TRAFFIC QUALITY ON THE METROPOLITAN WASHINGTON AREA FREEWAY SYSTEM

SPRING 2008 REPORT

Final

May 20, 2009

Prepared by
Skycomp, Inc., (Columbia, Maryland)

National Capital Region Transportation Planning Board

The preparation of this report was financially aided through grants from the Virginia Department of Transportation, the Maryland Department of Transportation and the District of Columbia Department of Public Works and the U.S. Department of Transportation Federal Highway Administration under SAFETEA-LU.

ABSTRACT

TITLE: Traffic Quality on the Metropolitan Area Freeway System, Spring 2008 Report

DATE: May 20, 2009

AGENCY: The Metropolitan Washington Council of Governments is the regional planning organization of the Washington area's major local governments. COG works on finding solutions to regional problems, especially those related to regional growth, transportation, housing, human services, and the environment.

ABSTRACT: This report presents findings of the Spring 2008 survey of the metropolitan Washington region's limited access highway system. The findings include the system performance represented by levels of service and the changes to the system performance over time by comparing the 2008 results with 1993, 1996, 1999, 2002 and 2005 survey data.

COPIES AVAILABLE FROM:
Metropolitan Washington Council of Governments
777 N. Capitol St, NE - Suite 300
Washington, DC 20002-4239
www.mwcog.org/transportation
(202) 962-3200

ACKNOWLEDGMENTS

Director,
Department of Transportation Planning
Ronald F. Kirby

System Planning Applications
Director
Michael J. Clifford

Project Manager
Daivamani Sivasailam

Consultant
SKYCOMP, INC
Gregory Jordan
Jasper Craig
Ryan Bowers
Zarina Edwards
Billie R. Barnett
Melissa Purnell

If there are any questions about this survey, report or the underlying methodology, please contact Daivamani Sivasailam at MWCOG at 202-962-3226 or SKYCOMP, Inc at 410-884-6900

DISCLAIMER
The preparation of this report was financially aided through a grant from the Virginia Department of Transportation, the Maryland Department of Transportation and the District of Columbia Department of Public Works and the U.S. Department of Transportation Federal Highway Administration under SAFETEA-LU.

EXECUTIVE SUMMARY

This report documents the findings of the Spring 2008 aerial survey of the metropolitan Washington region's freeway system during the AM and PM peak periods. The report also presents changes through time by comparing the 2008 results with data from the 1993, 1996, 1999, 2002 and 2005 surveys.

After introductory and methodology sections, chapter III of the report includes AM and PM peak period conditions represented by levels of service for individual routes. For segments with congested conditions the severity of the congestion is indicated by density of traffic in passenger cars per mile per lane along with a narrative of observations.

Chapter IV of the report identifies top 10 congested locations in terms of density, along with a performance metric which indicates the top 5 corridors with the longest delay.

Chapter V provides Congestion summaries for the peak periods as well as the individual hours. Chapter VI discusses changes to the system over time by comparing 2008 data with prior years' survey data including changes to lane miles of congestion.

Appendix A discusses the methodology used for estimating level of service based on the highway capacity manual (HCM). Appendix B documents the use of the locally calibrated Van Aerde model used to develop speed estimates from densities.

TABLE OF CONTENTS

Chapter I

Introduction

a. BACKGROUND

The purpose of this ongoing mobility monitoring program is to rate the performance of the regional Washington, D.C. highway system on a recurring basis, and provide the information it produces to regional planners, stakeholders, and decision-makers. This initiative began in the spring of 1993, at which time approximately 300 centerline miles of limited-access highway in the Washington, D.C. metropolitan area were surveyed. Coverage was repeated every three years (1996, 1999, 2002, and 2005), leading to an identification of locations experiencing both improved and degraded mobility. Most recently, coverage of the regional network was repeated in the spring of 2008. This document presents the findings of this last survey.

b. FEATURES OF THE AERIAL SURVEY PROGRAM

The aerial survey methodology takes advantage of the mobility and vantage point of fixed-wing aircraft, permitting data collection across a large highway network that would not be affordable using traditional ground-based survey methods. During the survey flights, overlapping photographic coverage was obtained of each designated highway, repeated once an hour over four morning and four evening commuter periods (this means that, altogether, there were 12 morning and 12 evening observations of each highway segment). The morning times of coverage were 6:00-9:00 a.m. outside the Capital Beltway and 6:30-9:30 a.m. inside the Capital Beltway. The evening times were 4:00-7:00 p.m. inside the Capital Beltway and 4:30-7:30 p.m. outside the Capital Beltway. Survey flights were conducted on weekdays, excluding Monday mornings, Friday evenings and mornings after holidays. Data were extracted from the aerial photographs to measure average recurring daily traffic conditions by link and by time period. Products of the aerial survey program include:

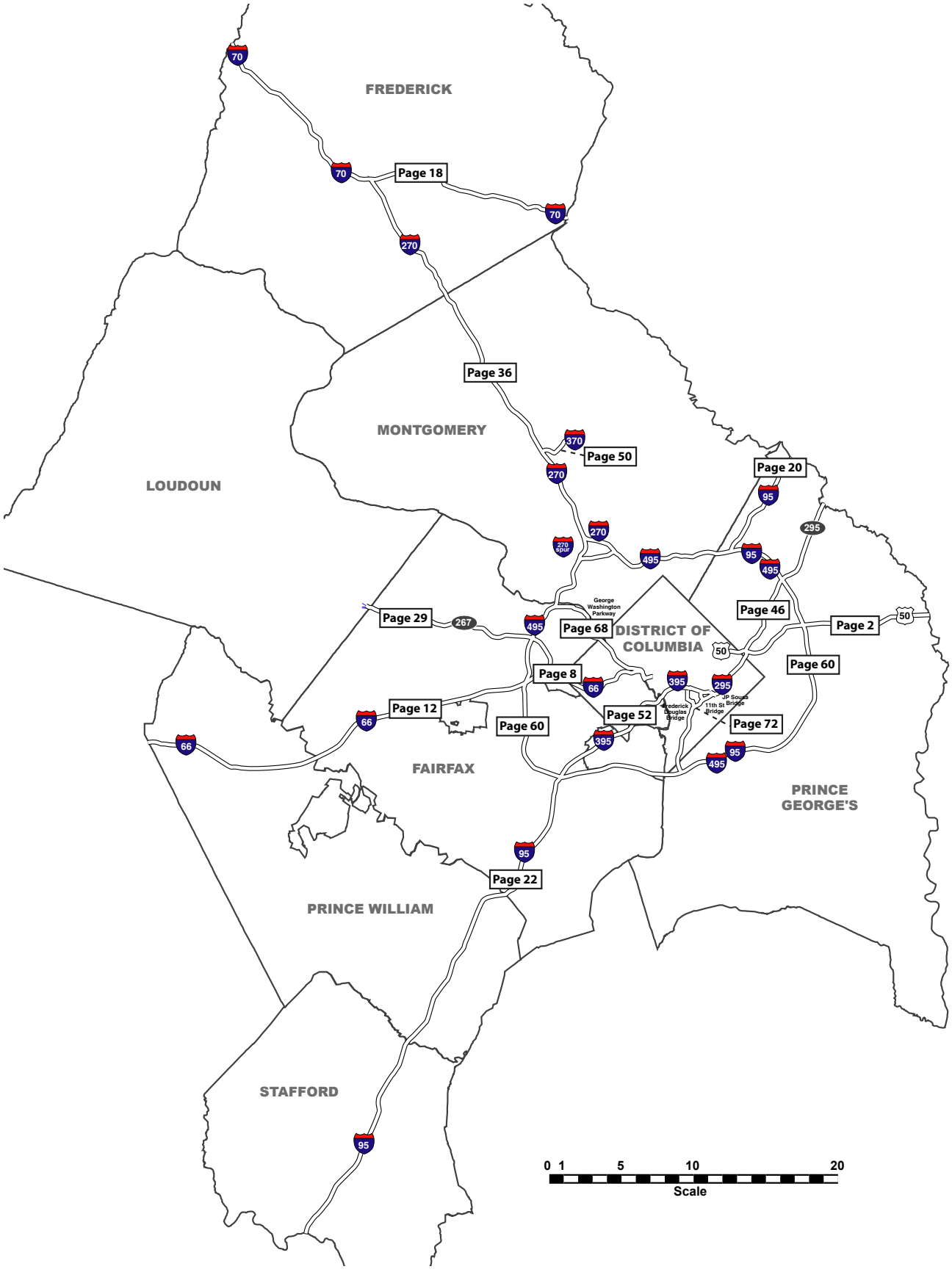
c. SURVEY DATABASE

A primary task for this project is to produce a 2008 Survey Database (built in the Microsoft Access format). This database contains all of the data collected from the 2008 aerial survey, from vehicle counts and road segmentation parameters to survey flight records.

d. WEB-BASED INTERACTIVE SLIDE SHOW

Another primary task is to create a web-based interactive slide show. This slide show provides user access to highlight aerial photographs of congested bottlenecks; users open these photos by clicking on any of the bottleneck arrowheads on morning and evening congestion inventory maps.

Map of Surveyed Highways, Spring 2008



Chapter II

Report Layout

Traffic Quality on the Metropolitan Area Freeway System, Spring 2008 report is made up six chapters and two appendices. Chapter I provide a background into the aerial survey program and discusses the features of the program. This chapter (chapter II) discusses the layout of the report and chapter III provides details of individual route levels of service along with a narrative of the observations. For segments with congested conditions the severity of the congestion is indicated by density of traffic in passenger cars per mile per lane.

Chapter IV of the report identifies top 10 congested locations in terms of density, along with a performance metric which indicates the top 5 corridors with the longest delay.

Chapter V provides Congestion summaries for the AM and PM peak periods as well as the individual peak hours in the AM and PM peak periods.

Chapter VI discusses changes to the system over time by comparing 2008 data with prior years' survey data including changes to lane miles of congestion. The 2005 top 10 congested locations are included for reference.

Appendix A discusses the methodology used for estimating level of service based on the highway capacity manual (HCM). Appendix B documents the use of the locally calibrated Van Aerde model used to develop speed estimates from densities.

(Blank)

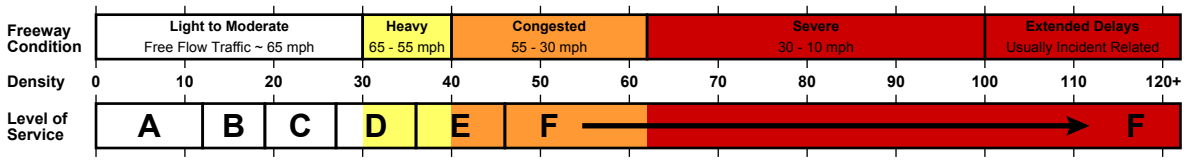
Chapter III

Metropolitan Washington Area Surveyed Highways - Spring 2008

Traffic Quality Rating Tables

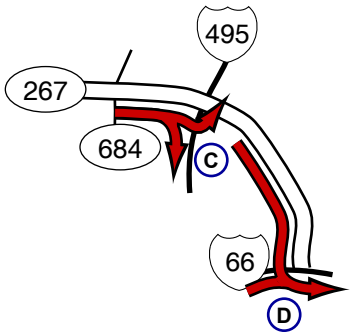
The following pages contain morning and evening traffic quality rating tables for all highways surveyed in the spring of 2008. Traffic quality ratings are presented by segment, hour and direction. Each rating is a composite reflecting all ratings for that hour – usually four –derived from survey flights on four different days, except that ratings affected by incidents or other unusual events were segregated and excluded from consideration.

Traffic Quality Ratings:



Congested Locations

Each level-of-service table includes arrowheads that depict locations where congestion was found. A narrative that clarifies the frequency and severity of the congestion accompanies each arrowhead; where evident, apparent causes of the problems are also described. See example below:



C
During the peak period, eastbound congestion was found on VA 267 approaching the Beltway; congestion on the Beltway exit ramps extended back into the right lane of VA 267 (thru-traffic on VA 267 was typically able to bypass the queue).

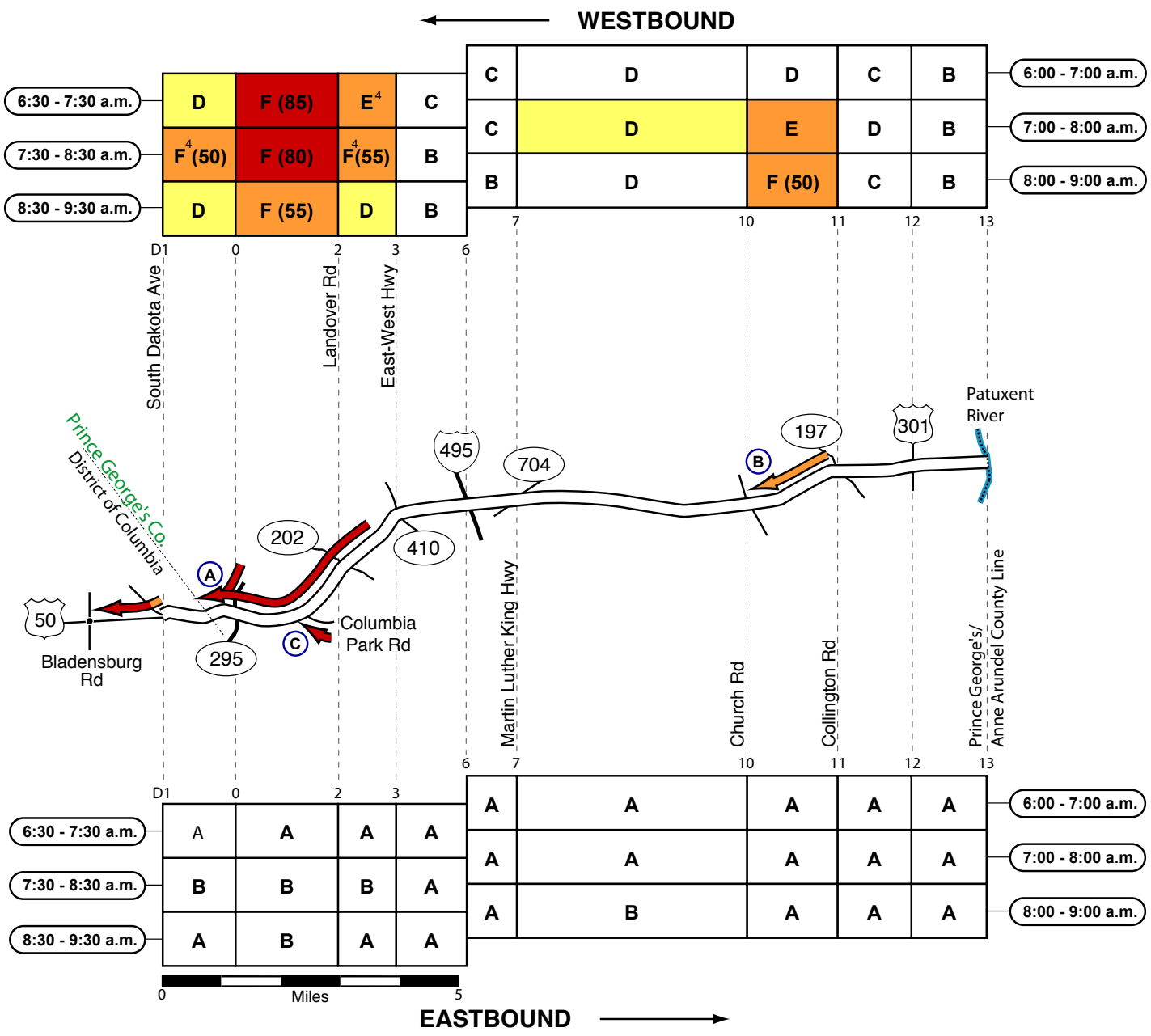
A scale accompanies each rating table in this section of the report.

Nested Congestion

Level-of-Service data for some highway segments represent the mathematical average of densities that varied widely; these data have been tagged with a superscript number in the LOS tables. Four types of "nested" congestion that contributes to the variability have been identified as follows:

Descriptions	Type
Type 1 - Congestion present on some days, but not others.	1
Type 2 - Congestion more severe in left or right-hand lanes.	2
Type 3 - Congestion present only in the first or second half-hour (hourly averages).	3
Type 4 - The length of the congested zone within the segment varies.	4

US 50 (Maryland) - Morning



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

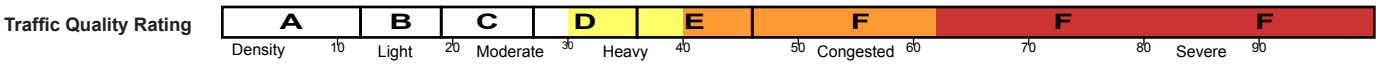
Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

US 50 (Maryland) - Morning

A
Congestion Type: Mainline Congestion
Location: Approaching & beyond BW Parkway into DC
Frequency: Most observations
Direction: Westbound
Queue Length: 3 to 5 miles
Estimated Speed: 15 to 30 mph
Note: Severe congestion was found on this major approach corridor toward downtown Washington DC; the primary bottleneck points were the merges with MD 295 traffic and then at the downstream signal at Bladensburg Rd in DC.

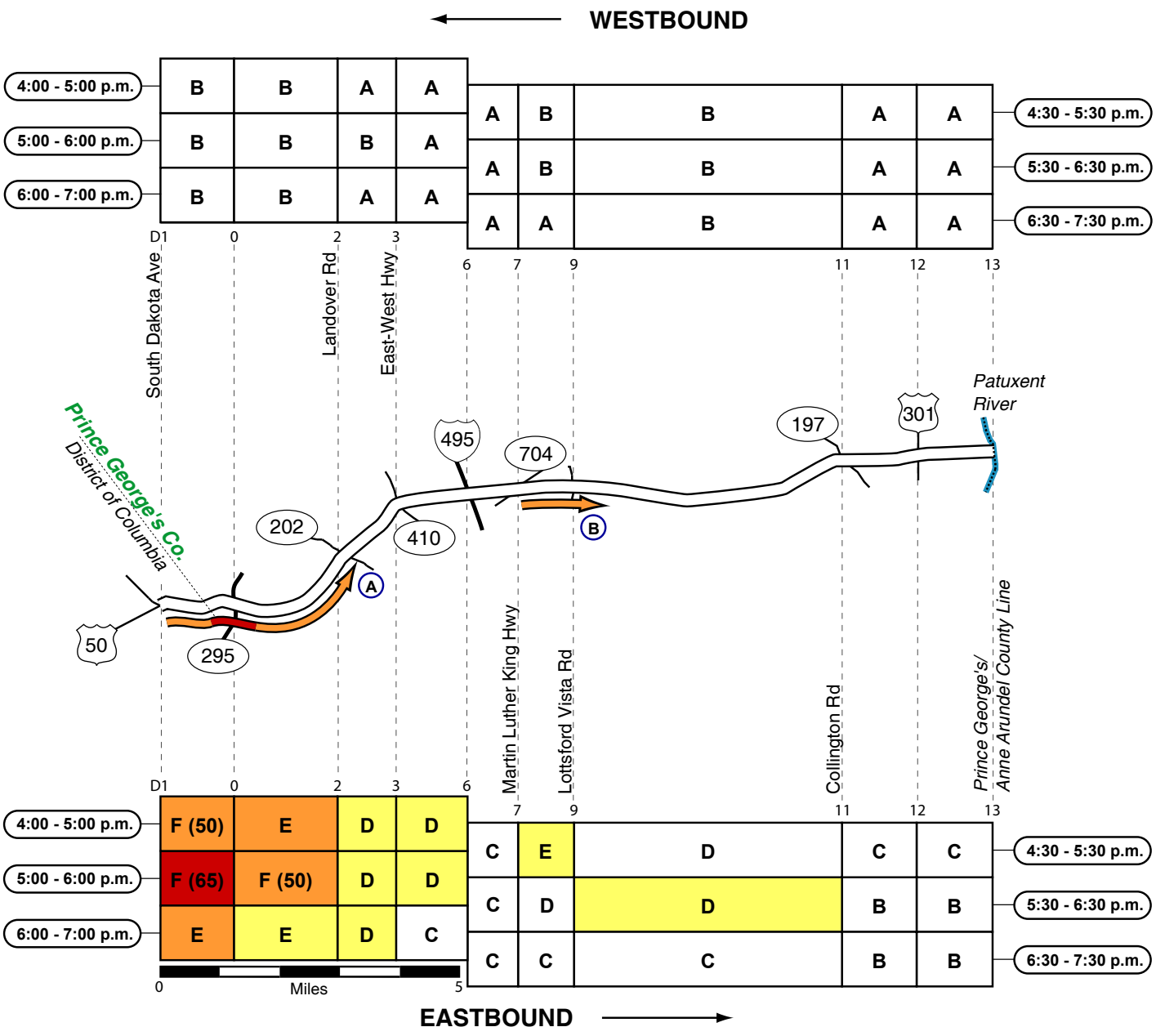
B
Congestion Type: Mainline Congestion
Location: West of MD 197
Frequency: Most observations
Direction: Westbound
Queue Length: 1 to 2 miles
Estimated Speed: 25 to 45 mph
Note: Light to moderate westbound congestion was found on US 50 between MD 197 and the Church Rd overpass; a contributing factor was heavy merge volume from southbound MD 197. Another possible factor: MD 197 users for HOV had to weave 4 lanes to the left across this segment, since entering the HOV lane beyond Church Rd was prohibited.

C
Congestion Type: Cross Road Signal Queue
Location: Columbia Park Rd bridge over US 50
Frequency: Most observations between 7:00 and 8:30 am
Direction: Westbound
Queue Population: 30 to 70 vpl
Number of Lanes: 1
Note: Columbia Park Rd appears to be an option for some drivers to join US 50 downstream of part of the congestion. Access to the Cheverly metrorail station may also be a factor.



Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

US 50 (Maryland) - Evening



Traffic Quality Rating

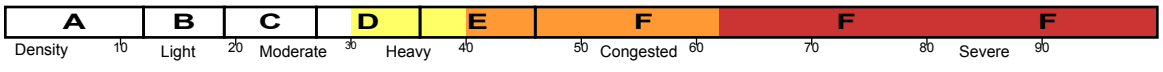
A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

US 50 (Maryland) - Evening

A
Congestion Type: Mainline Congestion
Location: Approaching MD 295 merge
Frequency: Most observations
Direction: Eastbound
Queue Length: 1 to 3 miles
Estimated Speed: 25 to 50 mph
Note: Minor eastbound congestion was found on US 50 approaching the MD 295 interchange; merging traffic from northbound MD 295 using a short acceleration lane appeared to be the underlying cause. Beyond the merge, traffic flow improved but remained at speeds below free flow until beyond MD 202.

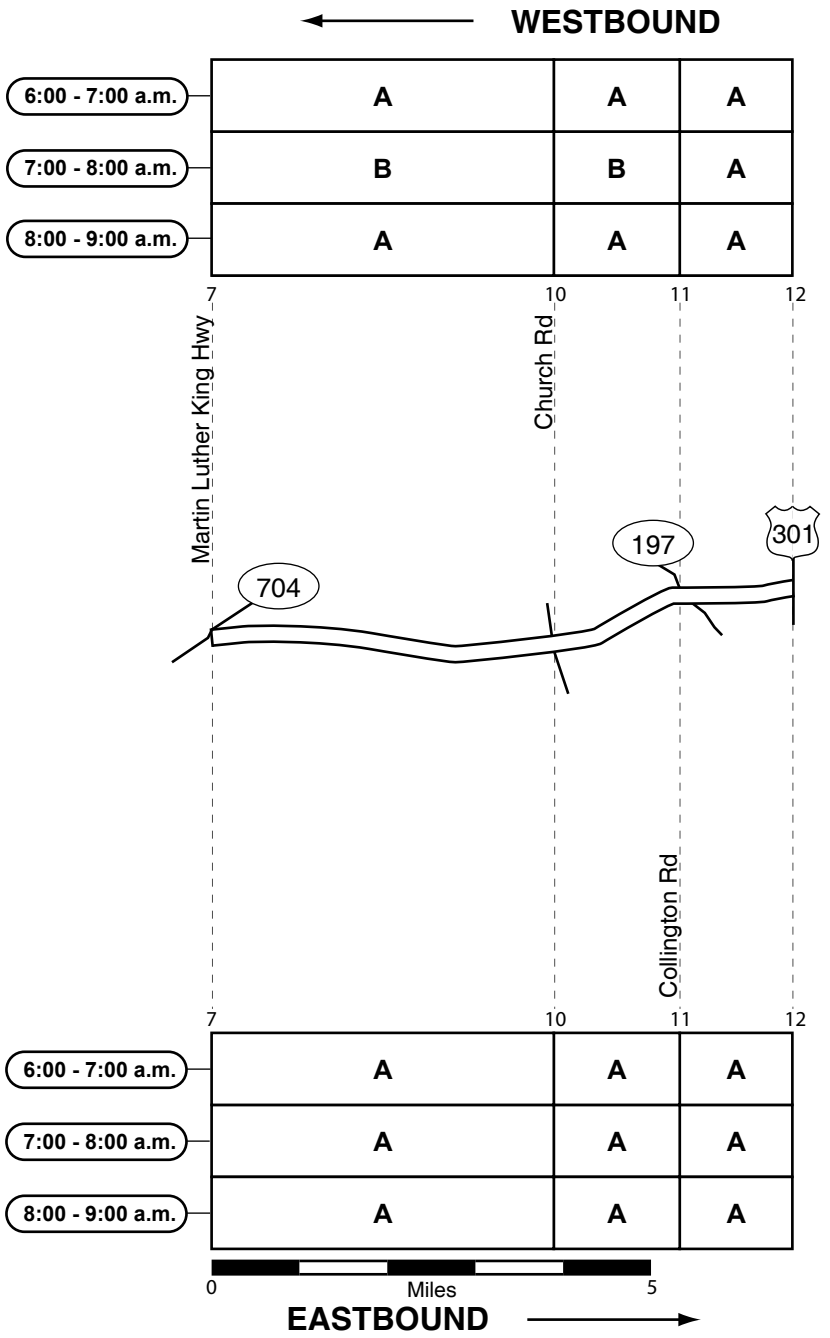
B
Congestion Type: Mainline Congestion
Location: Lane drop at Lottsford Vista Rd
Frequency: Intermittent
Direction: Eastbound
Queue Length: 0.5 to 1 miles
Estimated Speed: 30 to 50 mph
Note: Conditions ranging from free-flow to light to moderate congestion were found on US 50 at the lane drop from 4 to 3 lanes vic. Lottsford Vista Rd; severe eastbound congestion found here in 2005 was only found once (apparently due to avoidance of unusual congestion on I-495).



Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

US 50 HOV (Maryland) - Morning

HOV OPERATIONS
HOV 2
24 HOUR



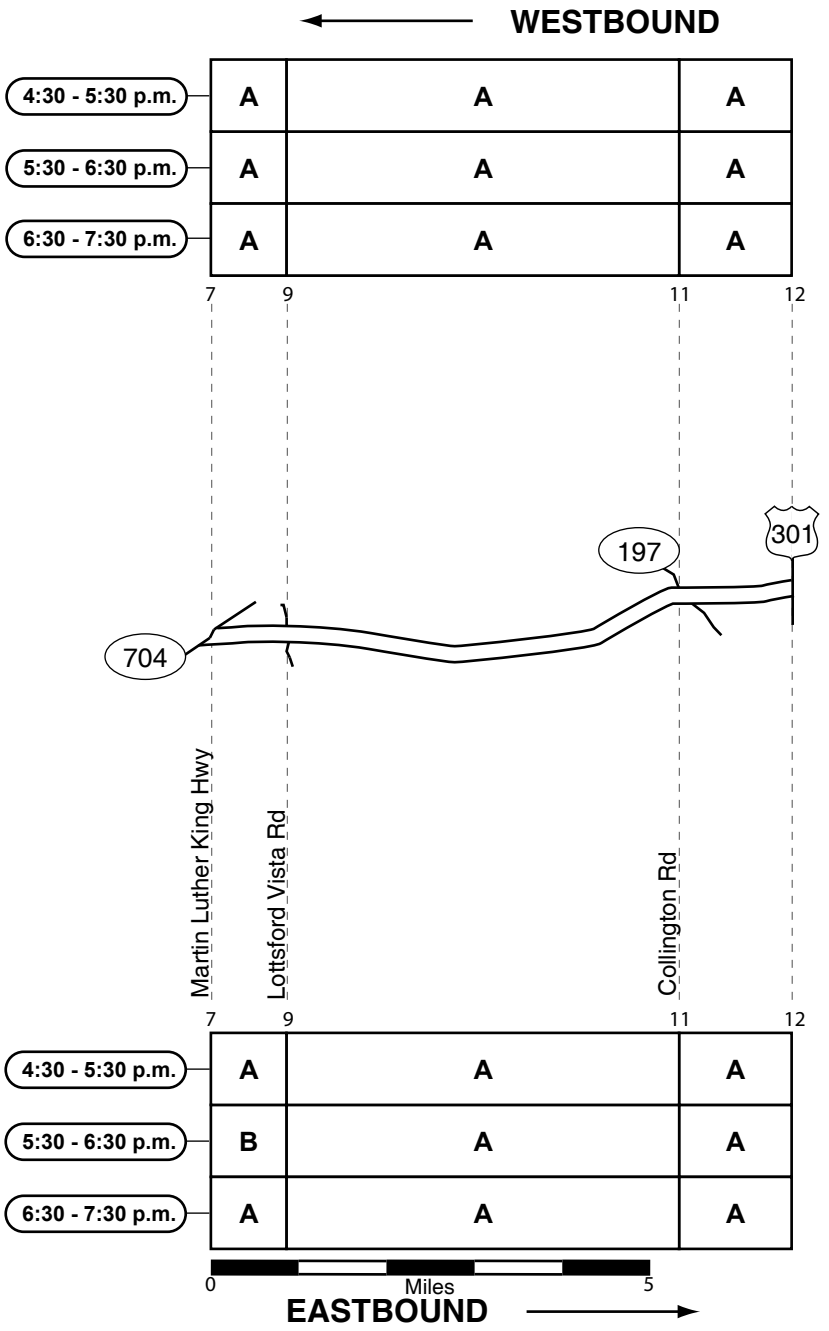
Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

US 50 HOV (Maryland) - Evening

HOV OPERATIONS
HOV 2
24 HOUR

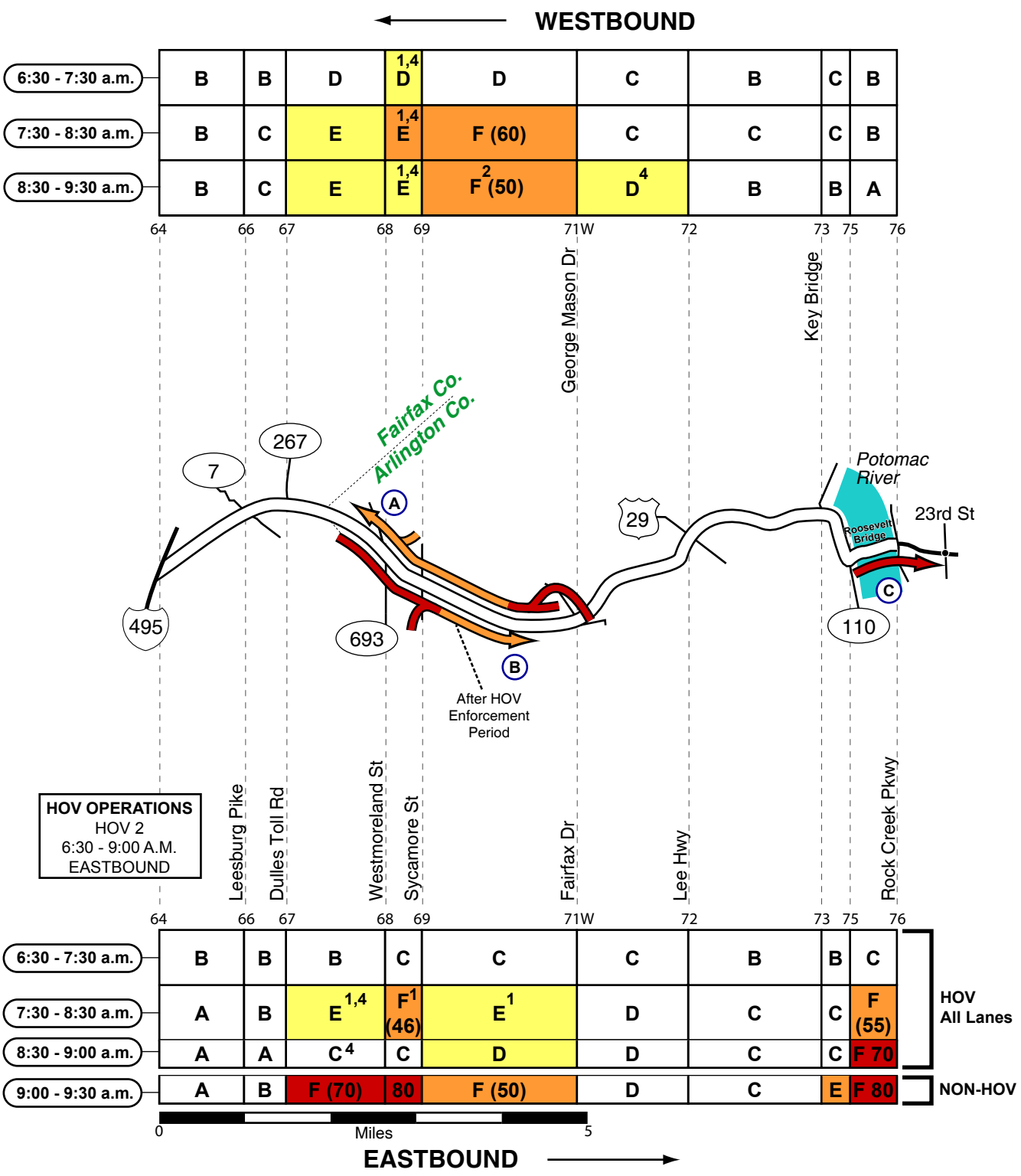


Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-66 Inside Beltway (Virginia) - Morning



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

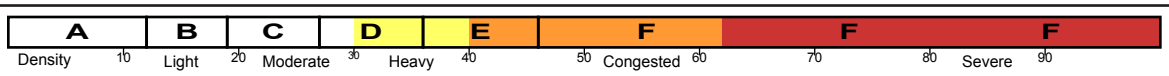
Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-66 Inside Beltway (Virginia) - Morning

A
Congestion Type: Mainline Congestion
Location: Between Fairfax Dr & Westmoreland St
Frequency: Most observations after 7:30 a.m.
Direction: Westbound
Queue Length: 2 to 3 miles
Estimated Speed: 30 to 50 mph
Note: Congestion appeared to be caused or exacerbated by traffic entering at Fairfax Dr and Washington Blvd.

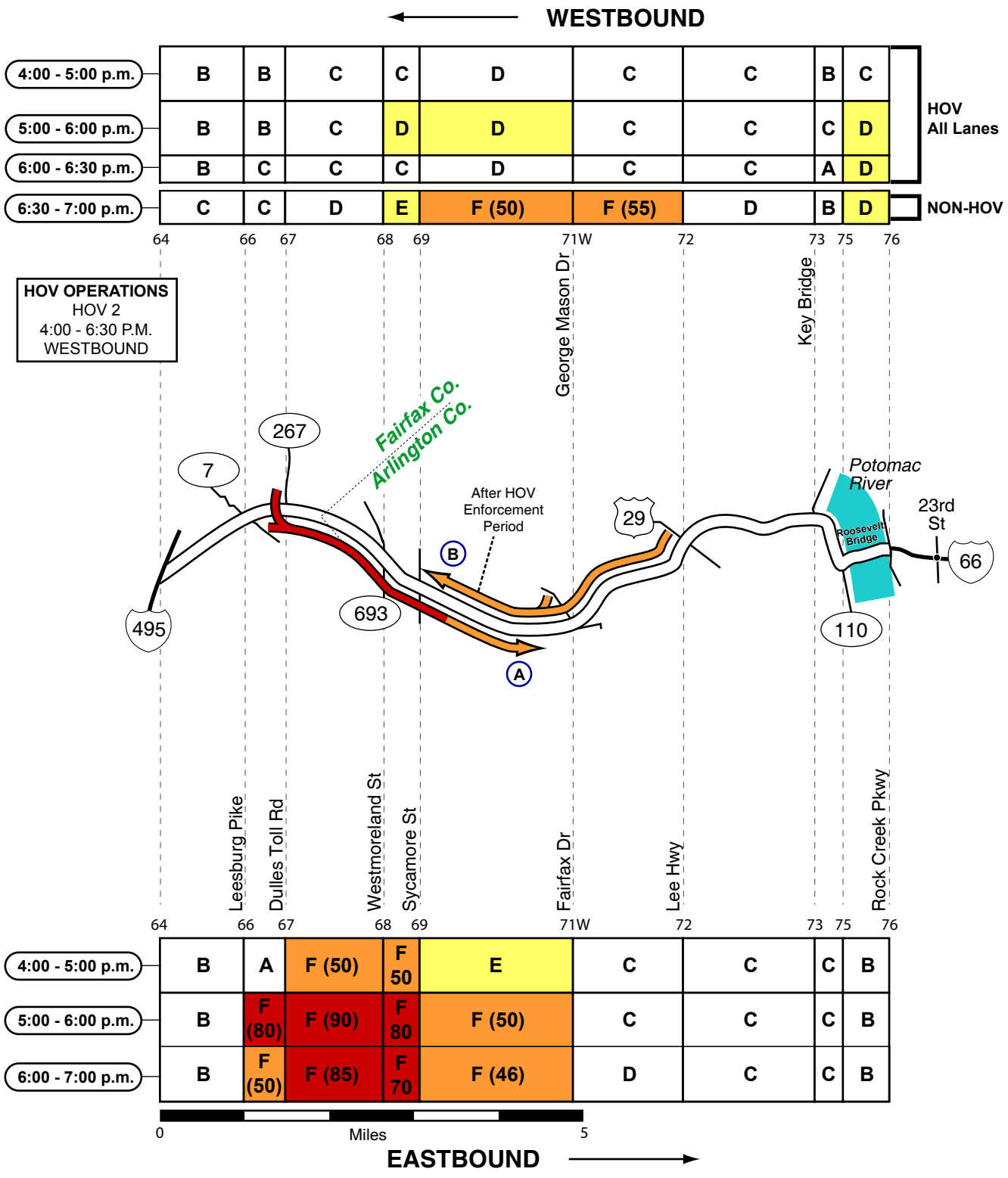
B
Congestion Type: Mainline Congestion
Location: Between VA 267 & Fairfax Dr
Frequency: Between 8:00 and 8:30 a.m. and again after 9:00 a.m.
Direction: Eastbound
Queue Length: 2 to 4 miles
Estimated Speed: 20 to 50 mph
Note: The primary bottleneck was the lane drop (3 lanes to 2) at Westmoreland St; congestion was typically most severe after 9:00 a.m. when HOV restrictions are not enforced.

C
Congestion Type: Mainline Congestion
Location: Approaching and across the Roosevelt Bridge
Frequency: Most observations after 7:30 a.m.
Direction: Eastbound
Queue Length: 1 to 1.5 miles
Estimated Speed: 20 to 40 mph
Note: The head of the queue was found at the signalized intersection at 23rd St; after 8:30 a.m., congestion typically extended back onto the George Washington Memorial Parkway and Arlington Blvd.



Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

I-66 Inside Beltway (Virginia) - Evening



Traffic Quality Rating

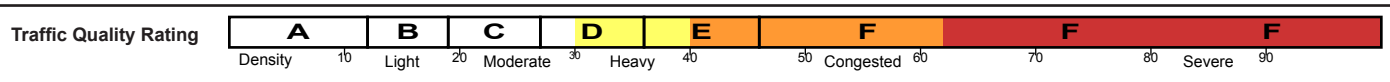
A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

I-66 Inside Beltway (Virginia) - Evening

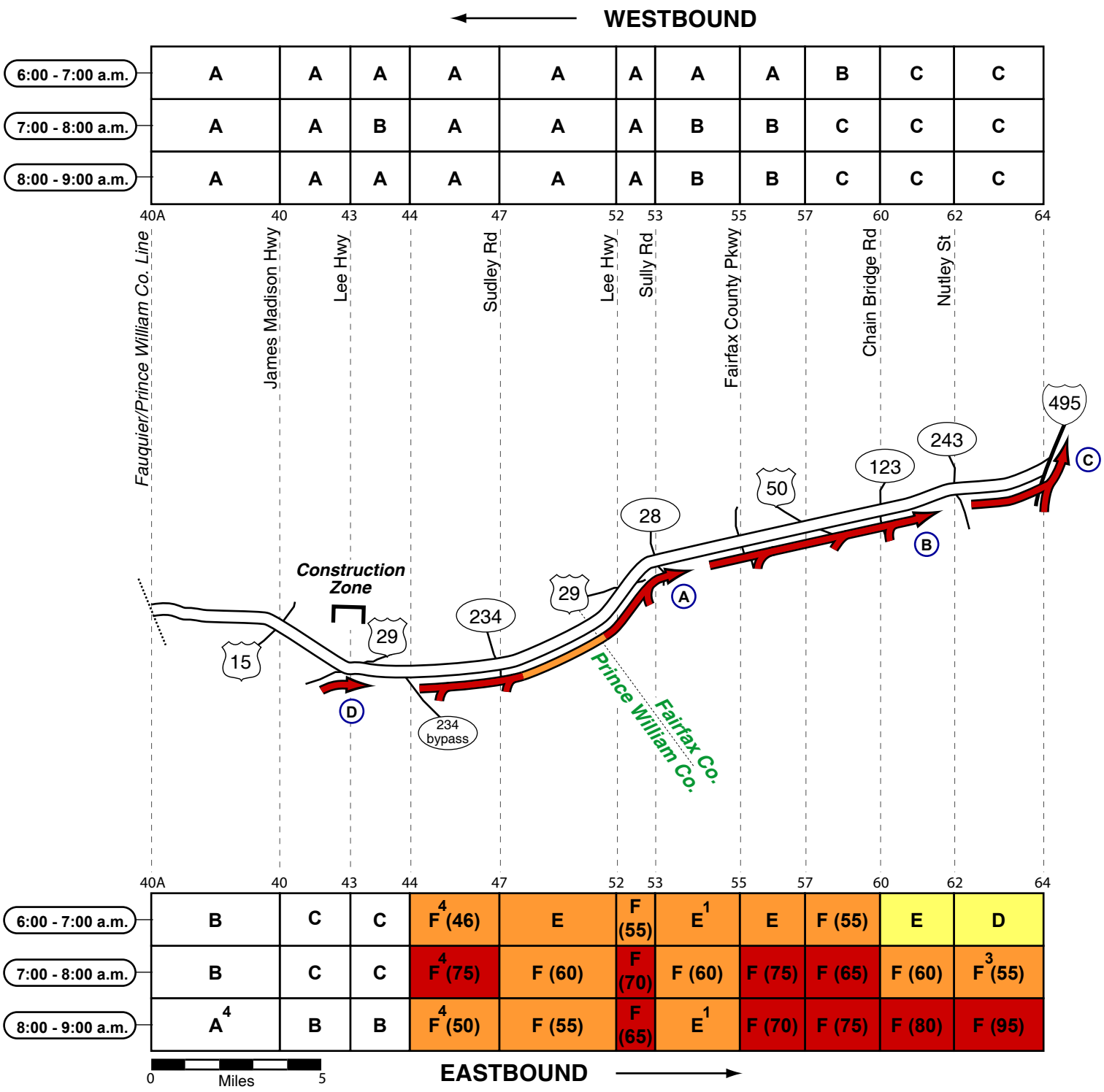
A
Congestion Type: Mainline Congestion
Location: Between VA 7 and Fairfax Dr
Frequency: Most observations
Direction: Eastbound
Queue Length: 4 to 5 miles
Estimated Speed: 10 to 40 mph
Note: Congestion was caused or exacerbated by the series of lane drops (4 lanes to 3 and 3 lanes to 2) approaching Westmoreland St; while congestion persisted east of Westmoreland St, traffic flow gradually improved.

B
Congestion Type: Mainline Congestion
Location: Between US 29 & Sycamore St
Frequency: After 6:30 p.m. (HOV Restrictions not enforced)
Direction: Westbound
Queue Length: 3 to 4 miles
Estimated Speed: 30 to 50 mph
Note: The primary bottleneck was found where traffic entered at Fairfax Dr; while congestion persisted west of Fairfax Dr, traffic flow typically improved.



Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-66 Outside Beltway (Virginia) - Morning



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

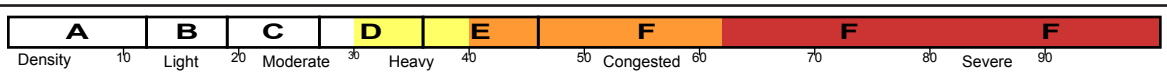
I-66 Outside Beltway (Virginia) - Morning

A
Congestion Type: Mainline Congestion
Location: Between VA 234 Bypass and VA 28
Frequency: Most observations
Direction: Eastbound
Queue Length: 6 to 9 miles
Estimated Speed: 15 to 45 mph
Note: Congestion appeared to be caused or exacerbated by traffic entering at the VA 234 Bypass, VA 234 and VA 28 interchanges.

B
Congestion Type: Mainline Congestion
Location: Between VA 28 & Nutley St
Frequency: Most observations
Direction: Eastbound
Queue Length: 7 to 9 miles
Estimated Speed: 15 to 45 mph
Note: Factors contributing to the congestion were: 1) traffic entering at Fairfax County Parkway, US 50 and Chain Bridge Rd and; 2) the merging associated with the Nutley St exit ramp (Note: Metro service begins at Nutley St).

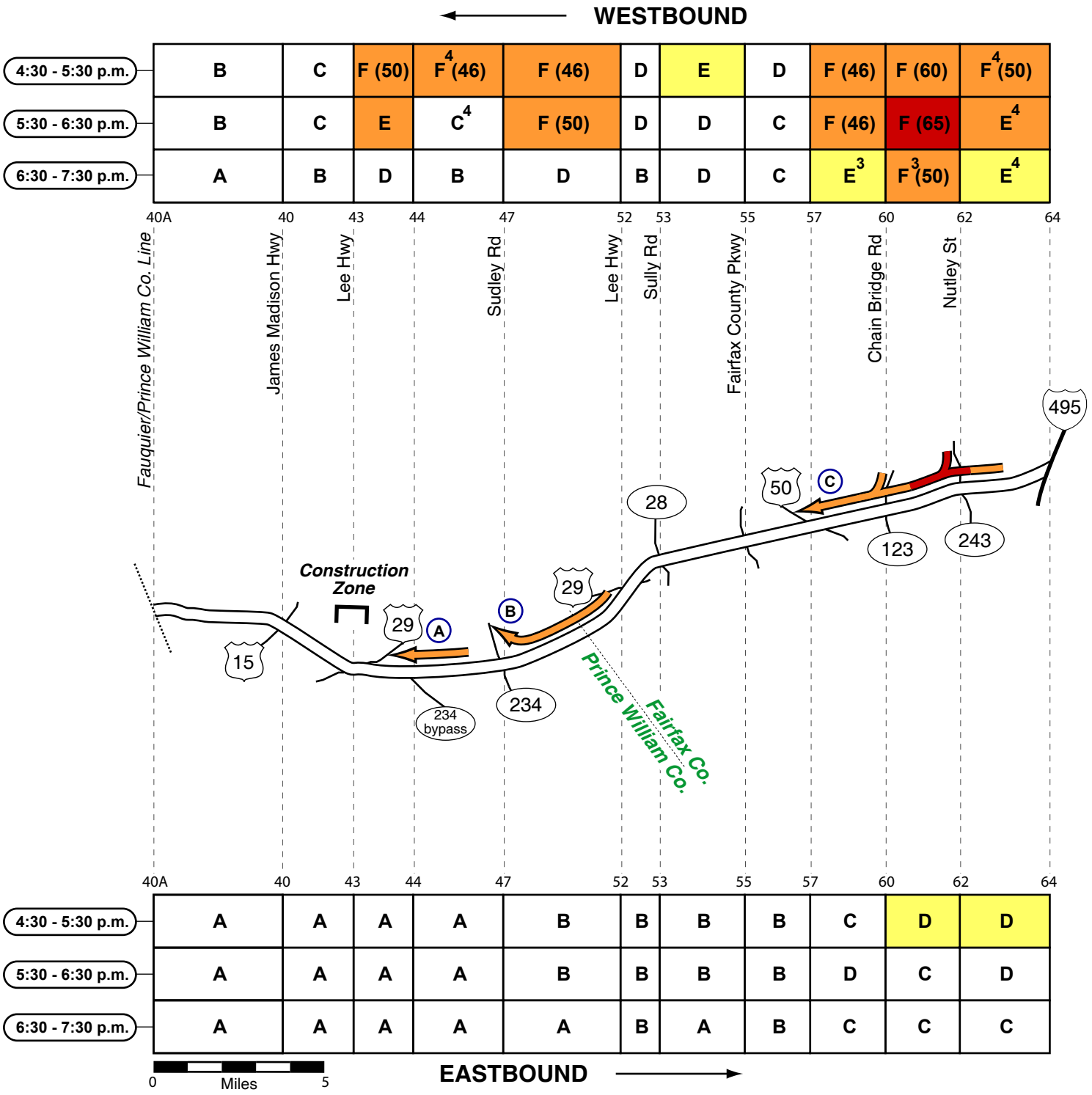
C
Congestion Type: Mainline Congestion
Location: Between Nutley St & the Beltway
Frequency: Most observations after 7:30 a.m.
Direction: Eastbound
Queue Length: 2 to 3 miles
Estimated Speed: 15 to 45 mph
Note: The head of the queue was found on the ramp to the inner loop of the Beltway; congestion typically extended back into the right lane (and eventually across all lanes) of I-66.

D
Congestion Type: Entrance Ramp Queue
Location: US 29
Frequency: Peak hour
Direction: Eastbound
Queue Length: 0.5 to 1 miles
Note: The head of the queue was found at the lane drop (2 lanes to 1) on the ramp; congestion extended back into the mainline of US 29 (northbound). Thru-traffic on I-66 was not affected by the ramp congestion.



Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-66 Outside Beltway (Virginia) - Evening



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

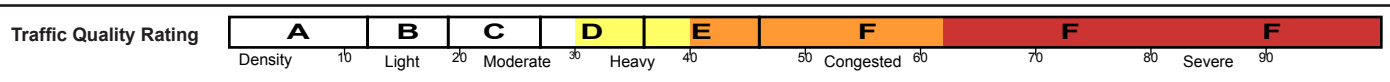
Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-66 Outside Beltway (Virginia) - Evening

A
Congestion Type: Mainline Congestion
Location: Vicinity of VA 234 Bypass
Frequency: Most observations before 6:30 p.m.
Direction: Westbound
Queue Length: 1 to 2 miles
Estimated Speed: 40 to 50 mph
Note: Factors contributing to the congestion were: 1) the merge at the HOV terminus; 2) the lane drop (3 lanes to 2) at the VA 234 Bypass and; 3) traffic entering from the VA 234 Bypass.

B
Congestion Type: Mainline Congestion
Location: Between US 29 & VA 234
Frequency: Most observations before 6:30 p.m.
Direction: Westbound
Queue Length: 2 to 4 miles
Estimated Speed: 30 to 50 mph
Note: The head of the queue was found on the ramp to VA 234 (southboud); congestion extended back into the right lane (and eventually across all lanes) of I-66.

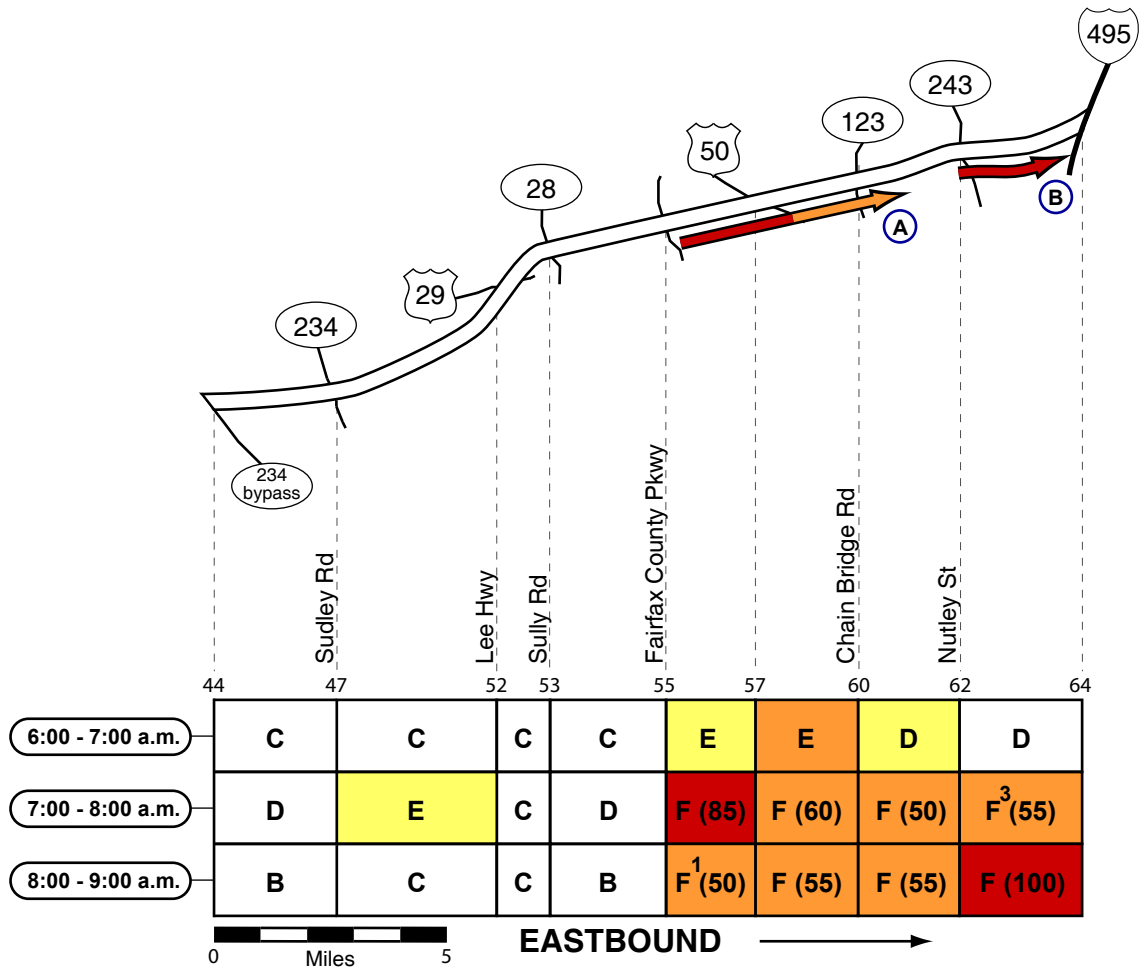
C
Congestion Type: Mainline Congestion
Location: Between I-495 & US 50
Frequency: Most observations
Direction: Westbound
Queue Length: 5 to 7 miles
Estimated Speed: 25 to 50 mph
Note: The primary bottleneck was where traffic entered from Nutley St (Note: Metro service ends at Nutley St).



Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

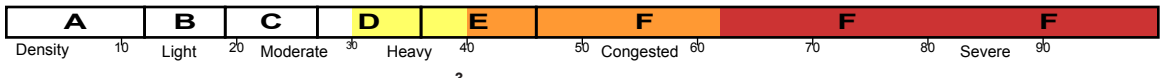
I-66 (Outside Beltway) Left Lane / Concurrent Flow HOV - Morning

HOV OPERATIONS
HOV 2
5:30 - 9:30 A.M.
EASTBOUND



A
Congestion Type: Mainline Congestion
Location: Between Fairfax County Parkway & Nutley St
Frequency: Most observations
Direction: Eastbound
Queue Length: 5 to 7 miles
Estimated Speed: 15 to 50 mph
Note: Factors contributing to the congestion were: 1) traffic entering from the center of the roadway at VA 608 and; 2) friction between the HOV roadway and the congested "general-purpose" lanes.

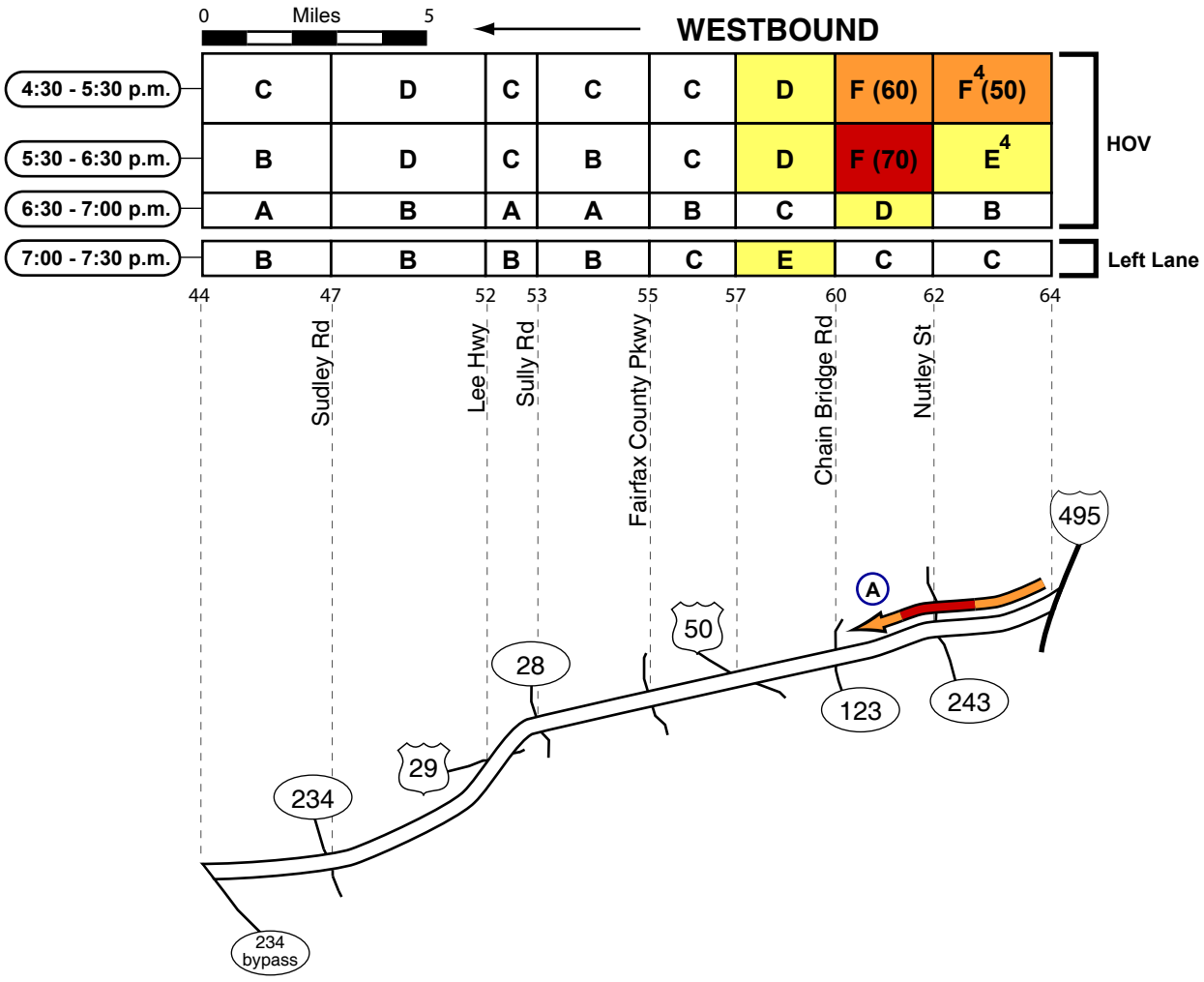
B
Congestion Type: Mainline Congestion
Location: Between Nutley St & the Beltway
Frequency: Most observations after 7:30 a.m.
Direction: Eastbound
Queue Length: 1 to 2 miles
Estimated Speed: 15 to 25 mph
Note: Congestion appeared to be exacerbated by friction between the HOV facility and the congested "general-purpose" lanes; traffic flow typically improved east of the "general-purpose" ramp to the innerloop of the Beltway.



Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-66 (Outside Beltway) Left Lane / Concurrent Flow HOV - Evening

HOV OPERATIONS
HOV 2
3:00 - 7:00 P.M.
WESTBOUND



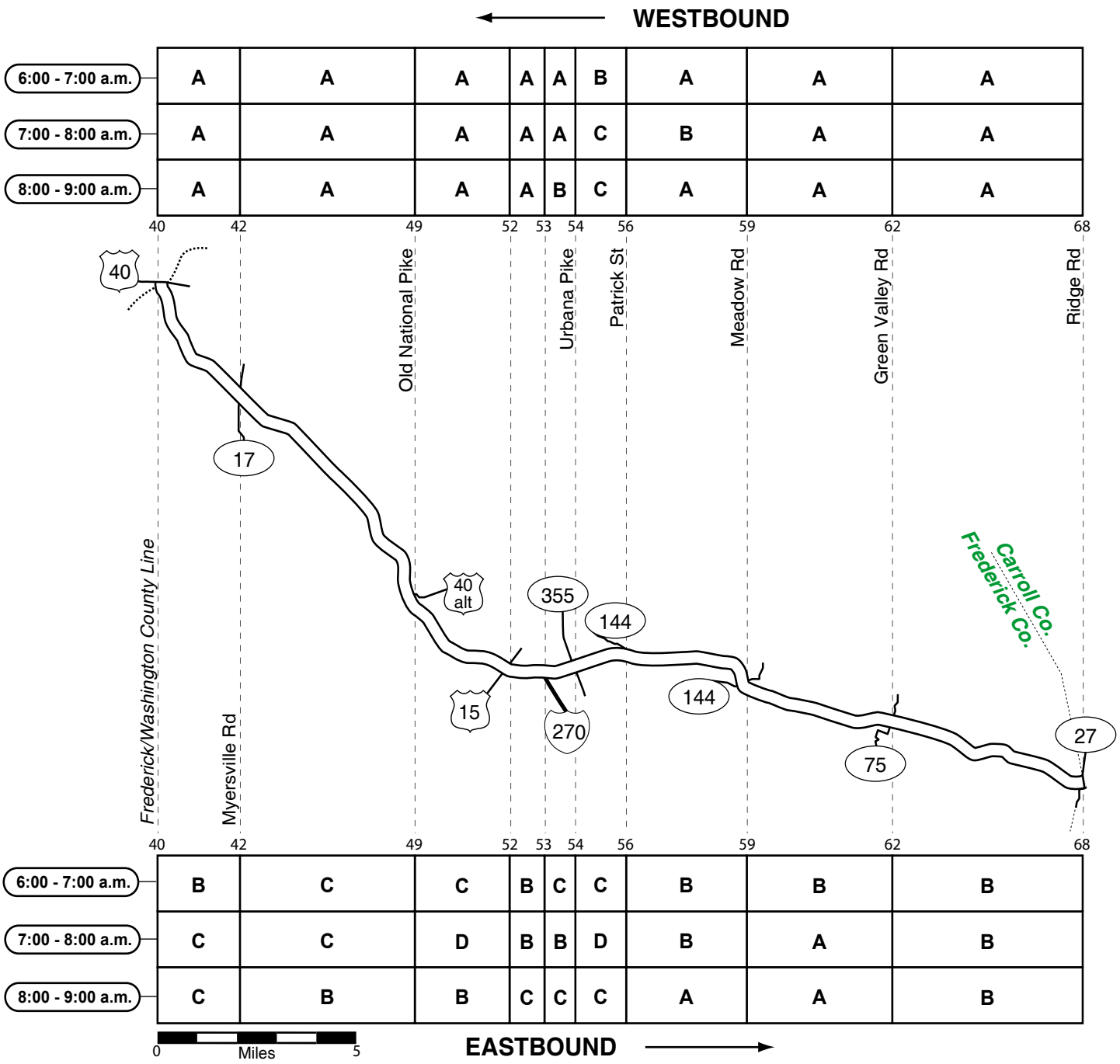
A
Congestion Type: Mainline Congestion
Location: Between I-495 & Chain Bridge Rd
Frequency: Most observations before 6:00 p.m.
Direction: Westbound
Queue Length: 3 to 5 miles
Estimated Speed: 25 to 50 mph
Note: Congestion was likely exacerbated by friction between the HOV facility and the congested "general-purpose" lanes.

Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-70 (Maryland) - Morning

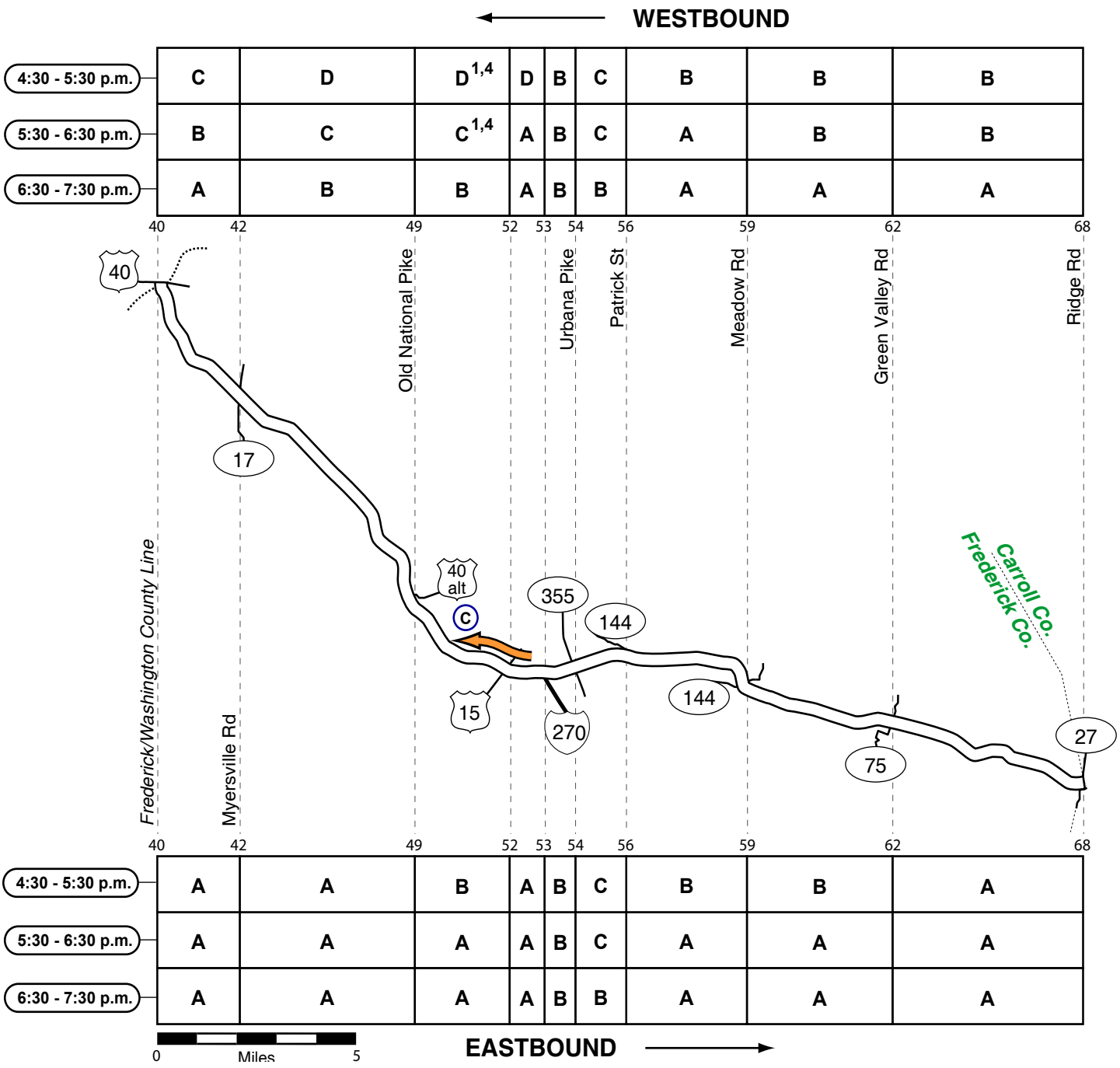


Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-70 (Maryland) - Evening



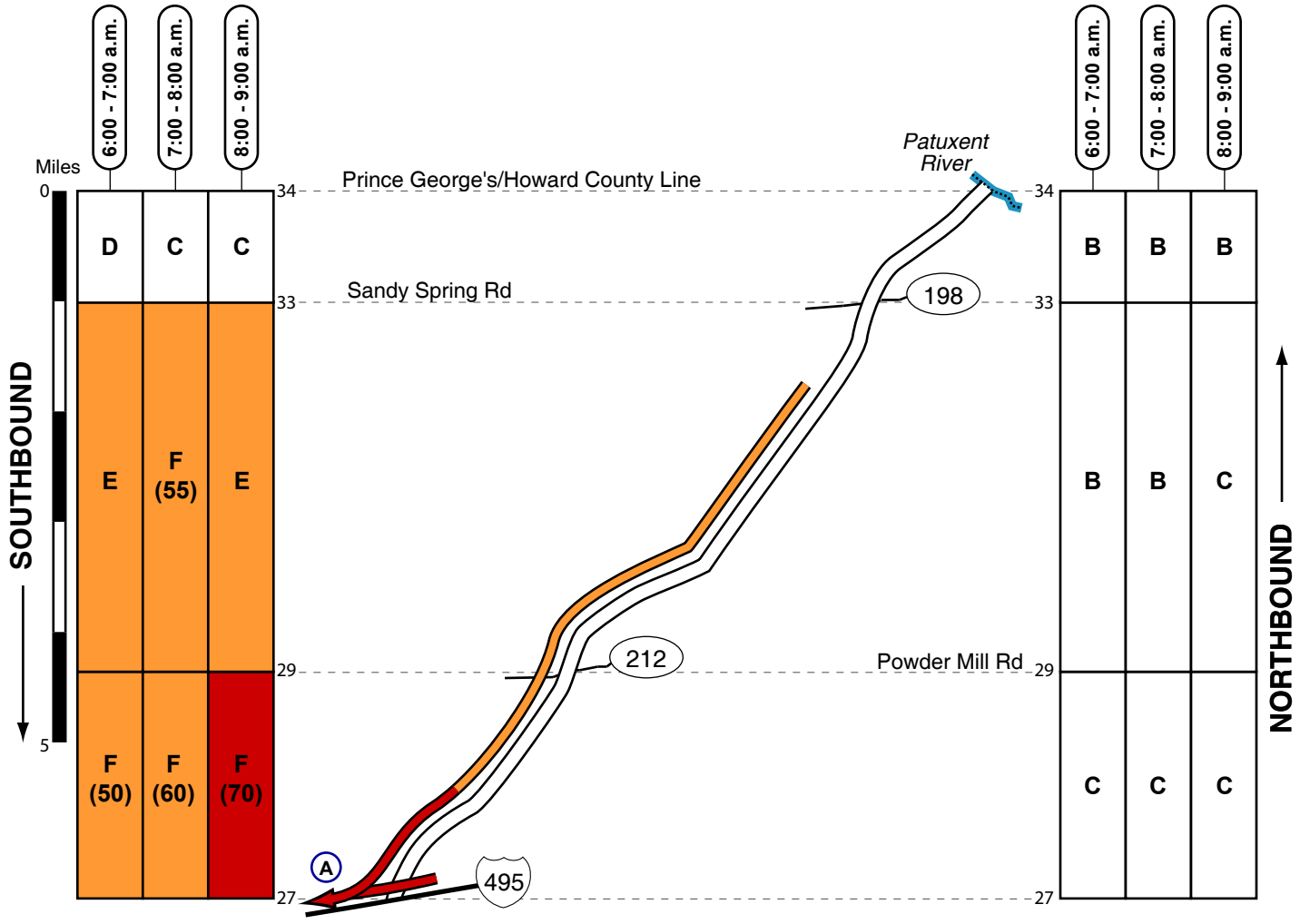
C
Congestion Type: Mainline Congestion
Location: Just west of US 15 / 40
Frequency: Intermittent
Direction: Westbound
Queue Length: 0.5 to 1 miles
Estimated Speed: 30 to 50 mph
Note: This zone of minor congestion was generated by traffic merging onto the 2 lanes of westbound I-70 from the US 15 northbound / southbound ramp. Beyond the merge, traffic speeds gradually picked up.

Traffic Quality Rating

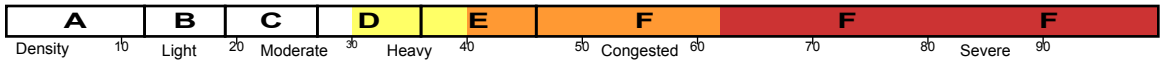
A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

I-95 (Maryland) - Morning

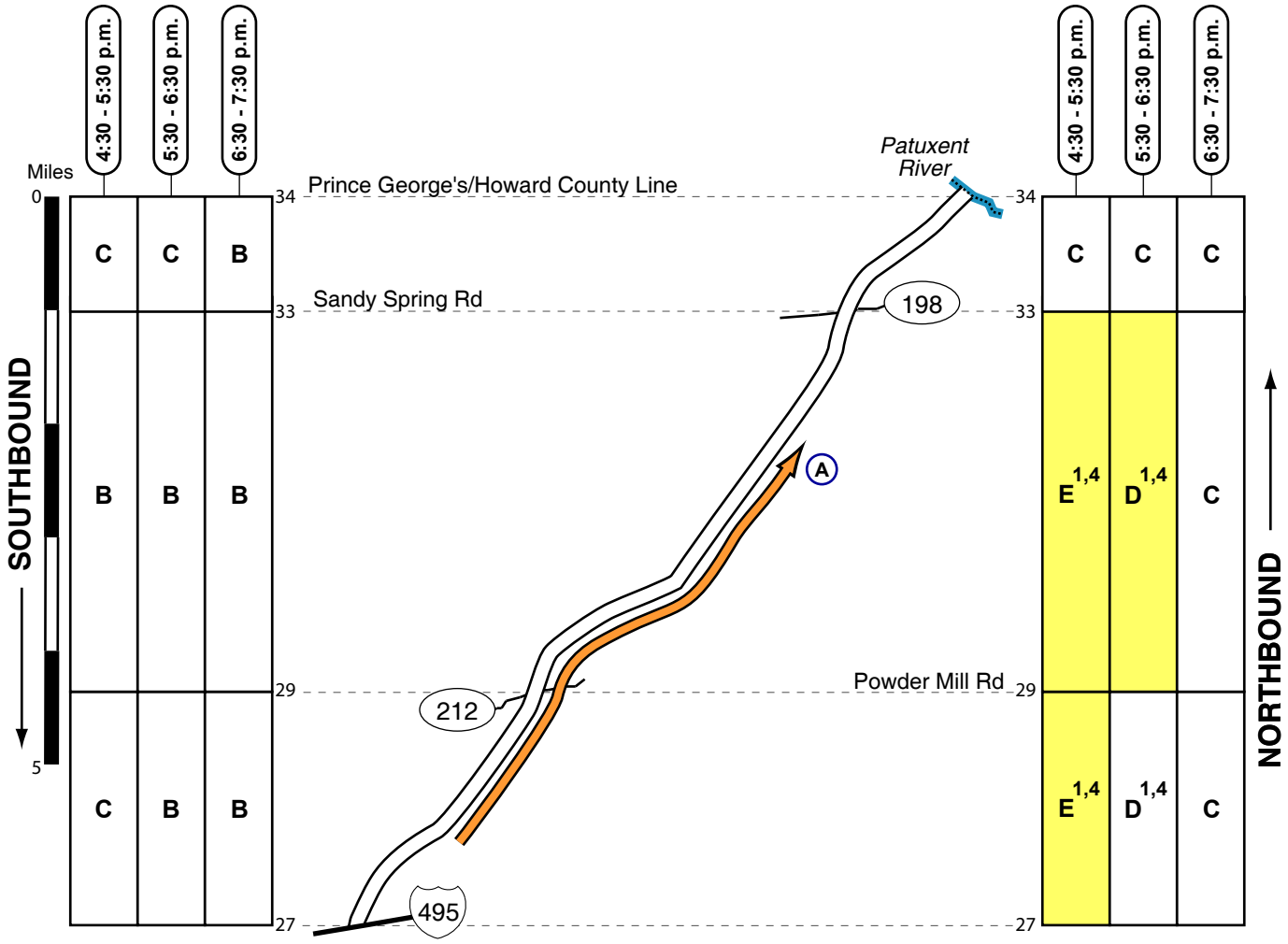


A
Congestion Type: Mainline Congestion
Location: Approaching I-495 (beltway)
Frequency: Most observations
Direction: Southbound
Queue Length: 3 to 6 miles
Estimated Speed: 25 to 45 mph
Note: Moderate southbound congestion on I-95 was found approaching the I-495 interchange during most observations between 6:30 and 9:00 a.m.; downstream congestion on the beltway outer loop was a contributing factor. Delays to the inner loop were not as extensive.



Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-95 (Maryland) - Evening



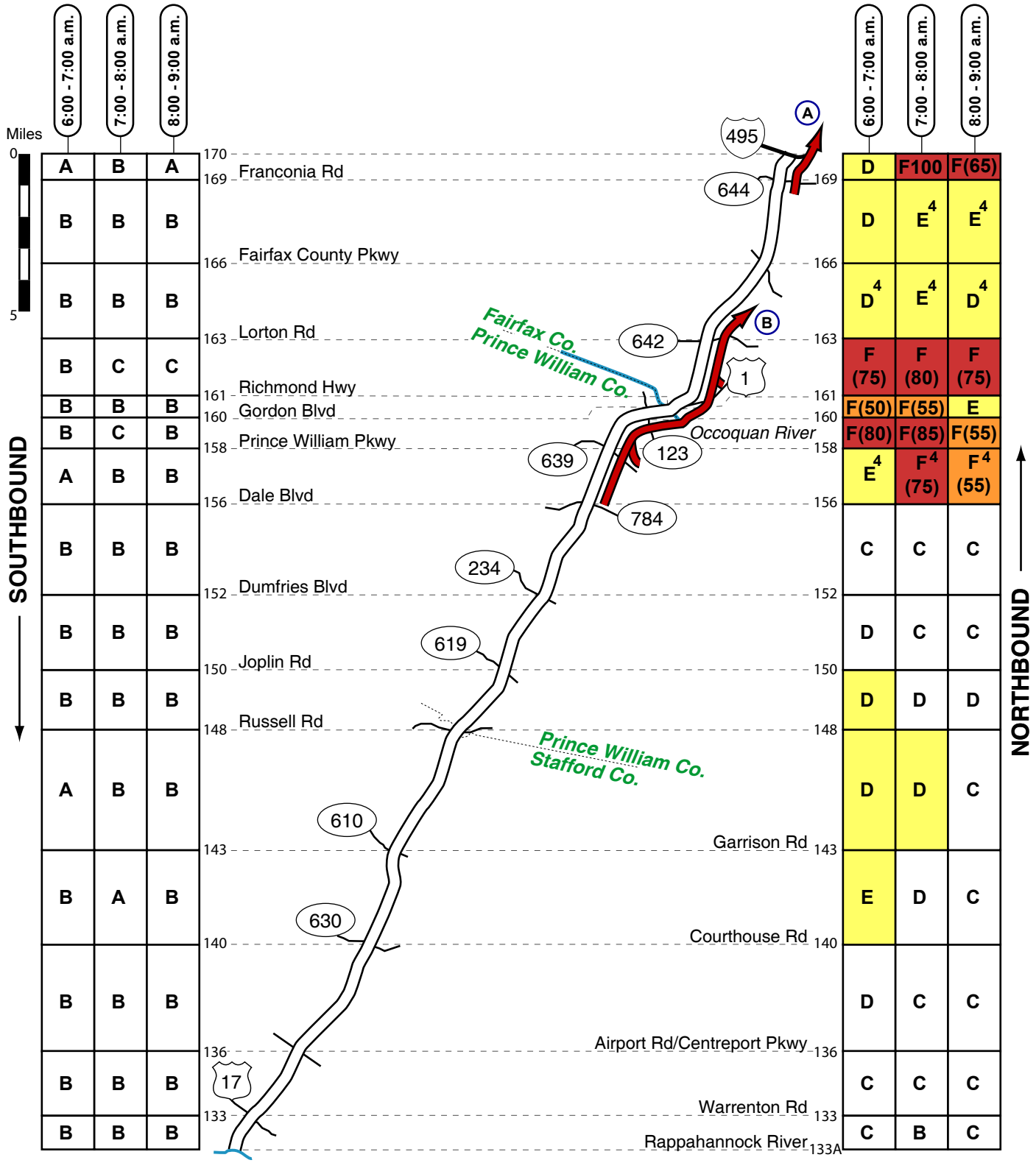
A
Congestion Type: Mainline Congestion
Location: I-495 (beltway ramps) to MD 198
Frequency: Intermittent
Direction: Northbound
Queue Length: 1 to 4 miles
Estimated Speed: 40 to 50 mph
Note: On some days but not others, light-to-moderate northbound congestion at reduced speeds of 40 to 50 mph was found on I-95 between the beltway interchange and MD 198.

Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-95 (Virginia) - Morning



Traffic Quality Rating

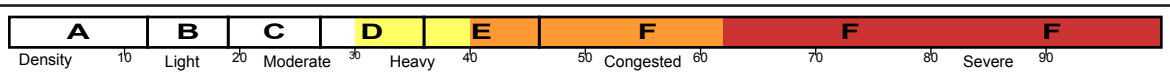
A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-95 (Virginia) - Morning

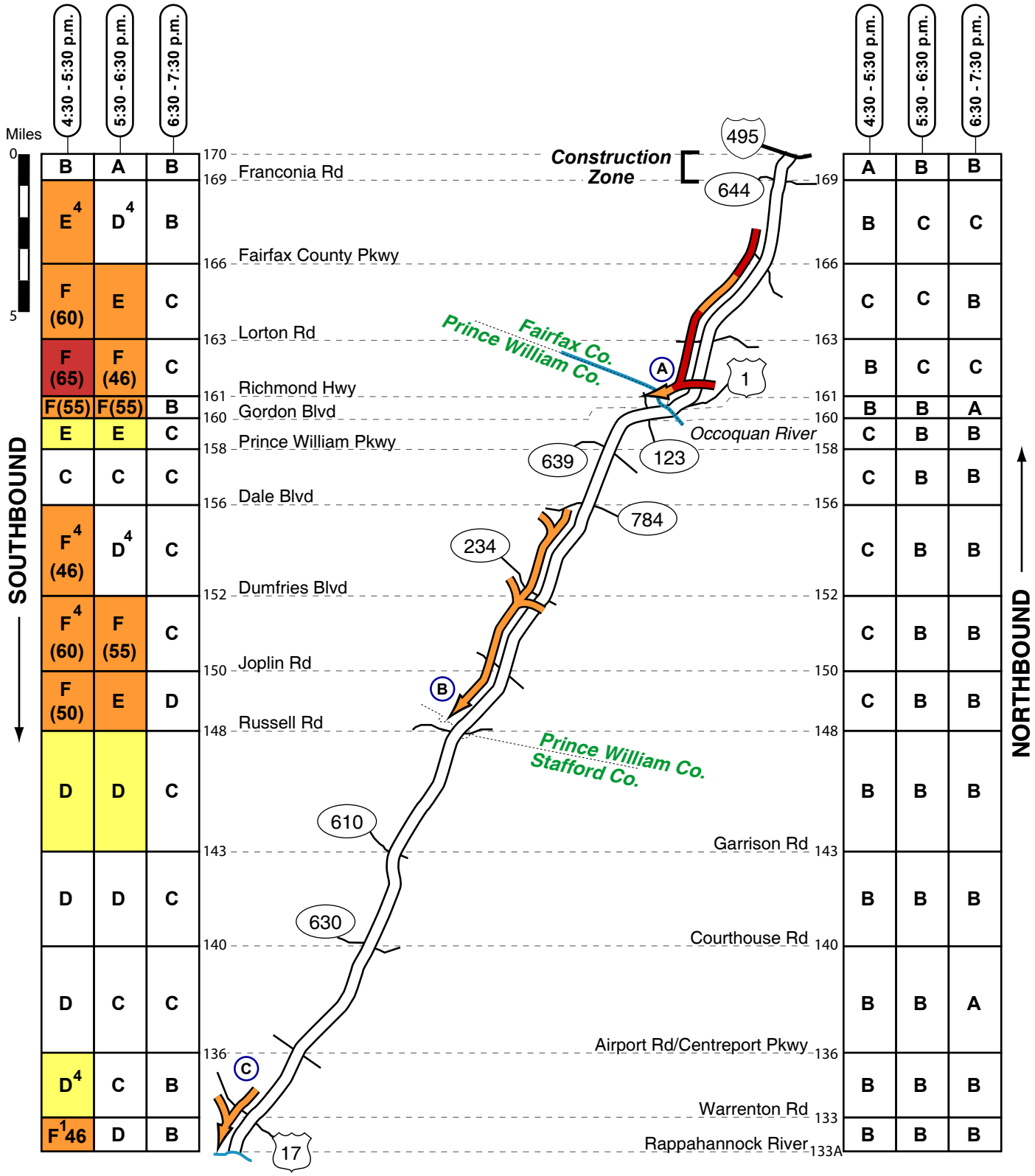
A
Congestion Type: Mainline Congestion
Location: Between Franconia Springfield Parkway & the Beltway
Frequency: Most observations after 7:00 a.m.
Direction: Northbound
Queue Length: 1 to 2 miles
Estimated Speed: 15 to 30 mph
Note: The head of the queue was found upstream on I-395 in the vicinity of VA 7.

B
Congestion Type: Mainline Congestion
Location: Between Dale Blvd & Fairfax County Parkway
Frequency: Most observations
Direction: Northbound
Queue Length: 6 to 9 miles
Estimated Speed: 15 to 45 mph
Note: Congestion was caused or exacerbated by merging associated with the Prince William Parkway and US Rte 1 interchanges.



Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-95 (Virginia) - Evening



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

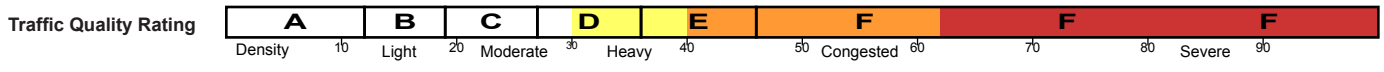
Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-95 (Virginia) - Evening

A
Congestion Type: Mainline Congestion
Location: Between Franconia Rd & Gordon Blvd
Frequency: Most observations before 6:30 p.m.
Direction: Southbound
Queue Length: 5 to 8 miles
Estimated Speed: 25 to 50 mph
Note: Factors contributing to the congestion were: 1) the lane drop (4 lanes to 3) at Fairfax County Parkway; 2) traffic entering at US Rte 1 and; 3) the Occoquan River Crossing.

B
Congestion Type: Mainline Congestion
Location: Between Dale Blvd & Russell Rd
Frequency: Most observations before 6:30 p.m.
Direction: Southbound
Queue Length: 6 to 8 miles
Estimated Speed: 25 to 50 mph
Note: Congestion was caused or exacerbated by traffic entering from Dale Blvd, Dumfries Rd and the HOV terminus.

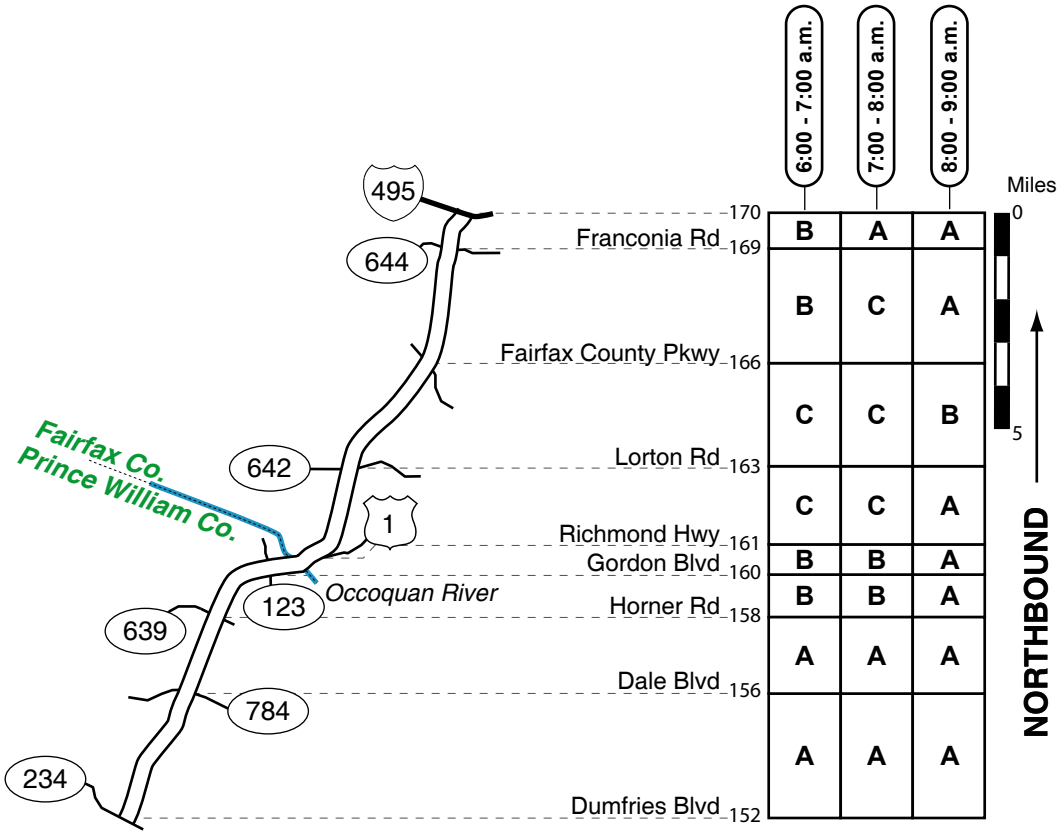
C
Congestion Type: Mainline Congestion
Location: Approaching the Rappahannock River Crossing
Frequency: Most observations before 5:30 p.m.
Direction: Southbound
Queue Length: 1 to 2 miles
Estimated Speed: 40 to 50 mph
Note: Congestion appeared to be caused or exacerbated by traffic entering at US 17.



Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

I-95 Barrier Separated HOV (Virginia) - Morning

HOV OPERATIONS
HOV 3
6:00 - 9:00 A.M.
NORTHBOUND

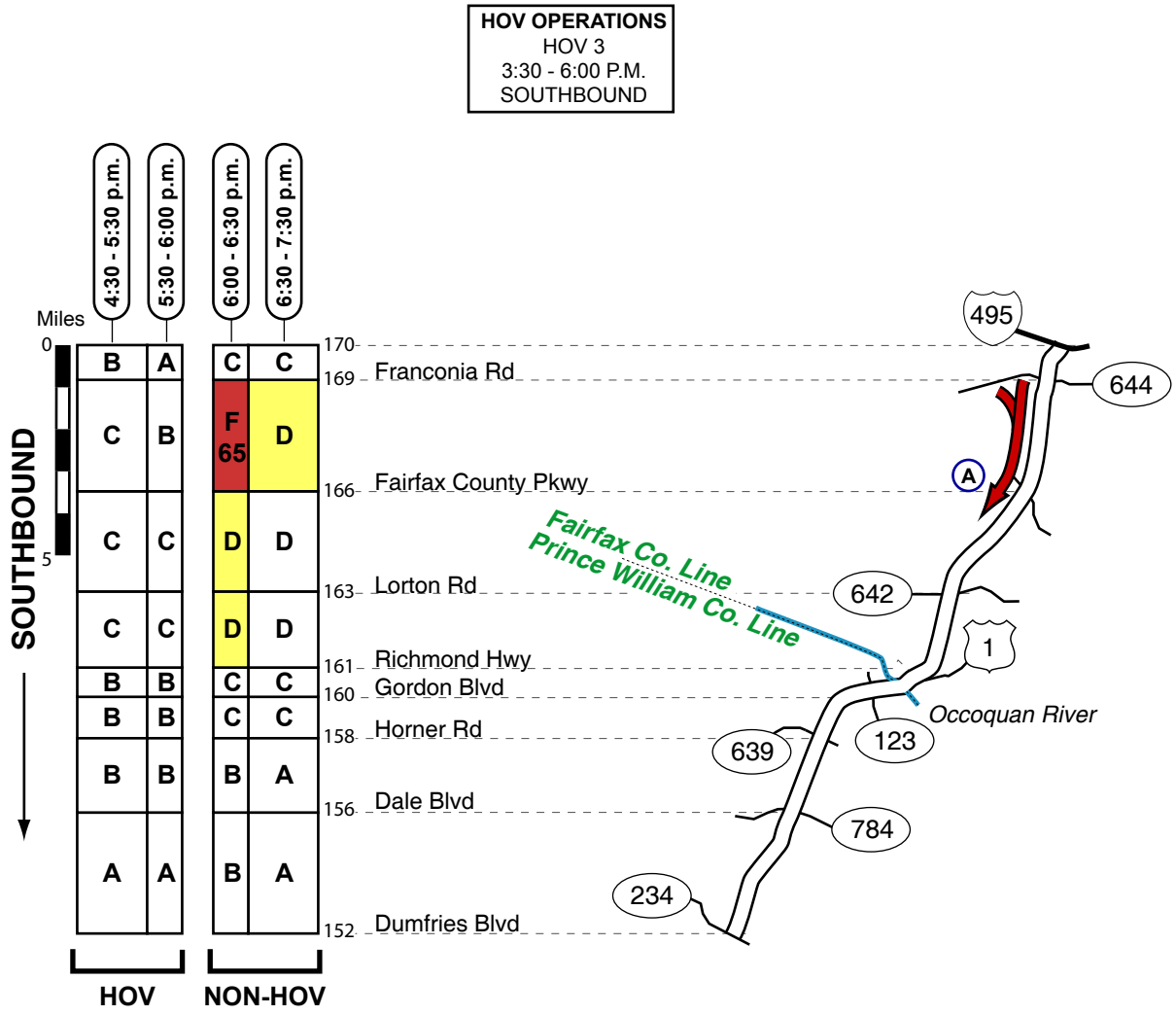


Traffic Quality Rating

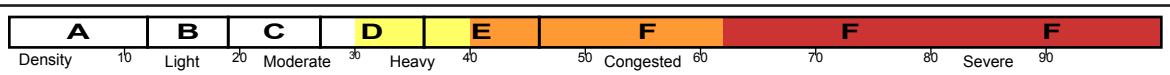
A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-95 BARRIER SEPARATED HOV (VIRGINIA) - EVENING



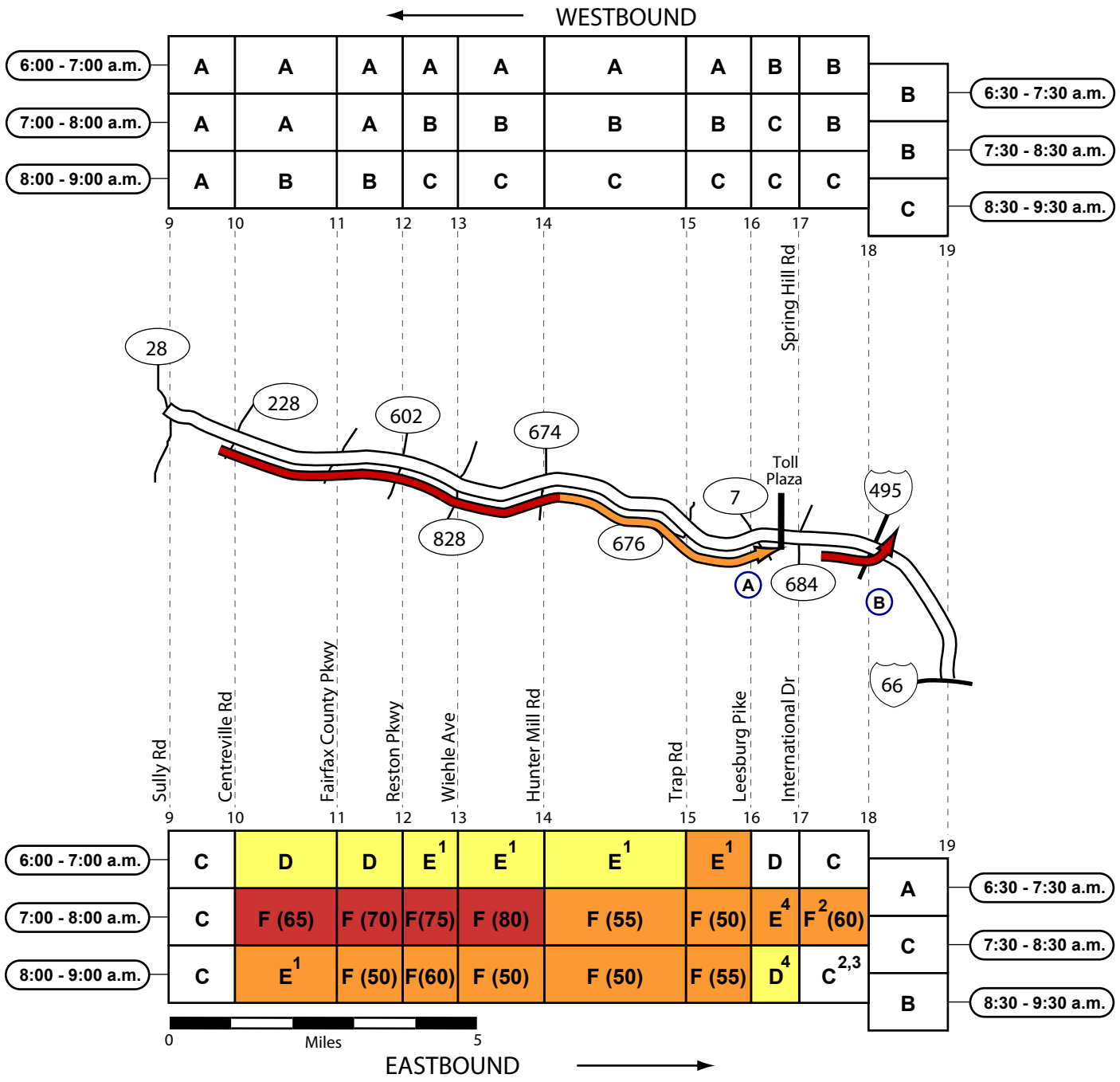
A
Congestion Type: Mainline Congestion
Location: Between Franconia Rd & Fairfax County Parkway
Frequency: After 6:00 p.m.
Direction: Southbound
Queue Length: 1 to 3 miles
Estimated Speed: 30 to 50 mph
Note: Similar to previous surveys, congestion was found after 6:00 p.m. in the left "general-purpose" lane approaching the HOV entrance at Franconia-Springfield Parkway; upstream congestion developed on both roadways approaching the merge. South of the HOV entrance ramp, traffic flow on the HOV roadway gradually improved.



Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

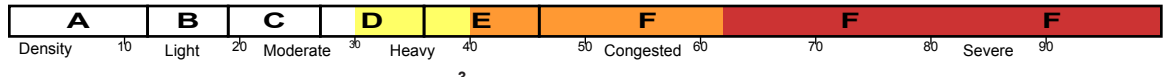
(Blank)

VA 267 (Toll Road) - Morning



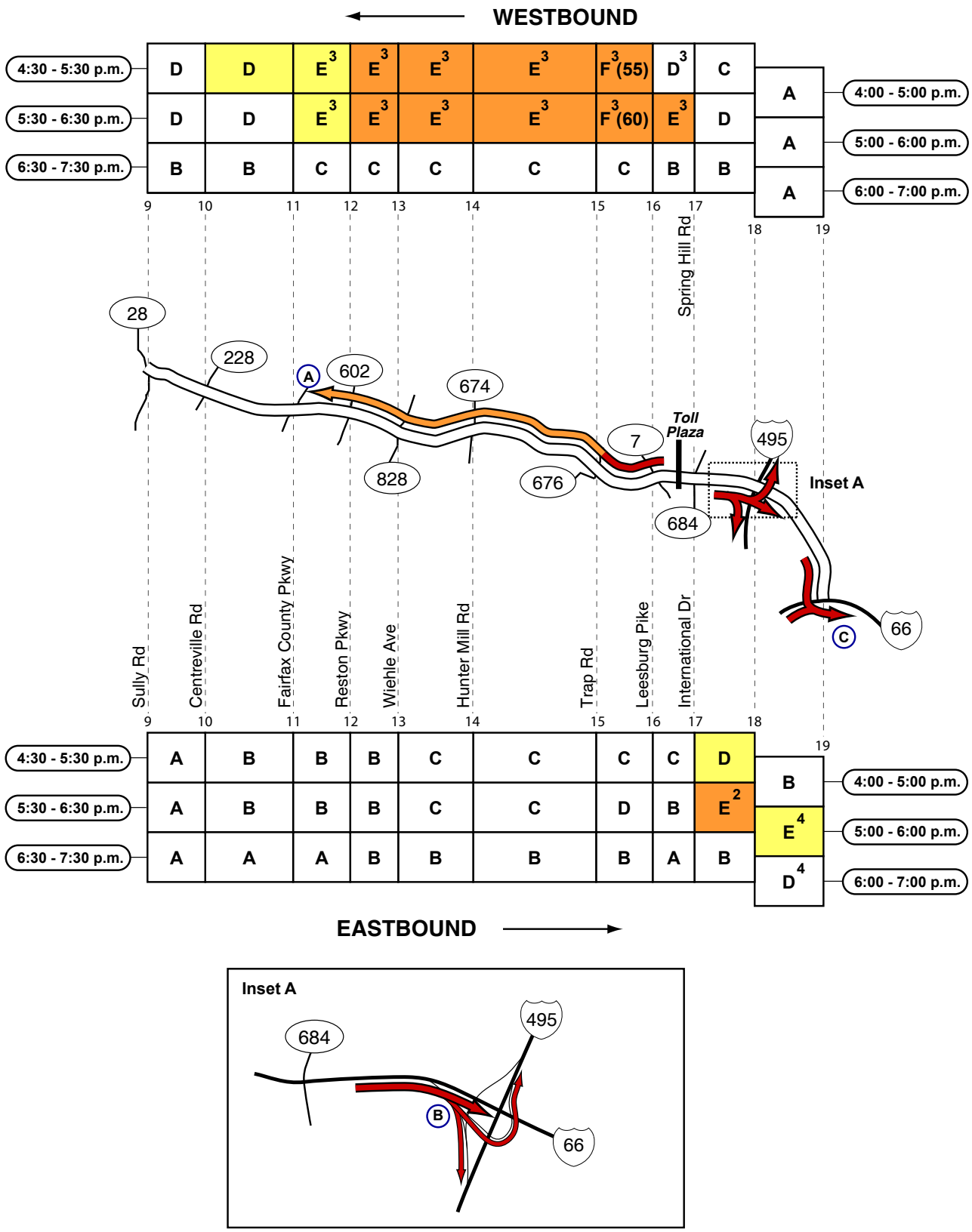
A
Congestion Type: Mainline Congestion
Location: Between Centreville Rd & the Mainline Toll Plaza.
Frequency: Most observations
Direction: Eastbound
Queue Length: 7 to 9 miles
Estimated Speed: 20 to 50 mph
Note: Factors contributing to the congestion were: 1) traffic entering at Fairfax County Parkway, Reston Parkway, Wiehle Ave and Hunter Mill Rd and; 2) the weaving associated with the high speed EZPass lanes at the mainline toll plaza. The toll plaza was not the capacity constraint.

B
Congestion Type: Mainline Congestion
Location: Between the Mainline Toll Plaza and the Beltway
Frequency: Most observations between 7:00 and 8:30 a.m.
Direction: Eastbound
Queue Length: 1 to 2 miles
Estimated Speed: 20 to 40 mph
Note: The head of the queue was found on the ramp to the innerloop of the Beltway; congestion appeared to be caused or exacerbated by the lane drop (2 lanes to 1) on the ramp. Congestion typically extended back into the right lane (and eventually across all lanes) of VA 267.



Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

VA 267 (Toll Road) - Evening



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

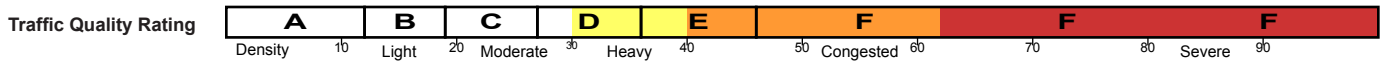
Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

VA 267 (Toll Road) - Evening

A
Congestion Type: Mainline Congestion
Location: Between the Mainline Toll Plaza and Fairfax County Parkway
Frequency: Most observations between 5:00 and 6:00 p.m.
Direction: Westbound
Queue Length: 6 to 8 miles
Estimated Speed: 20 to 50 mph
Note: The primary bottleneck appeared to be the lane drop (4 lanes to 3) in the vicinity of VA 7; congestion was exacerbated by the weaving and merging associated with the interchanges along this corridor.

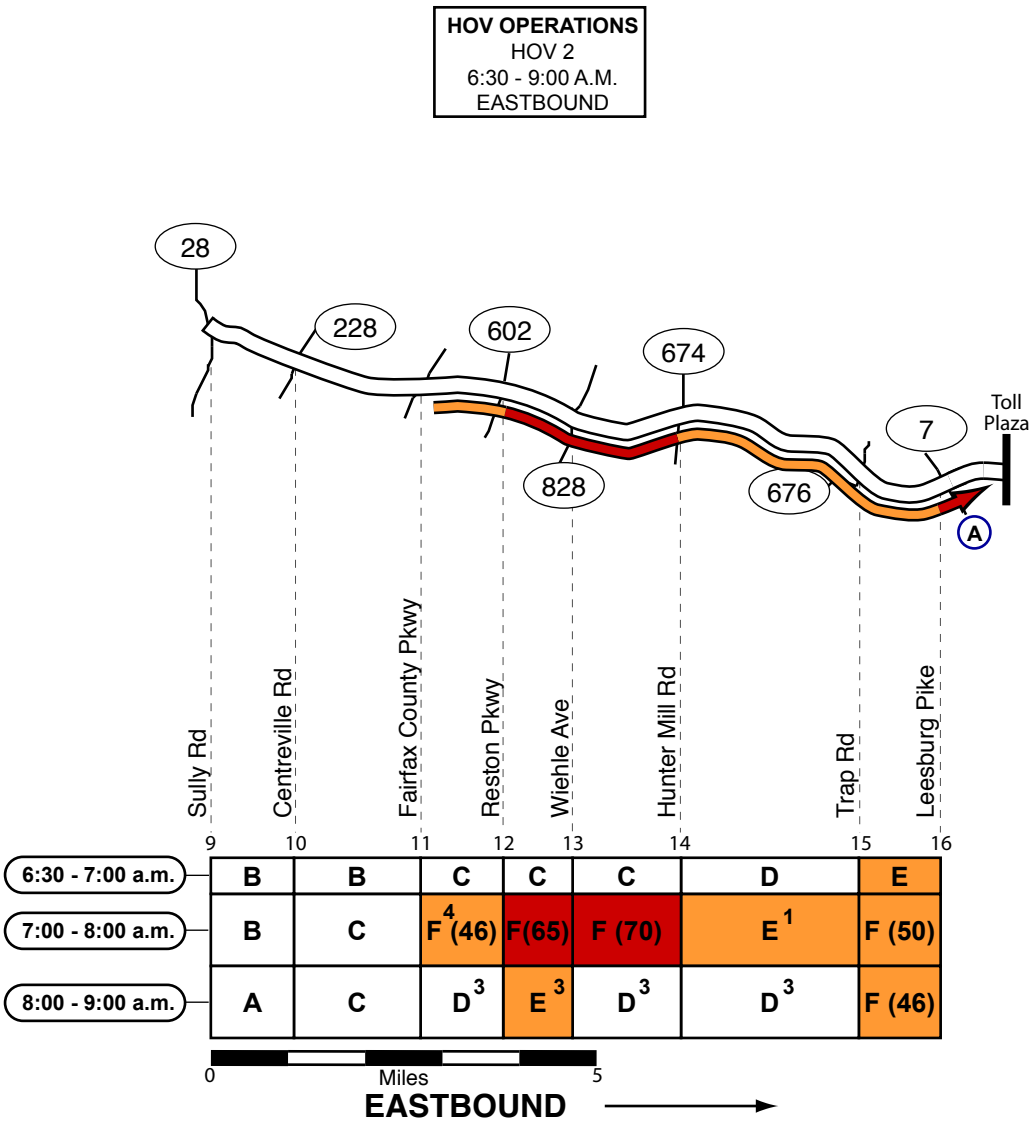
B
Congestion Type: Mainline Congestion/Exit Ramp Queue
Location: Approaching the Beltway
Frequency: On some days but not others
Direction: Eastbound
Queue Length: 0.5 to 1 miles
Estimated Speed: 20 to 40 mph
Note: Factors contributing to the congestion were: 1) congestion on the ramps to the Beltway which extended back into the right lane (and eventually across all lanes) of VA 267 and; 2) the lane drop (3 lanes to 2) at the Beltway.

C
Congestion Type: Mainline Congestion
Location: Approaching I-66
Frequency: Most observations after 5:00 p.m.
Direction: Eastbound
Queue Length: 1 to 2 miles
Estimated Speed: 30 to 50 mph
Note: Congestion was caused by the merge into congested flow on I-66 (eastbound).

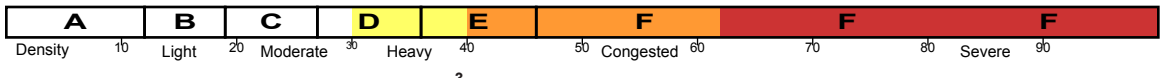


Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

VA 267 (Dulles Toll Road) Left Lane Concurrent HOV - Morning



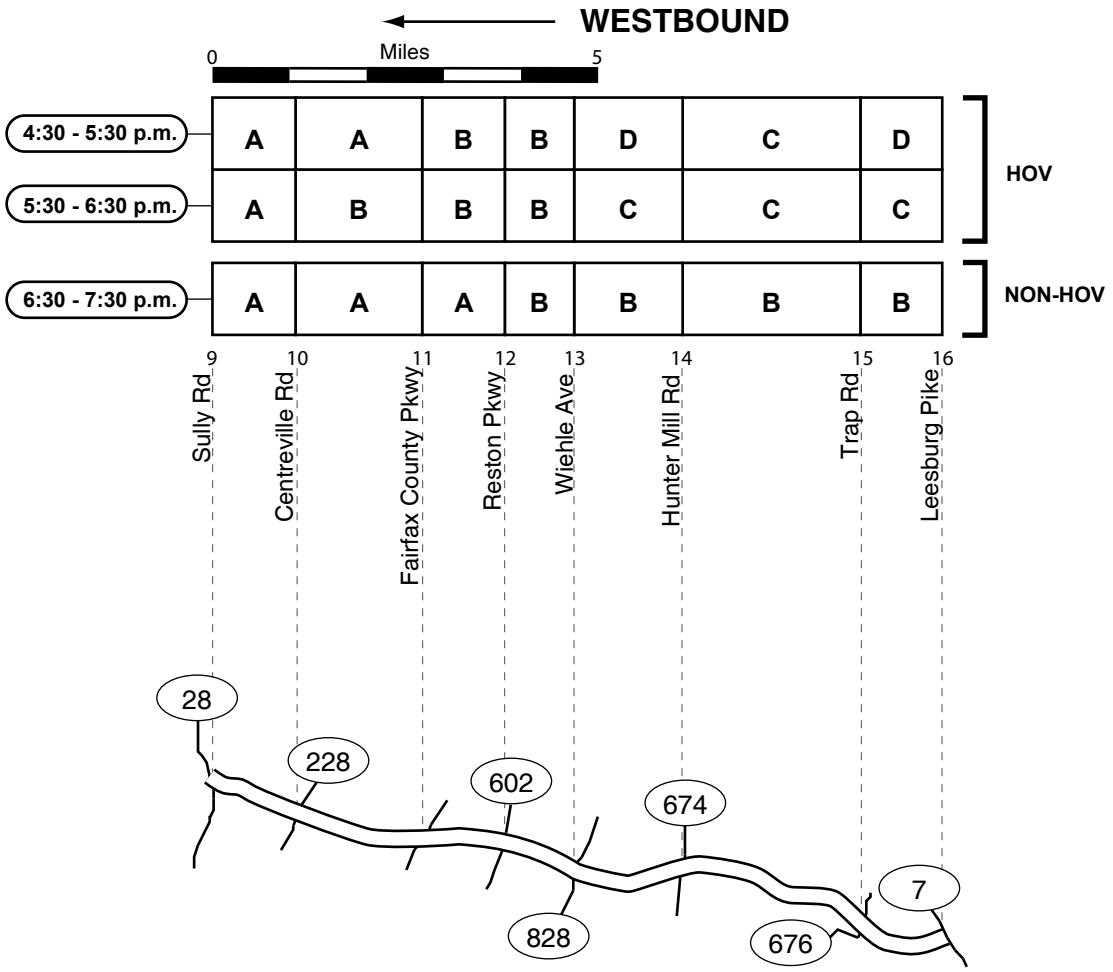
A
Congestion Type: Mainline Congestion
Location: Between Fairfax County Parkway and the Mainline Toll Plaza
Frequency: Most observations between 7:00 and 8:30 a.m.
Direction: Eastbound
Queue Length: 6 to 8 miles
Estimated Speed: 35 to 50 mph
Note: The head of the queue was found at the HOV terminus where the HOV lanes become dedicated EZPass lanes; congestion was exacerbated by the weaving associated with the “general-purpose” and HOV lanes approaching the mainline toll plaza.



Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

VA 267 (Dulles Toll Road) Left Lane Concurrent HOV - Evening

HOV OPERATIONS
HOV 2
4:00 - 6:30 P.M.
WESTBOUND

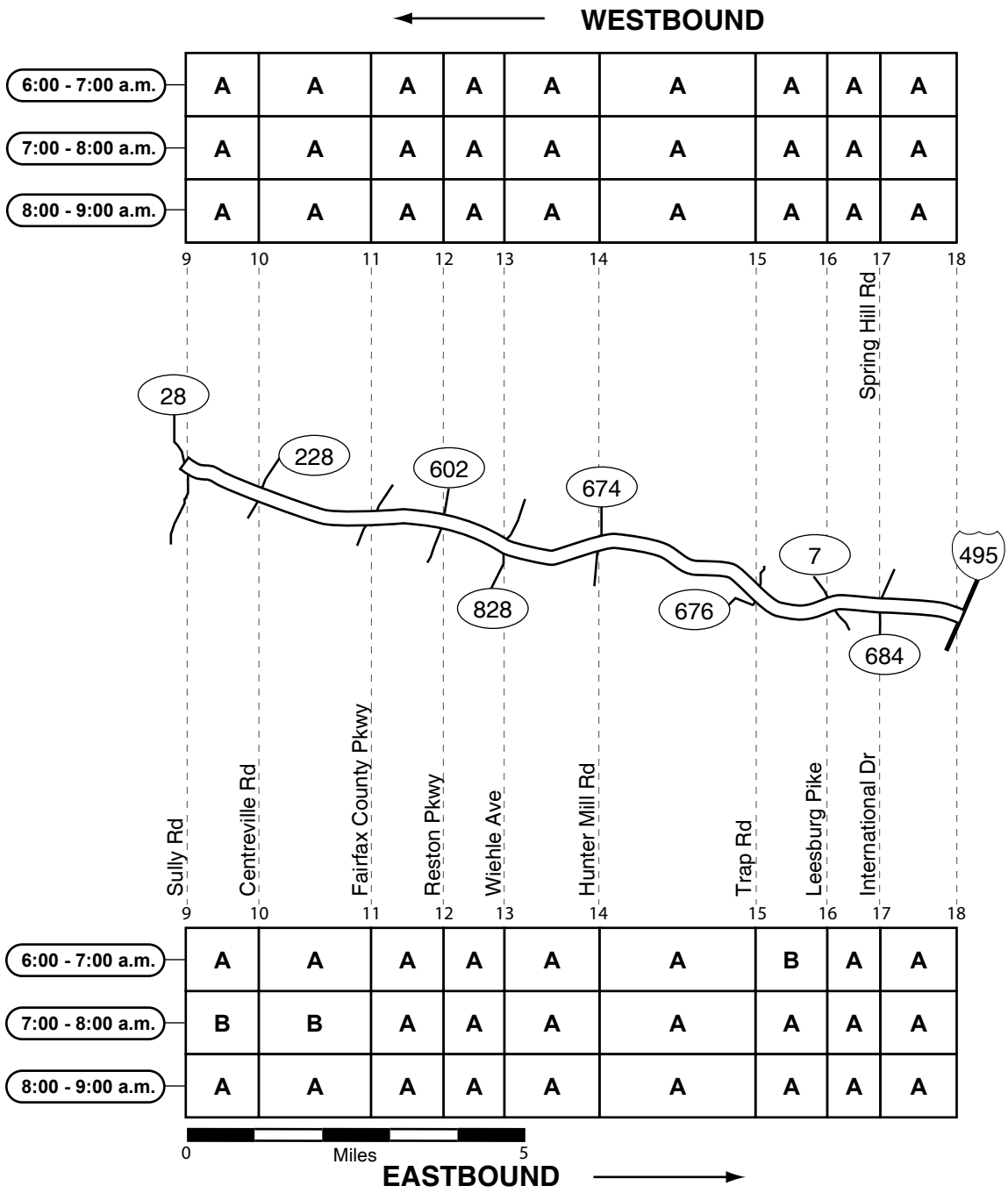


Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40	50	Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

VA 267 (Dulles Airport Access Road) - Morning

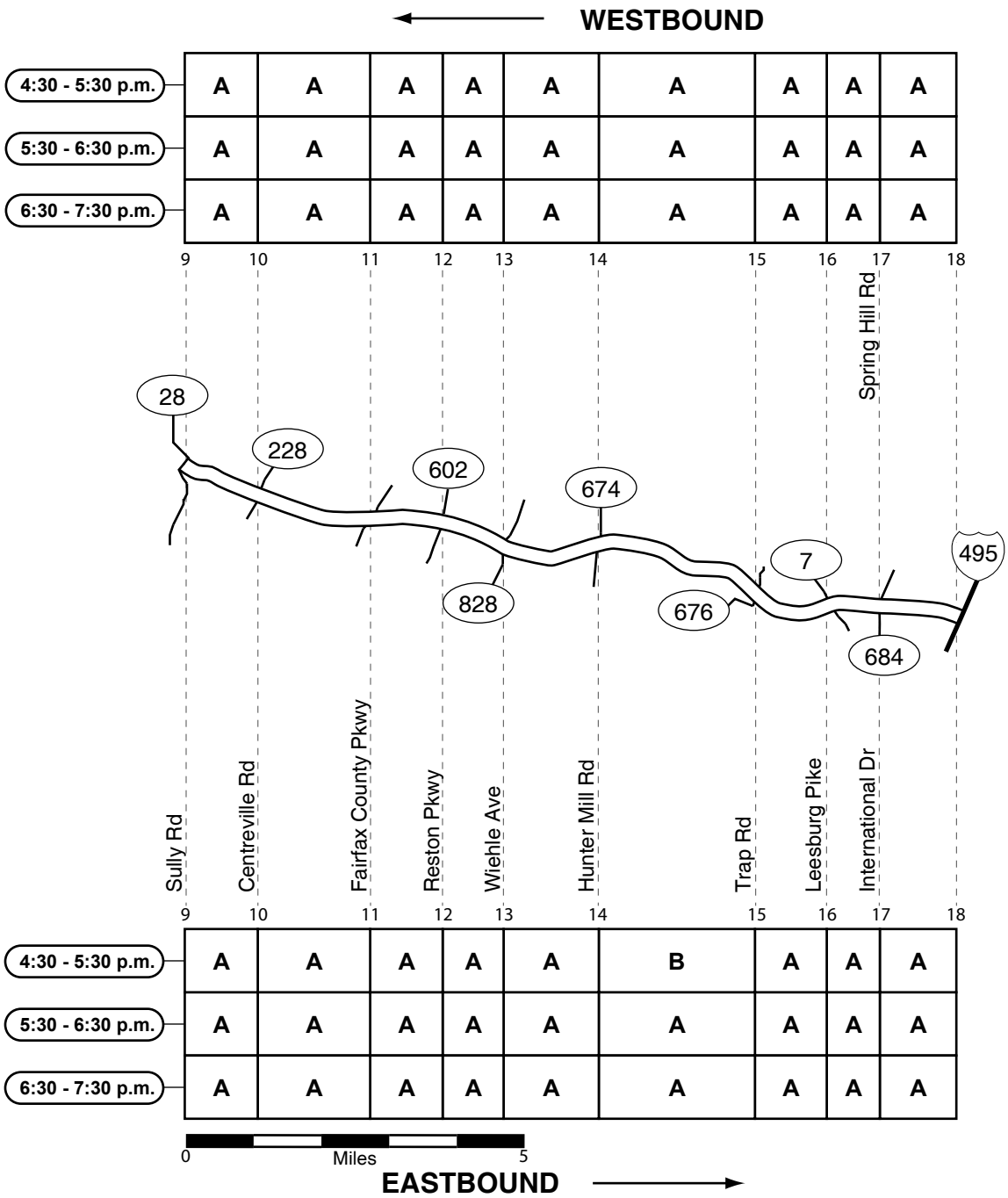


Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

VA 267 (Dulles Airport Access Road) - Evening

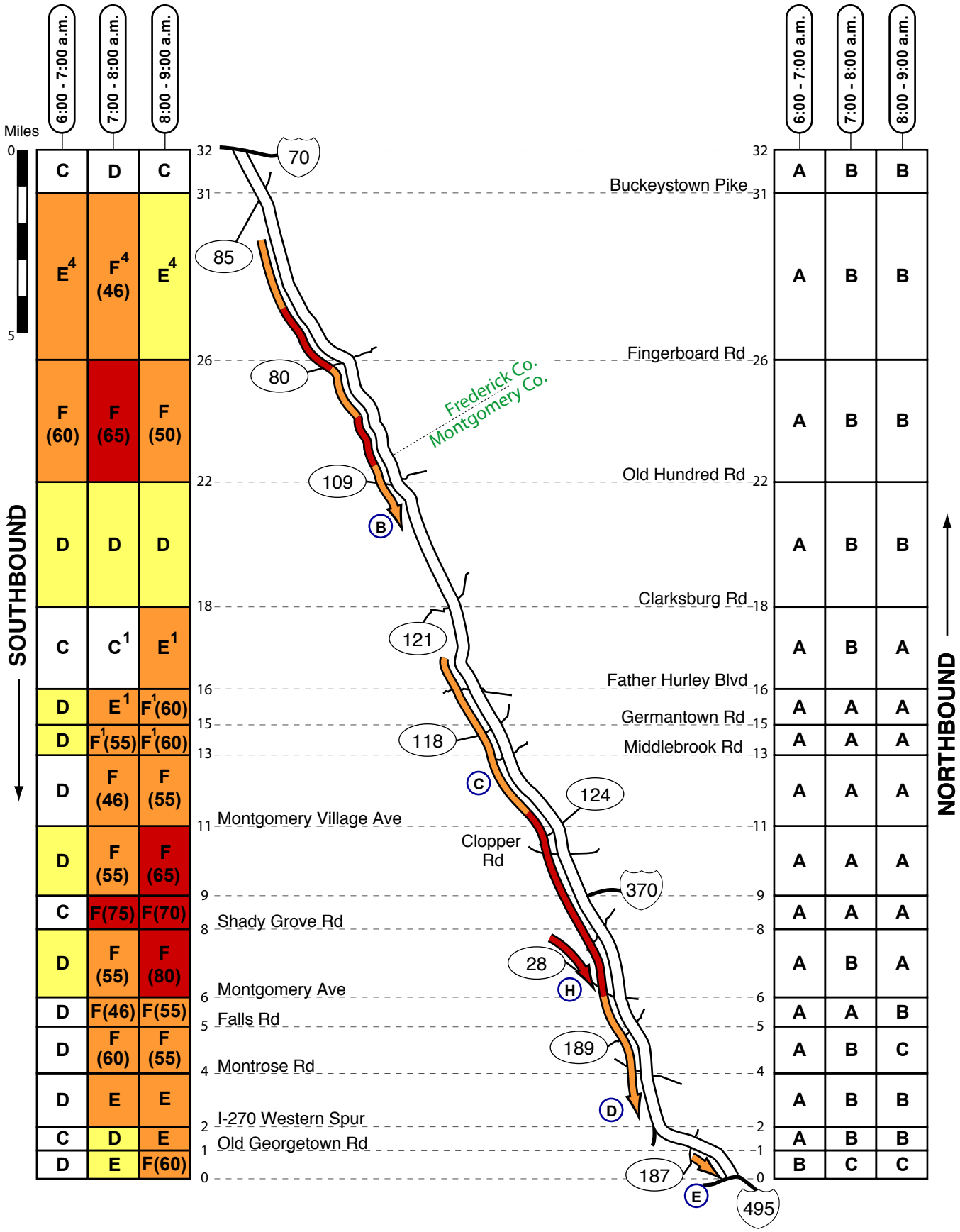


Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-270 (Maryland) - Morning



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-270 (Maryland) - Morning

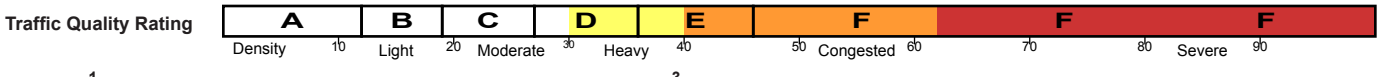
B
Congestion Type: Mainline Congestion
Location: Frederick into Montgomery Counties
Frequency: Most observations
Direction: Southbound
Queue Length: 4 to 7 miles
Estimated Speed: 20 to 50 mph
Note: A long zone of congestion with widely varying levels of severity was found through lower Frederick County and past the weigh station in Montgomery County. Merging traffic at MD 80 and MD 109 contributed to the delays; tractortrailers merging uphill from the weigh station probably played a role as well.

C
Congestion Type: Mainline Congestion
Location: Clarksburg Rd (MD 121) to Middlebrook Rd
Frequency: Intermittent
Direction: Southbound
Queue Length: 1 to 4 miles
Estimated Speed: 20 to 50 mph
Note: Between Clarksburg and Middlebrook Roads, southbound congestion was less predictable than farther to the south (to I-370 and beyond), as delays cleared early some days and persisted other days until late in the survey period.

D
Congestion Type: Mainline Congestion
Location: Middlebrook to Montrose Rds
Frequency: Most observations
Direction: Southbound
Queue Length: 8 to 10 miles
Estimated Speed: 15 to 40 mph
Note: An extended zone of moderate to severe southbound congeston was found on both the express and local lanes of I-270. Congestion was most severe between MD 124 and MD 28. The concurrent-flow HOV lane usually provided better service, although light to moderate congestion was often present.

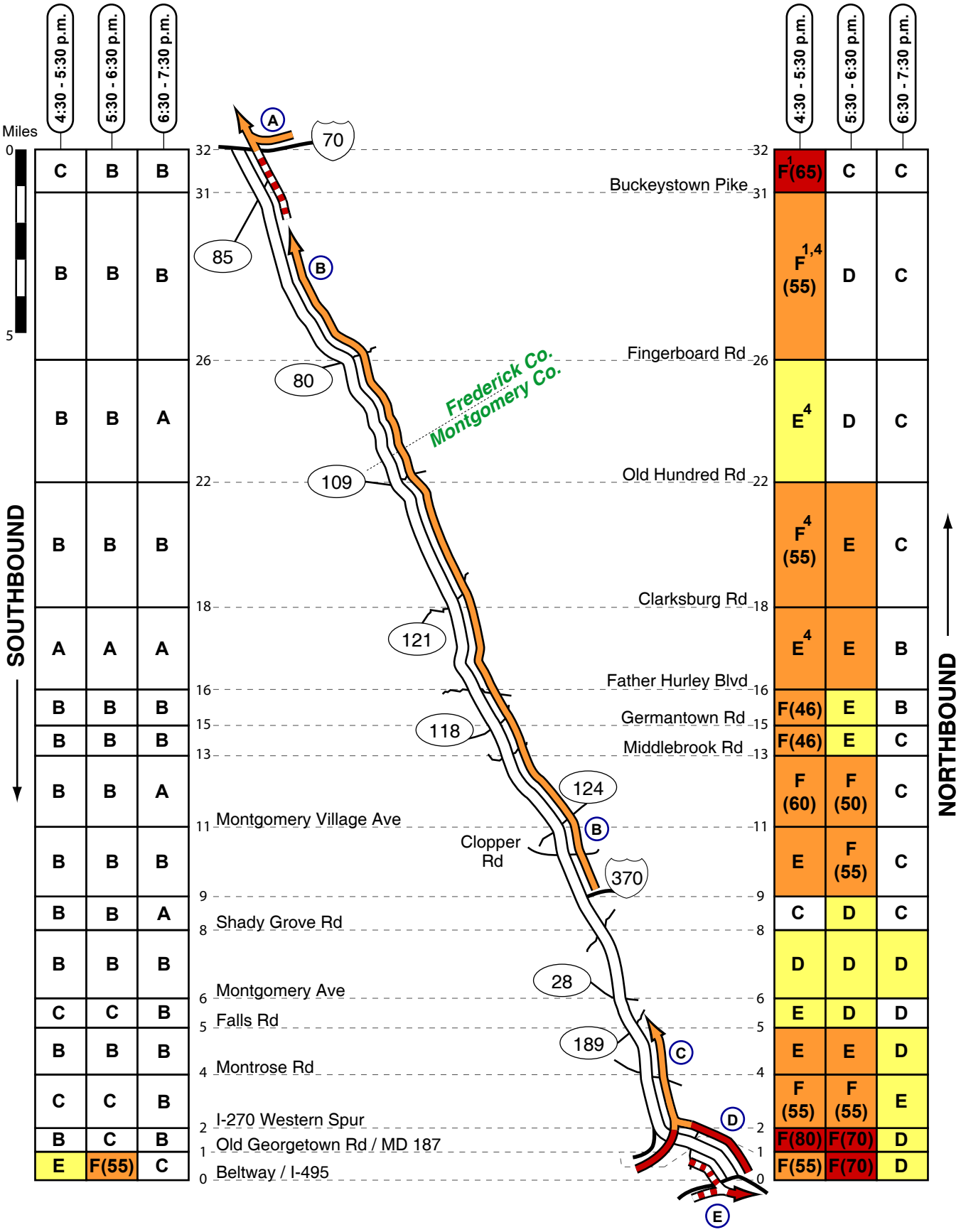
E
Congestion Type: Mainline Congestion
Location: Approaching I-495 / MD 355
Frequency: Intermittent
Direction: Southbound
Queue Length: 0.25 to 1.5 miles
Estimated Speed: 30 to 50 mph
Note: In the absence of downstream beltway congestion affecting I-270, which normally was the case, southbound I-270 traffic was only briefly delayed at the MD 355 / I-495 interchange. Weaving associated with the end of the HOV lane and the left exit to MD 355 was the apparent cause.

H
Congestion Type: Entrance Ramp Queue
Location: W. Montgomery Ave
Frequency: Most observations
Direction: Eastbound to southbound
Queue Population: 60 to 120 vpl
Number of Lanes: 1
Note: Vehicles waiting to enter the local lanes of I-270 were often severely congested in the right lane of MD 28, encountering the tail shortly after passing Darnestown Rd.



Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-270 (Maryland) - Evening



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

I-270 (Maryland) - Evening

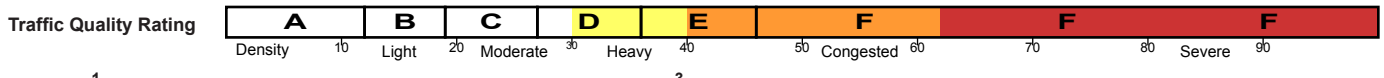
A
Congestion Type: Mainline "spillback" congestion
Location: Approaching I-70 and Frederick
Frequency: Some days, not others
Direction: Northbound
Queue Length: 1 to 4 miles
Estimated Speed: 30 to 50 mph
Note: I-270 approaching I-70 was congested for significant distances some afternoons but not congested at all during others. It appears that confirmed or suspected incidents on US 15 to the north were the difference, and that these segments serve as a "spillback" zone for frequent downstream problems. In any event, daily commuters experience the full range of traffic conditions approaching Frederick in the evening.

B
Congestion Type: Mainline Congestion
Location: Various locations
Frequency: Intermittent
Direction: Northbound
Estimated Speed: 20 to 50 mph
Note: Based on what was found during the four 2008 surveyed evenings, the entire distance from I-370 to Frederick appeared to be succession of interspersed lightly and moderately-congested travel zones. In the absence of incidents, congestion in these zones was not severe, although stop-and-go conditions were intermittently found. Delays were most likely at the end of the local lanes (vic. Montgomery Village Ave) and the end of the HOV lane (merge to 2 lanes north of Clarksburg Rd).

C
Congestion Type: Minor mainline slowing
Location: From spur to MD 189 (Falls Rd)
Frequency: Intermittent
Direction: Northbound
Queue Length: 1 to 3 miles
Estimated Speed: 35 to 50 mph
Note: At the confluence of I-270 and the I-270 spur, flow was characterized by minor speed reductions through a major weaving zone. North of the local lanes divide vicinity Montrose Rd, traffic on the mainline was heavy but, in the absence of incidents, significant delays were not found.

D
Congestion Type: Mainline Congestion
Location: From I-495 to merge at I-270 Spur
Frequency: Most observations
Direction: Northbound
Queue Length: 1 to 2 miles
Estimated Speed: 20 to 30 mph
Note: Moderate congestion with average travel speeds in the 20-30 mph range were found between the beltway and the merge at the I-270 Spur. The confluence of this congested flow with congested flow from the Spur appeared to be the underlying cause.

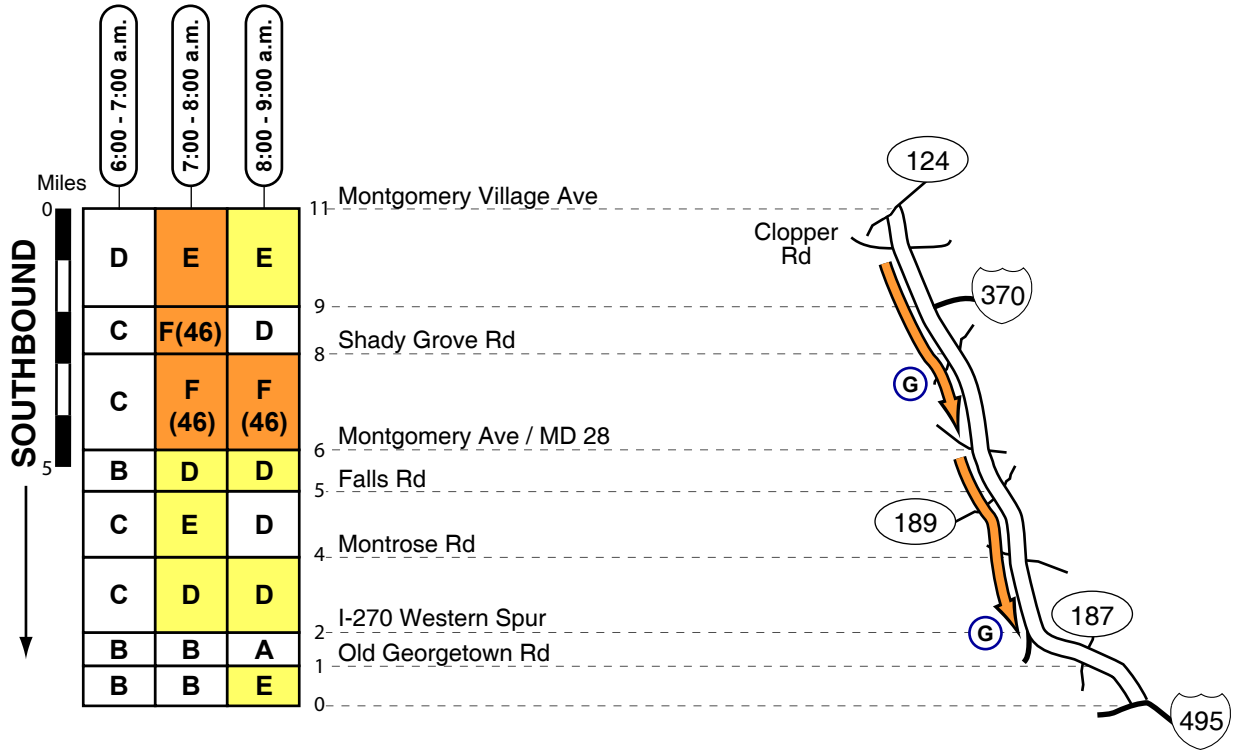
E
Congestion Type: Mainline "spillback" congestion
Location: I-270 approaching I-495 (beltway)
Frequency: Intermittent
Direction: Southbound
Queue Length: 0.5 to 1 miles
Estimated Speed: 20 to 40 mph
Note: The last segment of I-270 approaching the beltway appeared to serve as a "spillback zone" for congestion on the beltway that occurred some evenings but not others; it apeared, however, in the absence of beltway incidents, that vehicles normally traveled through this zone without encountering significant delays.



Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

I-270 (Maryland) Left Lane / Concurrent Flow HOV - Morning

HOV OPERATIONS
HOV 2
6:00 - 9:00 A.M.
SOUTHBOUND



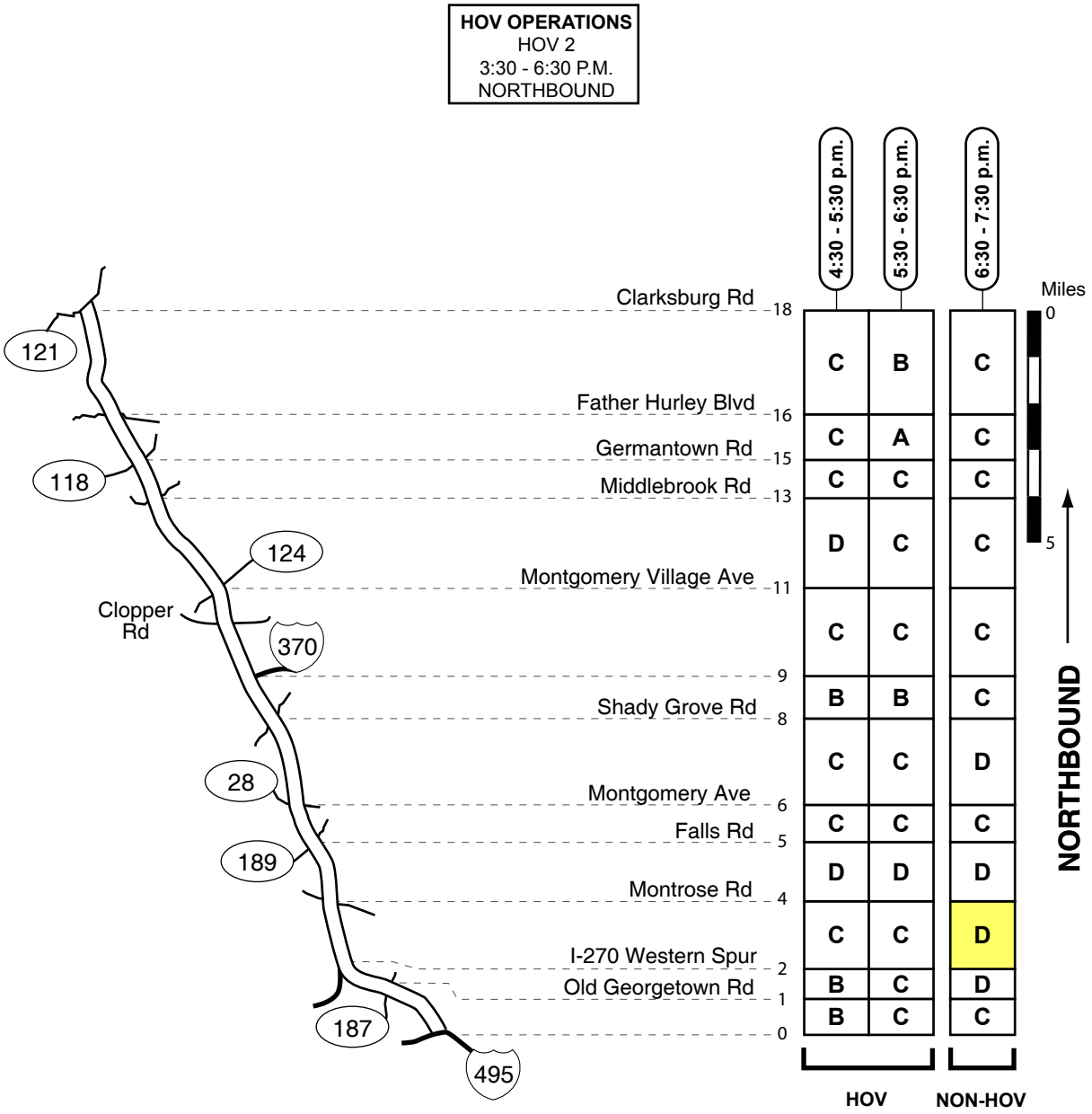
G
Congestion Type: Concurrent-flow HOV lane
Location: MD 124 to MD 28
Frequency: Most observations
Direction: Southbound
Queue Length: 3 to 5 miles
Estimated Speed: 30 to 50 mph
Note: During most observations, concurrent-flow HOV traffic flowed under moderately congested conditions north of MD 28 (W. Montgomery Ave); south of MD 28, HOV flow typically was only intermittently congested (a significant improvement over the 2005 survey findings; see I-270 Spur).

Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40	50	Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-270 (Maryland) Left Lane / Concurrent Flow HOV - Evening

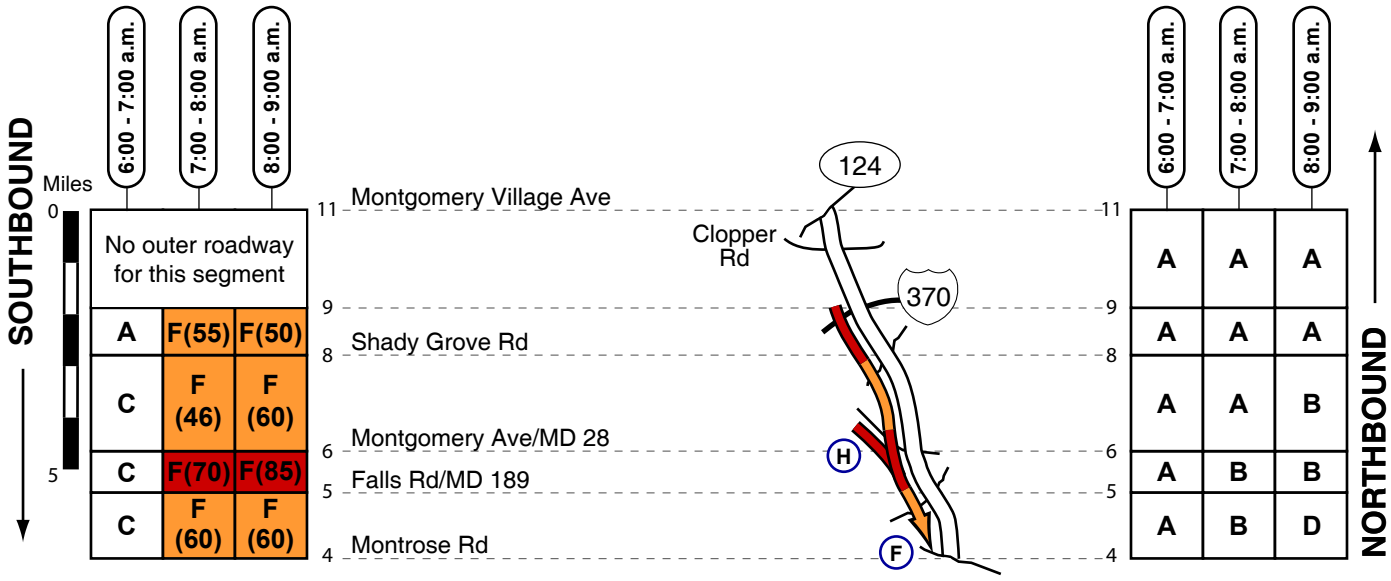


Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

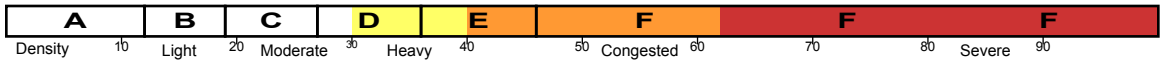
Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

I-270 Local Lanes - Morning



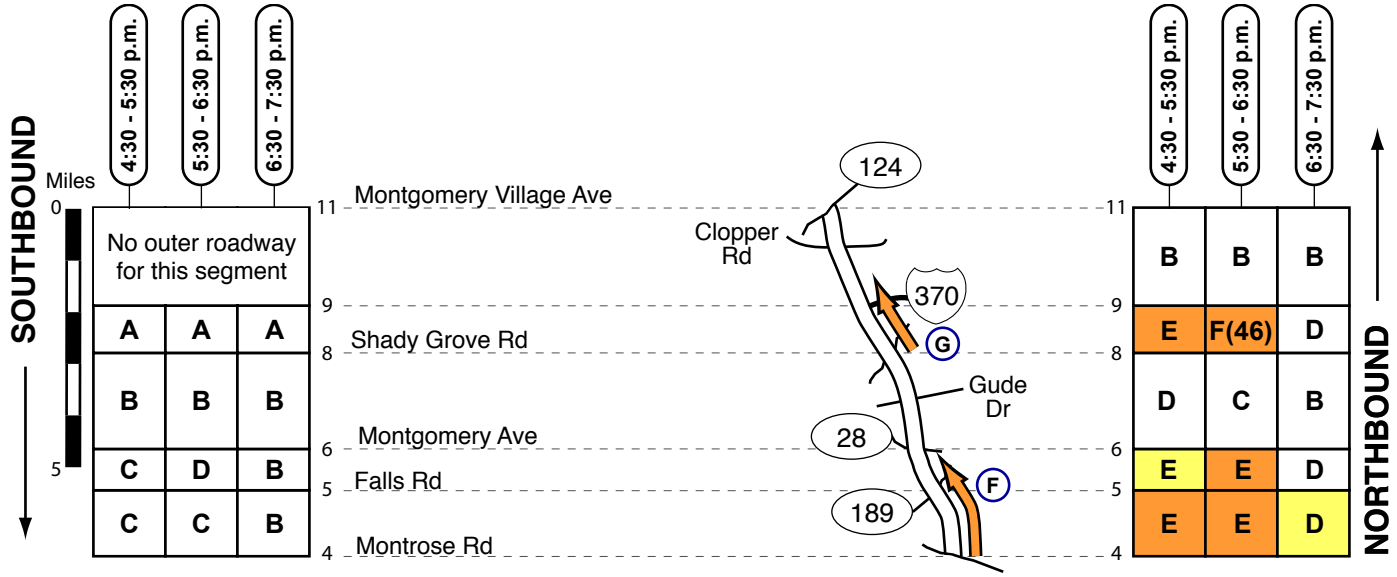
F
Congestion Type: Mainline Congestion
Location: Local lanes
Frequency: Most observations
Direction: Southbound
Queue Length: 3 to 5 miles
Estimated Speed: 20 to 50 mph
Note: An extended zone of moderate to severe southbound congeston was found on both the express and local lanes of I-270. In the local lanes, congestion was most severe between MD 28 and MD 189, due to the merge of traffic from MD 28.

H
Congestion Type: Entrance Ramp Queue
Location: W. Montgomery Ave
Frequency: Most observations
Direction: Eastbound to southbound
Queue Population: 60 to 120 vpl
Number of Lanes: 1
Note: Vehicles waiting to enter the local lanes of I-270 were often severely congested in the right lane of MD 28, encountering the tail shortly after passing Darnestown Rd.



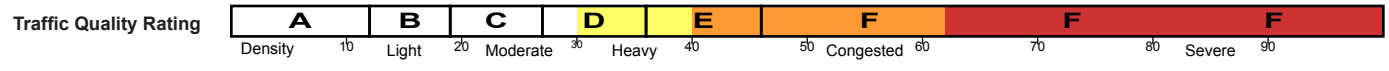
Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-270 Local Lanes - Evening



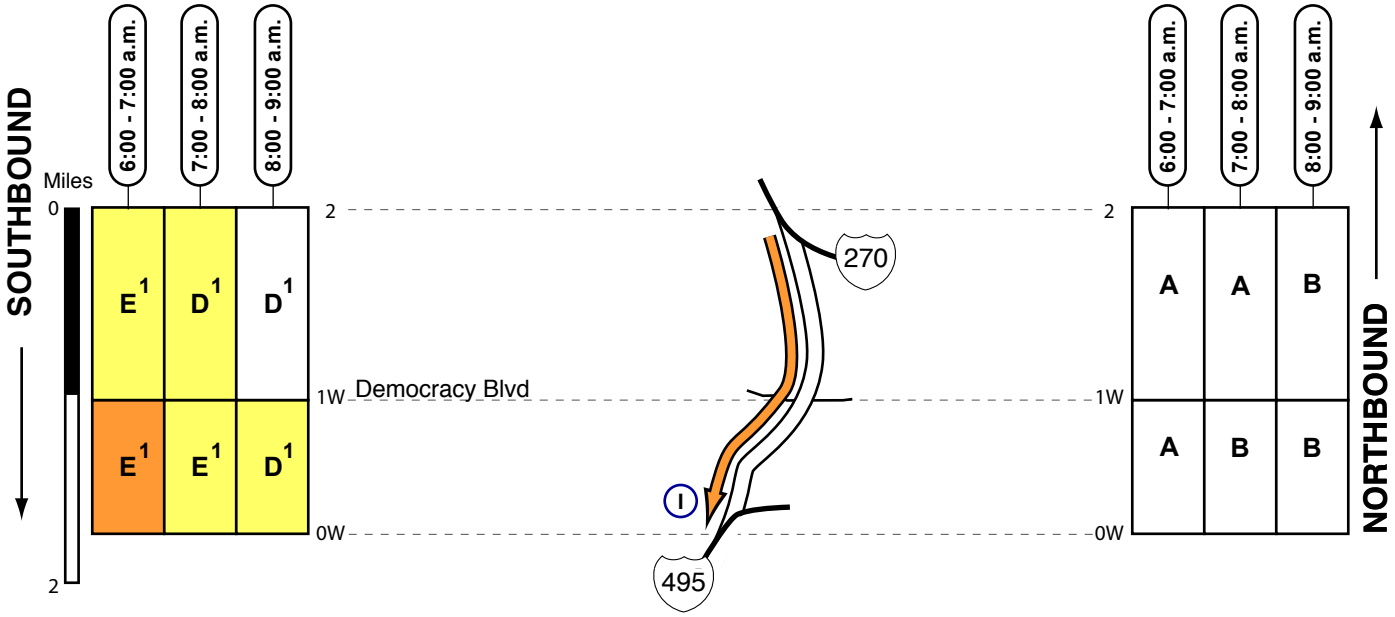
F
Congestion Type: Mainline Congestion
Location: Local lanes between Montrose Rd and MD 28
Frequency: Intermittent
Direction: Northbound
Queue Length: 0.5 to 1 miles
Estimated Speed: 30 to 50 mph
Note: Northbound flow on the local lanes was intermittenty congested between Montrose Rd and MD 28; the primary causes appeared to be high-volume entrance ramps at Montrose Rd and MD 189 (Falls Rd), and weaving associated with busy exit ramps at MD 28.

G
Congestion Type: Mainline Congestion
Location: Local lanes vic. Shady Grove Rd
Frequency: Intermittent
Direction: Northbound
Queue Length: 0.5 to 1 miles
Estimated Speed: 35 to 50 mph
Note: Northbound congestion was intermittently found on the local lanes vic. Shady Grove Rd; when congested, the head of the queue was the weaving zone between heavily-used entrance ramps from Shady Grove Rd and the next crossover to the main roadway.



Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

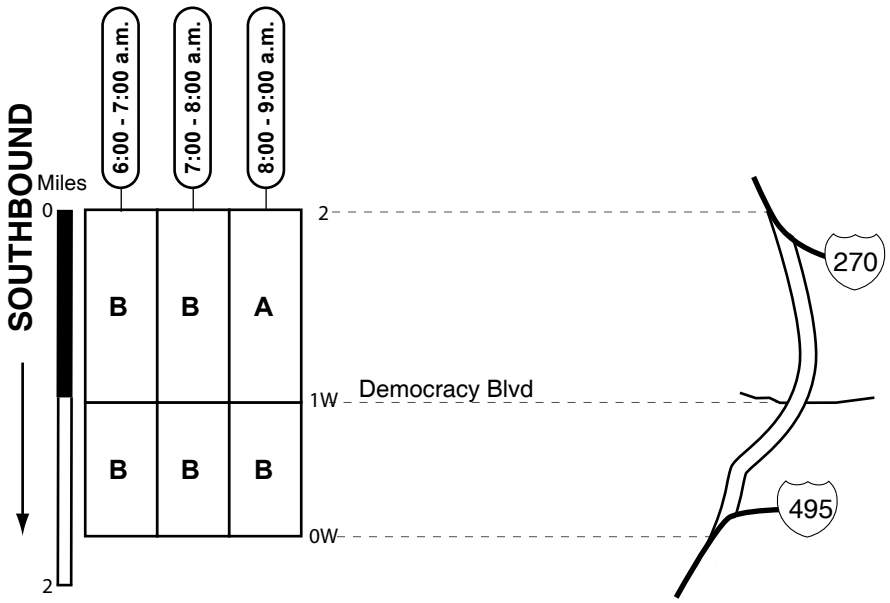
I-270 Western Spur (Maryland) - Morning

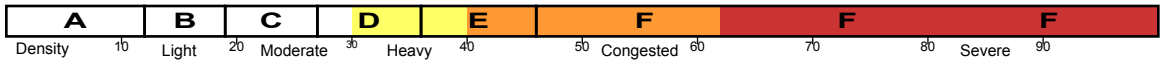


Left Lane / Concurrent Flow HOV -Morning

HOV OPERATIONS
HOV 2
6:00 - 9:00 A.M.
SOUTHBOUND

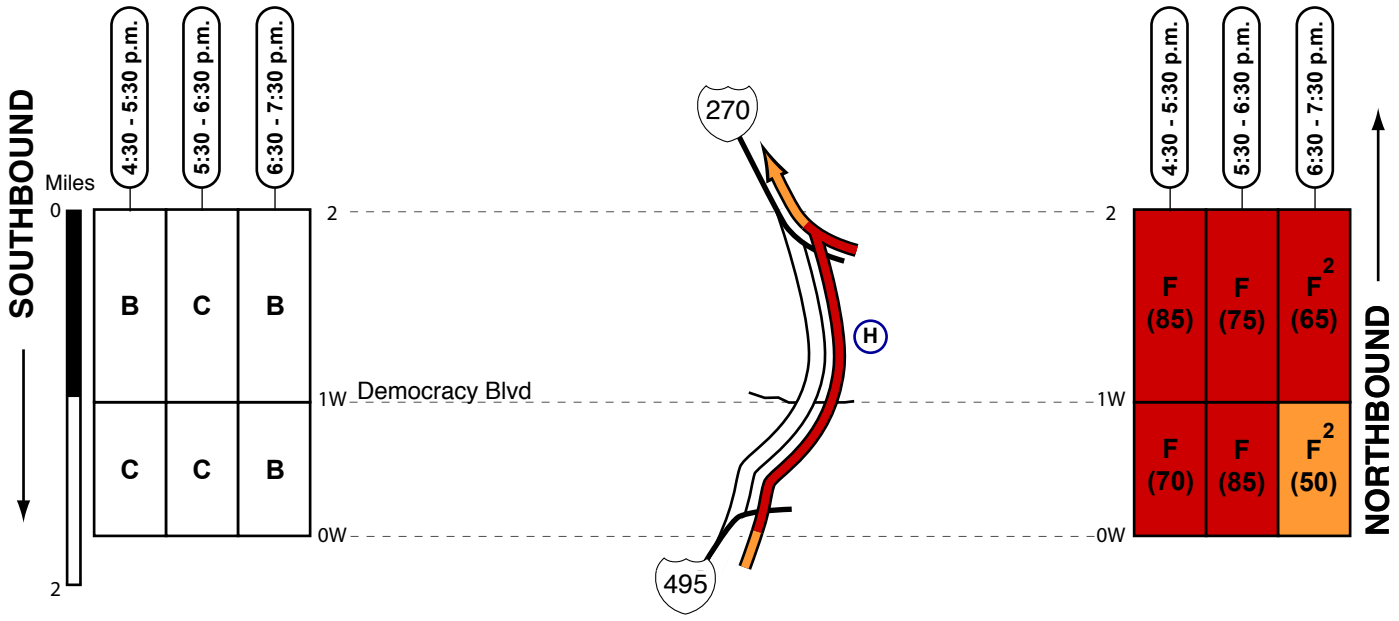
I
Congestion Type: Mainline Congestion
Location: Western spur
Frequency: Intermittent
Direction: Southbound
Queue Length: 0.25 to 1 miles
Estimated Speed: 40 to 60 mph
Note: Only minor, intermittent slowing was found on the I-270 spur in 2008 leading toward I-495 and Virginia, compared to severe congestion found in previous years. This improvement was apparently part of the overall improvement on the interstate system that resulted from the beltway ramp widening 7 miles downstream at VA 267 (opened in 2005 after survey flights had been completed).





Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

I-270 Western Spur (Maryland) - Evening

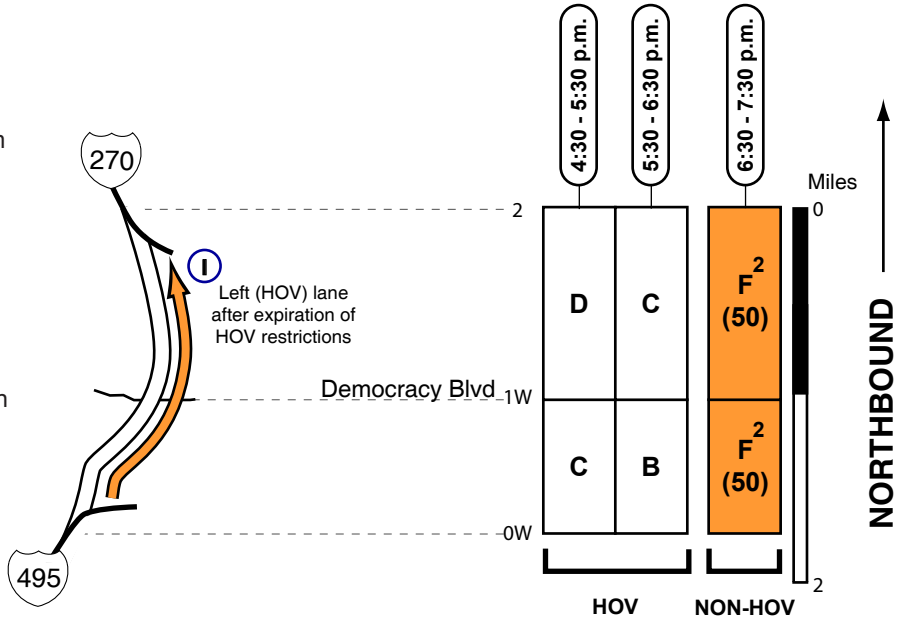


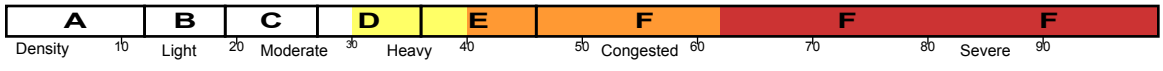
H
Congestion Type: Mainline Congestion
Location: Length of spur
Frequency: Most observations
Direction: Northbound
Queue Length: 1.5 to 1.5 miles
Estimated Speed: 20 to 30 mph
Note: The two general purpose travel lanes of the I-270 spur were congested during most observations; the bottleneck was generally at the I-270 merge. Flow improved after 6:30 pm when restrictions in the concurrent-flow left HOV lane were lifted.

Left Lane / Concurrent Flow HOV - Evening

HOV OPERATIONS
HOV 2
3:30 - 6:30 P.M.
NORTHBOUND

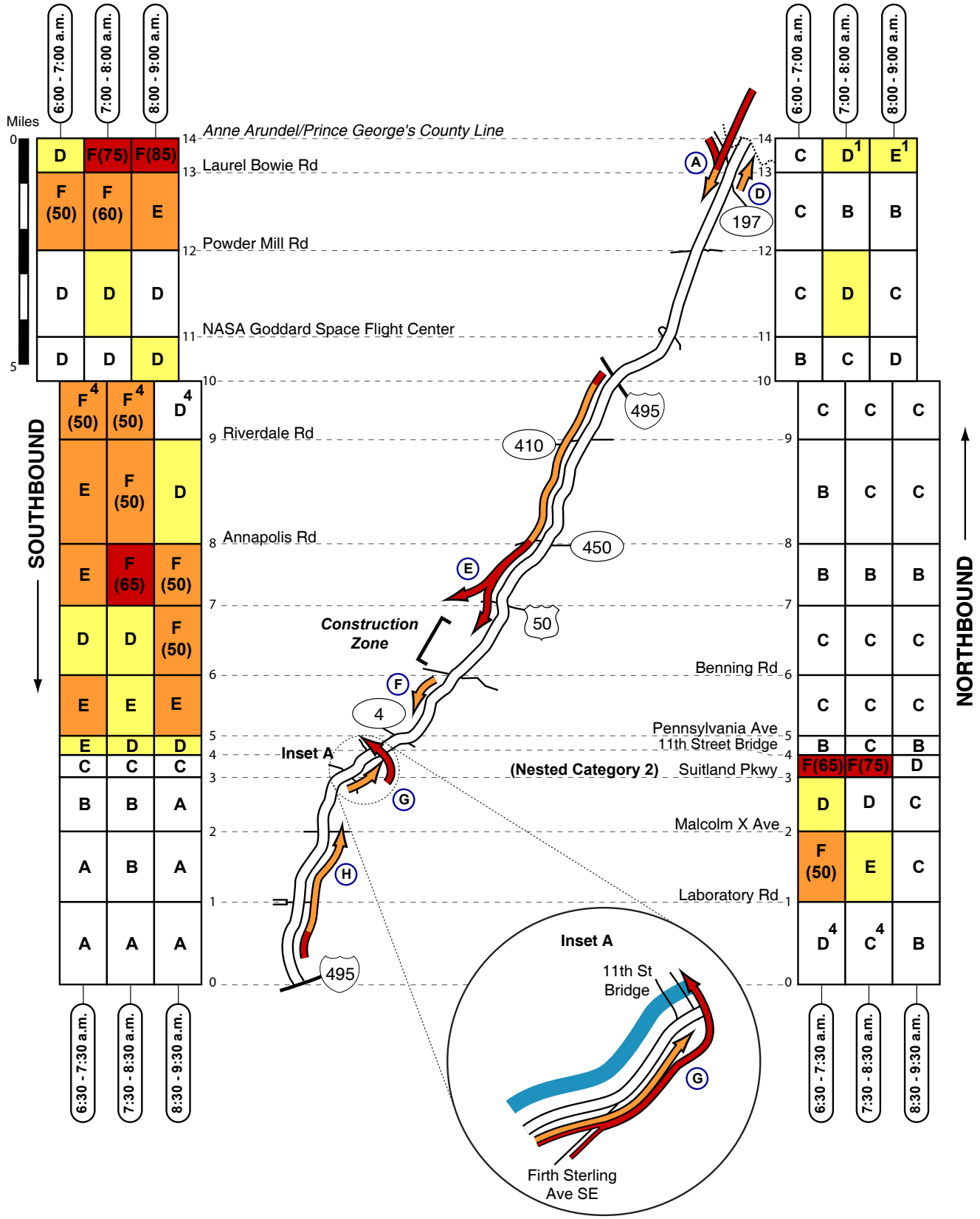
I
Congestion Type: HOV
Location: Left HOV lane
Frequency: After restrictions lifted at 6:30 pm
Direction: Northbound
Queue Length: 1.5 to 1.5 miles
Estimated Speed: 30 to 40 mph
Note: Vehicles were not significantly delayed in the left concurrent-flow HOV lane of the I-270 Spur until after the expiration of HOV restrictions (6:30 pm). Flow at reduced speeds of 30 to 40 mph were recorded until approximately 7:00 pm; thereafter congestion was not found on the Spur.





Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

I-295/D.C. 295/Kenilworth Ave/Baltimore-Washington Parkway - Morning



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

I-295/D.C. 295/Kenilworth Ave/Baltimore-Washington Parkway - Morning

A
Congestion Type: Mainline Congestion
Location: Between MD 198 and MD 197
Frequency: Severe on some days, not others
Direction: Southbound
Queue Length: 1 to 3.5 miles
Estimated Speed: 15 to 40 mph
Note: The merging of southbound MD 197 traffic into two lanes of the BW Parkway caused moderate to severe congestion during most survey periods, particularly between 7:30 and 8:30 a.m.; however, mornings with only minor delays were also noted.

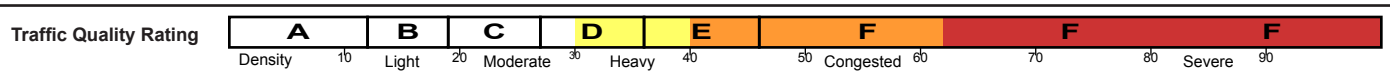
D
Congestion Type: Minor mainline congestion
Location: MD 197 merge
Frequency: Intermittent
Direction: Northbound
Queue Length: 0.25 to 0.5 miles
Estimated Speed: 30 to 50 mph
Note: Momentary delays were intermittently encountered by vehicles merging onto northbound MD 295 from MD 197.

E
Congestion Type: Mainline Congestion
Location: Approaching the US 50 / NY Ave interchange
Frequency: Most observations
Direction: Southbound
Queue Length: 2 to 5 miles
Estimated Speed: 20 to 40 mph
Note: Moderate southbound congestion was found approaching the US 50 / NY Ave interchange; traffic split toward one of two distinct bottlenecks: right to merge onto NY Ave toward downtown Wash. DC; or left to stay on MD/DC 295. Delays for the latter may have been exacerbated by reconstruction of the MD 295 bridge over the Northeast Corridor railroad tracks (narrow lanes).

F
Congestion Type: Marginal mainline Congestion
Location: vic. E. Capitol St.
Frequency: Intermittent
Direction: Southbound
Queue Length: 0.5 to 1 miles
Estimated Speed: 20 to 40 mph
Note: Several short zones of light-to-moderate congestion were intermittently found on SB DC 295 vic. E. Capitol St. 1) Traffic was briefly delayed in a right lane queue to exit toward the E. Capitol St. bridge across the Anacostia River; 2) traffic intermittently flowed at reduced speeds approaching and over the viaduct just south of E. Capitol St.; traffic entering from E. Capitol St. sometimes was a factor.

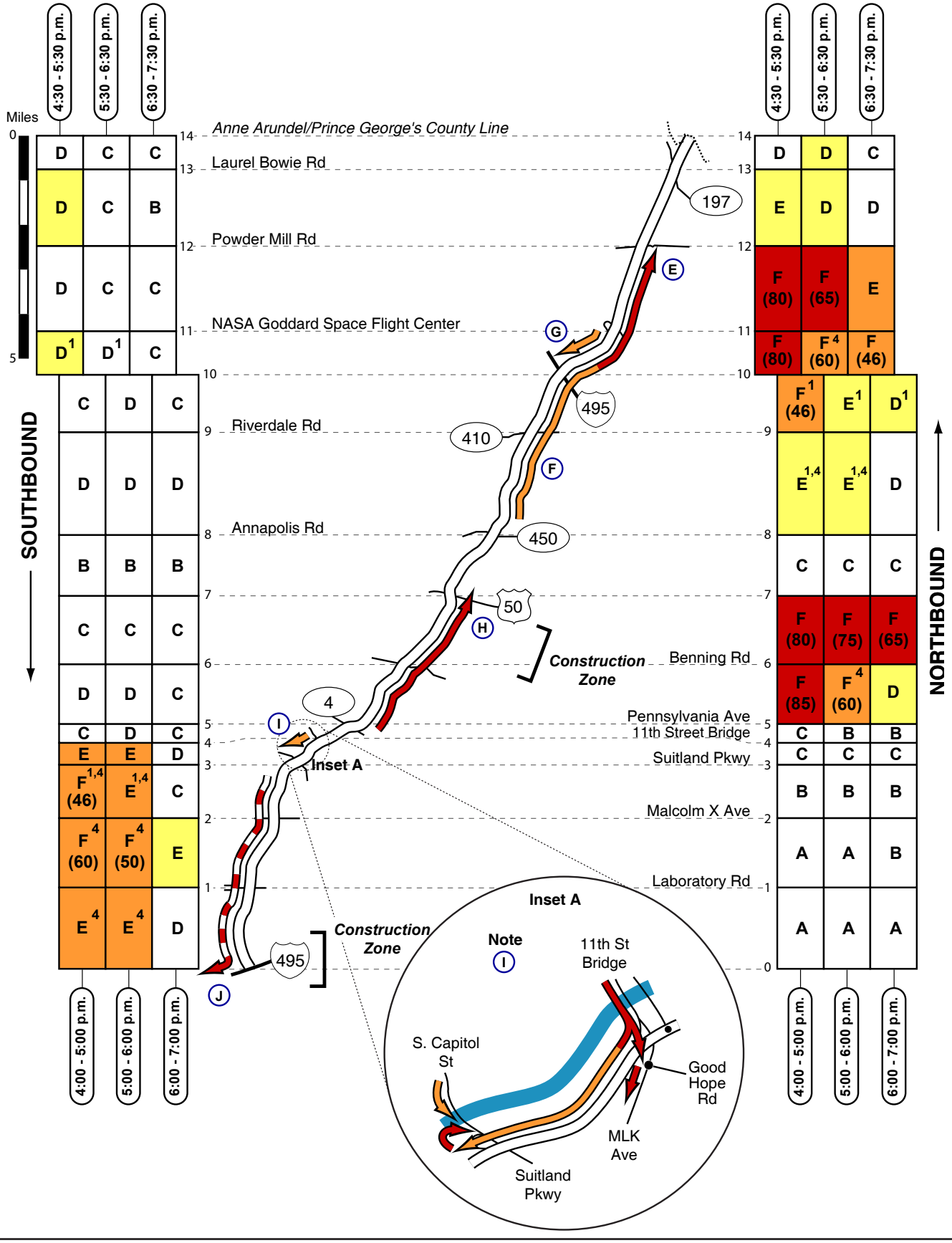
G
Congestion Type: Mainline Congestion
Location: Approaching ramp to 11th St Bridge
Frequency: Most observations
Direction: Northbound
Queue Length: 0.25 to 1 miles
Estimated Speed: 15 to 40 mph
Note: Since the 2005 survey period, modifications including a short auxilary ramp lane were added so that traffic entering from Firth Sterling Ave (carrying Suitland Pky traffic) no longer was forced to merge onto I-295 before exiting to the 11th St. Bridge. This allowed I-295 traffic not destined for the bridge to now bypass the exit queue, sometimes with only momentary slowing.

H
Congestion Type: Mainline Congestion
Location: Approaching Laboratory Rd and Malcolm X Ave
Frequency: Most observations before 8:00 am
Direction: Northbound
Queue Length: 0.5 to 2 miles
Estimated Speed: 30 to 50 mph
Note: Light to moderate northbound congestion was found prior to 8:00 am; the lane drop to two lanes at Laboratory Rd generated congestion during some flyovers; beyond that point, traffic still flowed at reduced speeds until reaching the three-lane section just before Malcom X Ave.



Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-295/D.C. 295/Kenilworth Ave/Baltimore-Washington Parkway - Evening



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested	60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-295/D.C. 295/Kenilworth Ave/Baltimore-Washington Parkway - Evening

E
Congestion Type: Mainline Congestion
Location: Approaching Powder Mill Rd
Frequency: Most observations
Direction: Northbound
Queue Length: 3 to 4 miles
Estimated Speed: 15 to 30 mph
Note: Moderate to severe northbound congestion again was found north of I-495 / beltway. The primary capacity constraint appeared to be at the traffic merge from Powder Mill Rd.

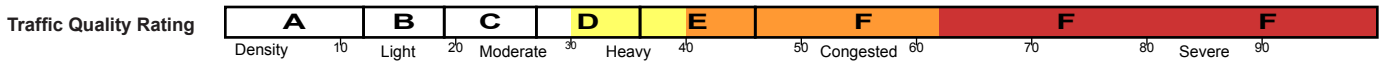
F
Congestion Type: Mainline Congestion
Location: Approaching I-495 / beltway
Frequency: Intermittent
Direction: Northbound
Queue Length: 2 to 4 miles
Estimated Speed: 30 to 50 mph
Note: Minor northbound delays were found on some surveyed evenings and not others; when congested, vehicles flowed at reduced speeds between Annapolis Rd, Riverdale Rd, and I-495. Roadway curves and general demand appeared to be the underlying causes.

G
Congestion Type: Minor mainline congestion
Location: Approaching MD 193
Frequency: Intermittent
Direction: Southbound
Queue Length: 0.25 to 0.75 miles
Estimated Speed: 40 to 50 mph
Note: Intermittently, light southbound congestion was found approaching the MD 193 interchange near the beltway. When congested, delays were minor.

H
Congestion Type: Mainline Congestion
Location: Approaching US 50
Frequency: Most observations
Direction: Northbound
Queue Length: 3 to 4 miles
Estimated Speed: 20 to 30 mph
Note: Reconstruction of the approach and bridge over the railroad just before US 50 exacerbated normal northbound congestion on DC 295 (Kenilworth Ave). Lanes across the bridge were reduced from 4 to 3 for construction. As in the past, the quick right turn to the ramp to eastbound US 50 remained a factor.

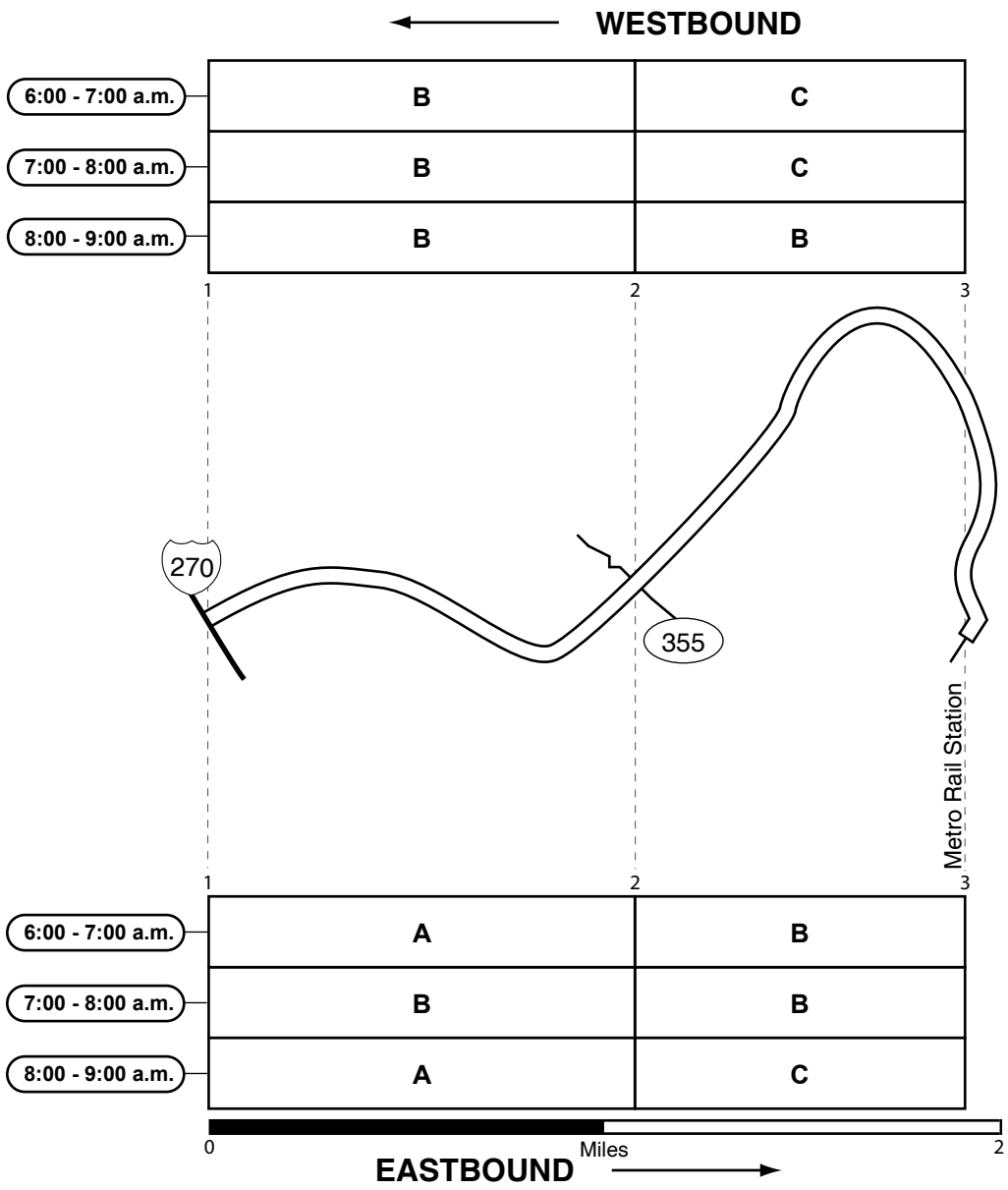
I
Congestion Type: Mainline congestion and exit ramp queue
Location: From 11th St Bridge merge to S. Capitol St. exit ramp
Frequency: Most observations before 6 pm
Direction: Southbound
Queue Length: 0.25 to 0.75 miles
Estimated Speed: 40 to 50 mph
Note: Traffic following southbound I-295 from the 11th St Bridge encountered minor merging- and weaving-related delays approaching the exit ramp to the Suitalnd Pky. The exit ramp was usually congested prior to 6:00 pm.

J
Congestion Type: Mainline Congestion
Location: Approaching WW Bridge construction zone
Frequency: 2 of 4 surveyed evenings
Direction: Southbound
Queue Length: 1 to 5 miles
Estimated Speed: 15 to 30 mph
Note: Severe southbound congestion was found on I-295 when survey coverage began, but only during 2 of 4 surveyed evenings. This was apparently left over from daytime work in the WW Bridge construction zone. During the other two evenings, vehicles moved at free-flow speeds during all observations. (Data shown are mathematical averages between the four surveyed dates.)



Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

I-370 - Morning

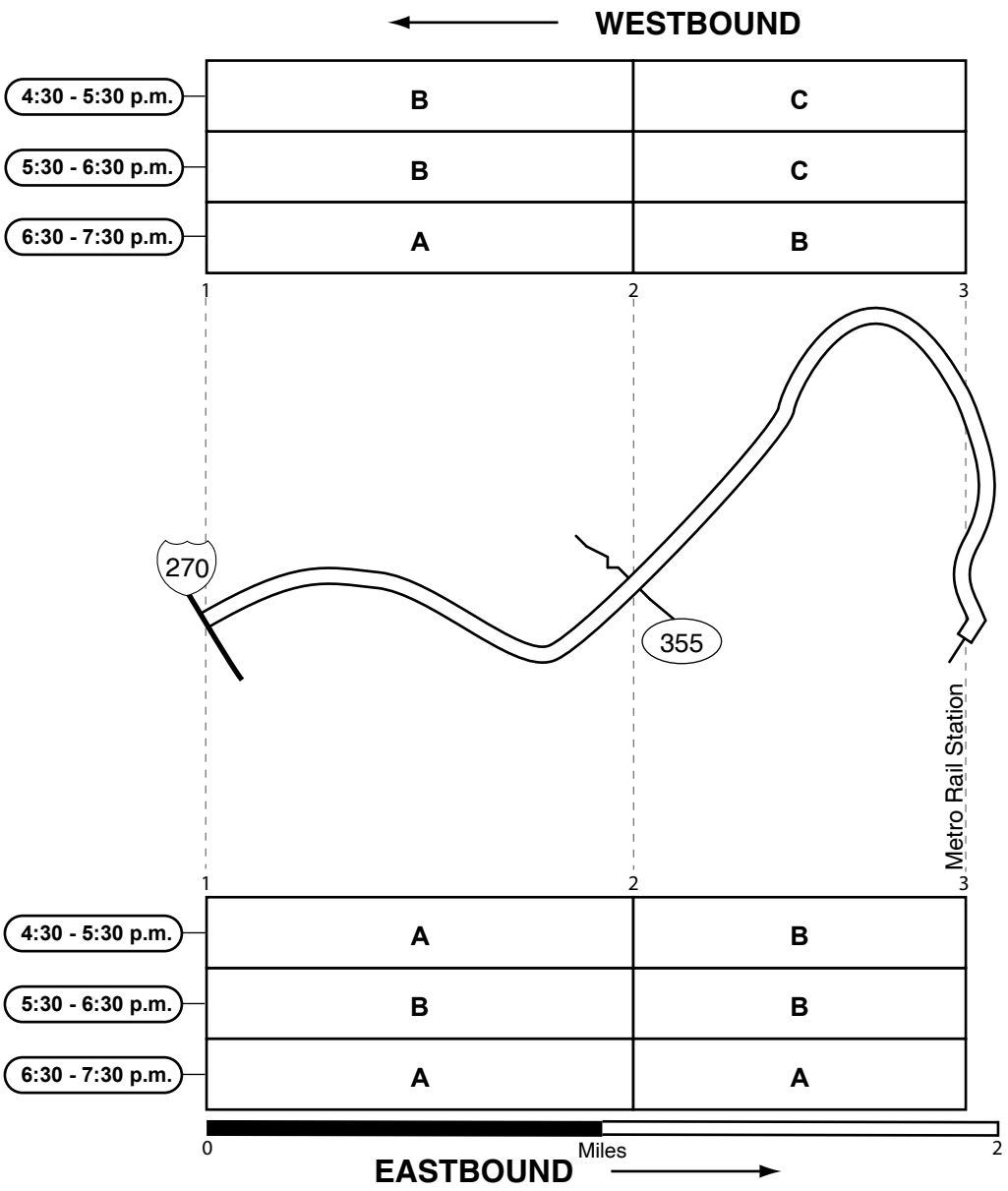


Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-370 - Evening

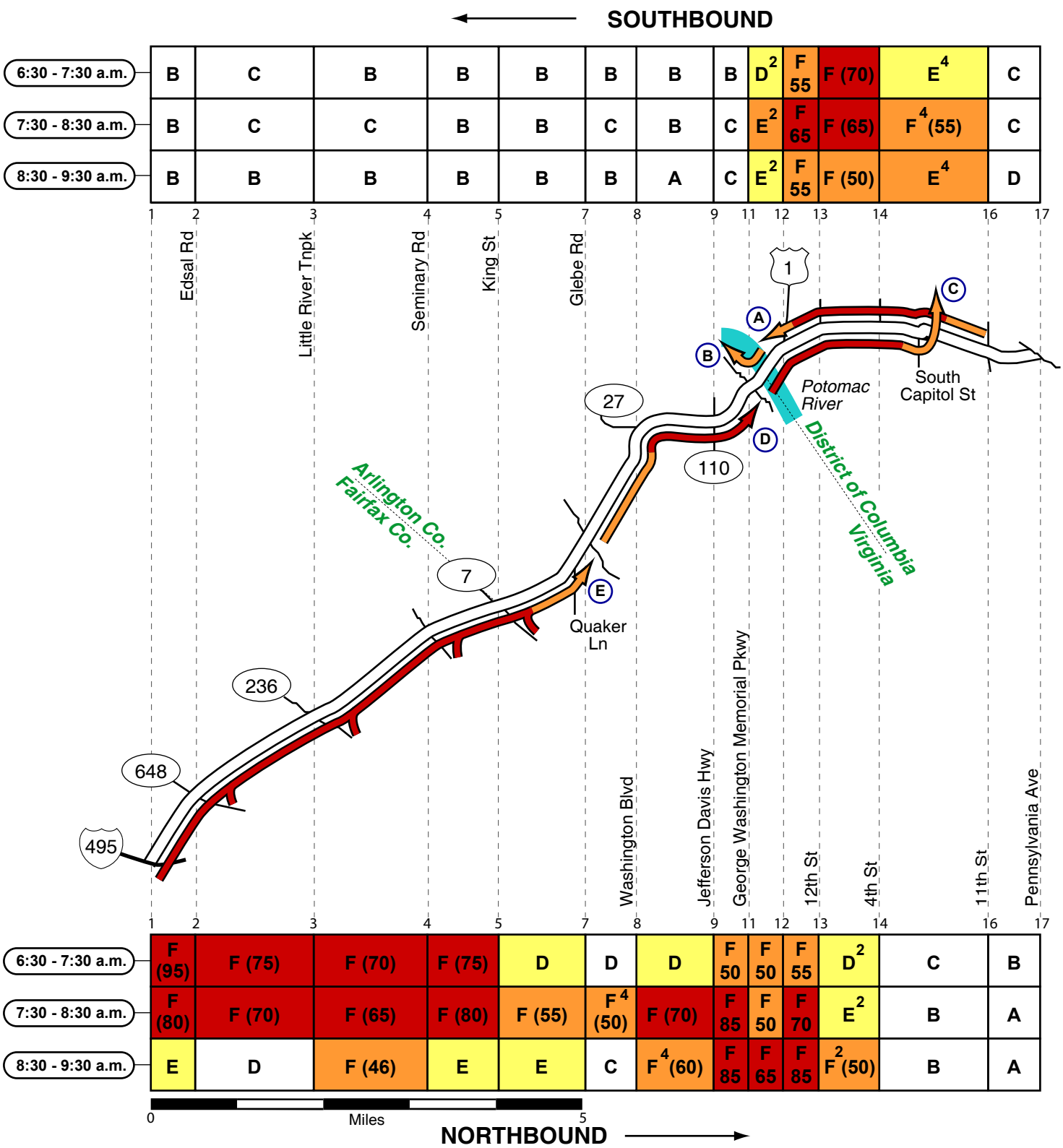


Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-395/Southeast/Southwest Freeway (Virginia/District of Columbia) - Morning



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-395/Southeast/Southwest Freeway (Virginia/District of Columbia) - Morning

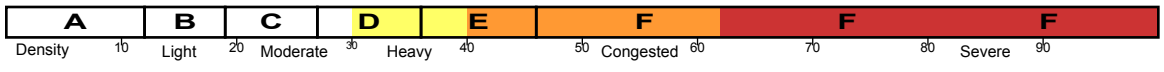
A
Congestion Type: Mainline Congestion
Location: Between 11th St & 14th St/US 1
Frequency: Most observations
Direction: Southbound
Queue Length: 2 to 4 miles
Estimated Speed: 20 to 50 mph
Note: Congestion was caused or exacerbated by the two separate lane drops at 7th St (4 lanes to 2) and 14th St (3 lanes to 2).

B
Congestion Type: Exit Ramp Queue
Location: George Washington Memorial Parkway
Frequency: Most observations
Direction: Southbound
Queue Length: 0.5 to 1 miles
Note: Congestion on the ramp typically extended back into the right lane of I-395; ongoing construction on George Washington Memorial Parkway may have contributed to the congestion.

C
Congestion Type: Mainline Congestion
Location: Between the 14th St Bridge & South Capitol St
Frequency: Most observations
Direction: Northbound
Queue Length: 1 to 2 miles
Estimated Speed: 15 to 45 mph
Note: The head of the queue was found at the I-395/Southeast Freeway split; congestion on the I-395 ramp typically extended back into the right two lanes (and eventually across all lanes) of I-395/ Southwest Freeway.

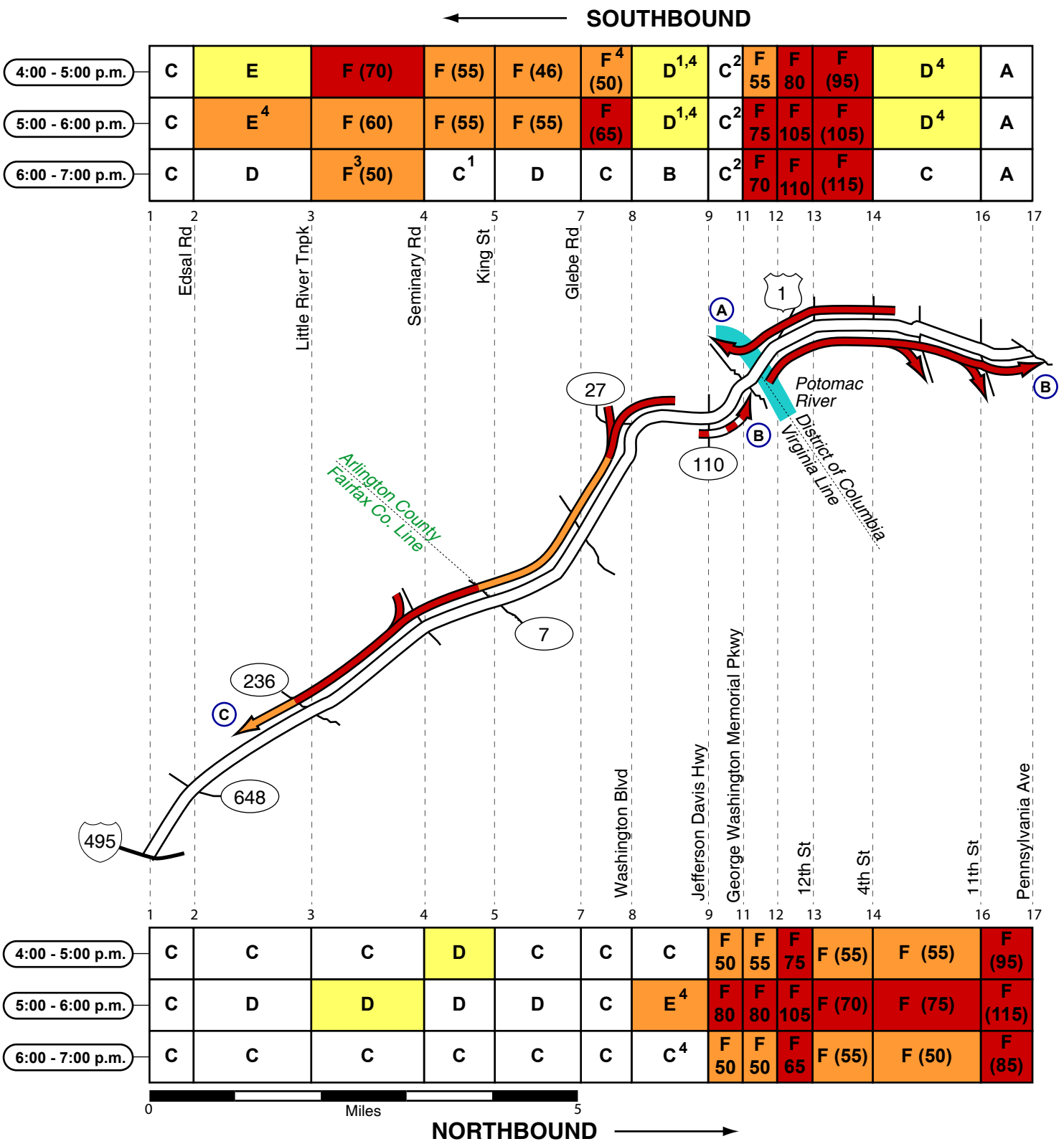
D
Congestion Type: Mainline Congestion
Location: Between Glebe Rd & the 14th St Bridge
Frequency: Most observations after 7:00 a.m.
Direction: Northbound
Queue Length: 1 to 3 miles
Estimated Speed: 10 to 50 mph
Note: The primary bottleneck was the lane drop (4 lanes to 3) in the vicinity of the George Washington Memorial Parkway.

E
Congestion Type: Mainline Congestion
Location: Between the Beltway and Glebe Rd
Frequency: Most observations before 9:00 a.m.
Direction: Northbound
Queue Length: 6 to 8 miles
Estimated Speed: 10 to 30 mph
Note: Congestion was caused or exacerbated by traffic entrering at the interchanges along this corridor; north of VA 7, traffic flow typically improved where the roadway widens from 3 to 4 lanes.



Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

I-395/Southeast/Southwest Freeway (Virginia/District of Columbia) - Evening



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

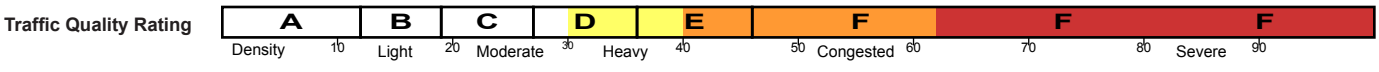
Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-395/Southeast/Southwest Freeway (Virginia/Distict of Columbia) - Evening

A
Congestion Type: Mainline Congestion
Location: Between 4th St & the George Washington Memorial Parkway
Frequency: Most observations
Direction: Southbound
Queue Length: 2 to 4 miles
Estimated Speed: 5 to 30 mph
Note: Factors contributing to the congestion were: 1) the two separate lane drops at Maine Ave (5 lanes to 3) and the start of the HOV facility (3 lanes to 2) and; 2) congestion on the ramp to the George Washington Memorial Parkway, that extended back into the right lane (and eventually across all lanes) of I-395.

B
Congestion Type: Mainline Congestion
Location: Between the George Washington Memorial Parkway & Pennsylvania Ave
Frequency: Most observations
D irection: Northbound
Queue Length: 6 to 8 miles
Estimated Speed: 5 to 45 mph
Note: Factors contributing to the congestion were: 1) the lane drop (4 lanes to 3) in the vicinity of the George Washington Memorial Parkway; 2) HOV traffic entering the mainline at the Case Bridge (HOV terminus); 3) congestion on the ramps to South Capitol St and 11 St, that extended back into the mainline of the Southeast Freeway and; 4) the signal queue at Pennsylvania Ave/Sousa Bridge (Southeast Freeway terminus).

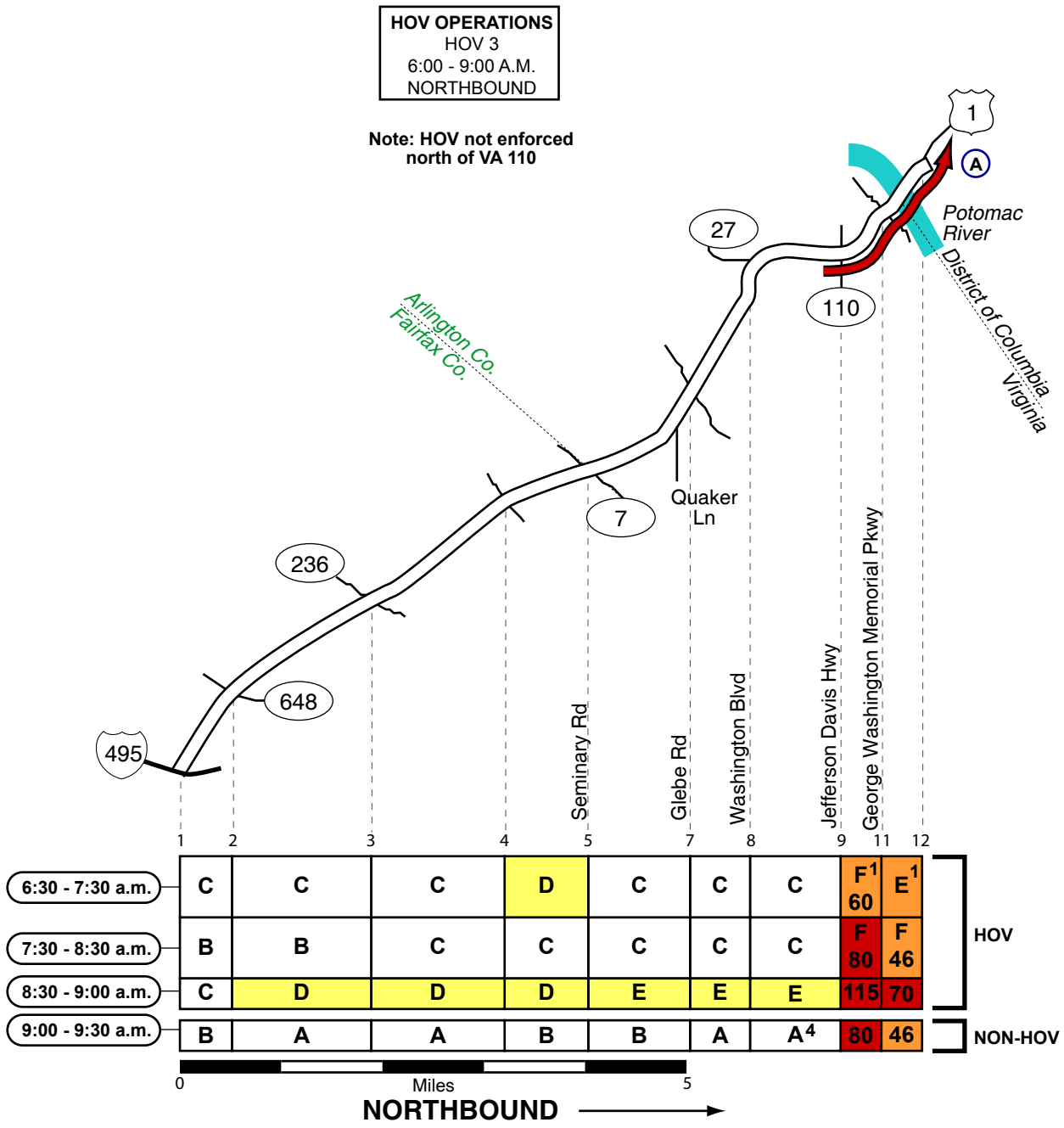
C
Congestion Type: Mainline Congestion
Location: Between VA 110 & Edsal Rd
Frequency: Most observations
Direction: Southbound
Queue Length: 5 to 8 miles
Estimated Speed: 25 to 50 mph
Note: Factors contributing to the congestion were: 1) traffic entering at VA 110, VA 27 and Seminary Rd and; 2) the lane drop (4 lanes to 3) at Little River Turnpike. While congestion persisted south of Little River Turnpike, traffic flow typically improved.



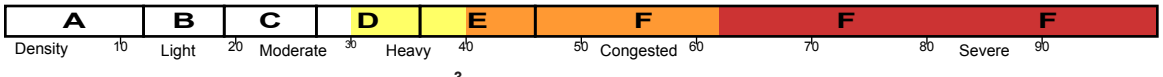
Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

(Blank)

I-395/SE FWY (VIRGINIA/DISTICT OF COLUMBIA) BARRIER SEPARATED HOV - MORNING



A
Congestion Type: Mainline Congestion
Location: Approaching and across the 14th St Bridge
Frequency: Most observations
Direction: Northbound
Queue Length: 1 to 2 miles
Estimated Speed: 10 to 50 mph
Note: Factors contributing to the congestion were: 1) the signals on US 1 at C St and Independence Ave (queues at these signals intermittently extended back into the mainline of the HOV roadway) and; 2) congestion on the ramp where HOV traffic merges with the "general-purpose" lanes at the Case Bridge.

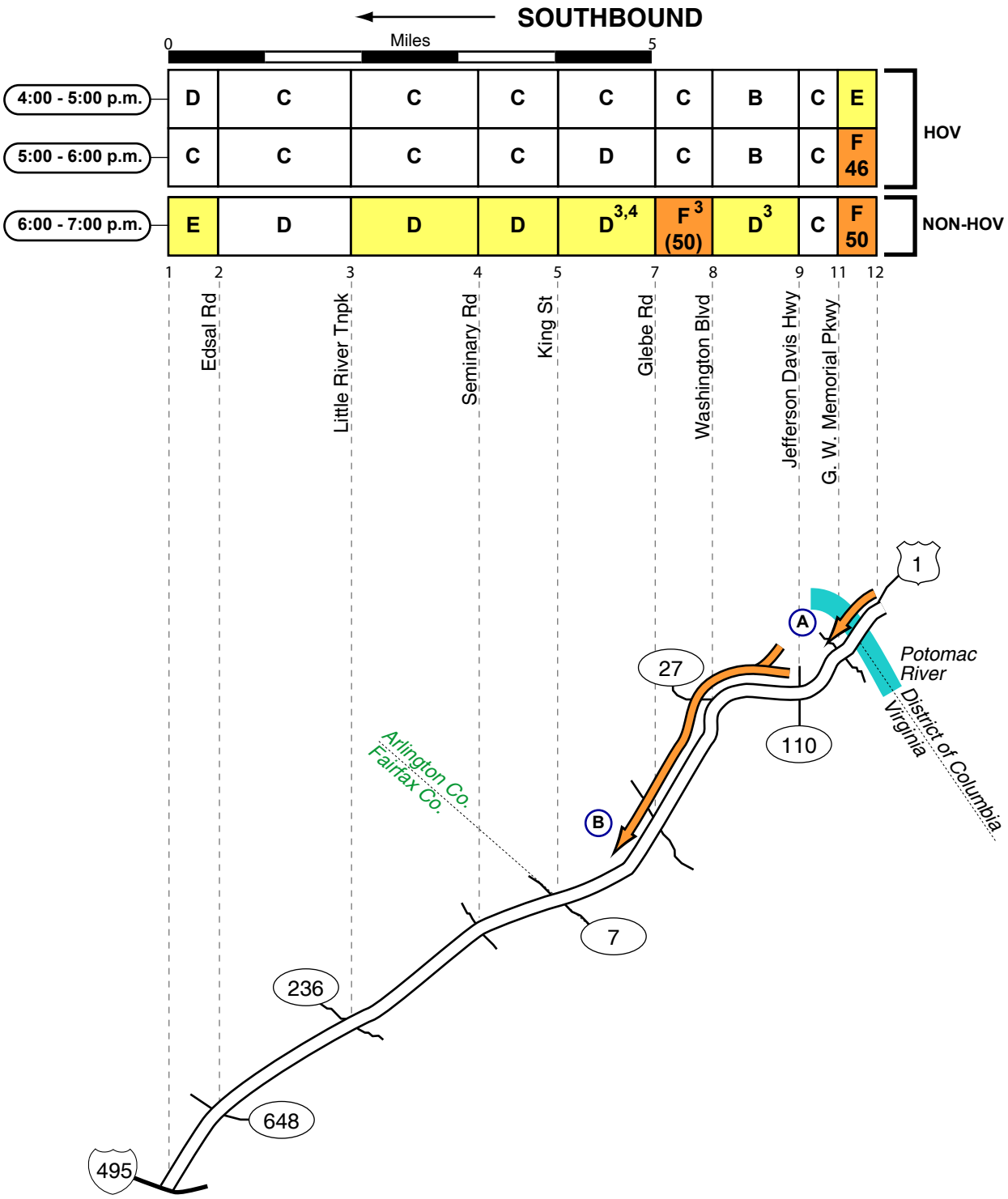


Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-395/SE Fwy (Virginia/Distict of Columbia) Barrier Separated HOV - Evening

HOV OPERATIONS
HOV 3
3:30 - 6:00 P.M.
SOUTHBOUND

Note: HOV not enforced north of VA 110



Traffic Quality Rating

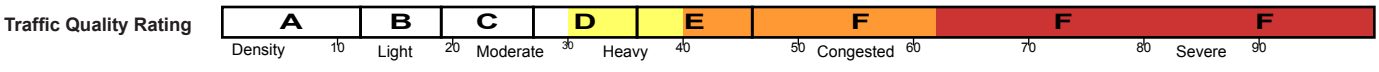
A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40	50	Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-395/SE Fwy (Virginia/Distict of Columbia) Barrier Separated HOV - Evening

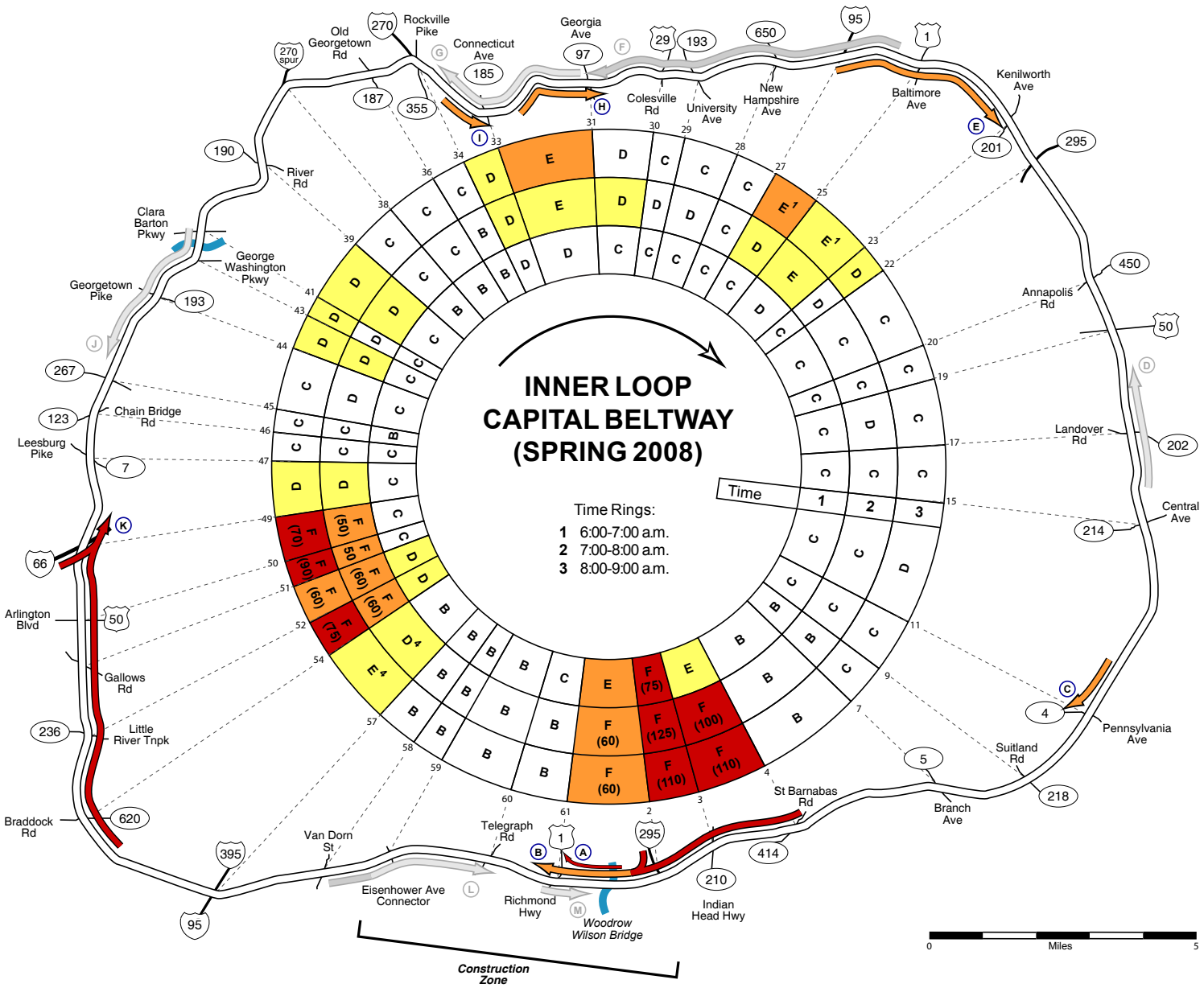
A
Congestion Type: Mainline Congestion
Location: Between US 1 & VA 110
Frequency: Most observations after 5:00 p.m.
Direction: Southbound
Queue Length: 0.5 to 1 miles
Estimated Speed: 40 to 50 mph
Note: The head of the queue was typically found where non-HOV vehicles are required to exit the center roadway at the crossover ramp in the vicinity of Boundary Channel Dr (Note: HOV restrictions are not enforced north of VA 110).

B
Congestion Type: Mainline Congestion
Location: Between VA 110 & VA 7
Frequency: Most observations after 6:00 p.m. (HOV Restrictions not enforced)
Direction: Southbound
Queue Length: 2 to 3 miles
Estimated Speed: 30 to 50 mph
Note: The primary bottleneck was where traffic entered the HOV roadway from VA 110; south of the VA 110 entrance ramp, traffic flow gradually improved.



Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

I-495/95 Capital Beltway (Inner Loop) - Morning



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-495/95 Capital Beltway (Inner Loop) - Morning

A
Congestion Type: Right lane exit queue
Location: Approaching ramp to NB US 1
Frequency: Most observations
Direction: Westbound
Queue Length: 0.25 to 1.5 miles
Note: The traffic signal on northbound US 1 at Franklin St. generated upstream congestion that delayed vehicles in the right lane of the Woodrow Wilson Bridge during most morning observations.

B
Congestion Type: Mainline Congestion
Location: Approaching the WW Bridge construction zone
Frequency: Most observations
Direction: Westbound
Queue Length: 1 to 3 miles
Estimated Speed: 10 to 15 mph
Note: Severe congestion historically found on the beltway inner loop toward the Woodrow Wilson Bridge was again found during the 2005 survey flights; three lanes were maintained across the river and through the construction zone during the spring 2008 survey flights. (The right lane queue to northbound US 1 was severely congested; see accompanying note.)

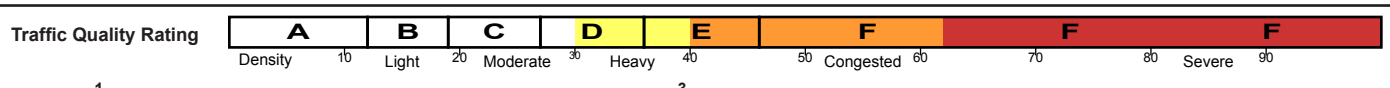
C
Congestion Type: Right lane exit queue
Location: Approaching exit ramp to MD 4
Frequency: Intermittent
Direction: Southbound
Queue Length: 0.25 to 0.5 miles
Note: During a few observations, vehicles exiting to MD 4 formed a queue in the right lane of I-495. Thru-traffic on I495 was affected during only one observation, and significant delays were not generated. The underlying cause was a downstream queue on MD 4 approaching the signal at Forestville Rd.

E
Congestion Type: Mainline Congestion
Location: vic. US 1 interchange
Frequency: Most observations between 7:30 and 9:00 a.m.
Direction: Eastbound
Queue Length: 1 to 2 miles
Estimated Speed: 35 to 55 mph
Note: During most observations between 7:30 and 9:00 a.m., light to moderate inner-loop congestion was found east of the I-495 / I-95 interchange through the US 1 interchange. Traffic entering from the auxilary lane at that interchange appeared to be a contributing factor.

H
Congestion Type: Minor mainline congestion and exit queue
Location: Approaching MD 97
Frequency: Intermittent
Direction: Eastbound
Queue Length: 0.5 to 1.5 miles
Estimated Speed: 40 to 50 mph
Note: Heavy eastbound flow at slightly reduced speeds was found approaching the interchange at MD 97 (Georgia Ave). There was also a queue in the dedicated exit lane to MD 97 during most observations; this queue did not affect the thru-lanes of I-495.

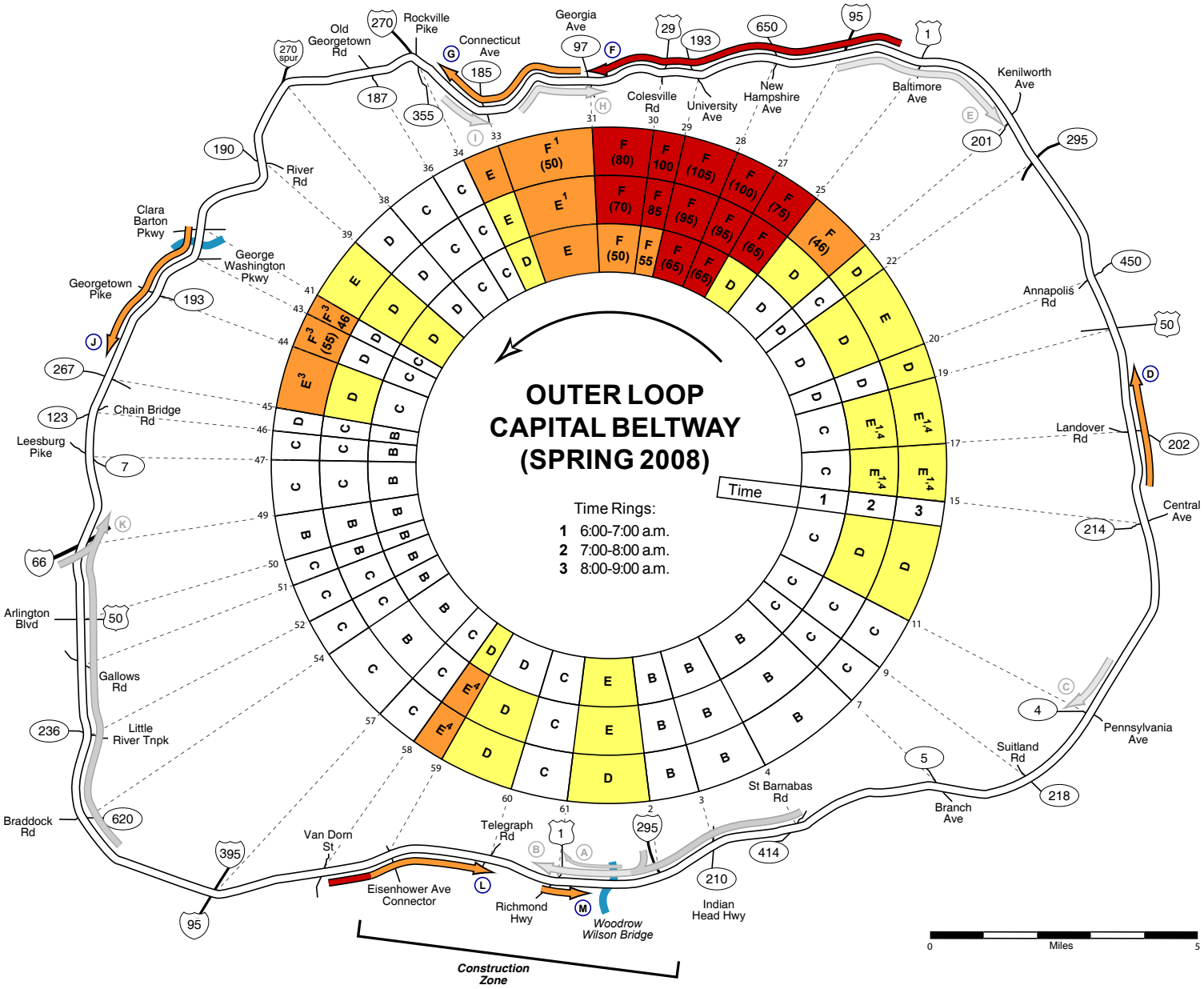
I
Congestion Type: Marginal mainline congestion
Location: Approaching MD 185 interchange
Frequency: Intermittent
Direction: Eastbound
Queue Length: 0.25 to 1 miles
Estimated Speed: 40 to 50 mph
Note: Minor slowing was intermittently found on the inner-loop approaching the MD 185 (Connecticut Ave) interchange. Highway curves and weaving associated with preparing to exit to MD 185 were contributing factors.

K
Congestion Type: Mainline Congestion
Location: Northbound inner-loop in VA
Frequency: Most observations
Direction: Northbound
Queue Length: 4 to 7 miles
Estimated Speed: 15 to 30 mph
Note: Inner-loop congestion first formed at two distinct locations: between the Braddock Rd and Gallows Rd interchanges, and downstream at the I-66 merge. Ultimately, the I-66 bottleneck caused severe congestion that extended to a point about 7 miles upstream, southeast of the Braddock Rd interchange.



Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-495/95 Capital Beltway (Outer Loop) - Morning



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested	60	70 80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-495/95 Capital Beltway (Outer Loop) - Morning

D
Congestion Type: Mainline Congestion
Location: Approaching construction zone south of US 50
Frequency: Intermittent
Direction: Northbound
Queue Length: 1 to 2 miles
Estimated Speed: 40 to 50 mph
Note: Minor congestion at reduced speeds was intermittently found through the construction zone between Arena Drive and US 50; four lanes were maintained during the 2008 survey period.

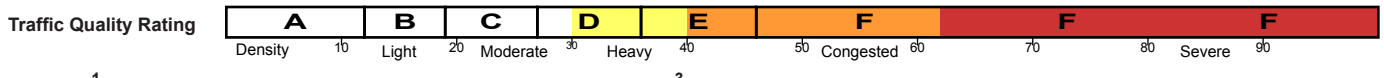
F
Congestion Type: Mainline Congestion
Location: Outer loop between I-95 and MD 97
Frequency: Most observations
Direction: Westbound
Queue Length: 5 to 6 miles
Estimated Speed: 10 to 25 mph
Note: Historical outer-loop congestion between I-95 and MD 97 (Georgia Ave) was again found during the 2008 survey flights. Traffic remained congested but flowed at better speeds beyond the MD 97 interchange.

G
Congestion Type: Mainline Congestion
Location: From MD 97 to MD 355
Frequency: Most observations
Direction: Westbound
Queue Length: 1 to 3 miles
Estimated Speed: 30 to 50 mph
Note: Outer-loop flow improved west of MD 97; however, minor congestion with flow at reduced speeds typically persisted until the vicinity of the I-270 / MD 355 interchange. Highway curves and weaving between interchanges were contributing factors.

J
Congestion Type: Mainline Congestion
Location: Potomac River to VA 267
Frequency: After 8:30 a.m.
Direction: Southbound
Queue Length: 2 to 3 miles
Estimated Speed: 30 to 40 mph
Note: Only moderate congestion was found on southbound I-495 approaching the VA 267 interchange, and only after 8:30 a.m. Severe congestion was found here during all surveys between 1999 and 2005, with impacts recorded 7 miles upstream at the I-270 Spur. This improvement resulted directly from a project to widen the VA 267 exit ramp to 2 lanes, completed shortly after the 2005 survey flights were flown.

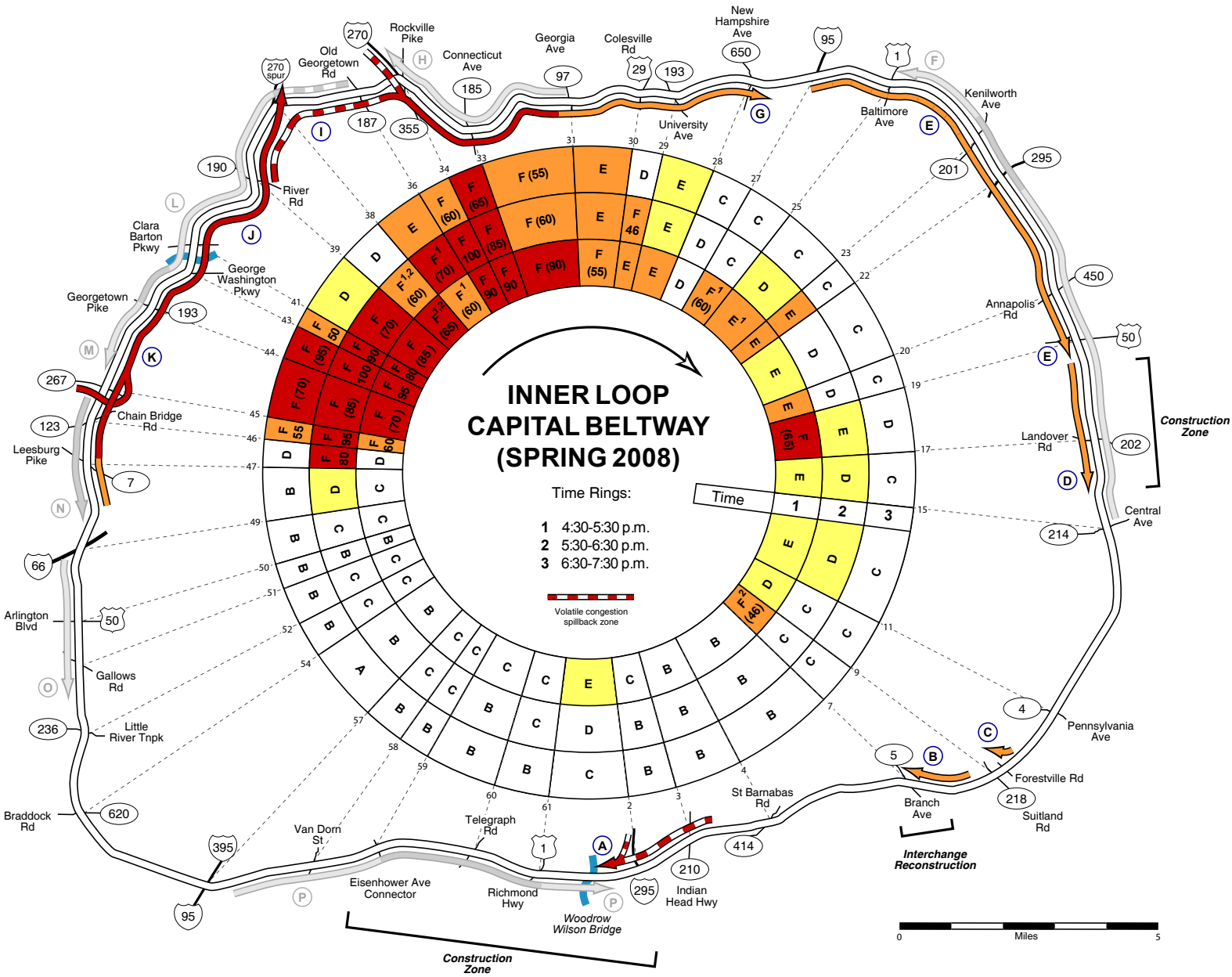
L
Congestion Type: Mainline Congestion
Location: Approaching WW Bridge construction zone
Frequency: Most observations
Direction: Eastbound
Queue Length: 2 to 5 miles
Estimated Speed: 30 to 50 mph
Note: A temporary lane drop for construction at Eisenhower Ave generated light to moderate eastbound congestion for vehicles approaching from the direction of Van Dorn St. Flow generally improved east of Eisenhower Ave through the 3-lane construction zone approaching Telegraph Rd.

M
Congestion Type: Mainline Congestion
Location: WW Bridge construction site
Frequency: Most observations
Direction: Eastbound
Note: Delays were incurred by vehicles crossing into Maryland at the Woodrow Wilson Bridge during most observations. Three lanes were available (in each direction) during the 2008 survey period.



Superscripts: [1] Type 1 nested congestion (some days, not others). [2] Type 2 nested congestion (more severe in left or right-hand lanes). [3] Type 3 nested congestion (present only in the first or second half-hour period). [4] Type 4 nested congestion (partial length of segment).

I-495/95 Capital Beltway (Inner Loop) -Evening



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-495/95 Capital Beltway (Inner Loop) -Evening

A
Congestion Type: Mainline Congestion
Location: Approaching WW Bridge construction zone
Frequency: Intermittent
Direction: Westbound
Queue Length: 0 to 3 miles
Estimated Speed: 15 to 60 mph
Note: During 4 of 14 flyovers, long, dense queues were found on the Maryland approach to the Woodrow Wilson Bridge construction zone. It is assumed that unobserved construction activities prior to the beginning of the survey period were the initiating causes (data excluded from the tables).

B
Congestion Type: Mainline Congestion
Location: MD 5 interchange reconstruction zone
Frequency: Intermittent
Direction: Westbound
Queue Length: 1 to 2.5 miles
Estimated Speed: 20 to 50 mph
Note: Reconstruction of the MD 5 / I-95 interchange may have exacerbated conditions for vehicles exiting the beltway. Intermittently, congestion normally found in just the right lane extended across all travel lanes of the beltway.

C
Congestion Type: Right lane to exit queue
Location: Approaching Forestville Rd exit
Frequency: Intermittent
Direction: Westbound
Queue Length: 0.25 to 0.5 miles
Note: During several observations, the right lane exit queue to Forestville Rd extended upstream along the right travel lane of the beltway; the head of the queue was at the end of the ramp, where right-turning beltway traffic yielded to Forestville Rd traffic.

D
Congestion Type: Mainline Congestion
Location: Construction zone south of US 50
Frequency: Intermittent
Direction: Southbound
Queue Length: 1 to 2 miles
Estimated Speed: 30 to 50 mph
Note: Intermittent southbound delays may have been caused or exacerbated by the lane-shift associated with beltway construction between US 50 and MD 202 (Landover Rd); four lanes were maintained.

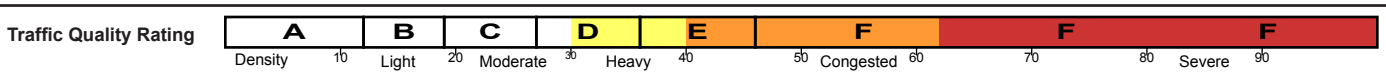
E
Congestion Type: Mainline Congestion
Location: Varying locations
Frequency: Most obeservations before 6:00 pm
Direction: Eastbound / southbound
Estimated Speed: 20 to 50 mph
Note: Conditions varied widely on survey dates along the 7-mile segment between College Park and US 50. In both directions, traffic was heavy and congestion was sporadically found in differing locations. In a few cases vehicles were stopped on the shoulders; these could have contributed to or been incidental to the congestion.

G
Congestion Type: Mainline Congestion
Location: From MD 355 to MD 650
Frequency: Most observations
Direction: Eastbound
Queue Length: 3 to 8 miles
Estimated Speed: 15 to 50 mph
Note: Severe eastbound congestion was found between MD 355 (Wisconsin Ave) and MD 185 (Conn. Ave). Merging traffic from I-270, MD 355 and MD 185 were major factors. Conditions gradually improved thereafter to the east, with only minor delays found east of MD 97.

I
Congestion Type: Mainline Congestion
Location: From River Rd to MD 187
Frequency: Some days, not others
Direction: Northbound / Eastbound
Queue Length: 0 to 6 miles
Estimated Speed: 10 to 30 mph
Note: Severe congestion was found some days -- and was entirely absent others -- on the inner loop between MD 190 (right two lanes of I-495) and MD 187 / Old Georgetown Rd. When present, these delays could have been initiated by afternoon incidents or roadwork. The tail sometimes extended back across the American Legion Bridge into Virginia, overall forming a continuous zone of severe congestion from Tysons Corner to Silver Spring.

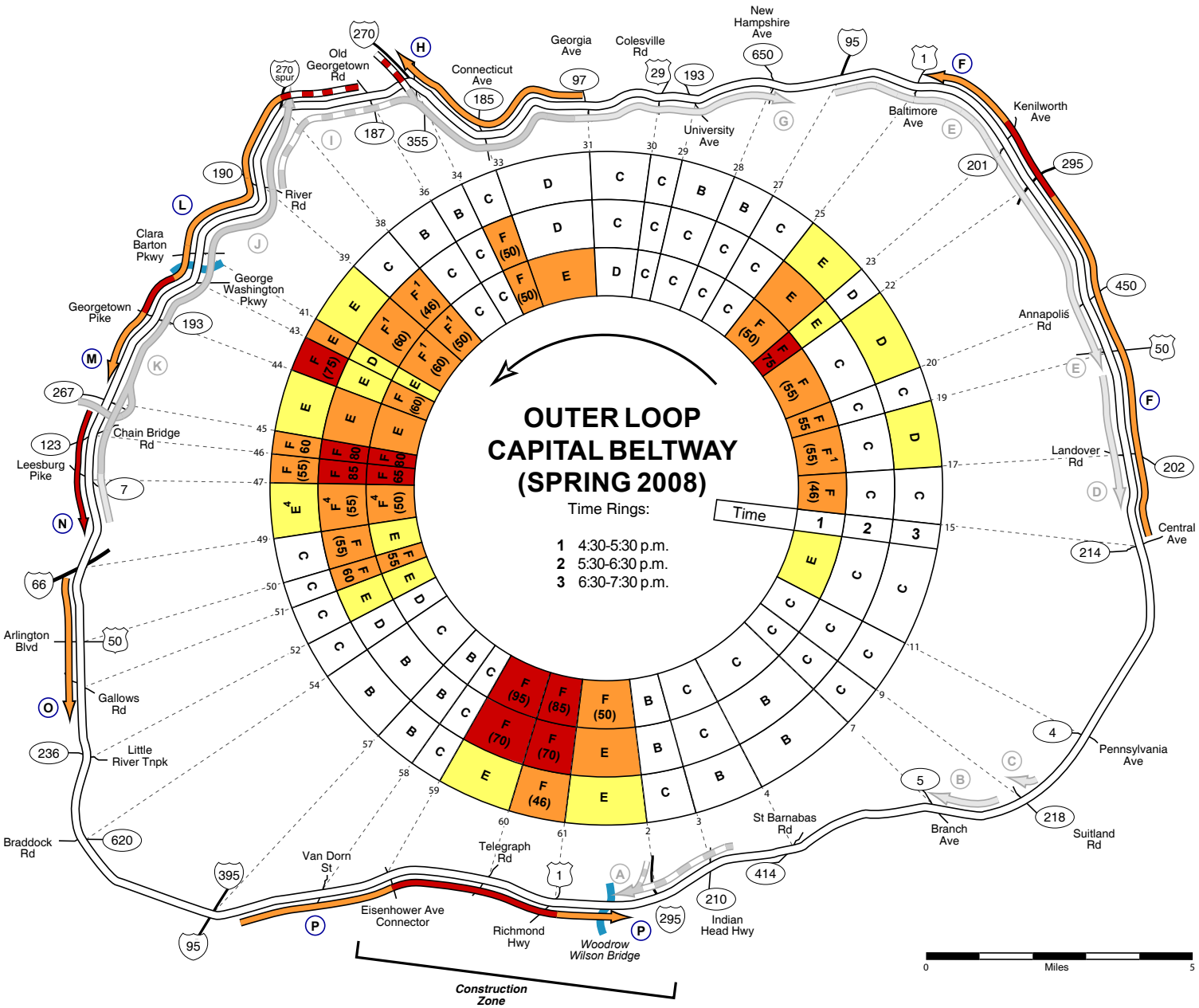
J
Congestion Type: Mainline Congestion
Location: Potomac River to I-270 Spur
Frequency: Most observations
Direction: Northbound
Queue Length: 3 to 3.5 miles
Estimated Speed: 20 to 30 mph
Note: Moderate to severe congestion was normally found from the Potomac River to the left exit to the I-270 Spur. Traffic entering at the Cabin John Parkway, MD 190, and weaving for I-270 were contributing factors.

K
Congestion Type: Mainline Congestion
Location: From VA 267 to Potomac River
Frequency: Most observations
Direction: Northbound
Queue Length: 3 to 7 miles
Estimated Speed: 15 to 40 mph
Note: An extended zone of moderate to severe congestion extended from the vicinity of VA 267 to the GW Parkway merge; beyond that, the congestion often continued to the I-270 Spur in Maryland (and sometimes beyond).



Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

I-495/95 Capital Beltway (Outer Loop) -Evening



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

I-495/95 Capital Beltway (Outer Loop) -Evening

F
Congestion Type: Mainline Congestion
Location: Varying locations
Frequency: Intermittent
Direction: Northbound / Westbound
Estimated Speed: 20 to 50 mph
Note: Conditions varied widely on survey dates along the 7-mile segment between US 50 and College Park. In both directions, traffic was heavy and congestion was sporadically found in differing locations. In a few cases vehicles were stopped on the shoulders; these could have contributed to or been incidental to the congestion.

H
Congestion Type: Mainline Congestion
Location: Approaching I-270
Frequency: Intermittent
Direction: Westbound
Queue Length: 1 to 4 miles
Estimated Speed: 25 to 50 mph
Note: Congestion was only intermittently found on I-495 outer loop passing Connecticut Ave toward I-270. When present, delays were relatively minor and not usually encountered until after passing the Conn. Ave interchange.

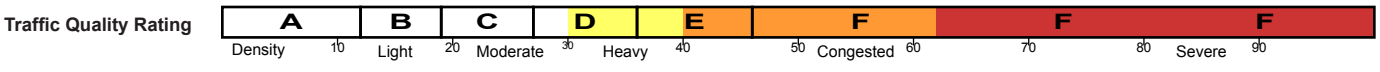
L
Congestion Type: Mainline Congestion
Location: From I-270 Spur to Potomac River
Frequency: Intermittent
Direction: Southbound
Queue Length: 3 to 5 miles
Estimated Speed: 20 to 40 mph
Note: On some surveyed evenings but not others, severe congestion extended from the vicnity of the I-270 Spur to the Potomac River and beyond. In some cases, these delays may have been initiated by afternoon incidents or other activities. On the whole, however, conditions were better than in 2005, probably reflecting improved outerloop flow approaching the widened ramp at VA 267.

M
Congestion Type: Mainline Congestion
Location: From Potomac River toward VA 267
Frequency: Most observations
Direction: Southbound
Queue Length: 0.5 to 2 miles
Estimated Speed: 20 to 50 mph
Note: Moderate congestion was found on the outerloop at the GW Parkway and VA 193 (Georgetown Pike) interchanges. Beyond the MD 193 merge, traffic flow gradually improved. (This zone was severely congested during the 2005 survey flights, which were conducted just before completion of the downstream ramp widening to VA 267.)

N
Congestion Type: Mainline Congestion
Location: From VA 267 to VA 7 merge
Frequency: Most observations
Direction: Southbound
Queue Length: 1.5 to 2 miles
Estimated Speed: 20 to 30 mph
Note: Heavy ramp merges from VA 267, VA 123 and VA 7 generated moderate to severe southbound congestion on I- 495; flow improved but remained intermittently congested through the interchanges south of the VA 7 merge.

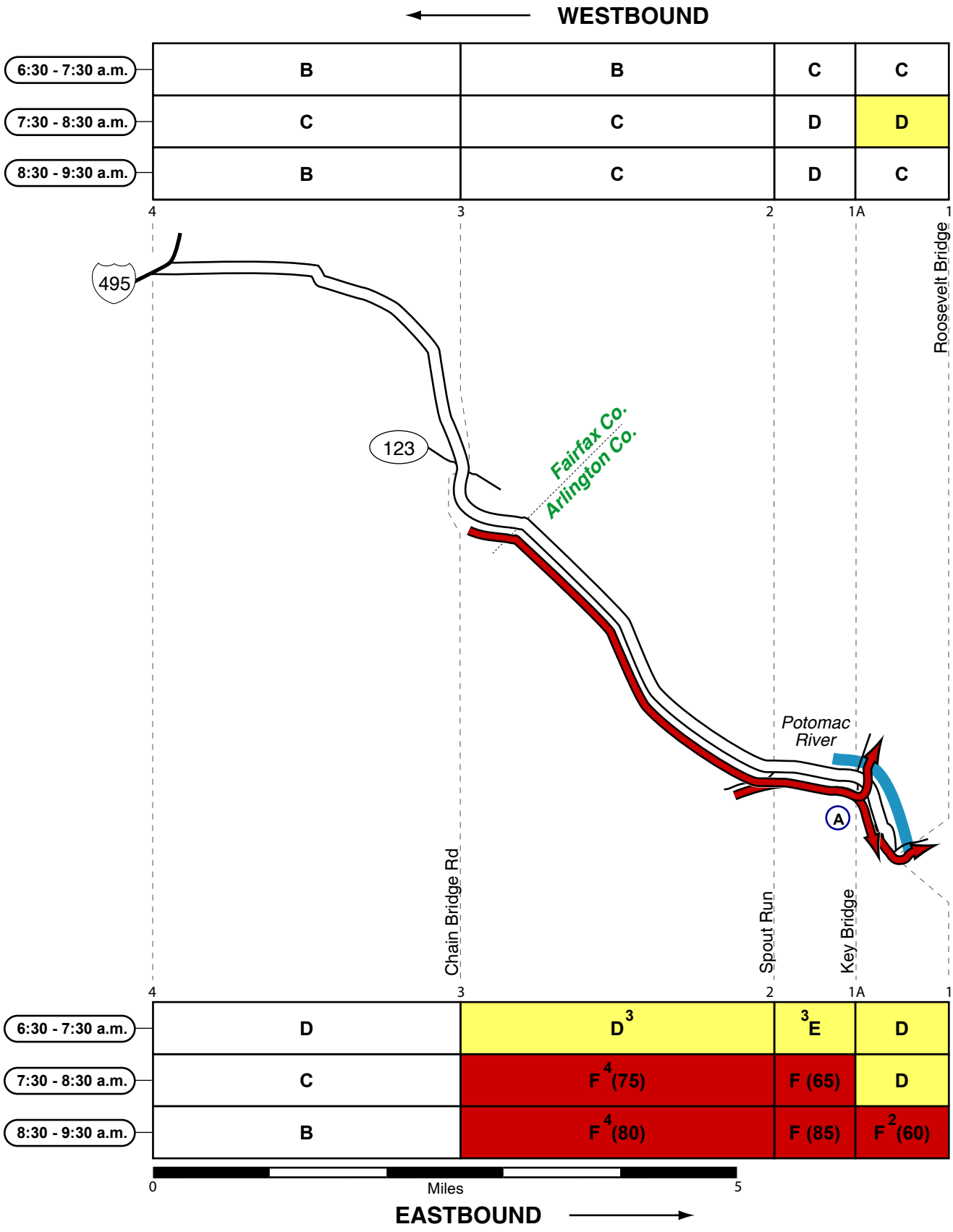
O
Congestion Type: Mainline Congestion
Location: I-66 to Gallows Rd merge
Frequency: Most observations
Direction: Southbound
Queue Length: 2 to 3 miles
Estimated Speed: 30 to 50 mph
Note: Light to moderate southbound congestion was found at the merges at I-66, US 50 and Gallows Rd; beyond Gallows Rd, speeds gradually picked up to free-flow.

P
Congestion Type: Mainline Congestion
Location: Approaching WW Bridge construction zone
Frequency: Most observations
Direction: Eastbound
Queue Length: 2 to 6 miles
Estimated Speed: 10 to 30 mph
Note: Severe eastbound congestion was found during most evening observations approaching the Woodrow Wilson Bridge construction zone. At its greatest observed extent, the tail was found just downstream of the I-395 (Springfield) interchange. (Note: only 3 lanes were available from a point just west of Eisenhower Ave.)



Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

George Washington Memorial Parkway (Virginia) - Morning



Traffic Quality Rating

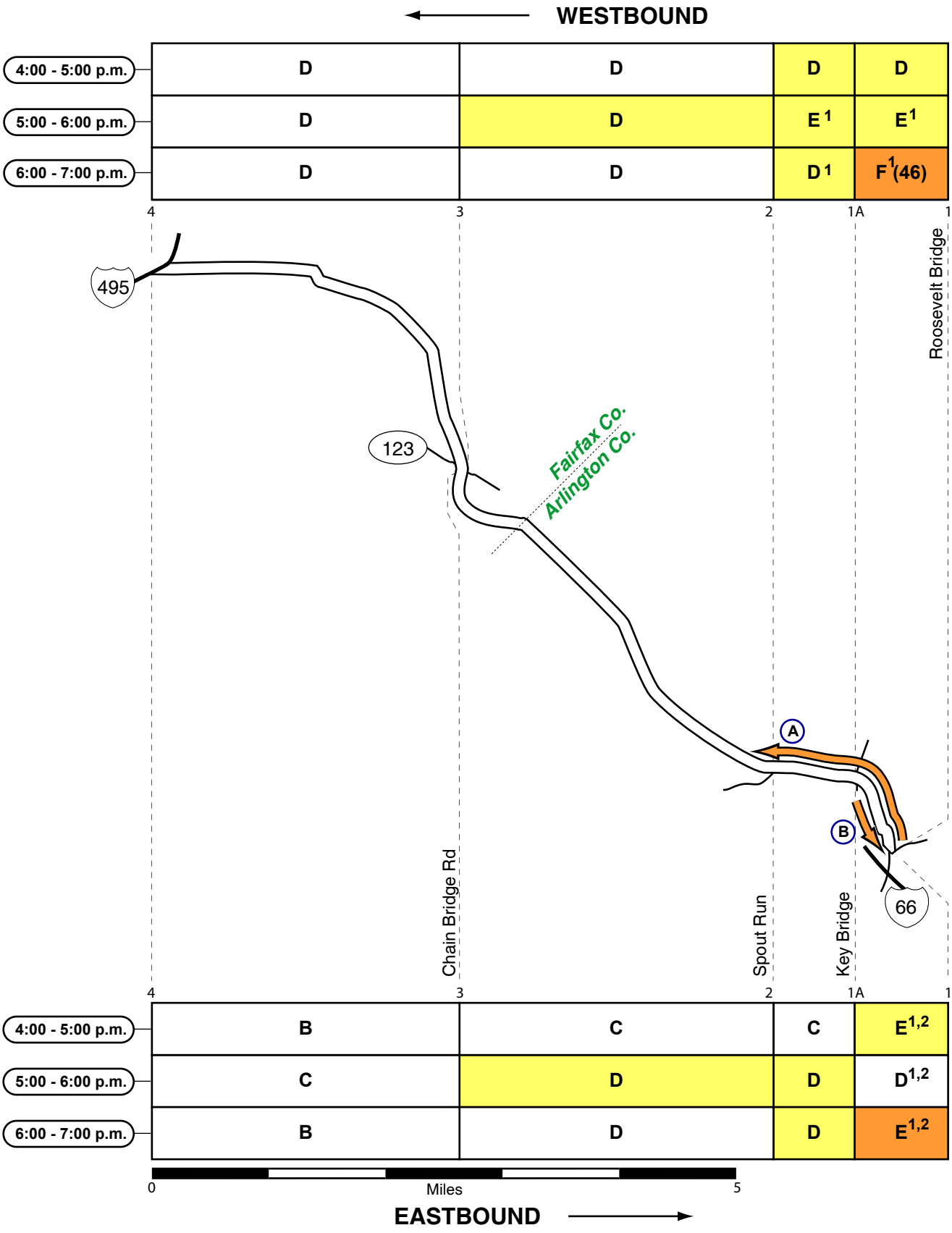
A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

George Washington Memorial Parkway (Virginia) - Morning

A
Congestion Type: Mainline Congestion
Location: Between Chain Bridge Rd & I-66
Frequency: Most observations after 7:00 a.m.
Direction: Eastbound
Queue Length: 3 to 4 miles
Estimated Speed: 15 to 45 mph
Note: The primary bottleneck was the lane drop (3 lanes to 2) where traffic entered at Spout Run. After 8:30 a.m., the head of the queue was found further east, where congestion on the Roosevelt and Key bridges extended back into the mainline of the GW Parkway.

George Washington Memorial Parkway (Virginia) - Evening



Traffic Quality Rating

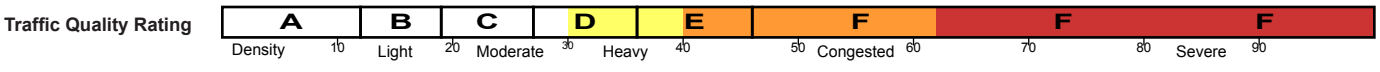
A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

George Washington Memorial Parkway (Virginia) - Evening

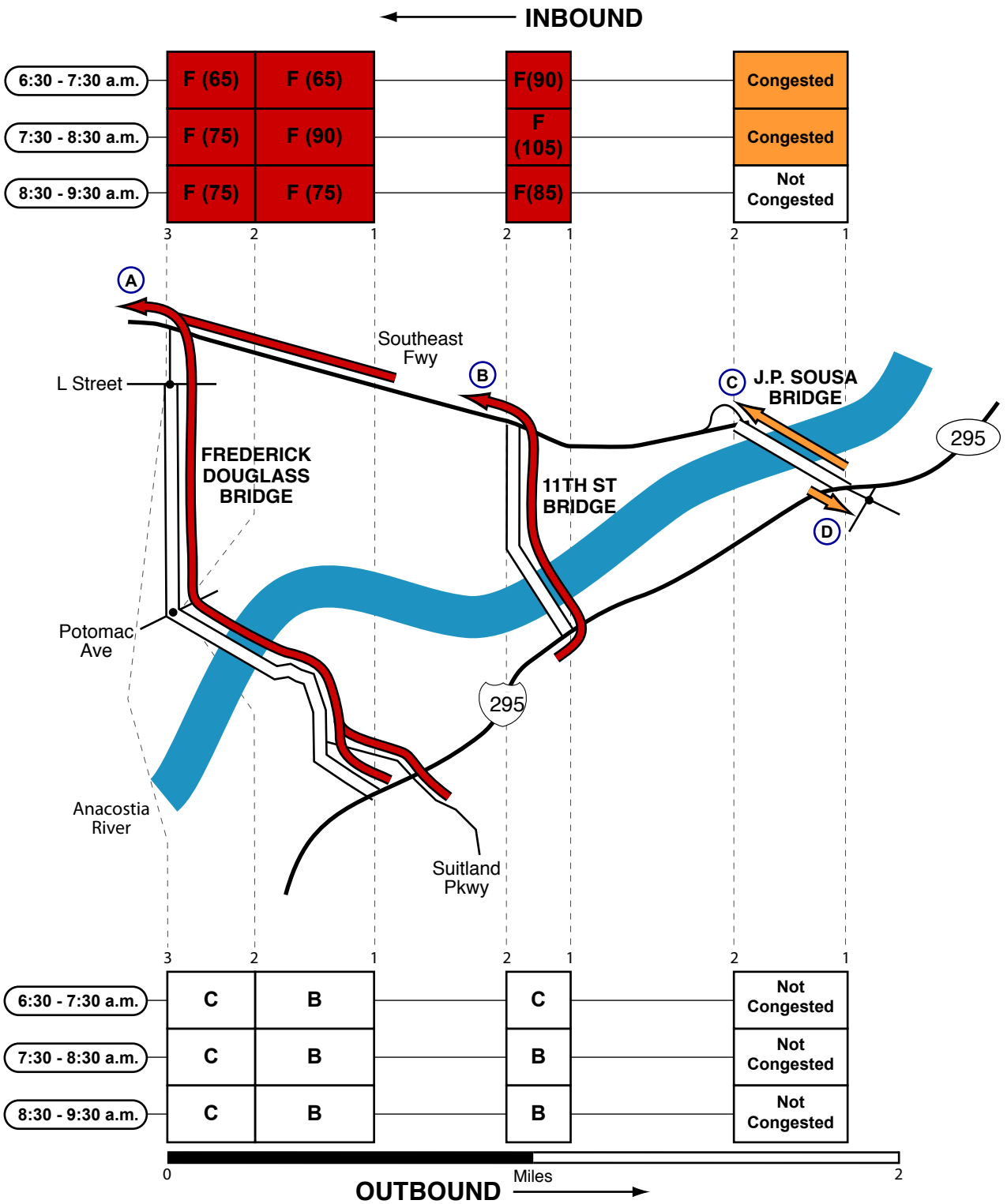
A
Congestion Type: Mainline Congestion
Location: Between I-66 & Spout Run
Frequency: Intermittent
Direction: Westbound
Queue Length: 1 to 2 miles
Estimated Speed: 40 to 50 mph
Note: Congestion appeared to be caused or exacerbated by the merging and weaving associated with the Key Bridge and Spout Run interchanges.

B
Congestion Type: Mainline Congestion
Location: approaching I-66
Frequency: Intermittent
Direction: Eastbound
Queue Length: 0.5 to 1 miles
Estimated Speed: 40 to 50 mph
Note: Congestion appeared to be caused by the merging associated with the ramp to the Roosevelt Bridge.



Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

Anacostia River Bridges - Morning



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

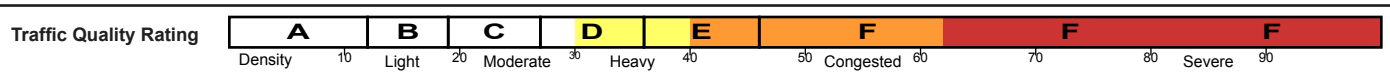
Anacostia River Bridges - Morning

A
Congestion Type: Mainline Congestion
Location: Between I-295 & Southeast Freeway
Frequency: Most observations
Direction: Inbound
Queue Length: 1 to 2 miles
Estimated Speed: 10 to 40 mph
Note: Factors contributing to the congestion were: 1) the signals at Potomac Ave and I St and; 2) the merge into congested flow on the Southeast Freeway. Intermittently, congestion extended back onto Suitland Parkway.

B
Congestion Type: Mainline Congestion
Location: 11th St Bridge
Frequency: Most observations
Direction: Inbound
Queue Length: 0.5 to 1 miles
Estimated Speed: 5 to 25 mph
Note: The head of the queue was found on the ramp to the Southeast Freeway (southbound).

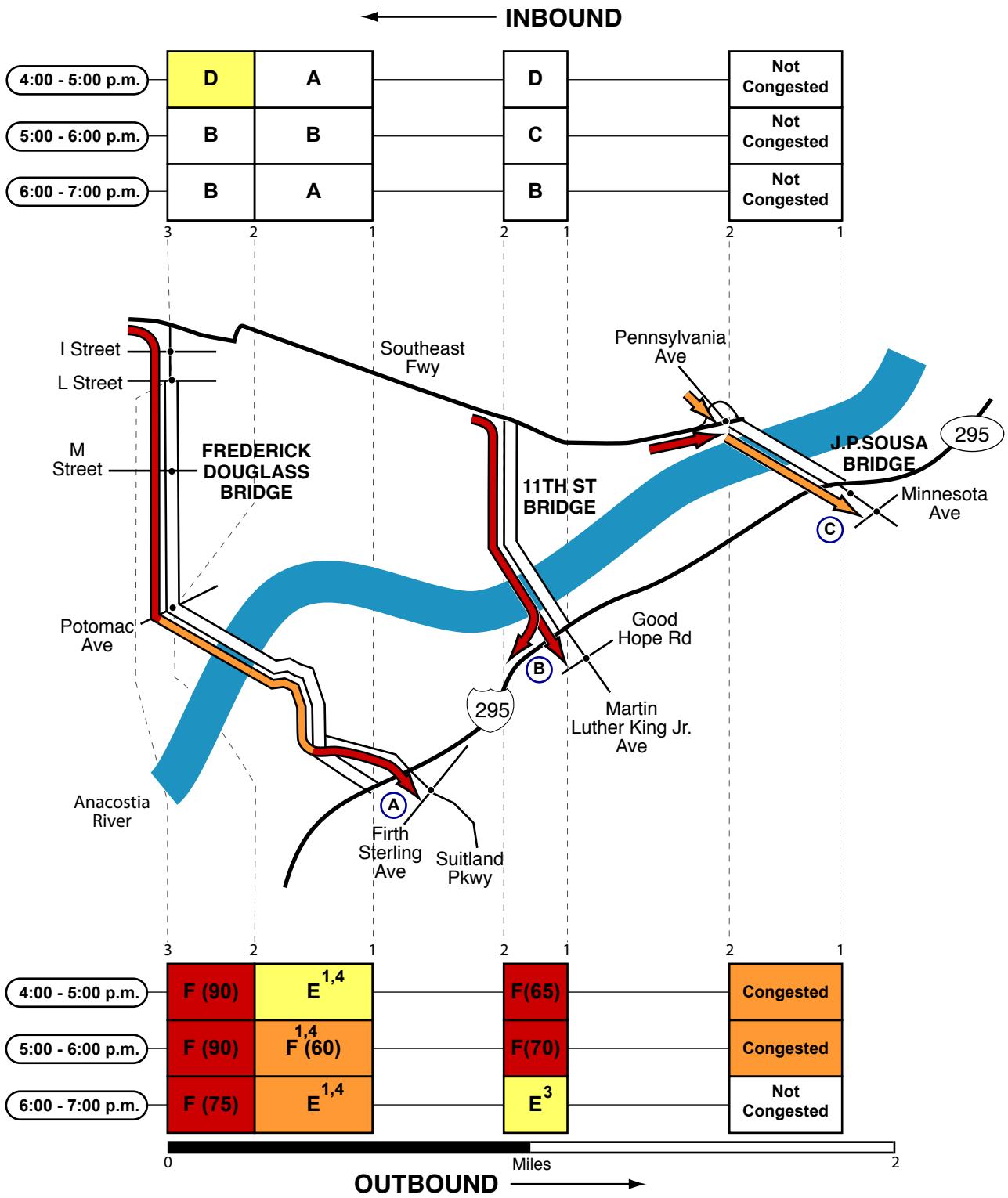
C
Congestion Type: Mainline Congestion
Location: J.P. Sousa Bridge
Frequency: Most observations before 8:30 a.m.
Direction: Inbound
Queue Length: 0.25 to 0.5 miles
Note: Factors contributing to the congestion were: 1) weaving approaching the Pennsylvania Ave/ Southeast Freeway split and; 2) the geometrics of the ramp to Southeast Freeway (sharp bend).

D
Congestion Type: Left-turn Queue
Location: D.C. 295 Entrance Ramp (Northbound)
Frequency: Intermittent
Direction: Outbound
Note: The head of the queue was found in the left-turn bay at the signal, intermittently, congestion extended back into the mainline of Pennsylvania Ave.



Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

Anacostia River Bridges - Evening



Traffic Quality Rating

A	B	C	D	E	F	F	F
Density 10	Light 20	Moderate 30	Heavy 40		50 Congested 60	70	80 Severe 90

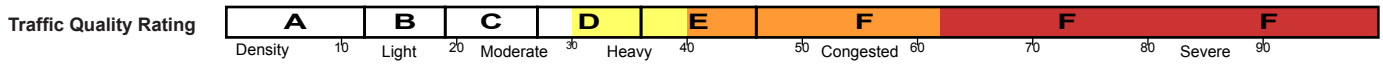
Superscripts: [1] Type 1 nested congestion (some days, not others).
[2] Type 2 nested congestion (more severe in left or right-hand lanes).
[3] Type 3 nested congestion (present only in the first or second half-hour period).
[4] Type 4 nested congestion (partial length of segment).

Anacostia River Bridges - Evening

A
Congestion Type: Mainline Congestion
Location: Between Southeast Freeway and I-295
Frequency: Most observations
Direction: Outbound
Queue Length: 1 to 2 miles
Estimated Speed: 5 to 35 mph
Note: Congestion was caused or exacerbated by the signals at I St, M St, Potomac Ave and Firth Sterling Ave (on Suitland Parkway).

B
Congestion Type: Mainline Congestion
Location: 11th St Bridge
Frequency: Most observations before 6:30 p.m.
Direction: Outbound
Queue Length: 0.5 to 1 miles
Estimated Speed: 20 to 50 mph
Note: Factors contributing to the congestion were: 1) weaving approaching the 13th St/I-295 split; 2) the lane drop (2 lanes to 1) on the ramp to I-295 (southbound) and; 3) the signal at Good Hope Rd (on Martin Luther King Jr. Ave).

C
Congestion Type: Mainline Congestion
Location: J.P. Sousa Bridge
Frequency: Most observations before 6:00 p.m.
Direction: Outbound
Note: Congestion was caused or exacerbated by the signals at D.C. 295 and Minnesota Ave.



Superscripts: [1] Type 1 nested congestion (some days, not others). [3] Type 3 nested congestion (present only in the first or second half-hour period).
[2] Type 2 nested congestion (more severe in left or right-hand lanes). [4] Type 4 nested congestion (partial length of segment).

(Blank)

Chapter IV

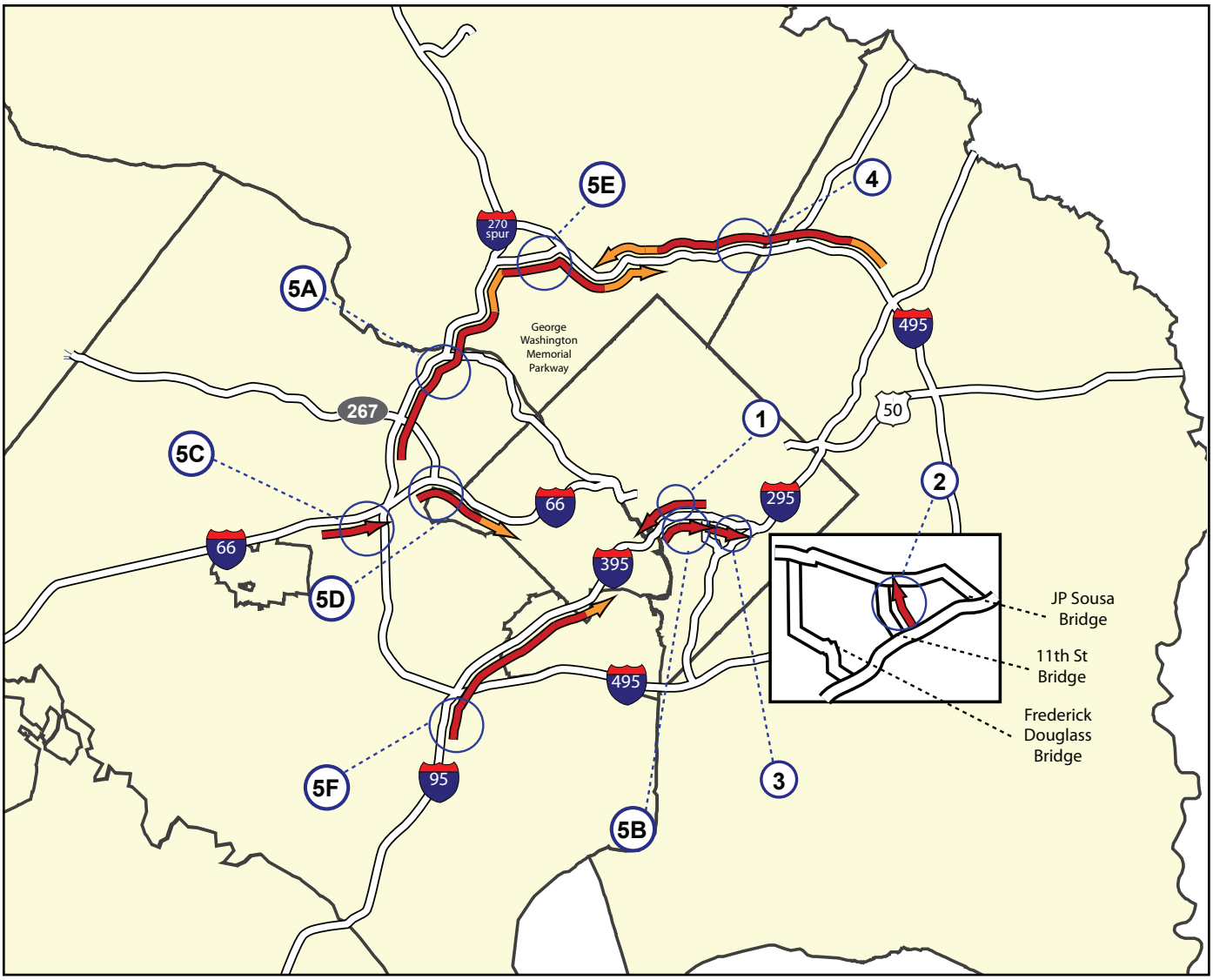
Summary of Congested Locations and Corridors

This chapter provides a summary of the “Top Ten Congested Locations” by ranking the densities of all segments and picking the top ten irrespective of whether they are congested during the AM or PM peak period.

Corridors with the longest delay is a new metric introduced in the report. The purpose of this metric is to identify corridors which may not have bottlenecks in the “Top Ten Congested Locations” but are long congested corridors. Delay is calculated by estimating the additional travel time during congested conditions over the free flow travel time. Free flow speed is assumed to be 60 mph. This chapter lists the Top Five Congested Corridors in the AM and PM peak period.

(Blank)

Top Ten Congested Locations



Top Ten Congested Segments on the Freeway System (2008)

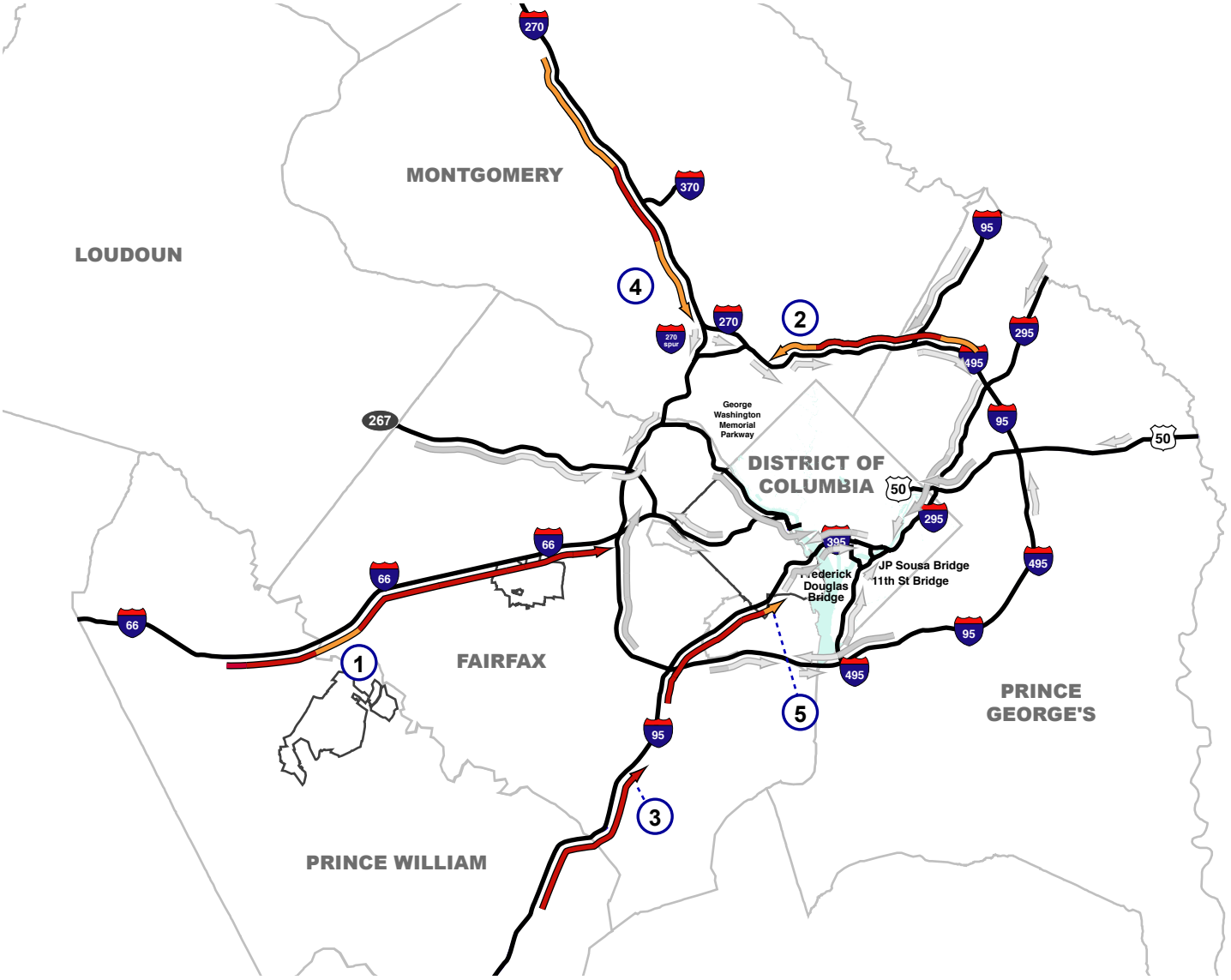
Rank	Route	From	To	Density	Speed Range
1	SB Soutwest/Southeast Fwy (5:30 to 6:30 PM)	Southwest Fwy/I-395 merge	US Route 1	115	10 to 15 MPH
2	WB 11th St Bridge (8 to 9 AM)	I-295/DC 295	Southeast Fwy	110	10 to 15 MPH
3	NB Southeast Fwy (4:30 to 6:30 PM)	11th Street	Pennsylvania Ave	105	12 to 20 MPH
4	OL I-495 (8 to 9 AM)	MD 650 (New Hampshire Ave)	US 29 (Colesville Rd)	100-105	12 to 20 MPH
5A	IL I-495 (5:30 to 6:30 PM)	VA 193 (Georgetown Pike)	George Washington Pkwy	100	14 to 20 MPH
5B	NB Southwest Fwy (4:30 to 5:30 PM)	US Route 1	Lenfant Plaza	100	14 to 20 MPH
5C	EB I-66 HOV (8 to 9 AM)	VA 243 (Nutley St)	I-495	100	14 to 20 MPH
5D	EB I-66 (6:30 to 7:30 PM)	VA 267	VA 693 (Westmoreland St)	100	14 to 20 MPH
5E	IL I-495 (5:30 to 6:30 PM)	MD 187 (Old Georgetown Rd)	MD 355 / I-270	100	14 to 20 MPH
5F	NB I-95 VA (7 to 8 AM)	VA 644 (Franconia Rd)	I-495	100	14 to 20 MPH

Longest Delay Corridors- Morning Peak Period

Site Name	Road Name	Time	Direction	From	To	Queue Length (miles)	Estimated Travel Time (minutes)	Estimated Speed (mph)	Estimated Delay (minutes)
Site #1	I-66	8:00 – 9:00	Eastbound	VA 234 Bypass	I-495	19.5	41	30	21
Site #2	I-495	8:00 – 9:00	Outerloop	MD 201	I-270	12	31	25	19
Site #3	I-95	7:00 – 8:00	Northbound	Dale Blvd	Lorton Rd	7	19.5	20	12.5
Site #4	I-270	8:00 – 9:00	Southbound	Clarksburg Rd	I-270 Spur	16	28.5	35	12.5
Site #5	I-395	7:30 – 8:30	Northbound	Franconia Rd	VA 7	7	18	25	11

* Free flow travel times based on speed of 60 mph

Note: Congestion on I-495 in the vicinity of the Woodrow Wilson Bridge was excluded due to ongoing construction

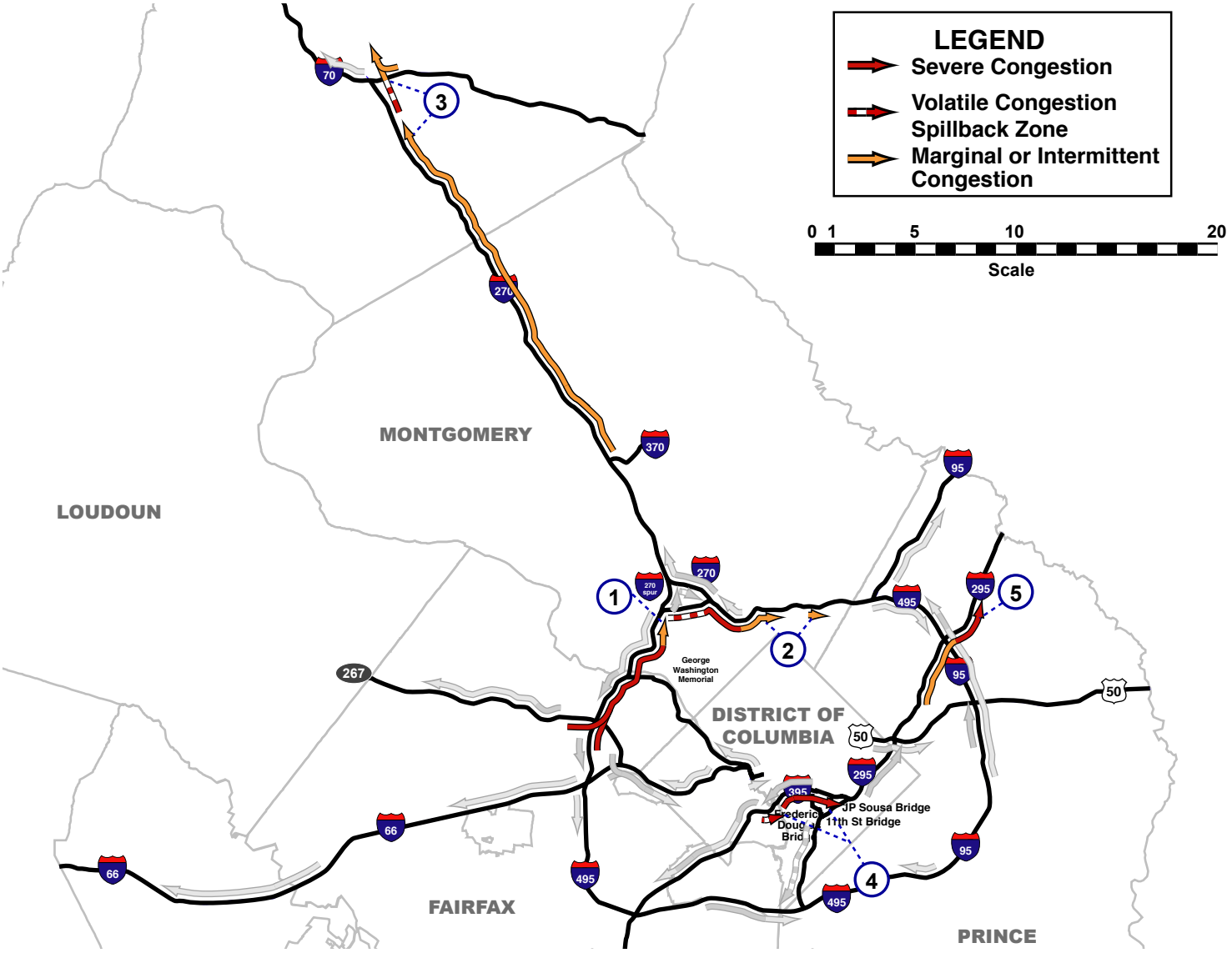


Longest Delay Corridors- Evening Peak Period

Site Name	Road Name	Time	Direction	From	To	Queue Length (miles)	Estimated Travel Time (minutes)	Estimated Speed (mph)	Estimated Delay (minutes)
Site #1	I-495	5:30 – 6:30	Innerloop	VA 7	I-270 Spur	8	24	20	16
Site #2	I-495	4:30 – 5:30	Innerloop	I-270 Spur	University Ave	10	24.5	25	14.5
Site #3	I-270	4:30 – 5:30	Northbound	I-370	I-70	23	34	40	11
Site #4	SE/SW Freeway	5:00 – 6:00	Northbound	VA 27	Pennsylvania Ave	5	15.5	20	10.5
Site #5	MD 295	4:30 – 5:30	Northbound	MD 450	MD 197	9.5	17.5	35	8

* Free flow travel times based on speed of 60 mph

Note: Congestion on I-495 in the vicinity of the Woodrow Wilson Bridge was excluded due to ongoing construction



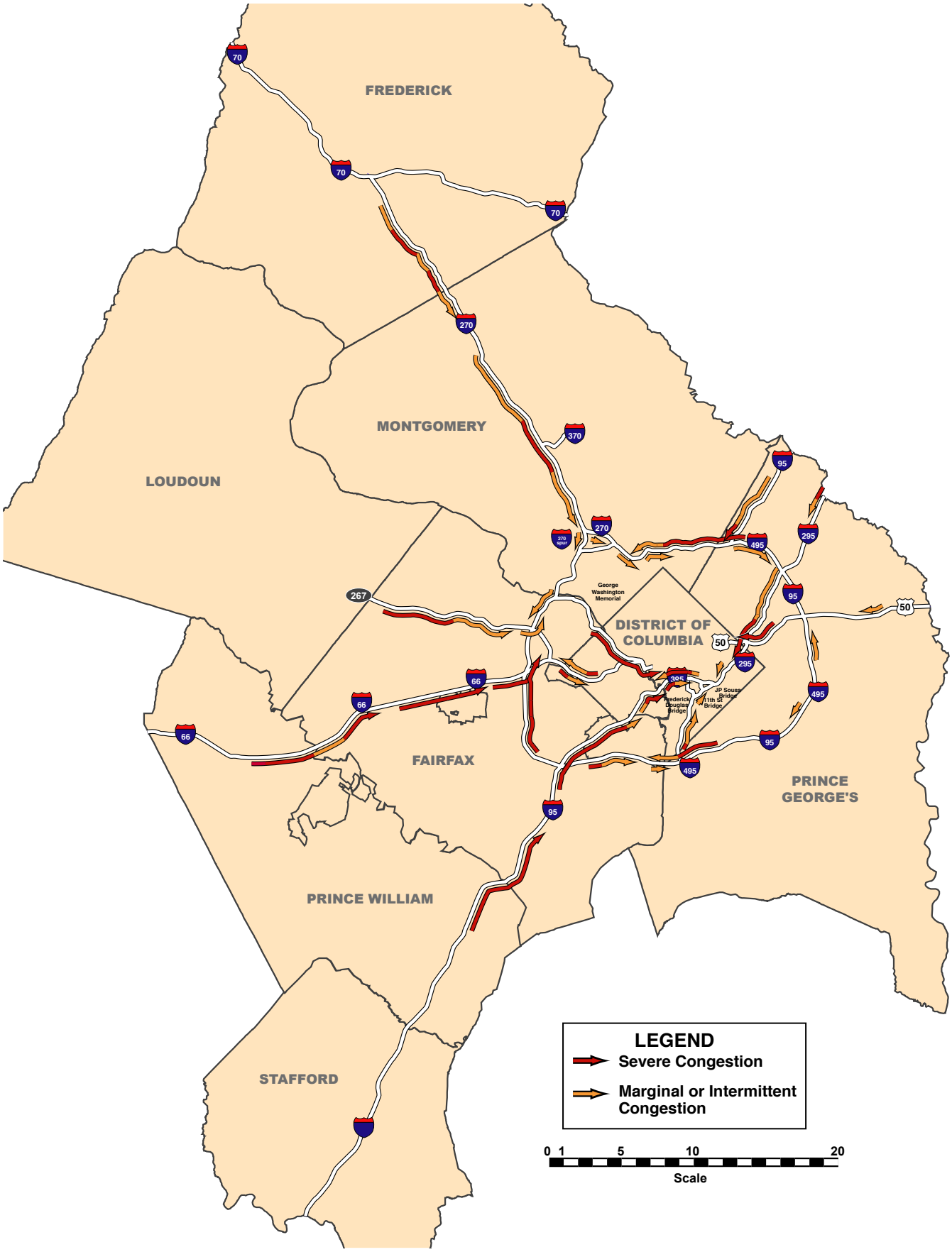
(Blank)

Chapter V

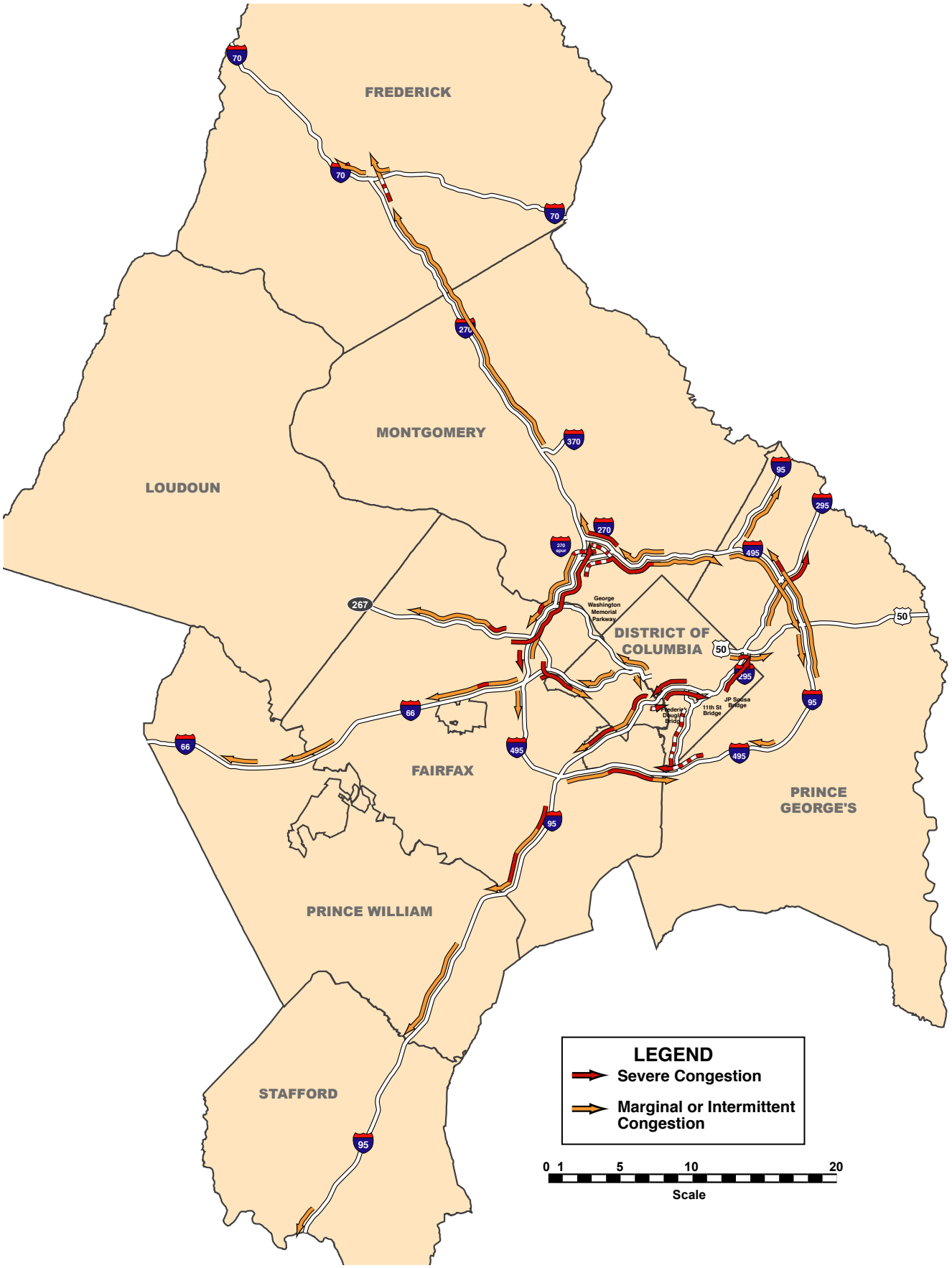
Regional Congestion Summary

This chapter shows summary maps of congestion in the region. The first set of maps summarizes all congestion that occurs within the three hour AM and PM peak period windows. If a segment is congested in two hours the worst of the two will be used. The second set of maps (six) illustrates congestion by the first hour, second hour and third hour during the AM and PM peak period. Users should pay attention since the survey times vary for facilities located within the Beltway and outside the Beltway.

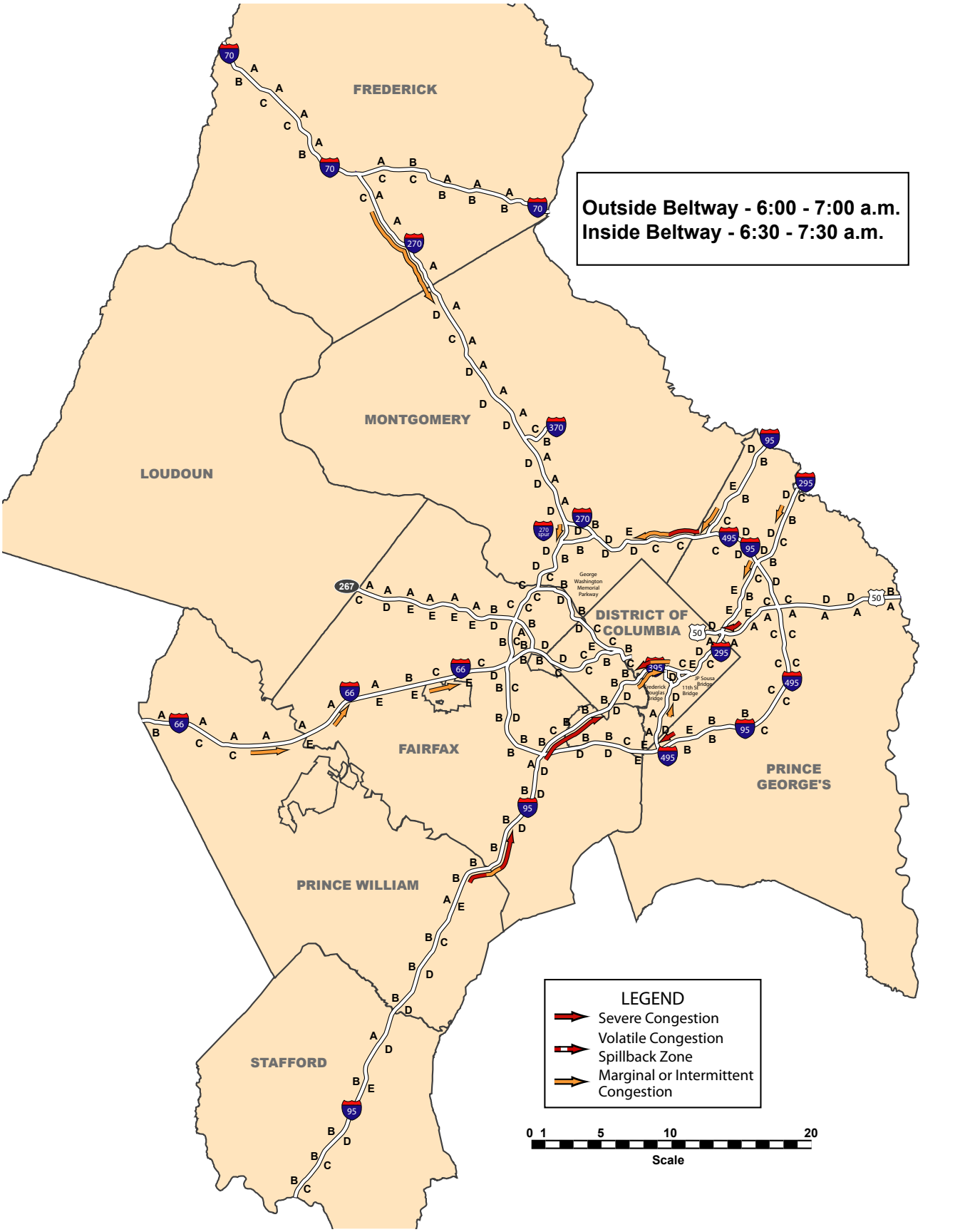
Morning Regional Congestion (Peak Period)-Spring 2008



Evening Regional Congestion (Peak Period)-Spring 2008



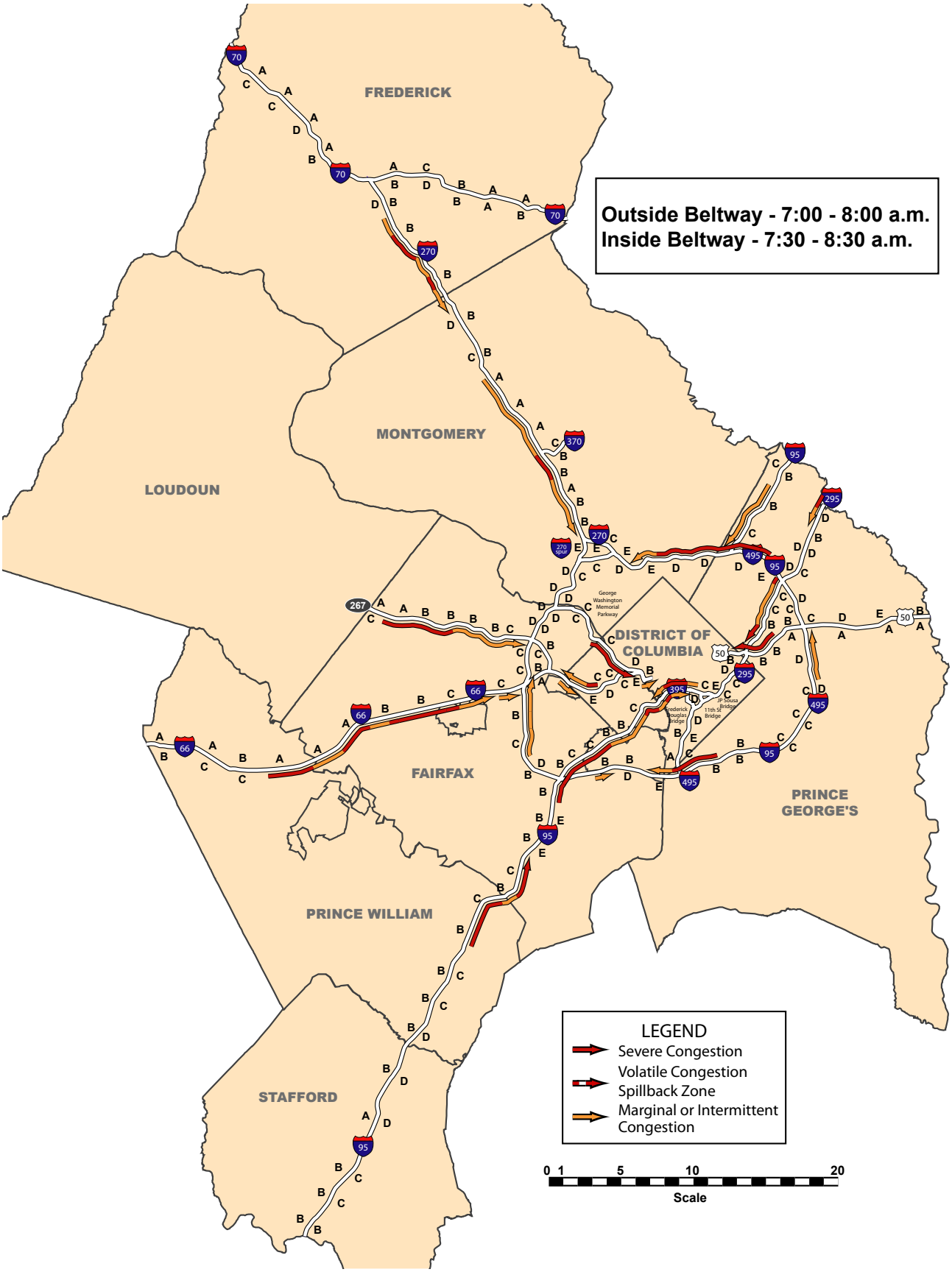
Morning - First Time Period



Freeway LOS Legend

A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

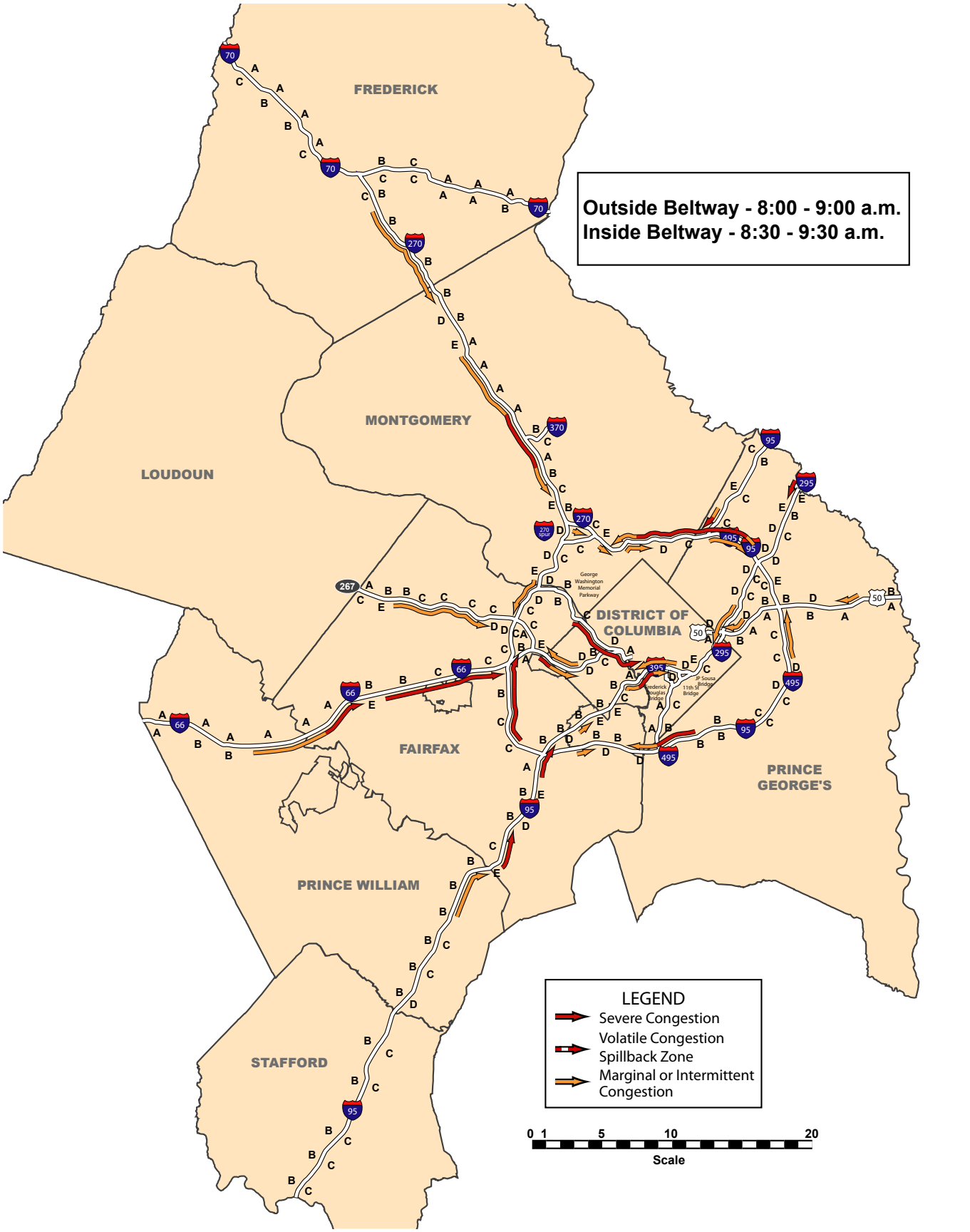
Morning - Second Time Period



Freeway LOS Legend

A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

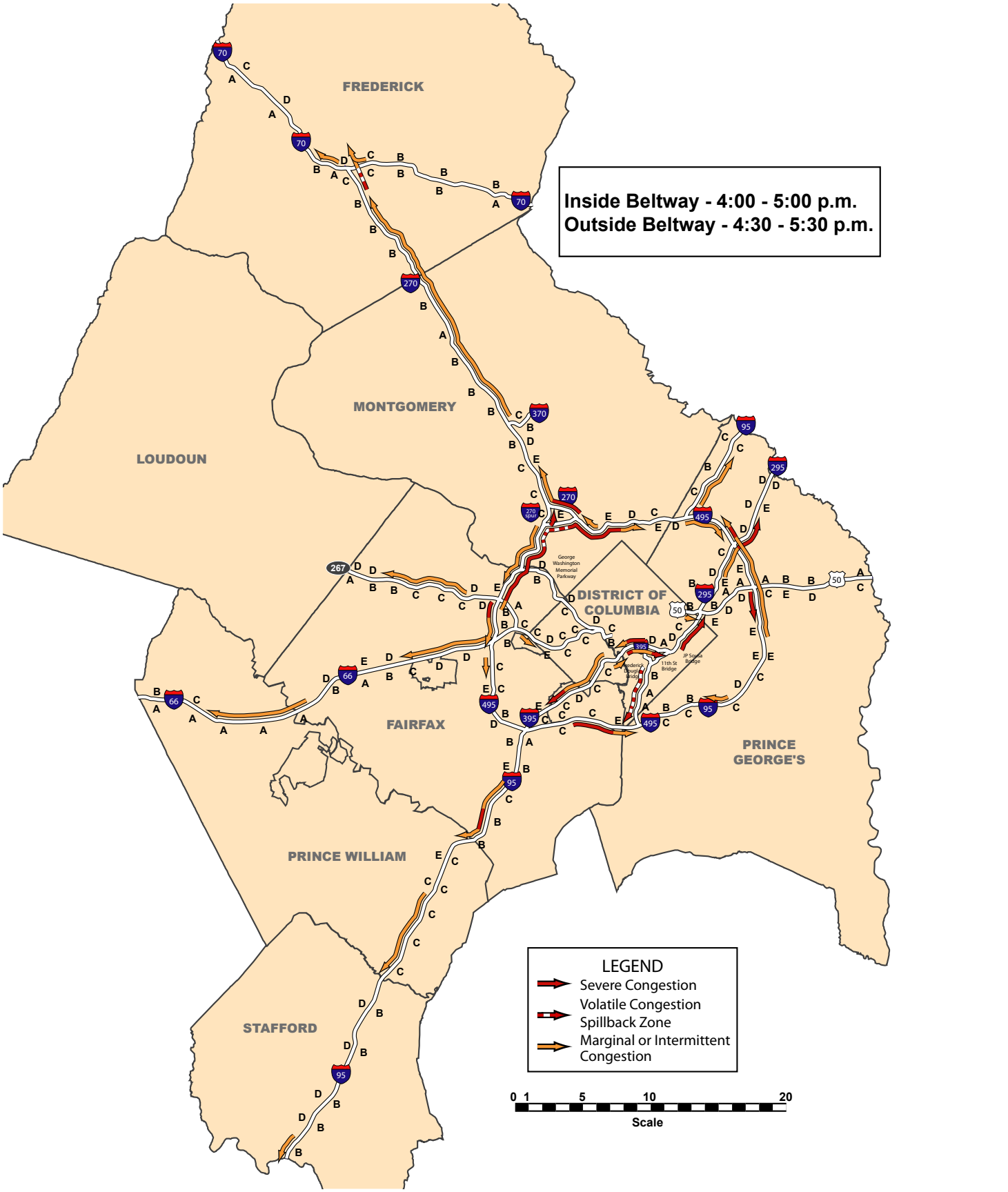
Morning - Third Time Period



Freeway LOS Legend

A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

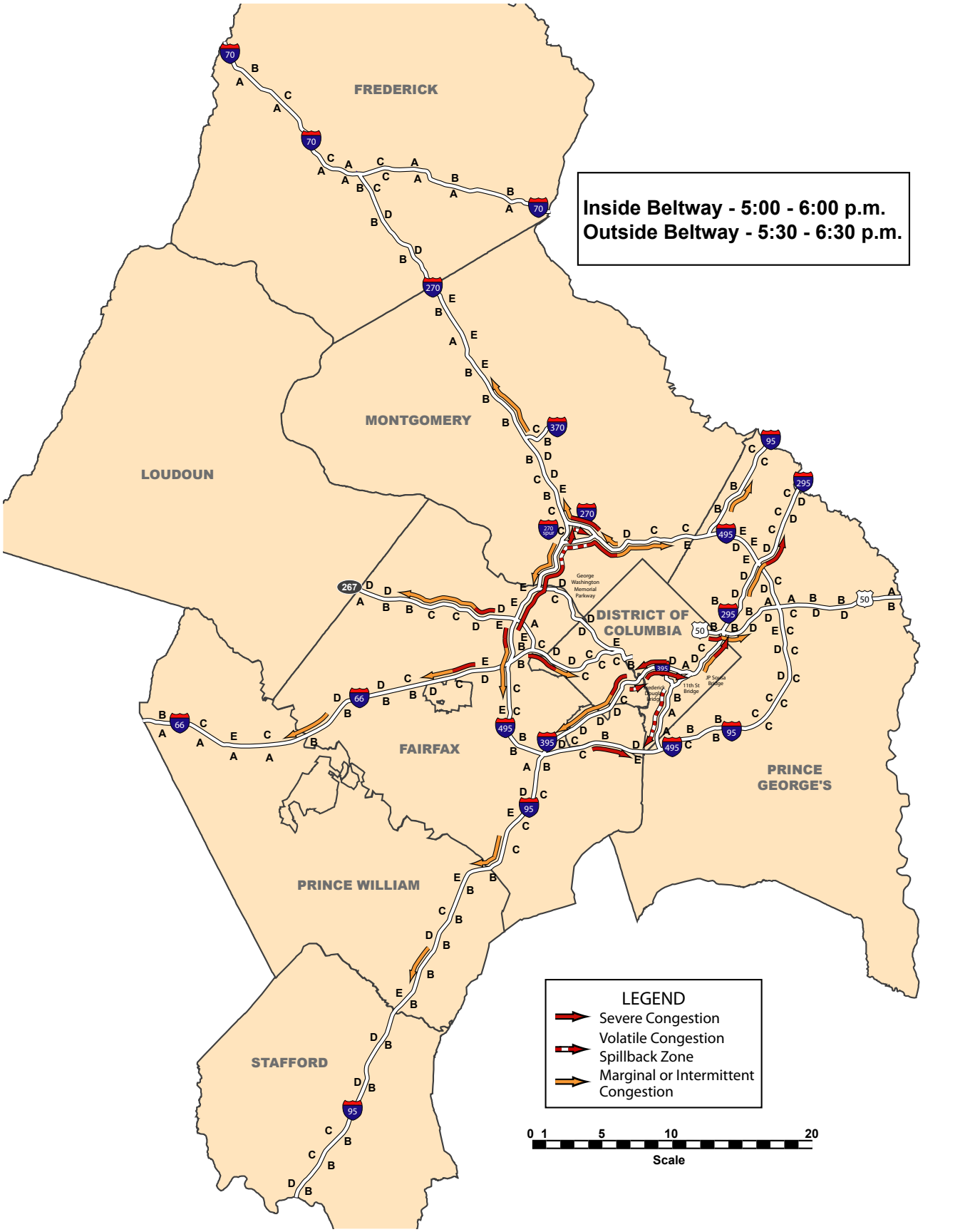
Evening - First Time Period



Freeway LOS Legend

A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

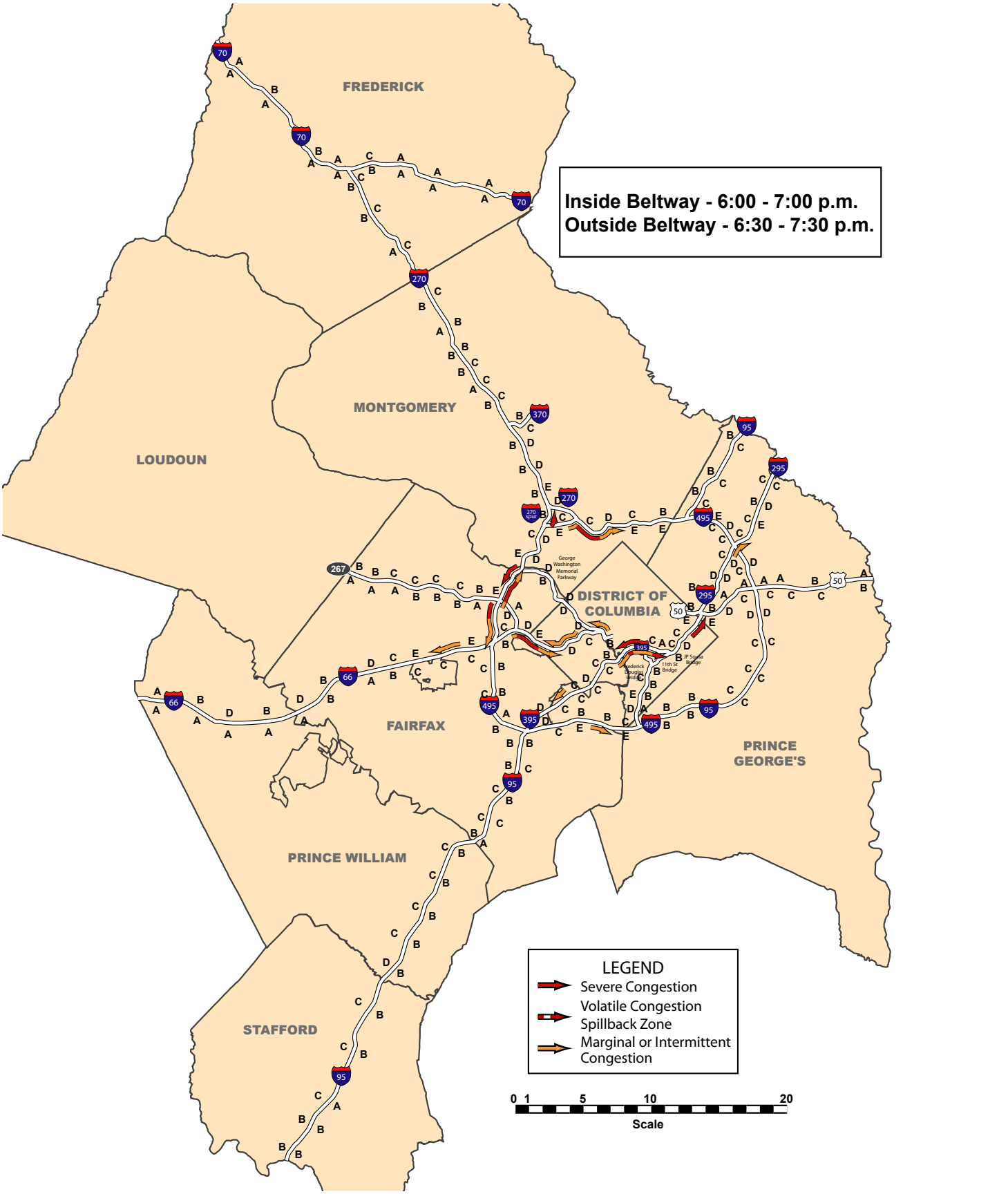
Evening - Second Time Period



Freeway LOS Legend

A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

Evening - Third Time Period



Freeway LOS Legend

A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

(Blank)

Chapter VI

Major Trends and Changes in Traffic Conditions

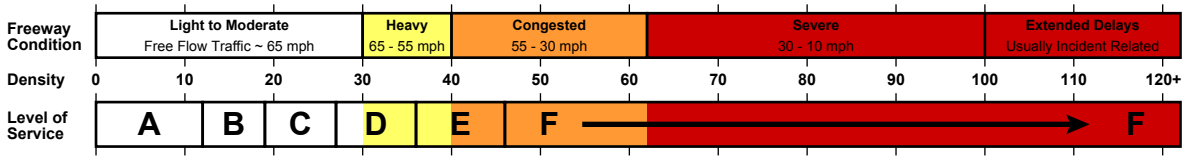
Between 1993 and 2008

This section of the report identifies locations on the highway system where major trends or changes in traffic conditions were found since the first aerial survey in 1993. On some highways, the absence or presence of construction contributed to the changed conditions. On other highways, added capacity contributed to improved flow; in some cases, no apparent cause could be attributed to the improvement or degradation of traffic flow.

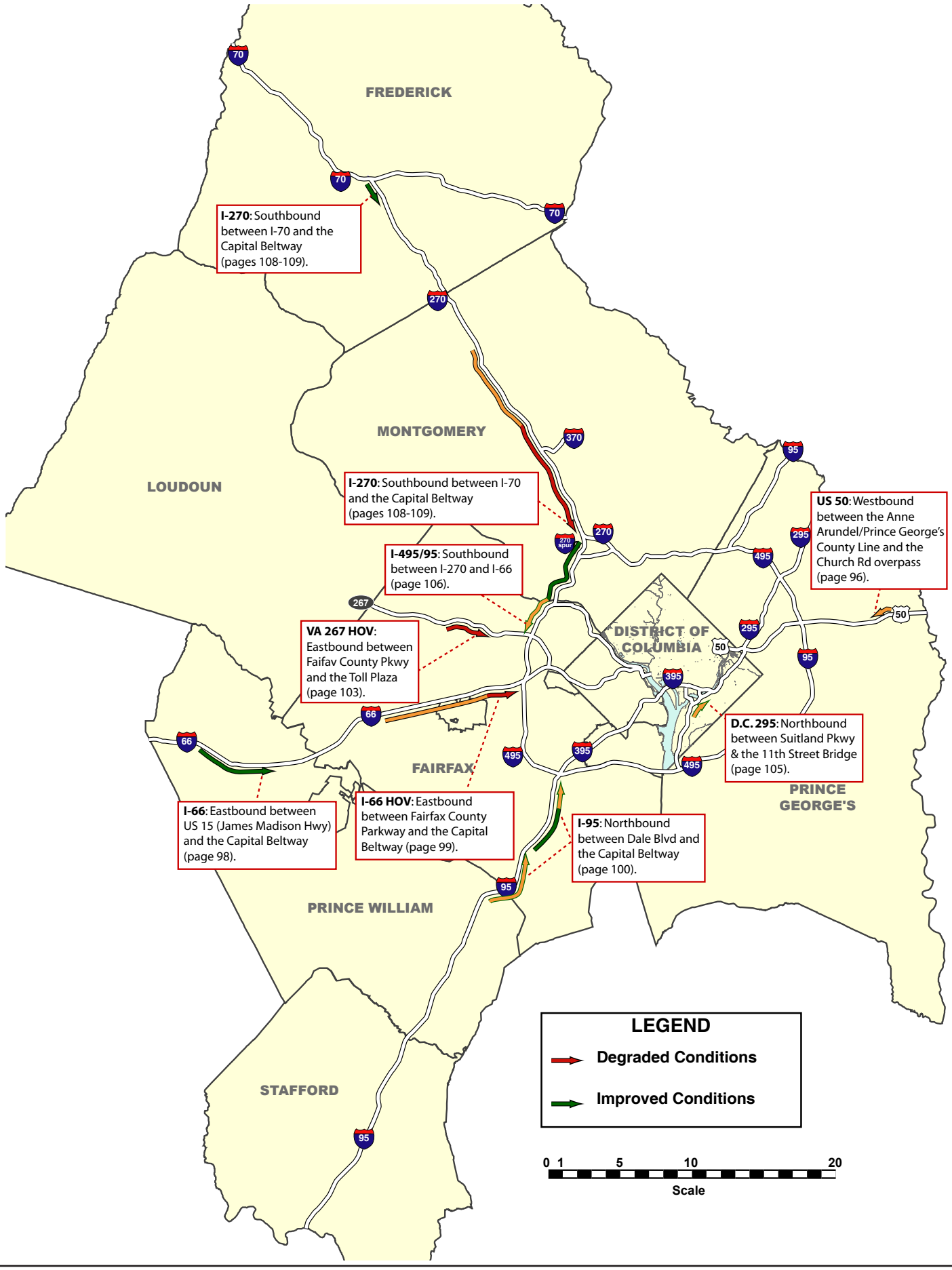
Excerpts from the level-of-service (LOS) tables contained in Part Two have been used in this section of the report to depict the changes in traffic conditions. For the purpose of comparing conditions from year to year, density data from the 1993, 1996, and 1999 surveys have been converted to levels-of-service using the boundaries outlined in the 2000 Highway Capacity Manual.

A summary of traffic conditions for each level-of-service is provided below.

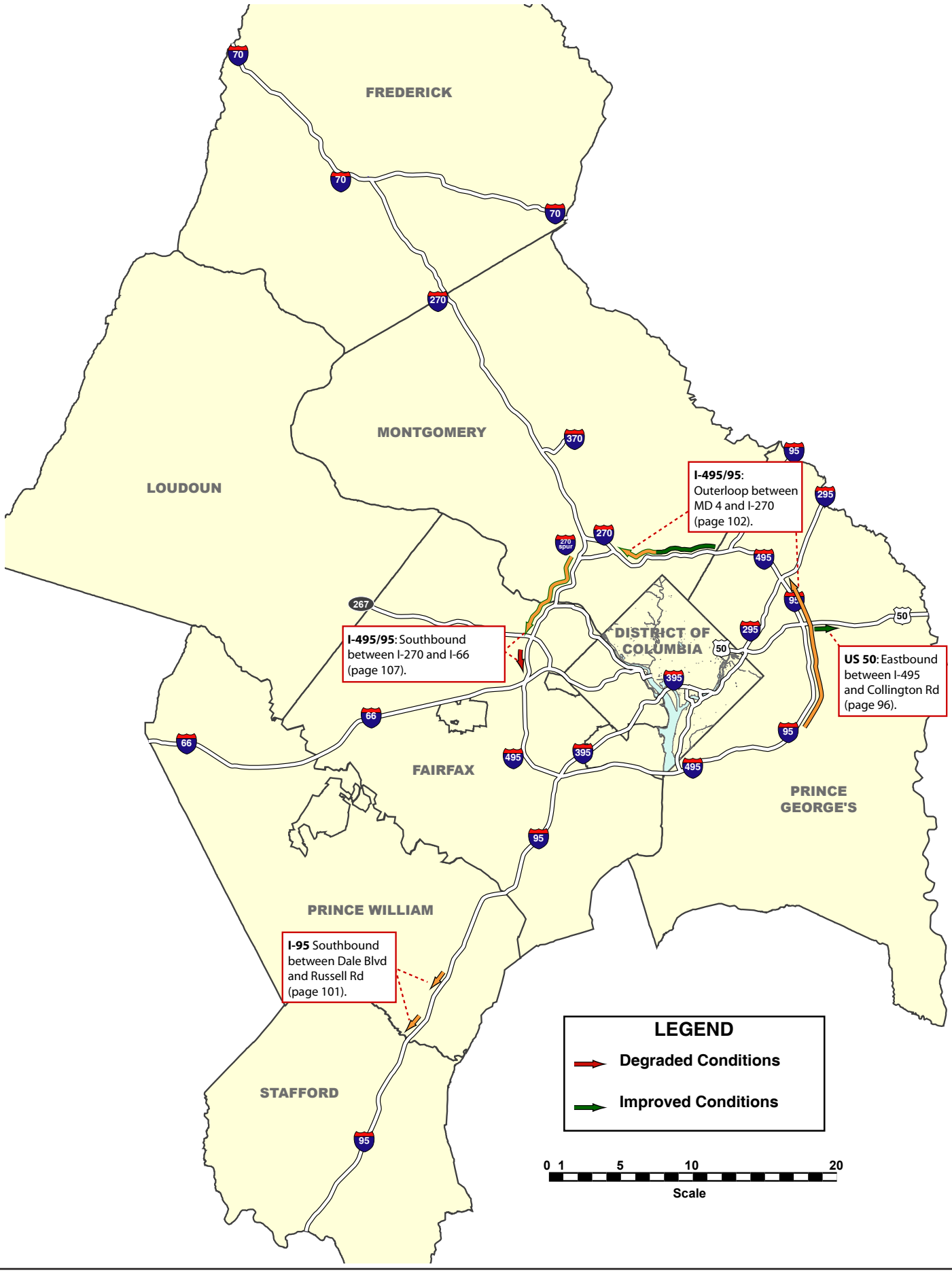
Traffic Quality Ratings:



Significant Changes (2005 - 2008) - Morning Peak Period



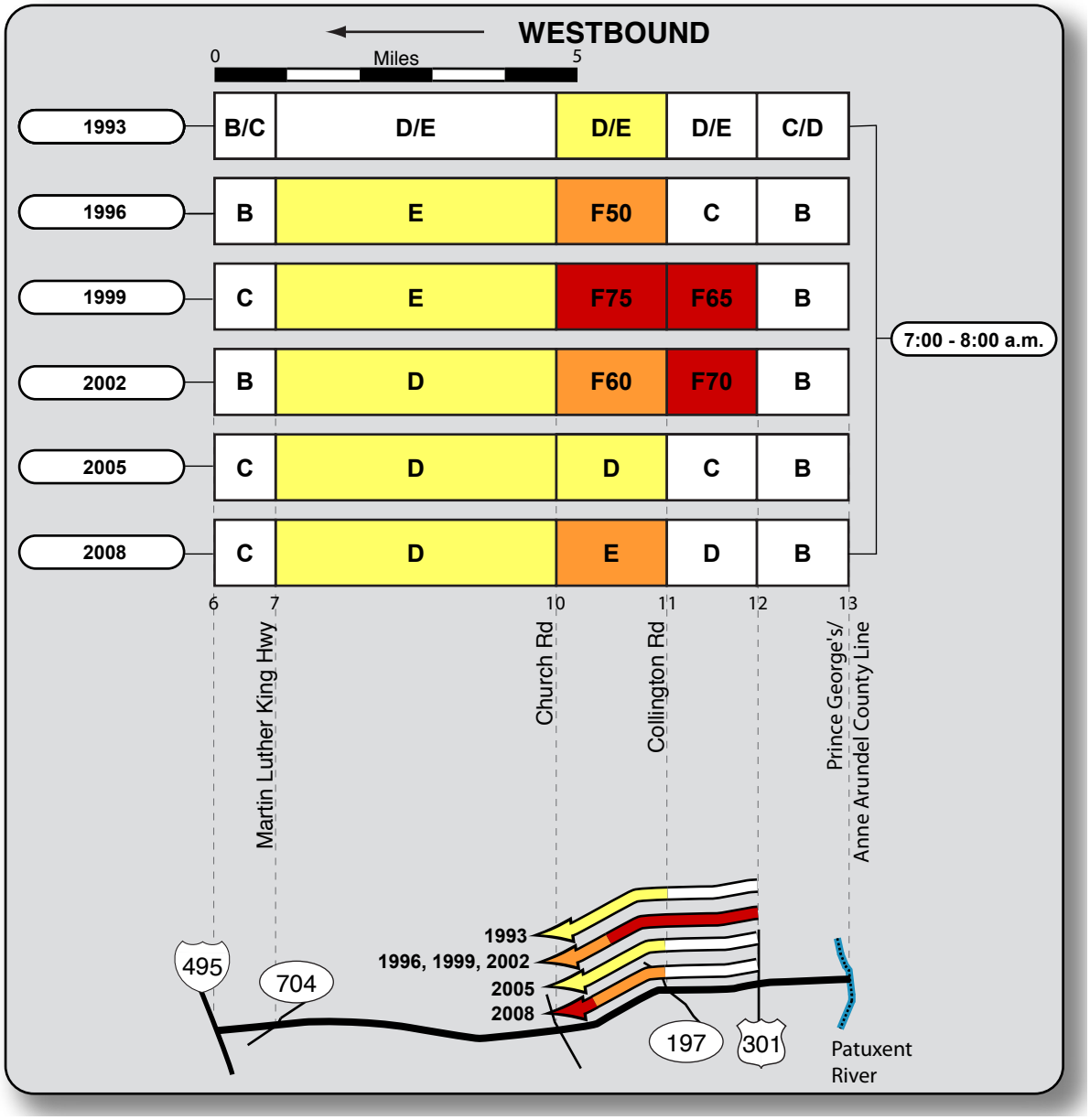
SIGNIFICANT CHANGES (2005 - 2008) - EVENING PEAK PERIOD



US 50 Maryland (Prince George's County) - Morning

Location:	Westbound between the Anne Arundel/Prince George's County Line and the Church Rd overpass
Time Period:	Morning (7:00-8:00 a.m.)
Type of Change:	Degraded
Potential Cause:	Increased Demand

During the morning survey period in 2005, a new concurrent-flow HOV lane on the left eliminated congestion that had been found during the 1999 and 2002 surveys. In 2008, congestion was found here again, but only between the entrance ramp at MD 197 (Collington Rd) and the beginning of the HOV lane. While overall 2008 congestion involved relatively minor delays, evidence of a trend toward increasing congestion was found.



Freeway LOS Legend

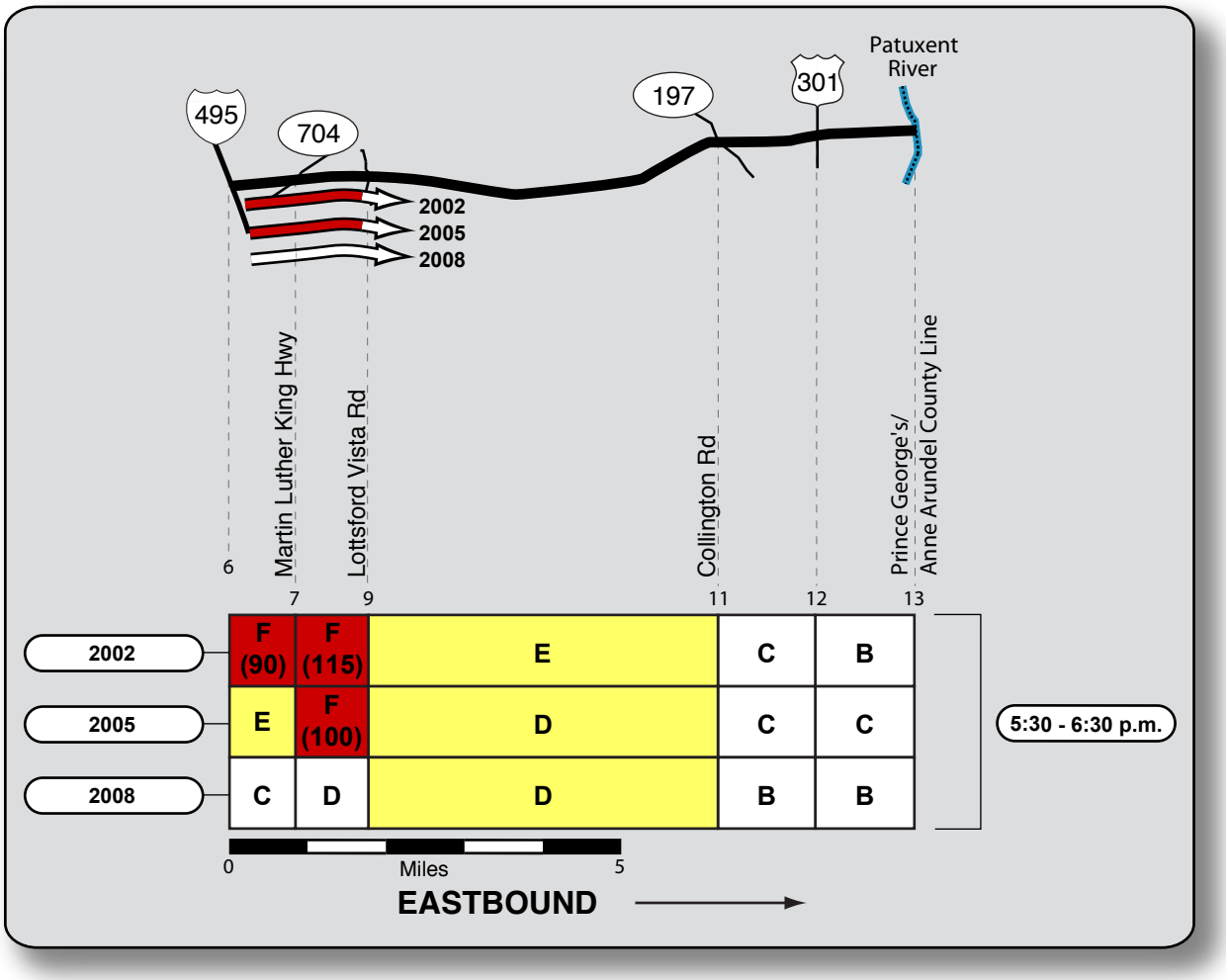
A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

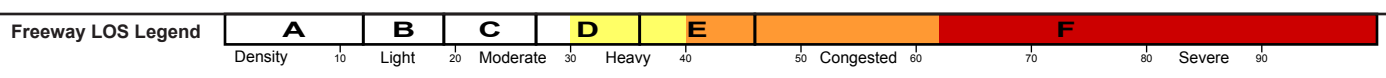
US 50 Maryland (Prince George's County) - Evening

Location:	Eastbound between I-495 and Collington Rd
Time Period:	Evening (5:30 - 6:30 p.m.)
Type of Change:	Improved
Potential Cause:	None identified

During the evening survey period in 2005, eastbound traffic flow on US 50 beyond the beltway had improved vs. 2002 approaching the lane drop at Lottsford Vista Rd; this apparently was a benefit from the operation of the recently-built concurrent-flow HOV lane. Nevertheless, congestion in 2005 still measured at the "severe" threshold, with average density equal to 100 pcplpm during the peak hour. In 2008, significant delays were only found during one of four flights, and that apparently was caused by driver diversion away from an incident on I-95 (beltway outer loop). Otherwise, only minor slowing was found on US 50 approaching the lane drop, and that was only between 4:30 and 5:30 pm (during the hour of 5:30 to 6:30 pm, which is depicted below, no delays were found).

There was no evidence found in the photography (such as widening or striping changes) that seemed to explain why a short, severely congested zone such as this measured significantly better in 2008 than in 2005. An overall decrease in volume appears to have contributed to the improvement.



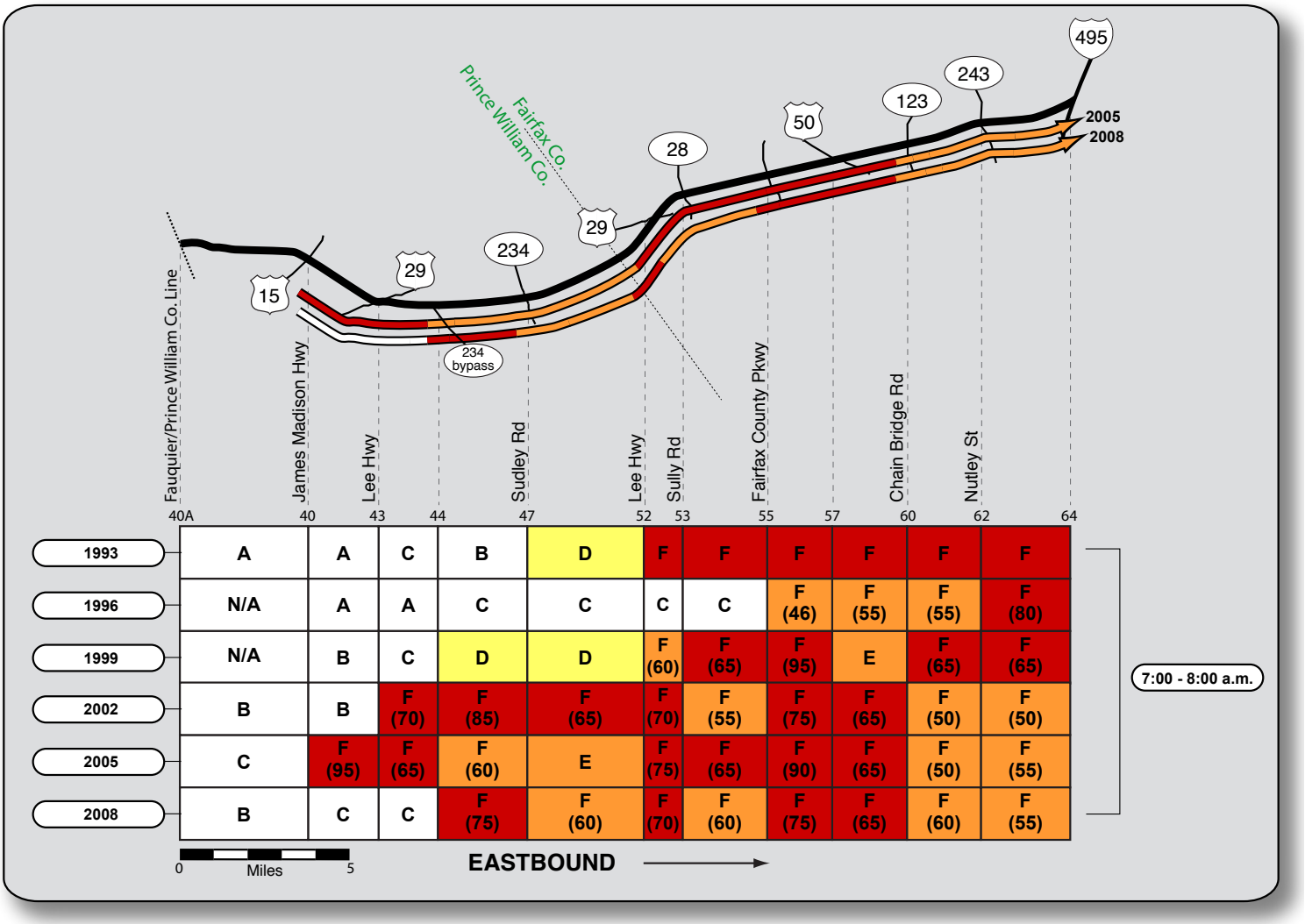


I-66 (Prince William & Fairfax Counties) - Morning

Location:	Eastbound between US 15 (James Madison Hwy) and the Capital Beltway
Time Period:	Morning (7:00 - 8:00 a.m.)
Type of Change:	Improved
Potential Cause :	(See discussion)

Between 1993 and 2008, widening and HOV-lane extensions have been ongoing along I-66, while demand has been steadily increasing. The graphic below shows the degree to which the improvements have or have not kept pace with demand.

Most recently, near-completion of projects west of Manassas has resulted in improved flow from the US 15 merge (Int. 40) to Prince William Pky (Int. 44). East of that point, inbound morning commuters in 2008 encountered moderate to severe congestion all of the way to the Capitol Beltway.



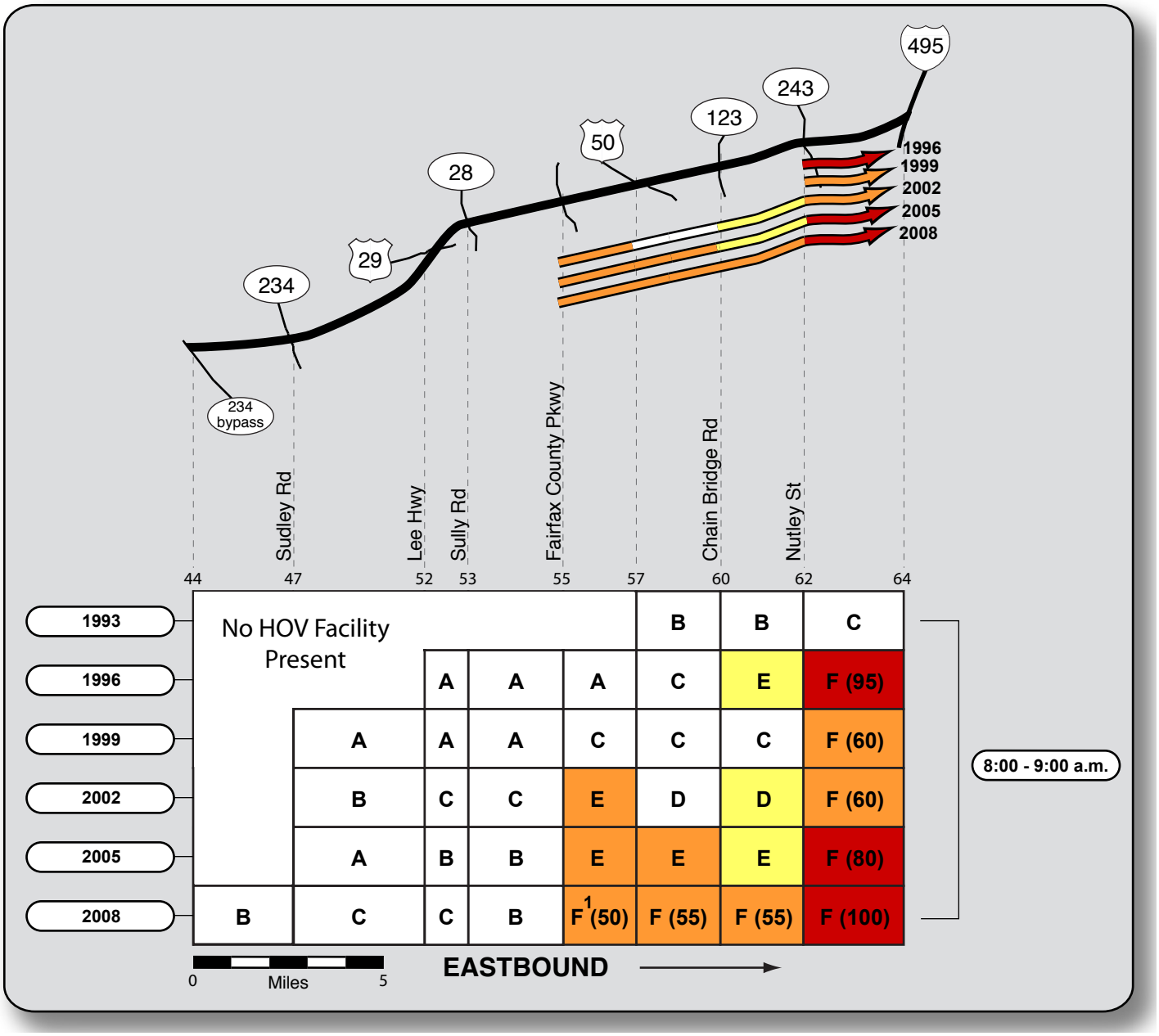
Freeway LOS Legend

A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

I-66 HOV (PRINCE WILLIAM & FAIRFAX COUNTIES) - MORNING

Location:	Eastbound between Fairfax County Parkway and the Capital Beltway
Time Period:	Morning (8:00 - 9:00 a.m.)
Type of Change:	Degraded
Potential Cause :	Increased Demand

During the 1996 survey, severe congestion was found in the I-66 HOV lane approaching the Beltway. Between the 1996 and 1999 surveys, a dedicated HOV ramp to the outer loop of the Capital Beltway was opened; HOV users no longer were required to merge across the "general-purpose" lanes of I-66 to access the outer loop. The table below depicts the improvement in level-of-service after the construction of the ramp and the gradual degradation in conditions likely caused by increased demand since the 1999 survey.



Freeway LOS Legend

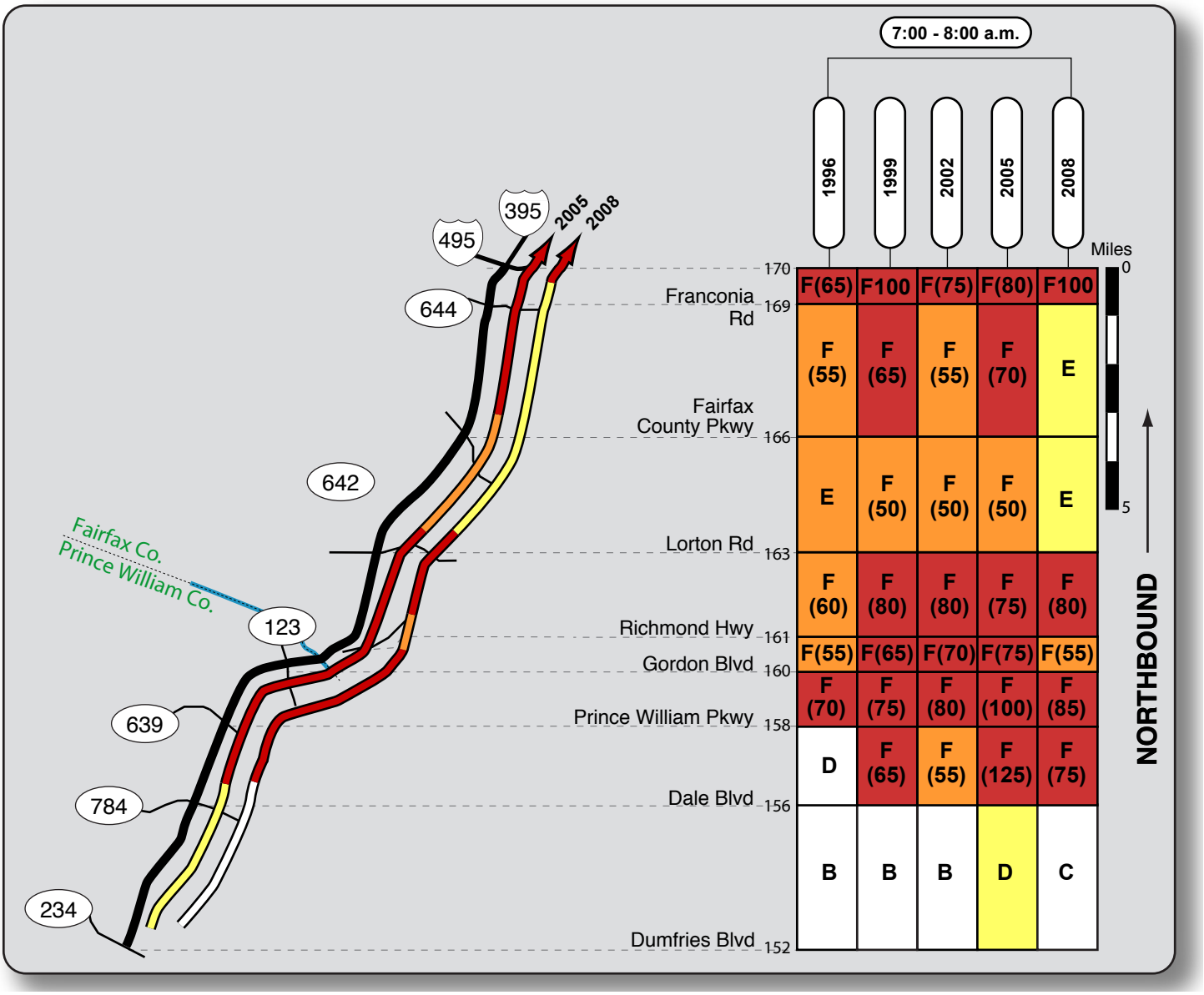
A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

I-95 Virginia (Prince William & Fairfax Counties) - Morning

Location:	Northbound between Dale Blvd and the Capital Beltway
Time Period:	Morning (7:00-8:00 a.m.)
Type of Change:	Improved
Potential Cause:	The completion of construction projects on I-95 at the Springfield Interchange and on Prince William Parkway between I-95 and US 1.

During the 1996 through 2005 surveys, northbound congestion was found on I-95 approaching and through the Springfield Interchange; the head of the queue was found on I-395 in the vicinity of VA 7. Northbound travelers on I-95 bound for I-395 and the Capital Beltway typically encountered the tail of the queue in the vicinity of Fairfax County Parkway (VA 7100). During the 2008 spring survey (after completion of construction on the Springfield Interchange), the tail of the queue approaching VA 7 was found in the vicinity of Franconia Rd; Beltway-bound travelers were typically able to bypass this queue with little or no delay (the ramps from I-95 to the Beltway begin in the vicinity of Franconia Rd).

Further south, improved conditions were found on I-95 between Dale Blvd and Lorton Rd (2005 vs. 2008). It appeared that the completion of construction on Prince William Parkway between I-95 and US 1 may have contributed to the improved conditions; Prince William Parkway provided travelers an alternate route to US 1 and across the Occoquan River.



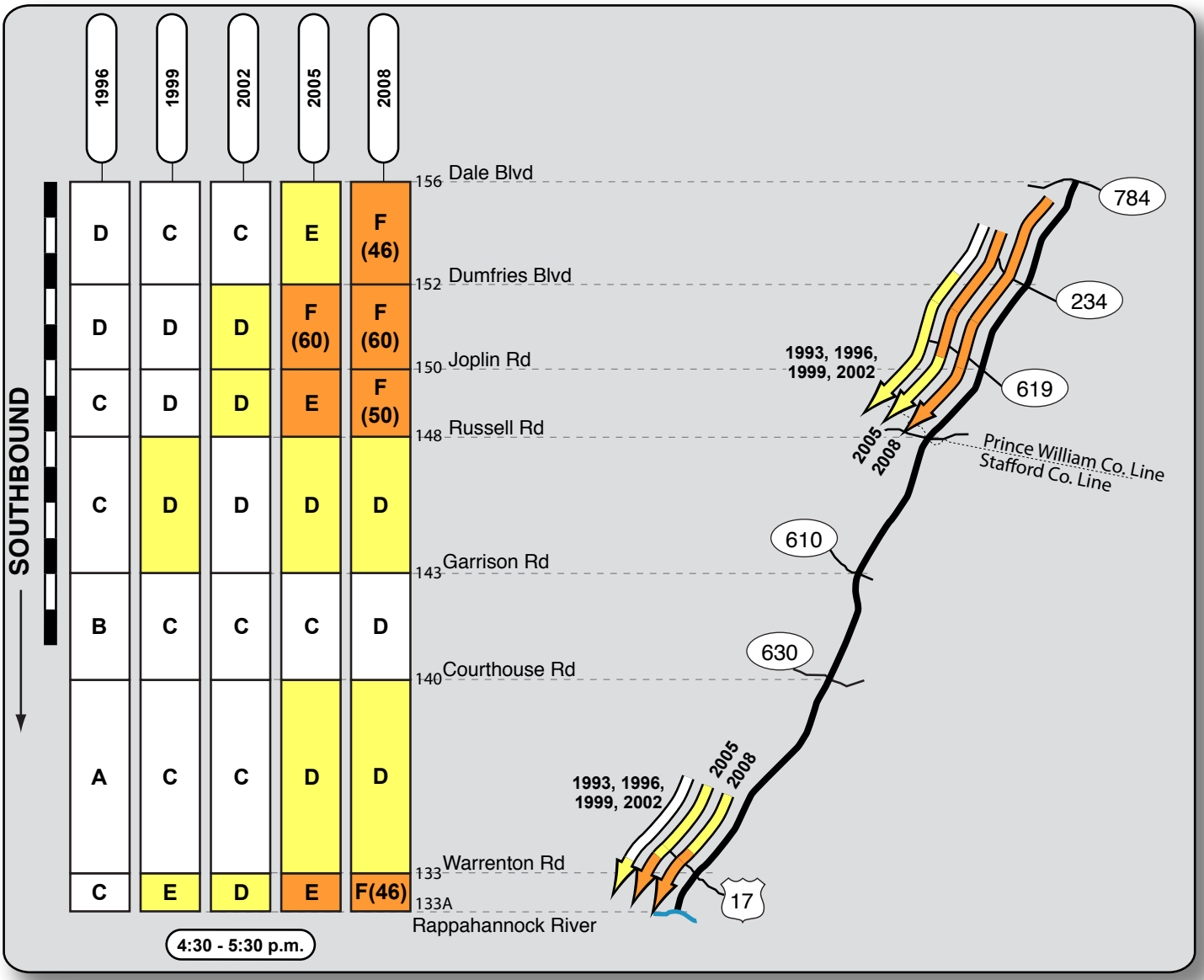
Freeway LOS Legend

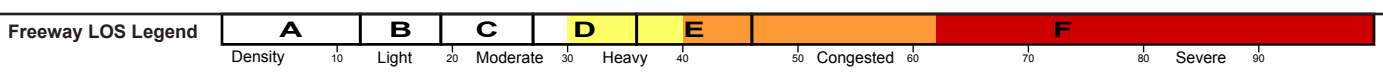
A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

I-95 Virginia (Prince William & Stafford Counties) - Evening

Location:	Southbound between Dale Blvd and the Rappahannock River
Time Period:	Evening (4:30 - 5:30 p.m.)
Type of Change:	Degraded
Potential Cause:	Increased Demand

The graphic below shows the continued degradation of level-of service on I-95 between the 1996 and 2008 surveys. Congestion increased in both severity and extent between the 2005 and 2008 survey periods.



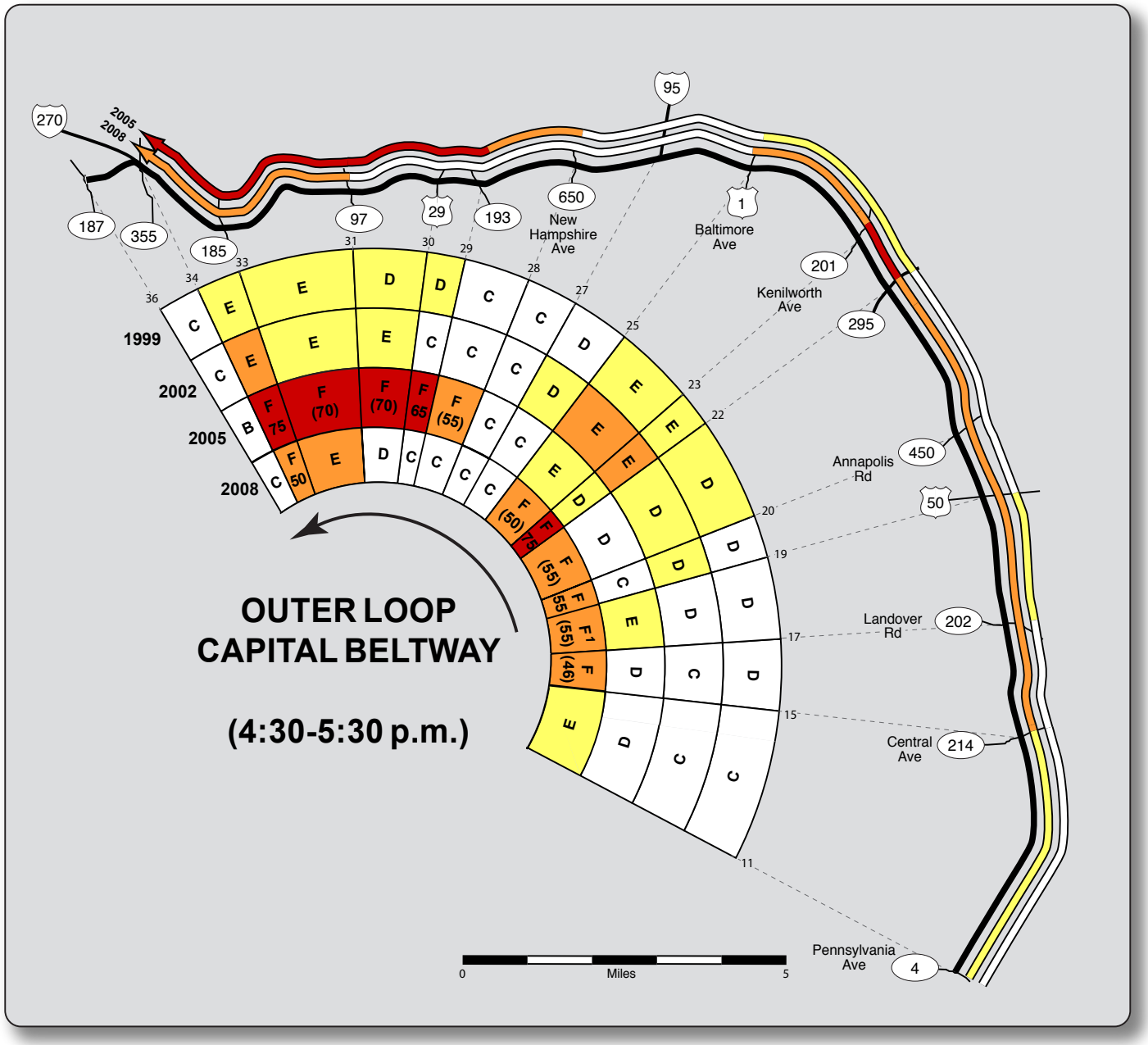


I-495/95 Capital Beltway (Outer Loop) - Evening

Location:	Outerloop between MD 4 and I-270
Time Period:	Evening (4:30 - 5:30 p.m.)
Type of Change:	Improved / Degraded
Potential Cause:	None identified

Part 1: Over the course of this 15 year survey period, the Capital Beltway in Maryland between I-95 and Central Ave has usually generated little or no delay on a recurring basis. Evidence was found in 2008 of degradation, however, with the finding of heavy traffic flow and intermittent delays, particularly in the vicinity of BW Parkway.

Part 2: In 2005, new westbound delays were consistently found on the Capital Beltway outer loop between University Ave (MD 193) and the exit to I-270. This degradation was not confirmed in 2008, as traffic flowed with only minor slowing during all survey flights. Overall, 2008 congestion measurements were almost the same as recorded in 2002. (Neither in 2005 or 2008 was there evidence in the photography of lane configuration changes or other factors that may account for this variability.)



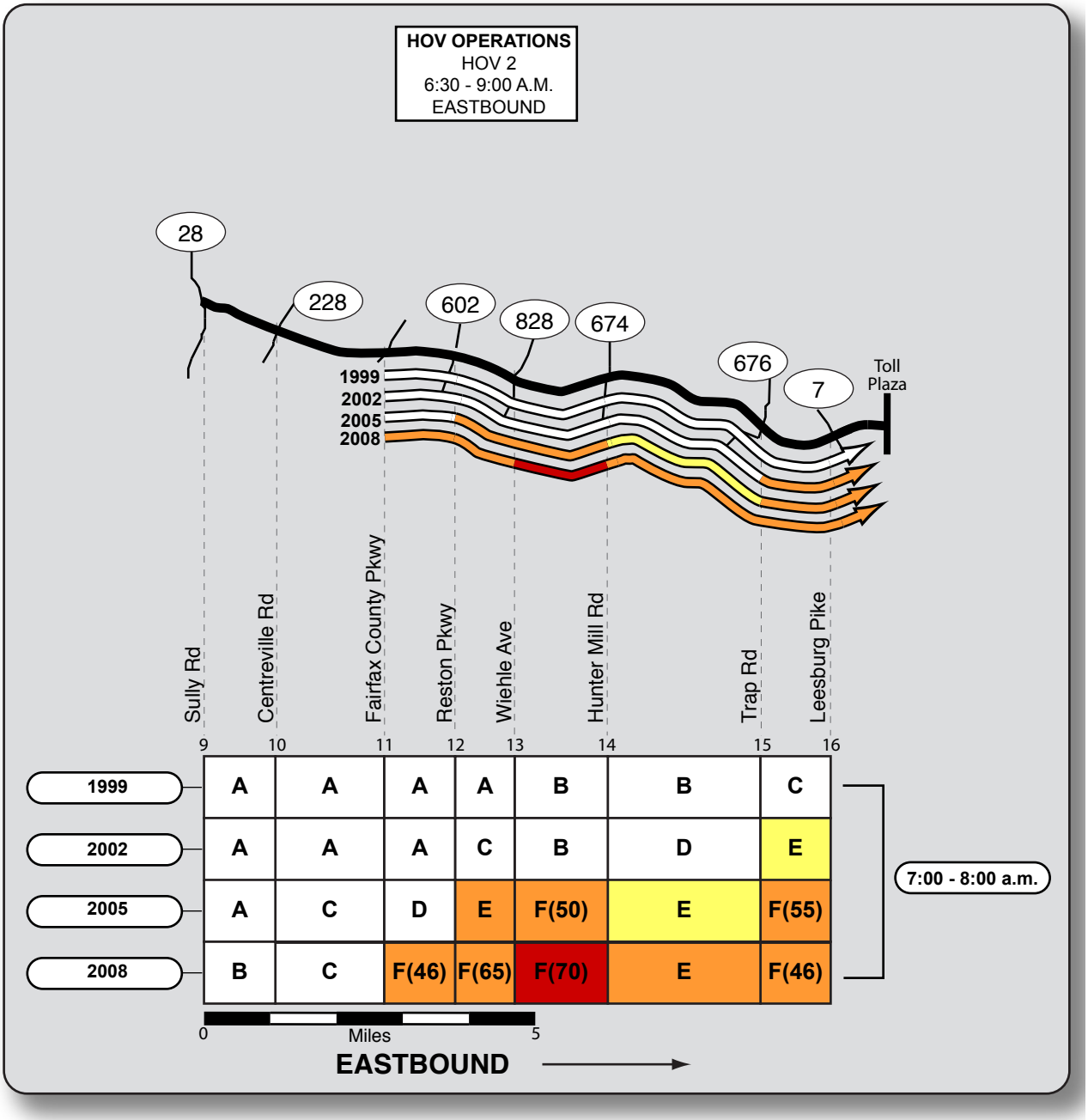
Freeway LOS Legend

A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

VA 267 HOV - DULLES TOLL ROAD (FAIRFAX COUNTY) - MORNING

Location:	Eastbound between Faifav County Pkwy and the Toll Plaza
Time Period:	Morning (7:00 - 8:00 a.m.)
Type of Change:	Degraded
Potential Cause:	Increased Demand

The graphic below depicts level-of-service on the Dulles Toll Road HOV facility. Increased demand appears to have contributed to a gradual degradation in conditions since the facility opened prior to the 1999 survey.

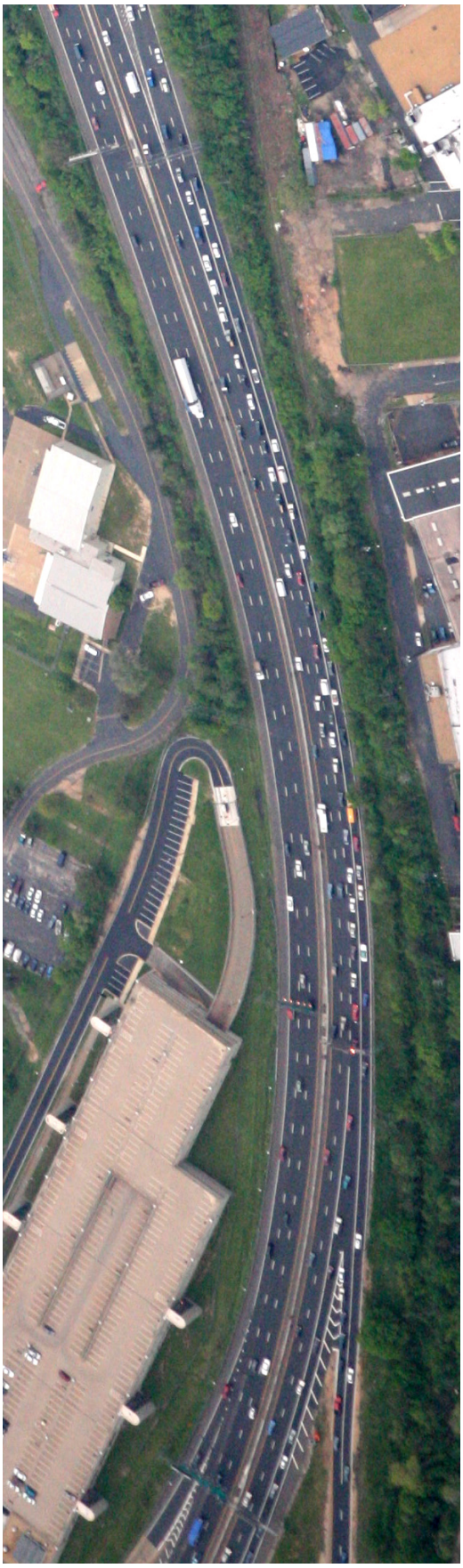


Freeway LOS Legend

A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

D.C. 295 (Washington D.C.) - Morning

This photo shows how the entrance ramp carrying traffic from the Suitland Parkway (bottom) was widened to two lanes and extended to join the exit ramp to the 11th Street Bridge (top). Note that through-traffic on I-295 was largely able to bypass congestion to the 11th Street Bridge.

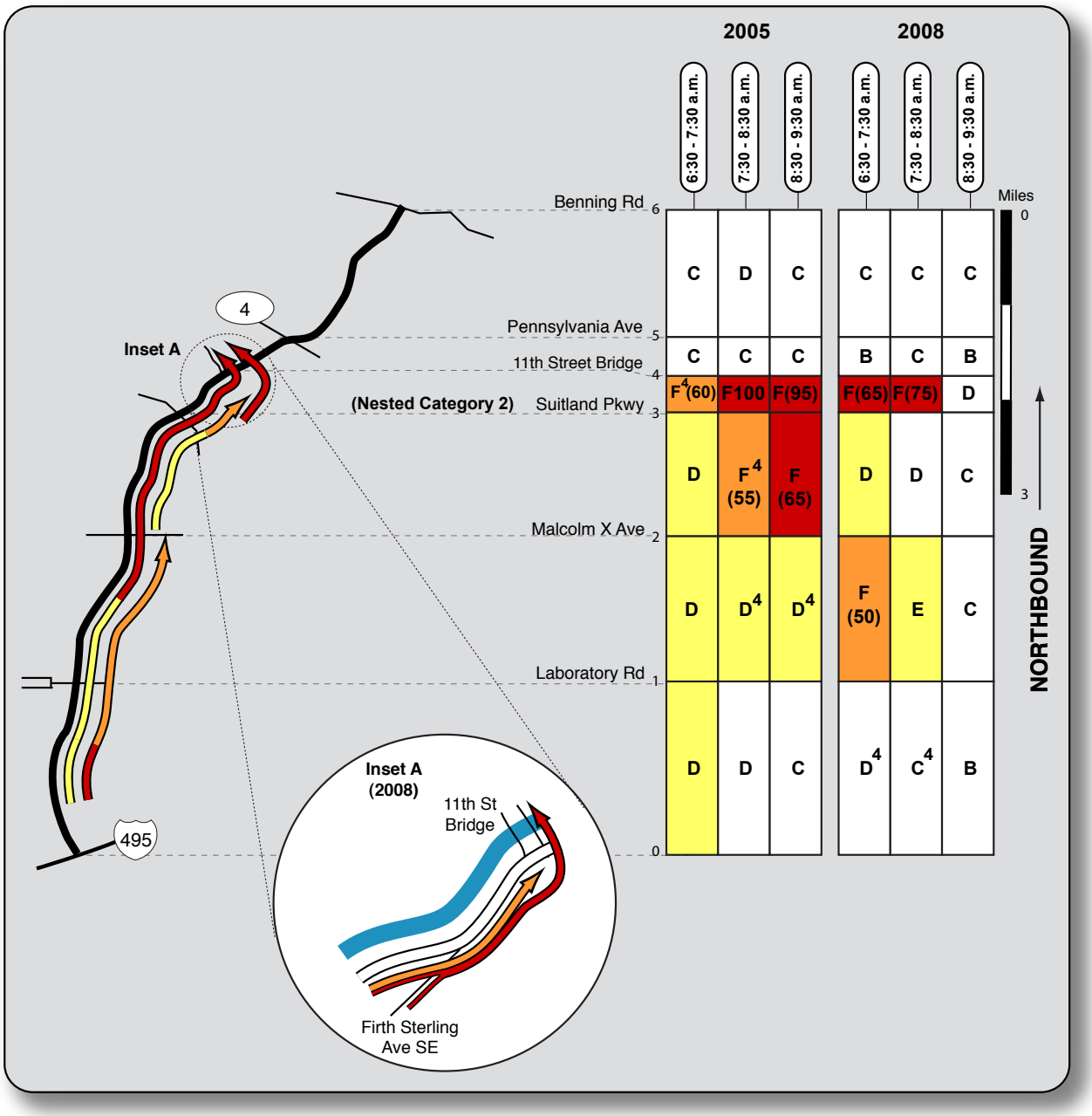


N

D.C. 295 (Washington D.C.) - Morning

Location:	Northbound between Suitland Pkwy and the 11th Street Bridge
Time Period:	Morning & Evening
Type of Change:	Improved
Potential Cause:	Completed project (widened entrance ramp)

Between the 2005 and 2008 survey flights, a simple improvement was made to the entrance ramp to I-295 from Firth Sterling Ave (this ramp carries traffic from the Suitland Pkwy). Previously, traffic on this one-lane ramp was required to merge entirely onto the three lanes of I-295, weaving with I-295 traffic while drivers from both origins were preparing to exit to the 11th Street Bridge. The modification was to widen the entrance ramp to two lanes, and extend the acceleration lane to join it with the deceleration lane for the 11th Street Bridge. There are now four lanes between these two points, so that Suitland Parkway traffic bound for the 11th Street Bridge is no longer required to merge onto I-295. Most weaving now takes place in the 2nd lane from the right, leaving two left lanes on I-295 for through-traffic to avoid the queue to the 11th Street Bridge. The result overall has been a shorter congested zone on I-295, often with no significant delays for through-drivers.



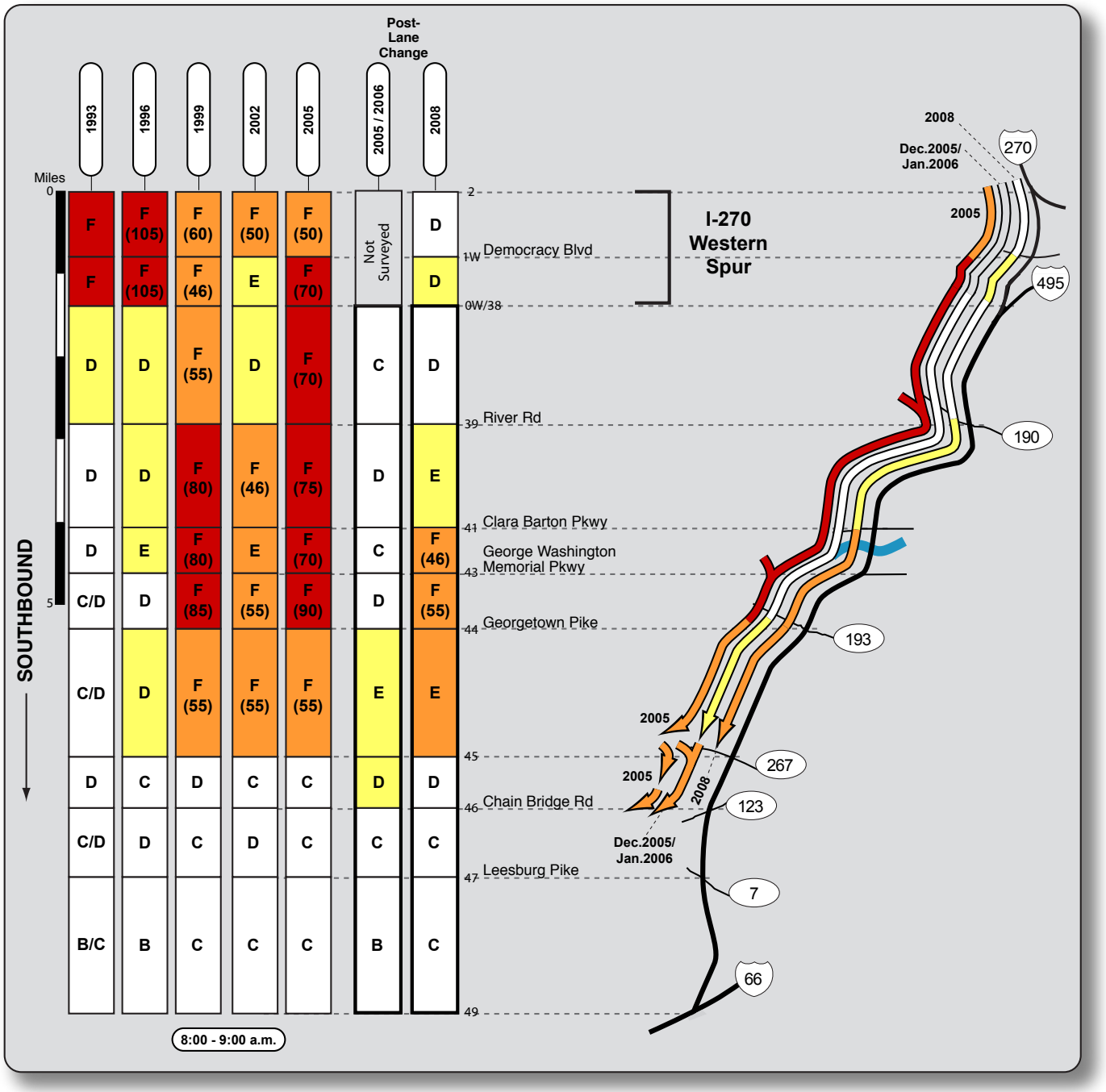
Freeway LOS Legend

A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

I-495/95 Capital Beltway (Outer Loop) & I-270 Western Spur - Morning

Location:	Southbound between I-270 and I-66
Time Period:	Morning (8:00 - 9:00 a.m.)
Type of Change:	Improved
Potential Cause:	Widened ramp

Widening in 2005 of the ramp at the Dulles Toll Road (VA 267), opened after the completion of all spring 2005 survey flights) apparently eliminated about 8 miles of severe morning congestion between the split to the I-270 spur and the exit ramp to the Dulles Toll Road, especially between 8:00 and 9:00 a.m. Because the ramp was widened after completion of the spring 2005 survey flights, supplementary flights near the end of the year (December 2005 and January 2006) showed how the congestion on the beltway no longer formed. This finding was confirmed in 2008, with only minor delays documented (all after 8:30 a.m.) near the Georgetown Pike interchange.



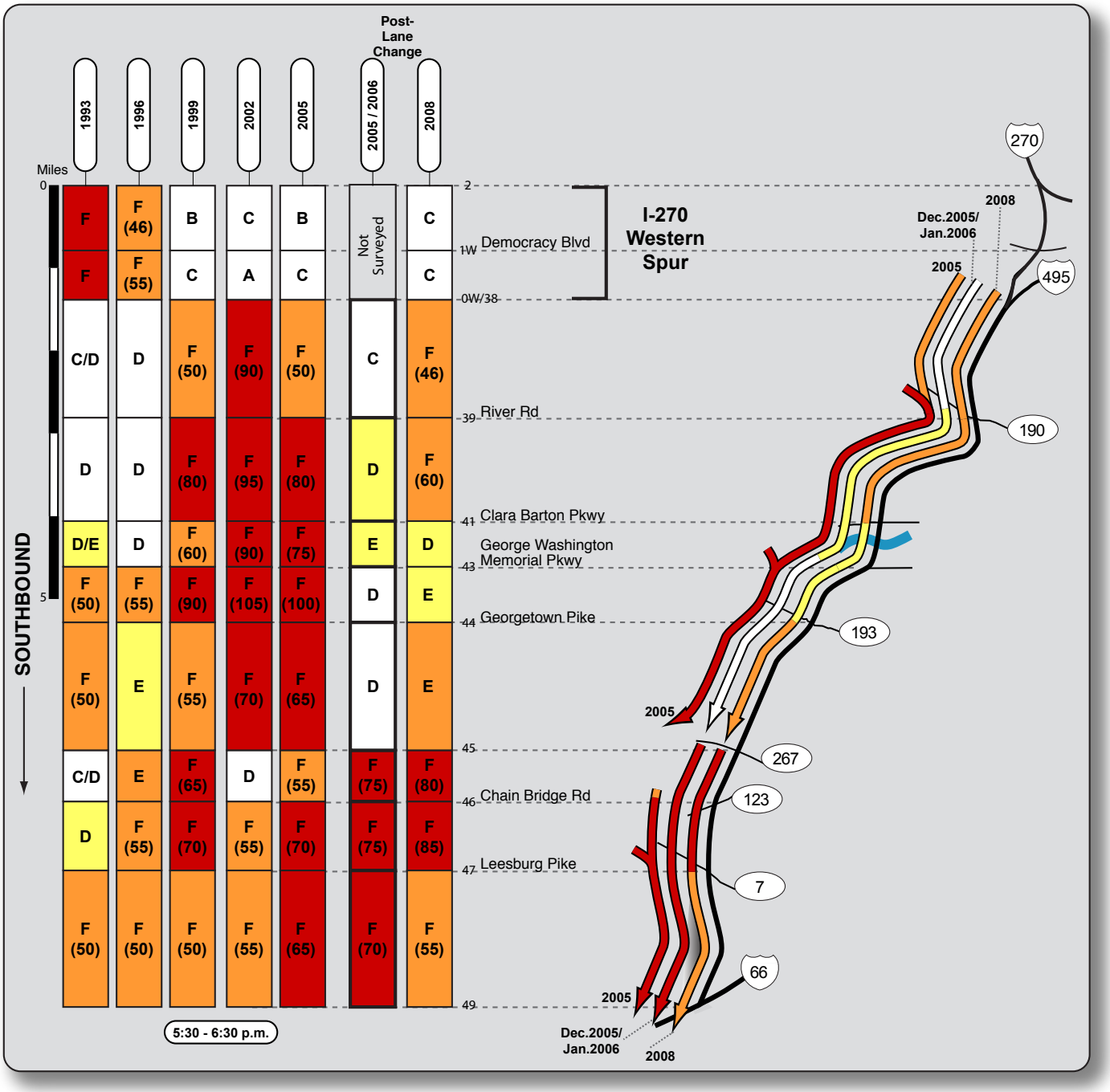
Freeway LOS Legend

A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

I-495/95 CAPITAL BELTWAY (OUTER LOOP) & I-270 WESTERN SPUR - EVENING

Location:	Southbound between I-270 and I-66
Time Period:	Evening (5:30 - 6:30p.m.)
Type of Change:	Improved / Degraded
Potential Cause:	Widened ramp

The ramp widening noted on the opposite page also resulted in the elimination of major evening congestion along the same highway segments. During the 2008 survey fights, more evidence was found of congestion than during the morning survey period; still, delays were minor compared to the severe congestion found prior to the 2005 improvement.



Freeway LOS Legend

A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

I-270 (Frederick & Montgomery Counties) - Morning

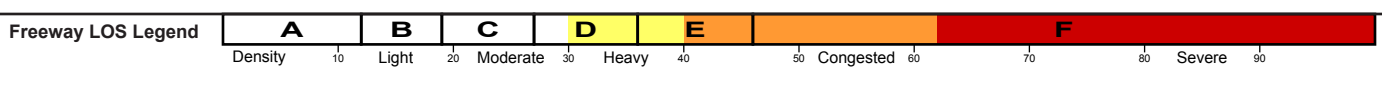
Location:	Southbound between I-70 and the Capital Beltway
Time Period:	Morning (6:00 - 9:00 a.m.)
Type of Change:	Improved / Degraded
Potential Cause:	Part 1: Completed project; Part 2: General degradation

Interchange (between I-70 and MD 85) : A simple lane extension was completed between 2005 and 2008 in Frederick: previously, all traffic entering southbound I-270 from eastbound I-70 was required to merge into two lanes prior to reaching the MD 185 interchange. The change was to extend the acceleration lane for these vehicles downstream and join it with the deceleration lane to MD 85; thus, three lanes were now available for the entire length of the weave between the two interchanges. The result was to entirely eliminate a major bottleneck for I-70 drivers transitioning to southbound I-270.

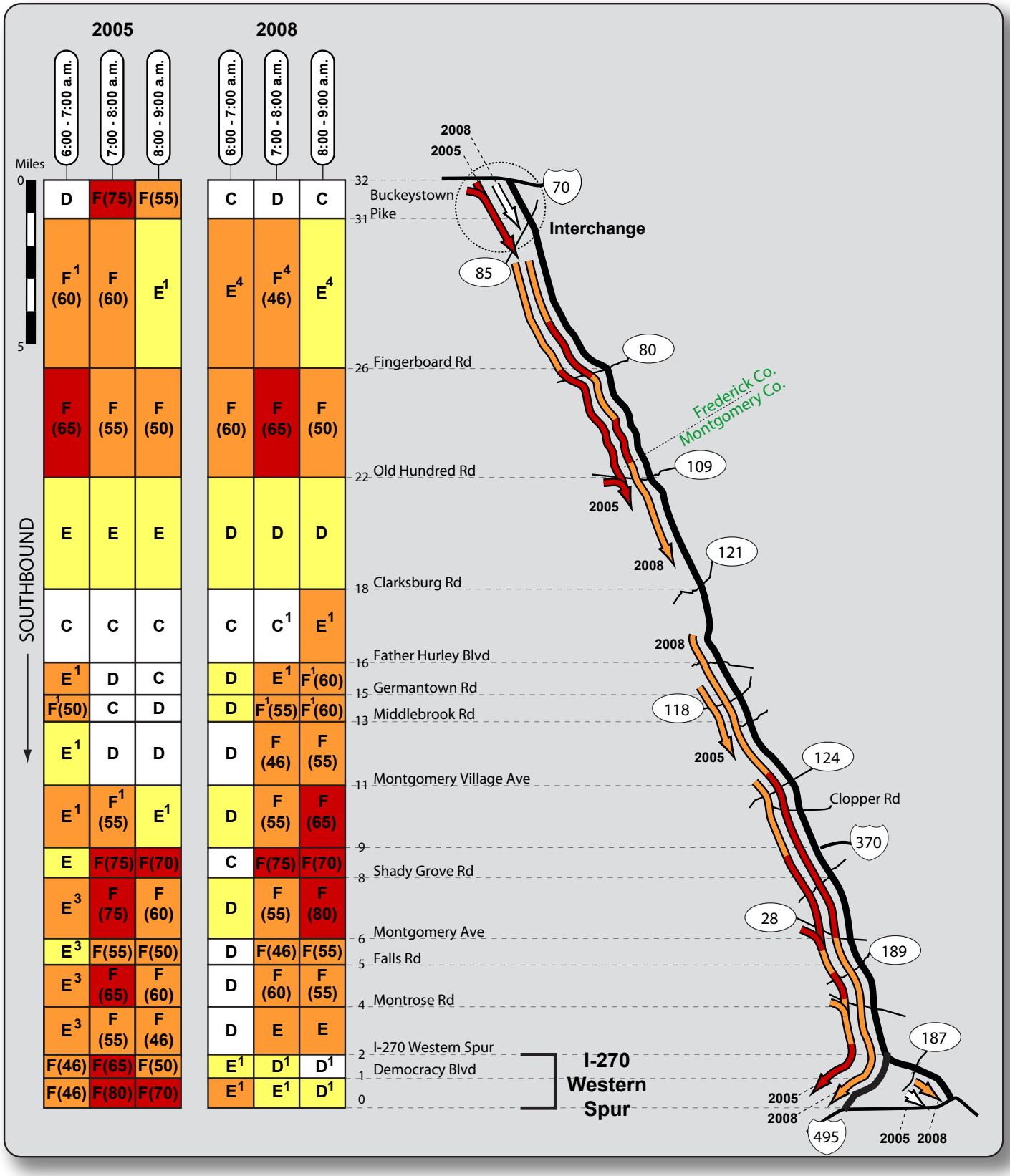
Mainline: Farther to the south, congestion on this corridor in general seems to have shifted later in the morning period, by about 30 minutes or more (note the shift in the three-hour side-by-side performance rating tables; improvement is evident in many links between 6:00 and 8:00 a.m., while degradation is mainly evident between 8:00 and 9:00 a.m.). This could be a further effect of the major improvement of beltway flow due to the 2005 widening of the ramp at the Dulles Toll Road (VA 267), opened after the completion of all spring 2005 survey flights. In previous years, users of I-270 bound for Virginia could expect to encounter about 8 miles of severe congestion between the split to the I-270 spur and the exit ramp to the Dulles Toll Road, especially between 8:00 and 9:00 a.m. After the one lane exit ramp to VA 267 was doubled in 2005, supplementary survey flights showed how the congestion on the beltway no longer formed. This finding was confirmed in 2008, with only minor delays found (all after 8:30 a.m.) near the Georgetown Pike interchange.

While it might require extensive research to confirm, it is plausible that a significant number commuters now depart from home later, confident that, once they clear the MD 28 interchange, the travel time to the beltway interchanges near Tysons Corner is normally around 15 minutes.

This photo shows typical 2008 peak-hour traffic conditions along the extended auxiliary lane between I-70 (off the photo to the right) and the MD 85 interchange (Buckeystown Pike, shown). This relatively minor improvement eliminated a major bottleneck from eastbound I-70 to southbound I-270.



I-270 (FREDERICK & MONTGOMERY COUNTIES) - MORNING

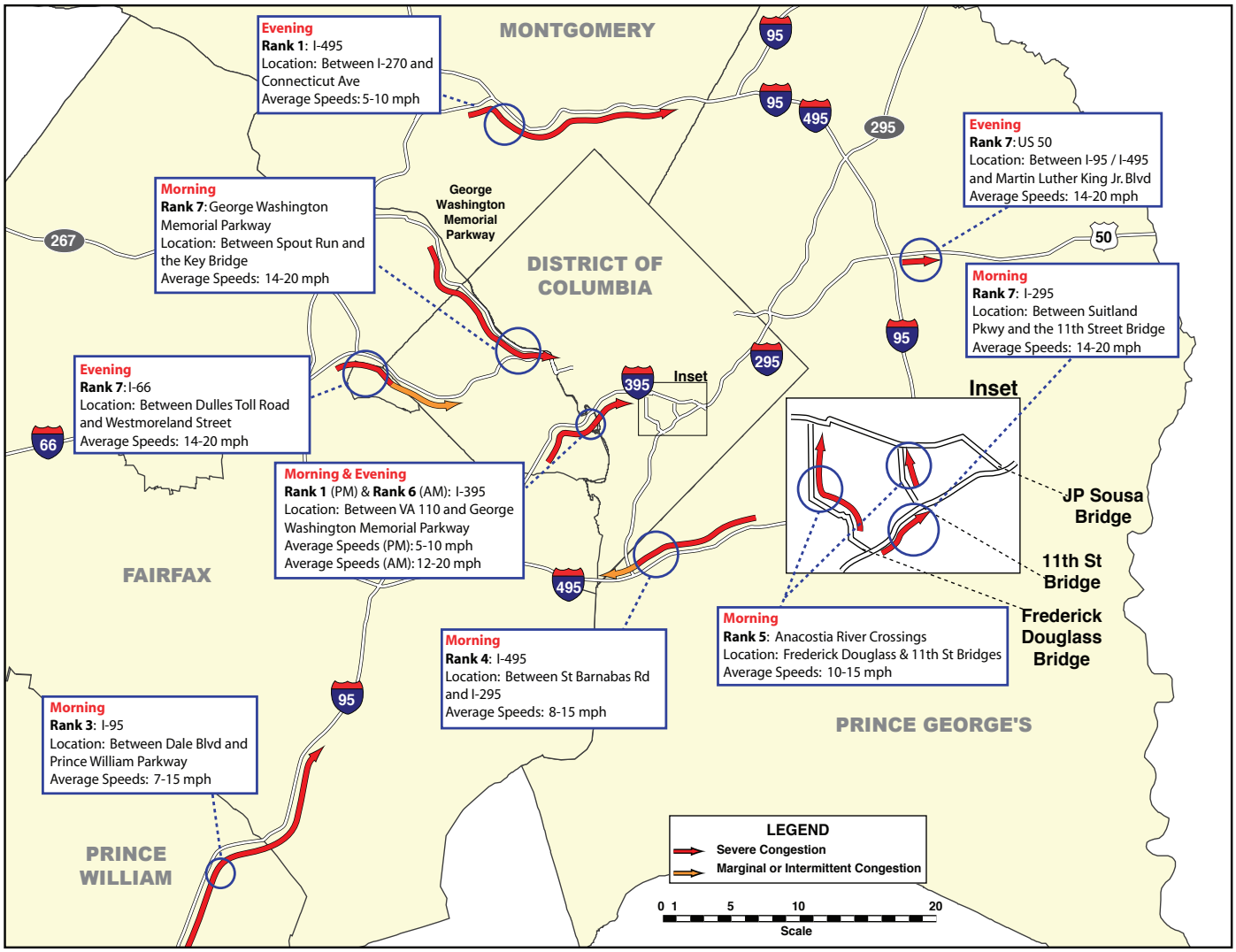


Freeway LOS Legend

A	B	C	D	E	F
Density 10	Light 20	Moderate 30	Heavy 40	50 Congested 60	70 80 Severe 90

(Blank)

Top Ten Congested Locations 2005



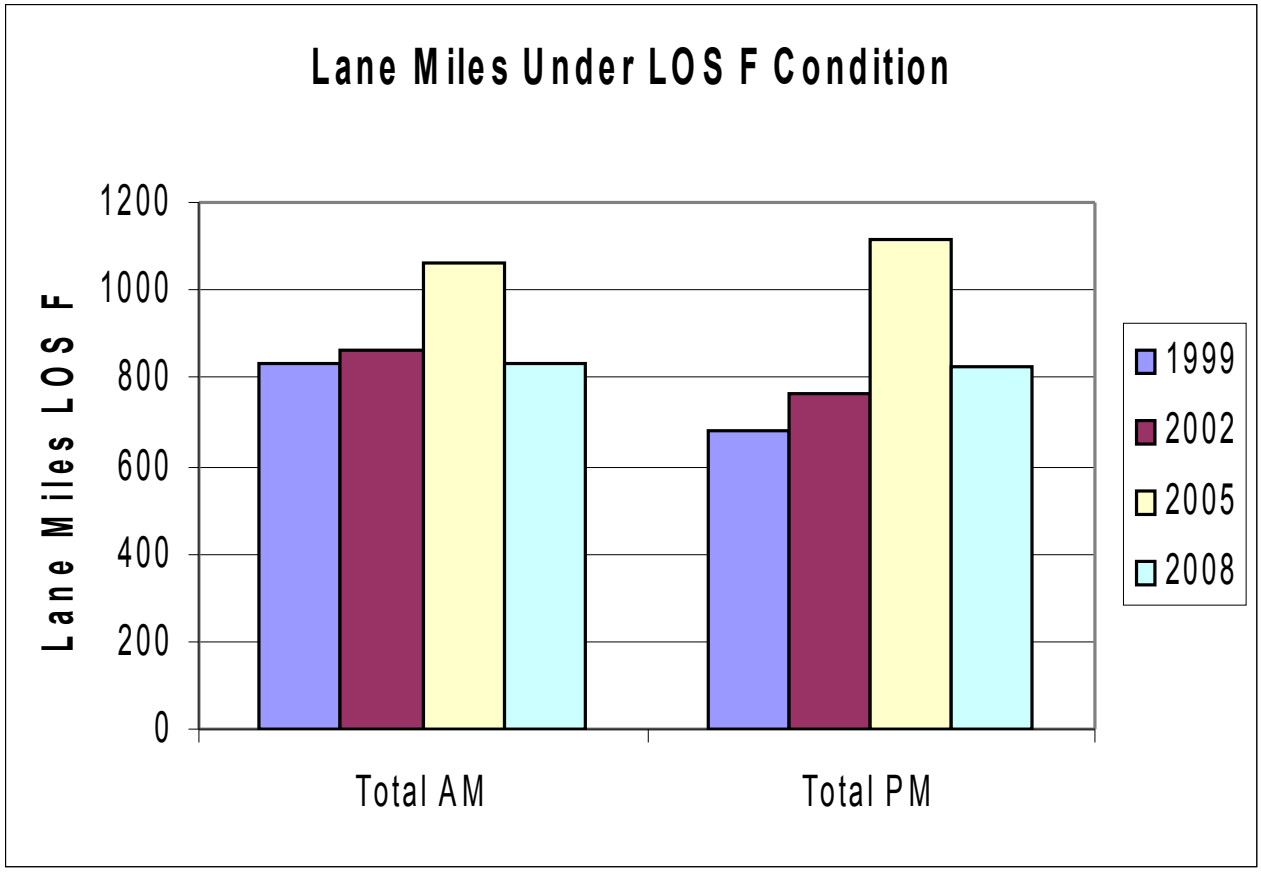
Top Ten Congested Segments on the Freeway System (2005)

Rank	Route	From	To	Density *	Speed Range
1	IL I-495 (4 to 4:30 PM)	I-270	Connecticut Avenue	130	5 to 10 MPH
1	NB I-395 (5 to 6 PM)	VA 110	GW Pkwy	130	5 to 10 MPH
3	NB I-95 (6 to 8 AM)	Dale Blvd	Prince William Pkwy	125	7 to 15 MPH
4	IL I-495 – (6:30 to 7AM)	St Barnabas Rd	I-295	120	8 to 15 MPH
5	WB Frederick Douglass and 11th Street Bridges – (8:30 to 9:30 AM)	Anacostia Bridges		115	10 to 15 MPH
6	NB I-395 (7:30 to 8:30 AM)	VA 110	GW Pkwy	105	12 to 20 MPH
7	NB I-295 (7:30 to 8:30 AM)	Suitland Pkwy	11th Bridge	100	14 to 20 MPH
7	GW Pkwy (7:30 to 8:30 AM)	Spout Run	Key Bridge	100	14 to 20 MPH
7	EB I-66 – (6 to 7 PM)	Dulles Toll Rd	Westmoreland St	100	14 to 20 MPH
7	EB US 50 – (5 to 6 PM)	I-95/I-495	Martin Luther King Jr. Blvd.	100	14 to 20 MPH

* **Density measured in passenger cars per mile per lane**

(Blank)

Lane Miles of Congestion AM and PM



(Blank)

APPENDIX A

PROCEDURE FOR DETERMINING FREEWAY LEVEL-OF-SERVICE

Introduction

Overlapping aerial photography can document many useful characteristics of traffic flow on highway networks. The photographs can be invaluable for screening problem sites, winning support for ideas, and explaining decisions to others. If formal rules and procedures are applied to the analysis of aerial photographs, the photography can provide a cost-effective basis for periodically rating the performance of large highway systems on a link-by-link basis.

Background

For highways, traffic flow is normally measured in terms of three basic parameters: *volume*, *speed*, and *density*. These parameters are related mathematically such that, if only two are known, the third can be calculated (volume equals speed times density). Other useful flow parameters related to speed are *travel time* and *delay* between specific points on a system.

The *Highway Capacity Manual (HCM),* updated in 2000 by the Transportation Research Board of the National Research Council, is an authoritative resource that has established a simplified concept by which the performance of all types of transportation facilities can be described and compared. This concept is called *level of service,* or *LOS*. For each type of facility, a single traffic flow parameter – the one deemed most appropriate by the committee that publishes the manual – is chosen to be the basis for defining six rating categories. These categories are represented by the letters “A” through “F”, ranging from the most favorable rating of LOS A (indicating high service quality associated with lightly-used facilities) to the poorest rating of LOS F (indicating a facility burdened by congestion or other undesirable performance characteristics). This LOS system, introduced in 1965 version of the HCM and revised periodically since, has been widely adopted for evaluating existing highway systems and planning future improvements. Because six LOS classes are easier to understand than tables of numbers, LOS has been widely used in the political process. In some jurisdictions, LOS standards are even found in legislation attempting to guide facility planning or control real estate development.

Uninterrupted-flow highways (grade-separated highways without signals)

Summary

The defining parameter for HCM LOS on freeways and other uninterrupted-flow highways is the *density* of traffic flow (in units of passenger cars per lane per mile). Density was chosen as the basis for HCM LOS because, when traffic flows without interruption, traffic density relates mathematically to both speed and volume. This means that a single LOS measure based on density provides not only general speed information, but also provides an approximation of how heavily the facility is utilized. It also indicates where demand has exceeded capacity, resulting in congestion and delays. (Speed is less desirable as a defining basis for LOS because uninterrupted-flow highways can process high volumes of traffic at high speeds; ratings based on speed alone might not differentiate clearly between facilities that were heavily or lightly utilized.) The most common way to determine LOS on an existing freeway is to measure the speed and volume of the traffic, and then calculate the density. Another method is to determine density directly from aerial photographs, which allows for cost effective data collection across very large highway networks. (This also affords the other benefits of aerial photography, which often shows the underlying causes of congestion as well as conditions on interchange ramps, merges and crossroads.) Accordingly, when Skycomp evaluates the performance

of uninterrupted-flow highway facilities, Skycomp derives traffic densities from aerial photographs and then determines density-based HCM LOS ratings.

As discussed above, the LOS rating system uses the letters "A" through "F" to describe traffic conditions: LOS "A" represents superior traffic conditions (very light traffic), while LOS "F" represents poor traffic conditions (congested flow involving various degrees of delay). These letters are assigned based on how densely cars are traveling on the road. Research has shown that for all densities below 40 pcplpm, vehicles generally move at or close to normal highway speed; LOS "A" through "E" represent these densities according to the following table (pcplpm):

LOS "A": densities from **zero to 11** (very light traffic);
LOS "B": densities from **12 to 18** (light to moderate traffic);
LOS "C": densities from **19 to 26** (moderate traffic);
LOS "D": densities from **27 to 35** (moderate to heavy traffic);
LOS "E": densities from **36 to approx. 45** (heavy traffic, but still at speeds close to free-flow)

At densities greater than **40**, speeds typically decrease and traveler delays are incurred. Because flow at all densities greater than **46** (approximately) are regarded as LOS "F", this report attaches actual densities to all LOS "F" ratings. Accordingly:

LOS "F":
- Densities from **46 to 60** indicate delay involving minor degrees of slowing; average speeds usually range between 50 and 30 mph;
- Densities from **60 to 80** indicate traffic flow at average speeds usually ranging between 40 and 15 mph;
- Densities from **80 to 100** indicate congested traffic flow, with some stopping possible; average speeds usually range between 10 and 25 mph;
- Densities above **100** indicate severe congestion, with considerable stop-and-go flow likely. For reference, densities above 120 almost always indicate the presence of unusual events (accidents, roadwork, etc.). The practical maximum value for density measurements is **180**; the theoretical maximum value is **264** (at 20 feet per vehicle).

Data Reduction Procedures

From overlapping time-stamped photographs, densities by highway segment were determined by manual counts taken along the entire segment length. Vehicles were classified as cars, trucks, buses, or tractor-trailers when counted; later, passenger-car equivalents (pce's) were derived according to the following table:

Vehicle type:	PCE's:
cars	1
buses	1.5
trucks	1.5
tractor-trailers	2.0

Data that were atypical due to roadwork or to known or suspected incidents were coded for exclusion

from the averaging process. All data were then entered into a microcomputer database program, which performed the following tasks: 1) samples were grouped by time slice; 2) average densities were calculated; and 3) densities were converted into service levels “A” through “F”. The computer then prepared matrices showing each averaged service level rating plotted by time and highway segment. These data matrices were then copied into the traffic quality tables, which are provided in this report.

In the tables, all LOS F conditions (congested traffic flow) have darkly shaded; this permits quick identification of locations experiencing demand at levels exceeding capacity. Because LOS “F” encompasses a wide range of densities, the actual density values are entered next to the “F”; using the travel characteristics in the density ranges provided above, the nature of the flow in LOS F segments can be determined.

(Blank)

APPENDIX B

METHODOLOGY DESCRIPTION

Procedures for obtaining speed/density samples for calibration of the Van Aerde Speed / Density Model

BACKGROUND

In the spring of 1995, Skycomp collected data to compare the speed of vehicles through congested freeway zones with corresponding densities obtained from aerial photographs. The purpose was to explore the relationship between the two, and, given a reasonable correlation, to prepare a model by which vehicle speeds could be estimated from aerial density photographs.

The program was conceived and executed by the Metropolitan Washington (D.C.) Council of Governments (MWCOG). Aerial data were collected by Skycomp; analysis of the data and calibration of the Van Aerde speed/density model were conducted by MWCOG.

A secondary objective was to evaluate the accuracy of aerial speed and density measurements by comparing them to data collected by traditional methods (floating cars and loop detectors embedded in the pavement).

Accordingly, segments of freeway were chosen to be surveyed that: 1) were expected to generate congested traffic flow; and 2) either contained a loop detector station or would accommodate quick turnarounds for multiple floating car runs. Thus, while data were being collected in the air (290 speed samples were obtained from the air, along with corresponding densities), loop detector or floating car data were collected concurrently on the ground.

The outcome of this study was a finding that travel speeds across congested freeway segments could be determined with reasonable accuracy using only aerial density photographs. It was also found that speeds and densities obtained through aerial techniques closely matched data obtained using the traditional ground methods.

PROCEDURES TO OBTAIN SPEED / DENSITY SAMPLES:

The observer/photographer followed the following procedure to obtain all speed/density samples: he first flew along the selected survey segment while taking time-stamped overlapping density photographs of the entire segment; next, at the upstream end, he selected a target "floating" car for tracking; he photographed the target as it entered and departed the segment, while simultaneously timing its run to the nearest second. He then took an "after" density photo set; and then recorded the following information on a clipboard: the time of the sample, the target vehicle description, lane(s) traveled, elapsed time, and any special notes. This procedure was repeated for each speed/density data point.

In the actual course of sampling, this procedure was modified in several ways. First, where cars were moving at high (free-flow) speeds, the density did not change significantly between samples; thus sometimes three or more floating cars were timed between density runs.

Another modification done in-flight is as follows: the observer noted in several cases that the density set taken before the target vehicle went through better reflected the conditions the car encountered than the density set taken after the vehicle went through (or vice versa). This was usually due to a delay in changing film, extra maneuvering the airplane, or any other event which delayed the "after" density sample for several minutes after the completion of the run. While normally the density associated with each speed sample was an average of the "before" and "after" density sets, in these cases only the "before" or "after" density set would be used (as directed by the observer).

With regard to selection of target vehicles, the plan was to select cars that reflected the average speed of traffic, just as floating car drivers are instructed to approximate the speed of traffic flow. Fortunately, vehicles have little freedom to choose their speeds in the congested density ranges (above 40 pcplpm). So, for example, almost any vehicle in a congested traffic stream in the middle lane of three will give a suitable floating car measurement. Even tractor-trailers (unless heavily loaded and traveling uphill) moved at the same speed as passenger cars. Thus the criteria the observer used in selecting each target vehicle was 1) is it in the correct lane; and 2) does the vehicle stand out so that it is easy to keep track of?

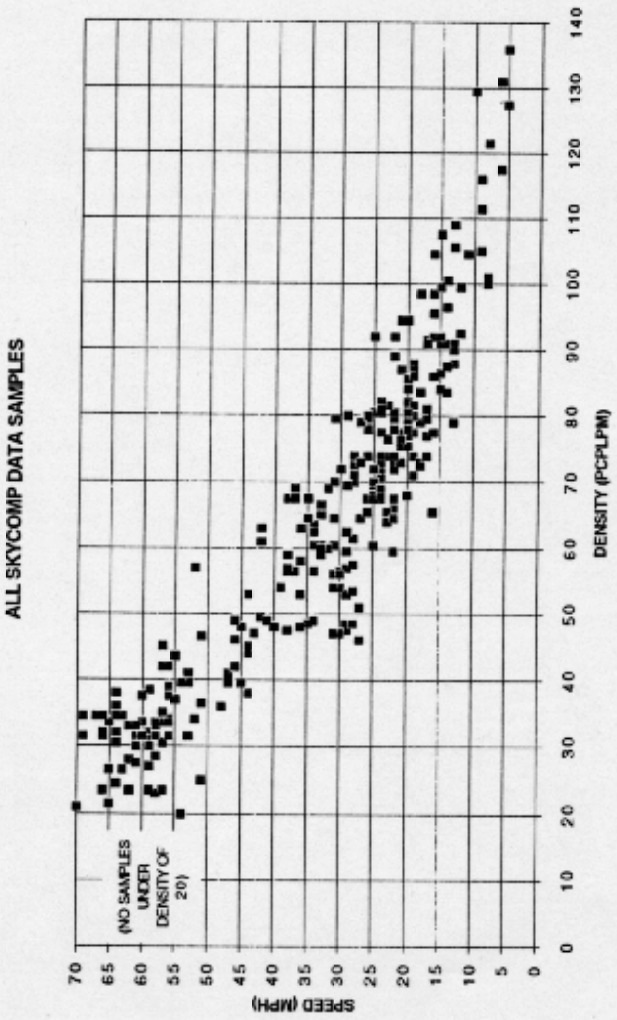
Also, in the event that the highway had four travel lanes in one direction, alternating samples were taken from both middle lanes.

In the event that a driver switched lanes while being tracked, the observer noted the lane change and also noted which lane the car spent the majority of time in (this is the lane for which a density count would be made later). In several cases (infrequently), the observer

abandoned tracking certain vehicles when: 1) the driver made multiple lane changes, trying to beat the average speed of traffic; 2) the driver switched lanes and changed speeds obviously and significantly; 3) the vehicle turned out to be a heavily loaded truck which delayed the traffic stream; or 4) the observer "lost" the vehicle being tracked. Also, for the samples made with traffic traveling at free-flow speeds, vehicles were abandoned which proved to be traveling significantly faster or slower than the average speed of traffic.

In the event that the target vehicle moved to the right lane in apparent preparation to exit, the observer often was able to switch tracking to another vehicle that had been just behind or ahead of the original vehicle in the same lane (and used the newly adopted vehicle to complete the sample). This was necessary because in some cases six or seven minutes had been invested in the tracking of a specific vehicle, and it was important to avoid wasting that time where possible.

It should also be pointed out that speeds were not tracked for very slow moving queues (densities over 120 / MWCOG samples only). Instead, density runs were made at 5 or 10 minute intervals, such that later on the ground the same vehicles could be found in succeeding sets of density photos; this allowed computation of speeds and associated densities.


ALL SKYCOMP DATA SAMPLES
SPEED (MPH)
DENSITY (PCPLPM)
(NO SAMPLES UNDER DENSITY OF 20)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140

DATA PROCESSING

After each flight, a topographic map was prepared for each zone which showed the starting and stopping points for each tracked car. Measurements were then made of the segment length (distance traveled). Then each tracked vehicle was entered into the computer database, including:

1. vehicle description
2. time-of-day
3. initial lane and subsequent lane changes
4. precise travel time (from stopwatch or time-lapse photographs)
5. density-photo preference, if any (default was to average the before- and after- density samples)
6. any special notes pertaining to that vehicle.

After the photos had been processed, each set of overlapping "density" photographs was taped together into a "mosaic" that showed each entire segment. Then vehicles in the required lane(s) were counted, listed by "car", "truck", "tractor-trailer" and "bus". These totals were translated into passenger-car equivalents (PCE's) using the following values:

Vehicle type:	PCE's:
cars	1
trucks	1.5
tractor-trailers	2.0
buses	1.5

(It should be noted that the distinction between "cars" and "trucks" could not be cleanly made, since there are many varieties of light and heavy pick-ups (both covered and uncovered). In general, a pick-up or van had to be at least twice the size of an average-sized car to be considered a "truck".)

PCE's were then divided by segment length to calculate densities. These density samples were then matched to corresponding speed samples; each speed/density data pair was then plotted on the chart.

CALIBRATION OF THE VAN AERDE MODEL

Van Aerde Model

The main advantages to a single-regime model are that boundaries between regimes do not have to be defined; and curves from adjacent regimes do not have to be spliced at the boundaries. A single-regime model allows for a more subjective and repeatable calibration process. This will be is especially true if more data from the high-speed end of the curve is ever incorporated into this process.

The disadvantages to this particular model are that it expresses this project's independent variable as a function of the dependent variable; and that it is a non-linear function. These disadvantages make performing the initial calibration more difficult. However, once SAS programs for the task are written, they can be used again usually with a minimum of effort.

The procedure for calibration was as follows: 1) The model's equation was coded into a spreadsheet so that the shape could be defined by recognizable parameters: two points that the curve passes through, the free-flow speed, and the speed at capacity. By overlaying this curve with the scatter plot of the observations, initial estimates of the parameters were made. 2) The initial parameter estimates, the equation, and the observations were used in a SAS PROC NLIN job to machine-calibrate the parameter estimates. 3) A second SAS program translated the calibrated equation into a look-up table that expresses speed as a function of density. 4) The results of the SAS work were imported into a spreadsheet for plotting and for calculation of prediction intervals.

Two outstanding technical issues related to this procedure are determination of the free-flow speed, and calculation of prediction intervals.

The free-flow speed for best fit can be determined by the PROC NLIN program, as are all other parameters. Due to the lack of data at the low-density region of the model, PROC NLIN returns a very high free-flow speed. Additional data from MD SHA was used to calculate a free-flow speed for general application on the Beltway. The calibration of the model presented here resulted from forcing the free-flow speed to match the SHA data analysis.

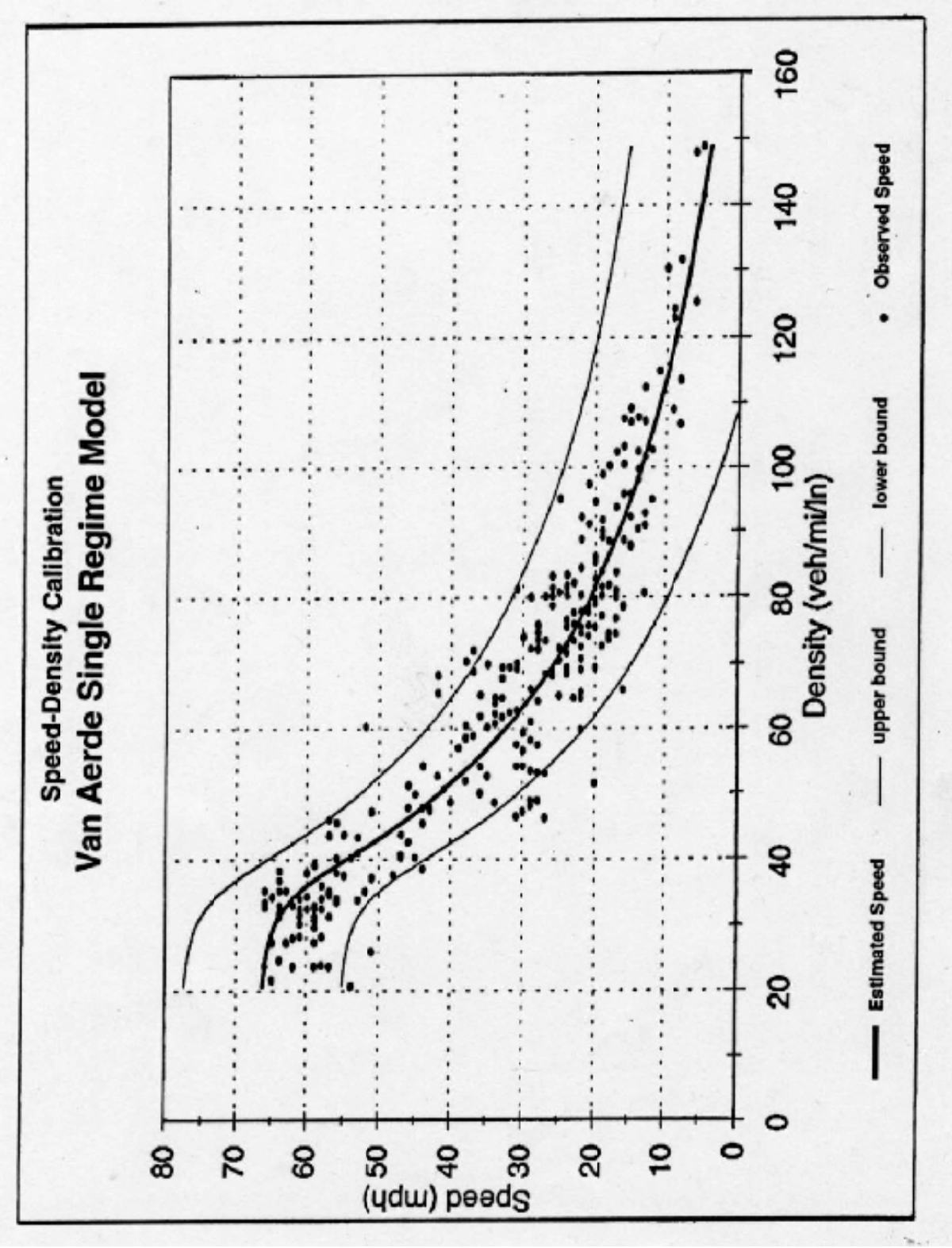
The prediction intervals shown in the current plot were calculated after the model was translated. This may have not been appropriate. PROC NLIN calculates prediction intervals directly as it calibrates the model. Those prediction intervals express density as a function of speed, however. Work is in progress to translate them, and to otherwise arrive at the most appropriate method of determining prediction intervals.
Since a single-regime model is more suitable in a computerized process, and for lack of significant difference in performance, the Van Aerde model is preferred over earlier approaches examined by MWCOG staff and presented before subcommittees.

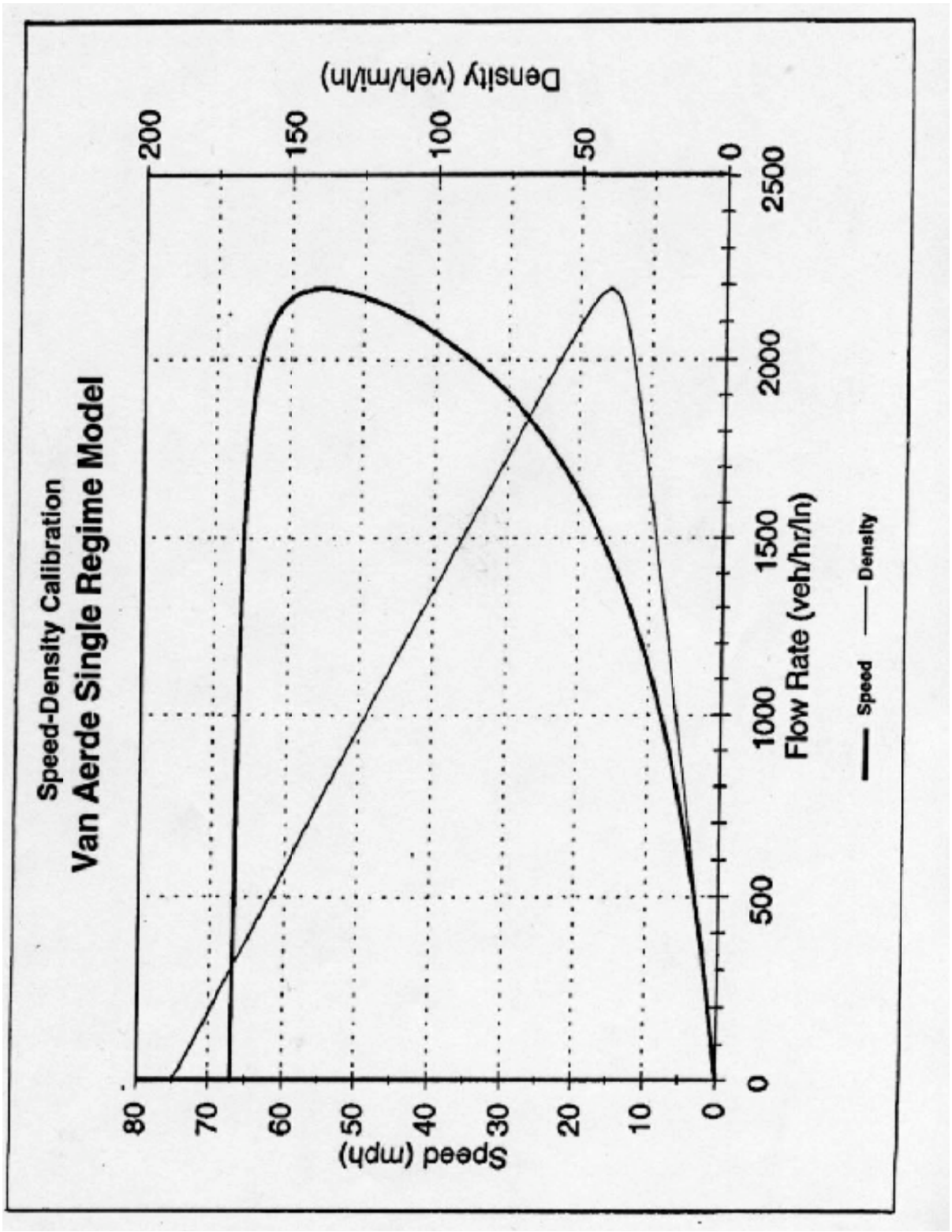
Speed-Density Calibration
Van Aerde Single Regime Model

free-flow spd = 67 mph / c1 = 0.00512 / c2 = 0.0114 / c3 = 0.000342

	DENSITY (veh/ln/mi)	SPEED (mph)	VOLUME (veh/ln/hr)
free-flow	0	67.0	0
	20	66.4	1,328
	25	65.8	1,661
	30	64.6	1,946
	35	61.3	2,144
capacity	39	55.8	2,190
	40	54.7	2,189
	45	47.8	2,153
	50	41.9	2,094
	55	36.8	2,025
	60	32.6	1,954
	65	28.9	1,880
	70	25.8	1,806
	75	23.1	1,731

DENSITY (veh/ln/mi)	SPEED (mph)	VOLUME (veh/ln/hr)	
80	20.7	1655	
85	18.6	1580	
90	16.7	1503	
95	15.0	1425	
100	13.5	1350	
105	12.1	1271	
110	10.9	1197	
115	9.7	1117	
120	8.7	1043	
125	7.7	963	
130	6.8	885	
135	6.0	810	
140	5.2	729	
187	0	0	jam


Speed-Density Calibration
Van Aerde Single Regime Model
Speed (mph)
0
10
20
30
40
50
60
70
80
Density (veh/mi/ln)
0
20
40
60
80
100
120
140
160
Estimated Speed
upper bound
lower bound
Observed Speed


Speed-Density Calibration
Van Aerde Single Regime Model
Speed (mph)
80
70
60
50
40
30
20
10
0
Density (veh/mi/ln)
200
150
100
50
0
Flow Rate (veh/hr/ln)
0
500
1000
1500
2000
2500
Speed
Density