TODDS LA	SB	-	14	11.8	0.44
VB	INDIAN RIVER RD	I-64	CENTERVILLE TNPK	EB	-	14	16.8	0.44
NN	OYSTER POINT RD	CANON BLVD	I-64	WB	-	14	17.3	0.45
PORT	ELM AVE	SOUTH ST	PORTSMOUTH BLVD	NB	-	14	14.8	0.51
VB	MILITARY HWY	PROVIDENCE RD	INDIAN RIVER RD	NB	-	14	21.4	0.53
NOR	I-64	GRANBY ST	I-564/LITTLE CREEK RD	WB	HRBT	13	14.8	0.25
VB	WITCHDUCK RD	PRINCESS ANNE RD	I-264	SB	-	13	13.3	0.37
NOR/PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	I-464	EB	DT	13	19.2	0.42
VB	INDIAN RIVER RD	CENTERVILLE TNPK	KEMPSVILLE RD	EB	-	13	18.0	0.47
NOR	NEWTOWN RD	I-264	VA BEACH BLVD	SB	-	13	18.5	0.50
VB	INDIAN RIVER RD	PROVIDENCE RD	I-64	WB	-	13	18.8	0.52
NOR	GRANBY ST	THOLE ST	LITTLE CREEK RD	NB	-	13	19.3	0.57
NOR	GRANBY ST	LITTLE CREEK RD	I-564	NB	-	13	19.3	0.57
NN	WARWICK BLVD	DENBIGH BLVD	BLAND BLVD	NB	-	13	22.6	0.58
IW	BENNS CHURCH BLVD	ECL SMITHFIELD (RTE 644)	CHURCH ST S	NB	-	13	27.9	0.60

Table 8 – Highest Number of Severely Congested Intervals – PM Peak Period (2010)

Data Source: INRIX. Includes all roadway segments that are severely congested for at least 13 of the 16 15-minute intervals between 3 pm and 7 pm.

westbound approaches to the Hampton Roads Bridge-Tunnel, and the eastbound and westbound Gilmerton Bridge approaches. Thirteen segments are severely congested for all 16 15-minute intervals during the PM Peak Period, including approaches to the three tunnels and sections of Saint Pauls Boulevard, George Washington Highway in Deep Creek, Indian River Road, and Benns Church Boulevard.

Congestion Levels

Looking at congestion on a regional level, there are approximately 2,040 directional roadway segments in the regional Travel Time Network. Of these 2,040 segments, 373 (18.3%) have at least one 15-minute interval that was severely congested during the AM Peak Period in 2010. During the PM Peak Period, 550 segments (26.9%) had at least one severely congested 15-minute interval.

On a roadway capacity basis, 10.9% of the lane-miles³ on the regional Travel Time Network had at least one severely congested interval during the AM Peak Period in 2010 (**Figure 3**). This percentage increased to 17.0% of the Travel Time Network lane-miles during the PM Peak Period. The discrepancy between the congested segments and lane-mile percentages indicates that many of the roadways that are classified as severely congested have a combination of shorter segments and fewer lanes.

As a means of comparison, 13.8% of the Travel Time Network lane-miles were severely congested in the PM Peak Hour in 2009 based on the previous analysis methods used in the Congestion Management Process that include traffic volumes, roadway characteristics, and Highway Capacity Manual equations. It is not clear whether this difference (17.0% vs. 13.8%) is due to the different thresholds for defining severe congestion used by the two methods, or due to the inherent limitations of the previous analysis method.

³ A lane-mile is defined as the length of a roadway segment multiplied by the number of lanes. A one-mile long, four-lane wide roadway segment would comprise four lane-miles.

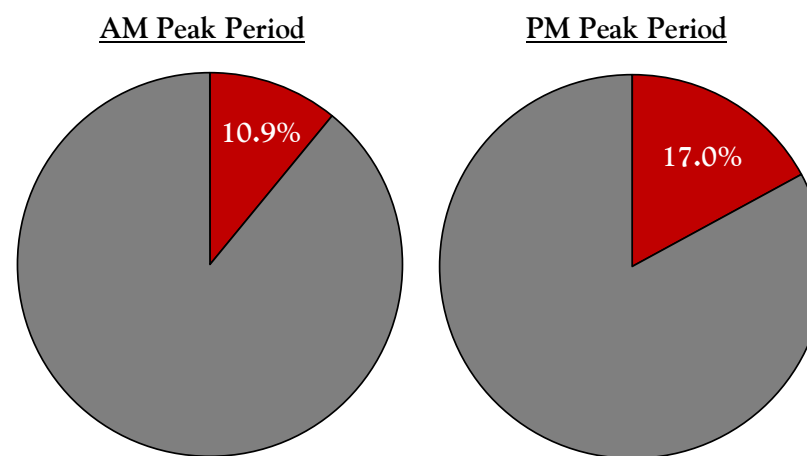
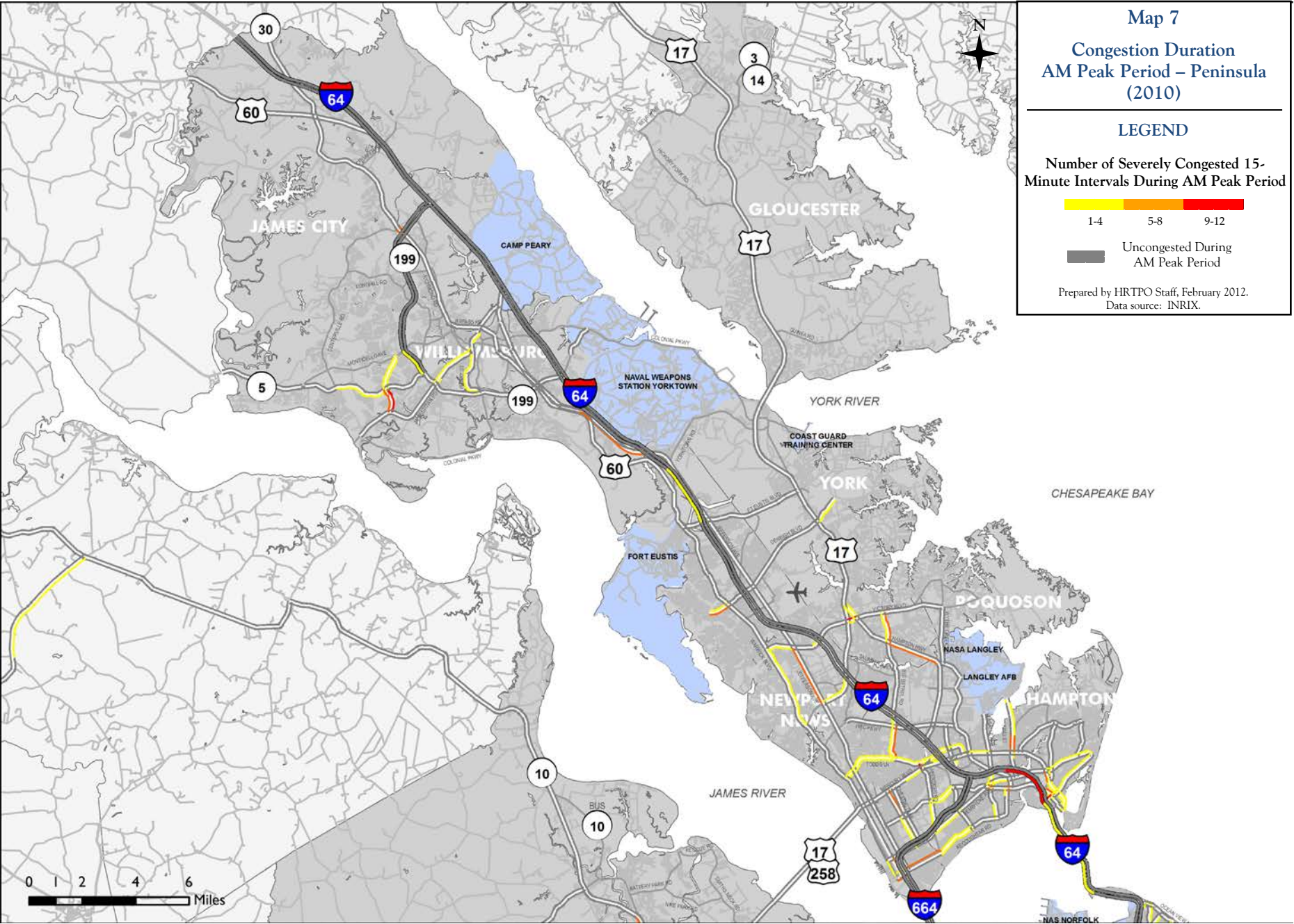
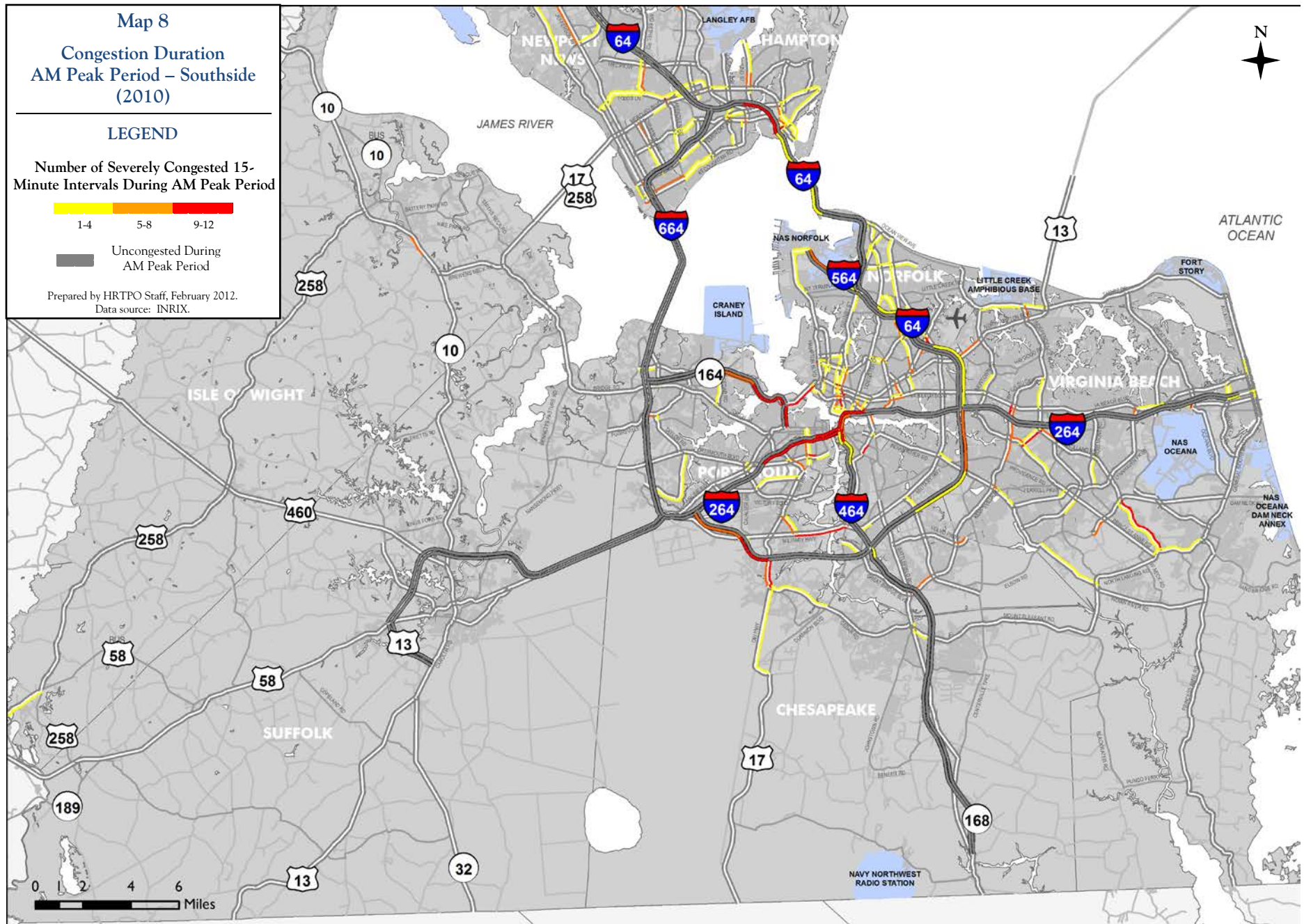
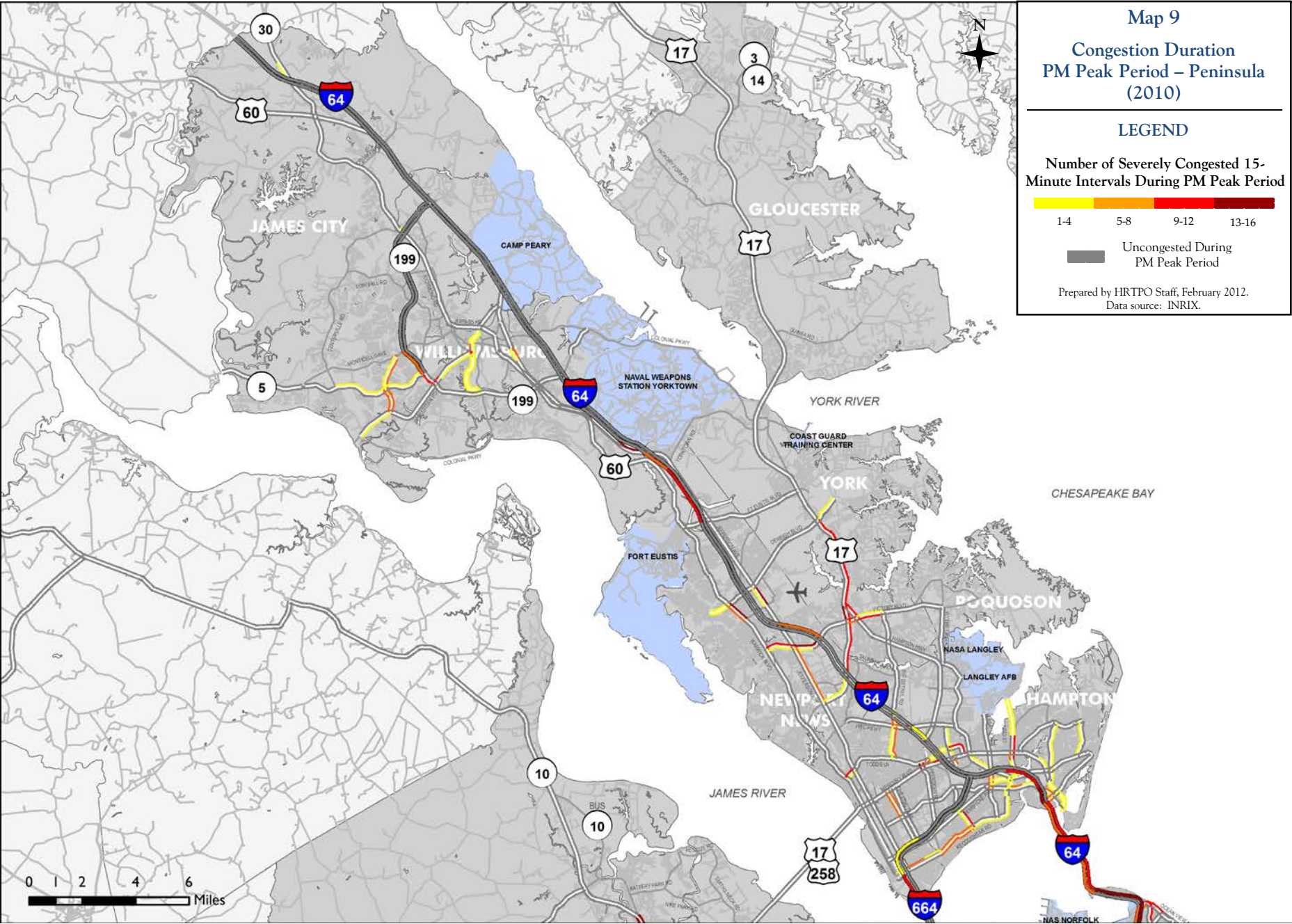


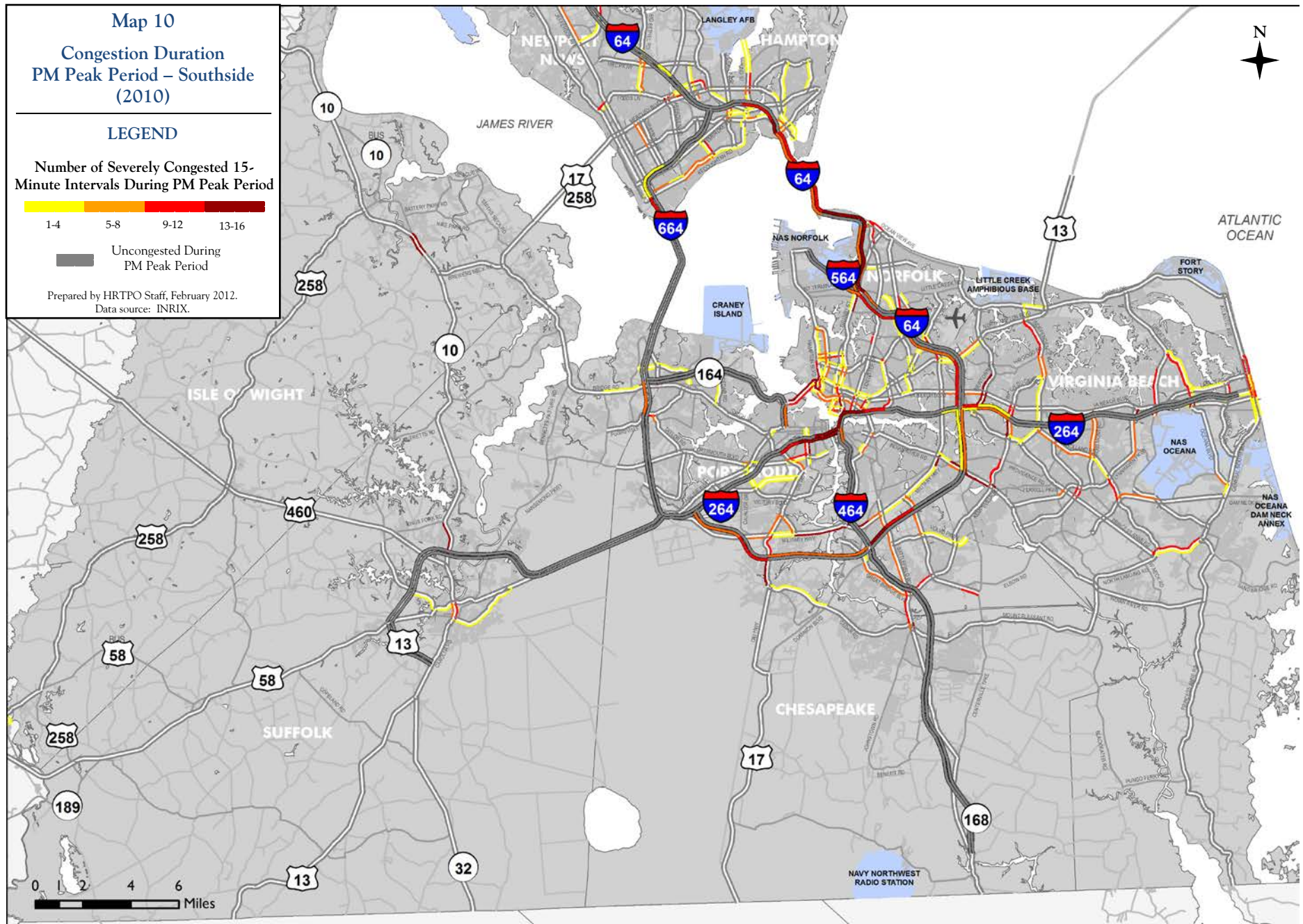
Figure 3 – Percentage of Lane-Miles with at Least One Severely Congested Time Interval, AM and PM Peak Periods (2010)

Data Source: INRIX.









Delay

The Regional Travel Time Database includes the total delay during each 15-minute period by direction for each roadway segment. This total segment delay was determined using TTI's methodology from the Urban Mobility Report. Delay is based on the amount of travel on each segment, the average travel speed, and the free flow speed. Total Segment Delay (in vehicle-hours) is defined as:

$$\text{Total Segment Delay} = \frac{\text{Vehicle-Miles of Travel}}{\text{Segment Travel Speed}} - \frac{\text{Vehicle-Miles of Travel}}{\text{Segment Free Flow Travel Speed}}$$

Appendix A includes the total AM Peak Period (6:00 am to 9:00 am) and PM Peak Period (3:00 pm to 7:00 pm) vehicle-hours of delay for each Travel Time Network segment. **Table 9** shows the roadway segments with the highest delay values throughout the region during the AM Peak Period, and **Table 10** includes the same information for the PM Peak Period.

It needs to be emphasized that since the above equation includes vehicle-miles of travel, total delay is impacted by the length of each segment. Travel Time Network segments vary in length since the endpoints of each segment are generally interchanges or major intersections. In general, Travel Time Network segments located in rural areas are longer than those located in suburban areas, which are longer than those located in urban areas.

In spite of this limitation, most of the segments with the highest delays during the AM and PM Peak Period are the high profile congested locations throughout the region. Segments approaching the Downtown Tunnel, Midtown Tunnel, Hampton Roads Bridge-Tunnel, and High Rise Bridge have the highest total delays during both peak periods. Examples of non-freeways that have the highest delays include sections of George Washington Highway in York County, Indian River Road,

JURISDICTION	FACILITY NAME	SEGMENT FROM	SEGMENT TO	DIR	HIGH PROFILE LOCATION	PEAK PERIOD DELAY (veh-hours)
PORT	I-264	DES MOINES AVE	EFFINGHAM ST	EB	DT	424.1
CHES	I-64	GEORGE WASHINGTON HWY	MILITARY HWY	WB	I-64 CHES	293.4
HAM	I-64	RIP RAP RD	SETTLERS LANDING RD	EB	HRBT	256.0
PORT	MIDTOWN TUNNEL	MLK FWY/WESTERN FREEWAY	NORFOLK CL	NB	MT	253.3
CHES	I-64	MILITARY HWY	I-264&664	WB	I-64 CHES	234.9
PORT	I-264	FUTURE MLK FWY	DES MOINES AVE	EB	DT	232.4
PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	NORFOLK CL	EB	DT	214.4
PORT	I-264	FREDERICK BLVD	FUTURE MLK FWY	EB	DT	205.1
PORT	WESTERN FWY	WEST NORFOLK RD	MLK FREEWAY/MIDTOWN TUNNEL	EB	MT	196.4
VB	I-64	NORFOLK CL	INDIAN RIVER RD	WB	I-64/I-264	187.6
HAM	I-64/HRBT	MALLORY ST	NORFOLK CL	EB	HRBT	182.2
NOR	MIDTOWN TUNNEL	PORTSMOUTH CL	BRAMBLETON AVE	NB	MT	157.3
NOR	I-64	NORTHAMPTON BLVD	I-264	WB	I-64/I-564	153.9
PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	NORFOLK CL	WB	DT	151.0
YC	GEORGE WASHINGTON HWY	HAMPTON HWY (RTE 134)	DARE RD	SB	US17 YC	132.4
NOR	I-264/BERKLEY BRIDGE	I-464	WATERSIDE/CITY HALL/TIDEWATER	WB	DT	129.4
NOR	I-564	FUTURE INTERMODAL CONNECTOR	INTERNATIONAL TERMINAL BLVD	NB	I-64/I-564	124.7
HAM	I-64	SETTLERS LANDING RD	MALLORY ST	EB	HRBT	123.7
NOR	I-264/DOWNTOWN TUNNEL	PORTSMOUTH CL	I-464	EB	DT	119.1
NOR	I-64	I-264	VA BEACH CL	WB	I-64/I-264	111.1
CHES	MILITARY HWY/GILMERTON BRIDGE	CANAL DR	BAINBRIDGE BLVD	EB	GILM	109.1
NOR	I-264	WATERSIDE/CITY HALL/TIDEWATER	BRAMBLETON AVE	WB	DT	105.8

Table 9 – Highest Delays – AM Peak Period (2010)

Data Source: INRIX. Includes all roadway segments with a delay of 100 hours or more during the peak period.

JURISDICTION	FACILITY NAME	SEGMENT FROM	SEGMENT TO	DIR	HIGH PROFILE LOCATION	PEAK PERIOD DELAY (veh-hours)
NOR	I-264/BERKLEY BRIDGE	I-464	WATERSIDE/CITY HALL/TIDEWATER	WB	DT	797.4
NOR	I-264	WATERSIDE/CITY HALL/TIDEWATER	BRAMBLETON AVE	WB	DT	683.3
CHES	I-64	BATTLEFIELD BLVD	I-464	EB	I-64 CHES	420.8
NOR	I-64	BAY AVE	GRANBY ST	WB	HRBT	418.7
NOR	I-64	OCEAN VIEW AVE	4TH VIEW AVE	WB	HRBT	372.5
NOR	I-64	NORTHAMPTON BLVD	I-264	EB	I-64/I-264	365.3
NOR	I-64	4TH VIEW AVE	BAY AVE	WB	HRBT	358.1
HAM	I-64/HRBT	MALLORY ST	NORFOLK CL	WB	HRBT	337.4
PORT	MIDTOWN TUNNEL	MLK FWY/WESTERN FREEWAY	NORFOLK CL	SB	MT	284.5
YC	GEORGE WASHINGTON HWY	HAMPTON HWY (RTE 134)	DARE RD	NB	US17 YC	282.1
CHES	I-64	GREENBRIER PKWY	BATTLEFIELD BLVD	EB	I-64 CHES	281.4
PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	NORFOLK CL	WB	DT	271.6
NOR	I-64	I-564/LITTLE CREEK RD	TIDEWATER DR	EB	I-64/I-564	257.4
HAM	I-64	RIP RAP RD	SETTLERS LANDING RD	EB	HRBT	244.4
HAM	I-64/HRBT	MALLORY ST	NORFOLK CL	EB	HRBT	244.0
CHES	I-64	I-464	GEORGE WASHINGTON HWY	EB	I-64 CHES	243.1
VB	I-264	NEWTOWN RD/ECL NORFOLK	WITCHDUCK RD	EB	I-64/I-264	234.1
VB	INDIAN RIVER RD	I-64	CENTERVILLE TNPK	EB	-	191.8
CHES	BATTLEFIELD BLVD	GREAT BRIDGE BYPASS	VOLVO PKWY	SB	-	179.0
VB	INDEPENDENCE BLVD	HAYGOOD RD	NORTHAMPTON BLVD	SB	-	178.3
NOR	MIDTOWN TUNNEL	PORTSMOUTH CL	BRAMBLETON AVE	SB	MT	176.7
CHES	MILITARY HWY	BAINBRIDGE BLVD	I-464	WB	GILM	173.7
VB	SHORE DRIVE	NORTHAMPTON BLVD	GREAT NECK RD	EB	-	172.5
NN	I-64	YORKTOWN RD	FORT EUSTIS BLVD	EB	I-64 NN	169.5
NOR	BRAMBLETON AVE	HAMPTON BLVD	COLLEGE AVE	WB	MT	169.1
PORT	I-264/DOWNTOWN TUNNEL	EFFINGHAM ST	NORFOLK CL	EB	DT	162.9
NOR	HAMPTON BLVD	PRINCESS ANNE RD	21ST ST	SB	MT	159.4
YC	GEORGE WASHINGTON HWY	HAMPTON HWY (RTE 134)	DARE RD	SB	US17 YC	156.6
CHES	BATTLEFIELD BLVD	CEDAR RD	GREAT BRIDGE BLVD/KEMPSVILLE RD	SB	-	154.9
NN	OYSTER POINT RD	WARWICK BLVD	JEFFERSON AVE	WB	-	152.5
NOR	I-264/DOWNTOWN TUNNEL	PORTSMOUTH CL	I-464	WB	DT	150.9

Table 10 – Highest Delays – PM Peak Period (2010)

Data Source: INRIX. Includes all roadway segments with a delay of 150 hours or more during the peak period.

Military Highway approaching the Gilmerton Bridge, and Battlefield Boulevard.

Another interesting concept that can be analyzed with the Regional Travel Time Database is comparing the amount of delay on the roadway network with the amount of travel by time of day. **Figure 4** shows the amount of travel and delay by 15-minute period for those roadways on the regional Travel Time Network between 5:30 am and 8:00 pm.

Throughout the AM Peak Period, the amount of delay largely parallels the amount of travel on the roadway network. Both increase at nearly the same rate until reaching their maximums at 7:30 am. Afterward, the amount of travel and delay decreases at nearly the same rate until the AM Peak Period ends at 9:00 am.

In the middle of the day, the volumes and delay also closely parallel each other. As the PM Peak Period begins at 3:00 pm, however, delay increases at a much faster pace than the volumes increase. Between the start of the PM Peak Period and the time when delays reach their maximum (5:00 pm), the volumes on the regional Travel Time Network increase 19.8%. During this same period, delays increase 64.8%. Soon after this peak, however, delays drop precipitously. Between 5:00 pm and the end of the PM Peak Period at 7:00 pm, delays decrease 70.4%, whereas volumes decrease 41.3%.

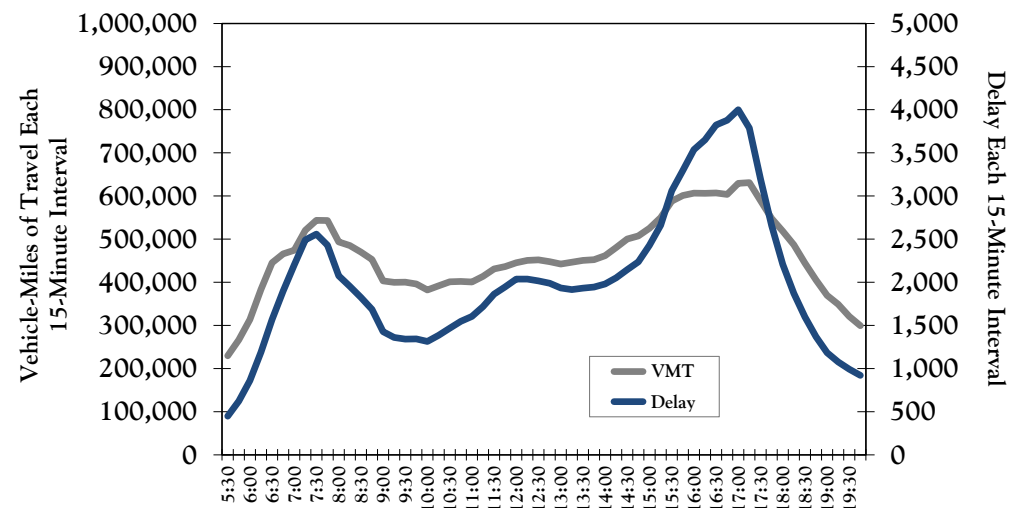


Figure 4 – Vehicle-Miles of Travel and Delay on the Regional Travel Time Network

Data Sources: INRIX, VDOT, various localities.

High Profile Locations

Previous sections of this report have detailed speeds, congestion levels and durations, and delays on roadways throughout the region. This section examines congestion in further detail at a number of high profile locations throughout Hampton Roads. These locations include:

- **Downtown Tunnel** - Pages 25-26
- **Midtown Tunnel** - Pages 27-28
- **Hampton Roads Bridge-Tunnel** - Pages 29-30
- **Monitor-Merrimac Memorial Bridge-Tunnel** – Pages 31-32
- **I-64 in Chesapeake** - Pages 33-34
- **I-64/I-564 in Norfolk** - Pages 35-36
- **I-64/I-264 Interchange Area** - Pages 37-38
- **I-64 in Newport News** - Pages 39-40
- **Route 17 in Newport News/York County** - Pages 41-42
- **Gilmerton Bridge** – Pages 43-44

Congestion levels and durations are shown at each of these facilities during the AM Peak Period (6:00 am to 9:00 am) and PM Peak Period (3:00 pm to 7:00 pm). These congestion levels and durations are also shown on app roaches to the major bridges and tunnels, so the characteristics of backups approaching these facilities can be determined. The total peak period delays are also shown for each of these high profile locations, and are also included in **Table 11** and **Figure 5**.

It should be noted that this section details congestion at a number of high profile locations throughout the region, and not necessarily those corridors with the highest congestion levels. This will allow for comparisons of congestion levels and durations at these high profile locations as time progresses, which will become particularly important as major projects such as the Midtown Tunnel widening become a reality.

HIGH PROFILE LOCATION	AM PEAK PERIOD DELAY IN SEVERELY CONGESTED CONDITIONS (veh-hours)	PM PEAK PERIOD DELAY IN SEVERELY CONGESTED CONDITIONS (veh-hours)
DOWNTOWN TUNNEL	1,901	2,533
MIDTOWN TUNNEL	665	1,203
HAMPTON ROADS BRIDGE-TUNNEL	571	2,186
MONITOR-MERRIMAC MEM. BRIDGE-TUNNEL	-	143
I-64 (CHESAPEAKE)	528	1,223
I-64/I-564 CORRIDOR	442	782
I-64/I-264 INTERCHANGE AREA	395	1,224
I-64 (NEWPORT NEWS)	62	310
ROUTE 17 (NEWPORT NEWS/YORK)	-	696
GILMERTON BRIDGE	109	520

Table 11 – Peak Period Delays in Severely Congested Conditions - High Profile Locations (2010)

Data Source: INRIX.

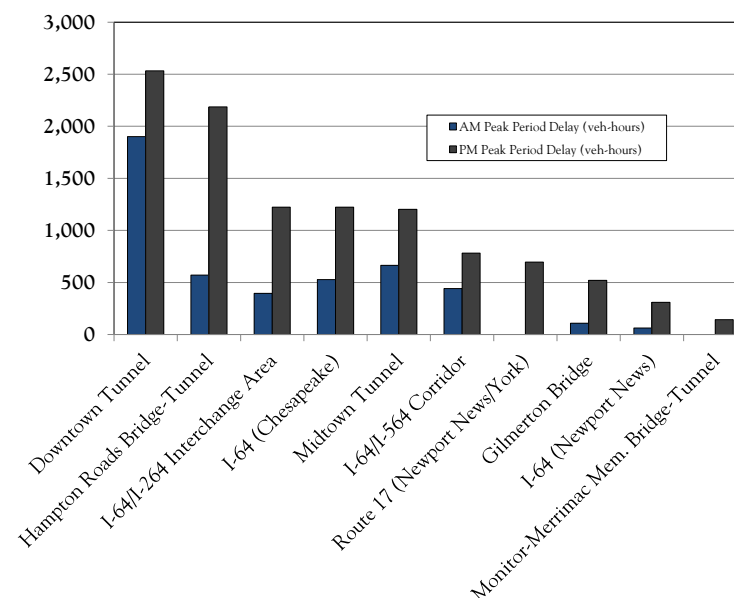
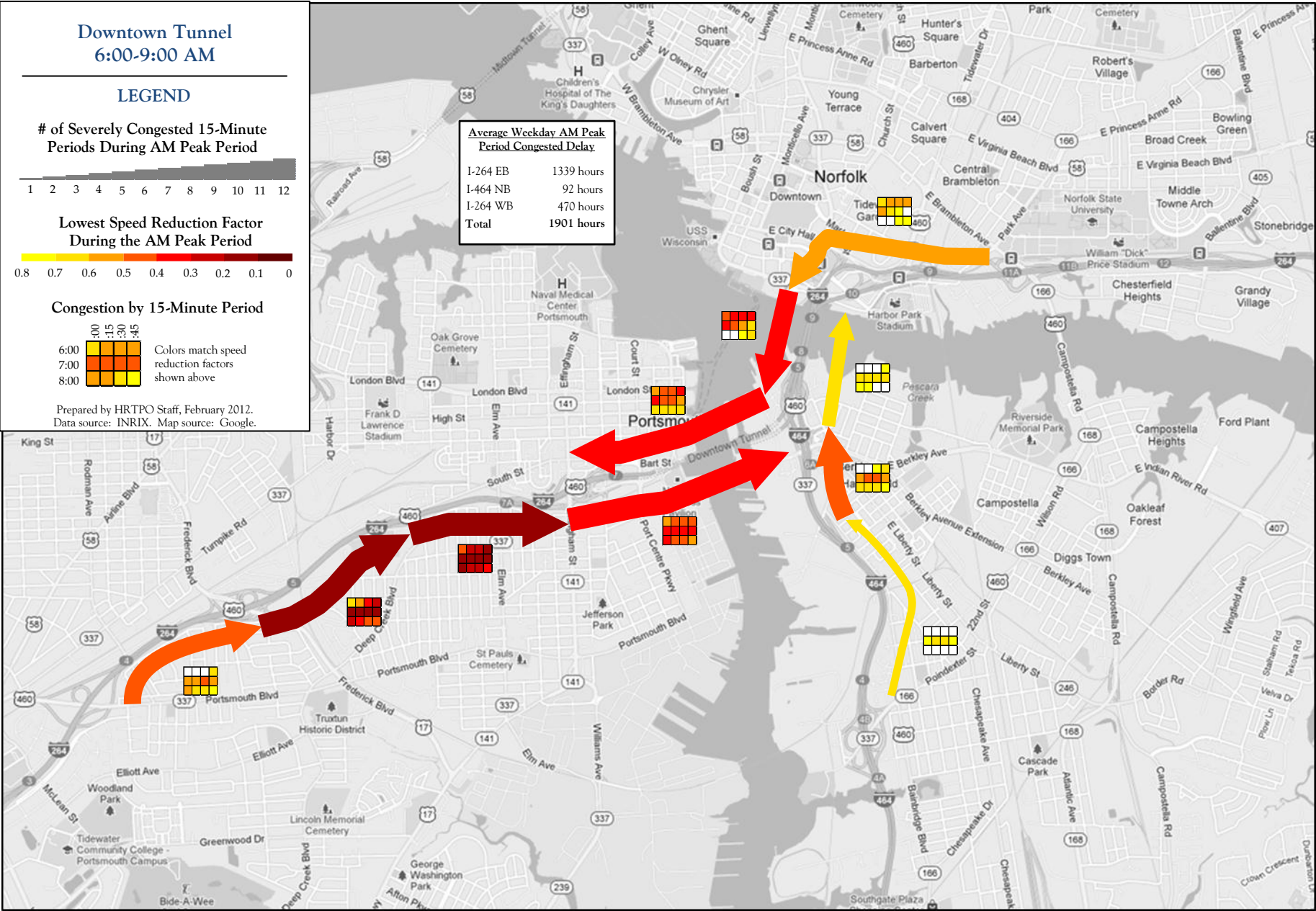
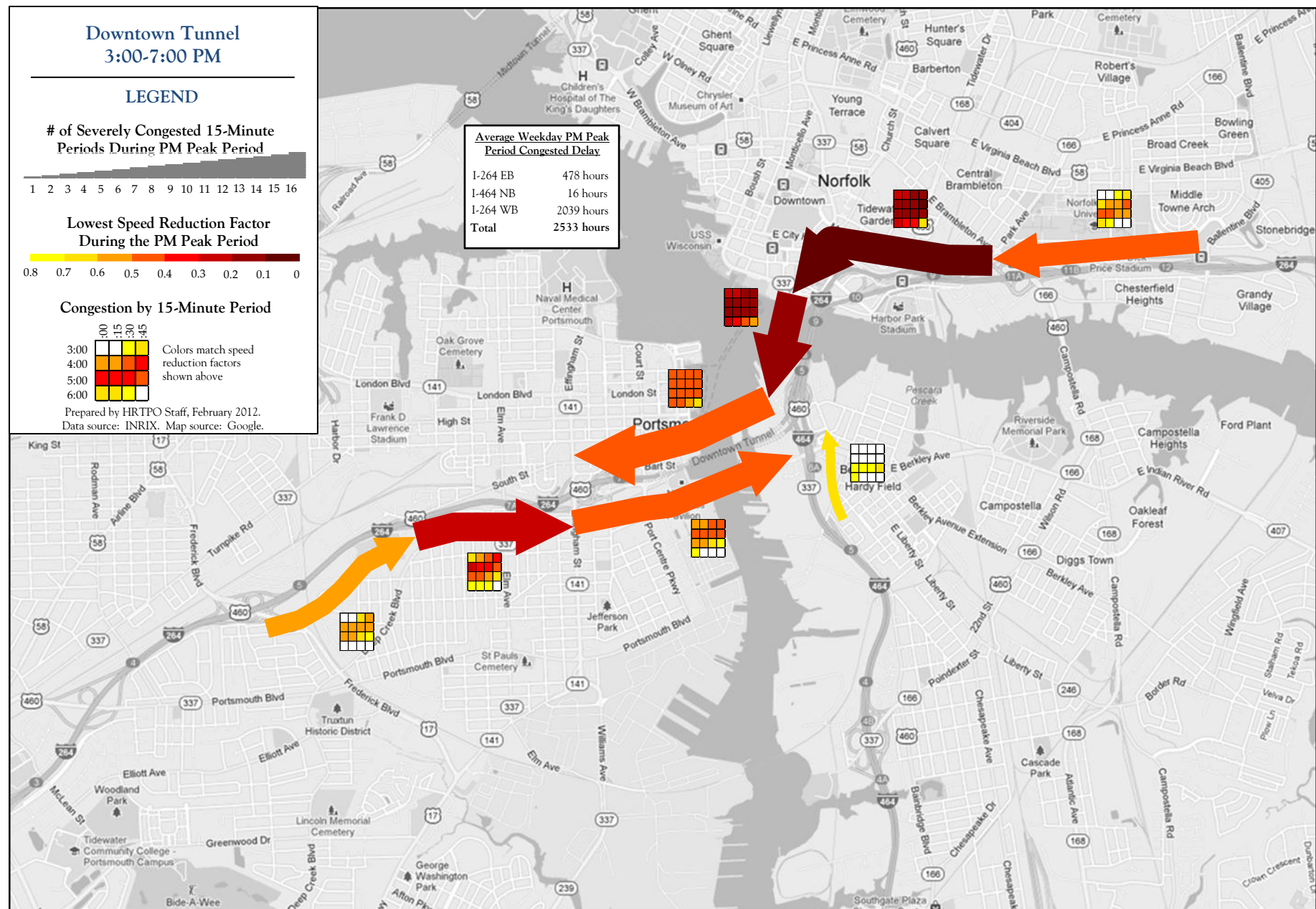
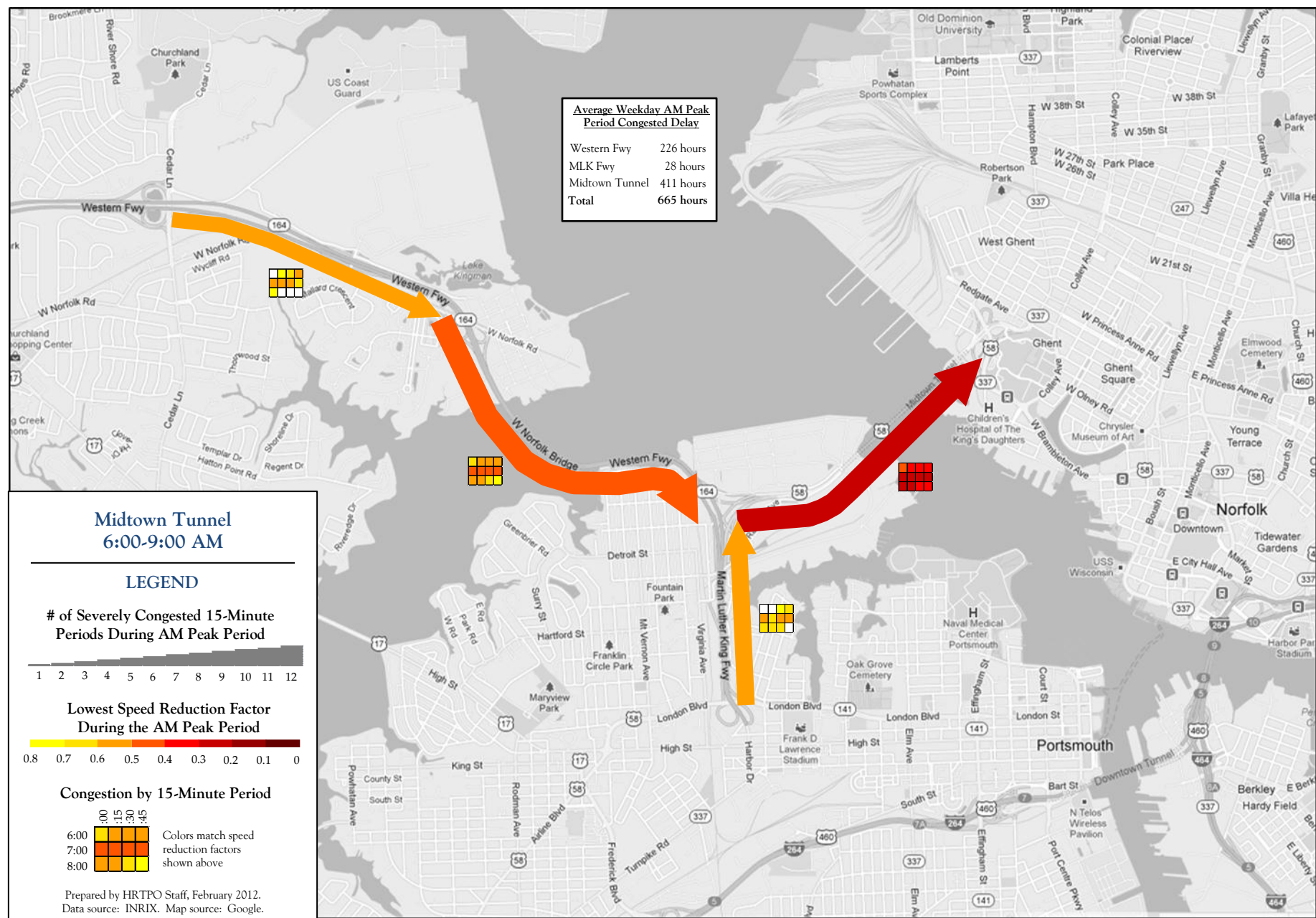


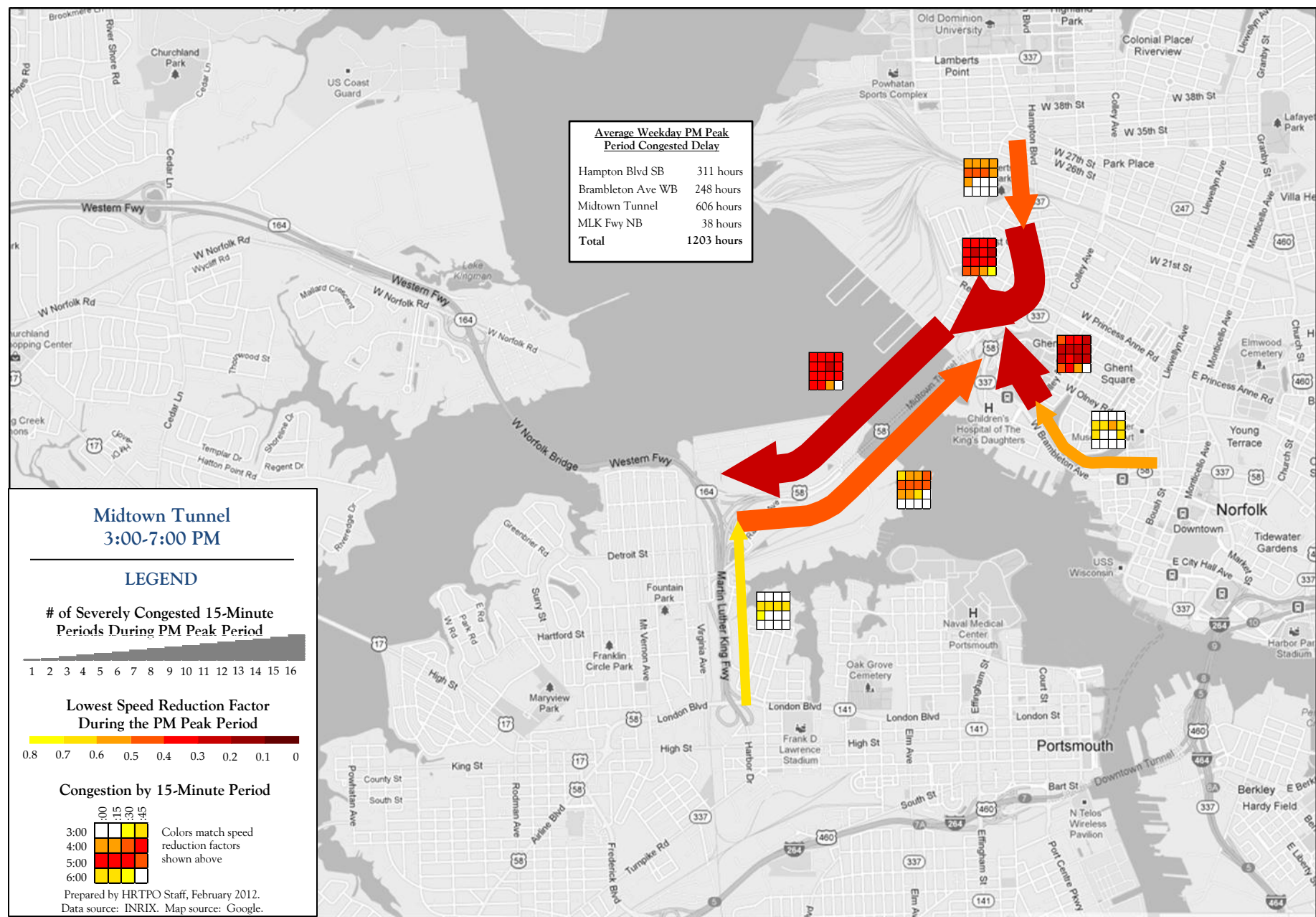
Figure 5 – Peak Period Delays in Severely Congested Conditions - High Profile Locations (2010)

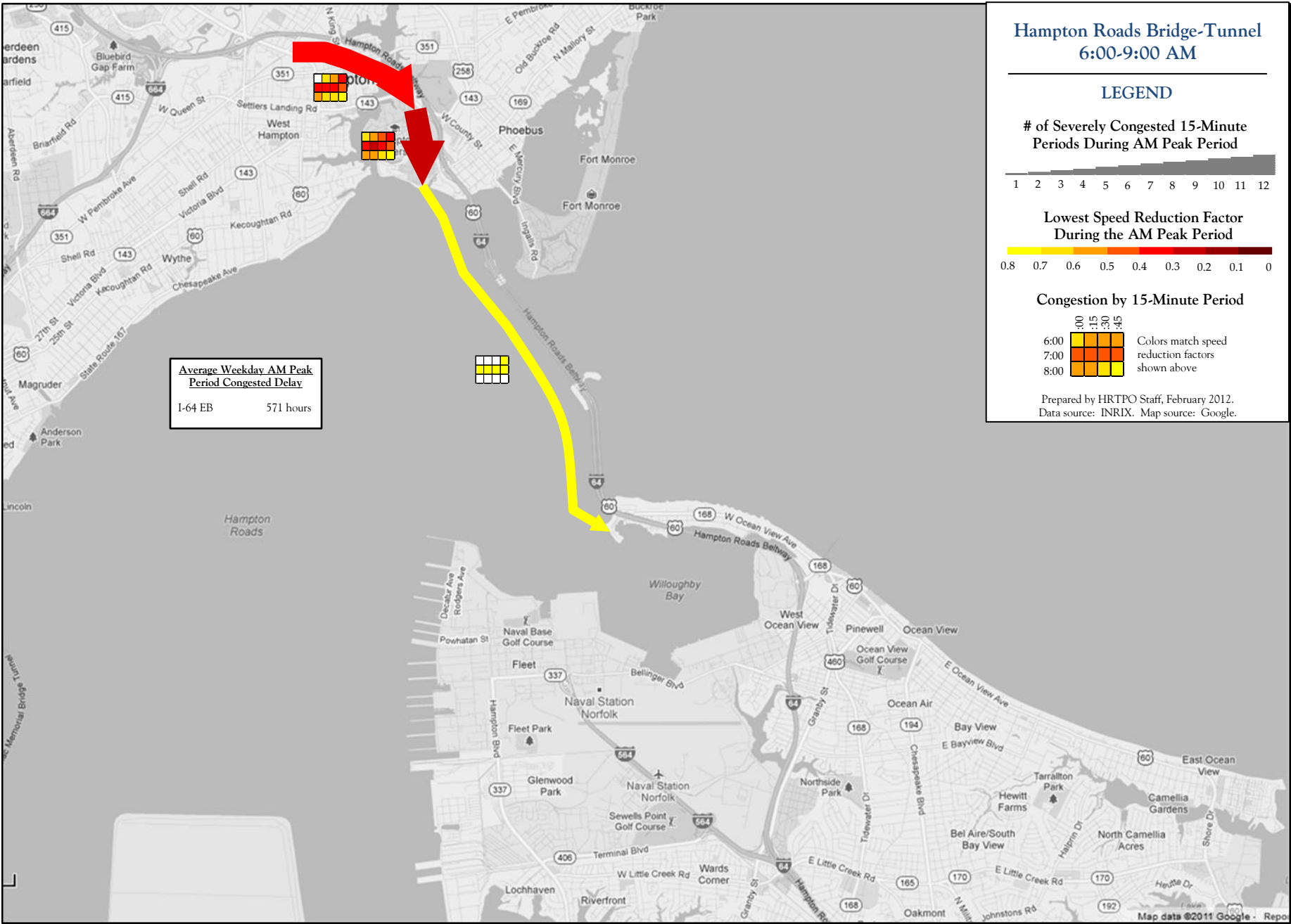
Data Source: INRIX.

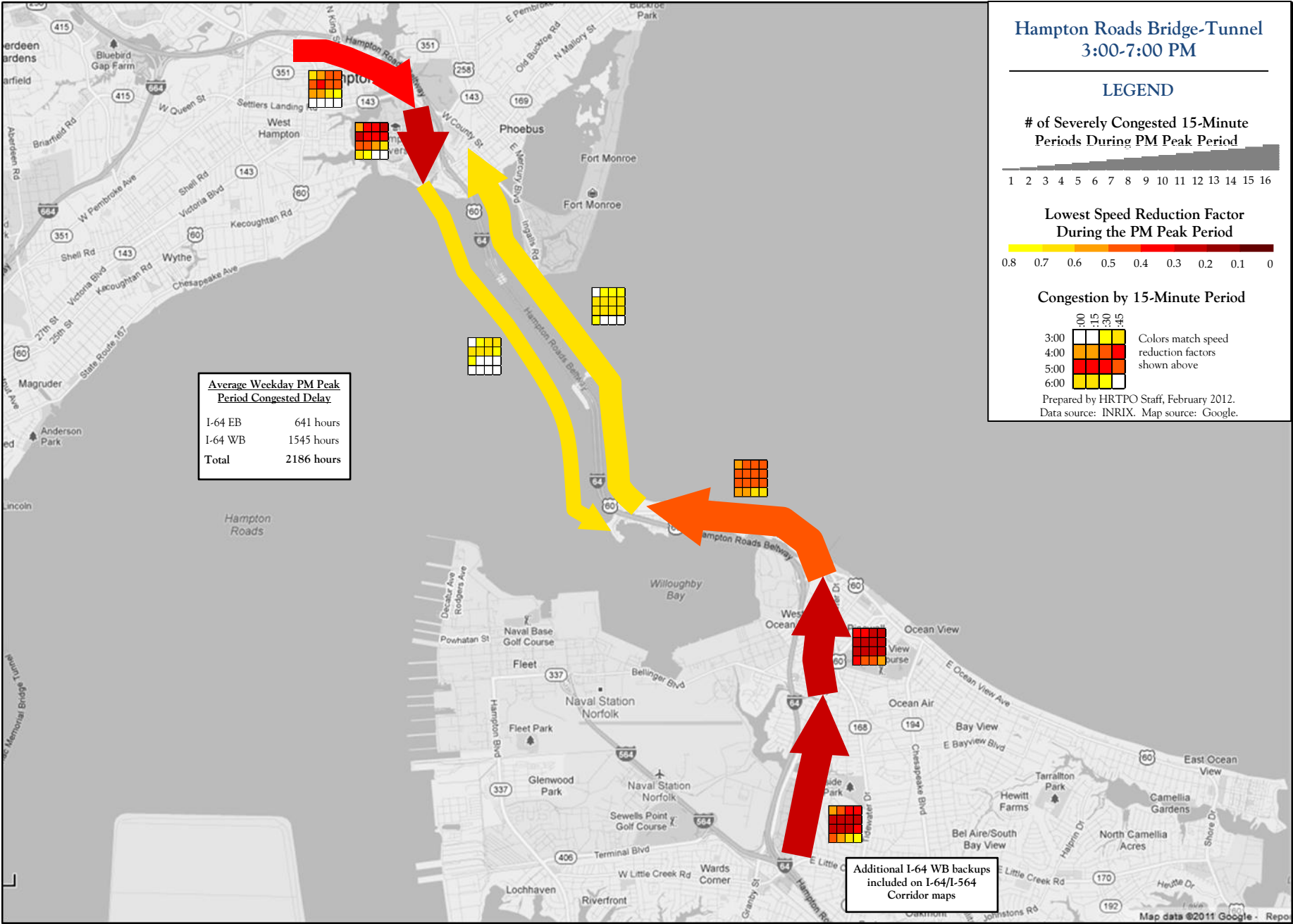


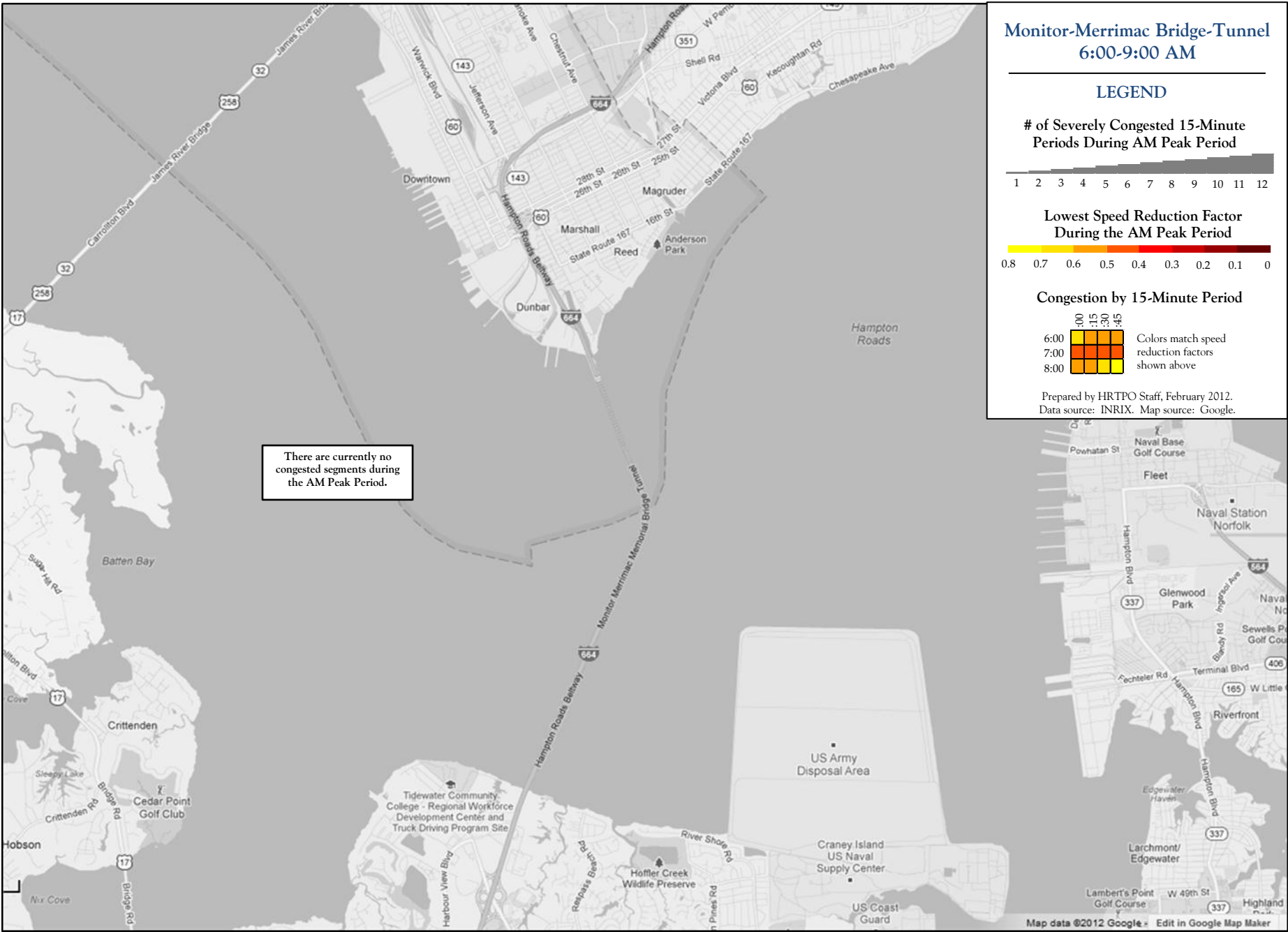


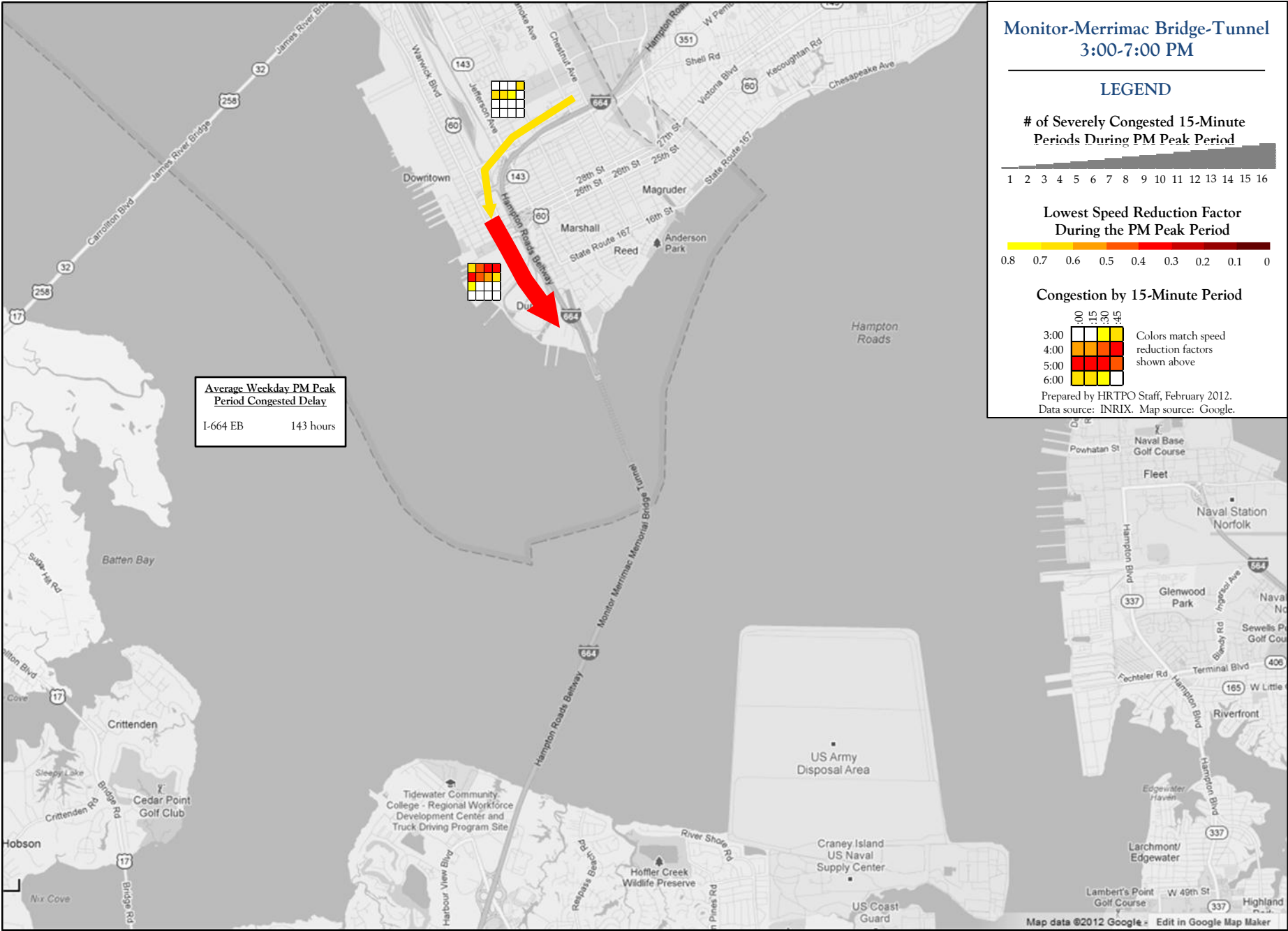


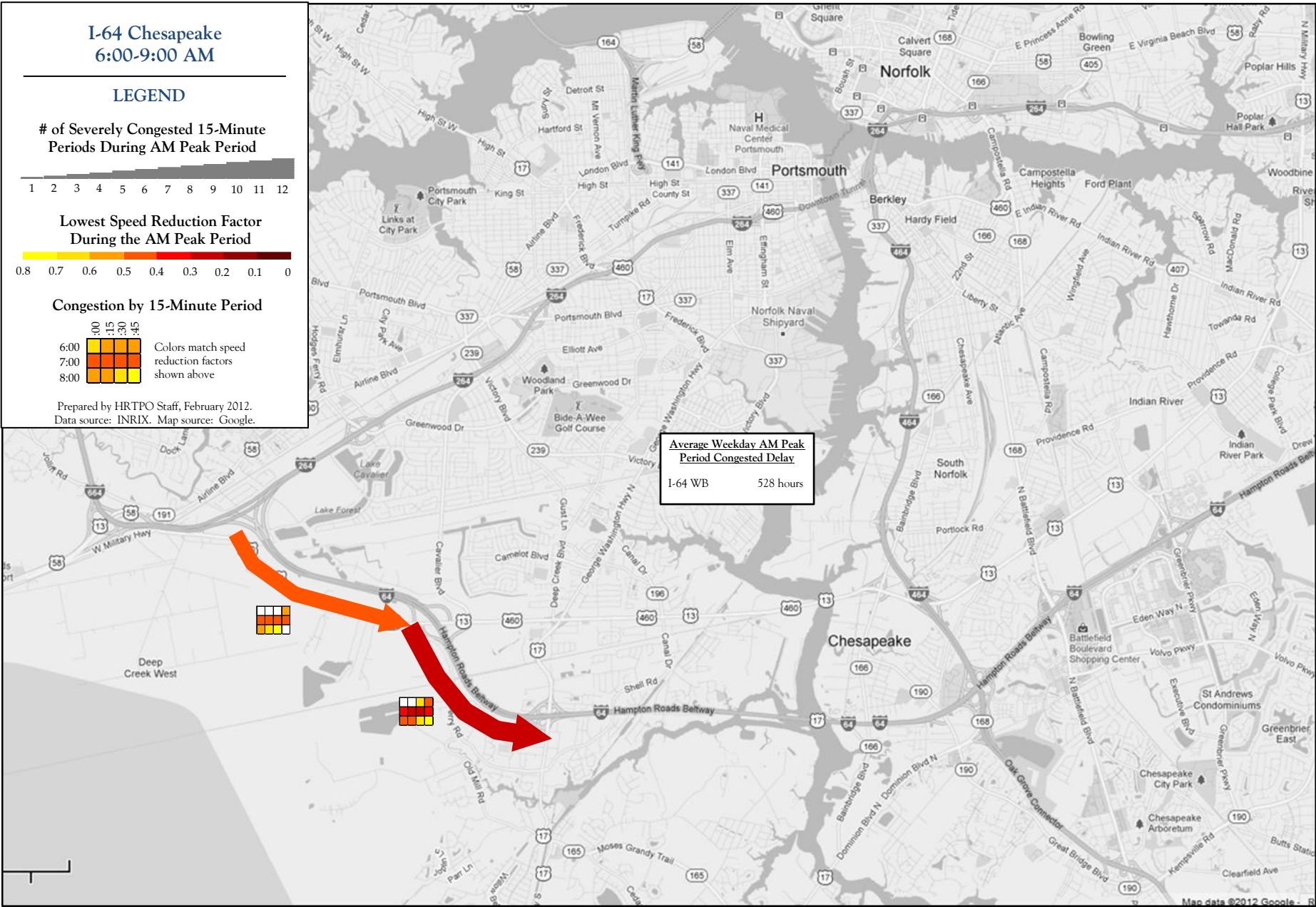


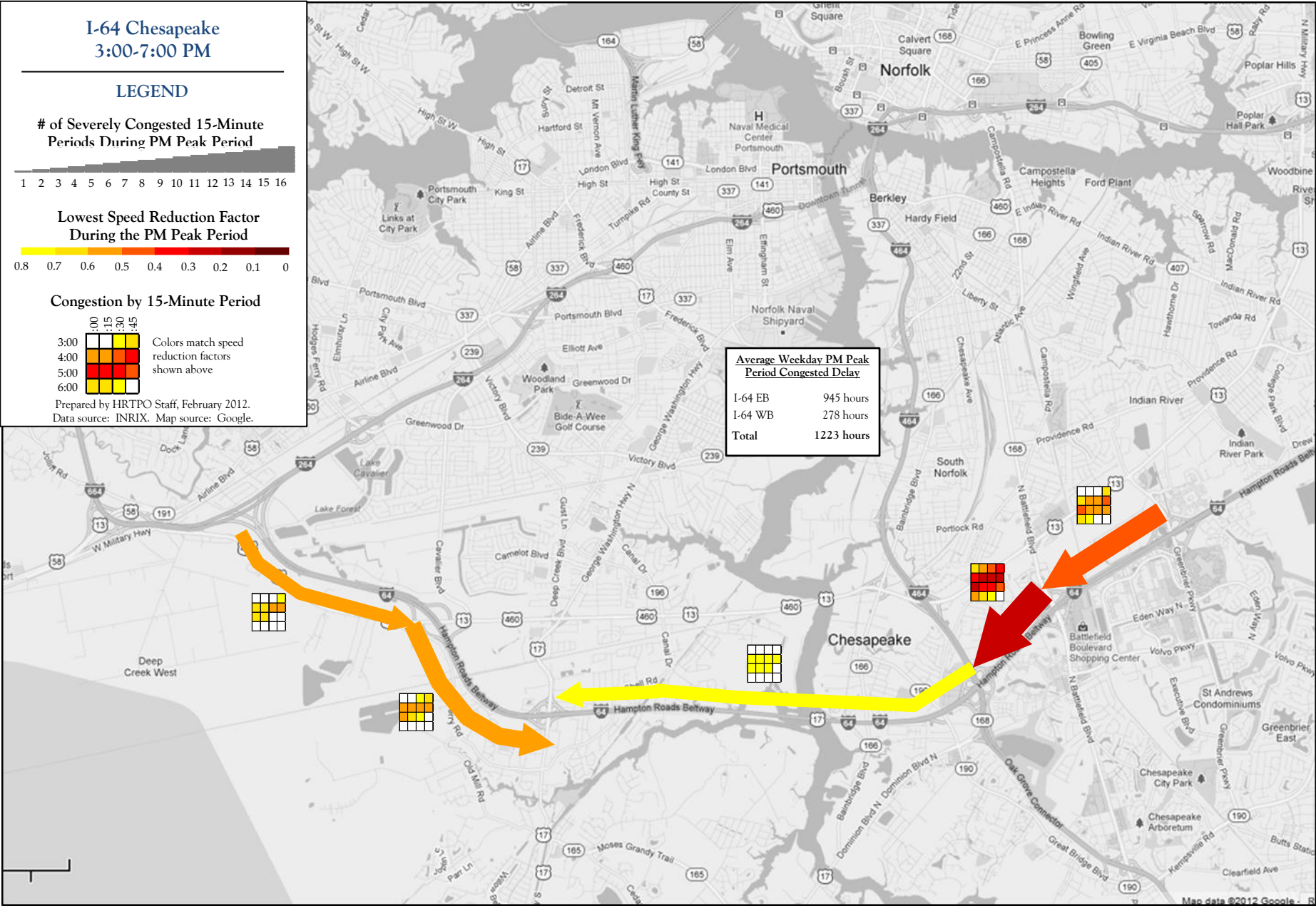


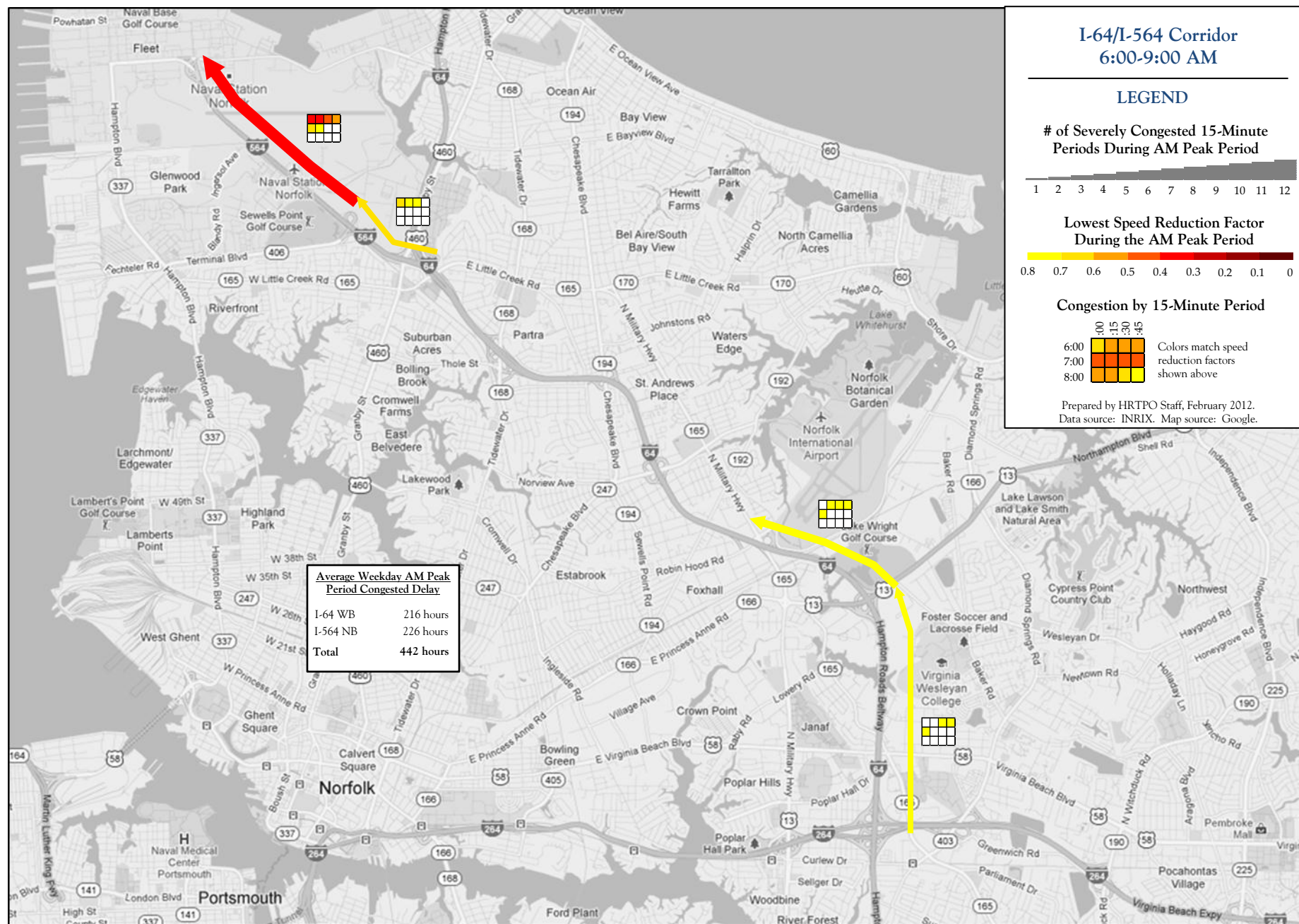


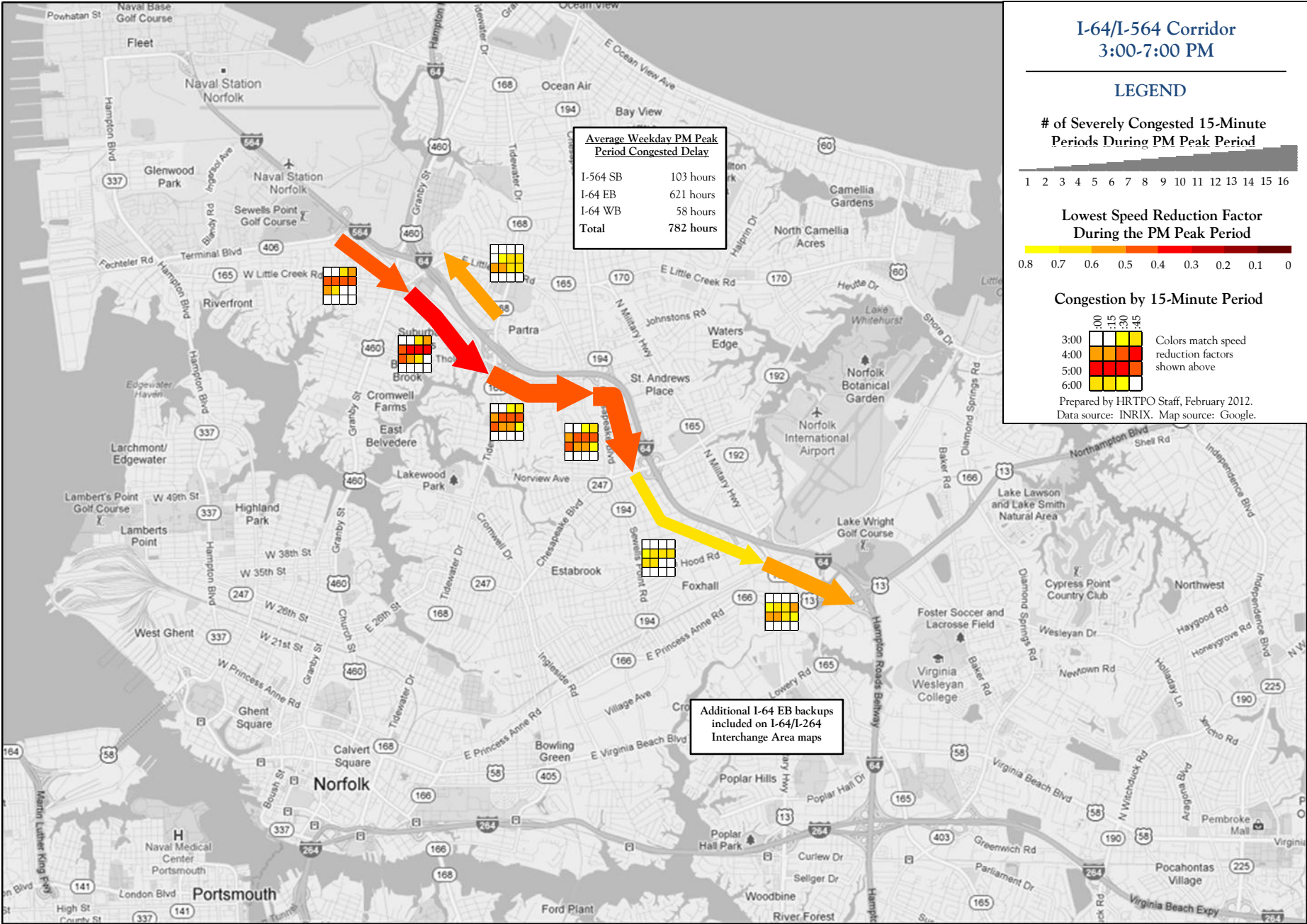


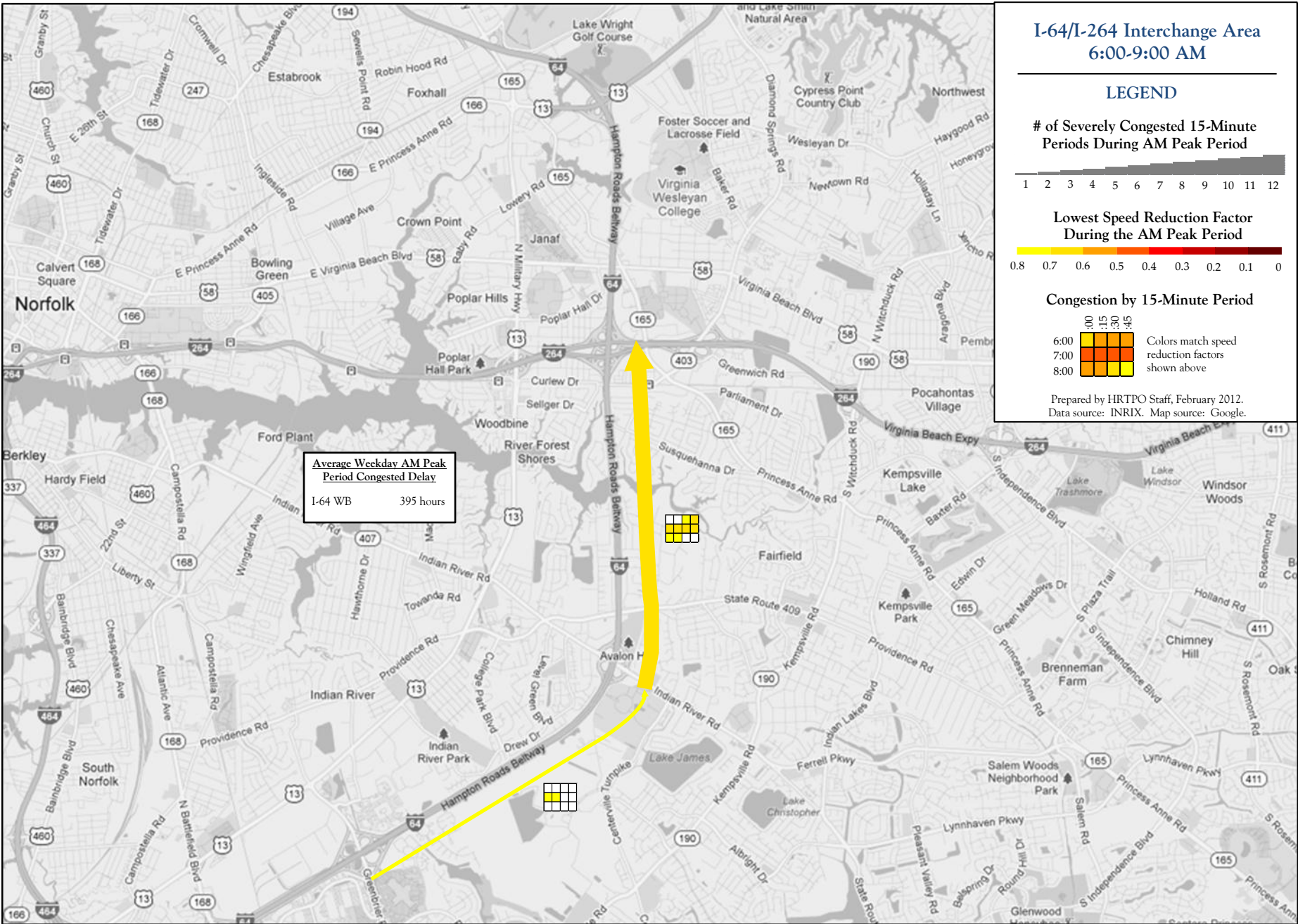


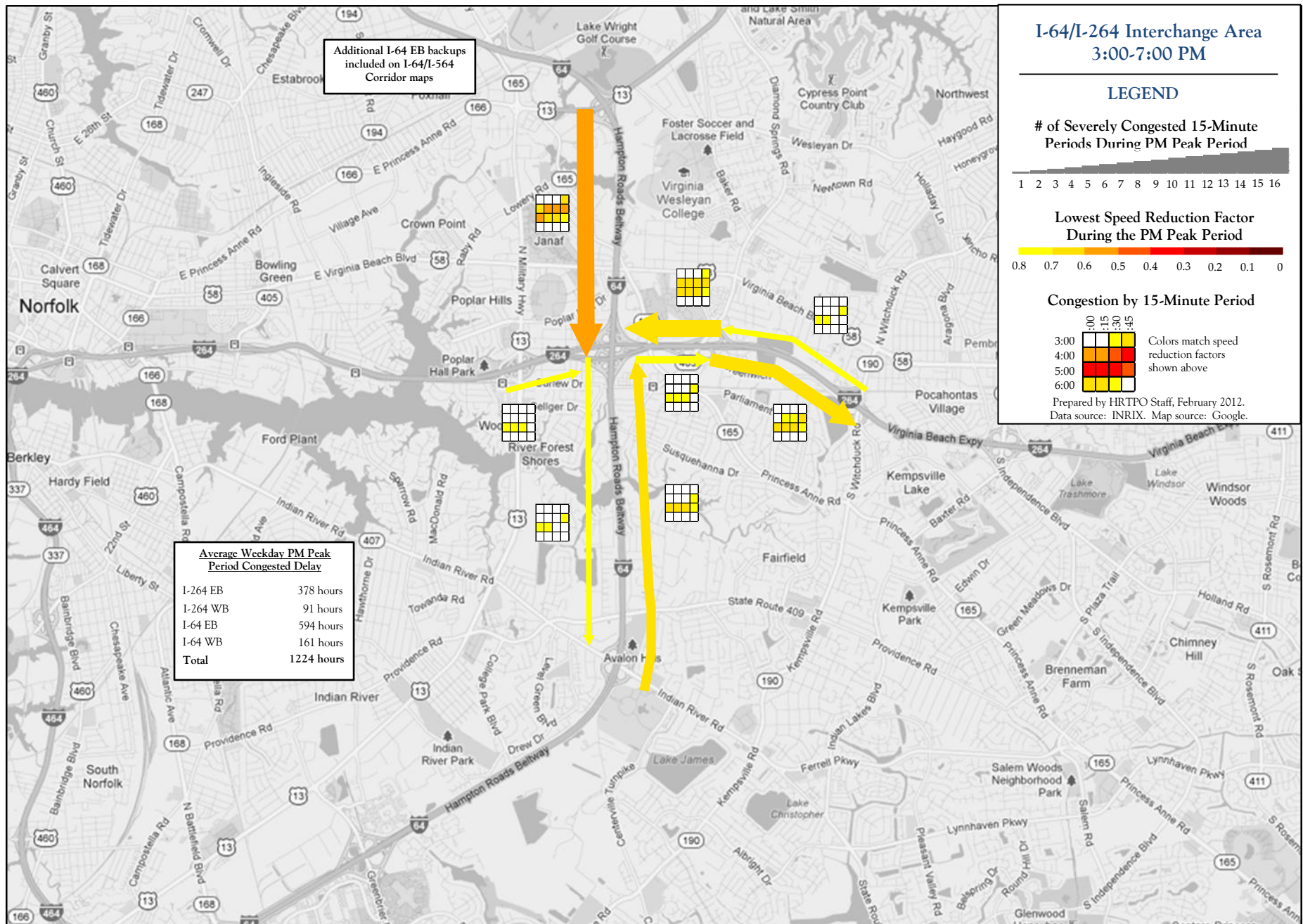




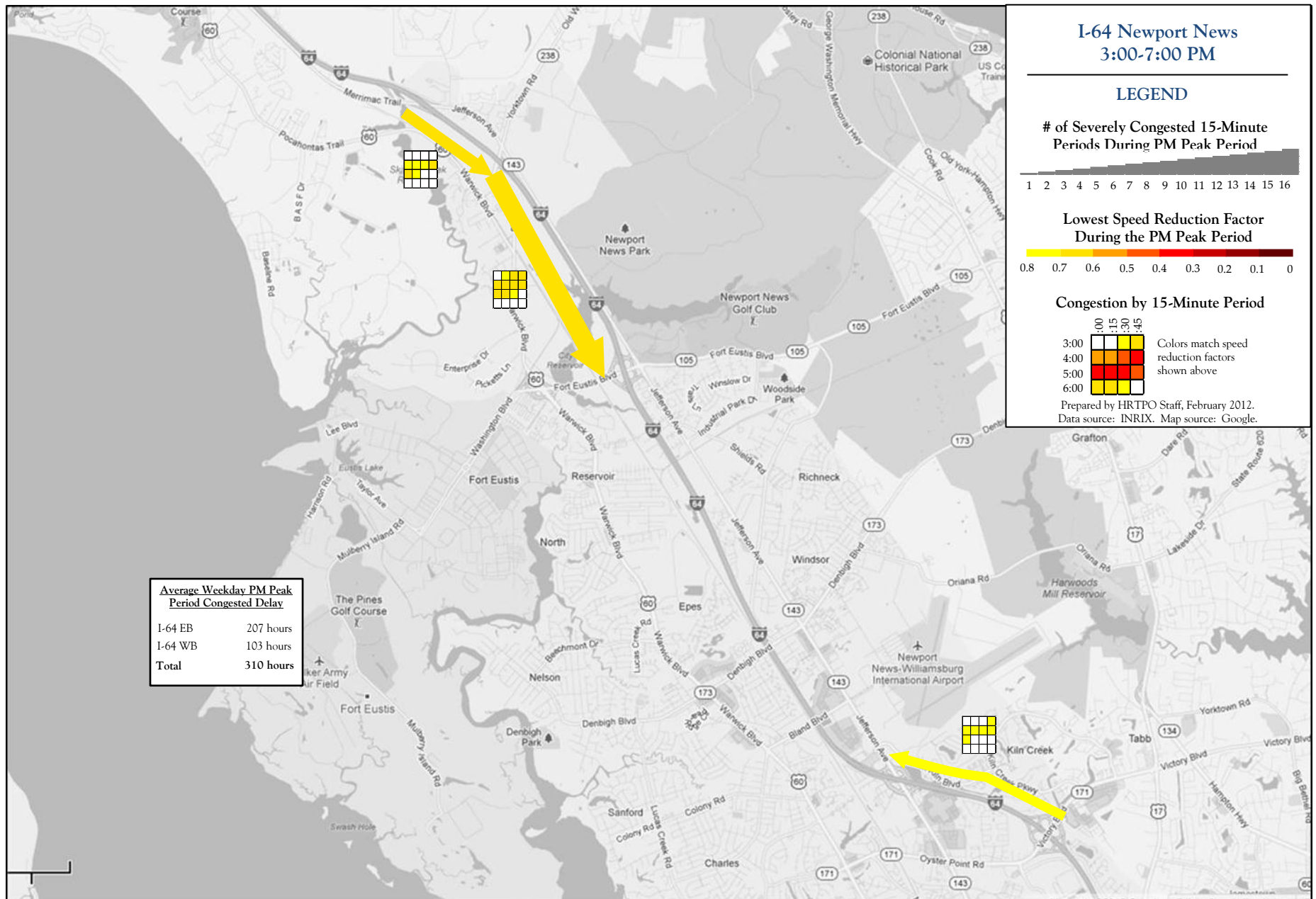


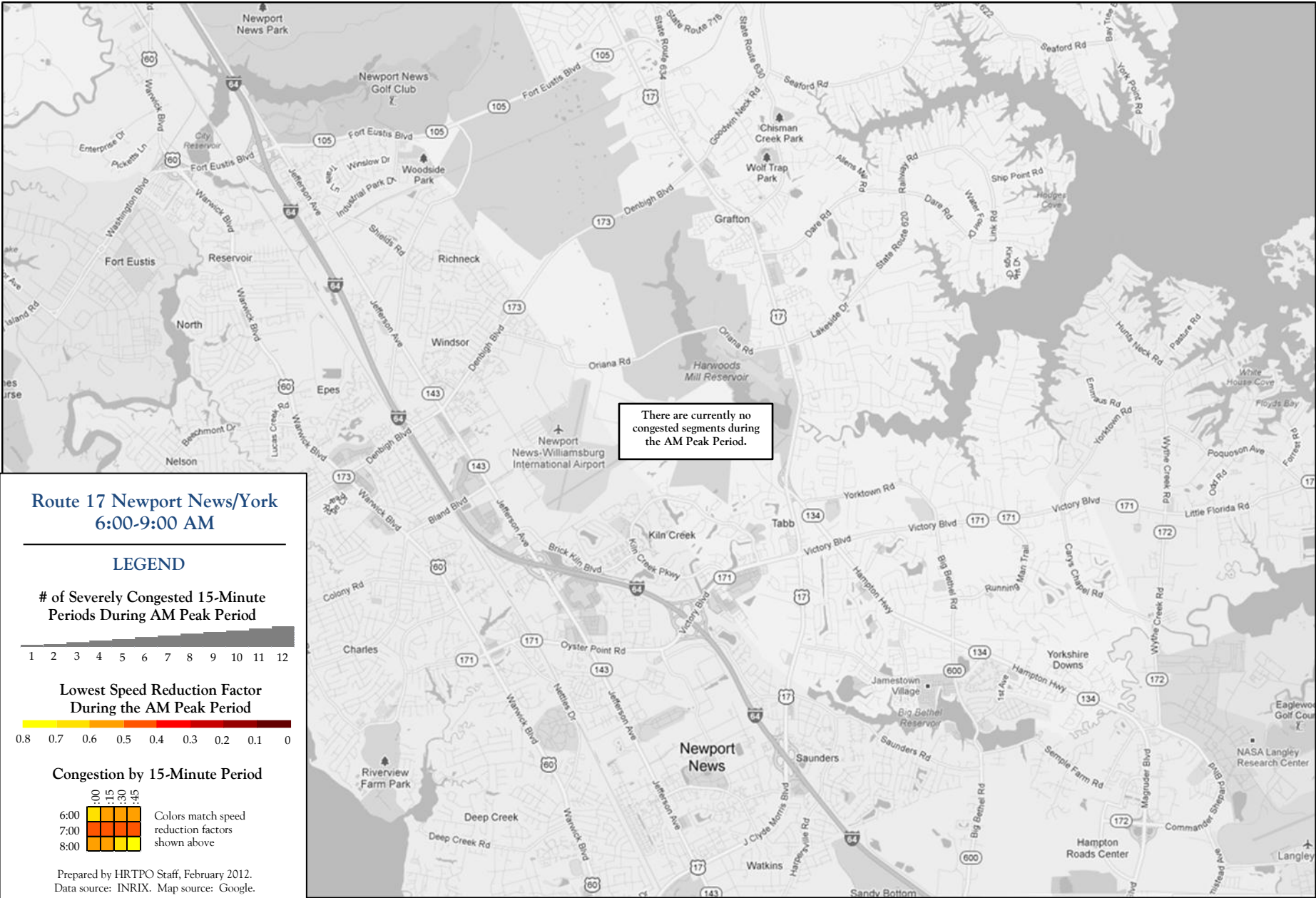


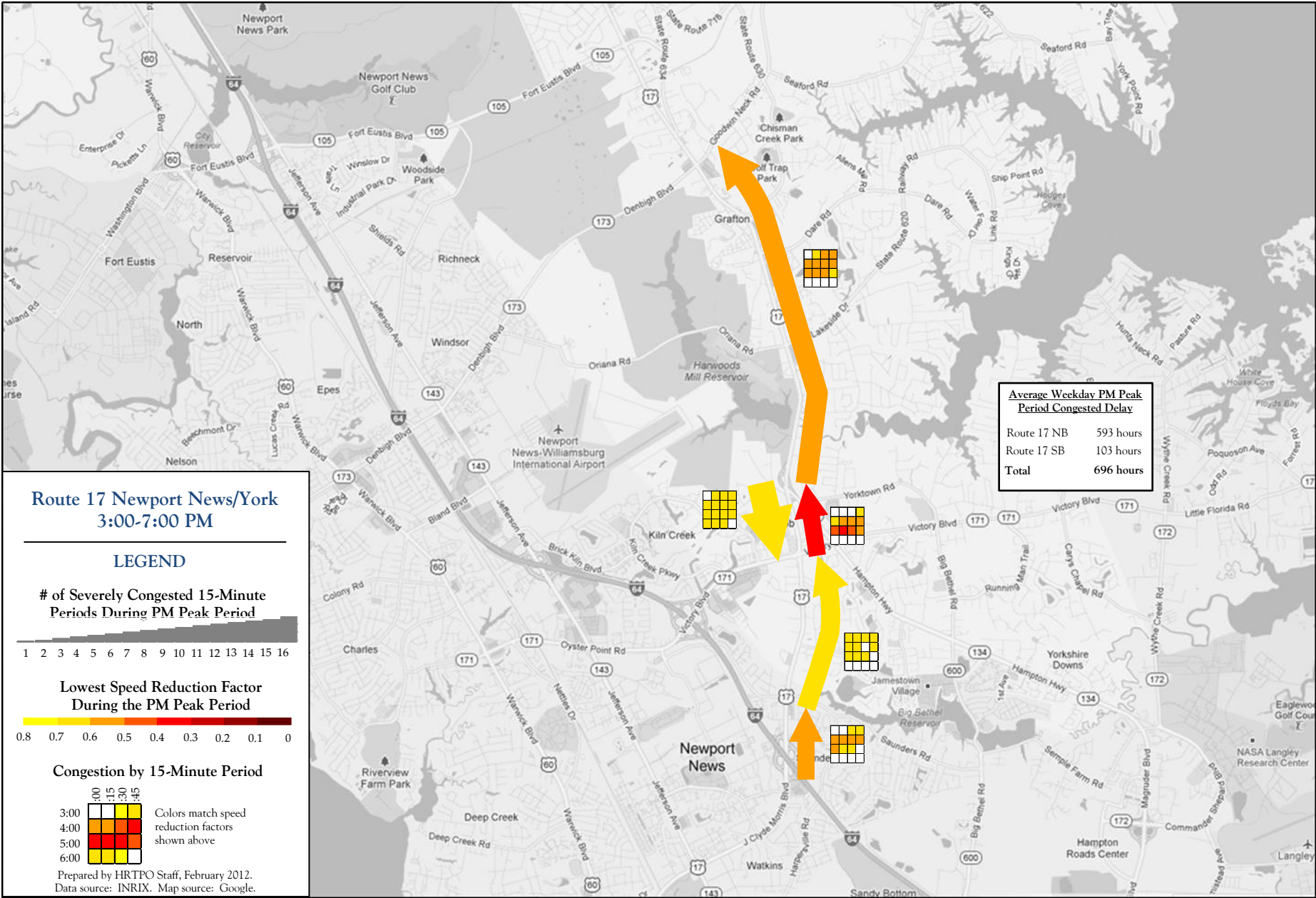


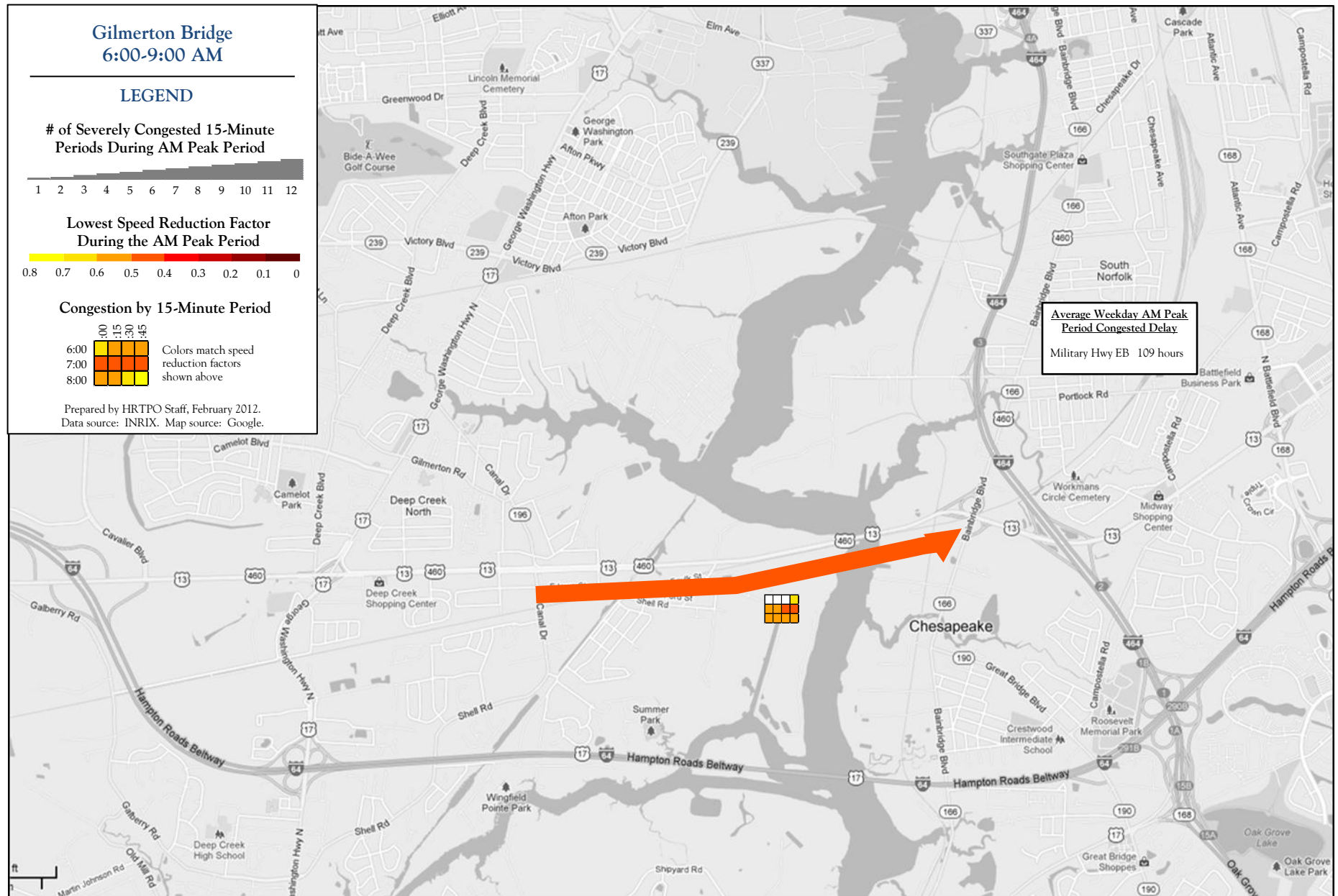


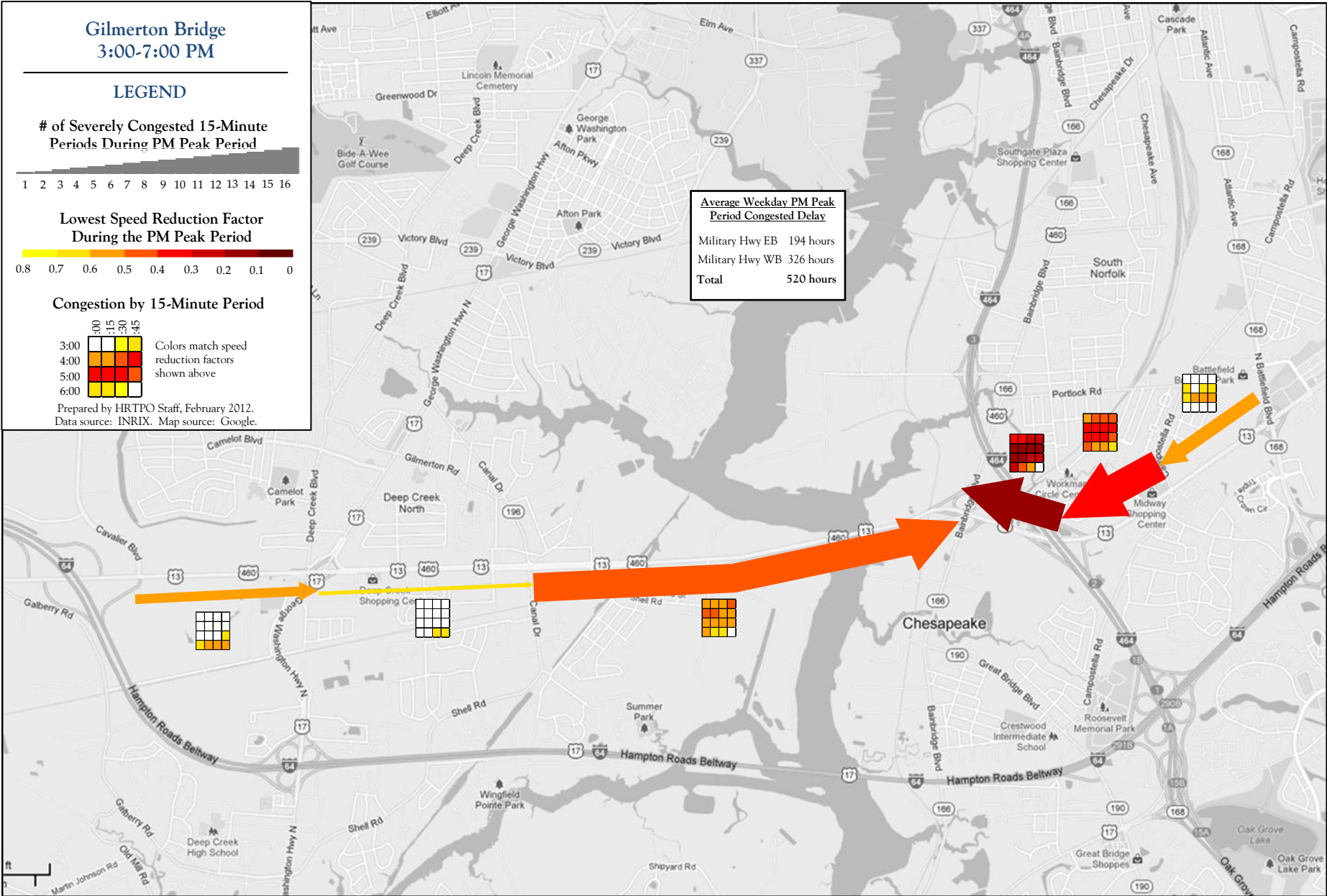












CONCLUSIONS/NEXT STEPS

INRIX's archived travel time and speed data has provided HRTPO a new and valuable tool to monitor roadway congestion throughout Hampton Roads. This data provides a means for HRTPO staff to determine roadway congestion levels based on actual travel times and speeds rather than the current method of estimating congestion levels based on traffic volumes and roadway characteristics. It also is the first time that HRTPO staff has analyzed congestion durations on a regional level. With this improved congestion data, the HRTPO can better select congestion mitigation strategies for the Congestion Management Process, and projects for inclusion in the Long Range Transportation Plan and Transportation Improvement Program.

A number of congestion-related measures were analyzed by HRTPO staff using the INRIX travel time and speed data. These measures include the speed reduction factors (which are the ratio of the actual travel speeds versus the free flow travel speeds), the number of congested 15-minute intervals, and total segment delays. Based on the analysis, a number of locations throughout the region ranked high on all of these measures. These locations, not surprisingly, include the approaches to the Downtown Tunnel, Midtown Tunnel, Hampton Roads Bridge-Tunnel, and High Rise Bridge, among others.

This report is only the first step in the usage of this new valuable data source. HRTPO is planning a number of future efforts using this travel time and speed data, including:

- **Further incorporate into planning efforts** – HRTPO staff will further incorporate this travel time and speed data into the Congestion Management Process and other HRTPO transportation planning efforts. Future iterations of the Congestion Management Process will use this data to determine congestion levels on Travel Time Network roadways. HRTPO will also use this data to assist with the project selection process for the Long Range Transportation Plan and Transportation Improvement Program. This data can also be used in other

transportation planning efforts conducted by the HRTPO, such as corridor and subarea studies.

- **Analyze 5-minute data** - As mentioned previously, VDOT purchased two sets of 2010 archived data collected by INRIX. For this report, HRTPO only analyzed the 15-minute dataset, which includes the average travel time and speeds by day of week and time of day. In the future HRTPO staff will analyze the 5-minute data to determine the reliability of travel times. This data includes all of the travel time and speed data from 2010 in 5-minute intervals. However, this data only covers the freeway system and select principal arterials, which is a much smaller network than the 15-minute data covers.
- **Analyze future data** – HRTPO staff will continue to analyze the travel time and speed data collected by INRIX as it becomes available and produce reports similar to this study. Future data will also allow HRTPO staff to monitor how congestion changes through the years both throughout the region and at the high profile locations, especially as major construction projects such as the Midtown Tunnel widening occur.

PUBLIC REVIEW AND COMMENTS

As part of the Hampton Roads Transportation Planning Organization’s (HRTPO) efforts to provide opportunities for the public to review and comment on this draft report prior to the final product being published, a two-week public comment period was provided. The public review period for the draft version of this study was conducted from March 7, 2012, through March 21, 2012. No public comments were received.

APPENDIX

Appendix A – 2010 Peak Period Speeds, Delay, and Congestion..... 47

Appendix B – 2010 Peak Hour Congestion by Roadway Segment 66

Appendix C – 2010 Northbound/Eastbound Congestion by Roadway Segment..... 87

Appendix D – 2010 Southbound/Westbound Congestion by Roadway Segment 106

Appendix B – 2010 Peak Hour Congestion by Roadway Segment (Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of Inrix data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a " are one-way roadways.

Appendix B – 2010 Peak Hour Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of Inrix data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a '/' are one-way roadways.

Appendix B – 2010 Peak Hour Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of Inrix data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a "J" are one-way roadways.

Appendix B – 2010 Peak Hour Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of Inrix data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a '/' are one-way roadways.

Appendix B – 2010 Peak Hour Congestion by Roadway Segment (Non-Interstates)

[illegible]

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Appendix B – 2010 Peak Hour Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of Inrix data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a " are one-way roadways.

Appendix B – 2010 Peak Hour Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of Inrix data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a '/' are one-way roadways.

Appendix C – 2010 Northbound/Eastbound Congestion by Roadway Segment (Interstates)

JURIS	FACILITY NAME	SEGMENT FROM	SEGMENT TO	ROAD DIR	NORTHBOUND/EASTBOUND																											
					AM CONGESTION																PM CONGESTION											
JURIS	FACILITY NAME	SEGMENT FROM	SEGMENT TO	ROAD DIR	5:30 5:45	6:00 6:15	6:30 6:45	7:00 7:15	7:45 8:15	8:30 8:45	9:00 9:15	9:30 9:45	10:00 10:15	10:30 10:45	11:00 11:15	11:30 11:45	12:00 12:15	12:30 12:45	13:00 13:15	13:30 13:45	14:00 14:15	14:30 14:45	15:00 15:15	15:30 15:45	16:00 16:15	16:30 16:45	17:00 17:15	17:30 17:45	18:00 18:15	18:30 18:45	19:00 19:15	19:30 19:45
JCC	I-64	NEW KENT CL	RTE 30	EW																												
JCC	I-64	RTE 30	CROAKER RD (RTE 607)	EW																												
JCC	I-64	CROAKER RD (RTE 607)	YORK CL	EW																												
YC	I-64	JAMES CITY CL	RTE 199/646	EW																												
YC	I-64	RTE 199/646	RTE 143	EW																												
YC	I-64	RTE 143	RTE 199 (EAST OF WILLIAMSBURG)	EW																												
YC	I-64	RTE 199 (EAST OF WILLIAMSBURG)	GROVE CONNECTOR	EW																												
YC	I-64	GROVE CONNECTOR	JAMES CITY CL	EW																												
JCC	I-64	YORK CL	NEWPORT NEWS CL	EW																												
NN	I-64	JAMES CITY CL	RTE 143 (NORTH)	EW																												
NN	I-64	RTE 143 (NORTH)	YORKTOWN RD	EW																												
NN	I-64	YORKTOWN RD	FORT EUSTIS BLVD	EW																												
NN	I-64	FORT EUSTIS BLVD	JEFFERSON AVE	EW																												
NN	I-64	JEFFERSON AVE	OYSTER POINT RD	EW																												
NN	I-64	OYSTER POINT RD	J C MORRIS BLVD	EW																												
NN	I-64	J C MORRIS BLVD	HAMPTON CL	EW																												
HAM	I-64	NEWPORT NEWS CL	HRC PARKWAY	EW																												
HAM	I-64	HRC PARKWAY	MAGRUDER BLVD	EW																												
HAM	I-64	MAGRUDER BLVD	MERCURY BLVD	EW																												
HAM	I-64	MERCURY BLVD	I-664	EW																												
HAM	I-64	I-664	ARMISTEAD AVE	EW																												
HAM	I-64	ARMISTEAD AVE	RIP RAP RD	EW																												
HAM	I-64	RIP RAP RD	SETTLERS LANDING RD</																													

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a " " are one-way roadways.

Appendix C – 2010 Northbound/Eastbound Congestion by Roadway Segment (Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a “/” are one-way roadways.

Appendix C – 2010 Northbound/Eastbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a " " are one-way roadways.

Appendix C – 2010 Northbound/Eastbound Congestion by Roadway Segment (Non-Interstates)

				ROAD DIR	NORTHBOUND/EASTBOUND																												
					AM CONGESTION																			PM CONGESTION									
JURIS	FACILITY NAME	SEGMENT FROM	SEGMENT TO		5:30 5:45	6:00 6:15	6:30 6:45	7:00 7:15	7:30 7:45	8:00 8:15	8:30 8:45	9:00 9:15	9:30 9:45	10:00 10:15	10:30 10:45	11:00 11:15	11:30 11:45	12:00 12:15	12:30 12:45	13:00 13:15	13:30 13:45	14:00 14:15	14:30 14:45	15:00 15:15	15:30 15:45	16:00 16:15	16:30 16:45	17:00 17:15	17:30 17:45	18:00 18:15	18:30 18:45	19:00 19:15	19:30 19:45
GLO	RTE 17	RTE 216 (GUINEA RD)	RTE 614 (HICKORY FORK RD)	NS																													
GLO	RTE 17	RTE 614 (HICKORY FORK RD)	RTE 17 BUS S (MAIN ST)	NS																													
GLO	RTE 17	RTE 17 BUS S (MAIN ST)	RTE 17 BUS N (MAIN ST)	NS																													
GLO	RTE 17	RTE 17 BUS N (MAIN ST)	RTE 606 (ARK RD)	NS																													
GLO	RTE 17	RTE 606 (ARK RD)	ROUTE 14	NS																													
GLO	RTE 17	ROUTE 14	ROUTES 33/198	NS																													
GLO	RTE 17	ROUTES 33/198	MIDDLESEX CL	NS																													
GLO	RTE 33	KING AND QUEEN CL	ROUTE 17	EW																													
HAM	ABERDEEN RD	PEMBROKE AVE	I-664	NS																													
HAM	ABERDEEN RD	I-664	BRIARFIELD RD	NS																													
HAM	ABERDEEN RD	BRIARFIELD RD	MERCURY BLVD	NS																													
HAM	ABERDEEN RD	MERCURY BLVD	TODDS LA	NS																													
HAM	ARMISTEAD AVE	COMMANDER SHEPPARD BLVD	HRC PARKWAY	NS																													
HAM	ARMISTEAD AVE	HRC PARKWAY	MERCURY BLVD	NS																													
HAM	ARMISTEAD AVE	MERCURY BLVD	PINE CHAPEL RD	NS																													
HAM	ARMISTEAD AVE	PINE CHAPEL RD	LASALLE AVE	NS																													
HAM	ARMISTEAD AVE	LA SALLE AVE	RIP RAP RD	NS																													
HAM	ARMISTEAD AVE	RIP RAP RD	PEMBROKE AVE	NS																													
HAM	ARMISTEAD AVE	PEMBROKE AVE	SETTLERS LANDING RD	NS																													
HAM	BIG BETHEL RD	TODDS LANE	HRC PKWY	NS																													
HAM	BIG BETHEL RD	HRC PKWY	THOMAS NELSON DR	NS																													
HAM	BIG BETHEL RD	THOMAS NELSON DR	SAUNDERS RD	NS																													

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a " are one-way roadways.

Appendix C – 2010 Northbound/Eastbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a " are one-way roadways.

Appendix C – 2010 Northbound/Eastbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a 'r' are one-way roadways.

Appendix C – 2010 Northbound/Eastbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a 'r' are one-way roadways.

Appendix C – 2010 Northbound/Eastbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a " " are one-way roadways.

Appendix C – 2010 Northbound/Eastbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is <0.75. For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is <0.65. Roadways marked with a 'r' are one-way roadways.

Appendix C – 2010 Northbound/Eastbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a " are one-way roadways.

Appendix C – 2010 Northbound/Eastbound Congestion by Roadway Segment (Non-Interstates)

				ROAD DIR	NORTHBOUND/EASTBOUND																												
					AM CONGESTION																								PM CONGESTION				
JURIS	FACILITY NAME	SEGMENT FROM	SEGMENT TO		5:30 5:45	6:00 6:15	6:30 6:45	7:00 7:15	7:30 7:45	8:00 8:15	8:30 8:45	9:00 9:15	9:30 9:45	10:00 10:15	10:30 10:45	11:00 11:15	11:30 11:45	12:00 12:15	12:30 12:45	13:00 13:15	13:30 13:45	14:00 14:15	14:30 14:45	15:00 15:15	15:30 15:45	16:00 16:15	16:30 16:45	17:00 17:15	17:30 17:45	18:00 18:15	18:30 18:45	19:00 19:15	19:30 19:45
SUR	ROUTE 10	ROUTE 31 (NORTH)	ROUTE 617	EW																													
SUR	ROUTE 10	ROUTE 617	ISLE OF WIGHT CL	EW																													
SUR	ROUTE 40	SUSSEX CL	ROUTE 615	NS																													
SUR	ROUTE 40	ROUTE 615	ROUTE 10	NS																													
VB	21ST ST	PARKS AVE	PACIFIC AVE	EW																													
VB	21ST ST	PACIFIC AVE	ATLANTIC AVE	EW																													
VB	22ND ST	PARKS AVE	PACIFIC AVE	EW	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
VB	22ND ST	PACIFIC AVE	ATLANTIC AVE	EW	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
VB	ATLANTIC AVE	83RD ST	PACIFIC AVE	NS																													
VB	ATLANTIC AVE	PACIFIC AVE	LASKIN RD	NS																													
VB	ATLANTIC AVE	LASKIN RD	22ND ST	NS																													
VB	ATLANTIC AVE	22ND ST	21ST ST	NS																													
VB	ATLANTIC AVE	21ST ST	VA BEACH BLVD	NS																													
VB	ATLANTIC AVE	VA BEACH BLVD	5TH ST	NS																													
VB	BAXTER RD	PRINCESS ANNE RD	INDEPENDENCE BLVD	NS																													
VB	BIRDNECK RD	GENERAL BOOTH BLVD	NORFOLK AVE	NS																													
VB	BIRDNECK RD	NORFOLK AVE	VA BEACH BLVD	NS																													
VB	BIRDNECK RD	VA BEACH BLVD	I-264	NS																													
VB	BIRDNECK RD	I-264	LASKIN RD	NS																													
VB	CHESAPEAKE BAY BRIDGE-TUNNEL	SHORE DR	TOLL PLAZA	NS																													
VB	CHESAPEAKE BAY BRIDGE-TUNNEL	TOLL PLAZA	NCL VA BEACH	NS																													
VB	DAM NECK RD	VA BEACH AMPHITHEATER	PRINCESS ANNE RD	EW																													

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a “/” are one-way roadways.

Appendix C – 2010 Northbound/Eastbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a "/" are one-way roadways.

Appendix C – 2010 Northbound/Eastbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a “/” are one-way roadways.

Appendix C – 2010 Northbound/Eastbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a "w" are one-way roadways.

Appendix D – 2010 Southbound/Westbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75. For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65. Roadways marked with a "/" are one-way roadways.

Appendix D – 2010 Southbound/Westbound Congestion by Roadway Segment (Non-Interstates)

				ROAD DIR	SOUTHBOUND/WESTBOUND																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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JURIS	FACILITY NAME	SEGMENT FROM	SEGMENT TO		5:30 5:45	6:00 6:15	6:30 6:45	6:45 7:00	7:00 7:15	7:15 7:30	7:30 7:45	7:45 8:00	8:00 8:15	8:15 8:30	8:30 8:45	9:00 9:15	9:15 9:30	9:30 9:45	10:00 10:15	10:15 10:30	10:30 10:45	10:45 11:00	11:00 11:15	11:15 11:30	11:30 11:45	12:00 12:15	12:15 12:30	12:30 12:45	12:45 13:00	13:00 13:15	13:15 13:30	13:30 13:45	13:45 14:00	14:00 14:15	14:15 14:30	14:30 14:45	15:00 15:15	15:15 15:30	15:30 15:45	15:45 16:00	16:00 16:15	16:15 16:30	16:30 16:45	16:45 17:00	17:00 17:15	17:15 17:30	17:30 17:45	17:45 18:00	18:00 18:15	18:15 18:30	18:30 18:45	18:45 19:00	19:00 19:15	19:15 19:30	19:30 19:45																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
CHES	GREENBRIER PKWY	KEMPSVILLE RD	VOLVO PKWY	NS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														

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Appendix D – 2010 Southbound/Westbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is <0.75. For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is <0.65. Roadways marked with a ' are one-way roadways.

Appendix D – 2010 Southbound/Westbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75. For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65. Roadways marked with a 'r' are one-way roadways.

Appendix D – 2010 Southbound/Westbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75. For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65. Roadways marked with a ' are one-way roadways.

Appendix D – 2010 Southbound/Westbound Congestion by Roadway Segment (Non-Interstates)

JURIS	FACILITY NAME	SEGMENT FROM	SEGMENT TO	ROAD DIR	SOUTHBOUND/WESTBOUND																			
					AM CONGESTION												PM CONGESTION							
					5:30	5:45	6:00	6:15	6:30	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45	9:00	9:15	9:30	9:45	10:00	10:15
NN	JEFFERSON AVE	MIDDLE GROUND BLVD	J CLYDE MORRIS BLVD	NS																				
NN	JEFFERSON AVE	J CLYDE MORRIS BLVD	HARPERSVILLE RD	NS																				
NN	JEFFERSON AVE	HARPERSVILLE RD	MAIN ST	NS																				
NN	JEFFERSON AVE	MAIN ST	CENTER AVE	NS																				
NN	JEFFERSON AVE	CENTER AVE	MERCURY BLVD	NS																				
NN	JEFFERSON AVE	MERCURY BLVD	BRIARFIELD RD	NS																				
NN	JEFFERSON AVE	BRIARFIELD RD	41ST ST	NS																				
NN	JEFFERSON AVE	41ST ST	35TH ST	NS																				
NN	JEFFERSON AVE	35TH ST	25TH ST	NS																				
NN	MAIN ST	WARWICK BLVD	JEFFERSON AVE	EW																				
NN	MAIN ST	JEFFERSON AVE	HAMPTON CL	EW																				
NN	MERCURY BLVD/JAMES RIVER BR	ISLE OF WIGHT CL	RIVER RD	EW																				
NN	MERCURY BLVD	RIVER RD	WARWICK BLVD	EW																				
NN	MERCURY BLVD	WARWICK BLVD	JEFFERSON AVE	EW																				
NN	MERCURY BLVD	JEFFERSON AVE	HAMPTON CL	EW																				
NN	OYSTER POINT RD	WARWICK BLVD	JEFFERSON AVE	EW																				
NN	OYSTER POINT RD	JEFFERSON AVE	CANON BLVD	EW																				
NN	OYSTER POINT RD	CANON BLVD	I-64	EW																				
NN	ROANOKE AVE	I-664	43RD ST	NS																				
NN	ROANOKE AVE	43RD ST	BRIARFIELD RD	NS																				
NN	ROANOKE AVE	BRIARFIELD RD	HAMPTON CL	NS																				
NN	VICTORY BLVD	I-64	YORK CL	EW																				
NN	WARWICK BLVD	JAMES CITY CL	YORKTOWN RD	NS																				
NN	WARWICK BLVD	YORKTOWN RD	FORT EUSTIS BLVD	NS																				
NN	WARWICK BLVD	FORT EUSTIS BLVD	SNIDOW BLVD	NS																				
NN	WARWICK BLVD	SNIDOW BLVD	DENBIGH BLVD	NS																				
NN	WARWICK BLVD	DENBIGH BLVD	BLAND BLVD	NS																				
NN	WARWICK BLVD	BLAND BLVD	OYSTER POINT RD	NS																				
NN	WARWICK BLVD	OYSTER POINT RD	MAXWELL LN	NS																				
NN	WARWICK BLVD	MAXWELL LN	DEEP CREEK RD	NS																				
NN	WARWICK BLVD	DEEP CREEK RD	J CLYDE MORRIS BLVD	NS																				
NN	WARWICK BLVD	J CLYDE MORRIS BLVD	HARPERSVILLE RD	NS																				
NN	WARWICK BLVD	HARPERSVILLE RD	MAIN ST	NS																				
NN	WARWICK BLVD	MAIN ST	CENTER AVE	NS																				
NN	WARWICK BLVD	CENTER AVE	MERCURY BLVD	NS																				
NN	WARWICK BLVD	MERCURY BLVD	HUNTINGTON AVE	NS																				
NN	WARWICK BLVD	23RD ST	39TH ST	NS																				
NN	WARWICK BLVD	39TH ST	HUNTINGTON AVE	NS																				
NOR	26TH ST	HAMPTON BLVD	COLLEY AVE	EW																				
NOR	26TH ST	COLLEY AVE	LLEWELLYN AVE	EW																				
NOR	26TH ST	LLEWELLYN AVE	MONTICELLO AVE	EW																				
NOR	26TH ST	MONTICELLO AVE	CHURCH ST	EW																				
NOR	26TH ST	CHURCH ST	27TH ST	EW																				
NOR	27TH ST	HAMPTON BLVD	COLLEY AVE	EW																				
NOR	27TH ST	COLLEY AVE	LLEWELLYN AVE	EW																				
NOR	27TH ST	LLEWELLYN AVE	MONTICELLO AVE	EW																				
NOR	27TH ST	MONTICELLO AVE	CHURCH ST	EW																				
NOR	27TH ST	CHURCH ST	26TH ST	EW																				
NOR	38TH ST	HAMPTON BLVD	COLLEY AVE	EW																				
NOR	38TH ST	COLLEY AVE	LLEWELLYN AVE	EW																				
NOR	38TH ST	LLEWELLYN AVE	GRANBY ST	EW																				
NOR	4TH VIEW ST	I-64	OCEAN VIEW AVE	EW																				
NOR	ADMIRAL TAUSSIG BLVD	HAMPTON BLVD	I-564	EW																				
NOR	AZALEA GARDEN RD	VA BEACH BLVD	PRINCESS ANNE RD	NS																				
NOR	AZALEA GARDEN RD	PRINCESS ANNE RD	SEWELLS POINT RD	NS																				

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75. For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65. Roadways marked with a '/' are one-way roadways.

Appendix D – 2010 Southbound/Westbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75. For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65. Roadways marked with a 'r' are one-way roadways.

Appendix D – 2010 Southbound/Westbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

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Appendix D – 2010 Southbound/Westbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

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Appendix D – 2010 Southbound/Westbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

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Appendix D – 2010 Southbound/Westbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times indicated indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75. For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65. Roadways marked with a "/" are one-way roadways.

Appendix D – 2010 Southbound/Westbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a "I" are one-way roadways.

Appendix D – 2010 Southbound/Westbound Congestion by Roadway Segment (Non-Interstates)

[illegible]

Prepared by HRTPO Staff based on an analysis of INRIX data. Times listed indicate the start of each 15-minute interval. Intervals shaded in gray are classified as severely congested. For Freeways, an interval is classified as severely congested if the Speed Reduction Factor (defined as the Actual Speed/Free Flow Speed) is < 0.75 . For Non-Freeways, an interval is classified as severely congested if the Speed Reduction Factor is < 0.65 . Roadways marked with a " are one-way roadways.